HEWLETT PACKARD

REFERENCE MANUAL

HP 3075A, 3076A, 3077A

DATA CAPTURE TERMINALS

(Including Options 001, 002, 004, 005,
006, 007, 008, 009, 010, 011, 012 and 013)

SERIAL NUMBERS

This manual applies directly to terminals with
serial number prefix from 2017F.

Manual Part Number 03075-90011
Microfiche Part Number 03075-90511

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LIST OF EFFECTIVE PAGES

Changed pages are identified by a change number adjacent to the page number. Changed information is indicated by a vertical line in the outer margin of the page. Original pages do not include a change number and are indicated as change number 0 on this page. Insert latest changed pages and destroy superseded pages.

Change 0 (Original) . . . . . September 1980

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Updating Supplement

MANUAL IDENTIFICATION

Manual Serial No. Prefix: 2017F

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Manual Title: Reference Manual
HP 3075A, 3076A, 3077A Data Capture Terminals

SUPPLEMENT DESCRIPTION

FEBRUARY, 1982

The purpose of this supplement is to adapt the manual to instruments containing production improvements made subsequent to the printing of the manual and to correct manual errors. Enter the new information (or the Change Number, if more convenient) into the appropriate places in the manual.

Serial Prefix	Change
2017F	Errata
2131F	1
2131F	2

Serial Prefix	Change

Serial Prefix	Change

Errata : October, 1981
Change 1: December, 1981
Change 2: February, 1982

ERRATA

The manual should be modified according to the following changes:

SECTION 2 CHANGES

Page 2-3, left column, Section 2-7, first paragraph
Delete sub-paragraph (3), i.e:
3) EscZ self test

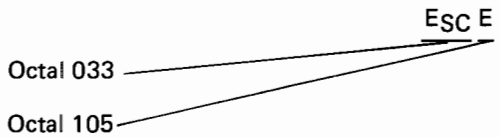
Page 2-3, left column, Section 2-8
Change Section 2-8 to read as follows:

2-8 FULL RESET (EscE)

CAUTION

This control sequence must be used with care as it completely clears the terminal's input/output data registers and resets the terminal's module/option configuration to the power-on state (see Appendix B).

Escape sequence:



EscE is equivalent to switching the terminal's power OFF and then ON, except that no computer Break is generated.

The terminal does not execute EscE until it has processed all the previously received escape sequences and data. In addition, any escape sequences or data sent immediately after EscE will be cleared from the terminal's buffer. Therefore, it is recommended that EscE should only be sent to terminals that have completely processed all previous escape sequences (and data). The processing time for the terminal and options is:

1) The standard terminal and options 004, 005, 007, 008, 010, 011, 012, 054 and 055 - negligible.
2) Option 006 (CRT) - up to one second.

3) Option 009 (Strip Printer) - up to 15 seconds. Bit 6 of the terminal's Interrupt Status (status byte 3) is set to 1 when the printer is busy. This bit should be monitored to ensure the printer has finished processing the data.
4) Option 013 (Serial I/O Interface) - the delay is equal to:

$$\frac{\text{number of bits sent}}{\text{terminal-to-device baud rate}}$$

Page 2-3, left column, Section 2-10
Delete completely Section 2-10 self test (ESCz)

Page 2-3, right column, Section 2-11
In sub-paragraph (1), change II-3 to I-3.

Page 2-8, Figure 2-1
Change "Computer issues Read request" to:
"Computer issues READ request (poll)"

Page 2-8, left column, Section 2-16 Break
Change sub-paragraph (5) to:
5) The Serial I/O detecting that the device is not ready due to a change in the state of the device's Data Set Ready line from READY to NOT READY.

SECTION 4 CHANGES

Page 4-2, right column, Section 4-3
Change sub-paragraph (6) line 4 to:
: ; < = > ? @ (octal 072 to 100)
[\ ] ^ (octal 133 thru 136)

SECTION 6 CHANGES

Page 6-14, Figure 6-10, third line
Change the dimension adjacent to "Section of line printer paper" from:
6.85 ± 0.38 mm
to: 6.35 ± 0.38 mm

Hewlett-Packard card layout form at the end of Section 6.
Add the following note between the two customer information boxes:

Note:
1) The 40 column clock is the maximum permissible for marked cards. The 80 column clock is the maximum permissible for punched cards. All the clock marks must be clock-after-data.
2) Non-reflective black ink must only be used for clock marks and pre-printed data marks. All other printing (e.g. logo, card form number and alignment boxes) must use reflective ink.

SECTION 12 CHANGES

Page 12-4, top of left column
Add the following new paragraph at the top of the column:

Ready lines. The ready lines comprise the terminal's Data Terminal Ready (CD) line, the terminal's Request To Send (CA) line and the serial device's Data Set Ready (CC) line. These three lines are independent of the handshake and are used as follows:
1) When the terminal is switched ON it always sets the Data Terminal Ready line ON (high) to inform the device that the terminal is powered on.
2) When the Serial I/O Interface is enabled by ESC-c1s/S it sets its Request To Send (CA) line ON (high) to inform the device that the interface is operational.

3) When the terminal is switched ON it continuously monitors the state of the device's Data Set Ready line. This line indicates the device's state of "readiness"; i.e. the Data Set Ready line is ON when the device is ready and OFF (low) when the device is not ready (i.e. power not on, paper low, etc.). Whenever the Data Set Ready line changes its state from READY to NOT READY a break is generated, see Section 2-16. In addition, bit 5 of the terminal's status byte 3 (Interrupt Status) is the inverse image of the Data Set Ready line; i.e. this bit is set to 1 when the line is OFF and is set to 0 when the line is ON. The terminal status is returned to computer upon receipt of E_{SC}^, see Section 2-14.

Note: A break is NOT generated when the Data Set Ready line changes from NOT READY to READY.

Page 12-4, left column, hardware handshake
Change the (former) second paragraph commencing "When handshake is selected . ." to:

CAUTION

If no handshake is used, data loss may occur. Data loss cannot occur when using the handshake.

When handshake is selected:
1) For data transfers from the terminal to the device, the terminal monitors the state of the device's Clear To Send (CB) line and only transmits data to the device when the line is ON.
2) For data transfers from the serial device to the terminal, when the therminal is available to receive data from the device, it sets the Secondary Request To Send (SCA) control line ON (this is done irrespective of whether or not the handshake is selected). The terminal then waits for the device's Received Line Detector (CF) line to be set ON before reading the input data.

Page 12-4, right column
Add the following new paragraph to the end of Section 12-4:

Intermessage spacing. To allow the terminal to process the messages, an intermessage spacing must be left. For ASCII and binary data received by the terminal (from both the device and computer), there must be a delay equivalent to three characters (i.e. 24 bits) between a message terminator character and the start of the next message.

Page 12-9/12-10, Section 12-21
Change the third paragraph starting "Handshake connection." and subsequent paragraphs to:

Handshake connection. When the handshake is selected (E_{SC}-s1h/H), the connection between the Serial I/O Interface and the serial device uses the following lines:

Terminal RS232C Connector	Connection	Serial Device RS232C Connector
AB (logic ground)	← Ground →	AB (logic ground)
BA (transmitted data) BB (received data)	— Tx data → ← Rx data —	BB (received data) BA (transmitted data)
CB (Clear To Send) SCA (Secondary Request To Send) CF (Received Line Signal Detector)	← Tx data handshake — — Rx data handshake → ←	SCA (Secondary Request To Send) CB (Clear To Send) CA (Request To Send)

The handshake operates as follows:
1) For data transmitted from the terminal to the device, one device signal (usually Secondary Request To Send, SCA) is connected to the Serial I/O Interface handshake control line CB (Clear To Send = terminal pin 6). The Serial I/O Interface monitors the CB line and only transmits data when the CB line is ON.
2) For data received by the terminal from the device, one device signal (usually Request To Send, CA) is connected to the Serial I/O Interface's control line CF (Received Line Signal Detector = terminal pin 8). In addition,

the Serial I/O Interface's control line SCA (Secondary Request To Send = terminal pin 11) is connected to the device (usually to Clear To Send, CB). When the Serial I/O Interface is available to receive data from the device it sets the signal SCA to ON. When the device has data available to send to the Serial I/O Interface it sets the terminal signal CF to ON, this causes the Serial I/O Interface to read the input data.

Note: For the data received by the terminal from the device, when the Serial I/O Interface is available to receive data it always sets signal SCA to ON irrespective of whether or not the handshake is selected. It is only when the handshake is selected that the Serial I/O Interface awaits for the CF line to be ON before reading the data.

Ready lines. The "ready" lines are independent of the handshake and use the following signals:

Terminal RS232C Connector	Connection	Serial Device RS232C Connector
CA (Request To Send)	→	CF (Received Line Signal Detector)
CC (Data Set Ready)	←	CD (Data Terminal Ready)
CD (Data Terminal Ready)	→	CC (Data Set Ready)

The ready lines operate as follows:

1) At power-on the Serial I/O Interface sets the CD line (Data Terminal Ready = terminal pin 20) to ON. This informs the device that the terminal is switched on.
2) When the Serial I/O Interface is enabled by ESC-c1s/S it sets the CA line (Request To Send = terminal pin 4) to ON. This informs the device that the Serial I/O Interface is operational.
3) One device signal (usually Data Terminal Ready, CD) is connected to the Serial I/O Interface's CC line (Data Set Ready = terminal pin 6). The device being enabled (i.e. available for data transfer operations) causes the terminal CC line to be set to ON. The CC line is OFF when the device is not ready. This allows the Serial I/O Interface to monitor the device's state of readiness.

SECTION 15 CHANGES

Page 15-2, Table 15-2
For the maximum voltage between phase and neutral, change 250 to 253. In the parameter column, change "Power interrupt" to "Power interrupt sensitivity".

Page 15-18, right column, Section 15-26
In line 2, change use to user.

Page 15-18, Table 15-4, fifth line
Change HP part number "8120-2588" to "8120-2322".

Page 15-19, Figures 15-13 and 15-14
Change HP part number "8120-2588" to "8120-2322".

SECTION 16 CHANGES

Page 16-4, Figure 16-4, below the terminal
Add "Point-to-point switches" above the horizontal bracket.

Page 16-5, Table 16-1, character parity bit
For switches I-3 and I-4 where both switches are set to 1, in the parity column change "none" to "odd".

Page 16-20, Table 16-2
Change Table 16-2 to:

Jumper Setting	Baud rate
CF = 0	Carrier detect line permanently low (used when the 3074 is connected to an electronic mail system)
CF = 1	Carrier detect line permanently high
5	9600, 4800
15	2400, 1200
40	600, 300

Page 16-21, left column, 3074A power cord
Change the first paragraph to:
3074A power cord. A terminal connected to a 3074A has its power input routed via the 3074A for power-on/off detection purposes (see Figure 16-10). This is achieved by connecting the special power cord supplied with the 3074A between the terminal power inlet and the 3074A power outlet. The standard power cord supplied with the terminal can be used to connect the 3074A to the site power outlet. If the terminal has a non compatible power inlet, the power cord supplied with the 3074A may be modified by cutting off the plug at the terminal end and substituting a compatible plug.

Page 16-26, left column, Figure 16-13
In the BITS/SEC row, delete 2400 and substitute 9600.

Page 16-27, left column, testing the data link
Change sub-section (4) to:
4) Obtain the status from the terminal:
   a) On the 2645A, type $E_{SC}\hat{}$ to request the status. This can be done because the 2645A continues to monitor the terminals.
   b) Press the 2645A ENTER key.
   c) The terminal status should appear on the 2645A screen.

Page 16-28, left column, Figure 16-15
In the BITS/SEC row, delete 9600 and substitute 2400.

Page 16-29, right column, HP 2645A Used In Driver Mode
In sub-paragraph (6) fourth line, change "Type DVR-AAAA" to "Type DVR -AAaA".

Page 16-38, left column, Section 16-78
Change the first paragraph to:

Once the 3075A/3076A/3077A terminal has been installed, its correct communications with the computer system must be verified. Escape sequence $E_{SC}\hat{}$ (terminal status, see Section 2-14) allows the terminal operations to be checked. The user must write his own sub-routine (in his chosen language) to request the terminal status and read the terminal status. The check must be done as follows:
1) Switch off then on the 3075A/3076A/3077A terminal to simulate power-on.
2) Send $E_{SC}\hat{}$ to the terminal to request its status, see Section 2-14.
3) Send $E_{SC}\hat{}$ to the terminal a second time, the status should be different as no power-on has occurred.

APPENDICES CHANGES

Appendix A, Page A-2, Table A-2
In right-hand column adjacent to octal 140, add the symbol " ` ".

Appendix C, Page C-1, Table C-1
In right-hand column adjacent to octal 140, add the symbol " ` ".

Appendix E, Page E-2, Table E-1
In right-hand column adjacent to hexadecimal 60 add the symbol " ` ".

Appendix F, Page F-1, Table F-1
For switches I-3 and I-4 when both are set to 1, in the parity column change "none" to "odd".

Appendix F, Page F-3, Figure F-3
Above the horizontal bracket (below the terminal) add:
"Point-to-point switches"

CHANGE 1 This change is to incorporate the two new bar code readers and the suppression of option 030 and the 92904A Wall Mounting Cradle into the manual.

TITLE PAGE CHANGE

Title page, under DATA CAPTURE TERMINALS
On the manual's title page, under DATA CAPTURE TERMINALS, add options 054 and 055 to the list of included options.

SECTION 1 CHANGES

Page 1-2, third paragraph (3075A/3076A terminal options)
Change sub-paragraph (7) to:
7) Bar Code Reader (options 010, 054 and 055), see Section 1-14.

Page 1-2, last paragraph (HP 92904A cradle)
The 3076A and 3077A terminals include as standard the Wall Mounting Cradle, however this cradle is no longer supplied as a separately orderable item. Consequently, change "HP 92904A Wall Mounting Cradle" to "Wall Mounting Cradle".

Page 1-3, Figure 1-2, fifth line
Change "010 Bar Code Reader" to:
"010, 054 or 055 Bar Code Reader"

Page 1-5, right column, Section 1-14 title
Change the title to:
1-14 BAR CODE READER (OPTIONS 010, 054 AND 055) see Section 9

Page 1-5, right column, Section 1-14 first paragraph
Change the first paragraph to read:
The 3075A and 3076A terminals can be equipped with a hand-held Bar Code Reader Wand capable of bidirectional reading (this enables it to read bar code labels that have been attached upside down to products). The available Bar Code Readers are:
1) Option 010 - general purpose bar code reader.
2) Option 054 - low resolution industrial bar code reader.
3) Option 055 - high resolution industrial bar code reader.

The Bar Code Reader Wand is linked to the terminal rear panel via a spiral cable. The module is supplied complete with a wand holder that can be installed in a position suitable for the application. A spare bar code wand, complete with cable and connector, is available.

Page 1-6, left column, first paragraph (readable codes)
Change the readable codes listed in the first paragraph to:
- Industrial 2 out of 5. Numeric code, one of the easiest to print and read.
- Matrix 2 out of 5. Numeric code, can be encoded at higher densities than Industrial 2 out of 5.
- Interleaved 2 out of 5. Numeric code, highest character density of the available 2 out of 5 codes.
- Code 39™*. Alphanumeric code.
- EAN 8 and 13. Numeric code.
- UPC A and E. Numeric code.

Page 1-6, left column, second paragraph (wand characteristics)
Change the second paragraph to:

Option 010 wand characteristics
Tilt angle: 0° to 30°
Depth of field: 0.25 mm (0.010 in.)
Resolution: 0.305 mm (0.012 in.)
Min. print contrast: 70%

Option 054 wand characteristics
Tilt angle: 0° to 45°
Depth of field: 1.00 mm (0.040 in.)
Resolution: 0.380 mm (0.015 in.)
Min. print contrast: 70%

Option 055 wand characteristics
Tilt angle: 0° to 45°
Depth of field: 1.00 mm (0.040 in.)
Resolution: 0.190 mm (0.007 in.)
Min. print contrast: 70%

Page 1-7, left column, Section 1-17
The cables for connecting the Serial I/O Interface to devices are no longer available. Consequently, in the first paragraph, delete "Two cables are available for device connection: HP 92905F (female) and HP 92905M (male)".

Page 1-7, right column, Section 1-18
In the title, change "1-18 92904A Wall Mounting Cradle" to "1-18 Wall Mounting Cradle".

In the first paragraph change "The 92904A Wall Mounting Cradle is provided to" to "The Wall Mounting Cradle (HP part number 5061-3806) is provided to".

Page 1-8, Figure 1-3
Delete "(see HP 92904A to order stand alone cradle)".

Page 1-12, left column
Due to hardware and software changes, the equipment listed in Sections 1-25 to 1-27 is no longer valid. Consequently, delete Sections 1-25, 1-26 and 1-27.

Page 1-12, right column, Section 1-30
The technical reference package has been suppressed, consequently change Section 1-30 to:

1-30 DATA LINK TESTER (92908A)

The HP 92908A Data Link Tester is a diagnostic tool designed to locate data link cable faults via three TRAFFIC ACTIVITY lamps. It is recommended to order one Data Link Tester per site.

Page 1-12, right column, Section 1-31
The option 030 installation kit has been suppressed, consequently change Section 1-31 to:

1-31 TEST CABLE (92909A)

The HP 92909A Test Cable comprises a four metre length of data link cable pre-wired with five connection boxes. It allows one computer and up to four devices to be connected together to form a "local" data link to allow system start-up and debugging programs to be verified.

Page 1-12, right column, Section 1-32 (Installation)
Change the section to read:
To start the installation of the power conduit/cables, data communications cables, connection boxes, etc. in advance of terminal delivery, simply order the cables, connection boxes, etc. as required.

Page 1-13/1-14, left column, Section 1-33
Change the three Bar Code Reader accessories lines to:

Bar Code Reader:
Option 010:
Wand HP ref. no. 92910A
Wand Tip HP part no. HEDS 3001
Wand Holder HP part no. 03075-40006
Option 054:
Wand HP ref. no. 92910C
Wand Tip HP part no. 1535-4165
Wand Holder HP part no. 03075-40010
Option 055:
Wand HP ref. no. 92910D
Wand Tip HP part no. 1535-4165
Wand Holler HP part no. 03075-40010

Change the Data Link tester accessory line to:
Data Link Tester: HP ref. no. 92908A
Test cable: HP ref. no. 92909A

Change the Wall Mounting Cradle accessory line to:
Wall Mounting Cradle: HP part no. 5061-3806

Delete lines "Serial Interface Cable: HP ref. no. 92905F/M connects external device to Serial Interface"

Page 1-13/1-14, right column, Section 1-38
Change the approvals lines to:
Approvals: UL, CSA, VDE and FTZ.

SECTION 2 CHANGE

Page 2-9, right column, Section 2-20
Change title to "2-20 WALL MOUNTING CRADLE RELAY"

SECTION 9 (Bar Code Reader) CHANGES

Remove Section 9 from the manual (14 pages) and add the new Section 9 (21 pages) supplied with this updating supplement.

SECTION 10 CHANGE

Page 10-2, right column
Change "92904A Wall Mounting Cradle" to "Wall Mounting Cradle".

SECTION 12 CHANGES

Page 12-2, left column
Delete the first nine lines (above the note)
In the note, change "92904A Wall Mounting Cradle" to "Wall Mounting Cradle".

Page 12-8, right column
Replace the first three lines by:
The user supplied serial I/O cable must use the internal wiring listed in Table 12-2.

SECTION 13 CHANGES

Page 13-1, left column, Section 13-1
In the fifth line, change "92904A Wall Mounting Cradle" to "Wall Mounting Cradle".

Page 13-2, left column, Cradle Relay
Change "92904A Wall Mounting Cradle" to "Wall Mounting Cradle".

Page 13-6, right column,
Change title "92904A Wall Mounting Cradle (see Section 2-20)" to "Wall Mounting Cradle (see Section 2-20)".

SECTION 15 CHANGES

Page 15-1, left column, Section 15-1
In sub-paragraph (3), change "92904A Wall Mounting Cradle" to "Wall Mounting Cradle".
In the same column, delete the second from the bottom paragraph starting "It is recommended...".

Page 15-1, right column, Section 15-4 (approvals)
In the second line, change 013 to 055.

Page 15-4, Figure 15-1
Change "Figure 15-1 92904A Wall Mounting Cradle - Positioning Guidelines" to "Figure 15-1 Wall Mounting Cradle - Positioning Guidelines"

Page 15-5, left column, Section 15-5
In the title and the first line, change "92904A Wall Mounting Cradle" to "Wall Mounting Cradle".

Page 15-9, left column, Section 15-12
Change the title to: 15-12 Bar Code Reader Wands (Options 010, 054 and 055) Cable Installation
Change Section 15-12 sub-paragraph (5) onwards to:

5) For option 010:
   a) On the sliding metal plate (used to cover the data cables inlet), unscrew and remove the blanking plate and perforated plate. They are secured to the sliding plate using a 6.35 mm (0.25 inch) AF nut.

      Note: The blanking plate must be retained as it must be replaced on the sliding plate (for safety reasons) if the wand is removed from the cradle.

   b) Pass the option 010 wand cable through the 19.00 mm (0.75 inch) diameter hole in the sliding metal plate, with the outside surface of the plate nearest the wand.

   c) Pass the perforated plate (formerly attached to the sliding plate) over the wand cable. Then secure it to the sliding metal plate using the 6.35 mm (0.25 inch) AF nut.

   d) Replace the sliding metal plate on the cradle base with the least gap possible between the plate and the back of the cradle. Tighten the plate locating screws.

6) For options 054 and 055:
   a) With the sliding plate from the data cables inlet removed, simply pass the wand vertically downwards through the inlet.

b) Then replace the sliding metal plate on the cradle base, with the least gap possible between the plate and the back of the cradle. Tighten the plate locating screws.

7) For options 010, 054 and 055, feed approximately 150 mm (6 inches) of the wand cable (that is terminated by the connector) through the cable clamp housing. Then replace and tighten the clamp.

8) Position the cable within the cradle as shown in Figure 15-5A.

9) Replace the cradle front cover and the cradle protection cover.

Page 15-10, left column, Section 15-14
Delete the first paragraph starting "Two serial I/O cables are...".

Page 15-12, Figure 15-7
In the table, in the Wall Mounting Cradle row, replace 92904A by 5061-3806.

Page 15-17, left column, Section 15-21
In the first paragraph, change "92904A Wall Mounting Cradle" to Wall Mounting Cradle".

Page 15-18, right column, Section 15-25
Change electrical resistance to "inner conductor <32 ohms per km (<51 ohms per mile), shield <13 ohms per km (<21 ohms per mile)".
Change capacitance to: "between inner conductors <66 p F/m (<20 p F/ft) between inner conductor and shield <115 p F/m (<35 pF/ft).

Page 15-22, left column, Section 15-28
In sub-paragraph (4), change "92904A Wall Mounting Cradle" to "Wall Mounting Cradle".

Page 15-23, right column
In the ninth line, change "92904A Wall Mounting Cradle" to "Wall Mounting Cradle".

SECTION 16 CHANGES

Page 16-3
Option 030 no longer exists, consequently delete page 16-3 (i.e. Section 16-8 and Figure 16-3).

Page 16-8, left column, Section 16-10
Change sub-paragraph (2) to:
2) The test connectors, badges and cards supplied with the terminal. The test connectors are required when performing a terminal communications test and an electrical interface test. The badges/cards are required to test the Multifunction Reader, Type V Badge Reader, Bar Code Reader and Magnetic Stripe Reader.

Page 16-8, right column, Section 16-11
Change the first line of sub-paragraph (2) to:
2) Fit the communications test connector (HP part number 03075-60026) supplied with the terminal onto the terminal rear panel 30-pin interface connector (see Figure 16-5).

Page 16-10, right column, Section 16-13
In sub-paragraphs (1), (3) and (4) change "supplied with the Installation and Programming Kit" to "supplied with the Multifunction Reader".

Page 16-11, right column, Section 16-14
In sub-paragraph (1), change "supplied with the Installation and Programming Kit" to "supplied with the badge reader".

Page 16-12, left column, Section 16-16
Change the first paragraph to:
Install the Bar Code Reader Wand on the terminal by plugging the wand cable into the wand connector on the terminal rear panel (see Section 9-2).
In the second paragraph, change "(part number 9320-4234) supplied with the Installation and Programming Kit" to "supplied with the Reader".

Page 16-12, right column, Section 16-16
Change the first paragraph at the top of the right column to:
Complete instructions for the Bar Code Reader are contained in Section 9. Take the Bar Code Test Pattern Sheet. Pass the tip of the wand over the longitudinal centre line of any of the codes. The terminal should beep to indicate a successful read and the decoded characters should appear on the display and printer (if printer fitted).

Page 16-12, right column, Section 16-17
In sub-paragraph (1), change "supplied with the Installation and Programming Kit" to "supplied with the reader".

Page 16-13, right column, Section 16-19
In the third paragraph, change "supplied with the Installation and Programming Kit" to "supplied with the Serial I/O Interface".

Page 16-14, left column, Section 16-21
In the first and second paragraphs, change "supplied with the Installation and Programming Kit" to "supplied with the option".
In the right column, sub-paragraph (2), change "Fit the Installation and Programming Kit test connector (HP part number 03075-60026)" to "Fit the test connector supplied with the terminal (HP part number 03075-60026)".

Page 16-14, right column, Section 16-22
In the first paragraph, change "supplied with the Installation and Programming Kit" to "supplied with the reader".
In the note, change "92904A cradle" to "cradle".

Page 16-15, left column, Section 16-23
In sub-paragraph (1), change "supplied with the Installation and Programming Kit" to "supplied with the reader".

Page 16-15, right column, Section 16-24
In the first paragraph, change "supplied with the Installation And Programming Kit" to "supplied with the reader".

Page 16-18, left column, Section 16-34
In the fifth line, change "92904A Wall Mounting Cradle" to " Wall Mounting Cradle".

Page 16-18, right column, Section 16-37
In the fourth line, change "92904A Wall Mounting Cradle" to "Wall Mounting Cradle".

Page 16-19, left column, Section 16-38
Change title to "16-18 WALL MOUNTING CRADLE RELAY TEST"

Page 16-23, Section 16-47
In the first paragraph, change the first line "The Data Link Tester (HP reference number 92908A) provides a convenient method of checking the Factory Data Link connections, without requiring specialist equipment.

Page 16-31, right column, Sections 16-59 and 16-62
In the fourth line of both sections, change "92904A Wall Mounting Cradle" to "Wall Mounting Cradle".

Page 16-32, left column, Section 16-64
In the first paragraph, change "supplied with the Installation and Programming Kit" to "Supplied with the terminal".

SECTION 17 CHANGES

Page 17-4, right column, Section 17-10
Change the second paragraph in the right-hand column to:

Tip replacement. If the tip shows visible indication of wear such that the shape is disfigured, or the aperture distorted, or the glass being opaque a new tip should be substituted.
The HP part number for the tip is:
1) For option 010, HEDS 3001
2) For options 054 and 055, 1535-4165

APPENDIX CHANGE

Appendix B, Page B-1, Table B-1
For the CRT option, change "(8) 92904A Wall Mounting Cradle relay: OFF" to "(8) Wall Mounting Cradle relay: OFF".

CHANGE 2 SECTION 6 CHANGE

Page 6-4, Figure 6-3
Add the following note within the drawing:
Note: In Image Mode either an odd or even number of characters may be transmitted, as all trailing blanks are suppressed.

HP 3075A, 3076A, 3077A DATA CAPTURE TERMINALS
REFERENCE MANUAL

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ILLUSTRATIONS (CONTINUED)

SECTION 1

GENERAL HARDWARE DESCRIPTION

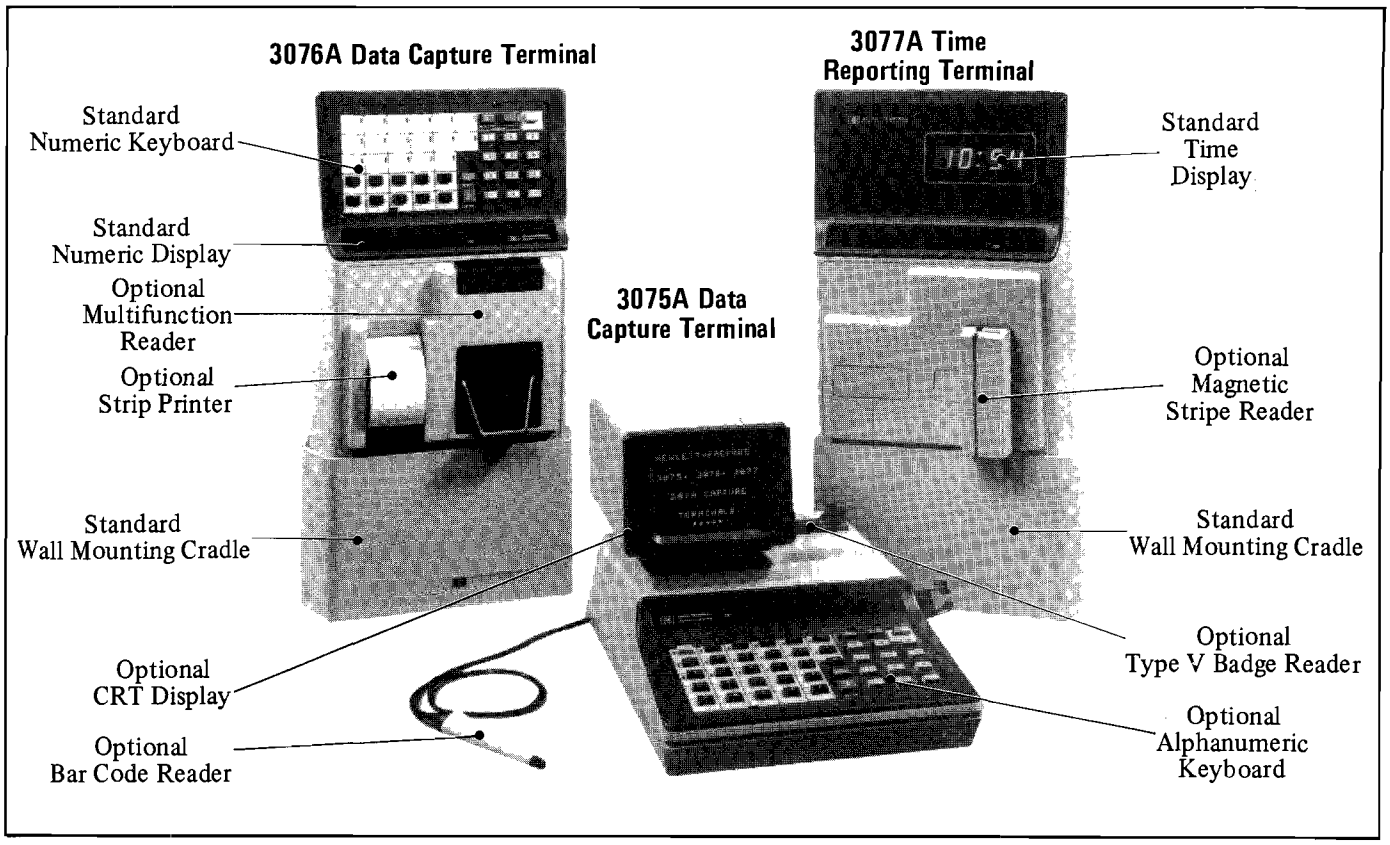


Figure 1-1 The HP 3075A, 3076A And 3077A Terminals

1-1 INTRODUCTION

This reference manual contains all the technical information necessary to install, maintain, operate and program the HP 3075A and HP 3076A Data Capture Terminals and the HP 3077A Time Reporting Terminal.

This section comprises a general (hardware) description of the standard terminal, terminal options and accessories. Section 2 contains general information necessary to program the terminals. Sections 3 through 12 contain technical information necessary to operate and program the 3075A and 3076A terminals standard modules/options. Section 13 contains technical information necessary to operate and program the 3077A terminal. Section 14 comprises a technical description of the communications protocol between the computer and the 3075A, 3076A and 3077A terminals. Sections 15 and 16 detail the terminal installation procedures. Section 17 describes the routine (e.g. bi-monthly) operator maintenance procedures. Appendices A through G contain general hardware/programming information.

1-2 TERMINAL DESCRIPTION

The 3075A/3076A/3077A family of easy-to-use data capture/time reporting terminals fulfils a wide range of data capture requirements in both manufacturing and distribution, in applications such as:
- stock control
- job vouchering
- work-in-process control and monitoring
- goods dispatching and receiving
- controlling access to restricted areas
- time reporting.

The terminals are especially designed for people whose job does NOT normally involve them with computer terminals. Simplicity, prompting lights, use of machine readable documents, information feedback are some of the features which make a non-computer specialist feel at ease with the terminals.

Several terminals may be controlled by a central computer that uses escape sequences (see section 2) to program the terminals. A self test/local operation mode (see section 16) allows all the terminal modules to be checked.

HP 3075A/3076A Data Capture Terminals. The 3075A is a desktop terminal for applications in offices, stockrooms or anywhere with desk space available. The 3076A is a wall mounted unit for machine shops, warehouses and similar areas where either desk space does not exist or data entry on a wall mounted terminal is more convenient.

The 3075A and 3076A terminals are both equipped with identical standard modules and options. The basic terminal has a Standard Numeric Keyboard (see section 1-5 for details) and a Standard Numeric Display (see section 1-8 for details).

The terminals have a wide range of options, i.e:

1) Alphanumeric Keyboard (option 004), see section 1-6.
2) Alphanumeric Display (option 005), see section 1-9.
3) CRT Display (option 006), see section 1-10.
4) Multifunction Reader (option 007), see section 1-11.
5) Type V Badge Reader (option 008), see section 1-12.
6) Strip Printer (option 009), see section 1-13.
7) Bar Code Reader (option 010), see section 1-14.
8) HP-IB Controller (option 011), see section 1-15.
9) Magnetic Stripe Reader (option 012), see section 1-16.
10) Serial I/O (RS232C) Interface (option 013), see section 1-17.

This enable the terminals to be built in over 300 different configurations. Figure 1-2 depicts the available option configurations. Thus the terminal can be tailored to suit the required application, from shop floor to office.

HP 3077A Time Reporting Terminal. The 3077A is a wall mounted Time Reporting Terminal. The basic terminal is equipped with a large digital clock time display and a Type V Badge Reader. As options, the terminal may be equipped with:

1) A Multifunction Reader (option 001).
2) A Magnetic Stripe Reader (option 002).
3) An Alphanumeric Display (option 005).

Figure 1-3 depicts the available option configurations.

The 3077A may be used to register personnel arrival and departure or to control access to restricted areas using a relay built into the Wall Mounting Cradle.

HP 92904A Wall Mounting Cradle. Both the 3076A and 3077A are secured on the wall using a 92904A Wall Mounting Cradle, which routes power and data communications signals to the terminal (see section 1-18). The cradle also contains a low power relay that is operated by the computer. The relay may be used to control an external device, such as an electric door lock.

Note: The 3076A and 3077A include as standard the Wall Mounting Cradle. Option 020 deletes the cradle.

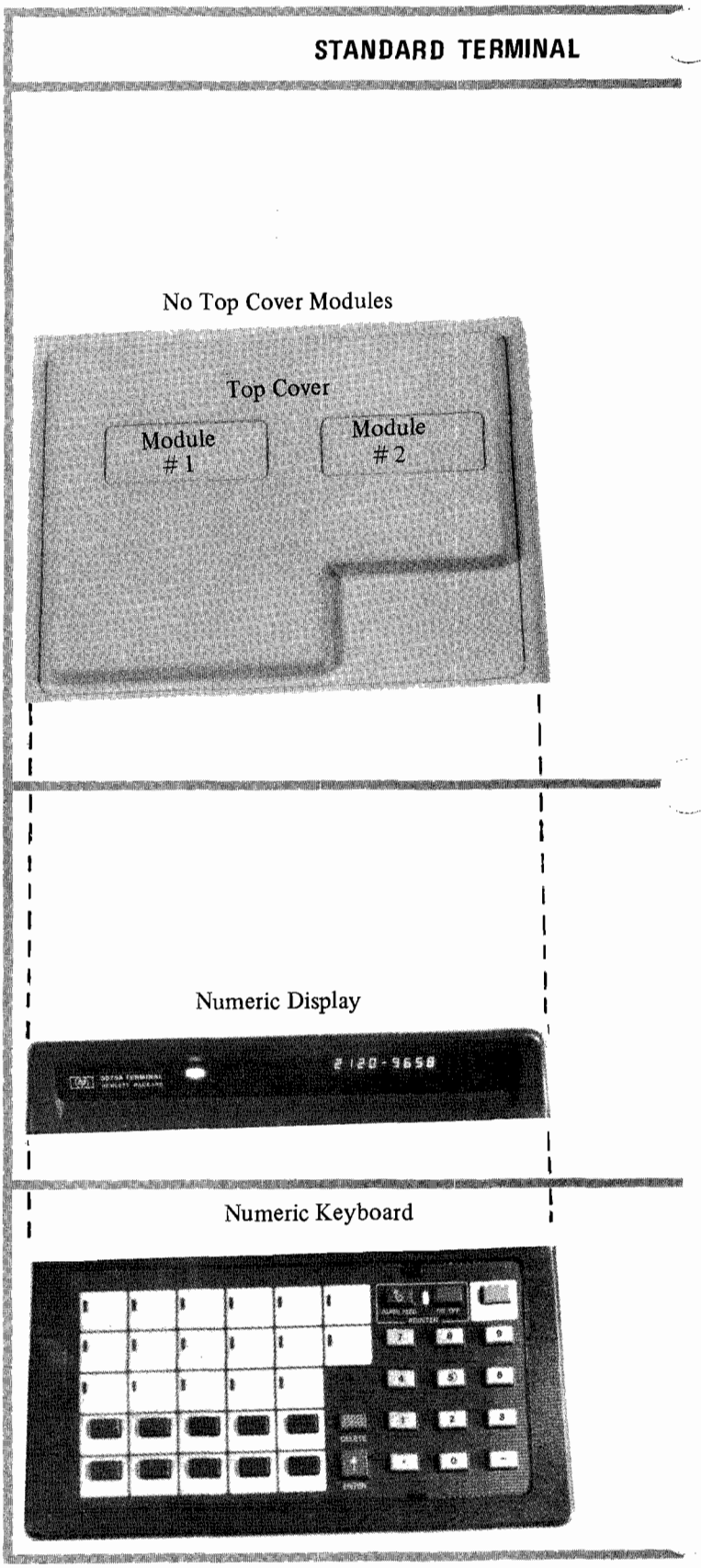
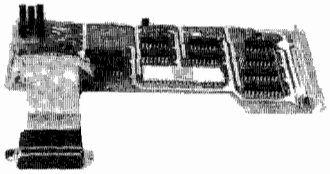


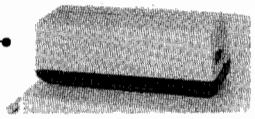
Figure 1-2 3075A And 3076A Terminal Option Configuration Chart

OPTIONS AVAILABLE

013 RS232C Interface

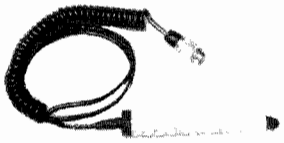


012 Magnetic Stripe Reader

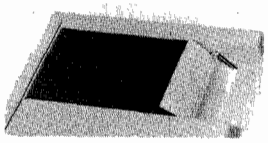


011 HP-IB Controller

010 Bar Code Reader

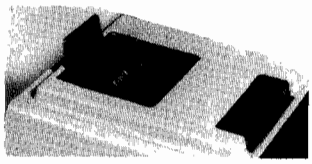


009 Strip Printer



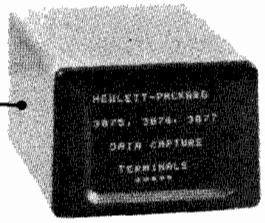
008 Type V Badge Reader

007 Multifunction Reader



Choice of up to 2 Modules (one of each kind)

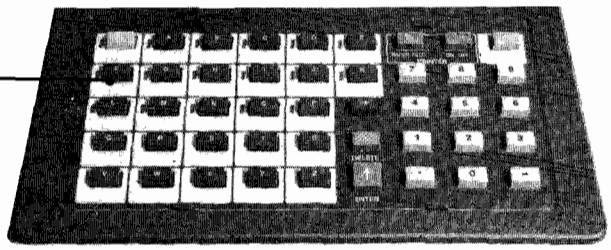
006 CRT Display



005 Alphanumeric Display

Choice of 1 Display

004 Alphanumeric Keyboard



Choice of 1 Keyboard

1-3 3075A AND 3076A TERMINAL SPECIFICATIONS

The Hewlett-Packard 3075A desktop and 3076A wall mounted Data Capture Terminals are both workstations offering the same basic functions and options. Figure 1-2 shows the options available.

1-4 KEYBOARD (see section 3)

The keyboard consists of a numeric keypad, user definable special function keys (SFK's) and 17 user definable prompting lights. An optional alphabetic keypad is available.

Each special function key and prompting light can be individually labelled to suit the particular application. The function names are written on an easy-to-change paper label which is protected by a transparent plastic overlay.

The keyboard can be locked out under program control (except the Attention key).

The keyboard is supplied complete with a pack of ten keyboard definition labels.

1-5 Standard Numeric Keyboard

Numeric keypad. Numerics 0 thru 9, decimal point, minus sign, Enter, Delete and system Attention key.

Special function keys (SFK's). 10 keys for user-defined functions. The keys can be individually programmed to send a terminator with the data character. This enables data to be entered using only one key.

1-6 Optional Alphanumeric Keyboard (Option 004)

The alphanumeric keyboard includes all the keys on the numeric keyboard plus:

Alphabetic keys. 26 keys organized in alphabetic order plus one space key and one shift key. The shift key enables the alpha keys to be used as special function keys.

1-7 DISPLAY

The 3075A and 3076A terminals can display data transmitted from the computer. In addition, data generated by the terminal itself; e.g. bar code readings, operator keyboard entries, can also be echoed on the display.

Any one of three displays can be fitted:
- a 15 digit numeric display } one line displays
- a 24 digit alphanumeric display }
- a compact, 5 inch CRT.

Each display can blink twice per second to attract the operator's attention. In addition, each display features a protected field that allows a text to be displayed and protected from overwriting by the operator.

The 3075A and 3076A are also equipped with terminal status lights; a green READY light and a red WAIT light.

1-8 Standard Numeric Display (see section 4)

The standard display is a 15 digit numeric display written left to right.

Displayable characters include numerics 0 thru 9, space, minus sign, decimal point, the □ character for special function keys and the ≡ character for point-to-point communications errors.

1-9 Optional Alphanumeric Display (Option 005) see section 4

The option 005 consists of a 24 digit Alphanumeric Display written left to right. Displayable characters include the full 64 ASCII character set (octal 040 to octal 137), the □ character for special function keys and the ≡ character for point-to-point communications errors.

1-10 Optional CRT Display (Option 006) see section 5

In situations where there is a need to display several lines of information, the 3075A and 3076A can be equipped with a CRT instead of the one line displays. The CRT is fitted with an anti-reflective screen to ensure good readability even in brightly lit environments. Two completely independent screens of information can be stored in the terminal memory at the same time. The two screens are program selectable and comprise one screen of large size characters (8 lines of 16 characters) and one screen of standard size characters (16 lines of 32 characters). The standard size screen features automatic scrolling. Either of the two screens can be displayed at any one time.

Display area:
94 mm W x 69 mm H (3.86 x 3 in.)

Display character set:
- large size set of 64 ASCII characters (octal 040 to octal 137).
- standard size set of 91 ASCII characters (octal 040 to octal 172).

Both screens use the ◀ symbol to indicate that a special function key has been pressed, and the ▓ symbol to indicate that a communications error has occurred.

Reading distance. The large size character screen is readable at distances of up to 4 m (13 ft.).

Control codes. The program can send data and control codes to the CRT. The control includes: displayed character size (standard or large), move cursor, clear display, clear from cursor position to end of display, backspace, delete, display blinking and one protected field.

1-11 MULTIFUNCTION READER (OPTION 007) see section 6.

The Multifunction Reader is so-called because it will accept several different types of non-embossed media. Media selection is made under program control.

The range includes:
- punched cards. Standard 80 column punched cards with no clock or clock-after-data format. A specially developed reading technique allows the reader to easily handle dirty punched cards.
- punched plastic badges. Compatible with Industry Type III specifications and containing data that corresponds to the first 22 columns of a punched card.
- optical mark forms. Same size as a standard punched card encoded with pencil marks or pre-printed information at up to 40 column density. The marked forms can be produced from continuous line printer stock and therefore may be used as Turn-around Documents. These are system generated documents that are subsequently re-entered into the system a number of times to record job progress. Clock-after-data format is used.

The Multifunction Reader can be disabled under program control to inhibit unwanted use.

Ease of use. Several features have been included to make the reader simple to use.
- automatic detection and rejection of incorrectly inserted cards.
- automatic detection and rejection of invalid codes marked in Hollerith mode.
- automatic card slippage detection and card rejection.

Reading modes. The reader accepts standard Hollerith marked or punched documents (128 characters set) and can also be set, by program, to read any combination of marks encoded on the card.

The module is supplied with a cleaning card for easy maintenance (see section 17).

1-12 TYPE V BADGE READER (OPTION 008) see section 7

The Type V Badge Reader reads punched Industry Type V Badges, non-embossed, with or without a clip. The absence of moving parts suits this reader to industrial environments. In addition, the reader is equipped with an easily removable badge pocket which can be taken out for inspection, cleaning or renewal. A valuable feature of the HP badge reader is its ability to read badges which are entered either side up. This simplifies badge entry for the user.

Reading mode. The reader accepts standard numeric punched badges of 10 digits, and can also be set, by program, to read any combination of data encoded on the badge. The unit can be enabled or disabled under program control.

1-13 STRIP PRINTER (OPTION 009) see section 8

This thermal printer is capable of printing 20 alphanumeric characters per line at a speed of 40 lines per minute.

Paper. Thermal paper on rolls 4.7 cm (1.86 in.) wide. Paper loading is made easy by the automatic loading feature. End of paper condition is detected and available to the computer.

Format. 5 x 7 dot matrix character generation. Lines are left justified and the full 64 ASCII character set (octal 040 to octal 137) is available together with a □ sign for special function keys and the ≡ character for point-to-point communications errors.

Control. Local printer control includes paper feed and printer on/off. Remote control by program is available using control sequences.

Text formatting. Automatic printing when more than 20 characters are transmitted.

The unit is supplied with one roll of thermal paper.

1-14 BAR CODE READER (OPTION 010) see section 9

The 3075A and 3076A terminals can be equipped with a Hewlett-Packard designed, hand-held Bar Code Reader Wand capable of bidirectional reading (this enables it to read bar code labels that have been attached upside down to products). The reader can accommodate a wide range of reading speeds from 7.6 cm/sec. to 76 cm/sec. (3 ins./sec. to 30 ins./sec.). The Bar Code Wand is linked via a spiral cable (min. 1 m extendable to 1.8 m) and connected to the terminal rear panel. The module is supplied complete with a wand holder that can be installed in a position suitable to the application. A spare bar code wand, complete with cable and connector is available.

Under program control, bar code data can be echoed locally on the 3075A or 3076A display as well as being sent to the computer. The readers also feature programmable check digit operation for those applications where digit substitution could have serious consequences.

Since bar code labels and documents are computer generated and the data is eventually fed back to the same computer system via the bar code wand, these labels and documents can serve as Turn-around Documents. Optional interfaces are available for the 3075A and 3076A which can drive HP-IB and RS232C - compatible printers.

Readable codes. The Bar Code Reader is specially designed to read black and white labels encoded with the following commonly used codes:

- Industrial 2 out of 5. Numeric data can be encoded. This is one of the easiest codes to print and read.
- Matrix 2 out of 5. Numeric data can be encoded at higher character densities thatn Industrial 2 out of 5.
- So-called Code 39*. Both numeric and alphanumeric data can be encoded.

Wand characteristics.
Tilt angle: 0° to 30°
Depth of field: 0,25 mm
Min. print contrast ratio: 70%

Documentation. Complete details on supported bar codes, print contrast ratios, check digit operation and printing considerations are available in section 9.

1-15 HP-IB CONTROLLER (OPTION 011) see section 10

Note:
The HP-IB (Hewlett-Packard Interface Bus) is Hewlett-Packard's implementation of IEEE standard 488-1978 "Digital Interface for programmable instrumentation".

Up to 14 HP-IB devices compatible with the IEEE 488-1978 Standard Digital Interface for programmable instrumentation can be directly connected to the HP-IB connector of the 3075A or 3076A Data Capture Terminals. The HP-IB module interfaces both control and data lines to device(s) and complies with subset specifications C1, C2, C3, C4 and C28. Up to 180 bytes can be transferred between the interface and device(s) at speeds of up to 7 kilobytes/sec.

** Code 39 is registered trademark of Interface Mechanisms Inc.*

The HP-IB Controller and the device(s) are controlled by powerful, easy-to-use high level commands which relieve the programmer of the task of managing the HP-IB protocol. Service requests from devices are permanently monitored and made available to the computer.
A further useful feature of the HP-IB Controller is a self operation mode which enables it to control HP-IB devices without the need for a computer.
Hewlett-Packard alone manufactures more than 100 HP-IB devices compatible with the HP-IB Interface of the 3075A and 3076A Data Capture Terminals.

1-16 MAGNETIC STRIPE READER (OPTION 012) see section 11

The Magnetic Stripe Reader is a compact, hand-operated, unidirectional reader that reads documents and embossed plastic badges encoded on track #2 of the ISO standard 3554. This is the track used by the American Bankers Association (ABA) to encode identification numbers on the standard credit card. This type of badge provides a high degree of security for personnel or account identification because it is difficult to duplicate. The reader also reads badges and cards encoded using the IBM wide track (3630) format. These cards can also be printed with human-readable alphanumeric characters.

The reader can accept badges/cards at speeds from 10 cm/sec. up to 100 cm/sec. (4 in./sec. to 40 in./sec.) and can be enabled/disabled by program.

The absence of moving parts suits this reader to industrial environments. A cleaning card and fluid are supplied for easy maintenance (see section 17).

Plastic badge. The standard credit card format is used on which up to 37 numeric characters can be encoded at 75 bits per inch. Five rows are available for embossed information; one row of 19 large characters and 4 rows of 26 small characters. Read errors are minimized through the use of parity and check characters.

Magnetic stripe document. This is an IBM 3630 compatible magnetic stripe document on which data is encoded at 128 bits per inch. The document can contain the same encoded numeric information as the plastic badges plus a 63 alphanumeric characters set. Data length can be up to 100 characters. Read errors are minimized through the use of parity and check characters.

1-17 SERIAL I/O (RS232C) INTERFACE (OPTION 013) see section 12

The 3075A and 3076A terminals can be fitted with an auxiliary electrical interface for connection of devices compatible with the EIA RS232C or CCITT V24/28 asynchronous interface specifications. One such device can be connected directly to the serial input/output port of the terminal, using the 25 pin female connector mounted on the rear panel. Two cables are available for device connection: HP 92905F (female) and HP 92905M (male). The interface is built into the terminal and can transmit/receive up to 180 characters at a time at speeds from 110 to 9600 baud. Communication between the external device and the terminal is completely independent of the communication between the terminal and the CPU. This allows a high degree of flexibility in matching the equipment to the application. The interface is computer controlled using control sequences to set:

- interface input/output, enable/disable.
- speed to 110, 300, 600, 1200, 2400, 4800 or 9600 baud or external clock.
- parity (odd, even, none), echo, handshake mode.
- ASCII or binary transmission of up to 180 input or output data characters.
- choice of any ASCII character as input terminator.
- termination of input according to length.
- input data displayable on terminal.

Handshake. The 3075A and 3076A terminals set the Request to Send line true when ready to transmit. Under computer control the terminals may or may not wait for the Clear To Send and Data Terminal Ready conditions. The terminals also set the Secondary Request To Send line false when not ready to accept data. The Data Terminal Ready line is monitored and a false condition is reported to the computer.

1-18 92904A WALL MOUNTING CRADLE

The 92904A Wall Mounting Cradle is provided to secure one 3076A or 3077A terminal in a vertical position. The terminal can easily and quickly be mounted or dismounted from the cradle. It routes all electrical power and data communications cables plus external equipment cables such as RS232C, HP-IB or bar code wand, to the terminal. The data communications connections for factory data link, multipoint or point-to-point cables are made using simple screw-type connector blocks. Color coded connectors make installation straightforward and easy (see section 15 for details).

Control relay. A low power relay can be actuated by program to control external devices.

Lock. The cradle cover is lockable. This restricts access to the terminal, switches and cables to authorized personnel only.

The Wall Mounting Cradle is included with the standard 3076A or 3077A terminal. However, it can be ordered in advance of the terminal if required for pre-installation.

1-19 3077A TIME REPORTING TERMINAL SPECIFICATIONS

The 3077A Time Reporting Terminal provides data capture capability combined with time management. It can be fitted with an Alphanumeric Display and either the Multifunction Reader, the Type V Badge Reader or Magnetic Stripe Reader. Time is indicated locally on the large four digit clock display (red, 7-segment LED's 20 mm high). At any time the terminal clock can be re-synchronized with the CPU master clock by a transmitted control sequence. The CPU can also check the local time by requesting terminal status. When badge data is reported to the CPU, time information is automatically appended (either 12 hour or 24 hour clock). This enables a time log of data entries to be easily kept. The 3077A has two operating modes to match it to particular applications:

- interactive mode. The data capture and time management operations are under program control so that individual badge validation can occur before the next badge is entered.
- buffered mode. The terminal takes local control over badge data capture and time management to enable a high throughput of personnel. The information from up to 20 badges can be stored locally before transmission.

Indicators. The 3077A has two programmable prompting lights (one red and one green) to indicate terminal availability. A programmable loud buzzer and an optional 24 digits Alphanumeric Display are provided for user feedback. Refer to section 1-9 for further information on the display.

Badges. Depending upon requirements, either the simple, economical Type III or Type V plastic badges can be used. Or, if greater security is required, the magnetic stripe plastic badges can be used. Refer to sections 1-11, 1-12 and 1-16 respectively for further information on the Multifunction Reader (for Type III Badges), the Type V Badge Reader and the Magnetic Stripe Reader.

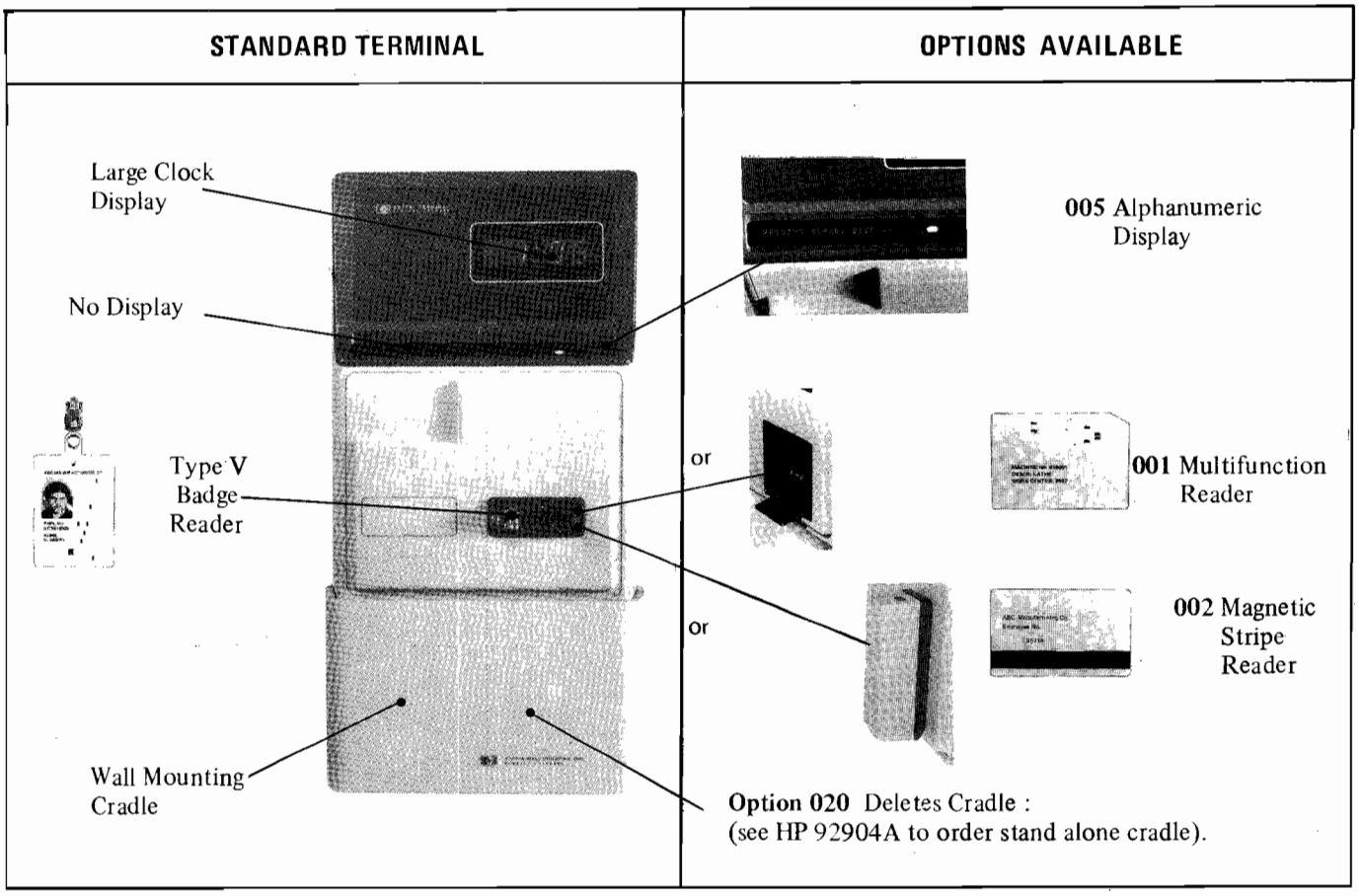


Figure 1-3 3077A Terminal Option Configuration Chart

1-20 3075A/3076A/3077A COMMUNICATIONS

The 3075A, 3076A and 3077A possess identical data communications capabilities. A choice is available in each terminal from three discrete data communications modes:

- Factory Data Link
- Daisy-chain
- Point-to-point.

} Utilise multiterminal ASYNC/BISYNC* protocol

Each mode is specifically suited to a particular type of system connection. Thus the terminals can be connected to HP systems and most other computers on the market today. Characters are transmitted in asynchronous ASCII 7-level mode with parity, and/or in binary 8-bit mode. Transmission speeds range from 110 to 9600 baud.

1-21 FACTORY DATA LINK (MULTITERMINAL) COMMUNICATIONS

The Factory Data Link is a data communications link used to interface a computer and a large number of terminals (see section 14). It is ideally suited for applications involving the collection of data from a large number of widely separated sources in the same building. It is compatible with any system that has RS232C data communications and supports ASYNC/BISYNC* protocol. This ensures compatibility with HP Computer Systems.

Installation (see section 15). The Data Link is a low-cost system that is very simple to install and modify. It consists of a single, shielded, twisted-pair cable (92902A) together with one connection box (92901A) for the computer and each 3075A terminal (plus spares if required). Modification involves simply adding further cable and boxes.

Its characteristics enable a large number of terminals to be connected anywhere along the same link at distances up to 4 km (2.5 miles) from the computer. Total link length can be up to 8 km (5 miles).
HP terminals may be connected directly to the Data Link. For other terminals compatible with ASYNC/BISYNC protocol, the HP 3074A Data Link Adpater is available to interface the electrical levels of the link to RS232C levels. This Adapter also provides power-on/off detection to ensure that when a terminal is switched on or off, it cannot generate random data on the link. This is vitally important in a data communications system and although HP Data Capture Terminals already incorporate power-on/off detection, many terminals do not.

High noise immunity. A further feature of the Data Link that suits it to industrial environments is its high noise immunity. The use of optical isolators and floating, differential signal lines enable it to be operated through machine shops, welding shops or electrically noisy environments while maintaining data integrity.

System reliability. System reconfiguration and maintenance is greatly simplified by the ability to connect/disconnect terminals from their Data Link connection boxes while the link is still operating. First, if a terminal is switched off, all other terminals on the link continue to function normally, without interruption. Second, a terminal can be moved from one connection box to another without disturbing the system, in fact, while data transmission is still in progress.

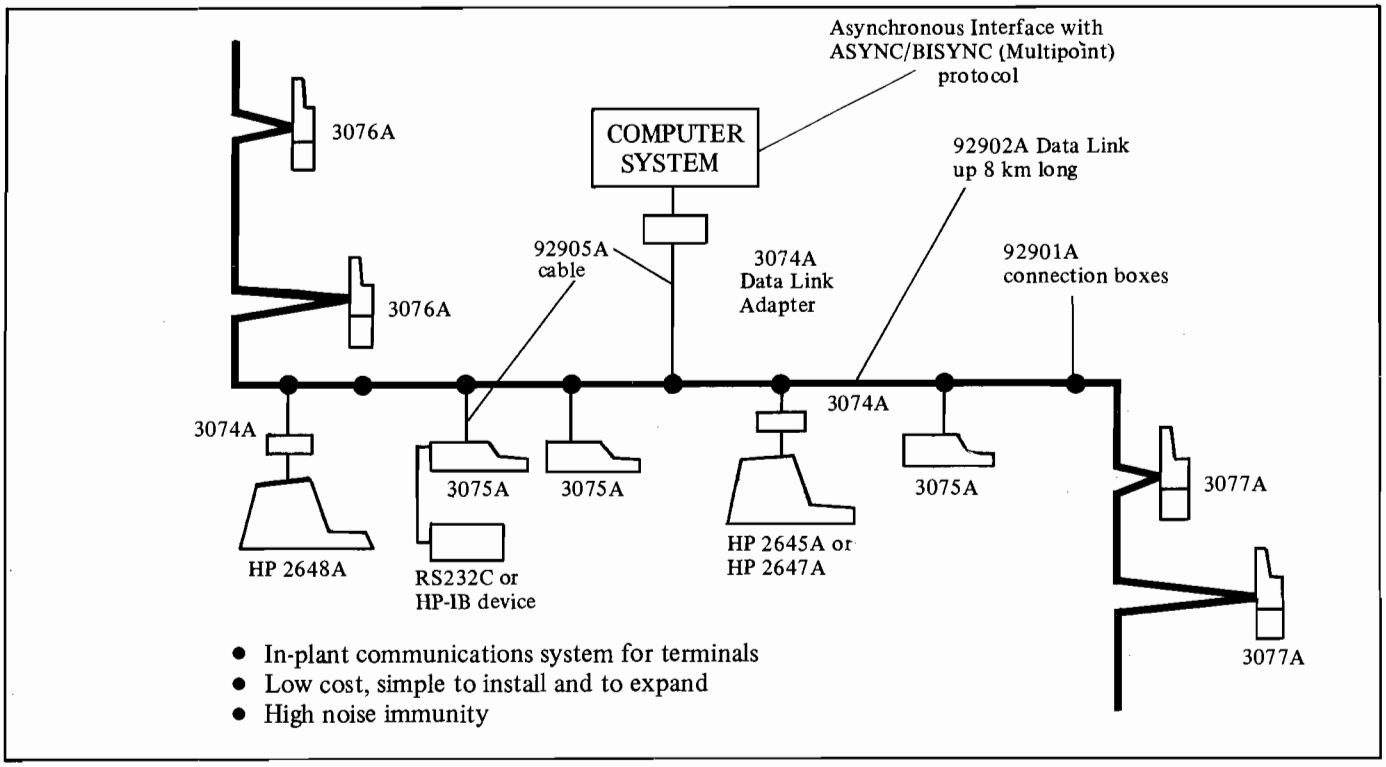


Figure 1-4 Typical Factory Data Link (Multiterminal) Connection

**ASYNC/BISYNC is the Hewlett-Packard implementation of the BSC Binary Synchronous Communication.*

1-22 Factory Data Link Equipment

Figure 1-4 depicts a typical Factory Data Link connection. Each Factory Data Link installation requires the following five basic components :

HP 3074A Data Link Adapter (see figure 1-5). The 3074A connects Asynchronous/Bisync-compatible devices, with an RS232C or CCITT V24 interface, to the system or CRT terminals such as HP 2645A, HP 2647A, HP 2648A. To a computer system, the 3074A acts as a half duplex modem and requires the Request To Send signal to be set high whenever data is to be transmitted to the Data Link. It provides in return a non-delayed Clear To Send signal, a Data Set Ready signal, and has Carrier Detect line processing.

The 3074A is fitted with power on/off detection circuitry to ensure that whenever the terminal is switched on/off, the random data it generates cannot be transmitted on to the Data Link.

The 3074A is fitted with a data link connector compatible with the 92905A Data Link-to-Device cable, an RS232C connector for computer or CRT terminal connection, and a device power connector (terminal power is routed via the 3074A). The adapter can be easily mounted on any flat surface of at least 250 mm by 110 mm.

HP 92901A Data Link Connection Box (see figure 1-6). The 92901A connection box connects one 3074A or 3075A terminal to the Data Link. Constructed in a hard plastic case 6.5 cm square, the Data Link Connection Box can be secured on any flat surface by means of screws.

The arrangement of the internal contacts ensures Data Link continuity when no device is connected. A protective cover is supplied to protect the contacts when the box is not in use. The connection box features make-before-break contacts which allow devices to be plugged/unplugged from the Data Link without interrupting operation. HP 92901A is a pack of 5 connection boxes.

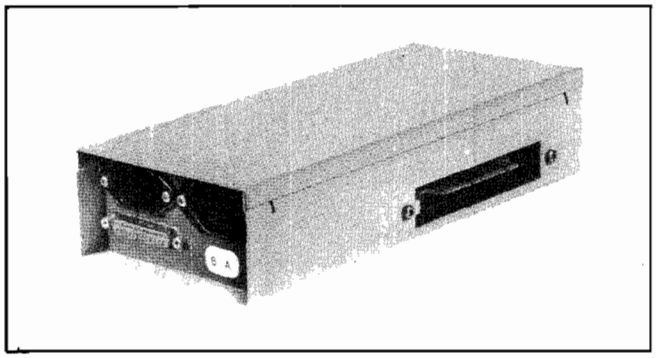


Figure 1-5 HP 3074A Data Link Adapter

HP 92902A Data Link Cable (see figure 1-6). The 92902A is a shielded, single twisted pair cable that is used to connect a large number of terminals to a computer. The cable can be up to 8 km (5 miles) long and terminals and computer can be connected at any point along it provided that no terminal is more than 4 km (2.5 miles) away from the computer.
The computer (via the 3074A) and the 3075A are connected to the Data Link using the 92905A cable which plugs into one 92901A connection box mounted on the Data Link. The 3076A or 3077A Wall Mounted Terminals connect directly to the Data Link using screw terminations. These connections are color coded to ease installation and are secured in the terminal Wall Mounting Cradle. The Data Link continuity is assured through the Wall Mounting Cradle, even if no 3076A or 3077A terminal is installed.

The 92902A cable is available in reels of either 100 or 300 metres with no connectors. Cable equivalent is BELDEN 9463.

HP 92905A Data Link-To-Device Cable (see figure 1-6). The 92905A cable is a twin version of the 92902A Data Link cable. It is 2 m (6.5 ft.) long and is fitted with a Data Link connector at one end and a connector for the 3074A or 3075A at the other end.

HP 13232A 3074A-To-Terminal Cable. The 13232A cable connects HP 2645A, HP 2647A, or HP 2648A CRT terminals fitted with Asynchronous/Bisync protocol to a 3074A Data Link Adapter. The 3074A is connected in turn onto the Data Link via 92905A cable.

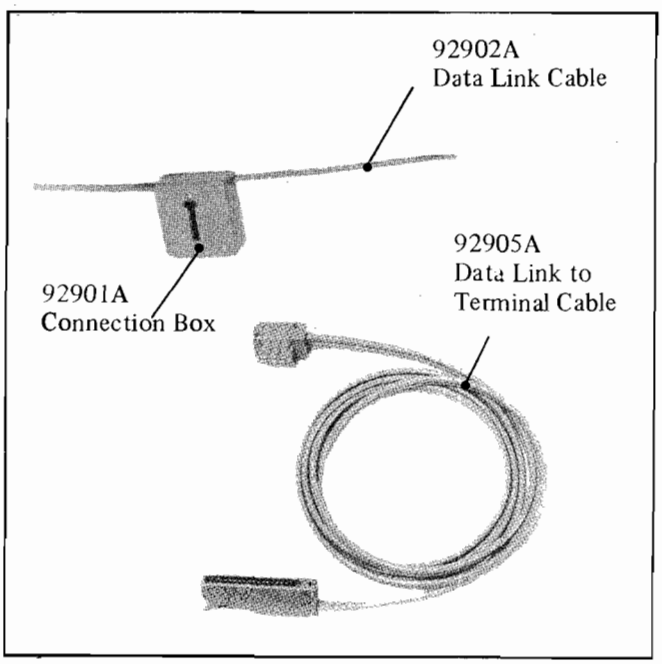


Figure 1-6 Factory Data Link Cables

1-23 DAISY-CHAIN (MULTITERMINAL) COMMUNICATIONS

Multiple terminals (including 264X series) can be daisy-chained to a single computer interface that supports the ASYNC/BISYNC polling protocol. The main advantage of this mode of communication it that it allows for multi-terminal communication over asynchronous half/full duplex modems. Figure 1-7 depicts a typical daisy-chain connection.

Note: Sections 15 and 16 detail the daisy-chain installation.

1-24 POINT-TO-POINT COMMUNICATIONS

Using the standard RS232C/CCITT V24 connection, one terminal can be connected to almost any conventional asynchronous terminal interface. Connection can be either hardwired or via full duplex modems. The main advantage of this mode of communications is that is allows direct replacement of teletype-like devices. Figure 1-8 depicts a typical point-to-point connection.

Note: Sections 15 and 16 detail the point-to-point installation.

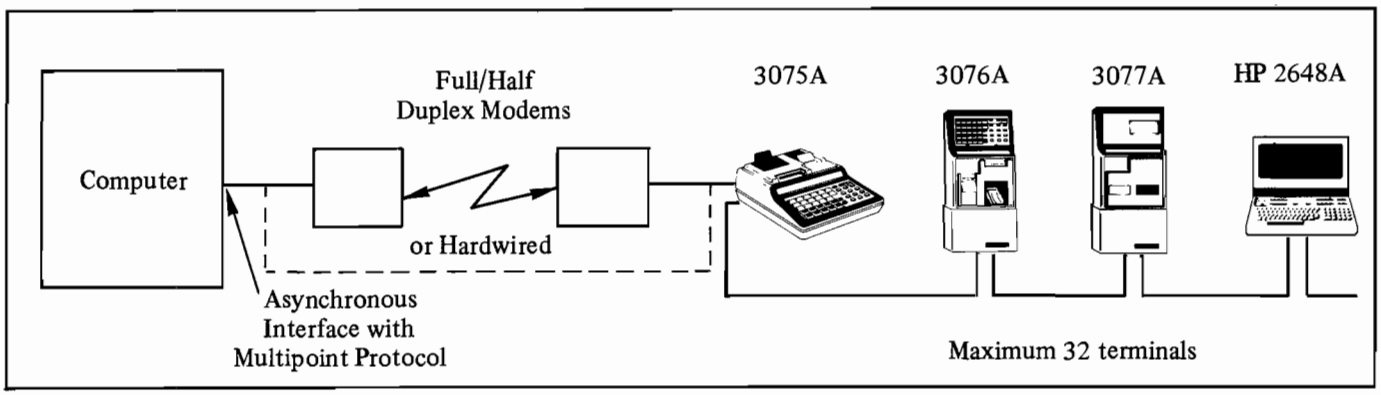


Figure 1-7 Typical Daisy-Chain (Multiterminal) Connection

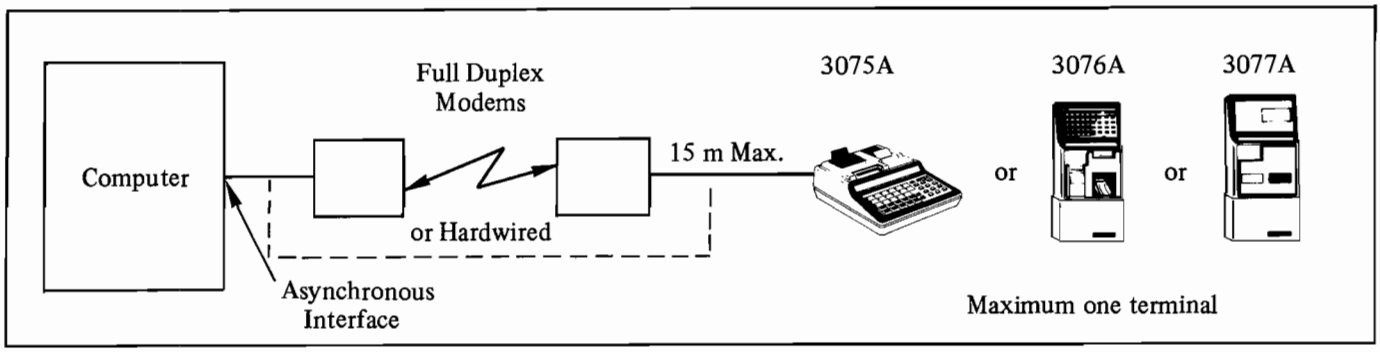


Figure 1-8 Typical Point-To-Point Connection

1-25 SOFTWARE AVAILABLE

The 3075A, 3076A and 3077A terminals are fully compatible with HP technical and business computer system families.

1-26 HP 1000 COMPUTER SYSTEMS

The HP 1000 computer system provides a powerful multiterminal interfacing package for supporting up to:

1) 56 3075A, 3076A and 3077A terminals using a Factory Data Link connection.
2) 32 3075A, 3076A and 3077A using a daisy-chain connection.

The interface software allows multiple 2645 or 2648 CRT terminals to be intermixed with the 3075A, 3076A and 3077A on the same multiterminal communications line.

DATACAP 1000. Datacap 1000 is a powerful tool for fast and easy creation of factory data collection systems - without programming. This software package, available on HP 1000 systems enables a "design it yourself" approach to building an interactive data collection system.
No computer programming is required, even for on-line access to data bases. All that is required are the answers to a series of questions that appear on the screen of a CRT terminal. Under Datacap/1000 management, data from the factory floor is continually being collected at source from the Data Capture Terminals and immediately used to update a data base. Data can also be stored on disc or magnetic tape for subsequent processing. Datacap/1000 offers the flexibility required to easily re-adapt factory data collection systems to the ever changing needs of a dynamic manufacturing plant.

1-27 HP 3000 COMPUTER SYSTEMS

The HP 3000 II/III computer system, complete with MTS/3000 (multipoint terminal software), will support a large number HP Data Capture/Time Reporting Terminals using either a Factory Data Link or a daisy-chain connection. The MTS interface software allows multiple 2645 or 2648 CRT terminals to be intermixed with the 3075A, 3076A and 3077A terminals on the same multiterminal communications line. The software manages the routine communications thereby allowing the user to concentrate on applications.

The HP 3000 II/III computer system also allows the 3075A, 3076A or 3077A to be point-to-point connected either hardwired or via full duplex modems.

1-28 ORDERING INFORMATION

1-29 PRODUCTS AND OPTIONS

The 3075A Desktop and 3076A Wall Mounted Terminals can both be equipped with a wide range of options. Option numbers and applicability can be easily determined using the 3075A and 3076A Terminal Option Configuration Chart, figure 1-2. The 3077A Time Reporting Terminal options are shown on the 3077A Terminal Option Configuration Chart, figure 1-3. All terminals may be ordered with option 015 to specify 220V/240V operation. All terminals are supplied with the Quick Reference Guide and the 3075A is supplied with a power cord.

1-30 TECHNICAL REFERENCE PACKAGE 92907A

Implementation of a Data Capture application often starts before delivery of terminals and it is good practice to order one Technical Reference Package (HP 92907A) for advanced planning. The package consists of the Data Capture Terminal Reference Manual (03075-90011) and the Quick Reference Guide (03075-90002). It provides necessary information about: programming, site preparation, terminal installation and maintenance. Also covered are specifications required for badges (punched, magnetic stripe), cards (punched, marked, overprinted) and bar codes.

1-31 INSTALLATION KIT

It is recommended to order one Installation kit (option 030 for 3075A, 3076A or 3077A) per Data Capture site. The kit includes test cards, test badges, bar code test sheet and all hardware connectors to verify proper operation of terminals and communications.

1-32 INSTALLATION

To start installation of the data communication cables, power conduits, connection boxes, Wall Mounting Cradles, etc. in advance of terminal delivery, simply order one Technical Reference Package (HP 92907A) and cables, connection boxes, 3074A Data Link Adapter, etc. as required. Order one 92904A stand alone Wall Mounting Cradle per 3076A and 3077A. Then order 3076A's and 3077A's with option 020 to delete the Wall Mounting Cradle.

1-33 ACCESSORIES

Keyboard: Pack of ten keyboard labels

Keyboard	3075A	3076A
Numeric	03075-60012	03076-60002
Alphanumeric	03075-60011	03076-60001

Multifunction Reader: Cleaning card HP part no. 7120-7562.
Type V Badge Reader: Pocket HP part no. 03075-60020.
Strip Printer Paper: Pack of six rolls HP ref. no. 82045A.
Bar Code Reader:
Wand HP ref. no. 92901A.
Wand Tip HP part no. HEDS 3001.
Magnetic Stripe Reader:
Cleaning card HP part no. 03075-80026.
Cleaning fluid HP part no. 8500-1251.
Wall Mounting Cradle: HP ref. no. 92904A.
Data Link Tester: HP part no. 03075-60021.
Serial Interface Cable: HP ref. no. 92905F/M connects external device to Serial Interface.
HP-IB Controller:
Cable HP ref. no. 10633A/B/C/D or 10631A/B/C/D.
Overlay HP part no. 03075-00027.

1-34 FACTORY DATA LINK EQUIPMENT

HP 3074A Data Link Adapter. Option 015 required for 220V/240V operation. Supplied with Operating and Service Manual and power cord.
HP 92901A: Pack of 5 connection boxes.
HP 92902A: Reel of Data Link Cable (no connector). Option: 001 for 100 m (325 ft.) ; 002 for 300 m (975 ft.).
HP 92905A Data Link to Device cable: Connects one 3075A or one 3074A to one 92901A connection box.
HP 13232A RS232C cable: Connects one 264X to a 3074A.

1-35 DAISY-CHAIN CABLES

HP 92906A: Reel of daisy-chain cable (no connector). Option: 001 for 100 m (325 ft.) ; 002 for 300 m (975 ft.).
HP 13232P: Connects computer to first terminal.
HP 13232Q: Connects between terminals.
HP 13232R: Extension cable.
HP 13232U: Modem bypass (required for test).

1-36 POINT-TO-POINT CABLE

Check computer interface cable. 13232A is usually used.

1-37 LITERATURE

HP 92907A Technical Reference Package
HP 3075A/3076A/3077A Quick Ref. Man. 03075-90002.
HP 3074A Operating and Service Manual 03075-90001.

1-38 POWER REQUIREMENTS (see section 15)

Input voltage:
115V AC (+ 10%, -25%)
230V AC (+ 10%, -15%).
Input frequency: 47.5 - 66 Hz.
Power consumption: 90 watts typical.
Approvals: UL, CSA. VDE and FTZ (pending for options 006, 010, 011, 012, 013 and 014).

1-39 ENVIRONMENTAL (see section 15)

(exclusive of badges, labels, forms and printer paper)

Temperature, free space ambient.
- non operating: -40° to + 75°C (-40° to + 167°F).
- operating: 0° to 55°C (32° to 131°F).
- bar code wand: non operating -20° to 55° (-4° to 131°F).

Humidity: 5% to 95% (non condensing) at 40°C (131°CF).
Altitude:
- non operating 15000 metres
- operating 4600 metres.

Vibration: type tested to withstand vibrations of up to 0.38 mm (0.015 in.) p-p, 5-55-5 Hz, 3 axis for 15 minutes.

1-40 PHYSICAL (see section 15)

3075A
Weight: Min. 6.6 kg (14.4 lb); Max. 8.7 kg (19.1 lb).
Minimum dimensions:
130 H x 275 W x 395 mm D (5.1 x 10.8 x 15.6 in.).
Maximum dimensions with CRT on top:
260 H x 275 W x 420 mm D (10.2 x 10.8 x 16.5 in.).

3076A, 3077A
Weight: Min. 10.6 kg (23.5 lb) ; Max. 12.7 kg (27.9 lb).
Minimum dimensions:
550 H x 290 W x 130 mm D (21.7 x 11.4 x 5.1 in.).
Maximum dimensions with CRT on side (3076A only):
550 H x 440 W x 190 mm D (21.7 x 17.3 x 7.5 in.).

SECTION 2

GENERAL PROGRAMMING INFORMATION

2-1 INTRODUCTION

This section contains general information necessary to program the 3075A/3076A Data Capture Terminals and the 3077A Time Reporting Terminal. More detailed information on programming the terminal standard modules/options is given in sections 3 to 13 inclusive. A technical description of the data communications is contained in section 14.

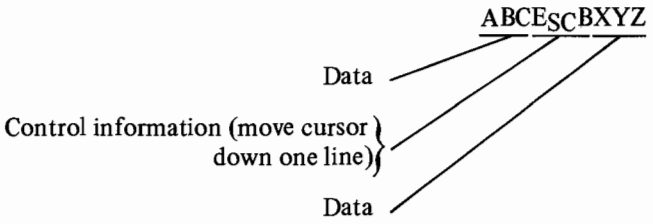
2-2 TERMINAL DATA AND CONTROL SEQUENCES

Two types of information may be sent to the terminal, namely:

1) Data. This may be displayed on the terminal display and routed to all the terminal output modules (e.g. the printer, HP-IB Interface, Serial I/O Interface, etc.).

2) Control sequences. These control the operation of the terminal.

The data and control sequences may be intermixed in the same block of characters sent from a program. In order for the terminal to distinguish between these two types of information, the control sequences are always prefixed by the same special character, ESCAPE (ASCII character E_{SC}=octal 033). Consequently the control sequences are called escape sequences. At the end of the escape sequence the terminal assumes all further characters are data, for example:



The data sent from the computer to the terminal may comprise either:

1) Any of the 128 ASCII characters from N_{UL} (octal 000) to D_{EL} (octal 177). Each ASCII character comprises seven data bits and one parity bit.

Note: ASCII characters N_{UL} (octal 000) to U_S (octal 037) and D_{EL} (octal 177) are non-displayable control characters. When sent to the terminal as data they must be in binary format.

2) 8-bit binary data (from octal 000 to 377). Primarily used with the HP-IB Interface and the Serial I/O Interface. Before binary data can be sent, the terminal must be configured and the character count specified as described in section 2-11.

Information sent from the terminal to the computer may be either:

1) Data. This generally in ASCII format (i.e. from N_{UL} octal 000 to D_{EL} octal 177) but binary data may also be transferred from, for example, the HP-IB Interface or Serial I/O Interface when the terminal is set to the transparency mode (see section 14-16).

2) Status information. This relates to the terminal itself. comprising such information as the model number, type of options fitted, etc. See section 2-14 for further details.

Temporary storage of data received from and transmitted to the computer is provided respectively by input and output data buffers. For the 3075A/3076A, these two independent buffers are each 180 characters long. Consequently no block of characters transmitted by the computer should exceed 180 characters. Similarily the terminal will not transmit blocks greater than 180 characters long. For the 3077A, the input buffer is 100 characters long and the output buffer is 240 characters long.

For point-to-point terminal connection to the computer, ASCII (and binary) data transfers from the terminal to the computer and vice-versa are terminated by the same data terminator character. Rear panel terminal configuration switch II-8 (see Appendix F) allows the selection of any ASCII character to be used as the terminator. If the switch is set to 0, the input terminator character (for data transfers from the terminal to the computer) is C_R (Carriage Return = octal 015). If the switch is set to 1, then the input terminator character may be any ASCII character from octal 000 to octal 177. The ASCII character is simply declared by setting the corresponding code on the terminal configuration switches III-2 through III-8. See Table 2-1 for an example of the switch settings.

Table 2-1 Example Of Point-to-Point Customized Terminator Character Selection

Switches	III							Octal Code	Equivalent ASCII Input Terminator Character
	2	3	4	5	6	7	8		
Switch Setting	0	0	0	0	0	0	0	000	N_{UL}
	0	0	0	0	0	0	1	001	S_{OH}
	0	0	0	1	0	1	0	012	L_F
	1	1	1	1	1	1	1	177	D_{EL}

Note: The output terminator character (for data transfers from the computer to the terminal) must be the same as the input terminator character specified on the terminal configuration switches.

For multiterminal connections to the computer, ASCII (and binary) data transfers from the terminal to the computer are terminated by the data terminator character, namely C_R (Carriage Return = octal 015).

For both point-to-point and multiterminal connections the input terminator character is generated:

1) By each input module/option at the end of its data.
2) When the ENTER key is pressed.
3) When a special function key (SFK) programmed as an input terminator (see section 3) is pressed. In addition the character corresponding to the SFK is sent to the computer.

The following sub-sections describe the terminal control sequences.

2-3 ASCII CONTROL CHARACTERS

ASCII characters from N_{UL} (octal 000) to US (octal 037) and D_{EL} (octal 177) are non-displayable control characters. Certain of these characters (e.g. B_{EL}, S_O and S_I) are used to control the terminal and are described with the escape sequences for the relevant modules/options.

Note: Appendix A lists the ASCII character set.

2-4 ESCAPE SEQUENCES

Two types of escape sequence are used, variable length and two character sequences.

2-5 Variable Length Escape Sequences

The escape sequence can be of any length (up to 180 characters) but must always have the same format, namely:

E_{SC}-$\beta N_1 \alpha_1 N_2 \alpha_2 N_3 \alpha_3 \ldots .$ Nn CAPITAL αn

where;

E_{SC}: is the ASCII control character (octal 033) that defines the start of the escape sequence, forcing the terminal to treat the following characters as control characters (not as data characters).

-: is the displayable ASCII minus character (octal 055) that specifies an escape sequence particular to the 3075A, 3076A, 3077A terminals.

β: is a lower case character that specifies the terminal module/option to which the control sequence is directed. β can have the following values:

c - Configuration of the terminal standard modules/ options

d - Displays, indicators and relay

h - HP-IB interface

k - numeric/alphanumeric Keyboard and printer

m - Magnetic stripe reader

r - multifunction, type V Reader

s - Serial I/O interface

t - Time reporting terminal (HP 3077A)

w - bar code reader Wand

Note: Within an individual escape sequence, all the control operations (defined by N α) are directed at the terminal module (defined by β).

Nα : are a combined number and letter used to specify a particular control operation.

N is a number (generally 1 or 0) used to specify an action, for example to set or clear a terminal feature.

α is an alpha character (i.e. letter) used to specify the feature to be acted on (e.g. a prompting light). The α character must be lower case when it is NOT the last character in the sequence. The α character must be upper case (i.e. CAPITAL) when it is the last character in the sequence. i.e. the upper case α character defines the end of the escape sequence, causing the terminal to interpret further characters as data characters (until a subsequent E_{SC} character is received).

For example:

E_{SC} -c1p0D

enables the printer and disables the Display.

Note:
1) If the terminal receives a wrongly structured escape sequence, it ignores all characters following the error until an upper case character is received, afterwhich all subsequent characters are interpreted as data.
2) Spaces (octal 040) are NOT allowed in an escape sequence.

2-6 Two Character Escape Sequences

These are fixed length discrete escape sequences that always have the same format, namely:

$E_{SC}\alpha$

where:

E_{SC}: is the ASCII control character (octal 033) that defines the start of the escape sequence (forcing the terminal to interpret the next character as a control character).

α : is a displayable ASCII character used to specify the control operation.

For example:

E_{SC}J

Clears the display screen.

Note:
1) A space (octal 040) is not allowed between the E_{SC} and the ASCII character specifying the control operation (e.g. J).
2) All the escape sequences are listed in Appendix G.

2-7 GENERAL CONTROL SEQUENCES

General control sequences are employed to provide the following programming capabilities:

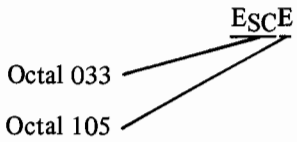
1) $E_{SC}E$	full reset
2) $E_{SC}f$	modem disconnect
3) $E_{SC}z$	self test
4) E_{SC}-bNα	send binary data
5) B_{EL}	sound terminal buzzer

These sequences are described below.

2-8 FULL RESET ($E_{SC}E$)

Note: This control sequence must be used with care as it completely clears the terminal input/output data registers and resets the terminal module/option configuration to the power-on state (See Appendix B).

Escape sequence:

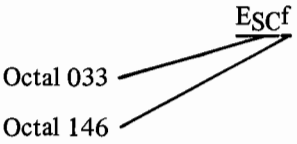


$E_{SC}E$ is equivalent to turning the terminal power off and on again, except that no computer break is generated (see section 2-16 for a description of the break process).

This escape sequence is discrete, i.e. a character block sent by the computer containing $E_{SC}E$ must not contain any other escape sequences or data.

2-9 MODEM DISCONNECT ($E_{SC}f$)

The terminal can be directed to disconnect the modem (if connected) from the telephone line by sending the escape sequence:

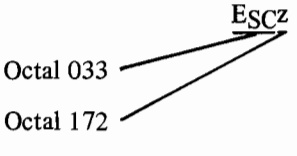


$E_{SC}f$ causes the terminal to clear its CD (Data Terminal Ready) line i.e. pin 20 low for two seconds to disconnect the modem.

2-10 SELF TEST ($E_{SC}z$)

Note: This control sequence must not be sent to an operating terminal as it causes the terminal to perform a self test (which may corrupt data).

Escape sequence:



This sequence is used to remotely check the terminals for correct operation. The computer should transmit $E_{SC}z$ then $E_{SC}\,\hat{}$ to trigger the terminal to prepare and transmit its status. If a malfunction occurs the terminal will not return its status bytes (see section 16-78).

$E_{SC}\hat{}$ (octal 136) is described in section 2-14.

2-11 SEND BINARY DATA COMMAND

Note: Data sent from the computer to the terminal normally use the ASCII characters from N_{UL} (octal 000) to D_{EL} (octal 177). Each ASCII character comprises seven data bits plus one parity bit.

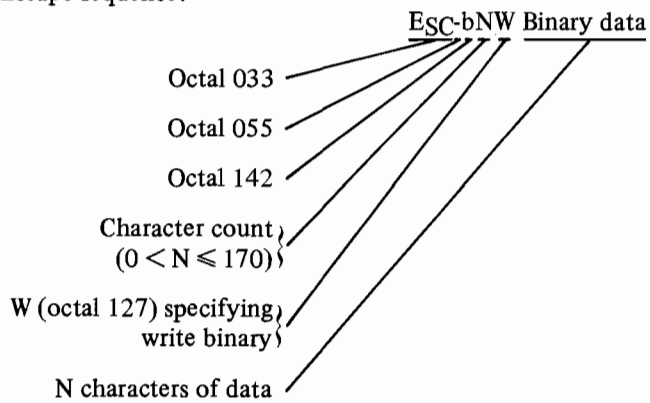
If required (e.g. for the HP-IB Interface, the Serial I/O Interface, etc.) the computer may send binary information to the terminal as data for onward transmission to the module. Each binary character comprises 8-bits (with no parity).

To enable the transfer of the binary data, the rear panel terminal configuration switches (see Appendix F), must be set as follows:

1) Switch II-3 set to 0, specifying no parity (i.e. enabling an 8-bit data transfer for point-to-point connections only).
2) Switch III-2 set to 0, specifying transparent mode (for multiterminal connections only, see section 14-16).

All output devices NOT receiving the binary data (e.g. the display and Strip Printer) must be disabled to prevent spurious data from being received by these devices.

Escape sequence:



This sequence must precede the binary data to specify the number of characters (from 0 to 170), where the total number of characters contained in the sequence must NOT exceed the maximum buffer size, i.e. 180 characters. Consequently, the N characters following the W character are treated as binary data and are not interpreted as ASCII control or displayable characters. After the specified number of characters have been received, the terminal automatically assumes all subsequent characters are ASCII.

For example :

E_{SC}-b2WE_{SC}J

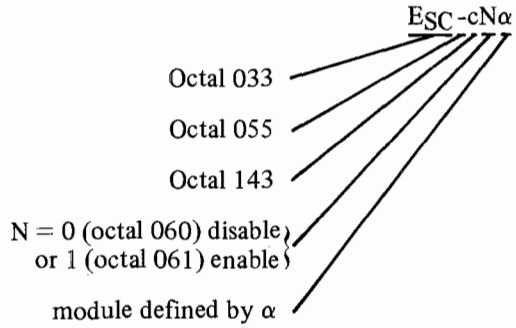
The terminal receiving this escape sequence will not execute the $E_{SC}J$ (clear display) escape sequence. This is because the two characters E_{SC} and J are interpreted as binary data and routed as such to the enabled terminal output devices (for example to the HP-IB Interface or Serial I/O Interface).

2-12 SOUND TERMINAL BUZZER COMMAND (B_{EL})

The computer can (at any time) direct the terminal to sound its internal buzzer once (for approximately 0.5 seconds) by sending the ASCII control character B_{EL} (octal 007).

2-13 TERMINAL MODULE ENABLING/DISABLING

Format:



Where α can have any ONE of the ASCII values listed in Table 2-2.

This escape sequence permits the enabling (configuration i.e. N = 1) or disabling (de-configuration, i.e. N = 0) of the terminal standard modules and options, (defined by α) for use by the operator. The modules/options may be controlled by program escape sequences even when disabled. At power-on, all the terminal standard modules/options are enabled (except the HP-IB Interface, Serial I/O Interface and the communications test feature), see Appendix B.

For example, to enable the display (CRT or one line numeric/alphanumeric) and disable the Strip Printer the following sequence must be sent.

E_{SC}-c1d0P

If data is required to be entered on one of the terminal input modules only (e.g. keyboard) all the other input modules should be disabled. This allows the program to know which input module is inputting data at any one time.

Disabling all the terminal input modules switches the terminal to the WAIT state (i.e. the terminal red light ON and green light OFF). This prevents any information being entered at the terminal; however computer originated data may be sent to the terminal.

The escape sequence E_{SC}-c1T is provided as a convenient method of remotely testing terminals connected in the multiterminal mode (see section 16-44).

Table 2-2 Module Enabling/Disabling Alpha Characters

α Character	Octal Value of α Character	Associated Module
b/B (i.e. b or B)	142/102	Type V **B**adge reader
d/D	144/104	**D**isplay (CRT/numeric/alphanumeric)
h/H	150/110	**H**P-IB interface
k/K	153/113	numeric/alphanumeric **K**eyboard
m/M	155/115	**M**agnetic stripe reader
p/P	160/120	strip **P**rinter
r/R	162/122	multifunction **R**eader
s/S	163/123	**S**erial I/O interface
w/W	167/127	bar code **W**and reader
t/T	164/124	communications **T**est (only applicable when terminal connected in multiterminal mode).

Upon receiving the ESC-c1T escape sequence, the terminal is set in a mode in which ALL data following the "T" will be automatically retransmitted to the computer (at the next read operation). This continues up to the time the terminal is returned to the normal mode with the ESC-c0T escape sequence. When in ESC-c1T mode, the terminal is in a WAIT condition i.e. disabled for all user's input, except the keyboard ATTENTION key.

ESC-c1T acts as if either the keyboard ENTER key or a special function key (SFK) set as an input terminator has been pressed. See section 3, Keyboard.

2-14 STATUS REQUEST FOR 3075A, 3076A (ESC^)

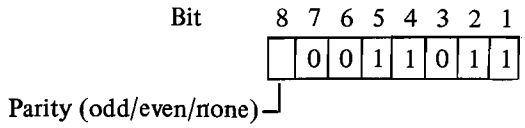
Note:
1) The status request for the 3077A is described in section 13-17.
2) The status request has no effect on operator data entry.
3) The terminal gives the highest priority to the status transmission. i.e. if a block of data is ready to be transmitted to the computer and a status request is received, the terminal transmits its status before it transmits its data (the data can be either information data or a computer break).

The 3075A and 3076A terminals store six internal status bytes which can be transmitted to the computer system upon receiving the escape sequence :

The contents of each of the six status bytes is as follows :

Byte 1 - Escape character ESC (octal 033)

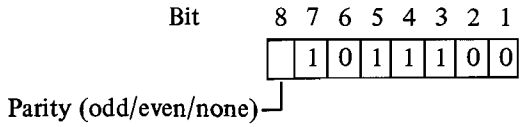
i.e.



Byte 2 - Electrical interface status

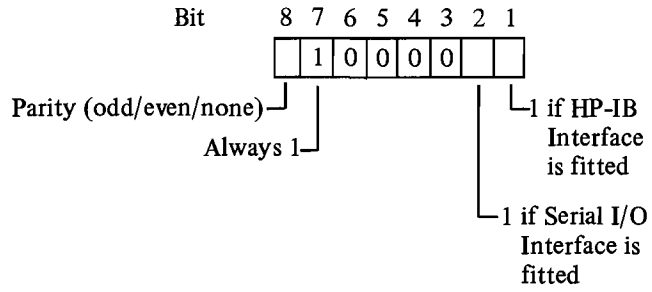
When NO electrical interfaces are fitted, byte 2 contains the back slash character \ (octal 134).

i.e.



When the terminal is equipped with electrical interfaces (e.g. HP-IB and Serial I/O), byte 2 contains status information indicating which electrical interface is configured.

i.e.

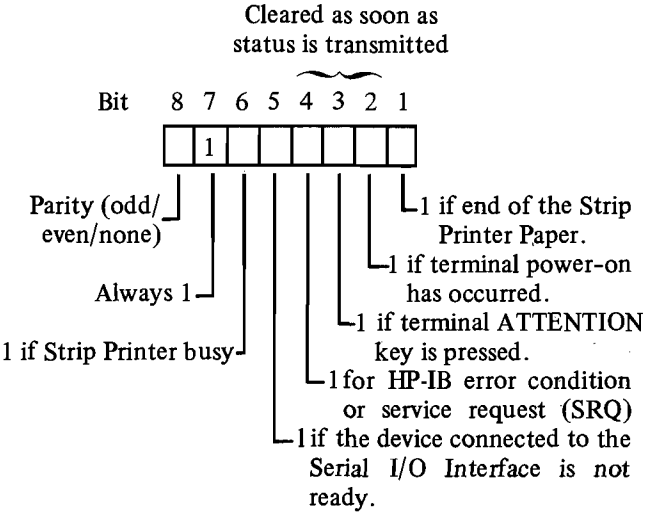


Bit 1 is set to 1 if the terminal is equipped with an HP-IB Interface. i.e. if the terminal only has the HP-IB fitted as an electric interface then byte 2 contain the ASCII character A (octal 101).

Bit 2 is set to 1 if the terminal is equipped with a Serial I/O Interface. i.e. if the terminal only has the Serial I/O as an electrical interface then byte 2 contains the ASCII character B (octal 102).

If the terminal is equipped with both the HP-IB Interface and the Serial I/O Interface byte 2 contains the ASCII character C (octal 103).

Byte 3 - Interrupt Status (returned as an ASCII character, from @ - octal 100 to DEL - octal 177).



Status byte 3 indicates special conditions which have been prompted to the computer through the computer break process (see section 2-16).

Bit 1 is set to 1 if the Strip Printer (see section 8) detects an end of paper condition. It remains at 1 until paper is loaded and the PRINT switch is switched on. When this happens, the integrity of the last block to be printed and the previous one cannot be guaranteed and they should be retransmitted from the computer.

Bit 2 is set to 1 whenever a power-on occurs in the terminal. This permits detection of a power fail at the terminal level. The bit is cleared as soon as the status bytes have been transmitted to the computer.

Bit 3 is set to 1 whenever the ATTENTION key is pressed. The bit is cleared as soon as the status bytes have been transmitted to the computer.

Bit 4 is set to 1 whenever the HP-IB Interface (see section 10) detects an error condition (i.e. syntax error, time out error, overflow error or hardware failure) or an HP-IB device service request (SRQ). The bit is cleared as soon as the status bytes have been transmitted to the computer.

Bit 5 is set to 1 whenever the serial device connected to the Serial I/O Interface (see section 12) is not ready (i.e. power not on, end of paper, etc.). This is detected by the Serial I/O Interface monitoring the serial device Data Set Ready (CC) line, i.e. Serial I/O cable pin number 6 is set false. The bit is only cleared when the serial device goes to the ready state (i.e. pin 6 set true).

Bit 6 is set to 1 if the Strip Printer is busy, i.e. there is data in the printer data buffer. The data buffer may contain data due to one of two reasons, namely:

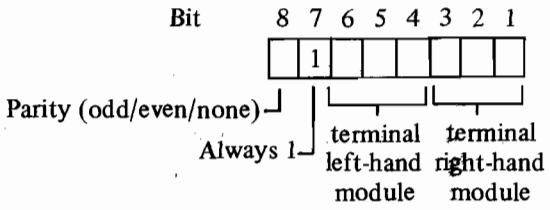
1) The printer is currently printing data.
2) A print line comprises less than 20 characters and does not have an input terminator.

i.e. each printed line normally comprises 20 characters. Lines containing less then 20 characters will only be printed under the following circumstances:

a) For manual (e.g. keyboard) data inputs, when either the ENTER key or a special function key (SFK) declared an "input terminator" is pressed.
b) When an input terminator is generated by a module/option at the end of its data.
c) For computer data inputs, when the computer sends a character corresponding to the declared terminator.

The bit is cleared only when the printed data buffer is empty.

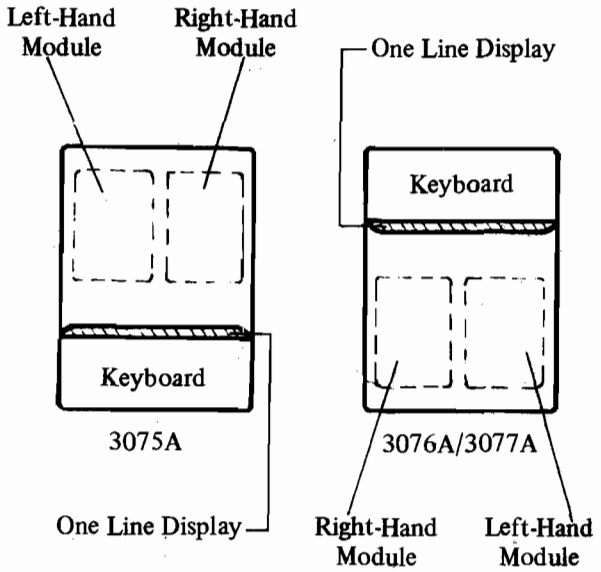
Byte 4 - Terminal Option Configuration (returned as an ASCII character, from @ - octal 100 to DEL - octal 177).



Bits	Module	Remarks
0 0 0	No module	–
0 0 1	Strip Printer	right-hand module only
0 1 0	Multifunction Reader	left-hand module only
0 1 1	Electrical interface*	–
1 0 0	Type V Reader	–
1 0 1	Magnetic Stripe Reader	–
1 1 0	Bar Code Reader	–
1 1 1	Not used	–

**Note : The type of electrical interface is specified in status byte 2.*

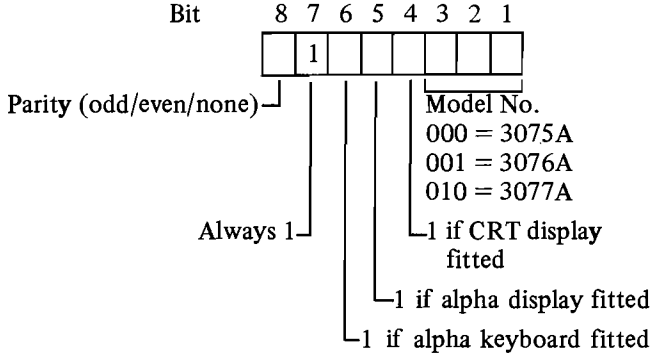
Where:



(Plan view of a terminal)

For example, when only a Strip Printer is fitted (right-hand module) the contents of byte 4 are ASCII character A (octal 101). When only a Multifunction Reader is fitted (left-hand module) the contents of byte 4 are ASCII character P (octal 120). If only an electrical interface is fitted and it is the right-hand module, the contents of byte 4 are ASCII character C (octal 103), byte 2 specifies the type of electrical interface.

Byte 5 - Terminal Type Configuration (returned as an ASCII character, from @ - octal 100 to D_{EL} - octal 177).



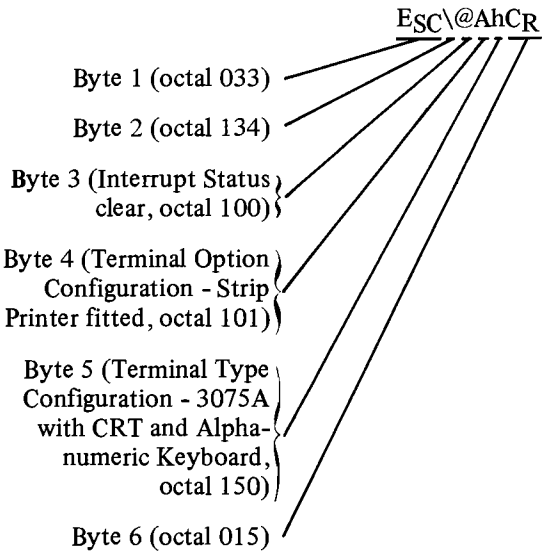
For example, when a 3075A has a CRT and an Alphanumeric Keyboard fitted, the contents of byte 5 are ASCII character h (octal 150).

Byte 6 - Returned Status Terminator Character.

1) Carriage Return (C_R - octal 015) for multiterminal connections.
2) Carriage Return or customized terminator for point-to-point connections, see section 2-2.

Bit 6 of byte 6 is always set to 0, to differentiate from the HP 264X terminals which always have bit 6 set to 1.

An example of the terminal response to E_{SC} ^ is:



Note: In the point-to-point communications mode, if terminal configuration switch II-7 = 0 the terminal returns its status 500 ms after it receives the E_{SC}^ escape sequence. When switch II-7 = 1 (i.e. D_{C1} handshake, see section 2-15) the terminal waits until it receives the D_{C1} character following E_{SC}^ before returning its status.

2-15 POINT-TO-POINT AND MULTITERMINAL COMMUNICATIONS SPECIAL CONSIDERATIONS

When the terminal is connected to the computer in the point-to-point mode, the data is transferred from the computer to the terminal using "handshake" techniques. These techniques allow the terminal to control the flow of computer originated data. This is necessary as for certain of the terminal output devices (i.e. the CRT Display, Strip Printer, HP-IB Interface and Serial I/O Interface) the data transmission rate can exceed the output device data processing rate, which could cause data to be lost. The terminals provide two types of handshake the E_{NQ}/A_{CK} and the X-ON/X-OFF (see section 14-21).

The E_{NQ}/A_{CK} handshake technique is the standard point-to-point protocol. With this technique each data block (maximum 180 characters) transmitted by the computer must be followed by an E_{NQ} character (octal 005). The terminal returns an A_{CK} character (octal 006) when it has processed the data block. The computer must wait for the A_{CK} character before it can transmit another data block.

By setting rear panel terminal configuration switch II-7 to 1, the X-ON/X-OFF protocol may be used (in addition to the E_{NQ}/A_{CK} protocol). At power-on and every time an input terminator is entered into the computer system the terminal goes into the WAIT state, i.e. all further data inputs are inhibited.

Input terminators include:
- the keyboard ENTER key pressed.
- a keyboard special function key designated an input terminator pressed.
- an input terminator generated by a module/option at the end of its data.

It remains in this state until the computer signals its availability to receive data by sending a D_{C1} character (octal 021) to the terminal, thereby returning the terminal to the READY state. The X-ON/X-OFF protocol also causes the terminal to return an X-OFF character (D_{C3} - octal 023) to the computer when its associated output device data buffer is full. The terminal also returns an additional X-OFF character each time extra data characters are received. The terminal returns an X-ON character to the computer when the output device is available to accept a further 20 characters. Therefore, by monitoring the X-ON/X-OFF characters the computer can control the flow of data sent to the terminal.

When the terminal is connected to the computer in the multiterminal mode, the communications protocol ensures that no data can be lost. Also in this mode, whenever an input terminator is generated by the terminal (e.g. the ENTER key pressed, etc.) the terminal automatically goes into the WAIT mode whilst it awaits for the data to be read by the computer (see figure 2-1). In the WAIT mode no further data can be entered to the computer as all the terminal input devices are disabled. When the data has been read by the computer, the terminal will only return to the READY mode (enabling further data to be entered) at the next WRITE (select) request from the computer.

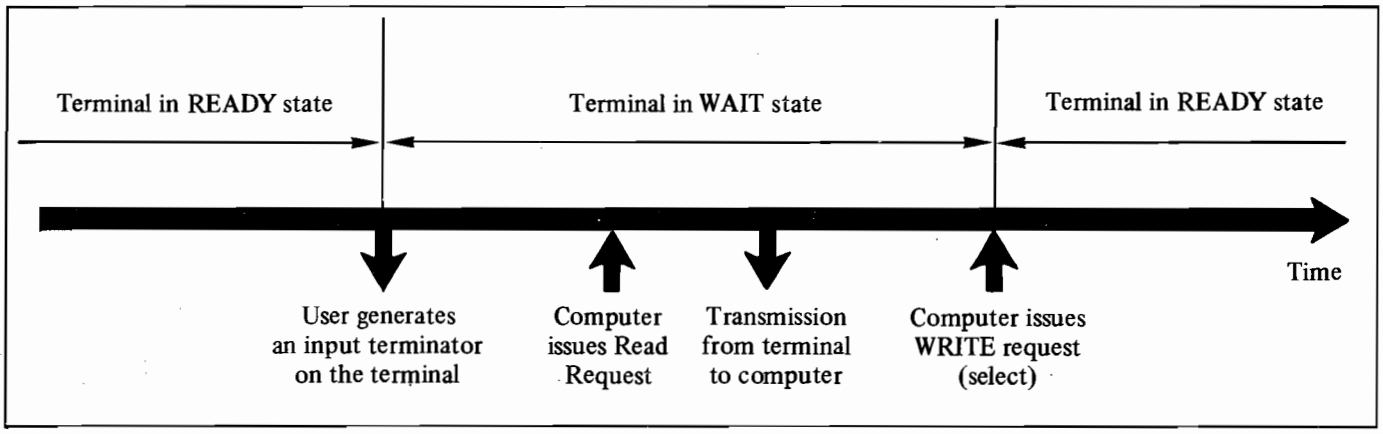


Figure 2-1 Terminal WAIT And READY States (Multiterminal Connections)

Consequently, to prevent the terminal from being disabled "WRITE" requests must be interposed between "READ" requests. i.e.

	READ X READ X READ X is not valid
However	READ Y WRITE Y READ Y WRITE Y
and	WRITE Z WRITE Z WRITE Z are valid.

2-16 BREAK

The terminal generates a break to the computer due to one or more of the following reasons:

1) The Strip Printer running out of paper.
2) Terminal power-on occurring.
3) The keyboard system ATTENTION key being pressed.
4) The HP-IB detecting an error or a Service Request (SRQ).
5) The Serial I/O detecting a change in the state of the Data Set Ready line (i.e. from READY to NOT READY and also from NOT READY to READY).

The condition that prompted the terminal to generate the computer break is recorded in byte 3 of the terminal status (see section 2-14).

The type of computer break generated depends on how the terminal is connected to the computer, i.e. point-to-point or multiterminal.

2-17 POINT-TO-POINT BREAK

Terminal configuration switch II-4 (see Appendix F) may be used to select the type of computer break generated for point-to-point connections as follows:

1) Switch II-4 set to 0 selects ASCII character D_{LE} (octal 020) followed by the input terminator character (i.e. C_R = Carriage Return octal 015 or a customized terminator character) to be sent to the computer when a break occurs.
2) Switch II-4 set to 1 selects the terminal to clear the RS232C data out from the terminal (line BA) low for a minimum of 100 milliseconds when a break occurs.

2-18 MULTITERMINAL BREAK

When the terminal is connected in the multiterminal mode, the program must detect if the break occurred for a "READ" or "WRITE" operation as follows:

1) For the "READ" operation, the program must detect if a simple CANCEL character (C_{AN} octal 030) has been received instead of the requested data (see section 14-17).
2) For the "WRITE" operation, the multiterminal data communications has a special procedure, RVI (see section 14-17), to indicate a break. In general, the program must check the system driver status to check if a break has occurred.

2-19 MULTIFIELD OPERATION

Note:
1) Multifield operation may only be used with 3075A/3076A terminals connected to the computer in the multiterminal mode.
2) When multifield operation is NOT selected, each input module/option generates an input terminator character C_R (Carriage Return - octal 015) at the end of its data.

The multifield operation allows one data transaction to contain several different user entries on the terminal input modules (e.g. the Numeric/Alphanumeric Keyboard, Type V Badge Reader, Multifunction Reader, Bar Code Reader, Magnetic Stripe Reader, Serial I/O Interface, HP-IB Interface etc.), configured for multifield operations. The data from the input modules is transmitted to the computer as one data block when either:

- the ENTER key is pressed.

- a special function key (SFK) programmed as an input terminator is pressed.

- an input terminator is generated by a module/option not in multifield operation.

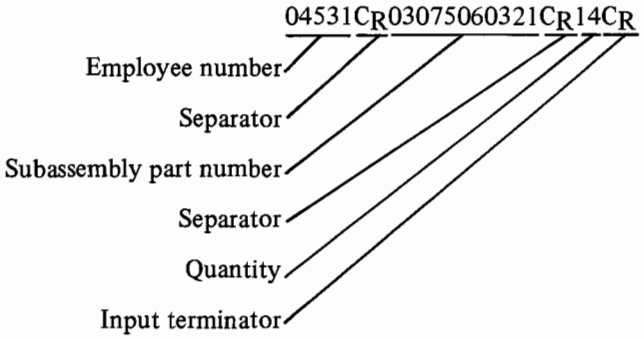
The data from each module is separated from the other modules by the ASCII character C_R (Carriage Return - octal 015).

If the transaction requires two consecutive keyboard entries one of the special function keys should be used as a character that the system software recognises as an item separator. This special function key must NOT be one that has been designated as an input terminator.

The only restriction on the multifield operation is that the total amount of data entered per transaction must not exceed 180 characters (output buffer size).

All the input modules (except the keyboard) are individually set for the multifield operation using escape sequences (see Appendix G).

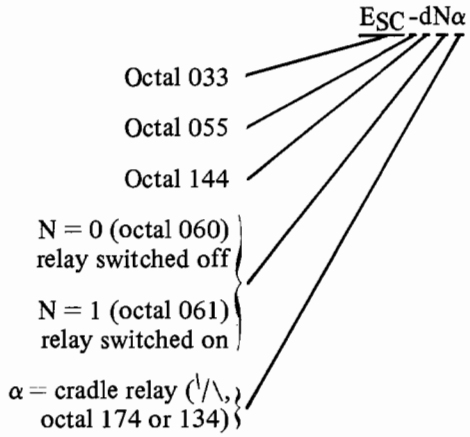
For example, if the user requires to update the computer system with the quantity of manufactured sub-assemblies, he must enter his employee number (Type V Badge), the sub-assembly part number (Bar Code Reader) and the quantity (keyboard) all as entries in the same transaction he must then press the ENTER key to transmit all the data to the computer. In this case the computer will receive the following block of data characters.



2-20 92904A WALL MOUNTING CRADLE RELAY

The Wall Mounting Cradle (used to house the 3076A Data Capture Terminal and the 3077A Time Reporting Terminal) contains a relay that may be employed to control an external user device (e.g. an electric door lock etc.). When the relay is used to control an external device it must be connected as described in section 15-15.

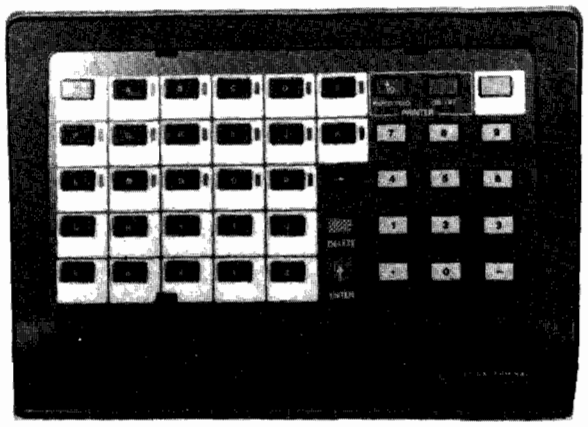
The following escape sequence may then be used to control the relay:



SECTION 3

STANDARD NUMERIC KEYBOARD AND ALPHANUMERIC KEYBOARD (OPTION 004)

Example Of Standard Numeric Keyboard On HP 3075A



Example Of Optional Alphanumeric Keyboard On HP 3076A

Figure 3-1 The Keyboard

3-1 INTRODUCTION

The following section describes the use of the Standard Numeric and the optional Alphanumeric Keyboard (option 004) on the 3075A and 3076A Data Capture Terminals. The use of both keyboards is identical.

Note: The 3077A Time Reporting Terminal does not have a keyboard.

3-2 STANDARD NUMERIC KEYBOARD

The standard keyboard comprises a numeric keypad, a user-definable special function key (SFK) keypad and user-definable prompting lights. The functions of each SFK and prompting light may be marked on the keyboard using the supplied keyboard definition labels (see Table 3-1). The standard Numeric keyboard is depicted in figure 3-2.

3-3 NUMERIC KEYBOARD DEFINITION LABELS

The 3075A and 3076A terminals are delivered with 10 blank keyboard definition labels. Table 3-1 lists their part numbers.

Table 3-1 Keyboard Definition Labels

Terminal Model and Keyboard	HP Keyboard Definition Label Part Number
3075A Standard Numeric 3076A Standard Numeric	03075-60012 03076-60002
3075A Alphanumeric 3076A Alphanumeric	03075-60011 03076-60001

To remove the label, first release the keyboard overlay catches adjacent to the display then withdraw the overlay and label. Fill in the label as required. Replace the label and overlay (take care to seat the overlay properly under all four catches).

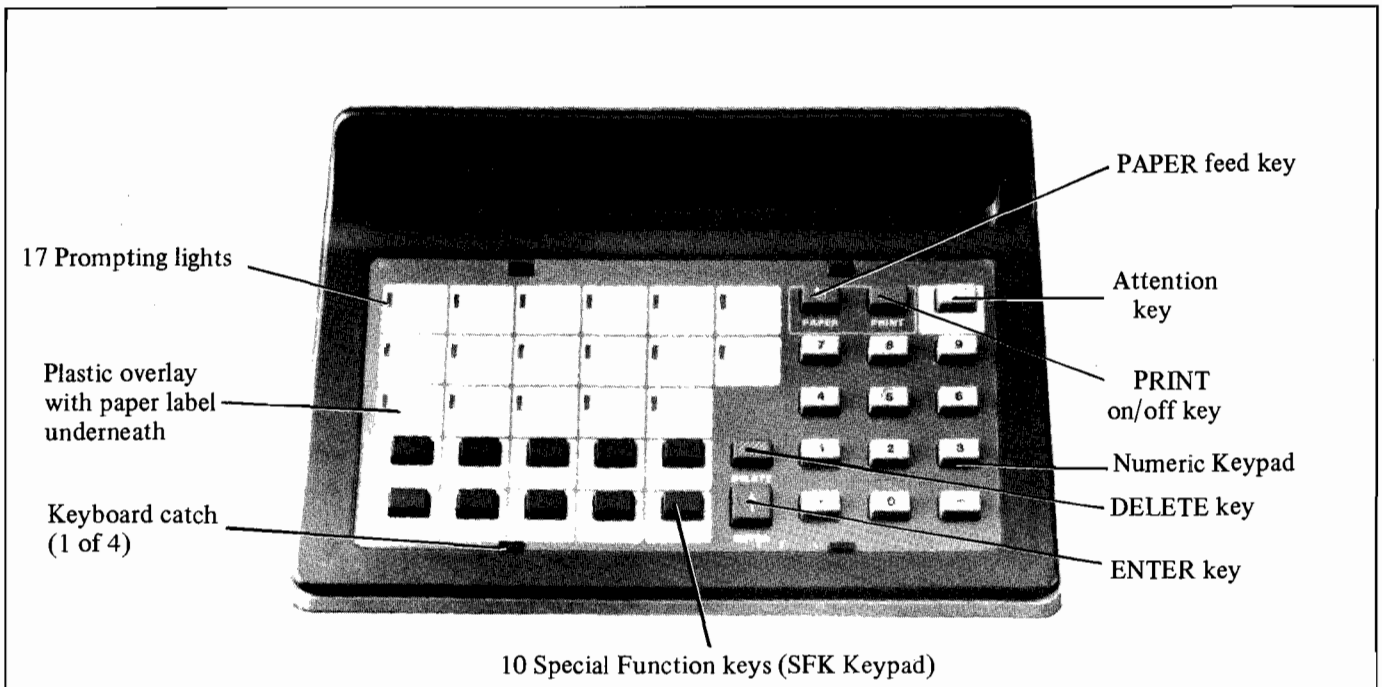
3-4 NUMERIC KEYPAD

When pressed, each key of the numeric keypad transmits a character. Table 3-2 lists each key and the corresponding transmitted code.

Note : The ASCII character set is listed in Appendix A

Table 3-2 Keyboard Numeric Keypad

Key	Code Transmitted
Numerics : 0 thru 9	ASCII character 0 thru 9 (octal 060 to octal 071)
Decimal point	Octal 056
Minus sign	Octal 055
PAPER feed key PRINT on/off key	Strip Printer control : processed in the terminal (no code transmitted).
ATTENTION key (golden key)	Break (see section 2-16), used to obtain the computer's attention
DELETE Key	In point-to-point : selectable on rear panel terminal configuration switches as backspace or delete last-entry • Backspace : B_S character (octal 010) • Delete last entry : either D_{EL} character (octal 177) or X_C character (C_{AN}-octal 033). Selectable on rear panel terminal configuration switches. In multiterminal: processed in the terminal (no code transmitted)
ENTER key	C_R (Carriage return-octal 015) or (in point-to-point mode only) customized terminator selectable on rear panel terminal configuration switches, see section 2-2.



Example of 3075A Numeric Keyboard

Figure 3-2 Standard Numeric Keyboard

The numeric keypad is buffered, i.e. keys can be pressed at high speed. All the characters corresponding to the keys pressed are sent to the computer. The keypad also has the N-key roll over capability, i.e. when a key has just been pressed and has not yet been released, a second key can be pressed. The character corresponding to the second key will be correctly transmitted after the one corresponding to the first key. This allows high speed data entry keying.

A local echo of the keyboard entered data, i.e. the data displayed and printed (if printer fitted) at the terminal, occurs under the following conditions:

1) For multiterminal connections a local echo always occurs.

2) For point-to-point connections the rear panel terminal configuration switch II-5 must be set to 1 to produce a local echo. When switch II-5 is set to 0 a remote echo (of the entered data) by the computer may be done.

Note : Switch II-5 must NOT be set to 1 when a remote echo is employed otherwise a double echo will be produced.

Key Definitions :

ENTER : In the point-to-point mode the data is transmitted to the computer as each key is pressed. Pressing the ENTER key terminates the data message by sending an input terminator (Carriage Return or a customized terminator) to the computer.
In the multiterminal mode the data is stored in the terminal output buffer as each key is pressed. Pressing the ENTER key causes all the stored data to be transmitted to the computer with a Carriage Return character as the input terminator.

Note :

1) Pressing the ENTER key causes the terminal to go into the WAIT mode (i.e. inhibiting all further inputs until the data is read by the computer). In the multiterminal mode the terminal returns to the READY mode after the data is read by the computer and the computer issues a WRITE (select). In the point-to-point mode using X-ON/X-OFF handshake, the terminal goes to the READY mode upon receipt of the D_{C1} character (octal 21) from the computer (see section 2-15).

2) The operation of the ENTER key can be remotely simulated (in the multiterminal mode) by sending escape sequence E_{SC}-c1T, see section 2-13.

DELETE : the function of this key is determined by the setting of terminal configuration switch II-1 on the rear panel (Appendix F). It can act either as a "Delete Last Entry" key (II-1 set to 1), which clears everything already keyed in and displayed and clears printer of anything not already printed, or as a "Backspace" (II-1 set to 0), which deletes one character at a time.

Note :

1) The DELETE key can only be used before the associated data is entered to the computer. The data is entered when:
(a) Either the ENTER key or a special function key (SFK) designated an input terminator is pressed.
(b) When an input module/option (not in multifield operation, see section 2-19) generates an input terminator character at the end of the data.

2) When working in the point-to-point mode, the data is sent to the computer as each key is pressed. Consequently, though the DELETE key erases the displayed data, the terminal system driver program must process the "delete last entry" or "backspace" character to erase the data from the computer.

3) When working in the multiterminal mode, the data is stored in the terminal output buffer as each key is pressed. Consequently the DELETE key erases both the displayed data and the data in the output buffer (only the last keyboard data field of a multifield entry is affected by the operation of the DELETE key).

PRINT : press for on, re-press for off key controlling the Strip Printer. A red light adjacent to the PRINT switch is lit when the printer is on. When the printer is on and the red light starts blinking, it indicates that the printer has run out of paper. As soon as a new roll of paper is installed (as described in Section 17), press the PRINT key and the light will be lit continuously.

Note : The PRINT on/off key is software overrideable using escape sequence E_{SC}-k1/0\|/@ (see section 3-15). i.e. although the printer may be off, the system may (if necessary) send a message to be printed by overriding the printer off condition. This escape sequence will also override the printer disable escape sequence E_{SC}-c0P (see section 2-13).

PAPER : pressing this key makes the Strip Printer roll of paper move one line at a time. Holding it down will make the paper advance as many line spaces as required.

