

**HP 39301A RS-232C (V.24)  
FIBER OPTIC MULTIPLEXER  
HP 39200B/HFBR-3100  
FIBER OPTIC CABLE  
Installation, Operating and  
Service Manual**



**HEWLETT  
PACKARD**

OPTOELECTRONICS DIVISION  
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- E - Special RS-232 Cable Interconnect Diagrams



## GENERAL INFORMATION

### 1-1. INTRODUCTION

1-2. This section provides general information on the HP 39301A Fiber Optic Multiplexer including a description, equipment supplied, and specifications.

### 1-3. DESCRIPTION

1-4. The HP 39301A Fiber Optic Multiplexer accepts 8 parallel EIA RS-232C (CCITT V.24) inputs on the primary Transmitted Data (BA) inputs of the eight RS-232 connectors. The eight Secondary Transmitted Data (SBA) inputs on the eight RS-232 connectors are also active and are available for special uses. The RS-232 signals are serialized and transmitted up to a kilometre on 39200B/HFBR-3100 fiber optic cable to a companion 39301A where the serial bit stream is converted to parallel RS-232 lines on the equivalent pins of the eight RS-232C connectors. Each HP 39301A contains both transmit and receive circuitry providing full duplex capability with one 39301A at each end of the duplex fiber optic cable. A typical configuration is shown in figure 1-5.

### 1-5. UNIT IDENTIFICATION

1-6. The HP 39301A Fiber Optic Multiplexer has a serial number plate attached to the bottom of the unit. The serial number is of the form 0000A00000. It is in two parts; the first four digits and the letter are the serial prefix and the last five digits are the suffix. The prefix is the same for all identical instruments; it changes only when a change is made to the instrument. The suffix, however, is assigned sequentially and is different for each instrument.

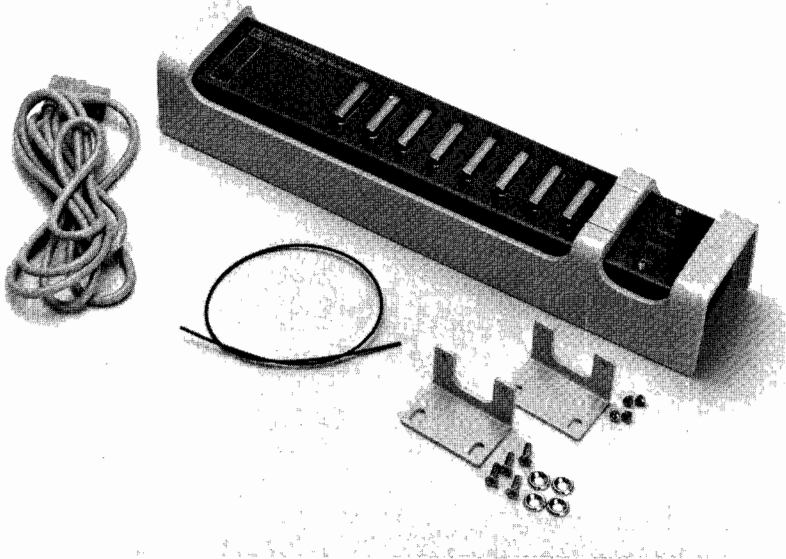
### 1-7. EQUIPMENT SUPPLIED

1-8. Table 1-1 lists the equipment supplied with the 39301A as shown in figure 1-1.

**TABLE 1-1**

**39301A EQUIPMENT SUPPLIED**

Qty	Description	HP Part Number
1	RS-232/V.24 Fiber Optic Multiplexer	39301A
1	Operation & Service Manual	39301-90001
1	Detachable Power Cord 2.31m (7.5 ft)	*
1	Fiber Optic Loopback Cable (0.5m)	5061-2694
1 set	Rack/Surface Mounting Flanges with Hardware	1600-0190
1	Repair Tag	9320-3896
	*for country of use	



**FIGURE 1-1**  
**39301A EQUIPMENT SUPPLIED**

**1-9. SPECIFICATIONS**

1-10. Specifications for the 39301A are given in Table 1-2.

**TABLE 1-2**  
**SPECIFICATIONS**

**SYSTEM PERFORMANCE [1]:**

Typical System Bit Error Rate:  $10E-9$

Maximum Pulse Width Distortion on any channel:  $\pm 6 \mu\text{sec}$  [2]

Recommended maximum symbol rate on data channel: 20 kBaud

**ELECTRICAL CHANNEL INTERFACE:**

Electrical: Conforms to: EIA Standard RS-232C, Section 2. CCITT  
V.28

Electrical Connector: 25 pin Subminiature "D" Female.

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<b>PIN #</b>	<b>EIA RS-232-C</b>		<b>CCITT V.24</b>		<b>NOTES</b>
1	Protective Ground	GND	Earth Common	101	3
2	Transmitted Data	TD	Transmitted Data	103	4
3	Received Data	RD	Received Data	104	4
6	Data Set Ready	DSR	Data Set	107	5
7	Signal Ground	SG	Signal Ground	102	3,4
14	Secondary Transmitted Data	STD	Transmitted Backward Channel Data	118	
16	Secondary Received Data	SRD	Received Backward Channel Data	119	

**OPTICAL PORTS:** Hewlett-Packard HFBR-4000 Fiber Optic Connector compatible.

**OPTICAL PORT CHARACTERISTICS:**

**Transmitter:**

Transmitter Output Optical Flux: -13 dBm (50  $\mu$ W) min. @ 820nm

Receiver: Receiver Input Optical Flux: -31 dBm (0.8  $\mu$ W) min @ 820nm

**Recommended Cable and Connector:**

**EITHER**

**OPTION**

Simplex Cable:  
(two required per system)

With HFBR-4000 Connectors Installed: HFBR-3000/39200A 001

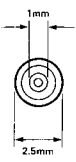
Without Connectors<sup>[6]</sup>: HFBR-3200/39200A

**OR**

Duplex Cable:  
(one required per system)

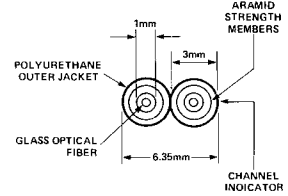
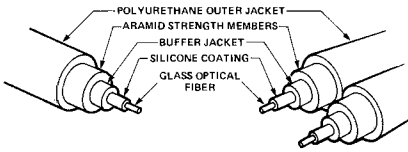
With HFBR-4000 Connectors Installed: HFBR-3100/39200B 001

Without Connectors<sup>[6]</sup>: HFBR-3300/39200B



SINGLE CHANNEL

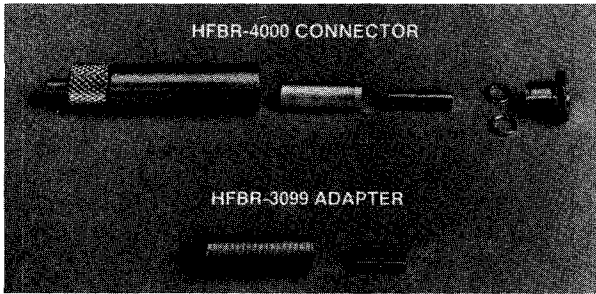
HFBR-3200/39200A



DUAL CHANNEL

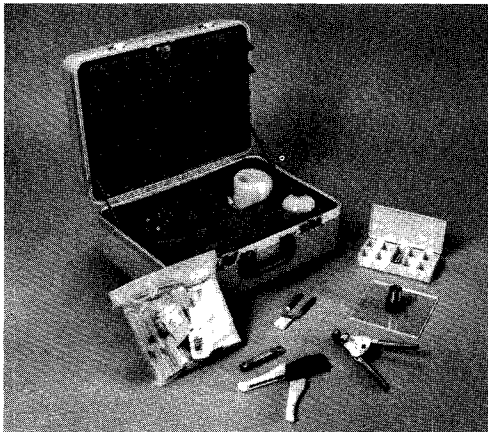
HFBR-3300/39200B

**FIGURE 1-2  
FIBER OPTIC CABLE**



Connector Adapter: HFBR-3099  
 Connector: HFBR-4000  
 Connector Assembly Tooling Kit: HFBR-0100

**FIGURE 1-3  
CONNECTOR COMPONENTS**



**FIGURE 1-4  
HFBR-0100 CONNECTOR ASSEMBLY TOOLING KIT**

### Connector/Cable Characteristics:

In-Line connection utilizing HFBR-3099 connector adapter.

Connector to Connector Insertion Loss: 2.0 dB typ.

### Transmission Distance Limits[7]:

- 1000 metres - with no in-line connection
- 800 metres - with 1 in-line connection
- 600 metres - with 2 in-line connections
- 400 metres - with 3 in-line connections
- 200 metres - with 4 in-line connections

### Cable:

- Cable Attenuation @ 820 nm: 10 dB/km maximum
- Tensile Force on Cable: 300 N maximum per channel
- Bend Radius: 25 mm minimum
- Operating Temperature: -20 degrees C to 70 degrees C
- Storage Temperature: -40 degrees C to 85 degrees C
- Relative Humidity: 95% at 70 degrees C

(Refer to HFBR-3000 data sheet for complete mechanical specifications.)

### INDICATORS AND SWITCHES

- AC Line Indicator: When "ON", indicates that power switch is on.
- Carrier Received Indicator: When "ON", indicates that the 39301A is receiving a modulated signal from the remote transmitter.
- Loopback Switch: In the "TEST" position, enables an electrical loopback at the interface between the multiplexer electronics and the fiber optic modules and also disables the "Carrier Received" indicator. This allows troubleshooting of all circuitry. In the "RUN" position, allows normal operation of 39301A system.

### ENVIRONMENTAL

- Storage Temperature: -40 to 75 degrees C.
- Operating Temperature: 0 to 55 degrees C.
- Relative Humidity (Operating): 95%
- Altitude (Operating): 4600m (15,000 ft)

## PHYSICAL CHARACTERISTICS

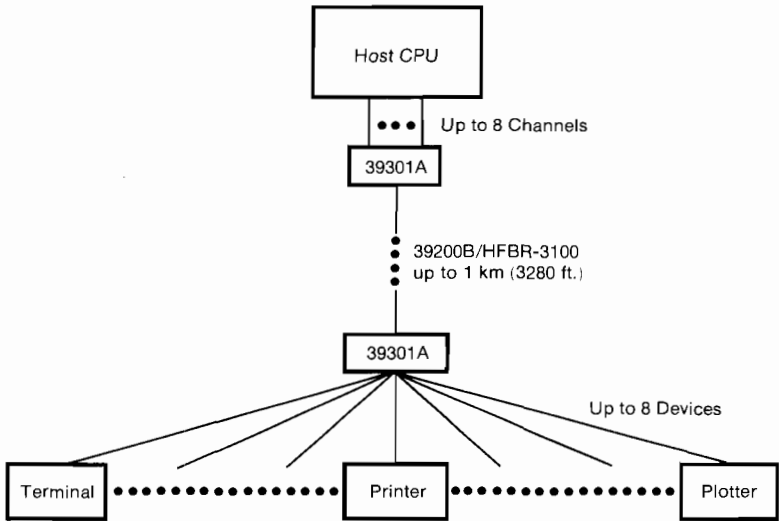
Size:	425mm × 89mm × 72mm (16.75" × 3.5" × 2.85")
Weight:	2.2 kg (4.75 lbs)
Power Requirements:	18 VA maximum
Factory Installed Power Options:	
Option: 210:	100 VAC -10% +5%, 48 - 66 Hz
212:	120 VAC -10% +5%, 48 - 66 Hz
222:	220 VAC -10% +5%, 48 - 66 Hz
224:	240 VAC -10% +5%, 48 - 66 Hz
Mounting Hardware:	
Standard:	Rack/Surface Mounting Kit
Option 001:	Extended Rack Mounting Kit <sup>[8]</sup>

### Notes:

1. A system consists of two 39301A's operating with the recommended optical cables and connectors.
2. Operated with RS-232 load of 3K Ohms and 2500 pF.
3. Signal ground connected to frame ground. (pin 1 to pin 7)
4. For the HP 3000 system environment, these are the only pins needed for a hardwired connection to the system.
5. Data set ready to +12V through 300 Ohm resistor.
6. HFBR-4000 Fiber Optic Connectors may be installed on unconnected Hewlett-Packard Fiber Optic Cables using the HFBR-0100 Connector Assembly Tooling Kit.
7. Connectors at cable ends joining the multiplexers are not included in the count.
8. See figure 5-3 for extended rack flange mounting configuration.

