7. Select the B element position and enter on the REFERENCE NUMBER thumbwheels the register which is the location of the SOURCE data. Press any ELEMENT TYPE pushbutton. The REFERENCE DISPLAY will show the register that has been entered.
8. Select the C element position and enter on the REFERENCE NUMBER thumbwheels the FUNCTION CODE. Press any ELEMENT TYPE pushbutton. The REFERENCE DISPLAY will show the code that has been entered.
9. Select D element position and enter on REFERENCE NUMBER thumbwheels the register which is the DESTINATION of the data.
10. Press any ELEMENT TYPE pushbuttons. The REFERENCE DISPLAY will show the register that has been entered.
11. If the DISABLE pushbutton is lit, and not specifically desired, press it to turn it OFF.

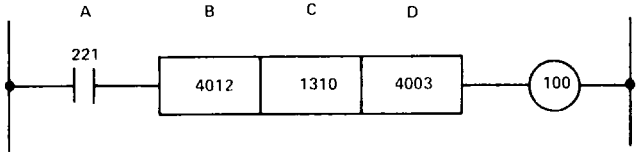

Figure 89. Data Transfer (Move) Line

1. Set Line Number switches to 0100.
2. Press DATA TRANSFER pushbutton.
3. Press A element pushbutton.
4. Set REFERENCE NUMBER switches to 0221.
5. Press Normally-Open Series ELEMENT TYPE pushbutton.
6. Press B element pushbutton.
7. Set REFERENCE NUMBER switches to 4012. Press any ELEMENT TYPE pushbutton.
8. Repeat steps 6 and 7 for the C element (1310), and D element (4003).
9. If the DISABLE Light is lit, and not specifically desired, press it to turn it OFF.

3.6 P500 PRINTER/D285 DISPLAY UNIT

3.6.1 Introduction

The P500 Printer (see Figure 90) is an industrial-environment hardcopy printer designed to provide data on the plant floor. It is capable of printing out management information such as number of parts produced, up times, efficiencies, recipe contents, etc.; or operator information such as error messages, batch completed notation, manual operations required, etc. The P500 Printer is not designed to document the user's program with ladder diagrams; this support is available from the Service Center (see 4.2.2).

The paper used in the P500 is pressure sensitive; thus the printer does not require carbon paper or ink and the associated maintenance problems. The paper is 3½ inches wide, each page approximately 5½ inches long— a convenient size to place in shirt pockets. Each page can contain up to 20 lines, each line 21 characters (see Figure 91). A summary of P500 specifications are provided in Table 15.

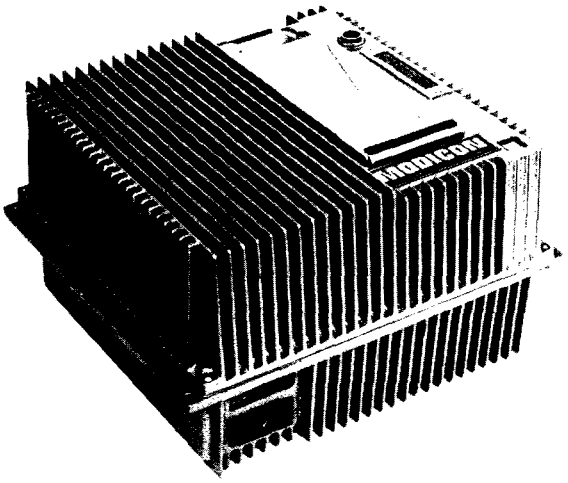

Figure 90. Programmable Printer

```
                SAMPLE

387621  14  783  9342


  DOWN  TIME  REPORT


PARTS  THIS  SHIFT  5673
EFFICIENCY     92.9%


STATUS  OF  MACHINE  617
   SEQUENCE  COMPLETE


FAILURE  OF  CARRIAGE
TO  ELEVATE  DURING
LOAD

CHECK  I/O  R  LIGHTS


CHARACTER  SET

ABCDEFGHIJKLMNOPQRSTU
VWXYZ  0123456789  ¢\>(
-:"£$%@'()*+^_./:;<=>
?
```

Figure 91. Sample Printout

Table 15. P500 Printer Specifications

Power Requirements	115 Vac ± 20%, 60 Hz (Standard) 115 Vac ± 20%, 50 Hz (Optional) 250 Volt-amps
Environmental:	
Ambient Temperature Humidity	0°C to 60°C 10% to 70% (non-condensing)
Dimensions:	19 in. x 11 in. x 17½ in.
Weight:	60 lb. (approx.)
Read-Only Memory:	108 lines of stored messages; each line contains 21 characters
Print Speed:	2 lines per second
Paper:	3½ in. wide, pressure-sensitive, fan-fold: 20 lines per page; approx. 1600 pages per box
Control I/O Level:	115 Vac or 24 Vdc
I/O Cable (supplied with P500):	25-wire, standard 12-feet long (Type W500)
Optional -Interfaces:	Parallel BCD or ASCII Serial, EIA RS-232C compatible
Model Variations:	P500-100 (115 Vac I/O, 60 Hz power) P500-200 (115 Vac I/O, 50 Hz power) P500-300 (24 Vdc I/O, 60 Hz power) P500-400 (24 Vdc I/O, 50 Hz power)
Mounting:	Standard horizontal (table-top) or optional vertical (wall-mounting)