ATTENTION key : this key is used to obtain the computer attention, even if the terminal is not in use or the keyboard is de-configured. The character that is transmitted when the Attention key is pressed depends on how the terminal is connected to the computer.

In the point-to-point mode, the Attention key can be set to transmit the character D_{LE} (octal 020) or to generate a "Break". In the first case the Attention key acts as an SFK and (depending on the software) could be used to restart a program for example. In the second case, as a "Break" key, it generates an interrupt of 100 milliseconds in the data transmission line (BA). The affect of the interrupt depends on system software.

In the multiterminal mode the Attention key generates a break to the computer. See section 2-16 for further details about the break process.

Because the function of the Attention key depends on the system software, a space is left on the keyboard definition label to define it.

Note : the entire keyboard (except the Attention key) can be locked out (i.e. disabled) under software control using escape sequence E_{SC}-c0K (see section 2-13). This is particularly useful to prevent people from entering data at the wrong time. When the keyboard is disabled, pressing any of the keys (except the Attention key) causes the terminal buzzer to sound.

3-5 SPECIAL FUNCTION KEYS

The standard keyboard includes 10 Special Function Keys (SFK's) located at the lower left hand side. The action taken by the system when each key is pressed is determined by the user's application software. The appropriate operator message must be written by the user on the keyboard definition label which fits under the plastic overlay on the keyboard (see section 3-3). As with the numeric keypad, each key pressed generates one character, which in this case is a lower case letter. Figure 3-3 shows the characters transmitted for each of the SFK's.

For example, in a quality control application :

1) r may be used to indicate a bad paint finish
2) t may be used to indicate a dimension tolerance has been exceeded.
3) s may be used to indicate the product meets the required specifications.

If the operator presses the first SFK, the lower case letter r (octal 162) is sent to the computer. When it receives this character the program knows that "r" corresponds to a bad paint finish.

Under software control any of the SFK's can be declared an "Input Terminator", using escape sequence E_{SC}-k0α (see section 3-13). When an SFK that is declared an "Input Terminator" is pressed, in addition to the character corresponding to the SFK being sent to the computer a terminator character is sent. The terminator character is as follows :

1) For multiterminal connections the character C_R (Carriage Return-octal 015)
2) For point-to-point connections either the character C_R or a customized terminator character chosen by the user (see section 2-2).

The SFK declared an "Input Terminator" then acts in the same way as the "ENTER" key. When pressed in the multiterminal mode the preceding characters entered via the keyboard or any peripherals working in multifield operation are sent to the computer and the terminal goes into the WAIT mode. In the point-to-point mode using X-ON/X-OFF handshake, the terminal goes into the WAIT mode until it receives the character D_{C1} from the computer (see section 2-15).

At power-on, all the SFK's are input terminators.

For the one-line displays and the Strip Printer, the □ character is displayed and printed for each SFK pressed. For the CRT display the ◀ character is displayed for each SFK pressed.

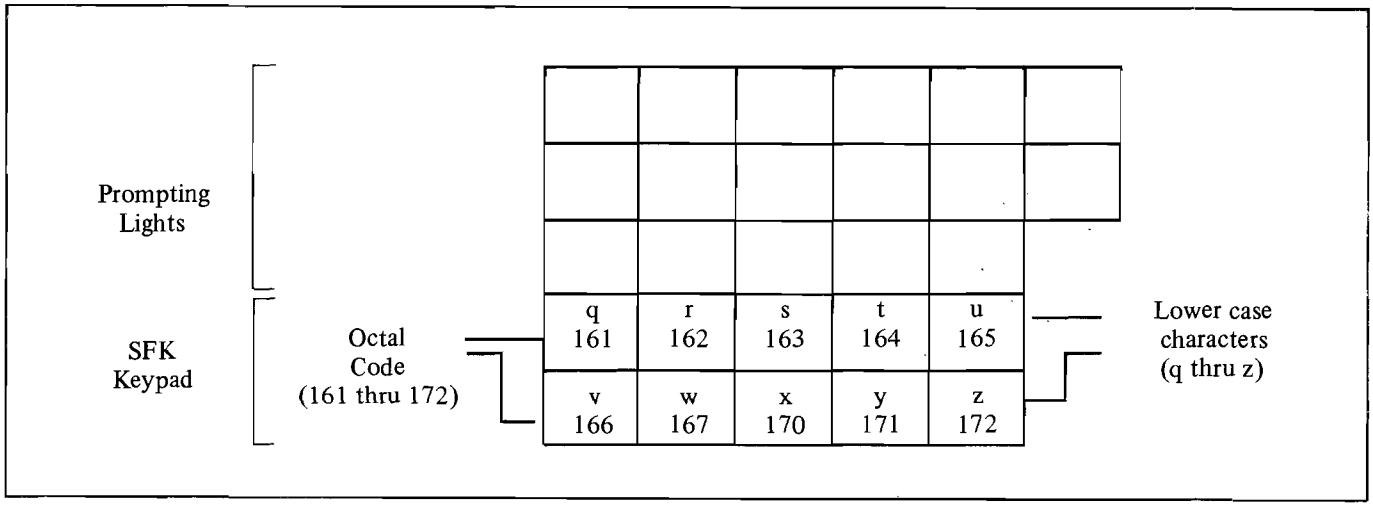


Figure 3-3 Standard Keyboard SFK Transmitted Characters

3-6 PROMPTING LIGHTS

The upper left portion of the standard Numeric Keyboard (and the Alphanumeric Keyboard) is occupied by three rows containing 17 red prompting lights. The function of these prompting lights must be defined by the user and the definition written on the paper underlay adjacent to each light. The purpose of the prompting lights is to send prompting messages to the user. Any one or all of the lights are switched on/off using escape sequence E_{SC}-d1/0α (see section 3-14).

Figure 3-6 depicts the position of the prompting lights and the associated letter assignment for the escape sequence. For software compatibility, the prompting lights are located in the same positions on the Numeric and Alphanumeric Keyboards.

The prompting lights may, for example, be labelled "Enter card", or "Enter part no...". When operating the terminal and one of these lights is switched on, the user then executes the corresponding command.

Note : Terminal configuration switch III-1 allows the keyboard (Numeric and Alphanumeric) and prompting lights to be set up so that the terminal will comply with the German FTZ regulations:

If the switch is set to 0 the standard keyboard and prompting lights are in use.

If the switch is set to 1, then the prompting light associated with the p key is set ON whenever the Data Set Ready condition is present from the modem. The last special function key z when pressed will disconnect the modem by dropping the Data Terminal Ready line for 2 seconds.

3-7 ALPHANUMERIC KEYBOARD (OPTION 004)

The Alphanumeric Keyboard comprises a numeric keypad, an alpha/special function key (SFK) keypad and user-definable prompting lights. The function of each alpha/SFK and prompting light may be marked on the keyboard using the keyboard definition labels. The Alphanumeric Keyboard is depicted in figure 3-4.

3-8 ALPHANUMERIC KEYBOARD DEFINITION LABELS

The 3075A and 3076A are delivered with 10 blank keyboard definition labels. Part numbers for these labels are listed in Table 3-1. To remove the label, first release the keyboard overlay catches adjacent to the display then withdraw the overlay and label. Fill in the label as required. Replace the label and overlay (take care to seat the overlay properly under all four catches).

3-9 ALPHA KEYBOARD

The alpha keyboard contains two control keys (Space and Shift) and 26 alpha keys. The key function are as follows:

SPACE (→) key : When pressed this key generates a space at the current cursor position (octal 040).

SHIFT key : This non-locking key is used to change the function of the alpha keys, from alpha to SFK. The default function (when the Shift key is not pressed) can be set to be either alpha or SFK's by terminal configuration switch II-1 on the rear panel, i.e. II-1 set to 0 specifies alpha and II-1 set to 1 specifies SFK's. The Shift key also reverses the function of the DELETE key (see section 3-10).

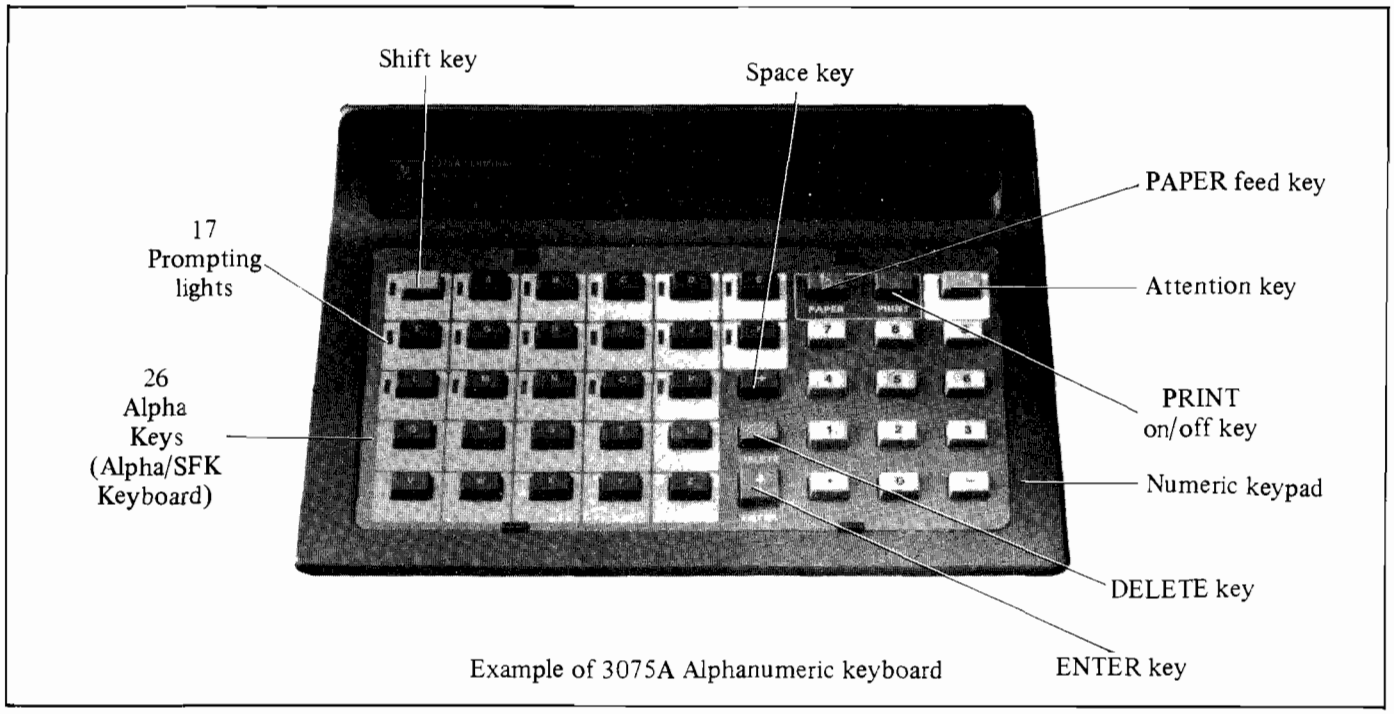


Figure 3-4 Optional Alphanumeric Keyboard

ALPHA keys : The alpha keyboard is really two keyboards in one, namely :

- A 26-key alpha keyboard
- A 26-key SFK (special function key) keyboard.

The Shift key controls the keyboard function. The default function of the Shift key (set by terminal configuration switch II-1) allows the user to select the most convenient keyboard for his use i.e. if he predominantly uses alpha keys the default condition should be alpha, and vice-versa.

When set as an alpha keyboard, pressing an alpha key (labelled A thru Z) causes the code of the upper case alpha character (i.e. octal 101 thru 132 respectively) to be transmitted to the computer. When set as an SFK keyboard, pressing any of the keys labelled A thru Z causes the code corresponding to the equivalent lower case letter (i.e. a thru z, octal 141 thru 172) to be sent to the computer.

When used as SFK's, the function of the 26 alpha keys can be used by software to fit the required application. The function may then be written by the user on the keyboard definition label which fits under the plastic overlay on the keyboard (see section 3-8).

Also when used as SFK's, the 26 alpha keys can be declared as "Input Terminators" under software control using escape sequence E_{SC}-k0α (see section 3-13). When an SFK that is declared "Input Terminator" is pressed, a C_R (Carriage Return - octal 015) character, or (in point-to-point mode only) any terminator chosen by the user (see Appendix F), is sent to the system in addition to the character corresponding to the SFK. Thus an SFK acts in the same way as the ENTER key: when pressed in multiterminal mode, the preceding characters entered via the keyboard or any peripherals working in multi-field operation are sent to the computer.

For the one-line displays and the Strip Printer, the □ character is displayed and printed for each SFK pressed. For the CRT display the ◀ character is displayed for each SFK pressed.

Table 3-3 lists the characters transmitted by each of the alpha/SFK keys, together with the function of the DELETE and Shift keys. Figure 3-5 depicts the layout of the keys.

Note: The entire keyboard (except for the Attention key) can be locked out (i.e. disabled) under software control using escape sequence E_{SC}-c0K (see section 2-13). This is particularly useful to prevent people from entering data at the wrong time. When the keyboard is disabled, pressing any of the keys (except the Attention key) causes the terminal buzzer to sound.

3-10 NUMERIC KEYPAD

The numeric keypad of the Alphanumeric Keyboard is the same as the one on the standard keyboard (section 3-4) but with the following exception:

DELETE key : When the alpha keys are set as special function keys the DELETE key performs the delete last entry function. When the alpha keys are set for alpha operations, the DELETE key performs the backspace function. The shift key reverses the function of the DELETE key.

Table 3-3 Alpha Key Functions

Terminal configuration switch II-1	Alpha key function	ASCII characters/octal codes transmitted				DELETE key function (octal code transmitted)
0	Default function alpha characters A to Z	A 101 B 102 C 103 D 104 E 105 F 106 G 107	H 110 I 111 J 112 K 113 L 114 M 115 N 116	O 117 P 120 Q 121 R 122 S 123 T 124 U 125	V 126 W 127 X 130 Y 131 Z 132	Backspace (BS - octal 010)
0	Shift key pressed SFK characters a to z	a 141 b 142 c 143 d 144 e 145 f 146 g 147	h 150 i 151 j 152 k 153 l 154 m 155 n 156	o 157 p 160 q 161 r 162 s 163 t 164 u 165	v 166 w 167 x 170 y 171 z 172	Delete Line (Xc - octal 030 or D_{EL} octal 177 selected by switch II-3)
1	Default function SFK characters a to z	a to z (141 to 172)				Delete Line (octal 030 or 177)
1	Shift key pressed alpha characters A to Z	A to Z (101 to 132)				Backspace (BS - octal 010)

Shift key	A/a	B/b	C/c	D/d	E/e
F/f	G/g	H/h	I/i	J/j	K/k
L/l	M/m	N/n	O/o	P/p	Space key
Q/q	R/r	S/s	T/t	U/u	Delete key
V/v	W/w	X/x	Y/y	Z/z	

Figure 3-5 Transmitted Alpha/SFK Characters On The Alpha Keyboard

3-11 PROMPTING LIGHTS

The prompting lights of the Alphanumeric keyboard have the same function as those on the standard keyboard (see section 3-6).

3-12 KEYBOARD CONTROL

The keyboard is controlled via escape sequences :

(1) E_{SC}-k1/0α sets the SFK's as Input Terminators

(2) E_{SC}-d1/0α controls the prompting lights

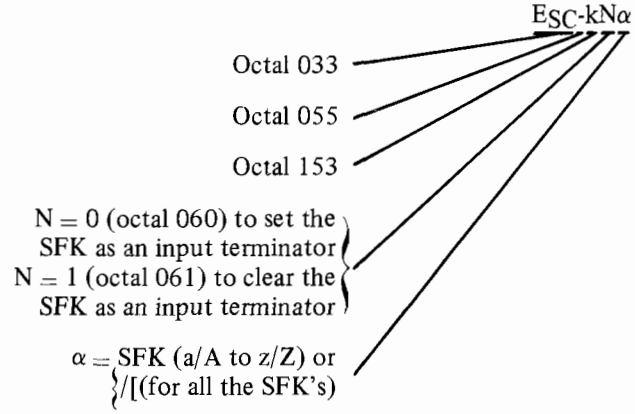
(3) E_{SC}-k1/0`/@ controls the PRINT switch

These escape sequences are detailed below.

Note : Escape sequence E_{SC}-c1/0k/K may be used to enable/disable the keyboard (see section 2-13).

3-13 SFK's AS INPUT TERMINATORS

The Numeric and Alphanumeric SFKs (special function keys) can be set or cleared as "Input Terminators" using escape sequence :



If a standard Numeric Keyboard is fitted, there are 10 special function keys which are assigned α characters q (octal 161) to z (octal 172), see Fig. 3-3.

If an Alphanumeric Keyboard is fitted there are 26 keys which can be used as special function keys and are assigned α characters a (octal 141) to z (octal 172), see Fig. 3-5.

Any number of the SFK's can be declared (or cleared) as input terminators in the same escape sequence, provided the last α character in the sequence is upper case.

For both the Numeric and Alphanumeric Keyboards, all the SFK's can be declared (or cleared) as terminators by assigning } (octal 173), upper case [(octal 133), as the α character.

For example, to declare SFK W as an input terminator and to clear SFK T as an input terminator the following sequence must be sent :

E_{SC}-k0w1T

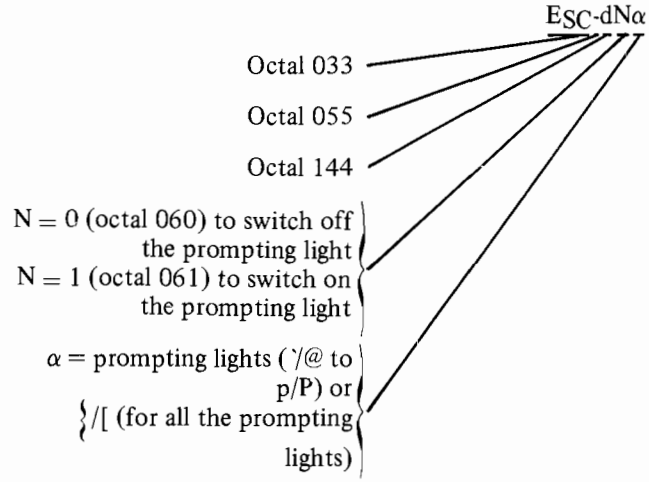
To set all the SFKs as input terminators the following sequence must be sent :

E_{SC}-k0[

At power-on or after a full reset (E_{SC}E, see section 2-8) all the SFKs are designated input terminators.

3-14 PROMPTING LIGHT CONTROL

The Numeric and Alphanumeric Keyboard's 17 red prompting lights may be switched on and off using escape sequence:



For both the Numeric and Alphanumeric Keyboards each light is assigned an α character from `/@ to p/P, as shown in figure 3-6.

Any number of prompting lights can be switched ON (or OFF) in the same escape sequence, provided the last α character is upper case.

For both the Numeric and Alphanumeric Keyboards, all the prompting lights can be switched on or off by assigning { (octal 173), upper case [(octal 133), as the α character.

For example, to turn OFF the prompting lights associated with keys H and L and to turn ON the prompting light associated with key N the following escape sequence must be sent :

ESC-d0h0l1N

To switch OFF all the prompting lights the following escape sequence must be sent :

ESC-d0[

At power-on or after a full reset all the prompting lights are switched off.

3-15 PRINT SWITCH CONTROL

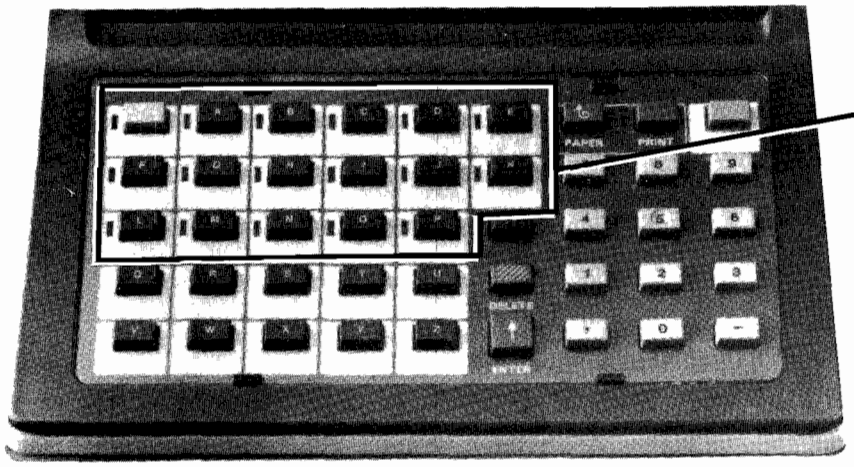
If the computer requires to override the keyboard PRINT on/off switch and the printer disable escape sequence (ESC-c0P, see section 2-13). The following escape sequence must be sent :

ESC-kNα

- Octal 033
- Octal 055
- Octal 153
- N = 0 (octal 060) to switch off the PRINT switch
- N = 1 (octal 061) to switch on the PRINT switch
- α = ` (octal 140) or @ (octal 100)

This enables the computer to print on the Strip Printer even if the keyboard PRINT switch is switched off.

At power on or after a full reset the PRINT switch is switched ON.



Example of 3075A keyboard

Prompting light block

'/@	a/A	b/B	c/C	d/D	e/E
f/F	g/G	h/H	i/I	j/J	k/K
l/L	m/M	n/N	o/O	p/P	

Figure 3-6 Prompting Light Escape Sequence Assignments

SECTION 4

STANDARD NUMERIC DISPLAY AND ALPHANUMERIC DISPLAY (OPTION 005)

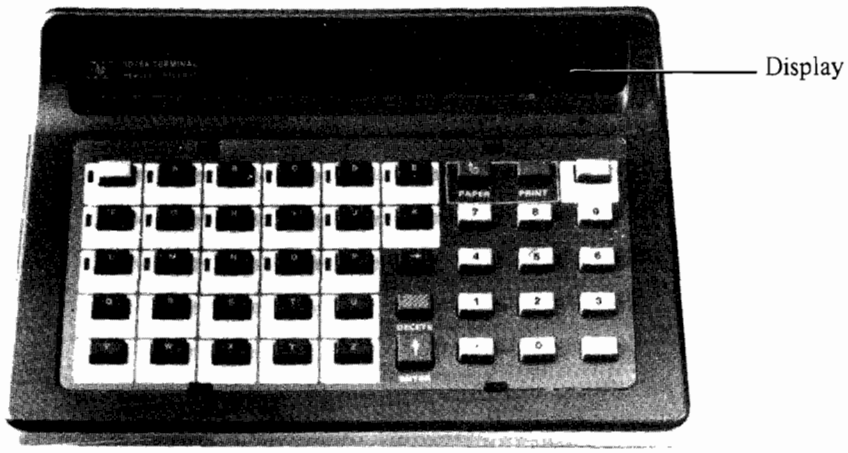


Figure 4-1 The 3075A One Line Display

4-1 INTRODUCTION

The following section describes the use of the one line Numeric (standard) and Alphanumeric (option 005) Displays on the 3075A and 3076A Data Capture Terminals and the Alphanumeric Display (option 005) on the 3077A Time Reporting Terminal.

4-2 STANDARD NUMERIC DISPLAY

Up to 15 digits written left to right, can be displayed on the Standard Numeric Display. The display character set comprises 13 ASCII characters and two special characters, namely:

1) Numeric 0 thru 9 (octal 060 thru 071)

2) Decimal point (octal 056)

3) Space (octal 040)

4) Minus sign (octal 055)

5) Two special characters :
   a) every time a special function key (SFK) is pressed, the "□" sign is displayed.
   b) in the point-to-point mode only, in the event of a parity of framing error in the communication between the computer and the terminal, the sign "≡" is displayed.

Note : A cursor is not displayed.

In addition, the display contains a green "READY" light and a red "WAIT" light. The green light is only lit when the data communications between the computer and the terminal is ready (i.e. open) and at least one of the terminal input modules (e.g. Keyboard, Multifunction Reader, Type V Badge Reader, Bar Code Reader, Magnetic Stripe Reader, Serial I/O Interface, HP-IB controller etc.) is enabled. The red light is lit when all the terminal input modules and/or the data communications are not ready. The module enabling/disabling is described in section 2-13.

Displayed data. When the display is disabled (ESC-c0D see section 2-13) no data can be displayed. When the display is enabled (ESC-c1D) the following data is displayed :

1) For multiterminal connections. All numeric data typed on the keyboard. When a special function key (SFK) is pressed the "□" character is displayed. If an alpha key is pressed no character (or space) is generated.
2) For point-to-point connections. Numeric data typed on the keyboard and the "□" character (when an SFK is pressed) is only displayed when rear panel terminal configuration switch II-5 is set to 1. If an alpha key is pressed no character (or space) is displayed. When switch II-5 is set to 0 a remote computer echo of the entered numeric data may be generated if data is required to be displayed.

Note : Switch II-5 must NOT be set to 1 when a remote echo is employed otherwise a double echo will be produced.

3) For point-to-point and multiterminal connections. All numeric data received from the Bar Code Reader, Serial I/O Interface or HP-IB Controller is displayed when these options are set (via escape sequences) to display received data.

4) All numeric data received from the computer is displayed. This may take the form of an "echo" of the received module/option data. The display does not recognize any alpha characters (upper or lower case). Consequently, if an alpha character is sent to the display no character (or space) is generated.

Display operation. Once the display is filled, any extra data that is keyed in (up to the system/terminal maximum of 180 characters) will not appear on the display. All the keyed in text will be either buffered in the terminal (for multiterminal connections) or transmitted to the computer (for point-to-point connections).

Note : For multiterminal connections, the data is stored in the terminal output buffer as each key is pressed. The data is only entered to the computer when an input terminator character is generated. For point-to-point connections, the data is transmitted to the computer as each key is pressed. The transmitted data is terminated and entered for computer processing when an input terminator is generated.

The displayed (and extra) data is entered (i.e. an input terminator is generated) when :

1) Either the ENTER key or a special function key (SFK) designated an input terminator is pressed.

2) When an input module/option (not in multifield operation) generates an input terminator character at the end of its data.

After the contents of the display have been entered the data remains on the display until the next digit is keyed in. It then disappears from the display and the digit just keyed in appears instead, left justified.

Error correction. The display can be completely or partially (one character at a time) erased using the keyboard DELETE key (see section 3-4).

Display blinking. The Numeric Display has a feature enabling the complete display to blink twice a second. This feature can be turned on/off via escape sequence ESC-d1/0{/] (see section 4-5) and may be used, for example, to attract the operators attention in the event of a wrong input. The blinking is automatically turned off by the terminal at the next data entry following a received CR character or customized terminator character.

The display also blinks once whenever :

(1) The ENTER key is pressed.

(2) An SFK designated an input terminator is pressed.

(3) When an input module/option (not in multifield operation) generates an input terminator at the end of its data.

Protected field. By sending escape sequence ESC [to the terminal (see section 4-6) a protected field can be set up on the display. It is an area of the display which cannot be erased using the DELETE key or on to which no character can be typed. The display area will remain protected until data is entered or a terminator character or the reset terminal (ESCE) or clear display (ESCJ) escape sequences are received.

4-3 ALPHANUMERIC DISPLAY (OPTION 005)

The Alphanumeric Display is 24 digits long written left to right. It can generate 64 ASCII characters from space (octal 040) to underscore (octal 137) and two special characters. These characters comprise :

1) Numerics 0 thru 9 (octal 060 thru 071)
2) Decimal point (octal 056)
3) Space (octal 040)
4) Minus sign (octal 055)
5) Two special characters :
   a) "□" every time a special function key is pressed.
   b) in the point-to-point mode, "≡" if a parity or framing error occurs.

(1) through (5) ▶ The same as the Numeric Display

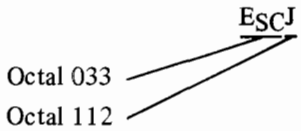
6) Commercial signs, namely :
   !"#$ % & ' ( )* +(octal 041 thru 053)
   / (octal 057)
   : / < = > ? @ (octal 072 thru 100)
   [\]^(octal 133 thru 136)
7) Comma (octal 054)
8) Underscore (octal 137)
9) Upper case alpha characters A thru Z. (octal 101 thru 132).

Note : A cursor is not displayed.

In addition, the display contains a green "READY" light and a red "WAIT" light (see section 4-2).

4-7 CLEAR DISPLAY

The terminal display can be cleared by sending escape sequence :

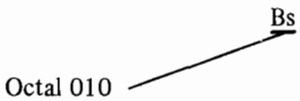


ESCJ also clears the blinking capability and the field protection. At power-on or after a full reset the display is automatically cleared.

4-8 BACKSPACE/DELETE LAST ENTRY

The program can perform similar operation to the keyboard DELETE key (see section 3), i.e. editing displayed data, by sending the following ASCII control characters :

1) Backspace

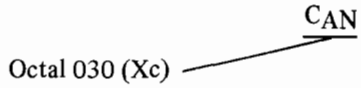


Deletes the last displayed character

2) Delete last entry

Either

or



Either character may be sent to the terminal but it must correspond to the delete last entry character specified on the rear panel terminal configuration switch II-3. i.e. II-3 set to 0 specifies CAN, II-3 set to 1 specifies DEL.

When the display does not contain protected data, delete last entry causes all the displayed data to be cleared. When the display contains protected data, delete last entry causes all the data displayed after the ESC[to be cleared.

Note . The backspace and delete last entry control sequences also effect the Strip Printer (if fitted), the HP-IB Controller (if fitted) and the Serial I/O Interface (if fitted). For details see section 8, 9 and 10 respectively.

SECTION 5

CRT DISPLAY (OPTION 006)

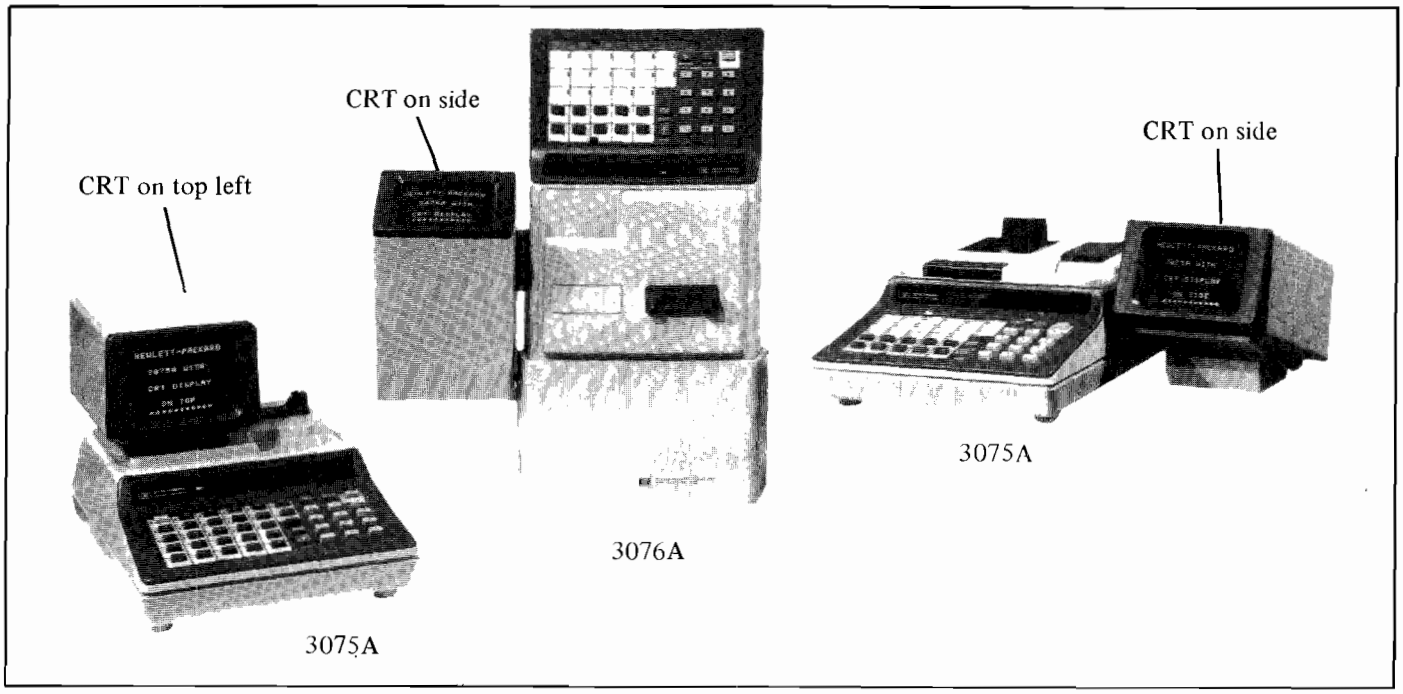


Figure 5-1 The CRT Display

5-1 INTRODUCTION

The following section describes the use of the CRT Display on the 3075A and 3076A Data Capture Terminals. This option features a cathode ray tube housed in a metal case, at the front of which is a plastic anti-reflective filter that enhances the displayed character/background contrast.

The CRT replaces the one line Numeric/Alphanumeric Displays and is mounted in one of the following positions on the 3075A terminal:

- Top right: if a Multifunction Reader (option 007) is also fitted.
- Top left: if either no other options are fitted or a Type V Badge Reader (option 008), or a Strip Printer (option 009), or a Bar Code Reader (option 010) or a HP-IB Controller (option 011), or a Magnetic Stripe Reader (option 012), or a Serial I/O Interface (option 013) is also fitted.
- Right side of terminal: if any two of options 007, 008, 009 and 0012 are also fitted.

The CRT is always mounted on the left side of the 3076A terminal.

5-2 CRT DISPLAY CHARACTERS

The following section details the CRT features.

5-3 DISPLAY PAGE - CHARACTERS SETS

The CRT employs two completely independent displayed character pages:

1) One page uses 16 lines of 32 standard size characters, comprising any of the 91 displayable ASCII characters from space (octal 040) to z (octal 172). Thus both upper and lower case characters can be displayed. This page may be used for the display of long and detailed information.

2) The other page uses 8 lines of 16 large size characters (each character being twice the height and twice the width of the equivalent standard size character), comprising any of the 64 displayable ASCII characters from space (octal 040) to _ (underscore octal 137). Thus only upper case characters are displayed, all received lower case characters being displayed as their upper case equivalent. This page may be used when short messages requiring operator attention need to be displayed, the displayed messages are readable at distances of up to four metres (13 feet).

Note: The ASCII character set is listed in Appendix A.

The two pages also use two special characters:

1) Every time a special function key is pressed the "◀" character is displayed.

2) In the event of a communications error (e.g. non-recognisable character, parity error or data overrun) the "▒" character is displayed.

The cursor is displayed as a blinking underline (_).
The program can select the current displayed (i.e. working) page using ASCII control characters S_I and S_O (see section 5-7). The displayed page is the only page that can receive new data and is the only page that is affected by control sequences. When the terminal is on-line, at power-on or after a full reset (ESCE, see section 5-20) the display is cleared and the standard size character page is enabled for display. When the terminal is in self operation (see section 16), at power-on or after a full reset the display is cleared and the large size character page is enabled for display.

The large and standard size character pages are completely independent, each having its own cursor position (the cursor being placed at the position where the next character will be written). This allows the displayed page to be modified without affecting the other page.

Table 5-1 Displayed Data

Input Module	Type Of Data	Keyboard Enabled/ Disabled	Characters Displayed On The CRT			
			Point-to-Point Connections		Multiterminal Connections	
			Large Size Character Screen	Standard Size Character Screen	Large Size Character Screen	Standard Size Character Screen
Keyboard*	Numeric/upper case alpha (A thru Z) chars.	Enabled	Numeric and upper case alpha characters			
	SFK characters	Enabled	◀	◀	◀	◀
Computer* or Bar Code Reader* or HP-IB Controller* or Serial I/O Interface*	Commercial signs numeric/upper case alpha chars.	Enabled or Disabled	Commercial signs, numeric and upper case alpha characters			
	Lower case alpha (a thru z) chars.	Enabled	◀	◀	Equivalent upper case characters	Lower case characters
		Disabled	Equivalent upper case characters	Lower case characters	Equivalent upper case characters	Lower case characters

**Note :*

1) For point-to-point connections, keyboard data is only displayed when rear panel terminal configuration switch II-5 is set to 1. When switch II-5 is set to 0 a remote computer echo (of the entered data) may be done if the data is required to be displayed. Switch II-5 must NOT be set to 1 when a remote echo is employed otherwise a double echo will be produced.

2) Characters received from the Bar Code Reader, HP-IB Interface and Serial I/O Interface are only displayed when these options are set (via escape sequences) to display received data.

3) Data from the computer may take the form of an echo of received module/option data.

5-4 DISPLAY OPERATION

The CRT has a useful screen size of 69 mm H x 94 mm W (2.72 x 3.70 ins), uses a spot size of < 0.4 mm (< 0.016 ins) and has a luminance of 18 ft. Lamberts (±10%).

Displayed data. When the display is disabled (E_{SC}-c0D, see section 2-13) no data can be displayed. When the display is enabled (E_{SC}-c1D) the data listed in table 5-1 may be displayed.

Display operation. Both the standard and large size character pages use automatic wrap around, i.e. when at the end of the line the next received character is written at the beginning of the next line. The standard size character page uses scrolling, i.e. when 16 lines are displayed if a 17th line arrives it is displayed as the last line and the first line is lost (from the screen and the CRT memory). On the large size character page, when the cursor is at the last character position of the last line it jumps to the first position of the first line and when the character is entered (in this position) the whole screen is automatically cleared. The last data typed onto the display (after a previous entry) is entered to the computer when:

1) The ENTER key is pressed.
2) A special function key designated as input terminator is pressed.
3) An input module/option (not in multifield operation) generates an input terminator character at the end of its data.

The entered data remains displayed on the screen.

5-5 CRT CAPABILITIES

Note: The CRT operates with the keyboards in an identical manner to the Numeric/Alphanumeric Displays.

Cursor movement. The program has control over the movement of the cursor using escape sequences (see section 5-10). There is no keyboard control over the cursor, apart from the Space (→) key and the DELETE key.

Error correction and clear display. By pressing the keyboard DELETE key (see section 3-4) either the last typed character or the complete last entry (from the last terminator) can be erased. The computer can also clear the display from either the cursor position to the end of the current line or from the cursor position to the end of the screen using escape sequences $E_{SC}K$ and $E_{SC}J$ respectively (see section 5-18 and 5-17).

Note : Pressing the DELETE key when the displayed data is either not in a protected field or has not been terminated by the relevant terminator character may cause unpredictable erasures on the screen.

Display blinking. The CRT has a feature enabling the complete display to blink. This can be turned on/off via escape sequence E_{SC}-d1/0{ /] (see section 5-8) and may be used, for example, to attract the operator's attention in the event of a wrong input. The blinking is automatically turned off by the terminal at the next data entry following a Carriage Return character or, in point-to-point, a customized terminator character.

Protected field. By sending the terminal escape sequence E_{SC}[(see section 5-9) a protected field may be set up on the display. This is an area of the display that cannot be erased using the DELETE key or into which no characters can be typed. The display remains protected until:

1) The ENTER key or an SFK designated an input terminator is pressed.
2) An input module/option generates an input terminator at the end of its data.
3) An input terminator (Carriage Return or, in point-to-point, a customized terminator) is received from the computer.
4) Escape sequences E_{SC}E (full reset) is received.
5) Power-on occurs.

Automatic line feed. For multiterminal connections, after a terminator Carriage Return character has been received (i.e. due to the ENTER key or SFK designated an input terminator being pressed, or at the end of the data from an input module, or the end of data received from the computer, etc.) an automatic line feed occurs. This repositions the cursor at the beginning of the next line. For point-to-point connections, a line feed only occurs when the rear panel terminal configuration switch II-5 is set to 1 (local echo), otherwise no action is taken.

High speed transmissions (point-to-point only). If the number of characters sent from the computer to the CRT exceeds 20, the time required for processing the data may cause some of the characters to be lost. To prevent this data loss, the data is transferred from the computer to the terminal using one of two handshake techniques, i.e. E_{NQ}/ACK or X-ON/X-OFF (see section 2-15 and 14-21). This allows the terminal to control the flow of computer originated data.

Note: Data loss does not occur for terminals connected in the multiterminal mode because the data communications protocol contains its own "handshake" operation (see section 14).

5-6 CRT DISPLAY CONTROL

The CRT Display is controlled by the following escape sequences and ASCII control characters:

1)	S_I	selects large size character page
2)	S_O	selects standard size character page
3)	E_{SC}-d1/0{ /]	display blinking
4)	E_{SC}[	protected field
5)	E_{SC}A	move cursor up one line
6)	E_{SC}B	move cursor down one line
7)	E_{SC}C	move cursor right one column
8)	E_{SC}D	move cursor left one column
9)	E_{SC}G	return cursor to first column of current line
10)	E_{SC}H	home up cursor
11)	E_{SC}J	clear display
12)	E_{SC}K	clear display from cursor position.
13)	B_S	backspace one character and delete character
14)	D_{EL}	delete last entry
15)	E_{SC}E	full reset

These control sequences are detailed in the following sections.

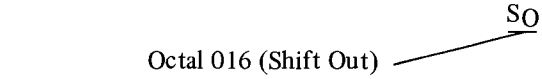
Note:
1) Control sequences (3) to (14) inclusive above only affect the DISPLAYED page.
2) An automatic line feed occurs for multiterminal connections. For point-to-point connections, this only occurs when terminal configuration switch II-5 is set to 1.
3) E_{SC}-c1/0d/D may be used to enable/disable the display and is described in section 2-13.

5-7 CHARACTER SIZE SELECTION

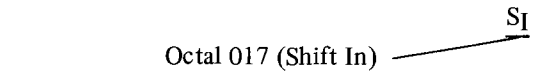
Note: At power-on or after a full reset (E_{SC}E) the standard size character page is automatically displayed. When working in self operation (see section 16) the large size character page is displayed at power-on.

The current working (displayed) page can be selected by sending the following ASCII control characters:

1) The standard size character page can be displayed by sending:



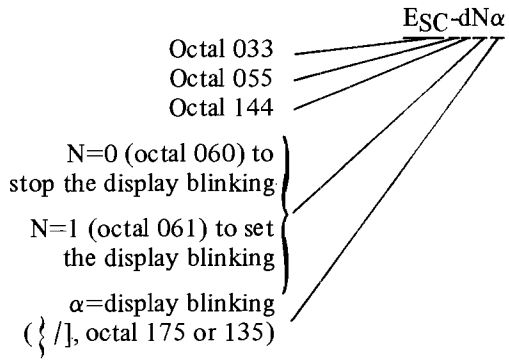
2) The large size character page can be displayed by sending:



Both pages are completely independent, the current (i.e. displayed) working page may modified without affecting the other page.

5-8 DISPLAY BLINKING

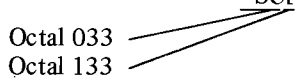
The display blinking feature is controlled by escape sequence:



This escape sequence may either precede or follow data that is required to be displayed.
When set (i.e. N=1), the complete display blinks twice a second to attract the operators attention. The blinking is automatically turned OFF by:
1) Escape sequence E_{SC}-d0{ /]
2) The next keyboard input by the operator following an input terminator character; C_R (Carriage Return = octal 015) or, in point-to-point, a customized terminator.
3) The next data received from the computer following an input terminator character.
4) Full reset (E_{SC}E) escape sequence (see section 5-20).
5) Power-on.

5-9 PROTECTED FIELD

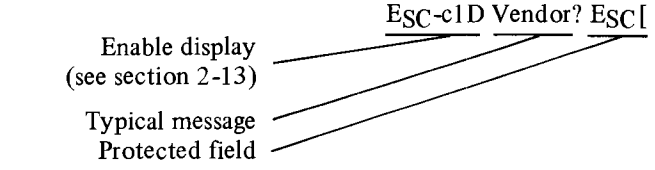
Messages sent to the display from the computer can be placed in a protected field by appending the following escape sequence to the transmitted data:



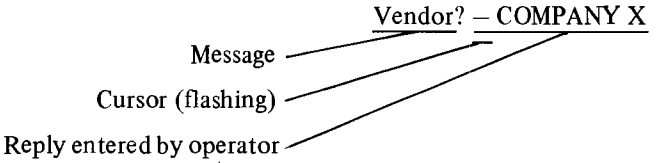
The protected field ensures that no further display entries can overwrite any part of the message sent by the computer. i.e. the protected message cannot be erased from the display by keyboard entries such as the DELETE key.

For example:

Transmitted message



Displayed message



The displayed message (Vendor?) cannot be erased from the display or overwritten by operator action at the keyboard. However, if required, the reply entered by the operator (i.e. COMPANY X) can be erased (leaving the message Vendor? displayed) by the operator pressing the DELETE key.

Note: ESC[protects the data against backspace or delete last entry operations (using either the DELETE key or program control sequences). Data protection does not occur if the cursor is moved (via escape sequences) before the cursor position where the ESC[was sent.

The protected field is cleared either by:
- pressing the ENTER key (normal procedure) or an SFK designated an input terminator.
- an input module/option generating an input terminator at the end of its data.
- ESCE transmitted by the computer.
- a terminator character transmitted by the computer.
- power on.

Note: In order:
1) Not to inadvertently cancel the protected field, and
2) To have the answer displayed on the same line as the question.
When a message (requiring protection) is sent to the terminal, the transmitted message must NOT be terminated by a C_R character. On the various HP systems this means that the underscore character (_) octal 137 must be appended at the end of the message to inhibit the generation of the C_R character.

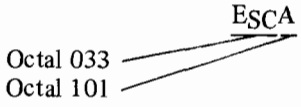
To enable the field protection to work in self test (see section 16), when ESC[is entered from optical cards (e.g. punched cards), it is necessary that the last data on the card is an underscore character (octal 137) to inhibit the effect of the C_R character.

5-10 CURSOR CONTROL BY ESCAPE SEQUENCES

The cursor is automatically placed at the position where the next character will be written, the following escape sequences allow the program to alter the position of the cursor without altering the displayed data.

5-11 Move Cursor Up One Line (↑)

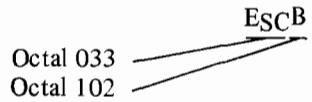
Escape sequence:



This sequence moves the cursor up one line. If the cursor is on the first line it wraps around to the last line.

5-12 Move Cursor Down One Line (↓)

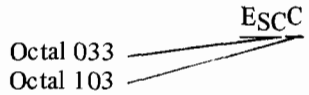
Escape sequence:



This sequence moves the cursor down one line if the cursor is on the last line, it wraps around to the first line.

5-13 Move Cursor Right One Column (→)

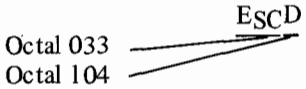
Escape sequence:



This sequence moves the cursor right one column. If the cursor is on the last column of a line it wraps around to the first column of the next line. If the cursor is on the last column of the last line, it is moved to the first column of the first line.

5-14 Move Cursor Left One Column (←)

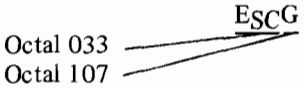
Escape sequence:



This sequence moves the cursor left one column. If the cursor is on the first column of a line, it wraps around to the last column of the previous line. If the cursor is on the first column of the first line, it is moved to the last column of the last line.

5-15 Return Cursor To First Column Of Current Line

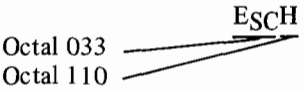
Escape sequence:



This sequence returns the cursor to the first column of the current line.

5-16 Home Up Cursor

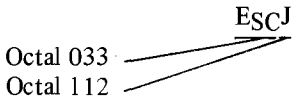
Escape sequence:



This sequence moves the cursor to the beginning of the first line of the displayed page.
At power on or after a full reset the cursor automatically homes up.

5-17 CLEAR DISPLAY

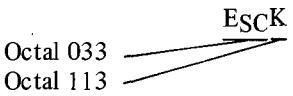
Escape sequence:



This sequence clears the CRT display from the cursor position to the end of the displayed page.
At power-on or after a full reset the display is completely cleared.

5-18 CLEAR TO END OF LINE

Escape sequence:

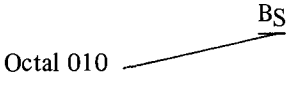


This sequence clears the current line from the cursor position to the end of the line.

5-19 BACKSPACE/DELETE LAST ENTRY

The program can perform similar operations to the keyboard DELETE key (see section 3) by sending the following ASCII control characters.

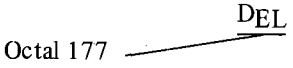
1) Backspace



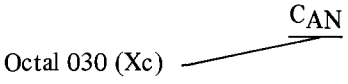
Moves the cursor one column to the left and clears the character. If the cursor is on the first column of a line, it wraps around to the last column of the previous line.

2) Delete last entry

Either:



or



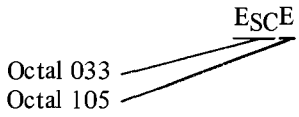
Either character may be sent to the terminal but should correspond to the delete last entry character specified on the rear panel terminal configuration switch II-3. i.e. II-3 set to 0 specifies CAN, II-3 set to 1 specifies DEL.

Delete last entry causes all the data displayed after the last entry or ESC[to be cleared and the cursor to move to the position specified by the last entry or ESC[.

Note: The backspace and delete last entry control sequences also affect the Strip Printer (if fitted) the HP-IB Interface (if fitted) or the Serial I/O Interface (if fitted), for details see sections 8, 10 and 12 respectively.

5-20 FULL RESET

Escape sequence:



This is equivalent to turning the terminal power off then on again, except that no computer break is generated (see section 2-16). This sequence completely clears the terminal input/output data registers.
When on-line, the display is cleared, the blinking feature is disabled the cursor is homed up and the standard size characters is enabled for display.
When the terminal is in self operation, the display is set as above except the large size characters are enabled for display.

Note: This escape sequence is discrete, i.e. a character block sent by the computer containing ESCE must NOT contain any other control sequences or data.

5-21 TYPICAL EXAMPLE

To select the large size character page, home up the cursor, clear the display, set the display blinking and display the message ROUTING CHANGE in a protected field, the following sequence must be sent.

ESC-c1DSIESCHESCJESC-d1]ROUTING CHANGE ESC[

ESC-c1D enables the display (if previously disabled) and is described in section 2-13.

SECTION 6

MULTIFUNCTION READER

(3075A, 3076A OPTION 007 3077A OPTION 001)

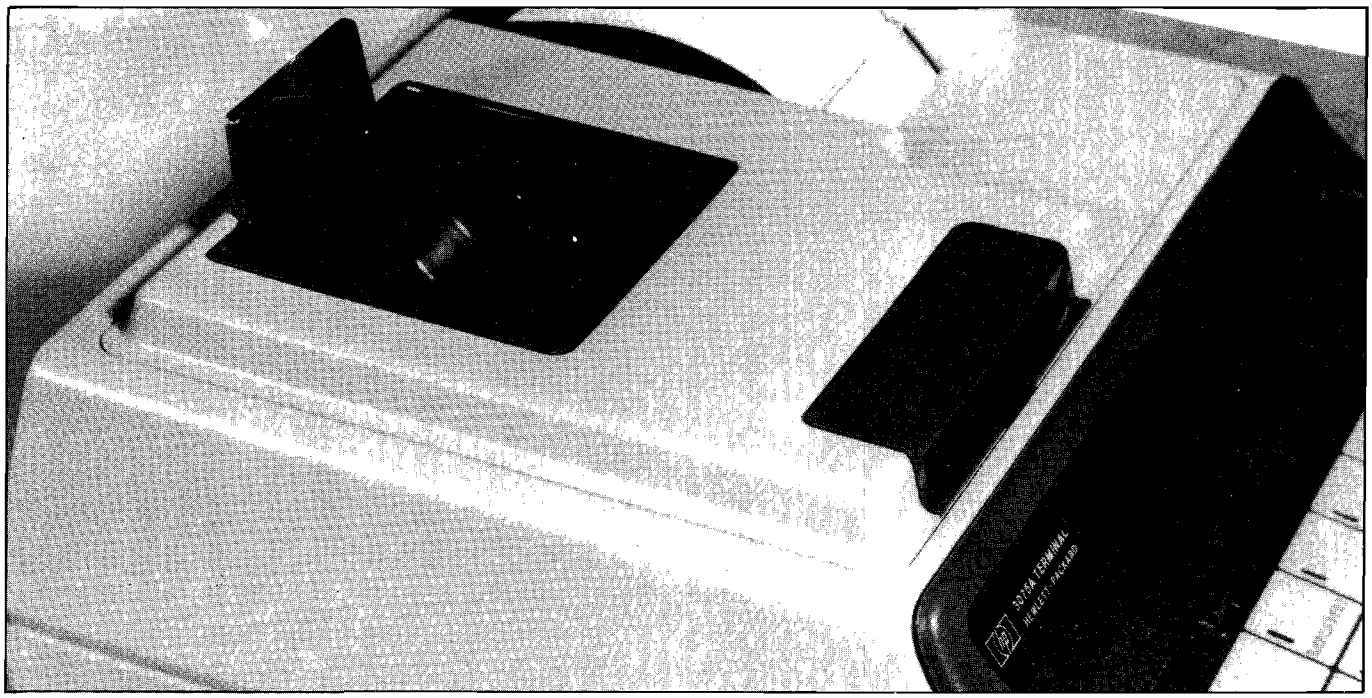


Figure 6-1 Multifunction Reader

6-1 INTRODUCTION

The following section describes the use of the Multifunction Reader on the 3075A and 3076A Data Capture Terminals and the 3077A Time Reporting Terminal. The Multifunction Reader is always mounted on the top left-hand side of the terminal (when viewed from the front of a 3075A).

6-2 READER CAPABILITIES

The Multifunction Reader is enabled by escape sequence ESC-c1R (see section 2-13), this allows the Reader to transmit the read data to the computer. At power-on or after a full reset (ESCE, see section 2-8) the Multifunction Reader is enabled.

6-3 READING MEDIA

The Multifunction Reader can read:
1) Industry Type III Badges (punched plastic).
2) Optical (paper) cards, namely:
   a) Marked cards.
   b) Turn-around Documents.
   c) Punched cards.

A detailed description of the card terminology and how to design and produce these badges/cards is contained in sections 6-21 to 6-49 inclusive.

Note: Optical cards must be produced using the clock-after-data format. Clock-on-data positioning must NOT be used.

6-4 **Type III Badges** (see section 6-44)

Type III Badges are punched plastic badges whose format corresponds to the first 22 columns of a standard punched card. i.e. the badge can contain up to 12 rows and a maximum of 22 columns of data encoded (without clock marks) at 80 column density. The data can be coded in either Hollerith or Image code, see section 6-9.

To enable the Multifunction Reader to read Type III Badges, it must be set as follows:

1) Reading holes using no clock marks. Selected using escape sequence ESC-r0n/N (see section 6-16).
2) Hollerith or Image reading. Selected using escape sequence ESC-r1/0i/I (see section 6-17).
3) Corner cut detection to ensure the Badges are inserted correctly. Selected using escape sequence ESC-r1/0c/C (see section 6-18).

6-5 **Marked Cards** (see section 6-25)

The Multifunction Reader can read optically marked cards whose size corresponds to standard punched cards. Data is manually encoded on the cards (in pre-printed marking boxes) using a soft lead pencil (e.g. HB or #2). Each card may contain up to 12 rows and a maximum of 40 columns of data at a maximum of 40 column density. The data may be coded in either Hollerith or Image code, in the clock-after-data format (see section 6-9).

To enable marked cards to be read, the Multifunction Reader must be set as follows:

1) Reading marks using clock marks in the clock-after-data format. Selected via escape sequence ESC-r1a/A (see section 6-15).
2) Hollerith or Image reading. Selected via escape sequence ESC-r1/0i/I (see section 6-17).
3) Corner cut detection to ensure the cards are inserted correctly. Selected via escape sequence ESC-r1/0c/C (see section 6-18).

6-6 **Turn-around Documents** (see section 6-30)

Continuous fan-fold cards may be overprinted with optical marks on a HP drum line printer equipped with an OCR ribbon. Since these cards are often generated by the manufacturing planning system and the printed data (plus manually inscribed data) is eventually returned to this system, the cards are called "turn-around" documents. For example, the cards may be used as travel documents to accompany and monitor work in progress.

The Multifunction Reader can read turn-around documents whose size corresponds to standard punched cards. Data may be encoded on the card in either Hollerith or Image code, in the clock-after-data format. Each card may contain up to 12 rows and a maximum of 35 columns of data at a maximum of 35 column density.

To enable the Multifunction Reader to read turn-around documents it must be set as for marked cards, see section 6-5.

6-7 **Punched Cards** (see section 6-37)

The Multifunction Reader can read standard size punched cards containing up to 12 rows and up to 80 columns of data, encoded at a maximum of 80 column density. The punched cards may be punched either without clock marks or using clock marks in the clock-after-data format. The data may be coded in either Hollerith or Image code (see section 6-9).

Note:
1) There must be no more than 40 non-punched columns between two punched columns.
2) The dimensions of the cards and punched holes must conform to ANSI X3.11-1969 specifications, see section 6-37 for details.

To enable the Multifunction Reader to read punched cards it must be set as follows:

1) Reading holes without using clock marks. Selected using escape sequence ESC-r0n/N (see section 6-16).

   Note: When reading punched cards with no clock marks the data must be encoded at exactly 80 column density as the Multifunction Reader automatically assumes the presence of clock marks at 80 column density.

2) Reading holes using clock marks in the clock-after-data format. Selected using escape sequence ESC-r0a/A (see section 6-15).

3) Hollerith or Image reading. Selected via escape sequence ESC-r1/0i/I (see section 6-17).

4) Corner cut detection to ensure the cards are inserted correctly. Selected using escape sequence ESC-r1/0c/C (see section 6-18).

Note: Both marks and punched holes may be used on the same card; however, the column density of the mixed marks and holes must not exceed 40 and clock marks must be used.

6-8 READING TECHNIQUE

The Multifunction Reader employs optical techniques to read the badges and cards. The badge/card background must be such that it reflects approximately 60% of the light beam generated within the Reader (see Table 6-2 for the absolute values). The marks are read by the absence of reflected light (as the card moves past a set of light detectors within the Reader) and the punched holes are read by the increase in reflected light, see figure 6-2.

Consequently, when the Reader is set to read punched holes only, marks do not affect the hole reading (which enables soiled punched cards to be read). When the Reader is set to read marks it will also read holes, however the card must be clean to prevent soil marks being read as data.

6-9 READING MODES

The Multifunction Reader can read badges/cards coded in either Hollerith or Image coding.

6-10 **Hollerith Reading Mode**

The Hollerith mode is the usual reading mode for card readers, in which the marked or punched data on a card is converted from the Hollerith format to ASCII characters (within the terminal) before being sent to the computer. One character is coded per card column. The Hollerith coding character set is listed in Appendix C.

For point-to-point connections: the set of 128 ASCII characters from N_{UL} (octal 000) to D_{EL} (octal 177) is available.

For multiterminal connections: since ASCII characters N_{UL} to U_S (octal 037) and D_{EL} are non-displayable control characters, certain of these characters may initiate local control action at the terminal (e.g. E_{NQ}, E_{TB}, E_{TX}, S_{TX}, etc.). To prevent this occurring (and to allow the complete set of 128 ASCII characters to be available), the terminal must be set for transparent working by setting rear panel terminal configuration switch III-2 to 0 (see section 14-16 for details).

For systems that do not support transparent transmission, the 3075A/3076A/3077A terminals can be configured not to transmit characters between octal 001 and 007 (S_{OH} and B_{EL}) inclusive and between octal 020 and 027 (D_{LE} and E_{TB}) inclusive and octal 037 (U_S), by setting terminal configuration switch III-2 to 1 (transparency OFF). If such characters are marked/punched on a card, they will be changed to a N_{UL} character (octal 000).

In Hollerith mode, if any invalid data is marked/punched on the card, the card is rejected back to the user.

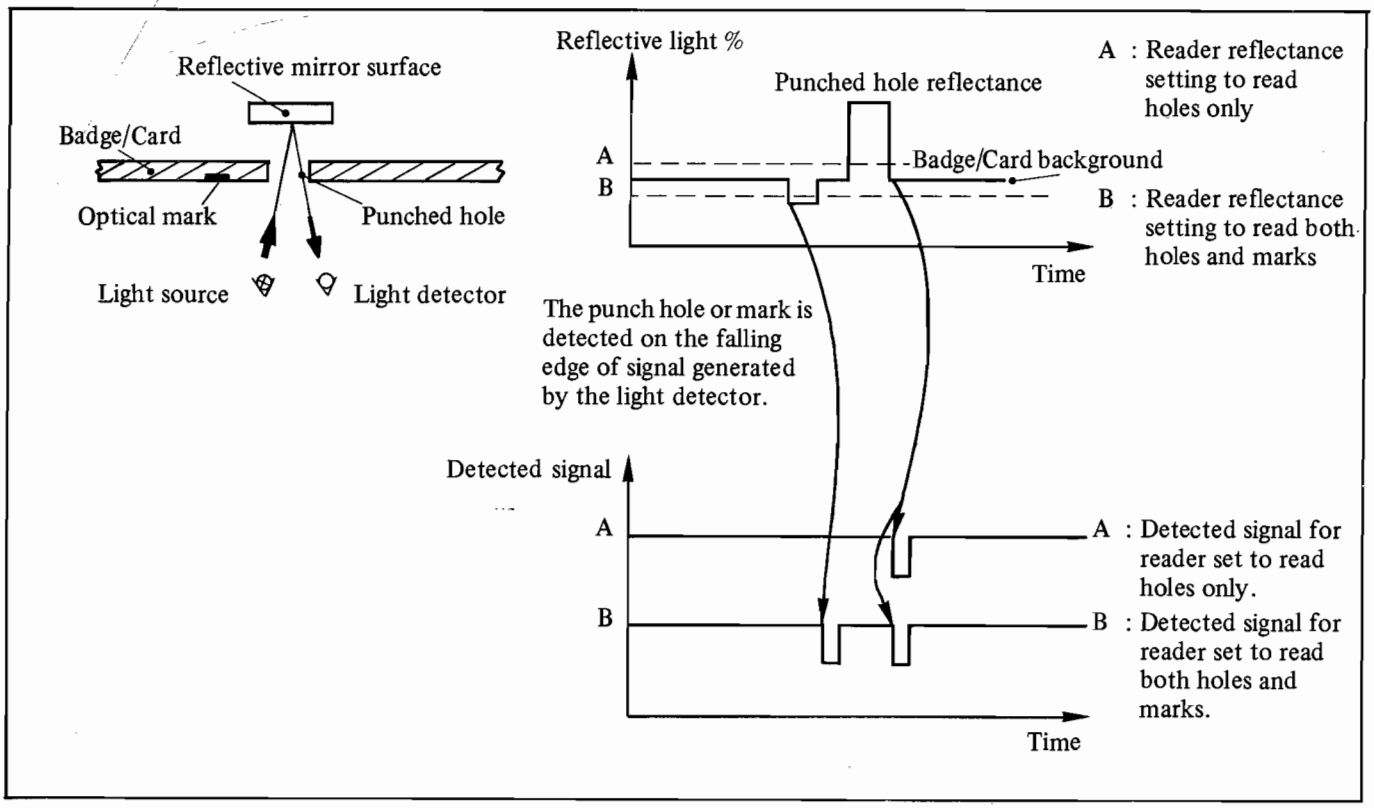


Figure 6-2 Multifunction Reader Reading Technique

6-11 Image Reading Mode

The Image reading mode is normally only used with marked cards and turn-around documents. This mode allows the terminal to transmit an exact "image" of one column of data to the computer. Since each column contains up to 12 rows of information, then each column of the card may be marked in any one of 2 to the power 12 (i.e. 4096) combinations.

In Image mode the encoded data is in binary format however, for the Multifunction Reader, data transfers to and from the computer are in ASCII format. Thus the encoded binary data has to be converted (within the Reader) to an ASCII format readable by the computer, as follows:

For each card column there are a maximum of 12 data bits, however each ASCII character comprises seven data bits (plus one parity bit). Thus, to change the encoded data to ASCII format, the 12 data bits are divided into two six-bit characters. In each column, rows 9 to 4 form one character (which is the first transmitted character) and rows 3 to 12 form the other character. To increase the number of data bits from six to seven (as required by the ASCII format), bit 6 of each character is inverted to form bit 7, which is the most significant bit (see figure 6-3). This means that either bit 6 or bit 7 of the character is always one. Thus, this seven bit character can correspond to one of the 64 displayable ASCII characters from space (octal 040) to underscore (_ octal 137).

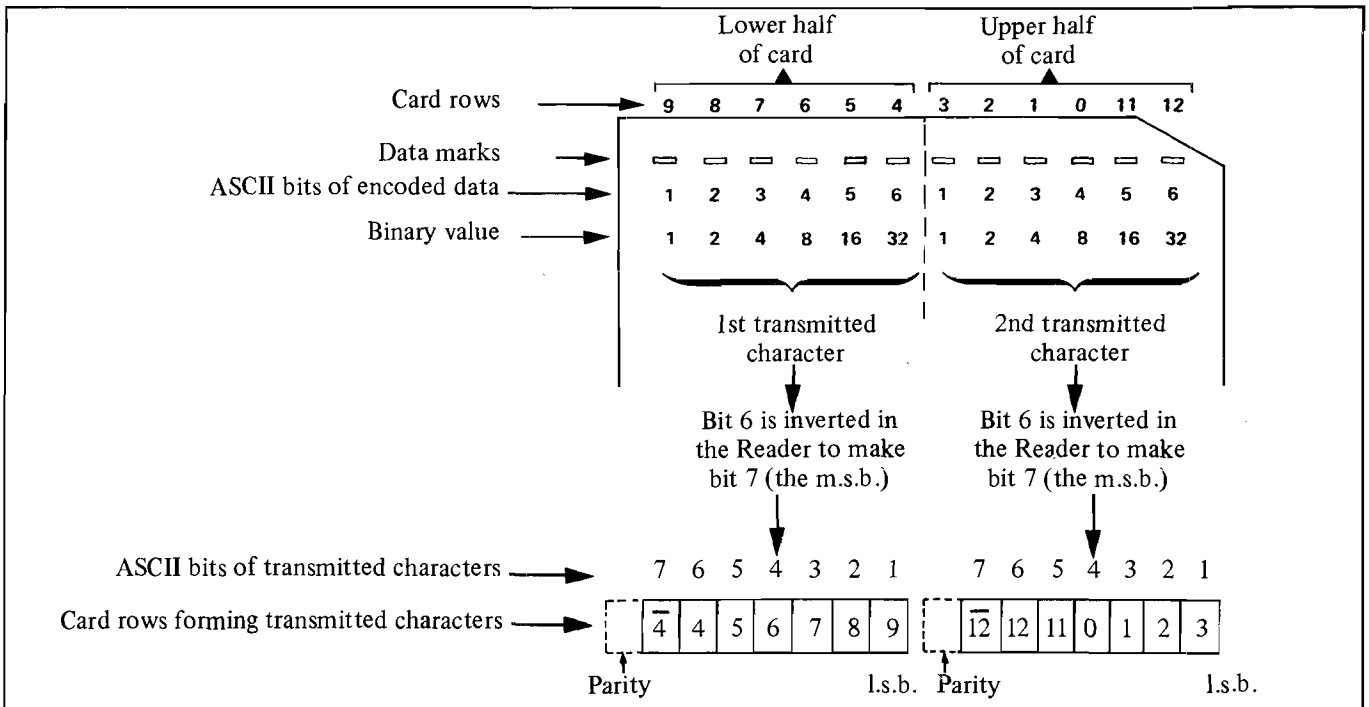
Alternatively, any of the 64 displayable ASCII characters from space to underscore may be directly encoded onto the card. Each ASCII character has two possible locations, depending on where the character is positioned on the card. Appendix C lists the Image character coding.

For example, if in any column ASCII character A (octal 101) is required to be positioned on the lower half of the card (rows 9 to 4) it must be coded as a mark in row 9. Alternatively, if character A is required to be positioned on the upper half of the card (rows 3 to 12) it must be coded as a mark in row 3.

6-12 MULTIFIELD OPERATION

Note: Multifield operation must only be used when the terminal is connected to the computer in the multiterminal mode.

Multifield operation is selected for the Multifunction Reader by escape sequence ESC-r1m/M (see section 6-19) Multifield operation allows multiple data entries in the same transaction, preventing the Multifunction Reader entering its data to the computer at the end of a single data transaction. The data from several input modules (operating in multifield) is transmitted to the computer as one data block when data is entered either via the keyboard or via a terminal input module/option not in multifield operation. The only restriction to the multifield operation is that the total amount of data entered per transaction must NOT exceed 180 characters (see section 2-19 for details).



Note: Since bit 7 is the m.s.b., the card rows (9 to 4 and 3 to 12) are laterally inverted to form the transmitted characters. This is so the m.s.b. is the left-hand character.

Figure 6-3 Image Mode Format

6-13 MULTIFUNCTION READER OPERATION

If the program is expecting an input via the Multifunction Reader, the badge/card should be entered into the Reader aperture with the end of the badge/card with the corner cut entered first (see figure 6-4).

When the Reader detects the leading edge of the document, the motor turns on and draws the document through the reader to the ouput hopper.

The Reader has a local misfeed error detection capability which enables it to reject any wrongly inserted badges/cards back to the user. i.e. the card is rejected backwards through the feed-in aperture. Errors may be due to:

1) Badge wrongly inserted (i.e. upside down or backwards) as detected by corner cut detection.
2) Time-out condition (approximately four seconds), e.g. card/badge jammed.
3) Card with Image data is read by a Reader set to the Hollerith mode.
4) Card with Image data contains more than 90 columns.

Note:
1) Even with the printer and/or display configured, no local echo of the data read from the reader is printed/ displayed on the terminal.
2) In point-to-point mode, for both Image and Hollerith formats, the card data is sent to the computer as one block. This does not imply any block processing (such as D_{C1}, D_{C2}, etc.), but simply that characters are transmitted one after the other asynchronously without any delay between them.

Reader disabled. If the Reader is disabled, the Reader motor is inoperative. Consequently, the badge/card cannot be inserted into the Reader.

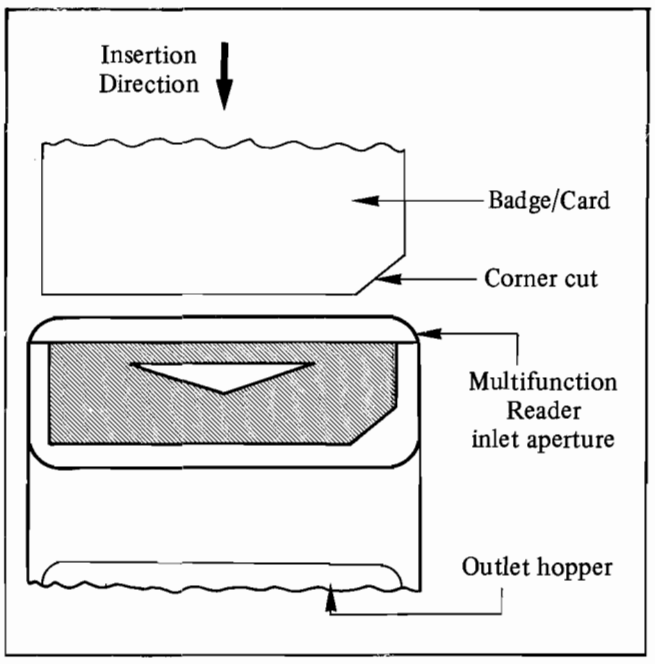


Figure 6-4 Multifunction Reader Aperture

Self operation. The local mode of operation (used for checking and demonstration only, see section 16-13) may be selected by setting rear panel terminal configuration switches I-1 to 1 and I-2 to 0. In self operation, the terminal may be programmed by entering the relevant escape sequences using punched cards. This allows the user to test subsequently entered badges/cards.

Note: To enable display screen field protection to work when ESC[(see sections 4 and 5) is entered from an optical card, the last data on the card must be an underscore character (octal 137) to inhibit the effect of the Carriage Return character (normally generated by the Reader at the end of a read operation).

Maintenance. The Multifunction Reader should be cleaned every two months by passing the supplied cleaning card (moistened with cleaning fluid) through the Reader, see section 17.

6-14 MULTIFUNCTION READER CONTROL

The Reader is programmed using escape sequences:

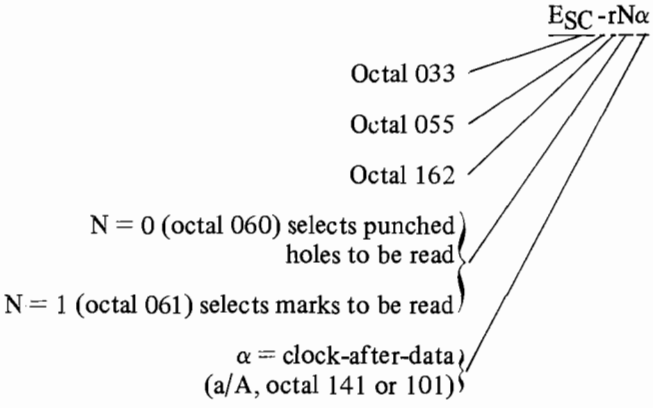
1) ESC-r1/0a/A	clock-after-data (clock marks)
2) ESC-r0n/N	no clock marks
3) ESC-r1/0i/I	reading mode
4) ESC-r1/0c/C	corner cut
5) ESC-r1/0m/M	Multifield operation

These escape sequences are detailed in the following sub-sections.

Note: ESC-1/0r/R may be used to enable/disable the Reader, see section 2-13 for details.

6-15 CLOCK-AFTER-DATA FORMAT

Selected by sending escape sequence:

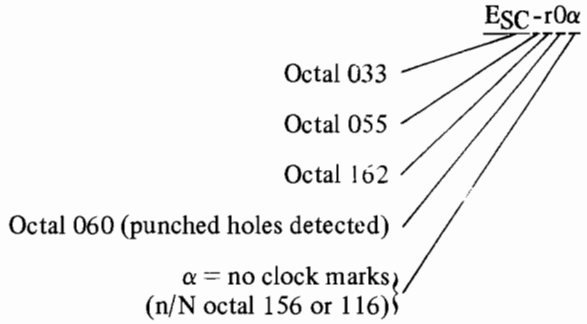


This ensures the data on the cards will only be accepted by the Reader if it is accompanied by clock marks and is positioned in the clock-after-data format.

6-16 NO CLOCK MARKS

Note: This is only used with punched cards and badges.

Selected by sending escape sequence:

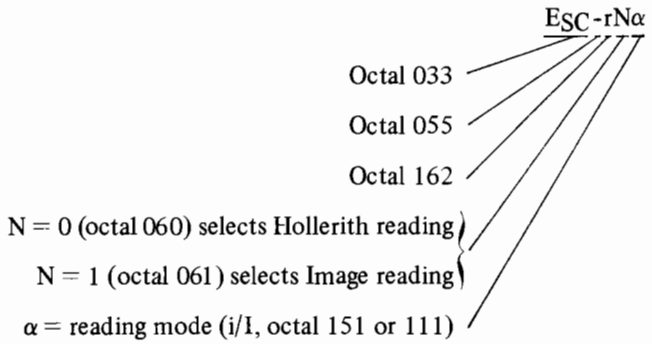


The data on the card is referenced to an assumed clock mark at 80 column density.

Note: No clock marks is the default mode at power-on or after a full reset.

6-17 READING MODE

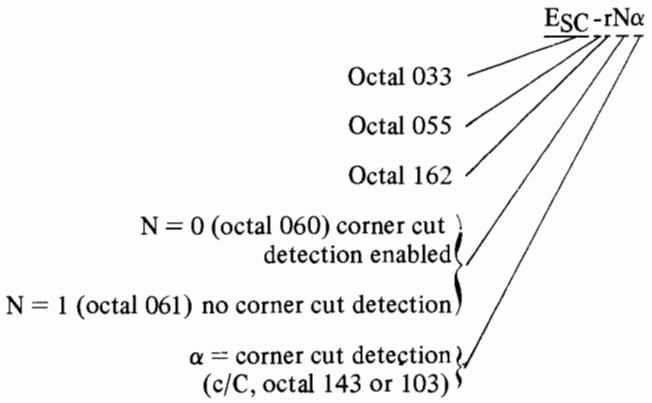
Selects either Hollerith or Image reading by sending escape sequence:



The default reading mode at power-on or after a full reset is Hollerith.

6-18 CORNER CUT DETECTION

Selected by sending escape sequence:



When enabled (i.e. N = 0), the corner cut detection ensures the cards have been correctly inserted.

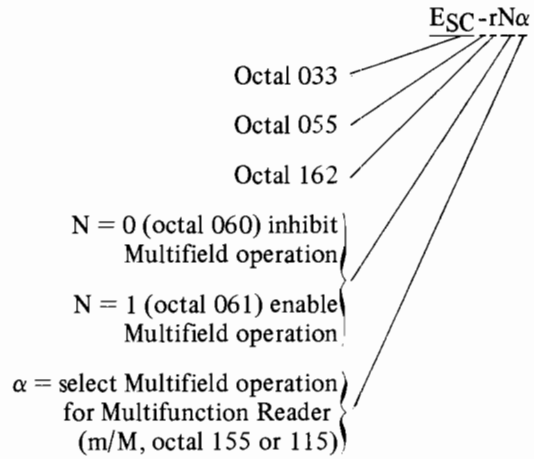
Note: Corner cut detection is enabled at power-on or after a full reset.

6-19 MULTIFIELD OPERATION SELECTION

Note:

1) The Multifield operation may only be used when the terminal is connected in the multiterminal mode.
2) Multifield operation must NOT be used with the 3077A Time Reporting Terminal.

The Multifield operation is selected for the Multifunction Reader by sending escape sequence:



At power-on or after a full reset the Multifield operation is disabled.

6-20 TYPICAL EXAMPLE

To enable the reader to read marks on a clock after data card in Hollerith format and check for corner cuts the following escape sequence must be sent:

ESC-c1R ESC-r1a0i0C

ESC-c1R enables the Multifunction Reader (if previously disabled) and is described in section 2-13.

6-21 INPUT MEDIA FOR THE MULTIFUNCTION READER

The following sub-sections detail the design specifications for the badges and cards employed by the Multifunction Reader. Also detailed are potential badge/card manufacturing equipment and potential suppliers of prepared badges and cards.

Note: The dimensions detailed in the following sub-section are valid for a temperature of 21°C (70°F) and a humidity of approximately 50%.

6-22 OPTICAL CARDS

The Multifunction Reader can read both optically marked cards and punched cards. Both types of card must conform to the standard card size (i.e. 187 mm, 7.375 inches long) and may contain up to 12 rows of data per column. Marked cards are cards overprinted by a line printer and/or inscribed with a pencil to provide a maximum of 40 columns of machine readable data (at 40 column density). Punched cards employ punched holes to provide a maximum of 80 columns of machine readable data (at 80 column density).

Note: Both marks and punched holes may be used on the same card; however, the column density of the mixed marks and holes must not exceed 40 and clock marks must be used.

Clock marks. Two different methods are available for accepting the data:

1) Clock marks (clock-after-data format). The mark or punched hole is only accepted as valid data when there is an associated clock mark on the bottom edge of the card. The Multifunction Reader accepts all detected marks/punched holes in front of the first clock mark and between one clock mark and the next.

2) No clock marks (only used with punched cards). When set in the no clock marks mode (see section 6-7), the Multifunction Reader assumes the presence of clock marks at regularly defined spacings, i.e. 80 column density. The reading is referred to the leading edge of the card.

Note: Clock-on-data positioning must NOT be used with the Multifunction Reader.

Table 6-1 lists the optical cards reading options.

Table 6-1 Marks and Punched Holes Reading Options

Encoded Data	No Clock Marks	Clock Marks (clock-after-data format)	Maximum Column Density
Marks	No	Yes	40
Punched holes	Yes	Yes	80

Optical card terminology. Figure 6-5 defines the basic terminology of HP cards.

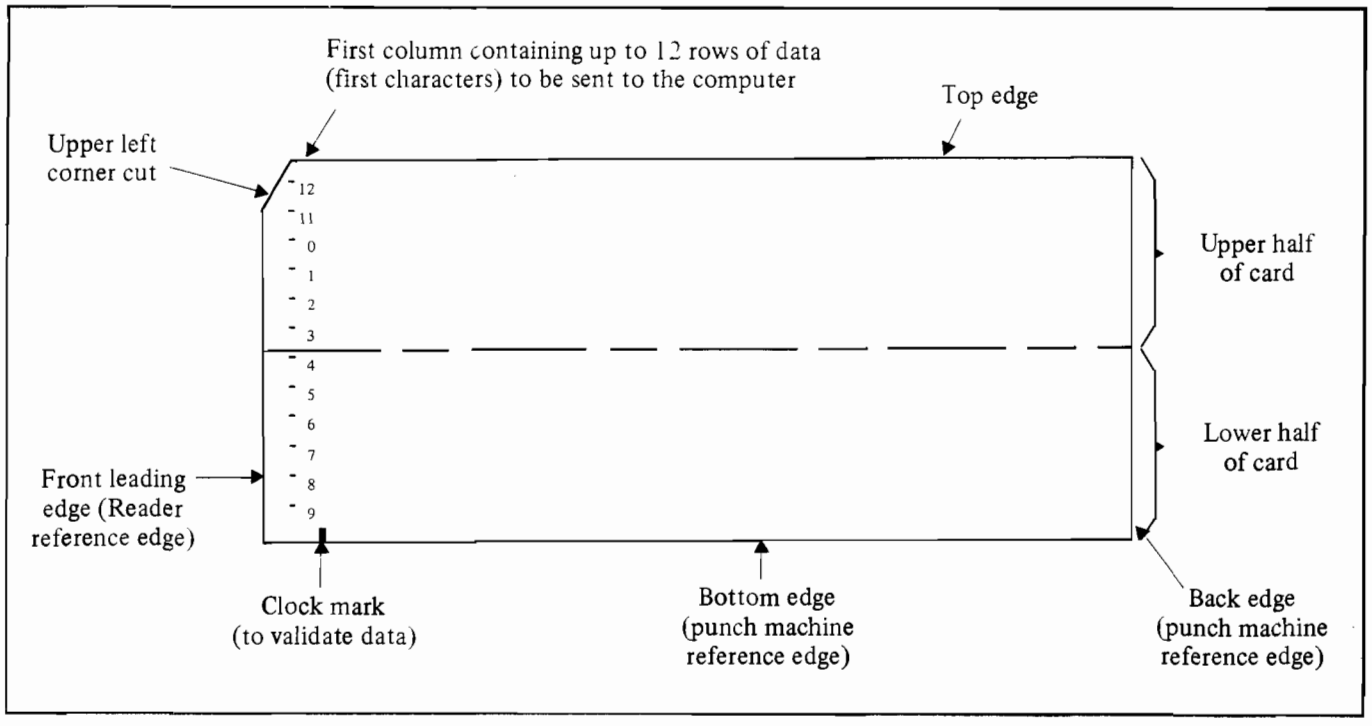


Figure 6-5 HP Optical Card Teminology

6-23 CARD CONTRAST AND REFLECTANCE SPECIFICATIONS

Since the Multifunction Reader detects data using reflection techniques (see section 6-8), the contrast and reflectance must be within definite limits (as specified in Table 6-2).

Contrast is defined by the relationship:

$$C = \frac{(R_L - R_D)\ 100\%}{R_L}$$

where, C is the contrast
R_L is the reflectance factor from the "light" background.
R_D is the reflectance factor from the "dark" data marks.

and the reflectance factor is defined by the relationship:

$$R = \frac{\emptyset s}{\emptyset r}$$

where, R is the reflectance factor.
$\emptyset s$ is the reflected light from the sample (background or printing).
$\emptyset r$ is the reflected light from a reference reflector, either an MgO (magnesium oxide) or BaSO4 (barium sulphate) standard.

0% contrast corresponds to a totally white card (the complete reflection of light).
100% contrast corresponds to a totally black mark (the complete absorption of light) on a totally white card.

The card background (i.e. card material) reflectance specifications are currently achieved using paper available from most card manufacturers. The card material may be any color, provided the reflectance stays within the specifications listed in Table 6-2.

Table 6-2 Optical Card Reflectance and Contrast Specifications

Parameter	Specification (%)
Card background reflectance	55 to 65
Background pre-printed layout reflectance	62 to 66
Contrast of pre-printed card layout/card background	< 18
Contrast of optical mark/ card background	> 50

The background pre-printed card layout (e.g. marking boxes, company logo, explanations, questions, etc.) must be done using reflective inks that provide the lowest contrast possible with the card background. This is to prevent the card background being interpreted as data. The layout may be printed in a variety of colors, provided the contrast (between the layout and the background) stays within the specifications listed in Table 6-2. Suitable reflective inks are listed in Table 6-4.

The Multifunction Reader is designed to detect data marks and clock marks that provide a contrast (with the card layout/background) of $> 50\%$. Therefore, clock marks and data marks must be printed in non-reflective ink that provides a contrast of at least 50%. Examples of suitable inks are listed in Table 6-3.

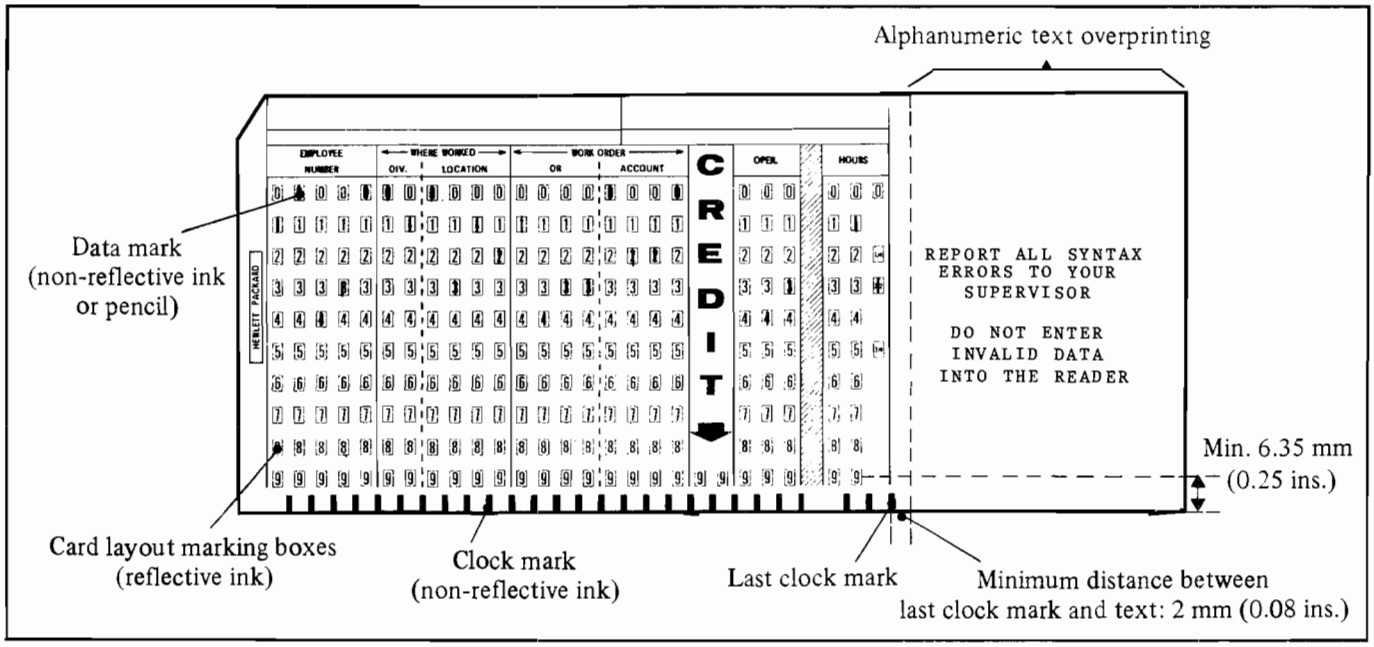


Figure 6-6 A Typical Optical Card

Note:

1) Normally data marks printed on continuous fan fold paper cards by a system line printer equipped with an OCR ribbon provide the necessary contrast (see section 6-30). Similarly, pencilled data using an HB or #2 type lead provides the necessary contrast (see section 6-25).

2) Overprinting of alphanumeric text by a line printer is permissible on the right-hand side of the card, at a minimum distance of 2 mm (0.08 ins.) after the last clock mark and 6.35 mm (0.25 ins.) from the bottom edge of the card (where it will not be read by the Multifunction Reader as clock marks).

6-24 DATA ENCODING

The Multifunction Reader can read cards where the marks and holes are coded in either Hollerith or Image coding.

Hollerith coding (see section 6-10). The Hollerith reading mode is the usual mode for card readers, in which the marked or punched hole data on a badge/card is converted from the Hollerith format to ASCII characters within the terminal before being sent to the computer. Appendix C lists the Hollerith character set.

Image coding (see section 6-11). The Image reading mode may normally only be used for marked cards and turn-around documents. The terminal is able to transmit an exact image of a column of data. Since each column contains up to 12 rows of data, then each column may be marked in any one of 2 to the power 12 (i.e 4096) combinations. The Reader decodes the data and transmits to the computer the two equivalent ASCII characters (space, octal 040, thru underscore, octal 137) for each column of data. Appendix C lists the Image character coding.

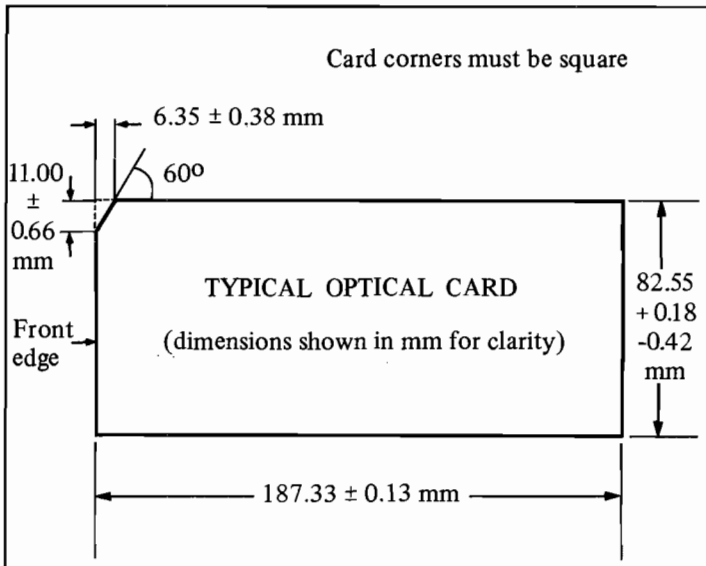
6-25 MARKED CARD DESIGN

Marked cards are cards on which the data is manually inscribed (in pencil) into pre-printed marking boxes. These cards require clock marks on the bottom edge of the card, printed at a maximum of 40 column density (see section 6-27 for details).

6-26 Marked Card Dimensions

The Multifunction Reader reads standard size cards produced using the same card material used for punched cards (see the ANSI standard referred to in section 6-37). The dimensions of the marked cards are listed and depicted in figure 6-7.

Note: The marked cards must be clean and lubricant free.



Parameter	Units	Dimension	Tolerance
Card width	mm	82.55	+0.18 −0.43
	inches	3.250	+0.007 −0.017
Card length	mm	187.33	± 0.13
	inches	7.375	± 0.005
Card thickness	μm	180	±10.0
	inches	0.0070	±0.0004
Card weight	g/m²	160	± 8 gms
	lbs/ream	99 lbs for 500 sheet reams	± 5 lbs

Note:
1.0 mm = 0.0394 inches
6.35 mm = 0.250 inches
11.00 mm = 0.433 inches

Figure 6-7 Optical Card Dimensions

6-27 Marked Card Pre-Printed Clock Marks

Clock marks must be printed on the bottom edge of the card using standard black non-reflective inks that provides the contrast listed in Table 6-2. The clock marks dimensions and suitable printing inks are listed in Table 6-3.

Note: The clock marks must be uniformly black.

Clock mark spacing. The clock marks used with marked cards must be spaced a **minimum** of 4.41 mm (0.174 inches) apart, enabling the card to accommodate a maximum column density of 40. The spacing between clock marks may be varied to allow the card to contain any number of columns from 40 to none.

6-28 Marked Card Pre-Printed Marking Boxes

The card must be designed with any pre-printed layout (e.g. marking boxes for data, company logo, questions, etc.) done using reflective inks that provide the minimum contrast with the card background (see Table 6-2). Table 6-4 lists both the optimum dimensions of marking boxes and suitable reflective inks.

The marking boxes **must** be positioned (with respect to the clock marks) in the clock-after-data format. In this format each column of marking boxes must be located in front of the clock mark that will transfer that column of data to the terminal output buffer. Up to 12 rows of marking boxes may be used, each row spaced 6.35 ±0.25 mm (0.25 ±0.010 inches) apart at the centres and the same distance from the bottom and top of the card.

Figure 6-8 depicts typical marking boxes and their clock-after-data positioning.

Table 6-3 Clock Marks Dimensions and Suitable Printing Inks

Dimensions	Height	3.56 ±0.38 mm	0.140 ±0.015 inches
	Width	1.02 ±0.25 mm	0.014 ±0.010 inches
Sinclair and Valentine Non-reflective inks	Black offset ink Black letter press ink	J-24107 J-20673 or equivalent	

Table 6-4 Marking Box Dimensions and Suitable Printing Inks

Dimensions	Height	4.0 to 5.5 mm	0.157 to 0.217 inches
	Maximum width	1.5 mm	0.059 inches
Sinclair and Valentine Reflective Inks	Blue	J-18710, J-20988, J-24186, J-24662, J-27972 or J-27973	
	Brown	J-22053	
	Green	J-22052, J-24185, J-24554, J-24555, J-24649 or J-27976	
	Magenta	J-22045	
	Orange	J-30269	
	Pink	J-24893 or J-24944	
	Red	J-19410, J-24882, J-25083, J-30495 or J-6983	
	Violet	J-20530	
	Yellow	J-24182 or J-27974 or equivalent	

Manually inscribed data. To ensure maximum reading reliability, it is recommended that when the data is manually inscribed into the marking boxes it is done as a VERTICAL stroke, at least 4 mm (0.16 inches) high and a minimum of 0.6 mm (0.024 inches) wide using an HB or #2 soft lead pencil. However, the data will be accepted provided the pencil stroke is at NO greater angle than 20° to the vertical.

6-29 **Potential Suppliers Of Marked Cards**

The Hewlett-Packard card layout form, contained at the end of this Multifunction Reader section, may be used to indicate to your supplier the required card background printing. Since a reflective reading technique is employed, both sides of the card may be used.

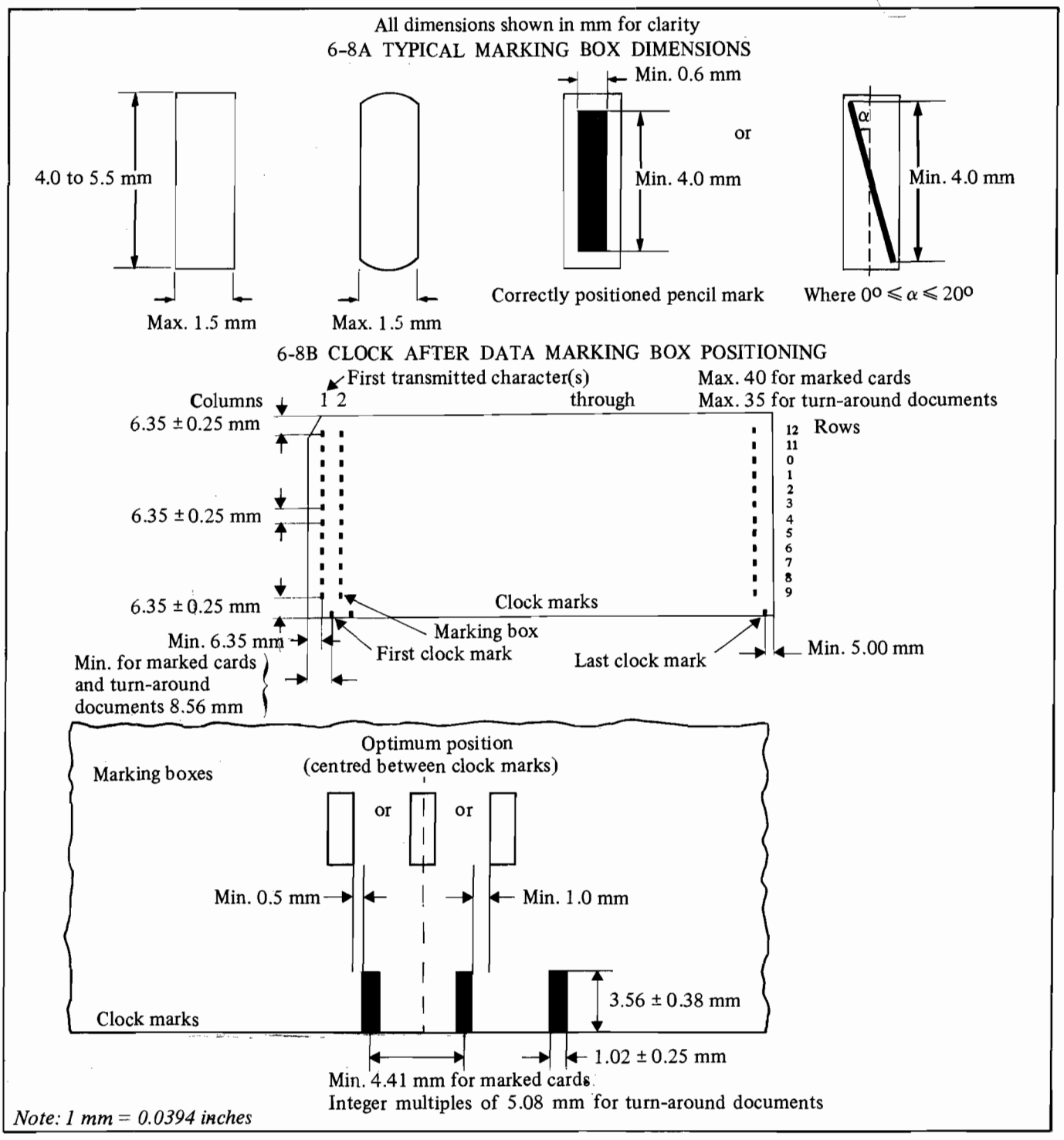


Figure 6-8 Clock-After-Data Marking Box Positionning

The layout form is scaled to twice actual size. The background printing should include guidance to a user on where to place marks. Up to 12 marks in the positions referenced 12, 11 and 0 through 9 may be detected in each column identified by a clock mark. The spacing of the clock marks need not be uniform. Examples of 40 and 80 column uniform spacing (clock-after-data) are shown.

If you are in any doubt that your completed card is suitable, Hewlett-Packard will be pleased to review it before submission to a supplier. Equally Hewlett-Packard will test a proof of the finished card if required. A copy of this manual would be useful to a supplier as it includes dimensions and tolerances which must be met, and lists suitable inks for printing.

Note: Additional copies of the Hewlett-Packard card layout form are available from your local HP sales office, under part number 5953-0129.

Potential suppliers are listed in table 6-5.

Table 6-5 Potential Marked Card Suppliers

USA	Globe Ticket Co. IBM. Moore Business Forms. Standard Register Co. U.A.R.C.O.
UK	IBM. Kenrick and Jefferson Ltd., High Street, West Bromwich Staffordshire, England B70 8NB. Roneo Vickers Business Forms.
Europe	Aussedat-Rey, 15 av. du President Wilson, 92 - La Plaine Saint Denis, France. Ferry Perfocard, 4 rue du Champy B.P.18 54210 St Nicolas-de-Port, France. Hummel (Magstadt, Germany). IBM.

6-30 TURN-AROUND DOCUMENT DESIGN

Note: This section details the use of continuous fan fold card stock and overprinting using HP line printers.

Continuous fan fold cards (equipped with side perforations to fit the line printer sprockets) may be overprinted with both optical marks and alphanumeric information by a line printer, under computer control. Manually inscribed marks may also be added to the card as it "travels" through the plant/office system. The card will ultimately be read by a Multifunction Reader which transfers the data to the computer, thus closing the data loop of the "turn-around" document.

Turn-around documents may be produced on an HP line printer (e.g. HP 2613A, HP 2617A or HP 2618A) when fitted with an OCR (Optical Character Recognition) ribbon, see section 6-34. The continuous fan fold card stock must be prepared with perforations (see section 6-31) and be printed with clock marks (see section 6-32) and marking boxes (see section 6-33). Optical marks, i.e. data, can be overprinted onto the card in the form of a capital I (octal 111) using clock-after-data positioning. Marks may also be manually inscribed onto the card (in the marking boxes) using a soft lead pencil, i.e. HB or # 2. The overprinted marks, together with any manually inserted marks, may subsequently be read by the Multifunction Reader.
A typical turn-around document can include up to three different types of data field, namely:

1) **The fixed data field.** Typically, this field contains an identification code printed with capital I characters by the line printer. This identification code references the transaction to be made on the card, and is for computer data processing. This field is to be ignored by the users, but has to be readable by the Multifunction Reader. Therefore, this field must carry clock marks on the bottom edge of the card.

2) **The variable data field.** This field contains the marking boxes in which the user will record data with pencil marks. The variable data field must be readable by the Multifunction Reader and must carry clock marks on the bottom edge.

   Note: As the reader uses the clock-after-data format, the fixed and variable data fields must be located on the left hand side of the card.

3) **The alphanumeric (text) field.** In this field, the system line printer prints alphanumeric characters to reference the card to a specific transaction. This field contains information for the operator's use and is **not** readable by the Multifunction Reader. Hence, this field does not carry clock marks on the bottom edge of the card.

Note: The alphanumeric field must be positioned after the last clock mark on the right hand side of the card, at a minimum distance of 2 mm (0.08 ins) after the last clock mark and 6.35 mm (0.25 ins) from the bottom edge of the card (see figure 6-6).

An example of a turn-around document is shown in figure 6-9.

6-31 Continuous Fan Fold Paper Stock Dimensions

Line printer paper. Cards produced using line printer paper must have the same dimensions as marked cards. These dimensions are listed and depicted in figure 6-7. The cards must also produce the correct background reflectance, as listed in Table 6-2. The card must be of sufficient weight and strength, to prevent the side perforations from tearing out during card feeding/ejecting operations, and must be free from paper dust and chad. When removed from their storage cartons, the cards must be flat and the edges and folds must not be damaged.

Perforations. The line printer paper requires perforations to allow the separation of the cards before they are input to the Multifunction Reader. The perforations must take the form of regularly spaced slits that provide a smooth transition from one card to the next. This avoids irregular edges that may catch in the line printer mechanism. Slits should be 6.35 mm (0.25 inches) long and the ties should be 1.02 mm (0.04 inches) long. Figure 6-10 depicts these perforations.

Note: Horizontal perforations between cards must be perpendicular to the line printer paper sprocket holes.

6-32 Turn-Around Document Pre-Printed Clock Marks

Clock marks must be printed on the bottom edge of the card using non-reflective ink. The dimensions of the clock marks and suitable non-reflective inks are listed in Table 6-3.

Note: The clock marks must be uniformly black and provide the contrast with the card background as listed in Table 6-2.

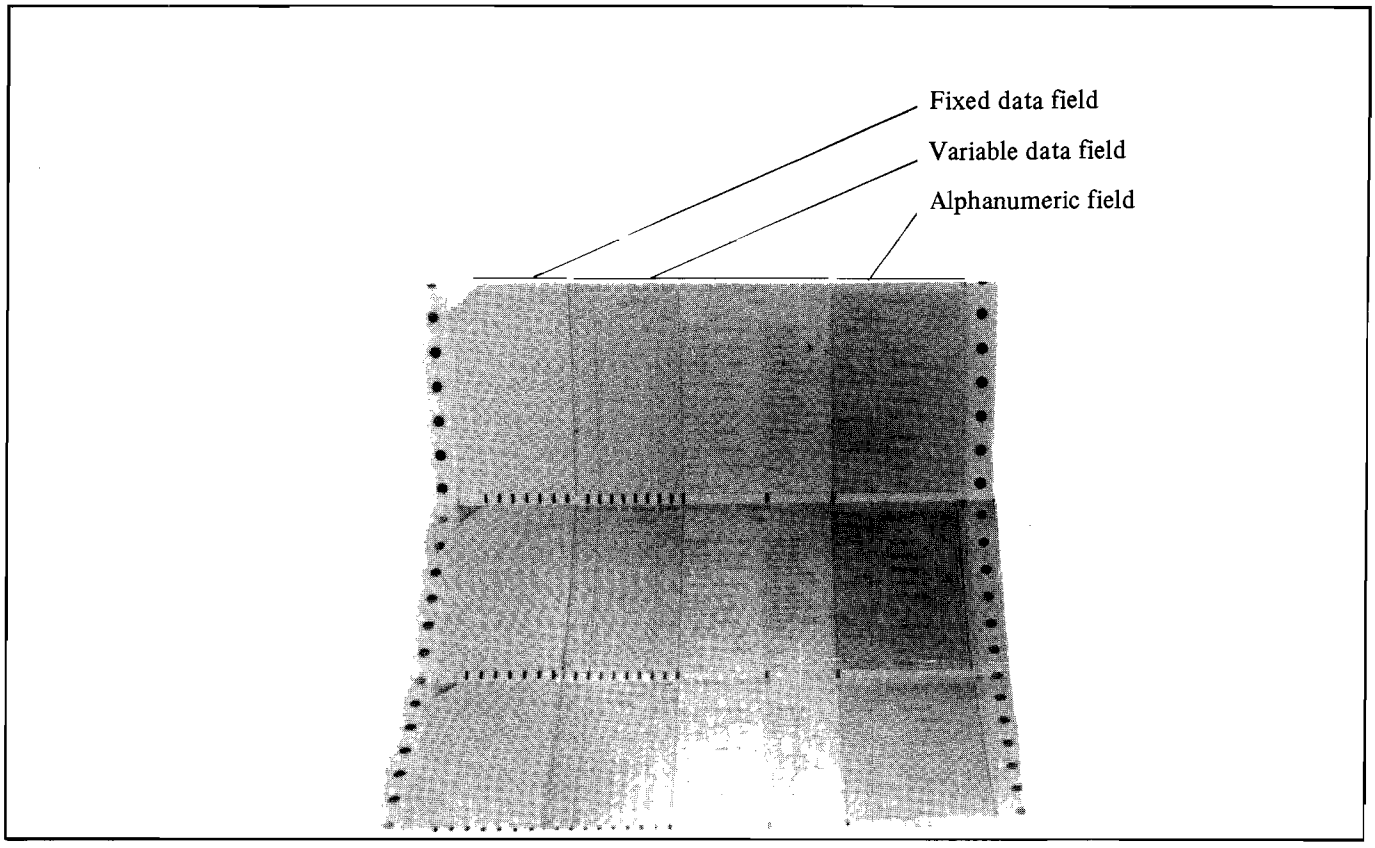


Figure 6-9 Typical Turn-Around Document

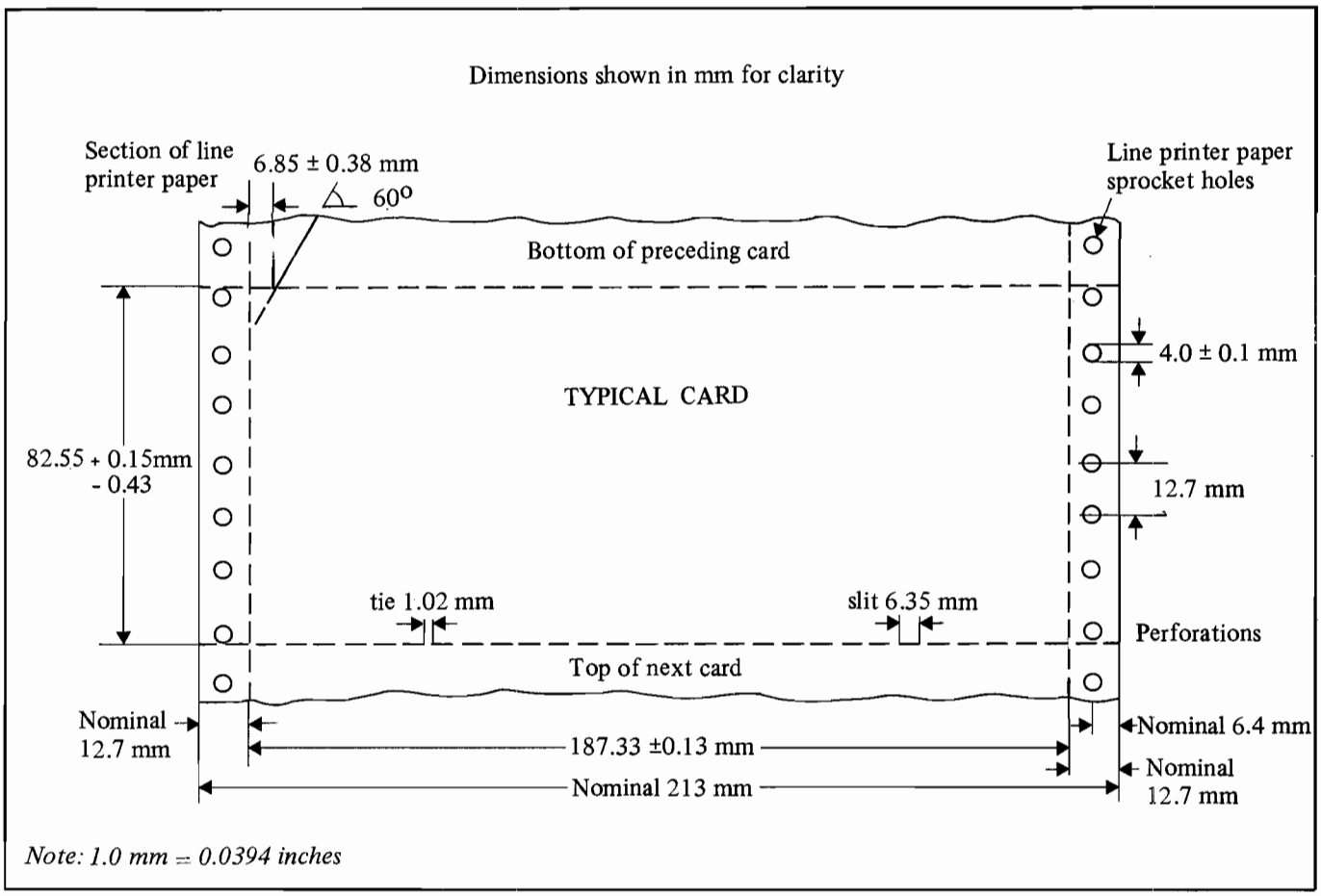


Figure 6-10 Recommended Perforations For Line Printer Paper

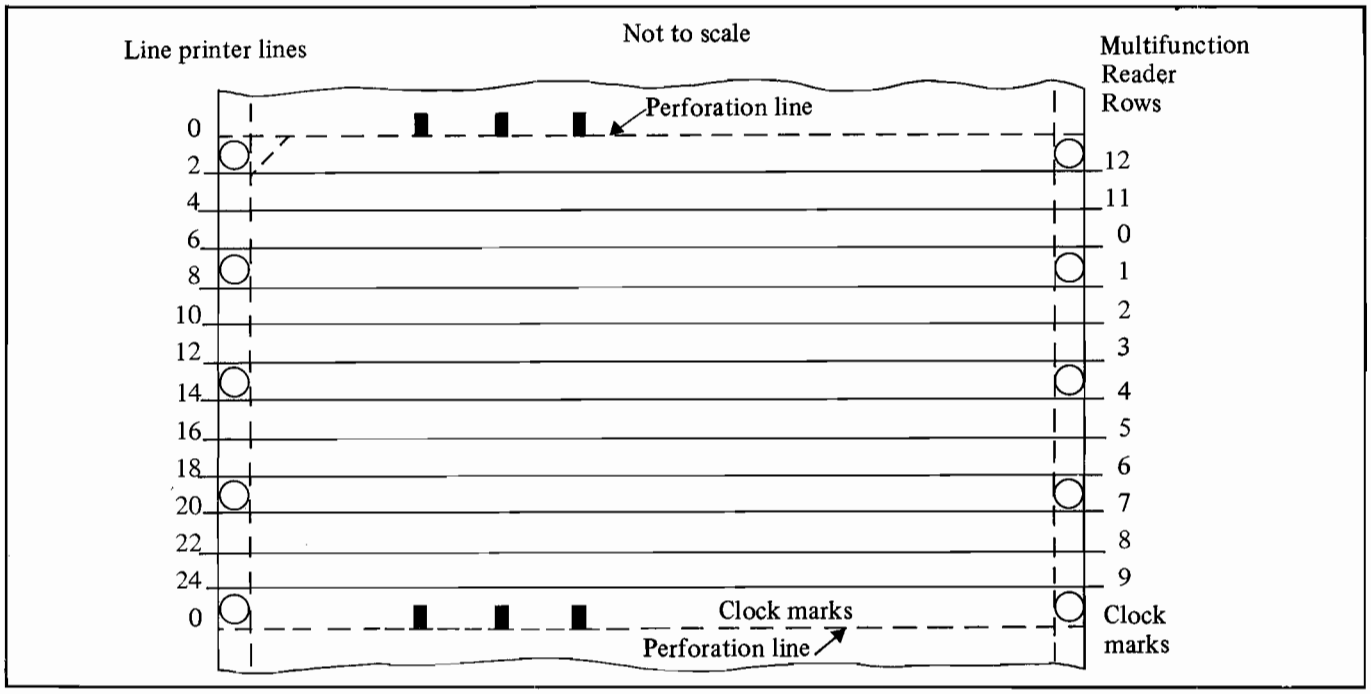


Figure 6-11 Printer Lines/Data Rows Detected By The Multifunction Reader

Clock mark spacing. The clock marks must be spaced 5.08 mm (0.200 inches), or INTEGER multiples of 5.08 mm apart. This allows the card to be overprinted by an HP drum line printer, when set to print 10 characters per inch and printing every other character (i.e 5.08 mm spacing). This corresponds to 35 column density. The spacing between the clock marks may be varied (by integer multiples of 5.08 mm) to allow the cards to accommodate any number of columns from the maximum permissible (35 due to space limitations) to none, see figure 6-8.

6-33 Turn-Around Document Pre-Printed Card Layout

The card must be designed with the marking boxes printed in reflective ink and positioned in the clock-after-data format. Up to 12 rows of marking boxes per column may be used, spaced 6.35 ±0.25 mm (0.250 ±0.010 inches) apart at the centres and the same distance from the top and bottom of the card. Table 6-4 lists both the optimum dimensions of marking boxes and suitable reflective inks. Figure 6-8 depicts typical marking boxes and their positioning.

Note: The marking boxes must produce the minimum contrast with the card background, see Table 6-2.

6-34 Choice Of Line Printer

The HP drum line printers HP 2613A, HP 2617A and HP 2618A may be used to overprint the optical marks when equipped with an OCR (Optical Character Recognition) ribbon. The character capital I (octal 111) is suitable for detection by the Multifunction Reader and the OCR ribbon provides the necessary contrast. For details contact your local HP Sales and Service Office (see the addresses at the rear of this manual).
When printing data (i.e. I's), the line printer must be set for 8 lines per inch spacing with printing done every OTHER line. This ensures that rows of marks are printed 6.35 mm (0.250 inches) apart. Figure 6-11 depicts the relationship between the line printer lines and the data rows detected by the Multifunction Reader. (If printing on every line was used exactly 26 lines could be printed across the card).

The line printer must also be set for 10 characters per inch with printing done at a minimum of every other character to ensure columns of marks are printed multiples of 5.08 mm (0.200 inches) apart. This corresponds to a column density of 35.

6-35 Line Printer Alignment

No modifications are required to the HP 2613A/2617A/2618A line printers to enable them to print on continuous fan fold cards. However, they do require to be adjusted so that the print positions are aligned correctly with respect to the perforations and the corresponding Multifunction Reader data rows. Operator adjustments for the HP 2613A and HP 2617A are given in the Printer "Operators Manual". Adjustment information for the HP 2618A is given in the Printer service manual.

To aid the alignment of the continuous fan fold cards with the line printer drum, it is recommended that two alignment boxes should be pre-printed (in reflective ink) at the top corners of the card in the alphanumeric field. i.e. that part of the card NOT referenced by clock marks (see figure 6-9). The alignment of any card may then be checked by having the program cause the line printer to fill these two alignment boxes with data marks. Figure 6-12 depicts these alignment boxes.

6-36 Potential Turn-Around Document Suppliers

Potential suppliers of turn-around documents are the same as those for marked cards, see section 6-29.

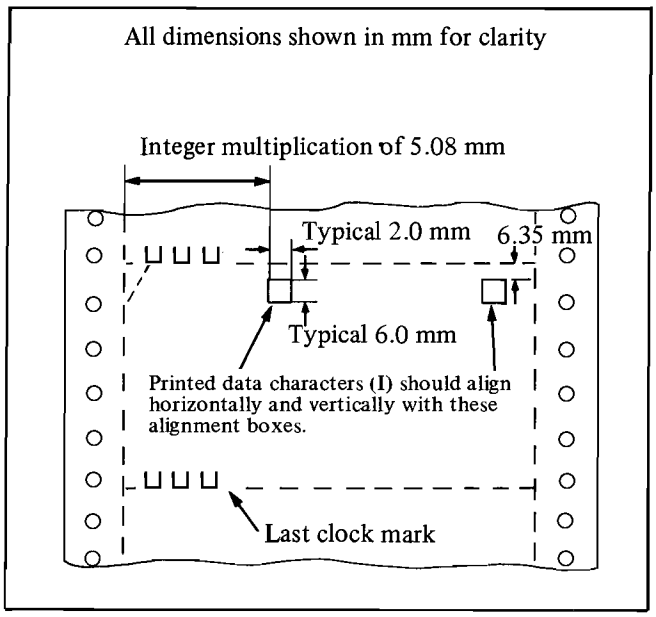


Figure 6-12 Alignment Boxes

6-37 PUNCHED CARD DESIGN

Note: For more detailed information on card material etc., reference should be made to:

1) *"American National Standard specification for general purpose cards for information processing (ANSI X3. 11-1969".*
2) *"USA Standard rectangular holes in twelve-row punched cards (USAS X3.21-1967).*
3) *"International organization for standardization ISO recommendation R1682 - Dimensions and location of punched holes in 80 column punched cards (180/R 1682-1971)".*

Punched cards must be produced using standard size (i.e 187 mm) cards. These cards may be pre-printed with the card layout and clock marks at 80 column density, as required. The punched data is read by the Multifunction Reader using either clock-after-data or no clock marks reading techniques. An example of a punched card is shown in figure 6-13.

6-38 **Punched Card Dimensions**

Punched cards must have the same dimensions as marked cards. These dimensions are listed and depicted in figure 6-7. The cards must also produce the correct background reflectance, see Table 6-2.

6-39 **Punched Cards With/Without Clock Marks**

Without clock marks. Punched cards may be produced without clock marks. The punched holes must be encoded at exactly 80 column density, i.e. the holes must be spaced integer multiplications of 2.21 mm (0.087 inches) apart, (the standard spacing for punched holes produced by key punched machines, see figure 6-14).

Note:
1) *There must be no more than 40 non-punched columns between two punched columns.*
2) *An optional corner radius may be used on the punched cards not using clock marks. Nominal radius 3.18 mm (0.125 inches), maximum 6.35 mm (0.250 inches).*

Clock-after-data clock marks. Clock marks (if required) must be printed on the bottom edge of the card using non-reflective black ink. The dimensions of the clock marks and suitable inks are listed in Table 6-3.

Note: The clock marks must be uniformly black and provide the contrast with the card background as listed in Table 6-2.

The clock marks must be spaced a minimum of 2.21 mm (0.087 inches) apart. This enables the card to accommodate a maximum column density of 80, see figure 6-14. The spacing between clock marks may be varied to allow the card to contain any number of columns from 80 to none.

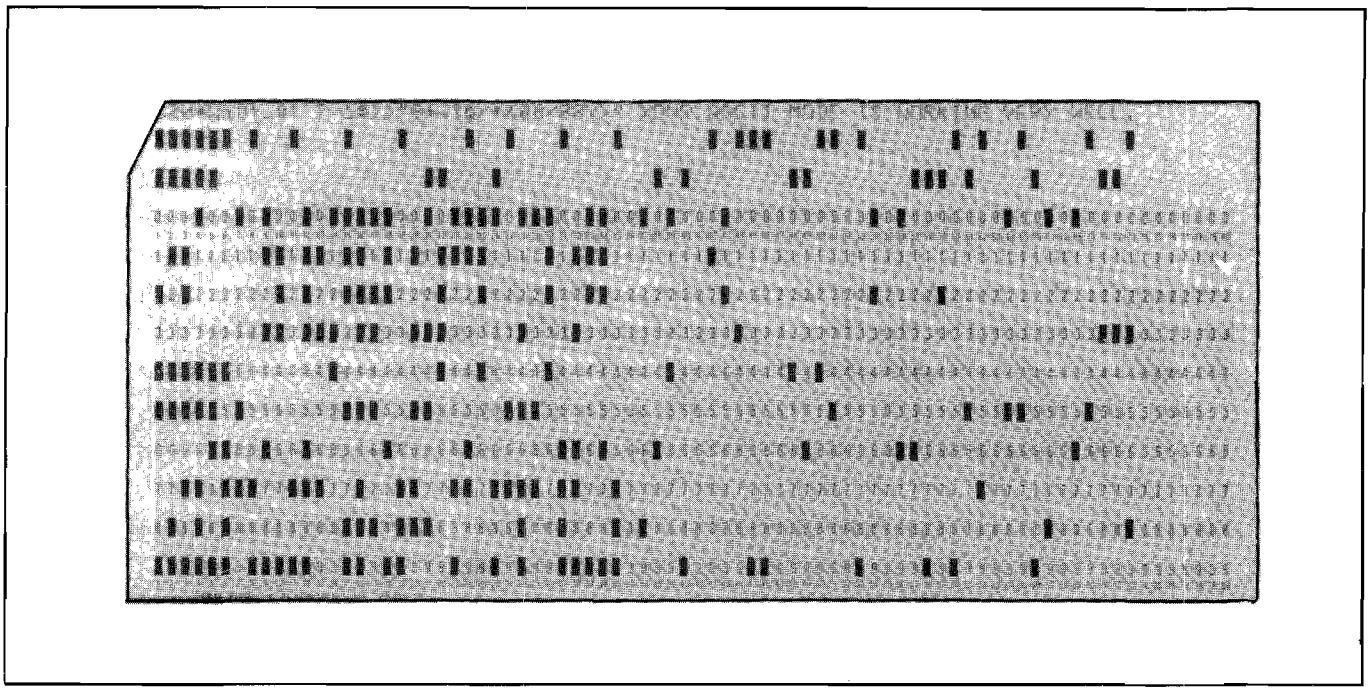


Figure 6-13 Typical Punched Card

6-40 Punched Card Pre-Printed Layout

The card may be designed with a pre-printed layout (e.g. company logo) done using reflective ink, suitable inks are listed in Table 6-4.

6-41 Potential Card Punching Equipment

Equipment that may be used to punch cards include:
IBM 029 Card Punch - contact your nearest IBM sales office.
Model 2620 Hand Punch - manufactured by Wright Line, Worcester Massachussetts, USA.

6-42 Variation Of Card Dimensions And Hole Locations

The stock commonly used for punched cards is inherently subject to changes in dimensions with changes in temperature and humidity. At a constant temperature of 23°C (73°F), a change in relative humidity from 20% to 75%, or from 75% to 20% will change the dimensions of the card as much as 0.46 mm (0.018 inches) in length and 0.58 mm (0.023 inches) in width; the location of punched holes will also vary according. These dimension changes become important if they occur during the storage period beginning after the clock marks are printed and the time the cards are actually key-punched. The clock marks may not be positioned correctly with respect to the punched holes, thereby affecting the reading of the data punched on the cards. Dimension changes of this type do not affect cards used only for pencil-mark reading, because the marking boxes and clock marks will always remain in the same relative positions. Temperature variations within the ranges normally maintained for human comfort will not substantially affect dimension changes. However, for maximum reliability of information interchange, cards should be printed with clock marks, punched, read, transported, and stored at the same temperature and relative humidity levels. The humidity and temperature should be approximately 53% at 23°C (73°F) at the time of printing.

Note: Cards should be stored standing edgeways up and tightly packed.

6-43 Potential Suppliers Of Punched Cards

The Hewlett-Packard card layout form (at the end of this section) may be used to indicate to your supplier the required card background printing layout. Potential suppliers of punched cards are the same as those for marked cards, see section 6-29.

