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**CONTROL DATA®  
955 PAGE AND DOCUMENT  
READER CONTROLLER**

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**REFERENCE MANUAL**

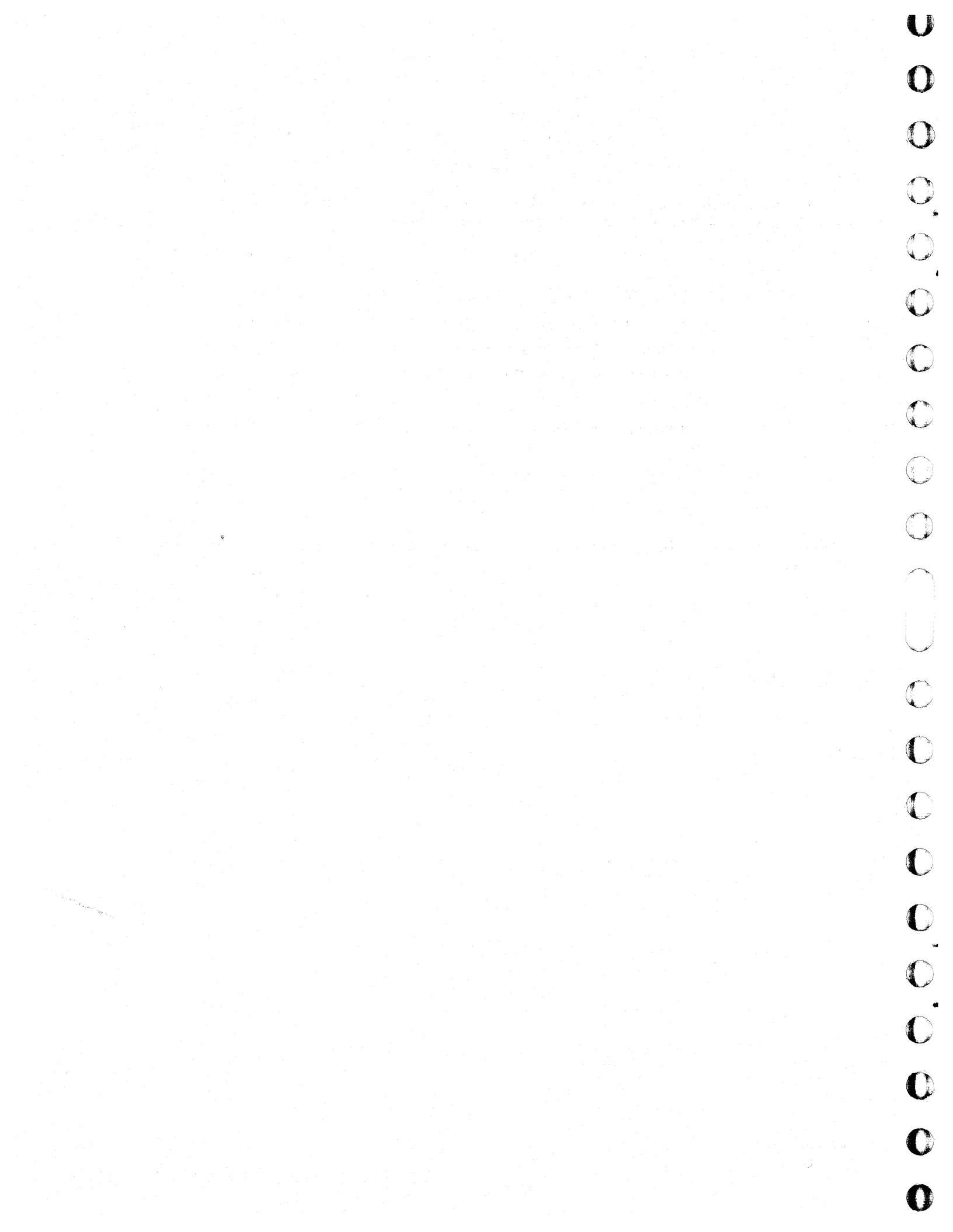


## PREFACE

The following publications contain additional reference information applicable to the CONTROL DATA® 955 Page and Document Reader system.

Title	Pub. No.
955 GRASP OCR Software Reference Manual	48430000
Tape SCOPE OCR Software Reference Manual	48430010
955 SETUP OCR Software Reference Manual	48430050
DRAFT OCR Software Reference Manual	48143900
955 OCR Media Manual	60216102
CJ122 Page and Document Reader Hardware Reference/Customer Engineering Manual	48430080
FF104-A Page and Document Reader Controller, and 1700 A/Q Coupler Customer Engineering Manual	60324700

Refer to the Control Data Literature Distribution Service catalog for latest revision levels of the above publications.



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## SECTION 1 GENERAL DESCRIPTION

The CONTROL DATA® Page and Document Reader Controller provides the logic interface for the Control Data 955, a multi-purpose optical character recognition (OCR) peripheral device designed for business data processing. The reader optically reads printed pages and documents and is capable of handling a wide variety of form layouts and sizes. Its high resolution optics enable it to read degraded or distorted print (as on carbon copies, for example), unevenly spaced or unevenly printed copy (as from high-speed printers), or poorly inked impressions (as from embossed-card imprinters). The basic reader reads a subset of the American National Standards Institute (ANSI), Size A character set; however, optional equipment may be added to the reader to enable reading a number of other type fonts, including handprint (see Table 1-3). For further information concerning print specifications, line spacing, forms design, and related topics, refer to the 955 OCR Media Manual (Pub. No. 60216102).

### SYSTEM HIGHLIGHTS

Highlights of the system include:

- Free field definition
- User choice of control symbols
- Field resequencing
- Input field size checking
- Input field contents checking (alpha/numeric)
- Header and trailer label options
- Code conversion capabilities
- Document size choice
- Sorting and marking for error documents
- Tape density and parity control
- Eight input record formats
- Accumulation of selected numeric fields
- Field duplication
- Optional use of stock or pre-printed forms
- User exit for special data manipulation (optional)

### OPERATING CHARACTERISTICS

Operating characteristics of the reader are listed in Table 1-1.

TABLE 1-1. READER OPERATING CHARACTERISTICS

Item	Specification
Paper weight	24 to 38 pound
Document size	Length 3-1/4 to 5-1/4 inches Width 4-7/8 to 8-1/2 inches Aspect ratio - length/width 0.64 minimum Nominal minimum caliper 0.003 inch Nominal maximum caliper 0.007 inch
Paper weight	18 to 24 pound
Document size	Length 3-1/4 to 12-5/8 inches Width 4-7/8 to 11-1/8 inches (12 inches S/N 130 and up) Aspect ratio - length/width 0.64 minimum Nominal minimum caliper 0.003 inch Nominal maximum caliper 0.007 inch
NOTE  Standard tab cards 3-1/4 by 7-3/8 are an acceptable exception to the aspect ratio requirement.	
Document limitations	Corners cut up to 1/2 inch by 45 degrees on one corner shall be acceptable.  Holes in documents are prohibited from a band 4 inches wide centered in the width of the document.
Double-feed prevention	Brushback roller on feeder returns double-fed document to input hopper. Photoelectric doubles detector at start of conveyor senses double-fed document and stops transport.
Input hopper capacity	Cards 5-inch stack Pages 3-1/2-inch stack
Feeder output skew	2 degrees nominal
Paper transport velocity	5 inches/second Forward (controller selected) 12.5 inches/second 20 inches/second 40 inches/second
Reverse	5 inches/second
Transport position accuracy	Maximum 0.005 inch cumulative error per 0.336 inch advance.
Takeaway/sort velocity	75 ±10% inches/second (60 Hz)

TABLE 1-1. READER OPERATING CHARACTERISTICS (CONT'D)

Item	Specification
Type font	
ANSI OCR-A Size I and Size IV	ANSI alphanumeric set includes upper case A through Z, 0 through 9, plus following symbols: apostrophe, semicolon, cancel, quotes, plus, right parenthesis, left parenthesis, asterisk, slash, minus, percent sign, comma, ampersand, dollar sign, period, colon, up fork, chair, equals, and hook.
Scan rate	75 inches/second
Power	
60 Hz (60 to 59 -0.6 Hz) 50 Hz (49.2 to 50.5 Hz)	208 ±10% vac, 30 amps/phase, 3-phase, wye connected with ac neutral and earth ground.
Instantaneous reading rate	750 characters/second (when character pitch = 10 characters per inch)
955 Reader input current	
Operating	12 amps/phase
Start-up	200 amps/phase, single cycle
Standby	2 amps, single phase
Operating power average	6.6 kva
Ambient temperature range	
Operating	60° to 80° F
Storage	30° to 150° F
Relative humidity	
Operating	30% to 60%
Storage	5% to 95% (no condensation)
Heat dissipation	23,800 BTU/hour
Altitude	-1,000 ft. to 6,000 ft. above mean sea level
Cooling	
Forced air	1000 cfm, max. inlet temp. 80° F

PHYSICAL DESCRIPTION

The reader is housed in a pair of welded-frame modules, each having casters to facilitate moving it into position and adjustable feet for leveling purposes. The conveyor, stacker, sorter, power control unit, optics system, read electronics, reader power supplies, and vacuum and compressed air systems are mounted in the reader module, and the controller, its associated power supplies, the cooling system, and the feedup table are housed in the controller module. Before operation, both modules are bolted together to form the unit shown in Figure 1-1. Physical characteristics of the reader are listed in Table 1-2.

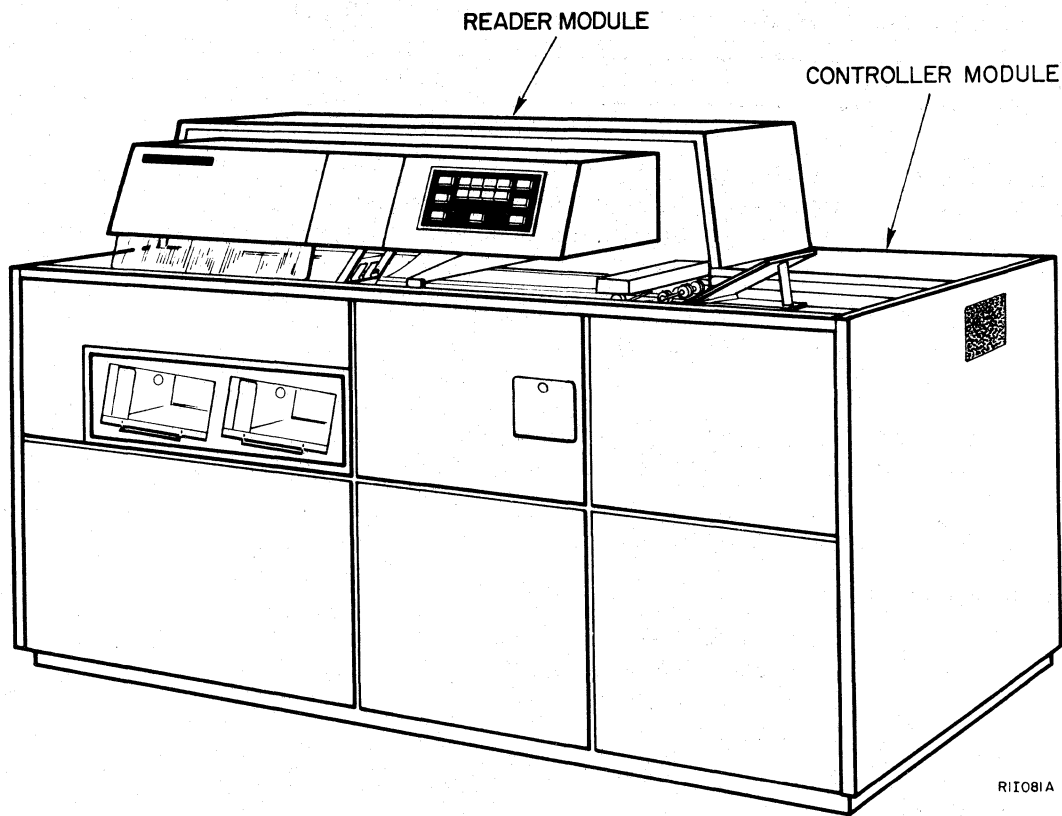


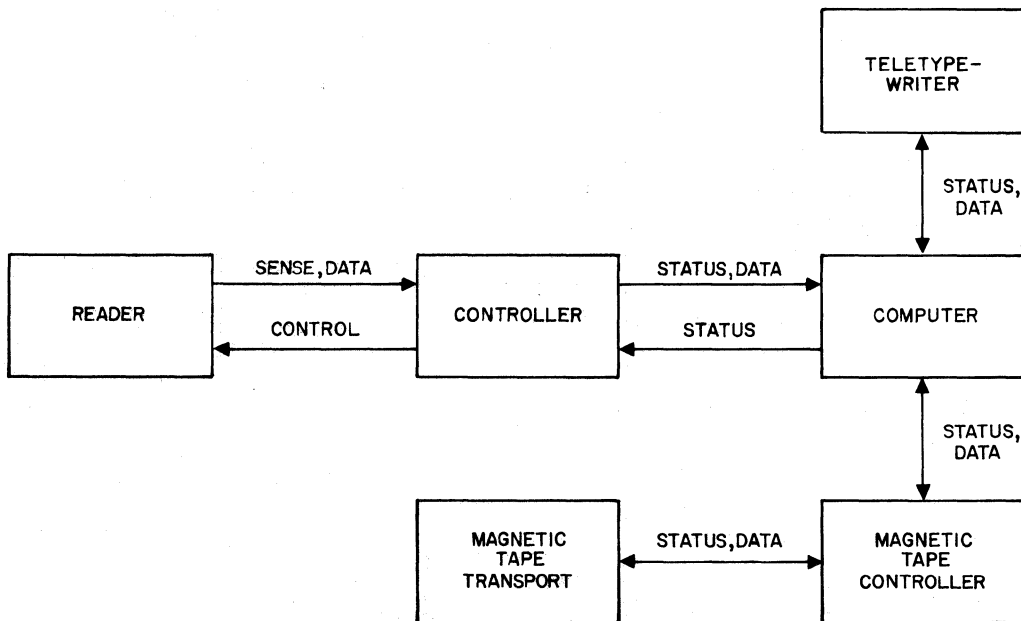
Figure 1-1. Page and Document Reader

The controller, including 4K memory stack and associated control circuits, occupies a space approximately 19 inches wide, 30 inches high, 12 inches deep in the back portion of the controller module cabinet. All electrical power required by the controller is supplied by the dc power supply in the controller module.

Readers with serial numbers below 151 were designed to function with separate configurators for the reader and the controller. Readers with serial numbers above 150 were designed to function with a controller included in the reader configurator. There are minor differences in the physical appearances of the two controllers and in the electronic circuits of each. However, logically they operate and function the same way. In addition, each type of controller is documented in a separate set of publications. The basic CE hardware reference manual for controllers in readers below serial number 151 is publication number 60324700 and for controllers in readers with a serial number above 150 the publication number is 48935300. Figure 1-2 depicts a Typical Reader System block diagram.

TABLE 1-2. READER PHYSICAL CHARACTERISTICS

Item	Specification
<b>Weight</b>	
Reader module	1400 pounds
Controller module	400 pounds
<b>Dimensions</b>	
Reader module height	57 inches
width	72 inches
depth	34 inches
Controller module height	48-1/2 inches
width	26-1/4 inches
depth	34 inches
Reader assembled height	57 inches
width	98-1/2 inches
depth	34 inches



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Figure 1-2. Typical Reader System

## FUNCTIONAL DESCRIPTION

Pages or documents to be read are loaded onto a feedup table on the reader and transported individually on vacuum belts to the read area where they are scanned a line of information at a time, as directed by the program in the computer. Light reflected from the area occupied by a single character is converted into electrical signals which are analyzed to determine the character read. After all characters in a line are read, a block of character data is transferred to the computer, and the document is advanced to the location of the next line that is to be read. After all lines on the page have been read, the document is moved out of the read area by a sort command and sorted into one of two output hoppers.

### PAGE ADVANCE CONTROL

Each document moves to and through the read area under control of the computer and the controller. A Director 3 (Positioning Mode) function code is used to provide the page advance step size and count. Under program control documents can be moved at the rate of 6, 5-1/3, 5, or 4 lines per inch or in small steps of 0.040 inch. Documents need not stop at the Document Ready position on the reader, but may be advanced directly to the first line on the page. This is done while the previous document is sorted. At the read area the documents are formed into a concave surface, accurately located to be in focus for scanning.

### MIRROR CONTROL

On receipt of programmed instructions, the controller applies signals to the reader to cause the line scanning mirror to move in a forward direction (left to right), reverse direction (right to left), stop, or return to zero horizontal-coordinate position. Line sweeps are accomplished by issuing the starting and stopping points (initial and terminal mirror coordinates), and a Director 4 (Mechanical Action) function code is used to zero the line scanning mirror. It should be noted that the mirror coordinate system can be reversed end-for-end using the Scan Right to Left bit in the Mirror Image Word (Character Control Word, HEX D).

Each line of characters is scanned at a velocity of 75 inches per second at the paper surface. When returning to read the next line (sometimes referred to as "flyback") the scanning mirror normally undergoes constant acceleration until it reaches the approximate midpoint of the next line to be scanned, and then constant deceleration to a velocity plateau and then deceleration until it stops at the desired coordinate. A dc motor drives the scanning system, and a shaft encoder provides position signals for every 0.048 inch of scan travel across the paper.

Mirror direction instructions are normally combined with page advance instructions. This reduces the line-to-line transition time since the mirror will move toward the new coordinates at the same time that the page is advancing to bring the new line of information to the read area.

