Systems

IBM 3211 Printer and 3811 Control Unit Component Description

This reference publication describes the 3211 Printer and the 3811 Control Unit used on input/output channels provided by processing systems. The manual is designed for those having a basic knowledge of programming and computer operation.

Described are the features, speeds (including formulas), type arrays, carriage operations, suggested error-recovery procedures, programming and operating information, and the IBM 3216 Interchangeable Train Cartridge. The programming information includes details of storage areas, addressing, and the commands and coding for each operation.

For additional information, refer to the Bibliography of the system to which the 3211 Printer is attached.

For additional specifications on forms, refer to the Systems Reference Library manual, *Form-Design Considerations-System Printers,* GA24-3488.

IBM

Preface

Use this manual with the systems manual for the input/output channel associated with the IBM 3211 Printer.

Any of the system's functions that initiate printer operations to the channel are described in the systems manual.

First Edition (June 1970)

Changes are continually made to the information herein; any such changes will be reported in subsequent revisions or Technical Newsletters.

Requests for copies of IBM publications should be made to your IBM representative or to the IBM branch office serving your locality.

This manual has been prepared by the IBM Systems Development Division, Product Publications, Dept. 171, P.O. Box 6, Endicott, N.Y. 13760. A form is provided at the back of this publication for readers' comments. If the form has been removed, comments may be sent to the above-mentioned address.

Contents

Abbreviations

CB	circuit breaker
CCW	Channel Command Word
CE	channel end
Char	character
CPU	Central Processing Unit
CSW	Channel Status Word
DE	device end
EBCDIC	Extended Binary Coded Decimal Interchange Code
ERP	Error Recovery Procedure
FCAR	Forms Control Address Register
FCB	Forms Control Buffer
Hex	hexadecimal
I/O	input/output
L	left
lpm	lines per minute
Min.	minimum
mm	millimeter
ms	millisecond
PBAR	Print Buffer Address Register
PEC	Print Error Check
PL	Print Line
PLB	Print Line Buffer
PLC	Print Line Complete
PSE	Print Scan Emitter
R	Right
SLI	Suppress Length Indication
UCS	Universal Character Set
UCSAR	Universal Character Set Address Register
UCSB	Universal Character Set Buffer
Xfer	Transfer

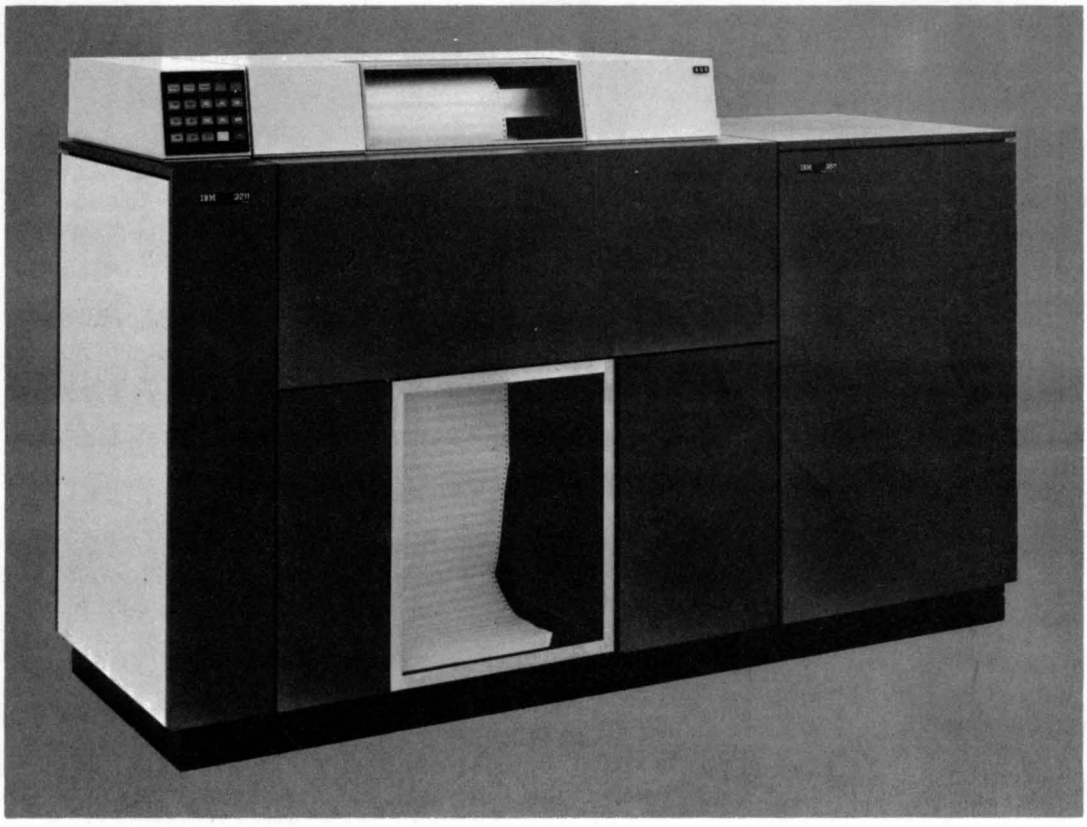


Figure 1. IBM 3211 Printer and 3811 Control Unit

3211 Printer and 3811 Control Unit Component Description

The IBM 3211 Printer (Figure 1) is a high-speed printer with speeds of 2,000 lines per minute, single spacing, using a 48-position character set.

The printer depends upon the 3811 Control Unit and the using system for its operation. The control unit, attached to the 3211 printer, contains the electronic circuitry to adapt the printer to the System/360 I/O channel provided by the processing system. In addition to the high-speed printing, other features of the printer are:

3216 Interchangeable Train Cartridge
Universal Character Set
Program-Controlled Carriage
Power Stacker
Automatic Forms-Thickness Control
Motorized Cover

3216 INTERCHANGEABLE TRAIN CARTRIDGE

The 3216 interchangeable train cartridge contains an endless train of 432 characters. The Extended Binary Coded Decimal Interchange Code (EBCDIC) permits using up to 254 different graphics (alphabetic, numeric, and special characters) on a print train.

UNIVERSAL CHARACTER SET

The universal character set permits optimizing the character arrangement to achieve maximum printing speeds. This feature allows selecting the characters best suited for maximum speed for an application.

PROGRAM-CONTROLLED CARRIAGE

The vertical format for each form is stored in the control unit by the program. Forms movement (spacing and skipping) is initiated by the program in accordance with the commands. Line feeding, 6 or 8 lines per inch, is also controlled by the stored format.

POWER STACKER

The power stacker both advances and stacks the forms for optimum high-speed forms movement according to the thickness of the forms. Stacking is adversely affected by high humidity.

AUTOMATIC FORMS–THICKNESS ADJUSTMENT

The automatic forms-thickness control adjusts the platen for the correct clearance for the forms used. This assures maximum print quality and maintains sufficient clearance for high-speed paper movement.

MOTORIZED COVER

The cover on the printer gives controlled access to the forms transport area. When a forms-check condition (end of form, jam, or stacker full) occurs, the cover automatically rises to alert the operator that attention is required. This cover can also be raised by program control.

Printing Method

The train of type characters moves in front of the print hammers (Figure 2) and successively presents every character to each hammer. The control unit identifies each character as it becomes aligned with each hammer to determine whether or not that character is the one to be printed in that position. When the desired character is in position where it should print, the control unit causes the print hammer to fire. The hammer drives the type against the ribbon, paper, and platen to print the character on the form. The horizontal spacing is ten characters to the inch (25,4 mm).