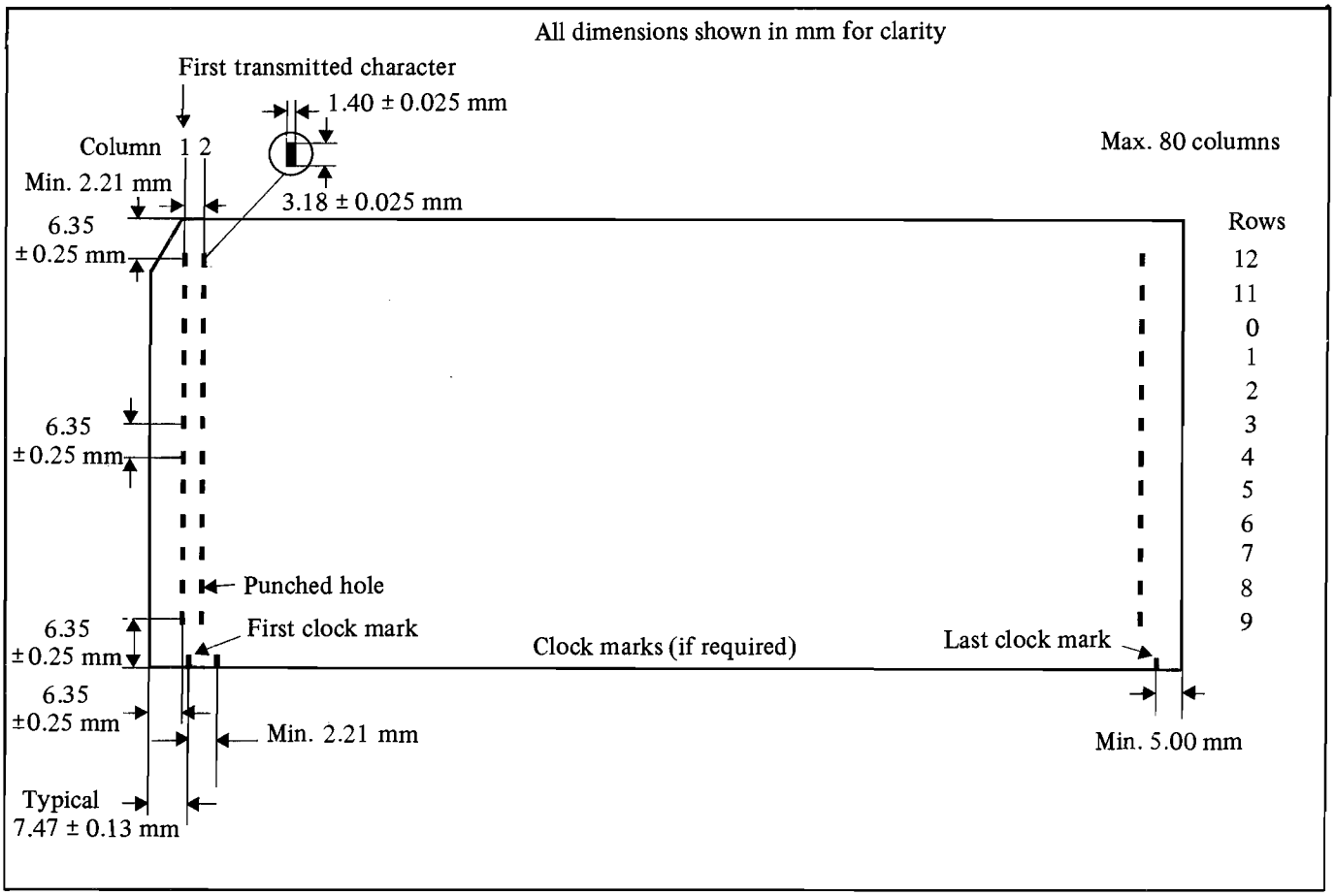


Figure 6-14 Punched Cards Hole Positioning

6-44 TYPE III BADGES

The Multifunction Reader can read Industry Type III punched plastic badges encoded either in Hollerith or Image coding at 80 column density.

Badge layout. The Type III Badge has a format corresponding to the first 22 columns of a standard 80 column punched card and can contain up to 12 rows of holes. Figure 6-15 depicts a typical Type III Badge.

6-45 TYPE III BADGE DESIGN

Since the badges are read using transmitted light, the entire badge must be made from a flexible compact opaque plastic, including the edges.

Typical badge materials are:
Polystyrene
PVC (Polyvinylchloride)
Polyethylene Terephthalate
Phenolic

The badges must be non-embossed and remain within their size specifications from 0°C to + 55°C (32° to 131°F) with up to 95% RH (non condensing).

Note:
1) The badges must be lubricant free.
2) The Type III Badges do not require clock marks.
3) Since only the punched holes are read as data, the badges may contain printing done in non-reflective ink (as required).

6-46 Type III Badge Dimensions

The dimensions of the badges are listed and depicted in figure 6-16.

Note:
1) The badge must be uniformly thick with smooth edges and respect the measurements contained in figure 6-16.
2) When using laminar badges, the badge should be dye cut AFTER lamination to ensure the dimensions are respected (as the laminating process causes the badges to expand).

6-47 Data Encoding

The data may be encoded on the badge in either
1) Hollerith code - a maximum of one character per column (see section 6-10 and Appendix C).
2) Image code - any one of 4096 combinations per column (see section 6-11 and Appendix C).

The data is encoded onto the badge in the form of punched holes. These holes are at the standard punched hole spacing (equivalent to 80 column density), the rows are 6.35 mm (0.250 inches) apart and the columns are 2.21 mm (0.087 inches) apart. The spacing of the punched holes is depicted in figure 6-17.

6-48 Potential Hole Punching Equipment

Equipment capable of encoding data onto the Type III Badges include:

Model 2620 Hand Punch - manufactured by Wright Line, Worcester, Massachussetts, USA.

6-49 Potential Type III Badge Suppliers

The dimensions listed in figure 6-16 may be used to indicate to your supplier the dimensions of Type III Badges Potential suppliers are listed in table 6-6.

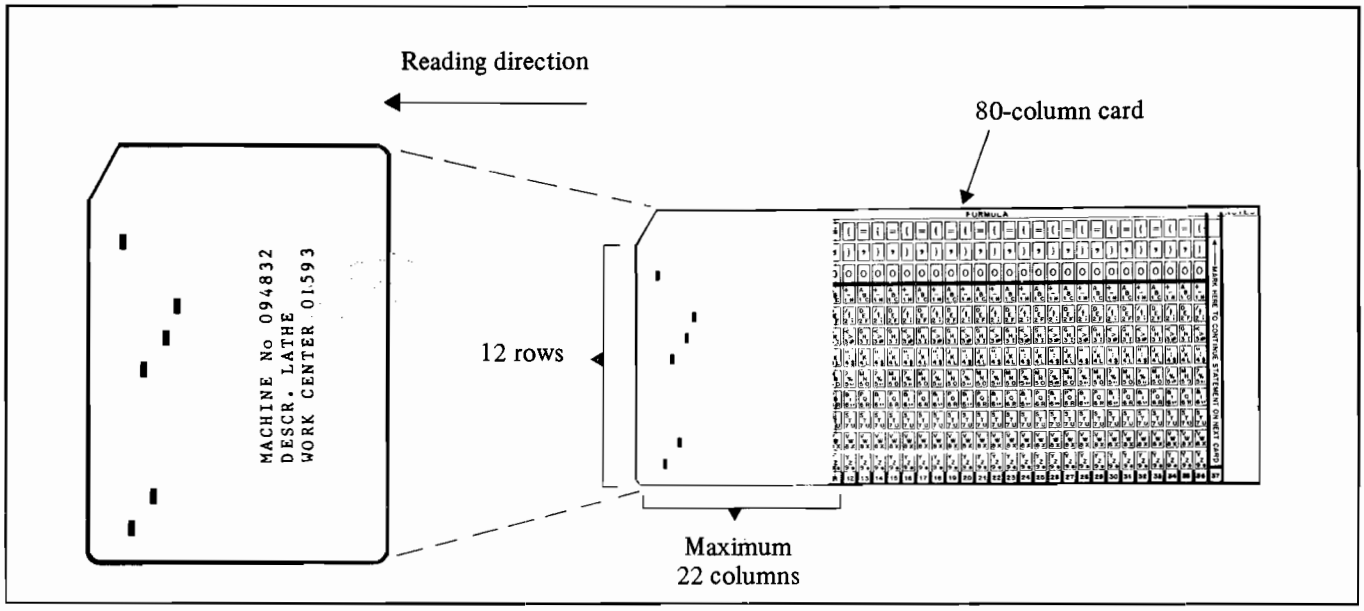
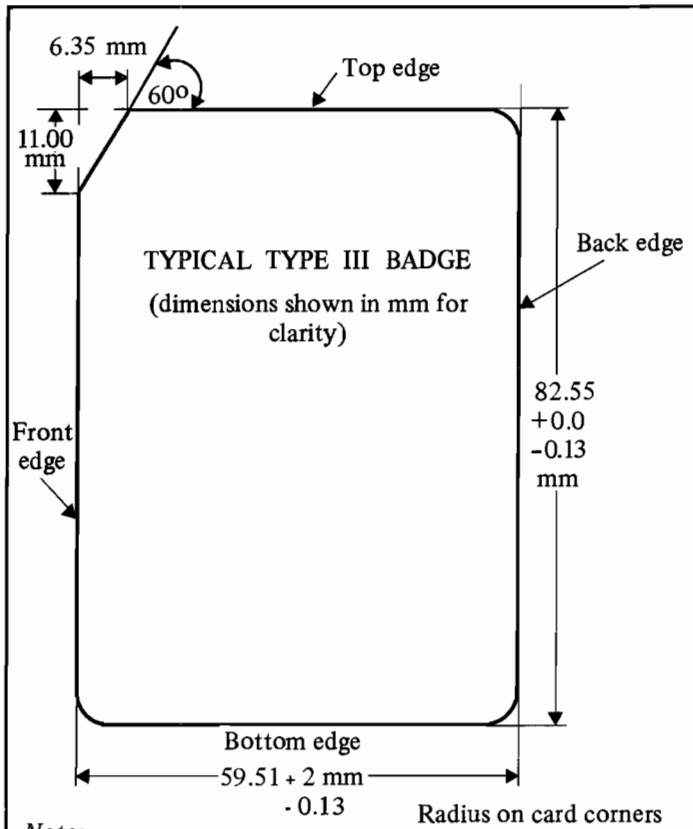


Figure 6-15 Typical Type III Badge



Parameter	Units	Dimensions	Tolerance
Badge width	mm	82.55	+0.0 −0.13
	inches	3.250	+0.0 −0.005
Badge length	mm	59.51	+0.0 −0.13
	inches	2.343	+0.0 −0.005
Badge thickness	mm	0.30 to 0.76	–
	inches	0.012 to 0.030	–
Badge background reflectance	%	60	±5
Infra red light* transmittance	%	< 10	–
Flexibility	When curved, a load of 227 gms (8oz) on the centre of the badge must be capable of compressing the badge to within 1.52 mm (0.060 inches) from the horizontal.		

Figure 6-16 Type III Badge Dimensions

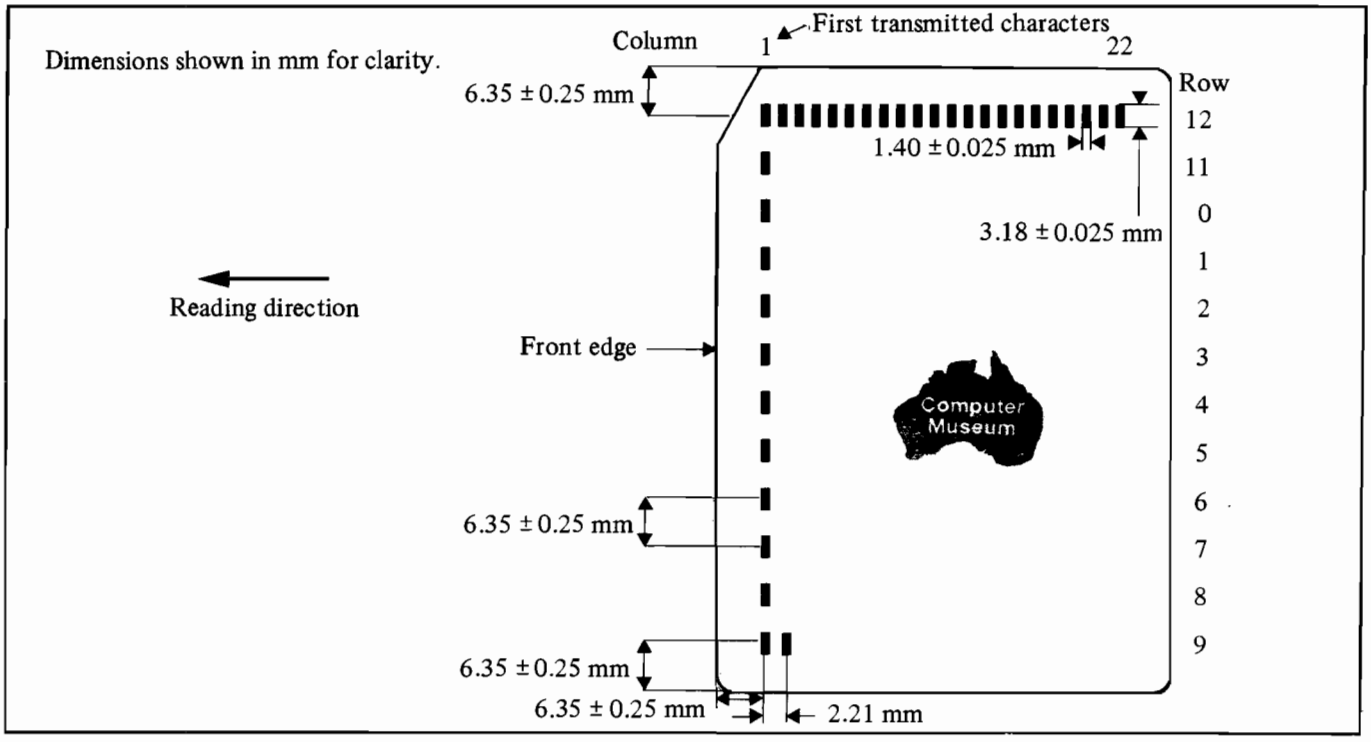


Figure 6-17 Type III Badge Punched Holes

Table 6-6 Potential Type III Badge Suppliers

USA Laminex
P.O. Box 577
Mathews, NC 28105
Tel: (704) 847-9143

or,

Graphic Laminating
51222 St. Clair
Cleveland, OH 44103
Tel: (216) 881-2100

UK Databac Ltd.
55 Park Road
Kingston, Surrey
Tel: 01 546 9826/7

or,

Laminex International
Bromfield Industrial Estate
Mold
Clwyd, CH7 1JR
Tel: Mold (0352) 58444
Telex 61402

Eire Data Protection Systems Ltd.,
97 Lower Baggot St.,
Dublin 2,
Tel: 767755

Europe Machines Havas
103, rue de l'Abbe Groult
75015 Paris
FRANCE
Tel: 594 64 17

or,

S.M.H.,
83 Bd de Sebastopol
75082 Paris
FRANCE
Tel: (1) 554 95 44
Telex 202-763

Europe (cont'd)

or,

S.M.H.
10 rue Varet
75015 Paris
FRANCE

Kreditkarten Service GMBH
6 Frankfurt Main 1
Escherscheimer Landstrasse
WEST GERMANY
Tel: 0611 598622
Telex 4-13267

Wright Line
Via S.G. Battista
De la Salle 5
20132 Milano
ITALY
Tel: 2566849

Adrex,
Rue de Trone, 103,
50 Brussels
BELGIUM
Tel: 02-512-25 75
Telex 24584

Ruys Handelsvereniging BV.
Post Box 19100
2500CC Gravenhague
HOLLAND
Tel: 070-889262
Telex 33718

Nordex A.G.
Schutzengasse 21
8001 Zurich
SWITZERLAND
Tel: 01-237488

EDCOM
20 Omirou St.
Athens 135,
GREECE
Tel: 3615675
Telex 212460

HEWLETT-PACKARD CARD LAYOUT FORM

HEWLETT PACKARD

Multifunction Reader

COLUMN NUMBER REFERENCE

DENSITY → 40 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40

→ 80 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

ROW POSITION

12
11
0
1
2
3
4
5
6
7
8
9

CUSTOMER DESIGN INFORMATION

COLUMN (S)	COLUMN HEADINGS STYLE

SCALE: 2 : 1
STANDARD CARD SIZE
82.55 x 187.33 mm
(3.250 x 7.375 ins.)

CORNER CUT: UPPER LEFT

LOWER CORNER CUTS NOT PERMISSABLE

ESTIMATED ANNUAL VOLUMN _____

CUSTOMER INFORMATION

CUSTOMER _____
ADDRESS _____
CARD TITLE _____
DRAFT BY _____
DESIGN BY _____
SEND PLATES TO _____
DATE _____ NEW _____
ORDER NO. _____ REVISION _____
PLATE NO. _____

Note: Black non-reflective ink can be used for clock marks and pre-printed data marks only. All other printing alignment marks and card form numbers must be reflective ink.

CLOCK-AFTER-DATA 40 COLUMN CLOCK →

COLUMN NUMBER REFERENCE → 40 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40

→ 80 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

80 COLUMN CLOCK →

Printed in France
5953-0129

SECTION 7
TYPE V BADGE READER
(3075A, 3076A OPTION 008
3077A STANDARD)

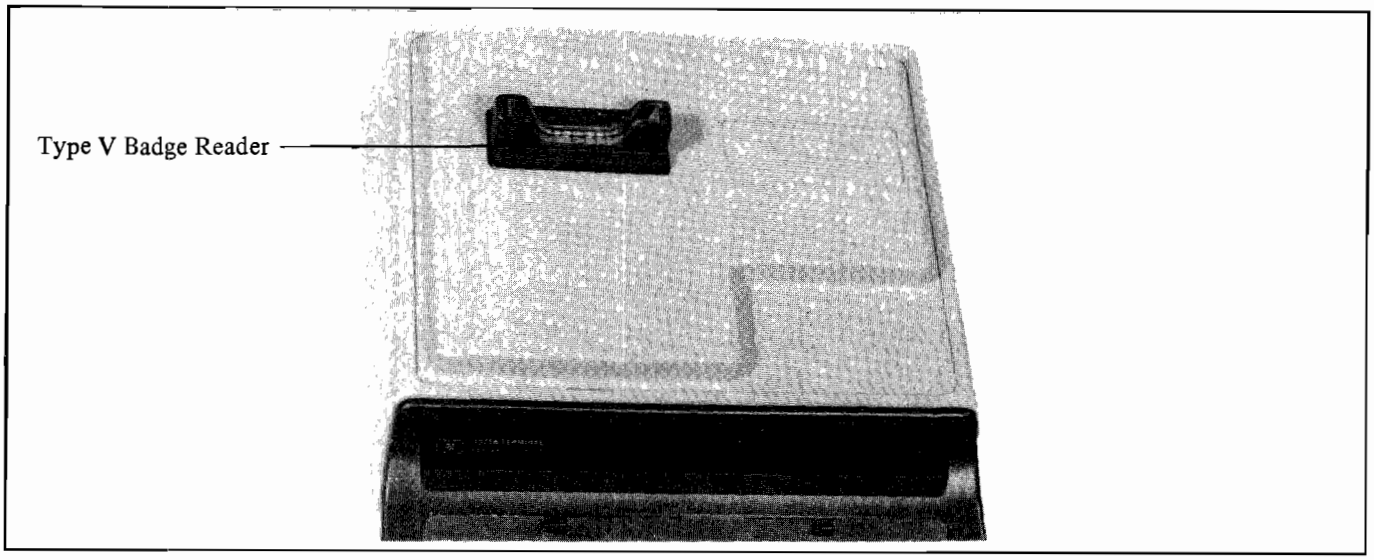


Figure 7-1 Type V Badge Reader

7-1 INTRODUCTION

The following section describes the use of the Type V Badge Reader on the 3075A and 3076A Data Capture Terminals and the 3077A Time Reporting Terminal. The badge reader may be mounted on either the top left-hand side or top right-hand side of the terminal (when viewed from the front of a 3075A), depending upon which other options are also configured.

A detailed description on how to design and produce the badges is given in section 7-16 to 7-21 inclusive.

7-2 READING CAPABILITIES

The Type V Badge Reader is enabled by escape sequence ESC-c1B (see section 2-13), this allows the Reader to transmit the read data to the computer. At power-on or after a full reset (ESCE, see section 2-8) the Type V Badge Reader is enabled.

7-3 TYPE V BADGES (section 7-17)

The Reader reads Industry Type V Badges only. These are punched plastic badges whose format corresponds to the first 10 columns of a standard punched card. The badges can contain up to 10 rows and a maximum of 10 columns of data encoded (without clock marks) at 80 columns density. The data can be coded in either Numeric or Image code (see section 7-5). The badges also contain a mandatory rectangular "guide hole" at the bottom and may contain an optional rectangular slot at the top for a clip.

7-4 READING TECHNIQUE

The Type V Badge Reader employs optical techniques to read the badges. The badge material must be opaque, the punched holes are then read by the presence of transmitted light as the badge moves past a set of light detectors within the Reader. See figure 7-2.

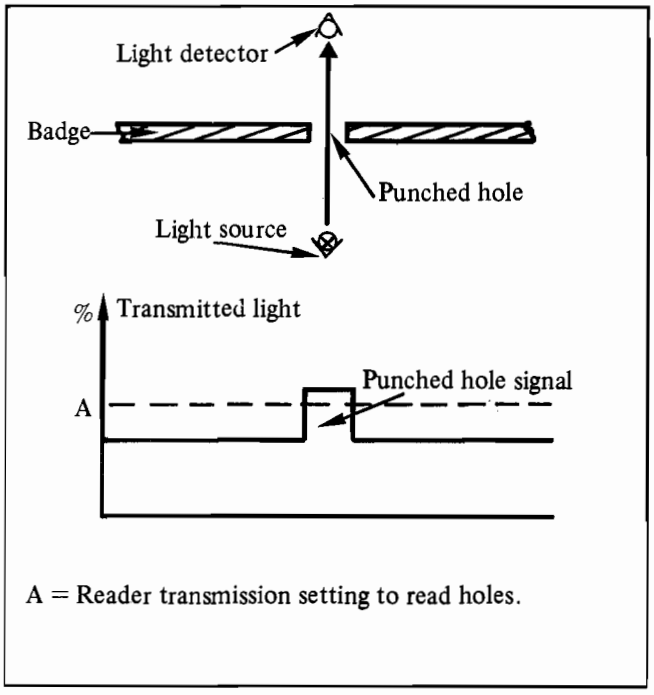


Figure 7-2 Type V Badge Reader Reading Technique

7-5 READING MODES

The Type V Badge Reader can read badges coded in either Numeric or Image coding. The reading mode is selected via escape sequence ESC-1/0j/J (see section 7-13 for details).

Note :

1) Column 1 is adjacent to the edge of the badge and column 10 is at the centre of the badge. The character in column 10 is transmitted first to the computer and the character in column 1 is transmitted last.

2) Row 0 is at the top of the badge (nearest the clip).

7-6 Numeric Reading Mode

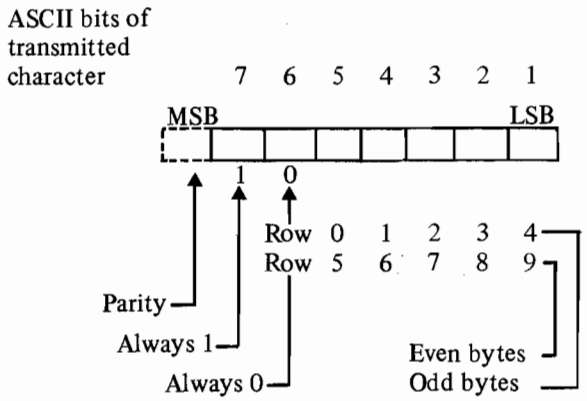
In this mode, one hole representing a single digit (0 thru 9) may be punched per column. In any column, row zero corresponds to the digit "0" and row nine corresponds to the digit "9". Thus, one code number of up to 10 digits may be punched per badge. The Reader de-codes the data and transmits the equivalent ASCII characters (060 thru 071) to the computer. Appendix C lists the Numeric character set.

7-7 Image (Alpha) Reading Mode

In this mode, any combination of data may be punched in the 10 x 10 matrix, instead of the 1 out of 10 code used for the Numeric mode. Since each column contains up to 10 rows of information, then each column may be punched in any one of 2 to the power 10 (i.e. 1024) combinations.

In Image mode the encoded data is in binary format however, for the Type V Badge Reader, data transfers to and from the computer are in ASCII format. Thus the encoded binary data has to be converted (within the Reader) into an ASCII format readable by the computer, as follows:

For each column there are a maximum of 10 data bits, however each ASCII character comprises seven data bits (plus one parity bit). Thus, to change the encoded data to ASCII format, the 10 data bits (in each column) are divided into two five-bit characters. Rows 0 to 4 (in each column) form one character and rows 5 to 9 (in each column) form the other character. Thus the data matrix can contain 20 five bit characters, as shown in figure 7-3. To increase the number of data bits from five to seven (as required by the ASCII format), the terminal adds two extra bits to the five bit character; bit 6 (which always equals 0) and bit 7 (which always equals 1) as shown below:



Thus, this seven bit character can correspond to one of the 32 alpha ASCII characters from @ (octal 100) to underscore (_ octal 137). Appendix C lists the Image character set.

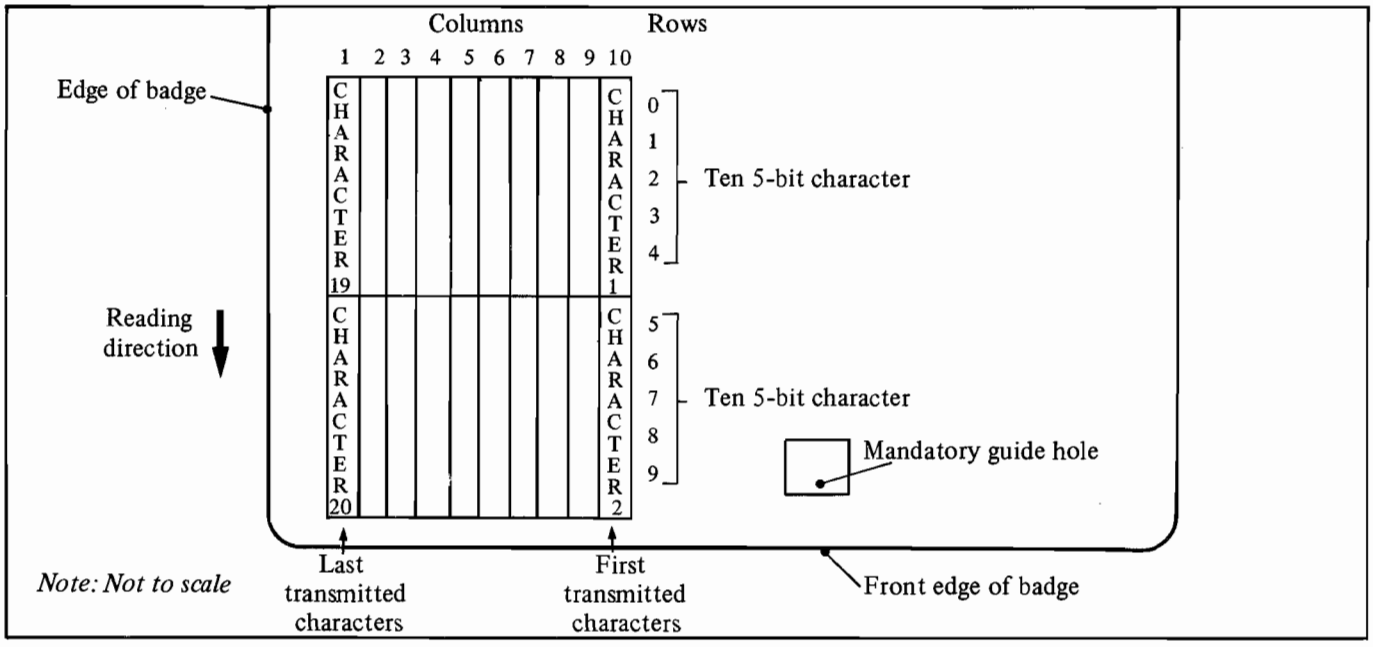


Figure 7-3 Type V Image Mode Characters

7-8 MULTIFIELD OPERATION

Note: Multifield operation must only be used when the terminal is connected to the computer in the multiterminal mode.

Multifield operation is selected for the Type V Badge Reader by escape sequence ESC-r1/0l/L (see section 7-14). Multifield operation allows multiple data entries in the same transaction, preventing the Type V. Badge Reader entering its data to the computer at the end of a single data transaction. The data from several input modules (operating in multifield) is transmitted to the computer as one data block when data is entered via the keyboard or via a terminal input module/option not in multifield operation. The only restriction to the multifield operation is that the total amount of data per transaction must NOT exceed 180 characters (see section 2-19 for details).

7-9 ENTERING A BADGE

If the program is expecting an input via the Type V Badge Reader, the badge should be entered into the Reader slot with the guide hole first (see figure 7-5). It can be inserted either face up, and should be pushed right to the end of the slot.
If the badge has been correctly inserted and read, the internal buzzer of the terminal will "beep" once, signalling to the user that the read operation has been correctly performed and that he can pull his badge out.
On the 3077A terminal a second, louder buzzer is used to indicate that a badge has been inserted incorrectly or at the wrong time.

The read operation will stop when a correct read is completed and for any of the following reasons:

1) Badge pulled out of Reader.
2) Time-out condition (approximately five seconds).
3) Too fast insertion speed (detected internally).
4) Badge inserted wrong end first.
5) A badge with alpha (i.e. Image) data is read by a Reader set to the Numeric mode.

Note. A special reading process ensures that if a badge is inserted, then stopped half way and even partially withdrawn, the reading operation will terminate correctly.

7-10 BADGE READER NOT CONFIGURED

If a badge is inserted when the badge Reader is disabled, on the 3075A/3075A it is ignored and on the 3077A the louder buzzer and the red light are activated. Even if the badge is in the unit when the badge reader is enabled, nothing will happen until the user pulls out the badge and re-enters it. This prevents incomplete or wrong data from being transmitted.

7-11 REMOVABLE POCKET

The plastic pocket into which the badge is inserted can be removed for cleaning. Press the ends of two pins, or paper clips, into the holes in the side of the reader aperture (see figure 7-4). The plastic pocket will slide out.

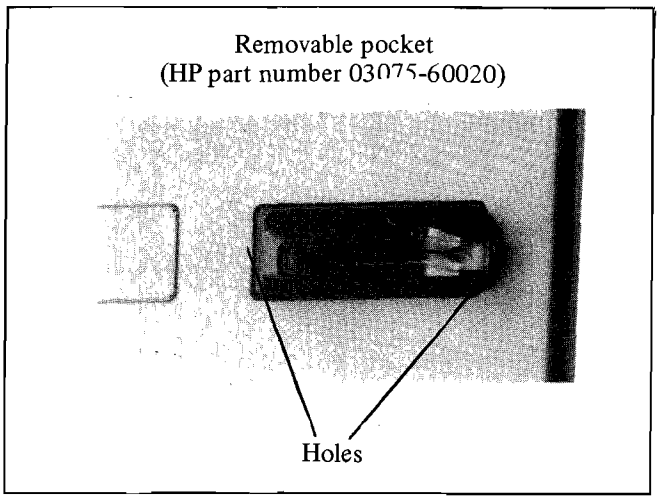


Figure 7-4 Type V Badge Reader Pocket Removal

7-12 TYPE V BADGE READER CONTROL

The reader is programmed by escape sequences:

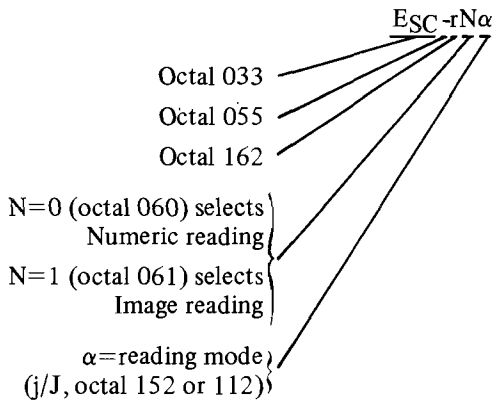
1) ESC-r1/0j/J - reading mode
2) ESC-r1/0l/L - multifield operation

These escape sequences are detailed in the following subsections.

Note : ESC-c1/0b/B may be used to enable/disable the badge reader (see section 2-13).

7-13 READING MODE

Selects either Numeric or Image reading by sending escape sequence:

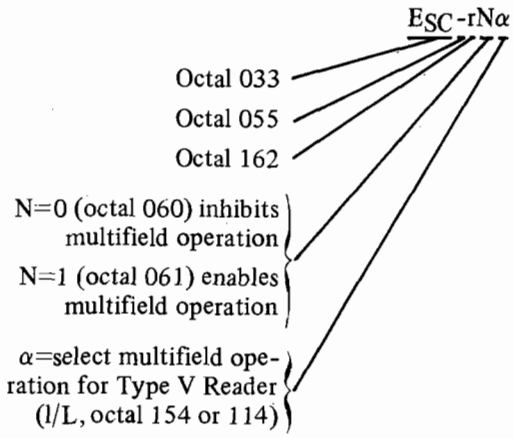


The default reading mode at power-on or after a full reset is Numeric.

7-14 MULTIFIELD OPERATION SELECTION

Note:
1) The multifield operation may only be used when the terminal is connected in the multiterminal mode.
2) Multifield operation must NOT be used with the 3077A Time Reporting Terminal.

The multifield operation is selected for the Type V Badge Reader by sending escape sequence:



At power-on or after a full reset the multifield operation is disabled.

7-15 TYPICAL EXAMPLE

To enable the reader to read badges in Numeric format using multifield operations the following escape sequence must be sent:

ESC-c1BESC-r0j1L

ESC-c1B enables the reader (if previously disabled) and is described in section 2-13.

7-16 INPUT MEDIA FOR THE TYPE V BADGE READER

The following sub-sections detail the design specifications for the Type V Badges. Also detailed are potential badge punching equipment and potential suppliers of prepared badges.

Note: The dimensions detailed in the following sub-sections are valid for a temperature of 21°C (70°F) and a humidity of approximately 50%.

7-17 TYPE V BADGE DESIGN

The Type V Badge has a format corresponding to the first 10 columns of a standard 80 column punched card and can contain up to 10 rows of punched holes. Figure 7-5 depicts a typical Type V Badge.

The badge is read using a scanning technique as it advances into the Reader. Background printing (e.g. employees number) or a photograph may be incorporated on the badge by the badge supplier, if required. The guide hole and slit for a plastic loop may also be incorporated by the badge supplier.

Note: Type V Badges do not require clock marks.

7-18 TYPE V BADGE DIMENSIONS

Since the badges are read using transmitted light, the entire badge must be made from a rigid compact opaque plastic, including the edges (e.g. polyvinylchloride, etc.). The badges must be non-embossed and remain within their size specifications from 0°C to +55°C (32° to 131°F) with up to 95% RH (non condensing).

The badge dimensions are listed and depicted in figure 7-6.

Note:
1) The Type V Badges do NOT use a corner cut.
2) When using a photograph, the badge must be uniformly thick and respect the measurements contained in figure 7-6. (i.e. the badge must not have a "stepped" surface). A recess in the badge may be used to house the photograph.
3) When using laminar badges, the badge should be dye cut AFTER lamination to ensure the dimensions are respected (as the laminating process causes the badges to expand).

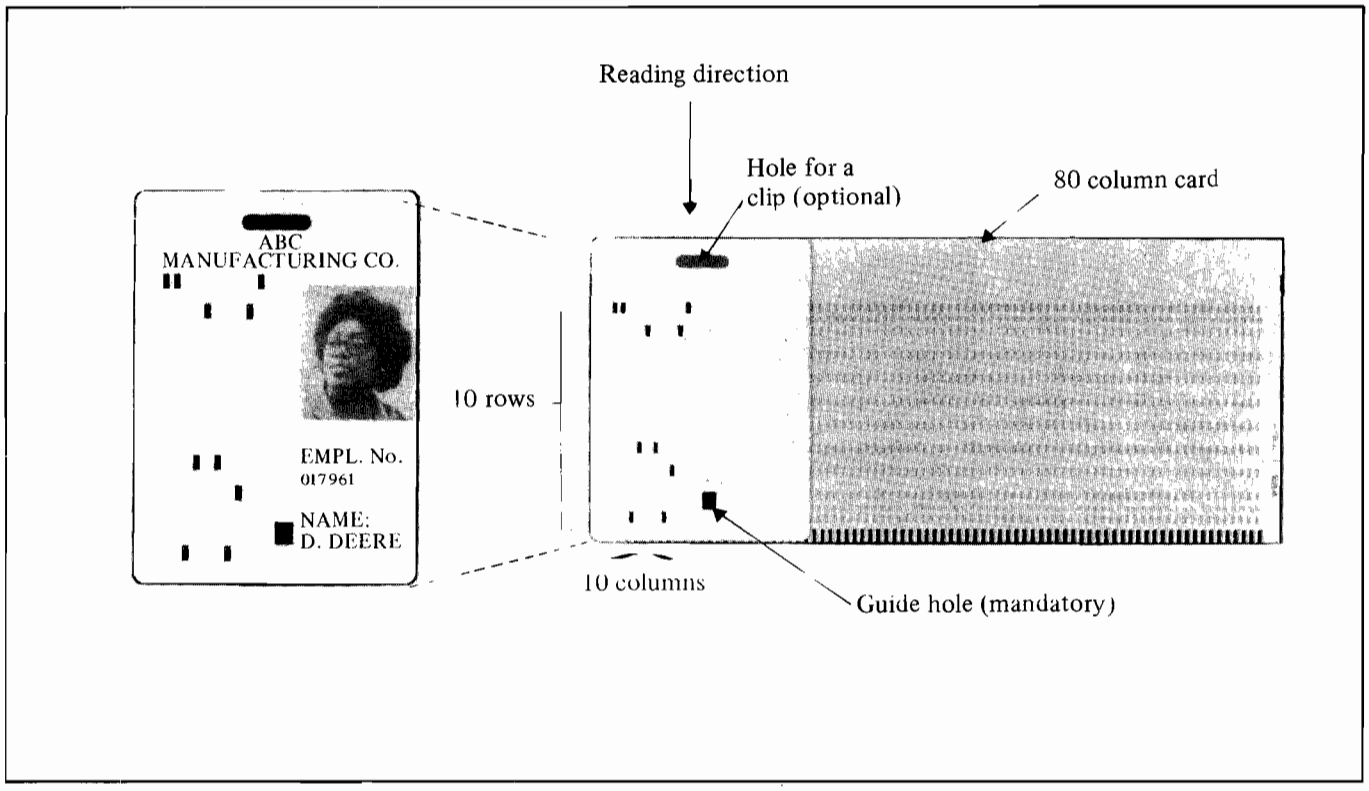
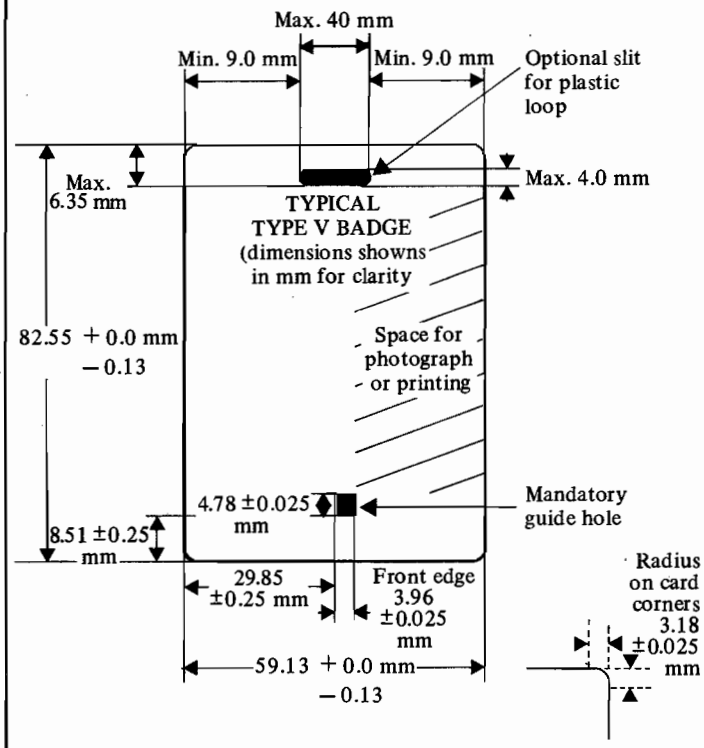


Figure 7-5 Typical Type V Badge

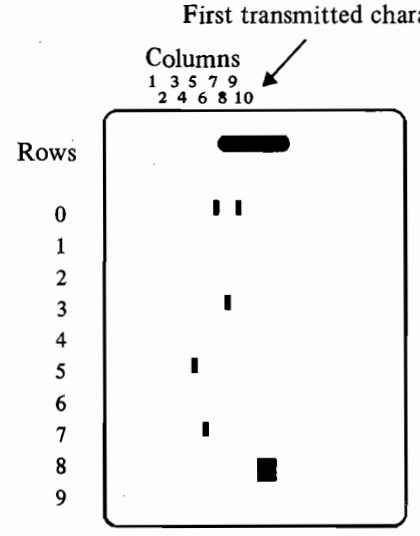


Parameter	Units	Dimension	Tolerance
Badge width	mm	59.13	+0.0 −0.13
	inches	2.328	+0.0 −0.005
Badge length	mm	82.55	+0.0 −0.13
	inches	3.250	+0.0 −0.005
Badge thickness	mm	0.8	+0.0 −0.05
	inches	0.031	+0.0 −0.002
Infrared light* transmittance	%	< 1	–

Note:
1) Measured at any wavelength from 800 to 1000 nanometres.
2) 1 mm = 0.0394 inches.

Figure 7-6 Type V Badge Dimensions

To encode numeric data 03075 on the badge, the punched holes (shown ■) must be located as follows:

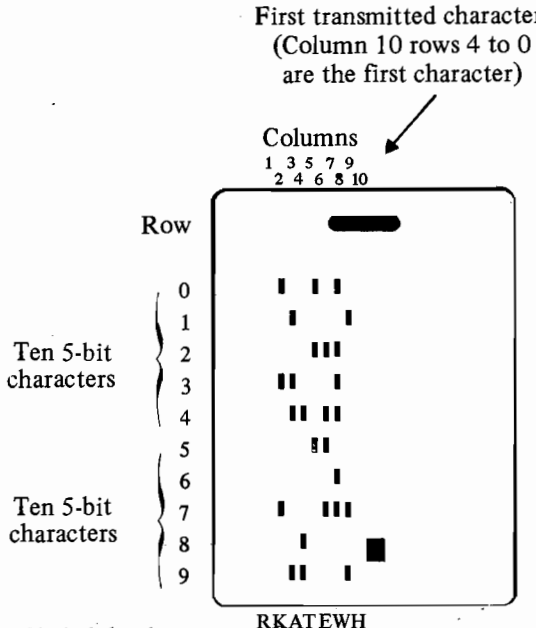


Encoded numeric data : 57030
Transmitted data: 03075@@@@@

Equivalent transmitted ASCII characters: (060) (063) (060) (067) (065) (100) (100) (100) (100) (100).

Figure 7-7 Example Of Type V Badge Numeric Encoding

To encode Image (alpha) data HEWLETT PACKARD on the badge, the punched holes (shown ■) must be located as follows:



Encoded alpha data :
Transmitted data: HEWLETT PACKARD@@@@@@

Figure 7-8 Example Of Type V Badge Image Encoding

7-19 DATA ENCODING

The data may be encoded on the badge in either Numeric or Image coding.

Numeric coding (see section 7-6). One hole representing one digit (0 thru 9) may be punched per column The reader decodes the data and transmits the equivalent ASCII character (060 thru 071) to the computer. For example, to encode numeric data 03075 onto the badge, punched holes must be located as shown in figure 7-7. Appendix C lists the Numeric character set.

Image coding (see section 7-7). In Image mode the terminal is able to transmit an exact image of a column of data. Since each column contains up to 10 rows, then each column may be punched in any one of 2 to the power 10 (i.e. 1024) combinations.

The Reader decodes the data and transmits to the computer the two equivalent ASCII alpha characters (from @, octal 100, thru underscore, octal 137) for each column of data. For example, to encode alpha data HEWLETT PACKARD on the badge, punched holes must be located as shown in figure 7-8.
Appendix C lists the Image character set.

Punched data. The data is encoded onto the badge in the form of punched holes. These holes are at the standard punched hole spacing (equivalent to 80 column density), the rows are 6.35 mm (0.250 inches) apart and the columns are 2.21 mm (0.087 inches) apart. The spacing of the holes is depicted in figure 7-9.

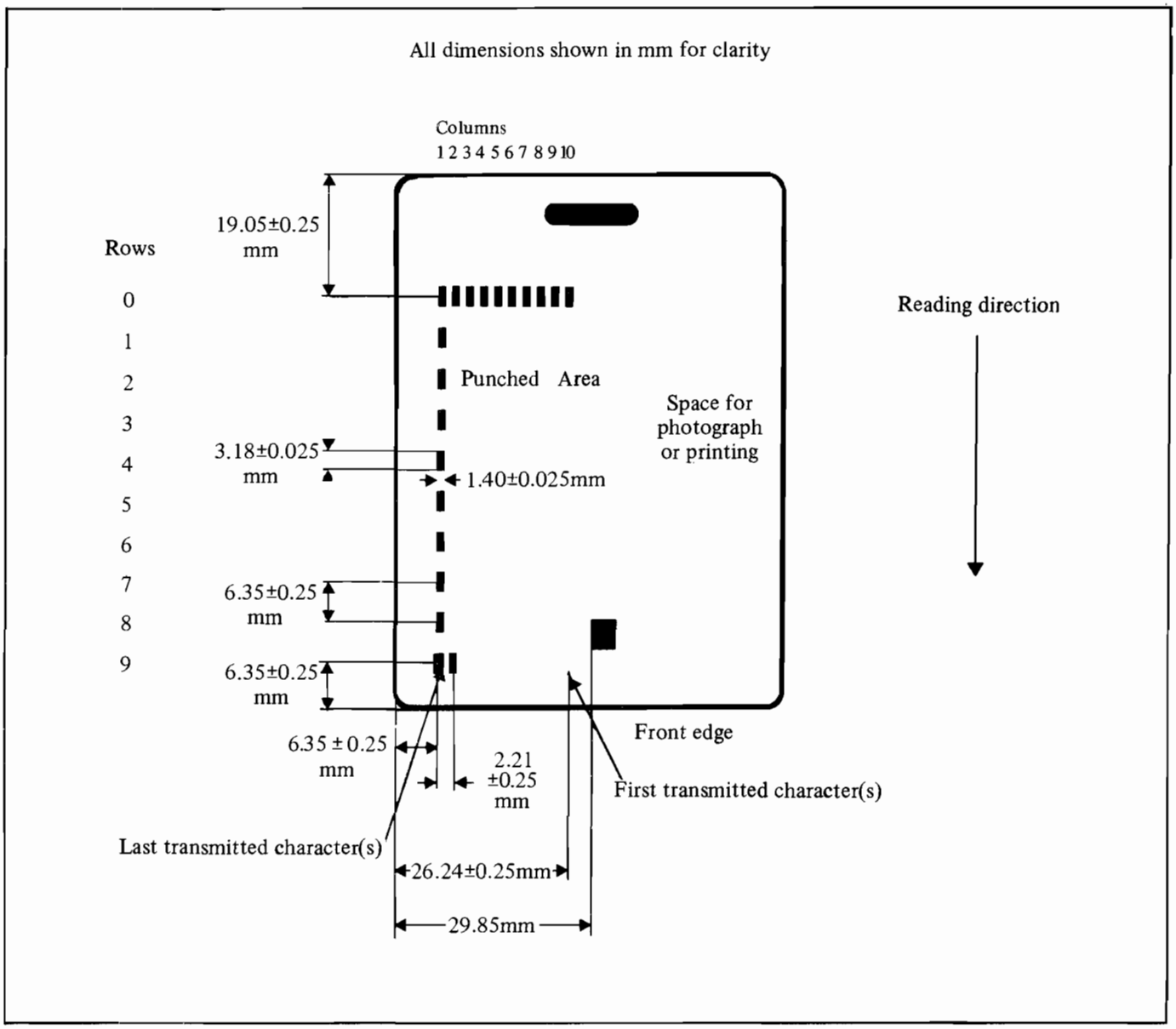


Figure 7-9 Type V Badge Punched Holes

7-20 POTENTIAL HOLE PUNCHING EQUIPMENT

Equipment capable of encoding data onto the Type V Badges includes:

Model 2320 Hand Punch-manufactured by Wright Line Worcester, Massachussetts, USA

7-21 POTENTIAL TYPE V BADGE SUPPLIERS

The dimensions listed in figure 7-6 may be used to indicate to your supplier the dimensions of Type V Badges.

Potential suppliers are listed table 7-1.

Table 7-1 Potential Type V Badge Suppliers

USA	Laminex P.O. Box 577 Mathews. NC 28105 Tel: (704) 847-9143	or	Graphic Laminating 51222 St. Clair Cleveland. OH 44103 Tel: (216) 881-2100		
UK	Databac Ltd. 55 Park Road Kingston. Surrey Tel: 01 546 9826/7	or	Laminex International Bromfield Industrial Estate Mold Clwyd, CH7 1JR Tel: Mold (0352) 58444 Telex 61402		
Eire	Data Protection Systems Ltd. 97 Lower Baggot St., Dublin 2, Tel: 767755				
Europe	Machines Havas 103, rue de l'Abbe Groult 75015 Paris FRANCE Tel : 594 64 17	or	S.M.H. 83, bd de Sebastopol 73082 Paris FRANCE Tel: (1) 554 95 44 Telex 202-763	or	S.M.H 10, rue Varet 75015 Paris FRANCE
	Kreditkarten Services GMBH 6 Frankfurt Main 1 Escherscheimer Landstrasse WEST GERMANY Tel: 0611 598622 Telex 4-13267	or	Wright Line Via S: G. Battista De la Salle 5 20132 Milano ITALY Tel: 2566849	or	EDCOM 20 Omirou St. Athens 135, GREECE Tel; 3615675 Telex 212460
	Ruys Handelsvereniging BV. Post Box 19100 2500CC Gravenhague HOLLAND Tel: 070-889262 Telex 33718	or	Nordex A.G. Schutzengasse 21 8001 Zurich SWITZERLAND Tel: 01-237488	or	Adrex, Rue de Trone, 103, 50 Brussels BELGIUM Tel: 02-512-25 75 Telex 24584

SECTION 8

STRIP PRINTER (OPTION 009)

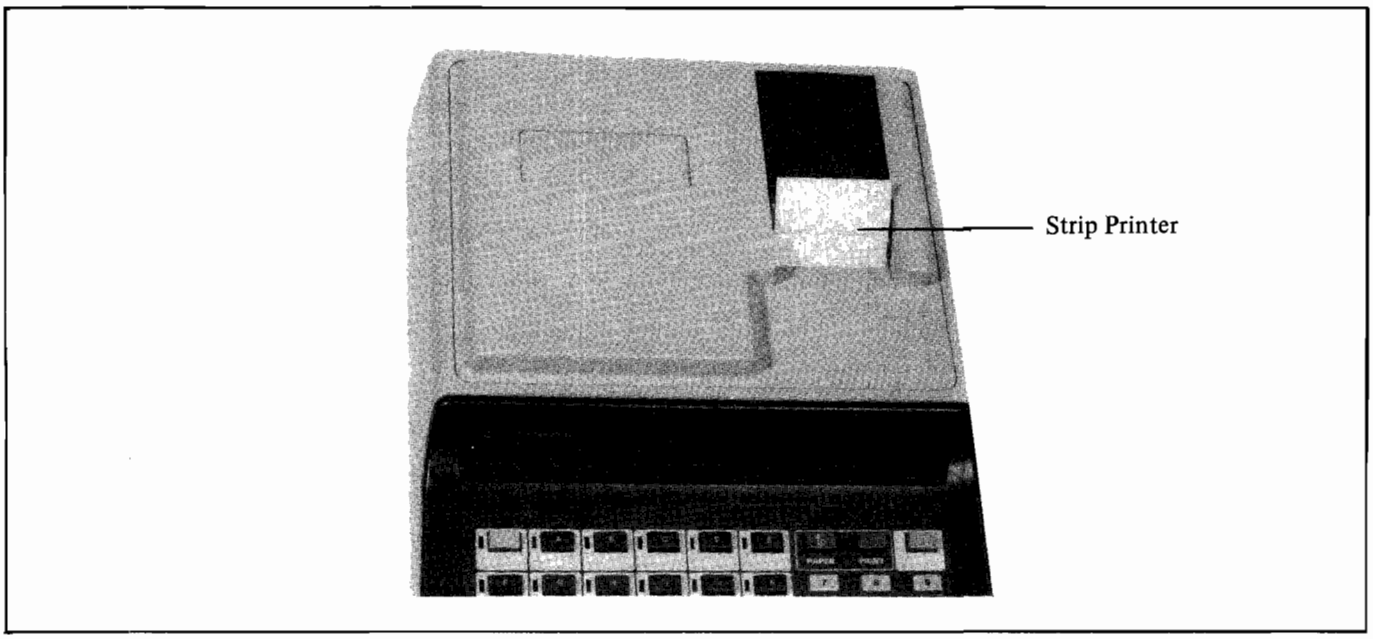


Figure 8-1 The Strip Printer

8-1 INTRODUCTION

The following section details the use of the Strip Printer on the 3075A and 3076A Data Capture Terminals. The printer is mounted on the top right-hand side of the terminal (when viewed from the front of the 3075A).

Note: The Strip Printer is not used with the 3077A Time Reporting Terminal.

8-2 PRINTER KEYBOARD CONTROLS

Two keyboard keys are available to operate the printer:

1) PRINT: a press for printer on, repress for printer off key. This key is software overridable using escape sequence ESC-k1/0`/@ (see section 8-9). i.e. although the printer may be off, the system may send messages to be printed by overriding the off condition. This escape sequence will also override the printer disable escape sequence ESC-c0P (see section 2-13). When the PRINT key is on, a red light adjacent to the key is lit. When the PRINT key is off, the red light is extinguished. When the PRINT key is either on or off and the printer runs out of paper, the red light blinks.

2) PAPER: pressing this key causes the roll of paper to move one line at a time. Holding it down causes the paper to advance as many line spaces as required.

8-3 PRINTER OPERATION

On the 20 character strip printer, the characters are printed right to left at a speed of 40 lines per minute and at a spacing of 5.15 mm (0.16 inches) per line. Thus, each roll of paper (approximately 25 m, 80 ft long) can contain approximately 6,000 lines of text.

The printer character set comprises:

1) The 64 ASCII character set from space (octal 040) to underscore (octal 137).

2) Two special characters, namely:
   a) every time a special function key (SFK) is pressed the "□" character is printed.
   b) in the point-to-point mode only, in the event of a parity or framing error in the communications between the computer and the terminal, the "≡" character is displayed.

Printed data. When the printer is disabled (ESC-c0P, see section 2-13), or the PRINT switch is off or the printer has run out of paper no data can be printed. When the printer is enabled (ESC-c1P), the PRINT switch is on and there is paper in the printer, the data listed in Table 8-1 can be printed.

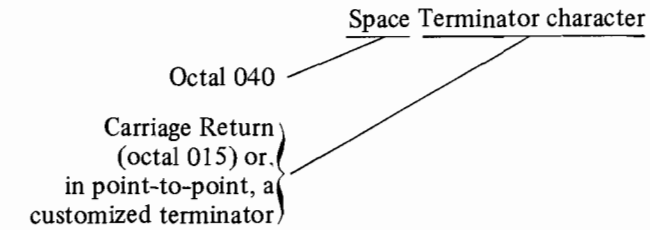
The printer automatically prints as soon as 20 characters have been typed on the keyboard or received from an input module (e.g. Bar Code Reader/ HP-IB Controller/Serial I/O Interface, when set to display received data) or received from the computer system. In the case where less than 20 characters have been typed or received, printing starts whenever data is entered via the terminal, i.e.:

1) The ENTER key is pressed.
2) A special function key (SFK) designated an input terminator is pressed.
3) An input module (not in multifield operation) generates a terminator character at the end of its data.

Less than 20 characters received from the computer can be printed if the data is followed by a terminator character ; C_R (Carriage Return - octal 015) or, in point-to-point, a customized terminator.

The text is printed left justified (i.e. the printer aligns the characters on the left-hand side of the paper). The printer also has a text formating capability to prevent words of less than eight characters being split over two lines. If the messages to be printer are less than 20 characters long, the text formater does not operate and all messages are printed (left justified) exactly as received. The text formater automatically comes into operation if the printer receives any messages longer than 20 characters.

Line skipping. This occurs when a two character sequence is received.



Display blanking. The one-line display (numeric or alpha-numeric) is turned off (becomes blank) during printing times. The original contents of the display re-appear as soon as the printing opration is completed.

8-4 END OF PAPER

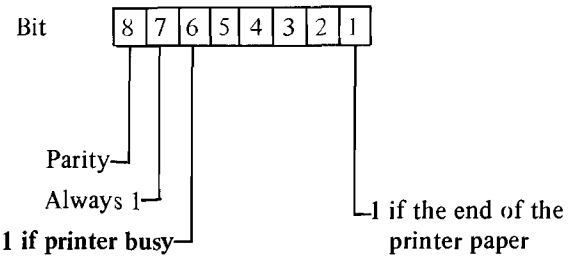
The printer features an automatic end-of-paper detection capability. When the printer runs out of paper, the printer automatically stops, the keyboard PRINT key is disabled and the red light adjacent to the PRINT key changes from a steady light to a blinking light. The blinking stops as soon as new roll of paper is fitted, see section 8-5
The end of paper condition is indicated to the computer system via a computer break (see section 2-16 for details) and the printer status. The terminal status is returned to the computer upon receipt of the status request escape sequence E_{SC} ^ (see section 2-14). Status byte 3 is the interrupt status, two bits of which indicate the status of the printer.

Table 8-1 Printed Data

Input Module	Type Of Data	Keyboard Enabled/Disabled	Characters Printed On the Strip Printer	
			Point-to-Point Connections	Multiterminal Connections
Keyboard*	Numeric and upper case alpha (A thru Z) characters	Enabled	Numeric and upper case alpha characters	
	Special function key (SFK) characters	Enabled	□	□
Computer* or Bar Code Reader* or HP-IB Controller* or Serial I/O Interface*	Commercial signs, numeric and upper case alpha characters	Enabled or disabled	Commercial signs, numeric and upper case alpha characters	
	Lower case (a thru z) characters	Enabled	□	Equivalent upper case character
		Disabled	Equivalent upper case character	

**Note:*
1) For point-to-point connections only, keyboard data is only printed when rear panel terminal configuration switch II-5 is set to 1. When switch II-5 is set to 0 a remote echo (of the entered data) may be done if the data is required to be printed. Switch II-5 must NOT be set to 1 when a remote echo is employed otherwise a double echo will be produced.
2) Characters received from the Bar Code Reader, HP-IB Controller and Serial I/O Interface are only printed when these options are set (via escape sequences) to display received data.
3) Data from the computer may take the form of an echo of received module/option data.

Status byte 3



Bit 1 is set to 1 when the end of paper condition is detected. It remains 1 until paper is loaded and the PRINT key is switched on.
Bit 6 is set to 1 when the printer is busy, i.e. there is data in the printer data buffer. This may be due to the printer currently printing data or a received print line comprises less than 20 character and no terminator character.
For both point-to-point and multiterminal connections, the data block on which the terminal is operating when the printer runs out of paper is lost. For multiterminal connections, potentially a maximum of two data blocks can be lost; the block of data on which the end of paper condition occurs and the block of data on which the terminal has responded with the break. It is therefore recommended that the software is capable of re-printing messages from a meaningful point in the event of an end-of-paper condition.

8-5 PAPER LOADING

The Strip Printer is delivered with a roll of thermal printer paper (HP part number 82045A).
To load the printer with new paper, first ensure the terminal is switched on (see section 16) and the loose end of the new paper roll is smoothly cut, then:

1) Open the printer cover by turning the knurled wheel and pulling the cover.
2) Hold the new roll with the loose end underneath. Press the loose end into the printer slot (see fig. 8-2). The paper will automatically feed through and then stop.

Close the cover and switch on the printer using the PRINT key.

8-6 PRINTING OPERATION WITH THE 3076A

When the Strip Printer is fitted on a 3076A, rear panel terminal configuration switch II-2 may be used to change the orientation of the printing as follows:

1) Switch II-2 set to 0: the first line of the received text becomes the last line of the printed text, e.g. if the text sent from the computer is:

A = 2	(first line of computer text)
B = 3	
TOTAL = A + B = 5	(last line of computer text)

The text is printed as follows:

TOTAL = A + B = 5	(first of printed text, last line of computer text)
B = 3	
A = 2	(last line of printed text, first line of computer text)

Therefore to ensure sequential printing of the data, the last line of any text must be sent first.

2) Switch II-2 set to 1: lines of text are printed correctly, i.e. the first line of the received text is the first line of the printed text. The printing is compatible with the 3075A terminal.

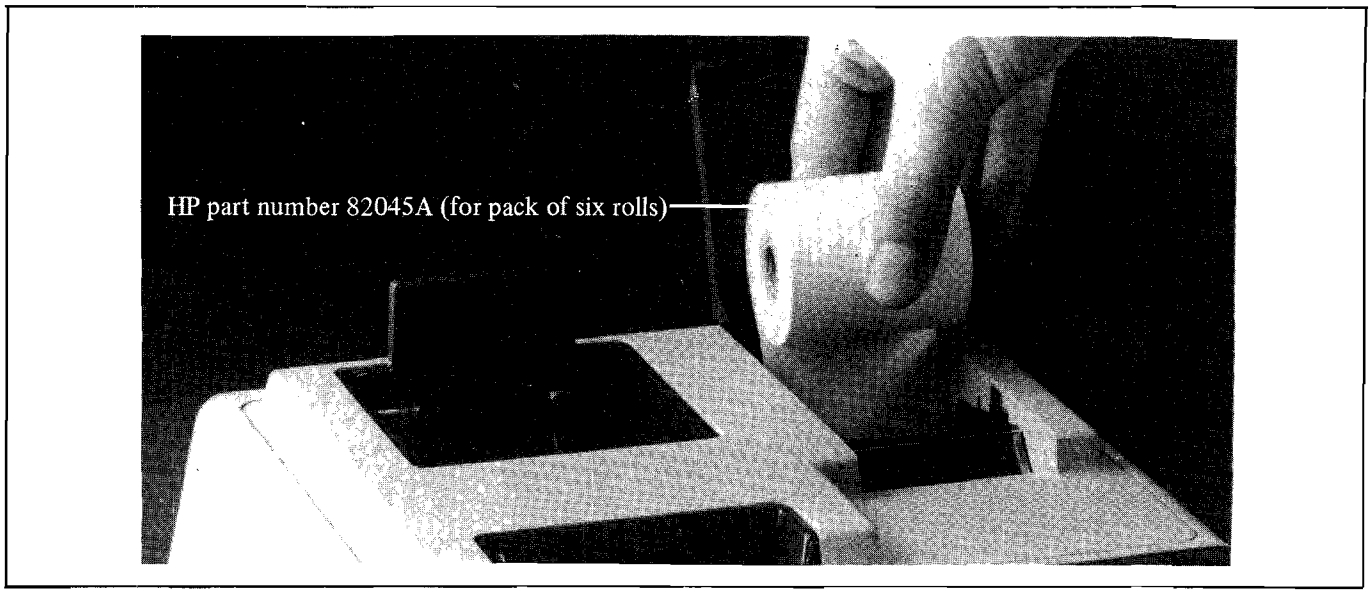


Figure 8-2 Printer Paper Loading

8-7 HIGH SPEED TRANSMISSION

Note: This only applies to terminals connected in the point-to-point mode.

If the number of characters sent to the printer exceeds 20, the time required for printing the data may cause some of the characters to be lost. To prevent this data loss, the data is transferred from the computer to the terminal using one of two handshake techniques, i.e. ENQ/ACK or X-ON/X-OFF (see section 2-15 and 14-21). These allow the terminal to control the flow of computer originated data.

Data loss does not occur for terminals connected in the multiterminal mode because the data communications protocol contains its own "handshake" operation (see section 14).

8-8 STRIP PRINTER CONTROL

The Strip Printer is controlled by escape sequence and ASCII control characters:

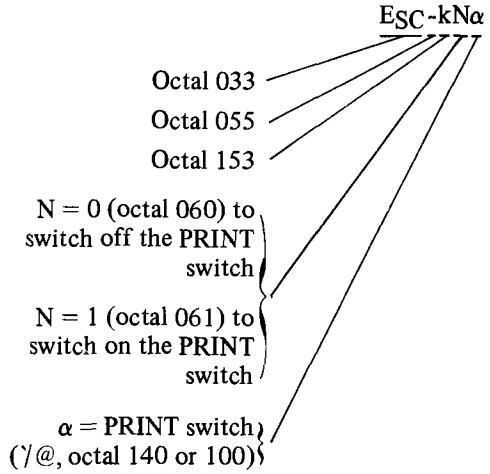
1) ESC-k1/0α	overrides the PRINT ON/OFF switch
2) BS	backspace
3) DEL	delete last entry

These control sequences are described in the following sub-sections.

Note: Escape sequence ESC-c1/0p/P may be used to enable/disable the printer (see section 2-13).

8-9 PRINT ON/OFF OVERRIDE

The keyboard PRINT ON/OFF switch and the printer disable escape sequence (ESC-c0P) may be overridden by sending escape sequence:



This enables the computer to print on the printer, even if the keyboard PRINT switch is switched off. At power-on or after a full reset (ESCE, see section 2-8) the PRINT switch is turned on.

8-10 BACKSPACE/DELETE LAST ENTRY

The program can perform a similar operation to the keyboard DELETE key (see section 3), i.e. editing data contained in printer input data buffer, by sending the following ASCII control characters:

Note: These delete operations only function before the data is printed.

1) Backspace

Octal 010 — BS

Deletes the last character stored in the printer buffer.

2) Delete last entry

Either

Octal 177 — DEL

Or

Octal 030 (XC) — CAN

Either character may be sent to the terminal but must correspond to the delete last entry characters specified on the rear panel terminal configuration switch II-3. i.e. II-3 set to 0 specifies CAN, II-3 set to 1 specifies DEL. Delete last entry completely erases the printer buffer after the last end of transmission character.

Note: The backspace and delete last entry control sequences also affect the displays, the HP-IB Controller (when fitted) or the Serial I/O Interface (when fitted). For details see sections 4, 5, 10 and 12 respectively.

SECTION 9

BAR CODE READERS (OPTIONS 010, 054, 055)

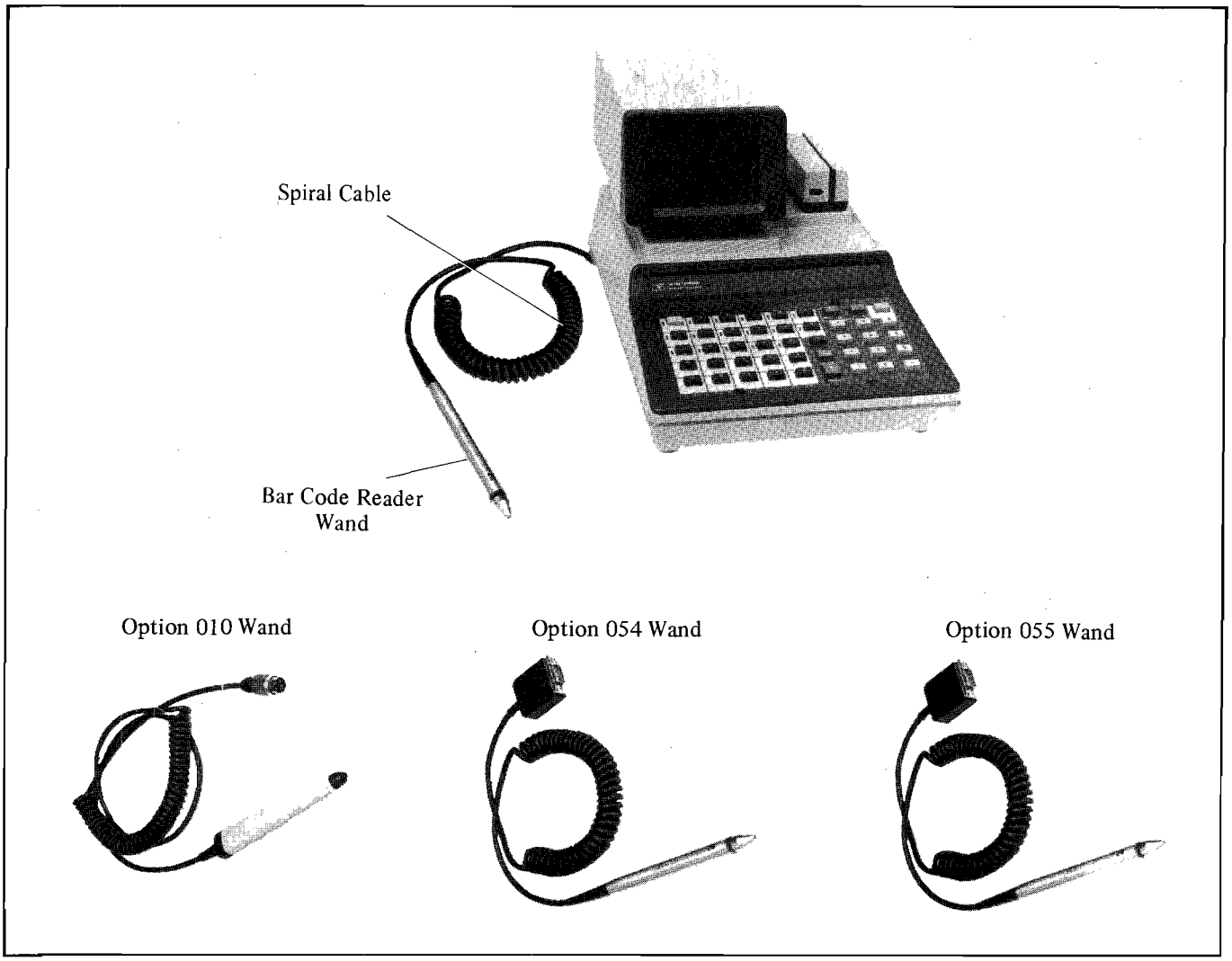


Figure 9-1 The Bar Code Reader

9-1 INTRODUCTION

The following section describes the use of the Bar Code Reader on the 3075A and 3076A Data Capture Terminals. Both types of terminal may be equipped with any one of the following three Bar Code Readers:

1) Option 010 (product number 92910A) general purpose Bar Code Reader.

2) Option 054 (product number 92910C) low resolution industrial Bar Code Reader.

3) Option 055 (product number 92910D) high resolution industrial Bar Code Reader.

Note:
1) The product number is for replacement wands and is printed on the wand.
2) The Bar Code Reader is not used on the 3077A Time Reporting Terminal.

Each Bar Code Reader comprises a wand, spiral cable and wand holder, see Figure 9-1. The wand reads labels and documents printed with a bar code, i.e. a sequence of vertical bars and spaces of varying widths (see Figure 9-2). The wand contains a light source and a light detector (see Figure 9-3), it reads the bar code as it scans the label/document by distinguishing between the presence of reflected light from a space (i.e. the label/document background) and the absence of reflected light from a bar. A detailed description on how to design bar code labels is given in Sections 9-15 to 9-26 inclusive.

The wand is attached to the terminal via the spiral cable, which is terminated by a connector (circular on option 010 and rectangular on options 054 and 055) that plugs into the terminal rear panel. The wand holder may be installed by the user in any convenient position.

The wands delivered with the three options differ primarily in their resolution and environmental specifications. The wand delivered with option 010 is a general purpose, medium resolution wand.

The wands delivered with options 054 and 055 have a stainless steel housing and sealed tip and are designed for industrial applications (ambient light up to 20 000 lux, shock up to 2000g). The option 054 wand has low resolution and the option 055 wand has high resolution. Only one wand can be connected per terminal.

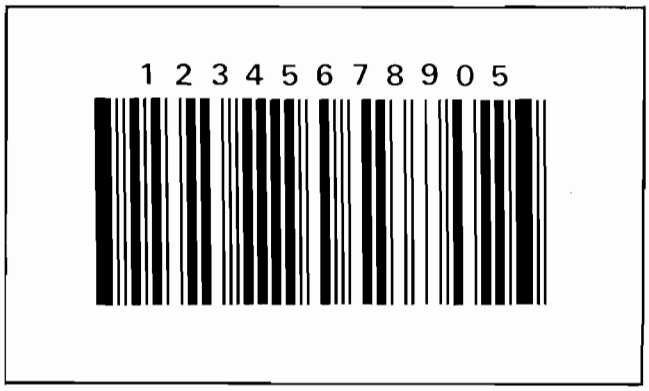


Figure 9-2 A Bar Code Label

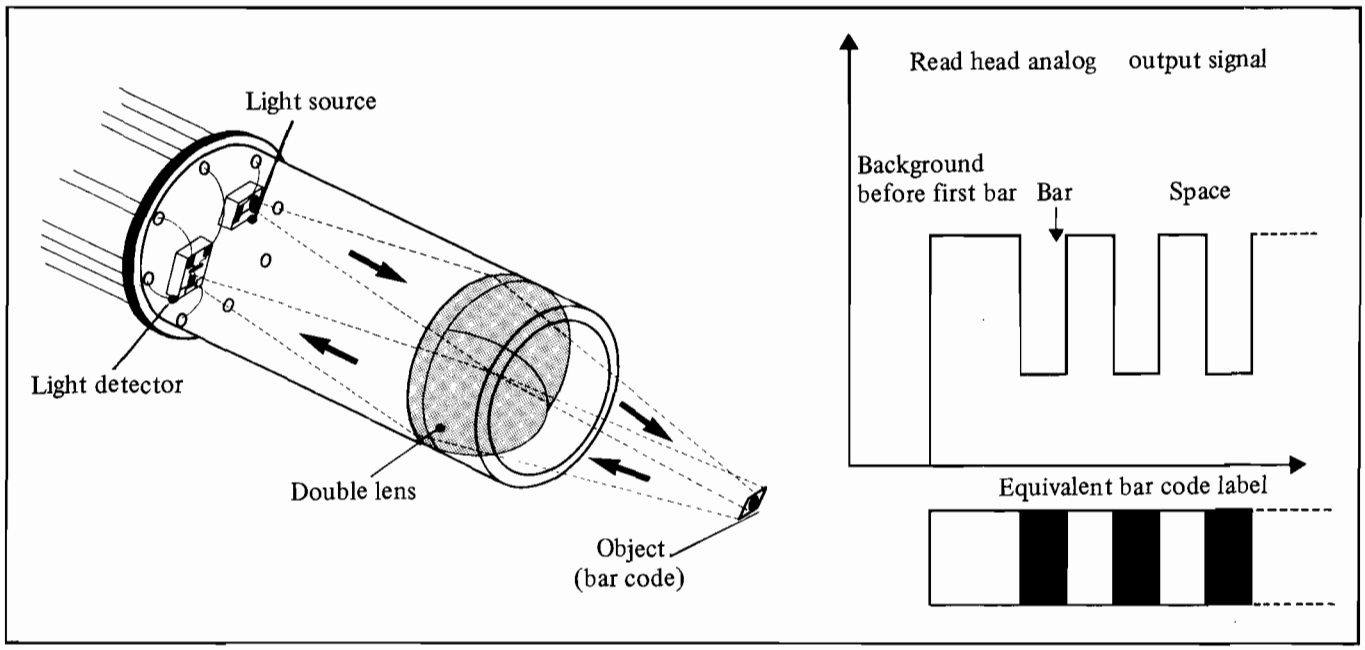


Figure 9-3 Bar Code Reader Operation

9-2 INSTALLATION AND MAINTENANCE

Installation. To install the Bar Code Reader Wand, the wand's spiral cable connector (male) must simply be plugged into the terminal's rear panel bar code wand connector (female). However, option 010 employs a circular connector and options 054 and 055 employ rectangular connectors. Thereby option 010 cannot be fitted to terminals built for use with options 054 and 055 (and vice-versa) but option 054 may be fitted to a terminal built for use with option 055 (and vice-versa).

Figure 9-4 depicts how to connect the cable connector to the terminal. For option 010, the cable's male connector must be plugged into the terminal's female connector; a "guide indent" on the male connector ensures its correct position in the female connector. The male connector's knurled locking ring must then be tightened (clockwise) to secure the male connector in position.

For options 054 and 055, the cable's connector has a securing mechanism comprising a metal locking plate mounted over the male connector. One edge of the locking plate has a circular hole and the other edge has a semi-circular cut-out. The connector should be fitted on the terminal and locked in position as follows:

1) Ensure that the circular hole in the locking plate is centered over the screw securing the locking plate to the male connector.
2) Fit the male connector over the terminal's female connector, the shape of the connectors ensures that they are correctly positioned.
3) Lock the male connector in position by sliding the side of the locking plate with the semi-circular cut-out towards the circular hole.

For the 3076A terminal; as this terminal is housed in a Wall Mounting Cradle, the wand cable must be passed through this cradle to be connected to the rear panel Bar Code Reader connector. The positioning of this cable within the cradle is described in Section 15-12.

The Wand Holder may be installed at the user's convenience using either double sided adhesive tape (provided with the holder) or two screws. The holder may be attached to the terminal using the double sided tape, see Figure 9-5.

CAUTION

The holder must NOT be attached to the terminal using screws, otherwise the warranty will be invalidated.

Maintenance. Periodic maintenance of the Bar Code Reader Wand will ensure long-term satisfactory performance. The aperture in the wand tip must not contain dirt or obstructions and the glass window on the optical sensor must be kept clean, see Section 17 for details. In addition, a bar code test pattern (supplied with the Bar Code Reader Wand) may be used to check the operation of the wand, for details see Section 16-16.

9-3 WAND OPERATION

To successfully use the Bar Code Reader the following characteristics must be observed:

1) Orientation. To optimise performance, the wand should be held in the position shown in Figure 9-6, at an angle of tilt (ϕ) of:

   a) For option 010 - 0° to 30°. The optimum angle being $10° \leqslant \phi \leqslant 20°$.
   b) For option 054 - 0° to 45°. The optimum angle being $10° \leqslant \phi \leqslant 20°$.
   c) For option 055 - 0° to 45°. The optimum angle being $10° \leqslant \phi \leqslant 20°$.

   Tilt is the angle between the wand and the normal to the bar code label.

2) Depth of field. This is the maximum height of the tip of the wand above the bar code. Optimum performance is obtained when the tip of the wand is in **light** contact with the bar code.

3) Scan speed. The wand must be drawn across the longitudinal centre line of the bar code at a uniform speed of:

   a) For option 010 - between 76 and 760 mm/sec. (3 and 30 ins./sec.).
   b) For option 054 - between 63 and 1000 mm/sec. (2.5 and 40 ins./sec.).
   c) For option 055 - between 63 and 510 mm/sec. (2.5 and 20 ins./sec.).

4) Bidirectional reading. The bar codes may be read by moving the wand either from right to left or from left to right across the code.

9-4 OPERATING PROCEDURE

If the program is expecting an input via the Bar Code Reader; the wand tip must be placed on the white margin (before the bar code) and drawn across the longitudinal centre line of the code at a uniform speed and in light contact with the code.

When in the white margin at the end of the code the wand must be lifted clear of the label. A wait time of at least 0.5 seconds is required before a subsequent bar code label is read.

A correct reading causes the terminal buzzer to "beep" once and the data to be sent to the computer. Escape sequence ESC-w1d/D (see Section 9-11) enables all data received from the Bar Code Reader to be echoed to the terminal display and printer (when fitted).

If the reading is incorrect the buzzer does not sound and no data is sent to the computer (or displayed on the terminal).

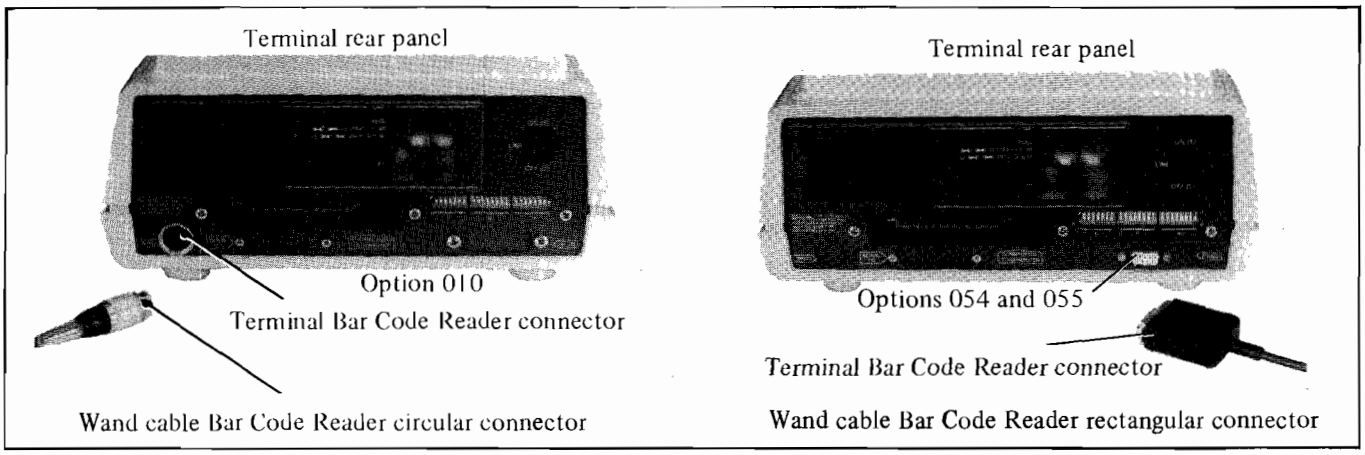


Figure 9-4 Terminal Bar Code Reader Connector

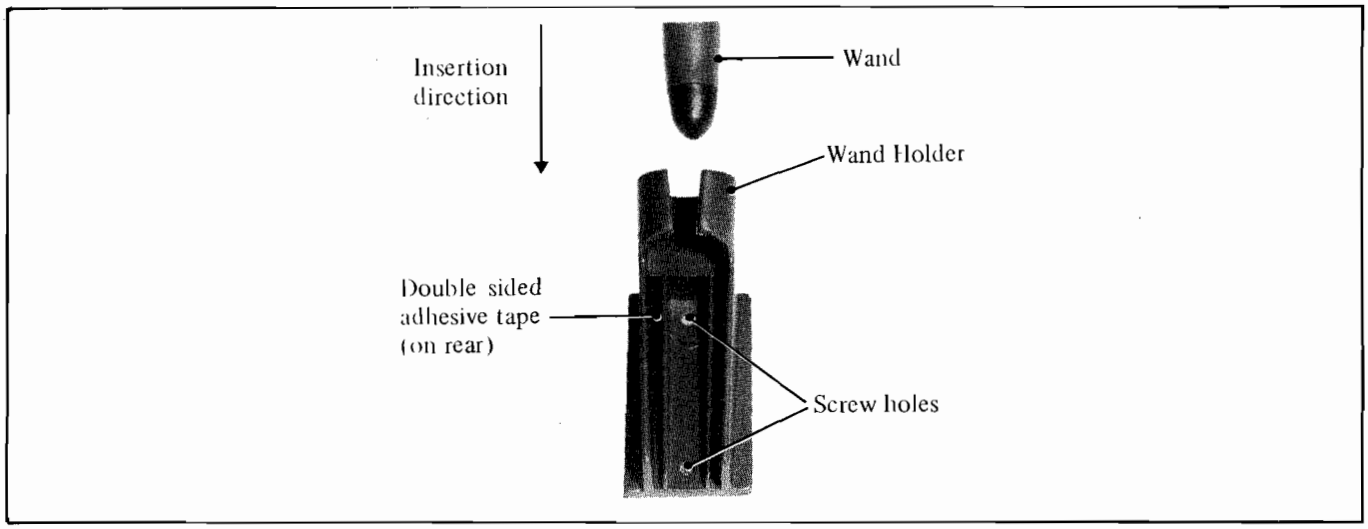


Figure 9-5 Wand Holder

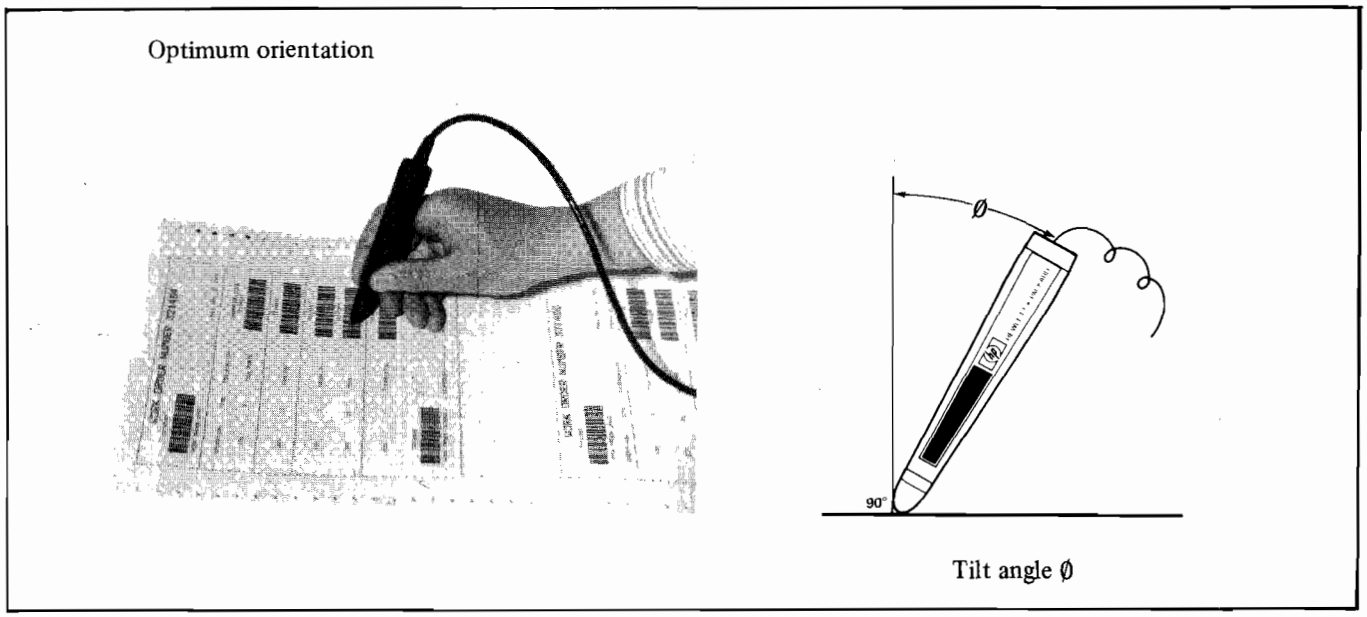


Figure 9-6 Bar Code Reader Wand Orientation

9-5 BAR CODE READER WAND SPECIFICATIONS

The following terms are used in this section :

1) Element: A bar or space within the bar code.
2) Resolution: The dimensions of the smallest element (bar or space) that can be identified by the wand.
3) Print contrast: The relationship between the light reflected from the spaces and the light reflected from the dark bars (see Section 9-18 for details).

Specifications for the three Bar Code Read Wands are contained in Table 9-1.

Note: For user convenience, it is recommended that the minimum bar height is approximately 1 cm (0.4 inches).

9-6 READABLE BAR CODES

Option 010 is a general purpose Bar Code Reader, option 054 is a low resolution industrial Bar Code Reader and option 055 is a high resolution industrial Bar Code Reader. All three Readers (when fitted to terminals with a serial number prefix from 2131F) are capable of reading the following six codes (in black and white only):

1) Industrial 2 out of 5 Code - a numeric code easy to print and read, with a check digit capability to improve reliability.

   Note: The check digit is a calculated character used for error detection appended at the end of the bar code. Its use is highly recommended as it reduces the occurrence of substitution errors when codes are read.

Table 9-1 Bar Code Reader Wand Characteristics

Parameter	Units	Option 010 (product number 92910A)	Option 054 (product number 92910C)	Option 055 (product number 92910D)
Resolution - minimum element size (i.e. narrowest narrow bar/space)	mm	0.305	0.380	0.190
	inches	0.012	0.015	0.007
Maximum element size (i.e. widest wide bar/space at a scan speed of 76 mm/sec.)	mm	2.794	2.794	2.794
	inches	0.110	0.110	0.110
Minimum print contrast (PCS), see section 9-18	%	70 (black and white only)	70 (black and white only)	70 (black and white only)
Wand light source wavelength	nm	700 (red)	940 (infrared)	940 (infrared)
Minimum tilt angle	degrees	0	0	0
Maximum tilt angle	degrees	30	45	45
Maximum depth of field (at 0° tilt)	mm	0.25	1.00	1.00
	inches	0.01	0.04	0.04
Minimum scan speed	mm/sec.	76	63	63
	inches/sec.	3	2.5	2.5
Maximum scan speed	mm/sec.	760	1000	510
	inches/sec.	30	40	20
Power-on delay	seconds	0	0	0

2) Matrix 2 out of 5 Code - a numeric code similar to the Industrial Code but denser, its use is recommended when coding large quantities of characters in small areas. This code has a check digit capability to improve reliability.

3) Code 39™* - an alphanumeric code with a check digit capability to improve reading reliability.

4) EAN (European Article Numbering) 8 and 13 - a numeric code with a check digit capability to improve reading reliability.

5) UPC (Universal Product Code) A and E - numeric code similar to the EAN code.

6) Interleaved 2 out of 5 Code - a continuous numeric code with a check digit capability to improve reliability.

It is recommended that the code 39™, and the three 2 out of 5 codes (i.e. industrial, matrix and interleaved) are employed by users who intend to print their own labels/ documents from a computer system and use them as "turn-around" documents. Complete specifications for these codes are given in Sections 9-15 to 9-26.

Table 9-2 Bar Code Reader Physical Specifications

Parameter	Units	Option 010 (product number 92901A)	Option 054 (product number 92901C)	Option 055 (product number 92901D)
Minimum storage temperature	°C °F	-20 -4	-40 -40	-40 -40
Maximum storage temperature	°C °F	+55 +131	+70 +158	+70 +158
Minimum operating temperature	°C °F	0 +32	0 +32	0 +32
Maximum operating temperature	°C °F	+55 +131	+40 +104	+40 +104
Humidity	% at 40°C (104°F)	5 to 95 (non condensing)	5 to 95 (non condensing)	5 to 95 (non condensing)
Maximum vibration		4 g at 5 to 55 Hz	4g at 5 to 200 Hz for 2 hours	4g at 5 to 200 Hz for 2 hours
Weight	kg	0.120	0.200	0.200
	lbs	0.26	0.44	0.44
Diameter	cm	2.2	1.3	1.3
	ins	0.87	0.51	0.51
Wand length	cm	13.3	13.4	13.4
	ins	5.24	5.28	5.28
Spiral cable length min.	m	1.35	1	1
	feet	4.4	3.3	3.3
Spiral cable length max.	m	2.54	1.8	1.8
	feet	8.3	5.6	5.6

** Code 39 is a Trademark of Interface Mechanism, Inc.*

9-7 BAR CODE READER CAPABILITIES

The Bar Code Reader is enabled by escape sequence ESC-c1W (see Section 2-13), this allows the Reader to transmit the read data to the computer. At power-on or after a full reset (ESCE, see Section 2-8). the Bar Code Reader is enabled.

Bar code selection. The program enables the Bar Code Reader to read the relevant bar code by means of escape sequence ESC-wNb/B (see Section 9-9).

Check digit. The check digit is a modulo check character encoded on the label/document to avoid substitution errors (see Section 9-21). The Code 39™, Industrial 2 out of 5, Matrix 2 out of 5 and Interleaved 2 out of 5 codes may include the check digit as required. For EAN8, EAN13, UPCA and UPCE the check digit is a mandatory part of the code and is always verified. It is recommended that Industrial 2 out of 5, Matrix 2 out of 5, Interleaved 2 out of 5 and Code 39™ bar code labels always include a check digit to avoid errors. The program enables the Bar Code Reader to interpret the least significant character (right character) of these codes as a check digit by means of escape sequence ESC-w1/0c/C (see Section 9-10). When enabled, the check digit is verified locally at the terminal and the read data is only sent to the computer if the check digit is valid.

For Code 39™, Industrial 2 out of 5, Matrix 2 out of 5 and Interleaved 2 out of 5 the check digit is NOT sent to the computer. For EAN8, EAN13, UPCA and UPCE the check digit is sent to the computer.

Note: For Code 39™, Industrial 2 out of 5, Matrix 2 out of 5 and Interleaved 2 out of 5; if a check digit is included on the label but the check digit verification is NOT enabled, the check digit will be read as being a data character.

Variable length codes. Code 39™, Industrial 2 out of 5, Matrix 2 out of 5 and Interleaved 2 out of 5 are all variable character length codes. For these four codes, any number of characters may be encoded on a label/document up to a maximum of 32. This number includes the data and check digit, but excludes the start and stop characters. Consequently when check digit verification is enabled, a maximum of 31 characters may be returned to the computer after decoding a label/document (since the check digit is not sent). When check digit verification is disabled, a maximum of 32 data characters may be returned to the computer.

Note: To minimise the possibility of reading errors, it is recommended that the bar code labels should be made as short as possible.

Fixed length codes. EAN8, EAN13, UPCA and UPCE are all fixed character length codes. For these four codes the number of characters that are sent to the computer after decoding each label/document are as follows:

1) EAN8 - 8 characters (including the flag and check digit).

2) EAN13 and UPCA - 13 characters (including the flags and check digit).

3) UPCE - 8 characters (including the flag and check digit). For UPCE, the return to the original UPC symbol (non compressed) is the responsibility of the programmer.

Field length check. The field length check is a check system used to count and verify the number of characters on the label/document. The program enables the Bar Code Reader to perform the field length check using escape sequence ESC-wN1/L (see Section 9-12). This escape sequence also specifies the number of characters to be counted (from 1 to 32), i.e.:

1) For the four variable length codes (i.e. Code 39™, Industrial 2 out of 5, Matrix 2 out of 5 and Interleaved 2 out of 5):

   a) This number includes:
      - The data characters.
      - The check digit when check digit verification is NOT enabled.
   b) This number excludes:
      - The start and stop characters.
      - The check digit when the check digit verification is enabled.

2) For the four fixed length codes (i.e. EAN8, EAN13, UPCA and UPCE):

   a) This number includes:
      - The data characters.
      - The flag(s).
      - The check digit.

   Note: For EAN/UPC the check digit verification is always enabled.

   b) This number excludes:
      - The centre pattern (i.e. field separator).
      - The guard bars.

   i.e. for the fixed length codes the field length is as follows:

EAN8	8 characters
EAN13	13 characters
UPCA	13 characters
UPCE	8 characters

When the field length check is enabled, the data is only sent to the computer if the number of read characters correspond to the specified field length. When the field length check is disabled, if the label contains more than 32 characters the data is NOT sent to the computer.

The field length check and the check digit greately reduce the possibility of substitution errors and truncation, without requiring the applications program to perform these tasks.

Local display of data. The local display of data is controlled by escape sequence ESC-w1/0/d/D (see Section 9-11). When enabled, all data subsequently read by the Bar Code Reader is displayed on the terminal display and printer (if fitted).

Multifield operation. When the terminal is connected to the computer in the multiterminal mode, the multifield operation may be selected for the Bar Code Reader using escape sequence ESC-w1m/M (see Section 9-13). Multifield operation allows multiple data entries in the same transaction, preventing the Bar Code Reader entering its data to the computer at the end of a single data transaction. The data from several input modules (operating in multi-field) is transmitted to the computer as one data block when data is entered via the keyboard or via a terminal input module/option not in the multifield operation. The only restriction to the multifield operation is that the total amount of data per transaction must NOT exceed 180 characters (see Section 2-19 for details).

Self operation. The local mode of operation (used for checking and demonstration only) may be selected by setting rear panel terminal configuration switch I-1 to 1 and I-2 to 0. In self operation there is automatic recognition of the read bar code. However, substitution errors may occur as the read data is successively compared with the known codes (within the Reader). i.e. bar code patterns are common to several codes but represent a different character in each code. This may cause the Reader to misinterpret the encoded data.

The data is displayed and printed (if a printer is fitted) when a comparison occurs. See Section 16-16 for details.

Note: This automatic recognition cannot be selected when the Reader is operating "on-line".

9-8 BAR CODE READER PROGRAMMING CONTROL

The Bar Code Reader is programmed by escape sequences:

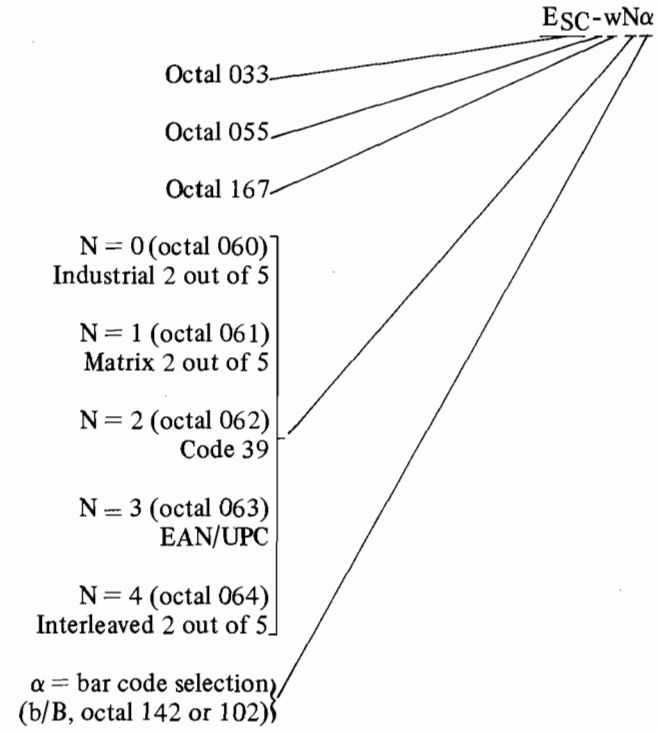
1) ESC-wNb/B bar code selection ($0 \leqslant N \leqslant 4$)
2) ESC-w1/0c/C check digit
3) ESC-w1/0d/D local display of read data
4) ESC-wNl/L field length check ($0 \leqslant N \leqslant 32$)
5) ESC-w1/0m/M multifield operation

These escape sequences are described in the following sub-sections.

Note: The Bar Code Reader is enabled/disabled by escape sequence ESC-c1/0w/W (see Section 2-13).

9-9 BAR CODE SELECTION

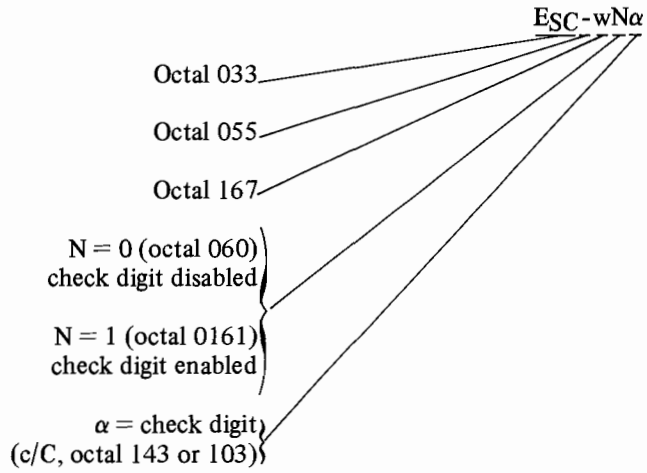
Selects the code to be read by sending escape sequence:



The default reading mode at power-on or after a full reset (ESCE) is Industrial 2 out of 5 code.

9-10 CHECK DIGIT

For Code 39™, Industrial 2 out of 5, Matrix 2 out of 5 and Interleaved 2 out of 5, the check digit verification is selected using escape sequence:



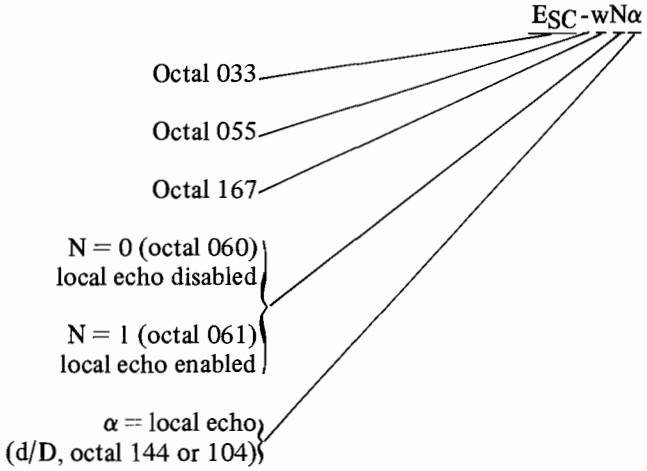
When enabled (N = 1), the check digit is checked locally on the terminal (but is not sent to the computer). The data is only sent to the computer if the check digit is correct.

At power-on or after a full reset the check digit verification is disabled and must be programmed if required.

Note: For EAN/UPC, the check digit is ALWAYS enabled and is ALWAYS sent to the computer.

9-11 LOCAL DISPLAY OF INPUT DATA

Selected by sending escape sequence:

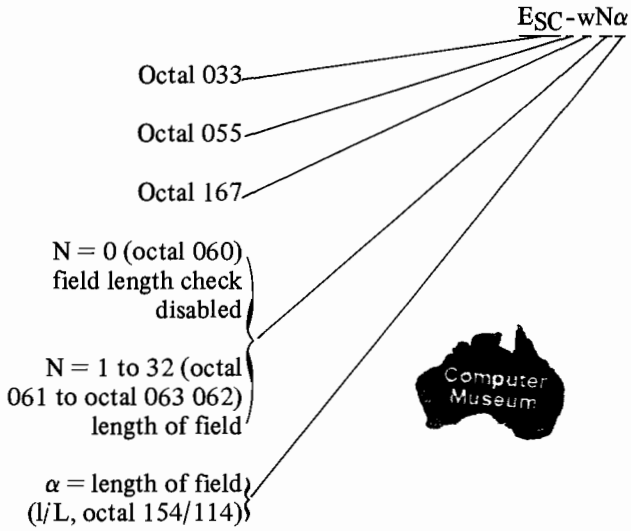


When enabled (i.e. N = 1) all data subsequently read by the Bar Code Reader is displayed on the terminal display and printer (if fitted). At power-on or after a full reset, the local display of input data is inhibited and must be programmed if required.

Note: The local display of input data must NOT be enabled when a remote echo is employed, otherwise a double echo will be produced.

9-12 FIELD LENGTH CHECK SELECTION

Selected by sending escape sequence:



When enabled (i.e. N = 1 to 32), the terminal checks that the number of characters on the label/document corresponds to the number specified in the escape sequence (i.e. 1 to 32). If the number of characters does not correspond to the specified field length the data is NOT read. Similarly, if a field length of > 32 is specified the label is NOT read. In addition, if the field length check is disabled (i.e. N = 0), any label with more than 32 characters is not read.

For Code 39™, Industrial 2 out of 5, Matrix 2 out of 5 and Interleaved 2 out of 5 the field length excludes the check digit when check digit verification is enabled. The check digit is included when the check digit is disabled. For EAN/UPC codes, the field length ALWAYS includes the check digit.

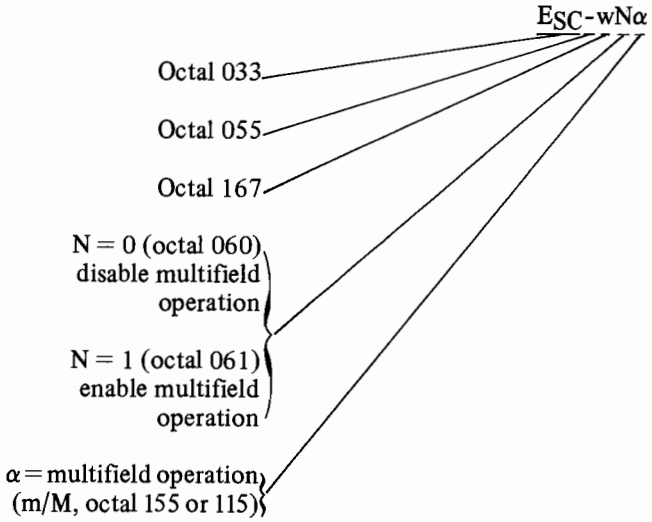
Note: The field length check character is NOT re-transmitted to the computer with the bar code data.

At power-on or after a full reset the field length verification is disabled and must be programmed if required.

9-13 MULTIFIELD OPERATION SELECTION

Note: The multifield operation must only be used when the terminal is connected in the multiterminal mode.

The multifield operation is selected for the Bar Code Reader by sending escape sequence:



At power-on or after a full reset the multifield operation is disabled and must be programmed if required.

9-14 TYPICAL EXAMPLE

To enable the Reader to read Industrial 2 out of 5 code, to use the check digit and provide a local echo, the following escape sequence must be sent:

ESC-c1WESC-w0b1c1D

ESC-c1W enables the Bar Code Reader if previously disabled and is described in Section 2-13.

9-15 PRINT MEDIA FOR THE BAR CODE READER

Bar code labels are labels (or documents) coded with machine readable data in the form of a sequence of printed vertical bars of differing widths and spacings. The Bar Code Reader Wand reads the labels by distinguishing between the presence or absence of reflected light. The label background must be such that it reflects most of the light beam generated by the Reader. The bars must be printed in non-reflective ink and are detected by the absence of reflected light as the Reader scans the label, see Figure 9-3.

If the bar code is to be protected by a transparent plastic cover a glossy surface must be avoided, as a reflective label surface may prevent the Reader from distinguishing the bars from the label's white background.

Note: The dimensions detailed in the following sub-sections are valid for a temperature of 21°C (70°F) and a humidity of approximately 50%.

9-16 BAR CODE SPECIFICATIONS

The following terms relating to bar codes are used in this section:

1) Bidirectional code: a code readable either from left to right or from right to left. All the codes described in this section are bidirectional.
2) Check digit: a calculated character used for error detection appended at the end of the bar code. Its use is highly recommended as it reduces the occurrence of subsittution errors when codes are being read.
3) Element: a bar or space.
4) Resolution: the dimension (width) of the narrowest element (unit) that can be read by the Reader.
5) Start and stop code: the bar code pattern used at the start and end (respectively) of each label to determine the start and end of the label.
6) Unit: the narrowest element in the code. Wide elements are specified in multiples of one unit.

9-17 BAR CODE PAPER SPECIFICATIONS

The Industrial 2 out of 5, Matrix 2 out of 5, Interleaved 2 out of 5 and Code 39™ bar codes must be printed on OCR (Optical Character Recognition) quality paper. Specifications for the OCR paper (i.e. reflectance, opacity, weight, thickness, smoothness, stiffness and tear resistance) are contained in the "American National Standard concerning Optical Character Recognition (OCR), ANSI X3.17-1974".

For the paper specifications for use with the EAN and UPC codes, refer to the codes specifications (see Section 9-25 for details).

9-18 BAR CODE PRINT SPECIFICATIONS

The Bar Code Reader reads the bar codes using a reflection technique (see Figure 9-3). In order to ensure its correct detection as data, the print contrast (between the bars and the background) must be within definite limits.

The print contrast is defined by the relationship:

$$PCS = \frac{(R_L - R_D)\ 100\%}{R_L}$$

Where PCS is the print contrast
R_L is the reflectance factor from the "light" spaces (i.e. background)
R_D is the reflectance factor from the "dark" bars

and the reflectance factor is defined by the relationship:

$$R = \frac{\emptyset s}{\emptyset r}$$

Where, R is the reflectance factor
$\emptyset s$ is the amount of reflected light from the sample (bar or space)
$\emptyset r$ is the amount of reflected light from a reference reflector, either a MgO (magnesium oxide) or BaSO4 (barium sulphate) standard

100% print contrast is a totally white background (the complete reflection of light) and totally black bars (the complete absorption of light).

The print contrast specifications are listed in Table 9-1. These specifications must be measured at a wavelength of 700 nanometres for option 010 and 940 nanometres for options 054/055, using a label where :

$R_L \geqslant 75\%$ (i.e. $D_L = 0.125$ maximum)

Where, R_L is the reflectance factor from "light" spaces.
D_L is the reflection density of the light background.

The reflection density is defined by the relationship.

$$D_L = -\log_{10} (R_L)$$

9-19 BAR/SPACE RELATIONSHIP

The Industrial 2 out of 5, Matrix 2 out of 5, Interleaved 2 out of 5 code and Code 39™ use two classes of element widths, namely wide elements and narrow elements. The following rules apply to these codes (see Figures 9-7 to 9-10 for examples of these rules):

If,

E = Narrowest element to be scanned (i.e. unit width)
WB = Wide bar width
WS = Wide space width
NB = Narrow bar width
NS = Narrow space width
CS = Space between characters (not used with Interleaved 2 out of 5 code)
BS = Space between bars (only applies to Industrial 2 out of 5)
Q_1 = Quiet zone of unprinted background before the start code
Q_2 = Quiet zone of unprinted background after the stop code
R_1 = Ratio between wide elements and narrow elements
R_2 = Ratio between space between characters and the narrow elements (not used with Interleaved 2 out of 5 code)
R_3 = Ratio between the space between bars and the narrow bars (only applies to Industrial 2 out of 5 code)

Then,

$NB = NS = E$

$WB = WS = E \times R_1$ (where $2 \leqslant R_1 \leqslant 3$)

$CS = E \times R_2$ (where $1 \leqslant R_2 \leqslant 3$)

$BS = E \times R_3$ (where $1 \leqslant R_3 \leqslant 3$)

$Q_1 = Q_2 \geqslant 30E$ (minimum 15 mm, 0.6 ins.)

The ratio R_1 depends upon the quality of the print. For matrix printers $R_1 = 3$ is advised. For good quality printing (where $E \geqslant$ printing tolerance) $R_1 = 2$ may be used.

For the bar/space relationship used with the EAN and UPC codes, refer to the code specifications (see Section 9-25 for details).

9-20 BAR CODE DESIGN

The minimum and maximum element size (listed in Table 9-1) and the maximum label length (described in Section 9-7) may be used to calculate the most suitable dimensions of the bars and spaces for each of the bar codes as described in the next sub-sections.

Note:

1) For user convenience it is recommended that the minimum bar height is approximately 1 cm (0.4 inches).

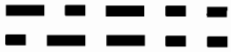
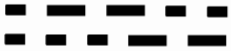
2) The numeric/alphanumeric values of the bar code may, if required, be printed at the bottom of the label.

9-21 Industrial 2 Out Of 5 Code

Industrial 2 out of 5 is a variable length, discrete, bidirectional numeric bar code comprising a start code, a stop code and ten characters (0 thru 9). Each character is represented by five bars, of which two are wide and three are narrow. The wide bars have a binary value of 1 and the narrow bars have a binary value of 0. No data is encoded in the spaces between the bars (or between characters).

Table 9-3 lists the Industrial 2 out of 5 character set and depicts the code pattern's; a "W" is a wide bar and an "n" is a narrow bar.

Table 9-3 Industrial 2 Out Of 5 Code Character Set

Character	Bar code pattern					Pictorial bar code pattern
1	W	n	n	n	W	
2	n	W	n	n	W	
3	W	W	n	n	n	
4	n	n	W	n	W	
5	W	n	W	n	n	
6	n	W	W	n	n	
7	n	n	n	W	W	
8	W	n	n	W	n	
9	n	W	n	W	n	
0	n	n	W	W	n	
Start Code	W	W	n			
Stop Code	W	n	W			

Check digit. It is recommended that the bar code should include a check digit. Industrial 2 out of 5 code uses a modulo 10 check digit that is printed as the last data character before the stop code. The check digit is calculated from RIGHT to LEFT on the bar code (excluding the start and stop codes) using the following formula:

Note: The terminal must be programmed to read the check digit when it is encoded in the bar code (see Section 9-10).

1) The least significant digit (i.e. the right-hand character) is ALWAYS an even position character (irrespective of its numeric value).
2) Sum the numeric values of all the odd position characters and multiply the total by one.
3) Sum the numeric values of all the even position characters and multiply the total by three.
4) Sum the multiplied odd and even totals.
5) Divide the summed total by 10.
6) Subtract the remainder (from this division) from 10.
7) The numeric answer is the check digit.

For example:

	least significant digit (always even position)
Message (start and stop codes not shown)	476132815
Multiply by one summed odd position characters (summed from right to left)	$1 \times (1 + 2 + 1 + 7) = 11$
Multiply by three summed even position characters (summed from right to left)	$3 \times (5+8+3+6+4) = 78$
Sum the multiplied odd and even totals	$11 + 78 = 89$
Divide the summed total by 10	89/10 = 8 remainder 9
Subtract the numeric remainder from 10	10 - 9 = 1

The check digit is 1. The above message with a check digit is 4761328151.

Character width. The width of the Industrial 2 out of 5 characters may be determined from the relationship contained in section 9-18 as follows. For example:

If,

$R_1 = \frac{WB}{NB} = 3$ (ratio between wide bars and narrow bars)

$R_2 = \frac{CS}{NB} = 1$ (ratio between space between characters and narrow bars)

$R_3 = \frac{BS}{NB} = 1$ (ratio between space between bars and narrow bars)

Then,
WB (wide bar) = 3 units
NB (narrow bar) = 1 unit
BS (space between bars) = 1 unit
CS (space between characters) = 1 unit

Therefore each character comprises (see Table 9-3):
2 x WB + 3 x NB + 4 x BS + 1 x CS = **14 units**

For each message (i.e. bar code label), the combined start and stop code comprises.
(2 x WB + 1 x NB + 2 x BS + 1 x CS) +
(2 x WB + 1 x NB + 2 x BS) = **19 units**.

Note: The stop code does not have a space between characters, CS.

Table 9-4 lists the minimum dimensions of characters, the combined start and stop code and the quiet zone; with $R_1 = 3$, $R_2 = 1$ and $R_3 = 1$. A label coded in Industrial 2 out of 5 code can contain a maximum of 32 characters plus the start and stop code.

Note.
1) The dimensions in Table 9-4 are based on the minimum element size specifications listed in Table 9-1.
2) On any one label, all the characters must be the same width.

Typical example. If a bar code label is made up of six data characters and the narrowest element (i.e. unit) is 0.381 mm (0.015 inches) wide; then with $R_1 = 3$, $R_2 = 1$ and $R_3 = 1$ the length of the encoded label is:

$$(6 \times 14 \times 0.381) + (1 \times 19 \times 0.381) = 39.243 \text{ mm } (1.545 \text{ ins})$$

(Length of combined start and stop code; Length of characters)

A quiet zone of at least 15.0 mm (0.6 inches) must precede and follow the encoded data.

Illustration. Figure 9-7 depicts an enlarged Industrial 2 out of 5 bar code. Within this figure; 1, 2 and 3 are the data and 6 is the check digit.

Table 9-4 Industrial 2 Out Of 5 Code Minimum Character Dimensions

Parameter	Option 010		Option 054		Option 055	
	mm	inches	mm	inches	mm	inches
Minimum character width	4.270	0.168	5.320	0.210	2.66	0.105
Number of characters per mm and per inch with minimum character width	0.238	6.050	0.188	4.770	0.376	9.550
Minimum combined start and stop code width	5.795	0.228	7.220	0.285	3.610	0.142
Minimum quiet zone (with narrowest characters)	15.0	0.6	15.0	0.6	15.0	0.6

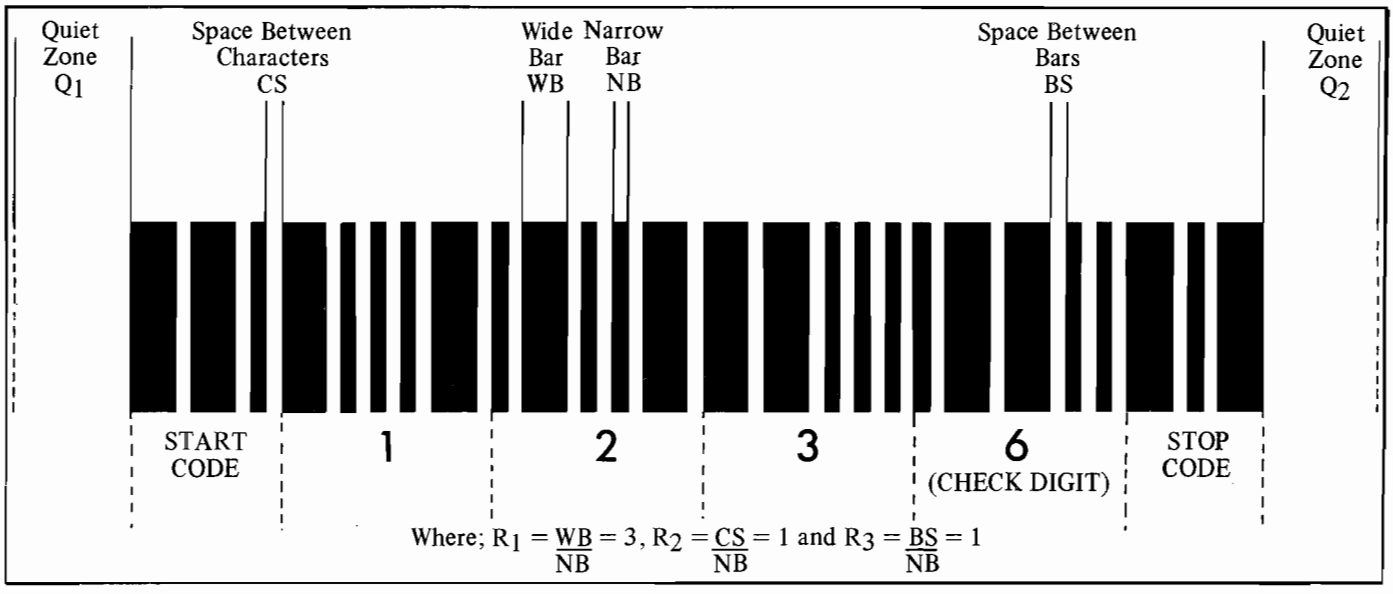


Figure 9-7 Enlarged Industrial 2 Out Of 5 Bar Code

9-21 Matrix 2 Out of 5 Code

Matrix 2 out of 5 is a variable length, discrete, bidirectional numeric bar code comprising a start/stop code (*) and ten characters (0 thru 9). Each character is represented by five elements: three bars and the two spaces between the bars. An element, i.e. bar or space, can be wide (with a binary value of 1) or narrow (binary value 0). For each character, two elements are wide and three are narrow. For the start/stop code (*), one element is wide and four are narrow. The space between characters has no code value and is always narrow.

Table 9-5 lists the Matrix 2 out of 5 character set and depicts the code pattern; a "W" is a wide element (bar or space), an "n" is a narrow element (bar or space).

Table 9-5 Matrix 2 Out Of 5 Code Character Set

Character	Bar code pattern (B-Bar, S-Space)					Pictorial bar code pattern
	B	S	B	S	B	
1	W	n	n	n	W	
2	n	W	n	n	W	
3	W	W	n	n	n	
4	n	n	W	n	W	
5	W	n	W	n	n	
6	n	W	W	n	n	
7	n	n	n	W	W	
8	W	n	n	W	n	
9	n	W	n	W	n	
0	n	n	W	W	n	
* (Start/ Stop Code)	W	n	n	n	n	

Start/stop code. The character * must only be used for the start and stop code. The first bar of this code must be wider than the regular wide bars (or spaces) of the numeric characters. For example:

If,
E = Narrowest element (bar/space)
WB^1 = First wide bar of the start/stop code
R_1 = The ratio between the regular wide elements and the narrow elements
R_1^1 = The ratio between the first wide bar of the start/stop code and the regular wide elements

Then,
$\mathbf{WB^1 = E \times R_1^1}$

Where,
$R_1^1 = 2 R_1 - 1$

Therefore if $R_1 = 3$ then $R_1^1 = 5$
(or if $R_1 = 2$ then $R_1^1 = 3$).

Check digit. It is recommended that the bar code should include a check digit. Matrix 2 out of 5 code uses a modulo 10 check digit that is printed as the last data character before the stop code. The check digit is calculated from right to left on the bar code (excluding the stop and start code) using the same formula as for the Industrial 2 out of 5 check digit; see section 9-21, check digit.

Character width. The width of the Interleaved 2 out of 5 characters may be determined from the relationship contained in Section 9-19 as follows. For example:

If,
$$R_1 = \frac{WB}{NB} = \frac{WB}{NS} = \frac{WS}{NS} = \frac{WS}{NB} = 3$$
(Where R_1 = ratio between wide elements and narrow elements).

$$R_2 = \frac{CS}{NB} = \frac{CS}{NS} = 1$$
(Where R_2 = ratio between space between characters and narrow elements)

Then,
$R_1^1 = 2 R_1 - 1 = 5$

(Where R_1^1 = ratio between first wide bar of start/stop code and regular wide elements).
WB (wide bar) = WS (wide space) = 3 units
WB^1 (first wide bar of start/stop code) = 5 units
NB (narrow bar) = NS (narrow space) = 1 unit
CS space between character) = 1 unit

Therefore each character comprises (see Table 9-5):
2 x WB + 3 x NB + 1 x CS = **10 units**

For each message, the combined start and stop code (*) comprises:
$(1 \times WB^1 + 4 \times NB + 1 \times CS) + (1 \times WB^1 + 4 \times NB) =$ **19 units**

Note: The stop code does not have a space between characters, CS.

Table 9-6 lists the minimum dimensions of characters, the combined start and stop code and the quiet zone; with $R_1 = 3$, $R_1^1 = 5$ and $R_2 = 1$. A label coded in Matrix 2 out of 5 code can contain a maximum of 32 characters plus the start and stop code.

Note:
1) The dimensions in Table 9-6 are based on the minimum element size specifications listed in Table 9-1.
2) On any one label, all the numeric characters must be the same width.

Typical example. If a bar code label is made up of six data characters and the narrowest element (i.e. unit) is 0.381 (0.015 inches) wide; then with $R_1 = 3$, $R_1{}^1 = 5$ and $R_2 = 1$ the length of the encoded label is:

$(6 \times 10 \times 0.381) + (1 \times 19 \times 0.381) =$ 30.099mm (1.185 ins.)

- $(1 \times 19 \times 0.381)$: Length of combined start and stop code
- $(6 \times 10 \times 0.381)$: Length of characters.

A quiet zone of at least 15.0 mm (0.6 inches) must precede and follow the encoded data.

Illustration. Figure 9-8 depicts an enlarged Matrix 2 out of 5 bar code. Within this figure; 1, 2 and 3 are the data and 6 is the check digit.

Table 9-6 Matrix 2 Out Of 5 Code Minimum Character Dimensions

Parameter	Option 010		Option 054		Option 055	
	mm	inches	mm	inches	mm	inches
Minimum character width	3.050	0.120	3.800	0.150	1.900	0.075
Number of characters per mm and per inch with minimum character width	0.33	8.470	0.263	6.667	0.526	13.370
Minimum combined start and stop code width	5.795	0.228	7.220	0.285	3.610	0.142
Minimum quiet zone (with narrowest characters)	15.0	0.6	15.0	0.6	15.0	0.6

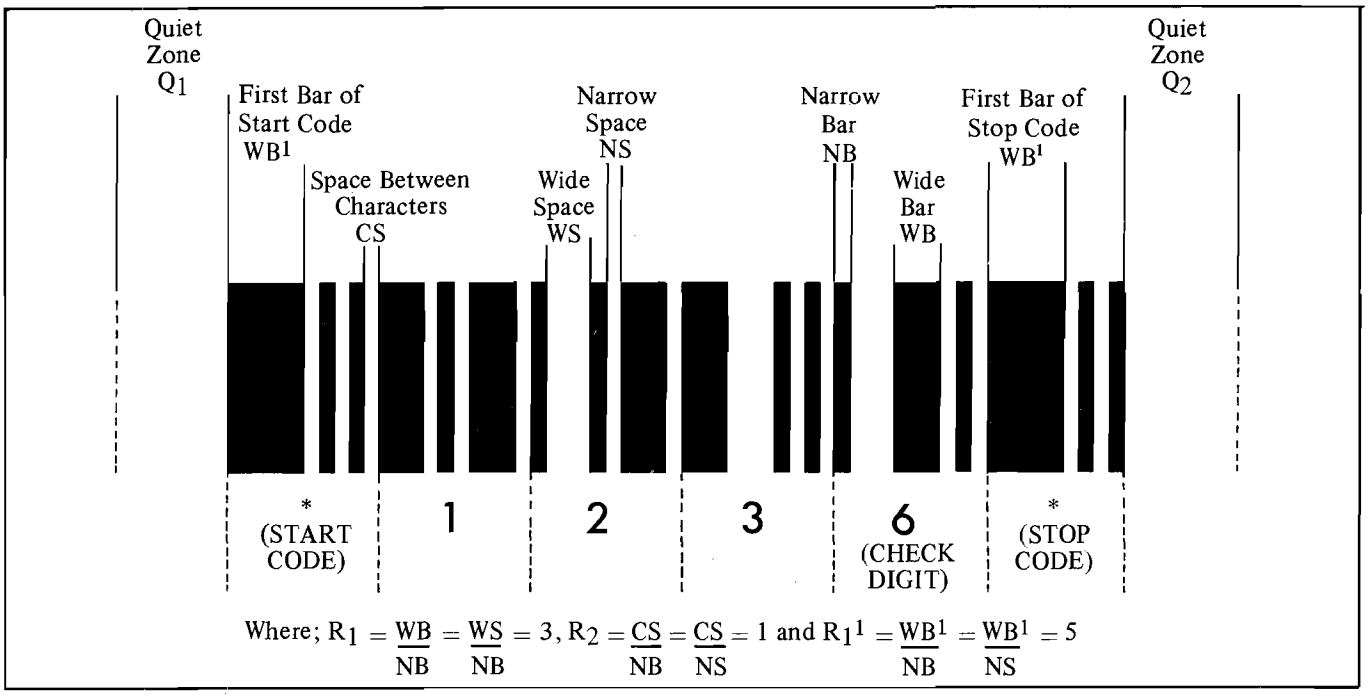


Figure 9-8 Enlarged Matrix 2 Out Of 5 Bar Code

9-23 Interleaved 2 Out Of 5 Code

Interleaved 2 out of 5 is a variable length, continuous, bidirectional numeric bar code comprising a start code, a stop code and ten characters (0 to 9). All of these characters are represented by a sequence of wide and narrow elements, where an element may be either a bar or the space between bars.

The start code is represented by four narrow elements. These comprise two narrow elements (both bars) separated by a narrow element (a space) and followed by a narrow element (a space).