### READ CONTROL

Director 5 (Read Mode) function codes provide the initial and terminal mirror coordinates which determine where reading will start and stop. As each character on the line is read, the reader translates it and provides a binary code (representing that character) to the controller. When the end of the line is reached, the controller will prepare for a block transfer of data to the computer. During the Read operation the normal scan height is three characters. This provides the largest allowable character misalignment in each line of

information; however, to avoid image overlap, line density on the document must be no more than three lines per inch.

#### DOCUMENT MARKING CONTROL (Option)

A Director 4 (Mechanical Action Mode) function can also be used to instruct the reader to place a small mark on the left-hand margin of the document alongside of the line being read. Marking the document in this manner may be accomplished for any reason at the discretion of the programmer.

#### SORT CONTROL

After the last line of a document is read, the reader moves the document to one of the two sort pockets. A Director 4 (Mechanical Action Mode) function code selects the sort pocket that is to receive the document, and the reader moves it to that pocket. All documents are normally placed in the primary sorting hopper, and the exceptions are sorted into sort pocket 2.

TABLE 1-3. READER OPTIONS

Option	Description
Handprint Numerics	0 through 9, plus, minus, equals, field mark, and upper case C, S, T, X, and Z. Field or factory installed.
ANSI OCR-A Size IV	Changes optical scaling of reader when installed and is selectable under program control. Factory installed only.
Marking Pen	Solenoid-activated device with pen that places circle on document's left margin, under program control. Field or factory installed.
Journal Tape	Feed spindle and driven spool with tape hold-down idler arms. Width ranges from 3 to 4-1/2 inches. Maximum roll diameter is 4 inches. Minimum character field is 12 inches. Minimum trailer is 30 inches. Factory installed only.
On-Line Reject Correction	Self-contained cathode ray tube (CRT) and keyboard video display shows characters on either side of rejected character. Operator corrects on-line by code insertion via keyboard. Field or factory installed.
Six lines/inch	Enables reader to read characters spaced at six lines to the inch or less. Modular logic assembly added to logic rack. Contains full character buffer memory, line tracking logic, and timing and control logic. Factory installed only.
Mirror Image	Program and associated electronics enables reader to read characters in normal position, reverse position, and mirror image of each: B, $\bar{B}$ , $\bar{B}$ , B. Provides right to left scan capabilities.

TABLE 1-3. READER OPTIONS (CONT'D)

Option	Description
ALTERNATE CHARACTER SETS	Readers with serial numbers below 130 require replacement of recognition rack with one designed for user-selected option. A maximum of three alternate sets may be installed plus handprint. When installed, the alternate character sets are controlled by three lines from the Controller, which may select a single alternate set or any combination of the three sets. Field or factory installed.
ANSI OCR-A	<p>0 1 2 3 4 5 6 7 8 9   ' " # \$ % &amp; ' ( ) * + , - . / : ; = + / * ^ # &amp; '</p> <p>ABCDEFGHIJKLMNOPQRSTUVWXYZ</p>
Lower Case Character Set	abcdefghijklmnopqrstuvwxyz
NOF Character Set	Numerals 0 through 9 and six symbols: H, or H, d, P, Y, W or W and G.
E13B Character Set	ANSI Standard for Magnetic Ink Character Recognition (MICR). Numerics 0 through 9 plus four symbols: #, @, ., '.
7B Character Set	For credit card application. Numerals 0 through 9 and two symbols: E, P. Requires ANSI OCR-A size IV option.
1403 Character Set	Numerals 0 through 9 and two symbols: hyphen, lozenge.
1428 Numeric Character Set	Numerals 0 through 9 and three symbols: H, hyphen, and period.
12F Character Set	Numerals 0 through 9 and two symbols: H, Hyphen.
ISO-OCR-B Character Set	Numerals 0 through 9 and four symbols: plus, minus, number, and currency.
Rabinow Character Set	Following symbols: semicolon, apostrophe, equals, delta, bow tie, number sign, fork down, quote, arrow down, and arrow up.
1428 Alphmeric Character Set	Numerals 0 through 9 and six symbols: C, S, N, T, X, Z, and f.



SECTION 2  
OPERATION

This section contains operating procedures for the reader, lists of controls and indicators and their functions, and illustrations showing the physical locations of the controls and indicators. Tables 2-1, 2-2, 2-4, and 2-8 contain operating procedures in step-by-step format showing where each step is performed, action to be taken, and the results of the action. Table 2-3 lists corrective action procedures to be followed when document feeding problems occur. For operator convenience, each of these tables starts on a separate page.

CONTROLS AND INDICATORS

The controls and indicators on the reader are described in Tables 2-5, 2-6, and 2-7, which are keyed to Figures 2-3, 2-4, and 2-5 respectively. In these tables, the Ref column lists the figure call-out number, the next column gives the panel name for the control or indicator, and the Function column states the functional purpose or use.

TABLE 2-1. POWER TURN-ON PROCEDURE

Step	Equipment	Procedure
1	Operator Control Panel (See Figure 2-2)	Press POWER ENABLE pushbutton indicator.
2		Press CONTROLLER POWER pushbutton indicator (S/N 103 and up, only).
3		Press READER POWER pushbutton indicator.
		NOTE
		Reader will not come on unless controller is on (S/N 103 and up). Reader will not function unless Controlware is loaded in controller.

TABLE 2-2. READER DOCUMENT LOADING PROCEDURE

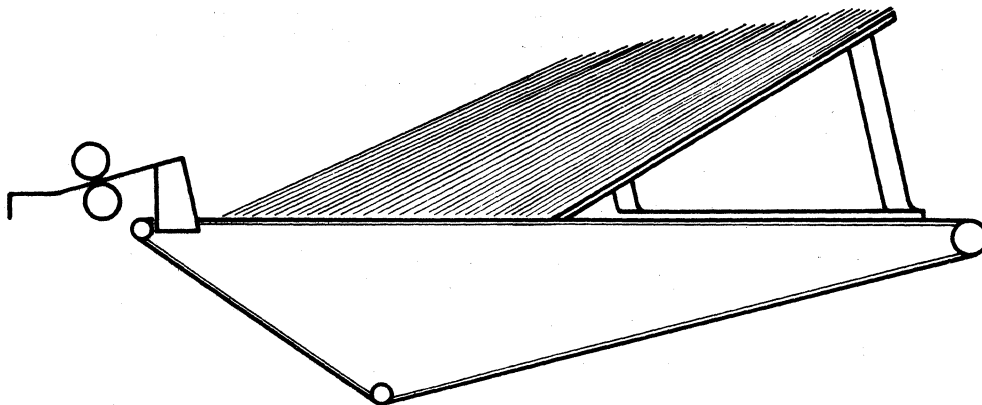
Step	Equipment	Procedure
1	Operator Control Panel	Ensure POWER ENABLE, READER POWER, and CONTROLLER POWER indicators are lit. Refer to Table 2-1 for power turn-on procedure.
2	Feedup table (See Figure 2-1)	Disable feedup and pull wedge, shown in Figures 2-1 and 2-2, back far enough so that a shingled stack of documents will fit on the belt without hitting the stationary ramp on the feeder.
3	Feedup table	Put sample document to be processed into feedup table.
4	Document adjustment panel	Adjust guide walls to within 1/8 inch of document edge by manipulating PAPER GUIDE WIDTH ADJUST switch.
5	Sort pockets	Place sample document in both sort pockets and adjust back plate until pocket length is 1/2 inch longer than document. Adjust stacker width guides until pocket width is 1/2 inch wider than document.
6	Feeder assembly	Place sample documents on feedup table. Press ENABLE FEED UP pushbutton.
7	Document Adjustment Panel	Repeatedly press LOAD switch to advance documents from feedup table while turning DOCUMENT THICKNESS ADJUST knob counterclockwise (thicker documents) until double document feed occurs. Then turn DOCUMENT THICKNESS ADJUST knob clockwise (thinner documents) until double document feed no longer occurs.

TABLE 2-2. READER DOCUMENT LOADING PROCEDURE (CONT'D)

Step	Equipment	Procedure
7 (cont'd)		<p>Turn DOCUMENT THICKNESS ADJUST knob an additional two complete clockwise turns to obtain proper gap setting between the feed and dedoubler rollers.</p> <p style="text-align: center;">NOTE</p> <p>If double document feed or misfeed condition reoccurs, check that documents are properly loaded on feed-up table.</p> <p>Insert one document in Doubles Detect area.</p> <p>Turn DOUBLES ADJUST knob in clockwise direction until DOUBLES INDICATOR on document adjustment panel goes out.</p> <p>Note position of knob.</p> <p>Insert two documents in Doubles Detect area.</p> <p>Turn DOUBLES ADJUST knob farther clockwise until DOUBLES INDICATOR goes out.</p> <p>Note position of knob.</p> <p>Set DOUBLES ADJUST knob to setting half way between two previously noted settings.</p>
8	Feedup table	<p>Edge document stack.</p> <p>Width and length of stack should be as close as possible to that of a single document before attempting to place stack on feedup table.</p> <p>Place stack of documents, face up, on feedup table so they rest on wedge, as shown in Figure 2-1.</p> <p>If they fit too tightly between width guides, remove stack and edge it again.</p> <p>Shingle documents toward feeder so angle of all documents in stack is equal to or less than angle of wedge.</p>
9	Operator control panel	<p>Press ENABLE FEED UP pushbutton.</p> <p>Belt and wedge carries stack of documents toward feeder.</p> <p style="text-align: center;">CAUTION</p> <p>Do NOT attempt to speed feed-in process by pushing wedge forward. Do NOT lift or touch prefeed roller for any reason.</p>

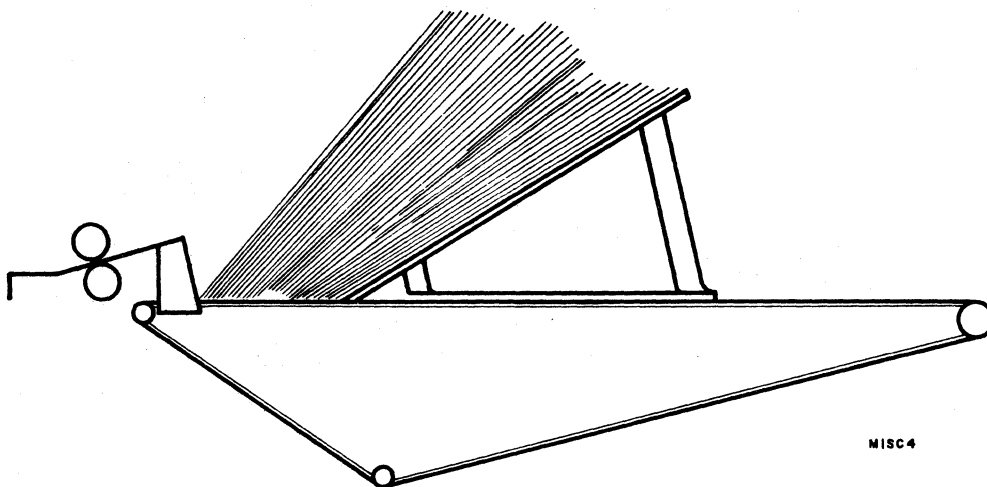
TABLE 2-2. READER DOCUMENT LOADING PROCEDURE (CONT'D)

Step	Equipment	Procedure
9 (cont'd)		<p>When the wedge stops press the LOAD pushbutton to advance documents from feedup table to read station.</p> <p>Press READY pushbutton indicator.</p> <p>READY lights.</p> <p>Documents are ready to be processed.</p>
10	Feedup table	<p>To load more documents of the same size, wait until feedup table is clear of all documents, then repeat procedure from Step 9.</p> <p style="text-align: center;">CAUTION</p> <p style="text-align: center;">Extreme caution should be taken when loading more documents while previous load is still being fed in.</p>
11	Operator Control Panel	<p>To load more documents of the same size but different thickness, repeat procedure from Step 6.</p> <p>When a sort pocket is full, SORT POCKET FULL indicator lights. Reader stops.</p> <p>Remove documents from sort pocket.</p> <p>SORT POCKET FULL indicator goes out when the READY or LOAD switch is pressed.</p> <p style="text-align: center;">NOTE</p> <p style="text-align: center;">Documents may be removed from sort pocket during operation.</p> <p>Repeat procedure from Step 10.</p>



**A. PROPER DOCUMENT LOADING :**

1. WEDGE PULLED SUFFICIENTLY BACK ON BELT.
2. DOCUMENTS SHINGLED TO ANGLE OF WEDGE.



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**B. IMPROPER DOCUMENT LOADING :**

1. WEDGE NOT PULLED BACK FAR ENOUGH.
2. DOCUMENTS IMPROPERLY SHINGLED AND JAMMED TOGETHER.

Figure 2-1. Document Loading

TABLE 2-3. CORRECTIVE ACTION PROCEDURE FOR READER HALTS

Step	Malfunction	Procedure
1	Sort paper jam. SORT CHECK lights, READY goes out.	Paper jam in sorting mechanism automatically stops reader. At sort gate, remove jammed paper and deposit in sort pocket. At operator control panel, press READY. READY lights.
2	Double document feed DOUBLES CHECK lights, READY goes out.	Reader stops. Remove all double feeds and return them to feedup table. At feeder, adjust redoubler roller (refer to Step 7 of Table 2-2). At Operator Control Panel press ENABLE FEED UP, and READY. ENABLE FEED UP and READY light.

TABLE 2-4. POWER SHUT-DOWN PROCEDURE

Step	Equipment	Procedure
1	Operator control panel	<p style="text-align: center;"><b>CAUTION</b></p> <p style="text-align: center;">In an emergency, press POWER ENABLE pushbutton indicator on operator control panel to turn off ac and dc power to reader and controller. POWER ENABLE goes out.</p> <p>Press READER POWER pushbutton indicator. READER POWER goes out.</p>

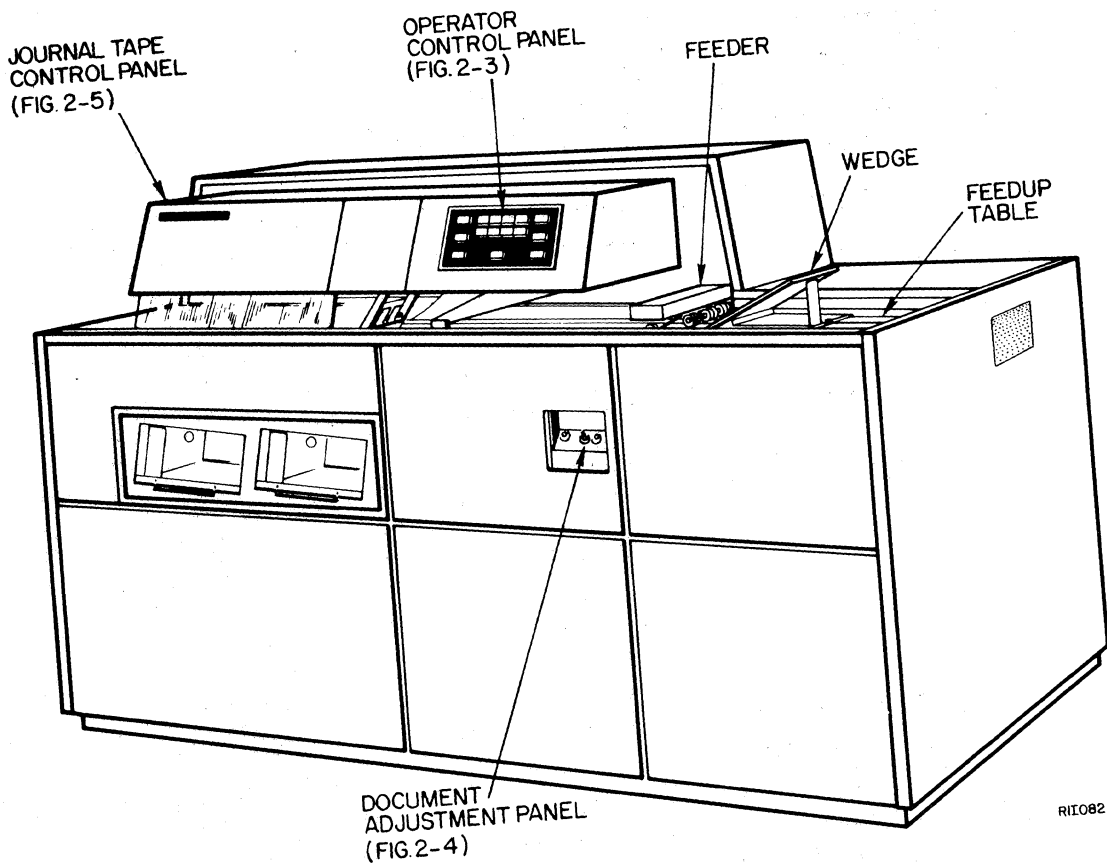
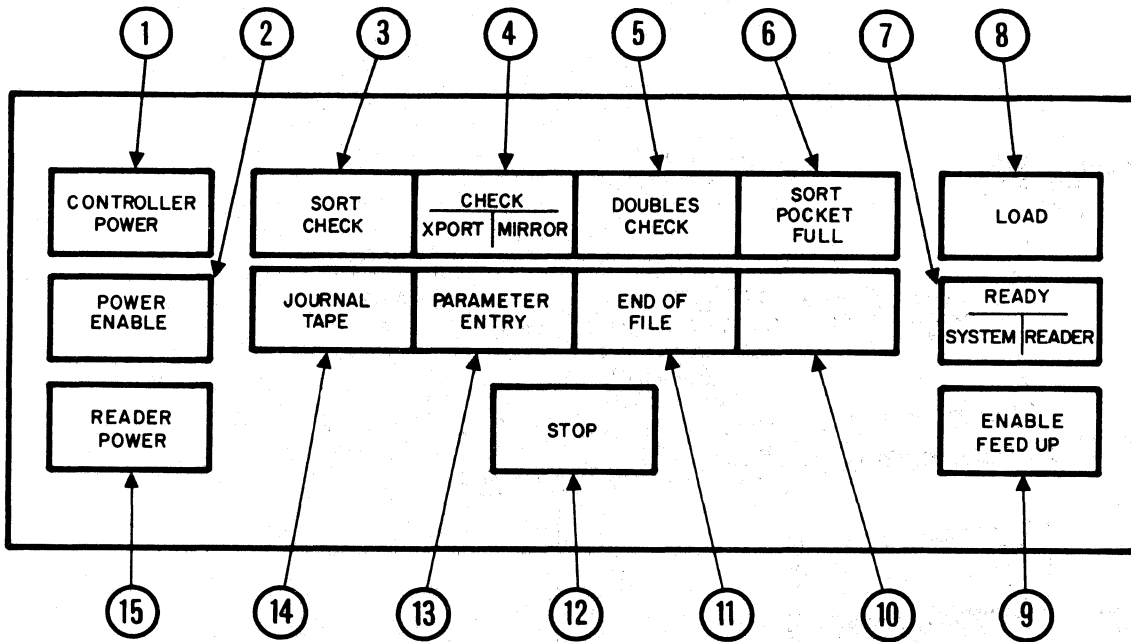


Figure 2-2. Reader Control Panels and Feedup Table



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Figure 2-3. Operator Control Panel

TABLE 2-5. OPERATOR CONTROL PANEL CONTROLS AND INDICATORS (S/N 103-150)

Figure 2-3 Index No.	Reference Designation	Control or Indicator	Function
1	S09 DS07-DS08	CONTROLLER POWER pushbutton switch and indicator lamps	Enables and disables ac power to the controller power supplies if the POWER ENABLE switch is set to ON. The indicator lamps light when power to the controller is ON and all controller dc supplies are operational.
2	S06 DS19-DS20	POWER ENABLE pushbutton switch and indicator lamps	This switch enables ac power to the reader and controller and functions as an emergency off switch. When the POWER ENABLE switch is set to ON the POWER ENABLE indicator lamps light.
3	DS21-DS22	SORT CHECK indicator lamps	A logic 1 level, originating in the controller, energizes the SORT CHECK indicator lamps when a detectable malfunction has occurred at a sort station.



