B 700

LINE PRINTER (A9249) I/O CONTROL

INTRODUCTION AND OPERATION

FUNCTIONAL DETAIL

CIRCUIT DETAIL

ADJUSTMENTS

MAINTENANCE PROCEDURES

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RELIABILITY IMPROVEMENT NOTICES

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Burroughs

FIELD ENGINEERING

TECHNICAL MANUAL

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INTRODUCTION

The B0243 Line Printer I/O Control provides the interface between the A9249 Line Printer and the System Processor (the processor will be specified when necessary).

B700 SYSTEMS

One of the requirements of the B700 System is that all printer operations, regardless of which printer is employed, be standardized to those developed initially for the A988 printer. Consequently, System operation of the A9249 printer is the same as for the A988 printer or any other line printer.

A9249 LINE PRINTER CHARACTERISTICS

Print Positions/Rates

The basic printer contains 132 print positions. The printer has a 64-character set and is capable of printing at a nominal rate of 120 lines per minute with paper spacing of six lines per inch. Options are available to use 48 or 96 character set at a nominal print rate of 180 and 110 LPM, respectively.

Horizontal Format

The printer accommodates paper forms up to a maximum form width of 17 inches. Pin-feed tractors keep the forms in position and can be adjusted horizontally toward or away from each other to adjust for form's width.

Vertical Format 2-Channel

Spacing and skips are initiated by the processor addressing holes in a two-channel vertical format tape. The sensing of a hole in a selected channel conditions the form to stop in a corresponding position. If no tape is present and either channel is selected, paper is advanced one line and stopped.

Vertical Format 12-Channel

A 12-channel vertical format unit is available for format control. This option is similar to the two-channel format capability except that channels 2-12 are available for vertical tab. The printer has no capability for signalling the IOC when this option is used. Therefore, when this option is used, an option must be installed in the B0243 IOC. See Sec. VIII.

Code Set

The 64-character ASCII code set is shown in Table I-1. Since the B700 Processor generates ASCII codes and the A9249 accepts ASCII codes, there is no code conversion necessary.

TABLE I-1 64-CHARACTER CODE SET, ASCII

PRINT CHAR.	PRINTER CODE	PRINT CHAR.	PRINTER CODE	PRINT CHAR.	PRINTER CODE
	BBB BBBB				
	765 4321				
(BLANK)	010 0000	5	011 0101	J	100 1010
!	010 0001	6	011 0110	K	100 1011
"	010 0010	7	011 0111	L	100 1100
#	010 0011	8	011 1000	M	100 1101
$	010 0100	9	011 1001	N	100 1110
%	010 0101	:	011 1010	O	100 1111
&	010 0110	;	011 1011	P	101 0000
'	010 0111	<	011 1100	Q	101 0001
(	010 1000	=	011 1101	R	101 0010
)	010 1001	>	011 1110	S	101 0011
*	010 1010	?	011 1111	T	101 0100
+	010 1011	@	100 0000	U	101 0101
,	010 1100	A	100 0001	V	101 0110
-	010 1101	B	100 0010	W	101 0111
.	010 1110	C	100 0011	X	101 1000
/	010 1111	D	100 0100	Y	101 1001
0	011 0000	E	100 0101	Z	101 1010
1	011 0001	F	100 0110	[	101 1011
2	011 0010	G	100 0111		101 1100
3	011 0011	H	100 1000	]	101 1101
4	011 0100	I	100 1001		101 1110
				–	101 1111

B0243 I/O CONTROL OPERATIONS

PROCESSOR COMMUNICATIONS (B700)

The initiation of an information transfer between the processor and the B0243 IOC is the same for all IOC's, the distinction being in the device address contained in the Base Register (BR1 or BR2) of the processor's output select gates (OS). The PSU decodes three bit groups from the processor to completely define the operation that is to take place. The command field (nano bits 51-54) establishes whether the operation is to be a device read, device write or an address status request. The four least significant bits of BR1 or BR2 contain the specific device address, and the most significant bit of BR1 or BR2 in conjunction with the command type distinguishes between a control, data or a status word. See Table I-2, B0243 I/O Control Operations.

DEVICE OP'S	BR1/BR2 OS LINES	CONTROL BITS MIR	FUNCTION
DW1 or 2	OS1 & Dev. Addr	MIR8/	Load Print Data
DW1 or 2	OS1 & Dev. Addr	MIR9/ to 16/	Format Control
DW1 or 2	Dev. Addr	MIR9/ to 16/	Data
DW1 or 2	OS1 & Dev. Addr		Enable Status
ASR			Enable Status

The B0243 IOC responds to device operations by sending to the PSU Data (DINT) or Status (SINT) interrupts. These two lines will enable the PSU levels, to the processor, IRQ, SRQ, or URQ, depending upon the IOC being selected or unselected. Table I-2 shows the variants.

TABLE I-2 INTERRUPTS

INTERRUPT	UNSELECTED	SELECTED	CONDITION
DINT	*		IRQ
DINT		*	SRQ
SINT	*		IRQ
SINT		*	URQ

Word Formats

Three different word formats are used in operations involving the B0243 IOC. See Figure I-1. Figure I-2 represents a block diagram of the A9249 I/O control – B0243.

Control Word – Operation of the Line Printer is initiated by the transfer of a control word from the processor to the DDP. The control word contains paper motion commands which define the line spacing during paper movement and operation commands which specify the function to be performed by the printer.

Data Word – Data transfer between the IOC is in eight-bit parallel, where bit 16 of the data word is considered the least significant bit.

Status Word – This word is returned from the IOC to the processor whenever the IOC wishes to notify the processor of a failure or functional condition. It consists of a device address which is inserted at the PSU and a device status field which is inserted at the DDP.

	1 (MSB)	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16 (LSB)
CONTROL WORD	—	—	—	—	—	—	—	LOAD PRINT DATA	FORM CONTROL 7	FORM CONTROL 6	FORM CONTROL 5	FORM CONTROL 4	FORM CONTROL 3	FORM CONTROL 2	FORM CONTROL 1	FORM CONTROL 0
DATA WORD	—	—	—	—	—	—	—	—	DATA 7	DATA 6	DATA 5	DATA 4	DATA 3	DATA 2	DATA 1	DATA 0
STATUS WORD	DATA REQUEST	—	—	DEVICE ADDR 4	DEVICE ADDR 3	DEVICE ADDR 2	DEVICE ADDR 1	DEVICE ADDR 0	—	—	—	PRINT COMPL	—	—	END OF PAGE	NOT READY

NOTE: DEVICE ADDRESS BITS OF STATUS WORD ARE INSERTED AT PSU.

Fig. I-1 B0243 WORD FORMAT

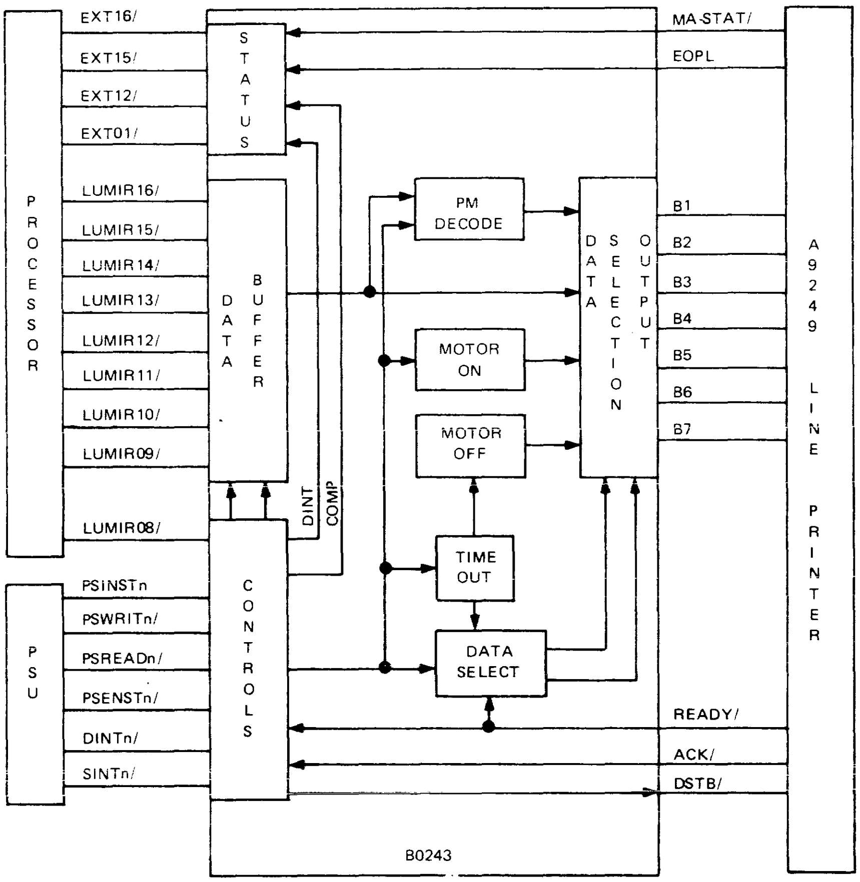


Fig. I-2 A9249 I/O CONTROL – B0243

WORD DESCRIPTION

Control Word MIR Bit(s)	FUNCTION
1/-7/	Not Used.
8/=0	Load Print Data – ~~Accept~~ "N" characters (up to 132) and store them into the Printer's print buffer.
9/-16/	Format Control – The following codes define the printer format control:

9/	10/	11/	12/	13/	14/	15/	16/	Operation Indicated
1	1	1	1	1	1	F	1	No Space – Carriage Return.
1	1	1	1	1	0	F	1	Single Space – Feed one line.
1	1	1	1	0	1	F	1	Double Space - Feed two lines.
1	1	0	1	1	1	F	1	Variable Skip – Vertical tab as directed by channel 2 of the 2-channel format tape, or by channel 6 of the optional 12-channel format tape.
0	0	1	1	1	1	F	1	Bottom of Form – Vertical tab as directed by channel 2 of the 2-channel format tape, or by channel 2 of the optional 12-channel format tape. The condition (End of Page) is sensed only on channel 12 of the optional 12-channel tape.
1	1	1	0	1	1	F	1	Top of Form – Form feed to top of form as directed by channel 1 of the 2-channel format tape, or by channel 1 of the optional 12-channel format tape.
0	1	1	1	1	1	F	1	Variable Skip – Vertical tab as directed by channel 2 of the 2-channel format tape, or by channel 4 of the optional 12-channel format tape.

NOTES: (MIR15/ = F)

1. F = 1, Execute print followed by specified format control.
2. F = 0, Execute specified format control only. (The printer executes print cycle by printing blanks from empty buffer and then move paper.)

Data Word MIR Bits	FUNCTION
1/-8/	Not Used.
9/-16/	Data – These eight lines are used to transfer eight data bits, defining the character to be printed, from the processor to the IOC.

Status Word EXT Bit(s)	FUNCTION
1	Data Request – IOC is ready to receive next character. This status condition follows the data interrupt (DINT/) signal to the processor.
2-3	Not Used.
4-6	Device Address – Device address bits are inserted at the port select unit.
9-11	Not Used.
12	Print Complete – Print buffer in Printer is ready to be filled.
13-14	Not Used.
15	End of Page – An End-Of-Page marker has been sensed by the Printer. This applies only to printers having the optional 12-channel format tape.
16	Not Ready – Printer is not ready for operation because of (1) power not on, (2) gate not closed, (3) brush reader not closed, (4) hammer solenoid fuse blown, (5) paper runaway condition exists, or (6) tractor switches detect no paper.

I/O CONTROL FUNCTIONS

Code Conversion

The 64-character ASCII code set as shown in Table I-1 is generated by the processor. Since the printer accepts ASCII codes, no conversion is necessary.

Character Count

The processor firmware maintains a character count of the number of characters contained in each line of print being sent to the printer. When ready to initiate a data transfer, the firmware stores a count in main memory corresponding to the number of characters (up to 132) comprising the print line. The count is decremented by one with each data interrupt (DINT/) received from the DDP until it reaches zero, signifying the end of the data transfer for that specific line of print.

Data Buffer

The IOC contains an eight-bit buffer which buffers the data from the processor to the line printer. Upon the transfer of the character from the buffer to the printer, the IOC issues a data interrupt (DINT/) to the processor requesting the next character. The printer stores the character in its print buffer until the complete print line ("N" characters) is assembled. Upon receipt of the last data character the printer automatically initiates printing.

Control Word

The receipt of an "Instruction" signal (PSINST) coincident with the "Write" signal (PSWRITn/) from the PSU specifies to the IOC that the information on the data lines (LUMIRxx/) from the processor is a control word.

Data Word

If the instruction signal (PSINST) is absent when the "Write" signal (PSWRITn/) is received, it notifies the IOC to accept the data word on the data lines from the processor.

Read Status

The receipt of an "Instruction" signal (PSINST) coincident with the "Read" signal (PSREADn/) from the PSU notifies the DDP to place all status indicators on the data lines (EXTnn/) to the processor.

Print Cycle Control

If a control word is received from the processor with the "Load Print Data" bit set (LUMIR08/), the IOC energizes the "Data Interrupt" line (DINT/) to the processor when ready to accept the data. The processor responds by executing a "Device Write" instruction, activating the "Write" line (PSWRITEn/) to the IOC. The IOC accepts the character from the data lines, temporarily storing it in its eight-bit buffer until the printer is ready to receive it. After transferring the character to the printer, the IOC generates a "Data Interrupt" (DINT/) requesting the next character. This cycle is repeated until the IOC receives a format control command from the Processor ("N" characters have been transferred). When printing is completed, the IOC returns a "Print Complete" status interrupt (SINT/), notifying the processor firmware that the print buffer is available for reloading.

Format Control

The format control command is used by the IOC to initiate printing and/or moving paper. If bit 15 (LUMIR15/) of the control word equals "0", the DDP initiates printing of the line followed by the specified format control. If bit 15 (LUMIR15/) equals "1", the IOC initiates printing of a full line of blanks from the empty buffer followed by the specified format control.

Status Indicators

All status indicators are returned to the processor in response to an Enable Status (PSENSTn/) or a Read Status Request (PSREADn/ * PSINST) from the PSU.

Status Interrupts

The "Status Interrupt" (SINT/) signal to the processor is energized with any of the following status conditions:

1. Not Ready
2. Buffer Full
3. Print Complete

The "Print Complete" status bit is set when the acknowledge signal (ACK/) from the printer is returned after the print command. Status conditions "Data Request" and "End Of Page" do not result in a status interrupt. Status interrupts are enabled only when the printer is executing an operation. Any status bit initiating a status interrupt is reset at the system clock following status interrogation.

INTERFACE BETWEEN THE B0243 IOC AND THE A9249 LINE PRINTER

Logic Level	– Logical True:	+2.4 to +5.0V
	– Logical False:	0.0 to +0.4V

Signals from A9249 Line Printer to B0243 IOC:

SIGNAL	FUNCTION
ACK/	Acknowledge – Indicates the completion of input of a character into printer memory or the end of a functional operation. This signal is used internally by the IOC.
READY/	Ready – Indicates that the printer is ready to accept information. The logical true state of this line will cause the IOC to set the "Not Ready" status bit.
EOPL	End of Page – When logical true, indicates that the end of page has been sensed. ~~(Available only with 12-channel format tape options.)~~
MA-STAT/	Machine Status – Indicates that the printer has been made ready by the operator and all alarm conditions are cleared. This signal is similar to READY/ except that it does not contain chain-motor-in-speed information.

GLOSSARY OF SIGNALS

P01=SHS.011

NAME	DESCRIPTION AND PURPOSE
CHL/	Character Loaded. Character may be control word or data. Enables data strobe to printer.
DINT/	Data Interrupt. IOC is available for data or control word.
EXT01/	External Buss Line 1. Represents data request in the status word.
JCOMP	The J Input to the COMP Flip-flop. Will set the COMP flip-flop and the SINT flip-flop when a paper motion operation is complete.
JPM	The J Input to the PM Flip-flop. Will set the PM flip-flop when a paper motion operation is to take place.
PM	Paper Motion. The Q output of the PM flip-flop. Enables first paper motion character to the printer.
PM2HF	Paper Motion 2nd Half Flip-flop. Enables second paper motion character to the printer.
POCOMP	Complete. Paper motion operation is complete.
POI/	Instruction Not.
POPAM/	Paper Motion Not. No paper motion is to take place when high.
POPM/	$\overline{Q}$ output of the PM Flip-flop.
POPM2HO	Paper Motion 2nd Half Only. Enables characters for second paper motion character.
PORDST	Read Status. Will enable the status bits to the EXT lines.
PO93	9300 Clock Input. Enables clock to the type 9300 SU IC.
PO93MR	9300 Master Reset Input. Will reset type 9300 SU IC when low.

P01-SHS.012

DACK	Acknowledge output of a DF Flip-flop. Must be high to enable a data strobe to the printer.

DEOPLF — End of Page output of a DF Flip-flop.
DSTB — Data Strobe output of Q output of JF Flip-flop. Enables data strobe to printer.
DSTB/ — Data Strobe Not. Data strobe line to printer.
DS2H — Data Strobe 2nd Half Q output of JF Flip-flop. Enables second half of the data strobe to the printer.
ENDACK — Enable DACK. Will enable DACK to set the DSTB Flip-flop.
MA-STATF — Machine Status. Q output of a DF Flip-flop. High when printer is available.
POEXT15/ — External Buss Bit 15 Not. Represents end of page status in the status word.
POEXT16/ — External Buss Bit 16 Not. Represents ready status in the status word.
POTMOUT/ — Timeout Not. $\overline{Q}$ output of a JF Flip-flop. Will enable a motor-off character to the printer when low.
SINT/ — Status Interrupt Not. The IOC has detected a status condition.
2HNMO — 2nd Half (Of the Data Strobe) Not. Motor off.
60 SEC — 60 Seconds. Output of count circuit when count time IOC not in use. If 60 seconds is reached and a control has not been sent to the IOC, 60 SEC will go high and set the timeout flip-flop to turn the printer motor off.

