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4923
DIGITAL CARTRIDGE TAPE RECORDER

USER'S MANUAL

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Fig. 1-1. 4923 Digital Cartridge Tape Recorder.

Section 1

DESCRIPTION

ABOUT THIS MANUAL

This manual provides the information necessary for the operator to install and operate the 4923 Digital Cartridge Tape Recorder unit. The manual is divided into three sections, as follows. Section 1 provides a general overview of the 4923, describes its characteristics and features, and details the differences between instrument configurations. Section 2 contains installation instructions, operating instructions, and familiarization procedure. Section 3 provides technical information, such as line voltage selection procedures, strappable option selection, and a description of the self-test feature.

No servicing information is provided in this manual. For information on servicing, refer to the optional 4923 Digital Cartridge Tape Recorder Service Manual (070-1909-00).

INTRODUCTION

The 4923 (Fig. 1-1) is a Digital Cartridge Tape Recorder unit. It provides the capability for local storage of digitally-recorded data by recording that data on a 3M® DC-300A Data Cartridge. Information may be recorded from a computer and/or a terminal.

All basic tape operations are controlled from a single row of pushbuttons on the front panel of the unit. In addition, Start and Stop Read Commands (DC1 and DC3, respectively) may be issued from the computer, the terminal, or on the tape (in the case of the DC3). Operation is described in Section 2; the front panel controls are described later in this section.

STANDARD ACCESSORIES

The following standard accessories are included with the 4923:

Users Manual 070-1908-01

3M® DC-300A Data Cartridge (1)

OPTIONAL ACCESSORIES

The following optional accessories are available for the 4923:

Service Manual 070-1909-00

Additional Data Cartridges
(package of 5) 119-0680-01

4923 CONFIGURATIONS

There are two basic configurations for the 4923 unit; the standard configuration (4010-series terminal based) and Option 1 (RS-232-C). This manual documents both instruments, since most operations are identical in both versions. When any detail of the unit applies to only one version (such as installation instructions), it will be noted in the text.

The "standard" 4923 interfaces directly to any 4010-series terminal through the terminal minibus; data is then routed through the minibus to the modem/computer with or without local display. Control of the Local/Line function is assumed by the terminal's LOCAL/LINE switch.

The 4923 Option 1 contains an interface for RS-232-C devices, with connections provided for a terminal and for a modem/computer. In the Option 1 configuration, control of the Local/Line function is provided by a button on the front panel. Note, however, that if the terminal also has a Local/Line control, both the terminal and the 4923 must be in the On Line position in order to be On Line, but only the 4923 need be in the LOCAL position for both the terminal and the 4923 to be in Local. It is therefore recommended that the terminal's control be left in the On Line position, leaving Local/Line control to the 4923.

The positions occupied by the 4923 in these two configurations are illustrated in Fig. 1-2.

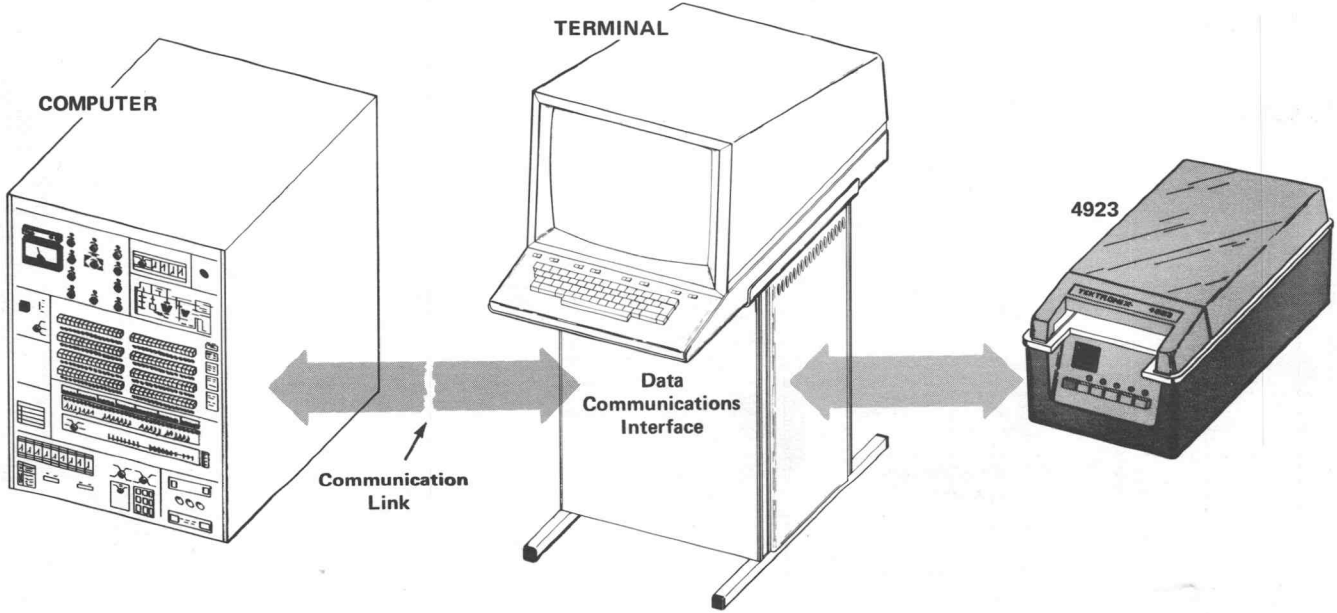

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Fig. 1-2a. Standard 4923 position in a system.

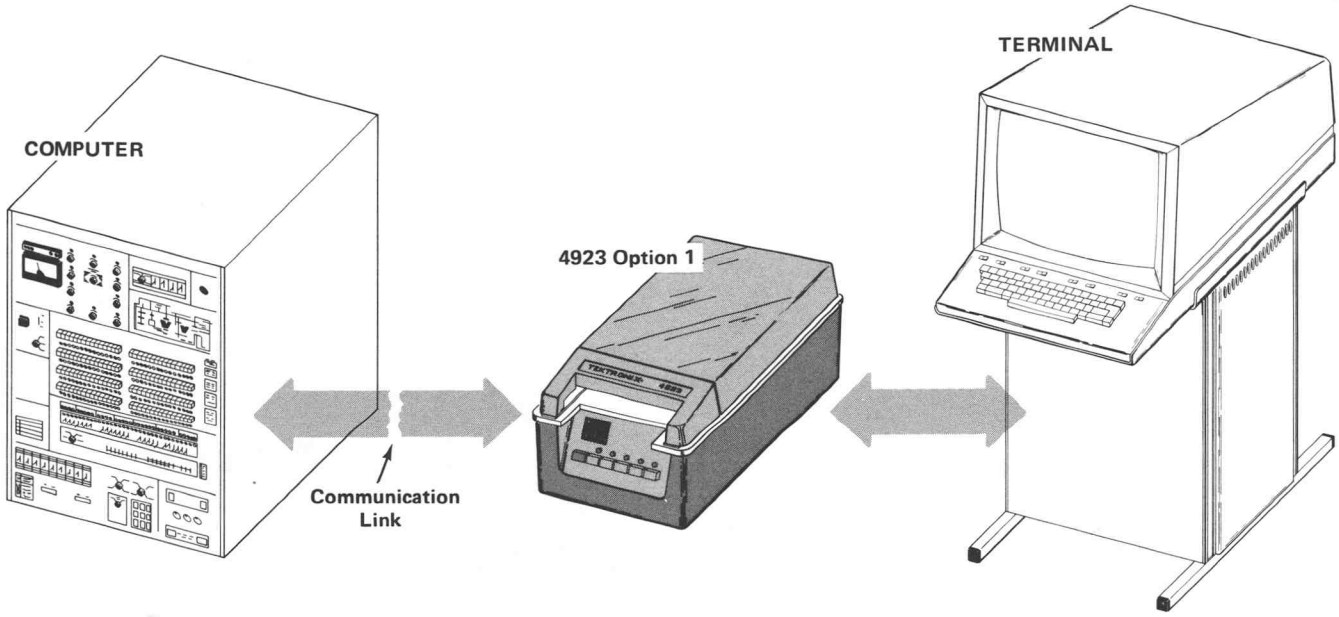

Fig. 1-2b. 4923 Option 1 position in a system.

MANUAL CONTROLS AND INDICATORS

There are six functional controls on the front panel, in addition to the POWER switch. The functions initiated by the controls are described in further detail in the Operation section. In addition, there are five indicators (LEDs), and a baud rate control on the back panel of the Option 1 unit only. The control panel is shown in Fig. 1-3; the functions of the controls and indicators are as follows:

POWER Switch

The POWER switch is located on the front panel and is used to apply power to the tape unit logic, transport control, and interface.

NOTE

On the standard 4923, terminal power must be applied prior to the 4923 power, to ensure microprocessor initialization.

RUN Control

A single momentary push of the RUN button places the 4923 in the Read Enable state, allowing it to respond to a DC1 (or another push) as a Start Read command. The unit reads until a DC3 is encountered, then waits for another Start Read command. If the RUN button is held down, the unit reads continuously as long as it is held (until the end of the file), ignoring DC3's.

It is also necessary to press the RUN control while holding the WRITE control, in order to initiate a Write Operation.

Pushing the RUN control when a blank tape area is encountered (at the end of the written data area) will cause a momentary forward motion, then a return to the end of the last file.

READ Indicator

The READ indicator (above the RUN button) illuminates during a Read Operation.

WRITE Control

The WRITE contol is held down while the RUN button is pressed in order to initiate a Write Operation.

WRITE Indicator

The WRITE indicator (above the WRITE button) illuminates during a Write Operation.

Fig. 1-3. 4923 Controls and Indicators. The 4923 Option 1 is shown; note that the ON LINE button is replaced by the BINARY button in the Standard unit.

STOP Control

When pressed, the STOP control causes any tape operation in progress to cease.

READY Indicator

The READY indicator (above the STOP button) illuminates when the tape unit is in the Stop state, and is ready to undertake another operation. The READY indicator (alone) should illuminate when power is applied.

FORWARD Control

A single momentary push of the FORWARD control initiates the Skip Forward function, which causes the unit to skip over one file at 30 inches per second. If the button is held pressed for approximately 1 second, the unit enters Fast Forward mode (90 inches per second) and winds until the end of the usable tape space is reached, or until the STOP button is pressed, whichever occurs first.

FORWARD Indicator

The FORWARD indicator illuminates during either type of Forward operation.

REVERSE Control

A single momentary push of the REVERSE control initiates the Skip Reverse function, which causes the unit to skip backward over one file at 30 inches per second. If the button is held pressed for approximately 1 second, Fast Reverse (Rewind) mode begins, causing the tape to rewind at 90 inches per second until the beginning of the usable tape space is reached, or until the STOP button is pressed, whichever occurs first.

REVERSE Indicator

The REVERSE indicator illuminates when either type of Reverse operation is in progress.

ON LINE Control (Option 1 Only)

This button controls whether the RS-232-C interface is on line to the computer (button depressed), whether it is operating locally, or with the terminal only.

BINARY Control (Standard Configuration Only)

In the READ Mode, this switch suppresses the detection of DC1, DC3, and NUL characters when the BINARY switch is depressed. (All data is transferred without decoding; DC1 will not start the tape, nor will DC3 stop the tape.) In Read mode, the Read Enable state is eliminated.

BAUD RATE Controls (Option 1 Only)

The BAUD RATE control applies to the Option 1 only, and is located on the back panel. (Back panel controls are shown in Fig. 1-4a.) The inner (smaller) knob selects the rate at which data is transferred to and from the modem, and from the terminal. The other (larger) knob selects the data transfer rate from the 4923 to the terminal only, independent of the other three paths. The rate to the terminal may be set higher than the other rates; it must be set to at least the same rate. Selectable data transfer rates are 110, 150, 300, 600, 1200, 2400, 4800, or 9600 baud.