TABLE 2-5. OPERATOR CONTROL PANEL CONTROLS  
AND INDICATORS (S/N 103-150) (CONT'D)

Figure 2-3 Index No.	Reference Designation	Control or Indicator	Function
4	DS23-DS24	CHECK XPORT/ MIRROR indicator lamps	<p>A logic 1 level, originating in the controller, energizes the XPORT CHECK indicator lamps when a detectable malfunction has occurred in the transport area or the input hopper is empty.</p> <p>A logic 1 level, originating in the controller, energizes the MIRROR CHECK indicator lamps when a detectable malfunction has occurred in the line scan mirror system.</p>
5	DS25-DS26	DOUBLES CHECK indicator lamps	<p>A logic 1 level, originating in the controller, energizes the DOUBLES CHECK indicator lamps indicating that a double document feed has been detected.</p>
6	DS27-DS28	SORT POCKET FULL indicator lamps	<p>A logic 1 level, originating in the controller, energizes the SORT POCKET FULL indicator lamps when either of the output hoppers is full and requires operator intervention to empty.</p>
7	S05 DS17-DS18	READY SYSTEM/ READER pushbutton switch and indicator lamps	<p>When the READY SYSTEM/READER switch is pressed, a logic 1 level, originating in the reader, indicates to the controller that the READY switch has been depressed.</p> <p>A logic 1 level, originating in the controller, energizes the READY system indicator lamps indicating that the READY switch was (or is being) depressed and that reader ready and controller ready are present. The READY reader indicator is representative of the READER/CONTROLLER being mechanically ready and on-line to the computer.</p>
8	S08 DS29-DS30	LOAD pushbutton switch and indicator lamps	<p>When the LOAD switch is pressed, a logic 1 level, originating in the reader, indicates to the controller that the LOAD switch is depressed and that document loading and clearing should be performed.</p> <p>The LOAD switch will be active only during a STOP (reader not ready) condition.</p>

TABLE 2-5. OPERATOR CONTROL PANEL CONTROLS  
AND INDICATORS (S/N 103-150) (CONT'D)

Figure 2-3 Index No.	Reference Designation	Control or Indicator	Function
8 (cont'd)			A logic 1 level, originating in the controller, energizes the LOAD indicator lamps. The LOAD indicator lamps will light with depression of the LOAD switch and will remain on until a document is at ready position.
9	S04 DS05-DS06	ENABLE FEED UP pushbutton switch and indicator lamps	Enables and disables the feedup table drive clutch. The indicator lamps light when the feedup table is enabled. Normally, feedup table is disabled for document loading.
10	DS15-DS16	Spare	Not used.
11	S03 DS13-DS14	END OF FILE push- button switch and indicator lamps	When the END OF FILE switch is pressed, a logic 1 level originates in the reader indicating to the controller that the end of file switch is depressed. A logic 1 level originating in the controller, energizes the END OF FILE indicator lamps. Pressing end of file causes the end of file indicator and end of file status to toggle, ON or OFF, based on its previous condition. END OF FILE will also clear on clear controller or master clear. The END OF FILE indicator lamps will reflect the condition of END OF FILE status to the computer and will be active only during a STOP condition.
12	S07 DS03-DS04	STOP pushbutton switch and indicator lamps	When the STOP switch is pressed, a logic 1 level originates in the reader, indicating to the controller that the STOP switch is depressed.  A logic 1 level, originating in the controller, energizes the STOP indicator lamps when the reader has lost its mechanical or functional ready condition or the STOP switch has been depressed. The STOP indicator is representative of a "reader not ready" status to the computer, and "reader off line" to the operator.

TABLE 2-5. OPERATORS CONTROL PANEL CONTROLS  
AND INDICATORS (S/N 103-150) (CONT'D)

Figure 2-3 Index No.	Reference Designation	Control or Indicator	Function
13	S10 DS11-DS12	PARAMETER ENTRY pushbutton switch and indicator lamps	<p>When the PARAMETER ENTRY switch is pressed a logic 1 level originates in the reader enabling PARAMETER ENTRY. Signal will cause controller to generate a parameter ready only condition.</p> <p>A logic 1 level, originating in the controller, energizes the PARAMETER ENTRY indicator lamps. Indicator lamps light when switch is depressed and controller is holding parameter ready only condition.</p>
14	S02 DS09-DS10	JOURNAL TAPE pushbutton switch and indicator lamps (option only)	Enables and disables journal tape option. Lights indicator lamps when pressed.
15	S01 DS01-DS02	READER POWER pushbutton switch and indicator lamps	Enables and disables reader ac power if the POWER ENABLE and CONTROLLER POWER switches are set to ON. The indicator lamps light when power to the reader is on and all dc supplies are operational.

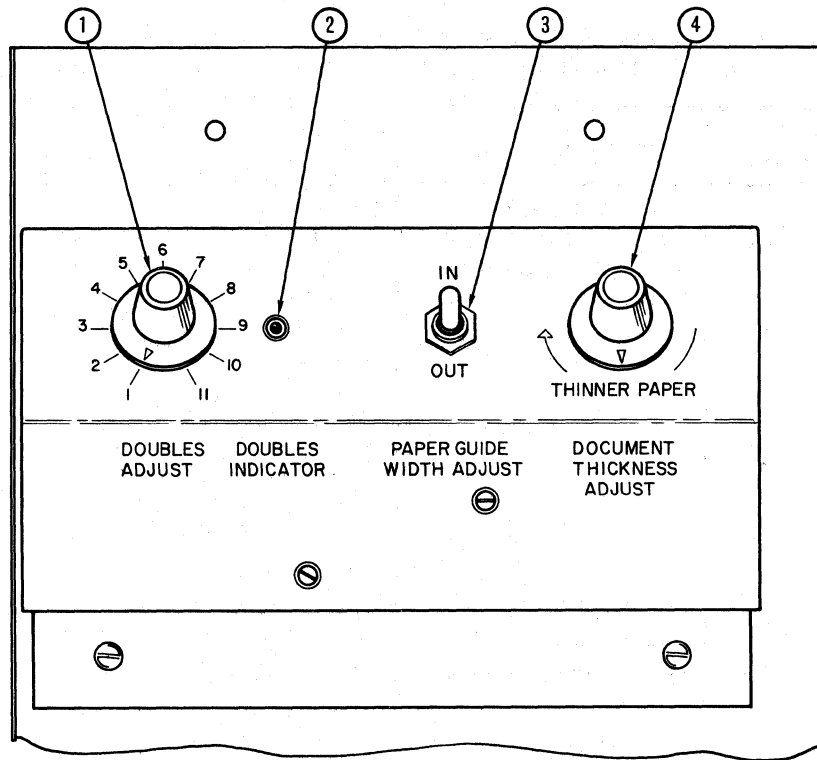


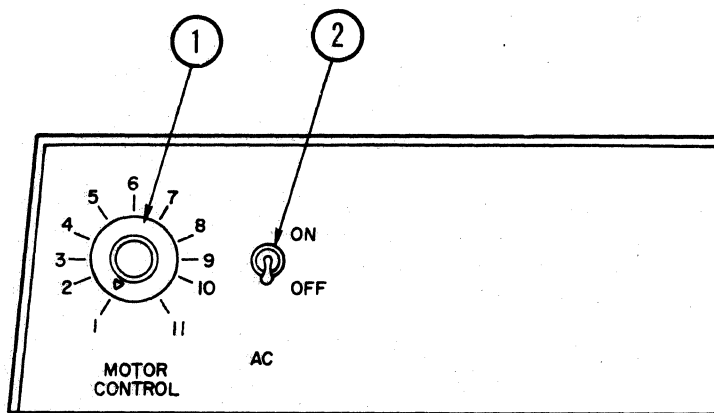
Figure 2-4. Document Adjustment Panel

TABLE 2-6. DOCUMENT ADJUSTMENT PANEL

Figure 2-4. Index No.	Reference Designation	Control or Indicator	Function
1	R01	DOUBLES ADJUST potentiometer	Adjusts doubles threshold level which is indicated by the DOUBLES INDICATOR.
2	CR01	DOUBLES INDICA- TOR	Lights when doubles are detected.
3	S01	PAPER GUIDE WIDTH ADJUST switch	Adjusts input hopper and edger guide plates.
4	C01	DOCUMENT THICKNESS ADJUST control	Controls position of brushback roller which is adjusted so that only one document will be fed at a time.

TABLE 2-7. JOURNAL TAPE CONTROL PANEL (SEE FIGURE 2-5)

Figure 2-5 Index No.	Reference Designation	Control or Indicator	Function
1	Potentiometer	MOTOR CONTROL	Controls the torque of journal tape motor.
2	Switch	AC toggle	Applies ac power to journal tape motor.



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Figure 2-5. Journal Tape Control Panel

TABLE 2-8. JOURNAL TAPE (OPTION) LOADING PROCEDURE

Step	Equipment	Procedure
1	Operator Control Panel	<p>NOTE</p> <p>If journal tape is less than 3 inches wide, a leader at least 3 inches wide must be spliced to the tape before loading is attempted. Splice may be either butt or overlapped using a non-bleed, clear transparent tape on the nonread side of the journal tape. If an overlap splice is used, the leader should be spliced to the nonread side of the journal tape. A 1/8 inch (3.175 mm) maximum overlap is permitted. (Refer to Pub. No. 60216102.)</p>

TABLE 2-8. JOURNAL TAPE (OPTION) LOADING PROCEDURE (CONT'D)

Step	Equipment	Procedure
2	Journal tape option	<p>Refer to Table 2-1 for power turn-on procedure.</p> <p>On journal tape assembly, lift and fasten read area cover. Push mechanical release arm pawl and arm latch to release both roller arms as shown in Figure 2-6. Adjust spooler assembly roll retainer and lower take-up spindle.</p>
3	Operator Control Panel	<p>Place tape roll on input spindle and thread through tape centering guides to reader conveyor as shown in Figure 2-6.</p> <p>Press JOURNAL TAPE pushbutton. JOURNAL TAPE indicator lights.</p> <p>Press LOAD pushbutton indicator.</p> <p>Tape moves to read area and stops.</p> <p>Press READY pushbutton indicator. READY lights.</p>
4	Journal tape option	<p>Tape is picked off vacuum belt by take-up fingers and guided through take-up spindle. When tape is approximately 3 inches past take-up spindle, tape is automatically wound around spindle.</p>
5	Takeup assembly	<p>When tape has been read, lift roll retainer and remove roll of tape using slight counterclockwise twist.</p>

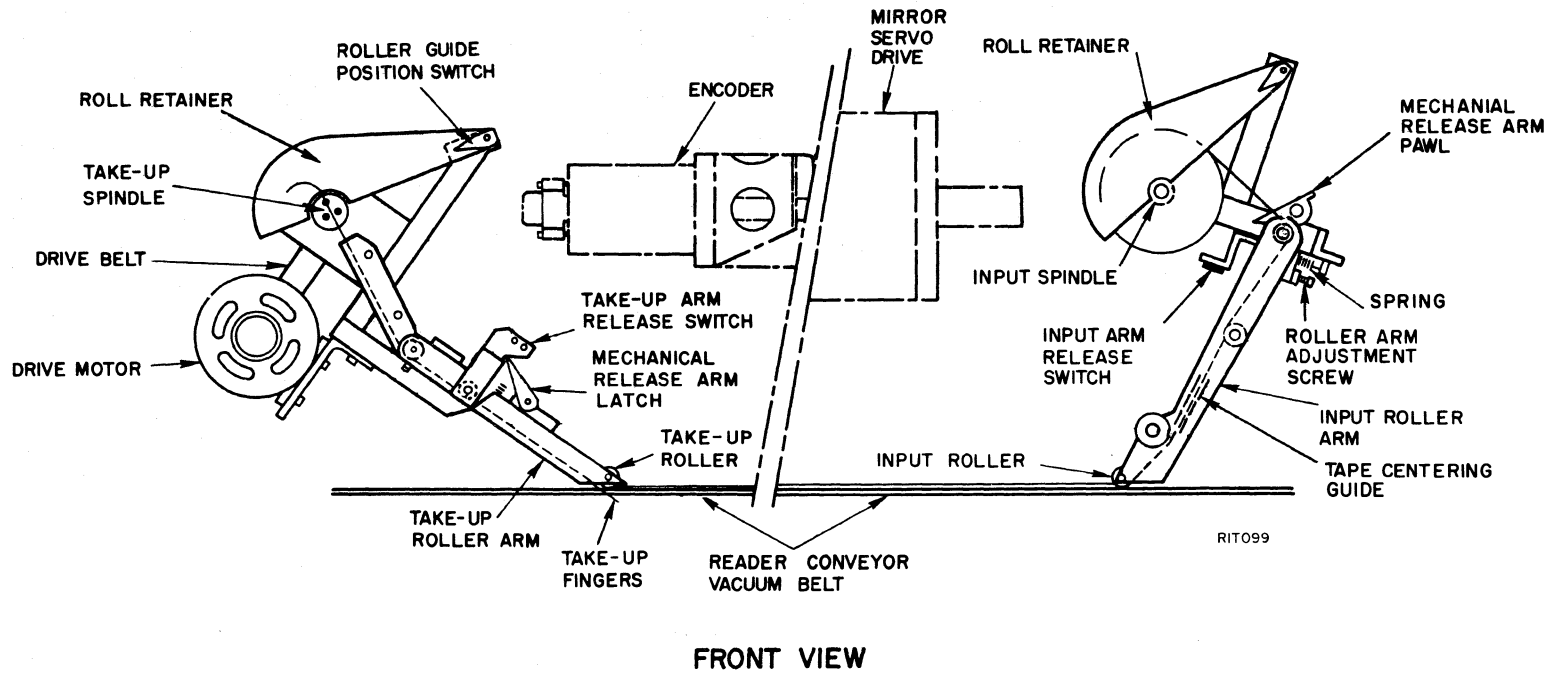


Figure 2-6. Journal Tape Option





SECTION 3  
PROGRAMMING

INTRODUCTION

This section contains programming information to enable reading and processing of printed pages and documents under control of a 1700 Computer. Function codes issued by the computer condition the controller to perform certain operations in controlling the reader. Status codes generated by the controller enable the computer to monitor certain conditions in the controller and the reader.

Two functions, Coupler mode and Autoload Control mode, require only that power be applied to the reader and the controller. For performance of any other functions the reader and controller must be Ready and the controller must be Not Busy.

The controller provides two levels of status. System status covers general conditions in the controller and the reader. Transport status is reserved for specific faults which occur in the transport system of the reader; for example, mirror faults. Current position of the line scanning mirror is included in the Transport status. Table 3-1 contains a list of Function and Status Codes and Table 3-2 contains a list of Data Transfer Words.

I/O COMMUNICATION

Communication between the 1700 Computer and the Buffer Controller is handled through the 1700's A/Q Channel. This I/O channel is directly linked to the A and Q Registers of the 1700 and to the Coupler of the Buffer Controller. The Basic Q register format is shown in Figure 3-1.