P02-SHS.021

BK/ — Detects a delete code and will cause a ? character to be sent to the printer.
DEC/ — Decode Not. Detects LUMIR11/ low and enables B6 to the printer.
EN7FF — Enable 7F Flip-flop Output. Is enabled when character is loaded into buffers.
EN14A — Enables 14A (Paper Motion Bit) during second half of paper motion operation.
EN15A1 — Enables 15A (Paper Motion Bit) during first half of paper motion operation.
EN15A2 — Enables 15A (Paper Motion Bit) during second half of paper motion operation.
INV/ — Invalid Not. Invalid character has been detected when low. LUMIR10/ and LUMIR11/ both high is invalid for a data character.
X1 — Enables 14A (Paper Motion Bit) during first half of a paper motion operation.
13A — Paper Motion Bit.
16A — Paper Motion Bit.
7F/ — Delete character has been detected when low.
09/ to 16/ — Outputs of Data Buffers.

P02-SH.022

B1 to B7 — Data output to Printer.
EXT12/ — External Buss Bit 12 Not. Represents an operation complete status.
PODSBIN/ — Data Strobe Inhibit Not. Will inhibit the second data strobe during the second half of a paper motion operation if not needed.
POSELATP — Select A Test Point. "A" input to S4 type I.C.
POSELBTP — Select B Test Point. "B" input to S4 type I.C.
14A — Paper Motion Bit.
15A — Paper Motion Bit.

LOAD PRINT BUFFER OPERATION

A Load Print Buffer operation is initiated by the processor when data is to be transferred to the printer. This operation will ensure that the printer's chain motor is on. If not, the IOC will send a "motor on" character to the printer. If the motor is on, a "DEL" character will be sent to the printer to clear the printer's print buffer.

See Figure II-1. For this operation, signal PSINSTN is high, PSWRITN/ is low, and LUMIR08/ is low. PSWRITN/ and PSINSTN will cause signal WI to go high. LUMIR08/ will cause signal MIR8 to go high. Signals WI and MIR8 high will cause signal PO93MR to go low. PSINSTN will cause signal POI/ to go low. POI/ and PSWRITN/ will keep signal PO93C low. (Refer to Figure II-2.)

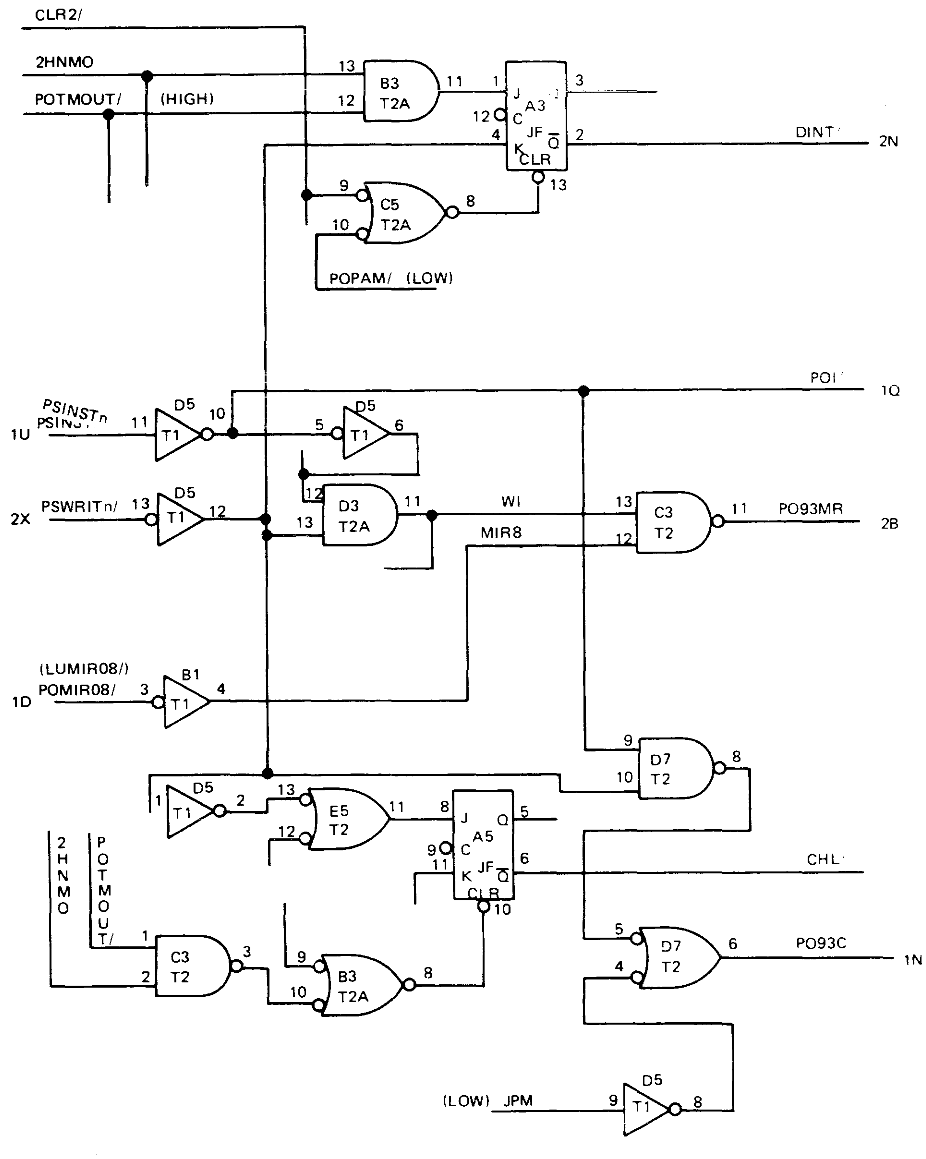


Fig. II-1 LOAD PRINT BUFFER OPERATION

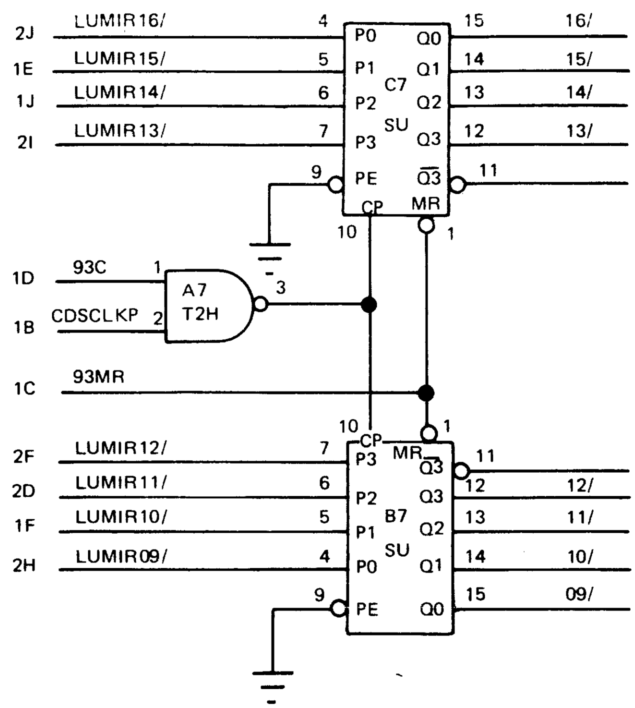


Fig. II-2 DATA BUFFERS

Signals PO93MR and PO93C low will inhibit the data buffers from setting. PSWRITN/ low will set the CHL flip-flop on the next clock causing signal CHL/ to go low. PSWRITN/ low will also reset the DINT flip-flop if it was set by a previous operation.

See Figure II-3. Signal CHL/ low will cause signal ENDACK to go high. Signal ENDACK and DACK high will set the DSTB flip-flop on the next clock pulse. The DACK flip-flop is initially set by Power On Clear or the Clear pushbutton (CGCLEAR). Thereafter it is set by ACK from the printer. Once the DSTB flip-flop is set, signal DSTB goes high, causing a signal DSTB/ to go low. DSTB/ low will strobe the data to the printer. DSTB high will also cause the DACK flip-flop to reset and sets the DS2H flip-flop on the next clock pulse. The DS2H flip-flop, once set, will cause signal DS2H to go high causing signal 2HNMO to go high and resets the DSTB and DS2H flip-flop at the next clock pulse. (Refer to Figure II-1.) Signal 2HNMO high will reset the CHL flip-flop and set the DINT flip-flop causing signals CHL/ to go high and DINT/ to go low. Signal DSTB/ high (when DSTB flip-flop is reset) enables an 8 usec single shot in the printer causing signal ACK/ to go low for 8 usec. When ACK/ goes low, the ACK flip-flop will reset. During the 8 usec's, the Data Interrupt (DINT/) will be detected at the processor initiating a Load Data operation.