LOCAL ECHO/TEST/COMPUTER ECHO Switch

This switch (Option 1 only, located on the back panel) determines whether echo to the terminal will be supplied by the computer or the 4923 interface. The TEST position of the switch enables the 4923's self-test feature. The self-test feature is detailed in Section 3 of this manual.

TEST/OPERATE (Standard Configuration Only)

On standard (terminal interface) 4923's, this switch has the same function as the TEST position of the LOCAL ECHO/TEST/COMPUTER ECHO switch, enabling the self-test feature. The self-test feature is detailed in Section 3 of this manual. The switch is located on the back panel (Fig. 1-4b.)

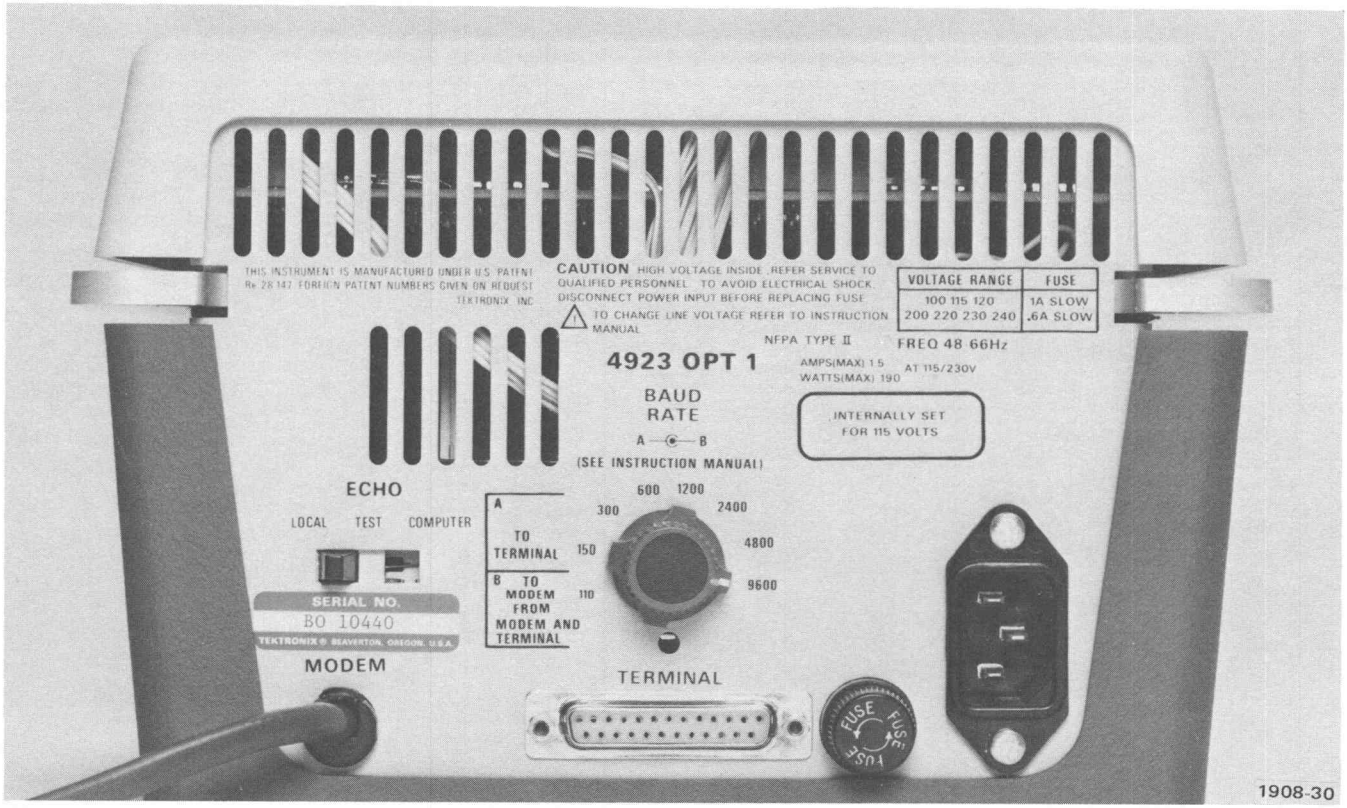

Fig. 1-4a. Option 1 back panel controls.

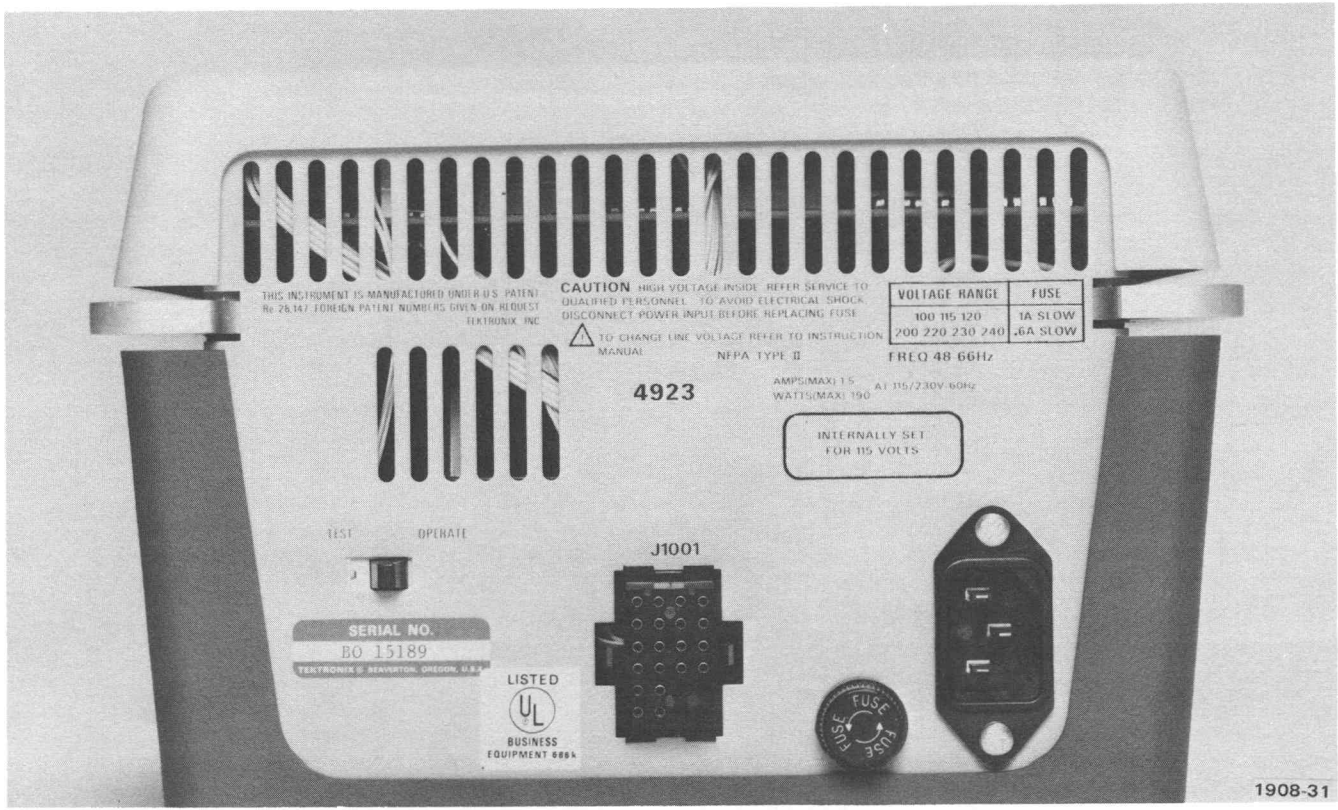

Fig. 1-4b. Standard version back panel.

Table 1-1

RECORDING FORMAT	
Character Format	8-bit serial with lsb (least significant bit) first, msb (most significant bit) last.
Characters per Record	128 8-bit bytes.
Records per File	Variable. The file length is the number of Records between the start of the Write Operation and the time when the STOP button is pressed, or End of Tape.
Characters per Cartridge	200,000 characters, nominal.
Tracks	Two data tracks (1's and 0's), combined into one data channel.
Head type	Single Read/Write Head.

Recording Format

The format used by the 4923 to record data onto the tape and read data from the tape is detailed in Table 1-1.

Drive Characteristics

The characteristics of the tape drive are detailed in Table 1-2.

Table 1-2

DRIVE CHARACTERISTICS	
Drive Speed: Normal	30 inches per second.
Fast Forward/ Rewind	90 inches per second.
Drive Type	Servo-controlled dc motor with tachometer.
Drive Method	Single capstan drive against capstan drive roller.

Cartridge Characteristics

The characteristics of the digital tape cartridge used in the 4923 are described in Table 1-3.

Table 1-3

CARTRIDGE CHARACTERISTICS

Cartridge Type	3M® DC-300A Data Cartridge (or equivalent).
Weight	8 ounces.
Cartridge Dimensions (outside)	4 inches by 6 inches by 0.665 inches.
Tape Length (usable storage)	300 feet.
Position Markers (light sensing holes)	EOT (End of Tape. BOT (Beginning Of Tape). Load Point. Early Warning.
Write-Protection	A screwdriver-activated cylinder prevents writing to the tape when the arrow points to the SAFE marker.

Physical Dimensions

The physical dimensions of the 4923 Digital Cartridge Tape Recorder unit are listed in Table 1-4.

Table 1-4

PHYSICAL DIMENSIONS

Width	8.75 inches
Depth	17.25 inches
Height	6 inches
Weight	17 pounds

Environmental Specifications

The environmental parameters for the 4923 are listed in Table 1-5. The parameters for the cartridge are listed separately, in Table 1-6.

Table 1-5

4923 ENVIRONMENTAL SPECIFICATIONS	
Temperature	
Operating (with tape)	10° C (50° F) to 40° C (104° F)
Storage (without tape)	−40° C (−40° F) to +65° C (149° F)
Altitude	
Operating	Up to 15,000 feet
Storage	Up to 50,000 feet
Humidity	20% to 80%, NON-CONDENSING

Table 1-6

CARTRIDGE ENVIRONMENTAL SPECIFICATIONS	
Temperature	
Operating and Storage with data	+5° C (41° F) to +45° C (113° F)
Transportation	−40° C (−40° F) to +45° C (113° F)
Humidity	20% to 80%, NON-CONDENSING
Conditioning	The cartridge must be conditioned to the operating environment for a time equal to the time away from the environment, not to exceed eight hours.

Section 2

INSTALLATION AND OPERATION

INSTALLATION

4923 Standard Configuration

The 4923 standard instrument configuration interfaces directly to the 4010-series terminal, and through the terminal to the modem/computer. Installation consists of selecting the appropriate line voltage range, and connecting to the terminal and to the power source. Information on line voltage selection is found in Section 3 of this manual. To complete the interconnection of the 4923, use the following procedure:

1. Place the 4923 in a suitable location close to the terminal. The standard interconnecting cable is 6 feet long; the 4923 must be located within the cable's range.

CAUTION

Do not install or remove cards while power is applied to the terminal.

2. With the terminal power off, gain access to the minibus within the terminal pedestal; details are found in the terminal manual. Install the Minibus Interface card in one of the spare connectors in the terminal Mother Board, as shown in Fig. 2-1. (It may be necessary to install a Mother Board extender to provide room for the interface; refer to the terminal manual for details.)

3. Thread the end of the interconnecting cable through the access opening in the rear of the terminal pedestal, threading the cable end to the front of the pedestal, for attachment to the Minibus Interface card.