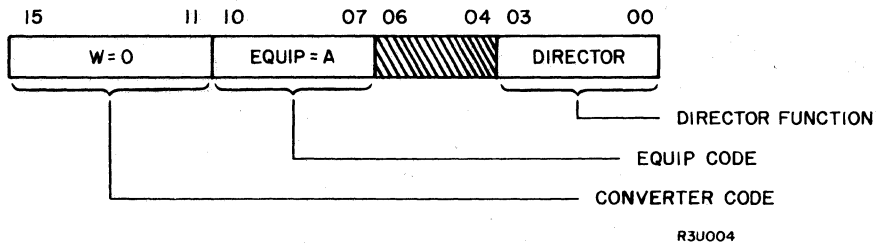


Figure 3-1. Q Register Format

CONVERTER CODE

For this system, Converter Code (W) = 0.

EQUIPMENT CODE

For this system, Equipment is A.

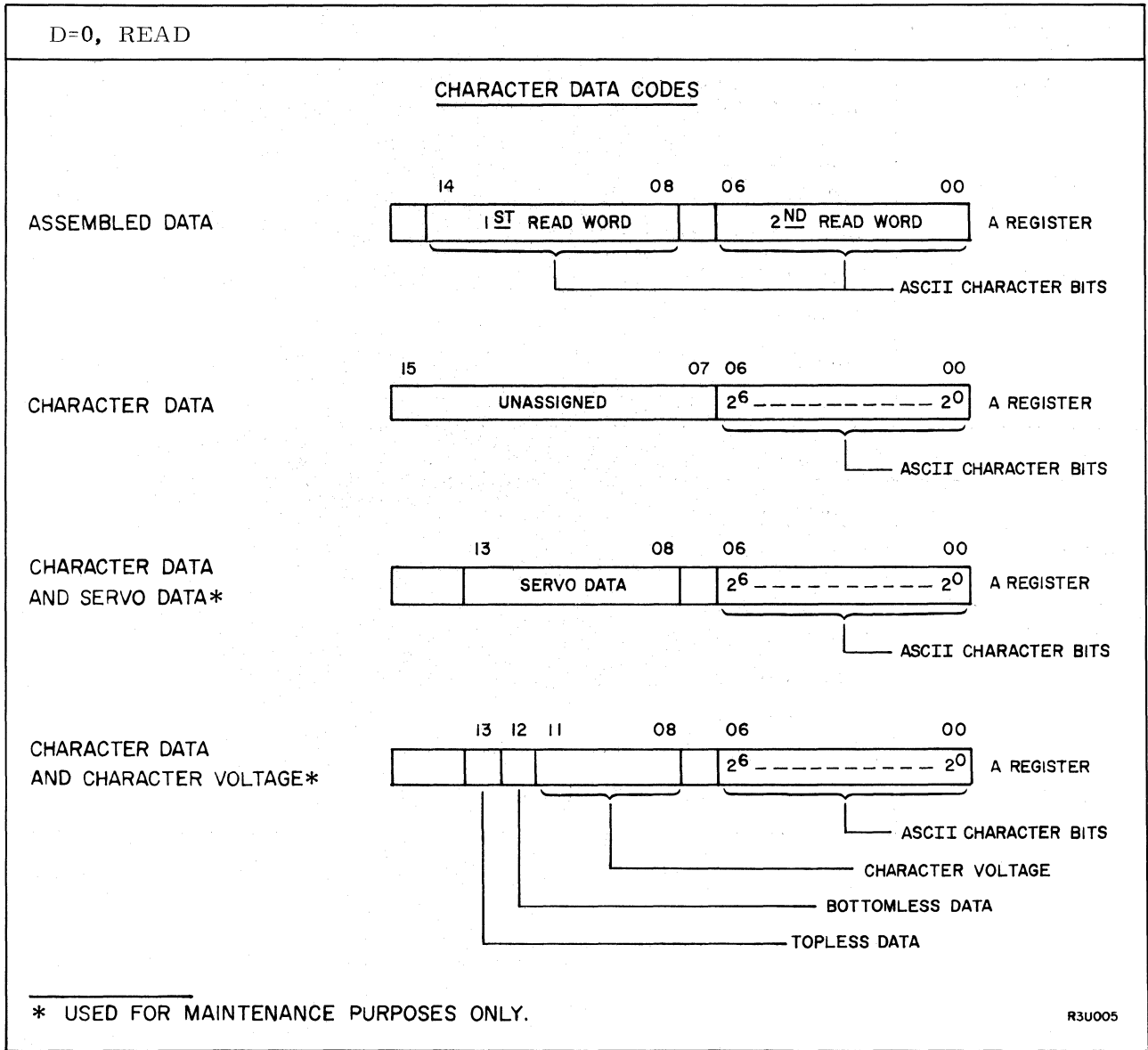
TABLE 3-1. FUNCTION AND STATUS CODES

Director	Title	Use
		<u>Function Codes</u>
		NOTE The coupler is the portion of the controller which actually interfaces with the 1700 Computer.
1	Coupler mode	Provides internal control to the coupler only, and permits selection and clearing of interrupts.
2	Parameter mode	Determines the transfer format of read data, controls the scan height, controls transmission of Font/Field and Control parameter tables, and indicates the number of words in a given parameter table.
3	Positioning mode	Determines the page advance parameters and provides a mirror count representing the coordinate to which the line scanning mirror is to be moved.
4	Mechanical Action mode	Includes selected mechanical actions: Zero Mirror, Sort to pocket 1, Sort to pocket 2, and Mark Document.
5	Read mode	Contains the initial and final mirror coordinates for the line to be read.
6	Line locate mode	Contains the initial and final mirror coordinates for a line that is to be located and centered in the read area.
8	Autoload data mode	Consists of a block of up to 4096 words comprising the resident software to be loaded into the controller memory.
9	Autoload control mode	Given just prior to loading the resident software program into the controller, this function also permits selection and clearing of interrupts.
		<u>Status Codes</u>
1	System status	Covers general conditions in the controller and the reader.
2	Transport status	Indicates line scanning mirror position and identifies specific faults in the transport system of the reader.

TABLE 3-2. DATA TRANSFER WORDS

Table Identifier Hex.	Word
D=0, WRITE	Used to send over the Font/Field or the Control Table Word or OLCC (ID 8)
	<u>Font/Field Word</u>
ID 1	Font Word
ID 2	Initial Field Coordinate Word (IFC)
ID 4	Terminal Field Coordinate Word (TFC)
ID 5	Video Word
ID 6	Line Width Word
ID 7	Handprint Font Select Word
ID 8	Character Correction Word
	<u>Control Word</u>
ID 9	End of Line Word
ID A	Cancel Character Word
ID B	Delete Line Word
ID C	Blank Line Word
ID D	Mirror Image Word
ID E	Rescan Word
ID F	Document Ready Advance Word

TABLE 3-2. DATA TRANSFER WORDS (CONT'D)



## DATA TRANSFER

To transfer data, all bits of the Director must equal zero, and an accompanying Read signal or Write signal will specify the direction of data flow. Write data consists of table words for the control of Font/Field or Control Tables or OLCC (see Table 3-2). A Director 2 (Parameter mode) function immediately precedes the transmission of Write data, and a Parameter Command within this function indicates how the new table words will be entered. For example, in some cases the previous table may be cleared and a new one entered, or the new table words may replace corresponding words in an existing font/field or control table. The uppermost 6 bits of the Director 2 function contain a binary count equal to the number of table words to be transmitted to the controller.

On a Read data, the first word of the data block will consist of a binary number defining the length of the data block being transferred. Table 3-2 contains a listing of the formats the READ DATA can be received in. The formats are selected in the Director 2 (PARAMETER MODE) function.

Read data is normally transmitted in the "assembled" format, with two 7-bit characters per 16-bit word; however, single-character transmission can be selected if desired. The data will be transmitted in the lower byte, and the upper byte of the word will be clear. For maintenance purposes, two additional Read modes are available in which additional information is transmitted in the upper byte. (See Table 3-2 and Director 2, function bits 5 and 6.) Table 3-3 lists the hexadecimal character codes used in this equipment for ANSI upper case and lower case characters.

## DIRECTOR FUNCTIONS

### INTRODUCTION

Six different System Control director functions are defined by bits 0 through 3 of the Q register, accompanied by a Write signal. The "specific" functions in each of these categories are defined by bits of the A register, and are acted on or stored by the Controller.

#### Coupler Mode (D=1)

Functions include Clear Controller; Clear Interrupt; Data Interrupt Request; End of Operation Interrupt Request (EOP), and Alarm Interrupt requests. The Coupler will accept all Coupler Mode functions, regardless of the state of Ready or Busy if power is on. Refer to Figure 3-2 for Coupler Mode Word Format.

#### Clear Controller

Bit 0 clears all interrupt requests, errors, and other clearable coupler logic, as well as providing for programmed clearing of the Controlware. This bit will be subordinate to all interrupt request bits after clearing interrupts and interrupt requests.

#### Clear Interrupt

Bit 1 clears all interrupt requests and responses. This bit will terminate data transfers between the buffer controller and the 1700 system. This bit will be subordinate to all interrupt request bits after clearing interrupts and interrupt requests.

TABLE 3-3. CHARACTER CROSS REFERENCE CHART

Hex.	OCR	TTY	Hex.	OCR	TTY	Hex.	OCR	TTY	
20	Space	Space	36	6	6	4C	L	L	
21	^	\	37	7	7	4D	M	M	
22	∇	"	38	8	8	4E	N	N	
23	*	#	39	9	9	4F	O	O	
24	⋈	S	3A	:	:	50	P	P	
25	%	%	3B	;	;	51	Q	Q	
26	&	&	3C	^	∅	Unused	52	R	R
27	∇	∇	3D	=	=	53	S	S	
28	{	(	3E	↑	↑	54	T	T	
29	}	)	3F	?	?	55	U	U	
2A	* *	*	40	Reject	Unused	56	V	V	
2B	+	+	41	A	A	57	W	W	
2C	,	,	42	B	B	58	X	X	
2D	-	-	43	C	C	59	Y	Y	
2E	.	.	44	D	D	5A	Z	Z	
2F	/	/	45	E	E	5B	Unused	Unused	
30	0	0	46	F	F	5C		<	
31	1	1	47	G	G	5D	↓	←	
32	2	2	48	H	H	5E	—	Unused	
33	3	3	49	I	I	5F	⋈	@	
34	4	4	4A	J	J	60	Unused	Unused	
35	5	5	4B	K	K				
ANSI Lower Case Character Set									
Hex.	OCR		Hex.	OCR		Hex.	OCR		
61	a		6A	j		73	s		
62	b		6B	k		74	t		
63	c		6C	l		75	u		
64	d		6D	m		76	v		
65	e		6E	n		77	w		
66	f		6F	o		78	x		
67	g		70	p		79	y		
68	h		71	q		7A	z		
69	i		72	r					
Control Character Code FF Indicates Field Separator									

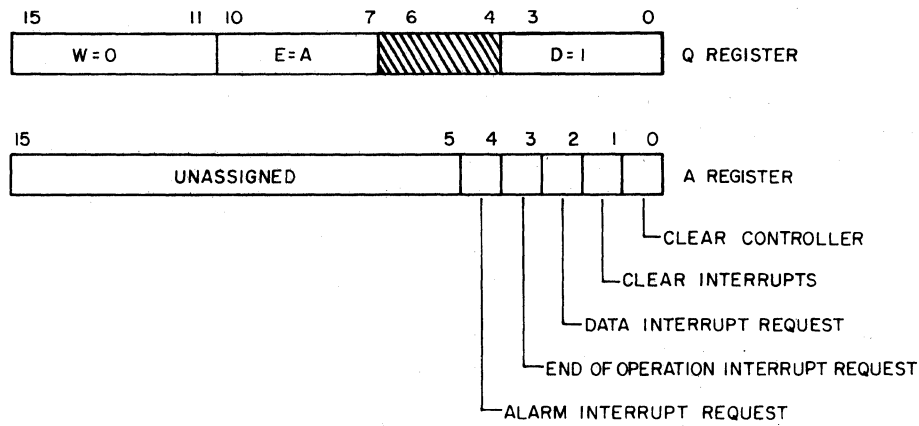


Figure 3-2. Coupler Mode Format

#### Data Interrupt Request

Bit 2 selects a Data Interrupt Request, causing an interrupt response to be generated when a data transfer is ready. The interrupt response is cleared by the Reply to data transfer. Both the interrupt request and response are cleared by either the Clear Controller, Clear Interrupt, or Master Clear signals.

#### End of Operation Interrupt Request

Bit 3 selects the End of Operation Interrupt Request. An End of Operation is defined as the completion of a directed operation. Both the interrupt request and response are cleared by either the Clear Controller, Clear Interrupt, or Master Clear signals.

#### Alarm Interrupt Request

Bit 4 selects the Alarm Interrupt Request. For this equipment, an alarm is defined as the occurrence of one of the following conditions: Not Ready, Lost Data, Transport Status Fault, Line Locate Failure, Autoload Required, Document No Sort, Data Skewed, or Document Length Fault.

#### NOTE

Feeder Doubles, Document Runout, Sort Check Fault, and Sort Pocket Full cause Ready to drop (as well as lighting the corresponding indicator) resulting in an Alarm condition.

Both the interrupt request and response are cleared by either the Clear Controller, Clear Interrupt, or Master Clear signals.

#### Unassigned

Bits 5 through 15 are unassigned.

Parameter Mode (D=2)

Functions include Clear, Data, End of Operation and Alarm Interrupt Requests, Character mode, Scan 2 mode, Parameter Command and Parameter Word Count. The Controller will accept Parameter Mode functions while Ready and Not Busy. On acceptance, the Coupler will go Busy and remain Busy until transmission of the parameter word(s) has been completed. All Parameter Mode functions must be selected prior to initiation of a Read Mode function (D=5). Refer to Figure 3-3 for Parameter Mode Format.

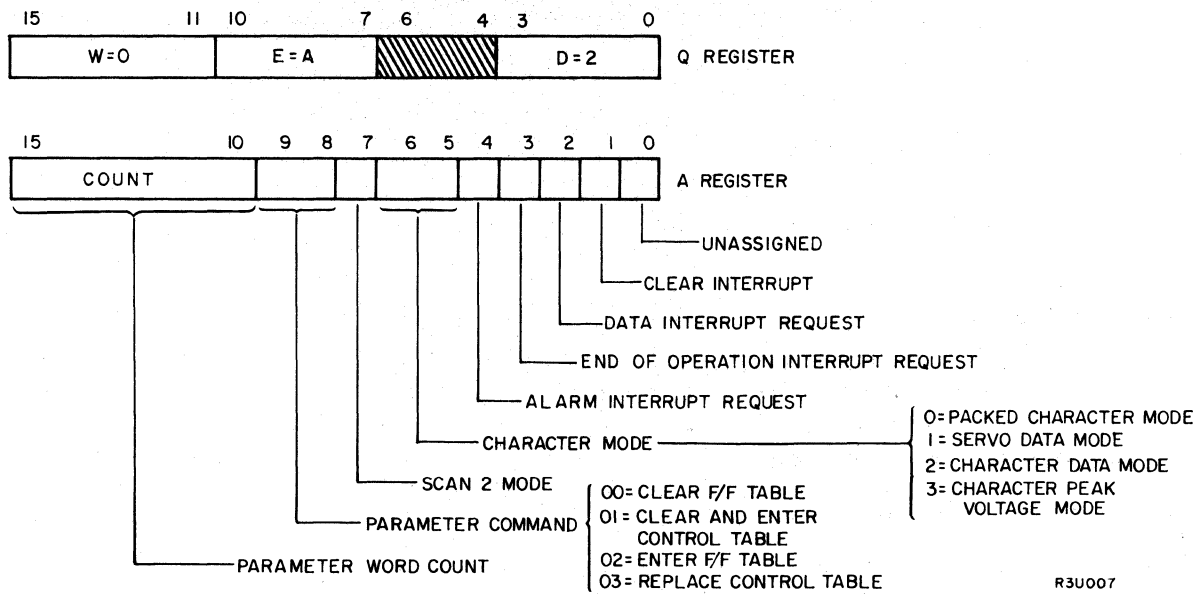


Figure 3-3. Parameter Mode Format

Clear Interrupt (Refer to Coupler Mode).

Data Interrupt Request (Refer to Coupler Mode).

End of Operation Interrupt Request (Refer to Coupler Mode).

Alarm Interrupt Request (Refer to Coupler Mode).

Character Mode

Bits 5 and 6 direct the Controller to transmit read characters as follows (see also Table 3-2):

00 - Assembled Data Mode

The Controller transmits the first read character in the most significant half of the data word, and the second read character in the least significant half of the data word.



10 - Character Data Mode

The Controller transmits read characters singly in the least significant half of the data word, and the most significant half of the data word is set to zero.

NOTE

The following modes of data transfer are used for maintenance purposes only.

01 - Character and Servo Data Mode

The Controller transmits read characters singly in the least significant half of the data word and the most significant half of the data word contains the servo count for that character. (Servo count indicates how well the character is registered with the center of the optics.)

11 - Character Data and Character Peak Voltage Mode

The Controller transmits read characters singly in the least significant half of the data word, and the most significant half of the data word equals the stored character peak voltage for that character plus an indication of data extending beyond the optical limits of the Reader. (Character peak voltage indicates the degree of correlation with the character matrix.)

Scan Mode

Bit 7 controls the height of the scan area on the page. When bit 7 is clear, the Reader will scan 3 characters high and when bit 7 is set, the Reader will scan 2 characters high. If the Reader is equipped with the 6 lines/inch option, selection of bit 7 enables reading of 6 lines/inch data.