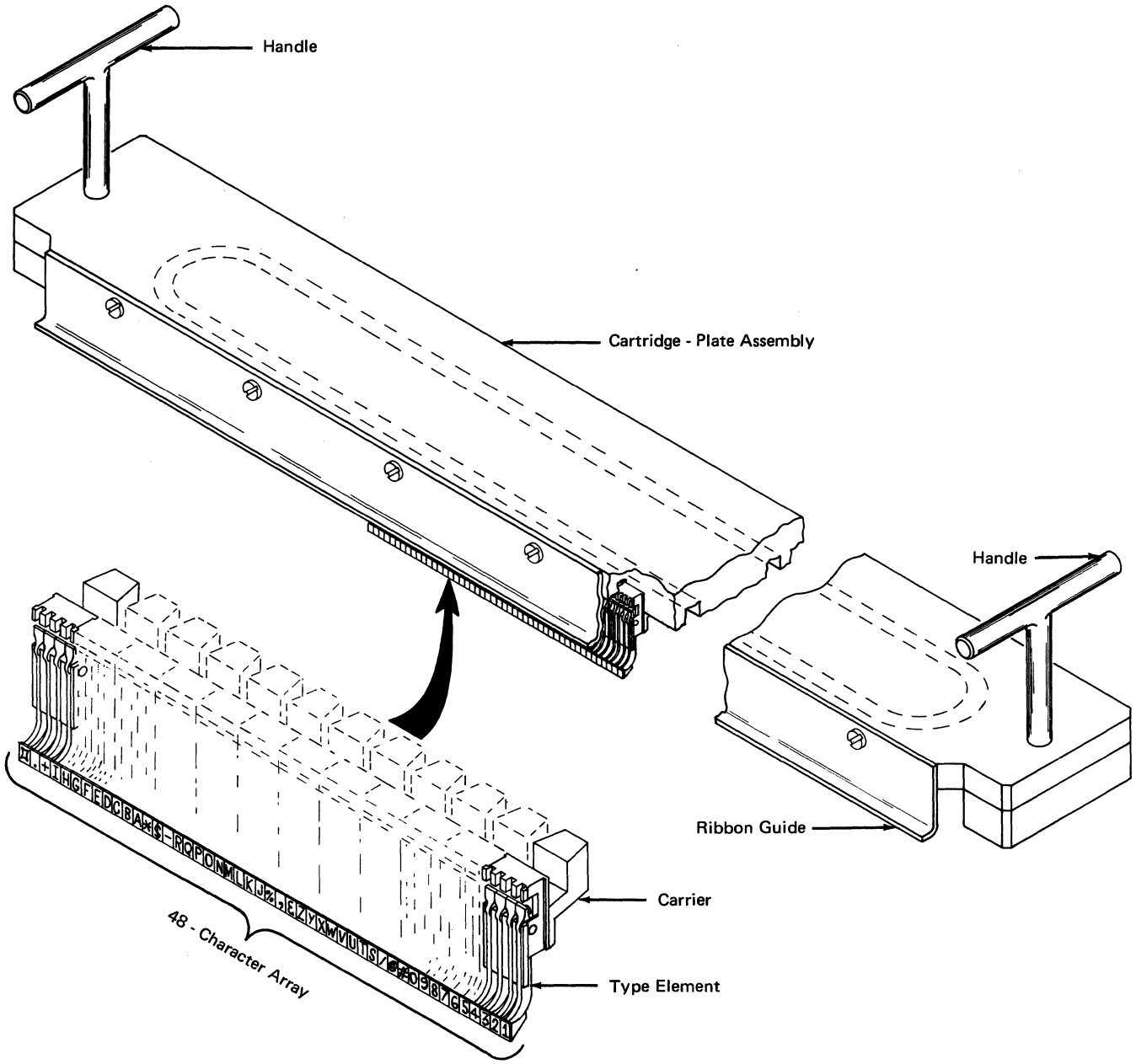


Figure 2. Print Train Schematic (48-Character Set)

Forms and Speed Considerations

The 3211 Printer accommodates marginally punched, continuous forms. Up to four-part forms are recommended. Multi-part forms in excess of either four parts or .020-inch (0,50 mm) thickness should be tested to ensure satisfactory performance. Consult the local IBM sales representative concerning unique multi-part forms that are non-uniform in thickness due to variations in ply widths, spot carbon, envelope carriers, etc.

To provide optimum print quality, an automatic forms-thickness control is provided. The maximum forms thickness, or equivalent, must be exposed to the forms-thickness sensor located about 1 inch (25 mm) above print positions 9 to 11. Thickness variation in the form beyond .003 inch (0,076 mm) can affect print quality and cause machine damage. Horizontal fastenings over .005 inch (0,13 mm) thicker than the sense area should be skipped past the print area.

Multi-part forms, including carbons, should be securely fastened, preferably on both edges. However, if a single-edge fastening method is used, the left edge must be fastened. For additional specifications on forms, refer to the Systems Reference Library manual, *Form-Design Considerations-System Printers,* GA24-3488.

Forms width can range from 3-1/2 to 18-3/4 inches (88,9 to 476,3 mm); form length from 3 to 22.5 inches (76,2 to 571,5 mm) for 8-line-per-inch, or 24 inches (609,6 mm) for 6-line-per-inch spacing. For replenishing forms in a continuous feeding operation, the forms tractors must be cleared and the new form positioned as in initial setup. An indicator establishes the first line of print, because 14 lines must be printed before the first line is visible to the operator. In positioning forms, the swing gate must be opened to move the form backward.

The printing speed depends on the arrangement of the characters within the type array and the number of arrays in the 432-character print train. Optimizing the universal character set permits each application to attain maximum printing speeds depending upon the frequency of the characters in the print train. Speeds up to 2,500 lines per minute with single spacing are possible.

The formula for the print rate (assuming equal distribution of characters) is:

60,000 (0,4427A + 8.75) equals the minimum rate in lines per minute.

Where A=432/f = the length of the array in characters and f is the number of arrays in the train.

The following chart lists the minimum line rates that can be achieved for various train configurations.

*Length of Each Array**	*Number of Repeated Arrays in Train*	*Minimum Print Rate (lpm)***
27	16	2500 (limited)**
36	12	2430
48	9	2000
54	8	1837
72	6	1477
108	4	1060
144	3	827
216	2	574
432	1	300

*An array is a complete group of characters that appears one or more times in the print train. The composition of the array can vary greatly in both the number and kinds of characters. By choosing those characters most frequently used and by eliminating those never used, arrays can be tailored to produce optimum printing speeds. Numeric arrays, for example, with limited alphabetic characters or special symbols, are shorter and repeat more often in the train, resulting in higher printing speeds. Moreover, with the UCS (Universal Character Set) feature, characters need not be represented equally within the array. UCS permits unlimited variations of character arrangements within the train (because the train image is stored in the UCS buffer), again permitting greater frequency of most-used characters with accompanying increases in printing speeds. The 3211 is ideally suited for high-speed printing operations (such as listings) in which extended skips are minimal.

**The minimum printing speeds presented here are worst-case conditions. In actual practice, printing rates exceed these figures, depending on the choice of characters in the train. Repeated sets of fewer than 36 characters are not advisable as the 3211 printer is interlocked so as not to sustain a print rate in excess of 2500 lpm. Both the number of graphics in a set and the repeatability of high-usage characters on the train directly affect the average line rate. When a preferred character set is optimized for a given application, throughput is increased. However, if the same train is used for a job requiring frequent use of graphics that are not repeated as often, the throughput decreases.

*Anticipated Throughput Rate with Special Cartridges**

Train Sets	*Char*	*Array Size*	*Min lpm*	*Expected Scans*	*Expected lpm*
P11	60	108	1060	54.9	1815
G11	64	108	1060	57.0	1765
T11	120	144	827	129.7	906

*Subject to variation depending on the specific application of more than 48 characters per array.

$$\text{Expected lpm} = \frac{60{,}000}{0.4427\ A + 8.75\ \text{ms}}$$

Where A = the number of scans (see table) needed to print a line. The time interval between the presentation of two successive characters to a print position is called scan time.

Note: The throughput rating of a printer is based upon a combined write and Space 1 (09) wherein the data transfer for the new line should be completed during the carriage-space operation. This means that, in order to maintain the compiled rates, the program must load the print line (PL) buffer within the 7.08 ms after device end has occurred.

Print Train Sets

The print train sets (Figure 3) are available in five different arrangements.

Arrangement A 11 (Standard Commercial) consists of 48 graphics in 9 identical arrays.

Arrangement H 11 (Standard Scientific) consists of 48 graphics in 9 identical arrays.

Arrangement G 11 (ASCII) consists of 64 graphics in 4 identical arrays of 108 characters.

Arrangement P 11 (PL 1) consists of 60 graphics in 4 identical arrays of 108 characters.

Arrangement T 11 (Text Printing) consists of 120 graphics in 3 identical arrays or 144 characters.

Note: The print trains using the 48-character set give speeds of 2,000 lines per minute with single spacing; however, the trains that use character arrangements of more than 48 characters per set reduce the speed in proportion to the number of additional characters and the application.

Carriage Performance

The stored-program-controlled carriage of the 3211 printer moves paper at 90 inches per second after initial acceleration. The following chart lists approximate carriage timing for moving forms up to ten (10) line spaces. For forms movement over ten lines, use the formula for calculating the approximate carriage time.

No of Lines	*6 Lines/Inch*	*8 Lines/Inch*
1	8.75 ms	8.75 ms
2	14.4 ms	11.80 ms
3	20.00 ms	16.00 ms
4	25.60 ms	20.20 ms
5	31.20 ms	24.40 ms
6	36.80 ms	28.60 ms
7	42.40 ms	32.80 ms
8	44.50 ms	35.00 ms
9	44.50 ms	35.00 ms
10	45.60 ms	34.00 ms
Over 10	45.6 + 1.86 ms (N-10)	34 + 1.39 ms (N-10)

Note: Limitations on successive carriage command. The time between consecutive carriage immediate commands is carriage time plus 11.5 ms.

A11 (48 Graphics – Standard Commercial)

1234	5678	90#@	/STU	VWXY	Z&,%	JKLM	NOPQ	R-$*	ABCD	EFGH	I+.¤

H11 (48 Graphics – Standard Scientific)

1234	5678	90='	/STU	VWXY	Z&,(	JKLM	NOPQ	R–$*	ABCD	EFGH	I+.)

G11 (64 Graphics – ASCH) Arrangement consists of 4 arrays of 108 characters. Only the first is shown.

0N(C	*K5-	LJDB	'14,	QIMW	3P/7	OU_.	H%FX	<86G	+TY;	29VZ	R#:E
=&AS	)$ 0N	(C* K	5-LJ	DB.1	4,QI	MW3P	/7OU	¦.H"	FX]8	6G[T	Y\29
V>R#	¬E=@	AS)?									