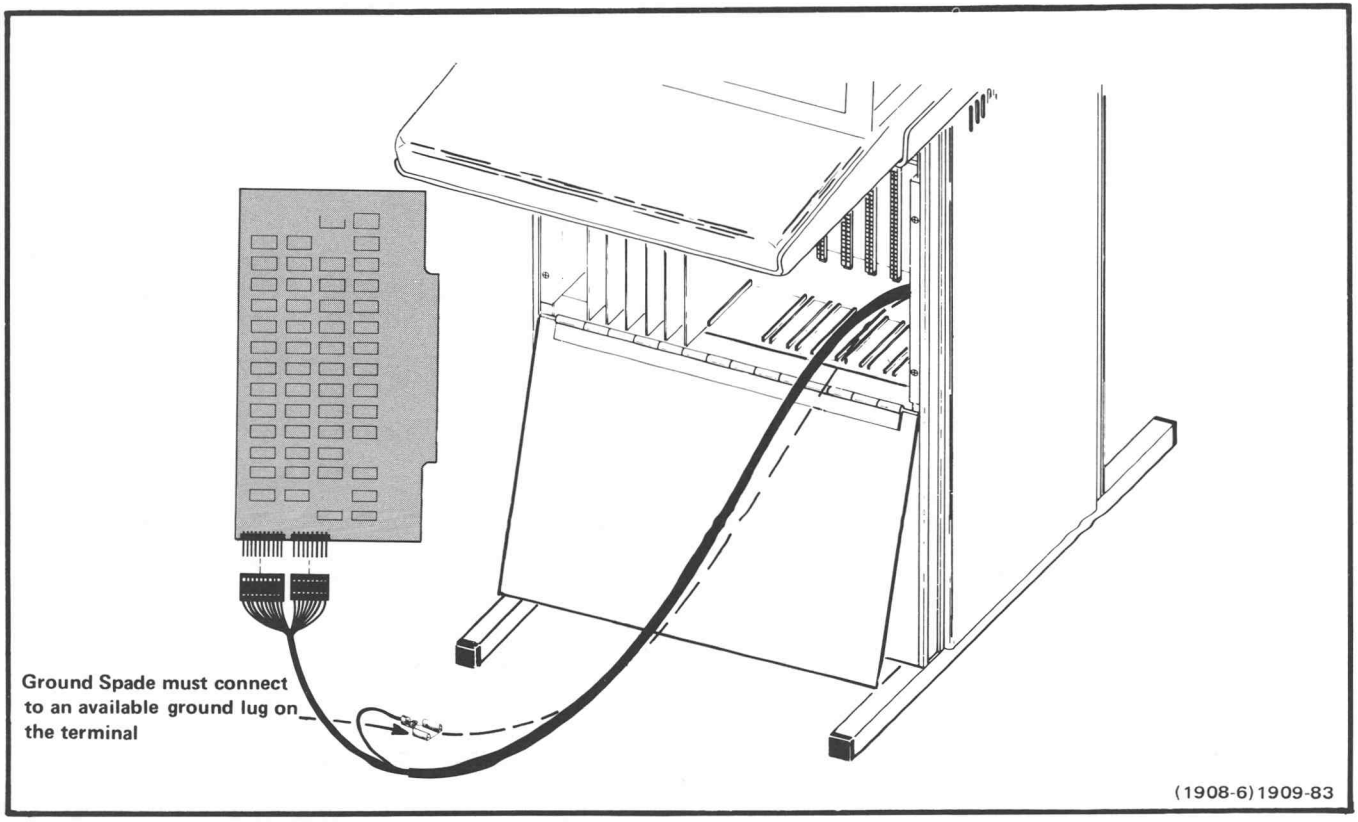

Fig. 2-1. Minibus Interface installation.

4. Install the two harmonica connectors (J380 and J381) onto the card connectors on the Minibus Interface, making certain to position pin 1 of the harmonica on pin 1 of the card connector. (Pin 1 is marked in each case by a small caret.) Connect the cable ground spade connector to a ground lug under the card rack within the terminal pedestal and secure the cable clamp to the cable entrance area at the back of the pedestal.

5. Attach the interconnecting cable to connector J1010 on the back panel of the 4923 (Fig. 2-2). There are two keys at the top of the connector, to align with slots at the top of the connector guide.

After installing the 4923 as described in the preceding paragraphs, power may be applied first to the terminal and then to the 4923, and they may be operated in the normal manner. Note that both the terminal power and 4923 power must be applied in this order to operate the standard unit. Operation of the 4923 is described later in this section.

4923 Option 1

The 4923 Option 1 contains an RS-232-C interface, for use with RS-232-C compatible devices. Connection is provided for connection to a terminal RS-232-C cable, and a cable is provided for connection to a modem. Installation consists of selecting the appropriate line voltage range, connecting to the terminal and modem, and connecting to the power source. Information on line voltage selection is found in Section 3 of this manual. To connect the 4923 Option 1 into a system, use the following procedure:

1. Place the 4923 Option 1 in a suitable location close to the equipment with which it is to be used. The modem cable is 9 feet long; distance to the terminal is determined by the length of the terminal's RS-232-C interconnecting cable.

2. Connect the cable from the terminal to the terminal connector on the back panel (Fig. 2-3), then connect the modem cable to the modem. Secure the connectors with their attaching screws.

3. Select the appropriate data transfer rates, using the dual BAUD RATE selector on the back panel (Fig. 2-3). The inner (smaller) knob controls the data transfer rate to and from the modem and from the terminal; the outer (larger) knob controls the data transfer rate from the tape to the terminal only. This configuration allows for the rate from the tape unit to the terminal to be set at a higher rate than the normal On-Line communication rate. Note, however, that the terminal rate must be at least as high as the communication rate.

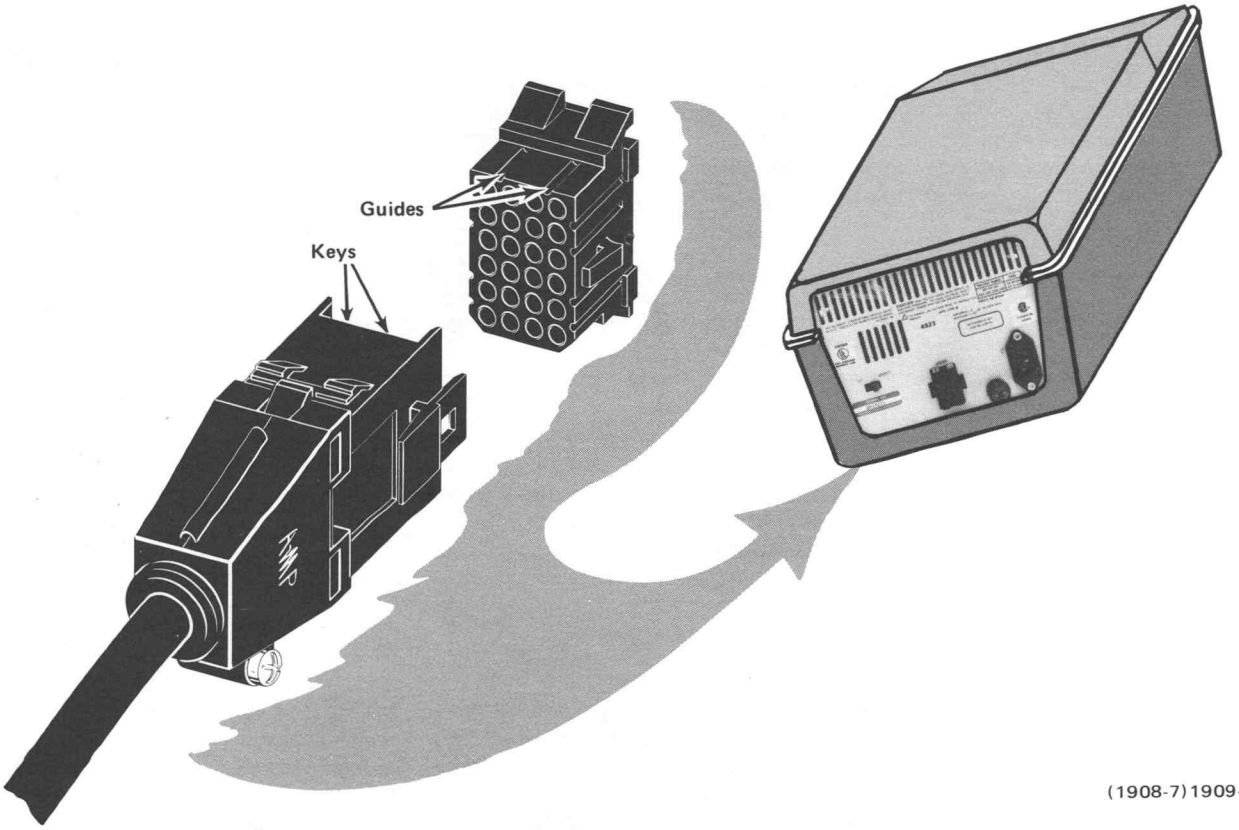

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Fig. 2-2. 4923-to-Minibus Interface cable connection.

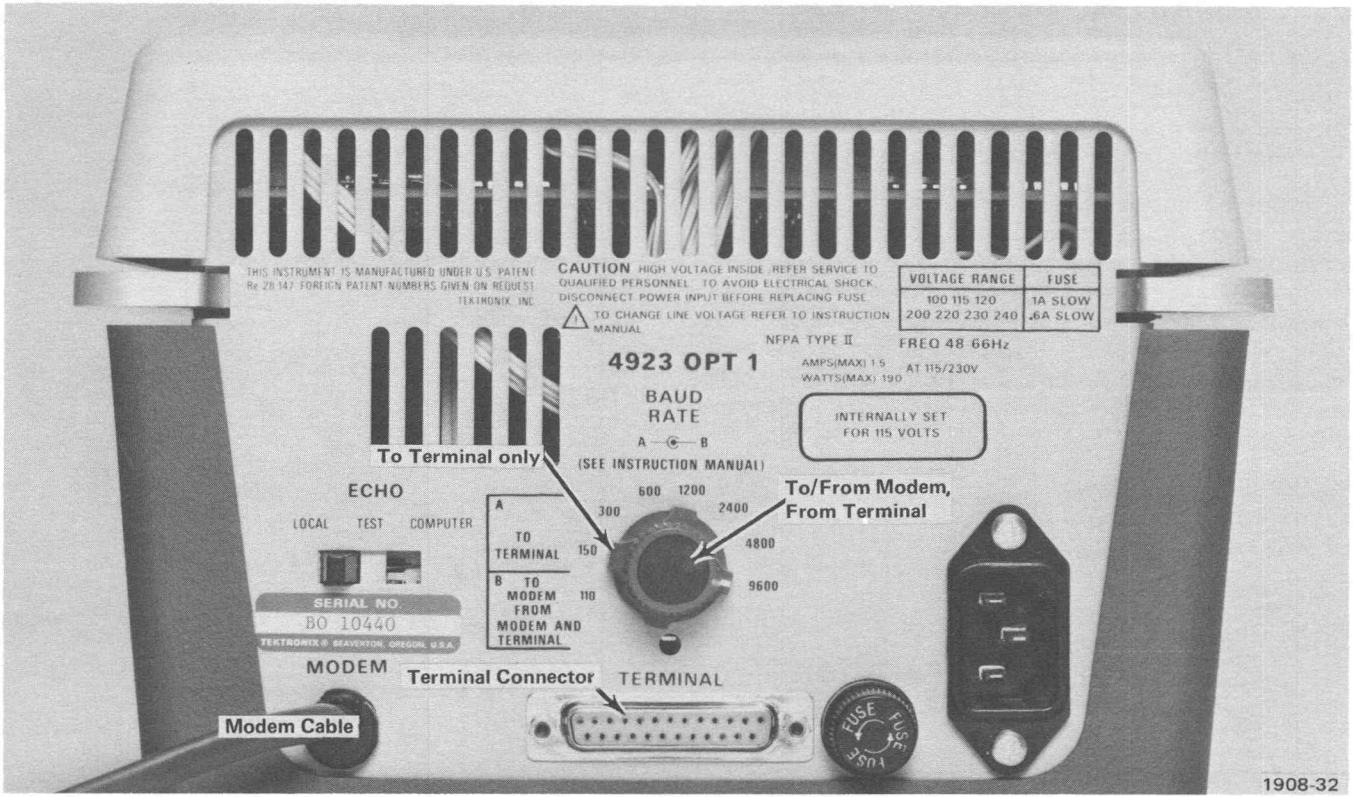


Fig. 2-3. 4923 Option 1 (RS-232-C) back panel.