Parameter Command

Bits 8 and 9 direct the Controller to Input font, field, and control parameters as follows:

NOTE

Table 3-2 contains a listing of the parameter command words, with their table identifiers.

00 - Clear Font/Field Selection

The Controller will stop coordinate testing and font selections for a previously entered font/field table.

01 - Clear and Enter Control Selection

The Controller will clear a previously entered control table and prepare to enter a new control table of (Parameter Word Count) words. A Parameter Word Count equal to zero acts as a Clear Control Table Function.

10 - Enter Font/Field Table

The Controller will prepare for input of font/field words that will define initial and terminal coordinates of a read, video parameters, and the font or ANSI

character subset that is to be read within a field. The entire table can contain up to 48 words, defining up to 8 different fields in this manner.

NOTE

The font, video, and line width words need not be repeated for each new field unless they change.

11 - Replace Control Table

The Controller will prepare for input of 1 to 8 control table words that will replace corresponding words in a previously entered control table.

Parameter Word Count

Bits 10 through 15 are used in conjunction with the Enter or Replace Table functions to indicate (by a binary number) how many parameter words are contained in the table to be transmitted to the Controller. For font/field tables, this number will not exceed 48 (defining a maximum of 8 fields), and for character control tables, this number will be 1 to 8, depending on the number of words to be entered.

Unassigned

Bit 0 is unassigned.

Position Mode (D=3)

Functions include a page advance count, page advance step sizes, and a mirror coordinate. Vertical positioning (down the page) is accomplished by page advance, and horizontal positioning of the line scanning mirror is accomplished by defining mirror coordinates. This function is accepted only when the coupler is Ready and Not Busy. Page advance and mirror motion will be executed simultaneously, and the coupler will remain Busy until all motion has stopped. Refer to Figure 3-4 for Position Mode Format.

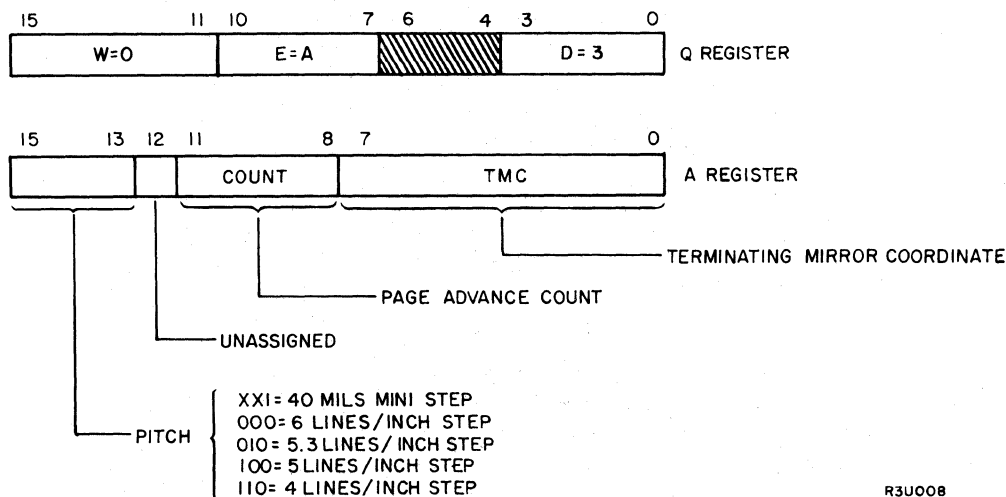


Figure 3-4. Position Mode Format

### Terminating Mirror Coordinate

Bits 0 through 7 contain the coordinate position to which the line scanning mirror is to be moved (for horizontal positioning). The coordinate will be in the form of a hexadecimal number between 01 and F9<sub>16</sub>, with each coordinate equal to approximately 0.048 inch.

### Page Advance Count

Bits 8 through 11 contain a hexadecimal number between 1 and F<sub>16</sub>, which indicates the number of steps that the page is to be advanced for vertical positioning. (Step size is indicated by bit 13 or bits 14 and 15.)

### NOTE

A Terminating Mirror Coordinate of zero will act as a Mirror "No OP" function, and a Page Advance Count of zero will act as a Page Advance "No OP" function.

### Unassigned

Bit 12 is unassigned

### PITCH SELECTION

Bit 13 selects the Mini-Step. When set, the value of the page advance count will be executed in .040 inch steps.

Bit 13 indicates the size of step that the page is to be advanced for each page advance count. When bit 13 is set, the step size is 0.040 inch, and when bit 13 is clear, the page is advanced one basic line for each page advance count.

### Enable Page Advance Increment

Bits 15 and 14 combine to define the size of the basic line step, as follows:

- 00 6/inch mode gives a step length of 0.168 inch.
- 01 5 1/3 lines/inch - step length is 0.192 inch.
- 10 5 lines/inch - step length is 0.200 inch.
- 11 4 lines/inch - step length is 0.248 inch.

### NOTE

If a document is Page Advanced out of the Read Zone, the controller will generate an Alarm status (and interrupt, if requested) and will set the Document No Sort bit of the system status word. The system will now hang until a Sort Command is received.

Mechanical Action Mode (D=4)

Functions include Clear Interrupt, End of Operation Interrupt requests, Alarm Interrupt Request and Mechanical Actions not referenced in other director functions i. e., Zero Mirror, Sort to Pocket 1, Sort to Pocket 2 and Mark Document. The coupler will accept Mechanical Action functions while in the state of Ready, Not Busy and will remain Busy until the Mechanical Action has been completed. Refer to Figure 3-5 for Mechanical Action Mode Format.

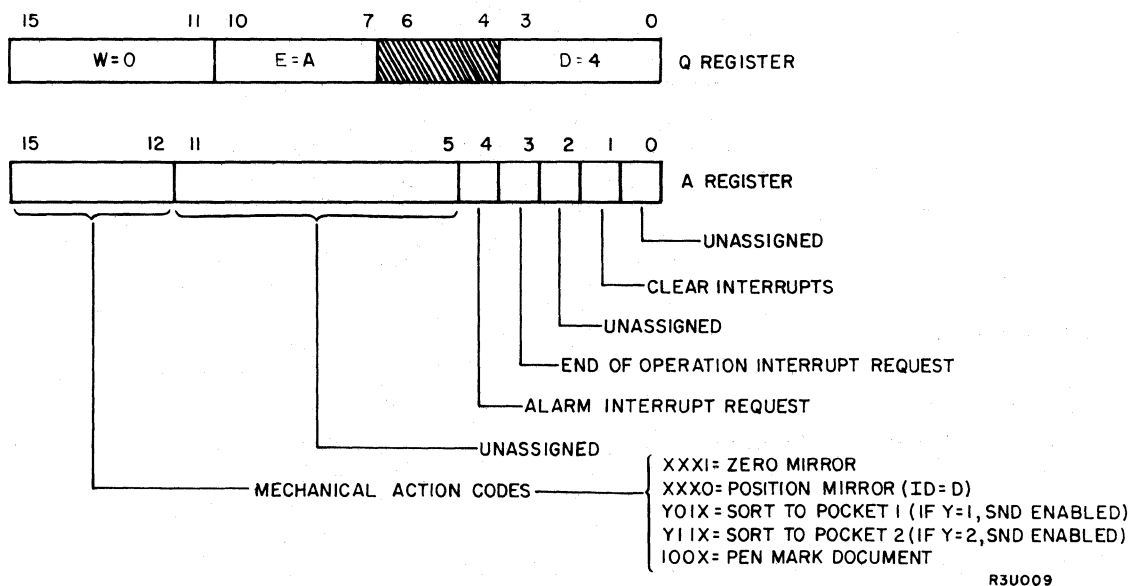


Figure 3-5. Mechanical Action Mode Format

Clear Interrupts (Refer to Coupler Mode)

End of Operation Interrupt Request (Refer to Coupler Mode)

Alarm Interrupt Request (Refer to Coupler Mode)

Unassigned

Bits 5 through 11 are unassigned.

Mechanical Action Codes

Bits 12 through 15 combine to select mechanical actions not referenced in other director functions, as follows:

XXX1 - Zero Mirror

This function code directs the Controller to move the line scanning mirror to the initial limit of the scan area. This will result in a "No-OP" if the mirror is already outside of the scan area. At the conclusion of this operation, the Scan Gate status and Mirror Position status will be cleared to zero and an End of Operation Interrupt will be generated if requested.

XXX0 - Position Mirror

The mirror will move to the Terminal Mirror Coordinate previously selected in the Control Table.

NOTE

If Zero Mirror or Position Mirror is selected along with one of the following mechanical actions, the End of Operation Interrupt will not be generated until both mechanical actions are completed. Neither Zero Mirror nor Position Mirror will be performed with the marking pen.

001X - Sort to Pocket 1

This function directs the Controller to release the document currently at the Read Station and prepare to sort the document to sort pocket 1. The operation is complete when the next document reaches the Document Ready plus the Document Ready Page Advance Count Position, or after 30 inches of transport belt motion which indicates that no further documents are in the system. When the operation is complete, and End of Operation Interrupt will be generated if requested. If document run-out occurs, an Alarm Interrupt will be generated if requested.

011X - Sort to Pocket 2

This function is the same as the previous function except the document is sorted to sort pocket 2.

NOTE

If a document is advanced beyond the specified limits for line reading, the Controller will generate an Alarm status, and Interrupt, if requested, and will set the Document No Sort status.

The Controller will require that the user define a sort pocket by means of a Mechanical Action function code before acting on any further page advance operation.

This function directs the Controller to initiate the marking sequence. At the completion of the marking sequence, an End of Operation Interrupt will be generated if requested.

NOTE

Where two mechanical actions are defined within one function code, End of Operation Status will be generated at the completion of all action.

Read Mode (D=5)

This director function is used to obtain character data from between specified coordinates on a given line. The coupler will accept a Read Mode director function while Ready and Not Busy, and will then go Busy and remain Busy until the read operation, including data transfer, has been completed. Refer to Figure 3-6 for Read Mode Format.

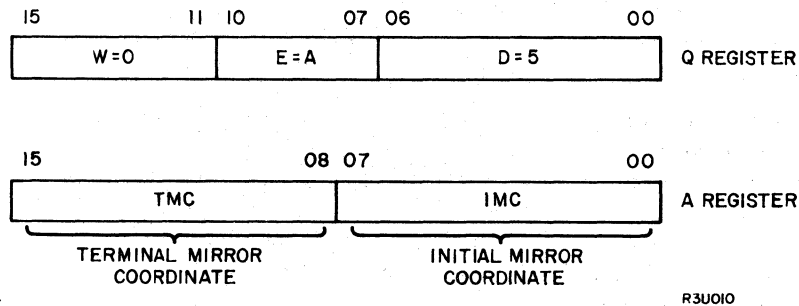


Figure 3-6. Read Mode Format

Initial Mirror Coordinate

Bits 0 thru 7 contain the IMC for a read operation. If the line scanning mirror is positioned at least four coordinates to the left of the IMC, the Controller will initiate the read operation. However, any attempt to read with a mirror position greater than IMC - 4, a TMC less than IMC, or a TMC greater than F9<sub>16</sub> will cause a mirror coordinate fault and generate an Alarm and Interrupt, if requested, and no mirror action will occur.

Upon initiation of the read operation, the line scanning mirror sweeps from left-to-right and when the mirror position and the IMC compare, the Read signal to the recognition logic will be enabled and character data will be stored in the data buffer. Data input will continue until the TMC or the last TFC is reached or the End of Line, Delete Line, or Blank Line Limit Parameters are reached (see Control Table).

After completing a line read, the Controller will prepare for a block transfer of data to the 1700 Computer and will generate a Data Interrupt, if requested. The first word to be transmitted by the Controller will contain the Data Buffer Count (total number of words to be transmitted). Data transmission will continue to the end of the data block or until either a Clear Interrupt (with Data Interrupt Request previously selected) or a Clear Controller is issued. At the end of data transfer, an End of Operation Interrupt will be generated, if requested. Data will normally be assembled with two 7-bit ASCII codes per 16-bit word, unless character mode has been selected with a Director 2 (Parameter Mode) function.

#### Terminal Mirror Coordinate

Bits 8 thru 15 contain the TMC for the read operation. When the mirror position and the TMC compare, the Read signal will drop and the Controller will prepare for a block transfer of character data to the 1700 Computer and will generate a Data Interrupt, if requested.

#### Line Locate Mode (D=6)

This director function is used to obtain a line sweep between specified mirror coordinates for the purpose of obtaining character positional information (character data is not taken). The coupler will accept a Line Locate Mode function while Ready and Not Busy, and will remain Busy until the line sweep has been completed. Refer to Figure 3-7 for Line Locate Mode Format.

#### NOTE

The completion of a Line Locate function will generate End of Operation status. Line Locate Failure and Alarm status will be generated if the Line Locate is not successful for any reason.

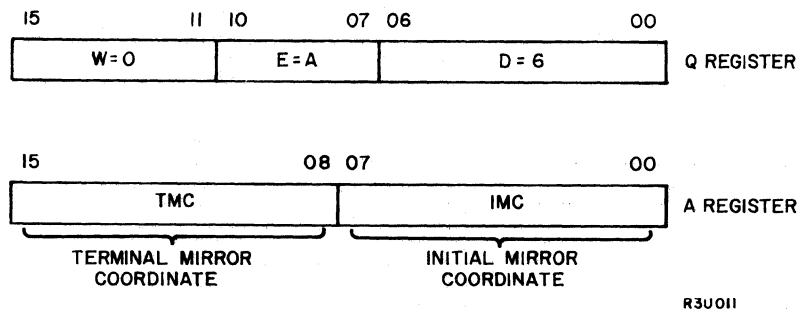


Figure 3-7. Line Locate Mode Format

#### Read Coordinates

The mirror coordinate set and mirror fault conditions for the Line Locate Mode are the same as for the Read Mode D=5.

The terminal read coordinate in Line Locate mode should be a minimum of three coordinates beyond the area where a character is expected to be read plus normal tolerances for document position.

The line locate function will cause the mirror to sweep in the direction selected with Servo Data being taken on full height characters only between IMC and TMC. Upon reaching TMC or the last TFC, the data gathered on the sweep will be analyzed and a decision made on the following basis to determine if the Line Locate was successful:

- A A delete line symbol will generate a successful line locate.
- B A topless or bottomless will cause a rescan to center the line.
- C If good servo data was received, it will cause a rescan to center the line.
- D If neither A, B, nor C - a non reject handprint character will generate a successful line locate.
- E If neither A, B, C, nor D, a line locate failure will be generated.
- F Failure to center the line after 5 rescans in conditions B and C will cause line locate failure.

### AUTOLOAD DIRECTOR FUNCTION

#### INTRODUCTION

These two director functions, defined by bits 0 and 3 of the Q register and a write signal, allow the controller program to be loaded from the 1700 Computer. The autoload procedure must be performed when power is initially applied to the Reader and any time the program fails to detect a Master Clear or a Controller Clear.

Autoload Data Mode (D=8)

After an Autoload Control Mode function, the Autoload Data Mode will be accepted until completion of the data transfer or until a Clear Controller or Clear Interrupt, with data interrupt previously selected, terminates the block transfer. Refer to Figure 3-8 for Autoload Data Mode Format.

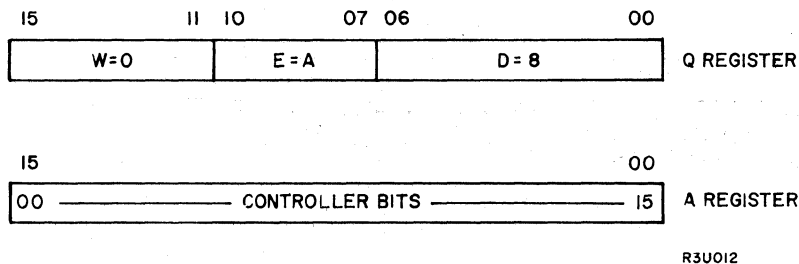


Figure 3-8. Autoload Data Mode Format

#### Data Words

The data word format for autoload data is shown above. After an Autoload Control Mode function, the Autoload Data Mode will be accepted until completion of the 4096 word transfer or until a Clear Controller or Clear Interrupt (with Data Interrupt selected previously)



terminates the block transfer. Note that the Controller bits 00 through 15 are reversed: this simply indicates that Controller bit 2<sup>0</sup> is "designated" as bit 15 and Controller bit 2<sup>15</sup> is "designated" as bit 00.

Autoload Control Mode (D=9)

Functions include Clear Controller; Clear Interrupts; and Data, EOP, and Alarm Interrupt requests. The Controller will accept all Autoload Control Mode functions regardless of the state of Ready or Busy if power is on. After accepting the autoload director function, the Controller will stop, Master Clear, and prepare for a block transfer of up to 4096 16-bit binary words. Refer to Figure 3-9 for Autoload Control Mode Format.