**1-11. TYPICAL CONFIGURATION**

1-12. A typical configuration of 39301A's is shown in figure 1-5.



**FIGURE 1-5**  
**TYPICAL 39301A CONFIGURATION**

**1-13. REFERENCE DOCUMENTS**

1-14. Reference documents that may be used for reference or background material are listed in Table 1-3.



**TABLE 1-3**  
**REFERENCE DOCUMENTS**

<b>Source</b>	<b>Note</b>	<b>Title</b>
EIA	1	RS-232C
CCITT	2	V.24/V.28
Hewlett-Packard	3	HFBR-3000 Fiber Optic Cable Data Sheet
Hewlett-Packard	3	HFBR-0100 F.O. Connector Assembly Tooling Kit User's Manual
Hewlett-Packard	3	HFBR-4000 F.O. Connector Data Sheet
Hewlett-Packard	3	AN-1000 Digital Data Transmission with the HP Fiber Optic System.

**Notes:**

1. EIA Engineering Department  
2001 Eye Street, N.W.  
Washington, D.C. 20006
2. International Telecommunications Union  
Palais Wilson  
Geneva, Switzerland
3. Hewlett-Packard Co.  
640 Page Mill Road  
Palo Alto, CA 94304

## THEORY OF OPERATION

### 2-1. INTRODUCTION

2-2. This section describes the theory of operation of the HP 39301A RS-232 Fiber Optic Multiplexer.

### 2-3. BASIC INFORMATION

2-4. The HP 39301A Multiplexer receives sixteen separate RS-232C serial bitstreams, combines them into a single serial biphase encoded bitstream which is then transmitted over an optical fiber to a second 39301A which converts the bitstream into sixteen separate RS-232C output channels. Each 39301A contains all the circuitry necessary to perform both the multiplexing and demultiplexing functions. In addition, circuitry is contained to aid in interfacing to terminal equipment and to aid in troubleshooting in the event of a link failure.

2-5. The electrical block diagram of the 39301A is shown in figure 2-1.

2-6. The output data streams from the demultiplexer are sampled versions of the input data streams. The multiplexer loads the contents of the sixteen RS-232C input lines into a sixteen bit shift register at a 200 kHz rate. These sixteen bits are shifted into the biphase encoder which creates a serial stream of pulses containing information about both timing and data. The serial bit stream consists of pulses which are either 143 nsecs or 286 nsecs in length. Two short pulses represent a high level on the corresponding input line and a single long pulse represents a low level on the input line. A short pulse followed by a long pulse represents an illegal data pattern and is used as a synchronization symbol to guarantee that the data corresponding to each input are demultiplexed to the proper output. Figure 2-2 describes the data coding pattern.

2-7. At the demultiplexer, the optical data stream is decoded into clock and data and fed into a shift register. When the synchronization symbol is detected, the data are loaded from the shift register into an output latch. The outputs are then converted to RS-232C electrical levels with standard integrated circuit translators.

2-8. Since all sixteen inputs are sampled simultaneously and the outputs are latched simultaneously, the data skew between two channels is at most one sample period (5  $\mu$ sec) plus mismatches in delays of output drivers. This feature makes the 39301A suitable for transmission systems in which control over skew between data is important, such as parallel bit streams and synchronous data transmission in which both clock and data are provided as inputs to the 39301A.



2-9. The 39301A does no conversion of the input data stream into a bit parallel format, hence the transmission is independent of baud rate and data format. The input need not represent asynchronous data, but can represent timing information (clock), a handshake signal (request to send) or a trigger voltage for a remote sensing and control application.

2-10. The upper bound of the bandwidth is limited by capacitive loading (including cable) on the RS-232 drivers and by the pulse distortion tolerance of the terminal equipment. In most cases, asynchronous data rates up to 20 kBaud over electrical cables of fifty feet provide acceptable distortion and synchronous data up to 20 kBaud will perform well if the terminal equipment can provide the clock. Distortion is independent of optical cable length within the specifications of the optical subsystem.

2-11. Typical circuits for both RS-232C inputs and outputs are shown on the block diagram.

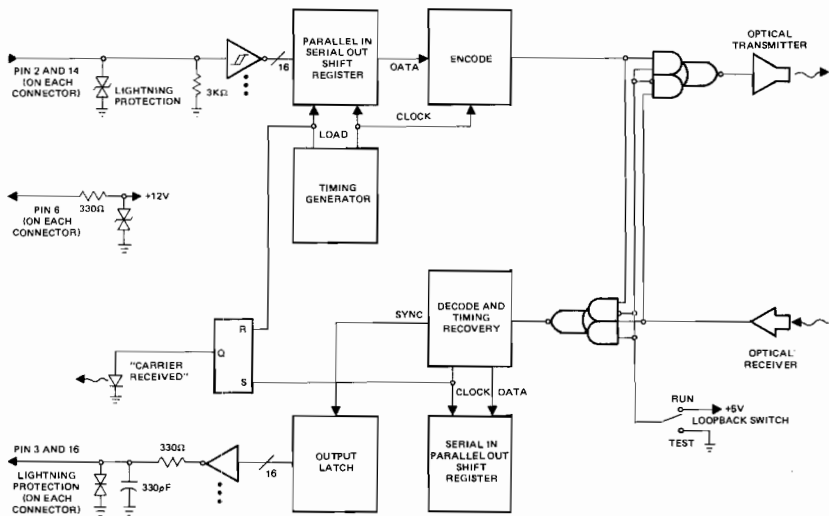
2-12. The "Carrier Received" indicator is meant as an indication that the remote 39301A is operating. The light is turned off every 5  $\mu$ sec and is turned on by the next transition at the optical receiver. Thus, the light indicates that the remote 39301A is operating and that the cable is intact, but does not guarantee that the input flux is within specifications or that error free operation can be expected.

2-13. The "Carrier Received" indicator is disabled if the loopback switch is in the "Test" position.

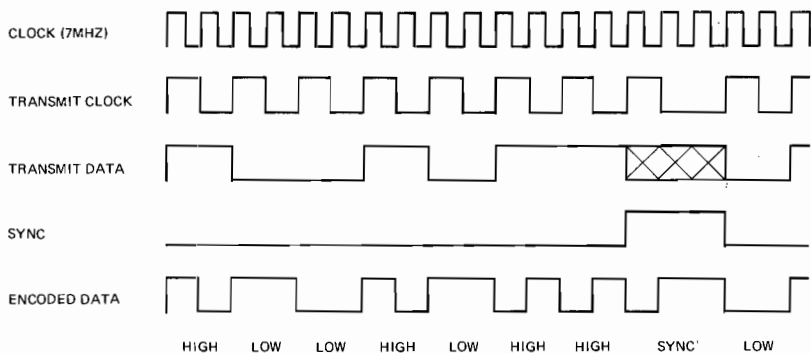
2-14. The loopback switch controls two two-to-one multiplexers which switch the inputs and outputs at the serial end of the circuit. When the loopback switch is in the "Test" position, the serial output data is connected to the serial input, and the received serial data is connected to the optical transmitter. When the switch is in the "Run" position, the serial output data is connected to the transmitter and the received data is connected to the serial input.

2-15. The loopback switch can be used to diagnose the performance of the electrical subsystem and of the optical subsystem. As such, it is useful in isolating failures within the system. More detail on how to use these features is included in Section IV, "Troubleshooting".

2-16. The optical loopback cable provided with this multiplexer is a 1000  $\mu$ m diameter plastic optical fiber. Because of area mismatch with the 200  $\mu$ m optical port on the optical receiver, this short cable provides approximately 15 dB attenuation. This can be used as an indicator that the optical modules of the 39301A are functional. Because of the large diameter of the fiber, no special alignment is necessary.



**FIGURE 2-1**  
**39301A ELECTRICAL BLOCK DIAGRAM**



**FIGURE 2-2**  
**DATA CODING TIMING DIAGRAM**

1

L

L

U

U

U

1

U

## OPERATION

### 3-1. INTRODUCTION

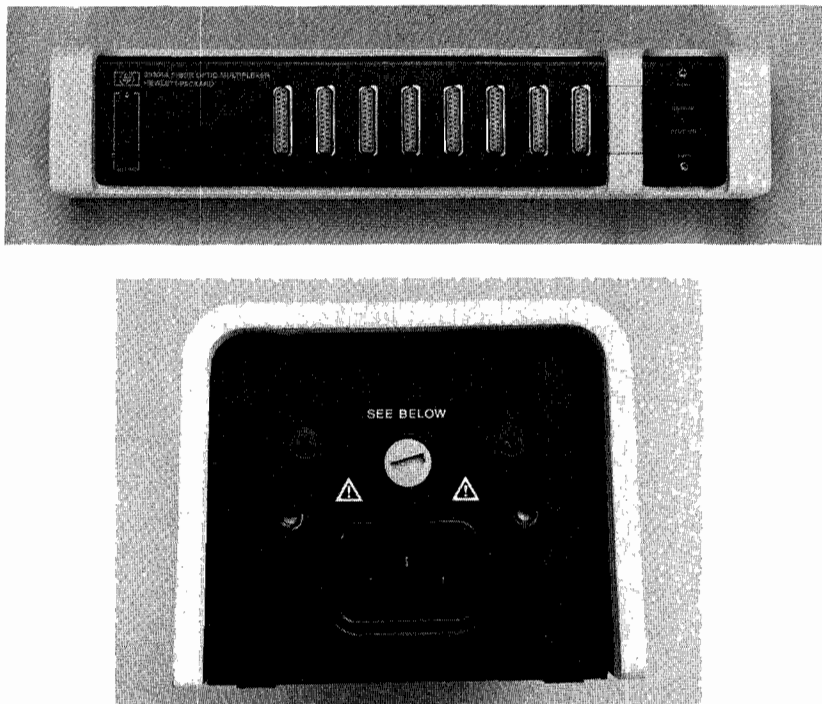
3-2. The operation section explains the functions of the control switches and indicator lamps of the 39301A Fiber Optic Multiplexer. It describes typical operating modes and indicators.

### 3-3. OPERATING CHARACTERISTICS

3-4. The HP 39301A Fiber Optic Multiplexer is capable of running in the normal full duplex mode or in an electrical loopback mode by a switch on the top of the unit. Provision is also made for an optical loopback with the large diameter plastic fiber optic cable (5061-2694) supplied with the HP 39301A.

### 3-5. PANEL FEATURES

3-6. Top and end views of the 39301A are shown in figure 3-1.



**FIGURE 3-1**  
**39301A TOP AND END VIEW**

### 3-7. OPERATING INSTRUCTIONS

3-8. The HP 39301A Fiber Optic Multiplexer has been configured to emulate an RS-232 compatible Data Communications Equipment (DCE). The RS-232 cables required to connect between the Data Terminal Equipment (DTE) and HP 39301A should be the modem interconnect cable compatible with the DTE and having male 25 pin subminiature "D" connectors that plug into the HP 39301A. Only a three wire connection is necessary (SIGNAL GND (AB) pin 7; Transmitted Data (BA) pin 2; and Received Data (BB) pin 3) for proper operation of the multiplexer. However shielded cable utilizing pin 1 is recommended for minimizing electro-magnetic interference. (See Appendix for the interconnection and recommended RS-232 cable.) For proper operation of the DTE, several other signal lines may be required. The HP 39301A has the Data Set Ready (CC) (pin 6) internally connected to + 12V, the normal operating level, pin 6 may therefore be used by the DTE.