P11 (60 Graphics – PL1) Arrangement consists of 4 arrays of 108 characters. Only on 8

0N(C	*K5-	LJDB	'14,	QIMW	3P/7	OU_.	H%FX	<86G	+TY;	29VZ	R#:E
=&AS	)$0N	(C*K	5-LJ	DB'1	4,QI	MW3P	/7OU	_.H%	FX<8	6G¦T	Y"29
V>R#	¬E=@	AS)?									

T11 (120 Graphics – Text Printing) Arrangement consists of 3 arrays of 144 characters. Only the first is shown.

06<>	aACi	oE8n	OstL	N=.7	F_PS	MdB4	,1c9	rhUu	-¦mp	TIfY	H3GJ
beRg	XQ12	Vy/¯	WK(5	)+w*	Dk$v	06#x	ZA●'	qE8:	⌞ ⌟t⌜	¬&.7	?zjS
%][4	}{ ;9	r²i+	. (@≤	TI⁴¬	³3"⁵	≥eR⁸	⁰±12	°¤≠–	⁹⁷⁶5	–■)*	D+!¢

Note: Trains G11, P11, and T11 have different appearing type assemblies. The reason for this is, a number of representative customer jobs have been analyzed by computer. This analysis tabulated the character usage and developed optimized trains for these character sets.

Figure 3. Type Arrangement for Print Train Sets

Ribbon

The 3211 printer uses a general-purpose ribbon. The ribbon life is reduced the first few months of usage when a new cartridge is installed. This is due to a run-in period on the new type faces.

IBM 3811 Control Unit Operation

The control unit contains controls and storage areas (odd-bit parity) for control signals, printer addressing, command decoding, status and sense information, and data handling.

STORAGE AREAS

Print Line Buffer

Print line buffer (PLB) has 132 print positions for a line of data to be printed. A special feature is available to increase this buffer to 150 positions. Each position contains a data byte and four check bits.

Data Byte

This byte consists of eight bits plus an odd-parity check bit.

Print Line Complete Bit

This bit is set for each position for which a print compare, a blank, or null character occurs. When a print complete bit has been set in every position, the printing of the line is complete.

Print Error Check Bit

This bit is turned on if a parity error is detected in the PLB during loading or printing, or if a print magnet malfunction occurs. The check condition is stored for each buffer position that is in error.

Parity Check Bit

Signifies even parity in the PLB data bits. (*See* "Check Read.")

Universal Character Set Buffer

The universal character set buffer (USCB) has 432 positions of eight (8) bits plus an odd-parity check bit. Each position can contain any one of the printable graphics. Two codes, null (Hex 00) and space (Hex 40), are assigned as space characters.

This buffer is program-loaded from the Central Processing Unit (CPU) by the load UCSB command. The character codes are stored in the same sequence as the characters on the train. During print operations, this buffer is scanned and compared to corresponding characters in the print line buffer.

Forms Control Buffer

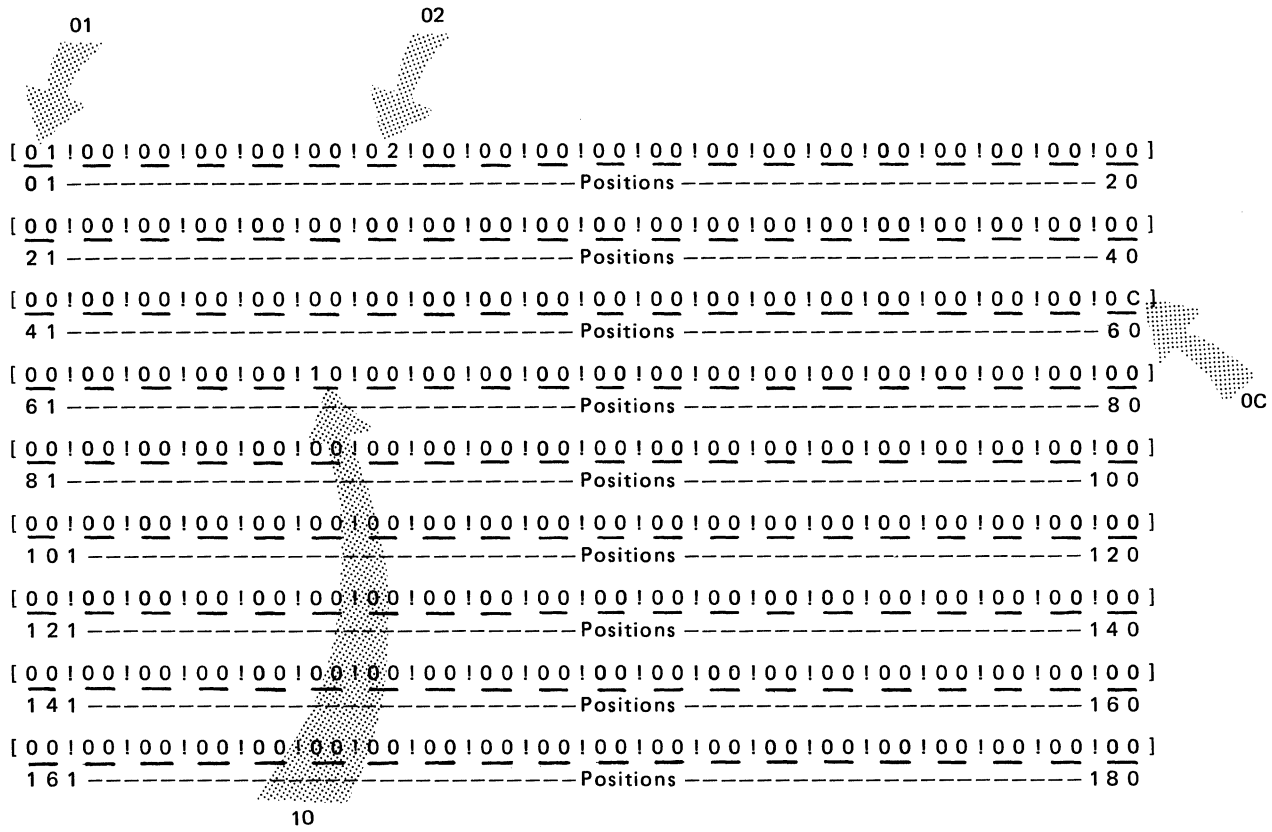
The forms control buffer (FCB) (Figure 4) has 180 positions for storing 12 channel codes. Each position represents a print line. The position corresponding to the last line of the form must contain the end-of-form flag bit.

CHANNEL CODES

The channel codes 1 through 12 (Figure 5) use four bits numerically weighted 1, 2, 4 and 8 for forms positioning.

Flag Bit

The flag bit is in position 3 of the EBCDIC code structure (*see* Figure 4). This bit specifies the spacing of the carriage and the length of the form. A flag bit in the first address position indicates 8-lines-per-inch spacing; no flag bit indicates 6-line-per-inch spacing. A flag bit in the storage position corresponding to the number of lines of the form returns the FCB to the starting position or the first address position for the next form.



Position 1 with Hex 01 indicates channel 1 for the first line of the heading.

Position 7 with Hex 02 indicates channel 2 for the first line in the body form.

Position 60 with Hex 0C indicates channel 12 for the last line of printing.

Position 66 with Hex 10 indicates the end of form with a flag bit.

This illustration shows the coding for an 11-inch form using the channels 1, 2, and 12 with the flag bit for the end-of-form.

Figure 4. Forms-Control Buffer (FCB)-Layout of Form

Channel Codes		
Binary Code	Hex	Channel
0 1 2 3 4 5 6 7	(Position)	
8 4 2 1 8 4 2 1	(Value)	
0 0 0 0 0 0 0 0	0 0	Space (Null)
0 0 0 0 0 0 0 1	0 1	Channel 1
0 0 0 0 0 0 1 0	0 2	Channel 2
0 0 0 0 0 0 1 1	0 3	Channel 3
0 0 0 0 0 1 0 0	0 4	Channel 4
0 0 0 0 0 1 0 1	0 5	Channel 5
0 0 0 0 0 1 1 0	0 6	Channel 6
0 0 0 0 0 1 1 1	0 7	Channel 7
0 0 0 0 1 0 0 0	0 8	Channel 8
0 0 0 0 1 0 0 1	0 9	Channel 9
0 0 0 0 1 0 1 0	0 A	Channel 10
0 0 0 0 1 0 1 1	0 B	Channel 11
0 0 0 0 1 1 0 0	0 C	Channel 12

Figure 5. Channel Code

Parity Bit

A parity bit is added to each channel code having an even-number bit structure.

STORAGE ADDRESSING

Print Buffer Address Register

The print buffer address register (PBAR) can address 132 positions of the print line buffer. With the special feature for increasing the print positions to 150, additional positions are added to the PBAR.

Universal Character Set Address Register

The universal character set address register (UCSAR) sequentially addresses all 432 positions of the universal character set buffer. During the printing operation, this register is synchronized with the print train as the graphic characters are aligned with print position 1.

Forms Control Address Register

The forms control address register (FCAR) addresses 180 positions of the forms control buffer. This register advances until the flag bit indicating the end-of-form is detected.