The stop code is represented by three elements, one wide and two narrow. These comprise one wide element (a bar) and two narrow elements (a space and a bar), the narrow space separates the wide and narrow bars.

Note: The start/stop code narrow space has no code (or character) value.

Each character is represented by five elements, of which two are wide and three are narrow. As the code is continuous, there are NO inter-character gaps; i.e. all the character spaces carry information. In addition, because the characters are "interleaved" together, for the odd position characters (i.e. the first, third, fifth, etc.) the elements are always bars. For the even position characters (i.e. the second, fourth, sixth, etc.) the elements are always spaces.

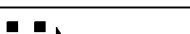
Note:
1) The interleaved bar code must ALWAYS be encoded with an even number of characters. Consequently if an odd number of significant characters are to be encoded, the message must be preceded by a (leading) zero in the left-hand (most significant) position. This leading zero is always read and sent to the computer.
2) The most significant character is ALWAYS an odd position character (irrespective of its numeric value).

Table 9-7 lists the Interleaved 2 out of 5 character set and depicts the code pattern; i.e. a "W" is a wide element and an "n" is a narrow element.

CAUTION

It is recommended that when using the Interleaved 2 out of 5 code, the Bar Code Reader's field length facility is programmed (see Section 9-12). This is to prevent the encoded data being misinterpreted if the Reader does not traverse all the code (including the start/stop codes). This is because if the Reader starts after the start code, the first character to be read will be truncated and may be erroneously read as being the valid start code. A similar problem occurs if the reader stops before the stop code, i.e. the last character will be truncated and may be erroneously read as being the valid stop code.

Table 9-7 Interleaved 2 out of 5 Character Set

Character	Bar Code Pattern	Pictorial Bar Code Pattern* Odd Position (bar pattern)	Even Position (space pattern)
		First bar	First space
1	W n n n W		
2	n W n n W		
3	W W n n n		
4	n n W n W		
5	W n W n n		
6	n W W n n		
7	n n n W W		
8	W n n W n		
9	n W n W n		
0	n n W W n		
Start code	n n n n	narrow space following bar	Not applicable
Stop code	W n n		Not applicable

** Note: for the pictorial bar code pattern:*

1) For the odd position characters, the spaces normally represent a character, but for clarity are all shown narrow in this table.

2) For even position characters, the bars normally represent a character, but for clarity are all shown narrow in this table.

For example: the data 912 should be encoded as follows:

1) As there must always be an even number of characters, a leading zero must be added to the data. Consequently, the data to be encoded is:

0912

2) The first (most significant) character is 0. This is an odd position character, consequently the elements are all bars with a pattern of:

n n W W n

3) The second character is 9. This is an even position character, therefore the elements are all spaces with a pattern of:

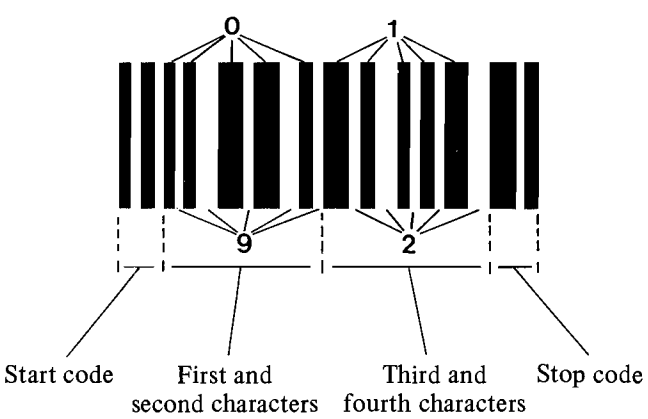
n W n W n

4) The third character is 1. This is an odd position character, therefore the elements are all bars with a pattern of:

W n n n W

5) The fourth character is 2. This is an even position character, consequently the elements are all spaces with a pattern of:

n W n n W



Check digit. It is recommended that the bar code should include a check digit. Interleaved 2 out of 5 code uses a modulo 10 check digit that is printed as the last data character before the stop code. The check digit is calculated from right to left on the bar code (excluding the stop and start code) using the same formula as for the Industrial 2 out of 5 check digit; see Section 9-21, check digit.

Character width. The width of the Matrix 2 out of 5 characters may be determined from the relationship contained in section 9-19 as follows. For example:

If,

$$R_1 = \frac{WB}{NB} = \frac{WB}{NS} = \frac{WS}{NS} = \frac{WS}{NB} = 3$$

(Where R_1 = ratio between wide elements and narrow elements).

Then,
WB (wide bar) = WS (wide space) = 3 units
NB (narrow bar) = NS (narrow space) = 1 unit

Therefore each character comprises (see Table 9-7):

2 x WB + 3 x NB = **9 units.**

Note: Interleaved 2 out of 5 messages must have an even number of data characters.

For each message, the combined start and stop code comprises:

(1 x NB + 1 x NS + 1 x NB + 1x NS) +
(1 x WB + 1 x NS + 1 x NB) = **9 units**

Table 9-8 lists the minimum dimensions of characters, the combined start and stop code and the quiet zone; with $R_1 = 3$. A label coded in Interleaved 2 out of 5 can contain a maximum of 32 characters plus the start and stop code.

Note:

1) The dimensions in Table 9-8 are based on the minimum element size specifications listed in Table 9-1.

2) On any one label, all the characters must be the same width.

Typical example. If a bar code label is made up of six data characters and the narrowest element is 0.381 mm (0.015 inches) wide, then with $R_1 = 3$ the length of the encoded label is:

(6 x 9 x 0.381) + (1 x 9 x 0.381) = 24.003 mm (0.945 ins.)

(1 x 9 x 0.381) → Length of combined start and stop code

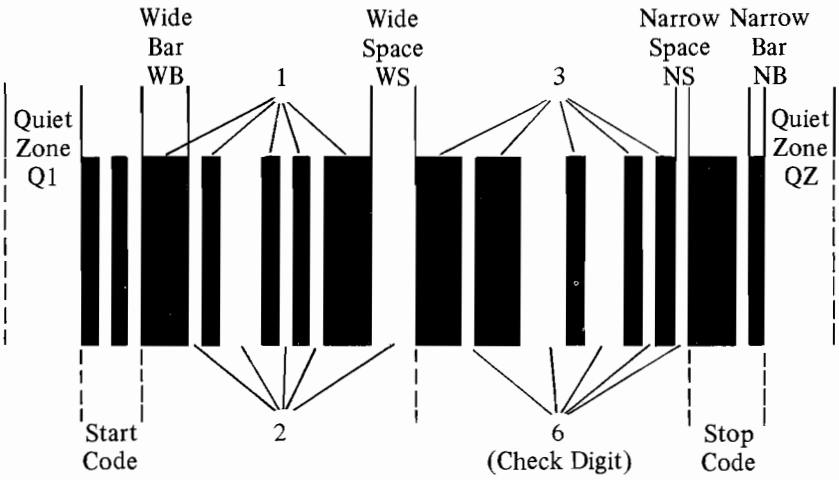
(6 x 9 x 0.381) → Length of characters

A quiet zone of at least 15.0 mm (0.6 ins.) must precede and follow the data.

Illustration. Figure 9-9 depicts an enlarged Interleaved 2 out of 5 bar code. Within, this Figure 1, 2 and 3 are the data and 6 is the check digit.

Table 9-8 Interleaved 2 out of 5 Minimum Character Dimensions

Parameter	Option 010		Option 054		Option 055	
	mm	inches	mm	inches	mm	inches
Minimum width of one character	2.754	0.108	3.420	0.135	1.710	0.068
Number of characters per mm and per inch with minimum character width	0.370	9.410	0.292	7.430	0.585	14.850
Minimum combined start and stop code width	2.754	0.108	3.420	0.135	1.710	0.068
Minimum quiet zone (with narrowest character)	15.0	0.6	15.0	0.6	15.0	0.6



Encoded data 1 2 3

$$\text{Where : } R_1 = \frac{WB}{NB} = \frac{WS}{NS} = \frac{WB}{NS} = \frac{WS}{NB} = 3$$

Figure 9-9 Enlarged Interleaved 2 Out Of 5 Bar Code

9-24 Code 39™

Code 39™ is a variable length, discrete, bidirectional alphanumeric bar code comprising a start/stop code (*) and a set of 43 characters (0 thru 9, A thru Z, minus, full stop, space, $, slash, plus and percentage). Each character is represented by nine elements, five bars and the four spaces between the bars. Three of the elements are wide (with a binary value of 1), the remaining six elements are narrow (binary value 0). The space between characters has no code value and is always narrow.

Table 9-9 lists the Code 39™ character set and depicts the code pattern; a "W" is a wide element (bar or space) and an "n" is a narrow element (bar or space).

Table 9-9 Code 39™ Character Set

Character	Bar Code Pattern (B-Bar, S-Space) B S B S B S B S B	Pictorial Bar Code Pattern	Bar Pattern	Space Pattern	Numeric Value Of Each Character For Check Digit
1	W n n W n n n n W		W n n n W	n W n n	1
2	n n W W n n n n W		n W n n W	n W n n	2
3	W n W W n n n n n		W W n n n	n W n n	3
4	n n n W W n n n W		n n W n W	n W n n	4
5	W n n W W n n n n		W n W n n	n W n n	5
6	n n W W W n n n n		n W W n n	n W n n	6
7	n n n W n n W n W		n n n W W	n W n n	7
8	W n n W n n W n n		W n n W n	n W n n	8
9	n n W W n n W n n		n W n W n	n W n n	9
0	n n n W W n W n n		n n W W n	n W n n	0
A	W n n n n W n n W		W n n n W	n n W n	10
B	n n W n n W n n W		n W n n W	n n W n	11
C	W n W n n W n n n		W W n n n	n n W n	12
D	n n n n W W n n W		n n W n W	n n W n	13
E	W n n n W W n n n		W n W n n	n n W n	14
F	n n W n W W n n n		n W W n n	n n W n	15
G	n n n n n W W n W		n n n W W	n n W n	16
H	W n n n n W W n n		W n n W n	n n W n	17
I	n n W n n W W n n		n W n W n	n n W n	18
J	n n n n W W W n n		n n W W n	n n W n	19
K	W n n n n n n W W		W n n n W	n n n W	20
L	n n W n n n n W W		n W n n W	n n n W	21
M	W n W n n n n W n		W W n n n	n n n W	22
N	n n n n W n n W W		n n W n W	n n n W	23
O	W n n n W n n W n		W n W n n	n n n W	24
P	n n W n W n n W n		n W W n n	n n n W	25
Q	n n n n n n W W W		n n n W W	n n n W	26
R	W n n n n n W W n		W n n W n	n n n W	27
S	n n W n n n W W n		n W n W n	n n n W	28
T	n n n n W n W W n		n n W W n	n n n W	29
U	W W n n n n n n W		W n n n W	W n n n	30
V	n W W n n n n n W		n W n n W	W n n n	31
W	W W W n n n n n n		W W n n n	W n n n	32
X	n W n n W n n n W		n n W n W	W n n n	33
Y	W W n n W n n n n		W n W n n	W n n n	34
Z	n W W n W n n n n		n W W n n	W n n n	35
–	n W n n n n W n W		n n n W W	W n n n	36
•	W W n n n n W n n		W n n W n	W n n n	37
SPACE	n W W n n n W n n		n W n W n	W n n n	38
$	n W n W n W n n n		n n n n n	W W W n	39
/	n W n W n n n W n		n n n n n	W W n W	40
+	n W n n n W n W n		n n n n n	W n W W	41
%	n n n W n W n W n		n n n n n	n W W W	42
*(Start/ Stop Code)	n W n n W n W n n		n n W W n	W n n n	–

Start/stop code. The character * must only be used for the start/stop code.

Check digit. It is recommended that the bar code should include a check digit. Code 39™ uses a modulo 43 check digit that is printed as the last data character before the stop code. The check digit is calculated from left to right on the bar code (excluding the start and stop code) using the following formula:

Note: The terminal must be programmed to read the check digit when it is encoded in the bar code (see Section 9-10).

1) Sum the assigned numeric values of all the characters in the message. (Table 9-9 lists the assigned numeric values).

2) Divide the summed total by 43.

3) The character (from Table 9-9) corresponding to the numeric remainder (from this division) is the check digit.

For example:

Message	*12345ABCDE/*
Sum of assigned numeric values	1+2+3+4+5+10+11+ 12+13+14+40 = 115
Divide the summed total by 43	115/43 = 2 remainder 29

The check digit is the character corresponding to the numeric remainder 29, i.e. T. The above message with a check digit is *12345ABCDE/T*.

Character width. The width of the Code 39™ characters may be determined from the relationship contained in Section 9-19 as follows. For example:

If,

$R_1 = \frac{WB}{NB} = \frac{WB}{NS} = \frac{WS}{NS} = \frac{WS}{NB} = 3$

(Where R_1 = ratio between wide elements and narrow elements)

$R_2 = \frac{CS}{NB} = \frac{CS}{NS} = 1$

(Where R_2 = ratio between space between characters and narrow elements).

Then,

WB (wide bar) = WS (wide space) = 3 units

NB (narrow bar) = NS (narrow space) = 1 unit

CS (space between characters) = 1 unit

Therefore each character comprises (see Table 9-6):

3 x WB + 6 x NB + 1 x CS = **16 units**

For each message, the combined start and stop code (*) comprises:

(3 x WB + 6 x NB + 1 x CS) + (3 x WB + 6 x WB) = **31 units**

Note: The stop code does not have a space between characters, CS.

Table 9-10 lists the minimum dimensions of characters, the combined start and stop code and the quiet zone; with $R_1 = 3$ and $R_2 = 1$. A label coded in Code 39™ can contain a maximum of 23 characters plus the start and stop code.

Note:

1) The dimensions in Table 9-10 are based on the minimum element size specifications listed in Table 9-1.

2) On any one label, all the characters must be the same width.

Table 9-10 Code 39™ Minimum Character Dimensions

Parameter	Option 010		Option 054		Option 055	
	mm	inches	mm	inches	mm	inches
Minimum width of one character	4.880	0.192	6.080	0.240	3.040	0.120
Number of characters per mm and per inch with minimum character width	0.208	5.290	0.164	4.180	0.329	8.360
Minimum combined start and stop code width	9.455	0.372	11.780	0.465	5.890	0.233
Minimum quiet zone (with narrowest character)	15.0	0.6	15.0	0.6	15.0	0.6

Typical example. If a bar code label is made up of six characters and the harrowest element (i.e. unit) is 0.381 mm (0.015 inches) wide; then with $R_1 = 3$ and $R_2 = 1$ the length of the encoded label is:

$$(6 \times 16 \times 0.381) + (1 \times 31 \times 0.381) = 48.387 \text{ mm } (1.905 \text{ ins})$$

Length of combined start and stop code

Length of characters

A quiet zone of at least 15.0 mm (0.6 inches) must precede and follow the encoded data.

Illustration. Figure 9-10 depicts an enlarged Code 39™ bar code. Within this figure; 1, 2 and 3 are the data and 6 is the check digit.

9-25 EAN/UPC Codes

The EAN8 and 13 and the UPCA and E are standard codes whose use, code size, print, structure, etc. is governed by standards authorities.

For full specifications on the EAN codes, refer to the: "General Specifications For The Article Symbol Marking" manual, obtained from:

EAN,
Rues des Colonies 28, Bte 8
1000 Brussels
Belgium

For full specifications on the UPC codes, refer to the "UPC Symbol Specifications" manual, obtained from:

Uniform Product Code Council, Inc.
7061 Corporate Way, Suite 106,
Dayton,
Ohio 45459
U. S. A.

For EAN/UPC, the minimum magnification factor for each option is as follows:

Option 010 - 0.78
Option 054 - 0.97
Option 055 - 0.48

9-26 POTENTIAL PRINTERS AND SUPPLIERS

For information on potential bar code printers and suppliers, contact your nearest HP sales and service office (see the addresses at the rear of this manual).

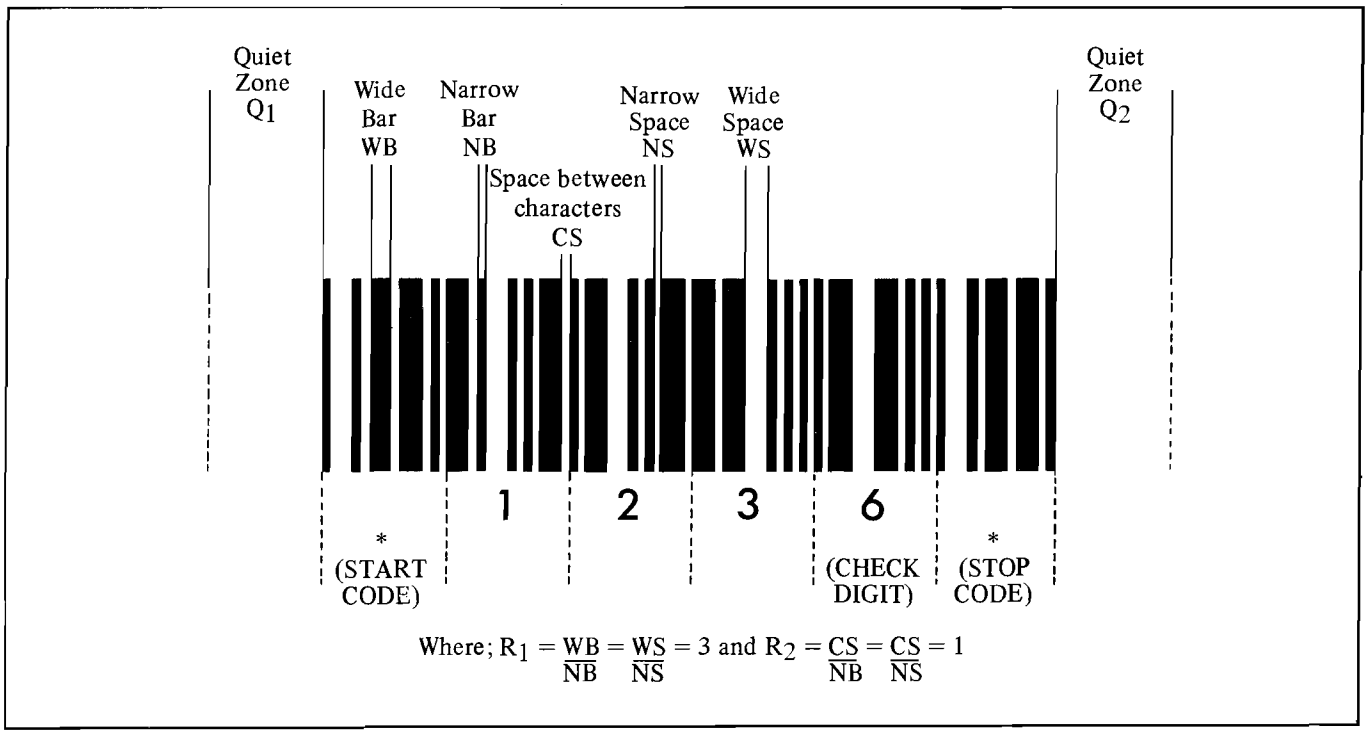


Figure 9-10 Enlarged Code 39™ Bar Code

SECTION 10

HP-IB CONTROLLER (OPTION 011)

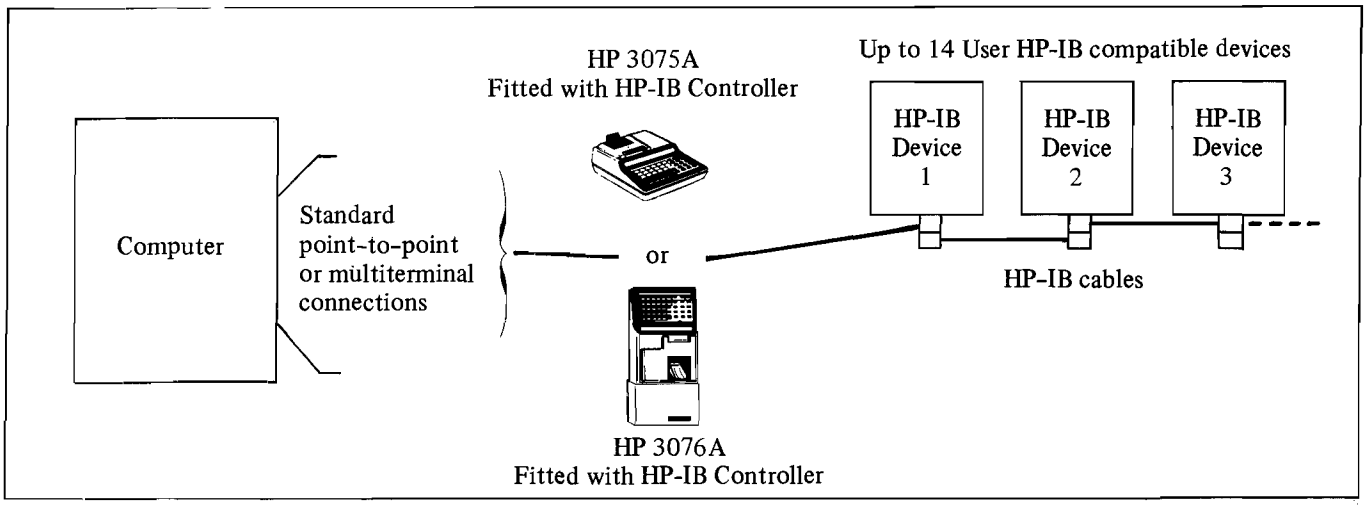


Figure 10-1 The HP-IB Controller Interface

10-1 INTRODUCTION

This section describes the use of HP-IB* (Hewlett-Packard Interface Bus) Controller on the 3075A and 3076A Data Capture Terminals. The HP-IB Controller is installed within the terminals to enable them to control several user HP-IB compatible devices.

Note: The HP-IB Interface is not used with the 3077A Time Reporting Terminal.

This option features a printed circuit HP-IB control card (i.e. HP-IB Controller) mounted in the terminal, which is wired to an HP-IB female connector on the terminal rear panel. The HP-IB connector may be connected via HP-IB cables to up to 14 user HP-IB compatible devices, for example:

1) Voltmeters, ammeters, power meters and LCR meters.
2) Logic state analysers
3) Thermometers
4) Spectrum analysers.
5) Counters

This enables several user devices (i.e. devices not offered as terminal options) to be connected to the terminal and program controlled via the terminal.

Note:

1) Only one HP-IB Controller must be used for each HP-IB cluster. i.e. NO HP-IB user device may be an HP-IB system controller.
2) The HP-IB Controller CANNOT be used to connect the terminal to the computer.

** The HP-IB is Hewlett-Packard's implementation of IEEE Standard 488-1978.*

The HP-IB Controller is microprocessor controlled to:

1) Decode and execute HP-IB high level COMMANDS
2) Control the HP-IB protocol (which is transparent to the computer program)
3) Convert serial computer data (in either ASCII or binary format) to parallel data required by the HP-IB devices, and vice-versa
4) Buffer data sent to the HP-IB devices (maximum 180 characters) and buffer data received from the HP-IB devices (maximum 180 characters).

The HP-IB Controller may also be operated in a local control mode (i.e. self operation) in order to allow the user to practice using the high level COMMANDS and develop and debug programs, see section 10-41 for details.

The HP-IB employs the following allowable subsets of the IEEE Standard 488-1978 controller interface functions:

C1 - system controller
C2 - send IFC (Interface Clear) and take charge
C3 - send REN (Remote Enable)
C4 - respond to SRQ (Service Request)
C28 - send I.F. (Interface) messages

Not provided by this controller are parallel poll and pass control, i.e. the HP-IB Controller always has control over the HP-IB bus (it cannot pass control to a connected device).

10-2 INSTALLATION

The HP-IB Controller is connected to the computer via the terminal point-to-point or multiterminal connector and is connected to the HP-IB compatible devices via an HP-IB cable. This latter cable plugs into the HP-IB female connector on the rear of the terminal (see figure 10-2), the other end of this cable plugs into the HP-IB female connector on the first HP-IB compatible device. Subsequent HP-IB devices are connected in any configuration (e.g. star, daisy-chain, etc.) to the first device using the HP-IB cable, as shown in figure 10-2. Four lengths of HP-IB cable are available, namely:

1 metre (3.3 feet) HP part number 10833A or 10631A
2 metres (6.6 feet) HP part number 10833B or 10631B
4 metres (13.2 feet) HP part number 10833C or 10631C
0.5 metres (1.6 feet) HP part number 10833D or 10631D

These cables conform to IEEE Standard 488-1978.

Up to 14 user HP-IB devices may be connected to one terminal fitted with an HP-IB Controller option. The communications between the HP-IB Controller and the devices are hardwired, i.e. no modems can be used. The only restrictions for connecting these devices are:

1) The maximum distance between the terminal and the first device is 4 metres (13.2 feet).
2) The maximum distance between devices is 2 metres (6.6 feet).
3) The maximum distance between the terminal and the last device is 20 metres (66 feet).

Note: For the 3076A terminal, as this terminal is housed in a 92904A Wall Mounting Cradle, the HP-IB cable must be passed through the cradle to be connected to the rear panel HP-IB female connector. The positioning of this cable within the cradle is described in section 15-13.

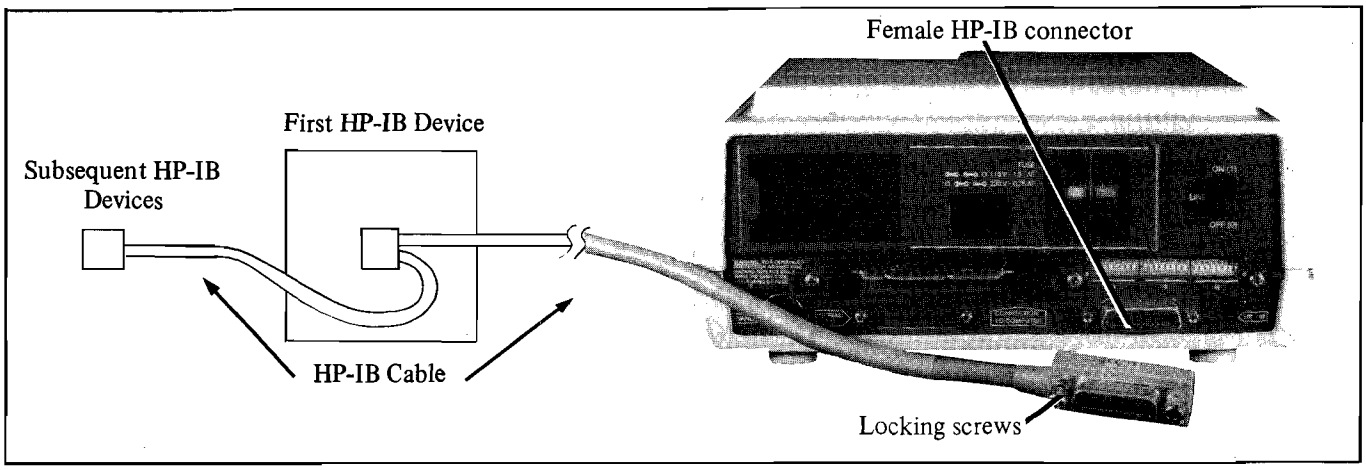
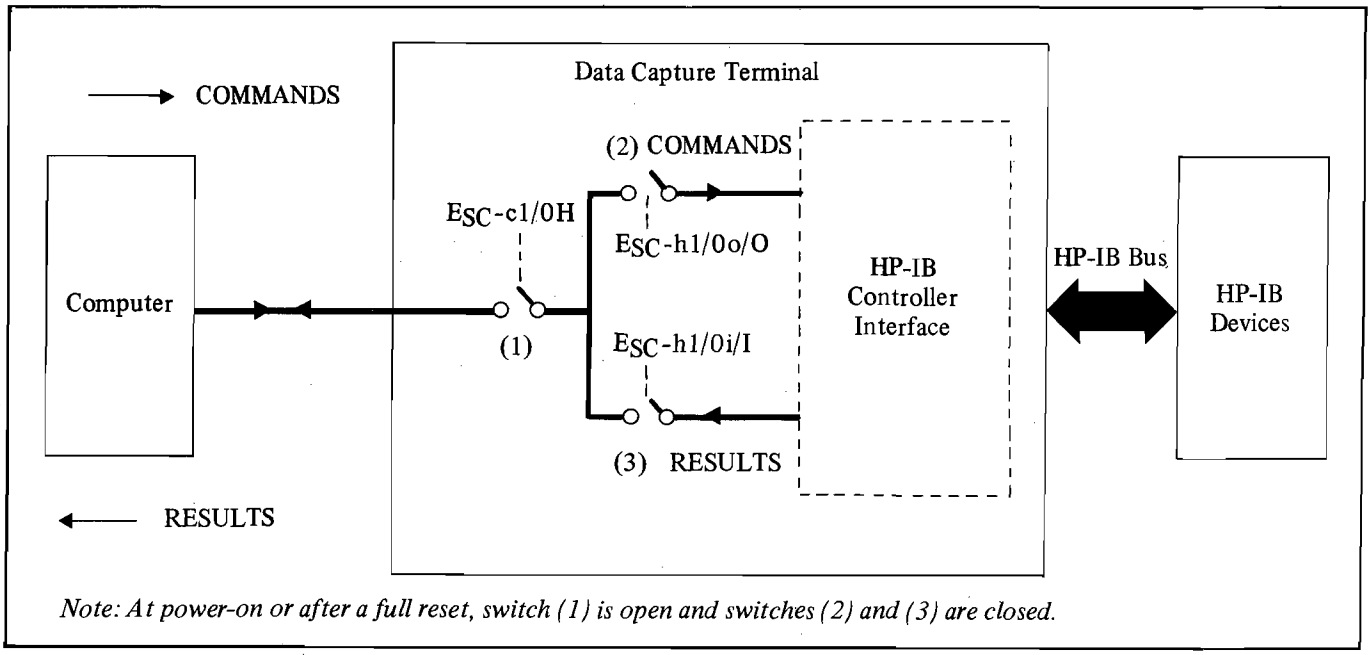


Figure 10-2 Typical HP-IB Cable Connections



Note: At power-on or after a full reset, switch (1) is open and switches (2) and (3) are closed.

Figure 10-3 HP-IB Controller Enabling/Disabling

10-3 HP-IB CONTROLLER AND THE 3075A/3076A TERMINALS

The HP-IB Controller is enabled by escape sequence ESC-c1H (see section 2-13), this allows the HP-IB Controller to respond to further program instructions and communicate with the HP-IB devices. At power-on or after a full reset (ESCE, see section 2-8) the HP-IB Controller is disabled.

The HP-IB Controller is programmed by the following escape sequences:

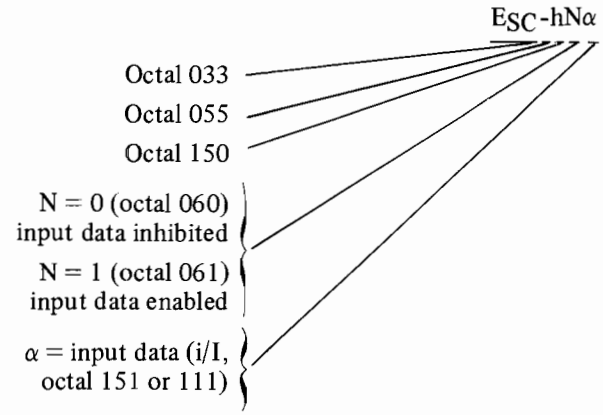
1) ESC-h1/0i/I	enable/disable input of HP-IB device RESULTS (i.e. DATA and STATUS).
2) ESC-h1/0o/O	enable/disable output of HP-IB DATA and COMMANDS.
3) ESC-h1/0d/D	display input data on terminal display.
4) ESC-h1/0m/M	multifield operation.
5) ESC-bNW	send binary data ($0 < N \leqslant 170$).

Note: ESC-h1/0i/I and ESC-1/0o/O are normally only required for point-to-point connections when the computer performs a remote echo of the read data.

These escape sequences are detailed in the following subsections.

10-4 ENABLE/DISABLE INPUT DATA

The transfer of RESULTS from the HP-IB Controller to the computer is controlled by escape sequence:

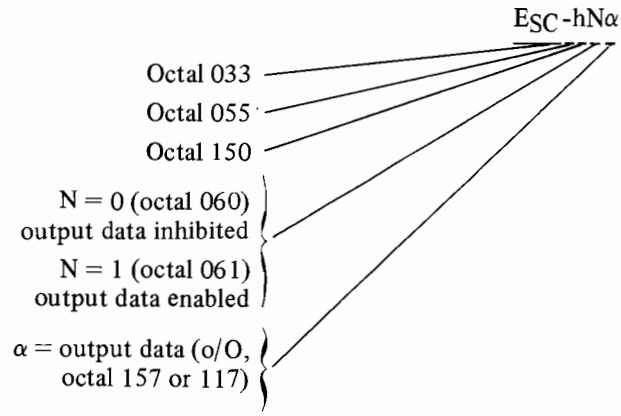


When enabled (i.e. N = 1) all RESULTS from the HP-IB Controller are transferred to the computer (figure 10-3 switch (3) closed). This assumes the HP-IB Controller is enabled by escape sequence ESC-c1H (figure 10-3 switch (1) closed).

When disabled (i.e. N = 0) no RESULT is sent from the HP-IB Controller to the computer. The RESULTS are stored within the HP-IB Controller (up to 180 characters) and are sent to the computer when the input of data is enabled.

10-5 ENABLE/DISABLE OUTPUT OF HP-IB DATA

The transfer of computer originated COMMANDS from the computer to the HP-IB Controller is controlled by escape sequence:



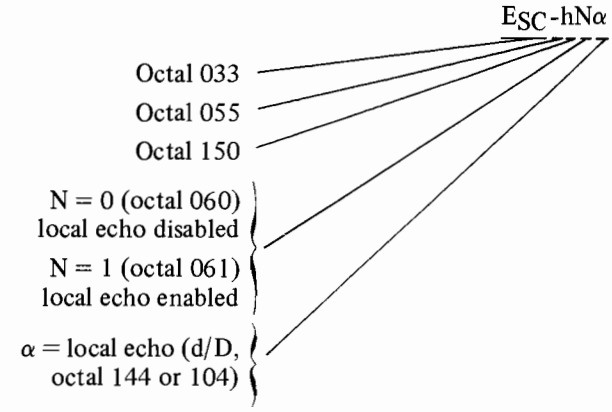
When enabled (i.e. N = 1) all COMMANDS from the computer are transmitted (output) to the HP-IB Controller for execution (figure 10-3 switch (2) closed). This assumes the HP-IB Controller is enabled by escape sequence ESC-c1H (figure 10-3 switch (1) closed).

When disabled (i.e. N = 0) the COMMANDS received from the computer are NOT transmitted to the HP-IB Controller.

Note: When the program reads the RESULTS from the HP-IB Controller ; if a remote computer echo of the DATA received by the computer is actioned, the output COMMAND must be disabled otherwise the RESULT will be returned to the HP-IB Controller and may cause a syntax error.

10-6 DISPLAY INPUT DATA

The local display of HP-IB device or HP-IB Controller originated DATA and STATUS information on the 3075A/3076A terminal display is controlled by escape sequence:



When enabled (i.e. N = 1) all ASCII DATA and STATUS information received by the HP-IB Controller (from the HP-IB devices) and all HP-IB Controller STATUS information will be displayed on the terminal display and (if fitted) the terminal printer.

Note: The RESULT header H0 or h0 (see section 10-17) precedes all data and is also displayed.

When N is set to 0 (or at power-on or after a full reset, $E_{SC}E$) the local display of input DATA (and STATUS information) is disabled.

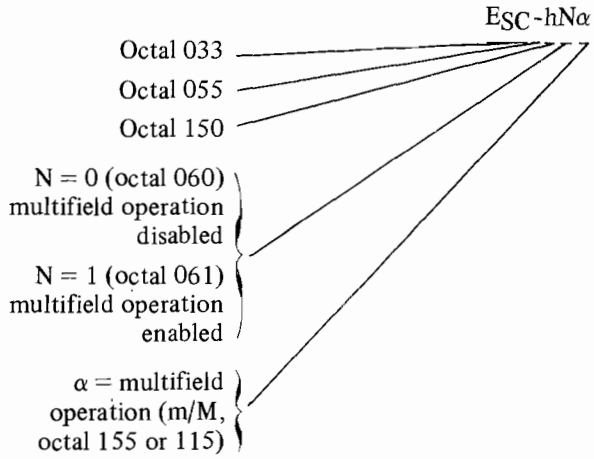
Note:
1) The local display of input DATA must be disabled when a remote computer echo is employed otherwise a double echo will be produced.
2) When binary DATA/STATUS is read it is recommended that the display is disabled to prevent spurious data being displayed.

10-7 MULTIFIELD OPERATION

Note: Multifield operation must only be used when the terminal is connected to the computer in the multiterminal mode.

Multifield operation allows multiple DATA entries in the same transaction. It prevents the HP-IB Controller entering its DATA to the computer at the end of a single DATA transaction. The DATA from several input modules (operating in multifield) is transmitted to the computer as one DATA block when DATA is entered either via the keyboard or via a terminal input module/option not in multifield operation. The only restriction to the multifield operation is that the total amount of DATA entered per transaction must NOT exceed 180 characters (output buffer size), see section 2-19 for details.

The multifield operation is selected for the HP-IB Controller by sending escape sequence:

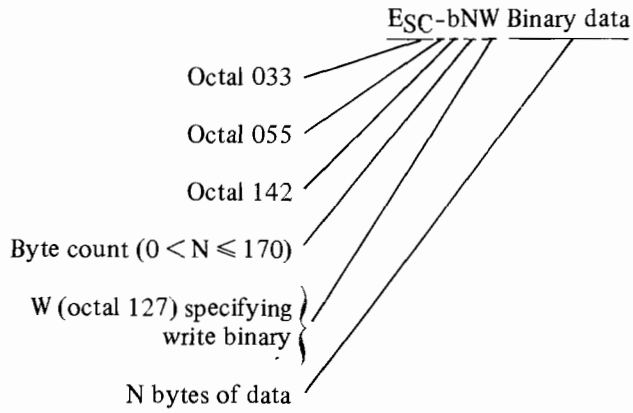


Multifield operation is disabled by setting N = 0 or at power-on or after a full reset.

10-8 SEND BINARY DATA

The computer may send binary DATA to the terminal for onward transmission to the HP-IB devices (see section 2-11). To enable this transfer:

1) The rear panel terminal configuration switches must be set as follows:
   a) Switch I-3 set to 0, specifying no parity (i.e. enabling an 8-bit binary DATA transfer for the point-to-point connections only).
   b) Switch III-2 set to 0, specifying transparent working (for multiterminal connections only, see section 14-16 for details).
2) All output devices NOT receiving the binary DATA (e.g. the terminal display and printer) must be disabled to prevent them receiving spurious DATA.
3) Escape sequence:



This sequence must precede the binary DATA to specify the number of bytes (from 0 to 170). Consequently, the N bytes following the character W are treated as binary DATA and are not interpreted as ASCII control characters by the terminal. After the specified number of bytes have been received, the terminal automatically assumes all subsequent characters are ASCII.

10-9 Backspace/Delete Last Entry

If the computer originated data is in ASCII format and contains the characters B_S (octal 010) and/or C_{AN} (octal 030) or D_{EL} (octal 177) they will action the following controls:

1) B_S (Backspace) clear the last character in the HP-IB Controller REQUEST buffer.
2) C_{AN} (Cancel) or D_{EL} (Delete), when this character corresponds to the delete last entry character specified on the rear panel terminal configuration switch II-3, it causes all the DATA received after the last message terminator to be cleared from the REQUEST buffer.

10-10 HP-IB CONTROLLER OPERATION

19 HP-IB high level COMMANDS are employed to control the operation of the HP-IB Controller over the HP-IB devices (see section 10-21). Within the HP-IB Controller, all HP-IB COMMANDS and computer originated data are buffered in a 180 character long REQUEST buffer, see figure 10-4. The task processor within the controller decodes all the COMMANDS and executes the COMMAND instructions. If a REQUEST causes a RESULT to be generated, the RESULT is buffered in a 180 character long RESULT buffer before being sent to the computer.

10-11 REQUEST FORMAT

The 19 HP-IB high level COMMANDS are listed in Table 10-1. The format of these COMMANDS is described in the following sub-paragraphs.

10-12 **Requests**

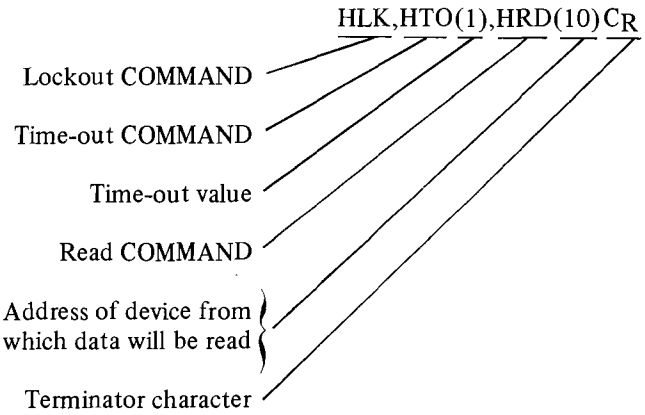
A REQUEST may comprise a string of one or more discrete high level COMMANDS. The individual COMMANDS may, if required, be separated by commas to improve readability.

Note: REQUESTS sent by the computer are only decoded by the HP-IB Controller when they are terminated by the relevant terminator character. The terminator character is normally automatically appended at the end of a message by the terminal system driver program and must not be suppressed by the programmer. The terminators are:

1) For multipoint connection C_R (Carriage Return = octal 015), a L_F (Line Feed = octal 012) following the C_R is ignored by the HP-IB Controller.

2) For point-to-point connections, C_R or a customized terminator.

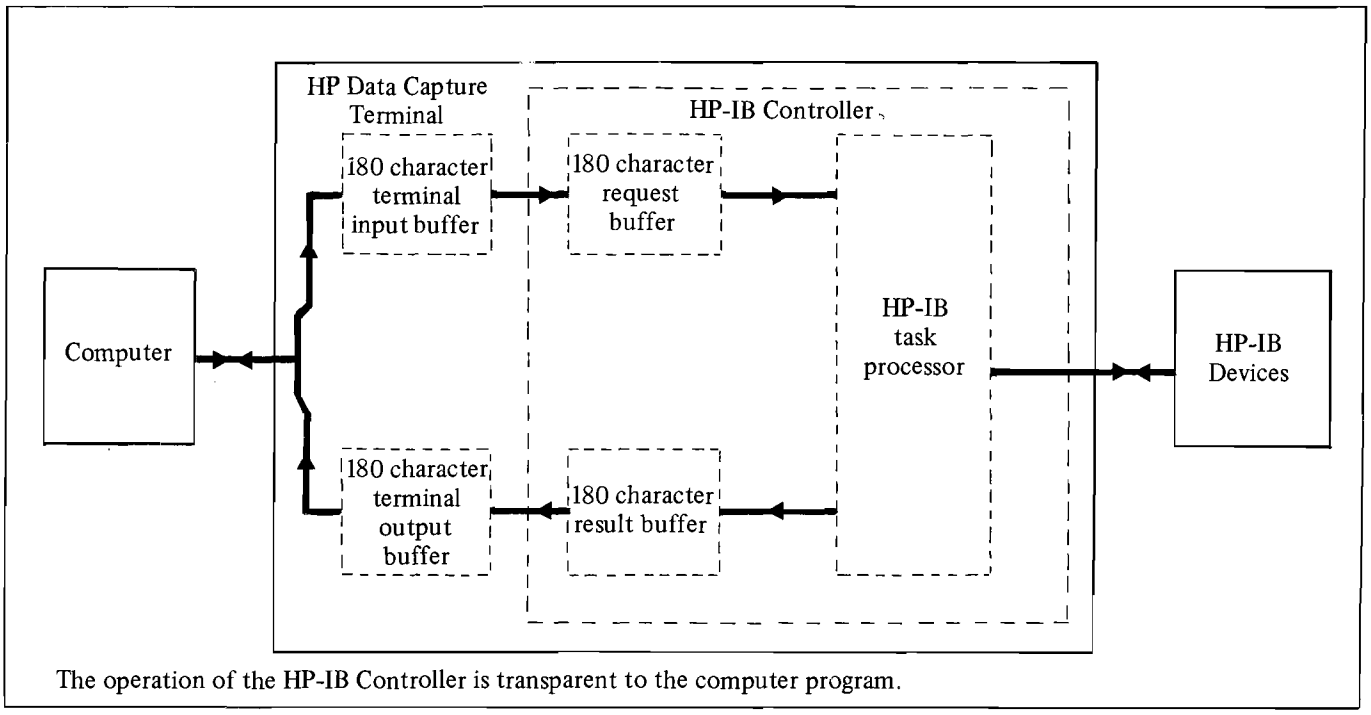
A typical example of a REQUEST is:



This REQUEST causes all the devices to be locked out (disabled) from local control, sets the time-out value as one second and reads from device address decimal 10.

The computer may send several consecutive REQUESTS, provided a single COMMAND does NOT extend from one REQUEST to the next. For example, the following Fortran program statement is illegal because the command HRD (15;12) is extended over two REQUESTS:

```
      WRITE (11,100)
      WRITE (11,110)
100   FORMAT ("HTO(10),HRD")
110   FORMAT ("(15;12),HSP")
```



The operation of the HP-IB Controller is transparent to the computer program.

Figure 10-4 HP-IB Controller

10-13 Types of Command

The 19 COMMANDS are split into two categories:

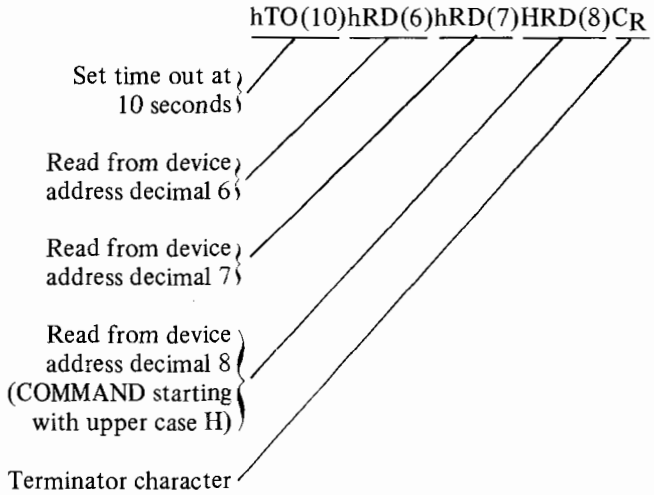
1) Priority COMMANDS that are executed immediately they are received without waiting for the completion of the previous COMMAND, i.e. HFR (full reset) and HPS (priority HP-IB Controller status).
2) Standard COMMANDS that are executed sequentially in the order in which they are received, i.e. the remaining 17 COMMANDS.

10-14 Linked (Concatenated) Standard Commands

Within a REQUEST, if the first character of a standard COMMAND is lower case h (octal 150), the execution of the COMMAND is delayed until a standard COMMAND starting with upper case H (octal 110) is received. This allows several standard COMMANDS to be linked (i.e. chained) so that the execution of these COMMANDS is synchronised and the RESPONSES to the various COMMANDS is in the form of a single RESULT (i.e. a single Fortran read), see section 10-18 for details.

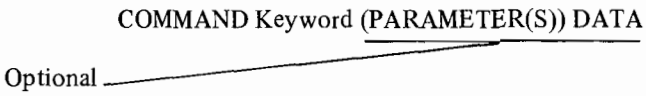
Note:
1) Priority COMMANDS (i.e. HFR and HPS) must not be linked to other COMMANDS and must always start with upper case H.
2) If in a REQUEST containing linked COMMANDS all the COMMANDS start with lower case h, the REQUEST is NOT actioned by the HP-IB Controller until an upper case H COMMAND is received in a subsequent REQUEST.

An example of a REQUEST containing linked COMMANDS is:



10-15 Command Structure

Each COMMAND is structured as follows:



Note: Blanks (i.e. spaces octal 040) between COMMAND characters are of no significance and may be included in the COMMAND to improve readability.

Command keyword. All COMMANDS start with a three ASCII character mnemonic keyword (see table 10-1). Seven of the available COMMANDS comprise the keyword only ; i.e. HFR, HCS, HIC, HLC, HLK, HPS and HSP. The remaining twelve COMMANDS may include one or more PARAMETERS that affect the execution of the COMMAND.

Parameters. These must be contained between parentheses (round brackets, octal 050 and 051) after the keyword. The PARAMETERS may consist of:

1) HP-IB device addresses (to which the COMMAND and/or DATA is destined).
2) Time out value (specified in decimal notation only).
3) Read terminator characters and write terminator characters.

The PARAMETERS may be specified in decimal, octal or hexadecimal notations. To distinguish between these notations, the following characters must prefix the PARAMETERS.

1) Decimal notation: NO prefix required.
2) Octal notation: the character % (octal 045) must prefix the PARAMETERS.
3) Hexadecimal notation: the character ! (octal 041) must prefix the PARAMETERS.

Up to 14 devices may be connected to the HP-IB Controller. Each device must have a discrete primary address in the range:

Decimal 00 thru 30 = octal 00 thru 036 = hexadecimal 00 thru 1E.

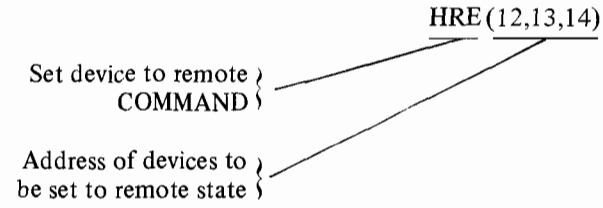
For each primary address, there may also be secondary (i.e. sub) addresses in the range:

Decimal 00 thru 31 = octal 00 thru 37 = hexadecimal 00 thru 1F.

Note: Device addresses may be specified using one, two or three digits. Any zeroes prefixing address digits one thru nine are of no significance.

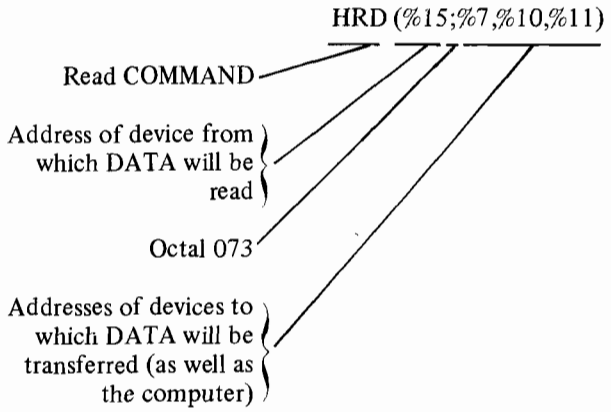
Parameter delimiters. Where more than one PARAMETER is specified, the PARAMETERS must be separated as follows:

1) Commas (octal 054) if the PARAMETERS are the same type (e.g. addresses of devices to receive DATA). For example:



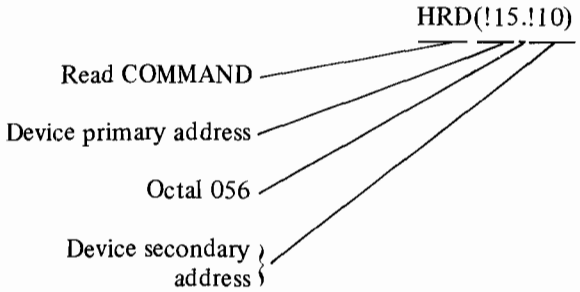
This COMMAND sets HP-IB devices with decimal addresses 12, 13 and 14 to the remote state (i.e. computer control).

2) Semi colons (; octal 073) if the PARAMETERS are different (e.g. addresses of devices receiving DATA and the address of device transmitting DATA), for example:



This COMMAND causes DATA to be read from HP-IB device with an octal address of 15 and transferred to the computer and HP-IB devices with addresses octal 7, 10 and 11.

3) A decimal point (. octal 056) to separate a device primary address and secondary address (i.e. sub address), for example:



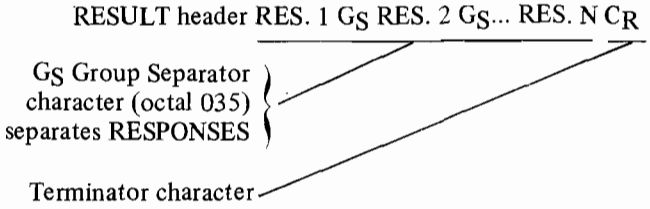
This COMMAND causes DATA to be read from secondary address hexadecimal 10 of the HP-IB device with a primary address of hexadecimal 15.

Data Transfers. DATA destined for the HP-IB devices can only be transferred from the computer to the device using the HWR COMMAND (see section 10-39). Blanks (i.e. spaces octal 040) contained in the DATA will be sent to the device.

The DATA can be in either ASCII or binary format.

10-16 RESULT FORMAT

Some COMMANDS generate a RESPONSE to the computer (i.e. HRD, HCS, HDS and HPS), whereas other COMMANDS do not (e.g. HTO, HWR, etc.). One or several RESPONSES are sent to the computer within a RESULT, which has the following format:



10-17 **Result Header**

A two byte header prefixes each RESULT in order to distinguish between the standard or priority COMMAND that produced it. If the first character of the header is lower case h (octal 150), the RESULT was produced by a standard COMMAND. If the first character of the header is upper case H (octal 110), the RESULT was produced by a priority COMMAND. The second byte of the header is always 0 (octal 060).

The following Fortran statement shows a typical REQUEST and RESULT.

For Fortran statement:

```
      WRITE (12,20)
      WRITE (12,30)
      READ (12,40) IBUF1
      READ (12,40) IBUF2
      READ (12,40) IBUF3
20    FORMAT ("hWR(6) 'HABIT', HRD(7), hWR(11)
     $'HICKORY',HRD(12)")
30    FORMAT ("HPS")
40    FORMAT ("8A2")
```

Three RESULTS are generated, each comprising a single RESPONSE.

```
H0A @@@@@
h012.5V
h0123.2
```

Note:
1) Write statements comprising ASCII DATA characters that are equivalent to high level COMMAND keywords (e.g. HICKORY) are only interpreted as DATA when the DATA is contained between delimiter characters (see section 10-39).
2) 8A2 specifies the maximum length of the data transfer. i.e. 8 x 2 byte words (required by the Fortran program).
3) For the local display of the RESULTS, when using the Alphanumeric Display the lower case h is displayed as its upper case equivalent, H. When using the CRT Display the keyboard must be disabled and the standard size character screen enabled to display lower case h.

Three Fortran read statements are necessary to obtain the RESULTS generated by these two requests:

1) One will obtain the HPS (i.e. status) DATA (H0A @@@@@)
2) One will obtain the RESULT from the HRD(7) read COMMAND (h012.5V).
3) One will obtain the RESULT from the HRD(12) read COMMAND (h0123.2).

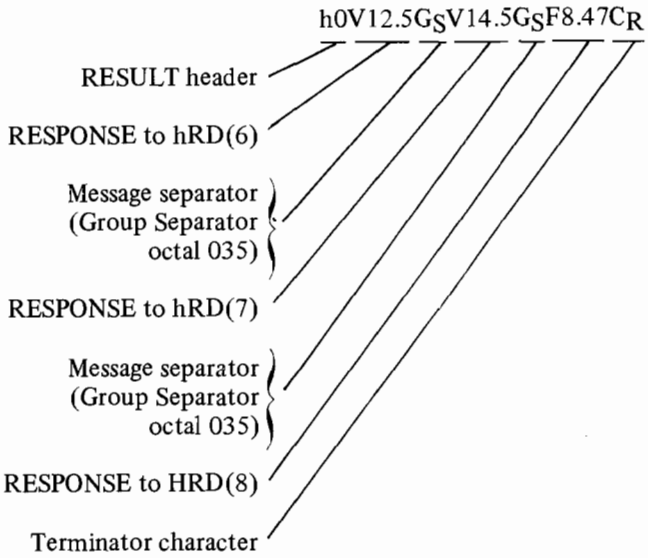
Although the HPS COMMAND was sent after the HRD(7) COMMAND, its RESULT will probably be returned earlier because HPS is a priority COMMAND (however this is not mandatory).

10-18 Results From Linked Commands

If in a group of linked COMMANDS there is at least one generating a RESPONSE to the computer, this RESPONSE is sent to the computer (within a RESULT) before the next group of linked COMMANDS (if any) are executed. Otherwise the next group of linked commands (if any) are immediately executed.

The RESPONSES obtained from several linked COMMANDS are in the form of a single RESULT. Within this RESULT, the RESPONSES are in the same order in which they were specified in the REQUEST. Adjacent RESPONSES are separated by the ASCII Group Separator character (G_S = octal 035).

An example of a RESULT to the linked COMMAND REQUEST described in section 10-14 is:



When linked COMMANDS are sent to the HP-IB Controller, each time a COMMAND starting with upper case H is received, the RESPONSE (if any) to this COMMAND, and all the RESPONSES from previous COMMANDS (starting with lower case h) since the last upper case H COMMAND, are sent to the computer as a single RESULT. For example:

If REQUEST 1 comprises:
hTO(10),hRD(6),hRD(7),HRD(8),hRD(9),hRD(10)C_R

and REQUEST 2 comprises:
hRD(11),hRD(12),HRD(13)C_R

Two Fortran read statements are required, one to read the RESULT obtained from:
hRD(6),hRD(7),HRD(8)

and one to read the RESULT obtained from:
hRD(9),hRD(10),hRD(11),hRD(12),HRD(13)

10-19 Response Data And Status Information

DATA can be transferred from the HP-IB devices to the computer using the HRD COMMAND (see section 10-33). The DATA may be in either ASCII or binary format. STATUS information may be transferred from:

1) The HP-IB devices to the computer using either the HDS or HSP COMMAND (see sections 10-25 and 10-36).
2) The HP-IB Controller to the computer using either the HCS or HPS COMMAND (see sections 10-23 and 10-32 respectively).

10-20 WRITE/READ STATEMENT SEQUENCE

To avoid an input overflow, no more than 180 data characters/high level COMMAND characters may be sent to the HP-IB Controller between read statements. The read statement must be used to re-synchronise the HP-IB Controller to the user's program. Four commands may be used to generate the read statement data (to the computer) and thus avoid an input overflow, namely HCS, HDS, HRD and HSP.

Note: The priority status COMMAND HPS is actioned immediately it is received (before any other COMMANDS are processed). Consequently, the HPS COMMAND cannot be used in this procedure.

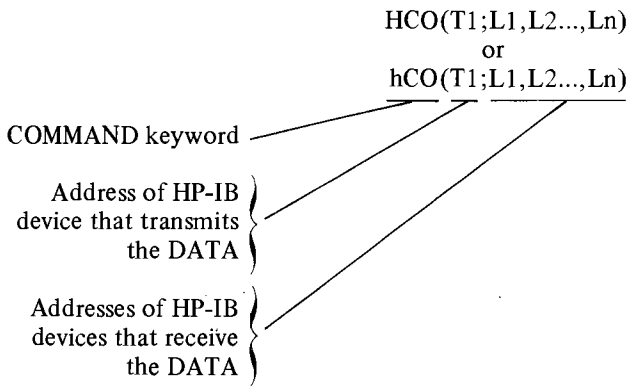
10-21 HP-IB HIGH LEVEL COMMANDS

Table 10-1 lists the keywords of the 19 HP-IB high level COMMANDS. These keywords use ASCII characters, the ASCII character set being listed in Appendix A.

The HP-IB COMMANDS are described in alphabetical order in the following sub-sections.

10-22 HCO Communications Between Two HP-IB Devices Command

Typical format:



This is a standard COMMAND that causes the DATA transmitted by device T1 to be transferred to devices L1 to Ln until the DATA is terminated (see the HRT COMMAND, section 10-35).

Note: DATA is NOT sent to the computer using this COMMAND.

Table 10-1 HP-IB High Level COMMAND Keywords

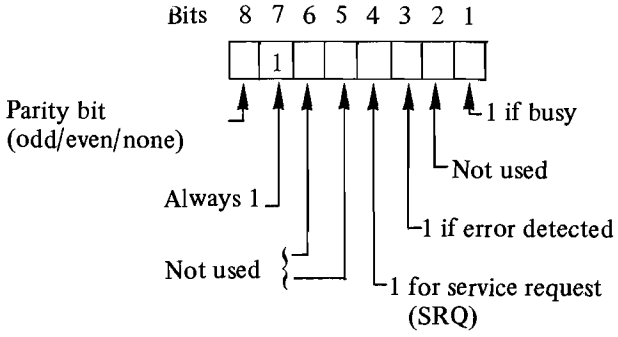
COMMAND	Description	Type of COMMAND	Detailed in section
HFR	Full reset	Priority	10-26
HPS	Priority HP-IB Controller status		10-32
HCO	Communications between two HP-IB devices	Standard	10-22
HCS	Standard HP-IB Controller status		10-23
HDC	Clear HP-IB device		10-24
HDS	HP-IB device status		10-25
HIC	Re-initialise HP-IB Bus		10-27
HLC	Clear HP-IB local lockout		10-28
HLK	Lockout HP-IB devices (local lockout)		10-29
HLO	Set HP-IB device to local state		10-30
HPL	Set device polling list		10-31
HRD	Read from HP-IB device		10-33
HRE	Set HP-IB device to remote state		10-34
HRT	Set terminator character for read command		10-35
HSP	Serial poll		10-36
HTO	Set time-out		10-37
HTR	Trigger HP-IB device		10-38
HWR	Write to HP-IB device		10-39
HWT	Set terminator character for write command		10-40

10-23 HCS HP-IB Controller Status Command

Typical format: HCS or hCS

This is a standard COMMAND comprising the keyword only, that may be used to obtain the HP-IB Controller STATUS (see also the HPS COMMAND section 10-32). The controller STATUS RESPONSE comprises a string of six STATUS bytes, namely:

1) **Byte 1**: General HP-IB Controller STATUS



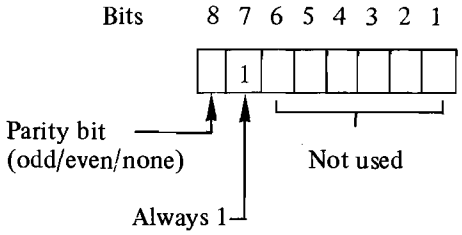
STATUS byte 1 indicates the general STATUS of the HP-IB Controller.

Bit 1 is set to 1 if the controller is busy, i.e. there are COMMANDS being executed or awaiting execution or DATA in the controller REQUEST buffer. Bit 1 returns to 0 when the controller is idle (i.e. the REQUEST buffer is empty or no COMMANDS are being executed).

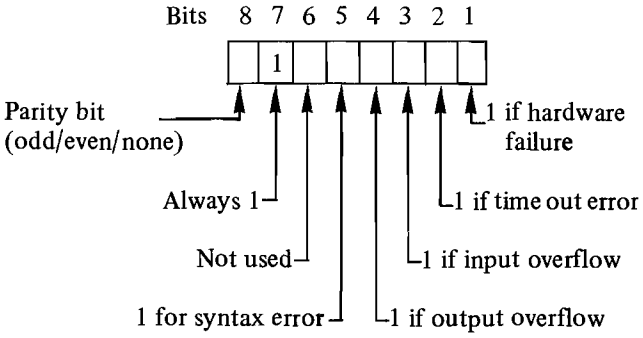
Bit 3 is set to 1 if an error is detected (byte 3 of the controller STATUS indicates the type of error detected). This also causes a computer break to be generated (see section 2-16). Bit 3 is set to 0 when the error has been cleared and COMMAND HFR has been received.

Bit 4 is the image of the service request (SRQ) line. It is set to 1 when SRQ is set true (i.e. a device has requested service) and is set to 0 when SRQ is false.

2) **Byte 2**: Not used



3) **Byte 3**: Error Condition STATUS



STATUS byte 3 indicates the HP-IB error:

Bit 1 is set to 1 if a hardware failure occurs ; i.e. failures on the HP-IB Bus (e.g. a line clamped to the high level, two data lines being short circuited, etc.). Bit 1 is reset to 0 when the error is cleared.

Bit 2 is set to 1 if a time-out error occurs ; i.e. a COMMAND is not executed in the time set by the set time-out COMMAND HTO (see section 10-37) or the power-on default time-out value (10 seconds).

Bit 3 is set to 1 if an input overflow error occurs ; i.e. a REQUEST sent by the computer contains more than 180 characters of data and/or linked COMMANDS.

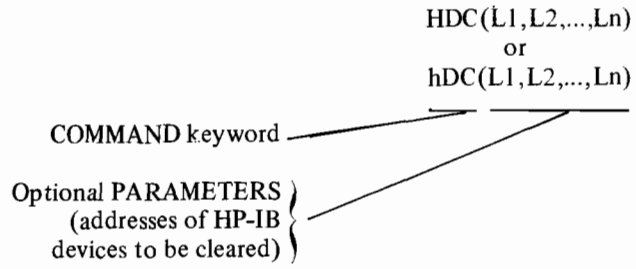
Bit 4 is set to 1 if an output overflow error occurs ; i.e. a RESULT obtained by a read (or linked read) COMMAND contains more than 180 characters/bytes.

Bit 5 is set to 1 if a syntax error occurs ; i.e. an error in the syntax of a COMMAND prevents the COMMAND being decoded by the HP-IB Controller. For example HWR being wrongly sent as HVR or an address being specified outside the allowable address range.

4) **Bytes 4, 5 and 6**: Not used (same bit configuration as byte 2).

10-24 HDC Clear HP-IB Device Command

Typical format:



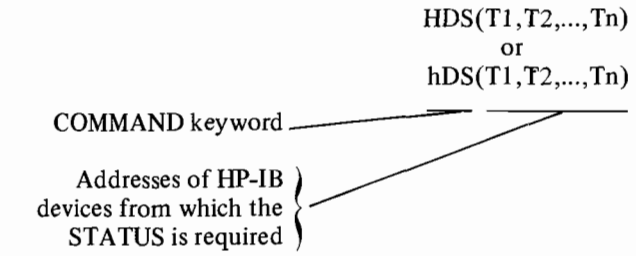
This is a standard COMMAND used to clear the specified HP-IB devices (i.e. initialise the devices to a pre-defined state). If no PARAMETERS (i.e. device addresses) are specified, all the connected HP-IB devices are cleared.

In terms of elementary HP-IB commands it means:

1) The SDC command (Selected Device Clear, octal 004) is sent to addressed devices L1,L2,...,Ln.
2) If no device is specified, the DCL command (Device Clear, octal 024) is sent on the HP-IB Bus.

10-25 HDS HP-IB Device Status Command

Typical format:



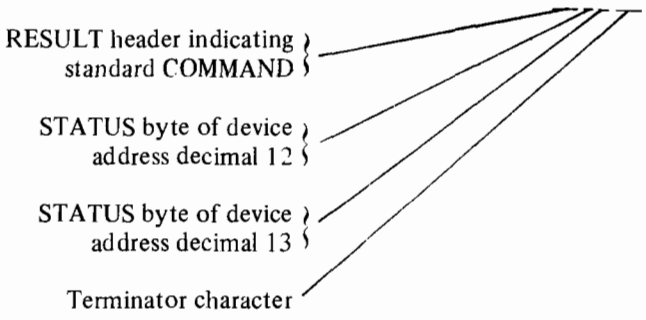
This is a standard COMMAND that causes the HP-IB Controller to request the STATUS of the HP-IB devices T1,T2,...,Tn. Each device responds with its STATUS byte, bit 7 of this byte indicates a device service request (SRQ).

Note: The bit pattern of the STATUS byte depends upon the device being used and can be in either binary or ASCII format.

The HP-IB Controller sequentially returns to the computer the same number of STATUS bytes as there were addresses specified in the COMMAND. Bytes are returned in the order they were specified. For example:

For REQUEST: HDS(12,13)

A typical RESULT is: h054C$_R$



If the STATUS information is in binary the terminal configuration switches must be set as follows:

1) Switch I-3 set to 0, indicating no parity (i.e. enabling an 8-bit binary data transfer for point-to-point connections only).
2) Switch III-2 set to 0, indicating transparent working (for multiterminal connections only, see section 14-16).

In addition, the local display of input DATA (see section 10-6) must be inhibited to prevent spurious DATA being displayed and printed.

In terms of elementary HP-IB commands it means the controller:

1) Issues the SPE command (Serial Poll Enable).
2) Obtains the STATUS byte of all the specified devices.
3) Issues the SPD command (Serial Poll Disable).

10-26 HFR Priority Full Reset Command

Typical format: HFR

HFR is a priority COMMAND (i.e. it must always be specified using upper case H and cannot be linked to other COMMANDS) comprising the keyword only that resets the HP-IB Controller to the power-on state.

If an error is detected the HP-IB Controller will only respond to the HFR COMMAND (to re-start operations) and the priority HPS COMMAND to obtain the HP-IB Controller STATUS, see section 10-32), all other HP-IB COMMANDS are ignored.

If an error is detected the HP-IB Controller causes a break to be sent to the computer (see section 2-16 for details). Upon receiving the break, the computer can transmit a terminal status request (escape sequence E_{SC} ^, see section 2-14) to determine the reason for the break. Bit 4 of terminal STATUS byte 3 (Interrupt STATUS) is set to 1 when the break is originated by the HP-IB Controller. If this bit is set, the priority Controller STATUS COMMAND HPS may be issued by the computer to obtain the HP-IB Controller STATUS. Byte 1 of the Controller STATUS provides general STATUS information (bit 3 is set to 1 when an error is detected). Byte 3 of the Controller STATUS provides the error condition STATUS (e.g. hardware failure, time-out error, data overflow or syntax error). The HFR COMMAND may then be issued by the computer to cause the following to occur:

1) The HIC (re-initialise HP-IB Bus) COMMAND procedure to be executed (see section 10-27).
2) The HP-IB Controller STATUS bits to be cleared (see section 10-23).
3) The polling list to be cleared (see section 10-31).
4) NO read terminator to be specified (see section 10-35).
5) NO write terminator to be specified (see section 10-40).
6) The time-out value to be set at the power-on default value of 10 seconds (see section 10-37).
7) The REN line is set false (device returns to local control).

10-27 HIC Re-initialise HP-IB Bus Command

Typical format: HIC or hIC

HIC is a standard COMMAND, comprising the keyword only, that causes all interchanges on the bus to be terminated.

In terms of the HP-IB protocol this means that the IFC control line (Interface Clear) is set low (true) for a time long enough to terminate all data communications between the HP-IB Controller and the HP-IB devices. The REN control line (Remote Enable) is not affected.

10-28 HLC Local/Clear HP-IB Lockout State Command

Typical format: HLC or hLC

This is a standard COMMAND, comprising the keyword only, that:

1) Clears the local (i.e. device) lockout messages.
2) Returns ALL the connected devices to local control (i.e. device front panel control) by clearing the HLK COMMAND, see section 10-29.

In terms of the HP-IB protocol it means the REN control line (Remote Enable) is set high (false).

10-29 HLK Lockout HP-IB Devices (Local Lockout) Command

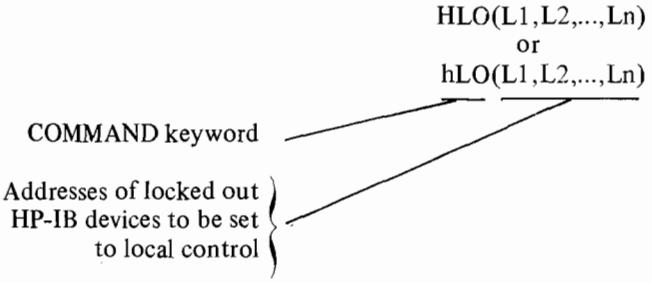
Typical format: HLK or hLK

This is a standard COMMAND comprising the keyword only. This COMMAND disables the local/remote switch on the devices, preventing an operator from changing the devices to local control by using the local switch (on the device).

In terms of elementary HP-IB commands it means that the LLO command (Local Lock Out, octal 021) is sent on the bus.

10-30 HLO Set HP-IB Device To Local State Command

Typical format:

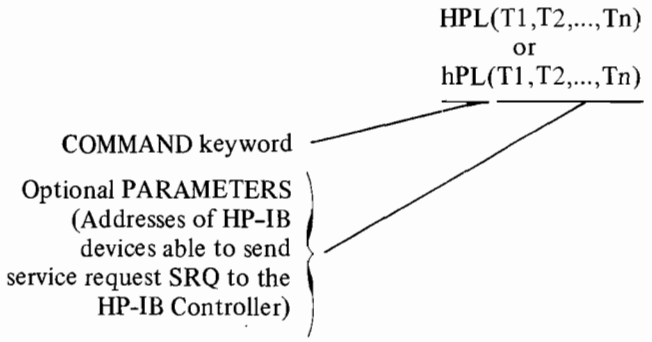


This is a standard COMMAND that causes the specified HP-IB devices to be set to local control.

In terms of elementary HP-IB commands it means that the GTL command (Go To Local, octal 001) is sent to devices L1,L2,...,Ln.

10-31 HPL Set HP-IB Device Polling List Command

Typical format:



A polling list is a table (stored within the HP-IB Controller) containing the addresses of devices that are able to request service from the HP-IB Controller. The HPL COMMAND is used with the serial poll HSP COMMAND (see section 10-36) to obtain both the address and the STATUS of a device requesting service.

Note: Only primary addresses may be specified in the polling list. The HDS COMMAND (see section 10-25) may be used to obtain the status from the secondary addresses.

HPL is a standard COMMAND that can be sent at any time to cancel the current polling list and set up a new list. The COMMAND specifies the sequence in which the associated HP-IB devices will be serially polled. If no PARAMETERS (i.e. addresses) are specified, the polling list is cleared and no serial poll can be issued. At power-on, after a full reset or after the HFR COMMAND the polling list is cleared.

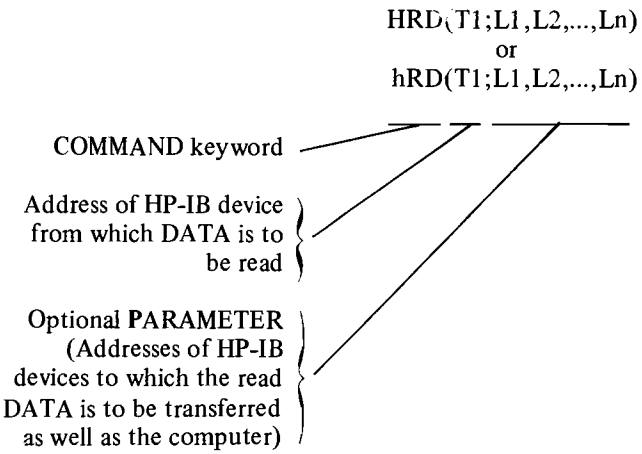
10-32 HPS Priority HP-IB Controller Status Command

Typical format: HPS

This is a priority COMMAND (i.e. it must always be specified using upper case H), comprising the keyword only, that can be sent at any time to immediately (i.e. not sequentially) obtain the HP-IB Controller STATUS. This STATUS comprises the string of six STATUS bytes used by the HCS COMMAND, see section 10-23 for details.

10-33 HRD Read From HP-IB Device Command

Typical format:



This is a standard COMMAND used to read DATA from a device (T1) and transfer it to the computer (and other HP-IB devices L1,L2,...,Ln if required).

The DATA can be in either ASCII or binary format. If in binary, the terminal configuration switches must be set as follows:

1) Switch I-3 set to 0, indicating no parity (i.e. enabling an 8-bit binary data transfer for point-to-point connections only).
2) Switch III-2 set to 0, indicating transparent working (for multiterminal connections only).

In addition, the local display of input DATA (see section 10-6) must be inhibited to prevent spurious DATA being displayed.

The HP-IB Controller reads DATA from device T1 until either:

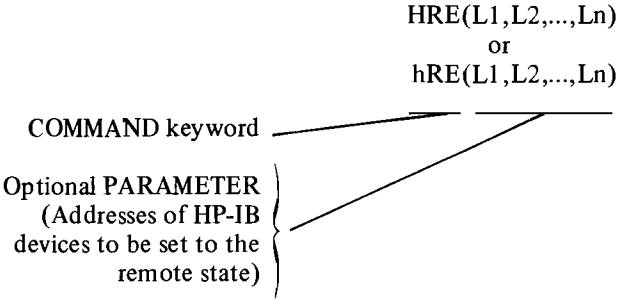
1) A message terminator character is detected (for details see COMMAND HRT, section 10-35).

or

2) The device EOI control line (End Or Identify) is set true, i.e. low.

10-34 HRE Set HP-IB Device To Remote State Command

Typical format:

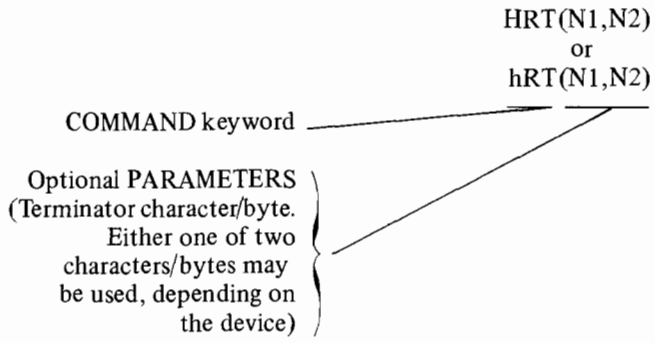


This is a standard COMMAND that immediately sets the addressed devices to the remote state (i.e. computer control). If no PARAMETERS are specified (i.e. addresses), the HP-IB devices are only set to remote when they are addressed to receive DATA using COMMANDS HCO,HDC, HLO and/or HWR.

In terms of the HP-IB protocol, this COMMAND causes the HP-IB Controller to set the REN control line (Remote Enable) true (i.e. low) and if HP-IB devices are specified these devices are addressed as listeners.

10-35 **HRT** **Select Read Command Terminator Character**

Typical format:



This is a standard COMMAND that can be sent at any time to specify the characters/bytes that will terminate DATA sent to the HP-IB Controller by the HP-IB devices. The HRT COMMAND may also be used to cancel the current terminator character(s) and set up new terminator character(s). If the COMMAND is used with no PARAMETERS specified, the read terminators are cleared.

This COMMAND is normally sent when one or more connected HP-IB devices are unable to use the EOI (End Or Identify) control line to terminate their DATA messages i.e. EOI true normally terminates DATA, but the HRT COMMAND allows those HP-IB device not able to use EOI to terminate their DATA via an ASCII terminator character. Typical characters are:

1) C_R (Carriage Return = decimal 13 = octal 015 = hexadecimal D).
2) L_F (Line Feed = decimal 10 = octal 012 = hexadecimal A).

For example, a typical command may be HRT (13,10).

If no PARAMETERS are specified (or at power-on, or after a full reset or after HFR), all the HP-IB devices can only terminate their messages by setting EOI control line true.

10-36 **HSP** **Serial Poll Command**

Typical format: HSP or hSP

A serial poll comprises a serial request to HP-IB devices to return their STATUS byte to the HP-IB Controller.

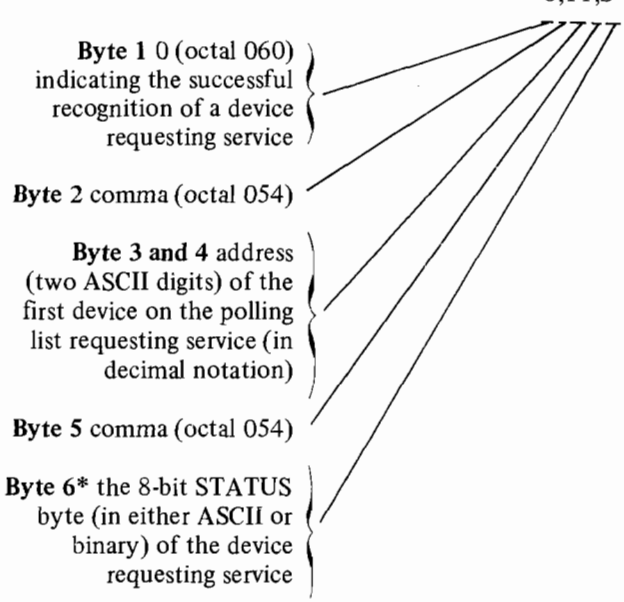
HSP is a standard COMMAND (comprising the keyword only) that is used to initiate a serial poll to the HP-IB devices in the sequence specified by the HPL COMMAND (see section 10-31).

When RESULTS are NOT being sent to the computer, the HP-IB Controller monitors the HP-IB SRQ control line (Service Request) typically every two milliseconds.

When RESULTS are being sent to the computer, the HP-IB Controller stops monitoring the SRQ line for the time the RESULT is transferred from the Controller to the teminal output buffer (see figure 10-4). If no other terminal module is active at this time the transfer typically does not exceed 10 milliseconds.

When a device requires to be serviced it sets the SRQ line true. When this is detected by the HP-IB Controller the following occurs:

1) The HP-IB Controller stops monitoring the SRQ line and sends a break to the computer (see section 2-16 for details).
2) Upon receiving the break, the computer can transmit a terminal STATUS request (escape sequence E_{SC}^, see section 2-14) to the terminal to determine the reason for the break. Bit 4 of **terminal** STATUS byte 3 (Interrupt STATUS) is set to 1 when the break is originated by the HP-IB Controller.
3) If bit 4 is set to 1, either the standard or priority controller status COMMAND HCS or HPS, respectively (see sections 10-23 and 10-32), can be issued by the computer to obtain the **HP-IB Controller** STATUS. Byte 1 of the controller STATUS provides general STATUS information ; bit 4 is set to 1 when a device SRQ is detected.
4) If bit 4 is set to 1 (i.e. SRQ detected) then the computer can issue the serial poll COMMAND HSP. This causes a serial poll to be issued to the devices specified by the HPL polling list COMMAND. If a device on the polling list is requesting service (i.e. bit 7 of the **device** STATUS byte being set to 1, see section 10-25), a six byte RESPONSE to the HSP COMMAND is returned to the computer. This RESPONSE has the following format:



** Bit 7 of byte 6 is set to 1 to indicate a device service request.*

Bit 4 of HP-IB Controller STATUS byte 1 is then cleared.

If there is the possibility that several HP-IB devices will simultaneously request service, the HSP COMMAND will give the address of the first device on the polling list that is requesting service. The HPS COMMAND (see section 10-32) should then be sent to ensure that no other HP-IB device has requested service (i.e. SRQ still active). If a device has requested service a new HSP COMMAND should be sent to obtain the address of the next device requesting service, and so on.

If a device requesting service cannot be recognised (i.e. it is not included on the polling list or the polling list is empty), the RESPONSE has the following format:

1

Byte 1 = 1 (octal 061) indicating the device cannot be recognised

The format of the SRQ detection is shown in figure 10-5.

10-37 **HTO** **Set Time Out Command**

Typical format:

HTO(T)
or
hTO(T)

COMMAND keyword

Optional PARAMETER (time out value in seconds, specified in decimal notation)

This is a standard COMMAND that can be sent at any time to change the existing time out value and set up a new value.

The following time out values (in seconds) may be specified (in decimal notation only):
.01 or 0.01
.1 or 0.1
1
10
100

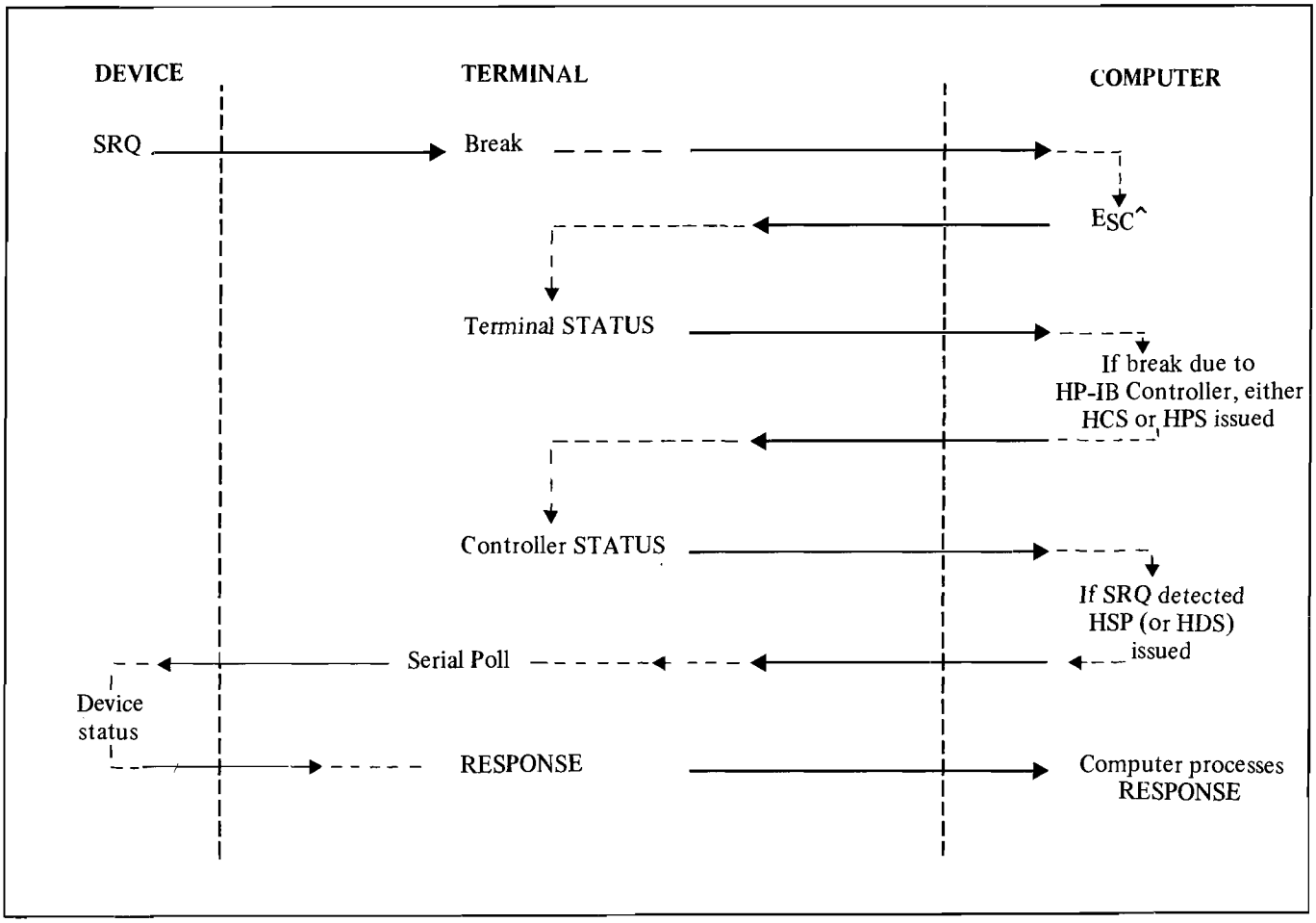


Figure 10-5. SRQ Detection Process.

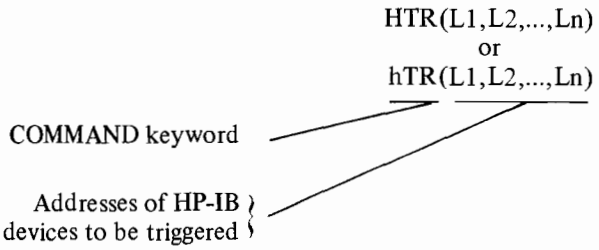
If the execution of any COMMAND lasts more than the time out value, a break is sent to the computer (see section 2-16) and bit 2 of HP-IB Controller STATUS byte 3 (Error Condition STATUS) is set (see section 10-23 for details).

If no PARAMETER (i.e. time out value) is specified there is no time limit for the execution of COMMANDS. However, if no time limit is declared the HP-IB Controller can wait indefinitely for a RESULT. When this occurs, the only way to reset the HP-IB Controller is to send the HFR COMMAND (see section 10-26 for details).

Note: The default time out value at power-on is 10 seconds.

10-38 HTR Trigger HP-IB Device Command

Typical format:

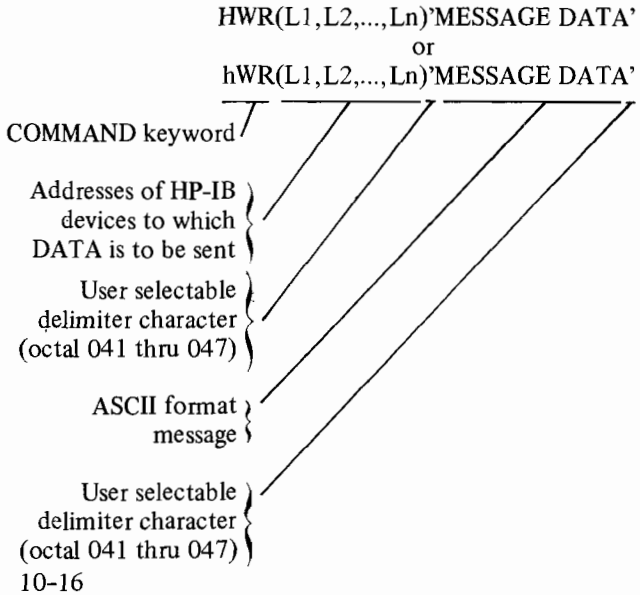


This standard COMMAND initiates a triggerable action at the addressed device(s). The action taken is device dependant. For example, it may be used to trigger a digital voltmeter to perform a measurement cycle.

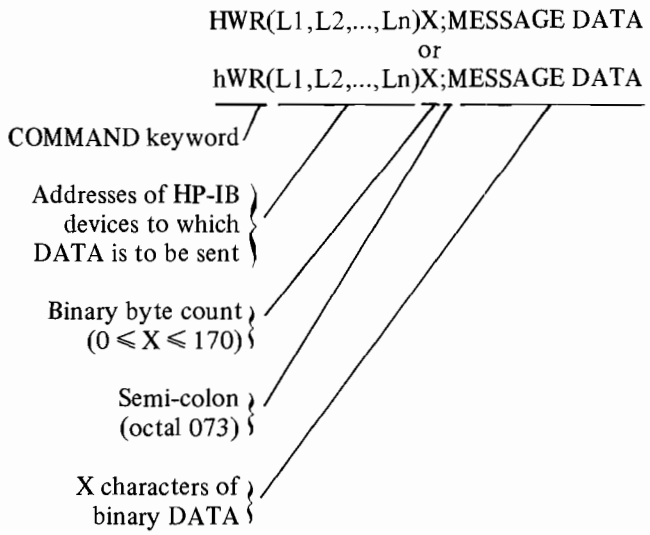
In terms of HP-IB elementary commands, it means that the GET command (Group Execute Trigger, octal 010) is sent to HP-IB devices L1,L2,...,Ln.

10-39 HWR Write To HP-IB Device Command

Typical format for ASCII DATA:



Typical format for binary DATA:



HWR is a standard COMMAND used to transfer DATA from the computer to the HP-IB devices. The DATA can be in either ASCII or binary format.

If the DATA is in ASCII format (i.e. 7 data bits plus one parity bit), any of the 95 displayable ASCII characters from space (octal 040) to tilde (~ octal 176) may be transferred to the HP-IB device.

Note: ASCII characters N_{UL} (octal 000) to U_S (octal 037) and D_{EL} (octal 177) are non-displayable ASCII control characters. Certain of these characters initiate local control actions on the terminal (e.g. B_{EL}, C_{AN}, C_R, D_{EL}, E_{NQ}, E_{SC}, E_{TB}, E_{TX}, S_I, S_O, S_{TX}, etc.). Therefore, if these characters are to be successfully transferred to the device as DATA they must be sent in binary format using the send binary escape sequence.

ASCII "delimiter" characters must precede and follow the ASCII message to define the limits of the message. They also ensure the message is read as DATA and is not interpreted as a high level COMMAND. The seven available delimiter characters are ! " # $ % & ' (i.e. octal 041 thru 047 inclusive).

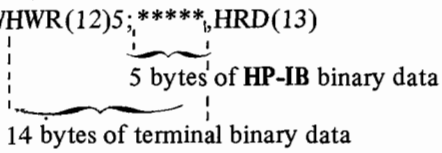
Note: The first and last delimiter character MUST be identical.

If the DATA is in binary format (i.e. 8 bit characters with no parity from octal 000 to 377) or uses non-displayable ASCII control characters that will initiate a local control action, the following procedures must be carried out:

1) To enable the transfer of binary DATA, the rear panel terminal configuration switches must be set as follows:
   a) Switch I-3 set to 0, specifying no parity (i.e. enabling an 8 bit DATA transfer for point-to-point connections only).
   b) Switch III-2 set to 0, specifying transparent working (for multiterminal connections only, see section 14-16).

2) All output devices not receiving the binary DATA must be disabled to prevent them receiving spurious DATA.

3) Escape sequence ESC-bNW (see section 10-8) must precede the HWR command containing the binary DATA to specify the byte count of both the binary message and the HWR command. This ensures any binary bytes corresponding to ASCII control characters do not initiate local control actions within the terminal. For example:



4) The HWR COMMAND for binary format messages must then be sent. Within this command:

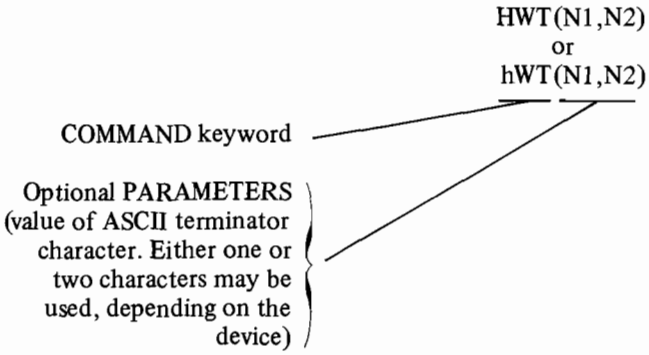
   a) X must specify the byte count of the binary message (where $0 < X \leq 170$). This ensures that any binary bytes corresponding to high level command characters do not initiate local control actions on the HP-IB Controller.

   b) The binary message must immediately follow the semi-colon (;).

As soon as the X number of bytes have been received, the HP-IB Controller automatically interprets all subsequent characters as COMMANDS.

10-40 HWT Set Write Command Terminator Character

Typical format:



This is a standard COMMAND used to specify the ASCII character(s) that will terminate the write to HP-IB device COMMAND (HWR) messages sent from the HP-IB Controller to the HP-IB devices. If no PARAMETERS are specified the previous write terminator characters are cleared.

Typical characters are C_R (Carriage Return = decimal 13 = octal 015 = hexadecimal D) and L_F (Line Feed = decimal 10 = octal 012 = hexadecimal A).

Note: When a terminator character is specified ; the HP-IB Controller automatically adds the terminator character without the programmer having to send a terminator character, which may (if it were a non-displayable ASCII control character) action a local control. This avoids having to use the send binary DATA escape sequence (ESC-bNW) in order to send an ASCII control character as a terminator character.

If no PARAMETERS are specified, no terminator characters are appended to the HWR messages. However, whether or not PARAMETERS are specified, control line EOI is always set low (true) by the HP-IB Controller for the last character of a DATA message.

10-41 LOCAL CONTROL MODE

When the terminal is equipped with:

1) An Alphanumeric Keyboard (option 004) or a Multifunction Reader (option 007).

and

2) A CRT Display (option 006) or an Alphanumeric Display (option 005) or a Strip Printer (option 009).

It may be used to provide local control over the HP-IB Controller in order to allow the user to practice using the high level COMMANDS and develop and debug programs.

Note: Only ASCII data transfers are possible.

The terminal may be set for local control over the HP-IB Controller by setting the rear panel terminal configuration switches as follows:

I-1 to 1 and III-8 to 1.

Note: When the terminal is equipped with a CRT Display the standard size characters are enabled for display.

When in the local mode the terminal is isolated from the computer. The user may then type HP-IB REQUESTS on the Alphanumeric Keyboard and/or enter REQUESTS using the Multifunction Reader. The RESULTS will then appear on the terminal display or printer.

This operating mode is identical to the normal on-line mode except:

1) A program is not required, the user merely types instructions on the terminal keyboard.
2) The RESULTS appear on the terminal display in the same format as they would be if sent to the computer.
3) If the terminal generates a break it is displayed on the terminal as the character ? (question mark).

When in the local control mode ; because the Alphanumeric Keyboard does not provide certain characters required by the HP-IB Controller, the following eight special function keys change their generated character as follows:

1) Shift A becomes (
2) Shift B becomes ,
3) Shift C becomes ;
4) Shift D becomes .
5) Shift E becomes)
6) Shift F becomes !
7) Shift G becomes %
8) Shift H becomes h

In order to know which key produces which symbol, a special overlay (HP part number 03075-00027) may be placed over the special function keys (see figure 10-6).

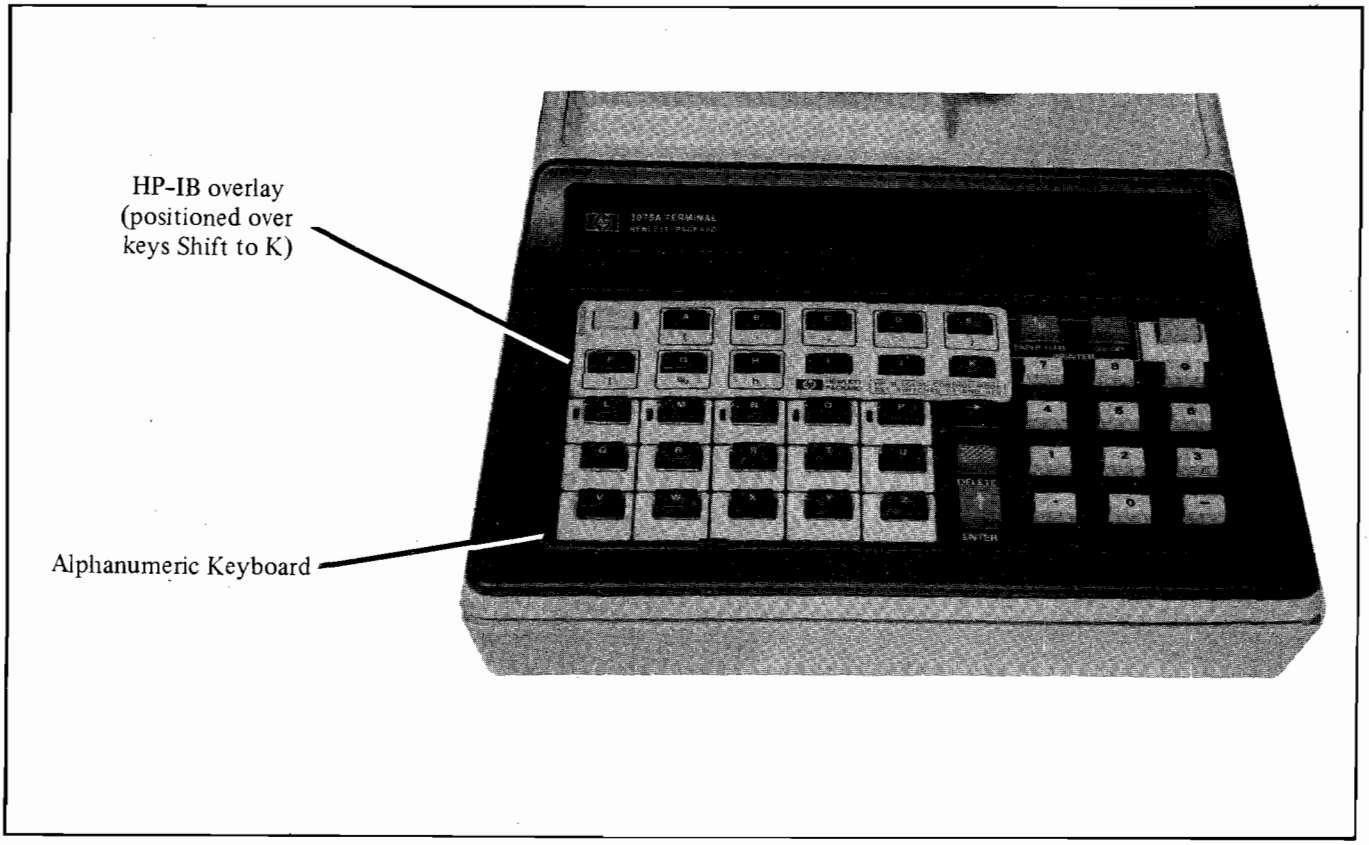


Figure 10-6 HP-IB Overlay

SECTION 11
MAGNETIC STRIPE READER
(3075A, 3076A OPTION 012
3077A OPTION 002)

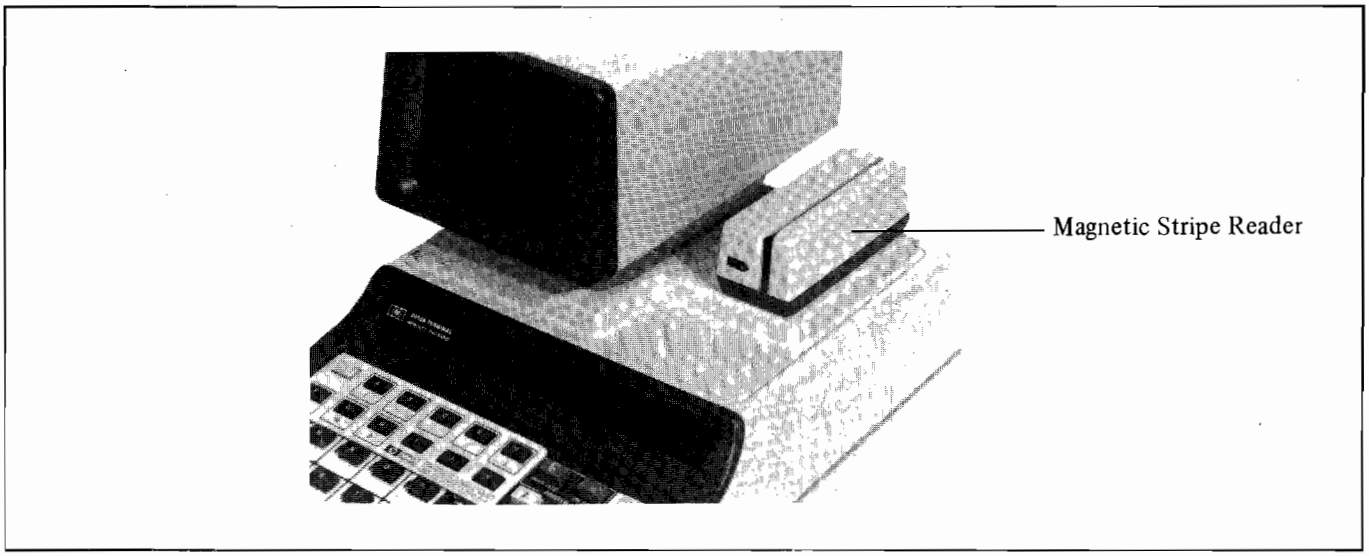


Figure 11-1 The Magnetic Stripe Reader

11-1 INTRODUCTION

The following section details the use of the Magnetic Stripe Reader on the 3075A and 3076A Data Capture Terminals and the 3077A Time Reporting Terminal. This option features a hand fed unidirectional Magnetic Stripe Reader which may be mounted on the top left-hand side or top right-hand side of the terminal (when viewed from the front of a 3075A), depending upon which other options are also fitted.

11-2 READING CAPABILITIES

The Magnetic Stripe Reader can read:

1) Plastic badges (e.g. credit cards) coded on track 2

2) IBM 3630 compatible magstripe cards

A detailed description on how to design these cards is given in section 11-10 to 11-22 inclusive.

11-3 PLASTIC BADGES

The Magnetic Stripe Reader reads plastic badges conforming to the dimensions of credit cards (see section 11-12). On the back of the badge is a magnetic stripe on which data may be encoded. On the front of the badge alphanumeric text may be embossed.

11-4 IBM 3630 MAGSTRIPE CARDS

The Magnetic Stripe Reader reads paper cards conforming to the dimensions of IBM 3630 cards (see section 11-15). On the front of the card is a magnetic stripe on which data may be encoded. Alphanumeric text may also be printed on the front of the card.

11-5 DATA ENCODING

Both the plastic badges and the IBM 3630 compatible cards may be encoded with data in EITHER of two ways, namely:

1) **Numeric encoding (credit card).** The data may be encoded according to either ANSI X 4.16-1976 or ISO 3554 specifications (see section 11-18). Track 2 of the magnetic stripe may contain up to 37 characters unidirectionally encoded at a density of 2.95 bits per mm (75 bits per inch) using a character set comprising ten numerics (0 through 9) and a separator.
2) **Numeric/alphanumeric encoding (IBM 3630).** The data may be unidirectionally encoded according to IBM 3630 specifications (see section 11-19). The magnetic stripe may be encoded with a maximum of 100 numeric characters or 50 alphanumeric characters redundancy encoded at a density of 5.04 bits per mm (128 bits per inch). Redundancy encoding allows the message to be repeated as many times as it will fit onto the stripe. When the stripe is read, the first correctly read message is sent to the computer ; subsequent correct or corrupt messages (on the same stripe) are not sent.

The data may be encoded using one of two character sets:

a) A character set comprising ten numerics (0 thru 9) and a separator.

Note. The separator character is replaced by a space (octal 040) for transmissions to the computer.

b) A 63 character set comprising:
- Ten numerics
- 26 upper case letters
- 22 commercial signs
- Space, full stop and comma
- ¢ and ⌐

Note: For the 63 character set
1) The character ¢ and ⌐ are replaced by a space (octal 040) within the terminal, as they do not exist in the ASCII character set.
2) The secure header and character set identifying code are not sent to the computer.

11-6 MAGNETIC STRIPE READER OPERATION

The Magnetic Stripe Reader is enabled by escape sequence ESC-c1M (see section 2-13), this allows the Reader to read either plastic badges or IBM 3630 compatible cards. At power-on or after a full reset (ESCE, see section 2-8) the Magnetic Stripe Reader is enabled.

11-7 MULTIFIELD OPERATION

Note: Multifield operation must only be used when the terminal is connected to the computer in the multiterminal mode.

Multifield operation is selected for the Magnetic Stripe Reader using escape sequence ESC-m1m/M (see section 11-9). Multifield operation allows multiple data entries in the same transaction, preventing the Magnetic Stripe Reader entering its data to the computer at the end of a single data transaction. The data from several input modules (operating in multifield) is transmitted to the computer as one data block when data is entered either via the keyboard or via a terminal input module/option not in multifield operation. The only restriction to the multifield operation is that the total amount of data entered per transaction must NOT exceed 180 characters (see section 2-19 for details).

11-8 ENTERING A BADGE/CARD

If the program is expecting an input via the Magnetic Stripe Reader, the badge/card should be passed through the reading aperture as follows:

1) Leading (i.e. front) edge first
2) With the magnetic stripe on the same side as the arrow on the Magnetic Stripe Reader (see figure 11-1)
3) At a speed between 100 and 1000 mm/sec (4 to 40 inches/sec.).

Note:
1) The badge/card must not be temporarily stopped in the middle of a read operation.
2) The badge/card may only be passed in one direction through the reader (leading edge first)

When the badge/card has been inserted and the data correctly read, the terminal buzzer "beeps" once. The data is then sent to the computer but, even with the display and/or printer enabled, no local echo of the data read by the Reader is displayed/printed on the terminal.

If the reading is incorrect (e.g. badge/card inserted wrong end first, at the wrong speed, not at a uniform speed or is stopped during the reading process) no data is sent to the computer. For the 3075A and 3076A the terminal buzzer does not sound. For the 3077A the louder buzzer sounds.

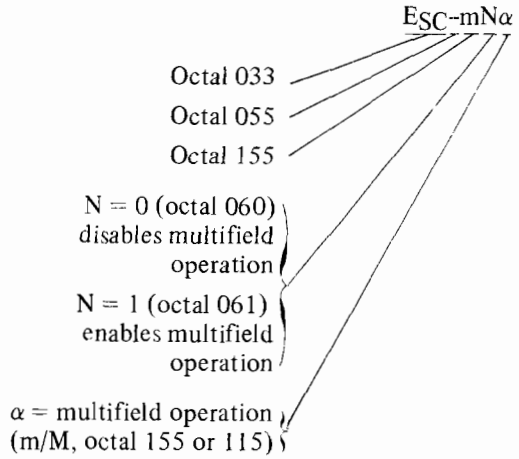
Note: The Magnetic Stripe Reader should be cleaned every 35,000 passes or every three months, by passing the supplied cleaning card (moistened with cleaning fluid) through the Reader, see section 17.

11-9 MAGNETIC STRIPE READER CONTROL

Apart from enabling/disabling using escape sequence ESC-1/0m/M (see section 2-13), the only program control over the Magnetic Stripe Reader is the selection of multifield operation.

Note:
1) The multifield operation must only be used when the terminal is connected in the multiterminal mode.
2) Multifield operation must not be used with the 3077A Time Reporting Terminal.

The multifield operation may be selected for the Magnetic Stripe Reader by sending escape sequence:



At power-on or after a full reset the multifield operation is disabled.

11-10 INPUT MEDIA FOR THE MAGNETIC STRIPE READER

The following sub-sections detail the design specifications for the magnetic badges and cards employed by the Magnetic Stripe Reader. Also detailed are potential suppliers of prepared badges and cards.

Note: The dimensions detailed in the following sub-sections are valid for a temperature of 21°C (70°F) and a humidity of approximately 50%.

11-11 PLASTIC BADGE DESIGN

The Magnetic Stripe Reader can read plastic badges that conform to the size of credit cards and are encoded with data on track 2. Figure 11-2 shows a typical plastic badge.

11-12 **Plastic Badge Dimensions**

Note: For plastic badge specifications, reference should be made to the American National Standards Specification for Credit Cards (ANSI X 4.13-1971) and the International Standards Organisation specification ISO 2894.

The badges must be made from plastic (e.g. polyvinyl chloride, etc.) that will not contaminate the magnetic stripe or the Reader. i.e. it must not contain ferrous particles and must be free from dust and plastic slivers. The badges must remain within the size specification from 0°C to +55°C (32° to 131°F) with up to 95% RH (non condensing).

Two sizes of badges may be used, the dimensions of both badges are listed and depicted in figure 11-3. Both badge sizes may contain two embossed areas:

1) Embossed area 1 may contain one line of up to 19 large numeric characters, spaced at 2.8 characters per cm (7 characters per inch).

2) Embossed area 2 may contain up to four lines. Each line may contain up to 26 small upper case alphanumeric characters, spaced at 4 characters per cm (10 characters per inch).

11-13 **Plastic Badge Magnetic Stripe Dimensions**

The magnetic stripe is located on the back of the badge. Track 2 of this stripe is readable by the Magnetic Stripe Reader. Figure 11-4 lists and depicts the dimensions of the magnetic stripe.

Note: The specifications of the magnetic stripe conform to the ANSI and ISO standards referred to in section 11-18.

The encoding of the magnetic stripe is described in section 11-17.

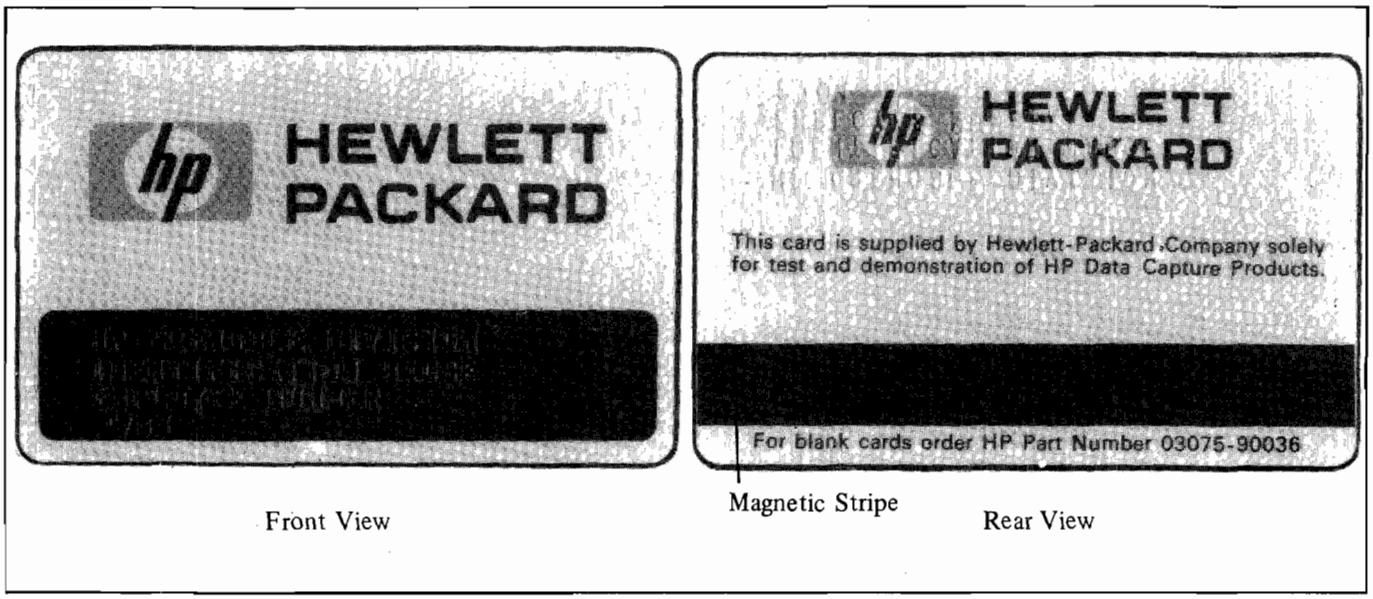
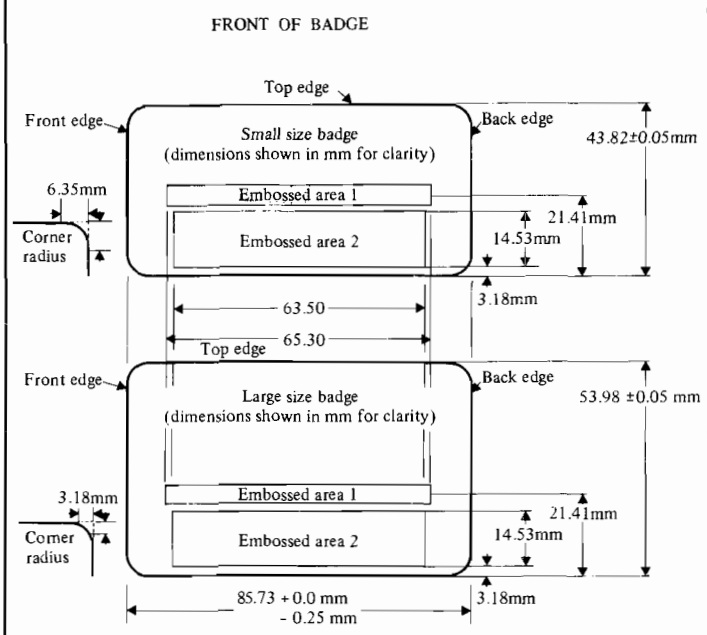


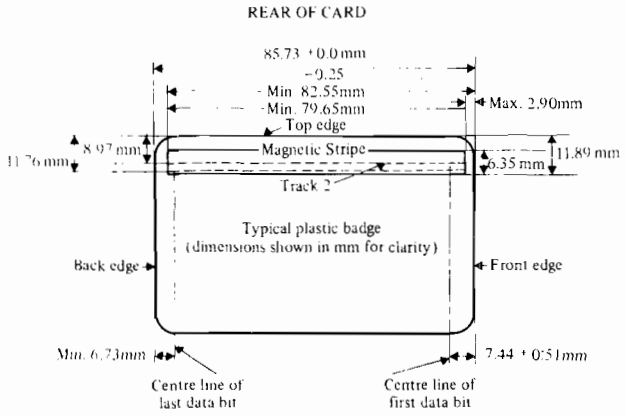
Figure 11-2 Typical Plastic Badge



Parameter	Units	Dimensions	Tolerance
Badge width	mm	43.82 or 53.98	±0.05
	inches	1.725 or 2.125	±0.002
Badge length	mm	85.73	±0.0 -0.25
	inches	3.375	±0.0 -0.010
Badge thickness	mm	0.76	±0.08
	inches	0.030	±0.003
Maximum height of embossing	mm	0.48	±0.0
	inches	0.019	±0.0

Note: 1 mm = 0.0394 inches

Figure 11-3 Plastic Magnetic Badge Dimensions



Parameter	Unit	Dimension
Minimum width	mm	6.35
	inches	0.250
Minimum length	mm	79.65
	inches	3.136
Minimum distance between stripe and top of card	mm	5.54
	inches	0.218

Note: 1 mm = 0.0394 inches

Figure 11-4 Plastic Badge Magnetic Stripe Dimensions

11-14 IBM 3630 COMPATIBLE MAGSTRIPE CARD DESIGN

The Magnetic Stripe Reader can read paper/card badges that conform to the specifications of IBM 3630 cards. Figure 11-5 shows a typical IBM 3630 card.

11-15 IBM 3630 Card Dimensions

Note: Specifications for these cards are contained in the "IBM 3630 Plant Communications System - System Description"; manual number GA24-3652-2.

The cards must be made from a paper that will not contaminate the magnetic stripe or the Reader. i.e. it must not contain ferrous particles and must be free from paper dust and chad. The dimensions of the card are listed and depicted in figure 11-6. The card may contain an area of typing on the front. This area may contain up to 10 lines of alphanumeric characters, spaced at 4 characters per cm (10 characters per inch).

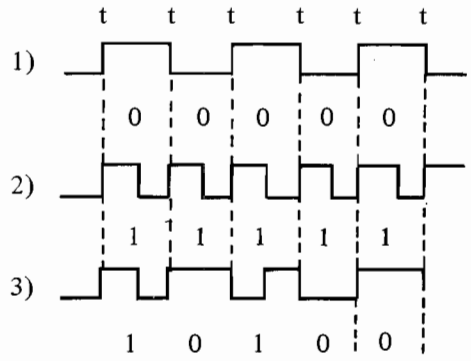
11-16 IBM 3630 Card Magnetic Stripe Dimensions

The magnetic stripe is located on the front of the card (below the area of typing). Figure 11-7 lists and depicts the dimensions of the magnetic stripe. The encoding of the magnetic stripe is described in section 11-17.

11-17 DATA ENCODING TECHNIQUES

Note: For details, see the ANSI standard referred to in section 11-18.

Both the plastic badges and the IBM 3630 cards must be encoded with the data using the same encoding technique. The data must be encoded onto the magnetic stripe using two-frequency coherent phase recording techniques that allow for serial recording of self-checking data. Three examples of the encoded data are as follows:



Note: t indicates the self-clocking timing intervals.

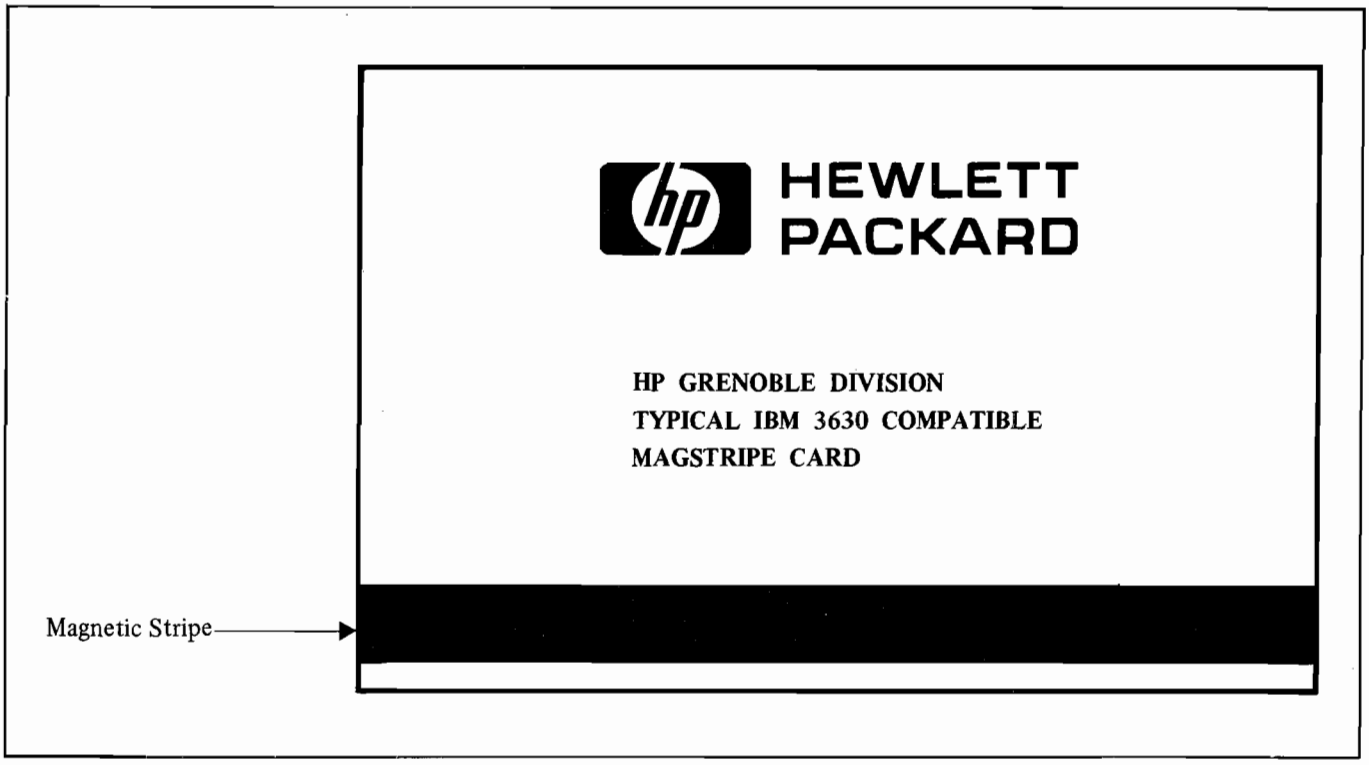
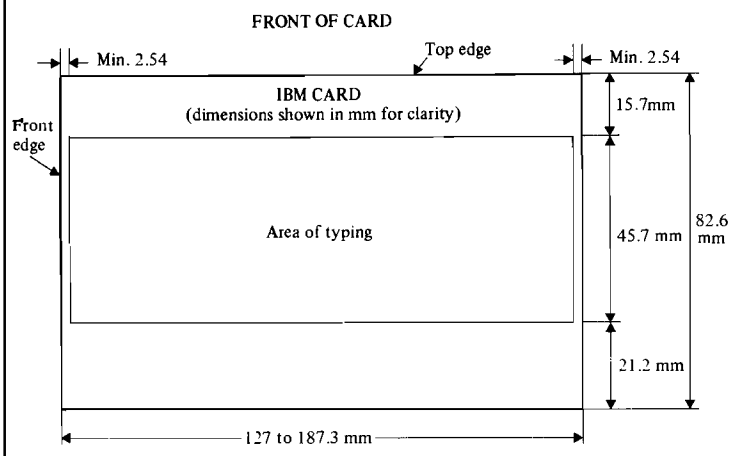


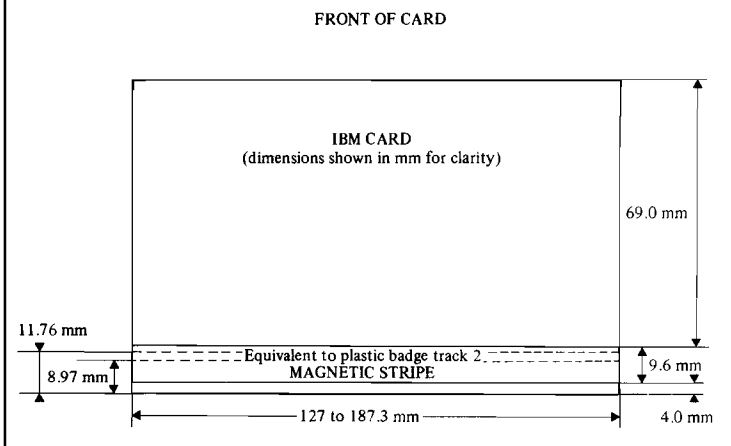
Figure 11-5 IBM 3630 Compatible Card



Parameter	Unit	Dimension
Card width	mm	82.6
	inches	3.250
Card length	mm	127.0 to 187.3
	inches	5.000 to 7.375
Maximum card thickness	mm	0.90
	inches	0.035
Minimum card weight	g/m2	160
	lbs/ream	99 lbs for 500 sheet reams

Note: 1 mm = inches

Figure 11-6 IBM 3630 Compatible Card Dimensions



Parameter	Unit	Dimension
Width	mm	9.5
	inches	0.375
Length (same as the card)	mm	127.0 to 187.3
	inches	5.000 to 7.375
Distance between stripe and bottom of card	mm	4.0
	inches	0.156

Note: 1 mm = 0.0394 inches

Figure 11-7 IBM 3630 Compatible Card Magnetic Stripe Dimensions

The encoded data thus comprises data bits and clocking bits. An intermediate magnetic flux transition occurring between clocking transitions signifies a "one" the absence of this flux transition signifies a "zero". The data must be recorded as a synchronous sequence of characters (without intervening gaps) parallel to the longitudinal centre line of the track.

Both the plastic badge and the IBM 3630 compatible cards may be encoded with either numeric data (track 2, according to ANSI/ISO standards) or alphanumeric/numeric data (according to IBM 3630 specifications), as described in the following sub-sections.

11-18 Track 2 Encoding To ANSI/ISO Standards

Note: For further details, reference should be made to the "American National Standard Magnetic-Stripe Encoding for Credit Cards" (ANSI X4.16-1976) and the International Standards Organisation specification ISO 3554.

Data encoding. The data must be uni-directionaly encoded onto track 2 of the magnetic stripe (with the first character nearest the front of the badge/card) at an average density of 2.95 bits per mm (75 bits per inch), ± 3%.