After 8 usec's, ACK/ goes high setting the ACK flip-flop, which will cause the DACK flip-flop to set. The IOC is now ready to load data and transfer it to the printer.

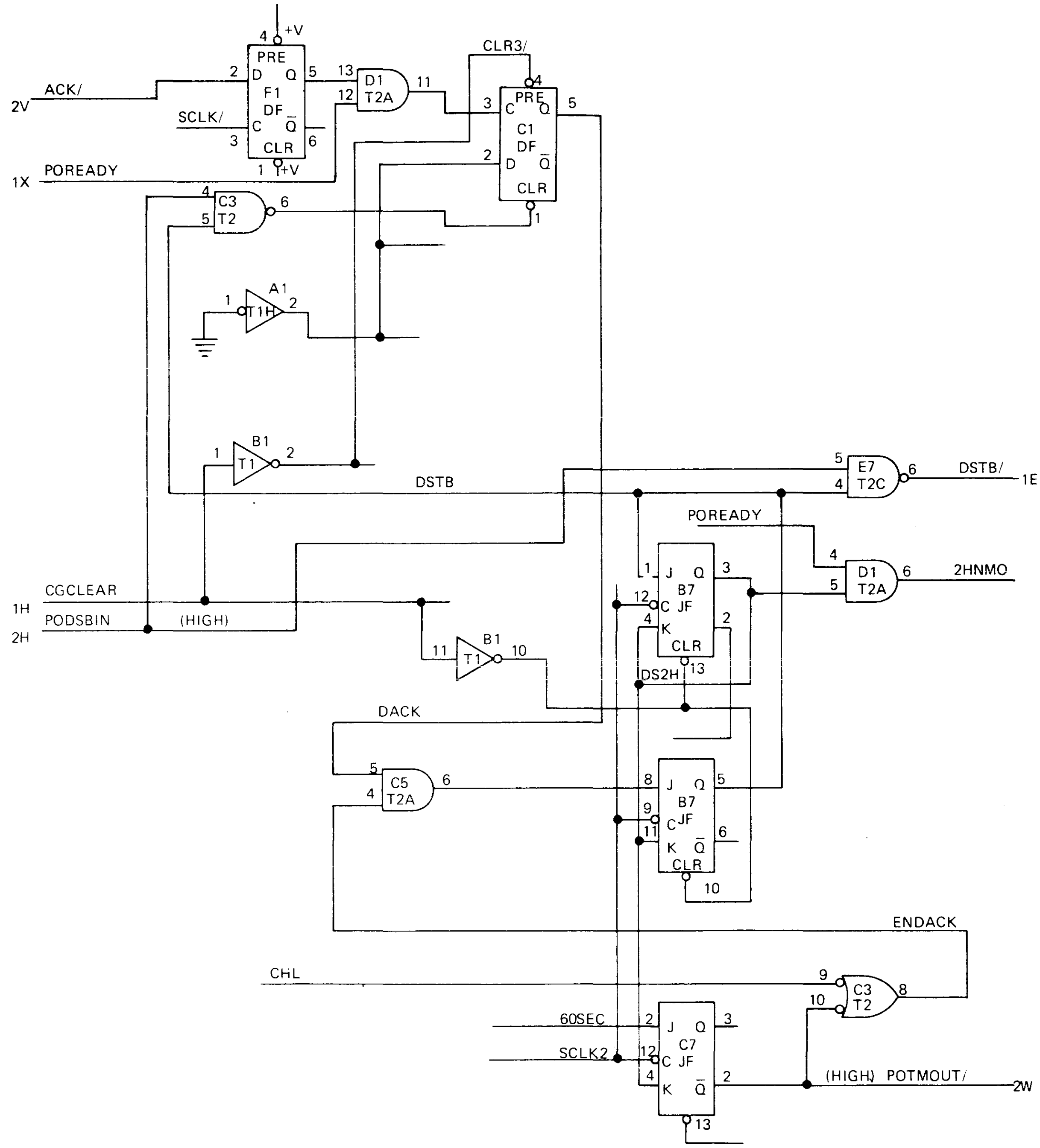


Fig. II-3 STROBE GENERATION

LOAD DATA OPERATION

See Figure II-1 and Figure II-2. For this operation, signal PSINSTN is low, PSWRITN/ is low, LUMIR08/ is high, and LUMIR09/ to 16/ contain the data. Since PSINSTN and PSWRITN/ are both low, signal WI will be low, but signal PO93C will go high. WI and MIR8 low will cause signal PO93MR to go high. PO93C and PO93MR both high will allow the data to be set into the data buffers.

PSWRITN/ being low will set the CHL flip-flop at the next clock pulse, causing CHL/ to go low.

See Figure II-3. CHL/ being low will cause ENDACK to go high. ENDACK high along with DACK being high will set the DSTB flip-flop on the next clock pulse. Signal DSTB high causes DSTB/ to go low, resets the DACK flip-flop, and at the next clock pulse will set the DS2H flip-flop. DSTB/ being low will strobe the data into the printer's buffer.

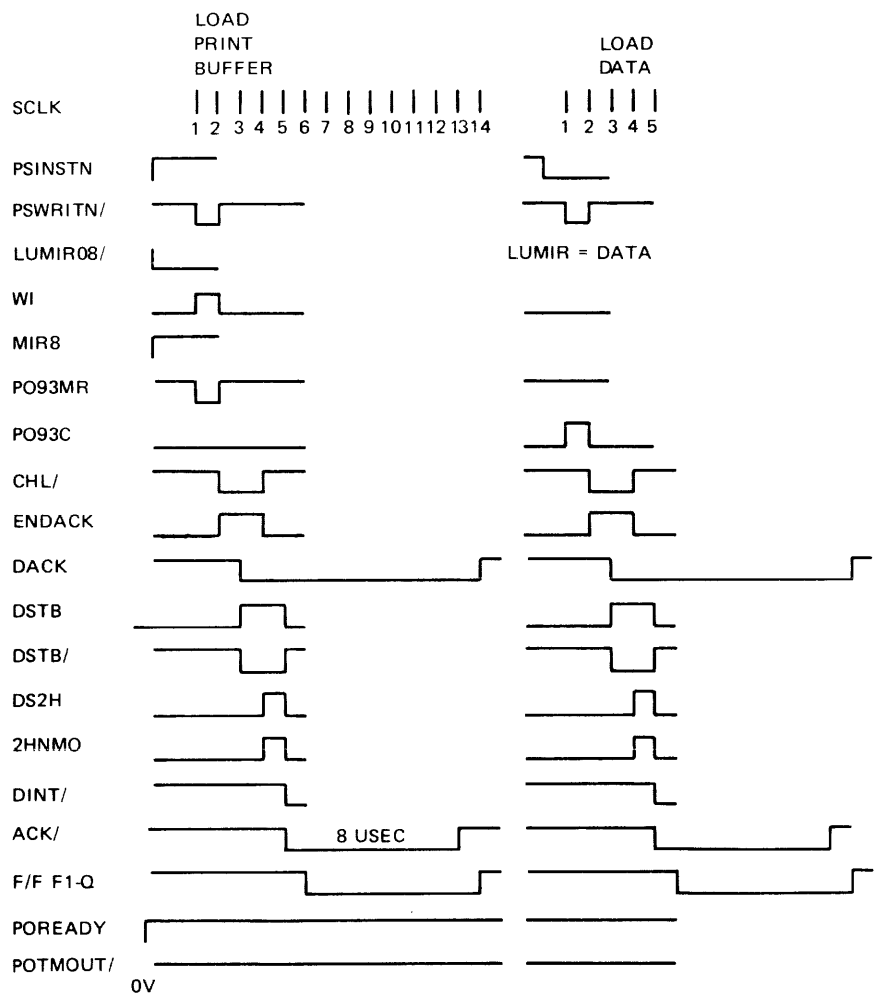
Once the DS2H flip-flop is set, causing a signal DS2H to go high, signal 2HNMO will go high. DS2H high will reset the DSTB and DS2H flip-flops on the next clock pulse.

Signal 2HNMO being high resets the CHL flip-flop and sets the DINT flip-flop, causing signals CHL/ to go high and DINT/ to go low. Once the DSTB flip-flop is reset, signal DSTB/ goes high enabling the 8 usec single shot in the printer, causing signal ACK/ to go low. ACK/ low will reset the ACK flip-flop.

DINT/ being low will cause a Data Interrupt in the processor, initiating another Load Data operation. Eight usec's after ACK/ goes low, ACK/ will go high, setting the ACK flip-flop which will set the DACK flip-flop. The IOC is now ready for another data transfer.

The next data transfer may take place during the 8 usec's that ACK/ is low. The data will be stored in the IOC's data buffers, awaiting DSTB/ to go low. DSTB/ will go low once ACK/ goes high and sets the DACK flip-flop, which will set the DSTB flip-flop.

Timing Chart II-1 depicts both Load Print Buffer and Load Data operations.