Channel Operations And Controls

The control unit is connected to the processor by the IBM System/360 I/O interface cable. Signals and commands received from the channel are interpreted and sequenced for executing the printing and spacing operations.

CHANNEL COMMUNICATIONS

The control unit operates on either the selector or multiplexer channel. The program initiates all operations by issuing a Start I/O instruction to the control unit. The first byte in the channel command word (CCW) defines the operation. The operation sequence is: initial selection, data transfer, and ending.

COMMANDS

Figures 6, 7, and 8 show the commands from the processor to the control unit.

Write

The write commands (Figure 6) transfer data from the channel to the control unit and initiate a printing operation. A write command with a modifier bit initiates spacing of 1, 2, or 3 lines, or skipping to a carriage channel, after printing a line.

Carriage Control

Carriage operations can be initiated by individual commands (control) (Figure 7) as well as by write command modifiers.

Initializing and Diagnostic

These commands (Figure 8) are required for initializing various functions within the control unit and for control and diagnostic purposes. These commands cause no printing or carriage motion.

Test I/O

The Test I/O command transfers pending status information from the control unit to the channel. If no status information is available, a zero status byte is sent to the channel. A busy status is indicated if an operation is still being executed and no end status is available.

Sense

The sense command transfers six sense bytes to the channel. These bytes contain detail or special diagnostic information about the unit-check bit in the status byte. Issue a sense command whenever a unit-check condition exists.

Write Commands		
Binary Code	**Hex**	**Function**
0 1 2 3 4 5 6 7		
0 0 0 0 0 0 0 1	0 1	Write without Spacing
0 0 0 0 1 0 0 1	0 9	Write and Space 1
0 0 0 1 0 0 0 1	1 1	Write and Space 2
0 0 0 1 1 0 0 1	1 9	Write and Space 3
1 0 0 0 1 0 0 1	8 9	Write and Skip to Channel 1
1 0 0 1 0 0 0 1	9 1	Write and Skip to Channel 2
1 0 0 1 1 0 0 1	9 9	Write and Skip to Channel 3
1 0 1 0 0 0 0 1	A 1	Write and Skip to Channel 4
1 0 1 0 1 0 0 1	A 9	Write and Skip to Channel 5
1 0 1 1 0 0 0 1	B 1	Write and Skip to Channel 6
1 0 1 1 1 0 0 1	B 9	Write and Skip to Channel 7
1 1 0 0 0 0 0 1	C 1	Write and Skip to Channel 8
1 1 0 0 1 0 0 1	C 9	Write and Skip to Channel 9
1 1 0 1 0 0 0 1	D 1	Write and Skip to Channel 10
1 1 0 1 1 0 0 1	D 9	Write and Skip to Channel 11
1 1 1 0 0 0 0 1	E 1	Write and Skip to Channel 12

Note: Write commands perform the required carriage functions after the line is printed.

Figure 6. Write Commands with Carriage Controls

Carriage Control Commands		
Command Byte Binary	**Hex**	**Function**
0 1 2 3 4 5 6 7		
0 0 0 0 1 0 1 1	0 B	Space 1 Immediate
0 0 0 1 0 0 1 1	1 3	Space 2 Immediate
0 0 0 1 1 0 1 1	1 B	Space 3 Immediate
1 0 0 0 0 0 1 1	8 3	Skip Immediate to Channel 0*
1 0 0 0 1 0 1 1	8 B	Skip Immediate to Channel 1
1 0 0 1 0 0 1 1	9 3	Skip Immediate to Channel 2
1 0 0 1 1 0 1 1	9 B	Skip Immediate to Channel 3
1 0 1 0 0 0 1 1	A 3	Skip Immediate to Channel 4
1 0 1 0 1 0 1 1	A B	Skip Immediate to Channel 5
1 0 1 1 0 0 1 1	B 3	Skip Immediate to Channel 6
1 0 1 1 1 0 1 1	B B	Skip Immediate to Channel 7
1 1 0 0 0 0 1 1	C 3	Skip Immediate to Channel 8
1 1 0 0 1 0 1 1	C B	Skip Immediate to Channel 9
1 1 0 1 0 0 1 1	D 3	Skip Immediate to Channel 10
1 1 0 1 1 0 1 1	D B	Skip Immediate to Channel 11
1 1 1 0 0 0 1 1	E 3	Skip Immediate to Channel 12

* Special command used during error recovery (see Bit 0 Sense Byte 1) command.

Figure 7. Carriage Control Commands

Initializing and Diagnostic Commands											
Command Byte Binary								Hex		Function	
0	1	2	3	4	5	6	7				
0	0	0	0	0	0	0	0	0	0	Test I/O	(Control)
0	0	0	0	0	1	0	0	0	4	Sense	(Diagnostic)
0	0	0	0	0	0	1	1	0	3	No Op	(Immediate)
1	1	1	1	1	0	1	1	F	B	Load UCSB	(Control)
0	1	0	0	0	0	1	1	4	3	Fold	(Immediate)
0	0	1	0	0	0	1	1	2	3	Unfold	(Immediate)
0	1	1	0	0	0	1	1	6	3	Load FCB	(Control)
0	1	1	1	0	0	1	1	7	3	Block Data Check	(Immediate)
0	1	1	1	1	0	1	1	7	B	Allow Data Check	(Immediate)
0	0	0	0	0	0	1	0	0	2	Read PLB	(Diagnostic)
0	0	0	0	1	0	1	0	0	A	Read USCB	(Diagnostic)
0	0	0	1	0	0	1	0	1	2	Read FCB	(Diagnostic)
0	0	0	0	0	1	1	0	0	6	Check Read	(Diagnostic)
0	0	0	0	0	1	0	1	0	5	Diagnostic Write	(Diagnostic)
0	1	1	0	1	0	1	1	6	B	Raise Cover	(Immediate)
0	0	0	0	1	1	1	0	0	E	Diagnostic Gate	(Immediate)

Figure 8. Initializing and Diagnostic Commands

No-Op

The No-Op command performs no function. No-Op is treated as a command immediate in which the status byte contains channel-end and device-end bits at the end of the initial selection sequence.

Load UCSB

The load UCSB command is used to load the universal character set buffer with the assigned code for each graphic in the same sequence as on the train. If fewer than 432 characters are loaded, the control unit indicates a load check. If loading more than 432 characters is attempted, the channel notes an incorrect length record by setting channel status word (CSW) bit 41. The suppress link indication (SLI) bit 34 in the channel command word (CCW) should not be masked by the program when the buffer is loaded.

Fold

The fold command folds the entire first, second, and third quadrants of the extended binary coded decimal interchange code into the fourth quadrant (Figure 9), causing the compare circuits in the control unit to ignore bit positions 0 and 1 when comparing the characters from UCSB and the PLB storage areas. Folding continues until the unfold command is received or until the power to the unit is turned off.

Unfold

The unfold command stops the folding operation (*see* "Commands, Fold") and returns the printer to normal operation.

Load FCB

The load FCB command loads the forms control buffer with the carriage codes for the line spacing required. A flag bit in the first address position sets the carriage space to eight lines per inch. The absence of the flag bit sets the carriage spacing to six lines per inch. The last line position loaded must contain a flag bit to indicate end of form.

After position 1 has been loaded, detecting a flag bit sets channel end and device end in the status byte and terminates the operation. An invalid channel code or a failure to load the FCB with a flag bit in the last line position results in a unit-check status bit and a load-check condition in sense byte 0. Any line position not containing a channel code should be assigned a space (null) code. After the load FCB command has been executed, the forms control address register is set to the first address position.

Block Data Check

The block data check command blocks setting of data check (bit 4) in sense byte 0 (unprintable character in the print line buffer). Block data check remains on until reset by allow data check command, a UCSB parity check, when the UCSB character is not repetitive, or until power is turned off.