Character set. The character set comprises ten numeric characters (0 through 9) and three control characters, namely:
1) SS (start sentinel, i.e. the start character).
2) Message separator (used to separate two fields of numeric data).
3) ES (end sentinel, i.e. the stop character).

An LRC (Longitudinal Redundancy Check) character is also used for error detection.

Each character is five bits long, including an odd parity bit. Table 11-1 lists the character set.

Note:
1) The separator character is replaced by a space character, octal 040 (within the terminal), for transmissions to the computer
2) The SS, ES and LRC characters are NOT transmitted to the computer
3) The Magnetic Stripe Reader does not recognise the three control characters that are specified in ISO 3554 (namely 11010, 11100 and 01110)

Error detection. Error detection is performed using:
1) An odd parity bit on each character
2) An LRC (Longitudinal Redundancy Check) character. This is an even bit parity longitudinal parity check character. i.e. each data bit of the LRC character represents the even parity of all the bits (having the same relative position) in all the characters in the message (including the SS. separator and ES characters)

Note:
1) The odd parity bit of the LRC character must be the parity of the four LRC data bits
2) The LRC character is checked at the terminal but is not sent to the computer. An incorrect LRC character causes an incorrect read operation (i.e. no data is sent to the computer)

Table 11-1 Track 2 ANSI/ISO Standard Character Set

Bits					Characters	Processing
Parity	2^3	2^2	2^1	2^0		
1	0	0	0	0	0	Transmitted to the computer system
0	0	0	0	1	1	
0	0	0	1	0	2	
1	0	0	1	1	3	
0	0	1	0	0	4	
1	0	1	0	1	5	
1	0	1	1	0	6	
0	0	1	1	1	7	
0	1	0	0	0	8	
1	1	0	0	1	9	
0	1	1	0	1	Separator	Replaced by a space (octal 040) for transmission to the computer
0	1	0	1	1	Start sentinel (SS)	Internally processed in terminal (not sent to computer)
1	1	1	1	1	End sentinel (ES)	

Bit configuration. Within each character, the least significant bit must be encoded first (nearest the front edge of the card) and the parity bit must be encoded last.

Track format (see figure 11-8). The lead-in from the front edge of the stripe to the start sentinel must be clocking bits (zeroes), to ensure the centre of the start sentinel is 7.44 mm (0.293 inches) from the front edge of the badge/card. A minimum of 12 clocking bits may be used, this is for when the front edge of the stripe is at its maximum distance from the front edge of the badge/card, 2.90 mm (0.114 inches). Similarly, the lead-out from the LRC character to the end of the stripe must be all clocking bits. A minimum of 12 may be used, this is for when the centre of the LRC character corresponds to the minimum distance from the end of the card, i.e. 6.93 mm (0.273 inches).

Note: The data may be encoded on a maximum of 71.36 mm (2.809 inches) of the stripe. This enables a maximum of 40 five bit characters (data plus control characters) to be encoded on the stripe at an average density of 2.95 bits per mm (75 bits per inch) ± 3%.

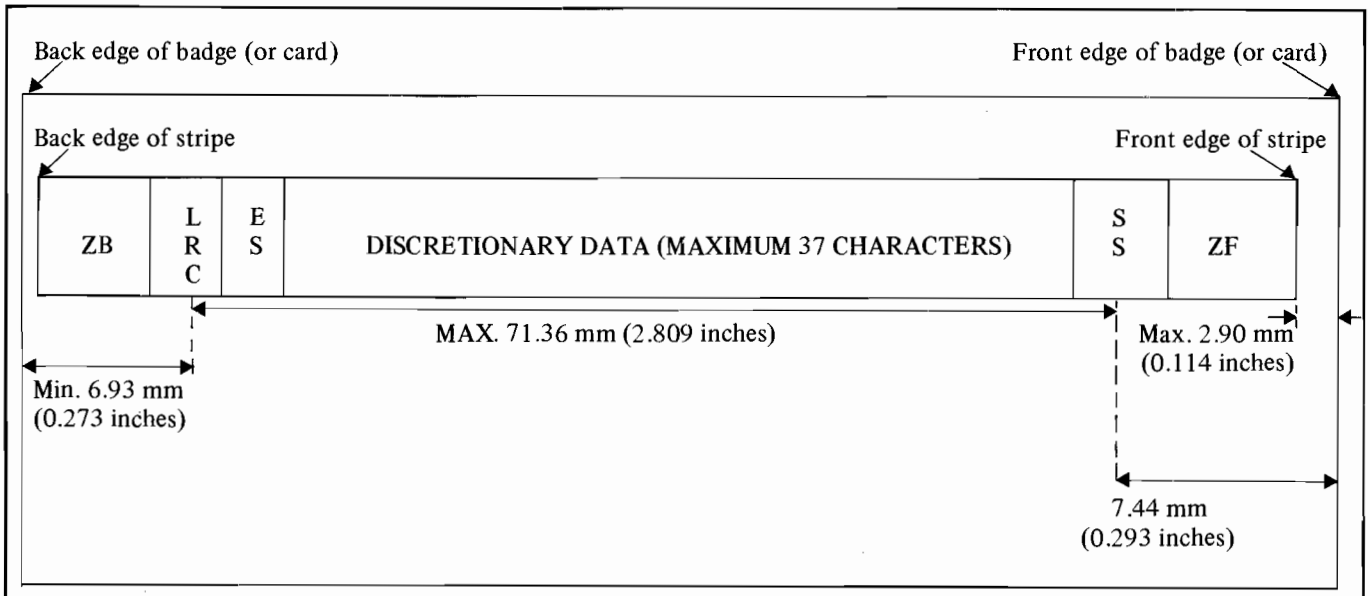
The format of track 2 is shown in figure 11-8. This figure shows the magnetic stripe on the rear of a plastic badge.

11-19 **IBM 3630 Encoding**

Note: For further details, reference should be made to the "IBM 3630 Plant Communications System - System Description"; manual number GA 24-3652-2.

Data encoding. The data must be uni-directionaly encoded onto the magnetic stripe (with the first character nearest the front of the badge/card) at an average density of 5.04 bits per mm (128 bits per inch), ± 3%. The data may only be encoded on the first 127 mm (5.0 inches) of the stripe.

Error detection. Error detection is performed using:
1) An odd parity bit assigned to each four bit character
2) An LRC (Longitudinal Redundancy Check) character. The LRC character must be calculated from the start sentinel (SS) to the end sentinel (ES) inclusive. The reverse start sentinel (RSS) following the LRC must not be included in the LRC calculation, see figure 11-9. The LRC is an even bit parity longitudinal parity check character. i.e. the four data bits of the LRC character (weighted 1,2,4 and 8) must be such that there is even parity on all the corresponding bits from SS to ES inclusive.



Where:
1) ZF is a minimum of 12 clocking bits.
2) SS is the start sentinel (one character).
3) Discretionary data = up to 37 five-bit characters (numerics plus a separator).
4) ES is the end sentinel (one character).
5) LRC is the Longitudinal Redundancy Check (one 5-bit character).
6) ZB is a minimum of 12 clocking bits.

Figure 11-8 Format Of Track 2 (ANSI/ISO) Encoding

Note:
1) The odd parity bit of the LRC character must be the odd parity of the four LRC data bits
2) The LRC character is checked at the terminal but is not sent to the computer. An incorrect LRC character causes an incorrect read operation (i.e. no data is sent to the computer)

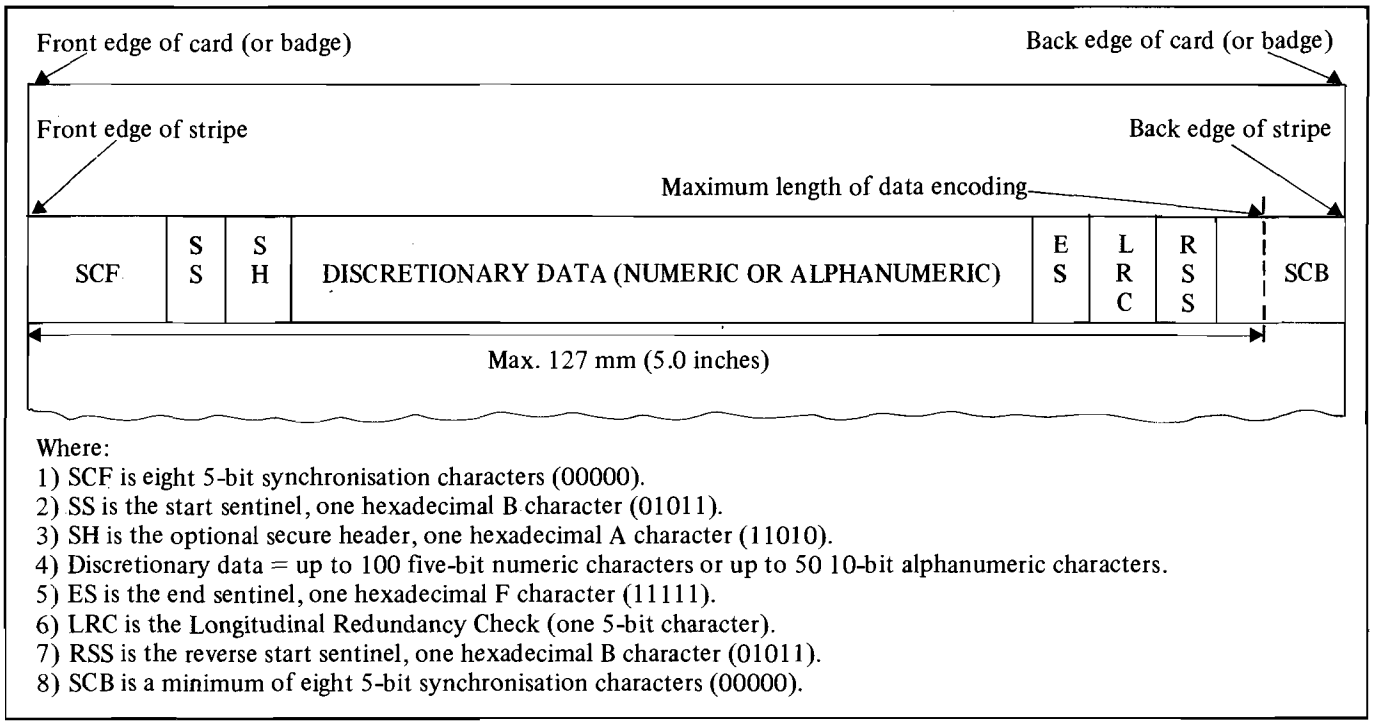
Bit configuration. Within each character, the least significant bit must be encoded first (nearest the front edge of the card) and the parity bit must be encoded last.

Stripe format (see figure 11-9). The lead-in from the front edge of the stripe to the start sentinel must comprise eight 5 bit synchronisation characters (i.e. all zeroes without parity). The discretionary data may be up to 100 five bit numeric characters long or up to 50 ten bit alphanumeric characters long.

Redundancy encoding may be used whereby the entire message between and including the start sentinel and reverse start sentinel may be repeated as many times as it will fit onto the stripe. Four 5 bit synchronisation characters (i.e. all zeroes without parity) must separate each redundant message. When the badge/card is read by the Magnetic Stripe Reader the first correctly read message is sent to the computer, subsequent correct or corrupt messages (on the same stripe) are not sent. The lead-out from the LRC character to the end of the stripe must comprise 5 bit synchronising characters, a minimum of eight may be used (for a 127 mm, 5.0 inches, long card).

The format of the magnetic stripe is shown in figure 11-9. This figure shows the magnetic stripe on the front of an IBM 3630 compatible card.

Note:
1) The data must only be encoded on the first 127 mm (5.0 inches) of the stripe. This enables a maximum of 128 five bit characters (data plus control characters) to be encoded on the stripe at an average density of 5.04 bits per mm (128 bits per inch) ± 3%.
2) The format of the IBM 3630 encoding includes a reverse start sentinel. However, the Magnetic Stripe Reader will only read the data correctly when the card/badge is entered into the Reader the correct way round (front edge first).



Where:
1) SCF is eight 5-bit synchronisation characters (00000).
2) SS is the start sentinel, one hexadecimal B character (01011).
3) SH is the optional secure header, one hexadecimal A character (11010).
4) Discretionary data = up to 100 five-bit numeric characters or up to 50 10-bit alphanumeric characters.
5) ES is the end sentinel, one hexadecimal F character (11111).
6) LRC is the Longitudinal Redundancy Check (one 5-bit character).
7) RSS is the reverse start sentinel, one hexadecimal B character (01011).
8) SCB is a minimum of eight 5-bit synchronisation characters (00000).

Figure 11-9 Format of IBM 3630 Encoding

11-20 IBM 3630 Discretionary Data Character Sets

The discretionary data may be produced using one of two character sets, a numeric or an alphanumeric set. The first two characters in each data text field (i.e. redundant message) must define the character set and secure header as follows:

##	Numeric character, not secure
A#	Numeric character, secure
CA	63-character, not secure
AC	63-character, secure

where:

is any hexadecimal value: 0,1,2,3,4,5,6,7,8,9,D (field separator)

A is the hexadecimal value 'A' and, if first, represents the secure header

C is the hexadecimal value 'C' and is used to identify 63-character set records

} Not sent to the computer

Note:

1) Secure and not secure headers are part of the IBM 3630 coding and are not sent to the computer

2) The two character sets must not be mixed on the same stripe

Numeric character set. The numeric character set uses ten 5 bit hexadecimal numbers (0 thru 9) and hexadecimal D as a separator character (i.e. field separator). Hexadecimal A is the secure header, hexadecimal B is the start sentinel/reverse start sentinel and hexadecimal F is the end sentinel. Hexadecimal C and E are not used. Table 11-2 lists the numeric character set.

Note: For the numeric character set the separator character (hexadecimal D) is replaced by a space (octal 040) for transmissions to the computer.

Alphanumeric character set. This comprises a 63-character set of alphanumeric characters, commercial signs and control characters. The recording of each character requires two hexadecimal characters (each character consists of four data bits and one odd parity bit).

Numeric characters are packed in pairs ; either an even number of numerics in any continuous string, or an odd number of numerics with hexadecimal A being the filler to preserve the alignment of the data on the stripe. Non-numeric characters must start in an odd number location. Table 11-3 lists the 63-character set showing each character as two four bit hexadecimal characters. The odd parity bit is not shown.

Note:

1) The character SP may be used as a separator

2) Hexadecimal patterns whose first or second digit is either "B" or "F" are invalid because they are used as control characters (shown as X in Table 11-3)

3) Within the terminal, the characters ¢ and ¬ are replaced by a space (octal 040), as they do not exist in the ASCII character set

Table 11-2 IBM 3630 Numeric Character Set

Bits					Characters	Processing
Parity	2^3	2^2	2^1	2^0		
1	0	0	0	0	0	Transmitted to the computer system
0	0	0	0	1	1	
0	0	0	1	0	2	
1	0	0	1	1	3	
0	0	1	0	0	4	
1	0	1	0	1	5	
1	0	1	0	0	6	
0	0	1	1	1	7	
0	1	0	0	0	8	
1	1	0	0	1	9	
0	1	1	0	1	Separator (Hex. D)	Replaced by a space (octal 040) for transmission to the computer
1	1	0	1	0	Secure header (Hex. A)	Internally processed in terminal (not sent to computer)
0	1	0	1	1	Start sentinel SS (Hex. B)	
1	1	1	1	1	End sentinel ES (Hex. F)	

Table 11-3 IBM 3630 Alphanumeric Character Set

READ FIRST

COLUMN		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
ROW	BIT	00				01				10				11			
	PAT	00	01	10	11	00	01	10	11	00	01	10	11	00	01	10	11
0	0000	00	10	20	30	40	50	60	70	80	90		X			\	X
1	0001	01	11	21	31	41	51	61	71	81	91		X	A	J	/	X
2	0010	02	12	22	32	42	52	62	72	82	92		X	B	K	S	X
3	0011	03	13	23	33	43	53	63	73	83	93		X	C	L	T	X
4	0100	04	14	24	34	44	54	64	74	84	94		X	D	M	U	X
5	0101	05	15	25	35	45	55	65	75	85	95		X	E	N	V	X
6	0110	06	16	26	36	46	56	66	76	86	96		X	F	O	W	X
7	0111	07	17	27	37	47	57	67	77	87	97		X	G	P	X	X
8	1000	08	18	28	38	48	58	68	78	88	98		X	H	Q	Y	X
9	1001	09	19	29	39	49	59	69	79	89	99		X	I	R	Z	X
A	1010	0A	1A	2A	3A	4A	5A	6A	7A	8A	9A		X	SP	&	–	X
B	1011	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
C	1100	¢	!		:	<	*	%	@				X				X
D	1101	•	$	,	#	(	)	_	'				X				X
E	1110	|	¬	?	"	+	;	>	=				X				X
F	1111	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

READ SECOND

11-21 POTENTIAL SUPPLIERS OF MAGNETIC BADGES/CARDS

A potential supplier of IBM 3630 cards is IBM (contact your nearest representative).
A potential supplier of magnetic plastic badges is Data Card. Table 11-4 lists their addresses.

11-22 POTENTIAL MAGNETIC STRIPE CARD ENCODER

A potential encoder of the magnetic badges/cards is the Magtek MT-50 or MT75.
For information on these encoders refer to Magtek 20725 SO. Annalee Ave, Carson, California 90746 USA.

Table 11-4 Potential Plastic Badge Suppliers

USA	Data Card Corporation, Troy Division, 2320-22 South Pullman ST., Santa Anna, California 92714, USA	
UK	Data Card International LTD., Drayton House, Chichester, West Sussex P020 6EW, England.	**Data Card (UK) LTD.,** **New Lane,** **Havant,** **Hants P09 2NR,** **England.**
Europe	Data Card GMBH, Bockenheimer - Landstrasse 51, Rhein - Main - Center, 6000 Frankfurt AM MAIN 1, Germany.	
	Data Card DCS S.A., BP 267, 1211 GENF 26, Switzerland.	
	Data Card AG, Box 9076, 12109 Johanneshov, Sweden.	

SECTION 12

SERIAL I/O INTERFACE (OPTION 013)

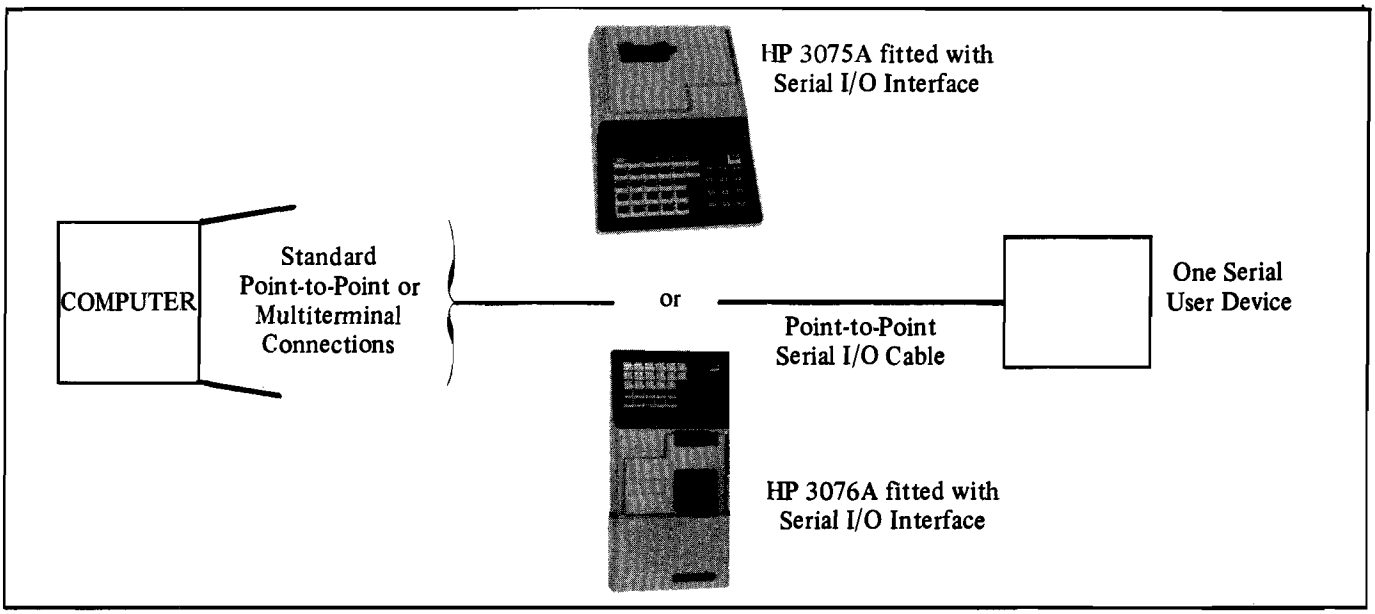


Figure 12-1 The Serial I/O Interface

12-1 INTRODUCTION

The following section details the use of the Serial I/O (Input/Output) Interface on the 3075A and 3076A Data Capture Terminals. The Serial I/O Interface is installed within the terminals and enables them to communicate with one user serial device. The communications between the Serial I/O Interface and the user serial device are point-to-point full duplex. The interface signals comply with EIA RS232C specifications and CCITT recommendations V24/V28.

Note: The Serial I/O Interface is not used with the 3077A Time Reporting Terminal.

This option features a printed circuit Serial I/O Interface mounted in the terminal, which is wired to a male RS232C connector on the terminal rear panel. The RS232C connector may be connected via a point-to-point Serial I/O cable to one user serial device; for example a digital weigh scale, large serial printer or cassette recorder, etc. This enables a serial user device (i.e. a device not offered as a terminal option) to be connected to the terminal and program controlled in a like manner to the terminal standard options.

Note:
1) The communication between the Serial I/O and the serial device is hardwired, i.e. no modems can be used.
2) The Serial I/O Interface CANNOT be used to connect the terminal to the computer.

12-2 DEFINITION OF TERMS

The following terms are used in this section:

1) Full duplex communications. The simultaneous bi-directional (i.e. receive and transmit) transfer of data.

2) Serial cable. A wire connection (comprising control and data lines) over which data is serially transferred one bit at a time (i.e. eight data transfers are required to transmit one 8-bit character).

3) Serial device. A piece of equipment (compatible with EIA RS232C specifications and CCITT recommendation V24/V28) that generates and/or receives data in serial form.

4) Serial interface. The hardware and firmware used to control the transmission/reception of serial data between the terminal and the serial device.

12-3 INSTALLATION

The Serial I/O Interface communicates with the computer via the terminal point-to-point or multiterminal connector and is connected to the serial user device via a serial I/O cable. This latter cable plugs into the Serial I/O male connector on the rear of the terminal (see figure 12-2), the other end of this cable plugs into the connector socket on the serial device.

Two identical serial I/O cables are available (both are 4.5m, 15ft. long):

1) Cable HP part number 92905F. Both ends of the cable are terminated by female connector plugs.

2) Cable HP part number 92905M. One end of the cable is terminated by a female connector, (for connecting to the 3075A/3076A terminal), the other end is terminated by a male connector.

Specification for these cables are given in section 12-19.

Note: For the 3076A terminal; as this terminal is housed in a 92904A Wall Mounting Cradle, the serial I/O cable must be passed through this cradle to be connected to the rear panel serial I/O male connector. The positioning of the cable within the cradle is described in section 15.

12-4 SERIAL I/O INTERFACE CAPABILITIES

The Serial I/O Interface is enabled by escape sequence ESC-c1S (see section 2-13), this allows the Serial I/O Interface to respond to further program instructions and to communicate with the serial device. At power-on or after a full reset (ESCE, see section 2-8) the Serial I/O Interface is disabled.

Enabling/disabling input data. The transfer of data from the serial device to the computer is controlled by escape sequence ESC-s1/0 i/I (see section 12-6). This sequence may be used to inhibit data inputs from the serial device, see figure 12-3.

Enabling/disabling output data. The transfer of data from the computer to the serial device is controlled by escape sequence ESC-s1/0o/O (see section 12-7). This sequence may be used to inhibit data outputs to the serial device, see figure 12-3.

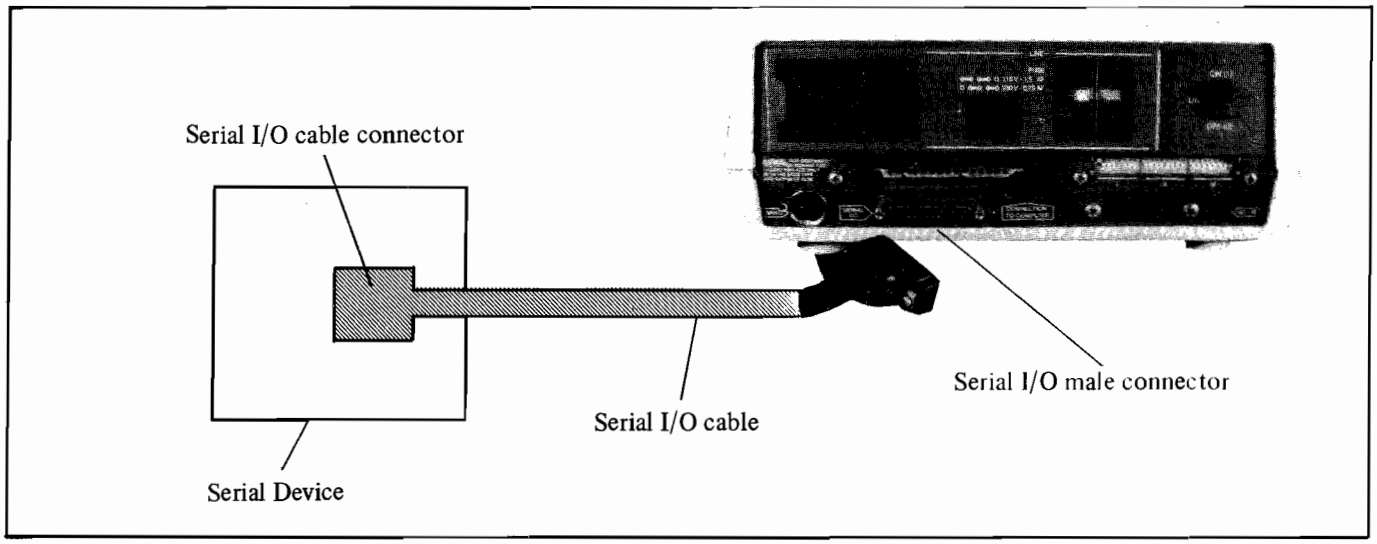
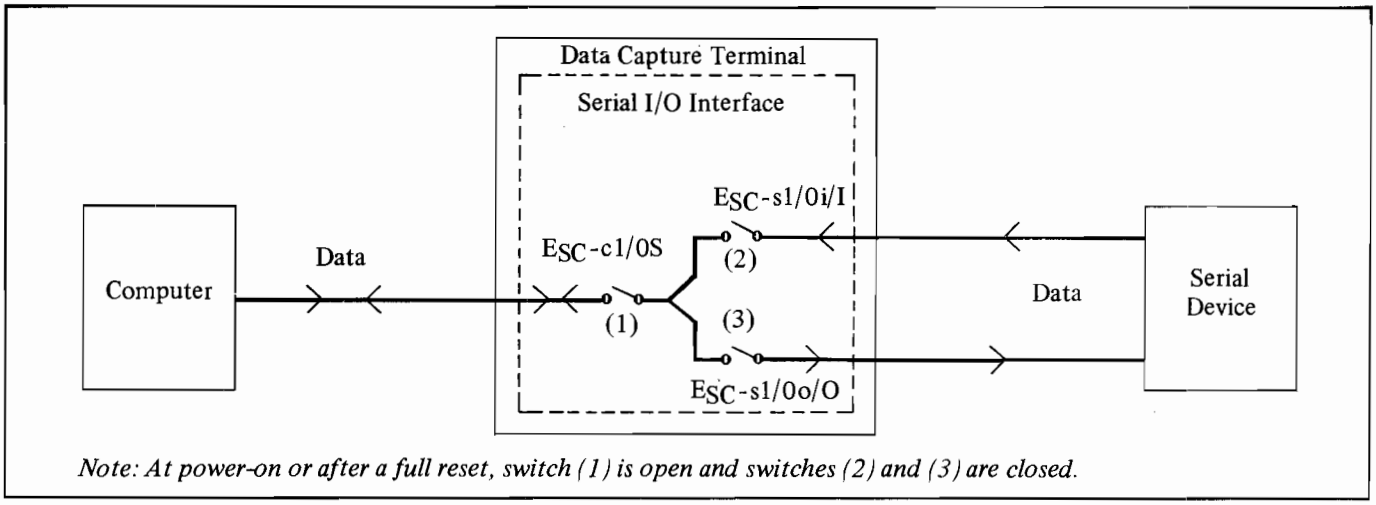


Figure 12-2 Serial I/O Cable Connections



Note: At power-on or after a full reset, switch (1) is open and switches (2) and (3) are closed.

Figure 12-3 Serial I/O Interface Enabling/Disabling

Data buffering. For point-to-point (terminal to computer) connections, data received from the computer is immediately transferred (via the terminal input buffer and Serial I/O Interface) to the device. The data is NOT stored in the terminal buffer. If more than 180 characters are received before a terminator character, the extra characters may be lost. For multiterminal (terminal to computer) connections, data received from the computer is stored in the terminal input buffer until the complete block is received. The data is then sent (via the Serial I/O Interface) to the serial device. For both point-to-point and multiterminal connections, serial device originated data is stored in the terminal output buffer (until either a terminator character or the specified number of binary bytes have been received) before being sent to the computer. If more than 180 characters are received, the terminal waits until a terminator character is received before transmitting the characters to the computer. The characters in excess of 180 are lost. Figure 12-4 depicts the flow of data.

Since the serial device originated data is buffered in the terminal, backspace and delete last entry control sequences generated by the serial device (see section 12-17) are treated locally and may be used to edit data before it is sent to the computer.

Data transfer rate. The data transmission/reception speed between the Serial I/O Interface and the serial device can be program selected by escape sequence ESC-sNb/B (see section 12-8). The selected transfer rate may be different to the transfer rate between the computer and the terminal. The available rates for the Serial I/O Interface are 9600, 4800, 2400, 1200, 600, 300 or 110 baud. The Serial I/O Interface clock signal output (pin 25 of the terminal RS232C connector, see table 12-2), at TTL + 5V levels, automatically assumes the selected clock rate and may be used by the serial device. If required, an external clock (at TTL +5V levels) may be supplied to the Serial I/O Interface (pin 24 of the terminal RS232C connector). This may be used to provide any speed in the range 110 to 9600 baud, see section 12-20 for details.

Parity. Escape sequence ESC-sNp/P (see section 12-9) selects the parity mode; i.e. none, odd or even. When selected, all ASCII characters transmitted to the serial device are output with the appropriate parity bit. When no parity is selected, characters are transmitted as they are received from the computer.

Note: Parity is not checked by the Serial I/O Interface.

Display input data. Escape sequence ESC-s1/0d/D (see section 12-10) enables all ASCII data received from the serial device (for transfer to the computer) to be echoed to the terminal display and, when fitted, to the printer.

Echo to serial device. ASCII or binary data received from the serial device (for transfer to the computer) may be echoed back to the device using escape sequence ESC-s1/0e/E, see section 12-11.

Multifield operation. When operating in the multiterminal mode only, multifield operation may be selected for the Serial I/O Interface via escape sequence ESC-s1/0m/M (see section 12-12). This allows multiple data entries in the same transaction and prevents the Serial I/O Interface entering its data to the computer at the end of a single data transaction. i.e. data from several input modules (operating in multifield) is sent to the computer as one data block when data is entered either via the keyboard or via a terminal input module/option not in multifield operation. The only restriction to the multifield operation is that the total amount of data entered per transaction must NOT exceed 180 characters (output buffer size), see section 2-19 for details.

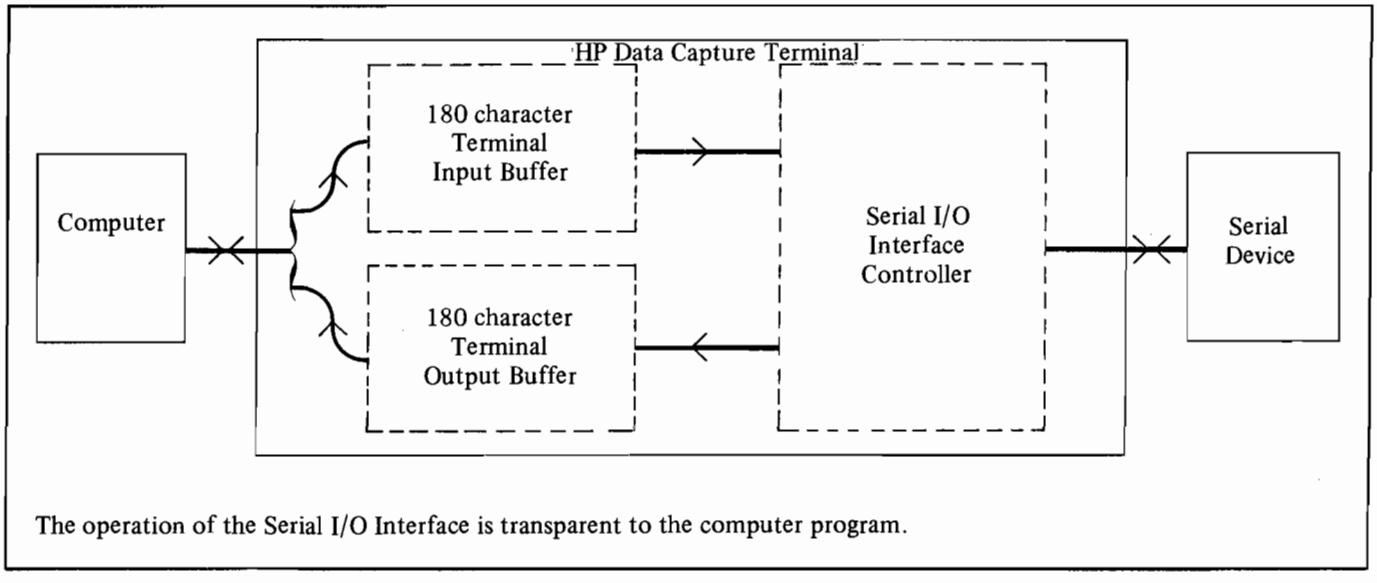


Figure 12-4 Serial I/O Interface Controller

Hardware handshake. Escape sequence E_{SC}-s1/0h/H (see section 12-13) controls the handshake used between the Serial I/O Interface and the serial device. When no handshake is selected, the Serial I/O Interface transmits data (to the device) immediately it is received from the computer. Similarly, the serial device transmits data (to the Serial I/O Interface) immediately it is available. i.e. the serial cable acts like a three wire connection (data in, data out and ground).

When handshake is selected:

1) The terminal control line Data Set Ready (pin 6 of the terminal RS232C connector), when connected to the serial device Data Terminal Ready signal, is used to indicate the state of readiness of the serial device. The Data Set Ready line is false when the serial device is not ready (e.g. power not on, paper low, etc.) The device not being ready is indicated to the computer via a break (see section 2-16 for details) and bit 5 of terminal status byte 3 (Interrupt Status) being set to 1. The terminal status is returned to the computer upon receipt of the status request escape sequence E_{SC}^ (see section 2-14). When the Data Set Ready line returns to the true state, bit 5 of terminal status byte 3 returns to 0 and a break is sent to the computer.
2) The Serial I/O Interface only sends data to the serial device when the terminal control line Clear To Send (pin 5 of the terminal RS232C connector) is set true by the serial device.

Note: Section 12-21 details the handshake connections.

ASCII data transfers. Data may be transferred between the computer and the serial device (via the Serial I/O Interface) using either ASCII or binary format. If the data is in ASCII format (i.e. seven data bits plus one parity bit), any of the 95 displayable ASCII characters from space (octal 040) to tilde (~ octal 176) may be transmitted to and received from the serial device.

Note: ASCII characters N_{UL} (octal 000) to U_S (octal 037) and D_{EL} (octal 177) are non-displayable ASCII control characters. Certain of these characters initiate local control actions on the terminal. Therefore, if these characters are to be successfully transferred to and from the device as data they must be sent in binary format.

The end of transmission of the ASCII data generated by the serial device is indicated by a terminator character. At power-on or after a full reset by default the terminator character is C_R (Carriage Return = octal 015), but this may be modified by escape sequence E_{SC}-sNt/T (see section 12-14). This terminator character is replaced in the terminal by the terminal terminator character (for transmission to the computer).

Binary data transfers. If the data transferred between the computer and the serial device is either in binary format (i.e. 8-bit characters with no parity from octal 000 to 377) or uses non-displayable ASCII control characters that will initiate a local control action, the following procedures must be carried out:

1) To enable the transfer of binary data, the rear panel terminal configuration switches must be set as follows:
   a) Switch I-3 set to 0, specifying no parity (i.e. enabling an 8-bit data transfer for point-to-point connections).
   b) Switch III-2 set to 0, specifying transparent working (multiterminal connections only, see section 14-16 for details).
2) All terminal output devices not receiving the binary data (e.g. display and printer) must be disabled to prevent them receiving spurious data.
3) For binary data transfers from the computer to the serial device, escape sequence E_{SC}-bNW (see section 12-15) must precede the data, where N specifies the byte count from 0 to 170. For details see section 2-11.
4) For binary data transfers from the serial device to the computer as the ASCII terminator character is no longer recognised as a control character, escape sequence E_{SC}-sNw/W (see section 12-16) must be issued by the computer; where N specifies the number of binary bytes (from 0 to 99) to be read from the serial device. To return the terminal to ASCII transmissions the computer must issue the escape sequence E_{SC}-sNt/T (see section 12-14) specifying the current ASCII terminator code.

Note:

1) If escape sequence E_{SC}-sNt/T is not issued by the computer, the terminal will continue to automatically enter data to the computer whenever it has received N characters of serial device ASCII or binary data (since the last terminator character).

2) In point-to-point, binary data sent to the computer whose format corresponds to the A_{CK} or X-OFF characters may affect the point-to-point handshake (see section 14-21).

12-5 SERIAL I/O INTERFACE PROGRAM CONTROL

The Serial I/O Interface controller is programmed by the following escape sequences and ASCII control characters.

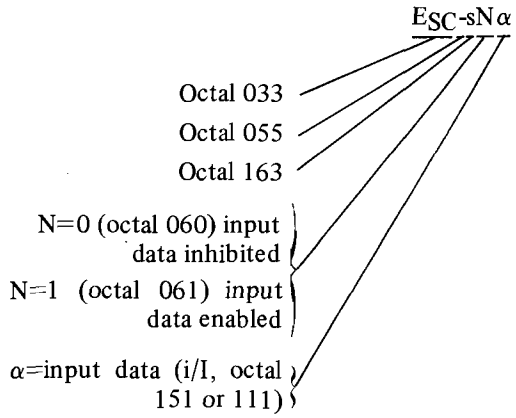
1)	E_{SC}-s1/0i/I	enable/disable input data
2)	E_{SC}-s1/0o/O	enable/disable output data
3)	E_{SC}-sNb/B	data transfer rate ($0 \leqslant N \leqslant 7$)
4)	E_{SC}-sNp/P	parity ($0 \leqslant N \leqslant 2$)
5)	E_{SC}-s1/0d/D	display input data
6)	E_{SC}-s1/0e/E	echo to serial device
7)	E_{SC}-s1/0m/M	multifield operation
8)	E_{SC}-s1/0h/H	enable/disable handshake
9)	E_{SC}-sNt/T	ASCII terminator character ($000 \leqslant N \leqslant 177$)
10)	E_{SC}-bNW	Send binary data to the terminal ($0 < N \leqslant 170$)
11)	E_{SC}-sNw/W	read binary data from serial device ($0 < N \leqslant 99$)
12)	B_S	backspace
13)	C_{AN}	delete last entry

These control sequences are detailed in the following sub-sections.

Note: E_{SC}-c1/0s/S may be used to enable/disable the Serial I/O Interface (see section 2-13).

12-6 ENABLE/DISABLE INPUT DATA

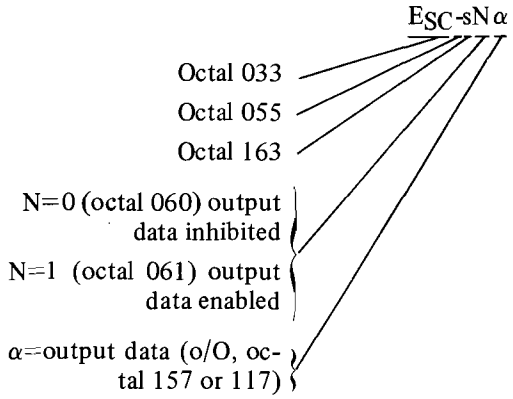
The transfer of data from the Serial I/O Interface to the computer is controlled by escape sequence:



When enabled (i.e. N=1 or at power on or after a full reset) all data received from the serial device is automatically transferred to the computer (provided the Serial I/O Interface is enabled by escape sequence ESC-c1S). When disabled (i.e. N=0), no serial device data is sent to the computer.

12-7 ENABLE/DISABLE OUTPUT DATA

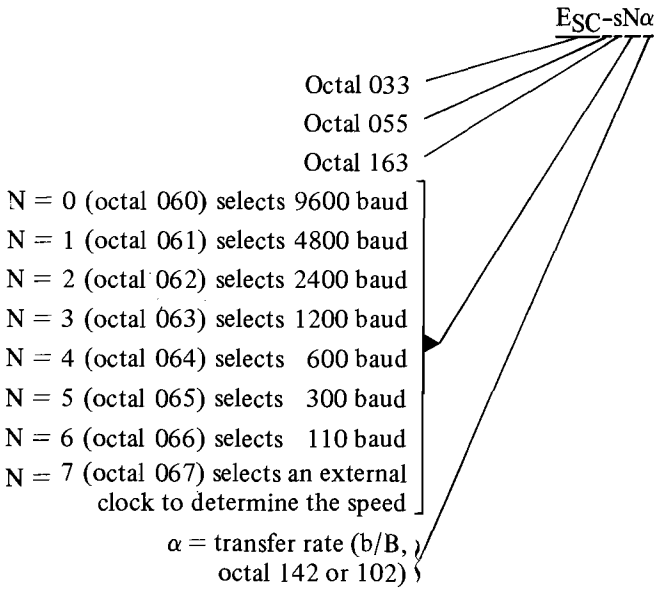
The transfer of computer originated data from the Serial I/O Interface to the serial device is controlled by escape sequence:



When enabled (i.e. N=1 or at power-on or after a full reset) all computer data received by the Serial I/O Interface is automatically transferred to the serial device (provided the Serial I/O Interface is enabled by escape sequence ESC-s1S). When disabled (i.e. N = 0) no computer data is sent to the device.

12-8 DATA TRANSFER RATE

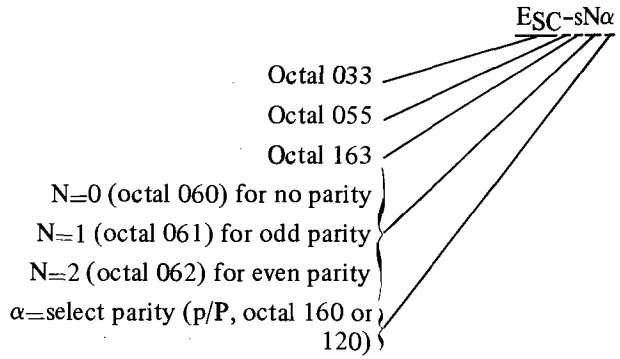
To select the data transmission/reception rate between the Serial I/O Interface and the serial device the following escape sequence must be sent:



At power-on or after a full reset (ESCE, see section 2-8) the default data transfer rate is 2400 baud.

12-9 PARITY BIT

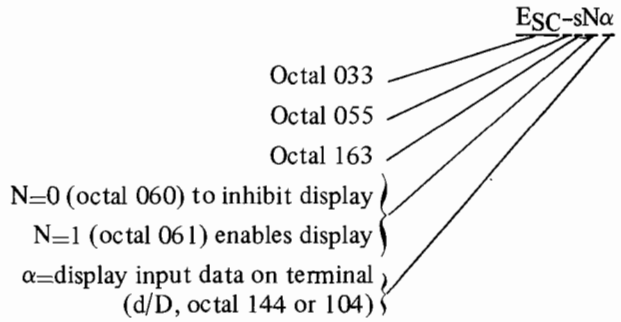
The parity bit of the ASCII characters transmitted by the Serial I/O Interface to the serial device may be selected by sending escape sequence:



At power-on or after a full reset by default no parity is selected.

12-10 DISPLAY INPUT DATA

ASCII data received by the terminal from the serial device, as well as being sent to the computer, may be displayed on the terminal display and printer (when fitted) by sending the following escape sequence:

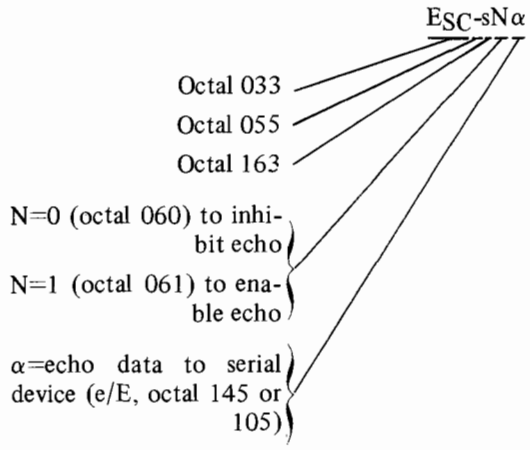


Note: The display of input data must be inhibited when binary data is being received to prevent spurious data being displayed.

At power-on or after a full reset the display of input data is disabled.

12-11 ECHO TO SERIAL DEVICE

Binary or ASCII data received by the terminal from the serial device, as well as being sent to the computer, may be returned to the serial device by sending the following escape sequence:

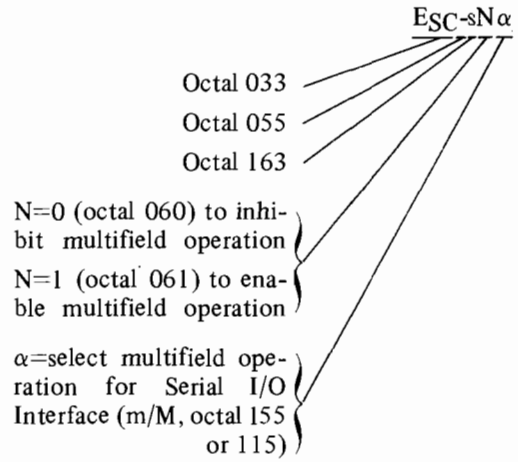


At power-on or after a full reset the echo to the serial device is inhibited.

12-12 MULTIFIELD OPERATION

Note: The multifield operation may only be used when the terminal is connected in the multiterminal mode.

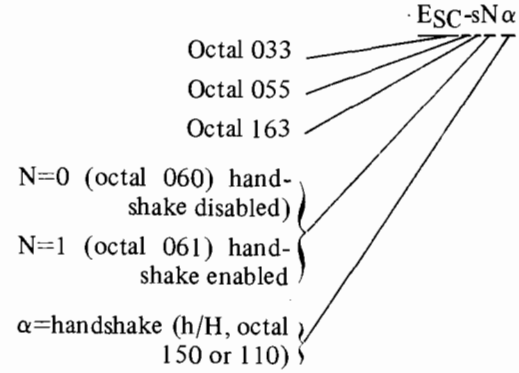
Multifield operation allows multiple entries in the same transaction. It prevents the Serial I/O Interface from generating a terminator character at the end of the serial data (see section 2-19). The multifield operation is selected for the Serial I/O Interface by sending escape sequence:



At power-on or after a full reset the multifield operation is switched OFF.

12-13 ENABLE/DISABLE HANDSHAKE

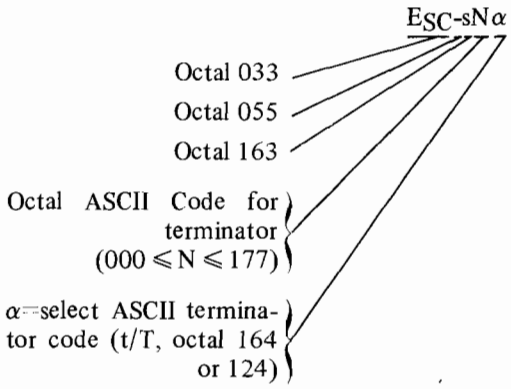
The hardware handshake between the Serial I/O Interface and the serial device is controlled by escape sequence:



When enabled (N=1) all data transfers between the Serial I/O Interface and the serial device use a handshake (see section 12-21).
When disabled (i.e. N=0 or at power-on or after a full reset) data is transferred between the Serial I/O Interface and the serial device immediately it is available.

12-14 ASCII TERMINATOR CHARACTER

The input terminator used to signify to the Serial I/O Interface the end of ASCII data transmissions by the serial device may be selected by escape sequence:



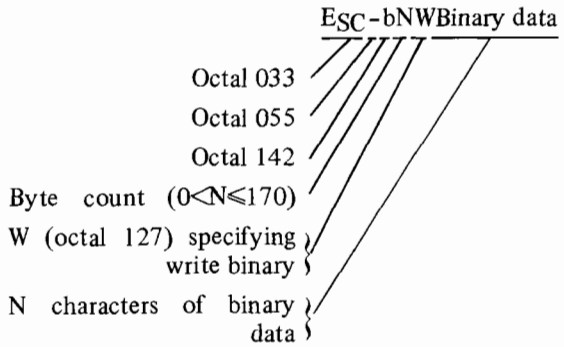
For example, if N=012 the character LF (Line Feed) is selected as the input terminator. At power-on or after a full reset by default the CR character (Carriage Return = octal 015) is selected.

Note:

1) *When the selected input terminator character is the same as the terminal terminator character, only the terminal terminator character is sent to the computer. When the selected input terminator character is different to the terminal terminator character, both the selected and terminal terminator characters are sent to the computer.*
2) *This selected ASCII terminator character is cancelled by the escape sequence specifying read binary, see section 12-16.*
3) *After reading binary data, this escape sequence specifying the ASCII terminator character must be sent to the terminal to re-set the Serial I/O Interface for ASCII reading.*

12-15 SEND BINARY DATA

The computer may send binary data to the Serial I/O Interface controller for onward transmission to the serial device by setting the terminal as described in section 12-4 (binary data transfers) and sending the following escape sequence:



This sequence must precede the binary data to specify the number of bytes (from 0 to 170), where the total number of bytes contained in the sequence must not exceed the maximum buffer size, i.e. 180 characters. Consequently, the N characters following the W are treated as binary data and are not interpreted as ASCII control characters. After the specified number of characters have been received, the terminal automatically assumes all subsequent characters are ASCII.

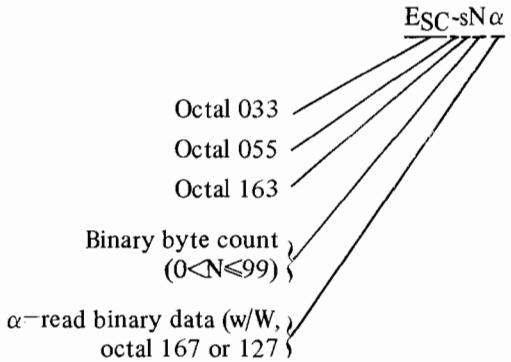
For example: ESC-b2WESC^

The terminal receiving this escape sequence will not execute the ESC^(status request) escape sequence. This is because the two characters ESC and^are interpreted as binary data and are routed as such to the Serial I/O Interface.

12-16 BINARY READING

Note: To enable the transfer of binary (i.e. 8 data bits) characters between the terminal and the computer system the rear panel terminal configuration switches must be set as described in section 12-4 (binary data transfers).

To allow binary data to be read from the serial device and transmitted to the computer, the following escape sequence must be sent to the terminal:



This sequence allows the specified number of binary data bytes to be read from the serial device and transferred to the computer.

For example: ESC-s3W

The terminal receiving this escape sequence may transfer any three binary/ASCII control characters to the computer. After the specified number of bytes have been received, the computer must perform an end of binary transmission operation. This takes the form of sending the escape sequence specifying the current ASCII terminator character (see section 12-14). If this is not done the terminal will continue to automatically enter data to the computer whenever it has received N characters of serial device ASCII or binary data (since the last terminator character).

12-17 BACKSPACE/DELETE LAST ENTRY

The following ASCII control sequences, when generated by the serial device allow the interface to edit device generated data before it is entered to the computer. For further details see section 12-4 (data buffering). The control sequences are as follows:

1) Backspace

Octal 010 → BS

BS deletes the last character stored in the buffer.

2) Delete last entry

Octal 030 (Xc) → CAN

CAN completely erases from the buffer all the data after the last end of transmission (terminator) character.

Note: For the Serial I/O Interface, only CAN may be used to delete the last entry, NO other character (such as DEL) will perform this operation.

12-18 TYPICAL EXAMPLE

To set the transmission speed to 600 baud, display input data on the terminal display and printer (when fitted) and select even parity, the following escape sequence must be sent:

ESC-c1SESC-s4b1d2P

ESC-c1S enables the Serial I/O Interface (if previously disabled) and is described in section 2-13.

12-19 ELECTRICAL INTERFACE - RS232C SIGNALS

The signals listed in Table 12-1 are available for use on the 25 pin male RS232C connector on the terminal rear panel.

Table 12-1 Available Rear Panel RS232C Connector Signals

Pin Number	Signal Title	Signal Description
1	GND	Protection Ground
2	BA	Transmitted Data (to device)
3	BB	Received Data (from device)
4	CA	Request To Send (to device)
5	CB	Clear To Send (from device)
6	CC	Data Set Ready (from device)
7	AB	Signal ground
8	CF	Received Line Signal Detector
11	SCA	Secondary Request To Send (to device)
20	CD	Data Terminal Ready (to device)
24		External Clock Input
25		Serial I/O Interface Clock Output

The two available serial I/O cables (HP part number 92905F and 92905M) both use the same internal wiring which is depicted in Table 12-2.

Table 12-2 Serial I/O Cable

To Terminal Female RS232C Connector		Connections	To Serial Device RS232C Connector	
Signal	Pin		Pin	Signal
GND	1	↔	1	GND
BA	2	→	3	BB
BB	3	←	2	BA
CA	4	→	8	CF
CB	5	←	11	SCA
CC	6	←	20	CD
AB	7	←Ground→	7	AB
CF	8	←	4	CA
SCA	11	→	5	CB
CD	20	→	6	CC
External Clock In	24	←	25	Clock Out
Clock Out	25	→	24	Clock in

Note: The maximum length of these cables is 15.2 m (50 feet) when working at 9600 baud.

12-20 EXTERNAL CLOCK

When escape sequence ESC-sNb/B selects a data transfer rate, the Serial I/O Interface clock output (i.e. terminal RS232C connector pin 25) provides the relevant clock signal to the serial device.

If an external clock is used, it must be connected to pin 24 of the terminal RS232C connector. When the clock is enabled by escape sequence ESC-s7b/B, the Serial I/O Interface clock output (terminal RS232C connector pin 25) automatically assumes the same frequency as the external clock input.

Note:

1) The external clock may be the clock output from the serial device.

2) The external clock frequency must be 16 times the baud rate.

12-21 HANDSHAKE CONNECTIONS

Escape sequence ESC1/0h/H determines which RS232C signals will be used to control the data transfers between the Serial I/O Interface and the device.

No handshake. When no handshake is selected (ESC-s0h/H), the data connection between the Serial I/O Interface and the serial device acts as a three wire connection. i.e. the only signals that are used are:

Terminal RS232C Connector		Serial device RS232C Connector
BA (transmitted data)	→	BB (received data)
BB (received data)	←	BA (transmitted data)
AB (ground)	↔	AB (ground)

Handshake connection. When the handshake is selected (ESC-s1h/H), the connection between the Serial I/O Interface and the serial device uses the signals shown in Table 12-2 as follows:

1) At power-on the Serial I/O Interface sets signal CD (Data Terminal Ready = pin 20) true, i.e. high. This informs the serial device that the Serial I/O Interface is connected and ready to work. This is true even when no handshake is selected.
2) When the serial device Data Terminal Ready (CD) signal is connected to the Serial I/O Interface control line CC (Data Set Ready = terminal pin 6), the device being enabled (i.e. available for data transfer operations) causes the terminal CC control line to be set true. The CC line is false when the serial device is not ready (i.e. power not on, paper low, etc.). This allows the interface to monitor the state of readiness of the serial device.
3) One serial device signal (usually Secondary Request to Send, SCA) is connected to the Serial I/O Interface control line CB (Clear To Send = terminal pin 5). When the terminal requires to send data to the serial device, the Serial I/O Interface sets signal CA (Request To Send = terminal pin 4) true. The data is only transmitted when the terminal CB control line is set true.
4) The serial device Request To Send (CA) signal is connected to the Serial I/O Interface control line CF (Received Line Signal Detector = terminal pin 8). When the Serial I/O Interface is available to receive serial device data it sets signal SCA (Secondary Request To Send = terminal pin 11) true. When the device has data available for transmission it sets the terminal CF control line true. This is done even if no handshake is selected.

SECTION 13

3077A TIME REPORTING TERMINAL

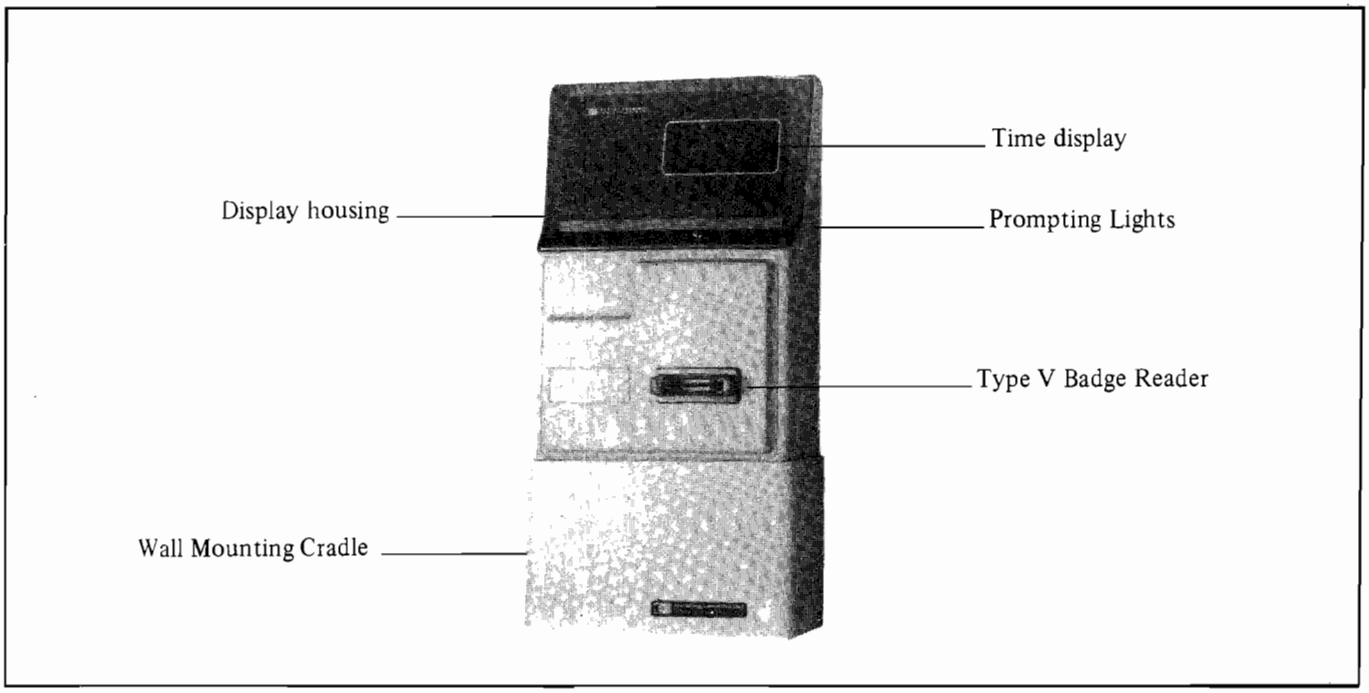


Figure 13-1 Standard 3077A Time Reporting Terminal

13-1 INTRODUCTION

Note: This section assumes the reader is already familiar with section 2 (General Programming Information) and section 14 (Data Communications).

The 3077A Time Reporting Terminal is wall mounted using a 92904A Wall Mounting Cradle (see section 15). In its standard form, the 3077A is equipped with:

1) A Type V Badge Reader (see section 7 for details).
2) A four digit time display.
3) Two prompting lights.

As accessories, the 3077A may be fitted with:

1) An Alphanumeric one line Display (see section 4 for details).
2) Either a Multifunction Reader (see section 6 for details) or a Magnetic Stripe Reader (see section 11 for details) that **replaces** the Type V Badge Reader.

The communication modes (i.e. multiterminal or point-to-point) and the programming of the 3077A are compatible with the 3075A and 3076A Data Capture Terminals.

13-2 3077A CAPABILITIES

Time display. The four digit time display (two digits for hours and two digits for minutes) may be used as either a 12 hour or 24 hour time reporting clock. This facility is controlled by escape sequence E_{SC}-t1/0c/C (see section 13-12). In addition, the displayed time may (at any time) be re-synchronised with the computer master clock using escape sequence E_{SC}-tββhγγM (see section 13-14). Whenever data is entered on the terminal (i.e. via the Magnetic Stripe Reader or Type V Badge Reader or Multifunction Reader) the time of entry is automatically added to the data sent to the computer. In addition, the computer may check the displayed time by requesting the terminal status using E_{SC}^ (see section 13-17).

Prompting lights. The left hand side of the terminal housing for a one line display contains two lights. A green "READY" light, controlled by escape sequence E_{SC}-d1/0g/G (see section 13-16), and a red "WAIT" light, controlled by escape sequence E_{SC}-d1/0r/R (see section 13-16). The green light should be lit and the red light extinguished whenever the terminal is ready and able to receive a badge/card. The green light should be extinguished and the red light lit whenever the terminal is unable to receive a badge/card.

Loud buzzer. The terminal is equipped with a loud buzzer that is controlled using escape sequence ESC-t1a/A (see section 13-15). This buzzer may be used to signal to the user that an error has occurred. The buzzer is automatically sounded by the terminal (for approximately one second) if the reading of a badge/card is stopped for any of the following reasons.

1) Type V Badge Reader, badge inserted wrong end first.
2) Type V Badge Reader, hardware failure detected.
3) Multifunction Reader, badge wrongly inserted (detected by corner cut).
4) Multifunction/Type V Badge Reader, a badge/card with Image data being read by a Reader set to Hollerith or Numeric reading.
5) Magnetic Stripe Reader, the badge being passed through the Reader either wrong end first or not at a uniform speed. To commence a read operation, the Reader must recognize the start character on the magnetic stripe. Therefore if the badge is inserted with the magnetic stripe NOT facing the arrow (on the Reader) the data cannot be read and the buzzer is not sounded.

Data Buffer. The 3077A terminal has an input buffer size of 100 characters and an output buffer size of 240 characters (the output buffer is used to stack badge/card data).

Cradle Relay. The 92904A Wall Mounting Cradle relay is controlled using escape sequence ESC-d1/0|/\ (see section 2-20). This relay may be employed to control an external user device (e.g. an electric door lock).

Type V Badge Reader. The Reader can read Industry Type V punched Badges encoded in either Numeric or 10-bit Image coding, see section 7 for details. When a 3077A is equipped with a Type V Badge Reader, after each read operation (when the badge is removed from the Reader) an internal check on the Reader data detection circuitry is performed. If a failure is detected, when a badge is subsequently entered the loud buzzer sounds and the data is NOT sent to the computer.

Note: This feature is not implemented on Type V Badge Readers fitted to 3075A or 3076A terminals.

Multifunction Reader. The Reader may be used to read optical cards (i.e. marked cards, turn-around documents and punched cards) as well as Industry Type III punched Badges. The badges/cards may be encoded in either Hollerith or 12-bit Image coding, see section 6 for details. Corner cut detection may be used to ensure the badges/cards are correctly inserted.

Magnetic Stripe Reader. The Reader can read both plastic badges and IBM 3630 compatible magstripe cards containing a magnetic stripe on which the data is encoded to either:

1) Credit card (ANSI X4.16-1976 or ISO 3554) specifications.
2) IBM 3630 specifications.

For details see section 11.

Alphanumeric Display. When the display is disabled (ESC-c0D, see section 2-8) no data can be displayed. When the display is enabled, commercial signs, numeric and upper case alpha characters received from the computer are displayed as they are received. All lower case alpha characters received from the computer are changed to their upper case equivalent. The local display of entered badges/cards data is not available. However, a remote (i.e. computer) echo of the entered badge/card data may be done, if required.

The Alphanumeric Display has the following features:

1) Display blinking, selected using escape sequence ESC-d1/0{ /] (see section 4-5).
2) Clear display, selected using escape sequence ESCJ (see section 4-7).

3077A power-on. When the 3077A is switched-on it generates a break to the computer (see section 2-16). The red WAIT prompting light automatically illuminates and the four digit time display is blank. The terminal goes into the WAIT mode, i.e. if the user attempts to insert a badge/card it is not read; for the Type V Badge Reader and Magnetic Stripe Reader the terminal loud buzzer is sounded, for the Multifunction Reader the buzzer does not sound (as the badge/card cannot be inserted in the Reader). The terminal remains in the WAIT mode until it receives the time from the computer, see section 13-14.

Self operation. The local mode of operation (used for test purposes and demonstration only) may be selected by setting rear panel terminal configuration switch I-1 to 1 and I-2 to 0. When in self operation, at power-on the red and green prompting lights simultaneously illuminate with 88:88 shown on the time display. The prompting lights are then extinguished and after approximately 10 seconds the time display changes to 1:00. The terminal then goes into the data input mode in which the functioning of the terminal may be checked, as follows:

1) When the 3077A is equipped with the optional Alphanumeric Display, the contents of entered badges/cards will be displayed.

2) When the display is not fitted, terminal configuration switch II-1 should be set to 1. This enables the special test badges provided with the Installation and Programming Kit (option 030) to be used to test the terminal. When a test badge is entered the data is compared with a stored, fixed pattern. If the comparison fails, the loud buzzer and red prompting light are activated. For details see section 16.

Note: For the Magnetic Stripe Reader, the test badge is not compared with a fixed pattern as a correct read is guaranteed by the encoded parity and LRC character. However, the loud buzzer and red prompting light are activated if a failure is detected.

13-3 3077A OPERATING MODES

The 3077A has two operating modes that are selected using escape sequence E_{SC}-t1/0b/B (see section 13-13), interactive mode and buffered mode.

1) Interactive mode: the terminal is completely under software control and only responds to escape sequences from the computer.
2) Buffered mode: the terminal has local control over badge/card entry and the turning on or off of the prompting lights and buzzers. This operating mode enables a 3077A to stack badge/time data in its 240 character output buffer. This approximates to:
   a) For the Type V Badge Reader; at least 10 badges with alphanumeric data or 20 badges with numeric data.
   b) For the Multifunction Reader; at least two punched cards, or up to five marked cards, or up to 10 Type III Badges.
   c) For Magnetic Stripe Reader; at least two IBM 3630 compatible magstripe cards, or up to six badges/cards completely encoded with numeric data (encoded to credit card specifications), or up to 20 badges/cards encoded with ten numeric characters (encoded to credit card specifications).

   This enables a high throughput of people using the terterminal even when the computer system is heavily loaded.

   For both modes, whenever a badge/card is inserted the time is also recorded and stored (with the badge/card data) in the output buffer. Thus, when the data is transmitted to the computer, each badge/card contents are accompanied by the time of insertion.

13-4 Interactive Mode - Sequence Of Operations

Point-to-point connections. For point-to-point communications, rear panel terminal configuration switches II-6 and II-7 control the handshake communications with the computer (see section 14-21). Switch II-6 is associated with the computer Clear To Send control line. Switch II-7 is associated with the D_{C1} character (octal 021). Table 13-1 shows how the switch settings control the point-to-point communications.

For point-to-point connections the sequence of operations is as follows:

Step 1. Reader enabled, time received, green light on and the red light off.

Step 2. As soon as a badge/card is correctly entered into the Reader, the green light is automatically switched off. The badge/card is then automatically completely read and its contents (plus the time) are transmitted to the computer. At the end of the read, the "quiet" terminal buzzer automatically sounds and the terminal goes into the "WAIT" state, i.e. the Reader is disabled and both the green and red prompting lights are off.

Note: If the badge/card is wrongly entered it is not read and the terminal loud buzzer is automatically sounded.

Step 3. The terminal stays in the WAIT state until it receives escape sequences to switch on the green light (E_{SC}-d1g/G) and enable the Reader.

Table 13-1 Point-To-Point Communications Switch Settings

Terminal Configuration Switch Settings	Comment
II-6 = 0 II-7 = 0	Terminal stores data in its output buffer and only transmits when the computer Clear To Send control line is high.
II-6 = 1 II-7 = 0	Terminal transmits each character as it is received (no data stored in the terminal).
II-6 = 0 II-7 = 1	Terminal stores data in its output buffer and can only transmit when both the computer Clear To Send line is high and a D_{C1} character is received from the computer.
II-6 = 1 II-7 = 1	Regardless of the Clear To Send line, the terminal stores data in its output buffer and only transmits when a D_{C1} character is received from the computer.

Multiterminal connections. For multiterminal connections the sequence of events is as follows:

Step 1. Reader enabled, time received, green light on and the red light off.

Step 2. As soon a badge/card is correctly inserted into the Reader, the green light is automatically extinguished. The badge/card is then automatically completely read and its contents (plus the time) are stored in the terminal output buffer. At the end of the read the "quiet" terminal buzzer automatically sounds and the terminal goes into the "WAIT" state, i.e. the Reader is disabled and both the green and red prompting lights are off.

Note: If the badge/card is wrongly entered it is not read and the terminal loud buzzer is automatically sounded.

Step 3. When a read operation is issued by the computer, the 3077A transmits one data block.

Step 4. The terminal stays in the WAIT state until it receives escape sequences to illuminate the green light (E_{SC}-d1g/G) and enable the Reader.

During the WAIT state, if the user attempts to insert a badge/card it is not read and, for the Type V Badge Reader and Magnetic Stripe Reader, the terminal loud buzzer is automatically sounded.

13-5 Buffered Mode - Sequence Of Operations

The buffered mode is available for both communications modes:

1) Multiterminal. When a read operation is issued by the computer, the 3077A sends the current contents of its buffer to the computer.
2) Point-to-point. In this case the 3077A communications handshake is set by rear panel terminal configuration switches II-6 and II-7, see section 13-4.

In the buffered mode, terminal control by the computer is restricted. The escape sequences used to action the following controls are ignored by the terminal:
- control of the green and red prompting lights.
- control of the loud buzzer.
- control over enabling/disabling the Reader.

The sequence of operations for point-to-point and multi-terminal connections is as follows:

Step 1. Reader enabled, time received, green light on and the red light off.

Step 2. As soon as a badge/card is inserted into the Reader, the green light is automatically extinguished and the badge/card read. For the Multifunction Reader, when set in the Hollerith mode the data is checked for Hollerith coding. For the Type V Badge Reader, when set in the Numeric mode the data is checked for numeric coding. For the Magnetic Stripe Reader, the Longitudinal Redundancy Check character is checked.

Step 3. If no error is detected and the output buffer is not full, a small beep automatically sounds, the badge data plus time is "stacked" in the output buffer, the green light is automatically switched on again and the sequence returns to step 2.

Step 4. If an error is detected locally, the louder buzzer sounds and the red light is switched on for one second. (If a Multifunction Reader is fitted, the badge/card is rejected backwards through the Reader aperture). After that, the green light is switched on again, the user can re-enter his badge/card and the sequence returns to step 2.

Step 5. If the output buffer is full, the louder buzzer sounds, the red light is switched on for one second, the red light and the green light remain off until the computer requests the data stored in the output buffer. (If a Multifunction Reader is fitted, the badge/card is rejected). Then the green light is switched on and the red light off; the user can re-enter his badge and the sequence returns to step 2.

Note: For the Multifunction Reader, if a badge/card is inserted while the green light is extinguished, the badge/card is physically rejected by the Reader and the red light switched on for one second.

13-6 BADGE/TIME STORAGE

13-7 Interactive Mode (Multiterminal and Point-To-Point Connections)

Note:
1) The data from only one badge/card is stored.
2) One READ statement is required per badge.

The first four characters stacked in the output buffer, before the badge data, are the current time information (see figure 13-2). They are separated from the badge data by an ASCII Record Separator character (R_S = Octal 036). A terminator character Carriage Return (C_R = octal 015) or, in point-to-point, a customized terminator is transmitted after the badge data.

Figure 13-2 depicts the output buffer in the interactive mode for:

1) Multiterminal connections.
2) Point-to-point connections when the data is stored in the terminal output buffer, see section 13-4. When the data is not stored it is sent one character at a time (with hours H1 first).

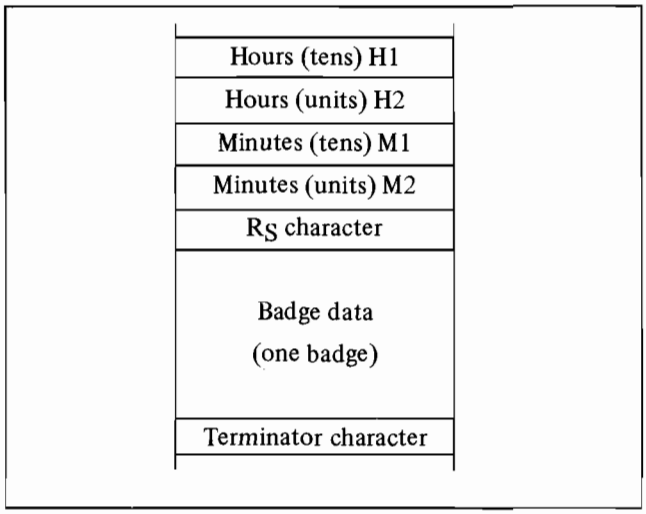


Figure 13-2 Output Buffer - Interactive Mode

13-8 Buffered Mode For Point-To-Point Connections

Note: The data plus the time of entry (of each badge/card) for several badges/cards (up to 240 characters) is stored.

In buffered mode with point-to-point connections; when the data is stored in the terminal output buffer (see section 13-4), the first four characters in the output buffer (before the badge/card data) are the current time information (see figure 13-3). They are separated from the badge/card data by the ASCII Record Separator character (R_S). The time of entry/data from one badge is separated from the time of entry/data of the next entered badge by the customized terminator character.

When using the Clear To Send line only to control transfers to the computer (i.e. switches II-6 = 0 and II-7 = 0), when the Clear To Send line goes high the complete contents of the output buffer (i.e. data plus time of entry for SEVERAL badges/cards) is transmitted to the computer, together with the customized terminator characters.
When using the D_{C1} handshake (i.e. switch II-7 = 1), one READ statement is required per badge/card:

1) If switch II-6 = 0, switch II-7 = 1 and the Clear To Send line is high, when a D_{C1} character is received the data plus time of entry for ONE badge/card only is transmitted to the computer (together with the customized terminator character).
2) If switch II-6 = 1 and switch II-7 = 1 (irrespective of the state of the Clear To Send line), when a D_{C1} character is received the data plus time of entry for ONE badge/card only is sent to the computer.

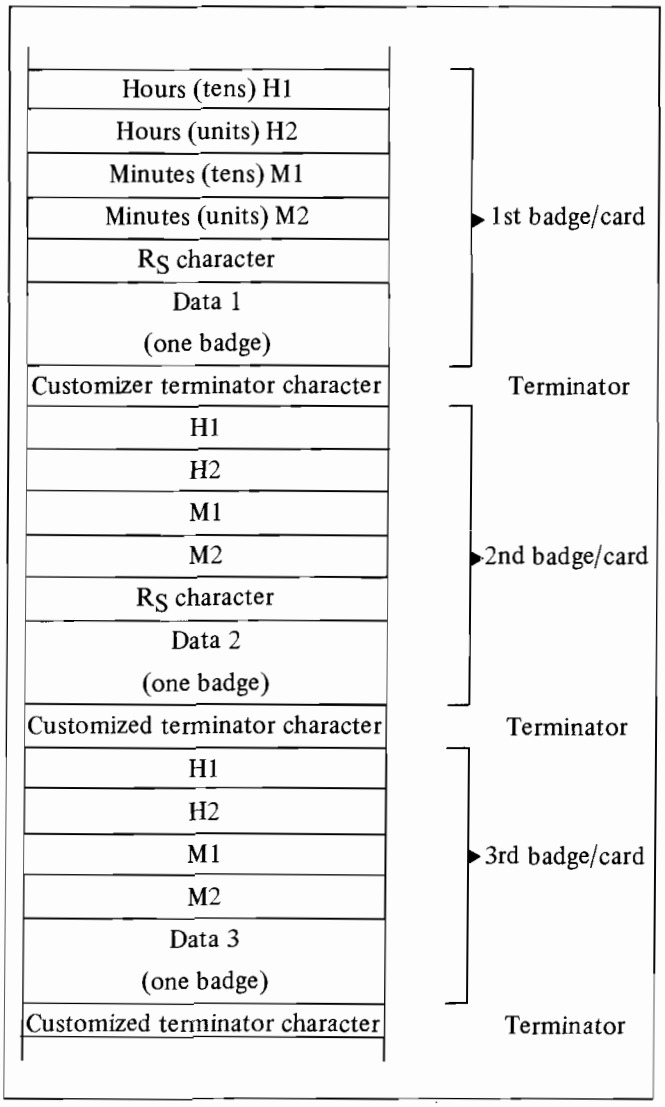


Figure 13-3 Output Buffer - Buffered Mode Point-to-Point Connection

13-9 Buffered Mode For Multiterminal Connections

Note: The data from several badges/cards is stored but the time is only stored at minute intervals.

In buffered operating mode with multiterminal connections, the first four characters in the output buffer are time information, as previously described (see figure 13-4 for details). The contents of each badge entered are then stacked in the output buffer, separated by an R_S character, until the time changes to the next minute. Then an ASCII Group Separator character (G_S = octal 035) is written after the last badge data and a new time is written in the next four locations, with R_S as a separator for next badge data. When a read operation is issued from the computer, the contents of the output buffer are transmitted together with a Carriage Return character (C_R = octal 015) as the terminator character.

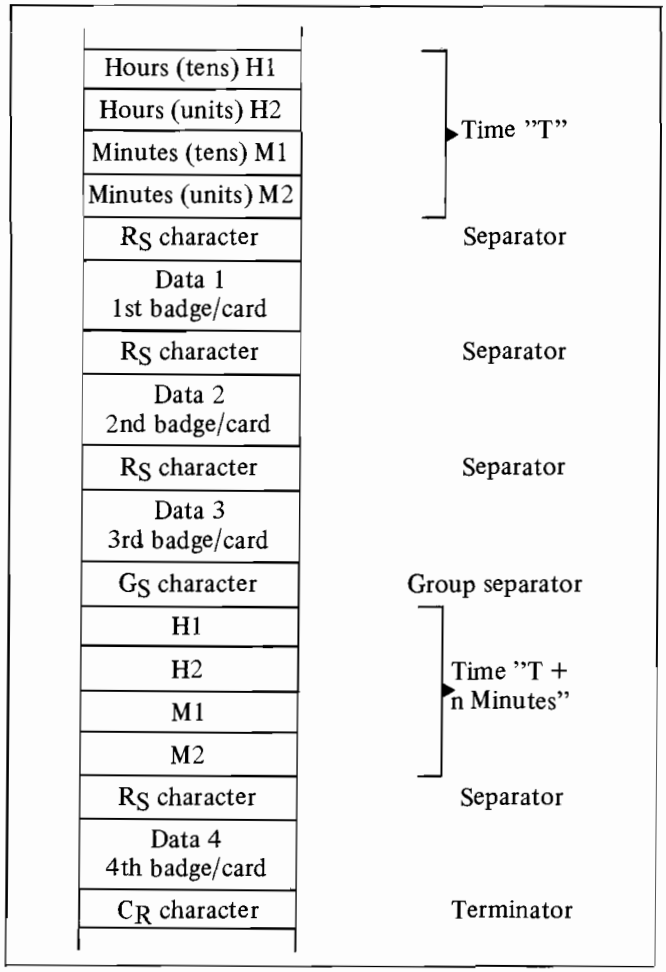


Figure 13-4 Output Buffer - Buffered Mode Multiterminal Connection

13-10 3077A TERMINAL STATUS

Note: The status request has no effect upon operator data entry.

The terminal gives the highest priority to the status transmission. i.e. if a block of data is ready to be transmitted to the computer and a status request is received, the terminal transmits its status before it transmits its data (the data can be either information data or a computer break indicating power-on).

The 3077A terminal stores ten internal status bytes which are transmitted to the computer system upon receiving the escape sequence ESC ^, see section 13-17.

13-11 3077A TERMINAL PROGRAMMING

The computer must wait for the terminal to generate a break (see section 2-16) to indicate power-on before the terminal can be programmed. At power-on the terminal goes into the WAIT mode (until it receives the time from the computer). The terminal must then be programmed in the following order:

1) The 12/24 hour clock must be selected (see section 13-12).
2) The operating mode must be selected (see section 13-13).
3) The time display must be synchronised to the computer (see section 13-14).

The terminal is then available for operations, according to the selected mode.

The 3077A may be program controlled using escape sequences:

1) ESC-t1/0c/C	select 24 or 12 hour clock
2) ESC-t1/0b/B	operating mode
3) ESC-tββhγγm/M	synchronize time display
4) ESC-t1a/A	loud buzzer
5) ESC-d1/0g/G	green prompting light
6) ESC-d1/0r/R	red prompting light
7) ESC ^	terminal status

These escape sequences are described in section 13-12 to 13-17 inclusive.

The escape sequences applicable to and available to control the 3077A modules/options are as follows:

Type V Badge Reader (see section 7).
The Reader is controlled by the following escape sequences:

1) ESC-c1/0B	enable (1)/disable (0) Reader (not available when the terminal is in buffered mode).
2) ESC-r1/0j/J	reading mode; 1 = Image, 0 = Numeric.

Multifunction Reader (see section 6).
The Reader is controlled using:

1) ESC-c1/0R	enable (1)/disable (0) Reader (not available when the terminal is in buffered mode).
2) ESC-r1/0a/A	clock-after-data reading; 1 = marks, 0 = holes.
3) ESC-r0n/N	punched cards with no clock marks.
4) ESC-r1/0i/I	reading mode; 1 = Image, 0 = Hollerith.
5) ESC-r1/0c/C	corner cut detection; 0 = enabled, 1 = disabled.

Magnetic Stripe Reader (see section 11).
The Reader is controlled using:

ESC-c1/0M	enable (1)/disable (0) Reader (not available when the terminal is in buffered mode).

Alphanumeric Display (see section 4).
The Display is controlled using:

1) ESC-c1/0D	enable (1)/disable (0) Display.
2) ESC J	clear display.
3) BS (octal 010)	backspace.
4) CAN (octal 030) or DEL (octal 177)	delete last entry.
5) ESC-d1/0{/]	display blinking; 1 = enabled, 0 = disabled.

The display may be controlled irrespective of the terminal operating mode.

92904A Wall Mounting Cradle Relay (see section 2-20).
The relay is controlled using escape sequence:

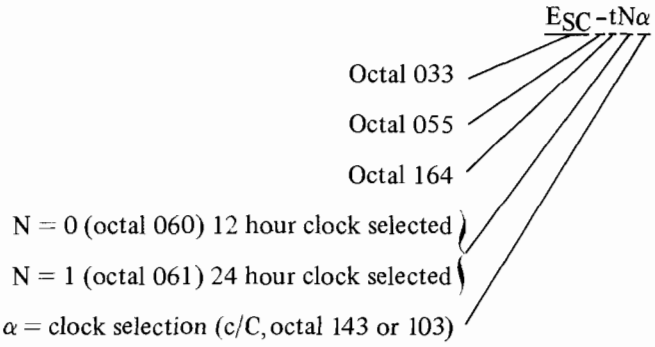
ESC-d1/0|/\	1 = relay enabled, 0 = relay disabled.

The relay is available irrespective of the terminal operating mode.

Note:
1) Multifield operation is not available with the 3077A terminal.
2) A protected field is not used on the display as the data cannot be modified by the terminal user.

13-12 24 OR 12 HOUR CLOCK SELECTION

The four digit time display may be selected to operate either as a 24 hour or 12 hour clock by sending escape sequence:

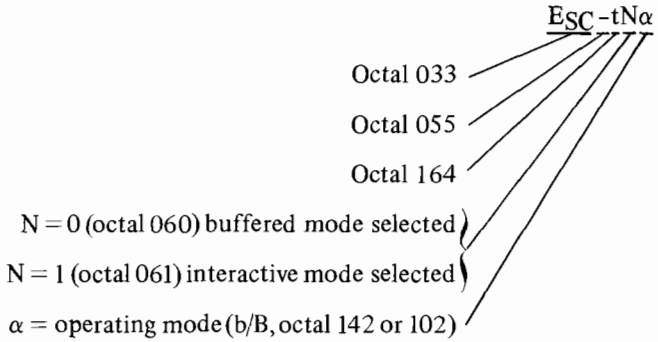


If the clock has to be changed from the 12 hour format to the 24 hour, and vice-versa, a full reset (ESC E, see section 2-8) must be sent to re-initialise the terminal before changing the clock.
At power-on or after a full reset the 12 hour clock is selected.

Note: Once the clock is selected, the displayed time may be altered as often as required (see section 13-14 for details).

13-13 3077A OPERATING MODE

The buffered or interactive operating mode may be selected by sending escape sequence:

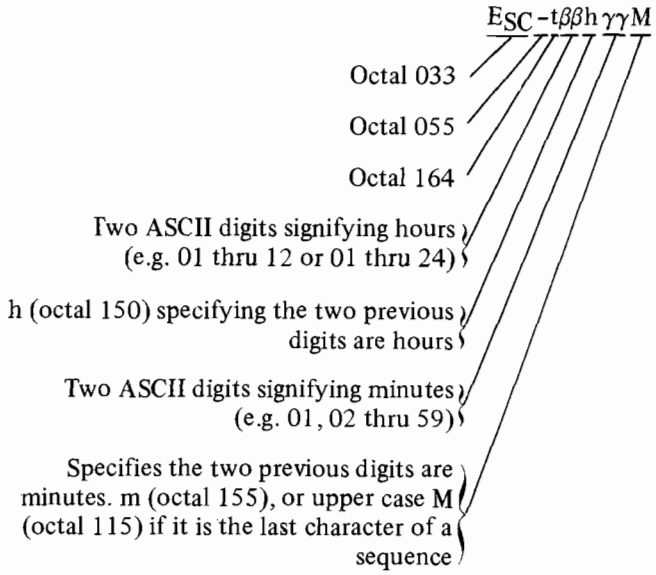


If the operating mode has to be changed, a full reset (ESC E) must be sent to re-initialise the terminal before the operating mode is changed.

At power-on or after a full reset the buffered mode is selected.

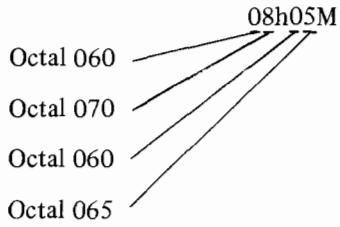
13-14 SYNCHRONISE TIME DISPLAY

The time shown on the terminal four digit time display may be synchronised to the computer master clock by sending escape sequence:



Note:
1) The time sent to the display must correspond to either the 24 hour or 12 hour clock previously specified for the terminal. If the time specified is outside these values it is rejected by the terminal and the time display is not updated.
2) It is recommended that the terminal displayed time should be synchronised to the computer master clock at least once every 24 hours. This may be done at any time.

The hours and minutes must always be specified using two ASCII characters. For example, five past eight (am) must be specified:

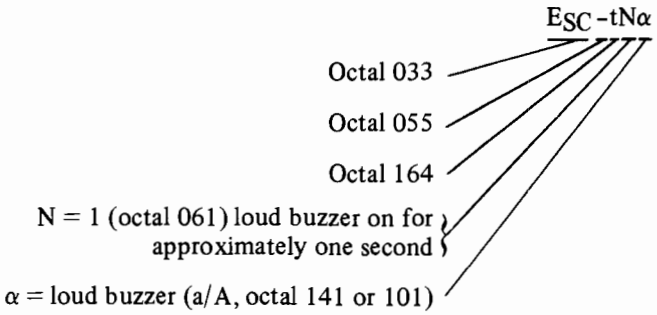


At power-on or after a full reset, the terminal is automatically placed in the WAIT state (with the time display blank) until it receives the time from the computer.

13-15 3077A LOUD BUZZER

Note: This escape sequence is not available when the terminal is in buffered mode.

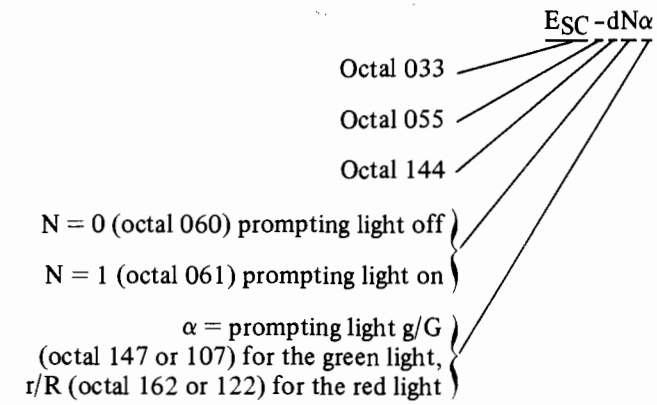
The loud buzzer may be controlled using escape sequence:



13-16 3077A PROMPTING LIGHTS

Note: This escape sequence is not available when the terminal is in the buffered mode.

The green "READY" and red "WAIT" prompting lights may be turned on and off using escape sequence:



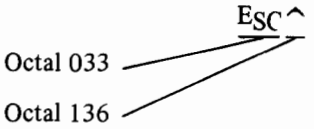
At power-on or after a full reset the green light is automatically switched OFF and the red light is switched ON.

For example, to switch on the green light and switch off the red light the following sequence must be sent.

ESC -d1g0R

13-17 3077A TERMINAL STATUS

The 3077A terminal stores ten status bytes that are transmitted to the computer upon receiving escape sequence:



The contents of each of the ten status bytes are as follows:

Byte 1. Escape Character ESC (octal 033).

Byte 2. Backslash Character \ (octal 134).

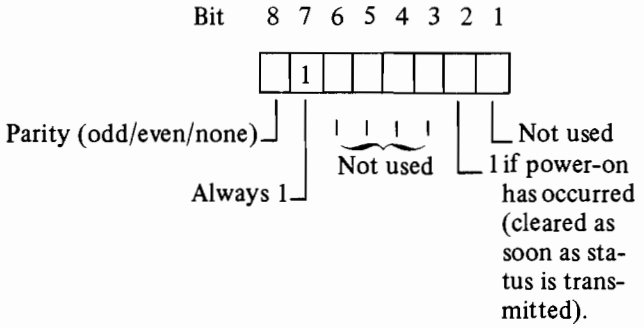
Byte 3. Hours (tens) i.e. 0, 1 or 2 (octal 060, 061 or 062).

Byte 4. Hours (units) i.e. 0 thru 9 (octal 060 thru 071).

Byte 5. Minutes (tens) i.e. 0 thru 5 (octal 060 thru 065).

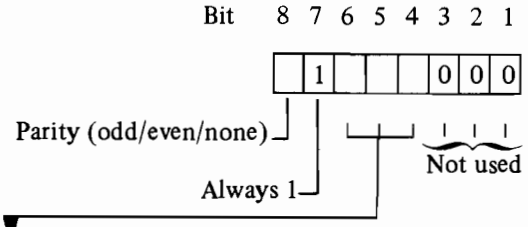
Byte 6. Minutes (units) i.e. 0 thru 9 (octal 060 thru 071).

Byte 7. Interrupt Status (returned as an ASCII chracter, either @ - octal 100 or B - octal 102).



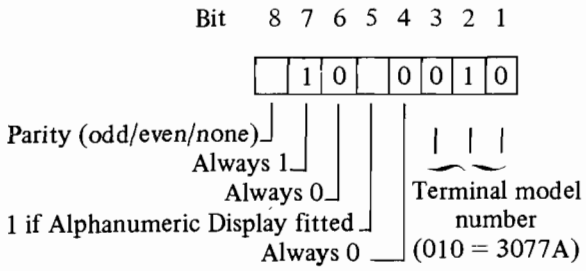
Bit 2 is set to 1 whenever terminal power-on occurs (this also causes a break to be sent to the computer, see section 2-16 for details). The bit is cleared as soon as the status is transmitted to the computer.

Byte 8. Terminal Option Configuration.



Bits 654	Terminal Option	Equivalent ASCII character sent to the computer
000	Not used	
001	Not used	
010	Multifunction Reader	P
011	Not used	
100	Type V Badge Reader	\
101	Magnetic Stripe Reader	h
110	Not used	
111	Not used	

Byte 9. Terminal Type Configuration.



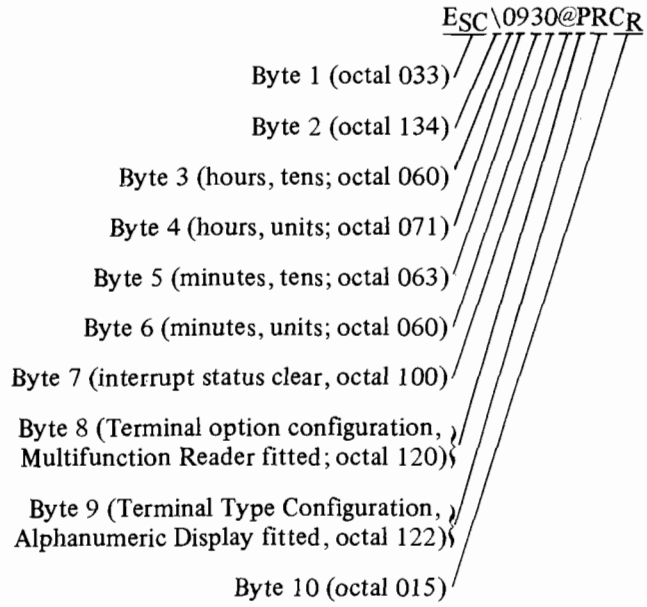
For example, if the 3077A does not have a display the contents of byte 9 is ASCII character B (octal 102). If the 3077A is fitted with an Alphanumeric Display, the contents of byte 9 is ASCII character R (octal 122).

Byte 10. Returned Status Terminator Character.

1) Carriage Return (C_R = octal 015) for multiterminal connections.
2) C_R or a customized terminator for point-to-point connections.

Bit 6 of byte 10 is always set to 0, to differentiate from the HP 264X terminals which always have bit 6 set to 1.

An example of the terminal response to E_{SC} ^ is:



Note:

1) In the point-to-point communications mode, if configuration switch II-7 = 0 the terminal returns its status 500 ms after it receives the E_{SC} ^ escape sequence. When using the D_{C1} handshake (configuration switch II-7 = 1), the terminal waits until it receives the D_{C1} character following the status request.

2) At power-on and before the terminal receives the time from the computer, if the terminal status is requested (even though the four digit time display is blank) status bytes 3, 4, 5 and 6 will each comprise ASCII character 8 (octal 070).

13-18 TYPICAL EXAMPLE

To set the 24 hour clock, display 8h30 and set the interactive mode the following sequence must be sent.

$E_{SC}EE_{SC}$-t1c1b08h30M

SECTION 14

DATA COMMUNICATIONS

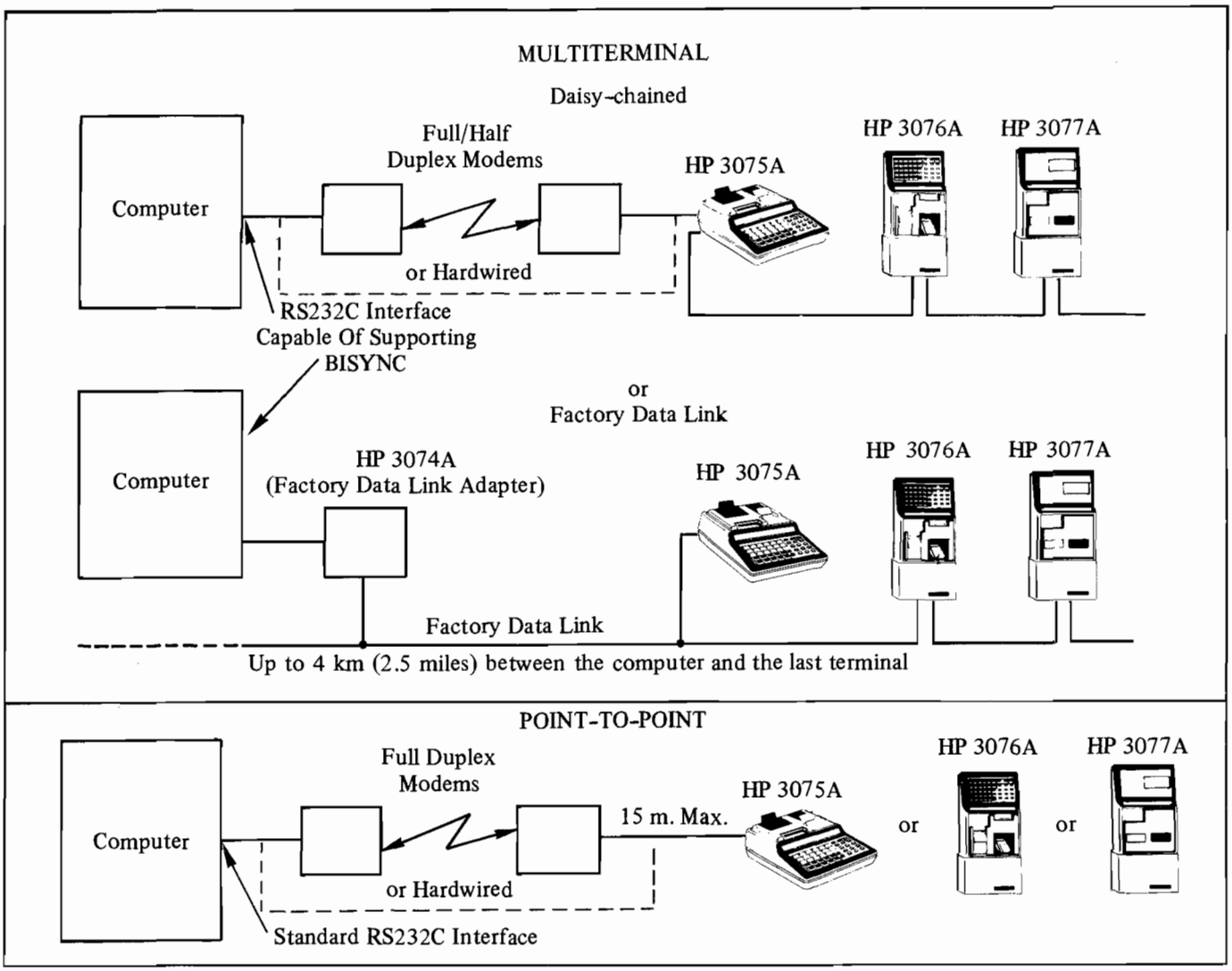


Figure 14-1 Communications Modes

14-1 INTRODUCTION

The 3075A, 3076A and 3077A terminals may be connected to the computer system in any of three ways; point-to-point, daisy-chained or factory data link (see section 15 for details). Two discrete communications protocols (i.e. the mode of communications between the computer and the terminal and vice-versa) are employed, multiterminal (for daisy-chained and factory data link connections) and point-to-point. Table 14-1 distinguishes between these two protocols.

The protocol, parity, transmission speed (110 to 9600 baud) and the terminator character settings are made on the rear panel terminal configuration switches (see Appendix F). Sub-sections 14-2 thru 14-19 describe the multiterminal protocol, sub-sections 14-20 and 14-21 describe the point-to-point protocol.

14-2 MULTITERMINAL CONNECTIONS (Asynchronous polled block mode protocol)

The asynchronous polled block mode protocol used by the 3075A/3076A/3077A terminals is compatible with the HP 264X series of asynchronous terminals. Thus both types of terminal can be mixed on the same communications link. Any mix of 264X terminals (equipped with the 13260C communications board) and 3075A, 3076A or 3077A terminals is possible.

With this protocol, the computer initiates all data transfers, whether they are from the computer to the terminal or vice-versa.

If the computer wants to send text to a terminal it first sends a "select sequence" to tell the particular terminal that it wants to transmit. If the terminal is ready to accept, the computer then transmits the text as a block(s).

If the computer wants to receive text from a terminal (or group of terminals), it sends a "polling sequence" to the particular terminal (or group) to request it to transmit its text (if ready). The text is then sent as a block(s).

Control sequences are required to:
- acknowledge text block transfers
- terminate text transfers
- inform the sender or receiver of status changes

Each sequence consists of one or more Block Protocol Control Characters. A list of these control characters is given in Table 14-2. A summary of the uses of these characters is given in Table 14-3.

In order to carry out the control sequences, the terminal must be in the appropriate operating mode:

Control Mode. When the terminal is neither transmitting non receiving.

Text-Out Mode. When the terminal transmits text to the computer.

Text-In Mode. When the terminal receives text from the computer.

A detailed description of each of these modes and the control sequences in each one is given in the following sub-sections.

14-3 Control Mode

A terminal is in Control Mode (see figure 14-2) whenever it is NOT transmitting or receiving to/from the computer. The terminal automatically enters the Control Mode any time it transmits or receives an EOT character. While in the Control Mode, the terminal monitors the communications link for the following:
- A poll sequence containing its own identification number. If, upon receiving such a poll sequence, a terminal has a text block to transmit, it enters the Text-Out Mode (see section 14-4).
- A select sequence containing its own identification number. If, upon receiving such a select sequence, a terminal is ready to receive text blocks, it enters the Text-In Mode (see section 14-5).

Table 14-1 Communications Protocols

Communications / Parameter	Multiterminal		Point-To-Point
Terminal Connection	Daisy-chain (hardwired or via full/half duplex modems)	Factory Data Link	Direct RS232C compatible connection (hardwired or via full duplex modems)
Protocol	Asynchronous polled block mode protocol patterned after asynchronous BISYNC (Binary Synchronous Communications)		Character mode protocol using: X-ON/X-OFF ENQ/ACK Clear To Send DC1
Data format	ASCII-7 data bits plus one selectable parity bit (odd/even/none).		

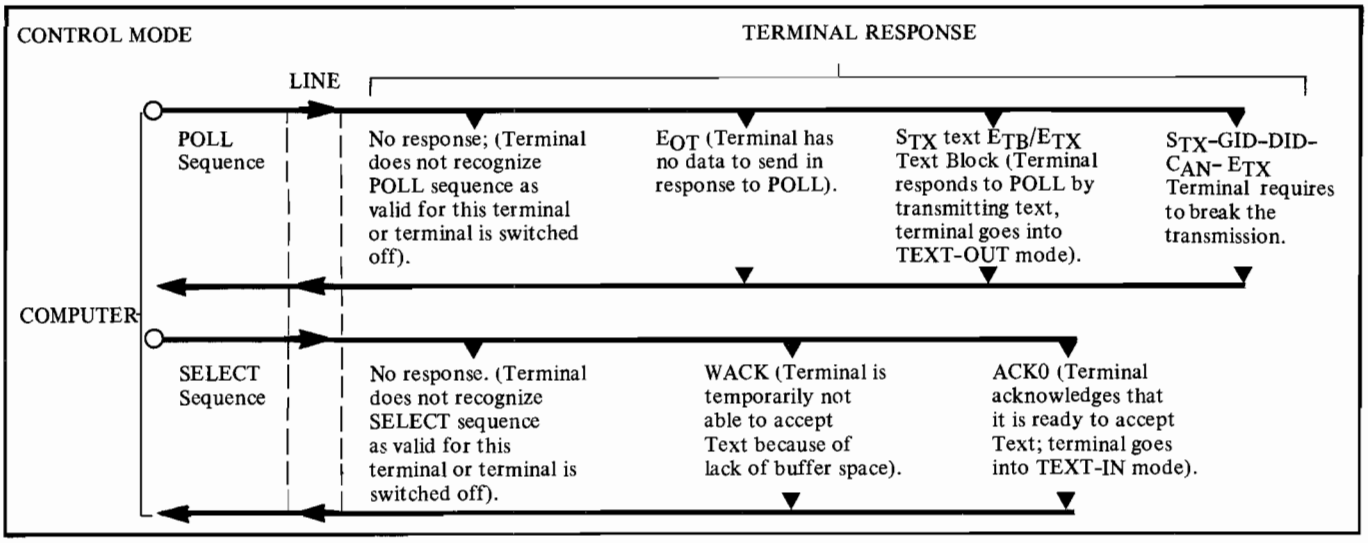


Figure 14-2 Operation Of Block Protocol Control Characters In Control Mode

14-4 Text-Out Mode

As soon as a terminal has been successfully polled, it goes into the transmit state to send its text block (framed by block framing characters S_{TX}, E_{TX}/E_{TB} and BCC, see section 14-15).

It then goes into the receive state waiting for the acknowledgement. When the acknowledgement has been received, the terminal goes back into the transmit state to send one of the responses shown in figure 14-3.

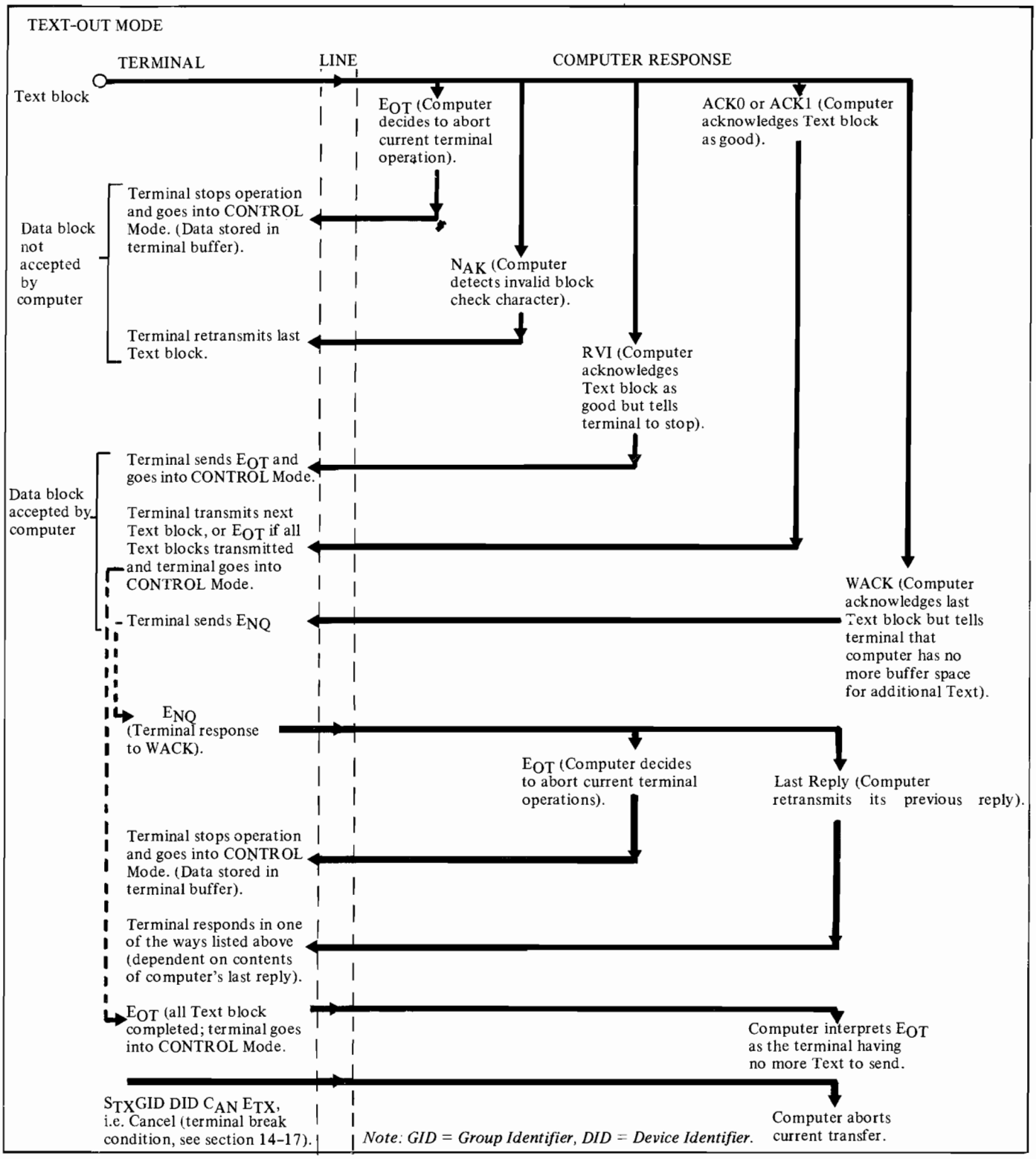


Figure 14-3 Operation Of Block Protocol Control Characters In Text-Out Mode

Table 14-2 Block Protocol Control Characters

CHARACTER	ASCII CODE (OCTAL)	DESCRIPTION
Data link control characters. These characters are used to frame messages and acknowledgements for both transmitted and received text blocks. They are also used to control all communications in an orderly fashion.		
D_{LE}	020	**Data Link Escape.** This is the first character in all two-byte control characters. It is used to indicate that the second character is to be interpreted as a control character rather than a data character. The D_{LE} character has no meaning when used alone.
ACK 0 ($\equiv D_{LE}$ 0)	020 060	**Acknowledge 0.** These control characters are sent by the terminal (after being selected) to tell the computer that the terminal is ready to accept a text block. They are also sent by the receiving station (computer or terminal) after even text blocks (2, 4, etc.) to tell the sending station (terminal or computer) that the block was received properly (see ACK 1).
ACK 1 ($\equiv D_{LE}$ 1)	020 061	**Acknowledge 1.** These control characters are sent by the receiving station (computer or terminal) after odd text blocks (1, 3, 5, etc.) to tell the sending station (terminal or computer) that the block was received properly (see ACK 0).
WACK ($\equiv D_{LE}$;)	020 073	**Wait Before Transmit.** These characters are sent by the receiving station (computer or terminal) to indicate that the last block was properly received but that the receiving station requests that the sender wait before sending the next block. The sending station should either send an E_{OT} to terminate or send an E_{NQ}. The receiving station will then return an ACK 0 if it is ready to receive data or a WACK in order to continue waiting.
N_{AK}	025	**Negative Acknowledge.** This character is used by the terminal to respond to a select sequence to tell the computer that it is not ready to receive text blocks at that time. This character can also be returned in response to a text block to indicate that the block was rejected because of a bad block check after it has sent a text block, the terminal will retransmit the block.
E_{NQ}	005	**Enquiry.** This character is always used to terminate a POLL or SELECT sequence. It is also used by the sending station to request a retransmission of the acknowledgement for the previous text block.
S_{TX}	002	**Start of Text.** This character must be the first character in every text block. It tells the receiving station to begin accumulating a block check character. The S_{TX} character is not included in the block check.
E_{TB}	027	**End of Transmission Block.** This character is used to tell the receiving station to stop accumulating a block check character and that the next character transmitted will be the block check character. When used the E_{TB} character must always follow the last character in the text block. The E_{TB} character is included in the block check character accumulation. (See the E_{TX} character).
E_{TX}	003	**End of Text.** This character must be the last (or only) text block in a message. It tells the receiving station to stop accumulating a block check character. The E_{TX} character is included in the block check character. (See the E_{TB} character).
E_{OT}	004	**End of Transmission.** When this character is sent or received by the terminal, it causes the terminal to switch to Control Mode. It is sent by the terminal when it detects a data over-flow condition while receiving text (buffer full), after sending the last text block of a message to the computer, or in response to a POLL sequence when it has no data to send. An E_{OT} is sent by the computer following the last text block in a message to indicate that the computer has no more data to send or when the computer wants to abort the communication sequence.
RVI ($\equiv D_{LE}$ <)	020 074	**Reverse Interrupt.** This character is sent by the computer to acknowledge that the last text block was properly received (see ACK 0 and ACK 1) and at the same time to request that the terminal stop sending as soon as possible. When this character is received by the terminal, the terminal will immediately send an E_{OT} to the computer.
TTD ($\equiv S_{TX}$ E_{NQ})	002 005	**TTD (Temporary Text Delay)** is sent in place of a text block which is temporarilly unvailable. This re-starts the time-out for a further 3 seconds.

Table 14-2 Block Protocol Control Characters (continued)

CHARACTER	ASCII CODE (OCTAL)	DESCRIPTION
Transmission control characters. These characters are used to initialize and terminate data without affecting data integrity.		
PAD (trailing)	177	**Trailing PAD.** This character is used to ensure that the last character of every transmission has time to be properly received before the receiving station begins transmitting. All transmissions must be terminated with a trailing PAD. In addition a trailing PAD must always be used after an E_{OT} when it is used in a POLL or SELECT sequence. (Note the accuracy of the PAD character cannot be guaranteed).
D_{LE} E_{OT}	020 004	**Disconnect.** When this sequence is received by the terminal instead of a normal response or text block the terminal will attempt to disconnect the modem attached to the communication line by dropping the Data Terminal Ready line for 2 seconds.
Characters not compatible with the protocol but accepted by the terminal.		
S_{YN}	026	Synchronisation character used to synchronise synchronous data communications, not used by the terminal (i.e. asynchronous) communications.

Table 14-3 Summary Of Block Protocol Control Characters

Mode / Character	CONTROL		TEXT-IN		TEXT-OUT	
	POLL RESPONSE	SELECT RESPONSE	RECEIVED	TRANSMITTED	RECEIVED	TRANSMITTED
S_{TX} - "TEXT" - E_{TB} - E_{TX}	Positive response to POLL	–	Sent by CPU as a response to an ACK received from terminal.	–	–	Sent by terminal as a response to an ACK received from CPU.
"E_{OT}"	Negative response to POLL. Terminal has no TEXT to xmit.	–	CPU has no more TEXT to xmit to terminal.	Terminal has detected data overflow.	CPU has decided to abort terminal xmission.	Term has no more TEXT to send to CPU or has just received an "RVI".
"E_{NQ}"	–	–	CPU requests terminal send last TEXT acknowledgement.	–	–	Term requests CPU retransmit last acknowledgment to TEXT.
"RVI"	–	–	–	Terminal acknowledges last TEXT block and informs CPU of a Break condition.	CPU acknowledges last TEXT block & requests term send "E_{OT}".	–
"ACK0/ACK1"	–	Terminal tells CPU that it is ready to accept TEXT (ACK0).	–	Terminal tells CPU that last TEXT block was received OK.	CPU tells term that last TEXT that term sent was OK.	–
"WACK"	–	Term is temporarily busy (term has no available buffers). Cannot accept TEXT.	–	–	CPU acknowledges last TEXT block sent by term but tells term to wait because CPU does not have anymore buffers.	–
"N_{AK}"	–	–	–	Term detected error in last TEXT block CPU sent. Invalid BCC or frame chars.	CPU detected error in last TEXT block term sent. Invalid BCC or frame chars.	–
"S_{TX} - GID - DID C_{AN} - E_{TX} (cancel)	Terminal wants to "Break" the transmission.	–	–	–	–	Terminal wants to "Break" the transmission.

14-5 Text-In Mode

As soon as the terminal has been successfully selected, it goes into the transmit state and sends an acknowledgement to the computer. Then, the terminal goes into the receive state and waits for the computer to send a text block (see figure 14-4). This sequence continues until the terminal receives an E_{OT} from the computer, which puts the device back in the Control Mode.

The terminal may break the transmission during the Text-In Mode due to one of the conditions listed in section 2-16. The terminal will respond with RVI in place of ACK 0/ ACK 1 and continue to respond to additional text blocks with RVI until the terminal is returned to Control Mode (i.e. by receiving an E_{OT} from the computer).

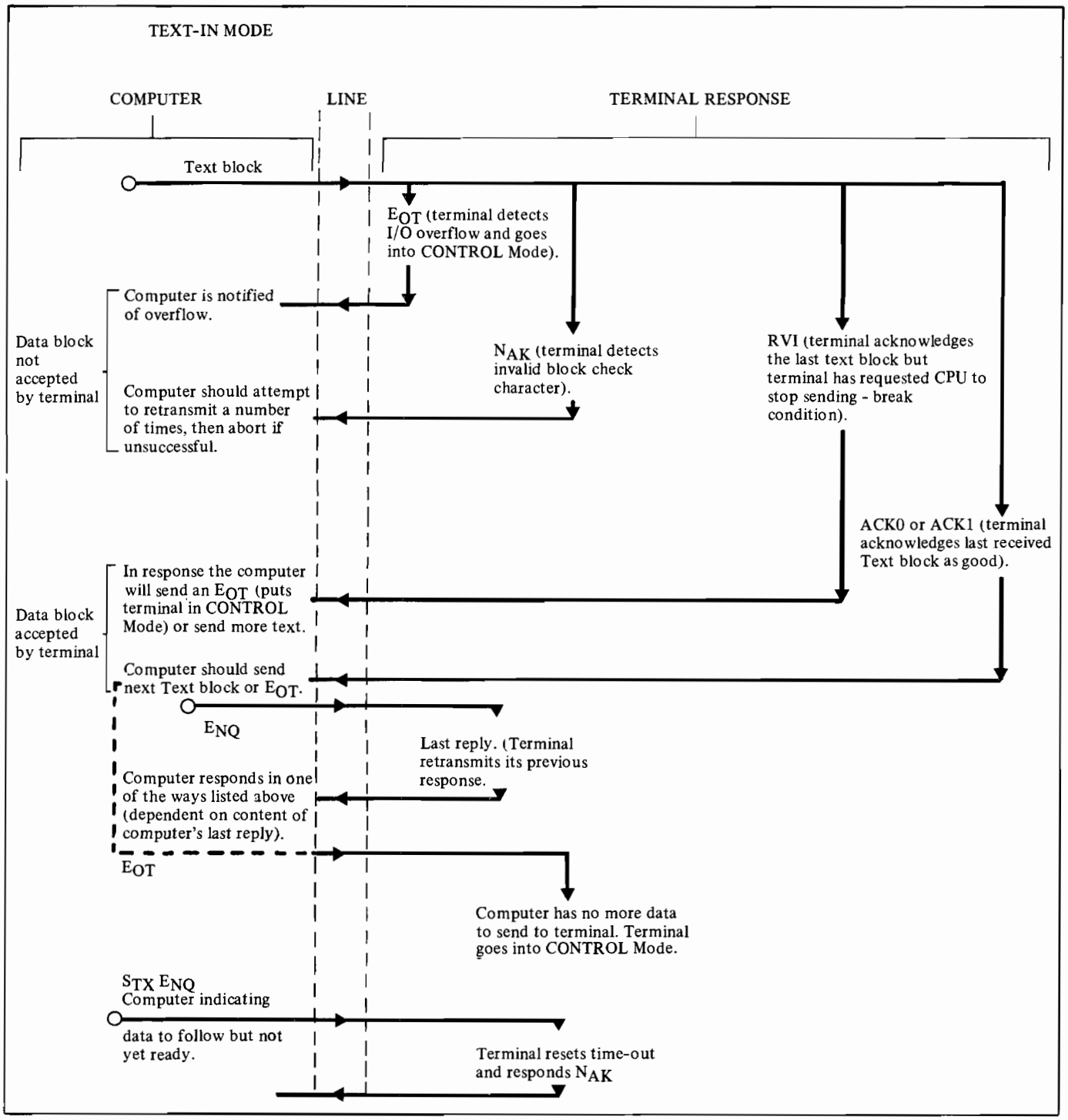


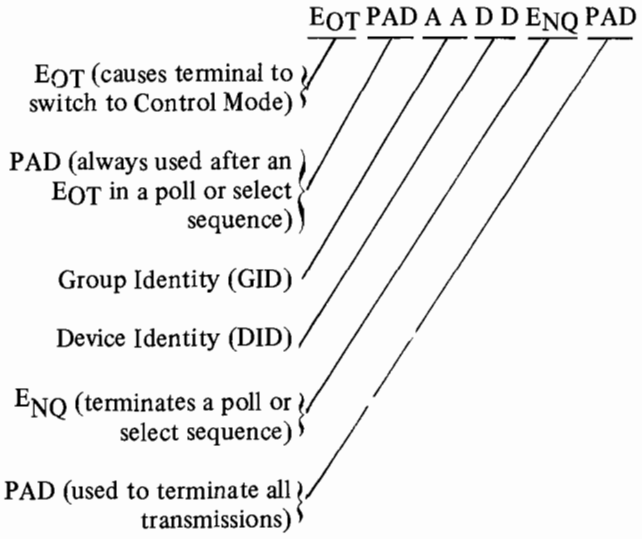
Figure 14-4 Operation Of Block Protocol Control Characters In Text-In Mode

14-6 CONTROL SEQUENCES

The terminal "polling" and "selection" that takes place in order to initiate data transfers is the method used by the computer to inform one (or more) terminals that it wishes to communicate with them. The computer sends a "polling sequence" when it wants to receive data from a terminal (group of terminals). It sends a "select sequence" when it wants to transmit data to a terminal (group of terminals). The sequences are generally called "Control Sequences" and are described in detail in the following sub-sections.

14-7 Individual Poll

If the computer wants to receive data from individual terminals one at a time, it sends one or more individual polls. Each poll contains the unique address of the terminal to which it is directed. For example, a poll of terminal D (i.e. device identifier, DID) in group A (i.e. group identifier, GID) would consist of the following character sequence:



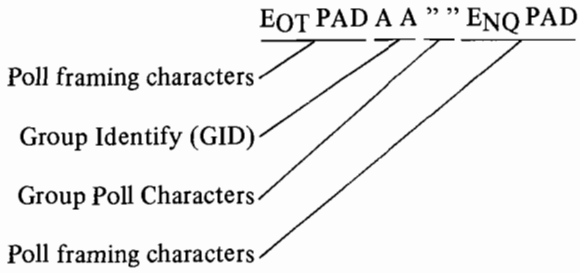
Addresses are always repeated (GID GID DID DID) for added security. The two GID's and the two DID's must be the same for a terminal to respond.

Note: In a poll the GID is always identified by an upper case letter (A thru Z).

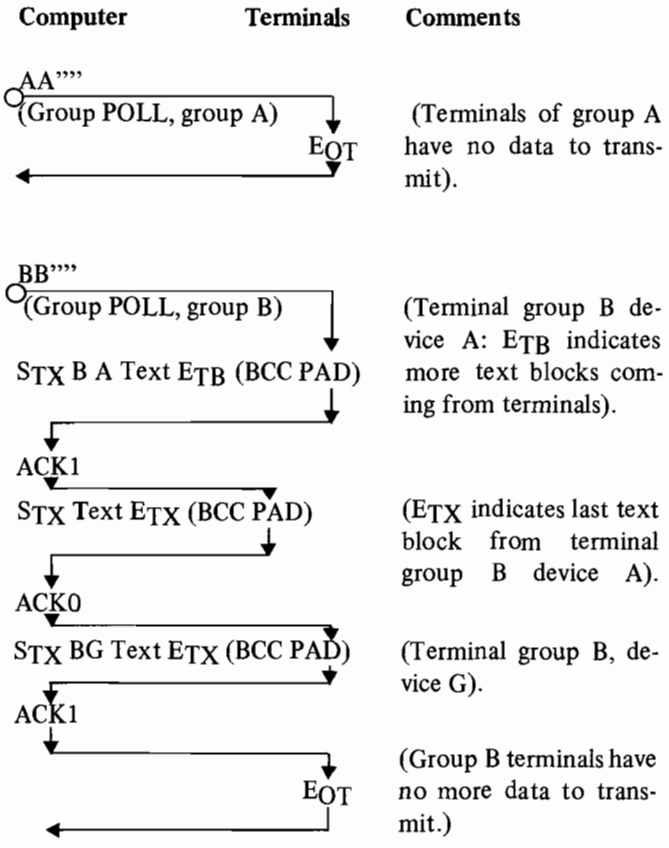
14-8 Group Poll For Daisy-Chained Connections

In order to reduce the time and programming required to poll each terminal on a communication line a group poll may be performed. This allows all of the terminals in a group (terminals having the same group identity, GID) with data ready to send, to respond to a single poll sequence. When the last terminal in the group with data to transfer has completed sending, it will send an EOT to indicate that the group has finished.

The group poll sequence is similar to the normal poll sequence, except that the " character (octal 042) is used in place of the device identifier (DID) character. For example, to poll all of the terminals in group A, you may use the following sequence:



Two example of data transfers:



14-9 Terminal Groups With Factory Data Link

One of the major advantages with the factory data link is the ability to make each terminal fully independent of the others. However, this necessitates polling terminals individually. Therefore, group polling (which often provides less overhead on the data communication) is not available on the factory data link.

To provide group polling, if required, and especially to easily adapt the factory data link to daisy-chained 264X's the arrangement shown in figure 14-5 is possible.

Thus, on the same link groups of any mix of 264X's and Data Capture Terminals can be achieved.

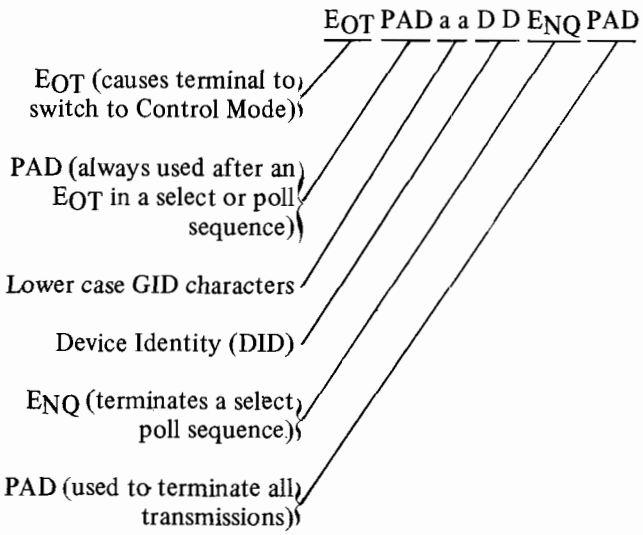
The limitations are:

- Terminals in the same group have to be from one (and only one) connection box, they cannot be connected to different connection boxes on the link.
- Whenever 264X's are interfaced on the link, at least one Data Link Adapter (3074A) or 307X terminal must be used.
- The protection against power on/off switching on daisy-chained terminals cannot be provided.