Installing the Tape Cartridge

Insert the tape cartridge from the front of the unit (Fig. 2-4) pushing in against light spring resistance until the cartridge snaps forward into place. The protruding outer edges of the metal cartridge base serve as keys, to be aligned with the guide slots at the edges of the cartridge opening during insertion. Note that a cover over the head access opening in the tape cartridge opens automatically as the cartridge is inserted, and closes as the cartridge is removed.

Fig. 2-4. Inserting the tape cartridge.

Activating the Write-Protect Feature

The cartridge has a screwdriver-activated Write-Protect feature built into the cartridge case as shown in Fig. 2-5. To Write-Protect a cartridge, use a screwdriver (or a coin) to turn the caret on the lockout plug to the SAFE position. This protects the cartridge from accidental erasure by writing over data on the cartridge. In this condition, the cartridge can be read in the normal manner, but may not be written upon.

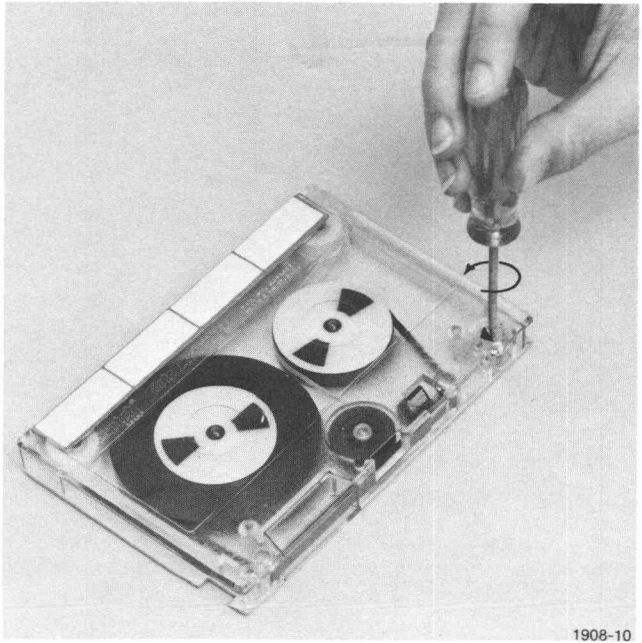


Fig. 2-5. Activating write-protection. When the arrow points to SAFE, the cartridge cannot be written upon.

Applying Power

Power is applied to the 4923 using the POWER rocker switch on the front panel. Note that power must be applied first to the 4010-series terminal and then to the 4923 when using the standard (minibus) version, in order to operate the 4923.

Operating Modes

The 4923 has six basic operational states, all of which are implemented from the unit's front panel. The states are summarized in Table 2-1; the implementation of each operation is further detailed in the following paragraphs.

Table 2-1

OPERATING MODES

Read Mode	Reads data from the tape to the terminal and/or computer.	Skip Reverse Mode	Skips over one file in the reverse direction at normal (30 in/s) speed. No data is transferred.
Write Mode	Writes data to the tape from the terminal and/or computer.	Fast Forward Mode	Winds forward at the fast (90 in/s) speed until the STOP button is pressed, or until the end of the tape is reached, whichever occurs first. No data is transferred.
Skip Forward Mode	Skips over one file in the forward direction at normal (30 in/s) reading speed, without transferring data.	Fast Reverse Mode (Rewind)	Rewinds at the fast (90 in/s) speed until the STOP button is pressed, or until the beginning of the tape is reached, whichever occurs first. No data is transferred.

Read Operations

There are two operational states within the Read mode; these are Read Enable and Read states. The Read Enable state is entered by a single momentary push of the RUN button. Once there, the unit enters (and leaves) the Read state under program control, using the DC1 (Start Read) and DC3 (Stop Read) commands. This is useful in systems which use inputs of one line at a time, as the tape can be written with a DC3 at each line end. When reading the tape back, it will stop at the end of each line, to be restarted with a DC1 when ready. In addition, the Read Operation may be started by again pressing the RUN button, in place of the DC1, and will run until another DC3 occurs (Fig. 2-6). Once reading, the unit will read to the end of the file, if no DC3 occurs on the tape or on the data lines.

Reading may also be started by pressing and holding the RUN button for about 1 second. The unit will then read from tape, ignoring DC3s while the RUN button is held down. Once the button is released, however, the unit will again stop the Read Operation when a DC3 is encountered.

When the unit is in the Read Enable state (but not yet Reading), both the READ and the STOP indicators will illuminate. While Reading, only the READ indicator will illuminate. When the end of the file is reached, the STOP indicator will light, indicating that the RUN button must be pressed again to start another Read Operation. (See also TAPEFETCH in strappable options.)

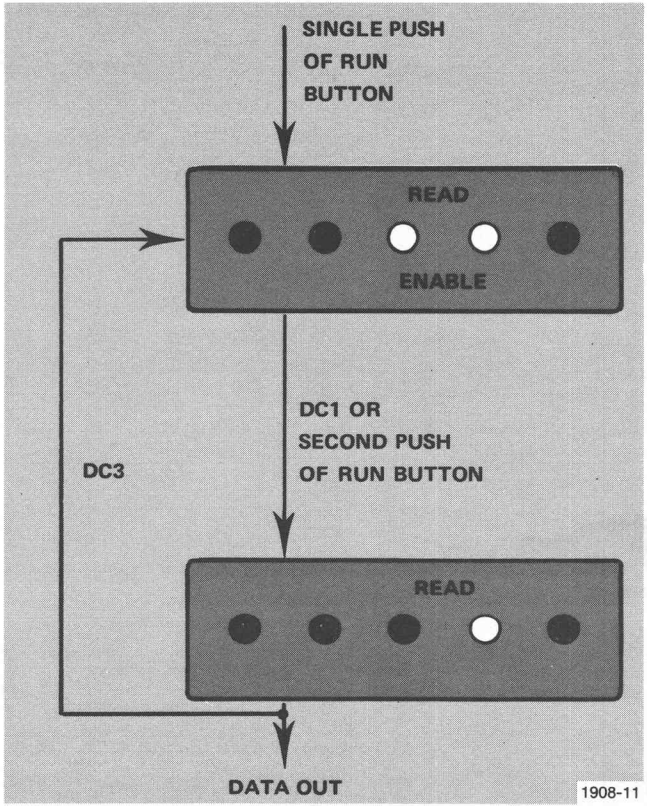


Fig. 2-6. Read Operations.

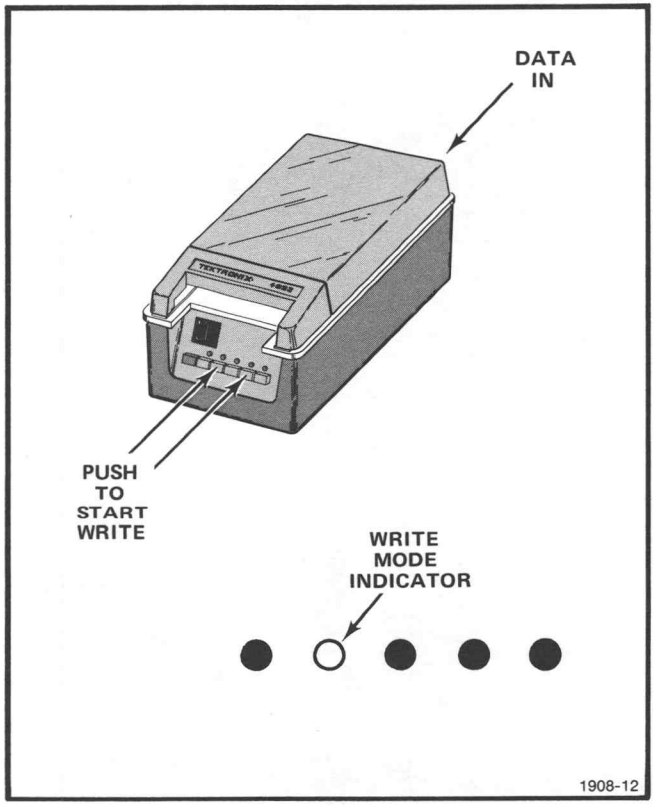


Fig. 2-7. Write Operation.

Write Operations

A Write Operation is used to write ASCII data onto the tape from the computer and/or terminal (Fig. 2-7). To enter Write mode, press in and hold the WRITE button and simulatneously press the RUN button. The WRITE indicator (above the WRITE button) will illuminate.

Once the Write mode has been entered, the Write Operation continues until the STOP button is pressed. Between the time when Write mode begins and the time when the STOP button is pressed, all data from the terminal or computer[1] is written onto the tape. It is written from the data lines into a buffer that holds 128 eight-bit bytes (characters). When the buffer is full, the 128 data bytes are written onto the tape, consituting one data record. Records are written sequentially onto the tape in this manner to form Tape Files of data. When the STOP button is pressed, any unused character positions within the buffer are filled with NUL characters, and the last record of the file is written onto the tape followed by an End-of-File mark.

[1]See footnote on following page.

Skip Forward Operations

Skip Forward allows the 4923 to skip over one data file in the forward direction without transferring data. The Operation may be ended earlier by pressing the STOP button. Skip Forward is implemented by a single momentary push of the FORWARD button. (Note that a momentary push is all that is required for the Skip Forward Operation. If the FORWARD button is held down, Fast Forward mode will begin, as described in the following paragraph.)

Fast Forward Operations

Fast Forward mode begins when the FORWARD button is pressed and held for about one second. When this occurs, the tape winds in the forward direction at 90 inches per second. This continues until the STOP button is pressed, or until the end of the usable tape area is reached, whichever occurs first.

Skip Reverse Operations

Skip Reverse allows the 4923 to back over one data file each time the REVERSE button is momentarily pressed. No data is tranferred. The operation may be ended earlier by pressing the STOP button. (Note that a momentary push of the REVERSE button is all that is required for a Skip Reverse Operation; if the button is held down, Fast Reverse mode will begin, as described in the following paragraph.)

Fast Reverse (Rewind) Operations

Fast Reverse begins when the REVERSE button is pressed and held for about one second. When this occurs,, the tape rewinds at 90 inches per second. Rewinding continues until the STOP button is pressed, or until the tape has rewound to the beginning of the usable tape area, whichever occurs first.

[1]The acceptable source(s) of data during a Write Operation is dependent on whether the tape/terminal system is On Line or in Local. On the standard 4923, this is determined by the terminal's LOCAL/LINE switch; on the Option 1 (RS-232-C) version, there is a LOCAL/LINE button on the front panel. When the tape/terminal system is in Local, data from the computer is not written onto the tape. (Note also that when the Option 1 4923 is used with a terminal that has a LOCAL/LINE switch, both the terminal's and the tape unit's switch must be ON LINE in order to communicate with the computer.)