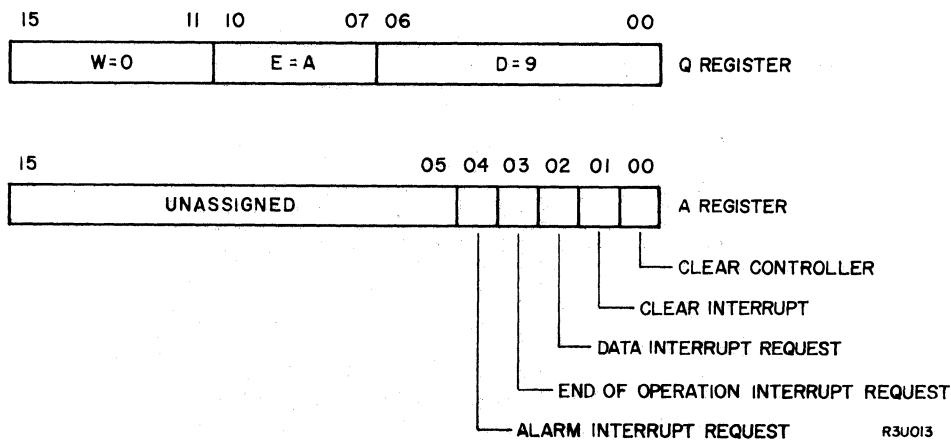


Figure 3-9. Autoload Control Mode Format

Clear Controller (Refer to Coupler Mode)

Clear Interrupts (Refer to Coupler Mode)

Data Interrupt Request (Refer to Coupler Mode)

End of Operation Interrupt Request (Refer to Coupler Mode)

Alarm Interrupt Request (Refer to Coupler Mode)

Unassigned

Bits 5 through 15 are unassigned.

DIRECTOR STATUS

Two levels of status, defined by bits 0 and 1 of the Q register and a Read signal, direct the data lines to transfer the status of the equipment to the computer.

SYSTEM STATUS (D=1)

Bits in the A register, if set after a request for system status, represent the usual conditions of Ready, Busy, Interrupt, Data, End of Operation, Alarm, Lost Data, and Program Protect, as well as the following special conditions unique to this system: Autoload, Line Delete, Character Reject, Line Locate Failure, End of File, Transport Status Fault, Document No Sort, and Data Skewed. Refer to Figure 3-10 for System Status Format.

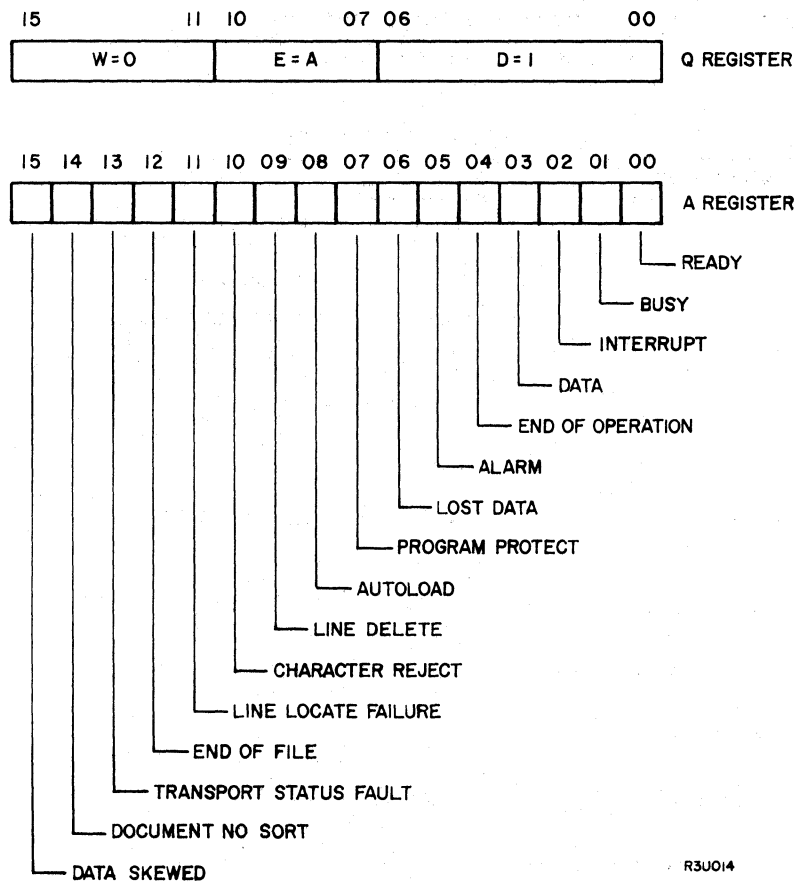


Figure 3-10. System Status Format

## Ready

Bit 0 indicates that the Reader is Ready and an operation can be performed. This bit is set when the Reader's Mechanical Ready and Electrical Ready signals are present, the Controller is Ready and has positioned a document for Document Ready, and the READY pushbutton indicator on the Operator Control Panel has been pressed. Ready status will be reflected at the Ready pushbutton indicator except during a Parameter Entry Ready and will clear on the loss of any of the above conditions. Ready status will also clear when the STOP pushbutton indicator is pressed.

If an operation is in process when STOP is pressed, the operation will be completed before the Ready status is permitted to clear. When Ready status clears, Alarm status (and interrupt, if requested) will be generated.

## Busy

Bit 1 indicates that the Controller has been directed to initiate an operation and stays set until the operation is completed.

## Interrupt

Bit 2 indicates that a system interrupt response has been sent from the Controller. Other status bits must be monitored to determine the cause of the interrupt. Interrupt status is cleared by a Clear Controller or Clear Interrupt.

## Data

Bit 3 indicates that the Controller is ready to perform a data transfer. If a Data Interrupt has been selected, this bit also indicates the type of interrupt that has occurred. It will be cleared by an input or output instruction with a command code D=0, a Clear Controller, or a Clear Interrupt. Clear Controller or Clear Interrupt will terminate data transfer.

## End of Operation

Bit 4 indicates that an operation that was initiated by a function code has operated to completion. This bit sets when the Busy status clears. This bit indicates the cause of the interrupt when End of Operation Interrupt is requested, as follows:

1. Completion of positioning motion.
2. Completion of mechanical action.
3. Completion of a read function.
4. Completion of a Line Locate function
5. No further action is possible.

This bit will be cleared by a Clear Controller or a Clear Interrupt or initiation of the next function.

## Alarm

Bit 5 indicates an alarm that is the result of one of the following conditions:

1. Not Ready,
2. Lost Data,
3. Transport Status Fault,
4. Line Locate Failure,
5. Autoload Required,
6. Document no Sort, or
7. Data Skewed.

#### NOTE

Feeder Doubles, Document Runout, Sort Check Fault, or Sort Pocket Full will cause Ready to drop, which will result in Alarm status. (Cooresponding panel indicators will light but no status bits are dedicated to these particular conditions.)

This bit indicates the cause of the interrupt when Alarm Interrupt is requested. This bit will be cleared by a Clear Controller, Master Clear, or initiation of the next function.

#### Lost Data

Bit 6 indicates that data was lost in the operation just performed. For I/O operations between the Controller and the 1700 Computer, data must be transferred within 500 microseconds after Data status is up, or data will be lost. On a read operation, the Reader can store up to two additional character codes after signalling Character Data Ready for a particular character. Then the Reader will issue a Late Character Data indication which will cause Lost Data status to be issued by the Controller. This status will cause the Alarm status, and an Alarm Interrupt will be generated if requested. This bit is cleared by a Clear Controller, Master Clear, or initiation of the next function.

#### Program Protect

Bit 7 indicates that the PROGRAM PROTECT switch on the Controller Maintenance Panel is set to the up (protected) position.

#### Autoload

Bit 8 indicates that the computer has directed the Controller to perform an autoload. It is cleared by completion of autoload.

#### Line Delete

Bit 9 indicates that a defined delete line symbol or the standard delete line bar was recognized while a line was being read. (See Character Control word, HEXB.) This bit is cleared by a Clear Controller, Master Clear, or initiation of the next function.

#### Character Reject

Bit 10 indicates that the Controller has received a Read Reject code from the Reader. (Reader logic circuits were unable to determine best character match from two possible characters.) This status is cleared by a Clear Controller, Master Clear, or initiation of the next function.

#### Line Locate Failure

Bit 11 indicates that the Line Locate operation has failed the search for a line of printing. This status is cleared by a Clear Controller, Master Clear, or acceptance of the next function.

#### End of File

Bit 12 indicates the the END OF FILE pushbutton indicator on the Operator Control Panel was pressed during a Not Ready condition. This status is cleared by Clear Controller, Master Clear, Clear Interrupt, or depression of End of File switch or Ready Switch.

#### Transport Status Fault

Bit 13 is used in conjunction with the Alarm status to indicate that the user should test Transport Status (D=2) to find the particular Alarm Fault condition. This status is cleared by Clear Controller, Master Clear, or initiation of the next function.

#### Document No Sort

Bit 14 indicates that the Controller has detected that a document has been advanced beyond the Read Zone boundary. This condition is cleared by the user's requesting a Sort 1 or Sort 2 Mechanical Action function. This status is cleared by Clear Controller, Master Clear, or initiation of the next function.

#### Read.

#### Data Skewed

Bit 15 indicates that the Controller has detected Servo Data from the line which indicates that the line is positioned partially outside the upper and/or lower limit of the Read Zone. Data Skewed status indicates an uncorrectable skew and an unreadable line. It is cleared by Clear Controller, Master Clear, or initiation of the next function.

#### TRANSPORT STATUS (D=2)

This level of status is reserved for Reader status. Eight bits contain the current position coordinate of the line scanning mirror. Several other bits are used for mirror faults of various kinds, one bit flags long documents, and another bit monitors Control Parameter and Font/Field Parameter table operations. Refer to Figure 3-11 for Transport Status Format.

#### Mirror Position Status

Bits 0 thru 7 contain the current position coordinate of the line scanning mirror in the form of a hexadecimal number. If the Controller is updating this coordinate when Transport Status is requested, the previous coordinate will be transferred. When ever the mirror is positioned outside of the scan area, the mirror position count will equal zero.

#### Unassigned

Bit 8 is unassigned.

#### Mirror/Transport Fault

Bit 9 indicates that a system malfunction has caused a mirror or transport function to be aborted. This status will cause the Alarm status, and an Alarm Interrupt will be generated if requested. This bit is cleared by a Clear Controller, Master Clear, or initiation of the next function.

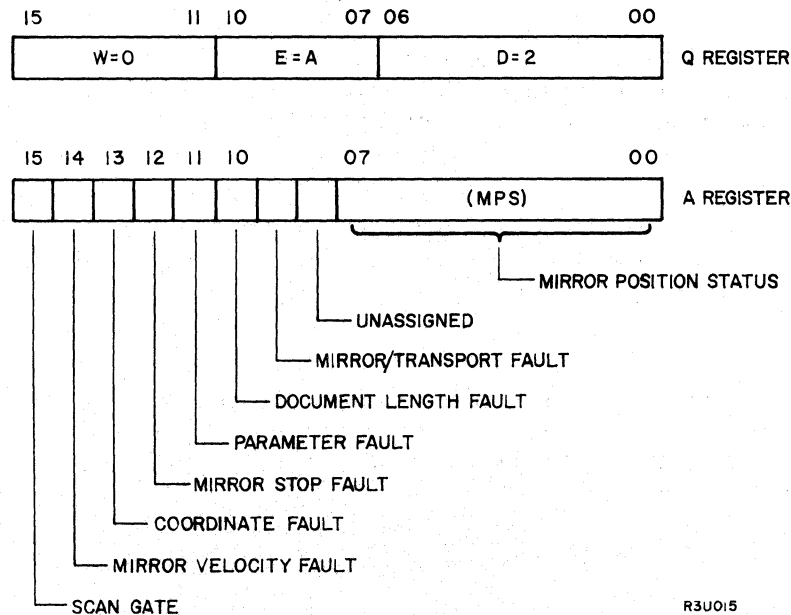


Figure 3-11. Transport Status Format

#### Document Length Fault

Bit 10 indicates that the document at the read station has exceeded the defined document length. This status will be cleared by Clear Controller, Master Clear, or initiation of Ready.

#### Parameter Fault

Bit 11 indicates that a fault was detected during initial processing of the Control Parameter or Font/Field Parameter table. This bit will set under the following conditions:

1. Any undefined Table Identifier is used,
2. A Font/Field table word is given out of sequence,
3. The Control Parameter word count is greater than eight,
4. The Font/Field parameter word count is greater than forty-eight,
5. More than eight fields are transmitted, or
6. The Table Data transfer is terminated because of Lost Data.

This bit will be cleared by Clear Controller, Master Clear, or initiation of the next function.

#### Mirror Stop Fault

Bit 12 indicates that the line scanning mirror, while presumably stopped, has drifted beyond the range of counter correction and a Zero Mirror (Director 4, bit 12) function is needed in order to re-establish positional counter accuracy. When this bit is set, any mirror function other than Zero Mirror will cause an alarm and that operation will not be performed. This bit will be cleared by Clear Controller, Master Clear, or initiation of the next function. This bit is not active in Controlware above version 2.02.

Coordinate Fault

Bit 13 indicates that the initial mirror coordinate (IMC) or terminal mirror coordinate (TMC) for either a Read or a Line Locate function has exceeded the Read Zone horizontal boundaries, or the IMC was greater than the TMC. The function generating the Coordinate Fault will not be performed. This bit will be cleared by Clear Controller, Master Clear, or initiation of the next function.

Mirror Velocity Fault

Bit 14 indicates that the line scanning mirror has exceeded the 14.8% tolerances on the 75 inches-per-second scan rate during a Read or a Line Locate function. As this may have caused an error in reading, the Read or Line Locate function should be repeated. This bit will be cleared by Clear Controller, Master Clear, or initiation of the next function.

Scan Gate

Bit 15 indicates that the line scanning mirror is positioned within the limits of a directable mirror motion. This bit will set and clear based on positional data from the line scanning mirror encoder.

DATA TRANSFER WORDS (D=0)

If the controller can receive or send data it will reply within approximately 1 microsecond, and if unable to receive or send data, the controller will reject within 1 microsecond. A requested data transfer will always be rejected if the controller is either Not Busy or Not Ready. Refer to Figure 3-12 for Font/Field Word Format.

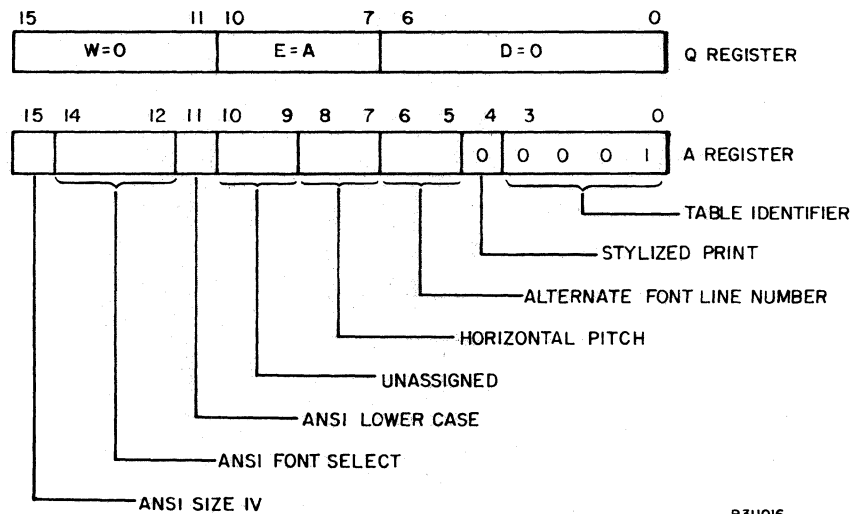


Figure 3-12. Font/Field Word Format

Table Identifier

Bits 0 through 3 are used to identify all table words, and 0001 is used to identify a font word.

Stylized Print

Bit 4 being zero designates this as a nonhandprint font word.

Alternate Font Line Number

Bits 5 and 6 select the alternate font line as follows:

00	No selection
01	Alternate font line 1
10	Alternate font line 2
11	Alternate font line 3

Horizontal Pitch

Bits 8 and 7 are used to define the horizontal pitch, as follows:

00	10 Character/inch
01	7 Character/inch
10	8 Character/inch
11	Undefined

Unassigned

Bits 9 and 10 are unassigned.

ANSI Lower Case

Bit 11 selects lower case in conjunction with any selectable ANSI font. The Controller assumes Alternate Font Line 1 as an enable.

ANSI Font Select

Bits 12 through 14 comprise an octal number which selects the ANSI character set as shown below:

<u>CODE</u>	<u>FONT</u>
08	Full ANSI-OCR-A
18	Mark Sense
28	Numeric
38	Numeric and Control
48	Numeric and Alpha 5
58	Numeric Alpha 26 and Punctuation 1
68	Numeric Alpha 26 and Punctuation 2
78	Unused



ANSI OCR-A Size IV

Bit 15 indicates to the Controller that ANSI OCR-A, Size IV Characters are to be read. A zero value for this bit selects ANSI OCR-A size I.

HANDPRINT FONT WORD

Refer to Figure 3-13 for Handprint Font Word Format

NOTE

The font word is never reset. The controlware maintains the last value assigned whether preset or programmed. The font word is preset to 0001<sub>16</sub>.

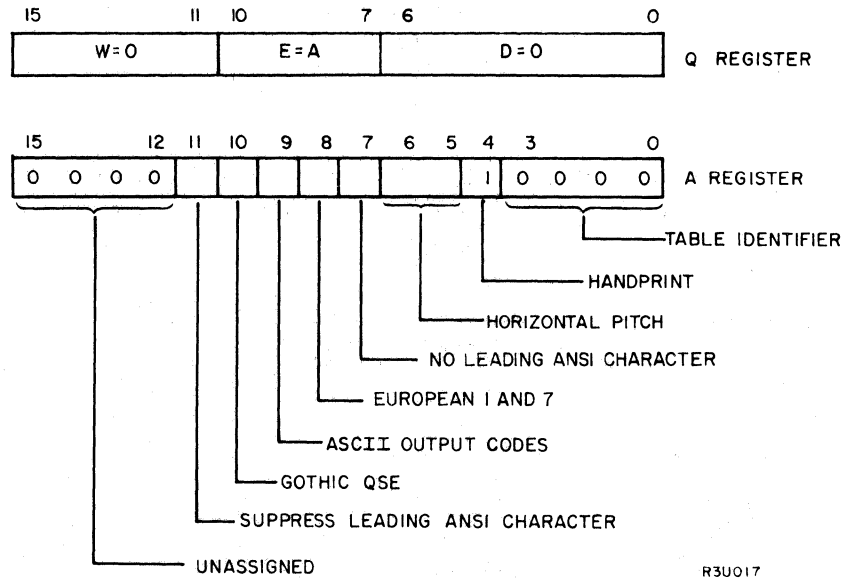


Figure 3-13. Handprint Font Word Format

Table Identifier

Bits 0 through 3 are used to identify all table words and 0001 is used to identify a font word.