TIMING CHART II-1 LOAD PRINT BUFFER TIMING

PAPER MOTION CONTROL WORD

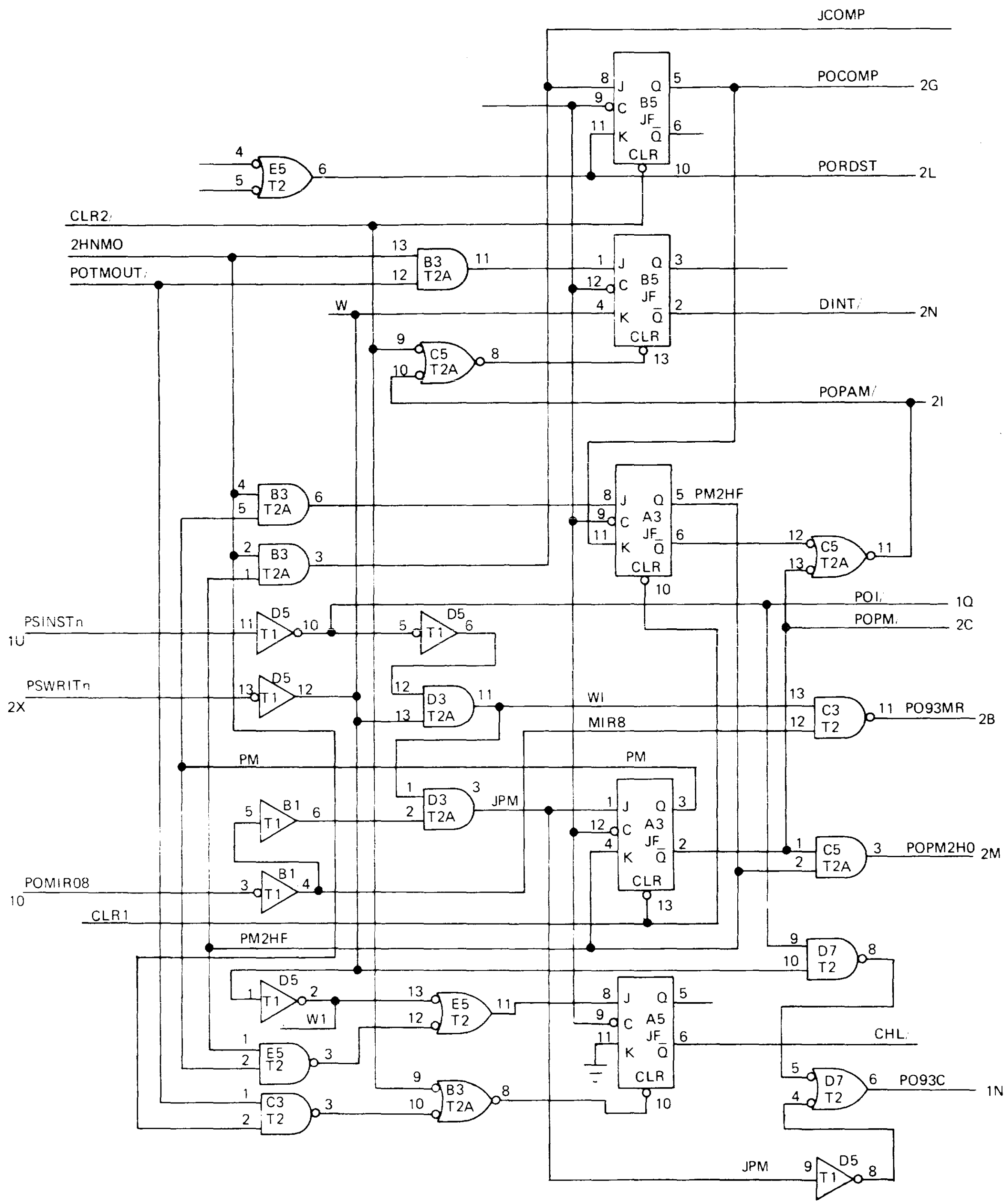
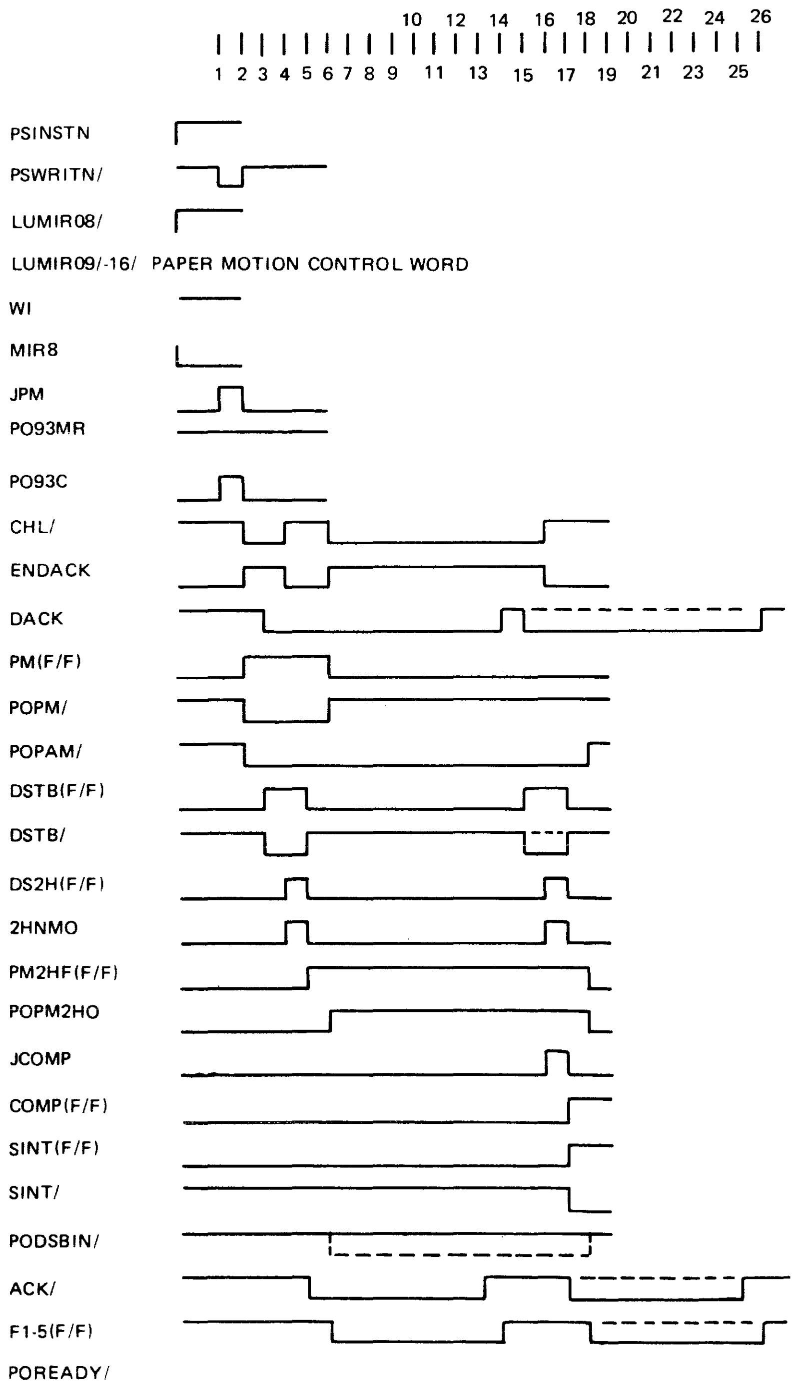


Fig. II-4 PAPER MOTION OPERATION

A paper motion control word is initiated by the processor to move paper. For this operation, signals PSINSTN is high, PSWRITN/ is low, LUMIR08/ is high and LUMIR09/ to LUMIR16/ will contain the paper motion operation to be performed. See Figure II-4. PSWRITN/ low and PSINSTN high will cause signal WI to go high. POMIR08/ (LUMIR08/) high will cause signal MIR8 to go low. PSWRITN/ low and POMIR08/ high will cause signal JPM to go high. WI high and MIR8 low will cause signal PO93MR to go high. JPM high will cause signal PO93C to go high. Signals PO93MR and PO93C high will allow LUMIR09/ to LUMIR16/ to be set into the data buffers (see Figure II-2). JPM high will also set the PM flip-flop, causing signal PM to go high. At the same time, PSWRITN/ being low will set the CHL flip-flop, causing a signal CHL/ to go low. See Figure II-3. Signal CHL/ being low will cause ENDACK to go high. ENDACK along with DACK being high will set the DSTB flip-flop, causing DSTB to go high and enabling DSTB/ to go low. DSTB/ being low will strobe the paper motion data word into the printer. The data sent to the printer consists of a decode of the IOC data buffer, which represents vertical tab information to the printer.