Data Capture Terminals have the Data Link Adapter built-in so that they can be interfaced directly to the link to start a daisy-chained group. A special cable (HP 92905P) is provided for such an arrangement.

14-10 Individual Select

An individual select occurs when the computer wants a particular terminal to accept a data transmission. The character sequences used in selection are the same as those used in polling. The only difference is that the lower case Group Identity character are used. This tells the terminal that a selection is being sent and not a poll. For example, to address the device D in group A the sequence would be as follows:



Note: In a select sequence, the group select characters are always lower case letters (a thru z).

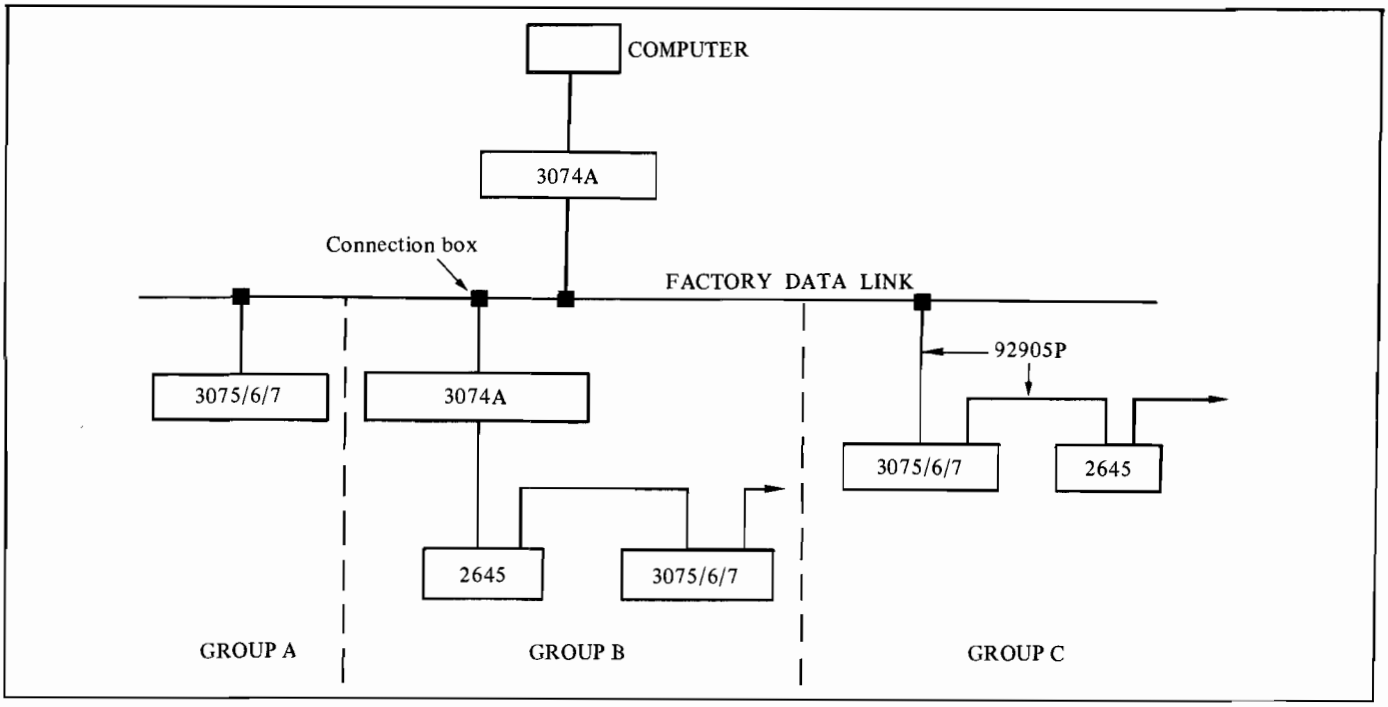
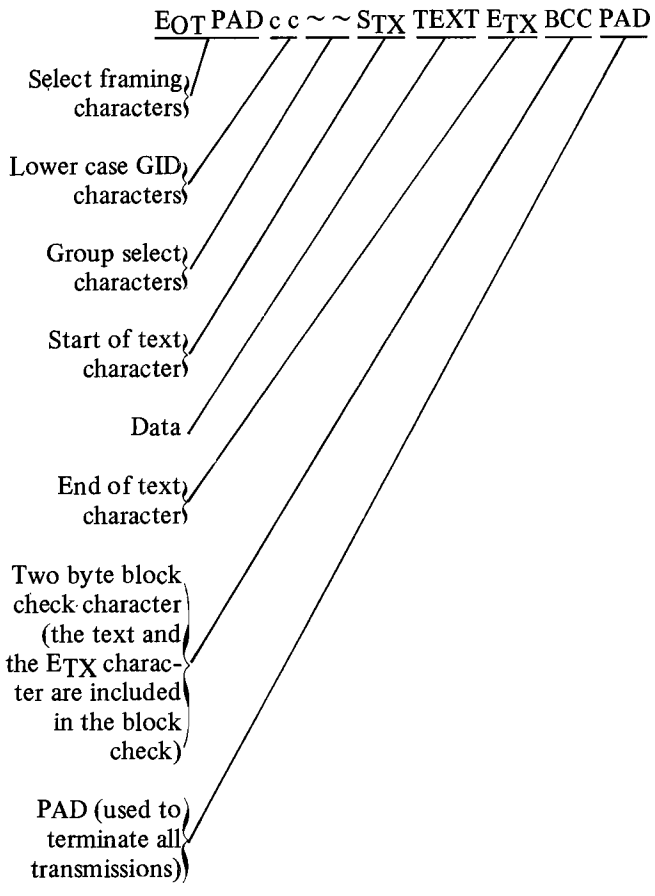


Figure 14-5 Terminal Groups With Factory Data Link

14-11 Group Select

A group select sequence can be used to send data to all of the terminals in a group. The terminals will not send any response to group select. The text transmission is appended directly to the end of the group select sequence. The group select is the same as an individual select sequence except that the device identity (DID) character is replaced with a tilde (~ octal 176).

For example, to send data to all of the terminals in group C the following sequences would be used:

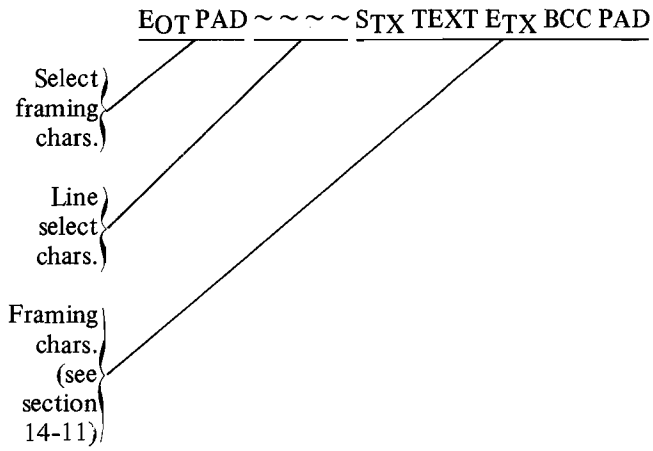


Note: BCC is described in section 14-15.

14-12 Line Select

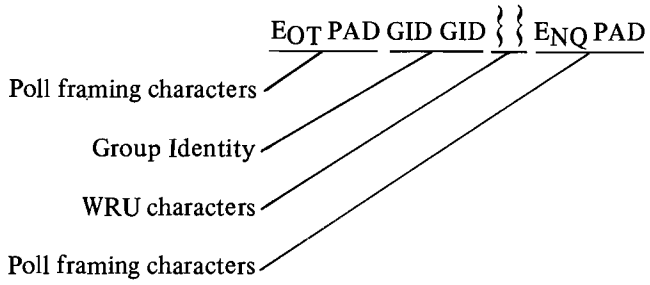
A line select enables the selection of all the terminals on a communication line. This is also known as "Broadcast" Mode. Both the group and device identity characters are replaced with tildes (~). The terminals will not send any response to Line Select.

For example:

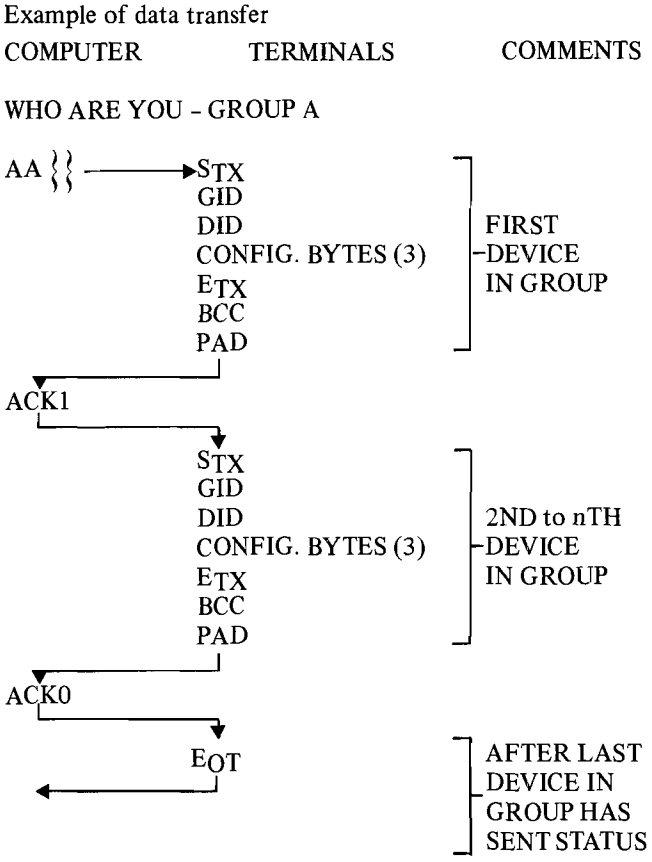


14-13 Terminal Configuration Reporting (WRU)

If the computer wants to find out what configuration of terminals is connected to a communications line it sends out a WRU (Who Are You?) control sequence. This sequence is similar to a group poll except that the terminals respond with configuration information instead of the normal text data. All terminals that are switched on in the group will send in their configuration. The character sequence and a typical example are shown below. The right brace character ({ octal 175) is used in place of the Device ID to indicate that this is a WRU sequence. For terminals on a factory data link the same restrictions apply as for group poll (see section 14-9).



Example of data transfer



The three configuration bytes are as follows:

Byte 1. Terminal Option Configuration (equivalent to byte 4 of the terminal status, see section 2-14 for details).

Byte 2. Terminal Type Configuration (equivalent to byte 5 of the terminal status, see section 2-14).

Byte 3. Returned Configuration Status Terminator Character. Carriage Return (C_R - octal 015) for multiterminal connections (customized terminator for point-to-point connections).

Bit 6 of byte 3 is always set to 0, to differentiate from the HP 264X terminals which always have bit 6 set to 1.

14-14 Data Blocks

The protocol used is called a "block mode" protocol because data is transferred from/to the computer in blocks.

The blocks are made up of three parts:
- Block framing characters
- Text (0 to n characters)
- Block check characters

The size of the text blocks is limited by the size of the terminal's communication buffer:

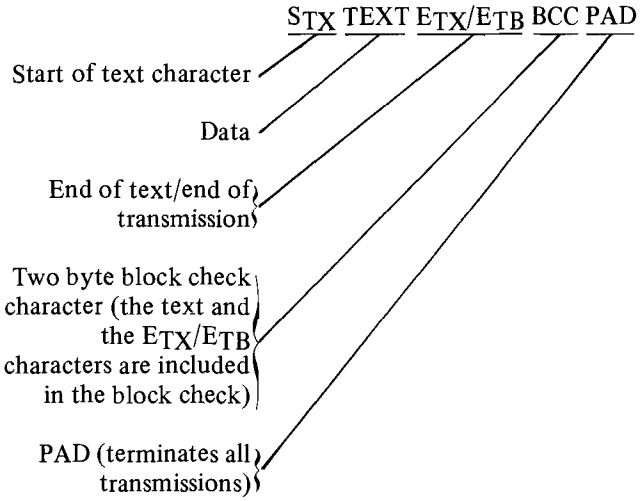
3075A, 3076A input/output buffer size - 180/180 characters.
3077A input/output buffer size - 100/240 characters.

Two forms of text blocks are shown in the example below. The first is a block received from the computer.

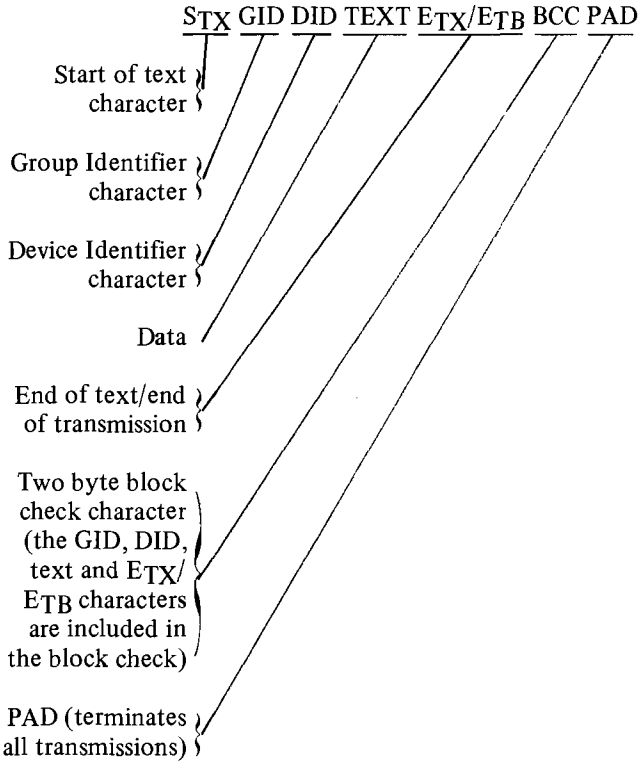
Note: No identity characters are used, since the terminal (or terminals) to receive the data have already been identified by a select sequence.

The second block is one sent from a terminal. In group polls, since more than one terminal has been polled, the first text block sent from each terminal must have the terminal identity included.

a) Received from computer



b) Sent by terminal



14-15 Block Check Characters

Each data block includes a Block Check Character (BCC). It consists of a two byte CRC 16 (Cyclic Redundancy Check) check sum and is calculated using the following generator polynomial formula:

$x^{16} + x^{15} + x^2 + 1$

This formula is compatible with IBM's CRC 16.

14-16 Transparency Mode

ASCII characters NUL (octal 000) to US (octal 037) are non-displayable control characters. Certain of these characters initiate local control actions on the terminal (e.g. BEL, CAN, CR, DEL, ENQ, ESC, ETB, ETX, SI, SO and STX). The Transparency Mode allows the terminal to send and receive 8-bit binary data. This also allows the sending of data bit patterns that might otherwise be interpreted as control characters.

This mode is controlled with the following character sequences:

DLE SYN	Allows recognition of one SYN character (octal 026).
DLE STX	Start transparency.
DLE ETX or DLE ETB	Ends transparency.
DLE DLE	Allows one DLE character to be sent.
DLE ENQ	Aborts current transmission.

Once in Transparency Mode, in order to send control characters and have them interpreted as **control** characters rather than binary data, the control character must be preceded with a single DLE character. Single DLE characters are seen as the beginning of control sequences rather than data. Thus if the terminal is in transparent mode and it has to send a byte that corresponds to one of the STX, ETX, ETB or DLE control codes, then it adds a DLE character (octal 020) in front of it.

When the terminal is equipped with a Multifunction Reader (option 007) and/or an HP-IB Interface (option 010) and/or a Serial I/O Interface (option 013), the complete ASCII character set from NUL (octal 000) to DEL (octal 177) is available. In order to send control characters as data the following procedure must be carried out:

1) The terminal must be set to the Transparent Mode by setting rear panel terminal configuration switch III-2 to 0.
2) Block protocol control characters (SYN, STX, ETX, ETB) that are to be interpreted as control characters must be preceded by an extra DLE character.

Note: If the terminal is set for non-transparent working (i.e. terminal configuration switch III-2 set to 1).

Octal characters 001 thru 007 (SOH thru BEL), 020 thru 027 (DLE thru ETB) and 037 (US). — *are changed to octal 000 (NUL)*

Figure 14-6 depicts a typical transparency mode sequence.

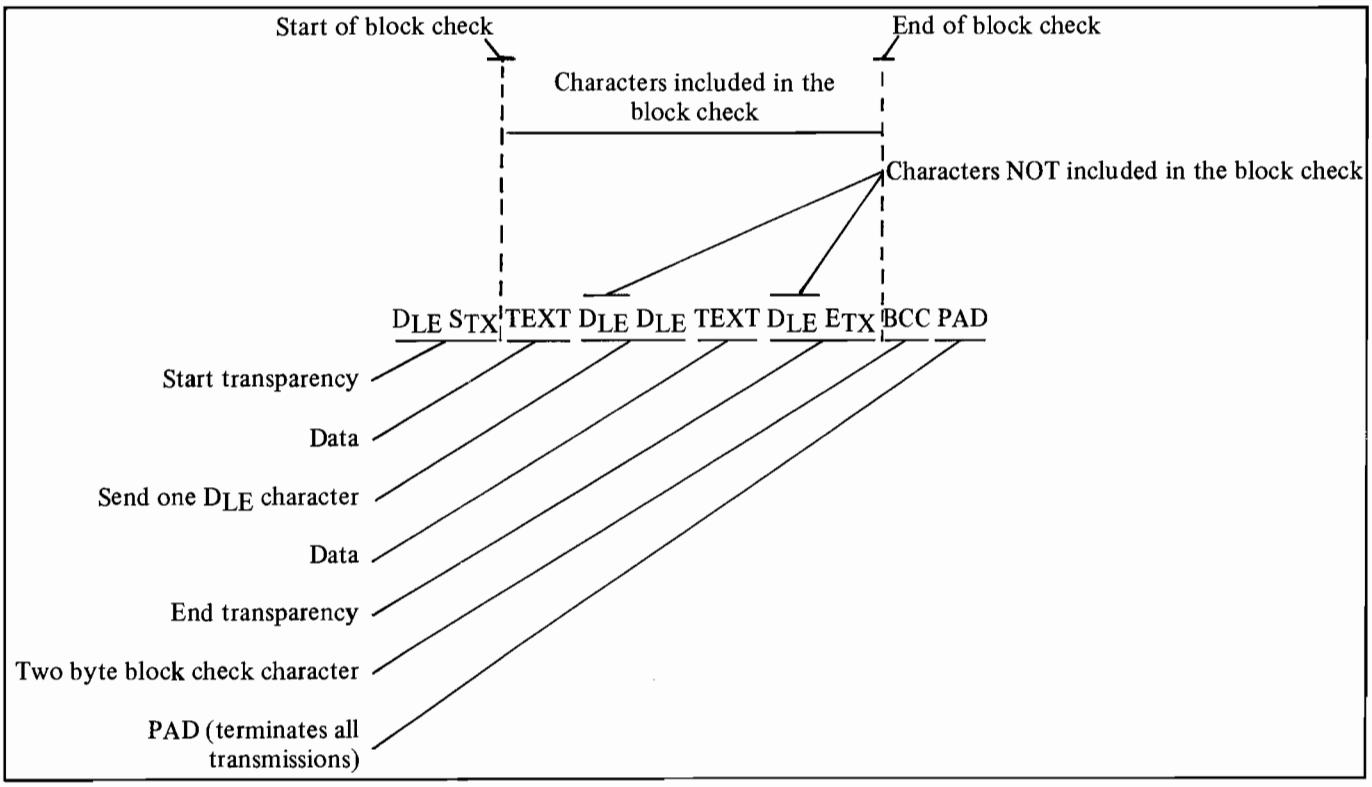
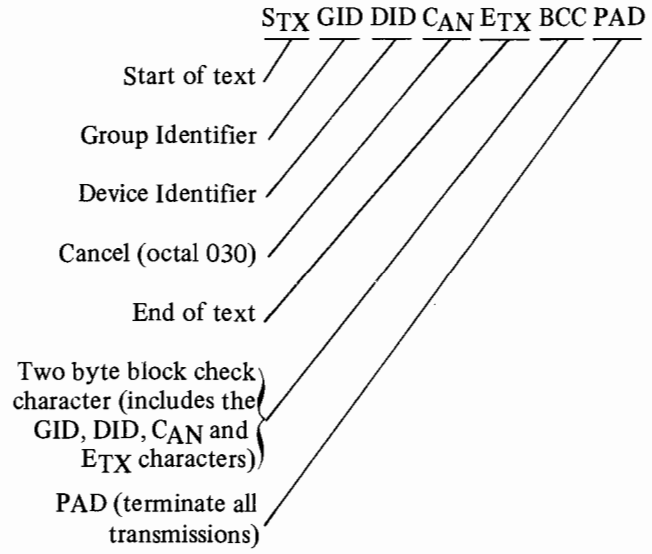


Figure 14-6 Typical Transparency Mode Sequence Sent By The Computer

14-17 RVI/CANCEL RESPONSES: BREAK PROCEDURES

The RVI (Reverse Interrupt) in Text-In Mode, and the Cancel response in Text-Out Mode allow 3075A, 3076A, 3077A terminals to report certain special conditions to the computer (see section 2-16 for details). If the terminal is currently in the Text-In Mode, it will respond with RVI (D_{LE} <) in place of ACK0/1. If it is in either the Text-Out Mode or Control Mode, the terminal will send:



in response to the next poll. It will be the responsibility of the computer software to handle both sequences according to its own algorithm. The data in the terminal input/output buffers will remain unaffected by both the RVI and Cancel responses.

After receiving the RVI/Cancel, the computer should then make a Status Request (section 2-14) to find out the cause of the RVI/Cancel.

14-18 MULTITERMINAL TRANSMISSION PRIORITIES

The terminal allocates priorities for data transmissions to the computer.

The highest priority transmission is the Status escape sequence: at the poll following the E_{SC}^select, the status alone (no other data) is transmitted. When responding to a status request, the data in the input/output buffers is unaltered.

The second priority of transmission is the Break condition, see section 14-17. Either RVI (select) or cancel character (poll) is transmitted if no status was requested. Again, the data in the input/output buffers is unaltered.

The last priority of transmission is for data which is transmitted when no break, and no status are pending.

14-19 TERMINAL ADDRESSES

Terminals on a communications line are arranged in groups, and each terminal on the same line has a unique address consisting of two parts: a Group Identifier (GID) and a Device Identifier (DID). Addresses are set on configuration switches on the terminal rear panel, as shown in figure 14-7.

The characters that can be used are @ (octal 100) and A thru Z (octal 101 through 132). This allows for 27 groups of up to 27 addresses in each group (i.e. 729 terminals). The terminal address characters are listed in Appendix E.

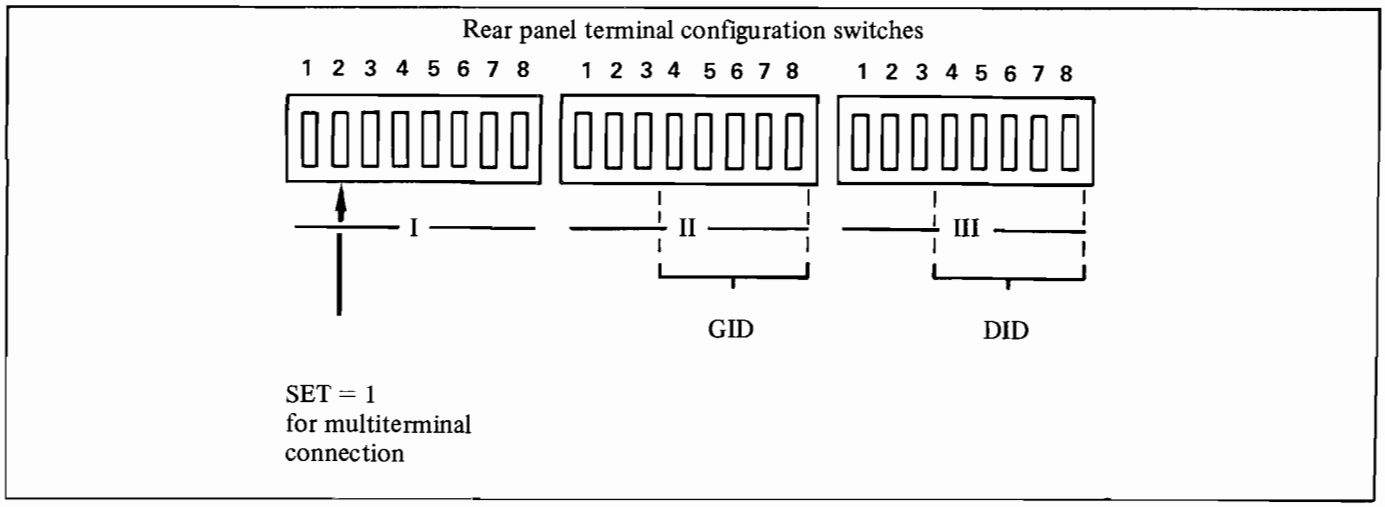


Figure 14-7 Terminal GID And DID Address Switches

14-20 POINT-TO-POINT CONNECTIONS (Character mode protocol)

Character mode is designed for point-to-point connection whereby data and/or commands are transmitted one character at a time. The data format is ASCII 7-level with selectable parity (odd, even, none) i.e. each data byte consists of one start bit, 7 data bits plus parity and one stop bit (two stop bits at 110 bauds). The protocol, parity and transmission speed are set on the terminal configuration switches on the rear panel (see Appendix F).

Only full duplex modems and hardwired connections are supported.

In character mode, the terminal looks like a simple TTY (teletypewriter) to the computer system. However, using escape sequences (see Appendix G), the computer has complete control over all terminal functions.

All terminal output data, except data from the keyboard (which is transmitted as each key is pressed), is transmitted to the computer as one data block (maximum 180 characters) with the terminator character at the end.

14-21 CHARACTER MODE PROTOCOL FEATURES

To provide the user with greater flexibility in point-to-point mode, the following features (controlled by terminal configuration switches on the rear panel) are available:

Delete Character
The switch II-3 allows the delete character in point-to-point communication to be either:
Switch II-3 set to 0: CAN, control X (octal 030).
Switch II-3 set to 1: DEL, delete character (octal 177).

Attention Key Function
The terminal keyboard Attention key (gold-colored) can be set up either to generate a hardware break (100 millisecond drop of the data line) or to transmit the DLE character (octal 020) followed by an input terminator.

Switch II-4 set to 0: DLE character (followed by the customized terminator character).
Switch II-4 set to 1: hardware break.

Echo
The switch II-5 allows an internal echo of entered keyboard data to be generated on the terminal (in case the computer or modem does not provide data loop back capability). When this switch is set to 1, data from the terminal keyboard (not from other input modules/ options e.g. cards or badges) is internally processed to be displayed and printed (if printer fitted) on the terminal.

Note: Input data from the Bar Code Reader (when fitted), HP-IB Interface (when fitted) and Serial I/O Interface (when fitted) may be displayed and printed (if printer fitted) on the terminal by using escape sequences. See sections 9, 10 and 12 respectively for details.

Table 14-4 Point-To-Point Handshakes

Handshake	Data Affected	
	Data Sent From Computer To Terminal	Data Sent From Terminal To Computer
THE (Hardware handshake)	–	Yes
ENQ/ACK (Protocol handshake)	Yes	–
DC1 (Protocol handshake)	–	Yes
X-ON/X-OFF (Protocol handshake)	Yes	–

Transmit Handshake Enable (THE)
The switch II-6 allows the computer to control the terminal when transmitting data.

-when this switch is set to 1, the terminal transmits to the computer regardless of the state (i.e. ready or not ready) of the Clear To Send line.

-when the switch is set to 0, the terminal transmits data only if the Clear To Send line is high (i.e. ready). Thus, the computer can control the output flow of the data from the terminal by lowering and raising the Clear To Send line.

Handshake Protocol
The switch II-7 allows a choice between two handshake protocols:
II-7 set to 0, selects the E_{NQ}/A_{CK} hanshake.
II-7 set to 1, selects the D_{C1} for output combined with the X-ON/X-OFF plus E_{NQ}/A_{CK} for input handshakes.

E_{NQ}/A_{CK} and X-ON/X-OFF allow the terminal to control the flow of data coming from the computer system. This is important because the computer data transmission rate can exceed the data processing rate of certain of the terminal modules/options (e.g. Strip Printer and CRT Display).

-E_{NQ}/A_{CK} handshake. With this technique, each data block transmitted by the computer must be followed by an E_{NQ} character (octal 005). The terminal returns an A_{CK} character (octal 006) when it has processed the data block. The computer must wait for the A_{CK} character before it transmits another data block.

-D_{C1} handshake. At power-on and every time the terminal generates an input terminator, the terminal goes into the WAIT state (i.e. all further data inputs are inhibited). It remains in this state until the computer signals its availability to receive data by sending a D_{C1} character (octal 021) to the terminal, thereby returning the terminal to the READY state.

-X-ON/X-OFF handshake. This handshake causes the terminal to return an X-OFF character (D_{C3} octal 023) to the computer when its data buffer is full. The terminal also returns an additional X-OFF character each time extra data characters are received. The terminal returns an X-ON character (i.e. D_{C1} octal 021) to the computer when it is available to accept a further 20 characters. Therefore, by monitoring the X-ON/X-OFF characters the computer can control the flow of data sent to the terminal.

Terminator Character
The switch II-8 allows selection of any character to be used as terminator.

If the switch is set to 0, the terminator to be used is Carriage Return (C_R = octal 015).

If the switch is set to 1, then the input terminator can be any ASCII character from octal 0 to octal 177. The ASCII character is simply declared by setting the corresponding code in the switches III-2 thru III-8 (see Appendix F).

FTZ Selection
The switch III-1 allows the keyboard and prompting lights to be set up so that the terminal will comply with the German FTZ regulations.

If the switch is set to 0 the standard keyboard and prompting lights are in use.

If the switch is set to 1, then the LED associated with the p key is set ON whenever the Data Set Ready condition is present from the modem. The last special function key z when pressed will disconnect the modem by dropping the Data Terminal Ready line for 2 seconds.

Note: FTZ selection may also be used on daisy-chain connections.

SECTION 15

SITE PREPARATION

15-1 INTRODUCTION

This section details all the information necessary to prepare a site before the installation of the 3075A/3076A Data Capture Terminals and the 3077A Time Reporting Terminal. The site must respect the terminal environmental restrictions (see Table 15-1). The site preparation and maintenance is the responsibility of the customer, who must ensure the correct installation of:

1) All power cabling and power sockets (see Table 15-2 for the terminal power requirements).

   Note: The 3075A terminal is supplied with a power cable approximately 203 cm (80 ins.) long, including connectors, for connection to the site power outlet socket. The 3076A and 3077A terminals have the power directly supplied to their Wall Mounting Cradle.

2) A clean, dry, flat, horizontal surface or table of adequate size and strength to house each 3075A (see Table 15-3 for the 3075A dimensions).

3) The 92904A Wall Mounting Cradles necessary to house the 3076A and 3077A terminals (see section 15-5 through 15-15 for details).

4) All cabling necessary for communications with the computer system. i.e. either:
   a) Multiterminal cabling; comprising either:
      - A Factory Data Link connection (see sections 15-16 through 15-26 for details).
      - A Daisy-chained connection (see sections 15-27 through 15-32 for details).
   b) Point-to-point connection (see sections 15-33 through 15-38 for details).

It is recommended that for sites using the 3076A and/or 3077A wall mounted terminals, the terminal should be ordered with option 020 (this option deletes the 92904A Wall Mounting Cradle from the terminal). The requisite number of stand-alone 92904A Wall Mounting Cradles (at least one for each 3076A and 3077A terminal) should be ordered to arrive in advance of the terminals. This allows the Wall Mounting Cradles to be installed prior to receiving the terminals.

If required, Hewlett-Packard will verify the site preparations. For details contact your nearest HP Sales and Service Office (see the addresses at the rear of this manual).

Note: The site should be prepared by the customer before the reception and installation of the terminals.

15-2 ENVIRONMENTAL CONDITIONS

The 3075A, 3076A and 3077A terminals are designed to be operated in environments normally maintained for human comfort. They provide a high resistance to extraneous interference and a high level of operator safety.

15-3 ENVIRONMENTAL SPECIFICATIONS

The terminals comply with HP class B environmental specifications. They are resistant to electrostatic discharges (onto the terminal) and electromagnetic interferences. Table 15-1 lists the terminal environmental restrictions, Table 15-2 lists the terminal power requirements and Table 15-3 lists the terminal physical dimensions.

15-4 TERMINAL APPROVALS

The terminals provide a high level of operator safety. The 3075A, 3076A, 3077A, options 004 through 013 are approved by the following safety regulations authorities:

1) CSA (Canadian Safety Agency) - certified under factory certification program CSA C22. 2-154 for EDP (Electronic Data Processing) equipment.

2) UL (Underwriters' Laboratories):
   - Under standard UL 478 for EDP equipment.
   - Under standard UL 114 for office equipment.

3) VDE (Verband Deutcher Elektrotechniker) under standard VDE 0730 part 2P, for both EDP and office equipment.

4) Comply with standard IEC (International Electrotechnical Commission) 380 for office equipment and IEC 435 for EDP equipment.

5) Inspected by FEI (Finland Electrical Inspectorate) according to publication CEE 10 part 2p section P.

For RFI (Radio Frequency Interference) the 3075A, 3076A, 3077A options 004 to 009 inclusive (excluding 006) comply with VDE 0871 interference limits. They have also been approved by FTZ (Fernmeldetechnisches Zentralamt) when connected to the following systems: HP 3000 model III and HP 3000 model 30.

Data communications with the 3075A, 3076A and 3077A, options 004 to 013 inclusive:

1) Comply with FTZ under number FTZ DEE 1168. This permits the connection to telephone lines via modems.

2) Approved by the British Post Office for connection to telephone lines via modems.

Table 15-1 3075A/3076A/3077A Terminal Environmental Specifications (exclusive of badges/cards/labels and printer paper)

Parameter	Condition	Dimension
Altitude	Operating Non-operating	4,600 metres (15,000 ft) 15,300 metres (50,000 ft)
Humidity	Operating and non-operating	5% to 95% RH (non condensing) at 40°C (104°F)
Radiation susceptibility	80 to 200 MHz	Maximum 3V/metre (3 V/3.3 ft)
Shock	Maximum (bench handling)	102 mm (4 inches) tilt drop
Static discharge	Onto terminal casing	Up to 15 KV
Temperature, free ambient. Terminal and all options excluding Bar Code Reader Wand	Operating Non-operating	0°C to +55°C (32° to 131°F) -40°C to +75°C (-40° to 167°F)
Bar Code Reader Wand	Operating Non-operating	0°C to +55°C (32° to 131°F) -20°C to +55°C (-4° to 131°F)
Transportation handling	Maximum (drop test)	762 mm (30 inches)
Vibration	Maximum	0.38 mm (0.015 in) p-p. 5-55-5 Hz 3-axis for 15 minutes

Table 15-2 3075A/3076A/3077A Terminal Power Requirements

Parameter	Condition	Dimension
Power requirements	115V AC 230V AC	86 to 127V AC 195 to 253V AC
Frequency	Range	47.5 to 66 Hz
Power consumption	Typical	90 watts
Maximum voltages	Between phase and ground Between phase and neutral Between neutral and ground	250V 250V 250V
Maximum voltage spikes (at any phase angle)	Typical. 15 nanosecond rise time, width 100 nanosecond to 50%	Up to 1kV
Power interrupt	Drop to 0V at > 10 seconds intervals	Typical up to 20 ms duration

Table 15-3 3075A/3076A/3077A Terminal Physical Specifications

Parameter	3075A	3076A*	3077A*
WEIGHT			
Minimum	6.6 kg (14.4 lbs)	10.6 kg (23.5 lbs)	10.6 kg (23.5 lbs)
Maximum	8.7 kg (19.1 lbs)	12.7 kg (27.9 lbs)	12.7 kg (27.9 lbs)
DIMENSIONS			
Minimum			
mm inches	130 H x 275 W x 395 D (5.1 H x 10.8 N x 15.6 D)	550 H x 290 W 130 D (21.7 H x 11.4 W x 5.1 D)	550 H 290 W x 130 D (21.7 H x 11.4 W x 5.1 D)
Maximum with CRT on side			
mm inches	190 H x 440 W x 430 D (7.5 H x 17.3 W x 16.9 D)	550 H x 440 W x 190 D (21.7 H x 17.3 W x 7.5 D)	–
Maximum with CRT on top			
mm inches	260 H x 275 W x 420 D (10.2 H x 10.8 W x 16.5 D)	–	–
REQUIRED FLAT SURFACE	Horizontal	Vertical	Vertical
Minimum no CRT			
mm inches	325 W x 445 D (12.8 W x 17.5 D)	600 H x 340 W (23.6 H x 13.4 W)	600 H x 340 W (23.6 H x 13.4 W)
Minimum with CRT on side			
mm inches	490 W x 480 D (19.3 W x 18.9 D)	600 H x 490 W (23.6 H x 19.3 W)	–
Minimum with CRT on top			
mm inches	325 W x 470 D (12.8 W x 18.5 D)	–	–

**Note: The 3076A and 3077A include the 92904A Wall Mounting Cradle.*

Table 15-3 (cont'd) Wall Mounting Cradle Physical Specifications

Weight: 4.0 kg (9.1 lbs)
Dimensions: 550 mm H x 290 mm W x 130 mm D (21.7 ins. H x 11.4 ins. W x 5.1 ins. D).
Required flat surface: Vertical 600 mm H x 340 mm W (23.6 ins. H x 13.4 ins. W).

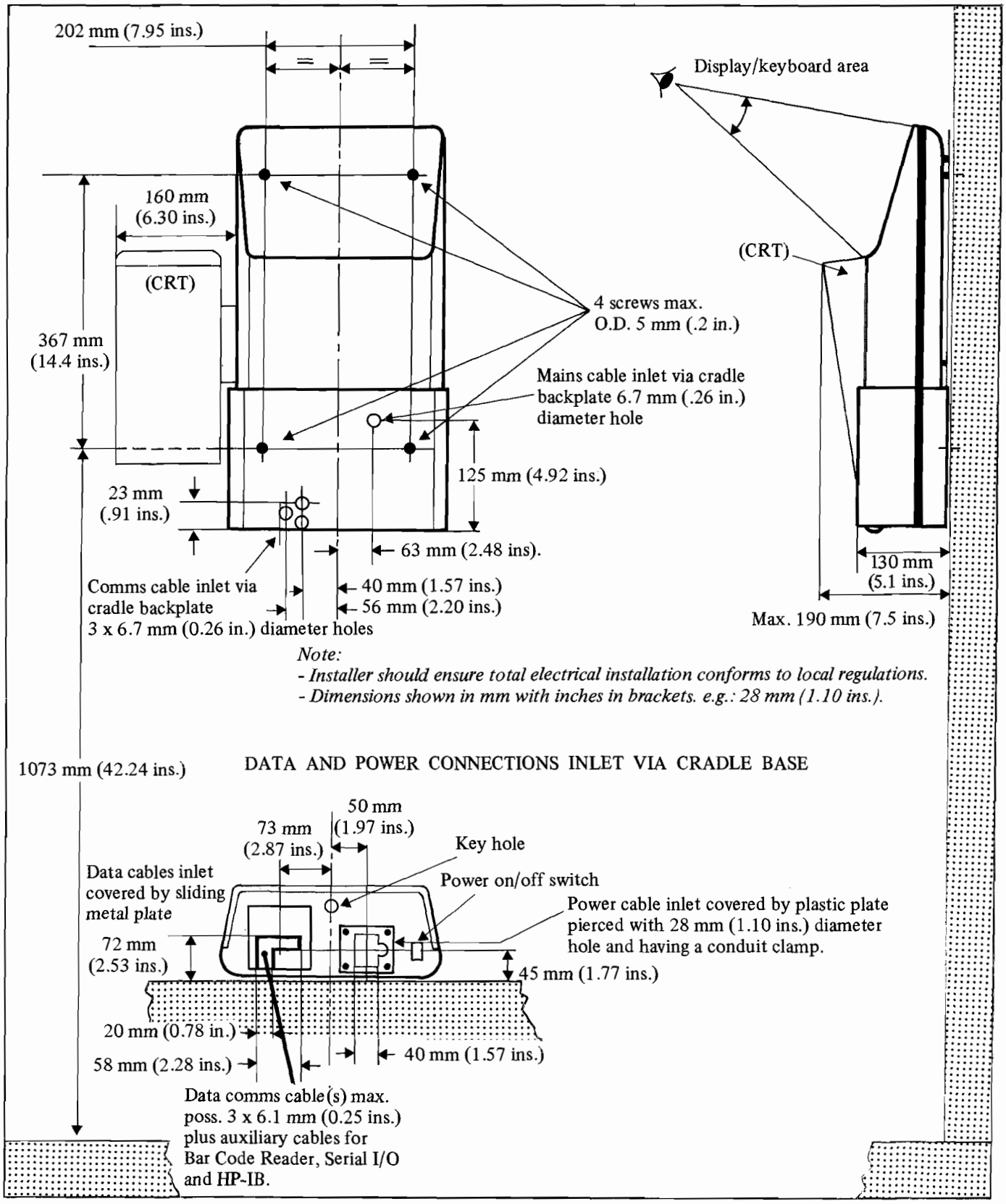


Figure 15-1 92904A Wall Mounting Cradle - Positioning Guidelines

15-5 92904A WALL MOUNTING CRADLE INSTALLATION

Each 3076A and 3077A terminal requires one 92904A Wall Mounting Cradle in order to securely house the terminal in a vertical position. The site must respect the environmental restrictions detailed in Table 15-1 and conform to the following specifications:

1) The mounting surface must be clean, dry, flat, vertical, and at least 600 mm high x 340 mm wide (23.6 inches H x 13.4 inches W).

2) The surface must have unrestricted front access with sufficient clearance above and below (at least 50 mm, 2 inches) to allow the circulation of air.

3) The mounting surface must be sufficiently strong to support the weight of cradle plus terminal: 10.6 kg (23.5 lb).

4) Before installing the cradle the method of routing the power and data communications cables must be decided. The cables can enter the cradle either:
   a) From below, up the exterior of the mounting surface. For power connections see section 15-9, for data communications cabling see sections 15-22, 15-31 and 15-35.
   b) From inside the mounting surface (via cable holes at the rear of the cradle backplate). For power connections see section 15-10.

5) If the power and the communications cables are routed up the surface of a wall, they must be protected (e.g. using conduit) to comply with local safety regulations.

6) Power supplies to all the cradles must be routed via a local power on/off contact breaker, rated at:
   a) For 115V supply - the number of cradles x 1.5 Amps
   b) For 230V supply - the number of cradles x 0.75 Amps

7) The cradle must be mounted at eye level height, see figure 15-1 for details.

15-6 MOUNTING THE CRADLE

Unlock the cradle and remove the cover from the cradle backplate by sliding it downwards. Hold the cradle backplate against the wall in the required position and mark the positions of the fixing holes (see figure 15-1).

Secure the cradle backplate to the wall using four screws (maximum outside diameter 5 mm, 0.2 ins) and washers. The screw heads should not project more than 7 mm (0.28 ins) from the inside surface of the cradle backplate.

Note: The HP part number for the cradle lock and key is 1390-0474.

15-7 CRADLE PROTECTION

The cradle base is supplied with a protection cover to inhibit the ingress of dirt when a 3076A/3077A terminal is not installed. It also prevents unauthorized access to the data communications and power connections. The protection cover is normally bolted to the inside surface of the cradle backplate (see figure 15-2). However, when the cradle has been mounted on a wall with the cradle front cover in place (and before the terminal is installed) the protection cover should be positioned on the base as follows:

1) Un-bolt the protection cover from the backplate; where it is attached by two nuts, each 6.35 mm (0.25 ins) A. F.

2) Locate the protection cover 15 mm (0.6 ins.) wide lug into the recess in the top inside surface of the cradle cover.

3) Press the back edges of the protection cover into the recess on the top inside surface at the back of the cradle base (see figure 15-2).

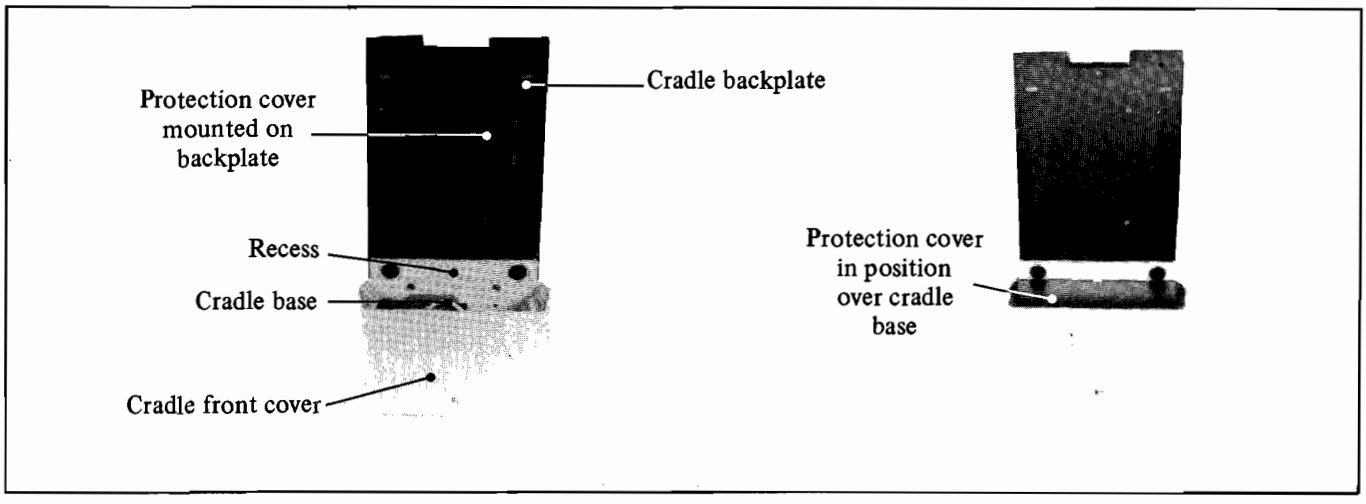


Figure 15-2 Cradle Base Protection Cover

15-8 CRADLE POWER CONNECTIONS

WARNING

Hazardous voltages are present inside the equipment. The procedures contained in this section must be performed by qualified service personnel only.

VORSICHT

Innerhalb des Geräts bestehen gefährliche Spannungen. Die in diesem Abschnitt enthaltenen Arbeiten dürfen nur durch Betriebsfachpersonal durchgeführt werden.

ATTENTION

Des tensions dangereuses sont présentes à l'intérieur du matériel. Les opérations décrites dans cette section ne devront être effectuées que par un personnel qualifié.

AVVISO

Pericolo: Alta tensione presente in questa apparecchiatura. Le procedure contenute in questa sezione debbono essere effettuate soltanto da qualificato personale di servizio.

ADVERTENCIA

Hay voltaje peligroso en el interior de este equipo. Los procedimientos expuestos en esta sección sólo deberá llevarlos a cabo el personal de servicio calificado.

高圧危険

内部装置に危険な高電圧がきています この章にある処置や手続に関しては、専門のサービスマンによってのみ行なって下さい

The cradle routes mains power to the terminal but consumes no power itself. A LINE (mains power) ON/OFF switch is located on the base of the cradle.

15-9 Power Connections From The Bottom Of The Cradle

When power is supplied to the cradle using a cable routed up the exterior of the mounting surface, the cable must be protected by being placed inside a conduit that complies to local safety regulations. The metal plate covering the power connection inlet on the bottom of the cradle base has a hole 28 mm (1.10 ins) in diameter to accept the mains cable. Over the hole is fitted a conduit clamp capable of accepting conduit with an outside diameter of 12 mm to 18 mm (0.47 to 0.71 ins).

WARNING

Ensure the power cable is NOT connected to the mains power supply before carrying out these procedures.

To wire the mains cable to the cradle, the following procedure must be carried out:

1) Unlock the cradle and remove the front cover from the backplate. This allows access to the power connection compartment (at the bottom right-hand side of the cradle).
2) Unscrew and remove the power connection compartment plastic cover to gain access to the mains power screw connector block, see figure 15-3.
3) Within the power connection compartment, unscrew and remove the power cable clamp (see figure 15-3).
4) Strip back the power cable outer jacket as required. Remove approximately 6 mm (0.25 ins) of insulation from each wire.
5) Loosen the conduit clamp at the bottom of the cradle base.
6) Thread the power cable through the conduit. Then feed approximately 150 mm (6 ins) of the cable through the conduit clamp.
7) Fit the conduit into the conduit clamp, then tighten the clamp.
8) Pass the power cable through the power cable clamp housing. Connect the three wires into the screw connector block; left connector = neutral, centre connector = phase (i.e. line) and right connector = earth (ground). See figure 15-3.
9) Replace and tighten the power cable clamp, then replace the power connection compartment protective cover.
10) Replace the cradle front cover and the cradle protection cover (see section 15-7).
11) Set the cradle LINE (power) switch to OFF (0).

15-10 Power Connection Through The Cradle Backplate

When the cradle power is supplied from inside the mounting surface, the power cable may be routed through the 6.7 mm (0.26 inch) diameter hole in the cradle backplate (see figure 15-1).

WARNING

Ensure the power cable is disconnected from the mains power supply before carrying out these procedures.

To wire the mains power cable the following procedure must be followed:

1) Unlock the cradle and remove the front cover.
2) Unscrew and remove the power connection compartment plastic cover to gain access to the mains power screw connector block (see figure 15-4).

3) Within the base, unscrew the locking nut and three cross-head screws holding the printed circuit data communications board to its mounting pegs and carefully remove the board.

4) Use a box spanner (i.e. socket) to remove the four 5/16 ins. (7.8 mm) A.F. nuts securing the cradle metal backplate to the cradle base.

5) Within the power connection compartment, unscrew and remove the power cable clamp (see figure 15-4).

6) Strip back the power cable outer jacket as required. Remove approximately 6 mm (0.25 ins.) of insulation from each wire.

7) Feed approximately 200 mm (8 ins.) of the power cable through the hole in the cradle backplate.

8) Replace the cradle base on the cradle metal backplate with the power cable between the two.

9) Pass the cable through the right hand slot on the top edge of the power cable clamp housing. Connect the three wires to the screw connector block; left connector = neutral, centre connector = phase (i.e. line) and right connector = earth (ground).

10) Replace the printed circuit data communications board.

11) Replace and tighten the cable clamp, then replace the power connection compartment protective cover.

12) Replace the cradle front cover and the cradle protection cover (see section 15-7).

13) Tighten the conduit clamp on the bottom of the cradle. *Note: A conduit is NOT required.*

14) Set the cradle LINE (power) switch to OFF (0).

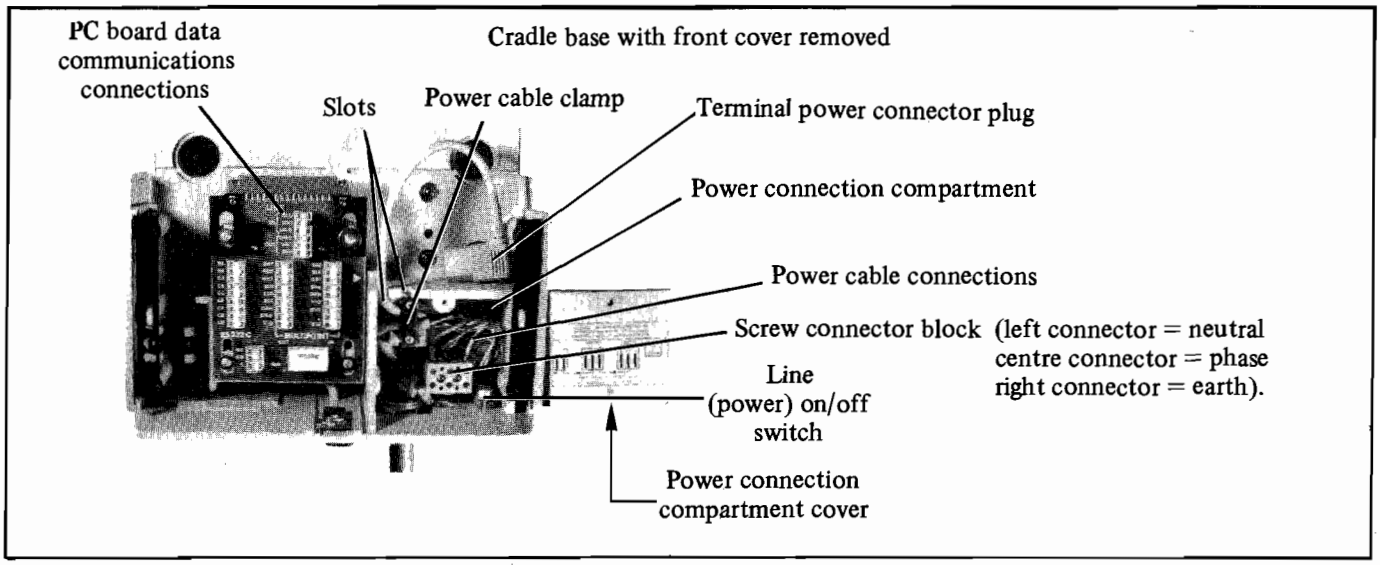


Figure 15-3 Power Supply Connection From The Base Of The Cradle

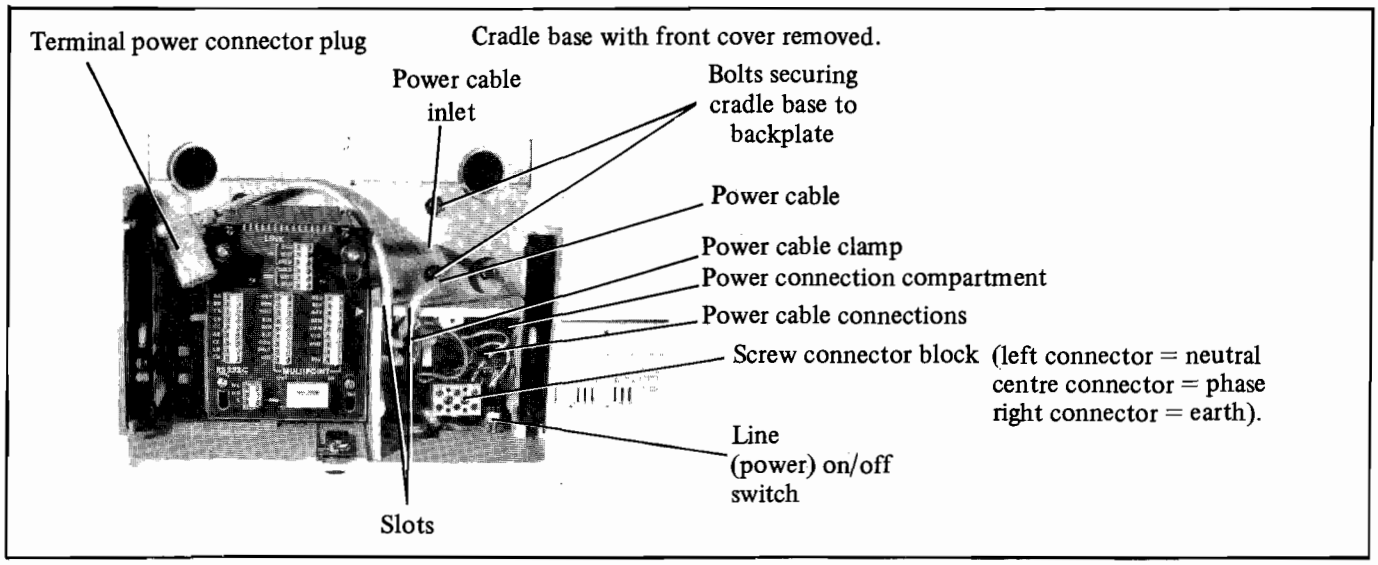
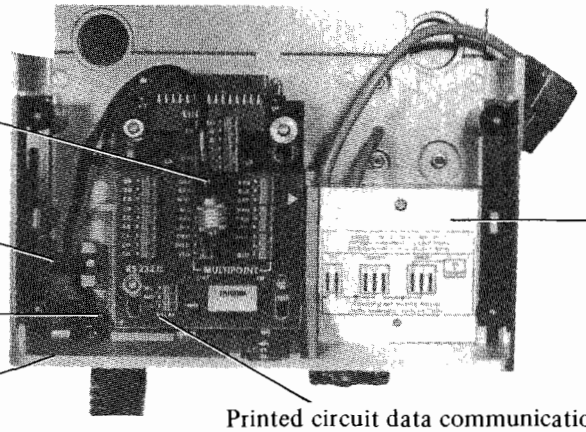


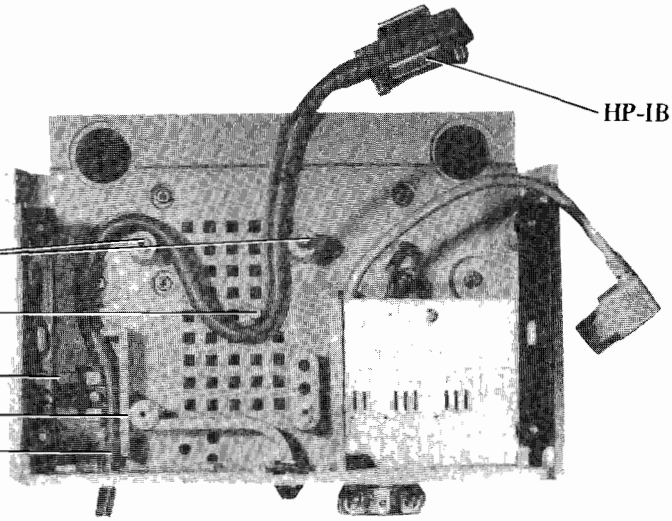
Figure 15-4 Power Supply Connection Through The Cradle Backplate

A. BAR CODE WAND CABLE

Cradle base with front cover removed



B. HP-IB CABLE



C. SERIAL I/O INTERFACE CABLE

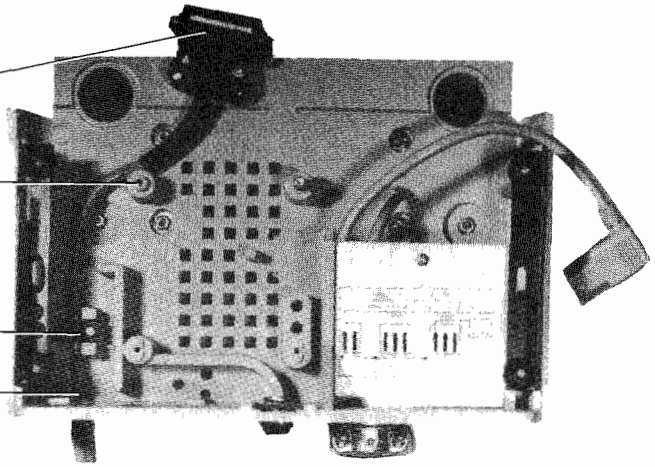


Figure 15-5 Cable Routing For Terminal Options

15-11 INSTALLATION OF CABLES FOR TERMINAL OPTIONS

If the cradle is to house a 3076A Data Capture Terminal and the terminal is equipped with a Bar Code Reader and/or a Serial I/O Interface and/or an HP-IB Controller, then the cables for these options should be installed as described in sections 15-12, 15-13 and 15-14 respectively.

15-12 Bar Code Reader Wand (Option 010) Cable Installation

The end of the wand cable is terminated by a connector that must be plugged into the bar code wand connector socket on the terminal rear panel. This cable must be installed in the cradle BEFORE the terminal is fitted, as follows:

1) Ensure the cradle LINE switch is OFF.

2) Unlock the cradle and remove the front cover.

3) At the bottom of the cradle base, unscrew and remove the (left-hand) sliding metal plate that covers the data cables inlet (see figure 15-1).

4) Within the base, unscrew and remove the data cable clamp situated above the data cables inlet, see figure 15-5A.

CAUTION

The Bar Code Reader Wand must be handled with care and must not be knocked or allowed to come into contact with dirt or liquids.

5) On the sliding metal plate (used to cover the data cables inlet), unscrew and remove the blanking plate and perforated plate. (They are secured to the sliding plate using a 6.35 mm/0.25 ins AF nut).

6) Fit the supplied plastic grommet (i.e. ring) over the Bar Code Reader Wand cable, approximately 215 mm (8.5 ins) from the end of the cable (terminated by the plug), with the narrowest end of the grommet nearest the plug.

7) Pass the wand cable plug through the 19 mm (0.75 ins) diameter hole in the cables inlet sliding metal plate, with the outside surface of the plate nearest the wand.

8) Pass the perforated plate (formerly attached to the sliding plate) over the wand cable and press it into position over the grommet. Then secure the perforated plate to the cables inlet sliding plate using the 6.35 mm (0.25 ins) AF nut.

9) Replace the sliding metal plate on the cradle base, with the least gap possible between the plate and the back of the cradle. Tighten the plate locating screws.

10) Feed approximately 150 mm (6 ins) of the wand cable (that is terminated by the connector) through the cable clamp housing. Then replace and tighten the clamp.

11) Position the cable within the cradle base as shown in figure 15-5A.

12) Replace the cradle front cover and the cradle protection cover (see section 15-7).

Note: The blanking plate removed from the sliding plate should be retained as it must be replaced on the sliding plate (for safety reasons) if the Bar Code Reader Wand is removed from the cradle.

15-13 HP-IB (Option 011) Cable Installation

Four lengths of HP-IB cables are available, see section 10-2. The connector on each end of each cable is a combined male/female connector. One end of the cable plugs into the HP-IB female connector on the terminal rear panel, the other end of the cable plugs into the HP-IB connector on the first HP-IB compatible device. The single HP-IB cable should be installed in the cradle BEFORE the terminal is fitted and BEFORE being connected to an HP-IB device, as follows:

1) Ensure the cradle LINE switch is OFF.

2) Unlock the cradle and remove the front cover.

3) At the bottom of the cradle base unscrew and remove the sliding plate that covers the data cables inlet.

4) Within the base, unscrew the locking nut and three cross-head screws holding the printed circuit data communications board to its mounting pegs and remove the board (see figure 15-5B).

CAUTION

The connectors on each end of the HP-IB cable must be handled with care and should not be knocked or allowed to come into contact with dirt or liquids.

5) Feed the HP-IB connector through the data cable inlet.

6) Pass the cable through the 10 mm (0.4 in.) wide gap between the data cable clamp housing and the plastic partition (that separates the data cables from the printed circuit communications board).

7) Feed approximately 350 mm (14 ins) of cable through the gap.

8) Position the cable (within the base) above the top left-hand printed circuit board mounting peg, below the central locating peg (at the centre of the cradle backplate air vent) and above the top right-hand printed circuit board mounting peg. See figure 15-5B for details.

9) Replace the printed circuit board over the HP-IB cable.

10) Replace the sliding metal plate that covers the data cables inlet. Slide the plate so that the cable is loosely trapped between the metal plate and the back of the cradle base, with the least gap possible. Tighten the plate locating screws.

11) Replace the cradle front cover and the cradle protection cover (see section 15-7).

15-14 Serial I/O Interface (Option 013) Cradle Installation

Two serial I/O cables are available; one cable has both ends terminated by female connectors (92905F), the other cable has one end terminated by a female connector and the other end terminated by a male connector (92905M), see section 12. The cable female connector plugs into the serial I/O male connector on the terminal rear panel, the other end of the cable plugs into the serial device.

The single serial I/O cable should be installed in the cradle BEFORE the terminal is fitted and BEFORE being connected to the serial device, as follows:

1) Ensure the cradle LINE switch is OFF.

2) Unlock the cradle and remove the front cover.

3) At the bottom of the cradle base unscrew and remove the sliding plate that covers the data cables inlet.

4) Within the base, unscrew and remove the data cable clamp situated above the data cables inlet, see figure 15-5C.

5) Within the base, unscrew and remove the printed circuit data communications board (see figure 15-5C). This is to prevent damage to the board when the cable is being installed.

CAUTION

The connectors on each end of the serial I/O cable must be handled with care and should not be knocked or allowed to come into contact with dirt or liquids.

6) Feed the female serial I/O connector through the data cable inlet and pass it through the data cable clamp.

7) Feed approximately 170 mm (6.7 ins) of cable through the cable clamp housing, then replace and tighten the clamp.

8) Position the cable (within the base) above the top left-hand printed circuit board mounting peg. See figure 15-5C for details.

9) Replace the printed circuit board over the cable.

10) Replace the sliding metal plate that covers the data cables inlet. Slide the plate so that the cable is loosely trapped between the metal plate and the back of the cradle base, with the least gap possible. Tighten up the plate locating screws.

11) Replace the cradle front cover and the cradle protection cover (see section 15-7).

15-15 CRADLE RELAY CONNECTIONS

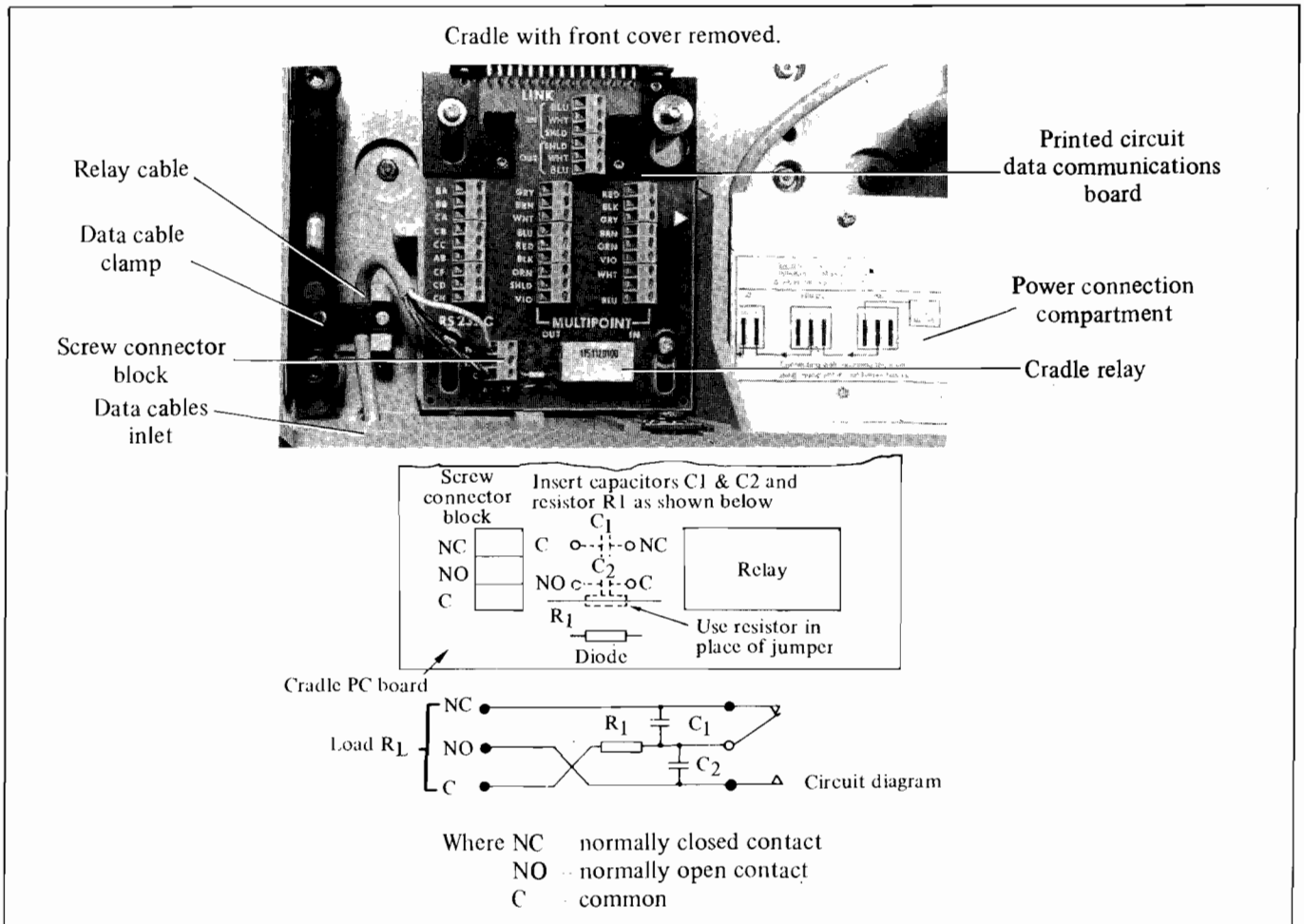
The cradle relay is mounted at the bottom of the printed circuit data communications board, housed in the base of the cradle (see figure 15-6). If the cradle relay is to be used to control an external device, the relay specifications must first be considered:
Contact maximum rating: 30V AC at 2.5A, 42V DC at 1A.

If the load to be connected to the relay is inductive or capacitive, the relay contacts should be protected from high current surges by wiring a resistor and capacitors across the contacts (see figure 15-6).

The values for C1, C2 and R1 must be calculated according to the nature of the load.

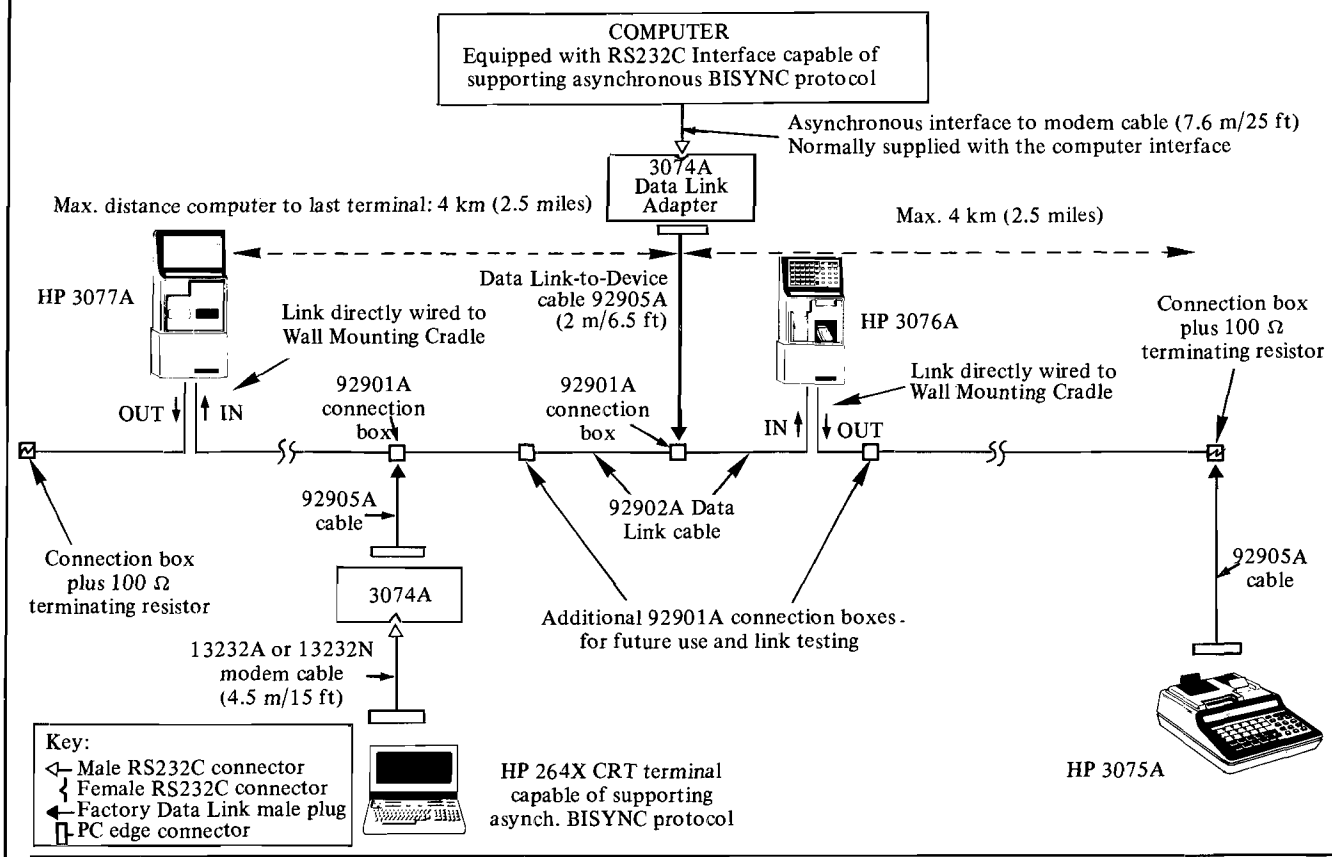
The relay cable should be fitted as follows:

1) Ensure the cradle LINE switch is OFF.
2) Unlock the cradle and remove the front cover.
3) At the bottom of the cradle base unscrew and open the sliding metal plate that covers the data cables inlet.
4) Within the base unscrew the data cable clamp situated above the data cables inlet, see figure 15-6.
5) Strip back the outer jacket of the relay cable as required. Remove approximately 6 mm (0.25 ins) of insulation from the three wires.
6) Feed the relay cable through the data cables inlet and through the cable clamp. Connect the wires to the relay screw connector block as shown in figure 15-6.
7) Ensure the relay cable has a loop (see figure 15-6). This is necessary because when the terminal is installed in the cradle the printed circuit board must be able to more upward to mate with the terminal 30-pin connector.
8) Tighten the cable clamp. Slide the metal plate that covers the data cables inlet so that the cable is loosely trapped between the metal plate and the back of the cradle base, with the least gap possible. Tighten the plate locating screws.
9) Replace the cradle front cover and the cradle protection cover (see section 15-7).



Note: The diode is connected in parallel with the relay coil to reduce the back e.m.f. generated by the coil.

Figure 15-6 Cradle Relay Connections



Equipment	HP Part Number	Comment
Computer Interface for system HP 1000	12790A option 001	Option 001 provides an asynchronous modem cable for 3074A connection, 7.6 m (25 ft).
Computer Interface for system HP 3000 series III	30055A option 001	Option 001 provides an asynchronous modem cable for 3074A connections, 7.6 m (25 ft).
Data Link Adapter	3074A	One for the computer and one per 264X terminal.
Factory Data Link cable	92902A option 001 and 002	Option 001 = 100 m (325 ft), no connector Option 002 = 300 m (1,000 ft), no connector.
Data Link Connection Box	92901A	Set of five boxes. One box required per 92905A cable.
Data Link-to-Device cable	92905A	2 m (6.5 ft). One cable required for each 3074A adapter and each 3075A terminal. This cable includes Data Link connection plugs.
Resistor 100Ω (0.5W)	0686-1015	One terminating resistor in the 92901A box at each end of the 92902A cable (or the last 92904A cradle), see section 15-19.
Wall Mounting Cradle	92904A	One per 3076A and 3077A terminal.
CRT terminal to 3074A cable	13232A or 13232N	4.5 m (15 ft). One cable for each HP 264X terminal connected to a 3074A adapter.

Figure 15-7 Factory Data Link Components

15-16 FACTORY DATA LINK CONNECTIONS

Note: The computer must be capable of supporting the polled mode protocol patterned after asynchronous BISYNC (Binary Synchronous Communications) that is used for multiterminal connections (see section 14).

The Factory Data Link uses a single cable, comprising a twisted pair and a shield, that may be up to 8 km (5 miles) long. The computer is hardwire connected to the cable using a HP 3074A Data Link Adapter (for details see the HP 3074A Operating and Service Manual). The 3075A terminal is connected to the cable using a Data Link Connection Box (HP part number 92901A for a pack of five). The 3076A and 3077A terminals are connected to the cable via the Wall Mounting Cradle printed circuit data communications board. One computer and a large number of terminals may be connected to the cable, the computer configuration guide must be consulted to determine the maximum number of terminals. The maximum distance between the first 3074A (after the computer) and the last terminal is 4 km (2.5 miles). This allows one computer to communicate with a large number of terminals that are physically remote from the computer.

Figure 15-7 depicts and lists the components that are required for a Factory Data Link installation.

Note: If required, the Data Link cables may be fabricated by the user. For details see section 15-24.

15-17 FACTORY DATA LINK CABLING CONSIDERATIONS

The following points should be taken into consideration when designing the installation:

1) The total link length can be up to 8 km (5 miles) provided that no terminal is more than 4 km (2.5 miles) from the first 3074A after the computer. This length includes any Link-to-Device cables that are used to connect 3074A's and the 3075A terminals. Since the Data Link-to-device cables go into and out of the terminal they must be counted twice. Therefore 6 metres (20 feet) must be added to the link length for each Data Link-to-Device cable used (see figure 15-8).

2) The link can be routed through electrically noisy environments without problems. Tests have shown that the link cable can be also routed alongside power cables without affecting data integrity. However, in the interests of good engineering practice, this is not recommended. All installations should be checked for conformity to local safety regulations before use.

3) The link cable is designed for use within the plant installation and not outside (e.g. between buildings). The major limiting factor to exterior use is that the cable would be exposed to environmental hazards (such as rain, lightning, accidental damage, etc.).

4) The link is controlled by a single computer (i.e link driver). Since the computer can only generate a limited drive current, the maximum number of terminals that can be loaded onto one link is 127. However, software considerations may reduce the number of terminals to less than this physical maximum. The terminals may be positioned anywhere on the link provided that, as previously mentioned, no terminal is more than 4 km (2.5 miles) from the computer.

5) The 3074A Data Link Adapters must be positioned between the link and the computer and between the link and any HP 264X terminals that are used. Since the 3074A acts as a modem it must be hardwired to the computer/264X terminal using an asynchronous modem cable, see figure 15-7.

6) To facilitate the testing of the Factory Data Link, it is recommended that additional Data Link Connection Boxes are installed on the Data Link on either side of the Wall Mounting Cradles. This allows test equipment, such as the Data Link Tester, to be easily connected to the link to monitor the communications traffic, see section 16 for details.

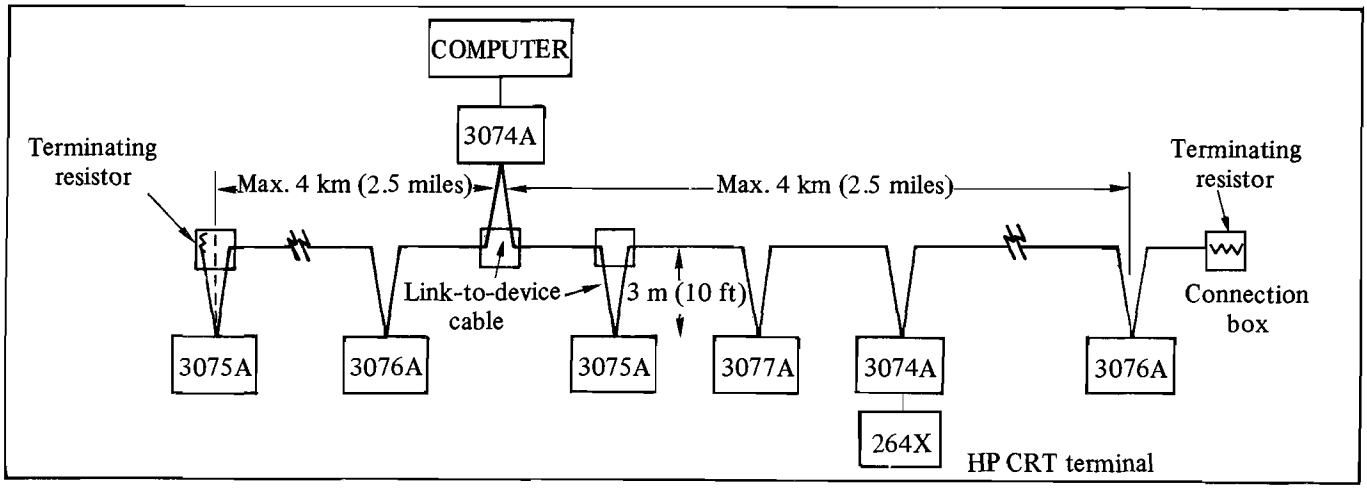


Figure 15-8 Factory Data Link Lengths

15-18 FACTORY DATA LINK INSTALLATION

CAUTION

1) If the Data Link is to be installed after the installation of the terminals and computer; ensure all the terminals and 3074A's are switched OFF (from mains power) and the first 3074A is disconnected from the computer.

2) If the Data Link cable is to be installed near to environmentally hazardous locations it must be adequately protected. Also, the cable should be neither kinked nor tightly trapped between sharp surfaces.

Note: In this manual, the term previous terminals means the preceding terminals towards the computer. The term next terminals means the immediately following terminals towards the end of the Data Link (away from the computer).

The 3074A Data Link Adapters provide an electrical interface between the Factory Data Link cable and both the computer and the HP 264X CRT terminals. One 3074A is required for each computer and each HP 264X connection. The 3074A is connected to the Data Link using a 92905A Data Link-to-Device cable that plugs into a Data Link Connection Box. The installation of the 3074A is described in section 16.

Each 3074A adapter and 3075A terminal requires the installation of a 92901A Data Link Connection Box to enable the 92905A cable associated with the 3074A/3075A to be directly plugged into the Data Link cable. The installation of the connection boxes is described in section 15-19.

The procedure for installing the Data Link cable consists of connecting one end of the cable to the connection box to which the first 3074A (associated with the computer) is to be plugged (see section 15-19 for wiring instructions). The cable must be then run from this connection box to the site of the first terminal. If this site is either for a 3075A terminal or a 3074A adapter associated with an HP 264X CRT terminal then a connection box must be installed (see section 15-19 for wiring instructions). If this site is for either a 3076A or 3077A terminal, the cable must be connected to the previously installed Wall Mounting Cradle as described in section 15-21. The Data Link cable should then be run to the next site and the site procedure repeated.

The installation of additional connection boxes and/or Wall Mounting Cradles to which no terminals are connected will not disturb the data communications. Their installation is recommended in order to provide for re-locating terminals, the future expansion of the system and aid the testing of the complete Data Link (see section 16).

Each end of the Data Link cable must be terminated by a 100 Ω 0.5 watt termination resistor. If the last terminal is either a HP 264X CRT terminal (connected to the link via a 3074A adapter) or a 3075A, the resistor may be wired in the associated connection box. If the last terminal is either a 3076A or 3077A, the resistor may be either wired in a connection box AFTER this terminal or directly wired in the cradle housing the terminal. For details see sections 15-19 and 15-22 respectively.

15-19 92901A Data Link Connection Boxes Installation

CAUTION

The connection boxes must be mounted on a solid mounting surface away from hazardous environments (e.g. liquids or where they may be subject to accidental damage).

The base of the connection box contains eight cable inlet apertures, two at each corner (see figure 15-9). Before the connection box is installed, two of these apertures (normally on opposite sides of the screw connector block) must be enlarged to facilitate the side entry and side exit of the Data Link cable, when required. This may be achieved using a pair of long-nosed pliers to snap off (from the rear of the base) the "thinner" outside wall of the base adjacent to the appropriate inlet aperture.

Note. When performing this procedure care must be taken not to crack or in any other way damage the base.

The Data Link Connection Boxes are opened by first unscrewing the two screws on the top of the box (that secure the outer case to the base) then removing the outer case. The base houses the Data Link screw connector block.

Connection box mounting. The connection boxes may be mounted either horizontally or vertically using the four countersunk holes provided in the base of the box (see figure 15-9). The boxes should normally be mounted so that when they are wired the Data Link inlet cable and outlet cable do NOT cross over one another within the box, as this may prevent the replacement of the outer case.

Connection box to link wiring. When the connection box is installed, the Data Link cable should be wired to the box as follows:

1) Strip the outer jacket of the Data Link cables as required. Remove approximately 6 mm (0.25 ins.) of insulation from each wire.

2) Remove the connection box outer case.

3) Pass the Data Link cable from the previous terminal through the relevant cable inlet aperture in the wall of the base. Connect the cable to the screw connector block contacts (see figure 15-9):

   Contact 1: Data Link blue wire (+) in.
   Contact 3: Data Link white wire (-) in.
   Contact 5: Data Link shield (bare wire) in and out.

4) Pass a length of the Data Link cable (that is going from this connection box to the next terminal) through the other cable inlet aperture in the wall of the base. Ensure the two cables (within the box) do not cross over. Connect the cable to the screw connector block contacts (see figure 15-9):

   Contact 2: Data Link blue wire (+) out.
   Contact 4: Data Link white wire (-) out.
   Contact 5: Data Link shield (bare wire) in and out.

5) Replace the connection box outer case, ensuring the reference hole in the case aligns with the reference hole on the screw contact block (see figure 15-9). When the connector box is not being used, the supplied protective cover should be inserted into the Data Link-to-Device plug aperture, to inhibit the ingress of dirt.

Link Terminating resistor installation. When the connection box is at the end of the Data Link cable, a 100 Ω 0.5 watt terminating resistor (HP part number 0686-1015) must be installed in the box. This resistor must be placed between contacts 2 and 4 (i.e. on the side of the screw contact block opposite to the cable coming from the previous terminal), see figure 15-9. This resistor is mandatory on both ends of the Data Link as it eliminates wave reflections.

Note: As an alternative, if the last terminal on the link is a 3076A or 3077A, the link terminating resistor may be directly mounted on the Data Link screw connection within the 92904A Wall Mounting Cradle, see section 15-22.

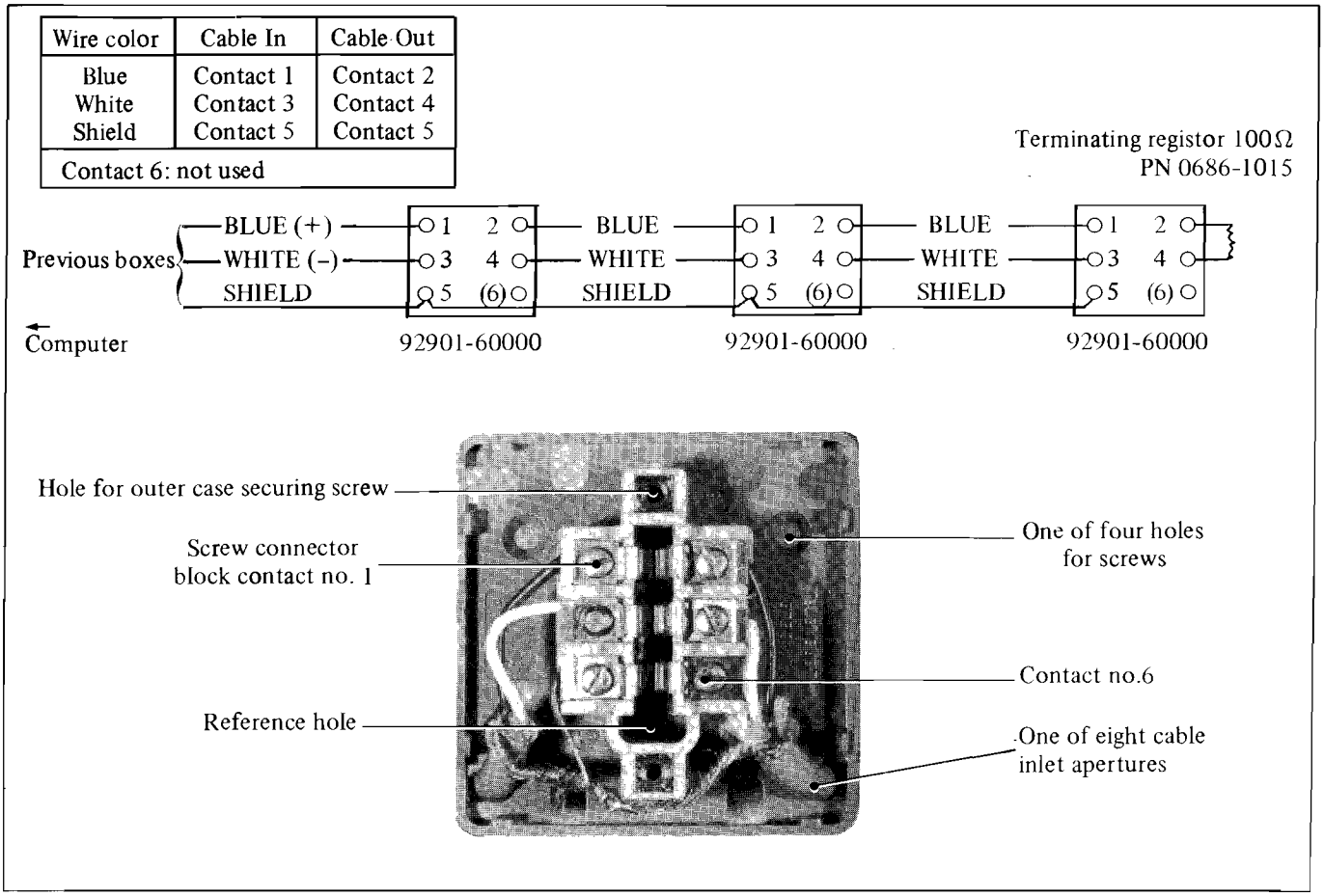


Figure 15-9 Factory Data Link Connection Boxes

Connection box Factory Data Link plug lock. The connection between the Data Link-to-Device cable and the connection boxes can be made as a locked or unlocked connection.

- In the unlocked configuration, when the Factory Data Link plug (on the end of the Data Link-to-Device cable) is plugged into the connection box it is firmly held in place by detents in the screw connector block contacts. However, the Factory Data Link plug can be easily removed by hand (without the use of a tool).
- In the locked configuration, the Factory Data Link plug can only be removed from the connection box after dismantling the locking mechanism with a screwdriver.

The security lock is a function of the position of the no. 6 contact and pressure plate in the connection box as shown in figure 15-10.

The connection box may be modified from un-locking to locking as follows:

1) Remove the connection box outer case.
2) Remove screw from contact no. 6 (no wire connection at this location).
3) Remove pressure plate and carefully lift no. 6 contact from its seat.
4) Turn the contact laterally through 180° and press the "short leg" at the rear of the contact into the slit next to the threaded hole of the connection box. This makes the contact non-functional by placing it in a storage position (see figure 15-10).
5) Replace the pressure plate with its protruding tab facing downward into the throat of the connector. This is achieved by passing the tab through a slit between the threaded hole and the connector throat (see figure 15-10).
6) Replace the screw to secure the pressure plate.
7) Replace the connection box outer case.

As soon as the Factory Data Link plug is pressed into the box it will be locked in position by the pressure plate protruding tab.

The plug may be removed from the connection box as follows:

1) Switch-off the terminal associated with the Data Link-to-Device cable.
2) On the case of the Factory Data Link plug, unscrew the two screws holding the case together (see figure 15-14) and remove the case.

CAUTION

If the Data Link is operational care must be taken NOT to short circuit, or in any other way, damage the plug contacts.

3) Remove the screw from contact no. 6 (this is the only contact that does NOT have a "lip" which is pressed into a slit above the screw).
4) The Factory Data Link plug may then be carefully withdrawn from the connection box.
5) Contact no. 6 should then be carefully withdrawn from the connection box and replaced in the Factory Data Link plug. Replace the plug cover.

15-20 FACTORY DATA LINK TO 3074A AND 3075A CONNECTION

When using a 92905A Factory Data Link-to-Device cable, this cable is equipped with a 30-pin connector (for connections to the 3074A or 3075A) and a Factory Data Link plug (for connections to the connection boxes). The cable must be simply plugged into the connection box (which provides a make-before-break contact) and the 3074A or 3075A. If required, the 92905A cable may be fabricated by the user. For details see section 15-26.

1) When connecting the 92905A cable 30-pin connector, the connector cable inlet aperture fits over the 10 mm (0.4 ins) wide lug on the right-hand side of the 3074A/3075A connector inlet. The other end of the connector must then be firmly pressed into position.

2) The 92905A cable may be plugged into and un-plugged from the connection boxes at any time (even when the Data Link is operational).

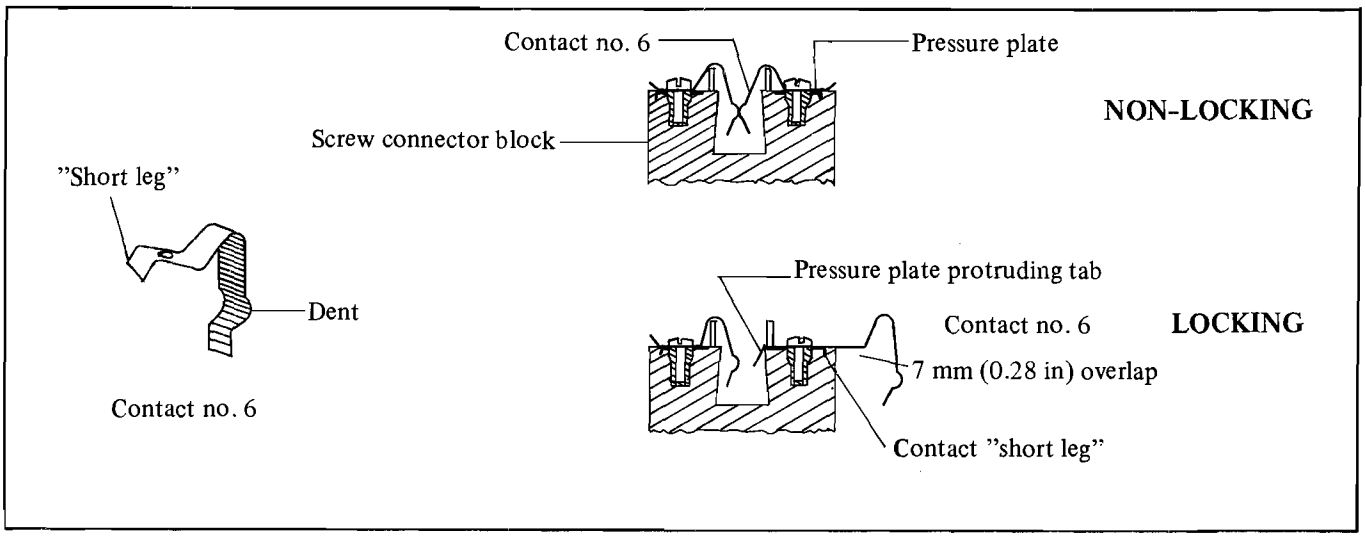


Figure 15-10 Factory Data Link Connection Box Security Lock

15-21 FACTORY DATA LINK TO 3076A AND 3077A CONNECTION

The Factory Data Link must be directly connected to the printed circuit data communications board in the 92904A Wall Mounting Cradle housing the terminal. This should be done before the terminal is installed in the cradle. The Factory Data Link may be connected to the printed circuit board either through the base of the cradle or through the cradle backplate. If the terminal is either the only or the last terminal, one cable is connected to the cradle. If the terminal is one of many, two cables must be installed in the cradle.

15-22 Factory Data Link Connections From The Bottom Of The Cradle

Install the cable(s) as follows:

1) Ensure the cradle LINE switch is OFF.

2) Unlock the cradle and remove the front cover.

3) At the bottom of the cradle base, unscrew and remove the (left-hand) sliding metal plate that covers the data cables inlet (see figure 15-1).

4) Within the base, slacken the data cable clamp (see figure 15-11).

5) Strip the outer jacket of the Data Link cable(s) back as required. Remove approximately 6 mm (0.25 ins.) of insulation from each wire.

6) Feed the end of the Data Link cable(s) through the data cables inlet and pass it through the data cable clamp. Feed approximately 160 mm (6.3 ins.) of cable through the clamp then tighten the clamp.

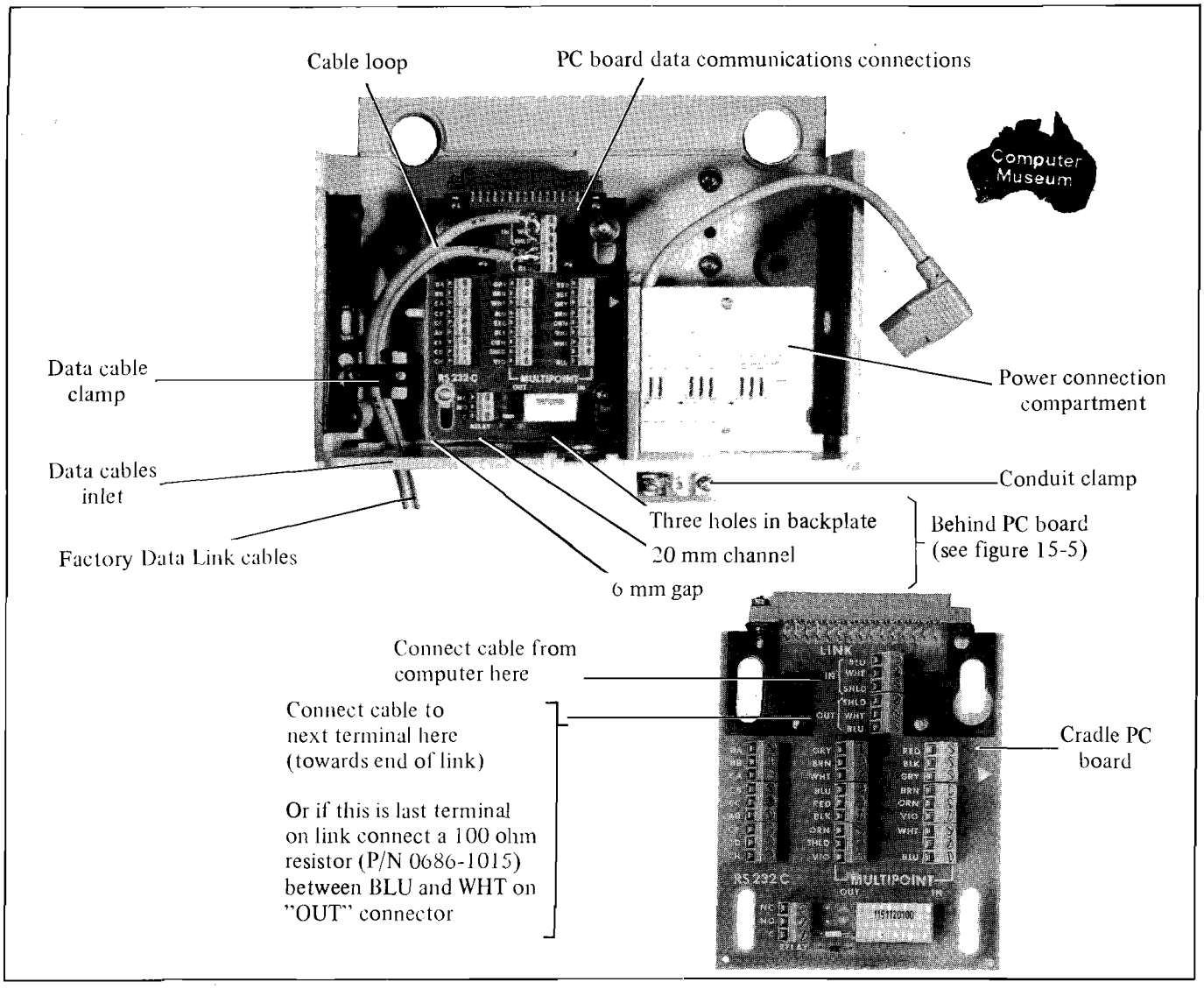


Figure 15-11 Factory Data Link Cradle Connections

7) Connect the Factory Data Link cable(s) to the screw connector labelled LINK at the top of the printed circuit data communications board (see figure 15-11). The wires within the Data Link cable are color coded and should be attached to the indicated connector. The cable from the previous terminal/connection box must be attached to the screw connector labelled LINK IN. The cable going out to the next terminal must be attached to the screw connector labelled LINK OUT.

   Note: Ensure that the Data Link cable(s) has a loop (see figure 15-11). This is necessary because when a terminal is installed the printed circuit board must be able to move upwards to mate with the terminal 30-pin connector.

8) If the cradle is to house the last terminal on the link, the 100Ω 0.5W link terminating resistor (part number 0686-1015) may be connected to the screw connection labelled LINK OUT between the connections labelled BLU and WHT. This may be used as an alternative to wiring the resistor in a connection box after the cradle.

9) Replace the sliding metal plate that covers the data cables inlet. Slide the plate so that the cable(s) is loosely trapped between the metal plate and the back of the cradle base, with the least gap possible. Tighten up the plate locating screws.

10) Replace the cradle front cover and the cradle protection cover (see section 15-7).

15-23 Factory Data Link Connections Through The Cradle Backplate

When the Factory Data Link cable is supplied from inside the cradle mounting surface, the cable(s) may be routed through the three 6.7 mm (0.26 ins.) diameter holes in the cradle backplate. The cables should be installed in a similar manner to the installation from the bottom of the cradle except:

1) The plate over the data cables inlet should not be moved.
2) The locking nut holding the printed circuit data communications board must be slackened and the board moved up to allow the entry of the cable(s).
3) The cable(s) should be routed to the data cable clamp via the 20 mm (0.79 ins.) wide channel at the base of the cradle and through the 6 mm (0.24 ins.) gap at the left-hand side of the channel. See figure 15-11.

15-24 FABRICATING YOUR OWN DATA LINK CABLES

The Factory Data Link and the Factory Data Link-to-Device cable may be fabricated by the user provided they follow the guidelines contained in sections 15-25 and 15-26.

15-25 Factory Data Link Cable Fabrication

The single 92902A Data Link Cable has the following characteristics:

Option 001: 100 m (325 feet)

Option 002: 300 m (975 feet)

Type: Shielded, single twisted-pair of wires.

Jacket outer: PVC rated for 85°C (185°F) at 300V AC

Electrical resistance: inner conductors <32 ohms per km (<41 ohms per mile), shield <16 ohms per km (<26 ohms per mile).

Capacitance:
between inner conductors <90 pF/m (<28 pF/ft)
between inner conductor and shield <200 pF/m (<61 pF/ft)

This cable may fabricated by the user provided that it respects these characteristics. An alternative source is BELDEN 9463 cable.

15-26 Factory Data Link-To-Device Cable Fabrication

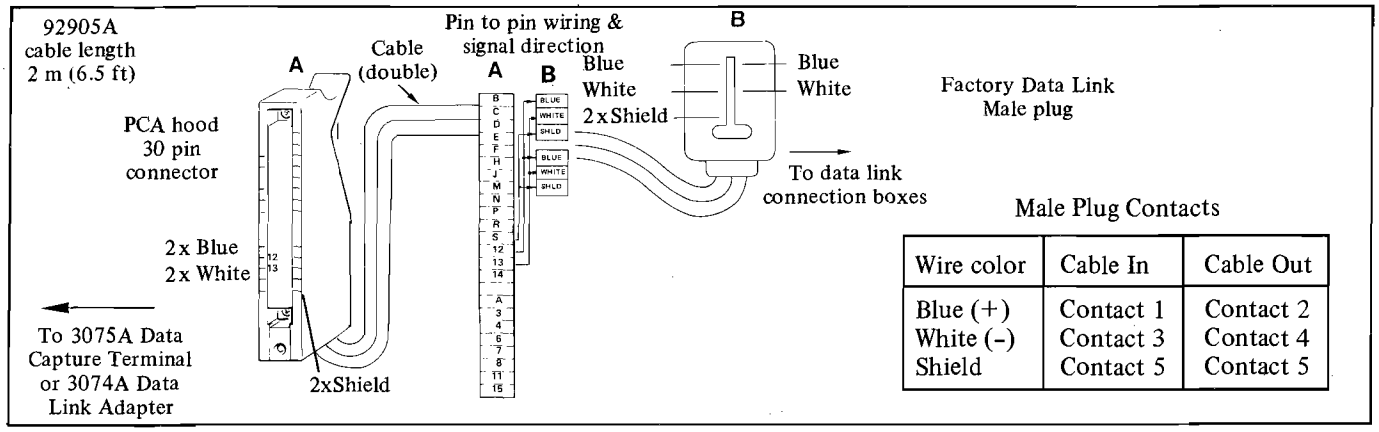
The 92905A Data Link-to-Device cable depicted in figure 15-12 may be fabricated by the use. The PCA (Printed Circuit Assembly) hood connector, Factory Data Link male plug and cables are available from Hewlett-Packard. Part numbers for these items are listed in Table 15-4.

Figures 15-13 and 15-14 depicts the assembly of the PCA hood connector and the Factory Data Link male plug, respectively.

Note: The Data Link-to-Device cable uses a double cable, one cable in and one cable out.

Table 15-4 Parts For Fabricating Data Link-To-Device Cables

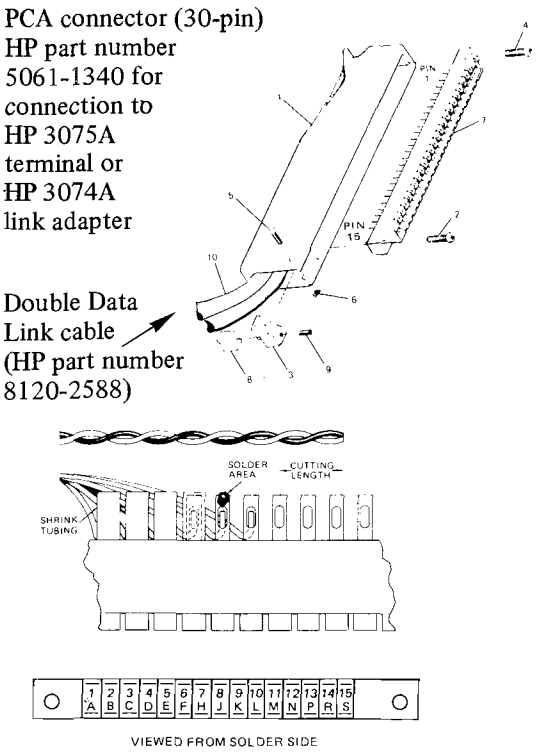
Item	HP Part Number	Alternative Source	Description
PCA hood connector	5061-1340		See figure 15-13 (includes contacts)
Factory Data Link male plug	1251-4661		See figure 15-14
Double Data Link cable	8120-2588	Twin length of single Factory Data Link cable can be used instead.	See section 15-25



Male Plug Contacts

Wire color	Cable In	Cable Out
Blue (+)	Contact 1	Contact 2
White (-)	Contact 3	Contact 4
Shield	Contact 5	Contact 5

Figure 15-12 Standard 92905A Data Link-To-Device Cable (Factory Data Link)



Assembly Procedure:

a. ( ) Insert cables (item 10) into the connector hood (item 1).

b. ( ) Strip the outer jacket of the cables back as required.

c. ( ) Remove approximately 6 mm (0.25 ins.) of insulation from each signal wire.

d. ( ) Starting at the end of the 30-pin connector (item 7) nearest pins S and 15, solder the signal wires to the appropriate pins on the connector, and insulate each pin with tubing.

e. ( ) Fasten connector to mounting block 3 with self-tapping screw 2.

f. ( ) Mount connector and mounting block to hood with self-tapping screw 4, screw 5 and nut 6. Do not tighten screw 5.

g. ( ) Set cable clamp 8 between mounting block and cable and tighten set screw 9.

h. ( ) Tighten screw 5.

Figure 15-13 Assembling The PCA Hood Connector (Factory Data Link)

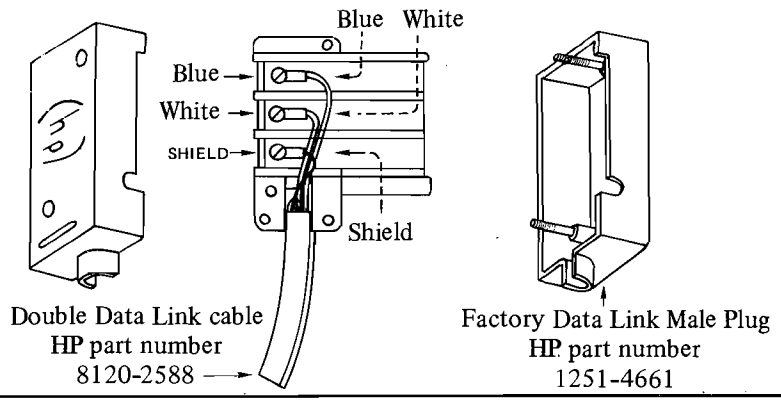


Figure 15-14 Assembling The Factory Data Link Male Plug

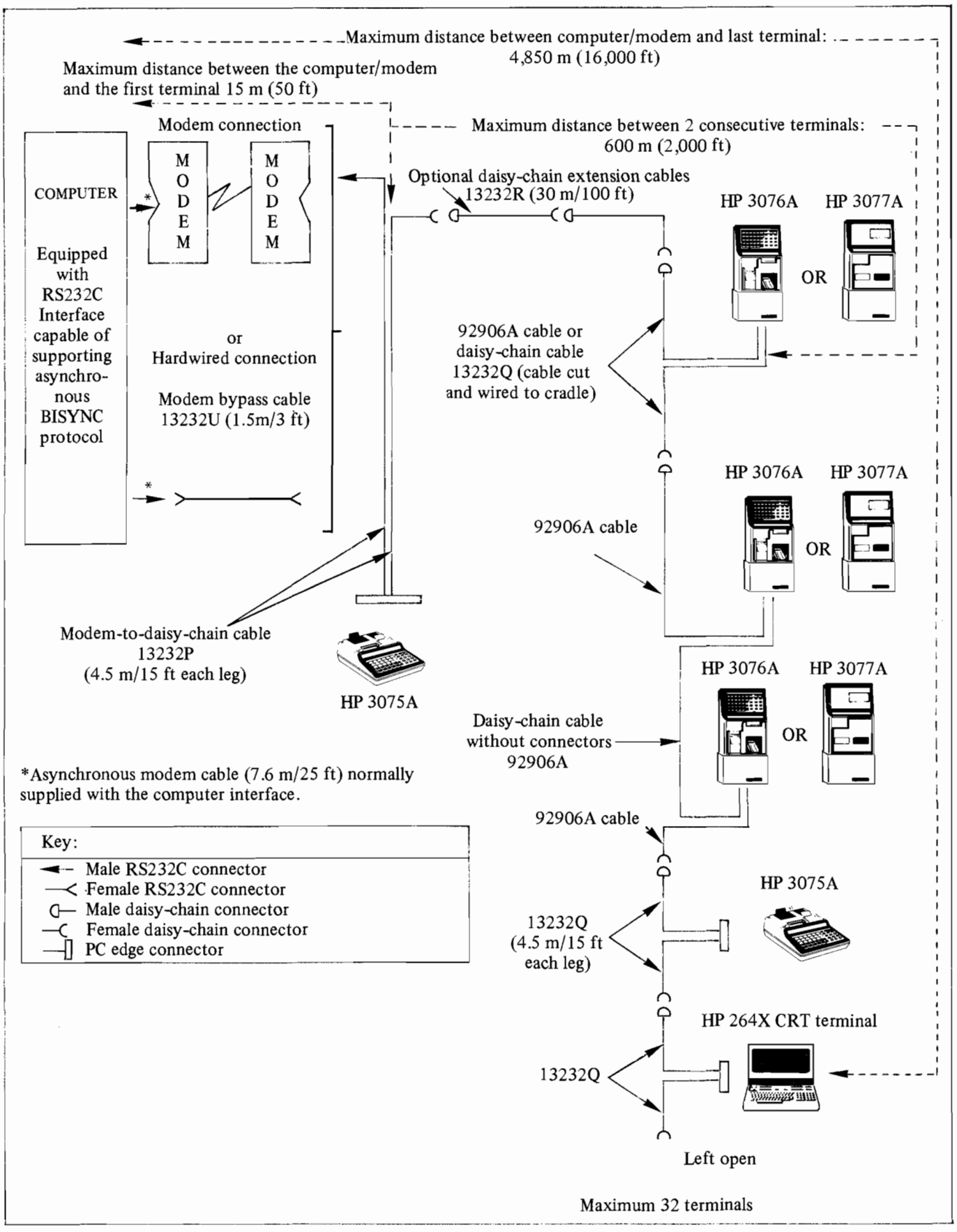


Figure 15-15 Daisy-Chain Components

15-27 DAISY-CHAINED CONNECTIONS

Note: The computer must be capable of supporting the polled mode protocol patterned after asynchronous BISYNC (Binary Synchronous Communications) that is used for multiterminal connections (see section 14).

For daisy-chained multiterminal connections, the cable associated with the first terminal may be connected to the computer using either:

1) A hardware connection comprising a modem bypass cable (HP part number 13232U).
2) Full/half duplex modems.

The subsequent terminals are daisy-chained from the first terminal.

The first terminal (3075A or 3076A or 3077A) MUST be connected to either the modem or the modem bypass cable using a modem-to-daisy-chain cable (HP part number 13232P). If the first terminal is either a 3076A or 3077A, the 13232P cable PCA hood must be removed and the cable directly wired to the Wall Mounting Cradle printed circuit board.

Daisy-chain extension cables (HP part number 13232R) may be used to increase the distance between terminals up to a maximum of 600 metres (2,000 feet). If the cable is required to be passed through a conduit, a daisy-chain cable without connectors (HP part number 92906A) may be used. However, daisy-chain connectors will have to be subsequently added to the cable.

If the second terminal is a 3075A (irrespective of whether the first terminal was a 3075A, 3076A or 3077A), a 13232Q cable must be used. If required this cable may be extended using 13232R extension cables.

If the second terminal is a 3076A or 3077A then it may be connected to the first terminal in one of two ways:

- If the first terminal was a 3075A, using a 13232Q cable with the PCA hood removed to allow the cable to be directly wired to the Wall Mounting Cradle.
- If the first terminal was a 3076A or 3077A, using a 92906A cable.

When connecting the 2nd through last terminal:

1) When connecting a 3075A terminal to a 3075A, each terminal MUST use a 13232Q cable. This cable may be extended using a 13232R extension cable.

2) When connecting a 3075A to a 3076A/3077A (or vice-versa), the 3075A must have a 13232Q cable (which may be extended using a 13232R cable) but the 3076A/3077A may have either:
   a) A 13232Q cable, with the PCA hood removed to facilitate connections with the Wall Mounting Cradle.
   b) A 92906A cable, with a male daisy-chain connector fitted to the cable to enable the connection with the 13232Q cable from the 3075A.

3) When connecting a 3076A/3077A to a 3076A/3077A, a 92906A cable must be used.

Equipment	HP Part Number	Comment
Computer Interface for system HP 1000	12790A option 001	Option 001 provides an asynchronous modem cable, 7.6 m (25 ft).
Computer Interface for system HP 3000 series III	30055A option 001	Option 001 provides an asynchronous modem cable, 7.6 m (25 ft).
Modem bypass cable	13232U	1.5 m (5 ft). Used for hardware connection instead of modems.
Modem-to-daisy-chain cable	13232P	4.5 m (15 ft). Connects the FIRST terminal to either the modem or the modem bypass cable.
Daisy-chain cable (with connectors)	13232Q	4.5 m (15 ft). Used to connect the first terminal to the second (and subsequent) terminal.
Daisy-chain extension cable	13232R	30 m (100 ft). Connects two 13232Q cables.
Daisy-chain cable (excluding connectors)	92906A	Used to connect 2nd thru 32nd 3076A and 3077A terminals. Option 001 = 100 m (325 ft) no connectors Option 002 = 300 m (1,000 ft) no connectors

Figure 15-15 Daisy-Chain Components (Cont'd)

A maximum of 32 terminals may be daisy-chained to one computer. The maximum distance between the computer/modem and the first terminal is 15 metres (50 feet). The maximum distance between the computer/modem and the last terminal is 4,850 metres (3.03 miles = 16,000 feet). The maximum distance between terminals is 600 metres (2,000 feet).

Figure 15-15 depicts and lists the components that are required for a daisy-chained installation.

Note: If required the daisy-chained connection cables may be fabricated by the user. For details see section 15-32.

15-28 DAISY-CHAIN CABLING CONSIDERATIONS

The following points must be taken into consideration when designing the installation:

1) The total length of the daisy-chained cables can be up to 4.85 km (3.03 miles). The maximum distance between the computer or modem and the first terminal is 15 metres (50 ft). The maximum distance between terminals is 600 metres (2,000 ft).

   Note: The power protect cable (HP part number 13232T) may not be used with the 3075A/3076A/3077A terminals, as they do not provide the +12V required to energise external relays.

2) The daisy-chained cables should NOT be routed through electrically noisy environments (e.g. adjacent to power cables). Also, they must be used within buildings and NOT outside. All installations should be checked for conformity to local safety regulations before use.

3) The daisy-chain is controlled by a single computer. Due to signal timing considerations, the maximum number of terminals that can be daisy-chained is 32.

4) The number of 92904A Wall Mounting Cradles installed should equal the number of 3076A/3077A terminals purchased, as the daisy-chain will not operate if there are empty cradles.

15-29 DAISY-CHAINED CONNECTION INSTALLATION

CAUTION

1) If the daisy-chained connection is to be installed after the installation of the terminals and computer, ensure all the terminals are switched OFF (from mains power). The cables must not be connected to or disconnected from an operational computer.

2) If the daisy-chain cables are to be installed near to environmentally hazardous locations it must be adequately protected. Also, the cables should be neither kinked nor tightly trapped between sharp surfaces.

Note: In this manual, the term previous terminals means the preceding terminals towards the computer. The term next terminals means the immediately following terminals towards the end of the daisy-chain (away from the computer).

The modem-to-daisy-chain cable (13232P) and the daisy-chain cable (13232Q) each comprises a PCA connector hood and two "legs" that are terminated by a male and a female connector respectively. The modem bypass cable (13232U) and the daisy-chain extension cable (13232R) each comprise a single cable with one end terminated by a male connector and one end terminated by a female connector. The daisy-chain cable (92906A) comprises a single cable with no connectors. All these cables are illustrated in figure 15-17. Depending on the terminal and its location on the daisy-chain, the terminals must be installed as described in section 15-30 and 15-31.

15-30 **3075A Daisy-Chain Connection** (figure 15-15)

If the 3075A is the first terminal after the computer it must be connected using a 13232P cable. The cable male connector plugs into either the modem or the modem bypass cable. The cable female connector plugs into the male connector on the cable associated with the next terminal. 13232R extension cables may be used to connect the 13232P cable to the cable associated with the next terminal.

Note:
1) The 13232P cable PCA hood plugs into the terminal 30-pin connector as described in section 16.
2) If the cable is required to go through a conduit, the 13232R cable may be replaced by a 92906A cable to which daisy-chain connectors will have to be subsequently added.

If the second (through last) terminal is a 3075A, a 13232Q cable must be used. The cable male connector plugs into the female connector of the previous cable. The 13232Q cable female connector plugs into the male connector on the cable associated with the next terminal. 13232R extension cables may be used to connect the 13232P cable to the cable associated with the next terminal.

15-31 **3076A/3077A Daisy-Chain Connection** (figure 15-15)

If the 3076A/3077A is the first terminal after the computer it must be connected using a 13232P cable. The cable PCA hood must be removed and the cable wired to the Wall Mounting Cradle printed circuit board.

Signals BA through CH are associated with the computer and must be connected to the printed circuit board RS232C screw connector. Signals BBO+ through AB are associated with the next (i.e. subsequent) terminal(s) and must be connected to the printed circuit board MULTIPOINT OUT screw connector (for details see below). The 13232P cable male connector plugs into either the modem or the modem bypass cable. The 13232P cable female connector plugs into the male connector on the cable associated with the next terminal. 13232R extension cables may be used to connect the 13232P cable to the cable associated with the next terminal.

If the 3076A/3077A is the second (through last) terminal it may be connected using either a single 13232Q cable or two 92906A cables (see section 15-27):

1) If a 13232Q cable is used, the PCA hood must be removed and the cable attached to the Wall Mounting Cradle printed circuit board. Signals BBI+ through AB are associated with the previous terminal(s) and must be connected to the printed circuit board MULTIPOINT IN screw connector. Signals BBO+ through AB are associated with the next terminal(s) and must be connected to the printed circuit board MULTIPOINT OUT screw connector (for details see below). The 13232Q cable male connector plugs into the female connector of the previous cable. The 13232Q cable female connector plugs into the male connector associated with the next terminal.

2) If two 92906A cables are used, they may be directly wired to the Wall Mounting Cradle printed circuit board (as the cable does not have any connectors). The cable from the previous terminal(s) must be connected to the MULTIPOINT IN screw connector. The cable associated with the next terminal(s) must be connected to the MULTIPOINT OUT screw connector. If the previous terminal was a 3075A (or HP 264X CRT), the 92906A cable must be terminated by a male connector (to enable a connection with the female connector of the previous cable). If the next terminal is a 3075A (or HP 264X CRT), the 92906A cable must be terminated by a female connector.

Note: If the 3076A/3077A terminal is the last terminal on the daisy-chain, NO connections are required to the MULTIPOINT OUT screw connector when using 92906A cables.

The daisy-chain cables may be connected to the cradle either through the cable inlet at the bottom of the cradle or through the cradle backplate.

Daisy-Chain Connection From The Bottom Of The Cradle

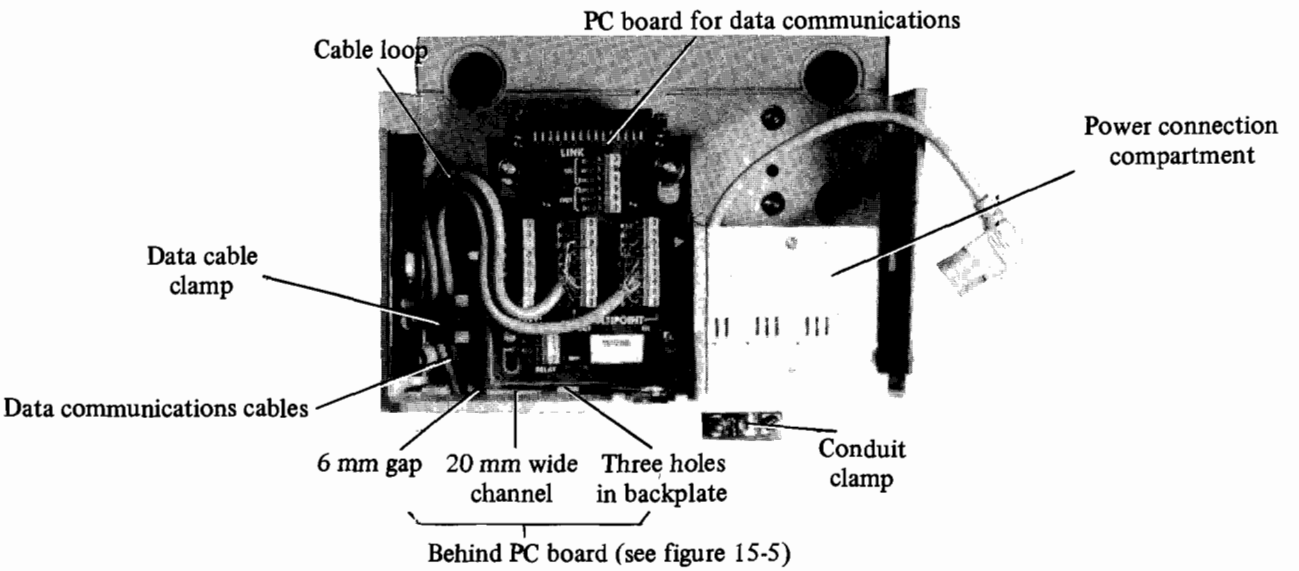
The cables must be installed in the 92904A Wall Mounting Cradle as follows:

1) Ensure the cradle LINE switch is OFF.
2) Unlock the cradle and remove the front cover.
3) At the bottom of the cradle base, unscrew and remove the (left-hand) sliding metal plate that covers the data cables inlet (see figure 15-1).
4) Within the base, slacken the data cable clamp (see figure 15-16).
5) If the cable to be connected is either a 13232P or a 13232Q, cut the cable adjacent to the PCA hood (see figure 15-17) to remove the hood. Strip back the outer jacket of the two "leg" cables as required. Remove approximately 6 mm (0.25 ins.) of insulation from each of the signal wires to be used.

   Note: On the 13232P cable, signals SCA (grey-brown), SCF (white), DA (white/blue) and CE (white/yellow) are not used. Consequently, these wires must be cut so that the end of the wire aligns with the end of the cable outer jacket, with NO bare wires showing.
6) If the cable to be connected is a 92906A, strip back the outer jacket of the cable as required. Remove approximately 6.35 mm (0.25 ins.) of insulation from each of the wires.
7) Feed the end of the cables through the data cables inlet and pass it through the data cable clamp. Feed approximately 150 mm (6 ins.) of cable through the clamp then tighten the clamp.
8) Connect the cables to the relevant screw connector, see figure 15-16.

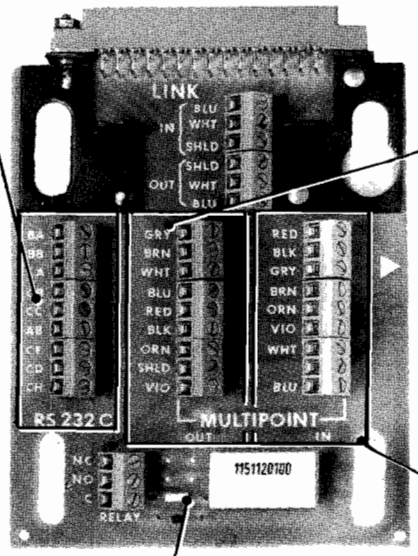
   Note: For the 13232P connections to the screw connector marked RS232C, a probe (or resistance meter) may be used to ensure that the wires connected to the screw connector correspond to the same signals used on the cable male connector. Figure 15-17 depicts the 13232P cable internal wiring.
9) Ensure that the daisy-chain cables have a loop (see figure 15-16). This is necessary because when the terminal is installed in the cradle the printed circuit board must be able to move upwards to mate with the terminal 30-pin connector.