Handprint

Bit 4 selects the Reader Handprint Option.

Horizontal Pitch

Bits 6 and 5 are used to define the horizontal pitch as follows:

- 00 No space generation
- 01 3 Characters/inch

10            4 Characters/inch  
11            5 Characters/inch

#### No Leading ANSI Character

Bit 7 is used to define a handprint field with no leading ANSI character. When bit 7 is zero, a single full width character from the full ANSI OCR-A Font is located prior to Handprint Data in this field.

#### European 1 and 7

Bit 8 is used to disable the recognition of normal 1 and 7 and enable the recognition of European 1 and 7 if the hardware option is installed.

#### ASCII Output Codes

Bit 9 is used to enable ASCII output codes. When bit 9 is zero, the 16 bit handprint code (see handprint option) will be transmitted. When bit 9 is a one, the ASCII code for the defined handprint character (see field word 7) will be transmitted.

#### Gothic QSE

Bit 10 is used to disable recognition of normal handprint characters and enable the recognition of Gothic Font numerals if the hardware QSE is installed.

#### Suppress Leading ANSI Character

Bit 11 is used to suppress the leading ANSI character. The character will be read and used to position the line but, it will not be put into the Data Buffer.

#### Unassigned

Bits 12 through 15 are unassigned.

#### HANDPRINT SUBFIELDS ID=7

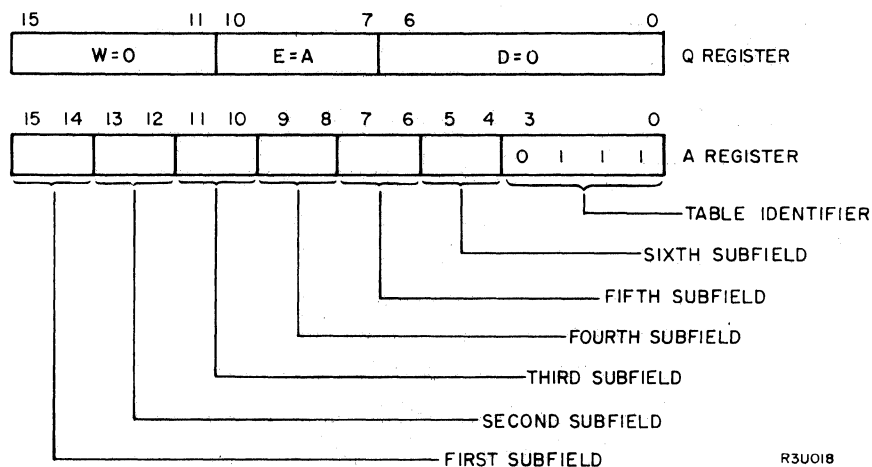
Handprinted characters in this field will initially be defined by the first subfield. Recognition of a field mark terminates the first subfield and following characters will be defined by the second subfield until the next field mark. After recognition of the sixth field mark, at the end of the sixth subfield, the definition changes to Alpha for the rest of the field. Refer to Figure 3-14 for Handprint Subfield Word Format.

#### Table Identifier

Bits 0 through 3 are used to identify all table words and 0111 is used to identify a handprint subfield word.

Each subfield definition has a value of 0 through 3 with the following definitions:

- 0 - subfield is ALPHA
- 1 - subfield is mixed numeric and symbol
- 2 - subfield is numeric with trailing ALPHA
- 3 - subfield is numeric only



R3U018

Figure 3-14. Handprint Subfield Word Format

If this field word does not follow the font word in the font/field table, and the font word specifies a handprint field with 16 bit handprint codes, the definitions become Alpha Numeric and Symbol and the character must be rejected under all three definitions for character reject status and rescans to occur.

NOTE

The controlware maintains the last value assigned, whether programmed or replaced. The controlware will replace the subfield definition with a  $FFF7_{16}$  when a subfield definition word fails to follow a font word.

FIELD WORD

Initial Field Coordinate Word ID=2

Terminal Field Coordinate Word ID=4

Refer to Figure 3-15 for Field Word Format.

Table Identifier

Bits 0 through 3 are used to identify field words as follows:

- 0010 Initial Field Coordinates
- 0100 Terminal Field Coordinates

Unassigned

Bits 4 through 7 in the IFC word are unassigned, and bits 4 through 6 in the TFC word are unassigned.

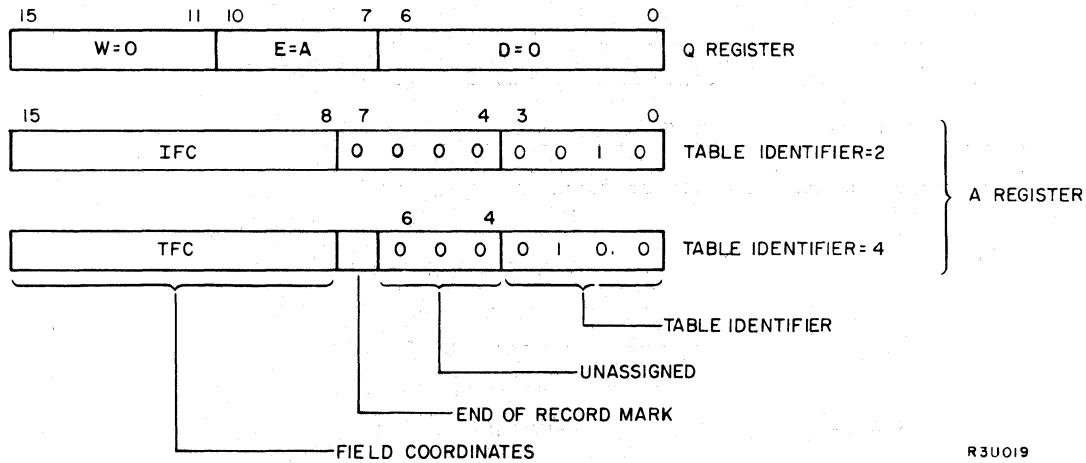


Figure 3-15. Field Word Format

End of Record Mark

Bit 7 requests that an end of record mark (ASCII Code = FF<sub>16</sub>, HP Code = AOFF<sub>16</sub>) be inserted at the end of the data field being read. This bit is active only on a terminal field coordinate parameter word.

Initial Field Coordinates/Terminal Field Coordinates

Bits 8 through 15 contain the coordinate position defining the beginning or ending point of a data field within a line scan. If no IFC or TFC is transmitted to the Controller, it assumes that the Read Mode (D=5) defines the beginning and ending points of a single field.

NOTE

An IFC or TFC to be active must lie within the limits of the Read IMC and TMC, disregarding the effect of control symbols (EOL, Delete Line, etc.). In the Figure 3-16 and 3-17, all coordinates are in hexadecimal notation.

Assume a Read IMC and TMC of 28 and B0 respectively. Then assume that the data fields are between coordinates 30 and 50, 60 and 80, and 90 and B0. The 955 would scan from coordinates 28 to B0, collecting information from each of the indicated fields (Figure 3-16).

Next, assume a Read IMC and TMC of 35 and A0, respectively, with the same fields as above. This time, the Reader would read only the information from coordinates 35 to 50, 60 through 80, and 90 through A0 as shown in Figure 3-17, and character data at the end of the line would be lost.

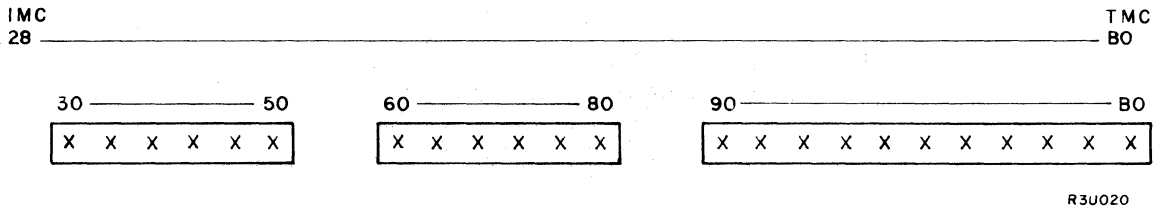


Figure 3-16. Field Coordinates

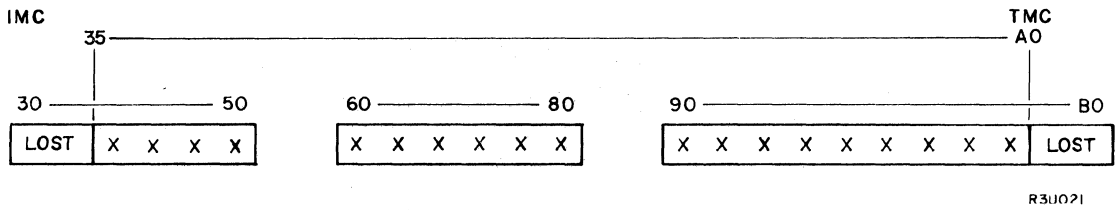


Figure 3-17. Field Coordinates

VIDEO CONTROL WORD ID=5

Refer to Figure 3-18 for Video Control Word Format

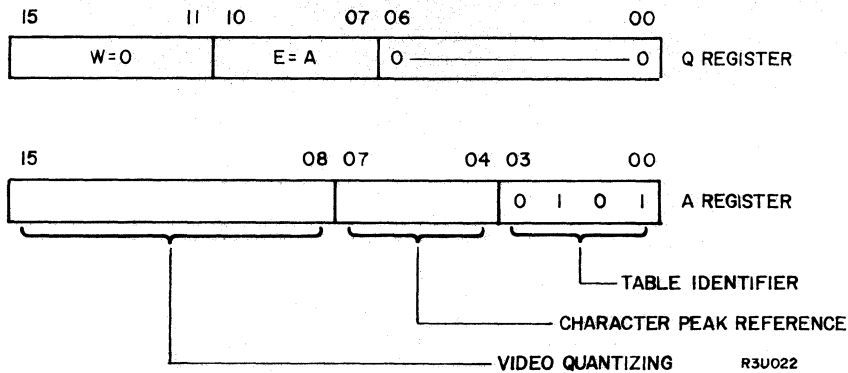


Figure 3-18. Video Control Word Format

Table Identifier

Bits 0 through 3 comprise the table identifier word, and 0101<sub>2</sub> is used for video control.

Character Peak Reference

Bits 4 through 7 define a hexadecimal value which will select a character peak reference voltage in the Reader for character recognition. (The character peak reference is preset to a nominal value of A<sub>16</sub> in the controlware.)

## Video Quantizing

Bits 8 through 15 define a value which will select the differential baseline voltage for video quantizing (black/white decision) in the Reader. (This value is also preset to a nominal value of  $80_{16}$  in the controlware.)

### NOTE

Neither character peak reference nor video quantizing is ever reset. The controlware maintains the last value assigned, whether preset or programmed.

## LINE WIDTH CONTROL WORD ID=6

Refer to Figure 3-19 for Line Width Control Word Format.

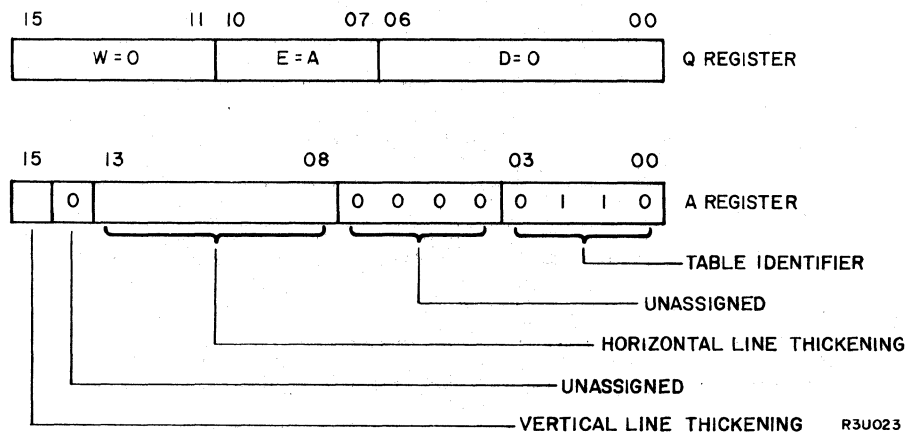


Figure 3-19. Line Width Control Word Format

### Table Identifier

Bits 0 through 3 comprise the table identifier word, and  $0110_2$  is used for line width control.

### Unassigned

Bits 4 through 7, and 14, are unassigned.

### Horizontal Line Thickening

Bits 8 through 13 contain a hexadecimal number between  $01$  and  $3B$  which specifies the number of stages of quantized video data to be accumulated in a single column. This allows the Reader to "see" a degraded, thin vertical line by expanding it horizontally. This value is preset to a nominal value of  $20_{16}$  in the controlware. The controlware will maintain the last assigned value whether preset or programmed.

### Vertical Line Thickening

Bit 15 activates the vertical line thickening capability in the Reader. This results in thicker horizontal lines, and the effect of thin and tilted character strokes is lessened. This bit is preset (by controlware) to zero. The controlware maintains the last assigned value, whether preset value or a programmed value.

### CHARACTER CONTROL WORDS

#### END OF LINE WORD ID=9

Refer to Figure 3-20 for End of Line Word Format.

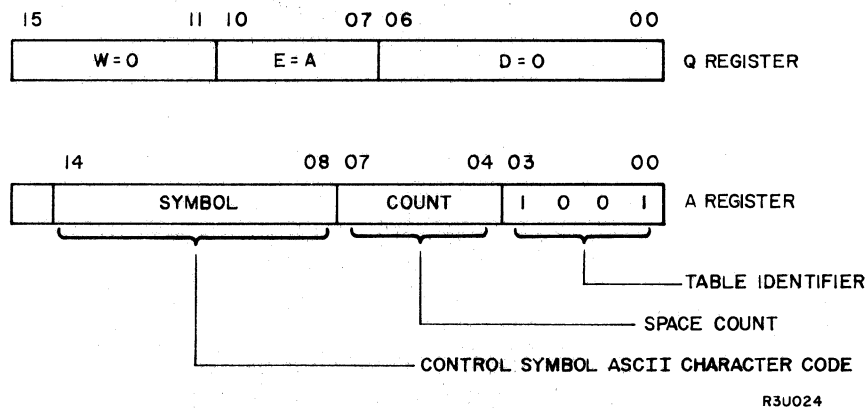


Figure 3-20. End of Line Word Format

#### Table Identifier

Bits 0 through 3 contain HEX 9, or 1001.

Read will terminate and mirror motion will stop when either of the following comparisons occur.

1. The number of consecutive spaces read at the end of a line matches the binary number (0 through 7) loaded in bits 4 through 6 (COUNT, above).
2. A read character compares with the ASCII code for the End of Line symbol loaded in bits 8 through 14 (SYMBOL, above).

If Space Count = 0, no comparison is made.

If the Control Symbol = 0, no comparison is made.

#### CANCEL CHARACTER WORD ID=A

Refer to Figure 3-21 for Cancel CharacterWord Format.

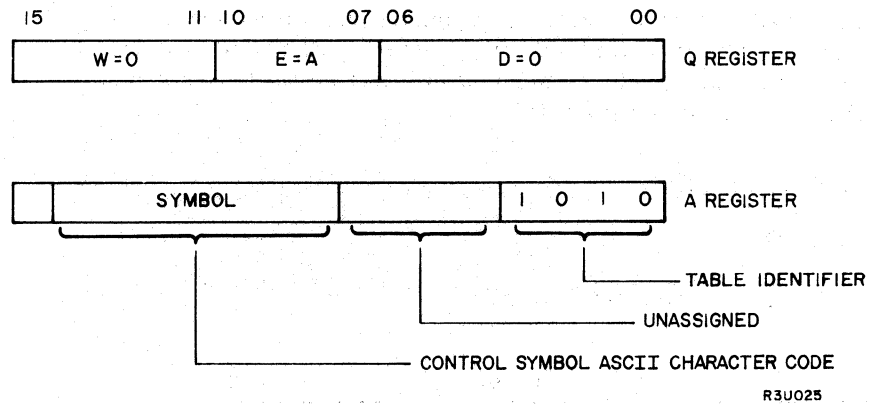


Figure 3-21. Cancel Character Word Format

Table Identifier

Bits 0 through 3 contain HEX A, or 1010.

If this word is sent (even if SYMBOL = 00) the controlware will delete any character which are typed over with the standard cancel character i. e. , (⌘, HEX 5F). See Figure 3-22.



Figure 3-22. Character Delete

If bits 8 through 14 (SYMBOL, above) contain an ASCII character code, the controlware will delete that character and the character which precedes it. See Figure 3-23.