Within the printer is a Programmable Read-Only Memory (PROM). This PROM is capable of storing 108 lines of preformatted alpha-numeric messages. These messages are programmed in accordance with the user's specification provided at the time of manufacture. The PROM can be changed by the MODICON factory. Changes are made on an exchange basis; a new message sheet is provided to MODICON, and a revised PROM (either just one chip or the entire memory) is sent to the customer. After installation, the old memory must be returned to the factory for reuse.

The P500 Printer is a general-purpose industrial unit capable of being driven from a computer, relay panel, or another controller as well as the MODICON 184/384 Controller if properly interfaced. When connected to the 184/384 Controller, the overhead control required to establish and store messages awaiting servicing by the printer, as well as providing numerical data to the printer, is all automatically handled by the DX Print capabilities.

Up to 16 printers can be connected to one 184/384 controller through the I/O and any number of logic lines can be used to drive separate messages to these printers. One printer is serviced at a time with messages in the real-time order they were energized within the Controller. Each printer connected to a 184/384 Controller requires an output register to provide data and commands to the printer, and two individual inputs to accept signals (Busy and Form Busy) from the printer. All data provided to the printer requires a positive response from the printer before another command or number is provided. This technique requires communication both ways and is called "handshaking" between the Controller and the printer.

The printer requires 115 Vac power locally to drive the print head, paper advance, DC power supply, etc., in addition to a 25-wire cable to connect to controller I/O. The AC power can be either 50 or 60 Hz and the I/O can be either 115 Vac or 24 Vdc, thus there are four models of printer available (see Table 15).

Table 16. Standard Character Set

A	Q	5	+
B	R	6	'
C	S	7	—
D	T	8	.
E	U	9	/
F	V		:
G	W	!	;
H	X	"	<
I	Y		=
J	Z	$	>
K		%	?
L	0	&	†
M	1	'	[
N	2	(	\
O	3	)	]
P	4	*	

Control Codes

Eb End of Block — indicates end of message to be printed.

Ff Form Feed — advance paper to next page; will always be executed prior to printing line in which Ff is located, regardless of Ff location in line.

Lf Line Feed — prints blank line; must be first character of a blank line in the PROM; nothing else can be programmed into this blank line.

Vd Variable Data — blanks to be filled in by data from the controller; one digit per blank.

The D285 Display Unit provides CRT display of messages using exactly the same handshaking as the P500 Printer. Any 184 or 384 controller that communicates to a P500 Printer can also control the D285 Display Unit.

3.6.2 Formatting Messages

Each printer's PROM is loaded with messages in accordance with each customer's requirements. Table 16 is a list of characters available with the standard P500. Each of the 108 lines (numbered 0 to 107 in the PROM) has space for 21 characters; Figure 92 provides a sample form completed to indicate a portion of one customer's requirements. Figure 93 shows sample forms that can be used to specify the contents of the printer PROM.

All print commands are originated within the Controller by Data Transfer (DX) logic lines. When these commands specify a message stored within the printer's PROM, they utilize the first line of the message as the identification for that message. The printer begins at the line specified and will continue printing until an End-of-Block (Eb) character is detected, which terminates the print of that message. All 21 characters in a line are printed simultaneously.

The location of the Eb characters is determined by the customer when completing the PROM specification (Figure 93); they are used to combine lines forming messages of multiple lines in length. Since only lines 0 to 99 are individually addressable, line 100 through 107 are used as a single continuation of a message that began earlier. Thus, typically, the longest message is placed at the end of the PROM to make maximum use of these continuation lines.