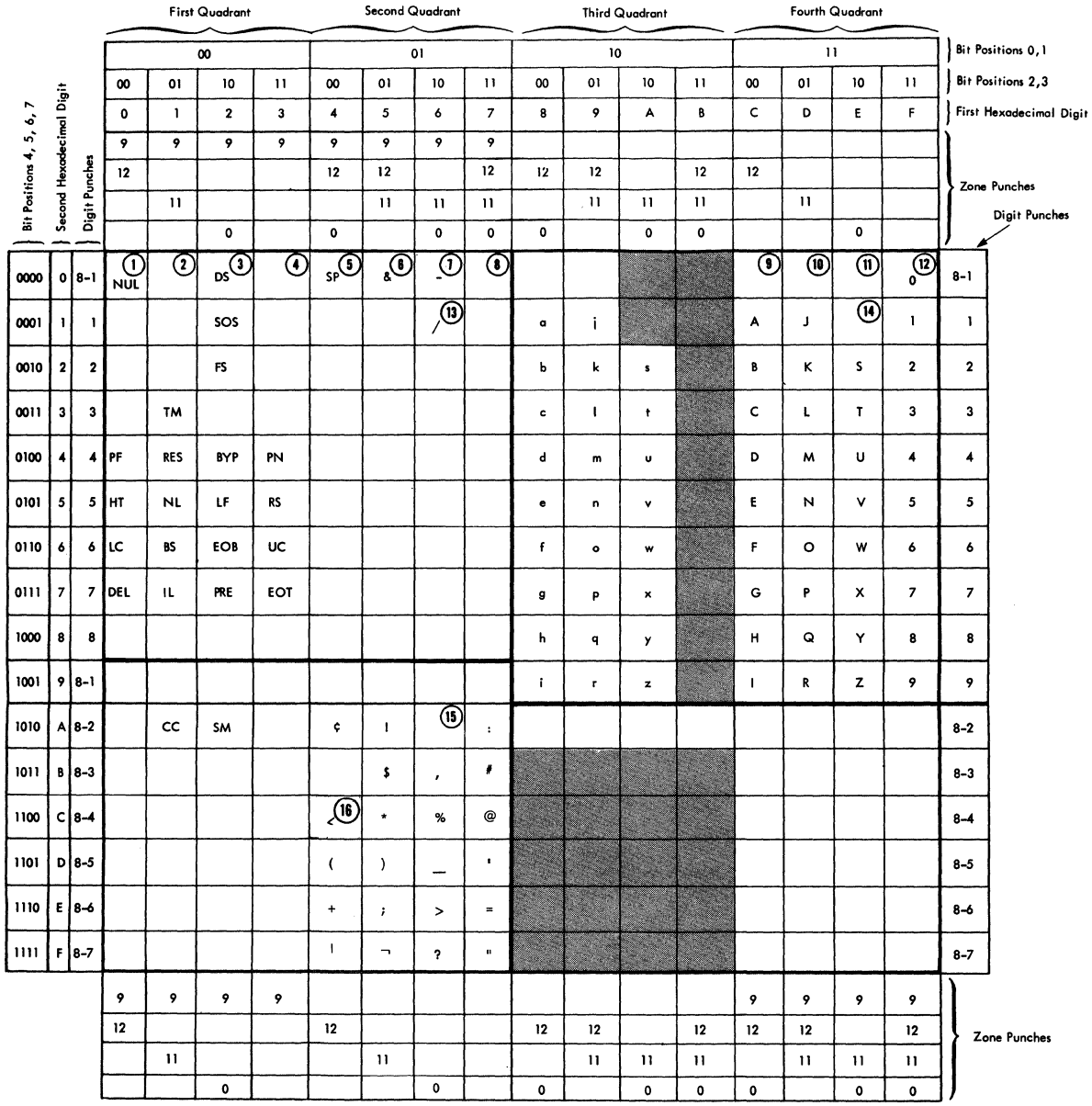


Figure 9. Extended Binary Coded Decimal Interchange Code and Quadrants

Allow Data Check

The allow data check command resets the block-data-check condition and allows the control unit to set data check (bit 4) in sense byte 0 after an unprintable character is detected in the PLB.

Read PLB

The read PLB command, normally for diagnostic functions, transfers data in the PLB to the channel, where it may be analyzed or compared to the print line loaded. This command reads out the eight data bits plus parity in the same bit allocation in which they were received, regardless of folding.

Read UCSB

The read UCSB, normally used for diagnostic purposes, transfers all 432 positions of the universal character set buffer to the channel. The transfer occurs in the same sequence and bit allocation as that for the buffer.

Read FCB

The read FCB command, normally for diagnostic purposes, transfers the carriage codes to the channel, where they may be analyzed or compared. The number of data bytes transferred is controlled by the count field in the CCW. For example, to check the carriage setting in the first address position for the presence or absence of a flag bit to determine the carriage space setting of six or eight lines per inch, set the count field to 1.

Note: To maintain vertical forms alignment, issue the read FCB command, only after skipping to a channel code stored in FCB address one. If read FCB is given at any other position, the form becomes misaligned because the FCB returns to address position one.

Check Read

This command transfers unique check information stored in each addressable position of the PLB to the channel. It is normally used for diagnostic purposes, such as fault isolation to an individual print position. Bit positions (zero) (0) through four (4) on bus-in are not used. Bit position five (5) signifies that the print line complete (PLC) bit was set, indicating that a print compare was completed for the corresponding position or that the PLB contained a blank or null code. Bit position six (6) signifies that the print error check (PEC) bit had been set due to invalid parity or a hammer check for the corresponding print position. Bit seven (7) signifies that invalid parity was detected for the nine data bits in that PLB position.

Diagnostic Write

The diagnostic write command is similar to a write-without-spacing command, except that no printing occurs. Diagnostic write can be followed by a read PLB command for verification of the data-transfer and print-scan-control operations.

Raise Cover

The raise cover command allows the programmer to raise the cover on the printer when he desires. The cover rises automatically when the forms check bit (bit 4, sense byte 1) occurs. This facilitates operator access to the machine when a forms-check condition occurs. (*See* "Keys and Lights, Form Check.")

Diagnostic Gate

The diagnostic gate command, for diagnostic purposes only, conditions the control unit to modify certain commands following the diagnostic gate command. The modification of the commands is:

1. *Check Read:* this is a setup to transfer via bus-in the 8 bits of the forms control address register.
2. *Any Carriage Control:* this sets a carriage scan latch. Now the sense command transfers via bus-in eight signals pertinent to the carriage operation every 8.96 us.
3. *Write without Spacing:* this enables hammer-flight time measurement of the logic circuits.
4. *Diagnostic Write Command:* this enables time measurement from the rise of the train home pulse to the rise of print scan emitter if the block data check latch was on; otherwise, the time measurement is from the rise of sync home emitter to the rise of the print scan emitter.
5. *Any Write Command (except without Spacing):* this enables logic circuitry for measurement of the print scan emitter pulses. In this case, PLB data bits 7 and 6 are used to control start and stop of time measurements, respectively.

Status Byte

The status is presented to the channel under the following conditions.

1. During the initial selection sequence after the channel sends a command byte.
2. After a printer operation ends because of an I/O interrupt, such as channel end after data transfer or device end after the completion of the mechanical portion of the operation.
3. During an I/O interrupt operation initiated by the control unit when the printer goes from not-ready to ready (device end is generated), or by activating the cancel key.
4. During initial selection for a Test I/O instruction.
5. To present any previously stacked status.

A status condition is reset when accepted by the channel, except that:

1. Unit-check (bit 6) is not reset until the printer has been restored to ready after an intervention-required condition.
2. Busy (bit 3) is not reset until device-end status is accepted by the channel.

STATUS BYTE FORMAT

Only bits 3 to 7 of the status byte are used. The contents of the status byte, except bit 6, are reset by a service-out response to status in, a system reset, selective reset, or a power-on reset.

Bit 3 Busy

Busy status is presented to the channel when the printer is executing a previous command or the control unit has an outstanding device-end condition in the status byte. Busy status is presented only at initial selection. Once the command has been accepted by the control unit, busy status is presented to any command until the outstanding device end has been accepted by the channel. Status conditions, if any, accompany the busy indication. Busy is not presented to a Test I/O command if channel end or device end is part of the status. After device end is accepted, the printer becomes not busy.

Bit 4 Channel End

Channel-end status is presented to the channel after completing a data transfer to or from the control unit. Channel end is also presented when a control command is accepted by the control unit. Channel end is not set if the command is rejected during the initial selection sequence.

Bit 5 Device End

Device-end status is presented to the channel when a previous command has been completed. The control unit can accept another command after the status is accepted by the channel. Device end is also generated by a change from not-ready to ready or by the operation of the cancel key. Device end is not set if the command is rejected during the initial selection sequence.

Bit 6 Unit Check

Unit-check status indicates that the printer requires program or operator intervention. A sense command should be given, and the sense data analyzed, to determine the cause and appropriate recovery procedure (*see* "Sense Byte"). The unit-check status bit can be presented at initial selection along with channel-end and/or device-end status. If unit check is set by intervention-required, it is not reset until the printer is restored to the ready condition.

Bit 7 Unit Exception

Unit-exception status indicates that the carriage control has sensed a channel 12 code in the forms control buffer during the execution of a carriage-space operation. Unit exception is not set during skip operations.

Sense Information

When a sense command is issued, six bytes of sense information (Figure 10) are transferred to the channel. (Transfer time is 32 microseconds.) The four bytes used indicate the causes of unit checks and direct programming procedures.

SENSE BYTE RESET

Intervention-required (byte 0, bit 1) is reset only after the cause of the condition is corrected and the printer is made ready. All other sense bytes pertain to the last printer operation executed. These bytes are reset when any command except Test I/O, Sense Command, or No Op is addressed to the printer, provided busy status (bit 3) is not indicated in the initial selection status byte.

SENSE BYTE 0: SUMMARY

(Byte 0, Bit 0) Command Reject

This bit is set during initial selection when a command other than those defined for the printer is decoded.

Sense Byte Summary Designations			
	Byte 0 Summary		**Byte 1 Programming**
0	Command Reject	0	Command Retry
1	Intervention Required	1	Print Check
2	Bus-Out Check	2	Print Quality
3	Equipment Check	3	Line Position
4	Data Check	4	Forms Check
5	Buffer Parity Check	5	Command Suppress
6	Load Check	6	Mechanical Motion
7	Channel 9	7	Unassigned
	Byte 2 Mechanical		**Byte 3 Electrical**
0	Carriage Failed to Move	0	UCSB Parity
1	Carriage Sequence Check	1	PLB Parity
2	Carriage Stop Check	2	FCB Parity
3	Platen Failed to Advance	3	Coil Protect
4	Platen Failed to Retract	4	Hammer Fire Check
5	Forms Jam	5	Service Aids
6	Ribbon Motion	6	UCSAR Sync Check
7	Train Overload	7	PSE Sync Check
	Byte 4 Future Options		**Byte 5 Future Options**

Figure 10. Sense Byte Designation Summary

(Byte 0, Bit 1) Intervention Required

The printer is not-ready because of one of the following conditions.