Two other data channels have been wired for use by the DTE. Pins 14, and 16 Secondary Transmitted Data, (SBA); and Secondary Received Data, (SBB). These two channels may be used as secondary channels by the DTE for transmitting data. By rewiring the 25 pin RS-232C plug-in connector, the secondary channels may be used to transmit and receive clock or the hand shake signals.

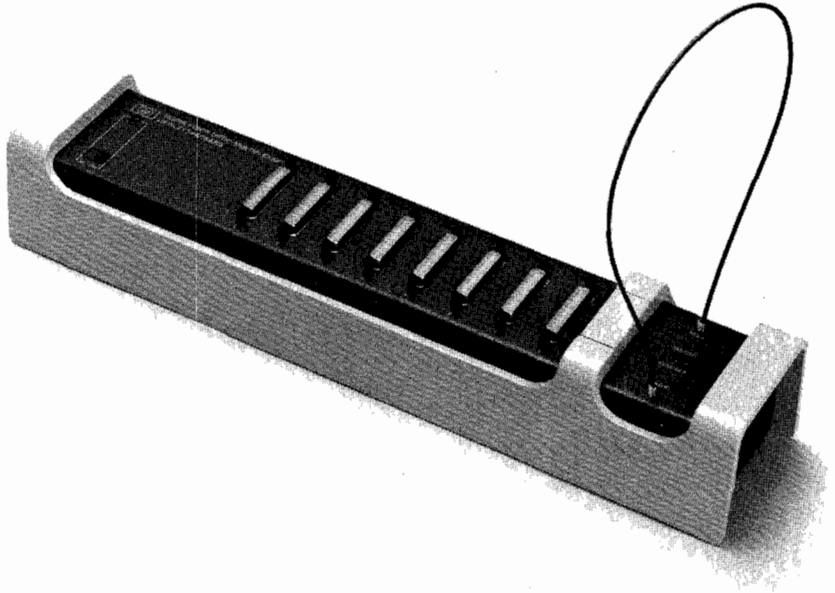
See Appendix E for the implementation.

### 3-9. UNIT VERIFICATION

3-10. The unit verification allow the operator to make a quick evaluation of the unit's main functions prior to connection of the electrical and fiber optic cables. Refer to Table 3-1 for switch positions and LED indicators. The electrical loopback switch is accessible through the top cover as shown in figure 4-5. (The top cover may be removed with a flat bladed screwdriver).

**TABLE 3-1**  
**39301A UNIT VERIFICATION**

<b>Test</b>	<b>Condition</b>	<b>Indication</b>
1. AC/DC Power Supply	AC line cord plugged into appropriate voltage. AC power switch "ON".	Yellow "AC Line" LED is "ON"
2. Electronics	Place loopback switch in "TEST" position.	Yellow "Carrier Received" LED is disabled
3. Optical Transmitters Receivers	(Return loopback switch to "RUN" position.) Place 0.5 metre plastic fiber optic cable (5061-2694) between Fiber Optic Transmitter and Receiver optical port. (See figure 3-2).	Yellow "Carrier Received" LED is "ON"



**FIGURE 3-2  
PLACEMENT OF FIBER OPTIC LOOPBACK CABLE**

**3-11. 39301A LINK VERIFICATION**

3-12. The following procedure can be used to verify the operation of a 39301A RS-232 Fiber Optic Multiplexer system.

**3-13. TEST EQUIPMENT REQUIRED**

3-14. The following equipment or its equivalent is required to test the 39301A system.

**TABLE 3-2  
LINK VERIFICATION TEST EQUIPMENT**

<b>Description</b>	<b>Model</b>
RS-232 Data Source and Receiver	HP-1640B
Male RS-232 loopback hood	8120-3570



3-15. To verify the 39301A Fiber Optic Multiplexer system, connect the 39200B/HFBR-3100 duplex fiber optic cable to the XMTR and RCVR optical ports of each 39301A. The channel identification extrusion/mark should be connected to the XMTR part of one 39301A and to the RCVR part of the opposite 39301A. Connect the source of RS-232 data; HP-1640B, Serial Data Analyzer, to connector number one of a 39301A and the male RS-232 loopback hood to connector number one of the opposite 39301A. The 39301A system is now configured to return both the primary and secondary data signals to the RS-232 source. Supply ac power and turn on the ac line switch.

All yellow LED's should be "ON". Verify the 39301A system by transmitting data on both the primary and then the secondary data channels to the 39301A and monitoring its return to channel one. Repeat the procedure for channels two through eight.

If any channels fail to transmit data, refer to "Troubleshooting" Section IV to determine the faulty element.

### 3-16. MINIMAL EQUIPMENT LINK VERIFICATION

3-17. If no loopback hood is available, the link may be verified with an RS-232 source/detector, such as a terminal and utilization of the loopback switch on the 39301A. The verification is done in two steps, each step has the terminal at the opposite end of the link and the procedures are identical.

First the terminal is configured for full duplex operation, and is connected to RS-232 connector number one of the 39301A. The remote 39301A is placed in the "TEST" mode with the loopback switch and the local 39301A is in the "RUN" mode. The remote "carrier received" LED should be "OFF" and the local "carrier received" LED should be "ON".

The system is now configured to return the RS-232 signal transmitted on pin 2 back to pin 3 of connector number one.

Verify that the character key depressed on the terminal is displayed on the screen. Repeat the test moving the terminal cable to each of the eight connectors of the 39301A. The same test is now repeated with the terminal at the opposite end of the link. The 39301A near the terminal is placed in the "RUN" mode and the 39301A at the opposite end of the link is placed in the "TEST" mode. Repeat the test sending characters from the terminal to the far end and back through connectors one through eight.

The test must be done in two steps to verify the multiplexer system. In the "TEST" position the signal is returned just after the optical detection and before the decoding/demultiplexing. Changing the terminal to the opposite side of the link then checks the decoding demultiplexing circuitry of the 39301A.

## TROUBLESHOOTING

### 4-1. INTRODUCTION

4-2. This section contains service information, recommended test equipment, performance check and troubleshooting.

### 4-3. TEST EQUIPMENT

4-4. Table 4-1 lists test equipment recommended for maintaining and checking the performance of the HP 39301A. Test equipment having equivalent characteristics may be substituted for the equipment listed.

**TABLE 4-1**  
**RECOMMENDED TEST EQUIPMENT**

Equipment	Model Number
Connected Fiber Optic Loopback Cable	5061-5716
RS-232 Loopback Hood	8120-3570
RS-232 Serial Data Analyzer	HP-1640B
Volt Meter	HP-3476A/B

4-5. Table 4-2 lists the recommended cable and connector repair equipment for the Hewlett-Packard fiber optic cable.

**TABLE 4-2**  
**CABLE REPAIR EQUIPMENT**

Equipment	Model Number
Connector Assembly Tooling Kit	HFBR-0100
Fiber Optic Connector	HFBR-4000
Fiber Optic Flux Meter w/HFBR-4000 Connector/Adapter	Photodyne 11XE Photodyne 2009
820nm Source w/HFBR-4000 Compatible Connector	39301A

### 4-6. TROUBLESHOOTING GUIDE

4-7. **INTRODUCTION.** The purpose of this section is to describe a general technique that should be used to identify any problem with a 39301A system composed of a pair of 39301A's and 39200B duplex fiber optic cable. It should first be determined that a malfunction does indeed exist and that the trouble is not external to the 39301A.

4-8. **INITIAL TROUBLESHOOTING PROCEDURE.** The majority of problems are due to dirty fiber optic connections or an improper electrical configuration. The following procedures should be followed first:

1. Verify signal sources (refer to manual of specific DTE equipment).
2. Verify proper installation, Section V. Check optical and electrical connections, for proper fit.
3. Perform Link Verification, section 3-12.
4. Perform Unit Verification section 3-7.

4-9. **ISOLATION TECHNIQUES.** If the malfunction is not corrected by the initial troubleshooting procedure, it should fall into one of the following categories:

Data terminal equipment, fiber optic cable, or a 39301A. The following guide will give a procedure for troubleshooting the fiber optic cable and the 39301A down to a board level exchange.

Part I will fix a power supply failure. Part II will determine if the fiber optic cable is at fault, and Part III will determine which board has failed in the 39301A.

**NOTE: OPTICAL FLUX MEASUREMENTS**

The optical flux level meter should be calibrated at 820nm for operation with the 39301A. If a calibration has been done at a different wavelength, the calibration factor must be included in the reading. Optical measurements are difficult to repeat, typical repeatability being  $\pm 5\%$  and precision no better than 5%. For optical measurements that read low, first clean the optical ports and only change the optical subassembly when the reading is vastly different from the specification.

**GUIDELINES:**

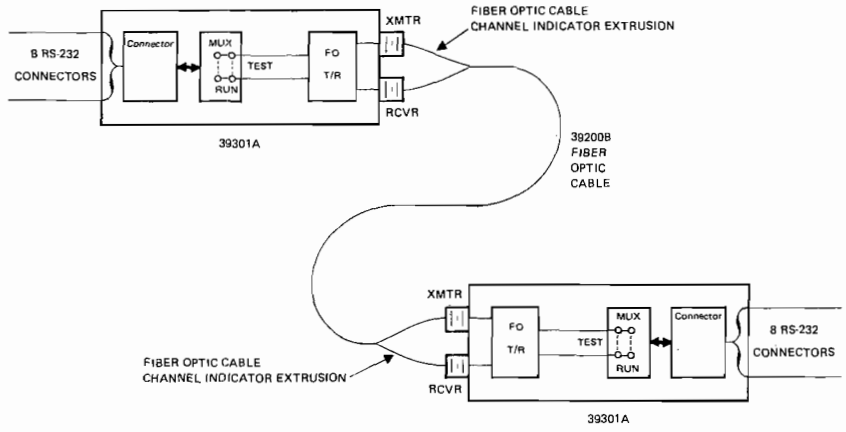
1. Before replacing any board verify that the power supply voltages are in tolerance.

On 39301-68004 board

Test Point	Range
+ 12 V	+ 11.4 to + 12.6 Vdc
- 12 V	- 11.4 to - 12.6 Vdc
+ 5 V	+ 4.75 to + 5.25 Vdc

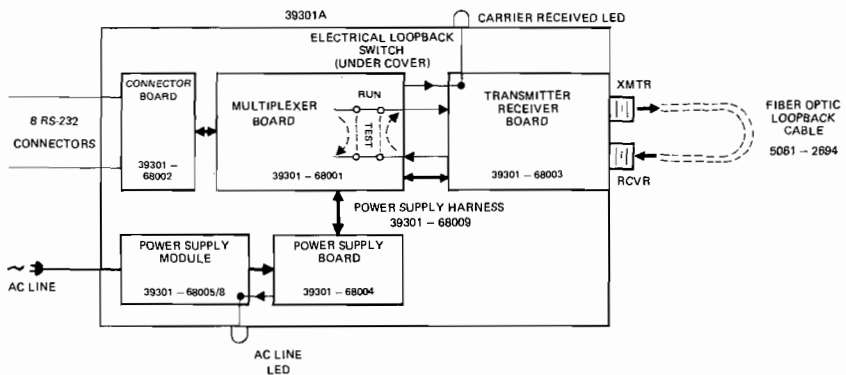
2. Repeat failed tests on replacement board then verify system operation per section 3-11.

**39301A SYSTEM**



**FIGURE 4-1**  
**39301A SYSTEM**

**RS-232 FIBER OPTIC MULTIPLEXER BLOCK DIAGRAM**



**FIGURE 4-2**  
**39301A MECHANICAL BLOCK DIAGRAM**

## SYMPTOM

## PROCEDURE

### I. AC Line LED "OFF"

Possible power supply failure

A. Check Fuse/Line Cord

B. Measure test voltages on power supply board 39301-68004

1) Replace 39301-68004 board if voltages are out of tolerance

+12 V . . . +11.4 to +12.6Vdc  
-12 V . . . -11.4 to -12.6Vdc  
+5 V . . . +4.75 to +5.25Vdc

2) Replace Power Module  
39301-68005/8

### II. Carrier Received LED "OFF" at either or both 39301A's

Possible fiber optic cable failure, fiber optic transmitter failure, or dirty optical ports.