Cradle with front cover removed.



Behind PC board (see figure 15-5)

INPUT from the computer/modem if this is the first terminal on the daisy-chain. Use the 13232P cable and connect signals BA thru CH to the RS232C connector, connect signals BBO + thru CAI- and shield to the MULTIPOINT connector.



OUTPUT (via cable female connector) to next terminal (end of daisy-chain direction), using signals BBO+ thru CAI- on cables 13232P, 13232Q and 92906A. No connections if this is the last terminal.

INPUT (via cable male connector) from previous terminal (computer direction) if this is NOT the first cable on the daisy-chain. Use either 13232Q cable or 92906A cable to connect signals BBI+ thru AB to the MULTIPOINT IN connector (connect signals BBO+ thru CAI- to the MULTIPOINT OUT connector).

Cradle PC board

RS232C Signals	
RS232C signal	Wiring HP wire color
BA	RED
BB	ORN
CA	YEL
CB	GRN
CC	BLU
AB	BLK
CF	GRY
CD	WHT/ORN
CH	WHT/GRN

MULTIPOINT OUT Signals			MULTIPOINT IN Signals		
Female connector pin	Signal	HP wire color	HP wire color	Signal	Male connector pin
1	BBO+	RED	RED	BBI+	1
2	BBO-	BLK	BLK	BBI-	2
3	BAI+	GRY	GRY	BAO+	3
4	BAI-	BRN	BRN	BAO-	4
5	CBO	ORN	ORN	CBI+	5
6	AB	VIO	VIO	CBI-	6
7	CAI+	WHT	WHT	CAO	7
8	CAI-	BLU	BLU	AB	8
9	SHIELD	SHLD (BLK)	SHIELD*		9

*SHIELD from input cable not connected.

Figure 15-16 Daisy-Chain Cradle Connection

10) Replace the sliding metal plate that covers the data cables inlet. Slide the plate so that the cables are loosely trapped between the metal plate and the back of the cradle base, with the least gap possible. Tighten up the plate locating screws.

11) Replace the cradle front cover and the cradle protection cover (see section 15-7).

Daisy-Chain Connection Through The Cradle Backplate

If the daisy-chain cables are routed to the cradle from inside the cradle mounting surface, the cables may be passed through the three 6.7 mm (0.26 ins.) diameter holes in the cradle backplate. The cables should be installed in a similar manner to the installation from the bottom of the cradle, except:

1) The plate covering the data cables inlet should not be moved.

2) The locking nut holding the printed circuit data communications board must be slackened and the board moved up to allow the entry of the cables.

3) The cables should be routed to the data cable clamp via the 20 mm (0.79 ins.) wide channel at the base of the cradle and through the 6 mm (0.24 ins.) wide gap at the left-hand side of the channel. See figure 15-16.

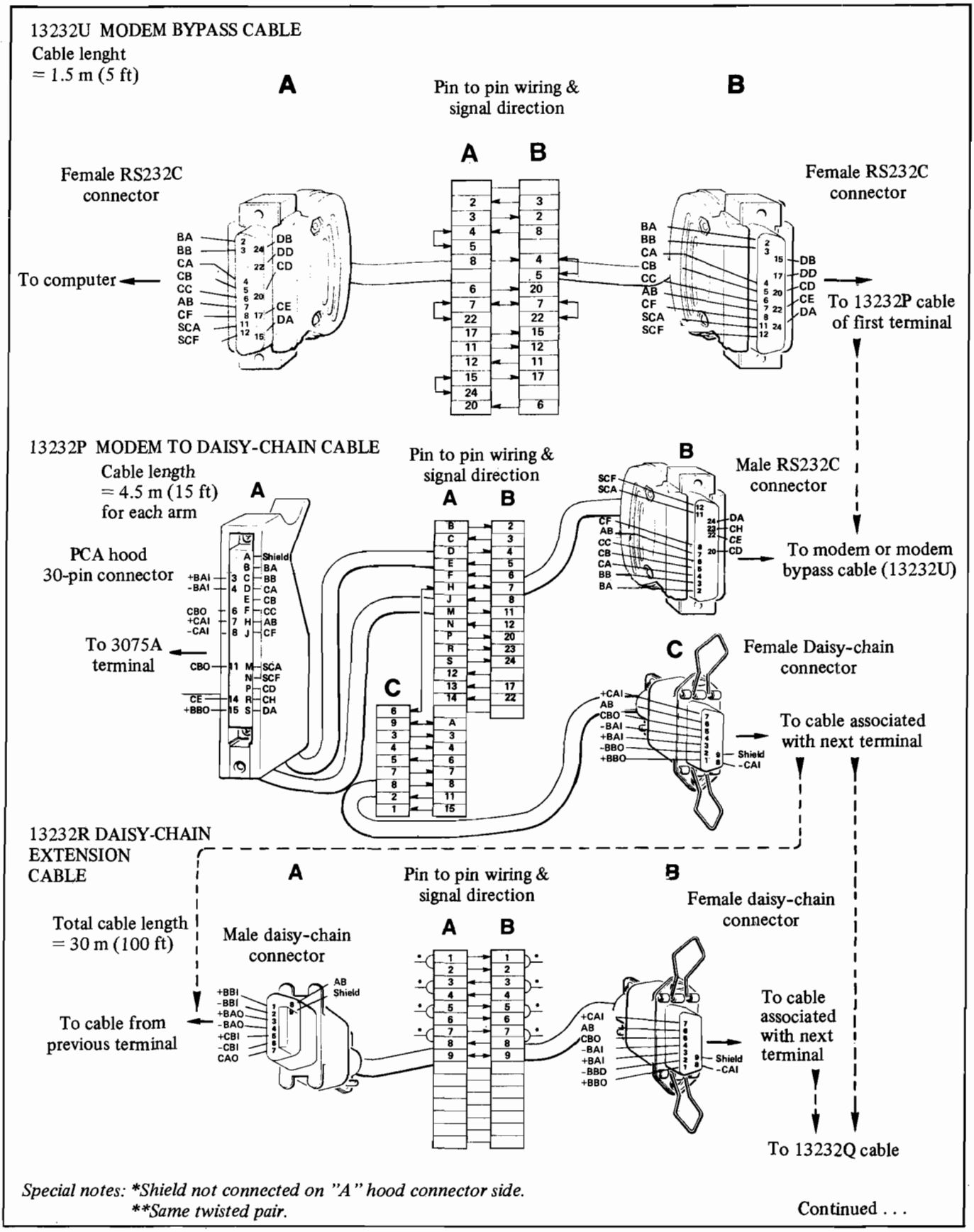
15-32 FABRICATING YOUR OWN DAISY-CHAIN CABLES

The 13232U, 13232P, 13232Q, 13232R and 92906A cables depicted in figure 15-17 may be fabricated by the user. The male RS232C connector, the PCA (Printed Circuit Assembly) hood connector, the daisy-chain male and female connectors and cables are available from Hewlett-Packard. Part numbers for these items are listed in Table 15-5. Figures 15-18, 15-19 and 15-20 depict the assembly of the RS232C connector, the PCA hood connector and the male and female daisy-chain connectors respectively.

Table 15-5 Parts For Fabricating Daisy-Chain Cables

Item	HP part number	Alternate source	Description
RS232 male connector	5061-2405		See figure 15-18
PCA hood connector	5061-1340		See figure 15-19
Male and female Daisy-chain connector	5061-2401		See figure 15-20
PCA hood to RS232 connector cable	8120-1903 or 8120-1930		26 AWG (or greater) low voltage computer cable.
Daisy-chain cable (excluding connectors)	HP 92906A Opt. 001: 100 m Opt. 002: 300 m	Brand Rex POSS4P22	22 AWG,4 twisted pair, overall shield, 75 ohm differential mode characteristic impedance.

Note: All connectors include contacts.



*Special notes: *Shield not connected on "A" hood connector side.*
***Same twisted pair.*

Continued . . .

Figure 15-17 Daisy-Chain Cable Details

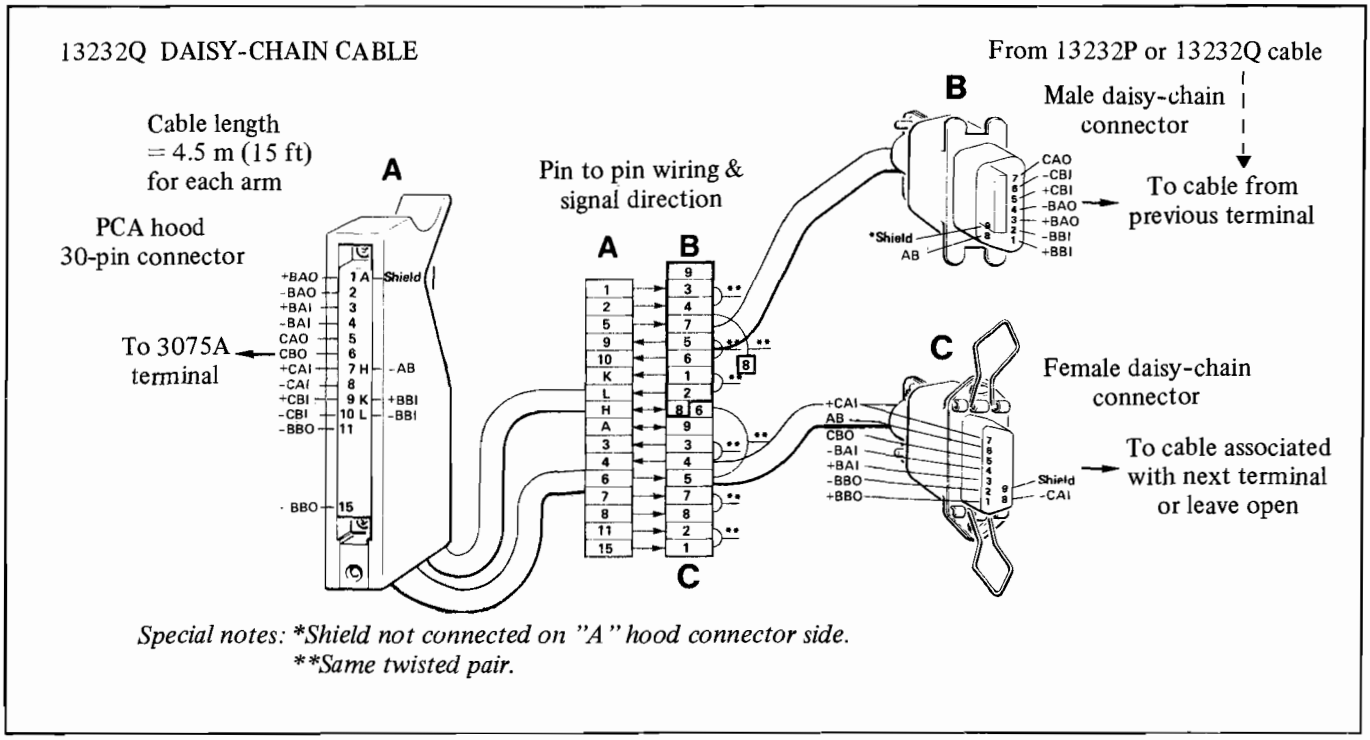
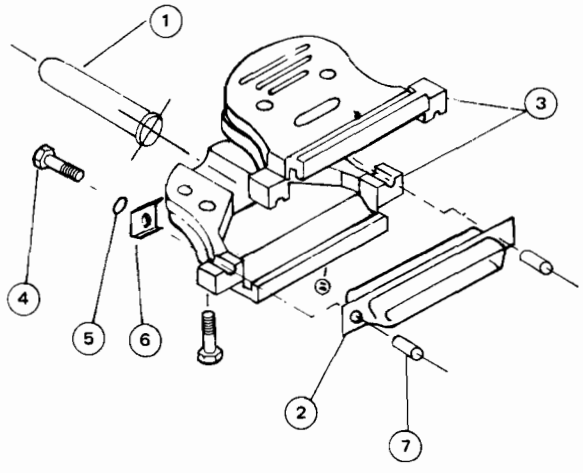


Figure 15-17 Daisy-Chain Cable Details (cont'd)



Assembly Procedure:

a. ( ) Slide rubber bushing (item 1) over end of cable, leaving about 150 mm (6 inches) of cable end exposed for wire stripping, etc.

b. ( ) Strip back the cable jacket 25 mm (1 inch).

c. ( ) Clip the unused conductor wires to the edge of the cable jacket.

d. ( ) Remove 6 mm (0.25 ins.) of insulation from the ends of the conductor wires to be used.

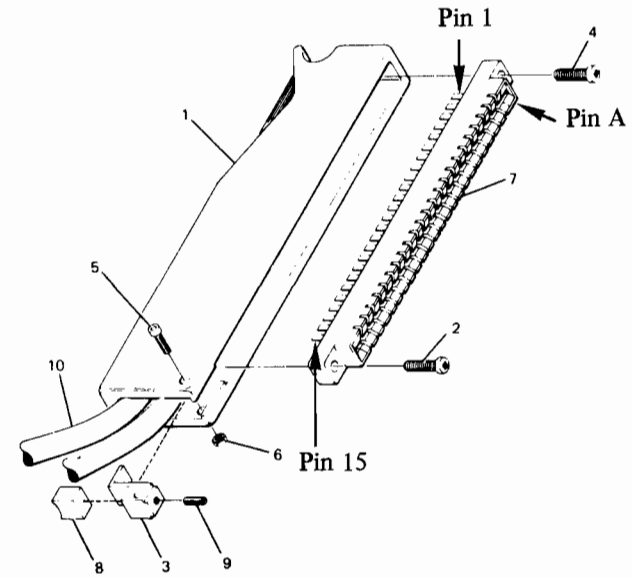
e. ( ) Solder the conductor wires onto the contacts of the contact assembly (item 2). (Select either the male or female contact assembly provided for your particular application).

f. ( ) Slide the rubber bushing to the end of the cable such that the rubber bushing flange is flush with the stripped end of the cable jacket.

g. ( ) Assemble the two halves of the connector (item 3) onto the contact assembly (item 2). (Use the screws and nuts provided).

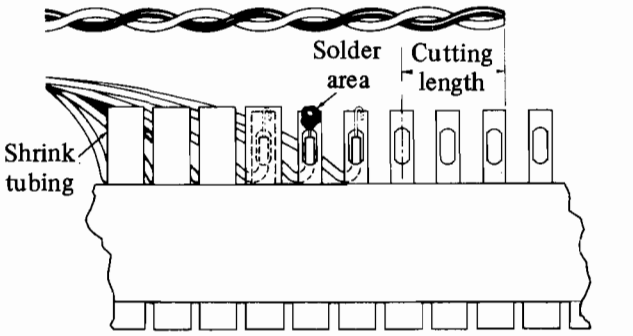
h. ( ) Mount the two screws, threaded spacers, and other hardware (items 4 thru 7) onto the contact assembly.

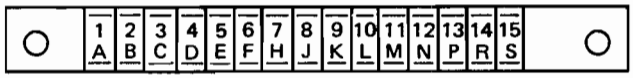
Figure 15-18 Assembling The Male RS232C Connector



PCA connector (30-pin)
HP part number
5061-1340

for connection to HP 3075A





Viewed from solder side

Assembly Procedure:

a. ( ) Insert cables (item 10) into the connector hood (item 1).

b. ( ) Strip the outer jacket of the cables back as required.

c. ( ) Remove approximately 6 mm (0.25 ins.) of insulation from each signal wire.

d. ( ) Starting at the end of the 30-pin connector (item 7) nearest pins S and 15, solder the signal wires to the appropriate pins on the connector, and insulate each pin with tubing.

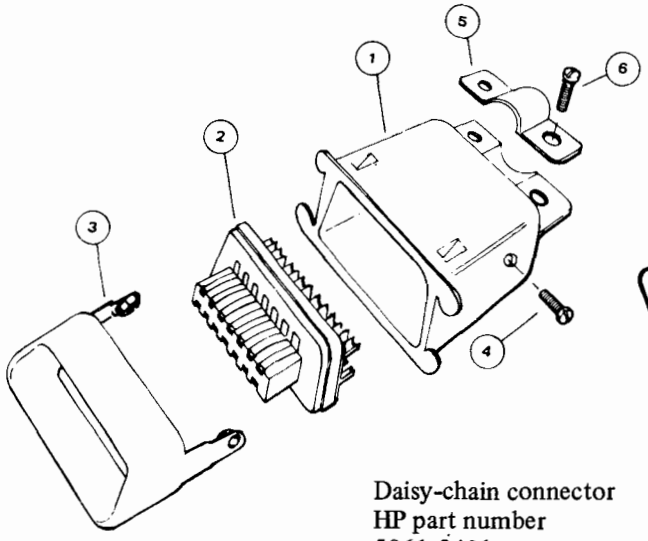
e. ( ) Fasten connector to mounting block 3 with self-tapping screw 2.

f. ( ) Mount connector and mounting block to hood with self-tapping screw 4, screw 5 and nut 6. Do not tighten screw 5.

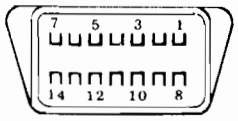
g. ( ) Set cable clamp 8 between mounting block and cable and tighten set screw 9.

h. ( ) Tighten screw 5.

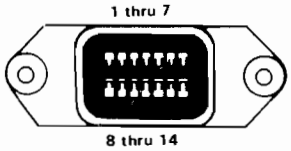
Figure 15-19 Assembling The PCA Hood Connector



Daisy-chain connector
HP part number
5061-2401
(male and female)



Daisy-chain connector P2
(viewed from solder side)



Daisy-chain connector
(viewed from solder side)

Assembly Procedure:

a. ( ) Insert cable through the outer housing (item 1).

b. ( ) Strip back the cable jacket 2.5 mm (1 inch).

c. ( ) Clip any unused conductor wires to the edge of the cable jacket.

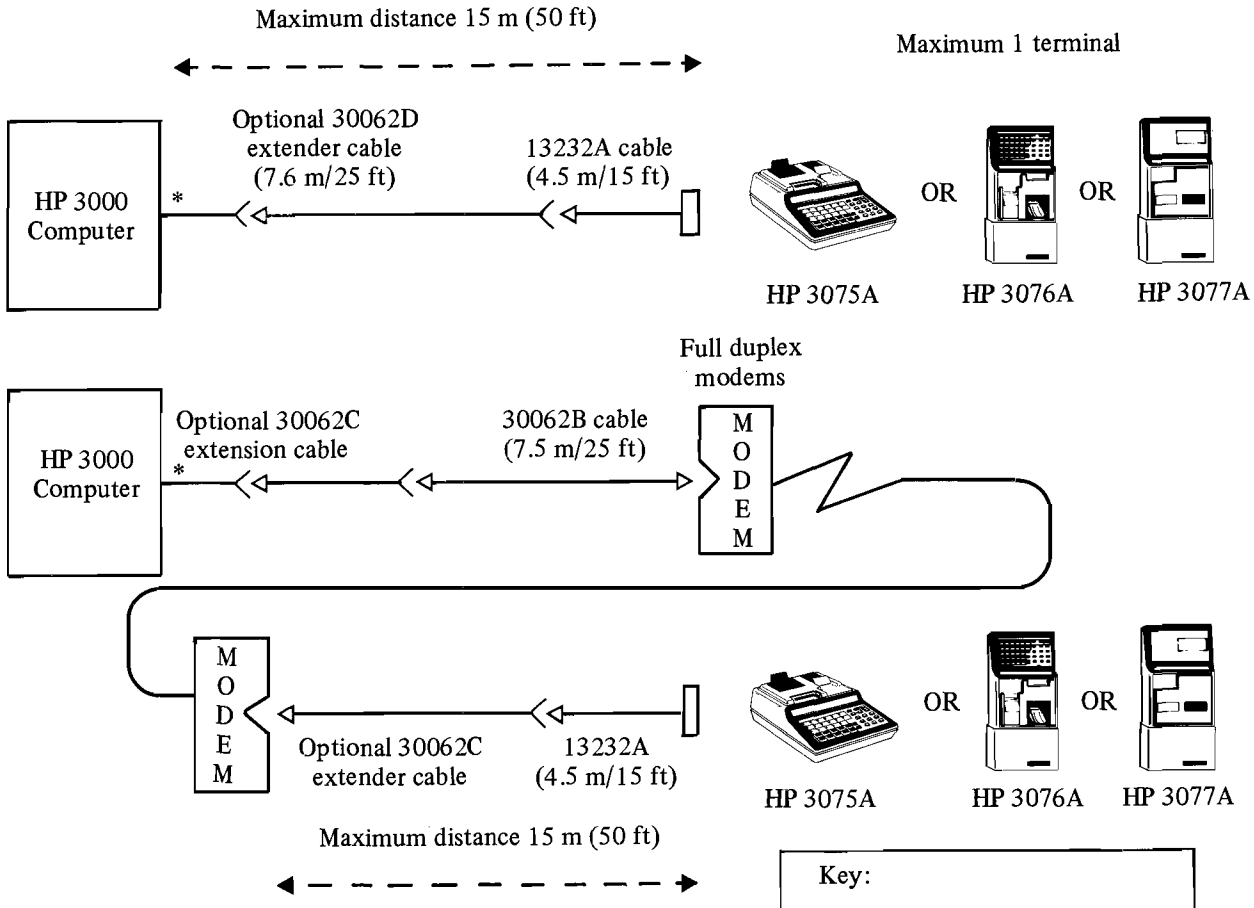
d. ( ) Removed 6.3 mm (0.25 ins.) of insulation from the ends of the conductor wires to be used.

e. ( ) Solder the conductor wires onto the contacts of the contact assembly (item 2).

f. ( ) Assemble the daisy-chain connector by sliding the inner housing (item 3) over the contact assembly (item 2). Slide the outer housing over items 2 and 3 until the screw holes are aligned. Secure the entire assembly with the two screws (item 4).

g. ( ) Mount the cable clamp (item 5) and secure with the two screws (item 6).

Figure 15-20 Assembling The Daisy-Chain Male And Female Connector



Equipment	HP part number	Comment
Computer Interface for system HP 3000 series II HP 3000 series III HP 3000 series 30 HP 3000 series 33	 30062B option 001 30032B option 001 30018A option 001 30018A	 No cable. No cable. Includes 2 m (6.5 ft) cable. Includes 2 m (6.5 ft) cable.
Hardware extender cable (optional)	30062D	7.6 m (25 ft). Used for hardware connection instead of modem.
Modem cable	13232A	4.5 m (15 ft). Connects terminal to either modem or computer.
Modem extender cable (optional)	30062C Option 001 Option 002	7.6 m (25 ft). 15 m (50 ft). 30 m (100 ft).
Data set cable	30062B Option 001	7.6 m (25 ft). Connects modem to computer (via 30062C cable). 15 m (50 ft).

Figure 15-21 Point-To-Point Components

15-33 POINT-TO-POINT CONNECTION

Note: A standard RS232C computer interface may be used for a point-to-point connection.

For the point-to-point connection, a single 3075A, 3076A or 3077A terminal may be connected to the computer using either a hardwire cable connection or via a full duplex modem. A modem cable (HP part number 13232A) must be used to connect the terminal to either the computer interface cable or the modem. If the terminal is either a 3076A or 3077A, the modem cable PCA hood must be removed and the cable directly wired to the Wall Mounting Cradle printed circuit board. If required, extender cables may be used to increase the distance between the terminal and the computer/modem up to a maximum of 15 metres (50 feet).

Figure 15-21 depicts and lists the components that are required for a point-to-point installation.

Note: If required, the modem cable may be fabricated by the user. For details see section 15-38.

15-34 POINT-TO-POINT CABLING CONSIDERATIONS

The following points must be taken into consideration when designing the installation:

1) The maximum distance between the computer or modem and the terminal is 15 metres (50 ft).
2) The point-to-point cable should NOT be routed through electrically noisy environments (e.g. adjacent to power cables). Also, the cable must be used within buildings and NOT outside. All installations should be checked for conformity to local safety regulations before use.
3) The point-to-point connection is RS232C/CCITTV24 compatible.

15-35 3076A/3077A POINT-TO-POINT CONNECTION

CAUTION

1) The cable must not be connected to or disconnected from an operational computer.

2) If the point-to-point cable is to be installed near to environmentally hazardous locations it must be adequately protected. Also the cable should be neither kinked nor tightly trapped between sharp surfaces.

One end of the 13232A modem cable is terminated by a male RS232C connector, the other end is terminated by a PCA connector hood (for connection to the 3075A terminal). When either a 3076A or 3077A terminal is used, the PCA hood must be removed from the 13232A cable and the cable wired to the Wall Mounting Cradle printed circuit board. The cable may be connected to the cradle either through the cable inlet in the bottom of the cradle or through the cradle backplate.

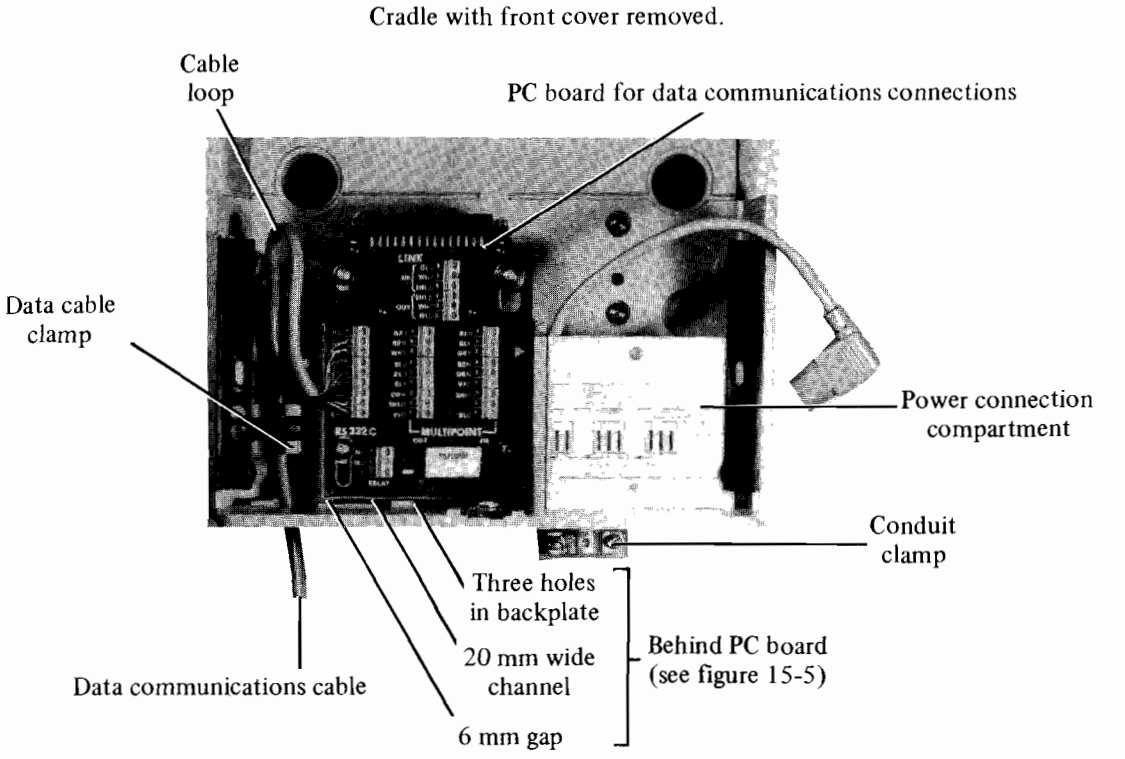
15-36 Point-To-Point Connection From The Bottom Of The Cradle

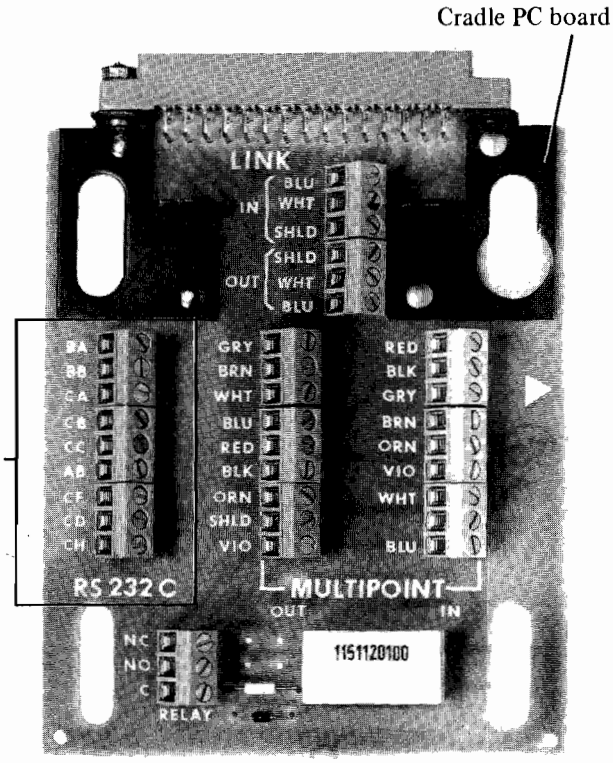
The cable must be installed in the cradle as follows:

1) Ensure the cradle line switch is OFF.
2) Unlock the cradle and remove the front cover.
3) At the bottom of the cradle base, loosen the two screws securing the (left-hand) sliding plate that covers the data cables inlet and open the plate.
4) Within the base, slacken the data cables clamp (see figure 15-22).
5) On the 13232A cable, cut the cable adjacent to the PCA hood (see figure 15-23) to remove the hood. Strip back the cable outer jacket, as required. Remove approximately 6 mm (0.25 ins.) of insulation from each of the signal wires to be used.

   Note: On the 13232A cable, signals SCA and SCF are not used. Consequently these wires must be cut so that the end of the wire aligns with the end of the cable outer jacket, with NO bare wires showing.
6) Feed the cable through the data cables inlet and pass it through the data cable clamp. Feed approximately 150 mm (6 ins.) of cable through the clamp then tighten the clamp.
7) Connect the cable wires to the relevant contacts of the RS232C screw connector, see figure 15-22.

   Note: A probe (or resistance meter) may be used to ensure that the wires connected to the screw connector correspond to the same signals used on the cable male connector. Figure 15-23 depicts the 13232A cable internal wiring. Appendix D lists the RS232C signals.
8) Ensure that the point-to-point cable has a loop (see figure 15-22). This is necessary because when the terminal is installed in the cradle the printed circuit board must be moved upwards to mate with the terminal 30-pin connector.
9) Slide the metal plate (that covers the cables inlet) so that the cables are loosely trapped between the metal plate and the back of the cradle base, with the least gap possible. Tighten up the plate locating screws.
10) Replace the cradle front cover and the cradle protection (see section 15-7).





INPUT from modem/computer. Use the 13232A cable and connect signals BA thru CH to the RS232C connector. The color code for the HP 13232A cable is shown here.

Cable male connector pin	Signal	HP wire color
2	BA	RED
3	BB	ORANGE
4	CA	YELLOW
5	CB	GREEN
6	CC	BLUE
7	AB	BLACK
8	CF	GREY
20	CD	WHITE/BLACK
15	CH	WHITE

Figure 15-22 Point-To-Point Cradle Connection

15-37 Point-To-Point Connection Through The Cradle Backplate

If the point-to-point cable is routed to the cradle from inside the cradle mounting surface, it may be passed through one of the three 6.7 mm (0.26 ins.) diameter holes in the cradle backplate. The cable should be installed in a similar manner to the installation from the bottom of the cradle, except:

1) The plate covering the data cables inlet should not be moved.

2) The locking nut holding the printed circuit data communications board must be loosened and the board moved up to allow the entry of the cradle.

3) The cable should be routed to the data cable clamp via the 20 mm (0.79 ins.) wide channel at the base of the cradle and through the 6 mm (0.24 ins.) wide gap at the left-hand side of the channel. See Figure 15-22.

Note: Appendix D lists the RS232C signals.

15-38 FABRICATING YOUR OWN POINT-TO-POINT CABLE

The 13232A cable depicted in figure 15-23 may be fabricated by the user. The male RS232C connector, the PCA (Printed Circuit Assembly) hood connector and the point-to-point cable are available from Hewlett-Packard. Part numbers for these items are listed in Table 15-6. Figures 15-18 and 15-19 depict the assembly of the RS232C connector and PCA hood connector respectively.

Note: The assembly of the point-to-point cable RS232C connector and PCA hood connector is similar to the daisy-chain RS232C and PCA connector, except the PCA hood may only contain one cable.

Table 15-6 Parts For Fabricating The Point-To-Point Cable

Item	HP part number	Description
RS232C male connector	5061-2405	See figure 15-18
PCA hood connector	5061-1340	See figure 15-19
PCA hood to RS232C connector cable	8120-1903	26 AWG (or greater) low voltage computer cable

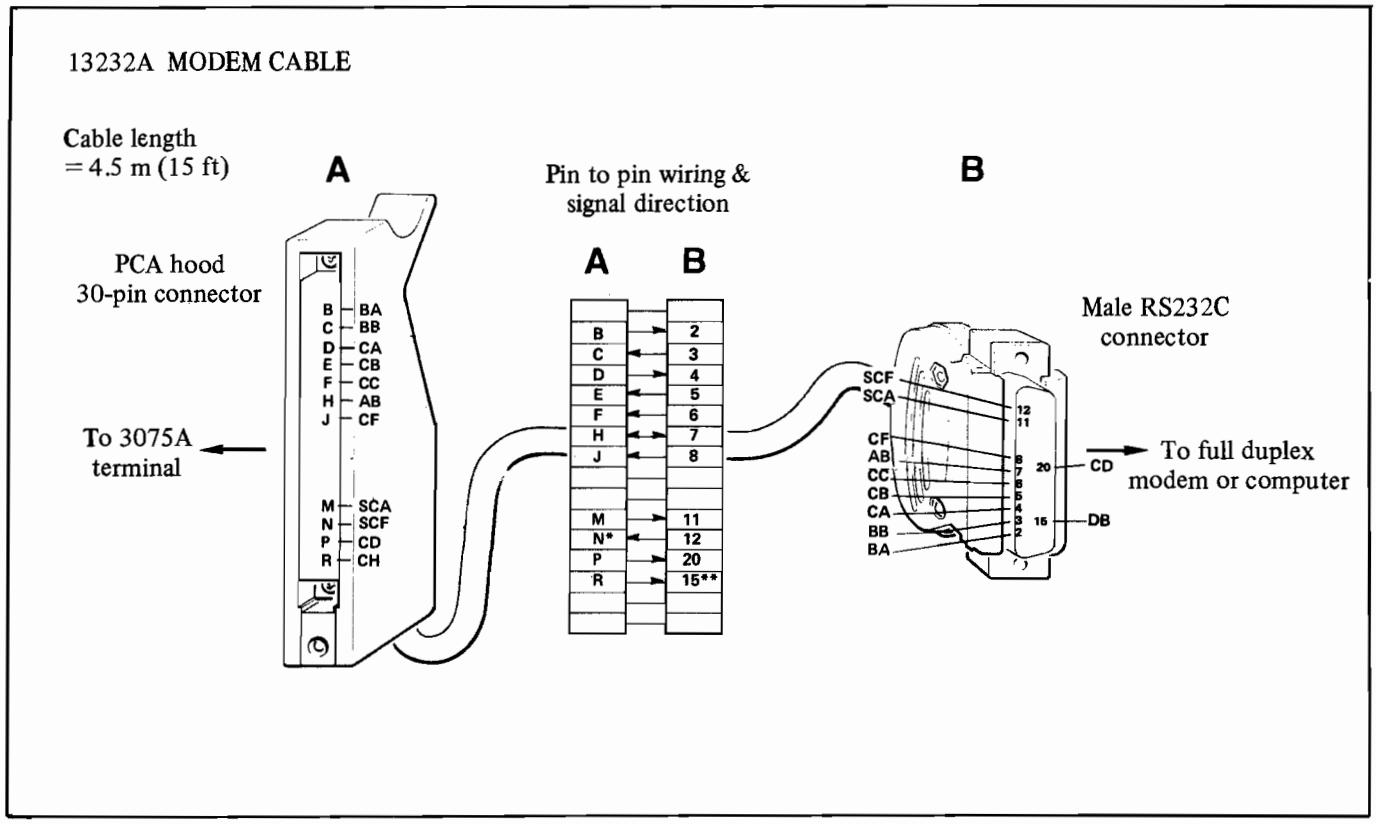


Figure 15-23 Point-To-Point Cable Details

SECTION 16

TERMINAL INSTALLATION

WARNING

If, upon receipt, the terminal is damaged do NOT connect it to an electric power supply.

16-1 INTRODUCTION

This section details all the information necessary to install the 3075A/3076A Data Capture Terminals and the 3077A Time Reporting Terminal on a previously prepared site. Also detailed is the installation of the 3074A Data Link Adapter. The site preparations (e.g. cabling) are described in section 15.

The terminal should be installed in the following sequence:

1) Unpack and prepare the terminal for use as described in sections 16-2 through 16-7.

2) Check that the terminal is functioning correctly as described in sections 16-10 through 16-25.

3) Install and prepare the terminal for operational use according to the terminal-to-computer communications mode. i.e. either:
   a) Multiterminal communications comprising either:
      - Factory Data Link installation (see sections 16-26 through 16-50 for details).
      - Daisy-chained installation (see sections 16-51 through 16-65 for details).
   b) Point-to-point installation (see sections 16-66 through 16-79 for details).

16-2 TERMINAL PREPARATION FOR USE

The unpacking and preparations for use of the 3075A/3076A/3077A terminals must be performed by qualified personnel following the guide lines laid down in section 16-3 through 16-7.

16-3 STORAGE

The terminals (excluding printer paper, badges and cards) may be stored or shipped in environments within the following limits:

Altitude	up to 15,000 m (50,000 ft).
Humidity	up to 95% (non condensing) at 40°C (104°F).
Temperature (excluding Bar Code Reader Wand)	-40°C to +75°C (-40° to 167°F)
Temperature (including Bar Code Reader Wand)	-20°C to +55°C (-4° to 131°F).
Transportation drop test	maximum 752 mm (30 ins.) drop

The terminal must be protected from temperature extremes that could cause condensation within the terminal.

16-4 UNPACKING/INSPECTION

CAUTION

The terminals should be handled with care; the 3075A weighs up to 8.7 kg (19.1 lbs) and both the 3076A and 3077A weigh up to 12.7 kg (27.9 lbs).

If the shipping carton is undamaged, with the carton standing upright on a solid flat surface, the terminal should be carefully removed and placed on a solid surface free from dirt or liquids.

If, upon receipt, the shipping carton is damaged request that the carrier's agent be present when the terminal is unpacked. Inspect the terminal for damage (scratches, dents, broken parts, etc.). If it is damaged, do not connect it to any electrical supply; notify the carrier and the nearest Hewlett-Packard Office immediately (Sales and Service Offices are listed at the back of this manual). Retain the shipping carton and the packing material for the carrier's inspection. The Sales and Service Office will arrange for the repair or replacement of the damaged terminal without waiting for settlement of any claims against the carrier. If possible, retain the original shipping carton for future use.

16-5 PACKAGING

Original Packing. Containers and materials identical to those used in factory packaging are available through Hewlett-Packard Offices. If the terminal 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 encourage careful handling. In any correspondance, refer to the terminal by model number and full serial number, detailed on a plate on the base of the terminal.

Other Packaging. The following general instructions should be used for repacking with commercially available materials.

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

2) Use a strong shipping container. A double-wall carton made of 160 kg (350 lbs) test material is adequate.

3) Use a layer of shock-absorbing material 70 to 100 mm (3 to 4 inches) thick around all sides of the terminal to provide firm cushioning and prevent movement inside the container. Protect the control panel with cardboard.

4) Seal shipping container securely.

5) Mark shipping container FRAGILE to encourage careful handling.

In any correspondance, refer to terminal by model number and full serial number (detailed on a plate on the base of the terminal).

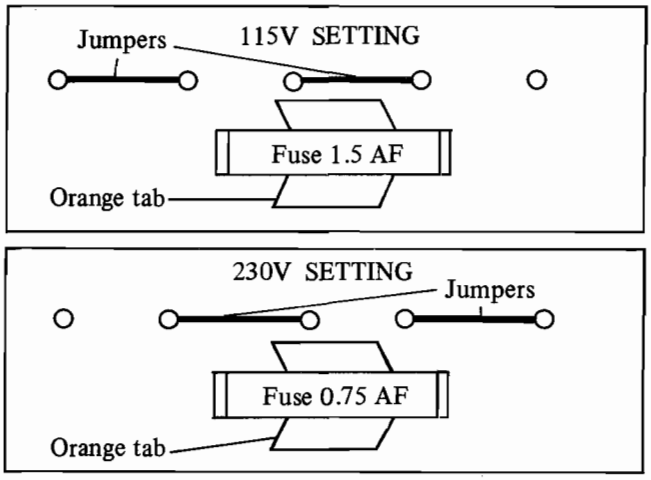
16-6 VOLTAGE AND FUSE SELECTION

Before being connected to a power outlet, the 3075A/3076A/3077A terminals must be checked to ensure they conform to the site power supply and the terminal fuse is of the correct rating. This should be done as follows:

1) Set the rear panel switch labelled LINE to OFF (0). Ensure the power cord is disconnected from the LINE (i.e. power) connector inlet, see figure 16-1.

2) Firmly slide to the left the translucent voltage selector/fuse cover on the terminal rear panel.

3) The supply voltage is set on the terminal using jumpers. Ensure the jumpers are set to the correct supply voltage and the correct valve fuse is installed. The fuse must be a fast-blow type.



4) The fuse may be removed by pulling the orange tab. If the fuse is replaced, the new fuse must be placed over the orange tab.

5) Close the voltage selector/fuse cover.

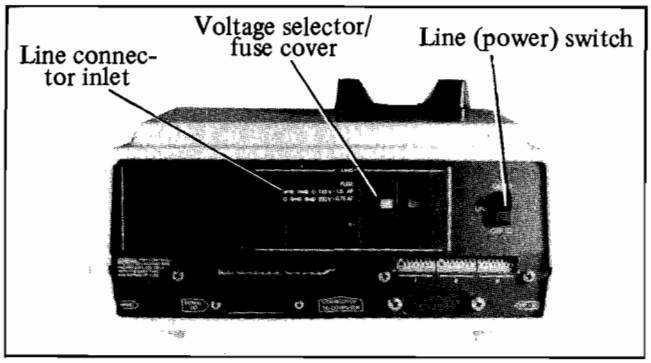


Figure 16-1 Terminal Rear Panel

16-7 3075A POWER CORD

The 3-wire power cord supplied with the 3075A terminal (one of those shown in figure 16-2) grounds the terminal when connected to the appropriate site power outlet. To preserve this safety feature when operating the terminal from an outlet without a ground connection, use an appropriate adapter and connect the ground lead (yellow/green) to an external ground.

If the plug on the cable does not fit your power outlet, cut the cable at the plug end and connect a suitable replacement. The plug must meet local safety standards and include the following features:

1) Minimum current rating of 2 amperes.
2) Ground connection.
3) Cable clamp.

The color coding used in the cable will depend on the cable supplied (see figure 16-2).

Note: An built-in 3-wire power cord within the Wall Mounting Cradle supplies the power to the 3076A/3077A terminals. The cradle power connections to an external power outlet are described in section 15-8.

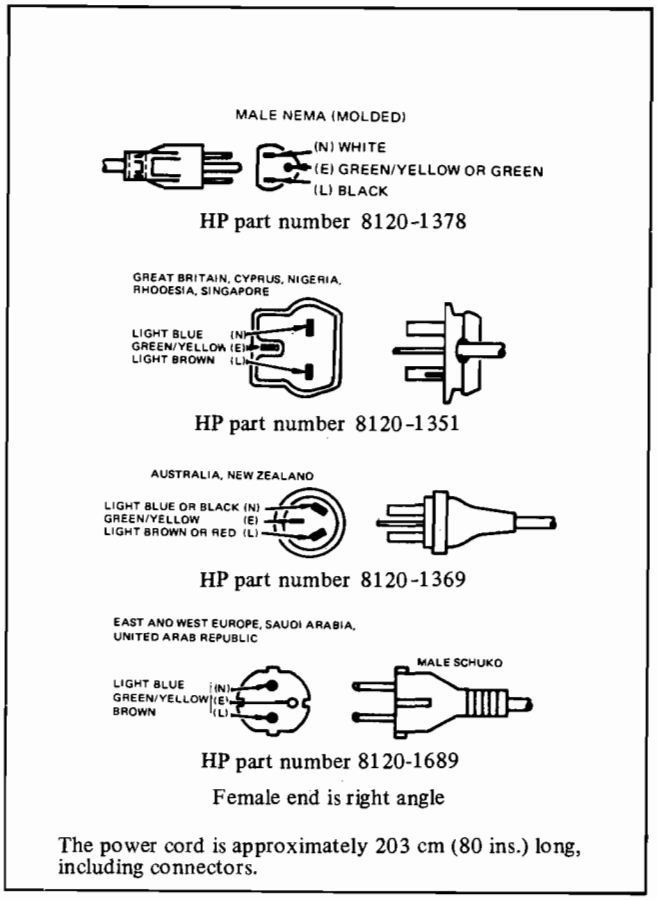


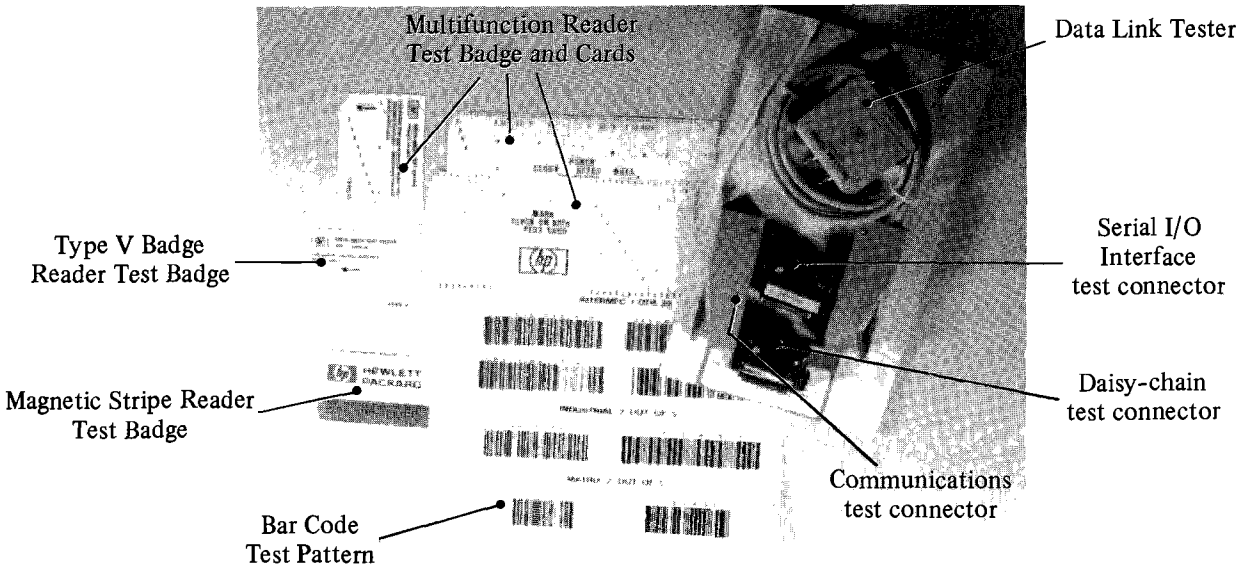
Figure 16-2 3075A Power Cord

16-8 INSTALLATION AND PROGRAMMING KIT (OPTION 030)

Each computer site using 3075A/3076A/3077A terminals requires one Installation and Programming Kit (option 030). This kit contains:

1) A set of test cards/badge/bar code test patterns to test the terminal modules/options. The use of these cards is described in section 16-11.
2) Test connectors to check the terminal before installation.
3) Test connectors to check the Factory Data Link and Daisy-chain connection after installation.

Figure 16-3 depicts and list the items that are included in option 030.



Equipment	HP part number	Description
Set of test cards	03075-60028	
	03075-90033	2 x Multifunction Reader numeric Type III Badges cards. (see section 16-13)
	03075-90038	2 x Multifunction Reader punched clock-after-data cards. (see section 16-13)
	03075-90039	2 x Multifunction Reader marked clock-after-data cards. (see section 16-13)
	03075-90035	2 x Numeric Type V Badges (see section 16-14).
	03075-90037	2 x Numeric Magnetic Stripe Reader Badges (see section 16-17).
	9320-4234	3 x Bar Code Test Patterns (see section 16-16).
Communications Test Connector	03075-60026	See section 16-11.
Serial I/O Interface Test Connector	03075-60211	See section 16-19.
Data Link Tester	03075-60021	See section 16-47.
Daisy-chain Test Connector	03075-60027	See section 16-64.

Figure 16-3 Installation And Programming Kit (Option 030)

16-9 TERMINAL CONFIGURATION SWITCHES

Mounted on the rear panel of the 3075A/3076A/3077A are 24 terminal configuration switches, see figure 16-4. These switches must be used to set the terminal to a known operating mode. Table 16-1 lists all the switches and their functions.

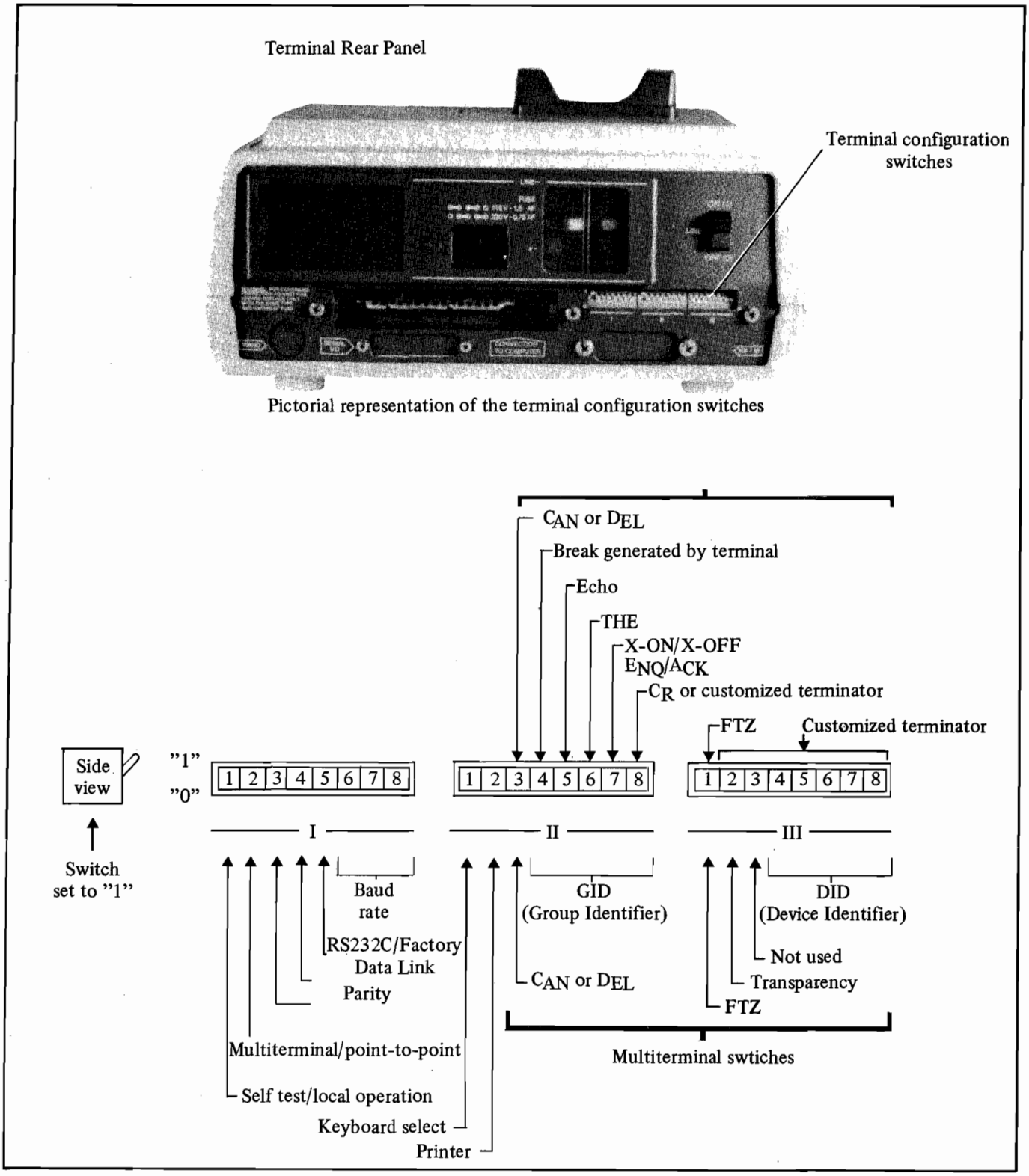


Figure 16-4 Rear Panel Terminal Configuration Switches

Table 16-1 Terminal Configuration Switch Functions

<table>
<tr><th>Switch</th><th>Function</th><th>Switch Setting</th></tr>
<tr><td>I-1</td><td>Terminal set to on-line or off-line (self test) operations</td><td>0: On-line. Normal setting for communications with the computer.
1: Off-line. Communications with the computer inhibited. The terminal is set to perform a self test routine before going into the local mode of operation. The local mode of operation is used for test and demonstration purposes, in which all data entered on the keyboard or readers is displayed and printed (if printer fitted) but is not sent to the computer. Two self test routines are available:

a) Self operation with the standard test: switches I-1 = 1, I-2 = 0 and the remaining switches = 0 (see section 16-11 for details).
Note:
- When switch I-1 = 1, setting switch III-8 = 1 allows the HP-IB Controller to be tested (see section 16-18).
- On the 3077A only when switch I-1 = 1, setting switch II-1 = 1 allows the Type III and Type V test badges supplied with option 030 to test the terminal when a display is not fitted (see section 16-21).

b) Self operation with a communications test: switches I-1 = 1, I-2 = 1, the remaining switches = 0 and the test connector fitted (see section 16-11).
Note: When switch I-1 = 1 and I-2 = 1, setting switch II-5 = 1 allows the terminal Factory Data Link circuitry to be tested without a test connector being fitted (see section 16-20).

The terminal self test can be restarted at any time by switching the terminal OFF then ON or (for the 3075A/3076A) pressing the Attention key (gold colored).</td></tr>
<tr><td>I-2</td><td>Communications mode</td><td>0: Point-to-point
1: Multiterminal (i.e. Factory Data Link or Daisy-chained).</td></tr>
<tr><td>I-3 and I-4</td><td>Character parity bit</td><td>Switches
<table><tr><th>3</th><th>4</th><th>Parity</th></tr><tr><td>0</td><td>1 or 0</td><td>no parity (8-bit binary transfer)</td></tr><tr><td>1</td><td>0</td><td>even</td></tr><tr><td>1</td><td>1</td><td>none</td></tr></table></td></tr>
<tr><td>I-5</td><td>Terminal to computer communications connections</td><td>0: Point-to-point or daisy-chain (i.e. standard RS232C connection).
1: Factory Data Link.</td></tr>
<tr><td>I-6, I-7 and I-8</td><td>Terminal to computer data communications rate (i.e. baud rate)</td><td>Switches
<table><tr><th>6</th><th>7</th><th>8</th><th>Baud</th></tr><tr><td>0</td><td>0</td><td>0</td><td>9600</td></tr><tr><td>0</td><td>0</td><td>1</td><td>4800</td></tr><tr><td>0</td><td>1</td><td>0</td><td>2400</td></tr><tr><td>0</td><td>1</td><td>1</td><td>1200</td></tr><tr><td>1</td><td>0</td><td>0</td><td>600</td></tr><tr><td>1</td><td>0</td><td>1</td><td>300</td></tr><tr><td>1</td><td>1</td><td>0</td><td>150</td></tr><tr><td>1</td><td>1</td><td>1</td><td>110</td></tr></table></td></tr>
</table>

Table 16-1 Terminal Configuration Switch Functions (cont'd)

Switch	Function	Switch Setting
II-1	Function of the 3075A/3076A keyboard Standard numeric keyboard DELETE key	0: Backspace. Erases last character on display and for point-to-point connections sends the character BS (octal 010) to computer. 1: Delete last entry. Erases everything already keyed in and displayed since the last entry, clears printer of everything not already printed. For point-to-point connections sends either the character CAN or DEL to the computer (switch II-3 specifies which character is sent).
	Alphanumeric keyboard	0: Alpha keyboard set as a 26 key alpha keyboard (DELETE key = backspace). 1: Alpha keyboard set as a 26 key special function key (SFK) keyboard (DELETE key = delete last entry, point-to-point character generated specified by switch II-3). } Pressing the Shift key (non-locking) reverses the keyboard function
II-2	3076A printing orientation (not actioned on the 3075A)	0: First line of received data becomes the last line of the printed data. 1: Lines of text printed correctly. First line of received data becomes first line of printed data.

Switch setting and function if switch I-2 is set to:

	0 ← Point-to-point settings	1 → Multiterminal settings
II-3	Point-to-point delete last entry character generated by the keyboard DELETE key. 0: CAN (octal 030). 1: DEL (octal 177).	Multiterminal computer originated character to action terminal delete last entry opration. 0: CAN (octal 030). 1: DEL (octal 177).
II-4	Computer break generated by the terminal. 0: DLE character (octal 020) followed by input terminator character. 1: Clears data line (BA) low for 100 milliseconds.	II-4 to II-8 define the terminal GID (Group Identifier) address for multiterminal communications (see sections 14-7 thru 14-19).
II-5	Local echo of keyboard data on the terminal display and printer. 0: Echo off. 1: Echo on.	
II-6	THE handshake (Transmit Handshake Enable, see section 14-21). 0: THE enabled (terminal only able to transmit when the computer Clear To Send line is high). 1: THE disable (terminal ignores the computer Clear To Send Line).	
II-7	Handshake protocol (see sections 2-15 and 14-21). 0: ENQ/ACK computer to terminal handshake. 1: DC1 for output combined with X-ON/X-OFF (terminal to computer handshake) plus ENQ/ACK.	
II-8	Message terminator character. 0: CR (Carriage Return = octal 015). 1: Customized terminator (see switches III-2 to III-8).	

Switches 4 5 6 7 8	char.	Switches 4 5 6 7 8	char.	Switches 4 5 6 7 8	char.
0 0 0 0 0	@	0 1 0 0 1	I	1 0 0 1 0	R
0 0 0 0 1	A	0 1 0 1 0	J	1 0 0 1 1	S
0 0 0 1 0	B	0 1 0 1 1	K	1 0 1 0 0	T
0 0 0 1 1	C	0 1 1 0 0	L	1 0 1 0 1	U
0 0 1 0 0	D	0 1 1 0 1	M	1 0 1 1 0	V
0 0 1 0 1	E	0 1 1 1 0	N	1 0 1 1 1	W
0 0 1 1 0	F	0 1 1 1 1	O	1 1 0 0 0	X
0 0 1 1 1	G	1 0 0 0 0	P	1 1 0 0 1	Y
0 1 0 0 0	H	1 0 0 0 1	Q	1 1 0 1 0	Z

Table 16-1 Terminal Configuration Switch Functions (cont'd)

<table>
<tr><th>Switch</th><th colspan="2">Switch setting and function if switch I-2 is set to:</th></tr>
<tr><th></th><th>0
Point-to-point settings</th><th>1
Multiterminal settings</th></tr>
<tr><td>III-1</td><td colspan="2">German FTZ requirement for use with modems.
0: FTZ disabled.
1: FTZ enabled. The last keyboard prompting light (P) indicates the condition of the modem Data Set Ready signal. Pressing the last special function key (z) disconnects the modem (see section 14-21).

If required, set on terminal when using a modem. | For daisy-chained connections, if required, set on the first terminal after the modem. Not used on Factory Data Link connections.</td></tr>
<tr><td>III-2</td><td>When switch II-8 = 1, switches III-2 to III-8 represent the binary image of the customized terminator character (see section 2-2). For example:</td><td>Transparency mode allows the terminal to send and receive 8-bit binary data that might otherwise be interpreted as control characters (see section 14-16).
0: Transparency on (binary transfer).
1: Transparency off. Octal characters 001 thru 007, 020 thru 027 and 037 are changed to 000 (NUL) for transmission to the computer.</td></tr>
<tr><td>III-3</td><td>Switches</td><td>Not used</td></tr>
<tr><td>III-4 thru III-8</td><td>
2 3 4 5 6 7 8 | Char.
0 0 0 0 0 0 0 | NUL
0 0 0 0 0 0 1 | SOH
0 0 0 1 0 1 0 | LF
0 0 1 1 1 1 1 | US
1 1 1 1 1 1 1 | DEL
</td><td>III-4 to III-8 define the terminal DID (Device Identifier) address for multiterminal communications (see sections 14-7 thru 14-19).
Switches 4 5 6 7 8 | char.
0 0 0 0 0 | @
0 0 0 0 1 | A
0 0 0 1 0 | B
0 0 0 1 1 | C
0 0 1 0 0 | D
0 0 1 0 1 | E
0 0 1 1 0 | F
0 0 1 1 1 | G
0 1 0 0 0 | H
Switches 4 5 6 7 8 | char.
0 1 0 0 1 | I
0 1 0 1 0 | J
0 1 0 1 1 | K
0 1 1 0 0 | L
0 1 1 0 1 | M
0 1 1 1 0 | N
0 1 1 1 1 | O
1 0 0 0 0 | P
1 0 0 0 1 | Q
Switches 4 5 6 7 8 | char.
1 0 0 1 0 | R
1 0 0 1 1 | S
1 0 1 0 0 | T
1 0 1 0 1 | U
1 0 1 1 0 | V
1 0 1 1 1 | W
1 1 0 0 0 | X
1 1 0 0 1 | Y
1 1 0 1 0 | Z
(same code as for the GID above, see switches II-4 to II-8).
</td></tr>
</table>

16-10 TERMINAL OPERATIONAL CHECKS

The 3075A/3076A/3077A terminals have a built-in self test/local operation feature. This allows the terminals to be tested to ensure they are operating correctly when disconnected from the computer system.

CAUTION

Terminals connected in point-to-point and daisy-chain mode must not be disconnected from an operational computer.

The self test procedures detailed below must be carried out as soon as each terminal is received and any failures immediately reported to your local HP Sales and Service offices.

In order to carry out the tests it is necessary to have:
1) A power cord (supplied with the 3075A terminal).
2) The Installation and Programming Kit (option 030). This provides:
   a) Test connectors necessary when performing a terminal communications test and electrical interface test.
   b) Test badges/cards required to test the Multifunction Reader, Type V Badge Reader, Bar Code Reader or Magnetic Stripe Reader (if fitted).

There are two versions of the self test: a standard version which checks all modules except the communications module (i.e. the terminal transmit/receive logic), and a full version which includes the communications module and requires the test connector.

- The standard self test (terminal configuration switch I-1 = 1 all other switches = 0). This allows data typed on the 3075A/3076A keyboard to appear on the terminal display. The data is also printed (if printer fitted) whenever either a special function key or the ENTER key is pressed or when more than 20 numeric/alpha keys are pressed. The data from a badge/card/label read by the Multifunction Reader, Type V Badge Reader, Bar Code Reader or Magnetic Stripe Reader or the data from an external device connected to the Serial I/O Interface (if fitted) is also displayed/printed in a similar manner. The data does not travel through the data communications circuitry.

- The full version communications self test (test connector fitted; terminal configuration switches I-1 = 1, I-2 = 1, all other switches = 0). Provided the data communications circuitry is operating correctly, data from the keyboard, Multifunction Reader, Type V Badge Reader, Bar Code Reader, Magnetic Stripe Reader and Serial I/O Interface (when fitted) is displayed/printed in a similar manner to the standard self test. The data is passed to the display/printer via the terminal communications circuitry and test connector. If the data communications circuitry has a malfunction the characters do not appear on the display/printer.

Note: If the terminal is set for the full version test and the test connector is not fitted, when data is entered the terminal goes into the WAIT mode (i.e. the red light on the display housing lights and all inputs are disabled and cause the terminal buzzer to sound).

At this stage, before the terminal is being installed, the full version of the communications test should be performed. Throughout the test, for orientation purposes, it is assumed that 3076A and 3077A terminals are stood upright in their normal working attitude. The test can be restarted at any time if required by pressing the Attention key (gold colored) or by turning the terminal off then on (3077A).

Note: If the 3075A/3076A/3077A terminal is powered when the configuration switches are set to perform the test, the terminal should be switched off then on in order to start the internal self test.

Suspected malfunction. The self test may also be used when a terminal malfunction is suspected. The self test may only be performed when the terminal is disconnected from the computer. However if required, the self test may be performed when the terminal is connected to a serial device (via the Serial I/O Interface option 013 connector) or HP-IB devices (via the HP-IB connector option 011).

Note:
1) The serial device will receive an echo of all characters displayed/printed on the terminal whilst performing these tests.
2) The HP-IB devices will not be affected when the other terminal options are tested, as terminal configuration switch III-8 must be set to 1 to perform an HP-IB test, see section 16-18 for details.

16-11 3075A/3076A CHECKING

The 3075A/3076A terminals should be set for the full self test as follows:

1) Remove the rear panel terminal configuration switch cover. Set the terminal for the full self test by setting switches I-1 to 1, I-2 to 1 and the remaining switches to 0 (see figure 16-5).

2) Fit the Option 030 communications test connector (HP part number 03075-60026) onto the terminal rear panel 30-pin interface connector (see figure 16-5). The connector "cable-inlet" aperture fits over the 10 mm (0.4 ins.) wide lug on the right-hand side of the terminal connector inlet, the other end of the connector must then be firmly pressed into position.

   Note: If the 03075-60026 test connector is not available, the standard test may be performed (switch I-1 set to 1 and the remaining switches set to 0).

3) Plug in the terminal power cord and switch on the terminal by setting the LINE switch to ON.

The red WAIT light (on the one line display housing) should illuminate. In addition, all the prompting lights should turn on together and then turn off one by one. When all the prompting lights are off (this takes approximately 10 seconds), the terminal should go into the data input mode in which the functioning of all the terminal modules/ options can be checked, i.e. the green READY light (on the one line display housing) should turn on.

Note: When the 3076A Terminal is mounted in its 92904A Wall Mounting Cradle, the cradle relay is activated from the time that all the prompting lights are illuminated to the time the last lamp is extinguished. This allows the relay to be tested as described in section 16-38.

The terminal modules/options may be tested as described in section 16-12 through 16-20.

16-12 3075A/3076A Keyboard and Display Test

Note:

1) These tests apply to the Standard Numeric Keyboard, the optional Alphanumeric Keyboard, the standard Numeric Display, the optional Alphanumeric Display and the optional CRT display.

2) When using the CRT Display, in self operation the large size characters are enabled for display.

3) When the terminal is equipped with a Strip Printer and it is switched-on, the keyboard tests will cause the characters to be printed (see section 16-15 for printer testing).

4) Set the terminal as described in section 16-11.

Standard Numeric Keyboard Test

1) Press each of the keys on the numeric keypad (minus, decimal point, 0 through 9) and check that the characters appear on the display until the display is full.
   a) The one line Numeric Display will display 15 characters, the one line Alphanumeric Display will display 24 characters. Further characters may be entered but they will not appear on the display.
   b) The CRT Display will display eight lines each of 16 large size characters. At the end of each line the next character is automatically displayed at the start of the next line. At the end of the last line on the screen, the next character is automatically displayed on the top left-hand corner of the screen and the screen is automatically cleared of all previous characters.

2) Press a few more numeric keys then press the ENTER key. Press some more numeric keys and check that:
   a) On the Numeric/Alphanumeric Displays the original displayed characters disappear after the first new character (after pressing ENTER) is typed and the new character appears on the left-hand side of the display.
   b) On the CRT: if it is not full the characters (and cursor) appear on the next line of the display screen. The CRT displays up to 128 characters (full screen). If the screen is full, the new characters (and cursor) appear on the top left-hand corner of the screen and the original characters disappear after the first new character is typed.

3) Press a few more numeric keys then press the DELETE key it should function as backspace.

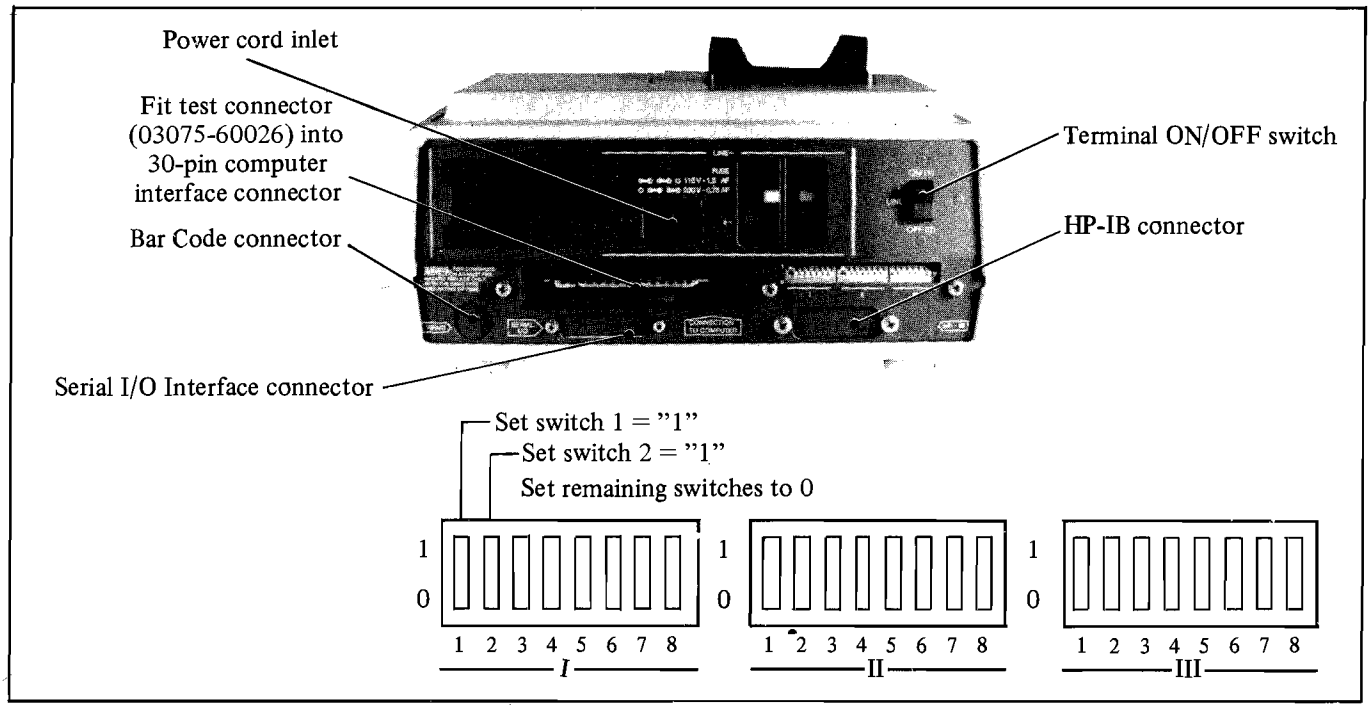


Figure 16-5 3075A/3076A Terminal Configuration Switch Settings For Full Terminal Test

4) Set terminal configuration switch II-1 to 1 and check that the DELETE key functions as delete last entry. Reset II-1 to 0.

5) Press each of the special function keys (SFK) and check that:

   a) For the Numeric/Alphanumeric Displays, for each key pressed, a single "□" character is displayed. Only one "□" will ever appear on the display because each SFK pressed terminates the line.

   b) For the CRT Display, a single "◀" character per line is displayed for each SFK key pressed.

Alphanumeric Keyboard Test

1) Press each of the keys on the numeric keypad and check that the numbers appear on the Numeric or Alphanumeric or CRT Display until the display is full (as previously described for the Numeric Keyboard).

2) Press each of the keys on the alpha (A through Z) keypad and check that the characters appear on the Alphanumeric or CRT Display until the display is full. No characters should be displayed on the Numeric Display.

3) Press a few more numeric and alpha keys and then check that the ENTER and DELETE keys function as previously described for the Numeric Keyboard.

4) Each of the alpha keys becomes a special function key when pressed with the Shift key. Press shift with each of the alpha keys and check that:
   a) If a Numeric/Alphanumeric Display is fitted a single "□" character is displayed.
   b) If CRT Display is fitted a single "◀" character is displayed per line for each key pressed.

5) Change the alpha keypad default configuration from alpha keys to special function keys by setting rear panel terminal configuration switch II-1 to 1 (see section 16-9). Each alpha key becomes a special function key, press the keys and check that the characters "□" or "◀" are displayed as described in 4 above.

6) With switch II-1 set to 1, pressing the Shift key with the alpha keys should cause alpha characters to be displayed as described in 2 above.

7) Reset switch II-1 to 0.

16-13 3075A/3076A Multifunction Reader Test

Note: Set the terminal as described in section 16-11.

At power-on, the Multifunction Reader is enabled to read punched badges/cards encoded in Hollerith code with no clock marks. In addition the corner cut detection is enabled (i.e. the badge/card should be rejected if incorrectly inserted into the Reader). The Multifunction Reader should be tested as follows:

1) Take the Type III punched Badge (HP part number 03075-90033) supplied with the Installation and Programming Kit. Enter it incorrectly into the reader inlet aperture with the corner cut as shown in figure 16-6A. The reader should reject the badge (i.e. eject it back through the reader inlet aperture).

2) Turn the badge over and re-enter it correctly as shown in figure 16-6B. The badge should be accepted and the following data appear on the display and printer (if fitted).

   0123456789.-

   CAUTION

   On the 3076A ensure the card retention spring in the reader outlet aperture does not obstruct the passage of the card, otherwise the card will be rejected.

3) Take the punched card inscribed PUNCH CLOCK-AFTER-DATA NO CLOCK TEST CARD (HP part number 03075-90038) supplied with the Installation and Programming Kit. Enter it correctly into the reader. The following data (read with no clock marks) should appear on the display and printer (if fitted):
   a) Numeric Display
      0123456789
   b) Alphanumeric Display
      READER: 0123456789
   c) CRT Display and Strip Printer
      &-0123456789
      THE QUICK BROWN FOX
      JUMPS OVER THE LAZY
      DOG
      READER: 0123456789

4) There is an escape sequence at the end of the punched card that reconfigures the reader to accept marked cards with clock-after-data. Take the optically marked card inscribed MARK CLOCK-AFTER-DATA TEST CARD (HP part number 03075-90039) supplied with the Installation and Programming Kit and enter it correctly into the reader. Check that the following data appears on the display and on the printer (if fitted):

   a) Numeric Display
      0123456789
   b) Alphanumeric Display or CRT Display
      MARK CARD 0123456789
   c) Strip Printer
      MARK CARD 0123456789

5) There is an escape sequence at the end of the marked card that reconfigures the reader to accept punched cards with clock-after-data (as opposed to the no clock marks previously read). Re-enter the supplied punched card (03075-90038) correctly into the reader. The following data should appear on the display and printer (if fitted):
   a) Numeric Display
      01234
   b) Alphanumeric Display
      READER: 01234
   c) CRT Display and Strip Printer
      &-0123456789
      THE QUICK BROWN FOX
      JUMPS OVER THE LAZY
      DOG
      READER: 01234

Pressing the Attention key resets the Reader to read punched badges/cards with no clock marks.

Programming the terminal via the Multifunction Reader. When the terminal is set for self operation, the Multifunction Reader may be used to enter escape sequences into the terminal to program the terminal modules/options. This allows the user to modify the terminal self operation feature as required. The encoding of the cards used by the Multifunction Reader is described in section 6. The escape sequences available to program the terminal are listed in Appendix G.

16-14 3075A and 3076A Type V Badge Reader Test

Note: Set the terminal as described in section 16-11.

At power-on, the Type V Badge Reader is enabled to read Type V Badges encoded in Numeric code. The Type V Badge Reader should be tested as follows:

1) Take the Type V punched Badge (HP part number 03075-90035) supplied with the Installation and Programming Kit. Enter it into the reader inlet aperture in the direction of the arrow on the card (the square hole indicates the front edge of the badge). Make sure the badge is pressed all the way in. The terminal should beep to indicate a successful read and the badge data should appear on the display and on the printer (if fitted):

   0123456789

2) Now turn the badge the other face up and repeat the test (i.e. enter the badge front edge first). The terminal should beep to indicate a successful read and the badge data should be displayed/printed as before. On both the CRT display and the printer the data will appear on the next line.

3) Now turn the badge the other edge round and enter it into the reader aperture (in the opposite direction to the arrow on the badge). The terminal should not beep and the badge contents should not be displayed/printed.

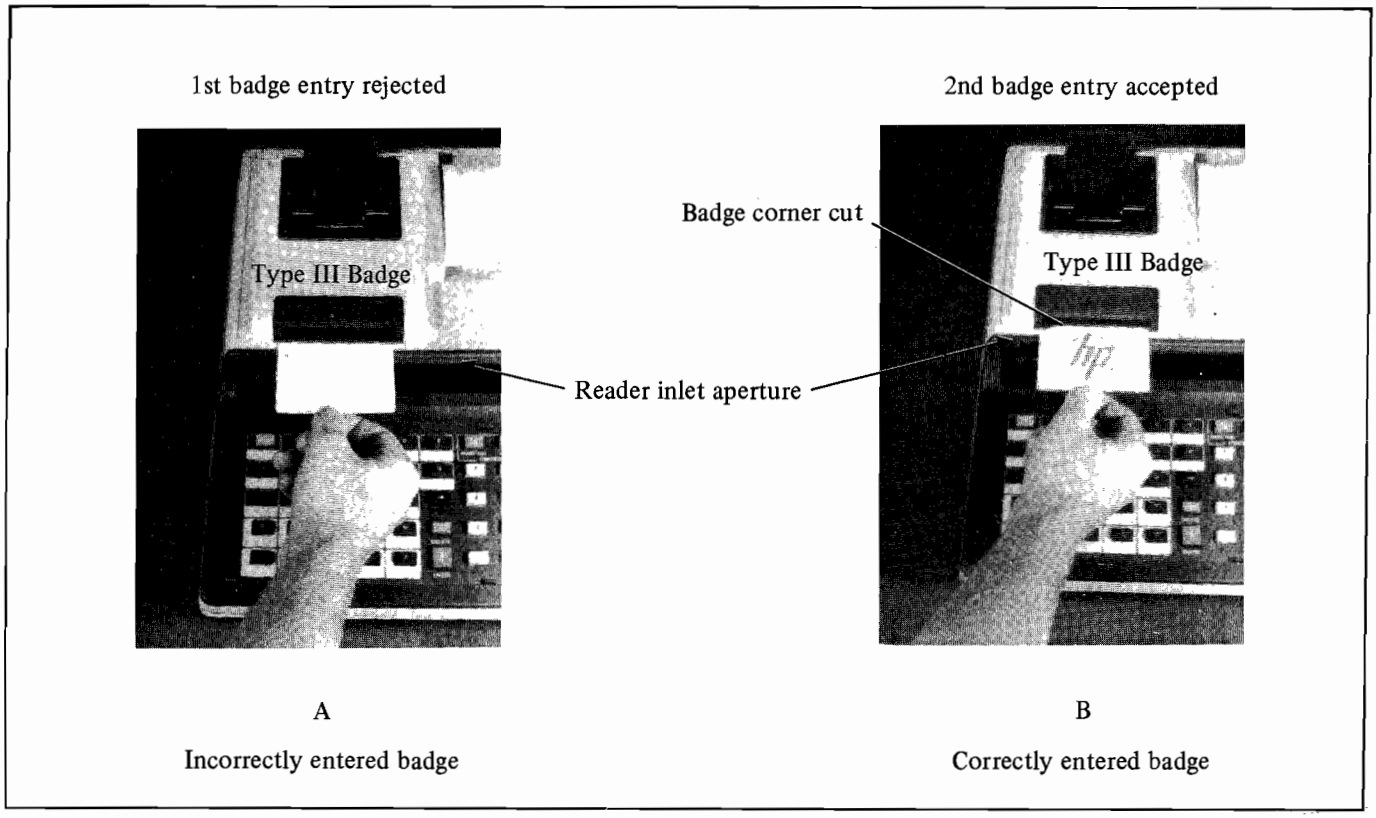


Figure 16-6 Multifunction Reader Test

16-15 Strip Printer Test

Note:
1) Set the terminal as described in section 16-11.
2) Instructions for loading the printer with paper are contained in section 17.

At power-on the Strip Printer should automatically switch-on and the green lamp next to the PRINT key should light. The printer should be tested as follows:

1) Press each of the keyboard numeric/alpha keypad keys (see section 16-12). Check that when the 21st character is entered, the printer automatically prints the preceding 20 characters.

2) Press a few more numeric/alpha keys then press the keyboard ENTER key. Ensure that the printer prints all the just entered characters.

3) Press each of the keyboard special function keys (SFK's) and check that the "□" character is printed on a new line for each of the special function keys pressed.

4) Press the PAPER key several times and ensure that the printer paper advances when the key is pressed.

5) Press the PRINT key (to switch OFF the printer), ensure the associated light turns off and the printer will not print when data is entered using the keyboard. Press the PAPER key and ensure the paper advances (even when the printer is off). Press the PRINT key (to switch on the printer), ensure the associated light turns on and repeat steps 1, 2, 3, and 4.

6) Remove the printer paper roll and ensure the light next to the PRINT switch blinks continuously. Reload the paper and switch on the printer.

16-16 Bar Code Reader Wand Test

Note: Set the terminal as described in section 16-11.

Install the Bar Code Reader Wand on the terminal by plugging the wand cable into the connector on the left-hand side of the terminal rear panel (see section 9-2).

When configured to do a self test, the Bar Code Reader performs an automatic recognition of the bar code patterns being read. The Reader may be tested using the Bar Code Test Pattern sheet (part number 9320-4234) supplied with the Installation and Programming Kit. This sheet is designed to ensure the reader can read codes containing the minimum and the maximum bar/space widths.

Note: When using the automatic recognition facility the reading accuracy cannot be guaranteed as substitution errors may occur. i.e. certain bar code patterns are common to several codes but represent a different character in each code. This may cause the terminal to misinterpret the encoded data.

Complete instructions for using the Bar Code Reader are contained in section 9. Take the Bar Code Test Pattern sheet. Pass the tip of the wand over the longitudinal centre line of either the Matrix 2 out of 5 code, the Industrial 2 out of 5 code or the Intermec Code 39®. The terminal should beep to indicate a successful read and the decoded characters should appear on the display and printer (if printer fitted).

Note: For the Numeric Display, only numeric (0 through 9), minus sign, decimal point and space can be displayed.

16-17 3075A/3076A Magnetic Stripe Reader Test

Note: Set the terminal as described in section 16-11.

At power-on the Magnetic Stripe Reader is enabled. It may be tested as follows:

1) Take the plastic magnetic badge (HP part number 03075-90037) supplied with the Installation and Programming Kit. Enter it into the reader, with the dark brown magnetic stripe on the badge adjacent to the arrow on the reader.

2) The terminal should beep to indicate a successful read and the following badge data should appear on the display and printer (if fitted):
   a) Numeric or Alphanumeric or CRT Display
      12345 67890
   b) Strip Printer
      12345 67890

16-18 HP-IB Controller Test

No HP-IB self test procedure is provided. However, when the terminal is equipped with:

1) An Alphanumeric Keyboard (option 004) or a Multi-function Reader (option 007).

2) An Alphanumeric Display (option 005) or a CRT Display (option 006) or a Strip Printer (option 009)

and the HP-IB Controller is connected to HP-IB devices (see section 10-2), the terminal is provided with an HP-IB local control mode facility. This facility is actioned by setting terminal configuration switches I-1 to 1, III-8 to 1 and the remaining switches to 0. When in the local control mode, because the Alphanumeric Keyboard does not provide certain characters required by the HP-IB Controller the following eight special function keys change their generated character as follows:

1) Shift A becomes (
2) Shift B becomes ,
3) Shift C becomes ;
4) Shift D becomes .
5) Shift E becomes)
6) Shift F becomes !
7) Shift G becomes %
8) Shift H becomes h

A special keyboard overlay (HP part number 03075-00027) may be placed over the special function keys to indicate their new function see section 10.

Note:
1) The HP-IB local control mode may be actioned irrespective of the terminal being connected to the computer.
2) If required, a terminal self communications test may be performed by setting terminal configuration switch I-2 to 1 and inserting the 03075-60026 test connector in the terminal 30-pin interface connector.
3) When the terminal is equipped with a CRT Display, the standard size characters are enabled for display.

The local control mode allows HP-IB commands entered using the keyboard to control the HP-IB devices. Any results from the HP-IB devices will be displayed on the terminal display and printer (if fitted), for details see section 10.

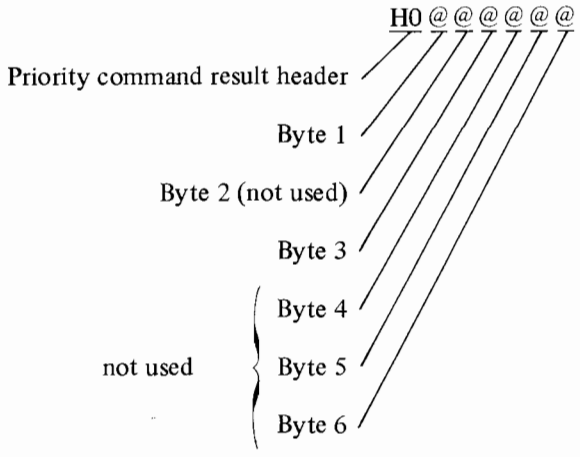
To check that the HP-IB Controller is operating correctly the following procedure should be followed:

1) Ensure all HP-IB devices are disconnected from the terminal.

2) Set the terminal to the local control mode.

3) Enter the following priority HP-IB Controller status command on the keyboard (ensure this command is correctly entered): HPS.

This causes a string of six controller status bytes plus a two byte header to be displayed and printed on the terminal. If the HP-IB Controller is operating correctly, the following should be displayed:



If bytes 1 and 3 do NOT contain the character @ it indicates the HP-IB Controller has a mulfunction. If this occurs repeat the test and if the failure is repeated contact your nearest HP Sales and Service Office.

If the test is successful, the HP-IB devices should be connected to the HP-IB Controller. HP-IB commands should be entered to control the operation of the devices and thus check the controller to device communications as required. Section 10 lists the HP-IB commands.

16-19 **Serial I/O Interface Test**

Both the Serial I/O Interface and the Serial I/O Interface-to-serial device communications may be tested.

Note: For both tests, the terminal should be set for the full terminal (communications) test, see section 16-11.

Serial I/O Interface test. Take the Serial I/O Interface test connector (part number 03075-60211) supplied with the Installation and Programming Kit. Fit the connector to the terminal rear panel Serial I/O connector (see figure 16-5). When fitted, the connector enables the simulation of data output by the terminal being echoed back to the terminal by the serial device. This allows the Serial I/O Interface circuitry to be tested. Consequently, for each key pressed on the keyboard the corresponding character should appear twice on the display. One character coming directly from the keyboard and the other coming from the keyboard via the test connector.

The Serial I/O Interface may then be tested as follows:

1) Press each of the keyboard numeric/alpha keys until the display is full. Ensure that two identical characters are displayed and printed (if printer fitted) for each key pressed.

2) Press the DELETE key, ensure that it acts as backspace and two characters are deleted from the display each time the key is pressed.

Remove the 03075-60211 test connector at the end of the test.

Serial I/O Interface to serial device communications test. The communications self test normally uses full handshake data transfers at 2400 baud with no parity.

Note: If the terminal is fitted with a Multifunction Reader, the Serial I/O Interface to device communications may be modified by entering the relevant escape sequences on optical cards. The encoding of these cards is described in section 6 and the escape sequences used to control the Serial I/O Interface are described in section 12.

The communications may be tested as follows:

1) Plug the serial device cable female connector into the terminal rear panel Serial I/O male connector (see figure 16-5).

2) Check the terminal to serial device communications by entering data on the terminal. Ensure that the data is correctly displayed and printed (if printer fitted) on the terminal and is correctly sent to the serial device.

3) Check the serial device to terminal communications by entering data on the serial device followed by a C_R character (Carriage Return = octal 015). Ensure that the data is correctly displayed and printed (if printer fitted) on the terminal.

16-20 3075A/3076A Factory Data Link Self Test

When the terminal is isolated from a computer system, it may be configured to enable the terminal Factory Data Link control circuitry to be tested. This must be done as follows:

1) Switch off the terminal and remove the 03075-60026 test connector from the rear panel (if fitted).

   Note: No test connector is needed because the terminal provides Data Link "loop-back" circuitry.

2) If connected, remove the Serial I/O Interface connector and the computer cable connector from the terminal rear panel.

3) Set rear panel terminal configuration switches I-1 to 1, I-2 to 1 and I-5 to 1 and the remaining switches to 0. Switch on the terminal.

4) Repeat the keyboard/display tests detailed in section 16-12 and ensure the correct messages appear on the display/printer.

5) When any of the reader options are fitted, repeat the relevant test detailed in sections 16-13 through 16-17 and ensure the correct messages appear on the display/printer.

16-21 3077A CHECKS

When the 3077A terminal is equipped with the optional Alphanumeric Display the full version self test may be used (i.e. the 03075-60026 test connector fitted and terminal configurations switches I-1 = 1, I-2 = 1 and the remaining switches set to 0). This allows badges/cards, including test badges supplied with the Installation and Programming Kit, to be entered into the reader and the data to be displayed. This data should be preceded by the four digits corresponding to the 3077A time display.

The 3077A terminal is equipped with a second self test. This must be used when a display is NOT fitted (but may also be used when the terminal is equipped with a display). This test is set up by fitting the 03075-60026 test connector and setting terminal configuration switches I-1 to 1, I-2 to 1, II-1 to 1 and the remaining switches to 0. This allows only the Type III or Type V or Magnetic Stripe test badges (supplied with the Installation and Programming Kit) to test the Reader. When the Type III or Type V Badge is entered into the Reader, the read data is compared with a stored fixed pattern (within the terminal). When the Magnetic Stripe Badge is entered into the Reader, the Reader checks the character parity and the LRC character (if these are correct the read operation is assumed to be correct). If the data is correctly read, the terminal quiet buzzer sounds and the data is displayed (if a display is fitted). The data should be preceded by the four digits corresponding to the time display. If the data is not correctly read, the terminal loud buzzer and the red WAIT lamp are activated. In addition the incorrectly read data is displayed (if display fitted).

The 3077A should be set up for a self test as follows:

1) Remove the rear panel terminal configuration switch cover. Set the terminal for the full test by setting switches I-1 to 1 and I-2 to 1 and the remaining switches to 0. If the second self test is to be used set switch II-1 to 1 (see figure 16-7). The remaining switches must be set to 0.

2) Fit the Installation and Programming Kit test connector (HP part number 03075-60026) onto the terminal rear panel 30-pin interface connector (see figure 16-7). The connector "cable inlet" aperture fits over the 10 mm (0.4 ins.) wide lug on the right-hand side of the connector inlet.

3) Plug in the power cord and switch-on the terminal.

The display housing green READY and red WAIT prompting lamps should light together with 88:88 on the time display. The two prompting lights should then go out and after approximately 10 seconds the time display should change to 1:00. The terminal should then go into the data input mode in which the functioning of all the terminal modules can be checked, i.e. the green READY light only should turn on and the time display should start to increment at one minute intervals.

Note: The relay in the 92904A cradle (housing the 3077A) is activated from the moment that the time display shows 88:88 until it changes to 1.00. This allows the relay to be tested as described in section 16-38.

The terminal modules/options may then be tested as described below. At this stage, before the terminal is installed, the second version of the full test should be performed. The test can be repeated at any time by switching the terminal off then on.

16-22 3077A Type V Badge Reader Test

Note: Set the terminal as described in section 16-21.

At power-on the Type V Reader is enabled. It should be tested to read the Numeric encoded Type V Badge (HP part number 03075-90035) supplied with the Installation and Programming Kit as follows:

1) Enter the badge into the reader inlet aperture in the direction of the arrow on the card. Make sure the badge is pressed in all the way. The terminal quiet buzzer should sound and the following data appear on the display (if fitted):

   $\alpha\alpha\alpha\alpha$0123456789

   where $\alpha\alpha\alpha\alpha$ should be the four digits corresponding to the time display.

2) Turn the badge over (i.e. other face up) and repeat the test. The terminal quiet buzzer should sound and the data displayed as before.

3) Turn the badge the other edge up and enter it backwards into the reader aperture (in the opposite direction to the arrow on the badge). The terminal loud buzzer should sound and nothing should appear on the display (if fitted).

16-23 **3077A Multifunction Reader Test**

Note: Set the terminal as described in section 16-21.

If the terminal is equipped with a display, the full version self test may be carried out using the punched card/marked card/Type III Badge as described in section 16-13. The four digits of the time display should precede all displayed data.

If a display is not fitted (or even when a display is fitted) the second version self test may be performed using the Type III Badge only, as follows:

1) Take the Type III punched Badge (HP part number 03075-90033) supplied with the Installation and Programming Kit. Enter it incorrectly into the reader inlet aperture with the corner cut as shown in figure 16-6A. The reader should reject the badge and the loud terminal buzzer should sound. If a display is fitted, nothing should be displayed.

2) Turn the badge over and re-enter it correctly as shown in figure 16-6B. The badge should be accepted and the terminal quiet buzzer should sound. If a display is fitted the following data should appear:

   αααα0123456789.-

   where αααα should be the four digits corresponding to the time display.

16-24 **3077A Magnetic Stripe Reader Test**

Note: Set the terminal as described in section 16-21.

At power-on the Magnetic Stripe Reader is enabled. It should be tested to read the plastic magnetic badge (03075-90037) supplied with the Installation and Programming Kit as follows:

1) Enter the badge into the reader, with the dark brown magnetic stripe on the badge adjacent to the arrow on the reader.

2) The terminal quiet buzzer should beep to indicate a successful read. If a display is fitted, the following data should appear:

   αααα12345 67890

   where αααα should be the four digits corresponding to the time display.

16-25 **3077A Factory Data Link Self Test**

When the terminal is isolated from a computer system, it may be configured to enable the terminal Factory Data Link control circuitry to be tested. This may be done as follows:

1) Switch off the terminal.

2) Remove the 03075-60026 test connector or computer cable connector from the rear panel (if fitted).

   Note: No test connector is required because the terminal provides Data Link "loop-back" circuitry.

3) Set terminal configuration switches I-1 to 1, I-2 to 1, I-5 to 1, II-1 to 1 and the remaining switches to 0.

4) Switch on the terminal.

5) Repeat the reader second version self tests described in sections 16-22 through 16-24. Ensure the tests are correctly performed.

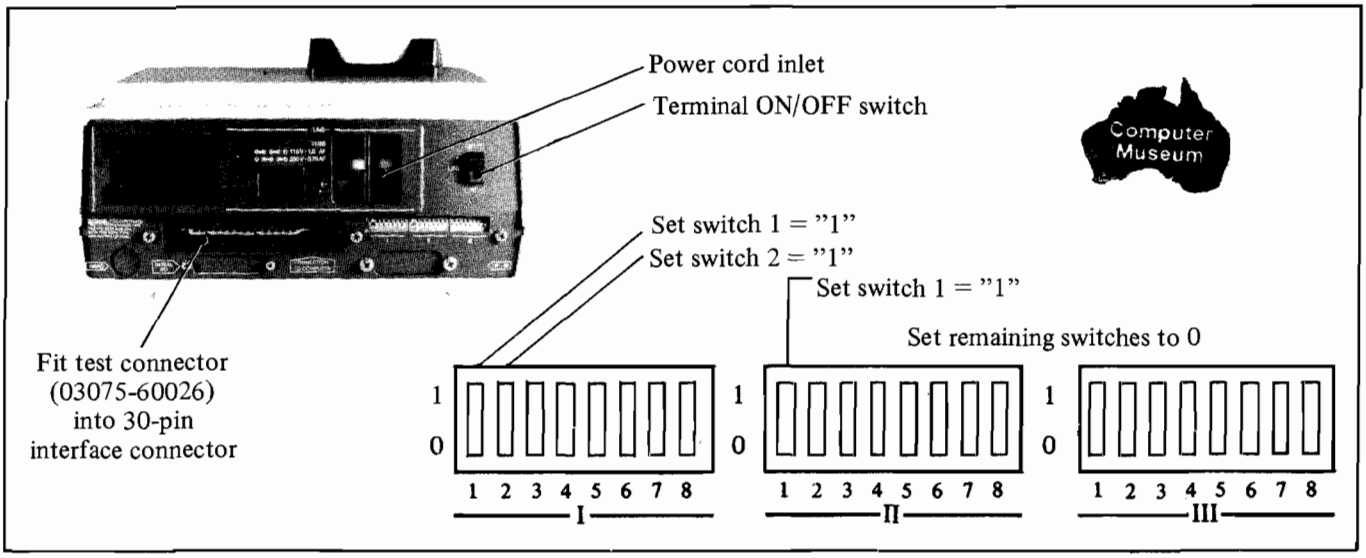
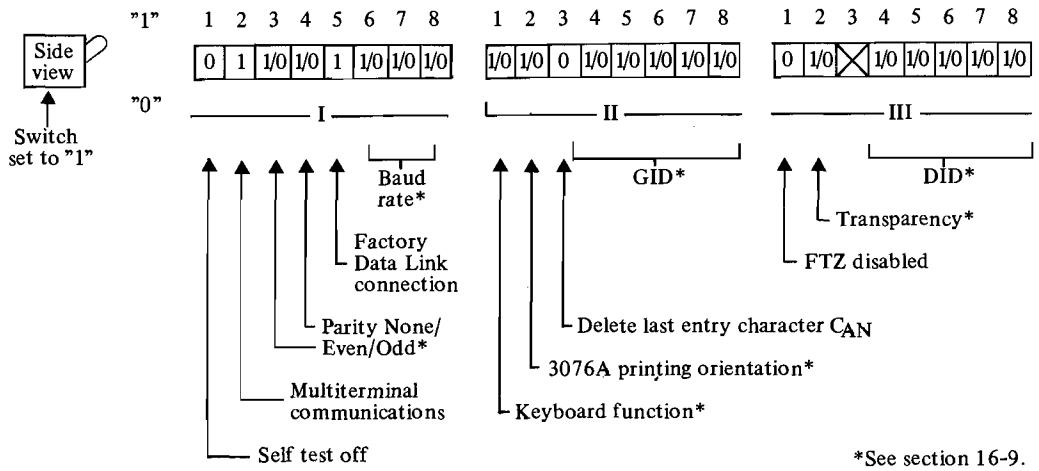


Figure 16-7 3077A Terminal Configuration Switch Settings For Full Test Using Test Badges



3075A Effective Switches		Switch Setting For Each Computer System		
		HP 1000	HP 1000 Datacap Software	HP 3000
I	1	0	0	0
	2	1	1	1
	3	0	0	1
	4	0	0	1
	5	1	1	1
	6, 7, 8	0, 0, 0	0, 0, 0	0, 0, 0
II	1	**	1	**
	2	0	0	0
	3	0	0	0
	4, 5, 6, 7, 8	GID	GID	GID
III	1	0	0	0
	2	0	1	0
	3	0	0	0
	4, 5, 6, 7, 8	DID	DID	DID

3076A Effective Switches		Switch Setting For Each Computer System		
		HP 1000	HP 1000 Datacap Software	HP 3000
I	1 thru 8	Same as the 3075A		
II	1	**	1	**
	2	**	1	**
	3	0	0	0
	4, 5, 6, 7, 8	GID	GID	GID
III	1 thru 8	Same as the 3075A		

3077A Effective Switches		Switch Setting For Each Computer System		
		HP 1000	HP 1000 Datacap Software	HP 3000
I	1 thru 8	Same as the 3075A		
II	1	0	0	0
	2	0	0	0
	3	0	0	0
	4, 5, 6, 7, 8	GID	GID	GID
III	1 thru 8	Same as the 3075A		

*Where: ** = As defined by the user according to his application.*
GID = Group address defined by the user. See section 16-9 and 14 for details.
DID = Device address defined by the user. See section 16-9 and 14 for details.

Figure 16-8 3075A/3076A/3077A Factory Data Link Typical Terminal Configuration Switch Settings

16-26 TERMINAL INSTALLATION FOR FACTORY DATA LINK

The 3075A/3076A/3077A terminals and 3074A Data Link Adapter should be installed as described in the following sub-sections. The terminal communications with the computer should be checked as described in section 16-43. Any problems with the Data Link installation may be resolved as described in section 16-46.

Note: It is recommended that the Factory Data Link should be operated at 9600 baud.

16-27 3075A DATA LINK INSTALLATION

The site for the 3075A must be a clean, dry, solid and flat surface supplied with a power socket and Factory Data Link cabling. Each 3075A should be installed in the sequence described in sections 16-28 through 16-31.

16-28 3075A Data Link Terminal Configuration Switch Settings

Before being installed, the rear panel terminal configuration switches must be set to configure the terminal to a known operating mode. Figure 16-8 details the switch settings for Data Link installations using HP computers. Ensure the terminal configuration switch cover is replaced before the terminal is switched on.

16-29 3075A Installation Of Cables For Terminal Options

Note: Figure 16-5 depicts the terminal rear panel.

The Bar Code Reader Wand cable, HP-IB cable and Serial I/O Interface cables (when fitted) should be installed as follows:

Bar Code Reader Wand. Plug the cable into the connector on the left-hand side of the terminal rear panel. Section 9-2 details this procedure.

HP-IB Controller. Plug the HP-IB cable male connector into the female HP-IB connector on the rear of the terminal. This female connector is located below the terminal configuration switches. Section 10-2 details this procedure and the connections between HP-IB devices.

Serial I/O Interface. Plug the serial cable female connector into the male Serial I/O connector on the rear of the terminal. This male connector is located below the 30-pin computer interface connector. Section 12-3 details this procedure.

16-30 Factory Data Link To 3075A Connection

The 3075A terminal must be connected to the Factory Data Link using a 92905A Data Link-to-device cable (or customer equivalent). The cable is equipped with a 30-pin PCA connector (for connection to the 3075A) and a Factory Data Link male plug (for connection to the 92901A Data Link Connection Boxes).

The cable PCA connector must simply be plugged into the terminal rear panel 30-pin computer interface connector (see figure 16-5). The PCA connector cable inlet aperture fits over the 10 mm (0.4 ins.) wide lug on the right-hand side of the terminal connector inlet, the other end of the connector must then be firmly pressed into position. The 92905A cable Factory Data Link male plug must be plugged into the site 92901A Data Link Connection Box.

Note: The male plug to 92901A box connection is a make-before-break contact. This allows the cable to be plugged in/unplugged from the connection box at any time (even when the Data Link is operational).

16-31 Switching On The 3075A Terminal

Ensure the terminal rear panel LINE switch is set to OFF. Plug the terminal power cord into the power cord inlet on the rear of the terminal (see figure 16-5). Plug the other end of the power cord into the site mains power socket. Switch on the terminal by setting the rear panel LINE switch to ON.

Check the terminal multiterminal communications with the computer as described in section 16-43.

16-32 3076A DATA LINK INSTALLATION

Each 3076A terminal should be installed in the sequence described in sections 16-33 and 16-34.

16-33 3076A Data Link Terminal Configuration Switch Settings

Before being installed, the rear panel terminal configuration switches must be set to configure the terminal to a known operating mode. Figure 16-8 details the switch settings for Data Link connections using HP computers.

16-34 3076A Cradle Installation

Note: For Data Link connections, the terminal may be installed/removed even when the computer is operational, provided the Data Link connections on the cradle printed circuit board are not detached.

The 3076A should be installed within the site 92904A Wall Mounting Cradle as follows:

1) First ensure the terminal rear panel LINE switch is set to ON and the cradle LINE switch is set to OFF.
2) Unlock the cradle and remove the front cover.
3) If the terminal is to have either an HP-IB Controller or Serial I/O Interface cable fitted, within the cradle base unscrew the locking nut and three cross-head screws holding the printed circuit data communications board to its mounting pegs. Carefully move the board to one side without disturbing the communications or relay cabling.
4) Hold the terminal vertically (in its normal upright positions).
5) Carefully hook the 90 mm (3.5 ins.) wide slot in the top back of the terminal (above the fan outlet) over the corresponding lug at the top of the cradle backplate.
6) If the terminal requires either a Bar Code Reader Wand or HP-IB Controller or Serial I/O Interface cable fitting, this should be done as described in section 16-29 with the terminal held in position. Ensure these cables are correctly routed within the cradle base, see section 15-11 for details.
7) Carefully replace the cradle base printed circuit data communications board, ensure the top right-hand locking screw is loose.
8) Hold the terminal in position and carefully push the cradle printed circuit data communications board upwards, so that the top of the board mates with the terminal 30-pin computer interface connector. Tighten the printed circuit board top right-hand locking screw.
9) Insert the cradle power plug into the power cord inlet at the bottom of the terminal.
10) Replace the terminal front cover.
11) Set the LINE switch on the bottom of the cradle base to ON.

If the cradle relay is to be used to control an external device it must be checked as described in section 16-38.

Check the terminal, multiterminal communications with the computer as described in section 16-43.

16-35 3077A DATA LINK INSTALLATION

Each 3077A should be installed in the sequence described in sections 16-36 and 16-37.

16-36 3077A Data Link Terminal Configuration Switch Settings

Before being installed, the rear panel terminal configuration switches must be set to configure the terminal to a known operating mode. Figure 16-8 details the switch settings for Factory Data Link connections using HP computers.

16-37 3077A Cradle Installation

Note: The terminal may be installed even when the Data Link is operational, provided the Data Link connections on the cradle printed circuit board are not removed.

The 3077A should be installed within the site 92904A Wall Mounting Cradle as follows:

1) First ensure the terminal rear panel LINE switch is set to ON and the cradle LINE switch is set to OFF.
2) Unlock the cradle and remove the front cover.
3) Hold the terminal vertically (in its normal upright position).
4) Carefully hook the 90 mm (3.5 ins) wide slot on the top back of the terminal (above the fan outlet) over the corresponding lug on the top edge of the cradle back-plate.
5) Hold the terminal in position and carefully push the cradle printed circuit data communications board upwards, so that the top of the board mates with the terminal 30-pin computer interface connector. Tighten the printed circuit board top right-hand locking screw.
6) Insert the cradle power plug into the power cord inlet at the bottom of the cradle (see figure 16-7).
7) Replace the terminal front cover.
8) Set the LINE switch on the bottom of the cradle base to ON.

If the cradle relay is to be used to control an external device it must be checked as described in section 16-38.

Check the terminal communications with the computer as described in section 16-43.

16-38 92904A WALL MOUNTING CRADLE RELAY TEST

The cradle relay can only be tested when the terminal is mounted in the cradle. However, in order to perform a self test, the terminal rear panel configuration switch I-1 must be set to 1 and the remaining switches set to 0. This can only be achieved by first removing the terminal from the cradle. When the terminal is re-installed in the cradle, the relay may be tested when the self test is initiated (i.e. by the terminal being switched on or the Attention key being pressed), as follows:

1) For the 3076A, when the test is started all the prompting lights should illuminate and the relay should activate. When the last prompting light is extinguished the relay should de-activate, this takes approximately 10 seconds.
2) For the 3077A, when the test is started the red and green prompting lights should illuminate, 88:88 should appear on the time display and the relay should activate. The relay should de-activate when the display changes from 88:88 to 1:00, this takes approximately 10 seconds.
3) Monitor the relay contact change over using an ohmeter. When the relay is de-activated there should be a short circuit between relay connector block contacts NC and C, and an open circuit between contacts NO and C. When the relay is activated this situation should be reversed.

If the test is successful, the terminal must be removed from the cradle and the rear panel terminal configuration switches set in the normal on-line operating position, before the terminal is replaced in the cradle.

16-39 3074A FACTORY DATA LINK ADAPTER INSTALLATION

Note: For further details about the 3074A, refer to the HP 3074A Data Link Adapter Operating and Service Manual.

The 3074A Adapter provides an interface between an RS232C compatible terminal/computer and the Factory Data Link. i.e. a 3074A must be positioned between the Data Link and the computer and between the Data Link and each HP 264X CRT terminal. The 3074A should be unpacked and installed as described in sub-sections 16-40 through 16-42. The layout of the fuse and jumpers on the 3074A printed circuit board is shown in figure 16-9.

16-40 3074A Preparation For Use

The 3074A may be prepared for use in a similar manner to the 3075A/3076A/3077A terminals.

Storage. The 3074A may be stored in the same environment as the 3075A/3076A/3077A terminals, see section 16-3 for details.

Unpacking/inspection. Unpack and inspect the 3074A in a similar manner to the 3075A/3076A/3077A terminals, see section 16-4 for details. If the 3074A has to be returned to Hewlett-Packard, follow the packing instructions contained in section 16-5.

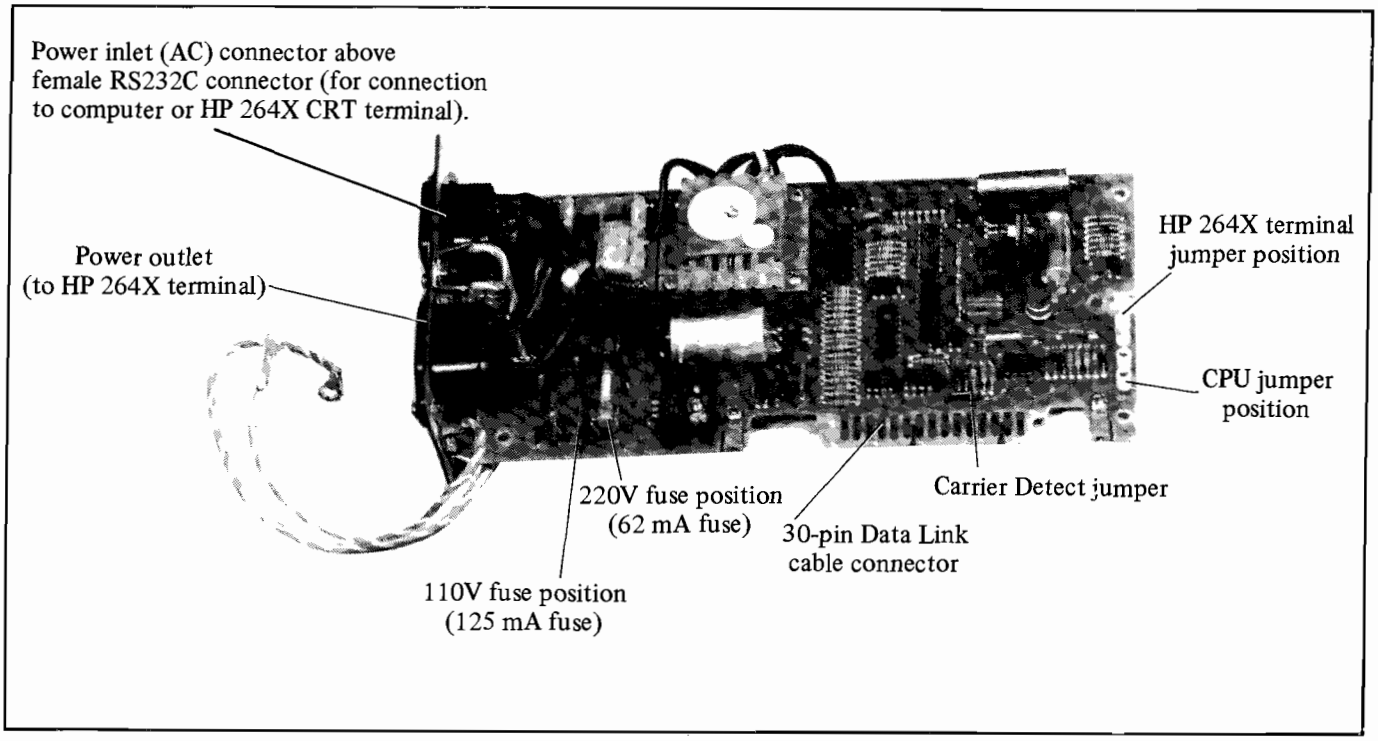


Figure 16-9 3074A Printed Circuit Board Jumper And Fuse Location

Voltage and fuse selection. The 3074A should already be set to the correct voltage and have the correct fuse fitted when you receive it. However, the voltage setting and fuse value should be checked before you attempt to use the 3074A.

Remove the four screws from the 3074A bottom cover. Remove the top cover taking care not to pull the ground lead that is attached to it.

Remove the fuse from the lower left-hand side of the printed circuit board (see figure 16-9) and check that it is the correct value: 125 mA for 110V operation, 62 mA for 220V operation.

CAUTION

There are two positions for the fuse and the position used determines the supply voltage setting. Take care to replace the fuse in the correct position. Also remember to change the fuse position and value when changing the supply voltage.

It is convenient at this stage to check the position of the two 3074A internal jumpers as described in sections 16-41 and 16-42.

After checking the jumpers, replace the 3074A top cover and secure with the four screws.

16-41 3074A Connection To The Computer

The 3074A should be installed and connected to the computer as follows:

3074A CPU jumper. The 3074A contains a jumper on the lower right-hand side of the printed circuit board (see figure 16-9). When the 3074A is to be connected to the computer the jumper should be inserted in the position labelled CPU. The position of the jumper may be checked (without removing the 3074A cover) through two small holes in the 3074A end cover. The jumper will show white through one of the holes. The hole nearest the Data Link cable connector is associated with the CPU position. If necessary, unscrew and remove the top cover and change the jumper position.

3074A Carrier Detect jumper. The 3074A contains a jumper on the lower half of the printed circuit board that is used to select the RS232C carrier detect timing (see figure 16-9). The jumper should be set in the correct position according to the data transmission speed. The available jumper settings are listed in Table 16-2.

Table 16-2 3074A Carrier Detect Jumper Setting

Jumper Setting	Baud Rate
5	9600, 4800
15	2400, 1200
40	600, 300

3074A mounting. The 3074A may be mounted on any clean, dry solid vertical or horizontal surface that is flat and of adequate size. Double sided adhesive tape is attached to the base of the 3074A so that it may be stuck to a flat, grease/dust free surface. Alternatively, two slots are provided in the 3074A base panel to allow it to be screwed to a flat surface.

3074A power cord. The 3074A is supplied with a 3-wire power cord similar to the 3075A (for details see section 16-7). When required, the cord should be plugged into the site power socket, which causes the 3074A to automatically switch-on.

3074A connection to the computer. When the computer is non-operational, the male connector on the end of the computer cable should be plugged into the 3074A female RS232C connector (adjacent to the 3074A power outlet socket).

3074A connection to the Data Link. When the computer is non-operational, the PCA connector on the end of the 92905A (Factory Data Link-to-device) cable should be plugged into the 3074A 30-pin Data Link cable connector. The Factory Data Link male plug on the other end of the 92905A cable should be plugged into the site 92901A Data Link Connection Box.

Check the computer to terminal communications as described in section 16-43.

16-42 3074A Connection To HP 264X CRT Terminals

The 3074A should be installed and connected to each HP 264X CRT terminal as follows:

3074A terminal jumper. The 3074A contains a jumper on the lower right-hand side of the printed circuit board (see figure 16-9). When the 3074A is connected to a HP 264X terminal the jumper should be inserted in the position labelled TER. The position of the jumper may be checked (without removing the 3074A cover) through two small holes in the 3074A cover. In the TER position the jumper will show white through the hole furthest away from the Data Link cable connector. If necessary unscrew and remove the top cover and change the jumper position.

3074A Carrier Detect jumper. The carrier detect jumper (see figure 16-9) should be set according to the data transmission speed. The available settings are listed in Table 16-2.

3074A mounting. The 3074A may be mounted on any clean, dry solid vertical or horizontal surface, as described in section 16-41. It may, for example, be attached using double sided adhesive tape to the outside surface of the HP 264X terminal rear panel data cable inlet cover.

3074A power cord. The 3074A is supplied with a 3-wire power cord similar to the 3075A, see section 16-7 for details. The 3074A also has a power outlet socket that supplies the power to the associated HP 264X terminal, for power on/off detection purposes. This connection is achieved by simply plugging the HP 264X terminal power cord into the 3074A power outlet socket. When required, the 3074A power cord should be plugged into the site power socket. This causes the 3074A to automatically switch-on and supplies the power to the HP 264X terminal, see figure 16-10.

3074A connection to the HP 264X terminal. The male connector on the end of the 13232A/N (CRT to 3074A) cable should be plugged into the 3074A female RS232C connector. The 13232A cable edge connector should then be plugged into the HP 264X terminal interface connector. The HP 264X terminal must be configured for multiterminal operations, with the DID, GID, baud rate and parity appropriately selected. Refer to 264X Reference Manual.

3074A connection to the Data Link. Plug the PCA connector on the end of the 92905A (Factory Data Link-to-device) cable into the 3074A 30-pin Data Link cable connector. Plug the Factory Data Link male plug (on the other end of the 92905A cable) into the site 92901A Data Link Connection Box.

16-43 MULTITERMINAL ON-LINE TERMINAL TO COMPUTER COMMUNICATIONS CHECKS

Once the 3075A/3076A/3077A terminals have been installed, their correct communications with the computer system must be verified. It is recommended that a maximum of five terminals are tested at any one time. If the computer system contains more than five terminals, they should be tested in batches of five.

The following sub-sections describe the multiterminal communications checks with the HP 1000 and HP 3000 systems. If required, similar checks may be performed on non Hewlett-Packard equipment. These checks are valid for Factory Data Link and daisy-chain communications.

First of all, the first batch of (up to) five terminals should be switched on by setting the terminal/cradle LINE switch to ON. All the terminals should go into the WAIT state (i.e. red WAIT light on and all inputs inhibited) until they receive the first computer originated WRITE (select) sequence. The terminal may then be checked as described in either sub-sections 16-44 (for the HP 1000 system) or 16-45 (for the HP 3000 system).

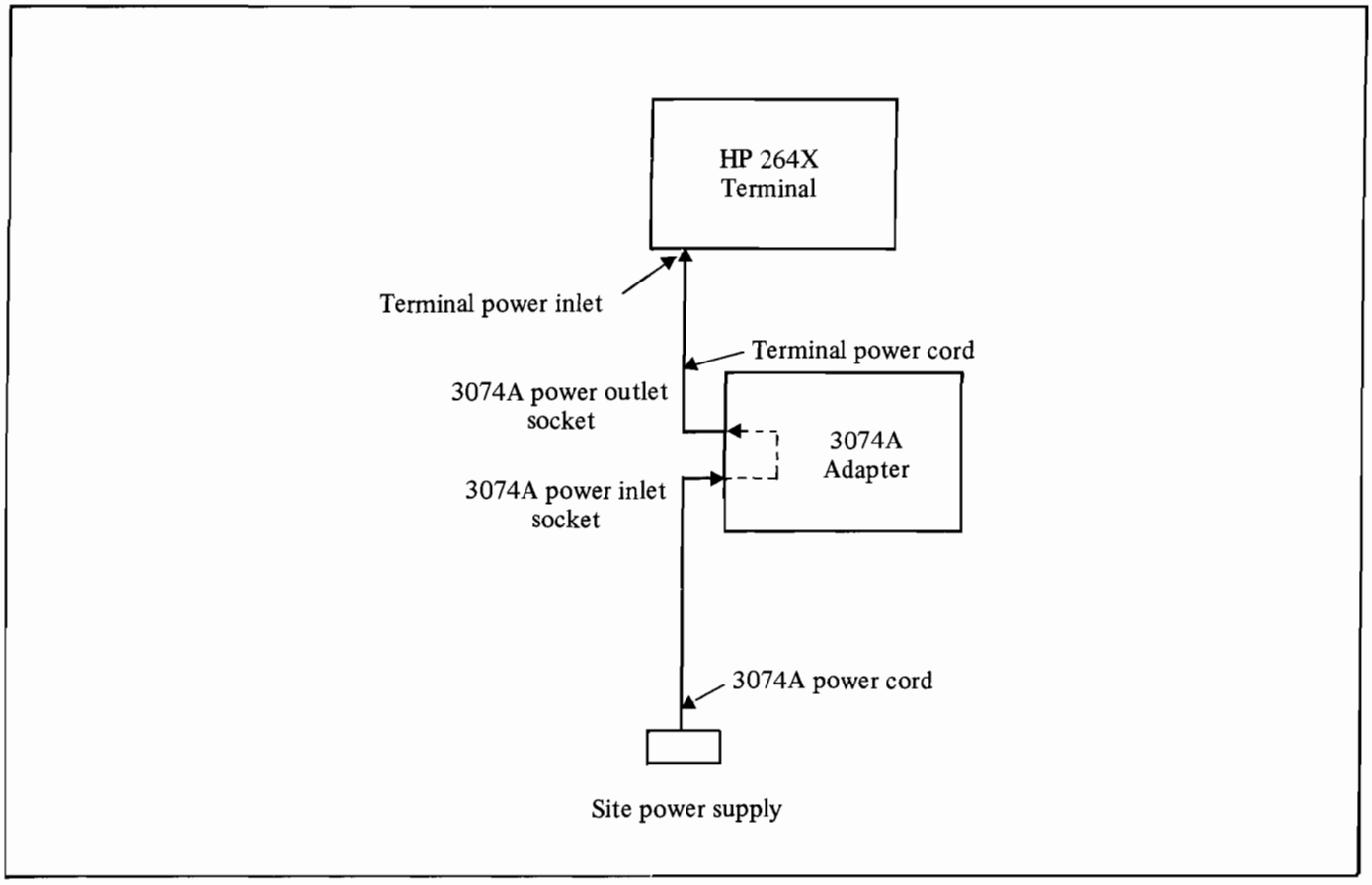


Figure 16-10 HP 264X Terminal To 3074A Power Connection

16-44 Multiterminal On-Line Terminal Checks With The HP 1000 System

Note: For information on HP1000 Factory Data Link and daisy-chain communication software, refer to the "91730A Multipoint Terminal Interface Subsystem User's Guide" (HP part number 91730-90002).

Escape sequence ESC-c1T (see section 2-13) allows the program to verify the Factory Data Link/daisy-chain communications between the computer and the 3075A/3076A/3077A terminals, without an operator being present at the terminal site. All characters following the T should be re-transmitted back to the computer on the next poll (READ).

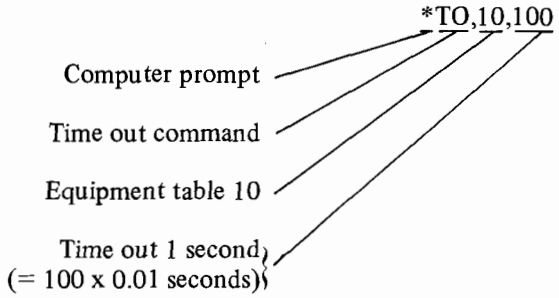
The communications may be checked as shown in the following example. Within this example:

- the system console (which originates the message and displays the returned test message) has logical unit number 1.
- the multiterminal interface line has logic unit number 24 and equipment table 10.
- the terminal being tested has logical unit number 25.

Typical communications check.

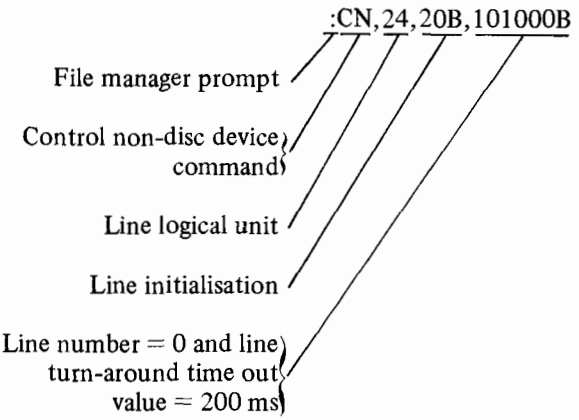
1) Ensure the line (i.e. Factory Data Link/daisy-chain connection) and the terminals are initialised. This may be done as follows:

   a) Set the terminal time out to one second:

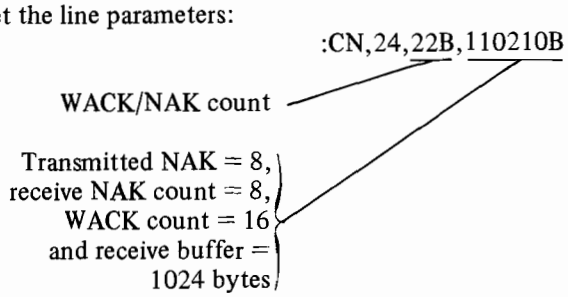


   b) Enter and run (RU) the File Manager (FMGR) program:
   *RU,FMGR

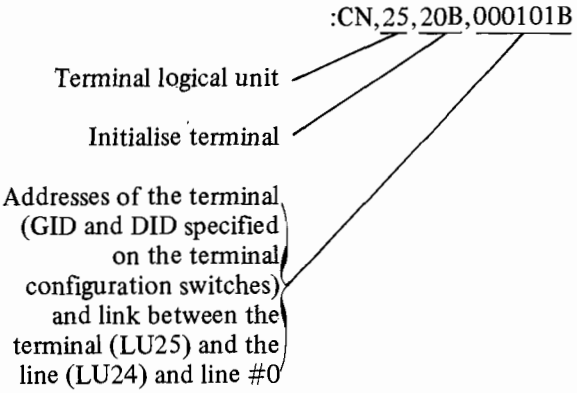
   c) Initialise the line:



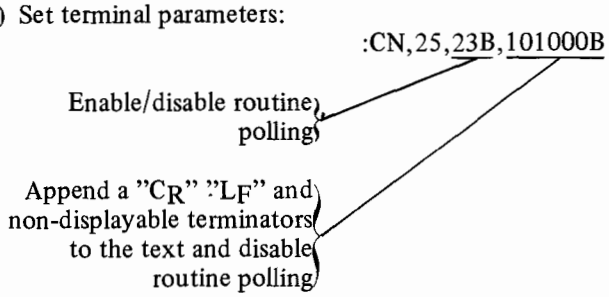
   d) Set the line parameters:



   e) Initialise the terminal:



   f) Set terminal parameters:



2) Store command. Transfer data from logical unit 1 (console) to logical unit 25 (terminal):
   :ST,1,25

3) If the terminal is a 3077A, set the clock for 12/24 hours and send the time (see section 13 for details).