Message Address	COLUMNS 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	
72																						P
73																						R
74																						O
75																						M
76																						
77																						6
78																						
79																						
80																						
81																						
82																						
83																						
84																						
85																						
86																						
87			P	R	O	D	U	C	T	I	O	N		S	U	M	M	A	R	Y		P
88				Vd	Vd	Vd	Vd		Vd	Vd	Vd	Vd		1	9	7	4					R
89				T	I	M	E		Vd	Vd	Vd	Vd	H	Vd	Vd	Vd	Vd	Vd	M	I	N	O
90				S	H	I	F	T		N	O		Vd									M
91	Lf																					
92	M	A	C	H	I	N	E		N	O		Vd	Vd									7
93	P	A	R	T	S		T	H	I	S		S	H	I	F	T		Vd	Vd	Vd	Vd	
94	E	F	F	I	C	I	E	N	C	Y		%			Vd	Vd		Vd	Vd		Eb	
95																						
96																						
97	Ff			D	O	W	N	T	I	M	E		S	U	M	M	A	R	Y			
98	T	Y	P	E			O	C	C	U	R			M	I	N	U	T	E	S		
99													C	U	M			W	A	I	T	P
100	T		C	H	G			Vd	Vd	Vd	Vd		Vd	Vd	Vd	Vd		Vd	Vd	Vd	Vd	R
101	M	-	R	E	P			Vd	Vd	Vd	Vd		Vd	Vd	Vd	Vd		Vd	Vd	Vd	Vd	O
102	E	L	E	C				Vd	Vd	Vd	Vd		Vd	Vd	Vd	Vd		Vd	Vd	Vd	Vd	M
103	L	O	A	D				Vd	Vd	Vd	Vd		Vd	Vd	Vd	Vd		Vd	Vd	Vd	Vd	
104	U	N	L	O	A	D		Vd	Vd	Vd	Vd		Vd	Vd	Vd	Vd		Vd	Vd	Vd	Vd	8
105								-	-	-	-		-	-	-	-				-		
106	T	O	T	A	L	S		Vd	Vd	Vd	Vd		Vd	Vd	Vd	Vd		Vd	Vd	Vd	Vd	
107	Ff	Eb																				

Figure 92. Sample P500 PROM Specification

Message Address	COLUMNS	
00		PROM 0
01		
02		
03		
04		
05		
06		
07		
08		
09		
10		
11		
12		PROM 1
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		PROM 2
25		
26		
27		
28		
29		
30		
31		
32		
33		
34		
35		

Figure 93. Blanks for Specifying P500 PROM Messages

Message Address	COLUMNS	
36		PROM 3
37		
38		
39		
40		
41		
42		
43		
44		
45		
46		
47		
48		PROM 4
49		
50		
51		
52		
53		
54		
55		
56		
57		
58		
59		
60		PROM 5
61		
62		
63		
64		
65		
66		
67		
68		
69		
70		
71		

Figure 93. Blanks for Specifying P500 PROM Messages (Cont)

Message Address	COLUMNS	
72		PROM 6
73		
74		
75		
76		
77		
78		
79		
80		
81		
82		
83		
84		PROM 7
85		
86		
87		
88		
89		
90		
91		
92		
93		
94		
95		
96		PROM 8
97		
98		
99		
N/A		
N/A		
N/A		
N/A		
N/A		
N/A		
N/A		

Figure 93. Blanks for Specifying P500 PROM Messages (Cont)

In many applications, blanks are required in the message format where numerical data from the Controller's memory is to be placed. These blanks are indicated by a special character called Variable Data (Vd) and can be used to indicate where the number of parts produced, efficiencies, up times, machine identification for diagnostics, etc., are to be printed. The location of these blanks are again per the customer's specifications (Figure 93). When the printer detects a Vd character, it requests the numerical digit (0-9) from the Controller. The Controller obtains the numerical data from registers specified in the DX print command.

Since the high-order digit (thousands digit) is provided to the printer first, most variable data blanks are left in groups of four (one register's content) to prevent restructuring of the data prior to transmission to the printer. For example, assume a blank is left for a machine number whose magnitude will be 1 to 20 (two digits maximum) and a blank is only two digits wide. If a counter is providing the machine number, the magnitude 0001 through 0020 is available in a register. However, when this register is used to fill in the blanks, the first two characters will always be zero, since the thousands and hundreds digits from the register are utilized first. This problem can be solved by either leaving four blanks so that the entire register's content is printed, or to count by hundreds with a calculate line in lieu of units as a counter does.

Two other special codes are available. The first is Line Feed (Lf), which causes a blank line to be printed (a line is skipped); Lf must be the first character of a blank line in the PROM. No other characters such as Eb, Ff, A, B, C, 3, 4, or another Lf can follow this first character. The second is a Form Feed (Ff), which causes the paper to be advanced to the top of the next page *prior* to printing the line in which Ff appears. Ff can be used to start a message on the top of a new page or force the paper up for removal after a message has been printed. Ff can occur at any character location in line; it is still executed prior to that line being printed.

All control codes occupy only one character of the 21 characters in a line, although it requires two letters to specify each code. Codes Eb, Lf, and Ff are replaced by blanks when the line is actually printed.