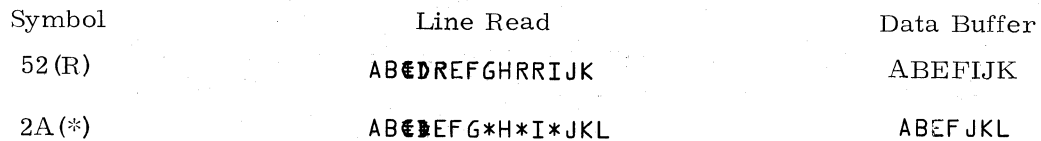


Figure 3-23. Character Delete

DELETE LINE WORD ID=B

Refer to Figure 3-24 for Delete Line Word Format



DELETE LINE WORD ID=B

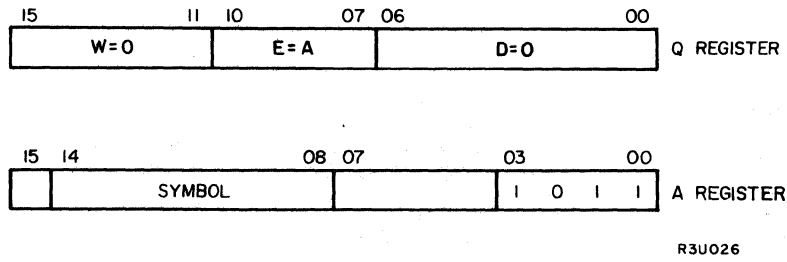


Figure 3-24. Delete Line Word Format

Table Identifier

Bits 0 through 3 contain HEX B, or 1011. If this word is sent (even if SYMBOL = 00) the controlware will delete any line in which the standard delete line symbol (—————, HEX 5E is detected.

If bits 8 through 14 (SYMBOL, above) contain an ASCII Character code, the controlware will delete any line in which that character is detected.

If the line is delete, there will be no buffer transfer and bit 9 of system status will be set.

If ID=B is not sent, the DELETE LINE SYMBOL will not be recognized.

BLANK LINE WORD ID=C

Refer to Figure 3-25 for Blank Line Word Format.

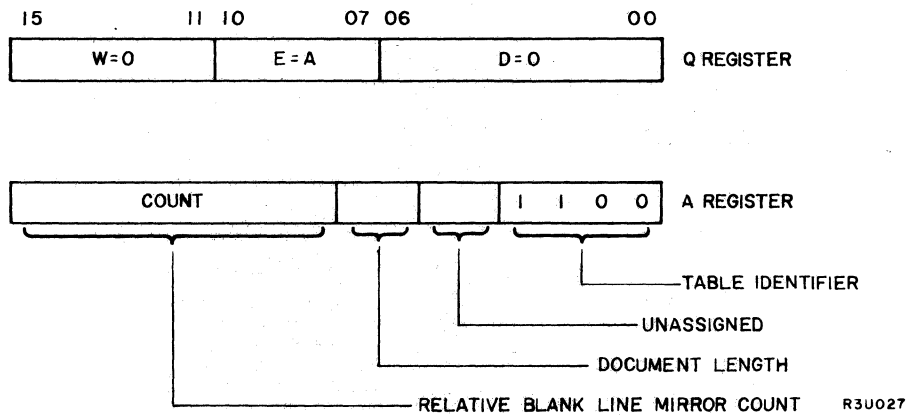


Figure 3-25. Blank Line Word Format

### Table Identifier

Bits 0 through 3 contain HEX C, or 1100.

### Unassigned

Bits 4 and 5 are unassigned.

### Document Length

Bits 7 and 6 are used to define the length of documents to be processed by the Reader, as follows:

00	Document less than 15.0 inches
01	Document less than 5.4 inches
10	Document less than 9.1 inches
11	Document less than 12.8 inches

When a processed document equals or exceeds the defined document length, Alarm Status (and Interrupt, if requested), Transport Status Fault, and Document Length Fault will be set.

### Relative Blank Line Mirror Count

Bits 8 through 15 contain the incremental binary value to be added to a Read or Line Locate IMC (see Read Mode, D=5, and Line Locate Mode, D=6) to give the Blank Line Coordinate. Read or Line Locate will be terminated if no character data is input between the IMC and the Blank Line Coordinate.

### MIRROR IMAGE WORD ID=D

Refer to Figure 3-26 for Mirror Image Word.

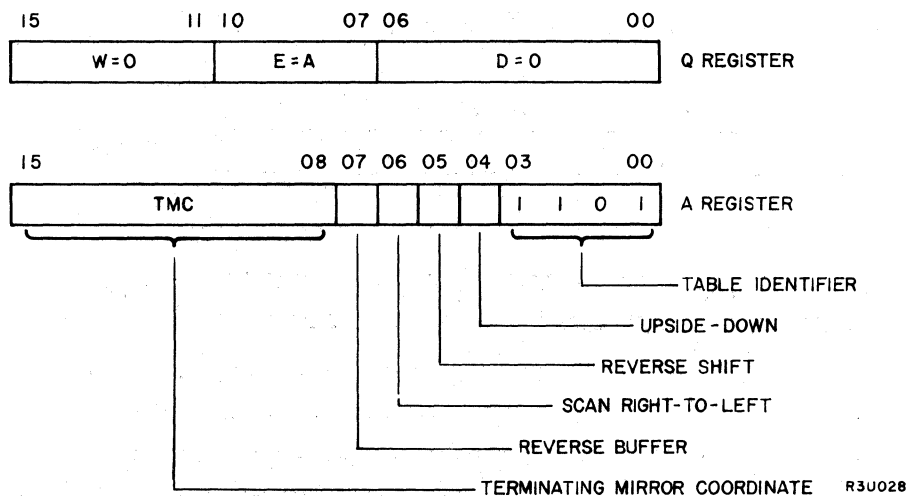


Figure 3-26. Mirror Image Word Format

Table Identifier

Bits 0 through 3 will be 1101<sub>2</sub> (HEX D) for this table word.

Upside-down

Bit 4 directs characters to be loaded upside-down into the Reader image register.

Reverse Shift

Bit 5 directs characters to be loaded and shifted through the Reader image register from left to right rather than the normal right to left.

Scan Right-to-Left

Bit 6 directs the Reader mirror control and status lines to be reversed so mirror coordinate 0 is the rightmost coordinate and FF<sub>16</sub> is the leftmost coordinate.

Reverse Buffer

Bit 7 directs the Controller to load the data buffer backwards. The first word transmitted after the data buffer count will be the last word from the Reader or the End of Field Flag, if requested, and the last word transmitted will be the first word read from the line.

Terminating Mirror Coordinate

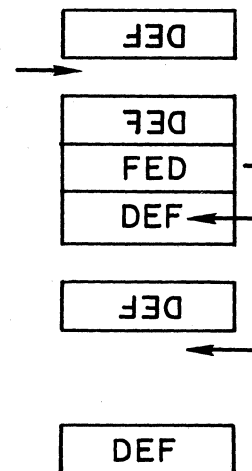
Bits 8 through 15 contain the coordinate position to which the line scanning mirror is to be moved during a sort operation. The Controller will compute the direction to be moved based on the difference between the present mirror coordinate and the coordinate given here.

NOTE

A Zero Mirror function code will override the TMC given here, and a TMC of zero will act as a mirror "no op" function.

The following shows two ways to use the Mirror and Image Register Control bits to read upside-down material on a page or document: Refer to Figure 3-27.

1. Assume the line reads "DEF" (upside-down), and normal scan, left-to-right, is used:
  - A. Bits 00, 02, and 03 are set for this table word.
  - B. Bit 04, upside-down is set.
  - C. Bit 05, reverse shift, is set.
  - D. Bit 07, reverse buffer, is set. Result:
2. This same line can be read right-to-left, as follows:
  - A. Bits 00, 02, and 03 are set for this table word.
  - B. Bit 04, upside-down, is set, and Bit 06, scan right-to-left, is set. Result:



R3U029

Figure 3-27. Mirror Image Read Format

RESCAN WORD ID=E

Refer to Figure 3-28 for Rescan Word Format.

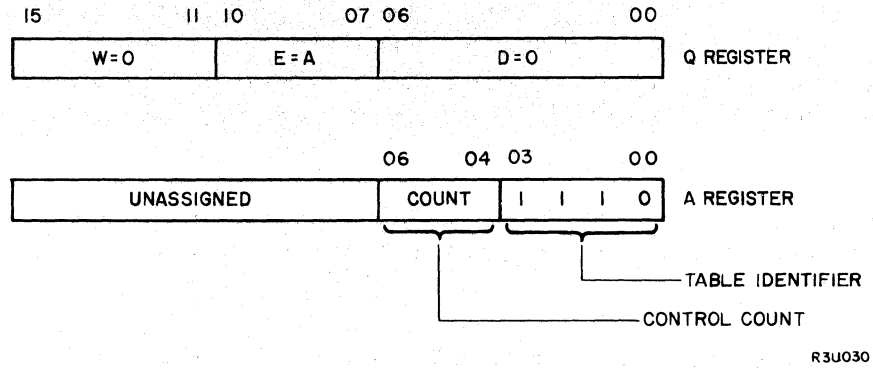


Figure 3-28. Rescan Word Format

Table Identifier

Bits 0 through 3 contain HEX E, or 1110.

Control Count

Bits 4 through 6 contain a value of 0 through 7 which will cause the Controller/Reader to automatically rescan until either no rejected character indication is detected or until the designated number of rescans has occurred. No End of Operation will be generated until this function has been completed.

DOCUMENT READY ADVANCE WORD ID=F

Refer to Figure 3-29 for Document Ready Advance Word Format.

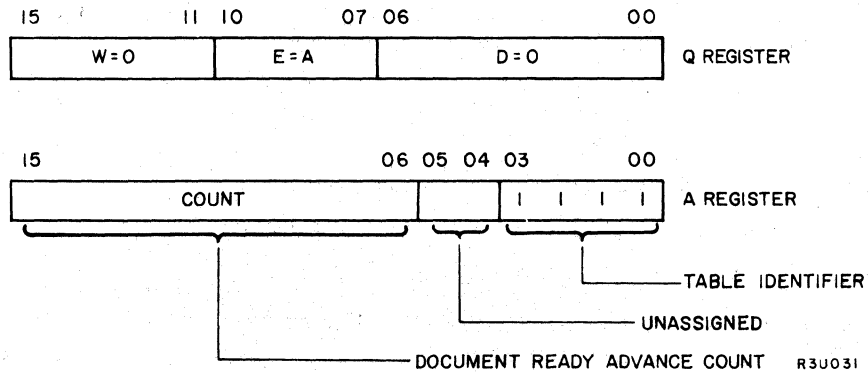


Figure 3-29. Document Ready Advance Word Format

#### Table Identifier

Bits 0 through 3 contain HEX F, or 1111.

#### Unassigned

Bits 4 and 5 are unassigned.

#### Document Ready Advance Count

Bits 6 through 15 indicate the number of 0.008-inch steps the document is to be advanced from the nominal Document Ready position (0.200 inch from the leading edge or top, of the document) for initial line scanning. This will apply to the current document if it is not already more than 0.216 inch into the read zone; otherwise, it will affect successive documents brought to Document Ready by a sort or load function.

### INTERRUPT SIGNALS

#### INTERRUPT ON DATA

Director function codes 1, 2, or 9 can be used to set this interrupt request, and it can be cleared by Director function codes 1, 2, 4, or 9. On a Read operation, the interrupt occurs when data has been loaded into the data buffer and is ready for transfer to the computer. The interrupt response is then cleared by the reply to data transfer. On a Write operation, the interrupt occurs when data can be loaded into the Controller. The interrupt response is then cleared by the reply to data transfer. System status (Director 1) bit 3 indicates the condition of the interrupt. A Clear Interrupt code will terminate data transfer.

#### INTERRUPT ON END OF OPERATION

Director function codes 1, 2, 4, and 9 can be used to set this interrupt request and clear the interrupt request and response. The operation may or may not be in process at the time of selection; however, the interrupt cannot occur from an operation which has ended before the selection was made. System status (Director 1) bit 4 indicates the condition of the interrupt.

#### INTERRUPT ON ALARM

Director function codes 1, 2, 4, and 9 set or clear this interrupt request and response. An alarm condition that exists at the time of the interrupt request immediately provides a response. System status (Director 1) bit 5 indicates the state of each alarm condition, and accompanying status bits indicates the particular type of alarm.

### HANDPRINT OPTION

When the 955 Reader includes the handprint option, the following data word is available in place of ASCII codes for each handprint character read. Use of this 16 bit handprint code word necessitates Character Mode buffer transfer.

#### HANDPRINT CODE WORD

Refer to Figure 3-30 for Handprint Code Word Format.

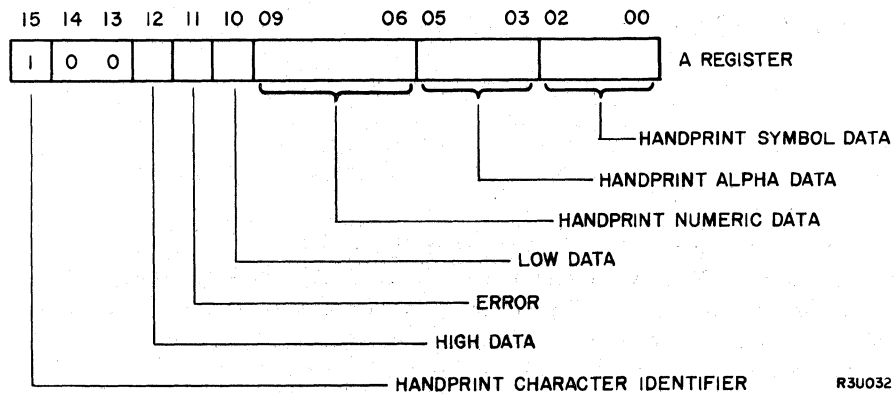


Figure 3-30. Handprint Code Word Format

#### Handprint Symbol Data

Bits 2 through 0 contain the character codes for handprint symbols as follows:

- |   |                   |
|---|-------------------|
| 0 | Plus sign (+)     |
| 1 | Minus sign (-)    |
| 2 | Field mark (!)    |
| 3 | Equal sign (=)    |
| 4 | Controller reject |
| 6 | Space             |
| 7 | Character reject  |

#### Handprint Alpha Data

Bits 3 through 5 contain the character codes for handprint alpha characters as follows:

- |   |                   |
|---|-------------------|
| 0 | C                 |
| 1 | S                 |
| 2 | T                 |
| 3 | X                 |
| 4 | Z                 |
| 5 | Controller reject |
| 6 | Space             |
| 7 | Character reject  |

#### Handprint Numeric Data

Bits 6 through 9 contain the character codes for handprint numeric characters as follows:

- |                 |                           |
|-----------------|---------------------------|
| 0 through 9     | 0 through 9, respectively |
| A <sub>16</sub> | Controller reject         |
| E <sub>16</sub> | Space                     |
| F <sub>16</sub> | Character reject          |

Low Data

Bit 10 indicates that the handprint data is low in the reader image area (analogous to Bottomless Data).

Error

Bit 11 indicates a malfunction in the handprint read logic in the Reader.

High Data

Bit 12 indicates that the handprint data is high in the reader image area (analogous to Topless Data).

Handprint Character Identifier

Bits 13 through 15 are used to indicate either normal handprint data or End of Handprint Record Mark, as follows:

- 4 Normal handprint data
- 5 End of Handprint Record Mark





APPENDIX A

TABLE A-1. CONVERSION TABLE

HEX.	DEC.	HEX.	DEC.	HEX.	DEC.	HEX.	DEC.	HEX.	DEC.
1	1	10	16	100	256	1000	4096	10000	65536
2	2	20	32	200	512	2000	8192	20000	131072
3	3	30	48	300	768	3000	12288	30000	196608
4	4	40	64	400	1024	4000	16384	40000	262144
5	5	50	80	500	1280	5000	20480	50000	327680
6	6	60	96	600	1536	6000	24576	60000	393216
7	7	70	112	700	1792	7000	28672	70000	458752
8	8	80	128	800	2048	8000	32768	80000	524288
9	9	90	144	900	2304	9000	36864	90000	589824
A	10	A0	160	A00	2560	A000	40960	A0000	655360
B	11	B0	176	B00	2816	B000	45056	B0000	720896
C	12	C0	192	C00	3072	C000	49152	C0000	786432
D	13	D0	208	D00	3328	D000	53248	D0000	851968
E	14	E0	224	E00	3584	E000	57344	E0000	917504
F	15	F0	240	F00	3840	F000	61440	F0000	983040

HEX.	DEC.	HEX.	DEC.	HEX.	DEC.
100000	1048576	1000000	16777216	10000000	268435456
200000	2097152	2000000	33554432	20000000	536870912
300000	3145728	3000000	50331648	30000000	805306368
400000	4194304	4000000	67108864	40000000	1073741824
500000	5242880	5000000	83886080	50000000	1342177280
600000	6291456	6000000	100663296	60000000	1610612736
700000	7340032	7000000	117440512	70000000	1879048192
800000	8388608	8000000	134217728	80000000	2147483648
900000	9437184	9000000	150994944	90000000	2415919104
A00000	10485760	A000000	167772160	A0000000	2684354560
B00000	11534336	B000000	184549376	B0000000	2952790016
C00000	12582912	C000000	201326592	C0000000	3221225472
D00000	13631488	D000000	218103808	D0000000	3489660928
E00000	14680064	E000000	234881024	E0000000	3758096384
F00000	15728640	F000000	251658240	F0000000	4026531840

POWERS OF SIXTEEN	
$16^0$	1
$16^1$	16
$16^2$	256
$16^3$	4096
$16^4$	65536
$16^5$	1048576
$16^6$	16777216
$16^7$	268435456



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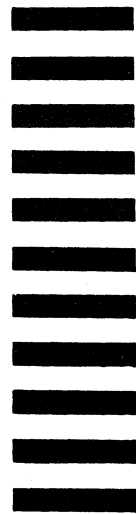
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