Cartridge Care

Performance of the 4923 Digital Cartridge Tape Recorder is dependent on the handling and care of the tape cartridge. Dust and other airborne contaminants can damage the tape and/or the tape head. The cartridge provides a door over the head access area, which is automatically opened and closed as the cartridge is inserted into or removed from the 4923 to prevent soiling of the tape. However, certain other precautions will aid in performance; they are as follows:

1. Keep the tape cartridge in a clean, dust-free area.

2. Do not allow the "windows" for the light-sensing mirrors (Fig. 2-8) to become soiled or dirty, as this may interfere with detection of the position markers (such as End-of-Tape). Under no circumstances should the windows be covered or coated.

3. Keep cartridges away from magnetic fields and from ferro-magnetic materials that might become magnetized. Strong magnetic fields can damage the magnetically-recorded data on the tape. This includes magnetic screwdrivers.

4. Use caution with cigarettes (cigars, pipes, etc.) around cartridges. Heat and contamination from a carelessly dropped ash can damage the tape and/or the Read/Write Head.

5. Do not expose the cartridge to heat or strong sunlight. (Environmental specifications are detailed in Section 1.)

6. Do not leave the tape cartridge in the 4923 for extended periods when the unit is not in use (such as overnight). This could cause a temporary flat spot on the drive roller, which in turn causes the unit to be excessively noisy during the first few minutes of operation when the unit is operated again.

7. Prior to using a new cartridge, or a cartridge which has been stored for extended periods, it may be helpful to run the tape to the end at the Fast Forward speed, then Rewind the tape to the beginning. This will eliminate uneven tension which may develop during temperature changes in storage.

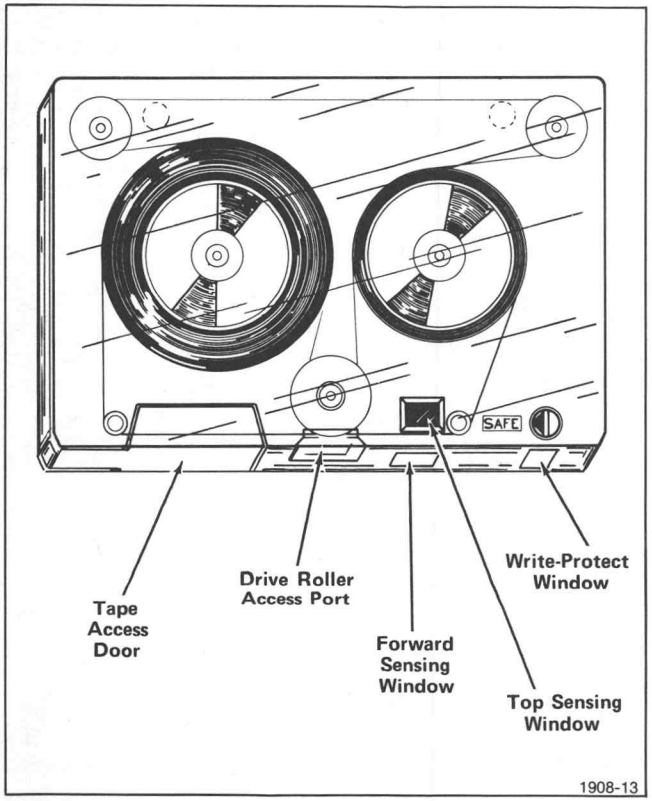


Fig. 2-8. Data cartridge parts.

Check-out and Familiarization Procedure

The following procedure may be used to familiarize the operator with the basic operation of the 4923, and at the same time ascertain that the unit is operating properly. This procedure is to be performed with the unit installed, a cartridge installed, and power applied, all of which are described earlier in this manual. (Note that power must be applied first to the terminal and then to the 4923.) In addition, the checks are to be performed with the unit in the Local mode of operation. This is accomplished by the 4010-series terminal's LOCAL/LINE switch with the standard unit, or with the front panel ON LINE button on the 4923 Option 1.

1. Install a data cartridge into the unit, aligning the metal outer edges with the guide slots in the cartridge opening. The cartridge must not contain data and must not be Write-Protected; that is, the caret at the forward edge of the cartridge must point away from the SAFE marker. The cartridge should be at the beginning of the useable data area (Load Point) prior to starting this procedure.

2. Press the WRITE button and hold it while pressing the RUN button. The Write indicator (above the WRITE button) will illuminate.

3. Enter 128 characters from the terminal keyboard, and note that upon receipt of the 128th character, the tape moves forward briefly as that record is written onto the tape.

4. Enter another group of characters, entering a DC3 (Ctrl S) at the end of each line. The DC3's will be used later, during Read mode.

5. After entering about three records, press the STOP button. Note that the Ready indicator illuminates. The previously-written records are now combined into one Tape File.

6. Momentarily press the REVERSE button to initiate the Skip Reverse Function. Note that the REVERSE indicator illuminates while the tape backs over the previously-written Tape File. When the operation is complete, tape motion will stop and the Ready indicator (above the STOP button) will illuminate.

7. Momentarily press the RUN button to enter the Read Enable state; both the Read indicator (above the RUN button) and the Ready indicator should illuminate. The unit is now ready to read data from the tape upon receipt of a DC1 or another push of the RUN button.

8. Press the RUN button again, but do not hold it pressed. The 4923 will now read data from the tape to the terminal until a DC3 is encountered on tape or elsewhere. (Recall that DC3's were written on the tape at the end of some lines.) When a DC3 is encountered, the unit will cease transferring data, and both the Ready and Read indicators will illuminate again.

9. After a DC3 has stopped transfer, issue a DC1 (Ctrl Q) from the terminal keyboard. (The RUN button may be pressed in lieu of a DC1, at any time.) The Ready indicator should be extinguished while data is transferred, and should illuminate again when another DC3 is reached. Repeat as many times as there are DC3's on the tape. When the end of the Tape File is reached, the Ready indicator will illuminate.

10. Press the RUN button again, holding it pressed for about 1 second. The tape will start forward and then return to the end of the last file. The unit will not enter Read Mode in a blank tape area. This is useful for finding the beginning of the blank tape area.

11. After reaching the end of the File, again press (momentarily) the REVERSE button to return to the beginning of the Tape File, then press and hold the RUN button. This time the unit will read the entire file without stopping for DC3's on the tape, as long as the RUN button is held pressed.

12. After reaching the end of the File, press and hold the FORWARD button for about 1 second. The Forward indicator should illuminate, and the unit should wind forward at the fast speed. It will do so until the end of the usable tape area is reached. Press the STOP button at some point to stop the tape and verify operation of the STOP button, then restart by pressing the FORWARD button again (for one second).

13. After the tape has reached the end of the usable tape area, the Ready indicator will illuminate. At this point, press the REVERSE button and hold it for one second. The Reverse indicator should illuminate, and the tape should rewind at the fast rate until the beginning of the usable tape space is reached. Press the STOP button again at some point to verify STOP button operation in Reverse mode, then restart by pressing (and holding for one second) the REVERSE button.

14. After the tape has rewound, momentarily press the FORWARD button to verify Skip Forward mode. The Forward indicators should illuminate, and the tape should advance at the normal reading speed until the end of the first Tape File is reached. (No data is transferred.)

15. Press the Reverse button to return to the beginning of the tape; the procedure is now complete.

OPERATING CONSIDERATIONS

When operating the 4923 or the 4923 Option 1 in a system, some of the following operating considerations may apply:

1. The standard 4923 may store an Esc FF sequence, which causes the 4010-series terminal screen to erase (page). If the terminal is in Local or On Line with Local Echo, the 4923 will delay further transfer of data until after the erase cycle is completed. If the terminal is On Line with Modem or Computer Echo, however, the 4923 will not delay; data will be transferred to the computer but data which may be echoed for local display purposes will be lost during the erase cycle.

2. When operating the 4923 Option 1 with a terminal and computer at equal baud rates, data overruns may occur when receiving from the computer unless the computer sends two stop bits to the 4923. The problem cannot arise if the 4923 is set to send to the terminal at a faster baud than that of the computer/modem.

3. If the RUN button is pressed once the tape has reached the blank tape area (past data), the tape will start forward and then return to the end of the last data area. This can be useful in locating the blank tape area prior to a Write Operation.

4. When a DC3 is placed on the tape to stop a Read Operation at a given point, it must be followed by another dispensable character (such as a CR).

5. When sending data from the 4923 Option 1, only one stop bit is provided after each character.

Section 3

SUPPLEMENTAL INFORMATION

THE FOLLOWING SERVICING INSTRUCTIONS ARE FOR USE BY QUALIFIED PERSONNEL ONLY. TO AVOID PERSONAL INJURY, DO NOT PERFORM ANY SERVICING OTHER THAN THAT CONTAINED IN OPERATING INSTRUCTIONS UNLESS YOU ARE QUALIFIED TO DO SO.

Top and Bottom Cover Removal and Replacement

1. Disconnect the unit from the power source prior to any disassembly.

WARNING

Dangerous voltages exist at several places inside the unit, unless the power cord is disconnected from the power source. (If the POWER switch is off, power may still be applied to the transformer connections unless the power cord is disconnected.)

2. Turn the 4923 over, resting it on the unit's top. Remove the four screws that attach both the unit's feet and the bottom cover (Fig. 3-1), then remove the bottom cover.

3. Leaving the unit on its top, remove the four black internal screws that attach the top cover (Fig. 3-1), then lift the chassis out of the top cover and place it upright on a work area.

4. To replace the covers on the unit, turn the chassis over, place it back into the top cover, then follow steps 2 and 3 in reverse order.

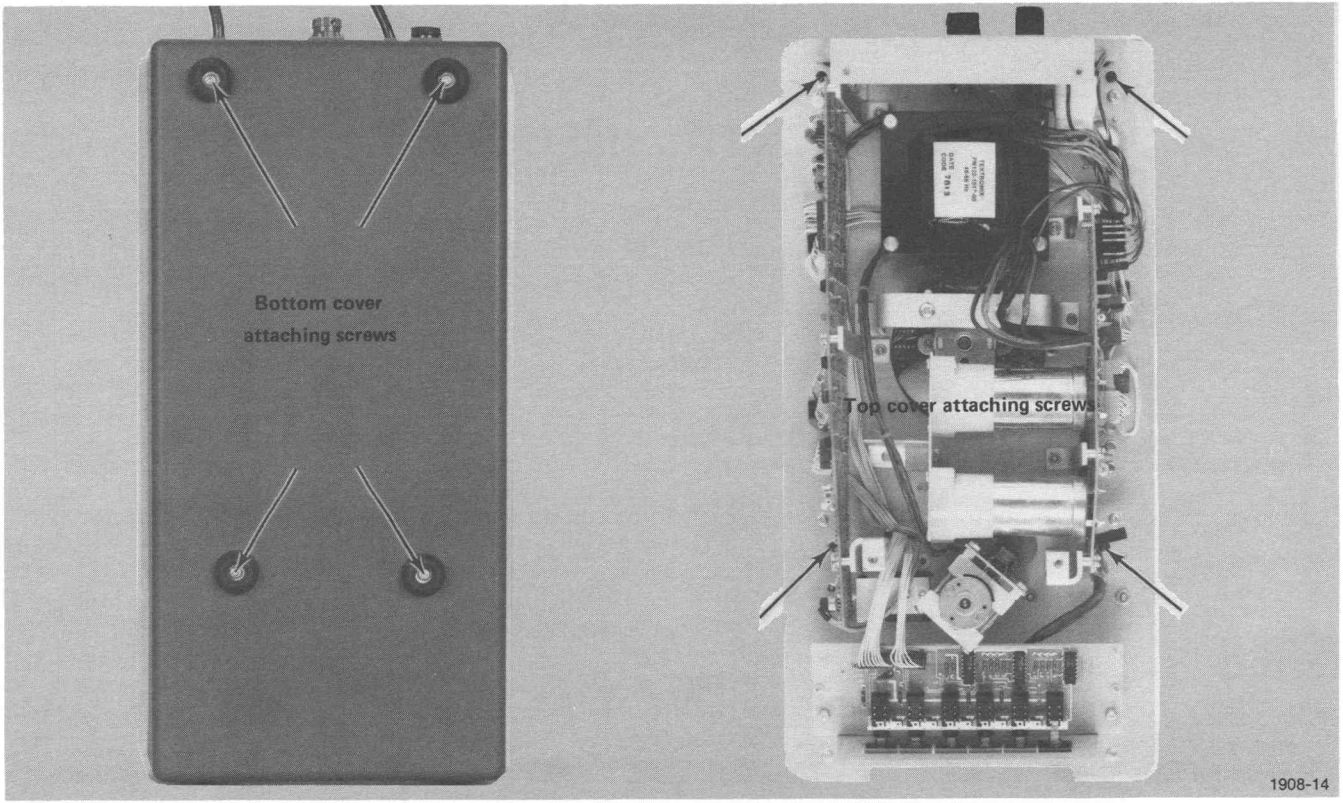


Fig. 3-1. Cover attaching screws. The unit is viewed from the bottom.