Remove 39200B fiber optic cables from each 39301A and optically loopback each 39301A with the 5061-2694/5061-5716 optical loopback cable, as in figure 3-2.

A. If carrier received LED's of both 39301A's turn "ON" the 39301A's are functional.

1) Fiber optic connectors require cleaning; use clean compressed air to remove particles or dirt; or methanol, propanol, or isopropyl alcohol on a cotton swab. The alignment clip may be removed with a pair of needle nose pliers. Avoid touching the internal ferrule.

2) Fiber optic cable is broken: First measure fiber optic transmitter output for correct level, as in figure 4-3.

Clean/replace fiber optic T/R board if output flux is less than -17.6 dBm.

For each fiber optic cable, attach to a 39301A XMTR port and measure optical flux emitted at opposite end of cable as shown in figure 4-4.

Clean/repair/replace fiber optic cable if the reading is less than -31 dBm.

B. Carrier received LED of either 39301A is "OFF": Possible board malfunction of that 39301A. Use Part III for board isolation.

## **SYMPTOM**

### **III. Carrier Received LED "ON"**

## **PROCEDURE**

Possible board malfunction, isolate to board level with electrical and optical loopback testing.

For each 39301A remove the 39200B fiber optic cables and attach the optical loopback cable 5061-5716 and HP-1640B serial data analyzer to RS-232 channel one as in figure 4-5.

A. Pry the loopback cover off with a screwdriver. Place the electrical loopback switch in the "TEST" position and monitor the HP-1640B for data errors on each 39301A I/O connector.

1) Data errors on the HP-1640B

a) Replace the Multiplexer board 39301-68001

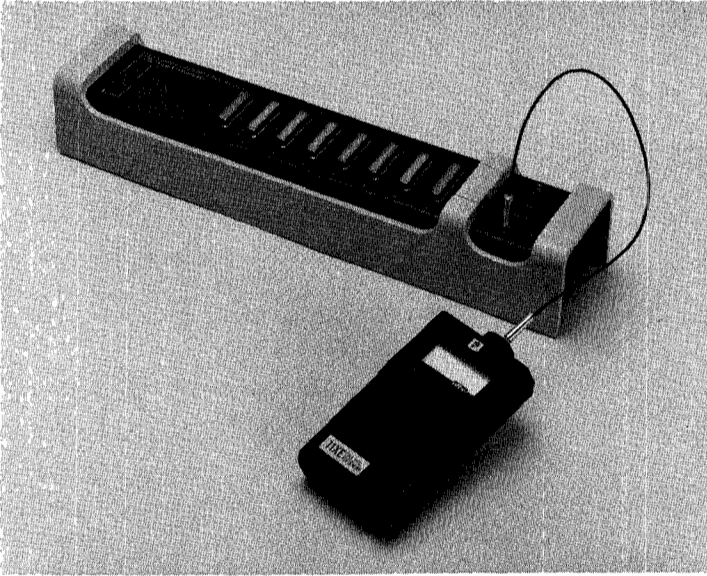
b) Replace the Connector board 39301-68002

2) NO data errors on the HP-1640B. Place electrical loopback switch in the "RUN" position and check optical loopback.

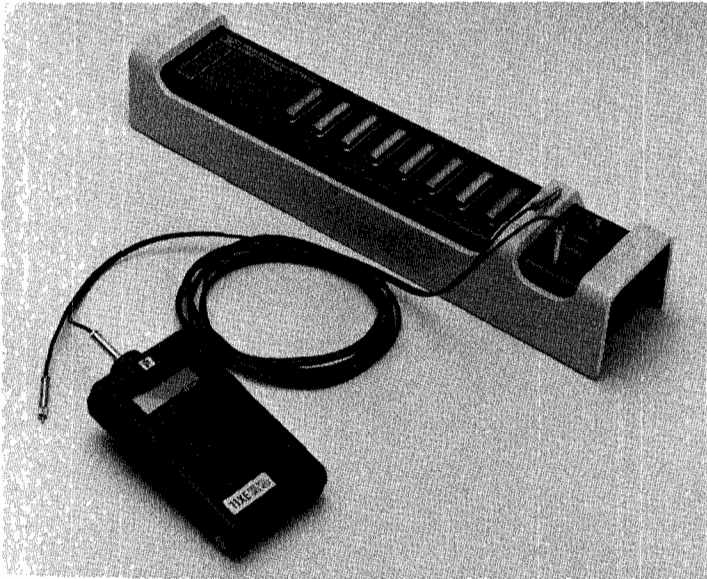
a) For data errors, replace Fiber Optic T/R module 39301-68003

b) Replace the Multiplexer board 39301-68001

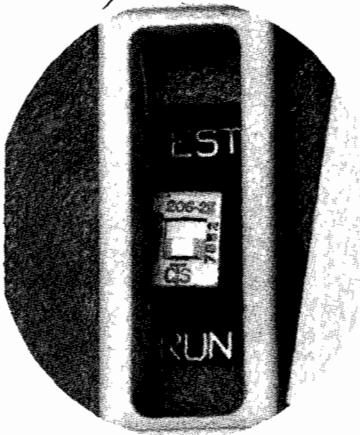
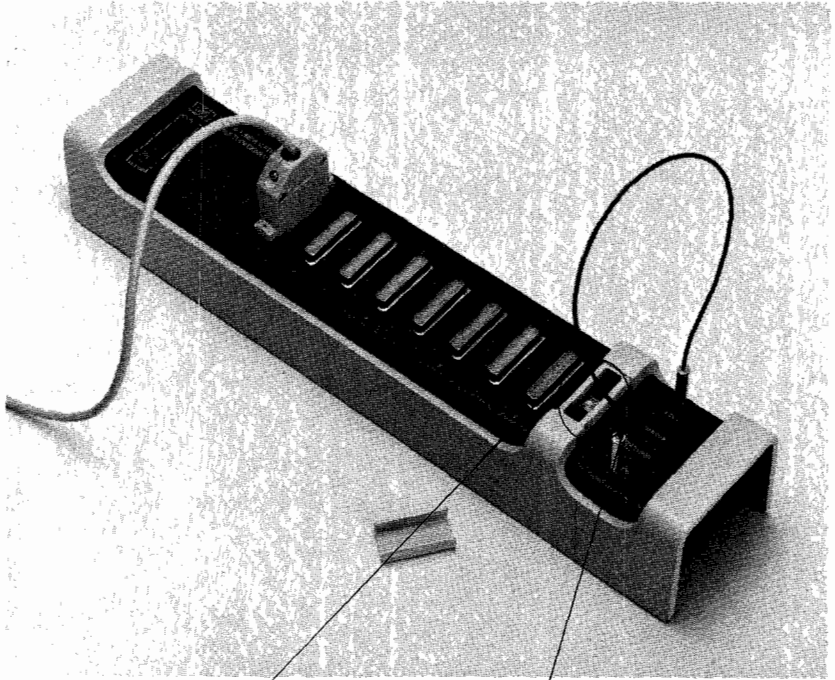
c) For NO data errors, possible low optical flux level, go to IIA and measure optical flux.



**FIGURE 4-3**  
**TRANSMITTER OUTPUT FLUX MEASUREMENT**



**FIGURE 4-4**  
**FIBER OPTIC CABLE FLUX MEASUREMENT**



Set the HP-1640B to transmit RS-232 data to PIN 2 and PIN 14, monitor the return signals on PIN 3 and PIN 16.

**FIGURE 4-5**  
**39301A TEST CONFIGURATION**



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## INSTALLATION

### 5-1. INTRODUCTION

5-2. This section contains information for unpacking, inspection, repacking, storage, and installation of the HP 39301A Fiber Optic Multiplexer.

### 5-3. INITIAL INSPECTION

5-4. Inspect the shipping container for damage. If the shipping container or cushioning material is damaged, it should be kept until the contents of the shipment have been checked for completeness and the instrument has been checked mechanically and electrically. The contents of the shipment should be as shown in Table 1-1. Procedures for checking electrical performance are given in Section III. If the contents are incomplete, if there is mechanical damage or defect, or if the 39301A does not pass the loopback tests, notify the nearest Hewlett-Packard office. If the shipping container is damaged, or the cushioning material shows signs of stress, notify the carrier as well as the Hewlett-Packard office. Keep the shipping materials for carrier's inspection. The HP office will arrange for repair or replacement at HP option without waiting for claim settlement.

### 5-5. PREPARATION FOR USE



### 5-6. Power Requirements

5-7. The 39301A has four optional power sources for use in countries where the power supply is 100, 120, 220, or 240 VAC, -10% to +5%, 48 to 66 Hz single phase. Power consumption is less than 18 VA. The installed power module voltage requirement is labeled on the power module and can be viewed through a cutout in the chassis bottom.

### 5-8. Line Voltage Selection

5-9. Table 5-1 provides instructions for the voltage and fuse selection. The line cord and proper fuse are factory installed for the country of destination. The fuse can be checked for proper size by referring to Table 5-1.

**TABLE 5-1**  
**FUSE SELECTION**

AC Volts Input	250V SLO-BLO Fuse	HP Part No.
100 - 120	0.25 A	2110-0201
220 - 240	0.125 A	2110-0318

**5-10. Power Cable**

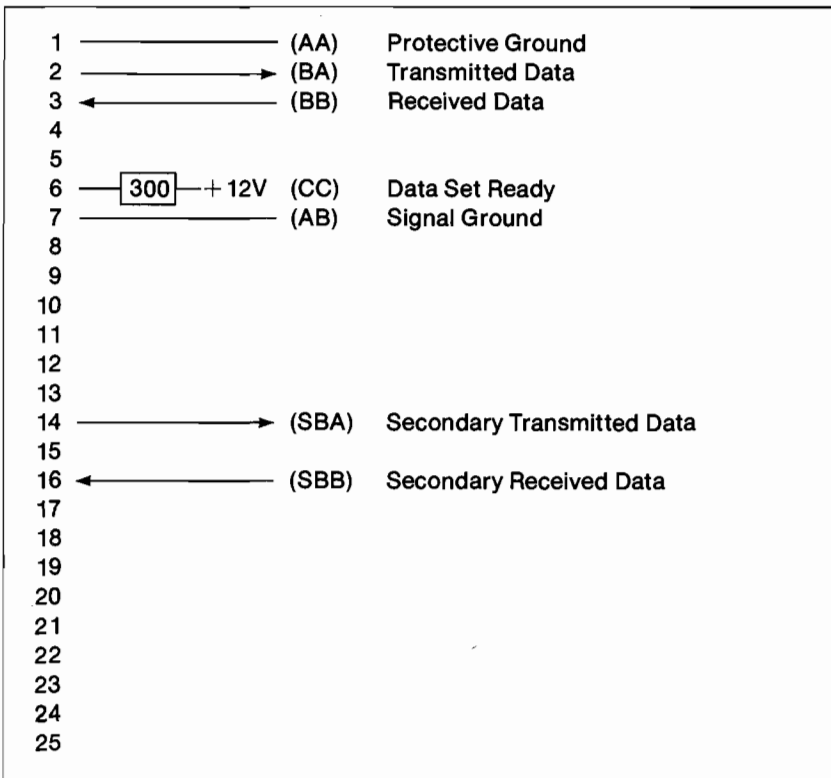
5-11. This instrument is equipped with a three-wire power cable. When connected to an appropriate ac power receptacle, this cable grounds the instrument cabinet. The type of power cable plug shipped with each instrument depends on the country of destination.

**5-12. INTERCONNECTIONS**

5-13. The RS-232 Fiber Optic multiplex communication system requires two 39301A's for system operation and should be connected together with Hewlett-Packard fiber optic cable and connectors.

**5-14. MATING CONNECTORS**

5-15. The RS-232 connectors on the 39301A are the standard 25 pin subminiature "D" type female with the pin configuration as shown in figure 5-1.