1. Interlocks
   a. Carriage stop/release key ON (sets form check (byte 1 bit 4).
   b. End of forms
   c. Stop key operated
   d. Single cycle key operated
   e. Vacuum (low, high, external)
   f. Stacker full
   g. Train cartridge improperly installed
   h. Print gate unlatched
   i. Electrical interlocks indicated on service panel
      1. CB trip
      2. Power trip
      3. Thermal trip
2. Print quality (byte 1, bit 2)
   a. Platen failed to advance (byte 2, bit 3)
   b. Ribbon motion (byte 2, bit 6)
3. Train overload (byte 2, bit 7)
4. Forms check (byte 1, bit 4)
   a. Forms jam (byte 2, bit 5)

(Byte 0, Bit 2) Bus-Out Check

This bit is set when the control unit receives a data or command byte with even parity. If this occurs during initial selection, no printer operation is initiated. If this occurs during a write command data transfer, unit check is given with channel end and device end. This indicates that the command was not executed.

If the error occurs during the execution of a load command, buffer loading continues and unit check is given with channel end and device end to indicate that the buffer was loaded improperly.

(Byte 0, Bit 3) Equipment Check

This bit is set by an equipment condition affecting the operation in process. The specific condition is further defined by the following.

1. Command retry (byte 1, bit 0)
   a. PLB parity (byte 3, bit 1)
2. Print check byte 1, bit 1)
   May have one or more of the following bits.
   a. Coil protect (byte 3, bit 3)
   b. Hammer fire check (byte 3, bit 4)
   c. UCSAR sync check (byte 3, bit 6)
   d. PSE sync check (byte 3, bit 7)

3. Print quality (byte 1, bit 2)
   a. Platen failed to advance (byte 2, bit 3)
   b. Platen failed to retract (byte 2, bit 4)
   c. Ribbon motion (byte 2, bit 6)
4. Line position (byte 1, bit 3) always has one or more of the following.
   a. Carriage failed to move (byte 2, bit 0)
   b. Carriage sequence check (byte 2, bit 1)
   c. Carriage stop check (byte 2, bit 2)
5. Mechanical motion (byte 1, bit 6)
   a. Cancel key.
   b. Device-end time-out
6. With byte 1, no bits
   a. Train overload (byte 2, bit 7)
   b. UCSAR sync check (byte 3, bit 6)
      A sync check has occurred before a channel end of a write command, and no device end is pending.
   c. PES sync check (byte 3, bit 7)
      A sync check has occurred before a channel end of a write command, and no device end is pending.

(Byte 0, Bit 4) Data Check

This bit is set due to:
1. Print check (byte 1, bit 1) set by a non-compare between the UCSB and PLB with block data check off.
2. Line position (byte 1, bit 3) indicates that the FCB does not contain a channel code to match the channel code in the skip command. This condition automatically halts the skip at the second occurrence of the FCB address one.

Note: The block data check command is effective only for data checks resulting from UCSB/PLB non-compare.

(Byte 0, Bit 5) Buffer Parity Check

This bit is set by:
1. Command retry (byte 1, bit 0)
   a. UCSB parity check (byte 3, bit 0)
      A write command is incomplete due to a parity check in the UCSB and a non-compare between the UCS and the PL buffers.
2. Line position byte 1, bit 3)
   a. PLB parity (byte 3, bit 1) during the execution of a PLB read command.
3. (Byte 1, no bits)
   a. UCSB parity (byte 3, bit 0)
      Write command complete or during the execution of a UCSB read command.
   b. PLB parity (byte 3, bit 1)
      During the execution of a PLB read command.
   c. FCB parity (byte 3, bit 2)
      During the execution of FCB read command.

(Byte 0, Bit 6) Load Check

This bit is set when:
1. The load UCSB command is terminated before all 432 positions have been assigned a data code.
2. During the execution of a load FCB command one or both of the following occurred:
   a. An invalid FCB code was received from the channel.
   b. The load was terminated without a flag bit (bit 3) in the last channel code transferred.

(Byte 0, Bit 7) Channel 9

This bit is set when a channel 9 code is sensed in the FCB during a carriage-space operation. This bit is not set during skipping operations.

SENSE BYTE 1: PROGRAMMING

(Byte 1, Bit 0) Command Retry

This bit is set if a parity error is detected in the PLB during printing, or if a parity error in the UCSB prevents the print line from being completed.
1. With buffer parity check (byte 0, bit 5): Indicates UCSB parity check (byte 3, bit 0)
2. With equipment check (byte 0, bit 3): Indicates PLB parity check (byte 3, bit 1)
   When the command retry bit is set, the following conditions are present.
   1. Positions in error are not printed and are indicated in the check planes. *See* "Check Read Command."
   2. Carriage motion for the failing command is suppressed.
   3. At this time, the recovery procedure given under "Byte 1, Bit 0, Suggested Error-Recovery Procedures" must be used, or the results are unpredictable.

(Byte 1, Bit 1) Print Check

This bit is set when the print line in process contains one or more print errors. The condition is indicated by:
1. Coil protect (byte 3, bit 3)
2. Hammer fire check (byte 3, bit 4)
3. UCSAR sync check (byte 3, bit 6)
4. PSE sync check (byte 3, bit 7)
5. UCSB parity (byte 3, bit 0)
   A write command is incomplete due to a parity check in UCSB and a non-compare between the UCSB and the PLB.

(Byte 1, Bit 2) Print Quality

This bit is set when a machine failure develops that can affect print quality; printing may be light or blurred. This condition indicates one of the following.
1. Platen failed to advance (byte 2, bit 3)
2. Platen failed to retract (byte 2, bit 4)
3. Ribbon motion (byte 2, bit 6)

(Byte 1, Bit 3) Line Position Check

This bit is set due to:
1. Carriage failed to move (byte 2, bit 0)
2. Carriage sequence check (byte 2, bit 1)
3. Carriage stop check (byte 2, bit 2)
   Improper forms movement and synchronization to the FCB is indicated.

(Byte 1, Bit 4) Forms Check

This bit is set when any of the following conditions occurs.
1. Forms jam (byte 2, bit 5)
2. Channel 1 code sensed in FCB with end of forms or stacker full indicated.
3. Carriage stop/release key on.

(Byte 1, Bit 5) Command Suppress

This bit is set when an interface disconnect occurs before channel-end status is accepted. No carriage motion or printing occurs.

(Byte 1, Bit 6) Mechanical Motion

This bit signifies that the command was not completed.

A timing interlock is initiated each time that channel-end status without device end is indicated by the control unit. If device end is not available before the end of the time-out period, the device is reset and pseudo device end with unit check is generated. The cancel key also sets this condition.

SENSE BYTE 2: MECHANICAL

(Byte 2, Bit 0) Carriage Failed to Move

This bit is set when the specified carriage movement is not sensed within the prescribed time period. This condition indicates improper form movement and form misalignment with the FCB.

(Byte 2, Bit 1) Carriage Sequence Check

This bit indicates improper carriage movement and forms misalignment with the FCB.

(Byte 2, Bit 2) Carriage Stop

This bit is set when the carriage does not stop within the prescribed time period. Carriage overshoot and forms misalignment with the FCB could have occurred.

(Byte 2, Bit 3) Platen Failed to Advance

This bit is set when the platen fails to move forward for printing, and shadowed or blurred printing can result.

(Byte 2, Bit 4) Platen Failed to Retract

This bit is set when the platen does not retract during a carriage operation. The printing may be blurred.

(Byte 2, Bit 5) Forms Jam

This bit is set when a forms feeding malfunction occurs in a forms tractor. This condition may be due to a forms jam, ripped or torn form, or form separation.

(Byte 2, Bit 6) Ribbon Motion

This bit is set when the ribbon moves to slow or not at all.

(Byte 2, Bit 7) Train Overload

This condition is manifested by a variation in the train velocity. To prevent damage or motor failure, the train is stopped, causing the device to go not-ready.

SENSE BYTE 3: ELECTRICAL

(Byte 3, Bit 0) UCSB Parity

This bit is set when even parity occurs for a code in the universal character set buffer.

(Byte 3, Bit 1) PLB Parity

This bit is set when even parity occurs for a code in the print line buffer. The print line is not completed, and carriage motion is suppressed.

(Byte 3, Bit 2) FCB Parity

This bit is set when even parity occurs for a code in the forms control buffer.

(Byte 3, Bit 3) Coil Protect

This bit is set when a print hammer is not reset.

(Byte 3, Bit 4) Hammer Fire Check

This bit is set when a malfunction of the print hammer circuits occurs.

(Byte 3, Bit 5) Service Aid

The setting of this bit does not result in a unit check and is selectable only by a service representative.