3.6.3 Programming DX Lines

This section applies to the Data Transfer Print capability available with some 184 MOPS 3 level execitives; see Table 12 for a list of MOPS 3 executives that provide print capabilities. All 384 controllers have DX print capabilities. These DX lines provide a simple method of outputting alpha-numeric data via the P500 Printer from the Controller. The general form of a DX line is still applicable (see Figure 70).

The A element, when closed, activates the print line and places the message in the print queue; this element has to be closed for only one scan. If the A element is cycled ON-OFF-ON while that particular print line is still in the queue (not completed at the printer), the second command will be ignored. If the A element remains closed, no additional commands will be generated when the print is complete; the A element must be cycled OFF-ON to enter a second print command after the previous print is completed.

The B element is a register, either holding or input, in which is placed the data to be printed if variable data is required by the print command. If more than four characters are required, the registers following the B element register will be used in sequence until sufficient characters are obtained.

NOTE

Characters are taken from the high-order digit first.

The C element is the DX code starting with the digit 4 (4YXX type); each code is discussed later in this section. The D element is *the* output register to which the printer is connected.

NOTE

Output registers programmed in the D element of a DX print line will automatically be permanently coded binary in the I/O Allocation Table, unless the Table is modified (see 4.1.4).

The coil on DX print lines will be energized as soon as the A element is closed (print command entered into the queue) and remains ON until the message is completed at the printer. The status of the coil is not affected by the condition of the A element, only by the status of the message in this print queue. Data in the B element table should be loaded prior to closing the A element, and not changed until the coil is de-energized. The following are discussions of the specific DX print codes available.

40PL — Print Numerical Data

NOTE

The Numerical Print capability is useful to print out report data in columns with the 41XX code providing the title and headings of the report. Do not waste PROM storage to specify format of purely numerical data.

This code causes only numerical data stored within the Controller to be printed in a specific format when the A element contact is closed. The B element register is the source of the data to be printed; if more than four digits are required by the format specified, successive registers will be utilized until the required data has been obtained. Data is supplied to the printer with the most-significant digits first.

The data format is specified in the functional code by the characters PL; P for page definition, and L for line content — see Table 17. The register in the D element identifies which output register the printer is connected to. The coil will be energized when the print line is activated and remain energized until the data is printed. As an example, see Figure 94.

Assume registers 4032-4035 contain the values 1234, 5678, 9012, and 3456, respectively. When input 1132 is energized, the printer will print one line of data and then one line feed (per page format 1 of Table 17); the line will contain four registers of data (per line format 4 of Table 17). The coil will be energized and remain ON until the print is accomplished regardless of the status of the A element contact; additional print commands of this line, while the coil is energized, will be ignored. If the data in the storage registers is changed after the A element is closed, but prior to the print being completed, the revised data may or may not be printed. Note that the B element register refers to four registers, depending on the page and line format specified in the functional code. The D element register refers only to itself.

41XX Print Specified Stored Message

NOTE

The Stored Message print capability is useful to provide report data or messages to the operator.

This code causes a message contained within the printer to be printed on closure of the A element contact. The B element register contains the numerical data (if any) to be printed in locations specified by the code Vd (variable data) in the message format; if more than four digits are required, the next register immediately after the B element register will be used. Data will be utilized with the most-significant digit first. Thus, if only one Vd code is placed in the message, the thousands digit of the register will be used. To simplify programming, whenever possible, blanks in the message should be designed as four digits in length.

The message number to be printed is specified by the last two digits (XX) of the functional code; these messages can be 00 to 99 inclusive. The message to be printed will begin at the line number specified (XX) and continue until an end-of-block (Eb) code is reached within the PROM. The D element register is the output register to which the printer is connected. The coil will remain ON until the complete message has been printed.

Table 17. P500 Printer Data Format

40PL

P = Page Format:

- 0 = Print 1 line
- 1 = Print 1 line, line feed
- 2 = 12 Line feeds, print 1 line, Form feed
- 3 = 11 lines, print 2 lines, Form feed
- 4 = 10 Line feeds, print 3 lines, Form feed
- 5 = 9 Line feeds, print 4 lines, Form feed
- 6 = 10 Line feeds, print 1 line, Line feed, print 1 line, Form feed
- 7 = 8 Line feeds, print 2 lines, Line feed, print 2 lines, Form feed

L = Line Format:

- 1 = XXXX
- 2 = XXXX XXXX
- 3 = XXXX XXXX XXXX
- 4 = XXXX XXXX XXXX XXXX
- 5 = XXXXXXXX XXXX
- 6 = XXXXXXXX XXXXXXXX

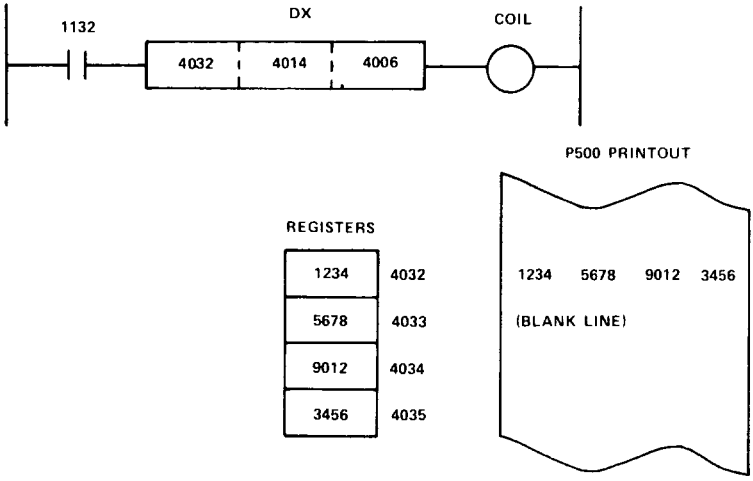

Figure 94. Sample Fixed Format Print

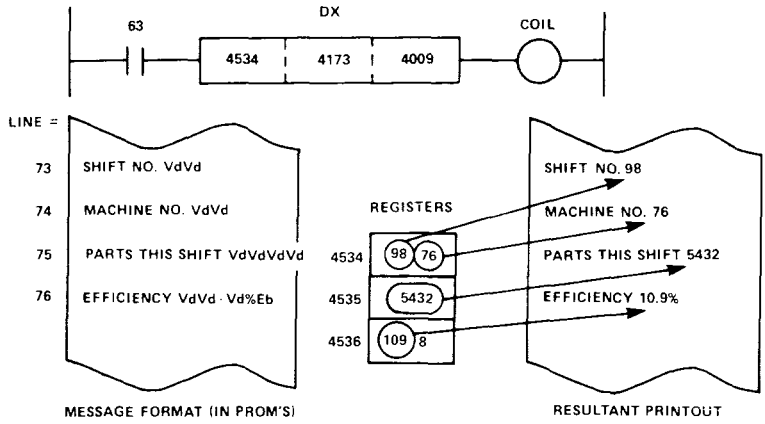

Figure 95. Sample PROM Format Print

As an example, refer to Figure 95. If registers 4534-4536 contain the data specified, when logic line 63 comes ON, message 73 will be printed with variable data blanks replaced by the contents of these registers. The coil will be ON until the message is actually printed out. If another line specified printing message 74, the printout will begin with line 74 (Machine No.) and continue to line 76. If logic line 63 remains ON at the completion of message 73, a second printing will NOT be commanded.

Note that the B element register refers to as many sequential registers as necessary to complete the variable data required by the message specified by the functional code and that the D element register refers only to itself.

4200 — Print Variable Stored Message

NOTE

The Variable Message Print capability is useful to print out error messages calculated by the Controller or messages whose addresses vary (e.g., dates printed out).

This code causes a message number contained in the B element register to be printed on the closure of the A element contact. This code operates very similar to the 41XX functional code previously discussed, except that the B element register contains, in the two least-significant digits, the message to be printed. Variable data, if any, will be obtained from the registers immediately following the B element register.

For example, assume Figure 95 contained, in the B and C elements of the logic line, the register 4533 and the functional code 4200, respectively. If register 4533 contained the value YY73 (where YY are ignored), message 73 will be printed with the data obtained from registers 4534 through 4536. By utilizing this instruction, the Controller can calculate and control both the message number and variable data to be printed.

NOTE

Procedures for entering Data Transfer lines, including DX Print lines, are provided in Section 3.5.4.

3.6.4 Connecting Printer to 184/384 Controller

Each printer connected to a Controller requires an output register and two single inputs (discrete or register) to provide communications both ways. The connections are made via a 25-wire cable (type W500, standard length 12 feet). This cable is plugged into the printer and has each of its wires on

the opposite end (Controller end) labeled with a number from 1 to 25. Table 18 summarizes the functions and connections for these wires when used with the 184/384 Controller.

The Busy and Form Busy signals are very important since they are the only method the printer has of communicating to the Controller. Whenever the printer is busy performing a function (manual paper advance, printing numbers, printing messages, etc.), the Busy signal is ON. When the printer is using its PROM for formatted messages, the Form Busy signal is ON.

If numerical data is required by the printer to complete its format (e.g., variable data blanks detected in the PROM), the Form Feed remains ON and the Busy is turned OFF.