**FIGURE 5-1**  
**39301A CONNECTOR PIN ASSIGNMENTS**

## 5-16. **TERMINAL EQUIPMENT PROGRAMMING**

5-17. The 39301A as an extender interface for RS-232 signals appears as a modem connection and will extend a basic RS-232 three wire interface. The computer I/O should be configured for a three-wire hard wire connection and programmed for the terminal device which is being extended. The terminal device should be wired for a hard wire connection. If control signals are required, modifications may be made at the connector to provide the required signals. See Appendix D for connector wiring options and Appendix E for special RS-232 I/O cables.

## 5-18. **OPERATING ENVIRONMENT**

5-19. **Temperature.** The 39301A may be operated in temperatures from 0 degrees C to +55 degrees C.

5-20. **Humidity.** The multiplexer may be operated in environments with relative humidity up to 95%. However, the multiplexer should also be protected from temperature extremes which cause condensation within the instrument.

5-21. **Altitude.** The instrument may be operated at altitudes up to 4,600 metres (15,000 feet).

## 5-22. **INSTALLATION INSTRUCTIONS**

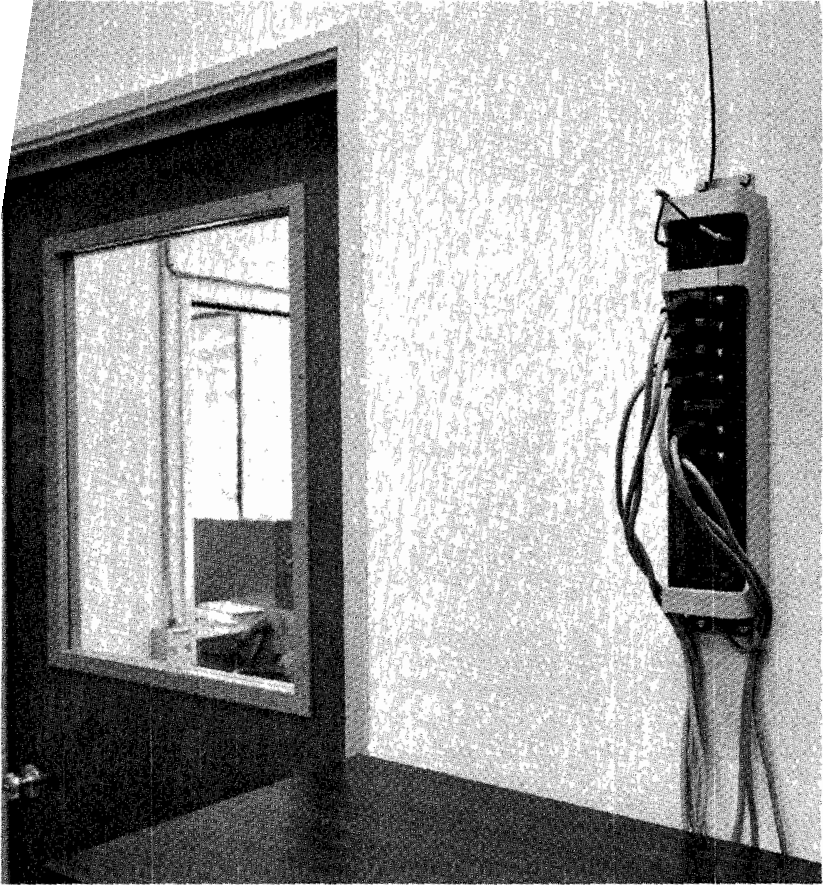
5-23. The HP 39301A may be rack or surface mounted with the standard mounting hardware. Optional mounting hardware available from Hewlett-Packard (Option 001) (HP Part No. 1600-1092) allows mounting as shown in figure 5-1 enabling the fiber optic connectors and cable and the RS-232 connector and cable to be rack mounted in a cabinet with a door closed and maintain the required bend radii of the cables.

## 5-24. **FIBER OPTIC CABLE INSTALLATION**

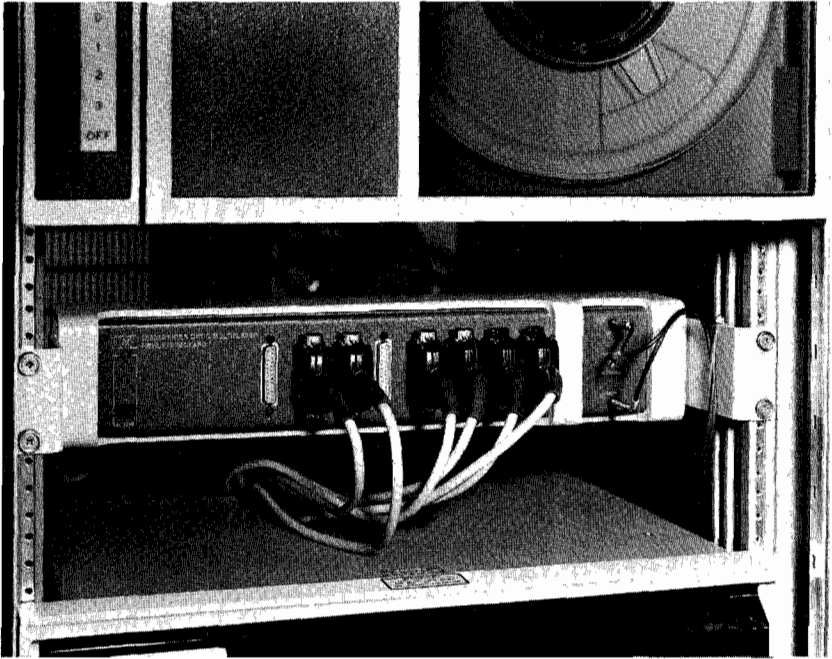
5-25. Refer to Appendix A for cable installation techniques.

## 5-26. **SITE PREPARATION**

5-27. The Hewlett-Packard 39301A RS-232 multiplexer must be rack mounted or surface mounted with the mounting flanges provided. For installation in an enclosed rack, optional extended mounting flanges are available. The optional extended mounting flanges recess the 39301A to provide the correct bend radii for the cables. Cable routing to protect the fiber cable will minimize the possibility of snagging and excessive bending which could break the glass fiber. Depending on the system reliability requirements and repair time requirements, spare fiber optic cables can be installed and used if the primary cables are broken. Also in conduit, junction boxes may be installed, terminating a main fiber optic cable and shorter fiber cables used to connect the 39301A to the junction box. This would limit the maximum cable distance to 600m. Thermal considerations must be considered when installing the 39301A in an existing enclosed rack so as to not obstruct the designed air flow patterns. Installation will require selection of the mounting hardware for the 39301A dependent on the material i.e., concrete, wood, or metal.



**FIGURE 5-2**  
**39301A SURFACE MOUNTING**



**FIGURE 5-3**  
**39301A RACK MOUNTING**

The 39301A is supplied with several voltage and power cord options for use in all countries. An ac power source should be located less than 2.3m (7.5 ft) from the 39301A. When using the recommended shielded RS-232 cables (see Appendix C) the DTE must be located within 5m (16 ft) of the 39301A. RS-232 specifications allow cables of lengths up to 15m (50 ft).

**5-28. STORAGE AND SHIPMENT**

**5-29. Environment**

5-30. The instrument may be stored or shipped in environments within the following limits:

- Temperature . . . . . - 40 degrees C to +75 degrees C.
- Humidity . . . . . Up to 95%
- Altitude . . . . . Up to 15,300m (50,000 ft)

The instrument should also be protected from temperature extremes which cause condensation within the instrument.

### 5-31. **Packaging**

5-32. **Tagging for Service.** If the instrument is being returned to Hewlett-Packard for service, please complete one of the blue repair tags supplied with the 39301A and attach it to the instrument.

5-33. **Original Packaging.** Containers and materials identical to those used in factory packaging are available through Hewlett-Packard offices. If the instrument is being returned to Hewlett-Packard for servicing, attach a tag indicating the type of service required, return address, model number, and full serial number. Also, mark the container FRAGILE to ensure careful handling. In any correspondence, refer to the unit by model number and full serial number.

5-34. **Other Packaging.** The following general instructions should be used for re-packing with commercially available materials:

a. Wrap instrument in heavy paper or plastic. (If shipping to Hewlett-Packard office or service center, attach tag indicating type of service required, return address, model number, and full serial number.)

b. Use strong shipping container. A double-wall carton made of 350-pound test material is adequate.

c. Use a layer of shock-absorbing material 70 to 100mm (3 to 4 inches) thick around all sides of the unit to provide firm cushioning and prevent movement inside container.

d. Seal shipping container securely.

e. Mark shipping container FRAGILE to ensure careful handling.

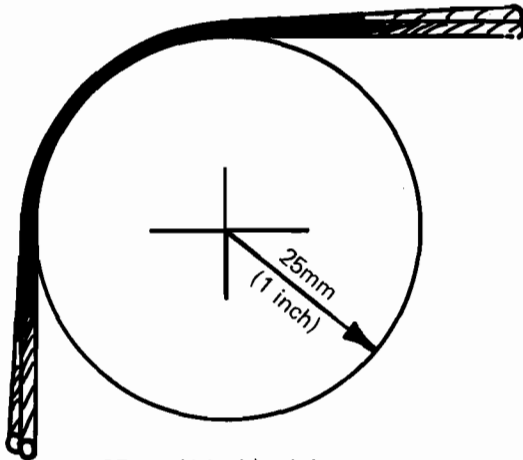
f. In any correspondence, refer to unit by model number and full serial number.

# FIBER OPTIC CABLE INSTALLATION

The following illustrations represent both physical limitations of fiber optic cable and suggested installation techniques.

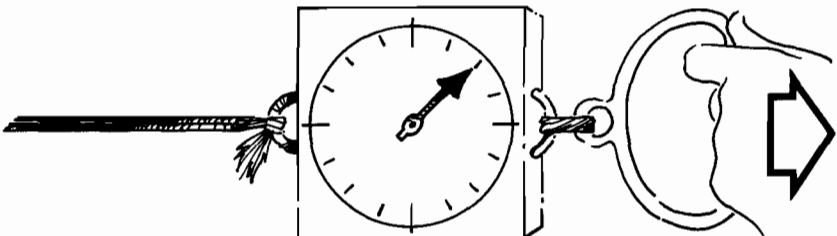
## DUPLEX FIBER OPTIC CABLE PHYSICAL LIMITS

### Bend Radius Limit



25mm (1 inch) minimum

### Pull Strength Limit



61 kg<sub>force</sub> (135 lb<sub>force</sub>) maximum



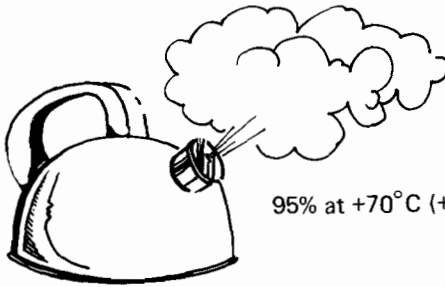
## Temperature Limits (Operating)

+70°C (+158°F)  
maximum



-20°C (-4°F)  
minimum

## Humidity



95% at +70°C (+158°F) maximum

# CONDUIT INSTALLATION

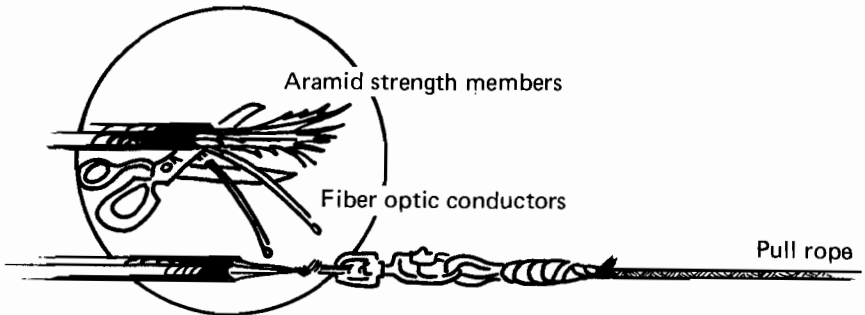
## Pull Head Attachment

### Connected Cable



- Use Kellems Fiber Optic Pulling Grip, Swivel Eye, Split Mesh, Part Number 033-29-003. [1]