(Byte 3, Bit 6) UCSAR Sync Check

This bit is set when a sync check occurs in the circuitry for the universal character set address register.

Note: A sync check causes a print check, only after channel-end status has occurred for a write command and device-end status is pending.

(Byte 3, Bit 7) PSE Sync Check

This bit is set when a sync check occurs in the print scan emitter pulse circuitry.

Note: A sync check causes a print check, only after channel-end status has occurred for a write command and device end is pending.

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Any printer or control-unit error causes a unit check to be set in the status byte. The channel accepts the status byte and places it in the channel status word (CSW), bit positions 32 through 39.

If unit check (bit 38) is present in the CSW, execute a sense command to obtain detailed information about the cause of the unit check.

Following are suggested programming actions if bit 38 is present in the CSW.

Note: Refer to "Sense Information" for a detailed description of the causes of the following sense conditions.

SENSE BYTE 0

Byte 0, Bit 0 Command Reject

Action:
Provide an operator message, indicate an unrecoverable error, and exit from this error-recovery procedure.

Byte 0, Bit 1 Intervention Required

Analyze sense bits detailed under "Byte 0, Bit 1" of "Sense Information," provide an operator message, and exit from the error-recovery procedure. After the printer is made ready, restart the program from a logical restart point.

Byte 0, Bit 2 Bus-Out Check

Action:
Retry the operation. If the error recurs, provide an operator message, and indicate an unrecoverable error. Exit from this error-recovery procedure.

Byte 0, Bit 3 Equipment Check

Action:

With Byte 1, Bit 0 Command Retry

Reissue the failing CCW. Only the error positions are retried. If the error recurs:

1. Issue a skip to channel 0 command (Hex 83) to clear the control unit and allow execution of the suppressed carriage operation.

With Byte 1, Bits 1, 2, or 3

Indicate that an error recording is required, provide an operator intervention-required message, indicate an unrecoverable error, and exit from this error-recovery procedure.

With Byte 1, Bit 6 Mechanical Motion

Provide an operator message, indicate an unrecoverable error, and exit from this error-recovery procedure.

With Byte 1, Bits 0-1-2-3-6 Off

An equipment check was detected but had no effect on command execution.

Byte 0, Bit 4 Data Check

Data check signifies that a compare for a code could not be made in the UCSB or FCB. To determine which buffer (or possibly both), examine sense byte 1.

Byte 1, Bit 1 Print Check

Print check signifies that the data check is in the UCSB. The last line is incomplete, and the information is questionable.

Byte 1, Bit 3 Line Position

Line position signifies that the data check is in the FCB.

Action:
The following sequence should be performed.

1. Indicate that an error recording is required
2. Generate an intervention-required operator message.
3. The operator has the following options.
   a. Correct the error condition and continue.
   b. Cause an unrecoverable I/O error indication by activating the cancel key.

Byte 0, Bit 5 Buffer Parity Check

Buffer parity check signifies an invalid parity for a code in the UCSB or FCB. This condition is reset by reloading the particular buffer. To determine which buffer has the parity check, interrogate sense byte 1 in the following sequence: bit 3; then bit 0.

Byte 1, Bit 3 Line Position

Line position signifies that the parity check is in the FCB. The form may be improperly positioned. If a compare cannot be made, the carriage stops after two successive address-one positions have been detected.

Action
Provide an operator message, indicate an unrecoverable error, and exit from the error-recovery procedure. Reload the FCB after a line-position error.

Byte 1, Bit 0 Command Retry

Command retry signifies an invalid parity for a data code stored in the UCSB. The line in process is incomplete, and the carriage portion of the command is suppressed.

Action
Reload the UCSB with the correct data; then reissue the failing CCW. Only the error positions are retried. If the error recurs:

1. Issue a skip to channel 0 command (Hex 83) to clear the control unit and allow execution of the suppressed carriage operation.

Byte 1, Bit 0 and 3 OFF

This condition is a result of:

1. Unit-check status presented with device end alone indicating an invalid parity was detected for a code in the UCSB after a write command was accepted. For a train containing multiple-character sets or repeated data codes, the line in process will be completed. In this case, command retry will not be indicated, and the job can continue. Unless the UCSB is reloaded, the throughput decreases. Also the block-data-check condition has been reset.

Indicate that the UCS buffer should be reloaded, provide a message to the operator that reloading is necessary, and continue.

2. Unit-check status presented with channel end and device end together indicates that a read command was in process. Invalid parity was detected for the buffer specified in the command.

Byte 0, Bit 6 - Load Check

Action
Retry the operation. If the error recurs, provide an operator message, indicate an unrecoverable error, and exit from this error-recovery procedure.

Byte 1, Bit 5 - Command Suppress

Action
Reissue the command. If the error recurs, provide an operator message, indicate an unrecoverable error, and exit from the error-recovery procedure.

Error-Recovery Priority

When certain malfunctions occur, the CSW may contain more than one error indicator. Usually, only one of these properly describes the malfunction; the others indicate secondary effects. Some printer-control-unit errors can set more than one sense bit.

Check all indicators defined, in the sequence shown in Figure 11, until the one caused by the error condition is found. This CSW priority scheme recognizes and acts upon the primary error indicator.

If bit 38 is not present in the CSW, performing a sense command to check the sense byte data is not necessary. Check the CSW indicators until the one caused by the error condition is found.

Error Recovery Priority Sequence

Priority	Status Bit	Sense Byte	Sense Bit	Condition
1	45			Channel Control Check
2	46			Interface Control Check
3	44			Channel Data Check
4	38			Unit Check
5		0	3	Equipment Check
6		0	2	Bus-Out Check
7		0	4	Data Check
8		0	5	Buffer Parity Check
9		0	0	Command Reject
10		0	6	Load Check
11		0	1	Intervention Required
12		1	5	Command Suppress
13		0	7	Channel 9
14	42			Program Check
15	43			Protection Check
16	41			Incorrect Length
*	35			Busy
*	36			Channel End
*	37			Device End
*	39			Unit Exception
*	40			Program Controlled Interrupt

* Note: These items are normal conditions. Priority of checking is not specified for these items.

Figure 11. Error Recovery Priority Sequence

KEYS AND LIGHTS

Figures 12 and 13 show the operating keys and lights.

Power On

This light indicates that power is applied to the printer.

End-of-Form

This light indicates that 1-1/2 inches (38 mm) or less of a form remains below the print line and forms runout is imminent. When this light turns on, printer ready light goes off, and the printer stops. Normal printer operation may be resumed by pressing the printer ready key. Printing then continues until the carriage reaches channel 1. Then the printer ready light again goes out, and the forms check light comes on. The printer cannot be restarted until the forms have been replenished and the check reset key pressed. Replenishing the forms turns out the end-of-form light. Operating the check reset key turns out the forms check light.

Form Check

This light indicates a form-feeding condition (such as jammed or torn forms, end-of-form) that requires operator attention. When this light turns on, the printer ready light goes out. To turn out the form check light, correct the condition that caused the stoppage and press the check reset key.

Carriage Check

This light indicates a forms-movement condition:

a. Forms movement did not conform to the carriage instruction. The carriage either failed to move, moved too far, or moved without a signal.
b. An initiated carriage skip occurred, and one unprinted form is above the print line.

Print Check

This light indicates that a print error occurred in the last line printed. If the error was caused by a coil-protect condition, the check reset light is also on.

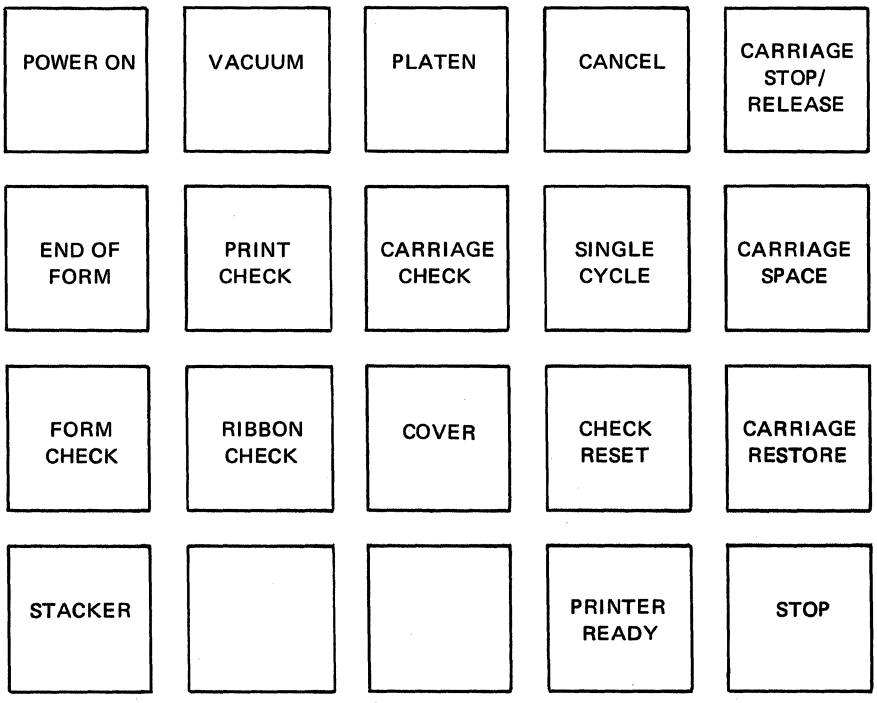

Figure 12. Operator's Panel (Front)

Vacuum

This light indicates that the type cleaner vacuum bag requires attention. Emptying and replacing this bag turns off the light.