DSTB high sets the DS2H flip-flop which will cause signal 2HNMO to go high and resets the DACK flip-flop. DS2H high will reset the DSTB flip-flop and DS2H flip-flop, causing signal DSTB/ to go high. DSTB/ going high causes ACK/ to go low for 8 usec and then sets the DACK flip-flop as described previously.



TIMING CHART II-2 PAPER MOTION TIMING

See Figure II-4. 2HNMO being high will not set the DINT flip-flop due to signal POPAM/ being low, keeping the DINT flip-flop reset. 2HNMO and PM being high will set the PM2HF flip-flop and reset the CHL flip-flop.

PM2HF and PM both high will set the CHL flip-flop, causing signal CHL/ to go high. At the same time PM2HF being high will reset the PM flip-flop, causing signal POPM2HO to go high.

CHL/ being low causes ENDACK to go high. ENDACK along with DACK being high will set the DSTB flip-flop and cause signal DSTB to go high. DSTB will cause DSTB/ to go low if PODSBIN/ is high. PODSBIN/ will be high if signal POPM2HO is high and the 2 channel printer option is installed and a double space operation is to take place; or if the 12 channel printer option is installed and a format tape channel is needed. (See paper motion data decode.)

When DSTB/ goes low, the second paper motion data word is strobed into the printer.

As before, DSTB high will set the DS2H flip-flop causing 2HNMO to go high and reset the DACK flip-flop. 2HNMO and PM2HF being high will cause signal JCOMP to go high. 2HNMO being high will also reset the CHL flip-flop.

JCOMP will set the COMP flip-flop, causing signal POCOMP to go high. JCOMP will also set the SINT flip-flop, causing SINT/ to go low. POCOMP high will reset the PM2HF flip-flop, completing the paper motion operation. ACK/ being low for 8 usecs, after DSTB/ went high, will again go high, setting the DACK flip-flop (DACK was reset by DSTB going high), priming the IOC for another operation.

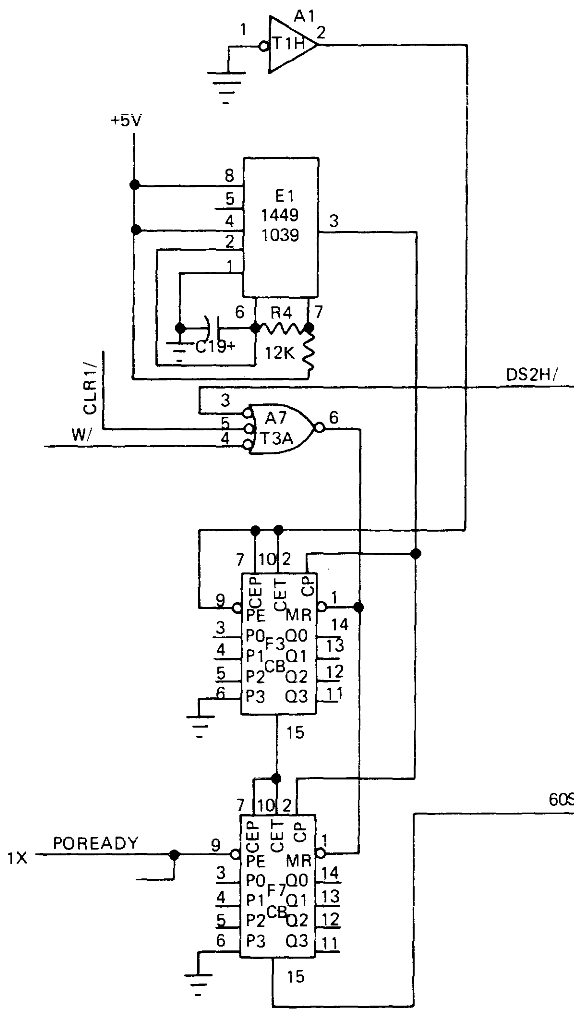
Timing chart II-2 depicts a paper motion operation.

TIMEOUT CIRCUIT

See Figure II-5. I.C. EI emits a pulse every .25 seconds. These pulses will be counted by I.C.'s F3 and F7, which are binary counters. The binary counters will be enabled if signal W/ is high (PSWRITN/ is high), CLR1/ is high, and the DS2H flip-flop is reset (control word is not in progress).

The binary counters will be inhibited if signal W/ is low (PSWRITN/ is low) or CLR1/ is low or if the DS2H flip-flop is set (control word is in progress).

As shown in Figure II-5, F7 output TC will set the timeout flip-flop. F7's TC output will go high at a count of 240 or 60 seconds (240 x .25 sec. = 60.00). When the TIMEOUT flip-flop is set, signal POTMOUT/ will go low, enabling signal ENDACK to go high, causing the DSTB flip-flop to set ENABLE signal DSTB/ to go low. DSTB/ low enables the data lines into the printer. The data lines will contain a motor off control word which will cause the printer motor to turn off. Description of this control word is located in Data Selection text.



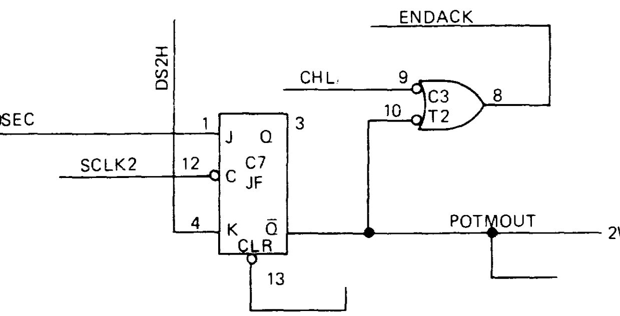


Fig. II-5 TIME OUT

DATA SELECTION

Data to the printer may be any one of four groups of data from the IOC. Selection is achieved by a selection circuit and three S4 type IC's as depicted in Figure II-6. The S4 IC has two outputs, 1Y and 2Y. Each of these outputs can be enabled by any of its inputs, 1C0, 1C1, 1C2, 1C3 for 1Y and 2C0, 2C1, 2C2, 2C3 for 2Y. These inputs are selected by input pins A and B. Input A = Binary 1 and Input B= 2, so there are four possible combinations of A and B. A = 0 and B = 0 will select 1C0 and 2C0. A = 1 and B = 0 sill select 1C1 and 2C1, and so on. Inputs A and B are generated by the selection circuit. The selection circuit has two outputs, signal POSELATP for A and signal POSELBTP for B.

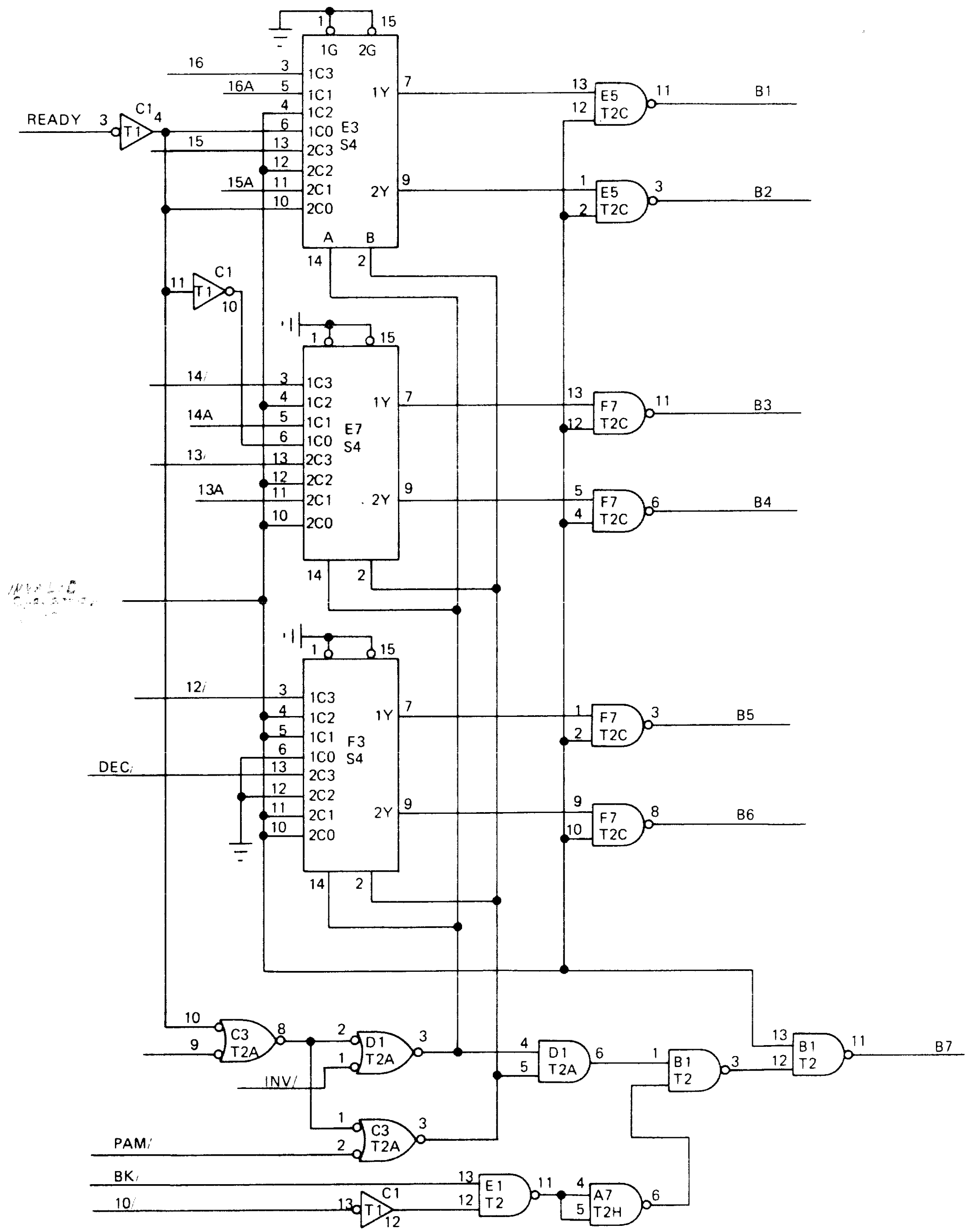


Fig. II-6 DATA SELECTION

SELECTING DATA

Table II-1 shows the function of each combination for signal POSELATP (A) and POSELBTP (B) and what inputs are selected.