CAUTION

The 4923 is intended to be operated from a single-phase power source that has one of its current-carrying conductors (neutral) at ground (earth) potential. Operation from other power sources where both current-carrying conductors are live with respect to ground (such as phase-to-phase on a multiphase system, or across the legs of a 115-230 volt single-phase three-wire system) is not recommended, since only the line conductor has over-current (fuse) protection within the unit.

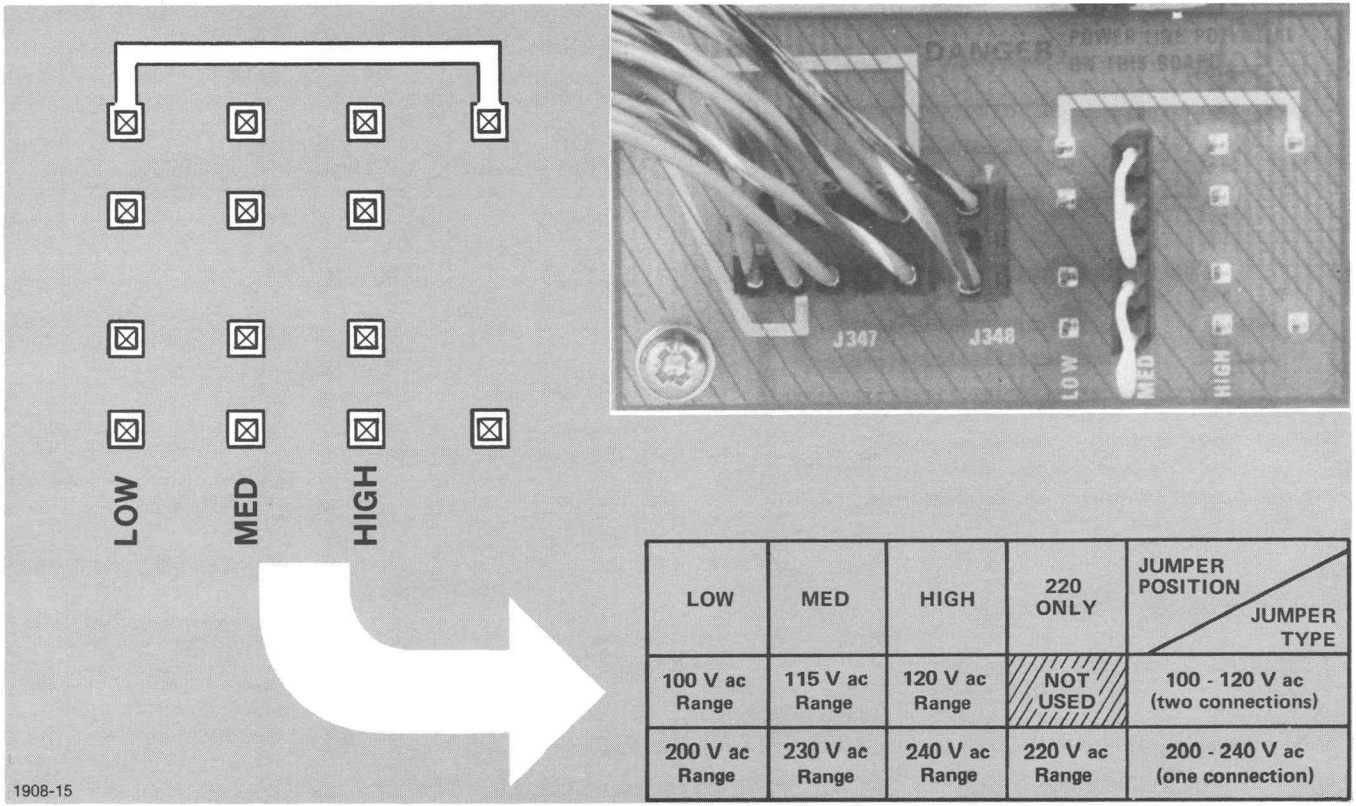
The 4923 is designed to operate from either a 115 or 230 volt nominal line voltage source that has a frequency of 50 to 60 Hz. In addition, any of three voltage ranges for 115 V ac or four voltage ranges for 230 V ac may be selected. Voltage, current and range limitations are listed in Table 3-1.

Table 3-1

4923 OPERATING VOLTAGES

Nominal Voltage	Tolerance	Voltage Range	Frequency	Line Fuse Value
100 V ac	±10%	90 to 110 V ac	50 to 60 Hz	1.0 A slow-blow
115 V ac		104 to 126 V ac		
120 V ac		108 to 132 V ac		
200 V ac		180 to 220 V ac		0.6 A slow-blow
220 V ac		198 to 242 V ac		
230 V ac		207 to 253 V ac		
240 V ac		216 to 264 V ac		

A fuse change and a transformer jumper arrangement permit the 4923 to be modified to suit the voltage supply. A tag on the back panel identifies the internal voltage setting for which the unit is wired when shipped from the factory. If the jumper arrangement is changed for any reason (changing the internal voltage setting) cross out the old setting and attach a tag with the new setting in its place.



LOW	MED	HIGH	220 ONLY	JUMPER POSITION / JUMPER TYPE
100 V ac Range	115 V ac Range	120 V ac Range	NOT USED	100 - 120 V ac (two connections)
200 V ac Range	230 V ac Range	240 V ac Range	220 V ac Range	200 - 240 V ac (one connection)

Fig. 3-2. Line voltage selection, showing Power Supply Board and strap position ranges.

Line Voltage Selection

To change the line voltage selection, access must first be gained to the line voltage selection jumper inside the unit. Remove the cover, as described earlier in this section.

The line voltage selection strap is located on the lower left side of the unit, as viewed from the front. To change line voltage selection, position the strap to the desired location. The jumper location is shown, and the various jumper positions explained in Fig. 3-2.

Note that for operation in the 100, 115, and 120 V ac ranges, the line voltage jumper makes two connections, pin 1 to pin 3 and pin 6 to pin 8. For operation in the four ranges above 200 V ac, an alternate jumper is supplied to be used in place of the above jumper (Fig. 3-3); it connects only the two outside pins (pin 1 to pin 8). Note also that a single pair of pins provides a jumper position for the 220 V ac range, while the HIGH, MED, and LOW positions provide for 240 V ac, 230 V ac, and 200 V ac respectively.

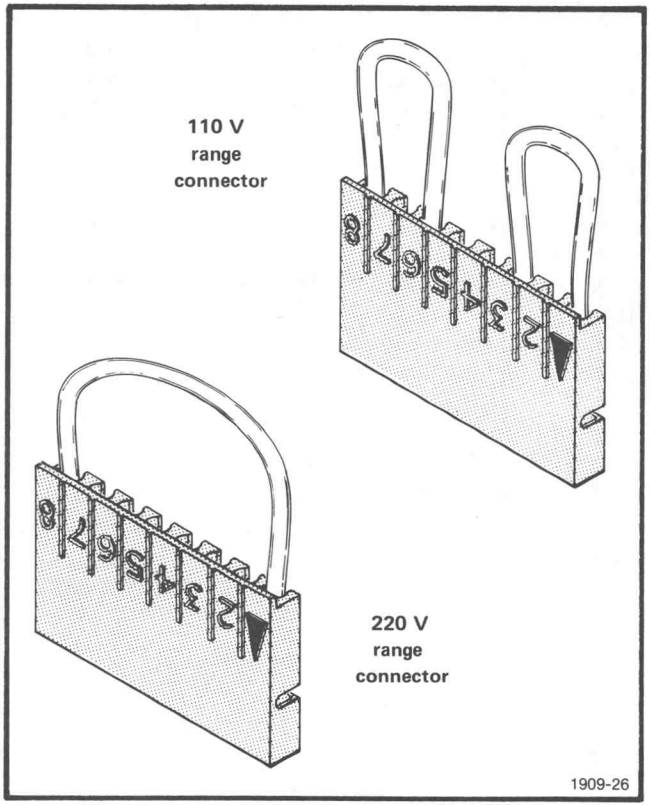


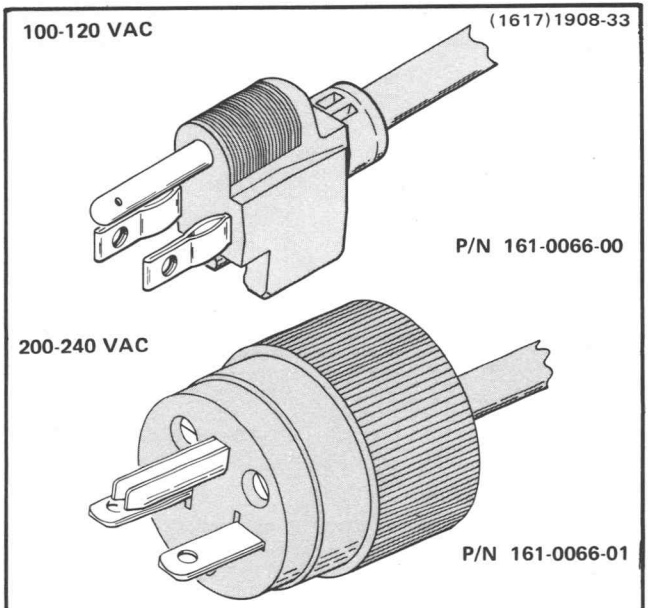
Fig. 3-3. Line voltage selection jumpers.

AC Power Cord and Grounding Requirements

This instrument has a three-wire power cord with a three-wire terminal polarized plug for connection to the power source and safety earth. See Fig. 3-4 for USA standard plugs. The safety earth terminal of the plug is directly connected to the instrument frame for electric-shock protection. Insert this plug only in a mating outlet with a safety earth contact or otherwise connect the frame of the unit to a safety earth system. The color coding of the cord conductors is in accordance with recognized standards, as shown. In other jurisdictions, replace the USA standard plug with a plug that satisfies local authorities.

WARNING

To avoid electrical shock or equipment damage, be sure to replace the cord set only with another of the same polarity.



Power Cord Conductor Identification

Conductor	Color	Alternate Color
Ungrounded (Line)	Brown	Black
Grounded (Neutral)	Blue	White
Grounding (Earthing)	Green-Yellow	Green-Yellow

Fig. 3-4. USA standard power cord plugs.