### Unconnected Cable [2]



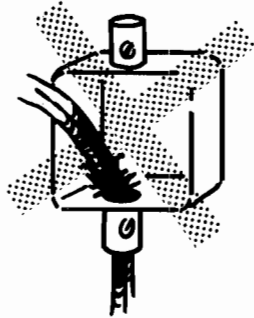
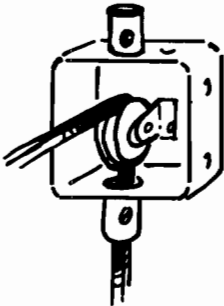
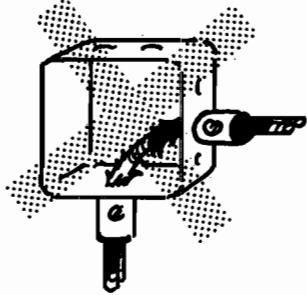
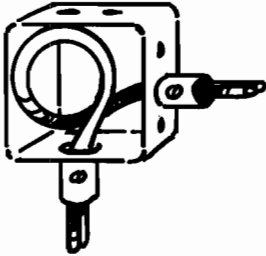
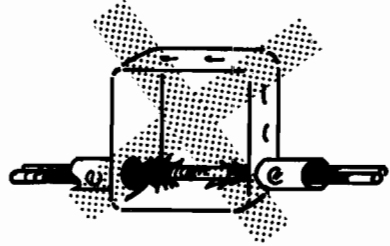
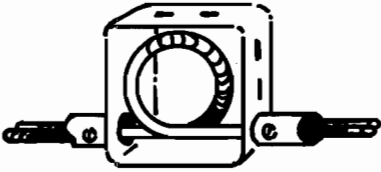
- Strip outer jacket.
- Cut back fiber optic conductors.
- Tie swivel to aramid strength members.

#### Notes:

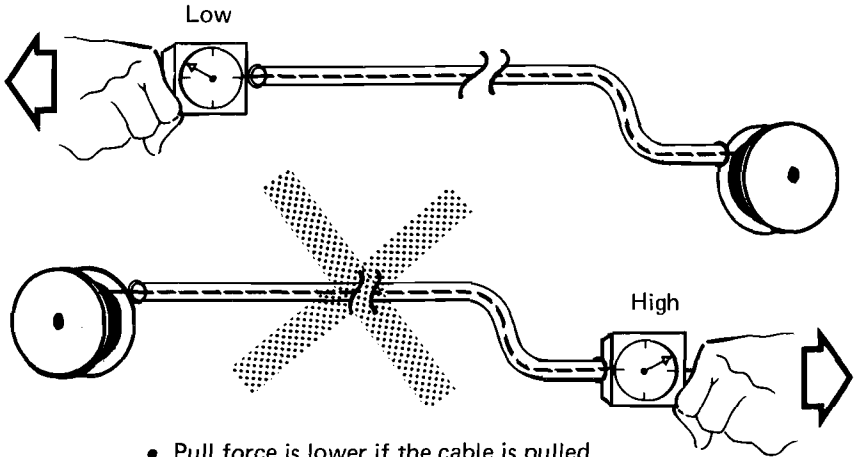
1. Ordering information available through:  
Harvey Hubbell Corporation  
Stonington, CT 06378  
(203)535-1250
2. An alternative is to use Kellems Pulling Grip, part number 033-29-1007.

## Junction Boxes

- Plan sufficient junction boxes to reduce pulling force through bends.
- Allow slack in junction boxes to reduce cable tension.
- Don't pull against sharp corners.



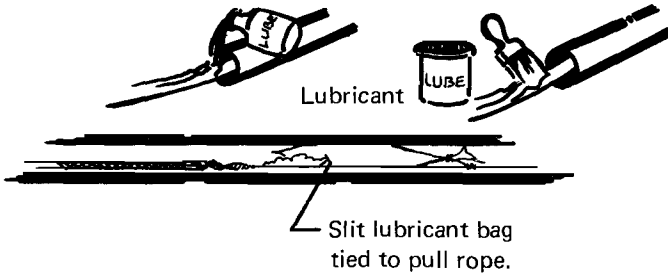
## Pull Direction



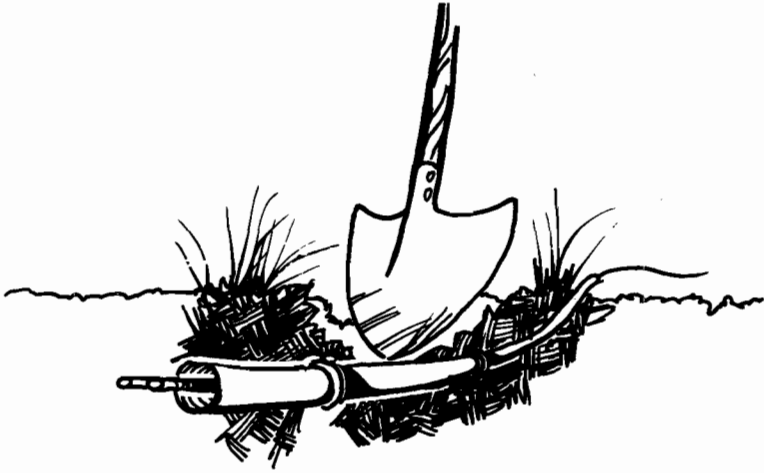
- Pull force is lower if the cable is pulled through conduit bends before going through straight part of conduit.

## Lubricants

- Use lubricants only for difficult pulls.



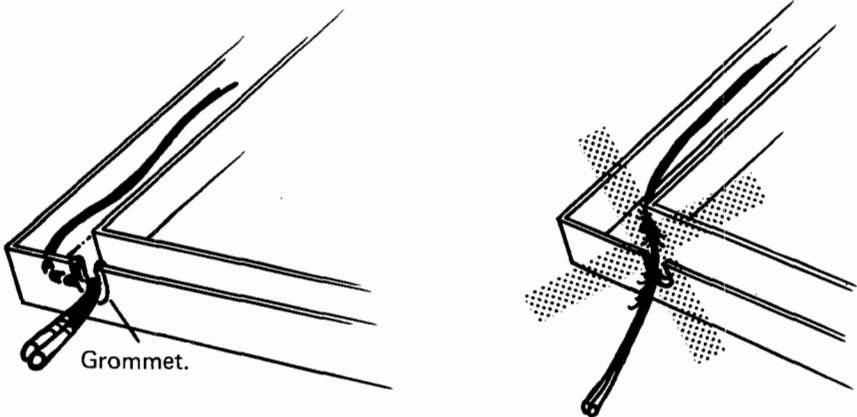
## Underground



- Underground cable installations require a duct for protection against water, temperature and mechanical stress.

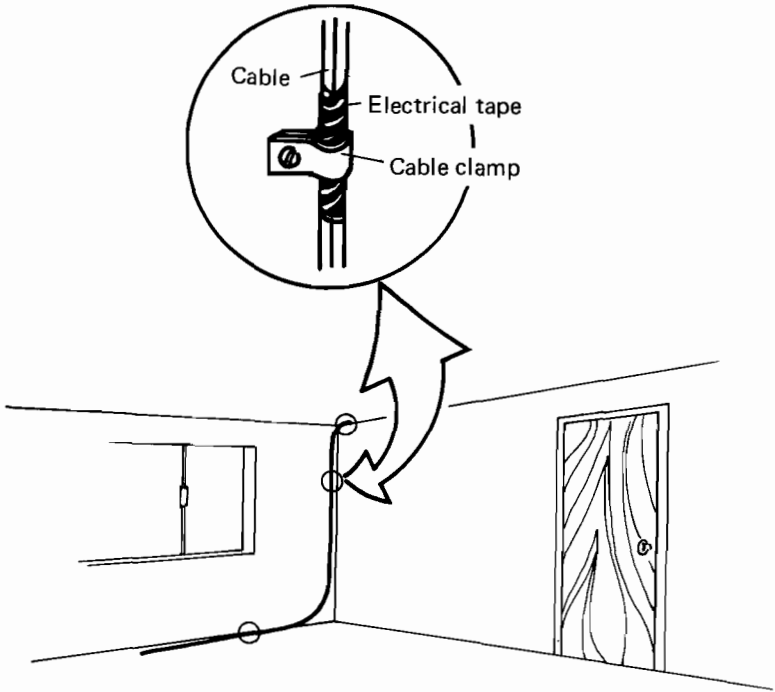
## NON-CONDUIT INSTALLATIONS

### Cable Trays

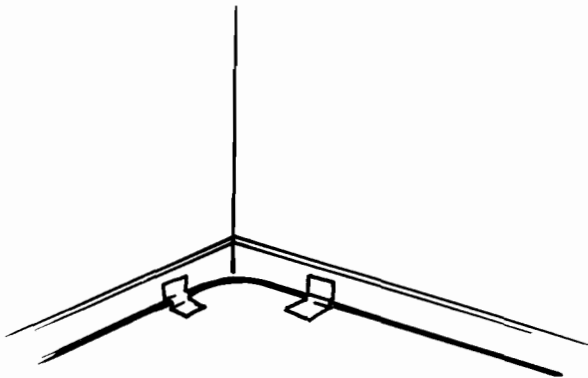


- Fiber optic cable installed in cable trays should be protected from sharp edges and tight bends.

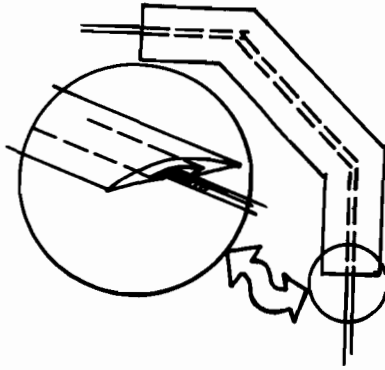
## Office Environment



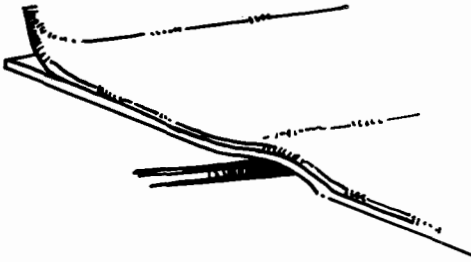
- Support fiber optic cable in vertical installations.



- Tape corners.



- Mitre floor ducts.



- No special precautions for installations under carpets.

## PARTS LISTS-REPAIR/REPLACEMENT

Appendix B lists the replaceable parts for the HP 39301A RS-232 Fiber Optic Multiplexer. The following section is in two parts: the replaceable subassemblies; and the replaceable mechanical parts.

The replaceable subassemblies for the 39301A are listed in Table 6-1.