TABLE II-1

POSELATP (A)	POSELBTP (B)	OUTPUTS 1Y	OUTPUTS 2Y	FUNCTION OF DATA
0	0	1C0	2C0	Motor Control
1	0	1C1	2C1	Paper Motion
0	1	1C2	2C2	Invalid Char.
1	1	1C3	2C3	Print Char.

DATA FUNCTION

MOTOR CONTROL

Motor On

If the printer's motor is off and a control word is sent to the IOC, the IOC will send a "motor on" command to the printer. This command word is generated by READY/ being high when the motor is off. As seen in Figure II-6, READY/ being high will cause signal POSELATP (A) and POSELBTP (B) to go low. S4 inputs A and B being low will select 1C0 and 2C0 inputs. (Motor Control) Table II-2 shows the data that is produced. The Dack Flip-flop, which enables the data strobe, is set by the previous ACK or by Clear if this is the first operation.

TABLE II-2 MOTOR ON

	S4 IN	S4 OUT	DATA OUT (Motor On)
E3	1C0 = 0	1Y = 0	B1 = 1
	2C0 = 0	2Y = 0	B2 = 1
E7	1C0 = 1	1Y = 1	B3 = 0
	2C0 = 1	2Y = 1	B4 = 0
F3	1C0 = 0	1Y = 0	B5 = 1
	2C0 = 1	2Y = 1	B6 = 0
	POSELATP = 0 = POSELBTP = 0		B7 = 0

Motor Off

When the processor has completed printer operations, the IOC will time out after 60 seconds. When the IOC has timed out, a motor off command is generated. This command word is generated by signal POTMOUT/ being low (see Timeout description). POTMOUT/ being low will cause signals POSELATP (A) and POSELBTP (B) to go low. S4 inputs A and B will select 1C0 and 2C0 inputs (motor control). Unlike the motor on operation, READY/ is low since the motor is on. READY/ being low will cause a motor off command word to be generated. See Figure II-6. Table II-3 shows the data that is produced.

TABLE II-3 MOTOR OFF

	S4 IN	S4 OUT	DATA OUT (Motor Off)
E5	1C0 = 1	1Y = 1	B1 = 0
	2C0 = 1	2Y = 1	B2 = 0
E7	1C0 = 0	1Y = 0	B3 = 1
	2C0 = 1	2Y = 1	B4 = 0
F3	1C0 = 0	1Y = 0	B5 = 1
	2C0 = 1	2Y = 1	B6 = 0
	POSELATP = 0 = POSELBTP = 0		B7 = 0

PAPER MOTION SELECTION

When the IOC receives a paper motion control word, the selection circuit will select paper motion data to be enabled to the printer. This selection takes place due to signal POPAM/ being low after a PM CW is sent to the IOC. See Figure II-6 and Timing Chart II-2. POPAM/ low will cause signal POSELBTP to go low. POSELATP will be high since POREADY is high. POTMOUT/ is high and INV/ is high. POSELATP being high and POSELBTP low will select 1C1 and 2C1 inputs. As shown in Figure II-6, 1C1 and 2C1 inputs are paper motion data.

INVALID CHARACTER SELECTION

When the IOC detects an invalid character (during data transfer) signal INV/ will be low causing the selection circuit output POSELATP to go low. POSELBTP will be high since POREADY is high and POTMOUT/ is high. POSELATP low and POSELBTP high will select 1C2 and 2C2 inputs. Table II-4 shows the data that is produced.

TABLE II-4

S4 IN	S4 OUT	DATA OUT	
1C2 = 1 (+V)	1Y = 1	B1 = 0	
2C2 = 1 (+V)	2Y = 1	B2 = 0	
1C2 = 1 (+V)	1Y = 1	B3 = 0	
2C2 = 1 (+V)	2Y = 1	B4 = 0	Blank
1C2 = 1 (+V)	1Y = 1	B5 = 0	
2C2 = 1 (+V)	2/ = 1	B6 = 0	
POSELATP = 0 = 0 POSELBTP = 0		B7 = 0	

PRINT CHARACTER SELECTION

When the IOC receives a print character, the selection circuit will select the character and enable it to the printer.

TABLE II-5

OPERATION	LUMIRxx/ 09	10	11	12	13	14	15	16		1ST CODE B 4 3 2 1	2ND CODE B 4 3 2 1
No Space	1	1	1	1	1	1	F	1	CR	1 1 0 1	0 0 0 0
Single Space	1	1	1	1	1	0	F	1	LF	1 0 1 0	0 0 0 0
Double Space	1	1	1	1	0	1	F	1	LF	1 0 1 0	1 0 1 0
Variable Skip 1	1	1	0	1	1	1	F	1	VT	1 0 1 1	0 1 1 0
Bottom of Form	0	0	1	1	1	1	F	1	VT	1 0 1 1	0 0 1 0
Top of Form	1	1	1	0	1	1	F	1	FF	1 1 0 0	0 0 0 0
Variable Skip 2	0	1	1	1	1	1	F	1	VT	1 0 1 1	0 1 0 0

15 = F
1 F = 1 Execute print followed by specified format control.
2 F = 0 Execute specified format control only.

Signals POSELATP and POSELBTP will be high selecting 1C3 and 2C3 inputs. As shown in Figure II-6, 1C3 and 2C3 inputs are the outputs of the IOC data buffer. If during a data transfer a "DEL" character (7F) is detected (all LUMIR/ lines low), signal BK/ will go low causing B7 to go low. 1C3 and 2C3 inputs will still be selected. Since the data buffer outputs are all low for a "DEL" character (7F), the data lines B1 to B6 will be high to the printer. B1 to B6 high with B7 low will cause a "?" to be printed in that print position.

PM DEODE CIRCUIT

Figure II-7 depicts the PM decode circuit. The outputs of the data buffer are decoded to produce outputs 16A, 15A, 14A and 13A. Signal PM will enable these lines for the first PM character. Signal POPM2HO (paper motion 2nd half only) high will enable the 2nd paper motion character for a 12-channel printer and for a double space operation for 2 and 12 channel printers. Table II-5 shows the codes that are produced for the paper motion operations.

PAPER MOTION OPERATION DECODE

When a paper motion is detected by the IOC, the paper motion operation must be decoded to produce the proper character for the printer. Figure II-7 shows the circuits used to decode the LUMIRxx/ lines to a valid paper motion character for the printer.

When the paper motion operation is for a two-channel printer, the IOC enables one paper motion character to the printer for all operations except double space. For a double space operation, two single space characters are enabled.

When the paper motion operation is for a 12-channel printer, the IOC may enable two paper motion characters to the printer. The first character is a vertical tab code and the second character, if necessary, is the format tape channel code.

DATA STROBE INHIBIT (PODSBIN/)

As shown in Table II-5, a second code is needed for double space, variable skip 1, bottom of form and variable skip 2 operations. Signals 13/ and 911/ represent these operations. Figure II-7 shows the data strobe inhibit circuit. Note that for a 12-channel printer "A" is wired to B and for a two-channel printer "A" is wired to C.

When signal POPM2HO is high, signal PODSBIN/ will go high if signal 13/ or 911/ is low, allowing a data strobe to be generated (DSTB/ low). Signal PODSBIN/ will go low if both 13/ and 911/ are high, indicating that a second data strobe is not needed.