Line Voltage Fuse

There is one line voltage fuse, located on the 4923 back panel (Fig. 3-5). This fuse is a 1.0 A slow-blow fuse for operation in the 100-120 V ac range; it must be changed to a 0.6 A slow-blow fuse for operation in the 200-240 V ac range.

Strappable Options

Strappable Options are straps located on circuit cards within the 4923; they can be set at the user site by qualified technical personnel.

The selection of strap options are dependent upon computer and program requirements, and in some cases upon user preference. They include those listed on the following circuit boards, and may be changed as described.

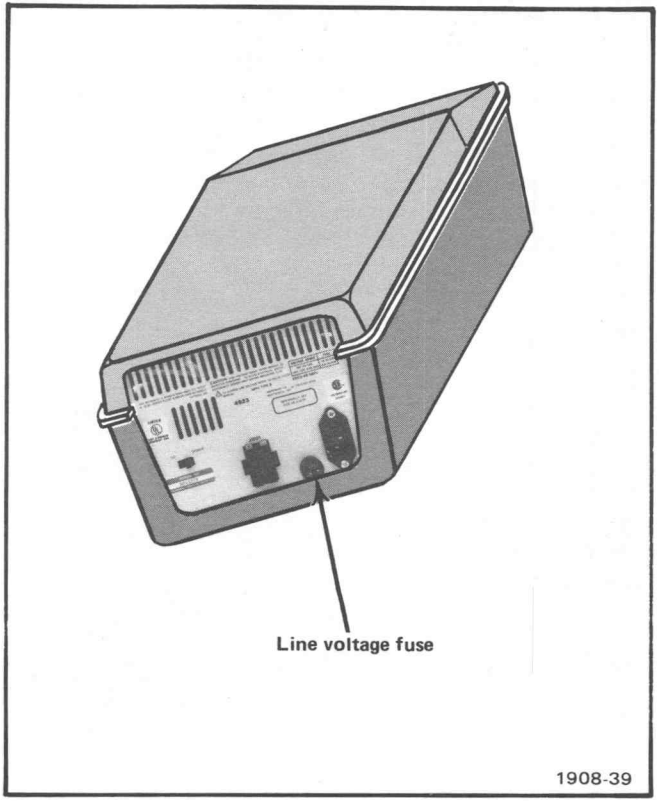


Fig. 3-5. Line voltage fuse location.

Control Board

To gain access to the straps on the Control board, the top and bottom covers must be removed from the unit, as described earlier in this section. After the straps have been placed in their desired position, replace the top and bottom covers prior to operation of the unit; this procedure is also described earlier in this section. Control board strap locations are shown in Fig. 3-6.

ROM/PROM Selection

This strap is set at the factory to select whether the memory available to the processor is contained in ROM (ROM position), in PROM (PROM position) or whether the memory will be divided between the ROM and the PROM (ROM/PROM position). When using PROM's on the 4923 Control board, both PROM's combine to equal the memory capacity of the ROM. When splitting the memory between the ROM and the PROM (as selected with the above strap), this strap selects whether the upper (HI) and/or lower (LOW) half of the ROM will be "replaced" by the PROMs. The strap should not be moved from the factory-set position.

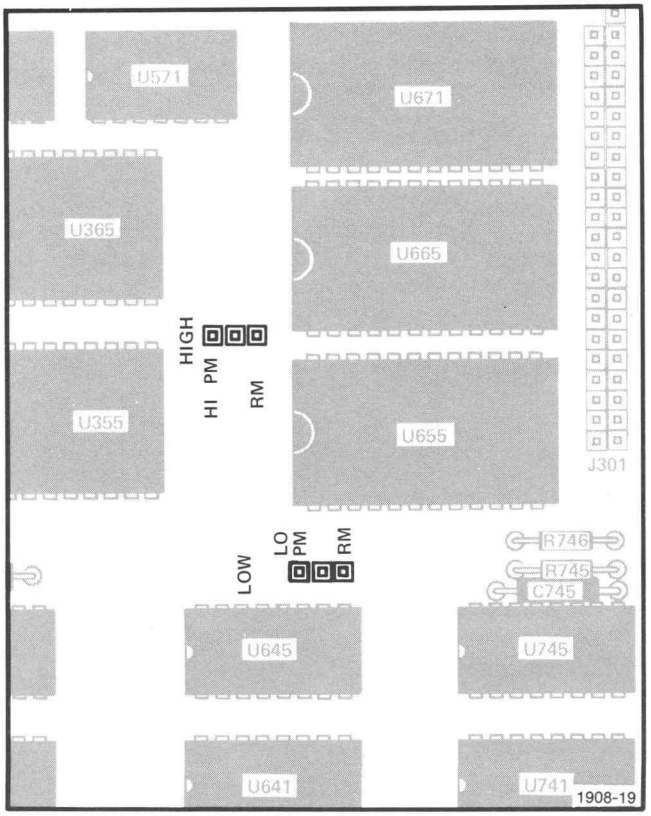


Fig. 3-6. Control board strap locations.

Minibus Interface Card

This card is found only on standard (4010-Series Terminal Interface) 4923 units; it is not used in the RS-232-C version. Whenever it is necessary to change a strap position on the Terminal Interface card, the terminal power should be switched off prior to strap positioning, unless the strap can be reached without removing the card. (Terminal Interface Card strap locations are shown in Fig. 3-7.)

CAUTION

Do not remove or replace circuit cards in the terminal bus with power applied to the terminal.

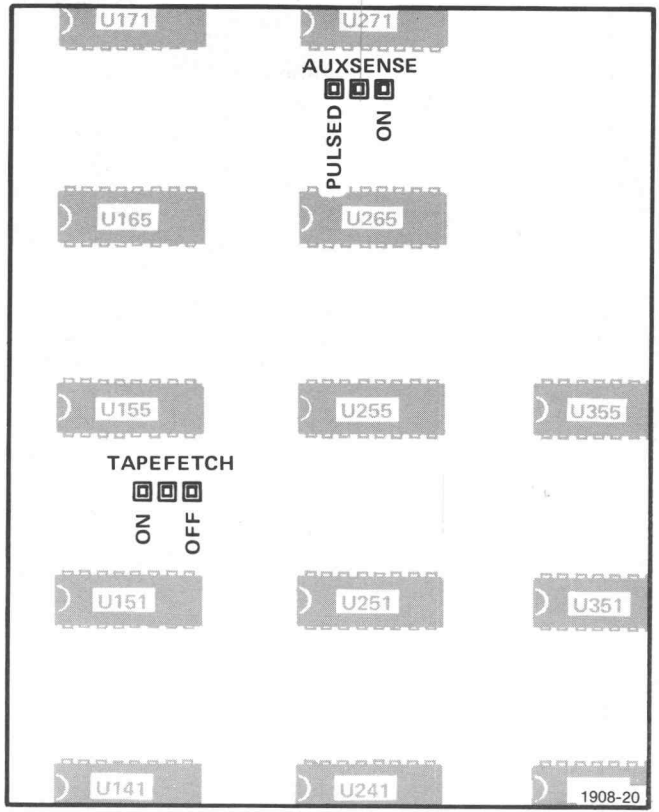


Fig. 3-7. Terminal Interface card strap locations.

TAPEFETCH IN/OUT	The TAPEFETCH option allows the computer to request data by pulling the TAPEFETCH line low. Data will be transmitted one character at a time. The TAPEFETCH line should be held low only until receipt of a character is acknowledged from the requesting unit. This process continues until the end of the file; TAPEFETCH signals are then not recognized until after the front panel STOP button has been pressed. TAPEFETCH is allowed to operate in this manner when the strap is in the IN position and only when the unit is in the stopped (READY) state. During operation, the READY and RUN indicators should blink.
AUXSENSE ON/PULSED	AUXSENSE is used by some systems to determine if a peripheral is operating. This strap determines whether AUXSENSE will be asserted at all times (ON) or Pulsed on (PULSED), when the 4923 is busy.

Routine Maintenance

Occasional cleaning will preserve the appearance of the 4923. In addition, periodic cleaning of the Read/Write head is necessary to remove accumulations of oxide from the tape, along with other foreign matter, to prevent data errors which such deposits may cause.

Cleaning the 4923 Case. The exterior of the 4923 may be cleaned by using the following procedure:

1. Turn the Power switch off, then disconnect the power cord. Remove the cartridge, if one is installed.

2. Use a cloth dampened in a mild detergent solution to wash the upper and lower case. Abrasive cleaners (such as scouring powder) and harsh chemicals must be avoided.

3. Wipe soap residue off with a clean damp cloth, then dry with a clean dry cloth.

4. Connect the power cord to the power source. The 4923 may again be operated normally.

Cleaning the Tape Head. The surface of the tape head (Fig. 3-8) must be kept clean in order to accurately read and write data to and from the tape. Tape head life and data reliability are directly related to Cartridge care (see Section 2) and tape head care. Oxide deposits from the tape, along with dust and other foreign particles, may be deposited on the tape head during operation. This alone may cause data errors by increasing the space between the tape and the head. In addition, these particles act as abrasives when propelled across the head by tape motion, thus increasing head wear and reducing head life.

In order to minimize oxide and foreign matter accumulation, the tape head should be cleaned regularly. Frequency of cleaning depends upon frequency of use and upon the cleanliness of the area in which it is used. Recommended cleaning intervals are once weekly for units that are used moderately, to once daily for units that are used in areas where high foreign matter accumulations occur. Cleaning may be required more frequently if data errors occur (indicated by rapid tape reversal and re-read). To clean the tape head, use the following procedure:

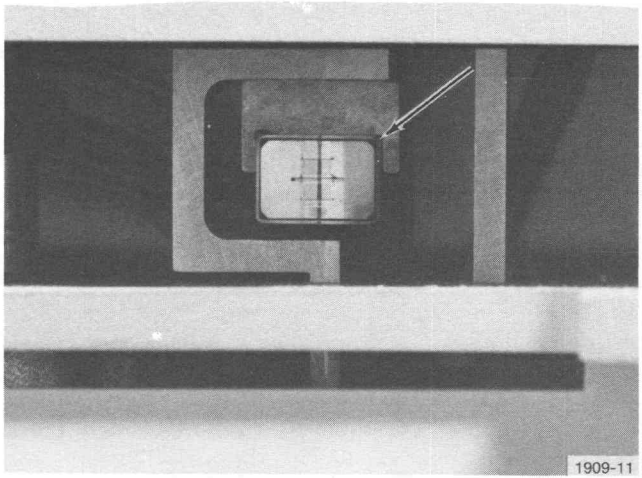


Fig. 3-8. Tape head location.

CAUTION

Do not use magnetic devices near the tape head. Do not contact the head with metal or other hard objects. To do so may damage the head and may result in damage to tape cartridges, resulting in lost data.

1. Inspect the head (Fig. 3-8) by shining a light, such as a penlight, across the surface of the head at an angle. This will reveal accumulations of foreign material, and will also reveal damage to the head. If the head is scratched, scored, or excessively worn (Fig. 3-9), it should be replaced; refer to the optional Service Manual for removing and replacing the Read/Write Head. If the head is dirty, continue with this procedure.

2. Use a cotton swab moistened with isopropyl alcohol to rub off accumulated matter. Light accumulations of oxide will probably be readily removable, while heavy or long-term accumulations may require more cleaning with alcohol and clean swabs.

3. After removing the oxides and other foreign matter, use a clean, dry cotton swab to polish the head and remove alcohol residue.