Table 18. Printer Output Register Connections

Wire No.	Function	Printer Pin	B230 or B232 Terminal	
1	Form Select 00	A	11	NOTE: On B230 Output Module only, add jumpers between terminals 2 & 7, 7 & 12, and 12 & 17. Apply power to terminals 1 & 2 as indicated. Terminal 14 is NOT connected. Output will always be Hi for B230 only.
2	Form Select 01	B	10	
3	Form Select 02	C	9	
4	Form Select 03	D	8	
5	Form Select 04	E	6	
6	Form Select 05	F	5	
7	Form Select 06	H	4	
8	Form Select 07	J	3	
9	Space	K	20	
10	Motor Turn ON	L	15	
11	Print	M	21	
12	Load Buffer	N	16	
13	Start Form	R	18	
14	Form Feed	S	19	
25	Clear	P	13	
			B230	**B232**
23	115 Vac Hot/24 Vdc Hi (+)	EE/BB	2	1
24	115 Vac Neut/24 Vdc Rtn (−)	HH/CC	1	2
18	Busy	u	Connect to B231 or B233 Input Module. See Figures 96-98.	
19	Form Busy	v		
15	BCD/ASCII	T	Unconnected or connect to neutral/return for BCD; connect to Hi for ASCII.	
16	Orientation	U	Unconnected or connect to neutral/return for normal printing; connect to Hi for inverted printing.	
17	Paper Out	t	Remote indication of paper out.	
20	Motor ON	w	Remote indication of motor ON.	
21	DC Power ON	x	Remote indication of dc power ON.	
22	Bell	y	Drives external bell when Printer receives bell character.	

When the character is accepted by the printer, the Busy is turned ON. If additional characters are required, the printer cycles the Busy signal OFF-ON-OFF as many times as necessary, transferring one character at a time to the printer until the format is completed. Characters are transmitted at the rate of one character every two scans of the Controller.

3.6.5 D285 Connections and Programming

The D285 CRT Display Unit connects via a W280 cable and requires one output module and two input circuits. The connections are very similar to the P500 Printer and are shown in Table 18A. There are four models of D285 Display Unit offering a variety of power sources (50 or 60 Hz) and I/O voltage levels (115V or 24 Vdc). As an option, this display unit can be equipped with an I/O device section which includes: one 4-digit thumbwheels, one 4-digit LED display, three 24 Vdc lamps, two pushbuttons, one snap switch, and one key lock switch. These devices are wired into the controller's I/O section via two W280 cables (see Table 18A for connections), separately from the W280 cable that drives the CRT.

Within the D285 display unit, messages can be stored in PROM loaded by the factory. These messages are similar to the P500 PROM messages, except they are 64 characters wide. Up to 32K ASCII characters can be stored within the D285 memory depending upon model number ordered (minimum 8K memory providing 7K ASCII characters); addressing is provided for 496 unique messages (numbered 1 to 496). Messages can be of any length, limited only by amount of memory available; messages do not have to be one "line" long nor do they have to be even increments of 64 ASCII characters. Special characters are available to control message format and are used as follows:

Eb End of Block — indicates end of message to be displayed

Ff Form Feed — clears bottom of screen (ignored when used with 40PL DX code)

Lf Line Feed — displays a blank line for each line feed encountered

Vd Variable Data — blanks to be filled in by BCD data from the controller; one digit per blank

Bl Blink Text — begins flashing all characters until Sb or Eb is encountered; replaced by a space when displayed

Sb Stop Blink — stops flashing message characters; no effect if not already flashing. Replaced by a space when displayed.

Ts Top of Screen — place message at top of screen and begin schrolling down. Normal entry is at bottom schrolling up.

Tb Blink Top — place message at top of screen and begin flashing.

The 12" CRT screen provides excellent clearity to view messages up to ten feet away. Up to 16 lines, each of 64 characters, can be displayed at one time. Messages can be entered at the bottom and schrolled up or at the top and schrolled down. As an option, an ASCII port can be added to provide the messages to another device (such as ASCII compatible line printer, remote CRT, or magnetic tape recorder) as they are placed on the CRT screen. The controller can select messages for CRT screen only or for both CRT and optional device. When this option is selected, user must specify baud rate and ASCII type (RS-232 or 20 ma loop) at time of order.