**TABLE 6-1**

**39301A REPLACEMENT SUBASSEMBLIES**

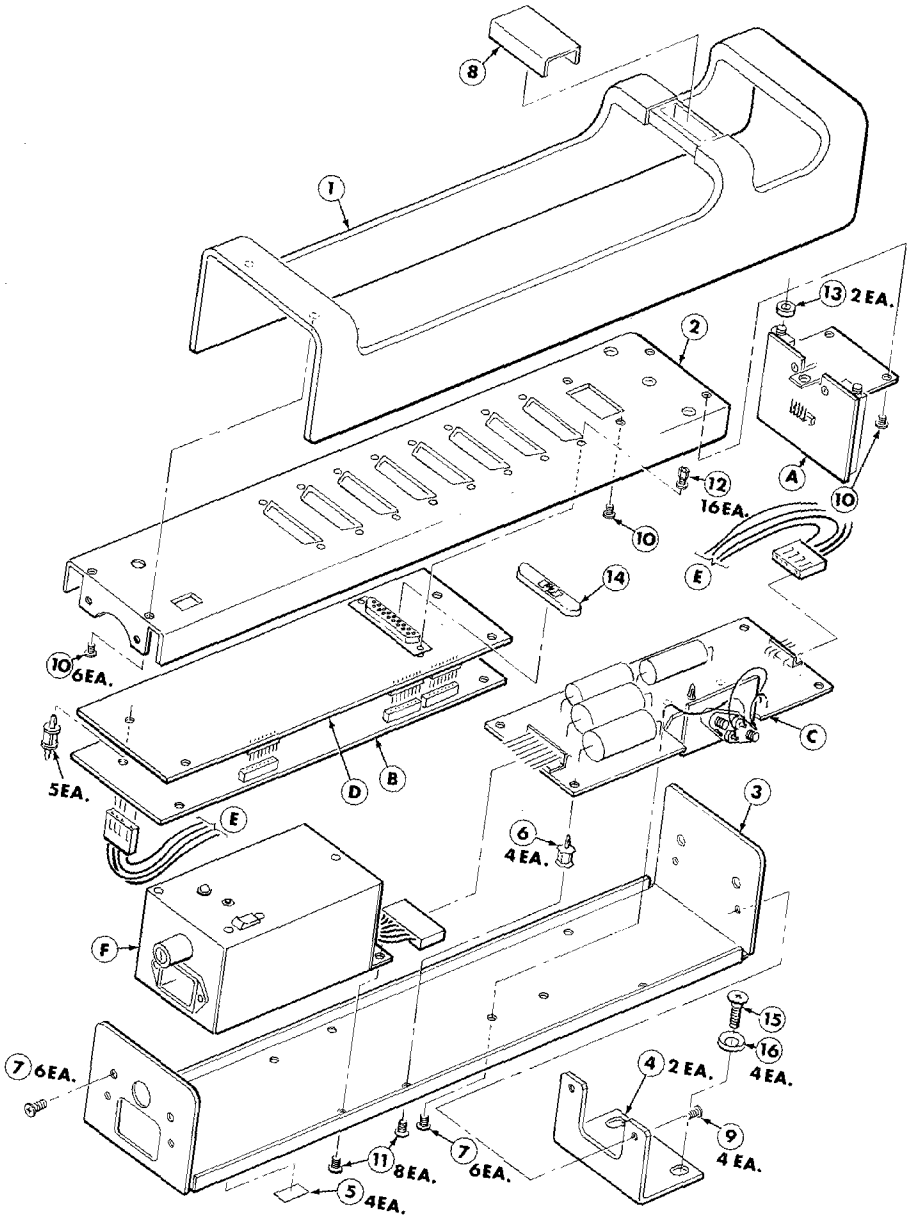
<b>Ref.Designation</b>	<b>Modules</b>	<b>Number</b>
A	Fiber Optic Transmitter/Receiver Board	39301-68003
B	Multiplexer Board	39301-68001
C	Power Supply Board (inc. +5V Regulator)	39301-68004
D	Connector Board	39301-68002
E	Power Harness	39301-68009
F	Power Supply Module 100V	39301-68005
	120V	39301-68006
	220V	39301-68007
	240V	39301-68008



Table 6-2 lists the parts used in the 39301A.

**TABLE 6-2**  
**39301A REPLACEABLE MECHANICAL PARTS**

Ref. Designation	HP Part No.	Qty.	Description
1.	5040-9951	1	Molded Cover
2.	39301-00002	1	Panel Connector
3.	39301-00003	1	Chassis-Main
4.	1600-1090	2	Bracket-Mounting (Rack mount bracket)
5.	0403-0267	4	Feet, Adhesive
6.	0380-1218	4	Standoffs .375" high
7.	2200-0599	6	Screw, 4-40 Blk Ox. 82 deg.
8.	1600-1089	1	Cover-Snap-On
9.	2360-0113	4	Screw 6-32 x .250" P.H.
10.	2200-0139	6	Screw 4-40 x .250" P.H.
11.	2360-0463	8	Screw 6-32 x .312" Blk Ox. 82 deg.
12.	0380-1436	16	Screw Lock Assembly
13.	8160-0376	2	Shield Mesh Washer
14.	5040-9956	8	Dust Cap
15.	2680-0119	4	Rack Mount Screws (10-32)
16.	3050-0007	4	Rack Mount Washer Cup
	1600-1092	2	Recessed Rack Mount Bracket (optional)
	8120-3570	2	RS-232 Loopback Hood (optional)

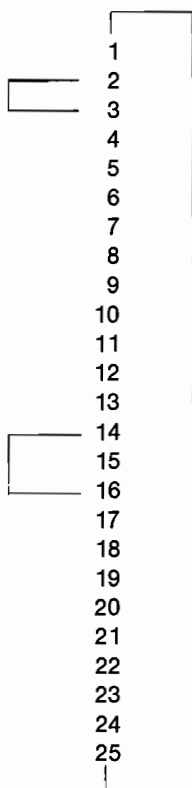


**FIGURE 6-1**  
**39301A EXPLODED VIEW**



**RS-232 LOOPBACK HOOD**

**8120-3570**



RS-232 Male Connector

## HEWLETT-PACKARD INTERFACE CABLES

### TERMINAL INTERFACE CABLE GUIDE

Terminal	Interface Cable to 39301A		
HP-264X	13232 M	(5061-2409)	4.5m (15 ft)
HP-262X or	13222 M	(13222-60002)	5m (16.7 ft)
	13222 Y	(13222-60005)	5m (16.5 ft)

### CONFIGURATION INFORMATION

Refer to the HP-3000 Computer Systems, System Manager/System Supervisor Reference Manual (3000 - 90014) for further information on configuring asynchronous devices connected to the multiplexer.

### COMPUTER INTERFACE CABLE GUIDE

Computer	I/O	Interface Cable to 39301A	
HP-3000	ATC	13242 G	5m (16 ft)
	ADCC	13242 G	5m (16 ft)
	ATP	13242G (modem)	5m (16 ft)
13242 X (direct)		5m (16 ft)	

Consult the Hewlett-Packard HP-3000 Computer Systems Configuration Guide for interconnecting cables to other Hewlett-Packard terminal equipment.

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# HEWLETT-PACKARD RS-232 CABLE INTERCONNECT DIAGRAMS

## HP-3000 COMPUTER WITH ATP

DTE	CABLE		DCE
HP-3000 ATP Modem Connect	13242 G		39301A
Protective Ground	1 ————— 1	AA	Protective Ground
Data In	2 ←————→ 2	BA	Transmitted Data
Data Out	3 ————— 3	BB	Received Data
	4 ————— 4		
	5 ————— 5		
	6 ————— 6	CC	Data Set Ready
Signal Ground	7 ————— 7	AB	Signal Ground
	8 ————— 8		
	9 ————— 9		
	10 ————— 10		
	11 ————— 11		
	12 ————— 12		
	13 ————— 13		
	14 ————— 14	SBA	Secondary Transmitted Data
	15 ————— 15		
	16 ————— 16	SBB	Secondary Received Data
	17 ————— 17		
	18 ————— 18		
	19 ————— 19		
	20 ————— 20		
	21 ————— 21		
	22 ————— 22		
	23 ————— 23		
	24 ————— 24		
	25 ————— 25		

### CONFIGURATION INFORMATION

All multiplex supports are direct-connect (hardwired) and therefore should be configured as subtype "0" (direct-connect, speed sensed).

Refer to the HP-3000 Computer Systems, Systems Manager/Systems Supervisor Reference Manual (3000-90014) for further information on configuring asynchronous devices connected to the multiplexer.

## HP-3000 COMPUTER WITH ATP

DTE HP-3000 ATP Direct Connect Type 232	CABLE 13242 X	DCE 39301A
Case	A ————— 1	AA Protective Ground
Data Out	B ————— 2	BA Transmitted Data
Data In	C ————— 3	BB Received Data
Signal Ground	D ———— 4	
	5	
	6	CC Data Set Ready
	7	AB Signal Ground
	8	
	9	
	10	
	11	
	12	
	13	
	14	SBA Secondary Transmitted Data
	15	
	16	SBB Secondary Received Data
	17	
	18	
	19	
	20	
	21	
	22	
	23	
	24	
	25	

### CONFIGURATION INFORMATION

All multiplex supports are direct-connect (hardwired) and therefore should be configured as subtype "0" (direct-connect, speed sensed).

Refer to the HP-3000 Computer Systems, Systems Manager/Systems Supervisor Reference Manual (3000-90014) for further information on configuring asynchronous devices connected to the multiplexer.

## HP-3000 COMPUTER WITH ADCC

DTE	CABLE		DCE
HP-3000 ADCC	13242 G		39301A
Protective Ground	1 ————— 1	AA	Protective Ground
Data In	2 ←————→ 2	BA	Transmitted Data
Data Out	3 ————— 3	BB	Received Data
	4 ————— 4		
	5 ————— 5		
	6 ————— 6	CC	Data Set Ready
Signal Ground	7 ————— 7	AB	Signal Ground
	8 ————— 8		
	9 ————— 9		
	10 ————— 10		
	11 ————— 11		
	12 ————— 12		
	13 ————— 13		
	14 ————— 14	SBA	Secondary Transmitted Data
	15 ————— 15		
	16 ————— 16	SBB	Secondary Received Data
	17 ————— 17		
	18 ————— 18		
	19 ————— 19		
	20 ————— 20		
	21 ————— 21		
	22 ————— 22		
	23 ————— 23		
	24 ————— 24		
	25 ————— 25		

### CONFIGURATION INFORMATION

All multiplex supports are direct connect (hardwired) and therefore should be configured as subtype "0" (direct connect, speed sensed) or subtype "4" (direct connect, speed specified).

Refer to the HP-3000 Computer Systems, System Manager/System Supervisor Reference Manual (3000 - 900 14) for further information on configuring asynchronous devices connected to the multiplexer.



## HP-3000 COMPUTER WITH ATC

DTE HP-3000 ATC	CABLE 13242 G		DCE 39301A
Protective Ground	1 ————— 1	AA	Protective Ground
Data In	2 ←————→ 2	BA	Transmitted Data
Data Out	3 ————— 3	BB	Received Data
	4 ————— 4		
	5 ————— 5		
	6 ————— 6	CC	Data Set Ready
Signal Ground	7 ————— 7	AB	Signal Ground
	8 ————— 8		
	9 ————— 9		
	10 ————— 10		
	11 ————— 11		
	12 ————— 12		
	13 ————— 13		
	14 ————— 14	SBA	Secondary Transmitted Data
	15 ————— 15		
	16 ————— 16	SBB	Secondary Received Data
	17 ————— 17		
	18 ————— 18		
	19 ————— 19		
	20 ————— 20		
	21 ————— 21		
	22 ————— 22		
	23 ————— 23		
	24 ————— 24		
	25 ————— 25		

### CONFIGURATION INFORMATION

All multiplex supports are direct connect (hardwired) and therefore should be configured as subtype "0" (direct connect, speed sensed) or subtype "4" (direct connect, speed specified).