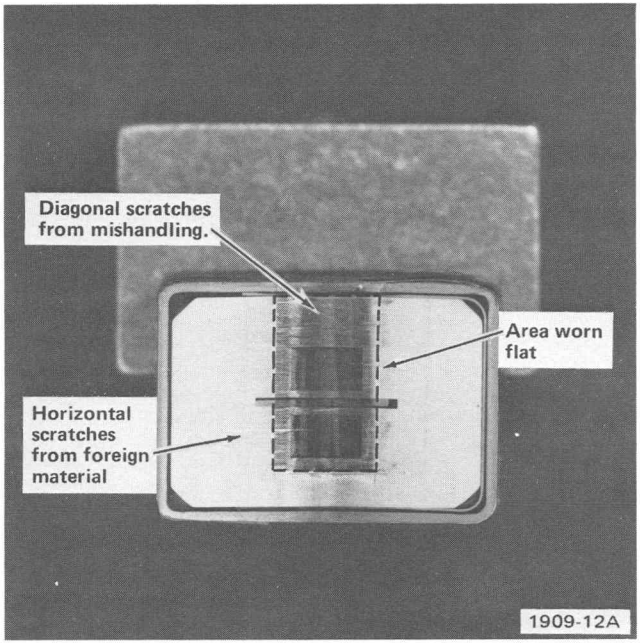


Fig. 3-9. Tape head damage.

Cartridge Respooling. The data cartridge used in the 4923 is open-ended; that is, the tape ends are not secured to either of the spools. The unit relies on light-sensing of small holes near either end of the tape to stop tape motion before the physical end of the tape is reached. The tape may fail to stop in time, causing the tape to run off one of the spools, under certain conditions. These conditions are: a burned out lamp, a possible circuit failure, or an obstruction in the light path (such as a soiled cartridge or Lamp-Detector assembly, or a faulty cartridge, particularly if it is a new one). Refer to the optional Service Manual for circuit diagnosis. Use the following procedure to respool the tape. Note that tape positioning is critical to proper interpretation of the data; it may not be possible to restore a tape that has run off of a spool.

1. Turn the cartridge over (metal side up) and remove the four screws that attach the metal base to the plastic cover (Fig. 3-10). Do not use a magnetic screwdriver when working on or around the cartridge.

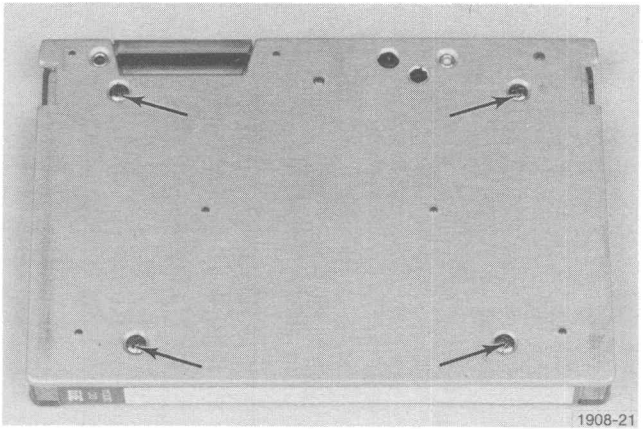


Fig. 3-10. Cartridge attaching screws.

2. Carefully remove the cartridge base from the plastic cover. Be careful not to lose the Write-Protect cylinder or the small metal spring between the cylinder and the metal base (Fig. 3-11).

3. Turn the base over, and place the loose end of the tape across the front of the cartridge, threading it through in front of the two guide posts. Now, keeping light tension on the tape, place the loose end of the tape around the outside edge of the take-up spool, to the point where the spool meets the tension band (Fig. 3-12).

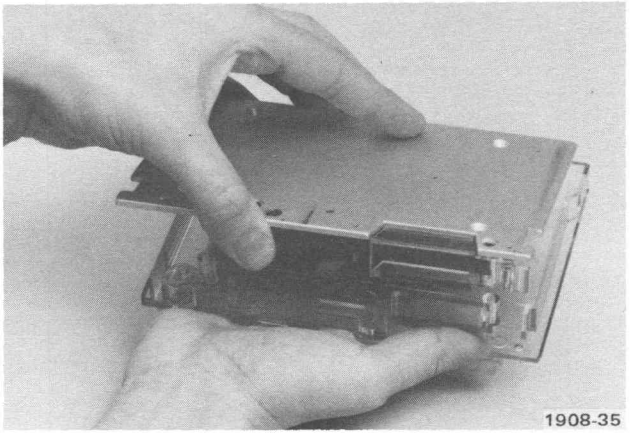


Fig. 3-11. Disassembling the tape cartridge.

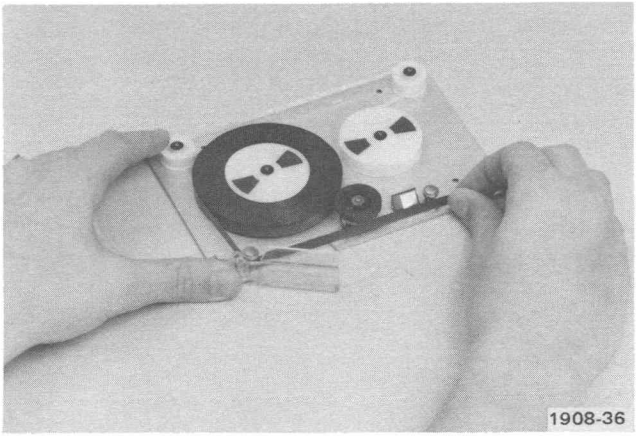


Fig. 3-12. Tape positioning within the cartridge.

4. Rotate the spool, causing the tape to pass around the spool, with the loose end passing through the inside edge of the spool (Fig. 3-13).

5. Hold the loose end of the tape against the spool, and continue to rotate until the loose end passes under the continuing length of tape, then continue to rotate for a few more turns by turning the drive roller, until all the beginning of tape (or end of tape) holes have passed the mirror. Make certain that these first windings stay evenly within the spool edges (Fig. 3-14).

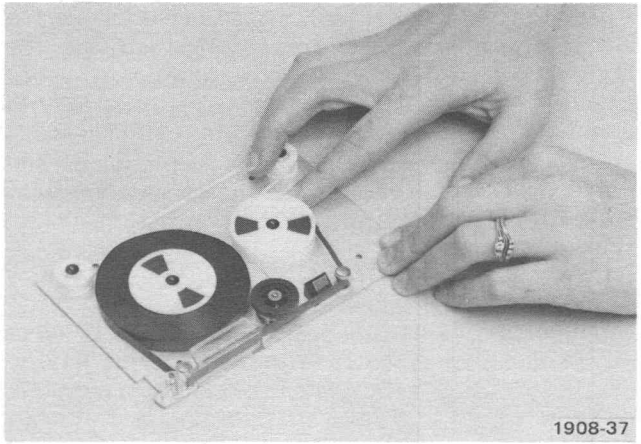


Fig. 3-13. Beginning the tape winding.

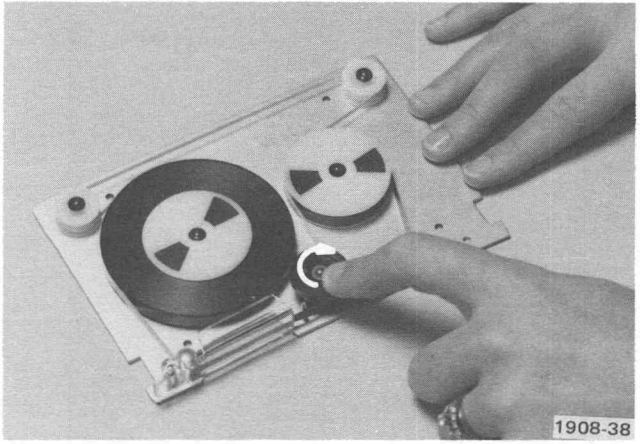


Fig. 3-14. Winding the tape.

6. Make certain that the Write-Protect cylinder is in position, with the spring washer between the cylinder and the metal cartridge base. Turn the cartridge base over, and carefully position it into the plastic case, making certain to fit the Write-Protect cylinder through the opening in the plastic case. Be careful not to catch and wrinkle the tape with the plastic case (Fig. 3-15).

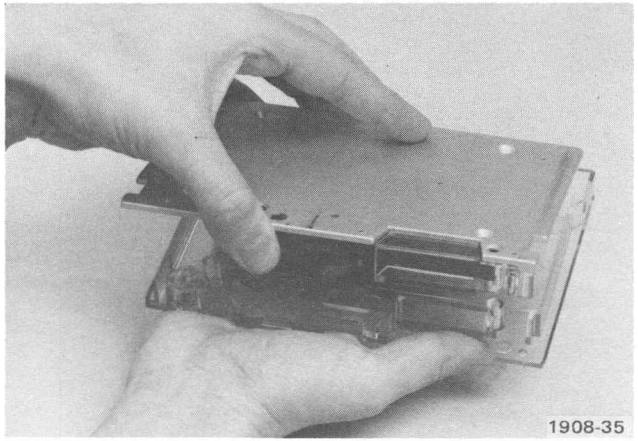


Fig. 3-15. Assembling the tape cartridge.

7. Holding the cartridge together, install the four screws that attach the plastic case to the metal base.

8. Install the tape cartridge in the 4923 and run it at fast speed to the end of the tape and back to the beginning.

SELF-TEST DESCRIPTION AND OPERATION

The self-test feature is provided in the 4923 to test the electronics within the unit for proper operation, particularly those on the Control board. It involves a combination of manual and automatic checks, all to be performed with the unit in its normal operating condition (unit installed, all power applied cartridge installed). The Option 1 unit must have the MODEM cable hooked to its terminal connector, and must be set for equal baud.

1. After making certain that the unit is in its operating condition, and in the stopped (READY) state, place the rear panel switch in the TEST position. On the standard 4923, this is the OPERATE/TEST switch; on the Option 1 unit, this is the LOCAL ECHO/TEST/COMPUTER ECHO switch. (The unit must be in the READY state to being the self-test operation.)

2. A slight delay occurs after the switch is placed in the test position. After this delay, all front panel indicators should illuminate brightly. This is the normal self-test configuration and indicates that the electronics are operating properly.

3. While the indicators are on, press each of the front panel buttons to check the buttons and their associated circuitry for proper operation. When a button is pressed, the indicators above the button should dim, to show that the button is operating properly.

4. If all indicators do not light brightly when the test begins, a circuit error may be indicated. Refer to Table 3-2 for error indications.

5. On the standard unit, transmit and receive may be checked while the unit is still in self-test. This is done by placing the terminal in LOCAL and issuing characters from the keyboard. While in self-test, the 4923 will cause a double echo (resulting in double characters on the terminal screen for each keyboard input) if the unit is operating properly.

6. Once the test is completed satisfactorily, place the rear panel switch back in the normal operating position.

Table 3-2

SELF-TEST ERROR INDICATIONS

Indicator	Error indicated by blinking indicator
FORWARD	This indicator is associated with those operations which require holding the button down ≈1 second to start an operation. (Fast, Forward, Rewind, Run). A blinking indicates a problem in the 100 ms timer circuitry.
READ	Error in program ROM or associated circuitry.
STOP	This indicator is associated with a read/write test to and from the buffer (RAM). A blinking indicates an error in the buffer, the serial-to-parallel circuitry, the parallel-to-serial circuitry, or the circuitry associated with the buffer. (The indicator will also blink if no cartridge is installed.)
WRITE	This indicator performs no check in the standard unit. In the Option 1 unit, it indicates an error in the UART (transmit and receive) circuitry. It will blink if the 4923 Modem cable is not looped back to the terminal connector.
REVERSE	This indicator performs no internal test other than the manual switch test.