Table 18A. D285 Connections Via W280 Cables

Connector Pin	Wire Color	Functions: D285 Control Cable	I/O Option Cables: Upper	I/O Option Cables: Lower
A	Wht/Blk/Grn	Load Buffer	TW BCD 1	Display BCD 1
B	Wht/Blk/Yel	Start Form	TW BCD 2	Display BCD 2
C	Wht/Blk/Orn	Clear	TW BCD 4	Display BCD 4
D	Wht/Blk/Red	SPARE	TW BCD 8	Display BCD 8
E	Wht/Blk/Brn	Space	TW BCD 10	Display BCD 10
F	Wht/Blk/Blk	Print	TW BCD 20	Display BCD 20
G	Wht/Gray	Form Feed	TW BCD 40	Display BCD 40
H	Wht/Violet	Hard Copy	TW BCD 80	Display BCD 80
J	Wht/Blue	Form Select 07	TW BCD 100	Display BCD 100
K	Wht/Green	Form Select 06	TW BCD 200	Display BCD 200
L	Wht/Yellow	Form Select 05	TW BCD 400	Display BCD 400
M	Wht/Orange	Form Select 04	TW BCD 800	Display BCD 800
N	Wht/Red	Form Select 02	TW BCD 1000	Display BCD 1000
P	Brown	Form Select 01	TW BCD 2000	Display BCD 2000
R	White	Form Select 00	TW BCD 4000	Display BCD 4000
S	Blue	Form Select 03	TW BCD 8000	Display BCD 8000
–	Wht/Brown	SPARE	SPARE	SPARE
T	Wht/Black	Form Busy	NO S4 Key Switch PB	Lamp #2
U	Gray	Busy	NO S1 Pushbutton	Lamp #3
V	Violet	Positive/Hi Voltage	NO S2 Pushbutton	Lamp #1
W	Green	Negative/Low Voltage	NC S3 Snap Switch	+24 Vdc Power
X	Yellow	SPARE	NO S3 Snap Switch	-24 Vdc Power
Y	Orange	SPARE	SPARE	Lamp Common
Z	Red	SPARE	SPARE	SPARE

The D285 Display Unit is controlled exactly as the P500 Printer is controlled via DX codes 40PL, 41XX, and 4200. Any controller capable of communicating to a P500 Printer is also capable of controlling the D285; no changes to the controller's hardware or executive program is required. There are only two exceptions unique to the D285 operation. When using DX codes 40PL, all Form Feed (Ff) executions will be ignored by the D285. This prevents the fixed format code from entering numerical data and then clearing the CRT screen, in lieu of advancing the P500's paper. As a maximum, only 21 of the 64 available characters in a D285 CRT line will be utilized by the fixed format DX code.

The second change is message addressing. D285 messages numbers 1-99 are used exactly as the P500 message are via either DX codes 41XX (XX = message number 01 to 99) or DX code 4200. To address messages above 99 (i.e. 100 — 496, since the D285 has 496 messages versus the P500's 100 message capacity), message zero is used as a converter. Within the D285, message zero can not be altered by the user and always has the form: Vd Vd Vd Vd. The content of these four blanks must be filled in by the controller with the message address (0001 — 0496) to be displayed.

For example, DX code 4100 will cause message zero to be addressed. The content of whatever register is entered into the B element of this logic line (all four BCD digits) will now be used as the message to be displayed. If this content is greater than 496 or not assigned within the PROM memory, the D285 Display Unit will display the message "ILLEGAL MESSAGE ADDRESSED". Another method of addressing messages above 99, is to use DX code 4200. The content of the B element register, two least significant digits only (units and tens) are made zero(XX00). The next register in sequence is assumed to contain the four digit address of the message to be displayed.

Other than the fixed format form feed and addressing messages above 99, all other features of DX Printing apply. Messages can be queued up in as many logic lines as necessary. They are serviced basically in logic line numerical order. Variable Data (Vd) will be filled in by BCD digits (0 — 9) from the register specified in the B element of the DX logic lines. All commands to the D285 require an active and positive response from the Display Unit, thus a two-way handshaking is employed. Busy, Form Busy, and Abort inputs must be programmed as discussed in paragraph 3.6.6 to insure proper handshaking capabilities.

If the ASCII port option is selected, to inhibit providing ASCII information to this port, pin H of the W280 cable is connected to a high voltage source. This can be controlled either by the appropriate type output module, or an external switch, or the output module driving the D285. The output module that provides commands and data to the D285 has one spare circuit that can be used via a DX Matrix (bit 10) set/clear operation if this capability is available. Otherwise, any single output circuit of the proper voltage can be used.

See Appendix A for further details on the D285 Display Unit.

3.6.6 Programming Busy, Form Busy, and Abort Inputs

The Busy and Form Busy signals from the printer can be connected to any convenient inputs of the proper voltage, either discrete or register inputs. To inform the Controller of which inputs were selected, special programming must be provided at the end of the ladder diagram. Counting back from the last line of the program (Watchdog Timer line), the WDT-4 coil must reflect

the printer's Busy signal, the WDT-3 the Form Busy signal, and the WDT-2 an optional Abort signal generated by the user. Table 19 summarizes the line assignments for these functions with executives of various length.

The Abort signal, when energized, will cause the current message being printed to be aborted and the next message in the queue utilized. Since the Abort signal only works on the OFF-ON transition of the abort coil, if more than one message is being aborted, this coil will be cycled OFF-ON-OFF-ON, (WDT references) as many times as there are messages to be aborted. If the Abort is not used, the WDT-2 line should contain null data to prevent its coil from being energized.