Ribbon

This light indicates improper movement or folding of the ribbon. Correcting the condition turns off the light.

Platen

This light indicates improper platen operation.

Cancel Key

The cancel key, located on the control panel, enables the operator to indicate to the program that an unrecoverable error has occurred. Operating this key causes a unrecoverable error to be program-recorded, and the job either cancelled or left to the discretion of the program. Inadvertent operation of this key can, depending upon the program option, cancel the job in process.

Stacker

This light indicates that the stacker is full. The printer stops, and the ready light goes off. By unloading the stacker, the stacker light is extinguished; and pressing the print ready key restores the printer to a ready condition.

Single Cycle

This key makes the printer ready (ready light turns on) if none of the following conditions exist:

1. The form check light is on.
2. A mechanical interlock is open in the printer.
3. Either the front or rear stop key is held operated.

The printer then remains ready until a write command is executed. At initial selection for the next command (after the single write command is executed), unit-check status (bit 6) is presented to the channel because sense bit 1 (Intervention Required) is on. If another single-cycle operation is desired, press the single cycle key again. If, however, the operator does not want further single-cycle operations, he presses the start key to return to normal continuous operation. Note that for single-cycle operation, the printer goes not-ready, only after a write command is executed. Therefore, if the single cycle key is pressed, commands (such as a control command to skip) are processed until a write command is executed. Then the printer goes not-ready.

Carriage Space

This advances the carriage one space. The key is active only when the printer is not ready (printer ready light out). The operation of this key also stops the meter.

Carriage Stop/Release

This key light is normally off when the carriage is in operation. Pressing this key causes the backlight to come on, indicating that power has been removed from the tractor drive motor to permit manual operation of the tractors during a setup operation. When the light is off, the tractors are locked in a fixed position and turn only under the carriage spacing and skipping control. When the carriage release key has been operated and the light is on, the printer is in a not-ready state. Second operation of the carriage stop/release key is required to put out the light before establishing printer ready. Another function of this key is in an emergency carriage runaway condition when the carriage failed to stop after a long skip or spacing operation. Pressing this key disengages the carriage drive and stops the printer by causing a not-ready condition to be set. However, this key should not be used as a stop key when the printer is operating under a normal job condition because the operation of this key allows the forms-feeding operation of the tractors to get out of synchronism with the job in process.

Check Reset

This key/light can reset a print check or forms check. Whenever the 3211 printer is not-ready or not-busy, this key initiates a general printer reset. Pressing the check reset key should restore the machine to operable condition.

Printer Ready

This key/light puts the 3211 in a ready condition and signals the control unit to initiate a device end. When the printer goes ready, the printer ready light comes on. If the end-of-form light is on and no paper jam exists, this key acts as a start key to cause normal printer operation to continue until the end of that form. For convenience, another printer ready key (without the light), is at the rear of the machine.

Cover

The operation of this key causes the printer cover to either rise to a fully open position (if closed) or to close fully unless obstructed. If the cover is blocked by an obstruction, the cover reverts to a fully opened position and remains there until the cover key is pressed again.

Carriage Restore

This key/light advances the carriage until a channel 1 code is detected. If the carriage stop/release key light is on, the forms do not move. The carriage restore key is effective only when the printer is not-ready (printer ready light is out). When this key is pressed, the usage meter stops. For convenience, another carriage restore key (without the light) is at the rear of the printer. The light section of the carriage restore key is turned on when the first channel 1 code in the FCB is detected, and the printer is in the not-ready condition.

Stop

This key stops the printer at the end of any operation in process. For convenience, another stop key is at the rear of the printer.

MANUAL CONTROLS

Print Unit Release Lever

This lever locks the print unit in printing position. Releasing this lever permits the print unit to be opened for access to the forms path.

Tractor Locating Pins

A spring-loaded pin in the right-hand tractor snaps into locating holes in the tractor mounting bar. These holes are spaced at quarter-inch (6,4 mm) intervals to accommodate varying widths of forms. The spring-loaded pin (latch) in each left-hand tractor permits positioning that tractor in one of four holes spaced at quarter-inch (6,4 mm) intervals. These latches provide for coarse horizontal alignment of the forms with the print positions.

Shift Forms (L↔R)

This knob adjusts the spacing horizontally by shifting the forms either left or right for alignment.

Tighten Forms

This knob moves all tractors for fine horizontal alignment of the forms with the print positions.

Advance Forms

This knob moves the tractors for coarse vertical alignment of the forms with the print line. Set the Advance Forms (Fine) at its mid position before making the coarse adjustment with the paper advance knob. The carriage stop/release light must be on.

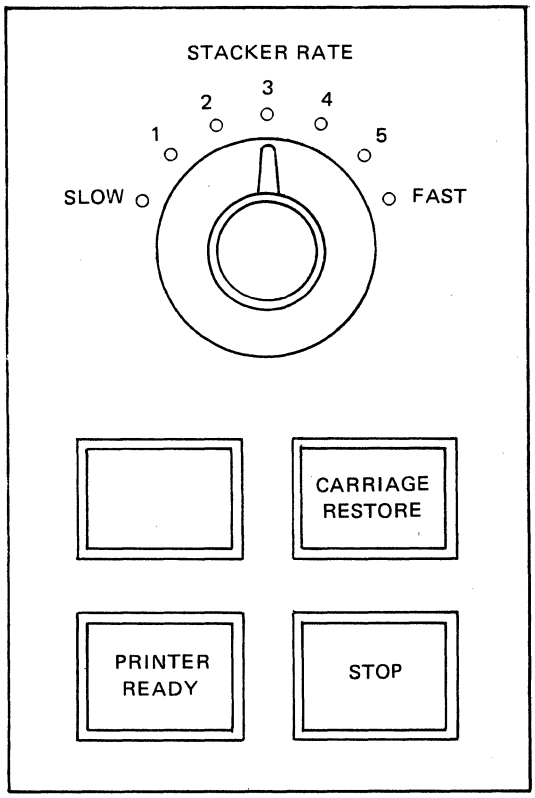

Figure 13. Operator's Panel (Rear)

Advance Forms (Fine)

This knob moves the tractors for fine vertical adjustment of the forms with the print line. The carriage stop/release light must be off.

Print Density Control Knob

This knob adjusts the print density.

Stacker Rate Knob

The stacker rate knob at the rear of the printer sets the speed control for the stacker rise during its self-adjusting cycle. Positioning this knob between fast and slow compensates for forms thickness to establish the rate for optimum stacking.

Stacker Adjusting Lever

This lever disengages the stacker assembly for manually raising or lowering the stacker.

INTERLOCKS

Interlocks assure proper mechanical operation of the printer. Check these when printer ready can not be established.

Platen Interlock

The platen interlock occurs when the platen is not fully retracted before the print unit is closed.

Cartridge Interlock

The cartridge interlock occurs when the interchangeable train cartridge is not properly seated in the print unit.

Print Unit Interlock

A print unit interlock occurs when the print unit gate is not fully closed.

Note: These interlocks are not indicated by individual lights; therefore, the operator must check for any of the interlock conditions when the ready light does not turn on after the printer ready key is pressed.

METERING

The meter starts with the first write command if the CPU meter is running. It continues to run, while the CPU meter is running, until a manual space or restore is initiated.

Appendix

Error-Recovery Procedure Summary

Sense Byte 0		*Sense Byte 1*		
Bit		*Bit*		
Pos	*Name*	*Pos*	*Name*	*Probable Cause*
0	Command Reject			Invalid command
		2	Print Quality	Platen failed to advance ribbon motion & ribbon skew.
		4	Forms Check	Carriage stop/release off Jam or torn forms
	Intervention			Out of paper.
1	Required			Stacker full.
		No	Interlock	Gate not latched.
	(Not Ready)	Bits	Condition	Train not positioned. Stop key activated. Vacuum check (low, high, external). Train overload.
2	Bus Out		Not CE & DE	Invalid parity on command.
			CE & DE	Invalid parity on data Xfer.
		0	Command Retry	PLB parity check.
		1	Print Check	Hammer fire check. Sync check. Coil protect.
		2	Print Quality	Platen failed to advance. Platen failed to retract.
3	Equipment Check			Ribbon motion/skew.
		3	Line Position	Carriage failed to move. Carriage sequence. Carriage stop.
		6	Mechanical motion.	Time out.
		No Bits		Transparent sync checks. Train overload.
4	Data Check	1	Print Check	Non compare UCSB.
		3	Line Position	Non compare FCB.
		0	Command Retry	Parity check UCSB.
5	Buffer Parity Check	3	Line Position	Parity check FCB.
		No Bits	Write Command Complete	Parity check UCSB.
		No	UCSB Read Command	Parity check UCSB.
		Bits	FCB Read Command	Parity check FCB.
			PLB Read Command	Parity check PLB.
6	Load Check			UCSB FCB
7	Channel 9			Normal occurrence.
		5	CMD Suppressed	Interface disconnect.

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