4) Enter the escape sequence and data (i.e. 0123456789) at the console keyboard:
   ESC-c1T0123456789

5) Press the console keyboard Control and D (D^C) keys to send the data to the terminal.

6) At the terminal, 0123456789 should be displayed/printed.

7) Enter the store command to transfer the data from logic unit 25 to logic unit 1:
   :ST,25,1

8) The following data should be returned and displayed on the console:
   0123456789

9) Enter the store command to transfer data from the console to the terminal:
:ST,1,25

10) At the console, enter the escape sequence ESC-c0T to terminate the test.

The test from 1 (e) through 10 above should be repeated for all the terminals in each batch. If the tests are successful the system may be initialised to on-line operations. If the tests are unsuccessful, refer to section 16-46 or 16-63 for Factory Data Link or daisy-chain communications troubleshooting respectively.

16-45 **Multiterminal On-Line Terminal Checks With The HP 3000 System**

Note: For information on HP 3000 Factory Data Link and daisy-chain communication software, refer to the "MTS/3000 Multipoint Terminal Software Reference Manual" (HP part number 32193-90002).

The program MPTEST. PUB. SYS allows the Factory Data Link/daisy-chain communications between the computer and the 3075A/3076A/3077A terminals to be checked.

Typical communications test:

1) Enter then run the MPTEST program by typing on any console:

:RUN MPTEST. PUB. SYS

2) The program will print a welcome message and a short message. In addition, the following question (shown upper case) will be printed to which the user should answer, as shown lower case in the following example:

FOR LINE: XX

IS THERE A CONFIGURATION FILE ? No

WHICH TERMINALS DO YOU WANT TO TEST ? Enter terminal addresses

DO YOU WANT TO TEST THE STRAP SETTING ? No

DO YOU WANT TO READ, WRITE AND VERIFY DATA ? Yes

3) The following reply must be entered at the system console HOW LONG DO YOU WANT THE TEST TO RUN ? Enter the number of minutes (e.g. 1).

After the user replies to the system console message specifying the duration of the test, the program reads, writes and compares the data to determine if the computer to terminal communications are functioning correctly. If the functioning is correct, the system indicates on the user's console the number of write and read operations. If errors occur, error messages are reported to the terminal where MPTEST is being run. When the testing is completed the following message is printed.

END OF PROGRAM

This procedure must be repeated for each batch of terminals. Once all the terminals have been successfully tested the system may be initialised to on-line operations. If the tests are unsuccessful, refer to section 16-46 or 16-63 for Factory Data Link or daisy-chain troubleshooting respectively.

16-46 RESOLVING FACTORY DATA LINK COMMUNICATIONS PROBLEMS

The following sub-section describes how the user may resolve Factory Data Link communications problems. If, after following the procedures described below, problems still occur contact your nearest HP Sales and Service Office.

16-47 **Locating A Faulty Data Link Branch**

The Data Link Tester (part number 03075-60021) supplied with the Installation and Programming Kit provides a convenient method of checking Factory Data Link connections, without the need for specialist equipment. The red/yellow/green TRAFFIC ACTIVITY lamps on the Data Link Tester monitor the Data Link cable + wire, - wire and shield in the direction specified by the switches on the tester. The on/off state of the lamps indicates the correct operation/short circuit/open circuit condition of the wires.

If during the installation (or normal on-line operations) a data communications problem between the terminals and the computer is suspected, the faulty branch of the Data Link may be located using the Data Link Tester, as follows:

1) Connect the PCA hood on the end of the Data Link Tester cable to a correctly operating terminal (i.e. one that has successfully completed the self checks described in section 16-10). Set the terminal configuration switches to the Factory Data Link setting listed in figure 16-8.

2) Connect the Data Link Tester plug into the Data Link Connection Box that is closest to the computer/3074A connection box (figure 16-11 position 1). Thereby, the terminal is connected to one branch of the Data Link via the Data Link Tester.

3) Set the Data Link Tester switches so that only one branch of the Data Link is enabled and the other branch is disabled, see figure 16-11 position 1.

4) Repeat the on-line checks described in section 16-44 (for HP 1000 systems) or 16-45 (for HP 3000 systems).

Note: For HP 1000 systems the escape sequence ESC-c1T should be repeated several times to simulate continuous polling. For the HP 3000 systems the MPTEST program performs a continuous poll for the time specified by the user.

5) If all three TRAFFIC LIGHTS (red/yellow/green) on the Data Link Tester flash together (at the same rate as the polling sequence), it indicates the enabled branch of the Data Link (figure 16-11, A) is functioning correctly. Consequently, the disabled branch (figure 16-11, B) is at fault and it may be tested as described in section 16-48.

6) If the three TRAFFIC LIGHTS do NOT simultaneously flash, it indicates the enabled branch could be at fault. This may be checked by testing the other branch of the Data Link as follows:

   a) Remove the Data Link Tester/terminal from their position on the Data Link, and plug them into the first connection box on the Data Link on the "other side" of the computer (figure 16-11 position 2).
   b) Repeat the on-line check but with the switches on the Data Link Tester reversed. This disables part of the previously enabled branch (figure 16-11, A), allowing the disabled branch (figure 16-11, B) to be tested.
   c) If the three TRAFFIC lamps simultaneously flash it indicates the (previously disabled) branch is operating correctly. Consequently, the previously enabled branch (figure 16-11, A) is at fault and it may be tested as described in section 16-48.

7) If the three TRAFFIC lights still do not simultaneously flash, it indicates the communications problem is due to the computer and/or its associated 3074A adapter. In this case:
   a) Verify the computer/3074A/Data Link connection as described in section 16-39. Repeat the on-line checks with the Data Link Tester.
   b) If the malfunction still occurs exchange the 3074A adapter and repeat the tests.
   c) If the malfunction still occurs, it is caused by the computer. To check that the fault is caused by a computer failure, either an HP 2645A CRT terminal or an HP 1640 Serial Data Analyzer may be used to simulate the computer polling and selecting. See section 16-50 for details.

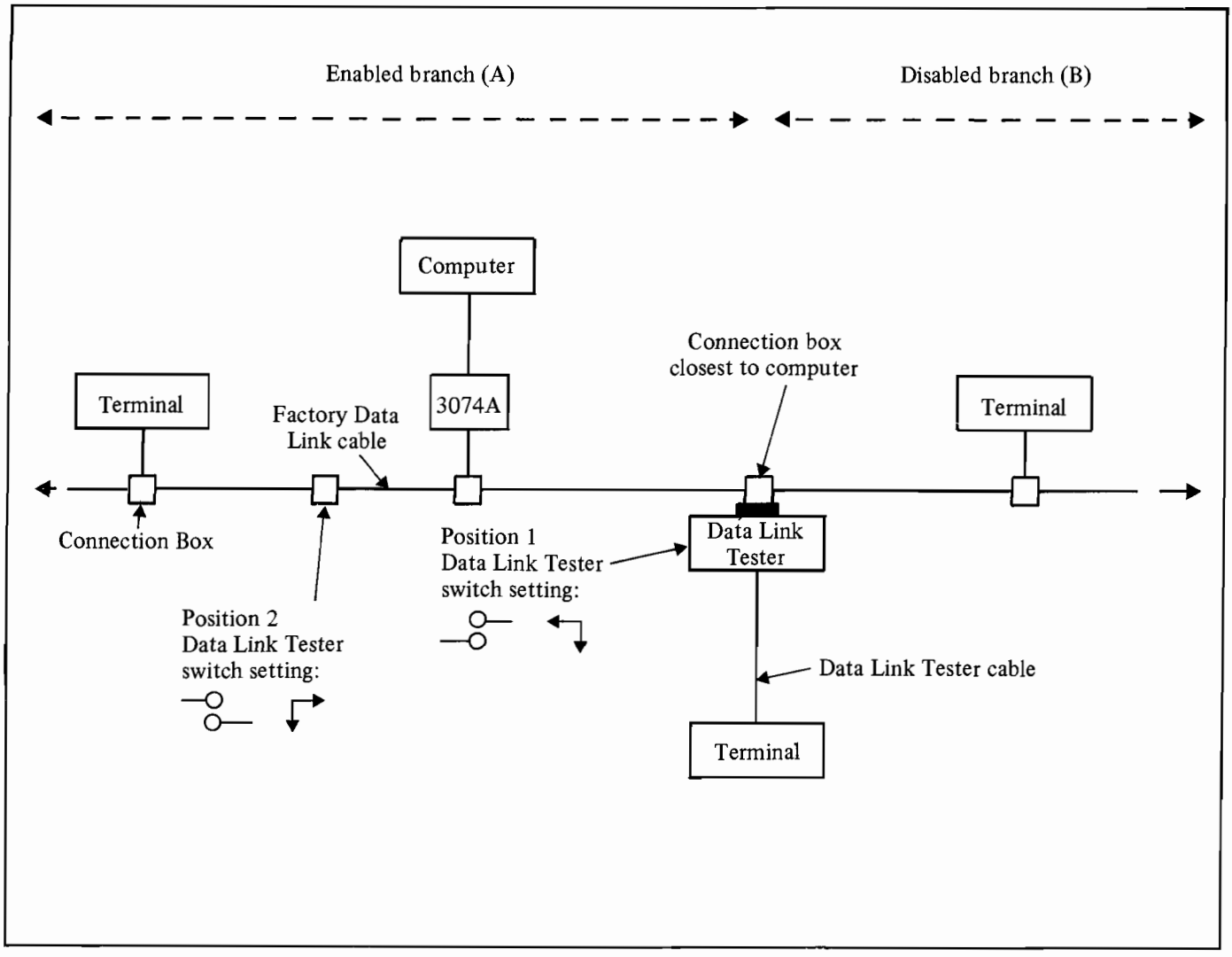


Figure 16-11 Data Link Tester Switch Settings To Disable One Branch Of The Factory Data Link

16-48 Locating The Fault On The Branch

Once the faulty branch has been identified, the fault may be located by "sectioning" the faulty branch as follows:

1) Move the Data Link Tester to approximately the centre of the faulty branch.
2) Set the Data Link Tester switches to enable the half of the branch in the direction of the computer and disable the branch in the direction of the last terminal.

   Note: The directions may be determined from the 92901A connection box. Contacts 1 and 3 are for the Data Link cable connections coming in from the computer. Contacts 2 and 4 are for cable connections going out towards the last terminal. A good practice is to print an arrow on the box to indicate the direction of data transmissions from the computer to the terminal.
3) Repeat the on-line checks described in section 16-47. The flashing of the Data Link Tester TRAFFIC lights will indicate how the half of the branch is operating:
   a) If the branch is operating correctly, move the Data Link Tester and terminal to the centre of the second half of the Data Link (towards the last terminal) and repeat the test.
   b) If the branch is malfunctioning, move the Data Link Tester and terminal to the centre of the first half of the Data Link (towards the computer) and repeat the test.
4) Repeat these tests until the fault is located. Once located, the on/off state of the TRAFFIC LIGHT will indicate possible cabling faults. Table 16-3 lists the TRAFFIC LIGHT on/off pattern for typical Data Link cable faults.

As an alternative to sectioning the branch, test each connection box starting from the one farthest from the computer and working back towards the computer. Stop at the connection box where the traffic lights indicate a good communication cable. The fault can be at this connection box, or the previous one, or the cable between these boxes (including the cable in the 92904A cradle).

Repair the fault as necessary then repeat the tests described in section 16-43 before going on-line.

Table 16-3 Data Link Tester Traffic Fault Pattern

Red	Yellow	Green	Possible problem
ON	OFF	ON	Short between + (blue wire) and shield.
OFF	ON	OFF	Short between - (white wire) and shield.
OFF	OFF	OFF	Short between + and - lines or all lines open.
OFF	OFF	ON	+ line or - line open.
ON	ON	OFF	Shield open.

If faults still occur, the Data Link communications will have to be monitored using specialised equipment. Section 16-49 details the use of the HP 1640A Serial Data Analyzer and HP 2645A CRT terminal to monitor the communications.

16-49 Data Link Communications Monitoring/Fault Detection

Note: For information on the HP 1640A and HP 2645A, refer to the "1640A Serial Data Analyzer Operating Manual" and the "HP 2645A Terminal User's Manual".

If the Data Link fault cannot be identified using the Data Link Tester on its own, the link may be tested using a HP 1640A Analyzer and a HP 2645A CRT. The 2645A must be used in place of the computer and the 1640A must be used in conjunction with the Data Link Tester to monitor the Data Link communications traffic.

Ensure the HP 2645A CRT has the required firmware to work in multipoint driver mode. Then, when the computer is non-operational, disconnect the computer cable from the 3074A adapter RS232C connector. Using a 13232A cable, connect the 2645A CRT to the RS232C connector of the 3074A to drive the Data Link cable, see figure 16-12.

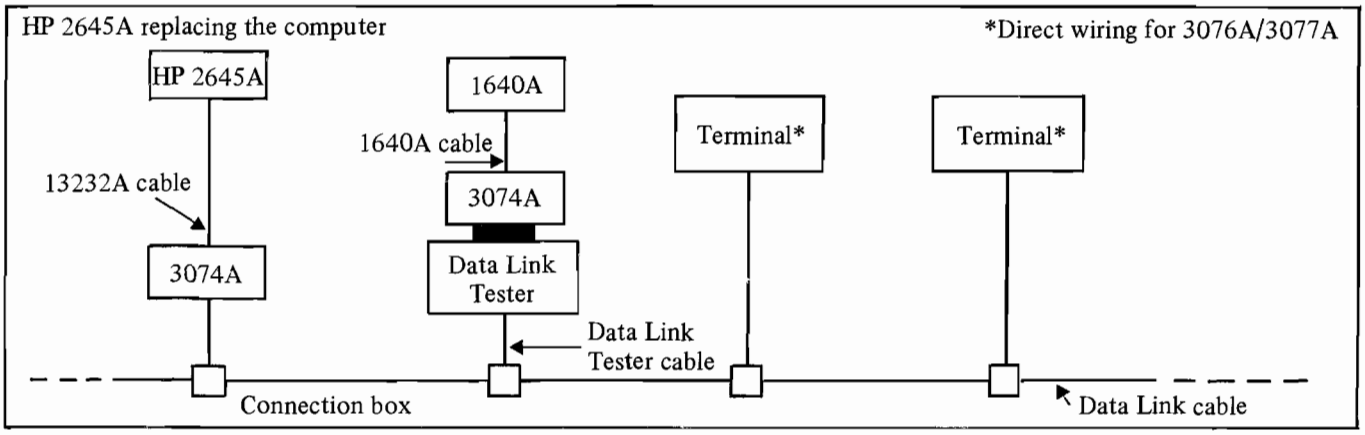


Figure 16-12 Data Link Monitoring Using An HP 2645A In Driver Mode

On the next connection box, plug in the Data Link Tester and plug its PCA connector into the 3074A 30-pin connector for the Data Link Cable. Connect the 1640A analyzer to the RS232C connector of this 3074A, see figure 16-12.

Ensure at least one 3075A/3076A/3077A terminal is connected to the Data Link.

Module configuration. With the modules switched on, configure the terminals, the Data Link Tester, the 3074A's, the 1640A and 2645A as follows:

1) For the terminals, use the rear panel terminal configuration switches to set:
   a) Factory Data Link communications mode (switches I-2 = 1 and I-5 = 1).
   b) Odd parity (switches I-3 = 1 and I-4 = 1).
   c) 9600 baud communications rate (switches I-6 = 0, I-7 = 0 and I-8 = 0).
   d) Alphanumeric keyboard default condition as special function keys (switch II-1 = 1).
   e) The terminals GID and DID addresses, as required (switches II-4 through II-8 and III-4 through III-8, see section 16-9).

2) For the Data Link Tester, set both switches to the right-hand to allow the "two way" communications.

3) For the 3074A's, set the carrier detect jumper to position 5, then:
   a) For the 3074A connected to the 2645A, set the CPU/TER jumper to the CPU position.
   b) For the 3074A connected to the 1640A, set the CPU/TER jumper to the TER position.

4) For the 1640A, configure it to monitor the Data Link communications as follows.
   a) Press the FORMAT key to display the Format parameters on the 1640A display. Configure the Format as shown in figure 16-13.

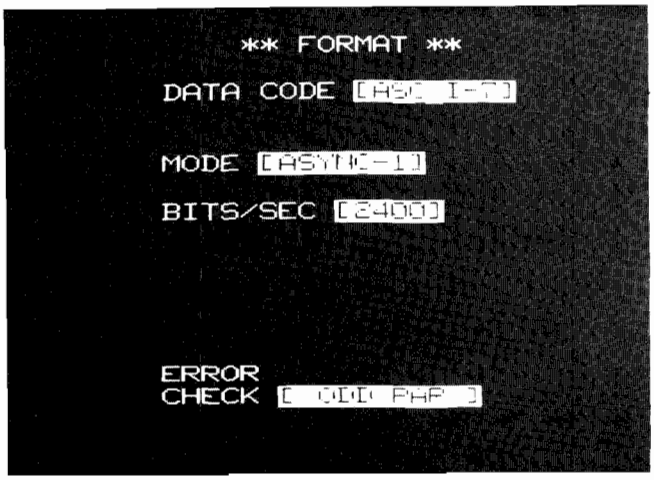


Figure 16-13 1640A Factory Data Link Format Selection (Communications Monitoring)

   b) Press the MODE key to display the Mode parameters. Select the Mode as shown in figure 16-14.

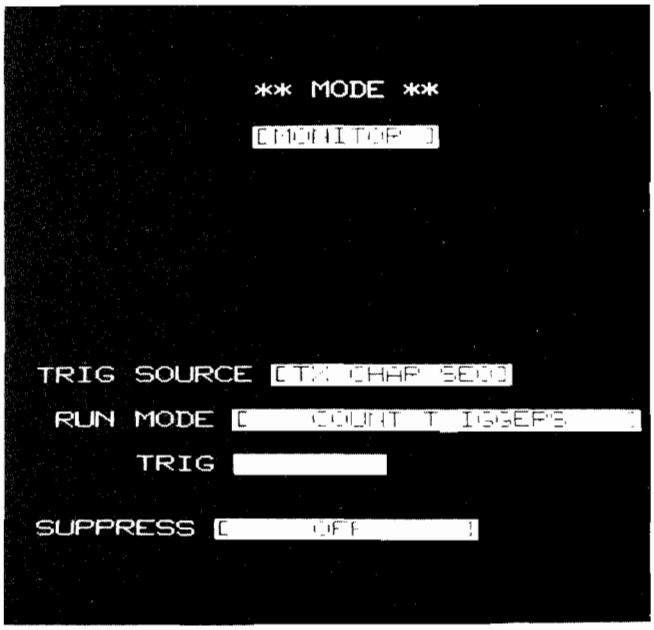


Figure 16-14 1640A Factory Data Link Mode Selection (Communications Monitoring)

   c) Set pins on the template above the screen as follows:
   TX: to pin 3
   GND: to pin 7

   Press RUN to operate the 1640A.

5) For the HP 2645A terminal, configure it to drive the Data Link as follows:
   a) On the ASYNCHRONOUS MULTIPOINT INTERFACE set switches:
   J17 to J11: Closed
   J10: Open
   J07: Closed
   J06: Open
   J05 to J01: Closed
   J00: Open
   INT: Open
   PL6 to PL0: Open
   A4: Closed
   A11 to -12: Open
   b) On the KEYBOARD INTERFACE: close all switches except for G, H and T which are open.
   c) Carry out a hard reset and clear the display.
   d) Press REMOTE. Release CAPS LOCK & MEMORY LOCK.
   Set the Baud Rate to 9600 (corresponds to 4800 baud half duplex switch settings for point-to-point). Set the parity to ODD.

Testing the Data Link. The Data Link must be tested as follows:

1) Switch off then on each 3075A/3076A/3077A terminal to simulate power-on.

2) Reset each 3075A/3076A/3077A terminal, i.e. at the 2645A:

   a) Carry out a soft reset on the 2645A. HOME the cursor and clear the display.

   b) Type DVR-<GID DID> <gid DID>
   (where:
   GID DID = the group and device identities to be used in poll sequences.
   gid DID = the group and device identities to be used in select sequences).

   c) Press ENTER.

   d) Press CNTL and DISPLAY FUNCTIONS. The red light should blink and the TRANSMIT light should flash every four to five seconds (or 10 seconds depending upon firmware revision).

   e) Type in $E_{SC}E$ (to reset the addressed terminals).

   f) Press the ENTER key.

3) Observe the communications on the 1640A analyzer display screen. Check the complete enquiry/reply sequence. Ensure the three TRAFFIC ACTIVITY lamps on the Data Link Tester flash with each poll.

4) Obtain the status from the terminal.
   a) On the 2645A, type in E_{SC}^ to request the status. This can be done because the 2645A continues to select the terminals.
   b) Press the 2645A ENTER key.
   c) HOME the 2645A cursor and clear the display.
   d) On the 2645A, type DVR-<GID DID> <gid DID> See 2b for details.
   e) Press the 2645A CNTL DISPLAY FUNCTIONS. The terminal status should appear on the 2645A screen.

5) Observe the 1640A analyzer screen, and compare it with the data displayed on the 2645A. The 1640A should show the text framing characters (e.g. S_{TX}, E_{TX}/E_{TB} and BCC, see section 14).

6) Repeat step 4 and 5) to obtain the terminal status a second time. The status should be different (to the first time) as no power-on has occurred. See sections 2-14 and 13-17 for details about the 3075A/3076A and 3077A status respectively.

Monitoring the communications allows the user to determine where on the Data Link the malfunction is occuring, by observing which terminals are generating corrupt data. By moving the Data Link Tester/1640A pair along the Data Link the exact location of the malfunction may be determined.

16-50 Verification Of Computer Failure For Data Link Connections

Either the HP 1640A Serial Data Analyzer or the HP 2645A CRT may be used to simulate the operation of the computer and so check the Data Link. If these tests are successful they signify the computer is causing the Data Link malfunction. These tests should be performed with the 3075A/3076A/3077A terminals connected to the Data Link. In addition, a Data Link Tester and a terminal should be connected to the connection box nearest to the 3074A/computer, as shown in figure 16-11. The Data Link Tester switches should be set to monitor the Data Link communications in both directions (i.e. both switches set to the right-hand position). The TRAFFIC ACTIVITY lamps should simultaneously flash at the same rate as a polling sequence is displayed on the 1640A CRT, or generated by the 2645A. If the test is successful, it should be repeated but with the Data Link Tester/terminal plugged into last connection box at each end of the cable (to check the condition of the complete cable).

HP 1640A Used In Simulation Mode. When the computer is non-operational, disconnect the computer cable from the 3074A adapter RS232C connector. Using the Y shaped cable supplied with the 1640A analyser, connect the 1640A to the RS232C connector of the 3074A to drive the Data Link cable.

Configure the 3075A/3076A/3077A terminals for Data Link communications but at a speed of 2400 baud (i.e. terminal configuration switches I-6 set to 0, I-7 set to 1 and I-8 set to 0) with odd parity (configuration switches I-3 set to 1 and I-4 set to 1). Set both the terminal GID and DID to A, as per 5 below.

Switch on the terminals. Then configure the 1640A as follows:

1) Press the FORMAT key to display the Format parameters. Configure the Format as shown in figure 16-15.

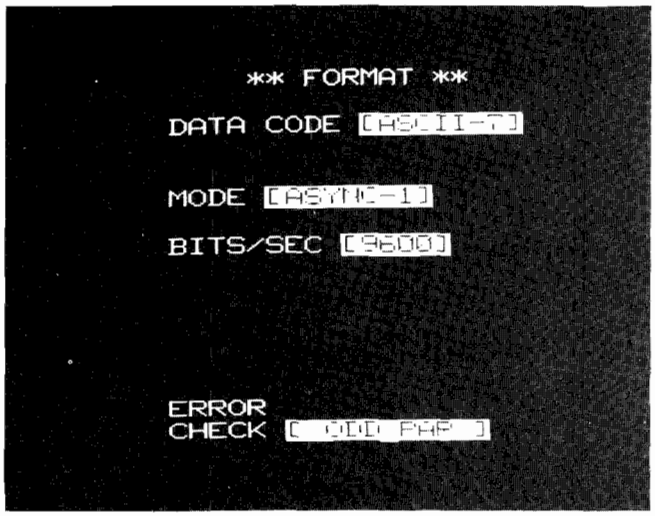


Figure 16-15 1640A Factory Data Link Format Selection (Simulation Mode)

2) Press the MODE key to display the Mode parameters. Configure the Mode as shown in figure 16-16.

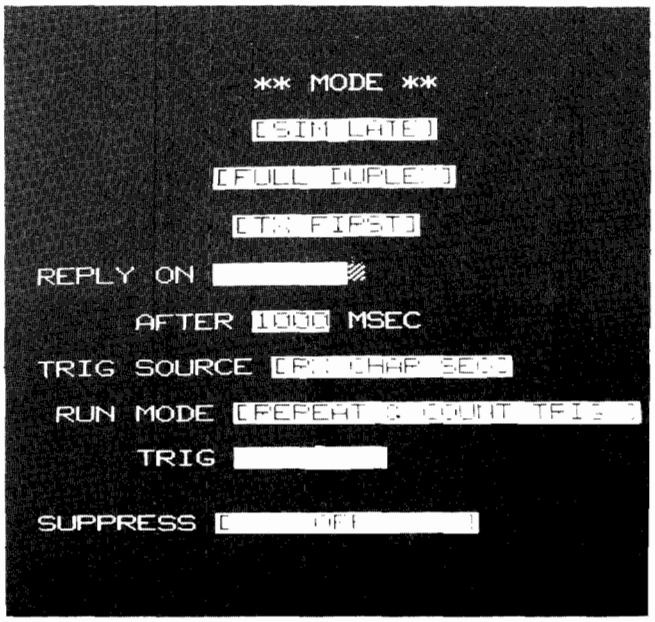


Figure 16-16 1640A Factory Data Link Mode Selection (Simulation Mode)

Note:

a) The PUSH "NOT" KEY TO EXIT MONITOR LINE disappears after the "NOT" key is pressed.

b) The REPLY ON line is displayed by pushing the "DON'T CARE" key seven times and then generating the PAD (▨) character in hexadecimal (i.e. F F).

c) AFTER ☐☐☐☐ MSEC defines the polling rate in milliseconds.

d) Leave TRIG clear.

3) Press the TX ENTRY key to display the transmission parameters. Configure the transmission as shown in figure 16-17.

Note: The last line ET▨AAAAEQ▨⊢ is displayed by pushing the following keys:
0 4 , F F , 4 1 , 4 1 , 4 1 , 4 1 , 0 5 , F F , END

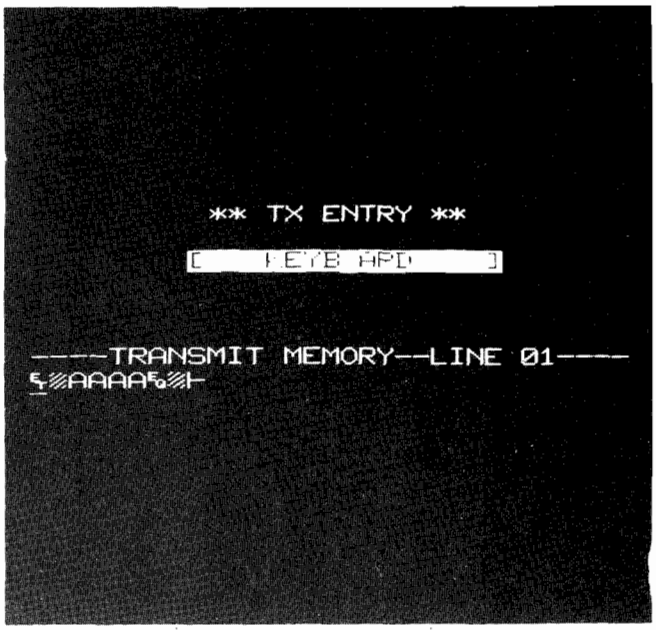


Figure 16-17 1640A Factory Data Link Transmit Entry Selection (Simulation Mode)

4) Set the pins on the template above the screen, as follows:
   TX: to pin 2
   RX: to pin 3
   RTS: to pin 4
   GND: to pin 7

5) Press RUN.
   The 1640A now polls the terminal which has a Group Identification Address (GID) of A and a Device Identification Address (DID) of A. It will wait until it gets an acknowledge back from the terminal before sending the next polling sequence. Figure 16-18 shows a typical polling-answer set of sequences, where 1640A requests (polls) are displayed in Normal video and terminal answers in Inverse video.

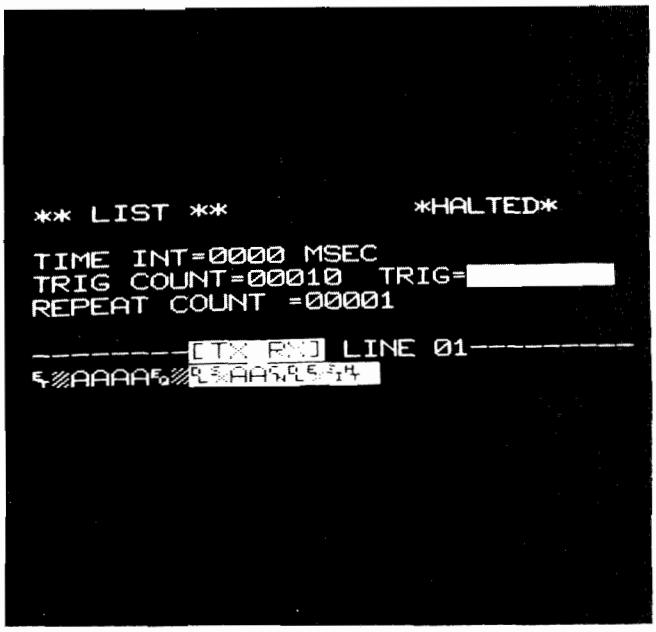


Figure 16-18 Typical Factory Data Link 1640A Polling - Answer Sequence (Simulation Mode)

Refer to section 14 for a description of the terminal data communications. If the tests are successful the computer is causing the malfunction, which should be tested according to the manufacturer's instructions.

HP 2645A Used In Driver Mode. Ensure the HP 2645A has required firmware to work in Driver Mode. Then, when the computer is non-operational, disconnect the computer cable from the 3074A adapter RS232C connector. Using a 13232A cable, connect the 2645A to the RS232C connector of the 3074A to drive the Data Link cable.

Configure the 2645A terminal as follows:

1) On the ASYNCHRONOUS MULTIPOINT INTERFACE. set switches:
   J17 to J11: Closed
   J10: Open
   J07: Closed
   J06: Open
   J05 to J01: Closed
   J00: Open
   INT: Open
   PL6 to PL0: Open
   A4: Closed
   A11 to -12: Open
   2SB: Closed

2) On the KEYBOARD INTERFACE:
   Close all switches except for G, H and T which are open.

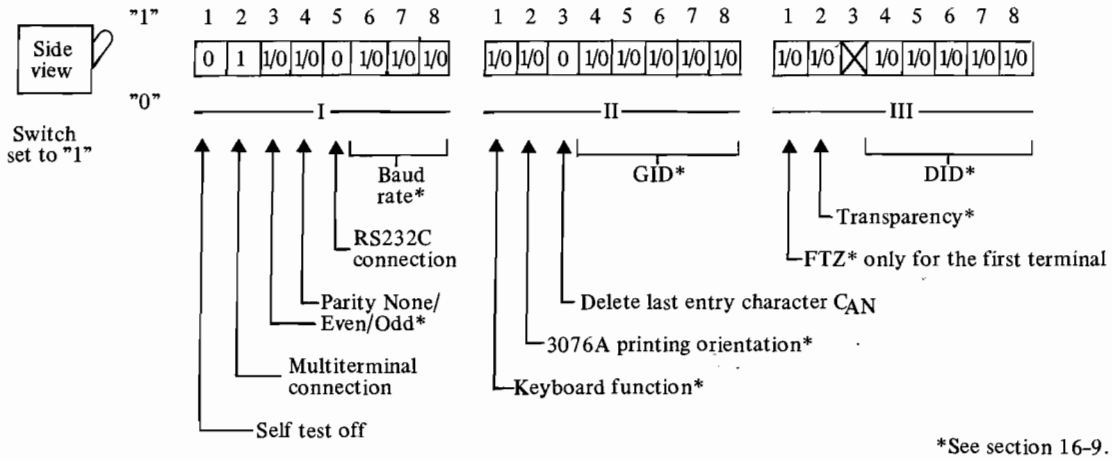
3) Carry out a hard reset and clear the display.

4) Press REMOTE. Release CAPS LOCK & MEMORY LOCK. Set the Baud Rate to 9600 (corresponds to 4800 baud, half duplex switch settings for point-to-point).

5) Set the parity to ODD.

6) To generate a polling sequence, proceed as follows. Carry out a soft reset on the 2645A. HOME the cursor and clear the display.
   Type DVR-AAAA.
   (terminal group and device identities used in the poll and select sequences).
   Press ENTER.
   Press CNTL and DISPLAY FUNCTIONS. The red light should blink and the TRANSMIT light should flash every four to five seconds (or 10 seconds depending upon firmware revision).

If the tests are successful the computer is causing the malfunction, which should be tested according to the manufacturer's instructions.



*See section 16-9.

3075A Effective Switches		Switch Setting For Each Computer System		
		HP 1000	HP 1000 Datacap Software	HP 3000
I	1	0	0	0
	2	1	1	1
	3	0	0	1
	4	0	0	1
	5	0	0	0
	6, 7, 8	**	0, 0, 0	**
II	1	**	1	**
	2	0	0	0
	3	0	0	0
	4, 5, 6, 7, 8	GID	GID	GID
III	1	0	0	0
	2	0	1	0
	3	0	0	0
	4, 5, 6, 7, 8	DID	DID	DID

3076A Effective Switches		Switch Setting For Each Computer System		
		HP 1000	HP 1000 Datacap Software	HP 3000
I	1 thru 8	Same as the 3075A		
II	1	**	1	**
	2	**	1	**
	3	0	0	0
	4, 5, 6, 7, 8	GID	GID	GID
III	1 thru 8	Same as the 3075A		

3077A Effective Switches		Switch Setting For Each Computer System		
		HP 1000	HP 1000 Datacap Software	HP 3000
I	1 thru 8	Same as the 3075A		
II	1	0	0	0
	2	0	0	0
	3	0	0	0
	4, 5, 6, 7, 8	GID	GID	GID
III	1 thru 8	Same as the 3075A		

Where: ** = *As defined by the user according to his application.*
GID = Group address defined by the user. See section 16-9 and 14 for details.
DID = Device address defined by the user. See section 16-9 and 14 for details.

Figure 16-19 3075A/3076A/3077A Daisy-Chain Typical Terminal Configuration Switch Settings

16-51 TERMINAL INSTALLATION FOR DAISY-CHAIN CONNECTIONS

The 3075A/3076A/3077A terminals should be installed as described in the following sub-sections. The terminal communications with the computer should be checked as described in section 16-43. Any problems with the daisy-chain installation may be resolved as described in section 16-65.

16-52 3075A DAISY-CHAIN INSTALLATION

The site for the 3075A must be a clean, dry, solid and flat surface supplied with a power socket and daisy-chain cabling. Each 3075A should be installed in the sequence described in sections 16-53 through 16-56.

16-53 3075A Daisy-Chain Terminal Configuration Switch Settings

Before being installed, the rear panel terminal configuration switches must be set to configure the terminal to a known operating mode. Figure 16-19 details the switch settings for daisy-chain installations using HP computers.

16-54 3075A Installation Of Cables For Terminal Options

The Bar Code Reader Wand cable, HP-IB cable and Serial I/O Interface cable (when fitted) should be installed as described in section 16-29.

16-55 Daisy-Chain To 3075A Connection

Note: For daisy-chain connections, the terminal must not be connected to or disconnected from an operational computer.

The 3075A terminal must be connected to the site daisy-chain cable, either a 13232P (if this is the first terminal) or a 13232Q (for the second through last terminal). The cable is provided with a PCA connector for connection to the 3075A. The PCA connector must simply be plugged into the terminal rear panel 30-pin computer interface connector (see figure 16-5). The PCA connector cable inlet aperture fits over the 10 mm (0.4 ins.) wide lug on the right-hand side of the terminal connector inlet, the other end of the connector must then be firmly pressed into position.

16-56 Switching On The 3075A Terminal

The 3075A terminal should be switched on as described in section 16-31. The terminal communications with the computer should be checked as described in section 16-43. If the communications checks high-light a malfunction, it may be resolved as described in section 16-63.

16-57 3076A DAISY-CHAIN INSTALLATION

Each 3076A should be installed in the sequence described in section 16-58 and 16-59.

16-58 3076A Daisy-Chain Terminal Configuration Switch Settings

Before being installed, the rear panel terminal configuration switches must be set to configure the terminal to a known operating mode. Figure 16-19 details the switch setting for daisy-chain connections using HP computers.

16-59 3076A Cradle Installation

Note:
1) For daisy-chain connections, the computer must be non-operational when the terminal is installed in or removed from the cradle.
2) Each of the 92904A Wall Mounting Cradles on the daisy-chain MUST house a terminal.

The 3076A terminal should be installed in the Wall Mounting Cradle as described in section 16-34. If the cradle relay is to be used to control an external device it must be checked as described in section 16-38. Check the terminal communications with the computer as described in section 16-43. If the communication checks high-light a malfunction, it may be resolved as described in section 16-63.

16-60 3077A DAISY-CHAIN INSTALLATION

Each 3077A terminal should be installed in the sequence described in section 16-61 and 16-62.

16-61 3077A Daisy-Chain Terminal Configuration Switch Settings

Before being installed, the rear panel terminal configuration switches must be set to configure the terminal to a known operating mode. Figure 16-19 details the switch setting for daisy-chain connections using HP computers.

16-62 3077A Cradle Installation

Note:
1) For daisy-chain connections, the computer must be non-operational when the terminal is installed in or removed from the cradle.
2) Each of the 92904A Wall Mounting Cradles on the daisy-chain MUST house a terminal.

The 3077A terminal should be installed in the Wall Mounting Cradle as described in section 16-37. If the cradle relay is to be used to control an external device it must be checked as described in section 16-38. Check the terminal communications with the computer as described in section 16-43. If the communications check high-light a malfunction, it may be resolved as described in section 16-63.

16-63 RESOLVING DAISY-CHAIN COMMUNICATIONS PROBLEMS

The following section describes how the user may resolve daisy-chain communications problems. If after following the procedures described below problems still occur, contact your nearest HP Sales and Service Office.

16-64 **Locating A Daisy-Chain Malfunction**

Note: Only 3075A/3076A terminals with a serial prefix greater than 2014F may be used to drive the daisy-chain network.

The Daisy-Chain Tester (part number 03075-60027) supplied with the Installation and Programming Kit provides a convenient method of checking the daisy-chain connection, without the need for specialist equipment. The test consists of replacing the computer by the Daisy-Chain Tester, then setting the last 3075A/3076A terminal on the daisy-chain to operate in the self operation mode (with communications test). Thereby, all data entered on the terminal keyboard is passed along the daisy-chain before being displayed on the terminal display/printer.

Note: The daisy-chain cables must not be disconnected from an operational computer.

The daisy-chain test should be performed as follows:

1) For hardwire connections, disconnect the 13232U modem by-pass cable from the computer. Then connect Daisy-Chain Tester into the end of the 13232U cable (so it replaces the computer), see figure 16-20.

2) For modem connections, disconnect the 13232P modem-to-daisy-chain cable from the modem. Then connect a 13232U cable to the 13232P cable. Connect the Daisy-Chain Tester into the end of the 13232U, see figure 16-20.

3) The last terminal on the daisy-chain must be a 3075A/3076A with a serial prefix of 2014F or above. Set this terminal for self operation with a communications test and odd parity by setting rear panel terminal configuration switches I-1 to 1, I-2 to 1, I-3 to 1 and I-4 to 1 and the remaining switches to 0, see figure 16-20. Ensure the terminal correctly performs the self checks described in section 16-11.

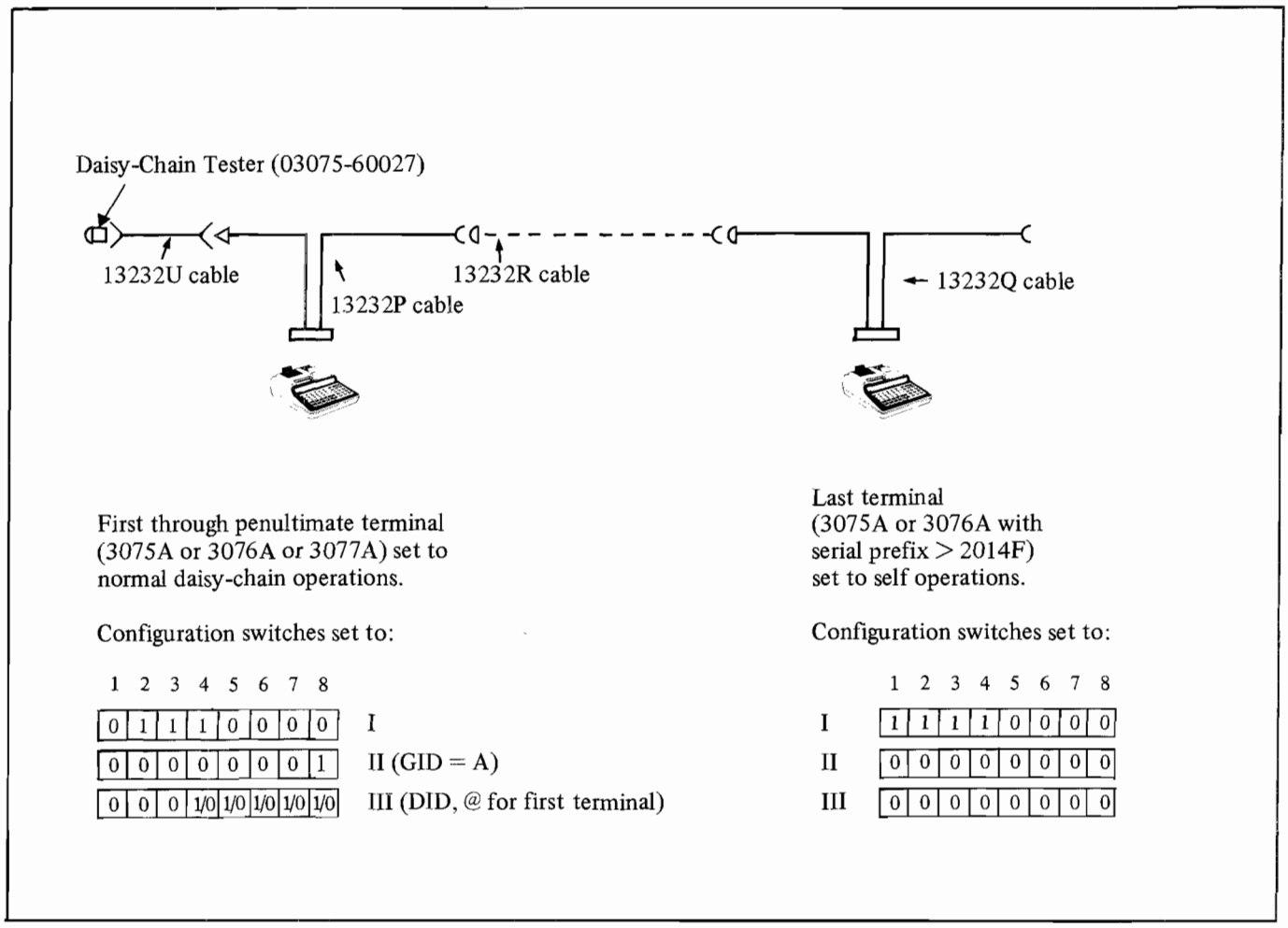


Figure 16-20 Daisy-chain Test

4) Set all the remaining terminals on the daisy-chain to normal daisy-chain operations with:
   a) Odd parity.
   b) 9600 baud communications speed.
   c) A Group Identifier (GID) address of A.
   d) A Device Identifier (DID) address of @ on the first, terminal, A on the second, B on the third and so on for all the terminals on the daisy-chain.

Figure 16-20 shows the switch settings.

5) Type any data on the last 3075A/3076A keyboard. The data will be transmitted along the daisy-chain and echoed back by the Daisy-Chain Tester to the last terminal display/printer.

If the transmitted and received data are identical, it indicates the computer or modem could be causing the malfunction and they should be tested according to the manufacturer's instructions. If the transmitted and received data are not identical it means the daisy-chain is causing the fault. The connection on the daisy-chain causing the malfunction may be isolated by:

1) Disconnecting the last terminal.
2) Configuring the "new" last terminal for self operations and repeating the daisy-chain test.

This procedure should be repeated until the daisy-chain test is performed successfully. This isolates the fault to the previous terminal position on the daisy-chain, or the cable between the previous position and the new position. Repair the fault as necessary.

If this procedure fails to isolate the fault, the daisy-chain will have to be checked using a HP 1640A Serial Data Analyzer to simulate the computer, for details see section 16-65.

16-65 **Testing The Daisy-Chain Using An HP 1640A**

Note: For information on the HP 1640A, refer to the "1640A Serial Data Analyzer Operating Manual" (HP part number 01640-90904).

The HP 1640A Serial Data Analyzer may be used to simulate the operation of the computer and so check the daisy-chain. These tests should be performed with all the 3075A/3076A/3077A terminals connected on the daisy-chain.

Note: The daisy-chain cables must not be disconnected from an operational computer.

The daisy-chain test should be performed as follows:

1) For hardwire connections, disconnect the 13232U modem bypass cable from the computer. Then connect the 1640A Y shaped cable to the 13232U cable.

2) For modem connections, disconnect the 13232P modem-to-daisy-chain cable from the modem. Then connect a 13232U cable to the 13232P cable. Connect the 1640A Y shaped cable to the 13232U cable.

3) Configure the 3075A/3076A/3077A terminals for daisy-chain communications but at a speed of 2400 baud (i.e. terminal configuration switches I-6 set to 0, I-7 set to 1 and I-8 set to 0). Set both the terminal GID and DID to A, as per 9 below.

4) Switch on the 1640A and all the terminals.

5) Configure the 1640A analyzer as follows:
   a) Press the FORMAT key to display the Format parameters. Configure the Format as shown in figure 16-21.

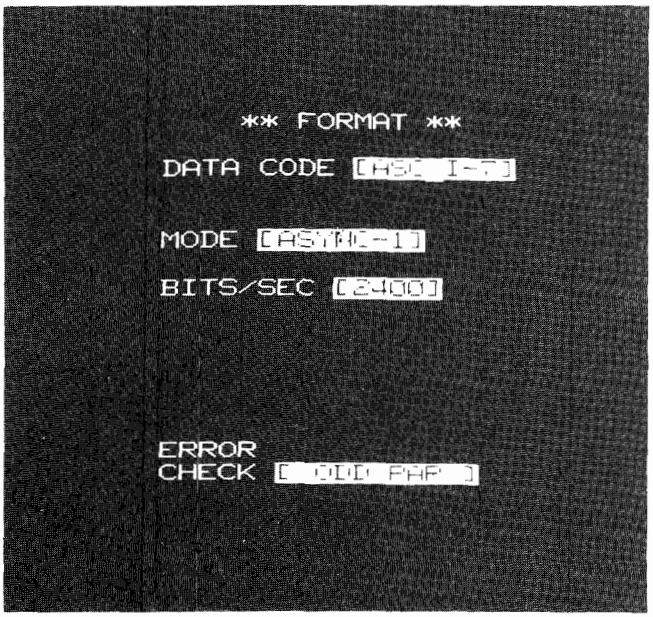


Figure 16-21 1640A Daisy-Chain Format Selection (Simulation Mode)

   b) Press the MODE key to display the Mode parameters. Configure the Mode as shown in figure 16-22.

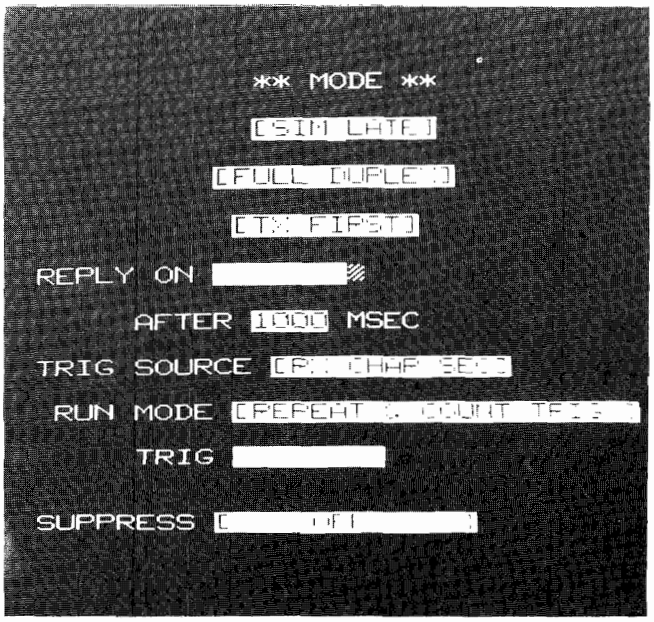


Figure 16-22 1640A Daisy-Chain Mode Selection (Simulation Mode)

Note:
1) The PUSH "NOT" KEY TO EXIT MONITOR LINE disappears after the "NOT" key is pressed.
2) The REPLY ON line is displayed by pushing the DON'T CARE key seven times and then generating the PAD character in hexadecimal (i.e. F F).
3) AFTER MSEC defines the polling rate in milliseconds.
4) Leave TRIG clear.

   c) Press the TX ENTRY key to display the transmission parameters. Configure the transmission as shown in figure 16-23.

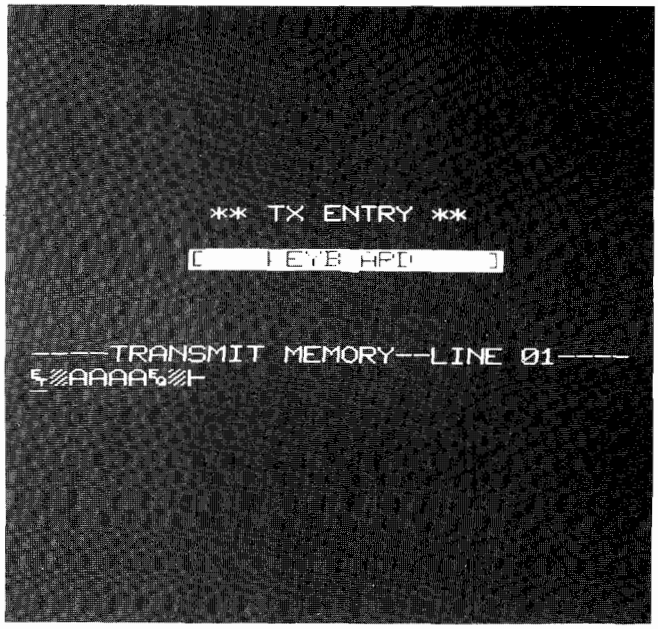


Figure 16-23 1640A Daisy-Chain Transmit Entry Selection (Simulation Mode)

Note: The last line ET AAAAEQ is displayed by pressing the following keys:
0 4 , F F , 4 1 , 4 1 , 4 1 , 4 1 , 0 5 , F F , END

   d) Set the pins on the template above the screen, as follows:
   TX: to pin 2
   RX: to pin 3
   RTS: to pin 4
   GND: to pin 7

e) Press RUN.
The 1640A now polls the terminal which has a Group Identification Address (GID) of A and a Device Identification Address (DID) of A. It will wait until it gets an acknowledge back from the terminal before sending the next polling sequence. Figure 16-24 shows a typical polling-answer set of sequences, where 1640A requests (polls) are displayed in Normal video and terminal answers in Inverse video.

Refer to section 14 for a description of the terminal data communications.

The results obtained from each terminal will aid the daisy-chain fault diagnosis.

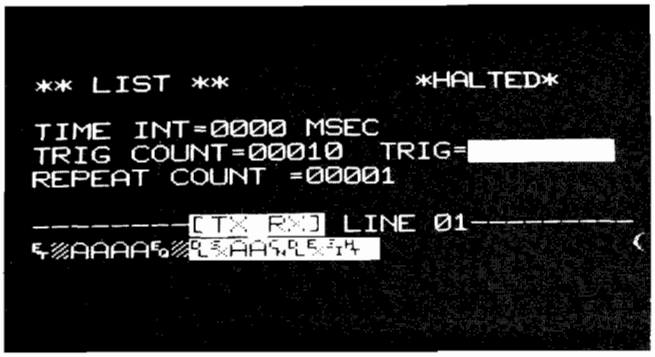
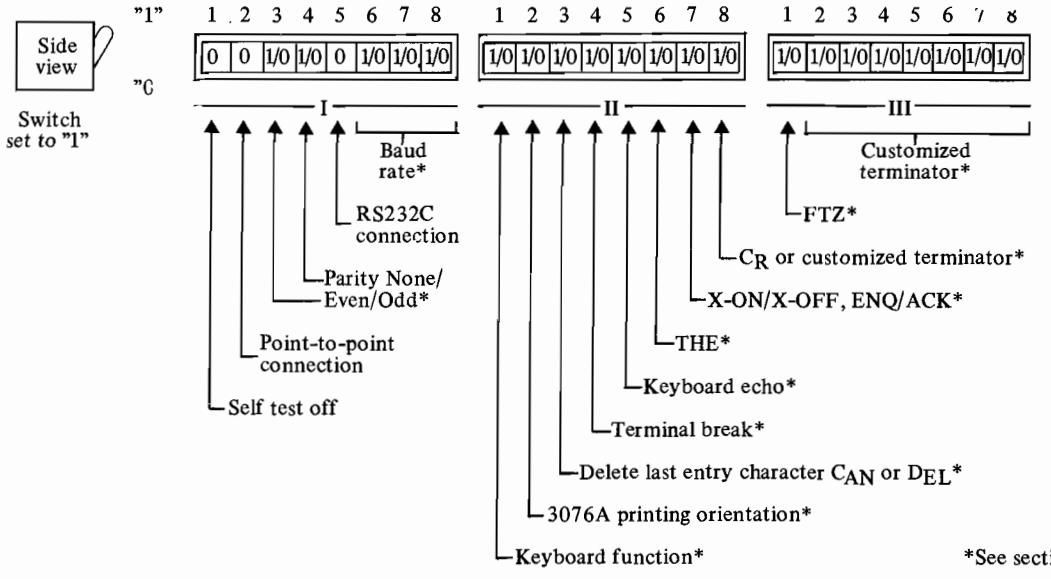


Figure 16-24 Typical Daisy-Chain 1640A Polling - Answer Sequence (Simulation Mode)



3075A Effective Switches		Switch Setting For HP 3000
I	1	0
	2	0
	3	1
	4	1
	5	0
	6, 7, 8	**
II	1	***
	2	0
	3	0
	4	0
	5	0
	6	****
	7	1
	8	0
III	1	***
	2 thru 8	0

3076A Effective Switches		Switch Setting For HP 3000
I	1	0
	2	0
	3	1
	4	1
	5	0
	6, 7, 8	**
II	1	***
	2	***
	3	0
	4	0
	5	0
	6	****
	7	1
	8	0
III	1	***
	2 thru 8	0

3077A Effective Switches		Switch Setting For HP 3000
I	1	0
	2	0
	3	1
	4	1
	5	0
	6, 7, 8	**
II	1	0
	2	0
	3	0
	4	0
	5	0
	6	****
	7	1
	8	0
III	1	***
	2 thru 8	0

Where: ** = Maximum communications speed 2400 baud.
*** = As defined by the user according to his application.
**** = Dependent on the cable:
1 if a 3 wire cable is used (i.e. using signals AB, BB and Ground only).
0 if a 13232A or equivalent cable is used.

Figure 16-25 3075A/3076A/3077A Point-To-Point Typical Terminal Configuration Switch Settings

16-66 TERMINAL INSTALLATION FOR POINT-TO-POINT CONNECTIONS

The 3075A/3076A/3077A terminals should be installed as described in the following sub-sections. The terminal communications with the computer should be checked as described in section 16-78. Any problems with the point-to-point installation may be resolved as described in section 16-79.

16-67 3075A POINT-TO-POINT INSTALLATION

The site for the 3075A must be a clean, dry, solid and flat surface supplied with a power socket and point-to-point cable. Install the 3075A in the sequence described in sections 16-68 through 16-71.

16-68 3075A Point-To-Point Terminal Configuration Switch Settings

Before being installed, the rear panel terminal configuration switches must be set to configure the terminal to a known operating mode. Figure 16-25 details the switch settings for point-to-point connections using an HP 3000 computer.

16-69 3075A Installation Of Cables For Terminal Options

The Bar Code Reader Wand cable, HP-IB cable and Serial I/O Interface cable (when fitted) should be installed as described in section 16-29.

16-70 Point-To-Point To 3075A Connection

Note: For point-to-point connections, the terminal must not be connected to or disconnected from an operational computer.

The 3075A terminal must be connected to the site 13232A modem cable (or equivalent). This cable is provided with a PCA connector for connection to the 3075A. The PCA connector must simply be plugged into the terminal rear panel 30-pin computer interface connector (see figure 16-5). The PCA connector cable inlet aperture fits over the 10 mm (0.4 ins.) wide lug on the right-hand side of the terminal connector inlet, the other end of the connector must then be firmly pressed into position.

16-71 Switching On The 3075A

The 3075A terminal should be switched on as described in section 16-31. The terminal communications with the computer should be checked as described in section 16-78. If the communications checks high-light a malfunction, it may be resolved as described in section 16-79.

16-72 3076A POINT-TO-POINT INSTALLATION

Each 3076A should be installed in the sequence described in section 16-73 and 16-74.

16-73 3076A Point-To-Point Terminal Configuration Switch Settings

Before being installed, the rear panel terminal configuration switches must be set to configure the terminal to a known operating mode. Figure 16-25 details the switch settings for point-to-point connections using an HP 3000 computer.

16-74 3076A Cradle Installation

Note: For point-to-point connections, the computer must be non-operational when the terminal is installed or removed from the cradle.

The 3076A terminal should be installed in the Wall Mounting Cradle as described in section 16-34. If the cradle relay is to be used to control an external device it must be checked as described in section 16-38. Check the terminal communications with the computer as described in section 16-78. If the communications checks high-light a malfunction, it may be resolved as described in section 16-79.

16-75 3077A POINT-TO-POINT INSTALLATION

Each 3077A terminal should be installed in the sequence described in sections 16-76 and 16-78.

16-76 3077A Point-To-Point Terminal Configuration Switch Settings

Before being installed, the rear panel terminal configuration switches must be set to configure the terminal to a known operating mode. Figure 16-25 details the switch settings for point-to-point connections using an HP 3000 computer.

16-77 3077A Cradle Installation

Note: For point-to-point connections, the computer must be non-operational when the terminal is installed in or removed from the cradle.

The 3077A terminal should be installed in the Wall Mounting Cradle as described in section 16-37. If the cradle relay is to be used to control an external device it must be checked as described in section 16-38. Check the terminal communications with the computer as described in section 16-78. If the communications checks high-light a malfunction, it may be resolved as described in section 16-79.

16-78 POINT-TO-POINT ON-LINE TERMINAL TO COMPUTER COMMUNICATIONS CHECKS

Once the 3075A/3076A/3077A terminal has been installed its correct communications with the computer system must be verified. Escape sequence ESCz (self test, see section 2-10) and ESC^ (terminal status, see sections 2-14 and 13-17) allow the terminal operation to be checked. The user must write his own sub-routines (in his chosen language) to request the terminal status, read the terminal status and cause the terminal to perform a self test. The check must be done as follows:

1) Switch off then on the 3075A/3076A/3077A terminal to simulate power-on.
2) Send ESC^ to the terminal to request its status.
3) Send ESC^ to the terminal a second time, the status should be different as no power-on has occurred.
4) Send ESCz to the terminal. Ensure that the terminal performs its internal self test routine (see sections 16-11 and 16-21 for details).
5) Send ESC^ to the terminal a third time, the status should NOT have changed from status returned at step 2.

If the test is successful the system may be initialised to on-line operations. If the test is unsuccessful, refer to section 16-79 for point-to-point troubleshooting.

16-79 RESOLVING POINT-TO-POINT COMMUNICATIONS PROBLEMS

The terminal may be checked by disconnecting the 13232A cable and performing the self checks described in sections 16-10 through 16-24. If these checks are successful, the point-to-point cables should be tested using a resistance meter. Test the resistance of each signal wire for the complete length of the point-to-point cable (including extender cables). The resistance of each used wire should be less than 75 ohms. If a failure is detected, repair as necessary.

If the failure cannot be detected it is probably due to either the modem or the computer, which should be tested according to the manufacturer's instructions.

SECTION 17

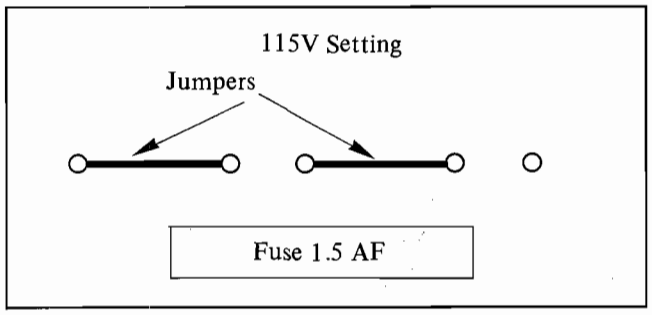
OPERATOR MAINTENANCE

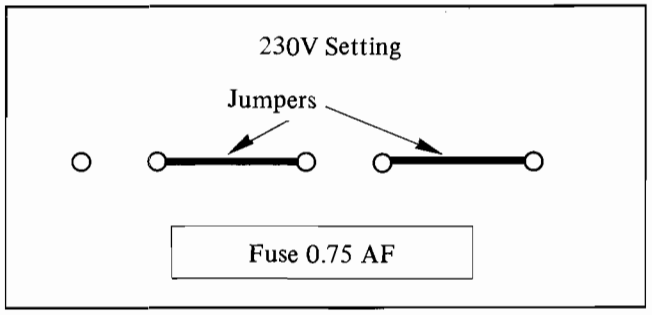
17-1 STANDARD TERMINAL MAINTENANCE

17-2 FUSE RENEWAL

If the terminal fuse blows, first check the supply voltage setting and then change the fuse as follows:

1) Set the rear panel switch labelled LINE to OFF (0) and disconnect the power cord from the LINE (power) connector, see figure 17-1.
2) Firmly slide to the left the translucent voltage selector/ fuse cover on the terminal rear panel. The supply voltage is set using jumpers. If necessary, change the jumper setting to the correct supply voltage.





3) Remove the faulty fuse by pulling the orange tab. Renew with a fast-blow fuse of the correct value, with the fuse placed over the orange tab.
4) Re-connect the LINE connector and switch on the terminal (by setting the LINE switch to ON (1)).

For other faults, refer to the Service Manual or your nearest HP Service office (see addresses at rear of this manual).

17-3 KEYBOARD DEFINITION LABEL REPLACEMENT (3075A/3076A ONLY)

Press the keyboard spring catches (see figure 17-1) towards the display to release the overlay. Remove the overlay and label.

Change/renew the label as necessary and replace label and overlay (take care to seat overlay properly under all four catches).

Keyboard	Keyboard Definition Label Part No
3075A standard	03075-60012
3075A alphanumeric	03075-60011
3076A standard	03076-60002
3076A alphanumeric	03076-60001

17-4 AIR FILTER CLEANING

Note: The air filter must be cleaned at least once every two months. More frequent cleaning may be required if the terminal is being operated in a dirty environment.

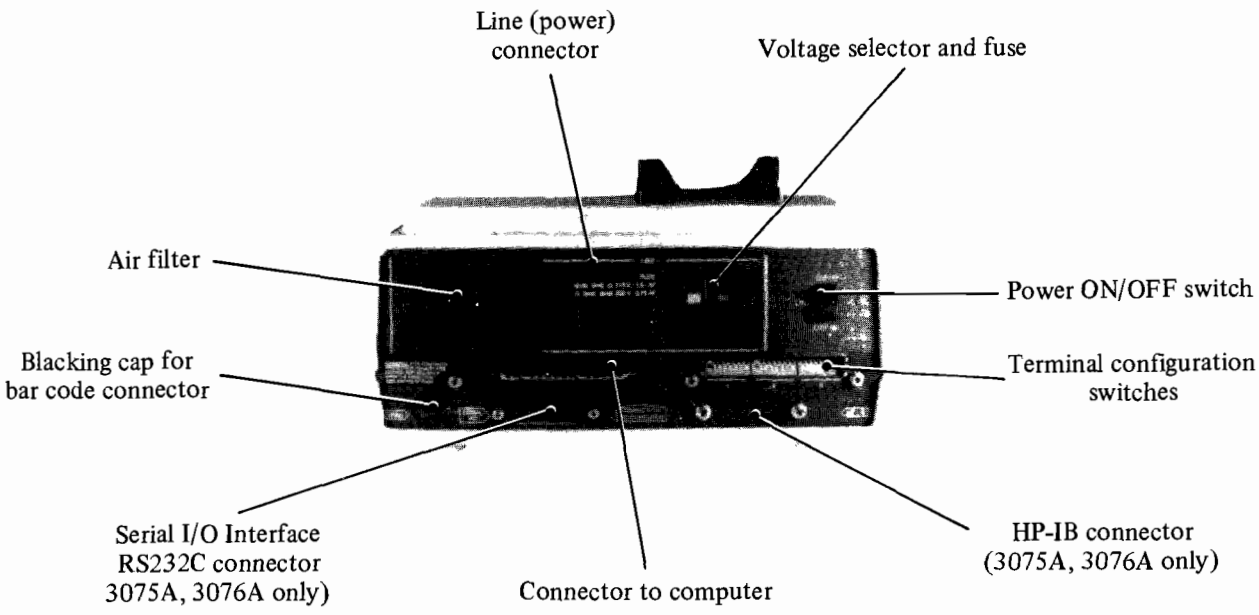
Remove the foam rubber air filter from the rear panel (see figure 17-1) and clean it with isopropyl alcohol. Refit the filter.

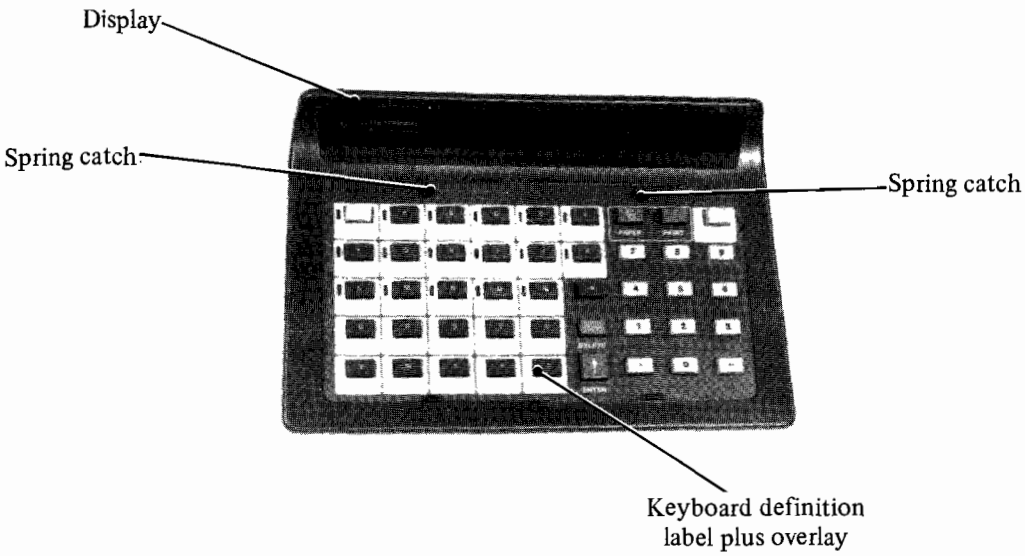
17-5 TERMINAL OUTER CASING CLEANING

If the outer casing becomes dirty it may be cleaned by being wiped with a cotton swab (or similar device) lightly moistened with isopropyl alcohol.

CAUTION

Isopropyl alcohol must not be sprayed directly onto the casing or keyboard or options.





3075A showing Alphanumeric Keyboard.

Figure 17-1 Terminal General Views

17-6 TERMINAL OPTIONS PREVENTIVE MAINTENANCE

The cleaning procedures described in the following subsections should be carried out at least once every two months. More frequent cleaning may be required if the terminal is being operated in a dirty environment.

17-7 MULTIFUNCTION READER MAINTENANCE

If the terminal is fitted with a Multifunction Reader, it can be cleaned using the cleaning card supplied (HP part no. 7120-7562) as follows:

1) Switch off the terminal by setting the LINE switch to OFF.
2) Moisten the cleaning card with a little isopropyl alcohol.
3) Insert the cleaning card with the cleaning surface underneath into the Multifunction Reader. Pull the card slowly through to clean the read head.
4) Turn the card with the cleaning surface uppermost and insert it into the reader again. Pull the card slowly through to clean the mirror.
5) Switch on the terminal by setting the LINE switch to ON.

17-8 TYPE V BADGE READER MAINTENANCE

The transparent plastic pocket can be removed from the Type V Badge reader for cleaning, renewal etc. Insert two pins (or paper clips) into the holes in the sides of the reader aperture and press the pocket out (see figure 17-2). Clean it with a tissue or cotton swab moistened with isopropyl alcohol. When refitting the pocket, press it into the aperture until it clicks into position.

The two pocket halves can be separated for more thorough cleaning.

17-9 STRIP PRINTER MAINTENANCE

If the terminal is fitted with a Strip Printer and it runs out of paper, the printer automatically stops, the keyboard PRINT key is disabled and the red light adjacent to the PRINT key blinks. To load a new roll of paper:

1) Ensure the terminal is switched ON.
2) Ensure the loose end of the new paper roll is smoothly cut.
3) Open the printer cover by turning the knurled wheel and pulling the cover.
4) Hold the new roll with the loose end underneath. Press the loose end into the printer slot (see figure 17-3) the paper will automatically feed through and then stop.

Close the cover and switch on the printer using the PRINT key.

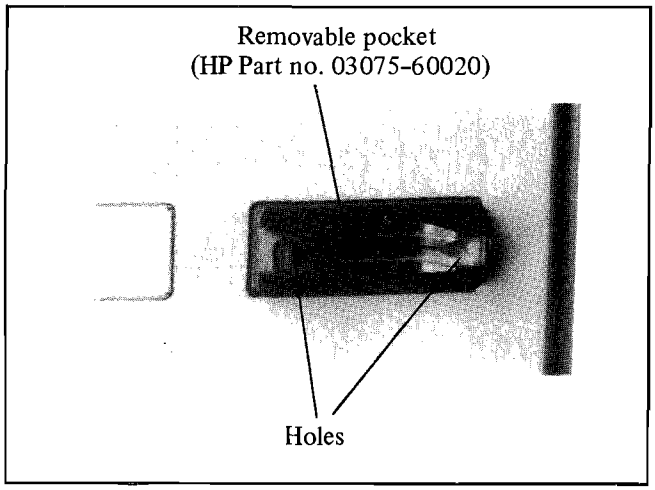


Figure 17-2 Type V Badge Reader Pocket Removal

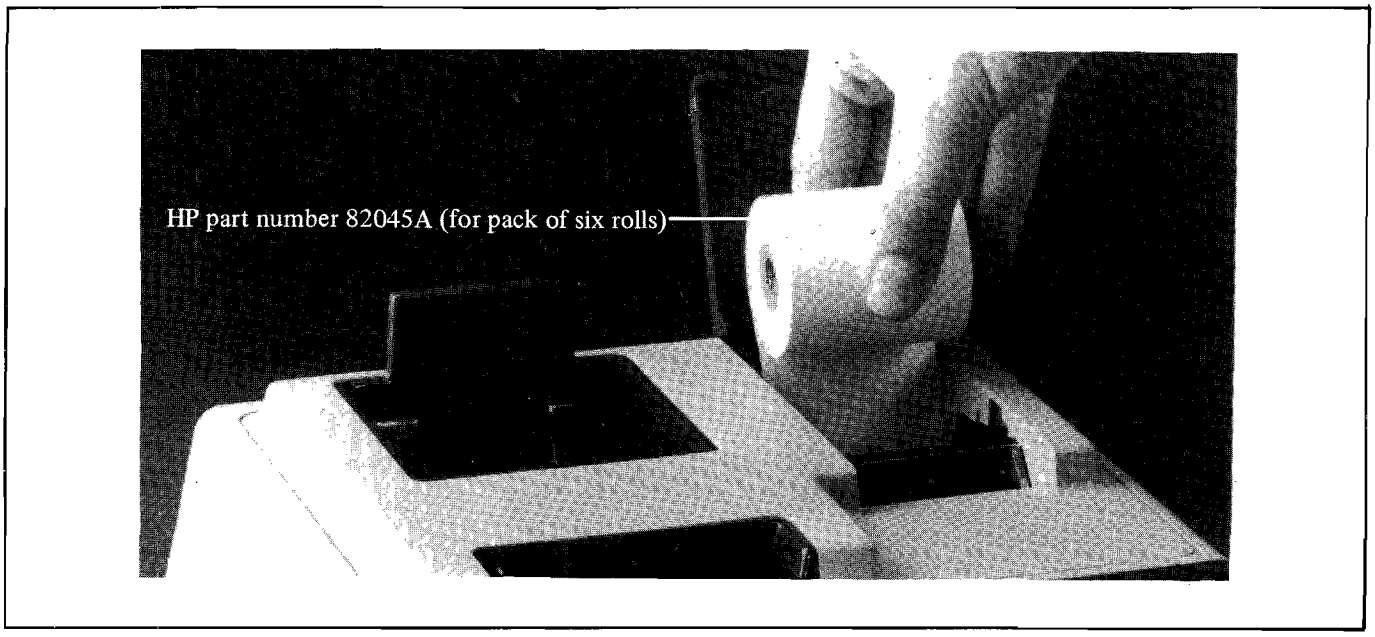


Figure 17-3 Printer Paper Renewal

17-10 BAR CODE READER MAINTENANCE

Periodic maintenance of the Bar Code Reader Wand will ensure long-term satisfactory performance. While there are no user serviceable parts inside the wand, the aperture in the wand tip must not contain dirt or obstructions and the glass window on the optical sensor must be kept clean.

Note: Before cleaning the wand, the terminal should be switched off by setting the LINE switch to OFF.

CAUTION

Cleaning fluid must NOT be sprayed directly onto the wand or sensor.

Cleaning. The tip should be checked periodically for wear and dirt or obstructions in the aperture. The tip aperture is designed to reject particles and dirt but a gradual degradation in performance will occur as the tip wears down or becomes obstructed by foreign materials.

Unscrew the tip then clean the aperture using a cotton swab (or similar device) moistened in a liquid detergent. The glass window on the sensor should be inspected and cleaned if dust, dirt, or fingerprints are visible. To clean the sensor window, moisten a lint free cloth with liquid glass cleaner. Clean the window with the cloth taking care not to disturb the orientation of the sensor.

After cleaning the tip aperture and sensor window, the tip should be gently and securely screwed back into the wand assembly.

Tip replacement. If the tip shows visible indications of wear such that the shape is disfigured, or the aperture distorted, a new tip should be substituted.

The HP part number for the tip is HEDS-3001.

17-11 MAGNETIC STRIPE READER MAINTENANCE

If the terminal is fitted with a Magnetic Stripe Reader, it should be cleaned every 35,000 passes (or three months) using the cleaning card supplied (HP part number 03075-80026) as follows:

1) Switch off the terminal.
2) Moisten the cleaning card with the supplied cleaning fluid (trichlorotrifluoroethane, HP part number 8500-1251).
3) Insert the cleaning card with the cleaning surface facing the arrow on the Magnetic Stripe Reader. Pull the card slowly through to clean the reading head.
4) Switch on the terminal.

APPENDIX A

ASCII CHARACTER SET

Table A-1 ASCII Non-Displayable Control Character Set

Decimal	Octal	ASCII character	Meaning
0	000	NUL	Null
1	001	SOH	Start Of Heading
2	002	STX	Start Of Text
3	003	ETX	End Of Text
4	004	EOT	End Of Transmission
5	005	ENQ	Enquiry
6	006	ACK	Acknowledge
7	007	BEL	Bell
8	010	BS	Backspace
9	011	HT	Horizontal Tabulation
10	012	LF	Line Feed
11	013	VT	Vertical Tabulation
12	014	FF	Form Feed
13	015	CR	Carriage Return
14	016	SO	Shift Out
15	017	SI	Shift In
16	020	DLE	Data Link Escape
17	021	DC1	Device Control 1
18	022	DC2	Device Control 2
19	023	DC3	Device Control 3
20	024	DC4	Device Control 4
21	025	NAK	Negative Acknowledgement
22	026	SYN	Synchronous Idle
23	027	ETB	End Of Transmission Block
24	030	CAN	Cancel Line
25	031	EM	End Of Medium
26	032	SUB	Substitute
27	033	ESC	Escape
28	034	FS	File Separator
29	035	GS	Group Separator
30	036	RS	Record Separator
31	037	US	Unit Separator

Table A-2 Displayable ASCII Character Set

Decimal	Octal	ASCII character
32	040	SP
33	041	!
34	042	"
35	043	#
36	044	$
37	045	%
38	046	&
39	047	'
40	050	(
41	051	)
42	052	*
43	053	+
44	054	,
45	055	-
46	056	.
47	057	/
48	060	0
49	061	1
50	062	2
51	063	3
52	064	4
53	065	5
54	066	6
55	067	7
56	070	8
57	071	9
58	072	:
59	073	;
60	074	<
61	075	=
62	076	>
63	077	?

Decimal	Octal	ASCII character
64	100	@
65	101	A
66	102	B
67	103	C
68	104	D
69	105	E
70	106	F
71	107	G
72	110	H
73	111	I
74	112	J
75	113	K
76	114	L
77	115	M
78	116	N
79	117	O
80	120	P
81	121	Q
82	122	R
83	123	S
84	124	T
85	125	U
86	126	V
87	127	W
88	130	X
89	131	Y
90	132	Z
91	133	[
92	134	\
93	135	]
94	136	↑
95	137	←

Decimal	Octal	ASCII character
96	140	
97	141	a
98	142	b
99	143	c
100	144	d
101	145	e
102	146	f
103	147	g
104	150	h
105	151	i
106	152	j
107	153	k
108	154	l
109	155	m
110	156	n
111	157	o
112	160	p
113	161	q
114	162	r
115	163	s
116	164	t
117	165	u
118	166	v
119	167	w
120	170	x
121	171	y
122	172	z
123	173	{
124	174	|
125	175	}
126	176	~
127	177	DEL

Note: DEL (octal 177) is also a control character, meaning Delete.

APPENDIX B

TERMINAL POWER-ON STATE

Switching on the terminal causes a break to be sent to the computer. The type of break generated depends on how the terminal is connected.

1) Multiterminal connections:
   a) For WRITE operations (Text-In Mode, see section 14-5) an RVI (Reverse Interrupt = octal 020 074) is sent to the computer.

   b) For READ operations (Text-Out Mode, see section 14-4) a single CANCEL character (C_{AN} = octal 030) is sent to the computer (instead of the requested data).

2) For point-to-point connections terminal configuration switch II-4 selects the break:
   a) If II-4 is set to 0 the D_{LE} character (Data Link Escape = octal 020) followed by the customized terminator character is sent to the computer.

   Note: Extra spurious "power-on" data may precede the D_{LE} character. This spurious data must be ignored by the computer.

   b) If II-4 is set to 1, the break causes a 100 millisecond drop on the data line.

In addition, power-on establishes a known starting point from which the terminals may be programmed. This starting point is as follows:

Table B-1 3075A/3076A/3077A Terminal Power-On State

Standard Module/Option	Power-On State	Escape Sequence Prefix
HP 3075A, 3076A Terminal	All modules and options enabled, except the electrical interfaces. 1. For multiterminal connections the terminal is initially in the WAIT state and requires a program WRITE sequence to change it to the READY state. 2. For point-to-point connections, when terminal configuration switch II-6 = 0 the computer signal Clear To Send must be high to place the terminal in the READY state. If terminal configuration switch II-7 = 1, at power-on the terminal is initially in the WAIT state and requires to receive a D_{C1} character (octal 021) from the computer in order to place it in the READY state.	E_{SC}-c
Bar Code Reader	1. Enabled. 2. Bar code selected: Industrial 2 out of 5. 3. Check digit: OFF. 4. Local display of read data: OFF. 5. Multifield operation: OFF.	E_{SC}-b
CRT/one line display, prompting lights and cradle relay.	1. Display enabled. 2. Blinking feature: OFF. 3. CRT cursor homed up. 4. CRT standard size characters enabled. 5. Display cleared. 6. Protected field: OFF. 7. All prompting lights: OFF. 8. 92904A Wall Mounting Cradle relay: OFF.	E_{SC}-d
HP-IB Controller	1. Disabled. 2. Display of input data: OFF. 3. Multifield operation: OFF. 4. Polling list: CLEAR. 5. Time out: 10 seconds. 6. Terminator character for read command: NONE. 7. Terminator character for write command: NONE. *Note: Control line EOI (End Or Identify) goes low to act as terminator for read and write commands.*	E_{SC}-h

Table B-1 3075A/3076A/3077A Terminal Power-On State (Continued)

Standard Module/Option	Power-On State	Escape Sequence Prefix
Numeric/Alphanumeric Keyboard	1. Enabled. 2. All SFK's enabled as input terminators. C_R (Carriage Return = octal 015) or, in point-to-point, customized terminator transmitted after every SFK.	ESC-k
Strip Printer	Keyboard PRINT switch: ON.	ESC-k
Magnetic Stripe Reader	1. Enabled. 2. Multifield operation: OFF.	ESC-m
Multifunction Reader	1. Enabled. 2. Corner cut detection: ON. 3. Hollerith reading. 4. Holes only (no clock marks). 5. Multifield operation: OFF.	ESC-r
Type V Badge Reader	1. Enabled. 2. Multifield operation: OFF. 3. Reading mode: Numeric.	ESC-r
Serial I/O Interface	1. Disabled. 2. ASCII format with CR (Carriage Return) as terminator character. 3. Local display of input data: OFF. 4. Echo to serial device: OFF. 5. Multifield operation: OFF. 6. Parity: NONE. 7. Transmission speed: 2400 baud. 8. Handshake: NONE.	ESC-s
3077A Time Reporting Terminal	1. Enabled. 2. Set in buffered mode. 3. Time display set to 12 hour clock. 4. Green "READY" light: OFF. 5. Red "WAIT" light: ON. 6. Remains in "WAIT" mode until it receives time from the computer.	ESC-t ESC-d

APPENDIX C

HOLLERITH, IMAGE AND NUMERIC CODES

C-1 HOLLERITH CODING (Multifunction Reader)

One character may be coded per column in the rows shown in Table C-1.

Note: Only used with the Multifunction Reader (optical cards and Industry Type III Badges).

Table C-1 Character Coding In Hollerith Mode

ASCII			Hollerith Coding (Rows)
Dec.	Oct.	Char.	
0	000	NUL	9-8-1-0-12
1	001	SOH	9-1-12
2	002	STX	9-2-12
3	003	ETX	9-3-12
4	004	EOT	9-7
5	005	ENQ	9-8-5-0
6	006	ACK	9-8-6-0
7	007	BEL	9-8-7-0
8	010	BS	9-6-11
9	011	HT	9-5-12
10	012	LF	9-5-0
11	013	VT	9-8-3-12
12	014	FF	9-8-4-12
13	015	CR	9-8-5-12
14	016	SO	9-8-6-12
15	017	SI	9-8-7-12
16	020	DLE	9-8-1-11-12
17	021	DC1	9-1-11
18	022	DC2	9-2-11
19	023	DC3	9-3-11
20	024	DC4	9-8-4
21	025	NAK	9-8-5
22	026	SYN	9-2
23	027	ETB	9-6-0
24	030	CAN	9-8-11
25	031	EM	9-8-1-11
26	032	SUB	9-8-7
27	033	ESC	9-7-0
28	034	FS	9-8-4-11
29	035	GS	9-8-5-11
30	036	RS	9-8-6-11
31	037	US	9-8-7-11

Non-displayable ASCII control characters

ASCII			Hollerith Coding (Rows)
Dec.	Oct.	Char.	
32	040	SP	(Blank)
33	041	!	8-7-12
34	042	"	8-7
35	043	#	8-3
36	044	$	8-3-11
37	045	%	8-4-0
38	046	&	12
39	047	'	8-5
40	050	(	8-5-12
41	051	)	8-5-11
42	052	*	8-4-11
43	053	+	8-6-12
44	054	,	8-3-0
45	055	-	11
46	056	.	8-3-12
47	057	/	1-0
48	060	0	0
49	061	1	1
50	062	2	2
51	063	3	3
52	064	4	4
53	065	5	5
54	066	6	6
55	067	7	7
56	070	8	8
57	071	9	9
58	072	:	8-2
59	073	;	8-6-11
60	074	<	8-4-12
61	075	=	8-6
62	076	>	8-6-0
63	077	?	8-7-0

ASCII			Hollerith Coding (Rows)
Dec.	Oct.	Char.	
64	100	@	8-4
65	101	A	1-12
66	102	B	2-12
67	103	C	3-12
68	104	D	4-12
69	105	E	5-12
70	106	F	6-12
71	107	G	7-12
72	110	H	8-12
73	111	I	9-12
74	112	J	1-11
75	113	K	2-11
76	114	L	3-11
77	115	M	4-11
78	116	N	5-11
79	117	O	6-11
80	120	P	7-11
81	121	Q	8-11
82	122	R	9-11
83	123	S	2-0
84	124	T	3-0
85	125	U	4-0
86	126	V	5-0
87	127	W	6-0
88	130	X	7-0
89	131	Y	8-0
90	132	Z	9-0
91	133	[	8-2-12
92	134	\	8-2-0
93	135	]	8-2-11
94	136	↑	8-7-11
95	137	←	8-5-0

ASCII			Hollerith Coding (Rows)
Dec.	Oct.	Char.	
96	140	`	8-1
97	141	a	1-0-12
98	142	b	2-0-12
99	143	c	3-0-12
100	144	d	4-0-12
101	145	e	5-0-12
102	146	f	6-0-12
103	147	g	7-0-12
104	150	h	8-0-12
105	151	i	9-0-12
106	152	j	1-11-12
107	153	k	2-11-12
108	154	l	3-11-12
109	155	m	4-11-12
110	156	n	5-11-12
111	157	o	6-11-12
112	160	p	7-11-12
113	161	q	8-11-12
114	162	r	9-11-12
115	163	s	2-0-11
116	164	t	3-0-11
117	165	u	4-0-11
118	166	v	5-0-11
119	167	w	6-0-11
120	170	x	7-0-11
121	171	y	8-0-11
122	172	z	9-0-11
123	173	{	0-12
124	174	|	11-12
125	175	}	0-11
126	176	~	1-0-11
127	177	DEL	9-7-12

Displayable ASCII characters

Note: DEL (octal 177) is also an ASCII control character.

C-2 12-BIT IMAGE CODING (Multifunction Reader)

When 12 rows (in each column) are to be encoded in Image mode, any of the 64 displayable ASCII characters from space (SP) to underscore (←) may be directly encoded. Each character has two possible locations, depending on where the character is positioned (rows 9 to 4 or rows 3 to 12).

Note: Only used with the Multifunction Reader (marked cards and Industry Type III Badges).

Table C-2 Character Coding In 12-Bit Image Mode

ASCII			12 Row Image Coding	
Decimal	Octal	Character	Rows 9 to 4	Rows 3 to 12
32	040	SP	4	12
33	041	!	9-4	3-12
34	042	"	8-4	2-12
35	043	#	9-8-4	3-2-12
36	044	$	7-4	1-12
37	045	%	9-7-4	3-1-12
38	046	&	8-7-4	2-1-12
39	047	'	9-8-7-4	3-2-1-12
40	050	(	6-4	0-12
41	051	)	9-6-4	3-0-12
42	052	*	8-6-4	2-0-12
43	053	+	9-8-6-4	3-2-0-12
44	054	,	7-6-4	1-0-12
45	055	-	9-7-6-4	3-1-0-12
46	056	.	8-7-6-4	2-1-0-12
47	057	/	9-8-7-6-4	3-2-1-0-12
48	060	0	5-4	11-12
49	061	1	9-5-4	3-11-12
50	062	2	8-5-4	2-11-12
51	063	3	9-8-5-4	3-2-11-12
52	064	4	7-5-4	1-11-12
53	065	5	9-7-5-4	3-1-11-12
54	066	6	8-7-5-4	2-1-11-12
55	067	7	9-8-7-5-4	3-2-1-11-12
56	070	8	6-5-4	0-11-12
57	071	9	9-6-5-4	3-0-11-12
58	072	:	8-6-5-4	2-0-11-12
59	073	;	9-8-6-5-4	3-2-0-11-12
60	074	<	7-6-5-4	1-0-11-12
61	075	=	9-7-6-5-4	3-1-0-11-12
62	076	>	8-7-6-5-4	2-1-0-11-12
63	077	?	9-8-7-6-5-4	3-2-1-0-11-12
64	100	@	(Blank)	(Blank)
65	101	A	9	3
66	102	B	8	2
67	103	C	9-8	3-2
68	104	D	7	1
69	105	E	9-7	3-1
70	106	F	8-7	2-1
71	107	G	9-8-7	3-2-1
72	110	H	6	0
73	111	I	9-6	3-0
74	112	J	8-6	2-0
75	113	K	9-8-6	3-2-0
76	114	L	7-6	1-0
77	115	M	9-7-6	3-1-0
78	116	N	8-7-6	2-1-0
79	117	O	9-8-7-6	3-2-1-0
80	120	P	5	11
81	121	Q	9-5	3-11
82	122	R	8-5	2-11
83	123	S	9-8-5	3-2-11
84	124	T	7-5	1-11
85	125	U	9-7-5	3-1-11
86	126	V	8-7-5	2-1-11
87	127	W	9-8-7-5	3-2-1-11
88	130	X	6-5	0-11
89	131	Y	9-6-5	3-0-11
90	132	Z	8-6-5	2-0-11
91	133	[	9-8-6-5	3-2-0-11
92	134	\	7-6-5	1-0-11
93	135	]	9-7-6-5	3-1-0-11
94	136	↑	8-7-6-5	2-1-0-11
95	137	←	9-8-7-6-5	3-2-1-0-11

Displayable ASCII characters

C-3 NUMERIC CODING (Type V Badge Reader)

One digit (0 thru 9) may be coded per column, as shown in Table C-3.

Note: Only used with the Type V Badge Reader.

C-4 10-BIT IMAGE CODING (Type V Badge Reader)

When 10 rows (in each column) are to be encoded in Image mode, any of the 32 displayable ASCII characters from @ to underscore (←) may be directly encoded. Each character has two possible locations, depending on where the character is positioned (rows 9 to 5 or rows 4 to 0).

Note: Only used with the Type V Badge Reader.

Table C-3 Character Coding In Numeric Mode

ASCII			Numeric Coding (Row)
Decimal	Octal	Character	
48	060	0	0
49	061	1	1
50	062	2	2
51	063	3	3
52	064	4	4
53	065	5	5
54	066	6	6
55	067	7	7
56	070	8	8
57	071	9	9

Table C-4 Character Coding In 10-Bit Image Mode

ASCII			10 Row Image Coding	
Decimal	Octal	Character	Rows 9 to 5	Rows 4 to 0
64	100	@	(Blank)	(Blank)
65	101	A	9	4
66	102	B	8	3
67	103	C	9-8	4-3
68	104	D	7	2
69	105	E	9-7	4-2
70	106	F	8-7	3-2
71	107	G	9-8-7	4-3-2
72	110	H	6	1
73	111	I	9-6	4-1
74	112	J	8-6	3-1
75	113	K	9-8-6	4-3-1
76	114	L	7-6	2-1
77	115	M	9-7-6	4-2-1
78	116	N	8-7-6	3-2-1
79	117	O	9-8-7-6	4-3-2-1
80	120	P	5	0
81	121	Q	9-5	4-0
82	122	R	8-5	3-0
83	123	S	9-8-5	4-3-0
84	124	T	7-5	2-0
85	125	U	9-7-5	4-2-0
86	126	V	8-7-5	3-2-0
87	127	W	9-8-7-5	4-3-2-0
88	130	X	6-5	1-0
89	131	Y	9-6-5	4-1-0
90	132	Z	8-6-5	3-1-0
91	133	[	9-8-6-5	4-3-1-0
92	134	\	7-6-5	2-1-0
93	135	]	9-7-6-5	4-2-1-0
94	136	↑	8-7-6-5	3-2-1-0
95	137	←	9-8-7-6-5	4-3-2-1-0

APPENDIX D

RS232C CONNECTIONS

The signals for the terminal rear panel 30-pin RS232C data communications connector (for connections to the computer) shown in figure D-1 are listed in Table D-1.

Note: In Table D-1:
1) DCC = Daisy-Chained connections.
2) FDL = Factory Data Link connections.
3) PTP = Point-to-point connections.
4) DCC/PTP = Point-To-Point connection or first terminal of Daisy-Chained connection.

A list of all the RS232C signals is given in Table D-2.

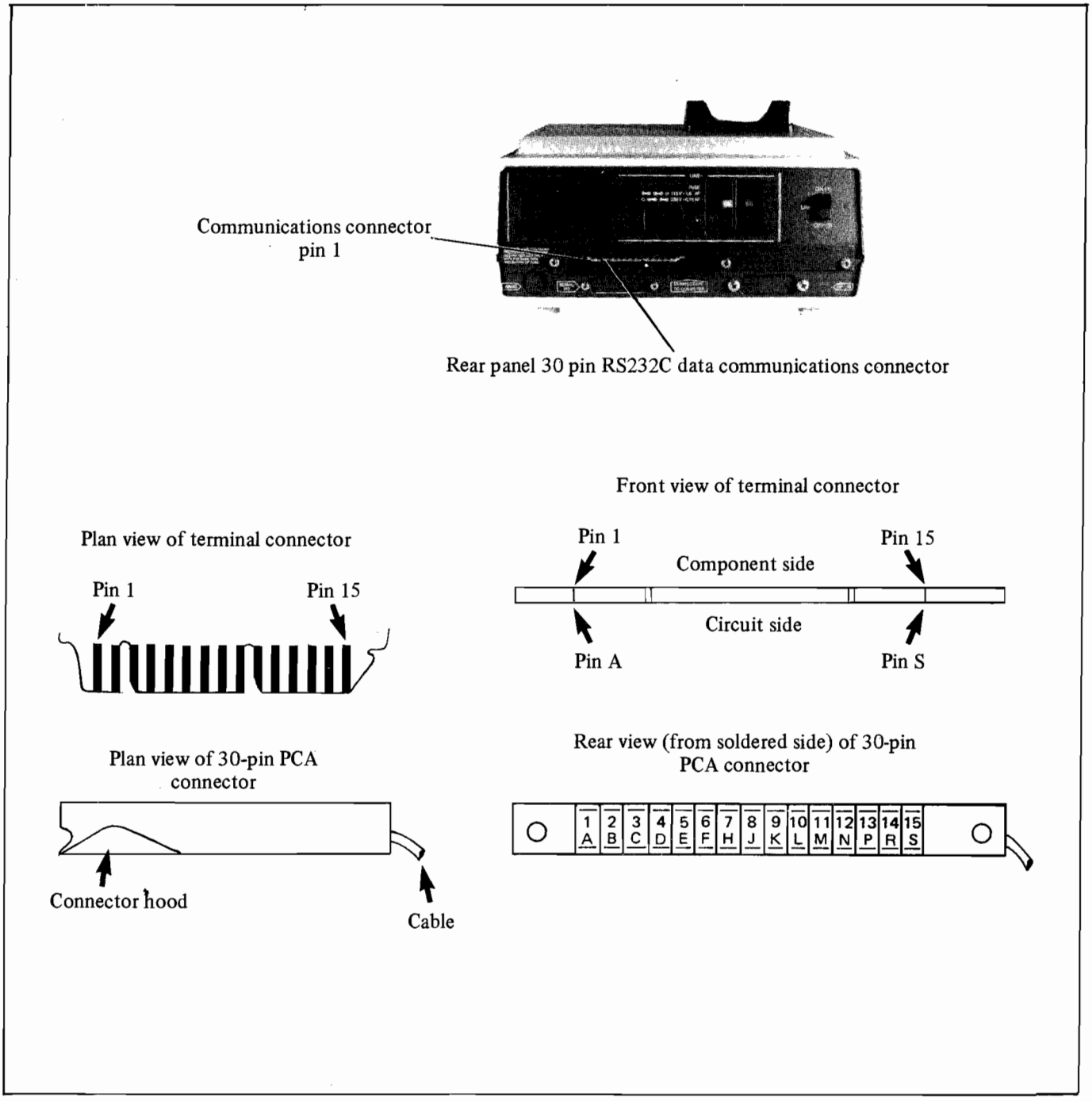


Figure D-1 3075A/3076A/3077A Rear Panel 30-Pin RS232C Data Communications Connector

Table D-1 3075A/3076A/3077A Rear Panel 30-Pin RS232C Data Connector Signals

Component Side				Circuit (Solder) Side			
Pin	Signal	Description	Connection	Pin	Signal	Description	Connection
1	+BAO	Transmitted Data Output	DCC	A	Shield	Frame ground	–
2	–BAO			B	BA	Transmitted Data	DCC/PTP
3	+BAI	Transmitted Data Input	DCC	C	BB	Received Data	DCC/PTP
4	–BAI			D	CA	Request To Send	DCC/PTP
5	CAO	Request To Send Output	DCC	E	CB	Clear To Send	DCC/PTP
6	CBO	Clear To Send Ouptut	DCC	F	CC	Data Set Ready	DCC/PTP
7	+CAI	Request To Send Input	DCC	H	AB	Signal ground	–
8	–CAI			J	CF	Received Line Signal Detector	DCC/PTP
9	+CBI	Clear To Send Input	DCC	K	+BBI	Received Data	DCC
10	–CBI			L	–BBI	Received Data	DCC
11	–BBO	Received Data Output	DCC	M	Relay	92904A cradle relay	–
12	+	Received Data	FDL	N		NOT USED	–
13	–			P	CD	Data Terminal Ready	DCC/PTP
14		NOT USED	–	R	CH	Data Rate Selector	DCC/PTP
15	+BBO	Received Data Output	DCC	S	Shield	FDL Shield	FDL

Table D-2 RS232C Data And Control Signal Description

Signal	Description	Modem		Ground	Data	Control	Timing
		To	From				
AA	Protective Ground			X			
AB	Signal Ground (Common Return)			X			
BA	Transmitted Data	X			X		
BB	Receive Data		X		X		
CA	Request To Send	X				X	
CB	Clear To Send		X			X	
CC	Data Set Ready		X			X	
CD	Data Terminal Ready	X				X	
CE	Ring Indicator		X			X	
CF	Received Line Signal Detector		X			X	
CG	Signal Quality Detector	X				X	
CH	Data Rate Selector (DTE Source)	X				X	
CI	Data Rate Selector (DCE Source)		X			X	
DA	Transmitter Timing (DTE Source)	X					X
DB	Transmitter Timing (DCE Source)		X				X
DD	Receiver Timing		X				X
SBA	Secondary Transmitted Data	X			X		
SBB	Secondary Received Data		X		X		
SCA	Secondary Request To Send	X				X	
SCB	Secondary Clear To Send		X			X	
SCF	Secondary Received Line Detector		X			X	

APPENDIX E

MULTITERMINAL GID/DID ADDRESSES

Terminals on a communications line are arranged in groups, and each terminal on the same line has a unique address consisting of two parts: a group identifier (GID) and a device identifier (DID). Addresses are set on configuration switches on the terminal rear panel as shown in figure E-1.

The characters that can be used are @, A through Z. This allows for 27 groups of up to 27 addresses in each group.

The terminal address characters are listed in Table E-1. The characters in column 1 are used for:
- group and device identity in polling sequences
- device identity in select sequences
- identity return address accompanying data from terminal to computer after a successfull poll.

The characters in column 2 are used for group identities in select sequences.

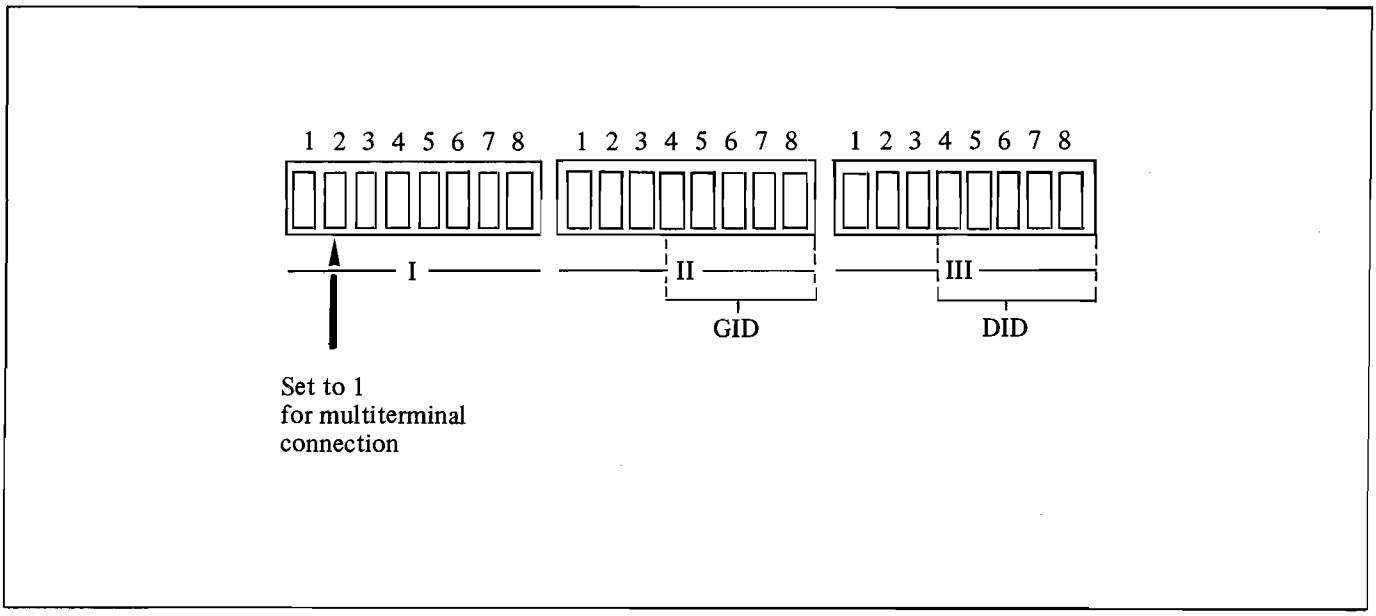


Figure E-1 Terminal GID and DID Address Switches

Table E-1 Terminal Address Characters

	COLUMN 1 Upper case characters used for Group and Device Identity: * Device ID for Poll or Select. * Group ID for Poll * ID return addresses			COLUMN 2 Corresponding lower case characters used to indicate Group Identity for Select.		
Group or Device Number	ASCII Character	ASCII Hexadecimal	ASCII Octal	ASCII Character	ASCII Hexadecimal	ASCII Octal
0	@	40	100		60	140
1	A	41	101	a	61	141
2	B	42	102	b	62	142
3	C	43	103	c	63	143
4	D	44	104	d	64	144
5	E	45	105	e	65	145
6	F	46	106	f	66	146
7	G	47	107	g	67	147
8	H	48	110	h	68	150
9	I	49	111	i	69	151
10	J	4A	112	j	6A	152
11	K	4B	113	k	6B	153
12	L	4C	114	l	6C	154
13	M	4D	115	m	6D	155
14	N	4E	116	n	6E	156
15	O	4F	117	o	6F	157
16	P	50	120	p	70	160
17	Q	51	121	q	71	161
18	R	52	122	r	72	162
19	S	53	123	s	73	163
20	T	54	124	t	74	164
21	U	55	125	u	75	165
22	V	56	126	v	76	166
23	W	57	127	w	77	167
24	X	58	130	x	78	170
25	Y	59	131	y	79	171
26	Z	5A	132	z	7A	172

APPENDIX F

TERMINAL CONFIGURATION SWITCHES

F-1 TERMINAL CONFIGURATION SWITCH SETTING

The rear panel terminal configuration switches depicted in figure F-1 may be set to configure the terminal (3075A/3076A/3077A) as described in Table F-1.

Note: For further details on the functions of these switches refer to section 16-9.

Table F-1 Terminal Configuration Switch Settings

Switch	Setting
I-1	On-line/self test - local operation. 0: On-line (normal setting) 1: Self test/local operation - self operation with standard test: switches I-1 to 1 and I-2 to 0 - communications test: switches I-1 to 1 and I-2 to 1
I-2	Communications mode. 0: Point-to-point 1: Multiterminal
I-3, 4	Parity Switches 3 | 4 — Parity 0 | 1 or 0 — no parity (8-bit binary transfer) 1 | 0 — even 1 | 1 — none
I-5	Data communications connection 0: Standard RS232C connection (point-to-point or daisy-chained) 1: Factory data link
I-6, 7, 8	Baud rate Switches 6 | 7 | 8 — Baud 0 | 0 | 0 — 9600 0 | 0 | 1 — 4800 0 | 1 | 0 — 2400 0 | 1 | 1 — 1200 1 | 0 | 0 — 600 1 | 0 | 1 — 300 1 | 1 | 0 — 150 1 | 1 | 1 — 110

Table F-1 Terminal Configuration Switch Settings (Continued)

<table>
<tr><th rowspan="2">Switch</th><th colspan="2">If switch I-2 is set to</th></tr>
<tr><th>0
Point-to-point settings</th><th>1
Multiterminal settings</th></tr>
<tr><td>II-1</td><td colspan="2">Alpha keyboard function
0: alpha (DELETE key ≡ backspace*)
1: SFK's (DELETE key ≡ delete last entry*) } Use of Shift key reverses keyboard function
* on standard keyboard, DELETE key is defined by switch II-1 as:
0: backspace
1: delete last entry</td></tr>
<tr><td>II-2</td><td colspan="2">Printing orientation (3076A only)
1: same as 3075A orientation
0: inverted</td></tr>
<tr><td>II-3</td><td>Point-to-point delete last entry character generated by DELETE key
0: C_{AN} (octal 030)
1: D_{EL} (octal 177)</td><td>Multiterminal computer originated character to action terminal delete last entry operation
0: C_{AN} (octal 030)
1: D_{EL} (octal 177)</td></tr>
<tr><td>II-4</td><td>Terminal break
0: D_{LE} (octal 020) sent
1: 100 ms drop on data line</td><td rowspan="5">II-4 to II-8 define GID (Group Identifier)

Switches / Switches / Switches
45678 char. | 45678 char. | 45678 char.
00000 @ | 01001 I | 10010 R
00001 A | 01010 J | 10011 S
00010 B | 01011 K | 10100 T
00011 C | 01100 L | 10101 U
00100 D | 01101 M | 10110 V
00101 E | 01110 N | 10111 W
00110 F | 01111 O | 11000 X
00111 G | 10000 P | 11001 Y
01000 H | 10001 Q | 11010 Z</td></tr>
<tr><td>II-5</td><td>Local echo of keyboard data
0: echo off
1: echo on</td></tr>
<tr><td>II-6</td><td>THE (Transmit Handshake Enable)
0: THE enabled
1: THE disabled</td></tr>
<tr><td>II-7</td><td>Handshake technique
0: E_{NQ}/A_{CK} handshake
1: X-ON/X-OFF plus D_{C1} plus E_{NQ}/A_{CK} handshake</td></tr>
<tr><td>II-8</td><td>Terminator character
0: Carriage Return (octal 015)
1: Customized Terminator (see switches III-2 to III-8)</td></tr>
<tr><td>III-1</td><td colspan="2">0: FTZ disabled
1: FTZ enabled } German FTZ requirement for use with modems. If required, set on the first terminal after the modem.</td></tr>
<tr><td>III-2</td><td rowspan="3">III-2 to III-8 represent binary image of input terminator chosen (see switch II-8). For details see section 2-2.</td><td>0: transparency on (binary transfer)
1: transparency off</td></tr>
<tr><td>III-3</td><td>Not used</td></tr>
<tr><td>III-4 to III-8</td><td>III-4 to III-8 define DID (Device Identifier). Same codes as for GID above (see switches II-4 to II-8).</td></tr>
</table>

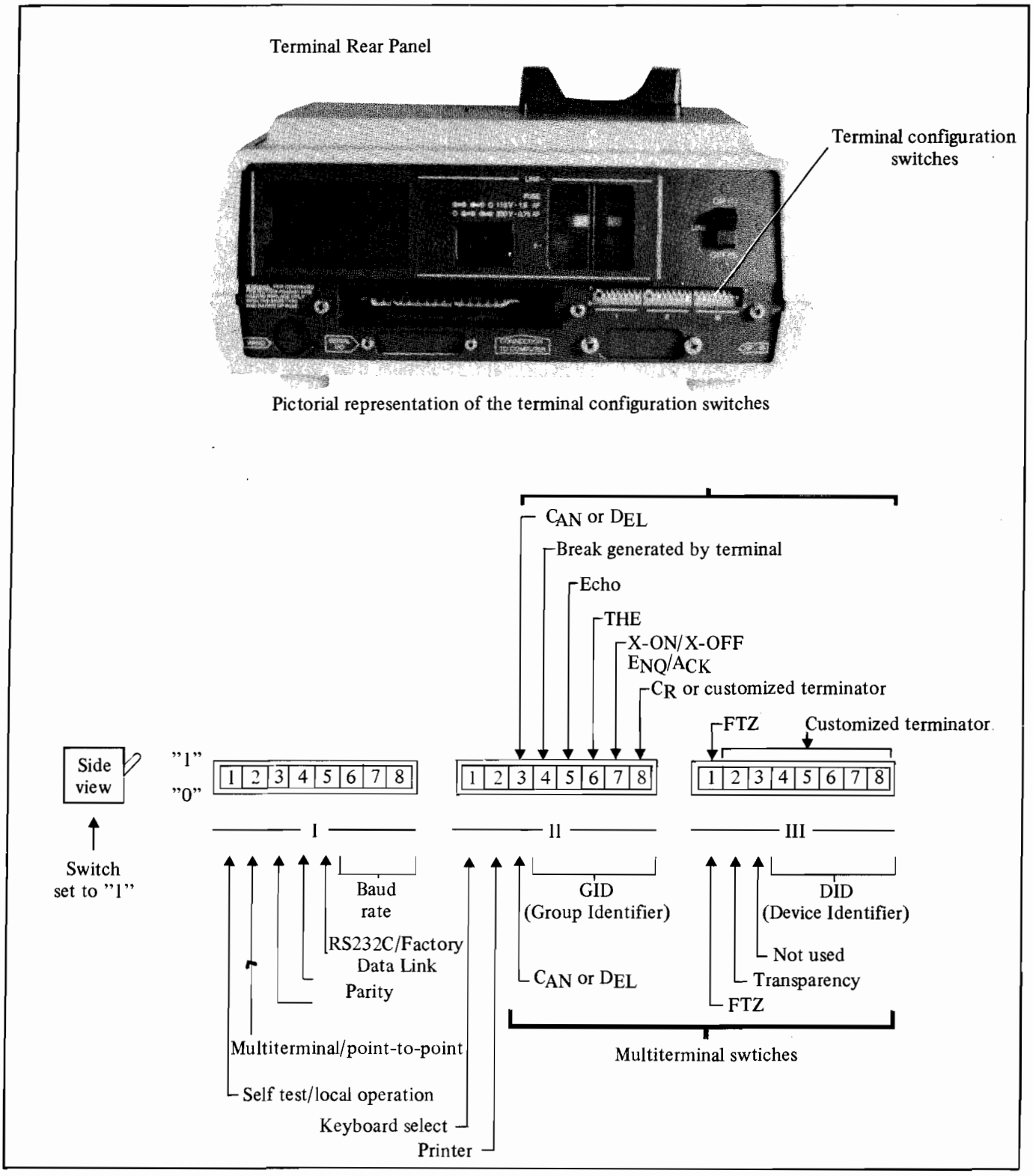


Figure F-1 Rear Panel Terminal Configuration Switches

F-2 SELF TEST/LOCAL OPERATION

Note: For further details refer to sections 16-10 through 16-25.

Internal check

Switch I-1 = 1
Remaining switches = 0

Re-started at power on, or when Attention key pressed. Checks out lights, cradle relay and enables data to be entered via keyboard or any fitted input modules. Data echoed on display (CRT) and output modules. Any escape sequence can be entered using the Multifunction Reader (punched card at power-on). Large character set selected on CRT. HP-IB local programming capability via Alphanumeric Keyboard. Bar Code Reader performs automatic code detection and reads labels as if there were no check digit. Serial Interface is enabled and checks for full handshake. If test connector is fitted on the Serial Interface, double display of entries occurs.

Internal check with Data Communications

Switch I-1, I-2 = 1
Remaining switches = 0
Test connector P/N: 03075-60026 installed

Identical to above test, but data is sent through the communication module.

HP 3077A Time Reporting Check

Selected as for 3075A, 3076A. At power-on, the red and green prompting lights illuminate together with 88:88 shown on the time display. The prompting lights then turn off and after approximately 10 seconds the time display changes to 1.00. The terminal then goes into the data input mode in which the function of all the terminal modules can be checked. When in self test and switch II-1 is set = 1, the terminal expects a test badge to be entered instead of a normal badge.

G-1 GENERAL PROGRAMMING INFORMATION

The terminals are programmed using escape sequences. Two types of sequence are used:

1) Variable length. The sequence may be any length but always has the same format.
   E_{SC}-$\beta N_1 \alpha_1 N_2 \alpha_2 N_3 \alpha_3$ . . . . Nn CAPITALαn
2) Two characters. The sequence has a fixed length that always has the same format: $E_{SC}\alpha$

G-2 GENERAL TERMINAL CONTROL

Status request	E_{SC}^	Ring Bell	BEL (octal 177)
Full Reset	E_{SC}E	Binary Write	E_{SC}-bNW
Modem disconnect	E_{SC}f		(N ≤ 170 bytes)
Remote Self Test	E_{SC}z		

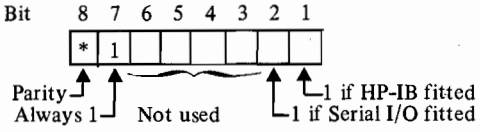
G-3 3075A, 3076A RETURNED TERMINAL STATUS

Six status bytes are returned

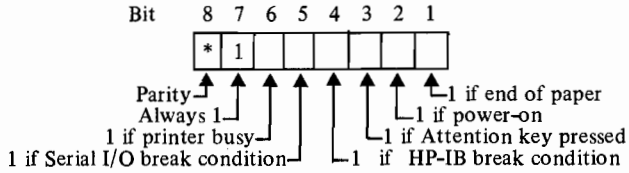
BYTE 1: Escape character E_{SC} (octal 033)

BYTE 2: Electrical Interface Status, either

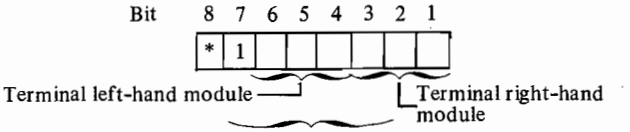
1) No electrical interfaces
   Back slash character (octal 134) or
2) Electrical interfaces fitted



BYTE 3: Interrupt Status

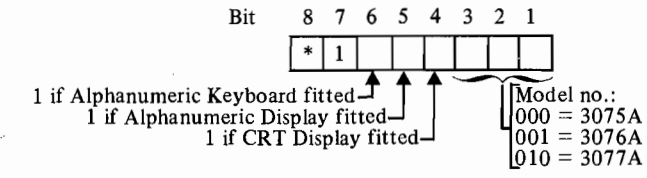


BYTE 4: Terminal Option Configuration



Bits	Module	Bits	Module
000	No options	100	Type V Reader
001	Strip Printer	101	Magnetic Stripe Reader
010	Multifunction Reader	110	Bar Code Reader
011	Electrical Interfaces	111	Not used

BYTE 5: Terminal Type Configuration



BYTE 6: Terminator character, Carriage Return or, in point-to-point, a customized terminator.

**Parity bit*

G-4 3077A RETURNED TERMINAL STATUS

The same as for the 3075A/3076A except that four time ASCII numeric characters (hours, hours, minutes, minutes) are inserted between bytes 2 and 3.

G-5 MODULE ENABLE/DISABLE E_{SC}-$c_0^1\alpha$ 1: enable 0: disable

Module	α
Type V Badge Reader	b/B
Display (one line/CRT)	d/D
HP-IB Interface	h/H
Keyboard	k/K
Magnetic Stripe Reader	m/M
Strip Printer	p/P
Multifunction Reader	r/R
Serial Interface	s/S
Bar Code Wand Reader	w/W
Communication Test	t/T

G-6 KEYBOARD E_{SC}-$k_0^1\alpha$

0: key set as terminator
1: key not set as terminator

Individual key

α:					
	a/A	b/B	c/C	d/D	e/E
f/F	g/G	h/H	i/I	j/J	k/K
l/L	m/M	n/N	o/O	p/P	
q/Q	r/R	s/S	t/T	u/U	
v/V	w/W	x/X	y/Y	z/Z	

Alpha Keyboard

Standard Numeric Keyboard

SFK block on keyboard

All keys set as terminators: α is {/[

PRINT switch override: α is `/@ (where 1 forces the printer on).

G-7 PROMPTING LIGHTS AND CRADLE RELAY E_{SC}-$d_0^1\alpha$

0: turns light OFF
1: turns light ON

Individual light

α:						
	`/@	a/A	b/B	c/C	d/D	e/E
	f/F	g/G	h/H	i/I	j/J	k/K
	l/L	m/M	n/N	o/O	p/P	

Prompting light positions on keyboard

All lights: α is {/[

Cradle relay: α is |/\

G-8 DISPLAY

Function	Control Code		
Clear display	ESC J	one line display	CRT
Backspace	BS (octal 010)		
Delete last entry	DEL (octal 177) or CAN (octal 030)		
Start unprotected field	ESC [		
Blink display	ESC - d {1 0} /]		
Select standard page	SO (octal 016)		
Select large page	SI (octal 017)		
Home up	ESC H		
Cursor ↑	ESC A		
Cursor ↓	ESC B		
Cursor →	ESC C		
Cursor ←	ESC D		
Cursor return	ESC G		
Clear to end of line	ESC K		

G-9 MULTIFUNCTION READER ESC-rNα

		N	α
Marks, Clock-after-data		1	a/A
Holes, Clock-after-data		0	a/A
No clock (holes only)		0	n/N
Hollerith reading		0	i/I
Image reading		1	i/I
Corner cut detection	1 disable	0 enable	c/C
Multifield operation	1 enable	0 disable	m/M

G-10 TYPE V BADGE READER ESC-rNα

	N	α
Numeric reading	0	j/J
Image reading	1	j/J
Multifield operation	0 disable 1 enable	l/L

G-11 MAGNETIC STRIPE READER ESC-mNα

	N	α
Multifield operation	0 disable 1 enable	m/M

G-12 BAR CODE WAND READER ESC-wNα

	N	α
Industrial 2 out of 5	0	b/B
Matrix 2 out of 5	1	b/B
So called code 39	2	b/B
Display of input data	0 disable 1 enable	d/D
Multifield operation		m/M
Check digit		c/C

G-13 SERIAL I/O INTERFACE (RS232C) ESC-sNα

Function		N	α
Speed	9600 baud	0	b/B
	4800 baud	1	b/B
	2400 baud	2	b/B
	1200 baud	3	b/B
	600 baud	4	b/B
	300 baud	5	b/B
	110 baud	6	b/B
	External clock	7	b/B
Parity	No	0	p/P
	Odd	1	p/P
	Even	2	p/P
Terminator	Octal value	0 ≤ N ≤ 99	t/T
Binary read	Byte count	0 < N ≤ 177	w/W
Echo		1 enable 0 disable	e/E
Multifield operation			m/M
Display of input			d/D
Handshake			h/H
Input control			i/I
Ouptut control			o/O

G-14 GENERAL HP-IB CONTROL ESC-h{1 0}α

Function	N	α
Multifield operation	1 enable 0 disable	m/M
Display of input data		d/D
Input control		i/I
Output control		o/O

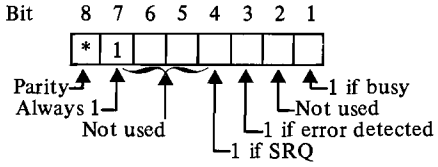
G-15 HP-IB CONTROLLER PRIORITY COMMANDS

Command	Comment
	First letter always upper case H
Full reset HFR	no result is returned
Controller status HPS	result = status bytes

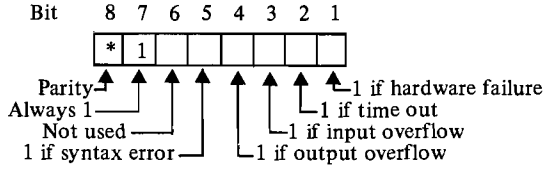
G-16 HP-IB CONTROLLER STATUS

Six status bytes are returned.

BYTE 1: General HP-IB Controller Status



BYTE 3: Error Condition Status



BYTE 2, 4, 5 and 6: not used

APPENDIX G

ESCAPE SEQUENCES

G-17 HP-IB CONTROLLER STANDARD COMMANDS

Command		Comments
		First letter upper case H = Immediate execution First letter lower case h = Linked execution
Communicate	HCO (source;$dest_1$,$dest_n$)	no result is returned
Controller Status	HCS	result = status bytes
Device Clear	HDC (add_1,add_2,--addn)	no result is returned
All Devices Clear	HDC	no result is returned
Device Status	HDS (add_1,add_2,--add_n)	result = 1 status byte per device
Interface Clear	HIC	no result is returned
Clear Lockout	HLC	no result is returned
Set Local Lockout	HLK	no result is returned
Set Local	HLO (add_1,add_2,--add_n)	no result is returned
Set Polling List	HPL (add_1,add_2,--add_n)	no result is returned
Clear Polling List	HPL	no result is returned
Read	HRD (source;$dest_1$,-$dest_n$)	$dest_1$,--$dest_n$ are optional - result is read data
Set Remote	HRE (add_1,add_2,--add_n)	no result is returned
Set Remote Line	HRE	no result is returned
Set Read Terminator	HRT ($char_1$,$char_2$)	$char_2$ optional - no result is returned
Clear Read Terminator	HRT	no result is returned
Serial Poll	HSP	result is byte #1: 0 successful; 1 no SRQ found bytes #2 and #5 Comma character bytes #3 and #4 Address of interrupting device byte #6 Device status byte
Set Time Out	HTO (T)	T = .01 or .1 or 1 or 10 or 100 seconds - no result is returned
No Time Out	HTO	no result is returned
Trigger	HTR (add_1,add_2,--add_n)	no result is returned
Write ASCII	HWR ($dest_1$,--$dest_n$)'MESSAGE'	no result is returned (delimiter characters ! " # $ % ,)
Write Binary*	HWR ($dest_1$,--$dest_n$)X;bytes	X = bytes count ($0 < X \leqslant 170$) - no result is returned
Set Write Terminator	HWT ($char_1$,$char_2$)	$char_2$ optional - no result is returned
Clear Write Terminator	HWT	no result is returned

**For binary, set configuration switches (Appendix F) for transparency (multiterminal) or 8-bit binary (point-to-point).*
Parameters between parentheses can be expressed as:

decimal value of character
% plus octal value of character
! plus hexadecimal value of character

G-18 3077A TIME SETTING Esc-tαcββhγγM

α = 1 for 24 hour clock
α = 0 for 12 hour clock
ββ two digits for hours
γγ two digits for minutes

G-19 3077A GENERAL FUNCTIONS Esc-tNα

Function	N	α
Operating Mode	1 = Interactive	b/B
	0 = Buffered	b/B
Loud Buzzer	1 enabled for 1 second	a/A

G-20 3077A PROMPTING LIGHTS AND CRADLE RELAY Esc-$d^{!}_{0}$α

Function		α
Green light		g/G
Red light		r/R
Cradle Relay	(octal 164/134)	|/\

G-21 WRU (WHO ARE YOU?)

Terminal response to WRU (multiterminal only) is the same as 3075A/3076A status bytes 4, 5 and 6.

INDEX

INDEX (CONTINUED)

REFERENCE MATERIAL

HP 3075A/3076A/3077A TERMINALS

A Guide To Data Capture.
HP 3075A/3076A/3077A Data Capture Terminals Data sheet.
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HP 92907A Technical Reference Package.

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HP 1640A Serial Data Analyzer Operating Manual.

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HP 2645A CRT TERMINAL

HP 2645A Terminal User's Manual.

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91730A Multipoint Terminal Interface Subsystem User's Guide (HP part number 91730-90002).

HP 3000 FACTORY DATA LINK/DAISY-CHAIN SOFTWARE

MTS/3000 Multipoint Terminal Software Reference Manual (HP part number 32193-90002).

STANDARDS (ANSI/ISO/IBM/IEEE)

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2. USA Standard rectangular holes in twelve-row punched cards (USAS X3.-21 1967).
3. International Standards Organisation ISO recommendation R1683-Dimensions and location of punched holes in 80 column punched cards (180/R 1682-1971).

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American National Standard concerning Optical Character Recognition (OCR), ANSI X3.17-1974.

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1. American National Standards specification for credit cards (ANSI X4. 13-1971).
2. International Standards Organisation specification ISO 2894.

Plastic magnetic badge (magnetic stripe).

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