Table 19. Line Assignments for Printer Control Functions

Program Length	Busy	Form Busy	Abort
432	428	429	430
496	492	493	494
512	508	509	510
608	604	605	606

If the Busy, Form Busy, and Abort signals are connected to discrete inputs, Figure 96 illustrates one method of programming the WDT-4 through WDT-2 lines. Whenever the printer is busy, the input signal to the Controller

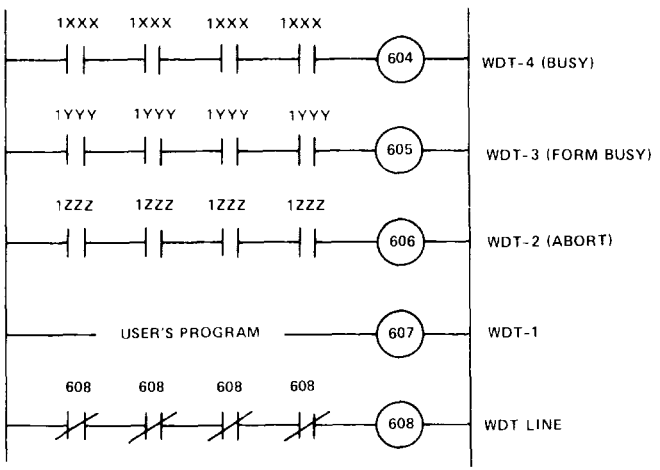

Figure 96. Typical Printer Control Lines using Discrete Inputs

(wire 18 of Table 18) is turned ON, input 1XXX to which this wire is connected becomes energized, and coil 604 is energized. Coil 604 will thus copy the Busy status of the printer via input 1XXX, which can be any discrete input to the Controller. A similar analysis can be performed for the Form Busy (1YYY) and Abort (1ZZZ) signals.

If the Busy, Form Busy, and Abort signals are connected to register inputs, a number of methods can be used to program the WDT-4 through WDT-2 lines. If matrix capabilities are available, the method in Figure 97 can be used. The three sense lines energize their coils only if the bits in the input registers (3014 and 3008) representing Busy, Form Busy, and Abort signals, are turned ON. Registers 4XXX, 4YYY, and 4ZZZ contain the bit numbers to which the Busy, Form Busy, and Abort signals are connected.

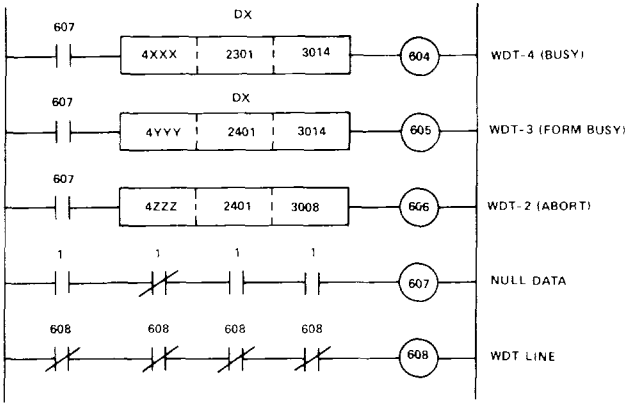

Figure 97. Typical Printer Control Lines using Matrix Register Inputs

If matrix capabilities are not available, subtraction lines similar to those in Figure 98 can be used. As an example, assume the Busy and Form Busy inputs are connected to the one and two lines of the thousands digit of BCD register 3014. The Abort signal is assumed to be a discrete input connected to 1ZZZ. Storage registers 4HHH, 4TTT, 4BBB, and 4MMM contain the values 1000, 2000, 3000, and 4000, respectively; lines 600, 601, 602, and 603 will be ON if, and only if, the contents of register 3014 exceeds or equals the values 1000, 2000, 3000, and 4000 respectively. Thus, the Busy line (604) will be ON if the thousands digit of register 3014 is a one (1) or a three (3) and the Form Busy line (605) will be ON if this digit is a two (2) or three (3).

If more than one printer is connected to the Controller, the Busy and Form Busy signals from each printer should be ORed into WDT-4 and WDT-3 lines. Thus, if any one printer is busy, the WDT-4 coil is energized, and if any printer has its Form Busy ON, the WDT-3 coil is energized. Figure 99 illustrates one method of programming these lines assuming three printers are connected and all inputs are wired to discrete input modules.

3.7 Improved Data Transfer Capabilities (384A)

The following DX functions have been developed and are available as standard features on the 384A and 384B controllers. All of the following functions are provided with these controllers in addition to all the standard DX functions previously discussed. A few 184 executives have been configured with one of these functions; see table 12 for specific details or which functions are available with 184 controllers.