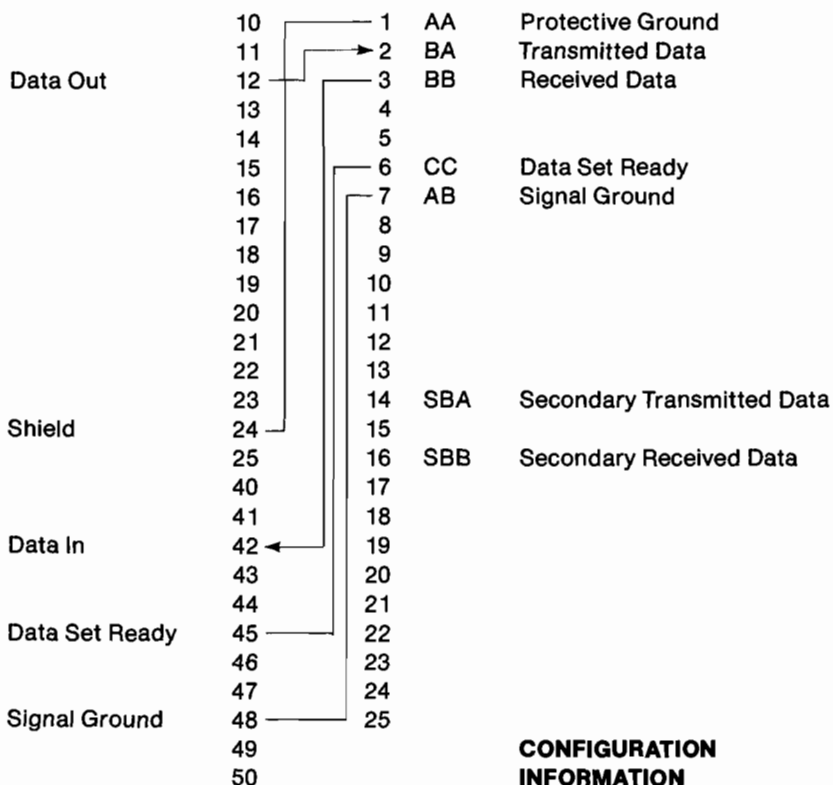
Refer to the HP-3000 Computer Systems, Systems Manager/System Supervisor Reference Manual (3000 - 90014) for further information on configuring asynchronous devices connected to the multiplexer.

**TERMINAL INTERFACE CABLE**  
**(active interconnects only)**

13222 M (13222-60002)

50 pin male connector

25 pin male connector



**TERMINAL INTERFACE CABLE**  
**(active interconnects only)**

13232 M (5061-2409)

HP-264X

39301A

Card Edge Connector

25 pin male connector

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Shield	A	1	AA	Protective Ground
Data Out	B	2	BA	Transmitted Data
Data In	C	3	BB	Received Data
	D	4		
	E	5		
Data Set Ready	F	6	CC	Data Set Ready
Signal Ground	H	7	AB	Signal Ground
	J	8		
	M	9		
	N	10		
	P	11		
	R	12		
	S	13		
	12	14	SBA	Secondary Transmitted Data
	13	15		
	14	16	SBB	Secondary Received Data
		17		
		18		
		19		
		20		
		21		
		22		
		23		
		24		
		25		

**CONFIGURATION INFORMATION**

## SPECIAL RS-232 CABLE INTERCONNECT DIAGRAMS

### ASYNCHRONOUS DATA TRANSMISSION

DTE	CABLE		DCE
Male	13242 M		39301A
Protective Ground	1 ————— 1	AA	Protective Ground
Data Out	2 —————> 2	BA	Transmitted Data
Data In	3 <———— 3	BB	Received Data
	4 ————— 4		
	5 ————— 5		
Data Set Ready	6 ————— 6	CC	Data Set Ready
Signal Ground	7 ————— 7	AB	Signal Ground
	8 ————— 8		
	9 ————— 9		
	10 ————— 10		
	11 ————— 11		
	12 ————— 12		
	13 ————— 13		
	14 ————— 14	SBA	Secondary Transmitted Data
	15 ————— 15		
	16 ————— 16	SBB	Secondary Received Data
	17 ————— 17		
	18 ————— 18		
	19 ————— 19		
	20 ————— 20		
	21 ————— 21		
	22 ————— 22		
	23 ————— 23		
	24 ————— 24		
	25 ————— 25		

#### CONFIGURATION INFORMATION

Configure terminal for hardwire operation.

NOTE: DTE may require pins 2 and 3 of cable crossed if DTE Data Out is on pin 3. (see cable 13242 G)

## ASYNCHRONOUS DATA TRANSMISSION

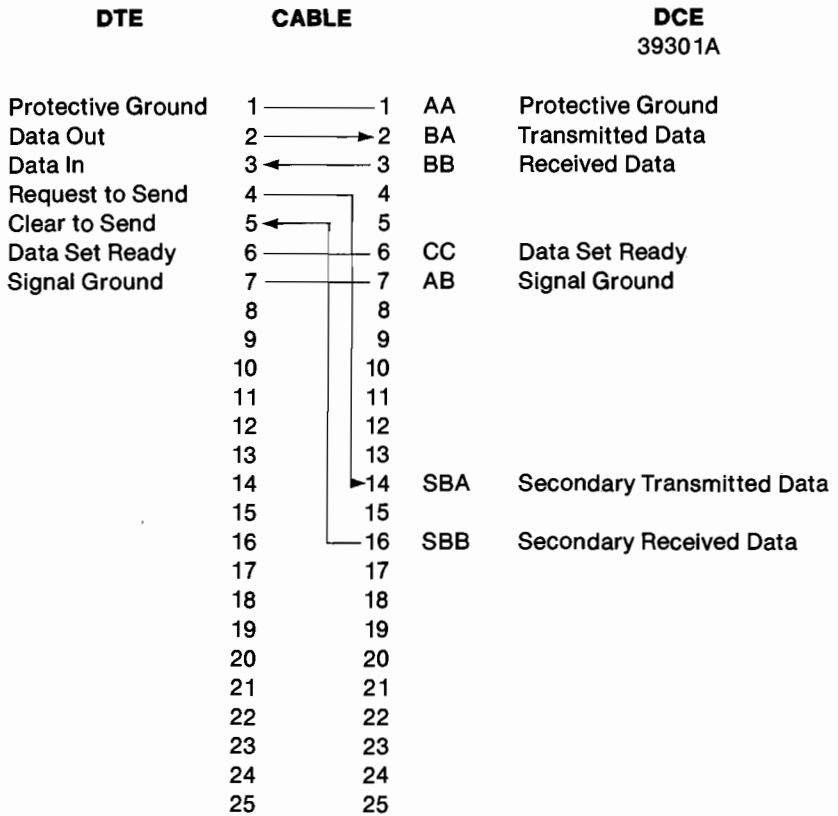
DTE Male	CABLE 13242 G	DCE 39301A Male
Protective Ground	1 ————— 1	AA Protective Ground
Data IN	2 ←————→ 2	BA Transmitted Data
Data OUT	3 ————— 3	BB Received Data
	4 ————— 4	
	5 ————— 5	
Data Set Ready	6 ————— 6	CC Data Set Ready
Signal Ground	7 ————— 7	AB Signal Ground
	8 ————— 8	
	9 ————— 9	
	10 ————— 10	
	11 ————— 11	
	12 ————— 12	
	13 ————— 13	
	14 ————— 14	SBA Secondary Transmitted Data
	15 ————— 15	
	16 ————— 16	SBB Secondary Received Data
	17 ————— 17	
	18 ————— 18	
	19 ————— 19	
	20 ————— 20	
	21 ————— 21	
	22 ————— 22	
	23 ————— 23	
	24 ————— 24	
	25 ————— 25	

### CONFIGURATION INFORMATION

Configure terminal for hardwire operation.

NOTE: DTE may not require pins 2 and 3 of cable crossed if DTE Data Out is on pin 2. (see cable 13242 M)

## ASYNCHRONOUS DATA WITH HANDSHAKING TRANSMITTED

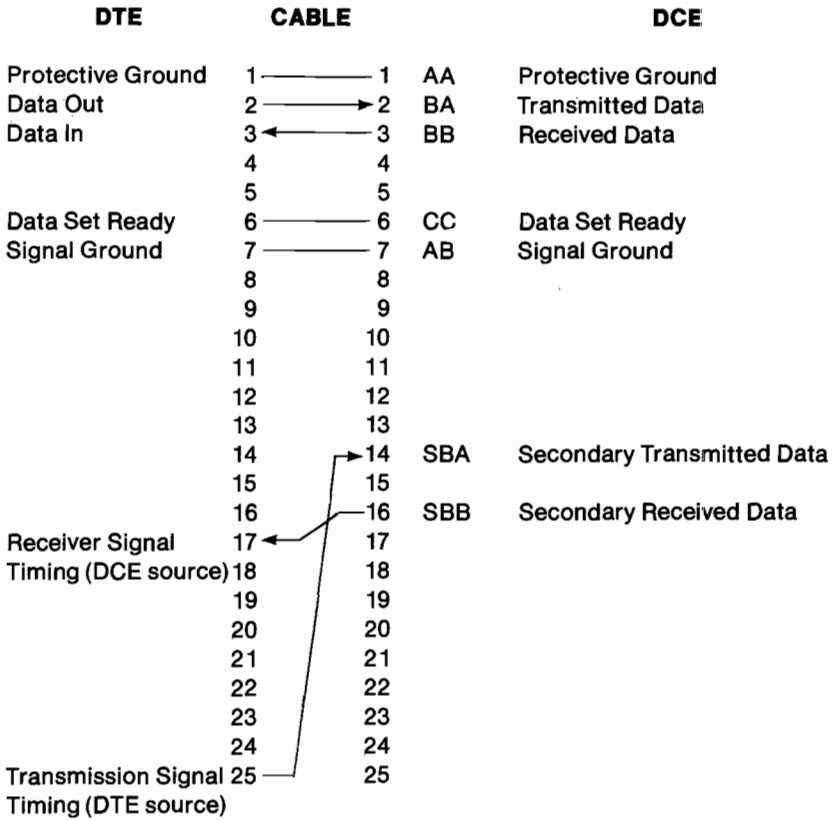


### CONFIGURATION INFORMATION

NOTE: DTE may require pins 2 and 3 of cable to be crossed if DTE Data Out is on pin 3.



## SYNCHRONOUS CLOCK AND DATA TRANSMISSION



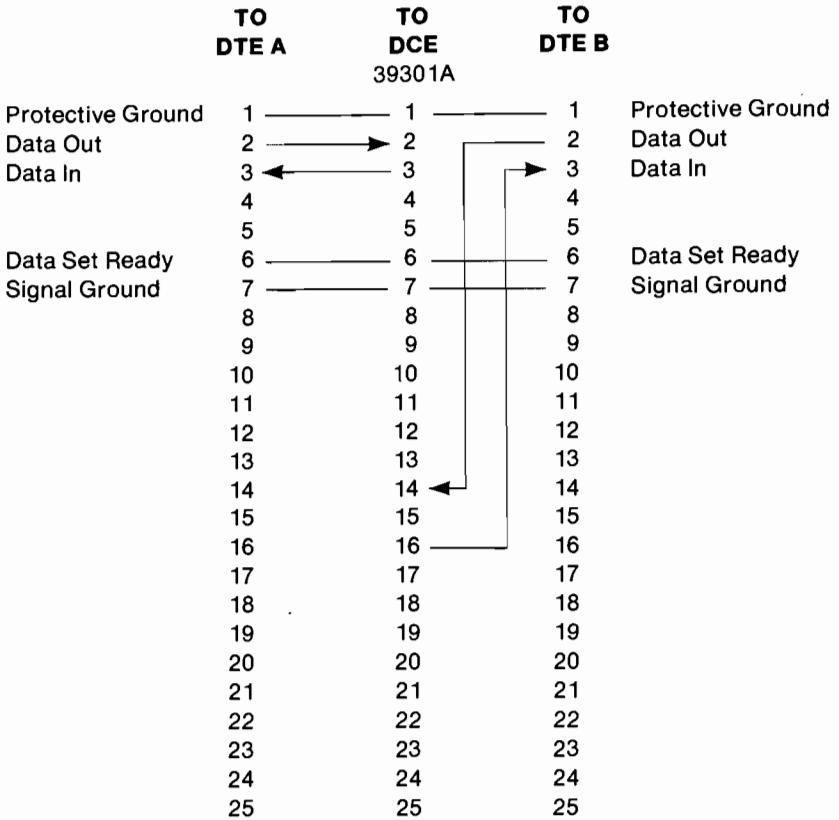
### CONFIGURATION INFORMATION

Recommended maximum clock frequency for synchronous operation is 20 kHz.

NOTE: DTE may require pins 2 and 3 of cable to be crossed if Data Out is on pin 3.

**SECONDARY 39301A CHANNELS PROVIDE A 16 CHANNEL MULTIPLEXER**

**CABLE**  
8120-3569



**CONFIGURATION  
INFORMATION**

The "Y" cable adapter has a male RS-232 connector that plugs into the 39301A and two female connectors at the DTE interface.