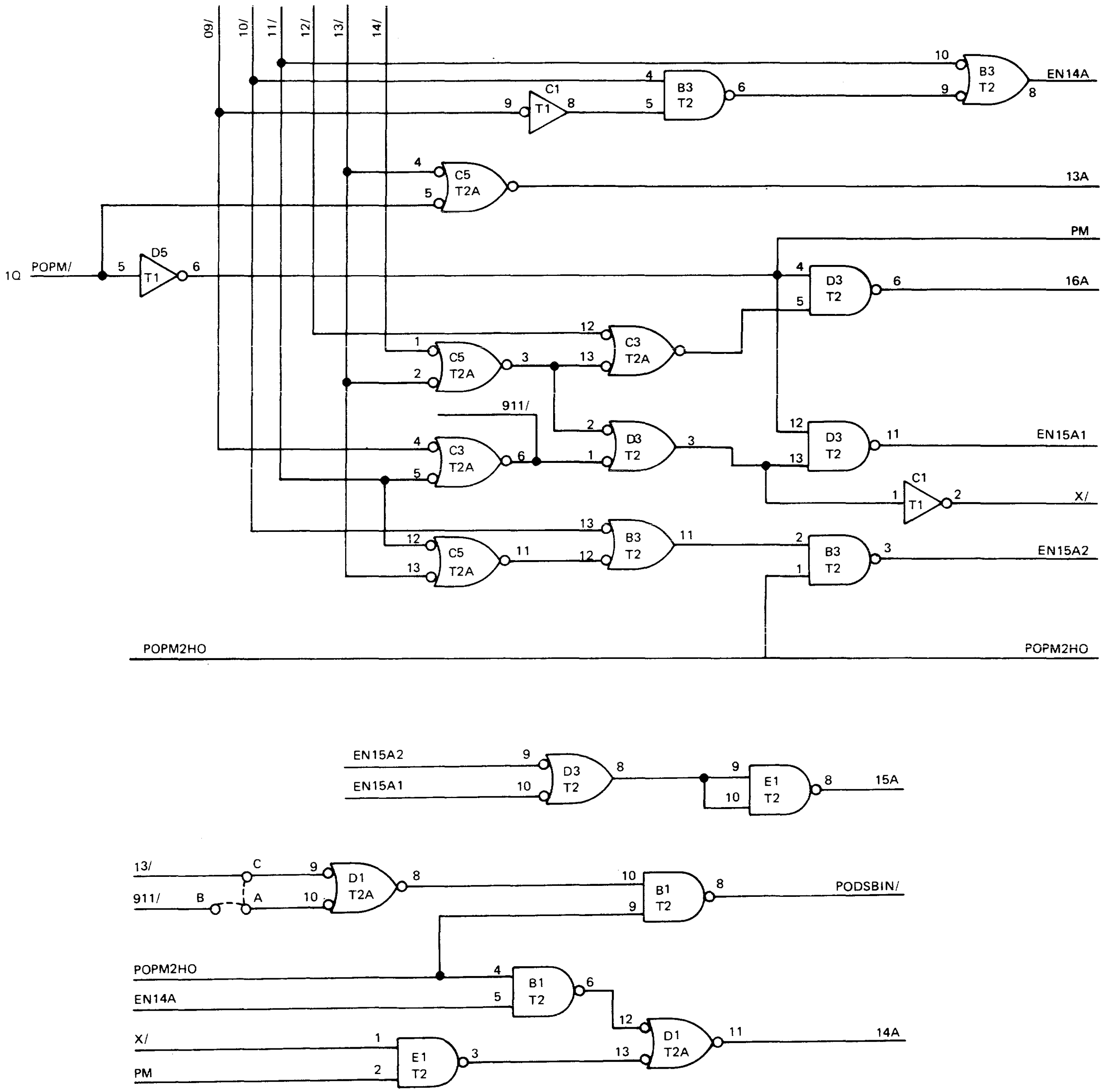


Fig. II-7 PAPER MOTION WORD GENERATION

DEL CHARACTER DETECT (7F)

Figure II-8 shows the DEL character detect circuit. Data buffer outputs 16/, 15/, 14/, 13/, 12/, 11/ and 10/ are checked for lows. If they are all low, output 7F/ will go low and NAND with signal EN7FF. Enable 7F being high will cause signal BK/ to go low. Signal EN7FF goes high when a character is enabled into the data buffer. BK/ being low will cause B7 output to go low. B7 being low along with B1 to B6 high will cause a ? to be printed in that print position.

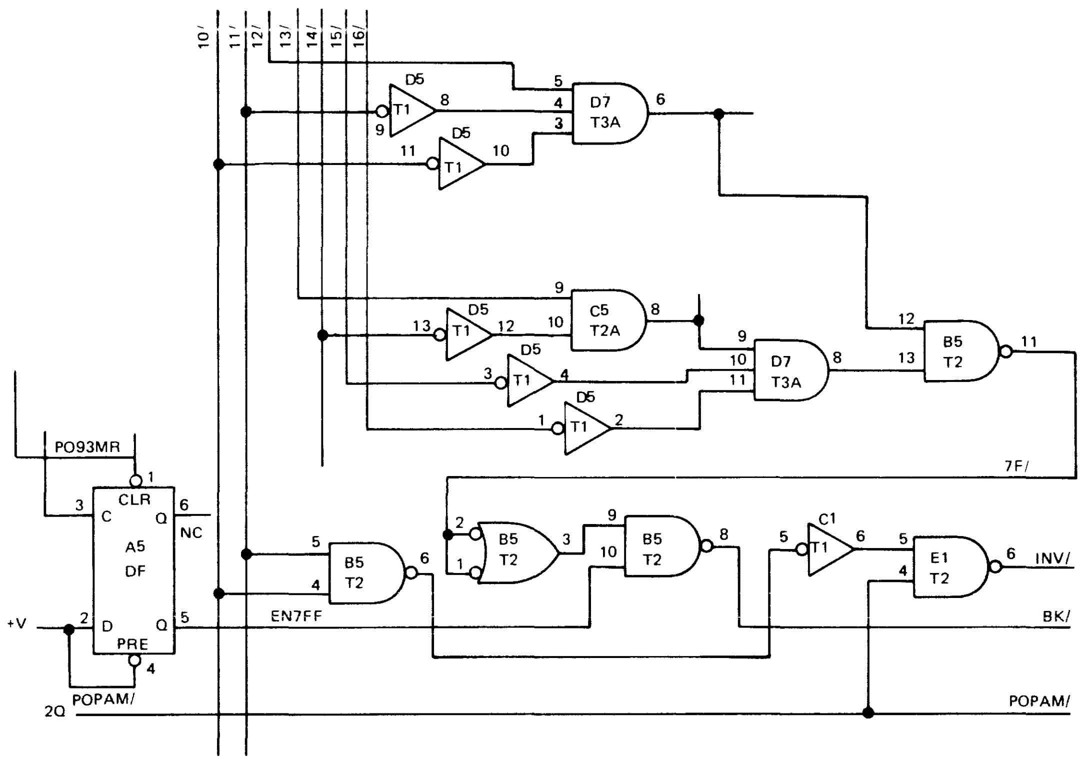


Fig. II-8 DEL & INV CHARACTERS GENERATION

INVALID CHARACTER DETECT

Figure II-8 shows the invalid character detect circuit. Data buffer outputs 11/ and 10/ are NAND at IC-B5 (T2) to produce a low if both 11/ and 10/ are high. The low output is inverted at IC-C1 (T1) to produce a high at the input of IC-E1 (T2). This high will cause signal INV/ to go low if signal PAM/ is high. Since an invalid character needs only to be detected during data transfer, signal PAM/ will only be high during a data transfer enabling signal INV/ to go low if an invalid character is detected. Signal INV/ low will cause the selection circuit to select the invalid character data to the printer to print a blank.

DATA INTERRUPT

Figure II-1 shows the data interrupt circuit. As shown, the DINT flip-flop can only be set when signals 2HNMO and POTMOUT/ are both high. The DINT flip-flop will be reset by signal W, when the next data word is sent to the IOC or a paper motion control is sent to the IOC. W is high when PSU signal PSWRITn/ is low. PSWRITn/ is low during data input or control word input to the IOC.

The DINT flip-flop can also be direct reset by signal CGCLEAR being high, causing signal CLR2/ to go low or by signal POPAM/ being low. POPAM/ will be low during a paper motion operation to inhibit signal 2HNMO from setting the DINT flip-flop.

STATUS INTERRUPT

Figure II-9 shows the status interrupt circuit. As shown, the SINT flip-flop can be set by signals MA-STATF and W being high. W will be high whenever data is being transferred to the IOC or a control word is being sent to the IOC. During these two operations, if printer signal MA-STAT/ is high (printer not ready for operation), the MA-STAT flip-flop will set causing the SINT flip-flop to be set. This SINT represents a not ready (EXT16/) status.

The other condition for setting the SINT flip-flop is by JCOMP being high. JCOMP will be high when the paper motion operation is complete. This SINT represents a print complete (EXT12/) status.

As shown in Figure II-9, End of Page status does not set the SINT flip-flop. The End of Page status will be enabled along with the other status conditions when signal RDST is high. As shown, RDST is high when either PSU signal PSENSTn/ is low or PSU signal PSREADn/ being low and signal PSINST being high.

DINT will also be enabled when RDST is high to produce a Data Request (EXT01/) status.

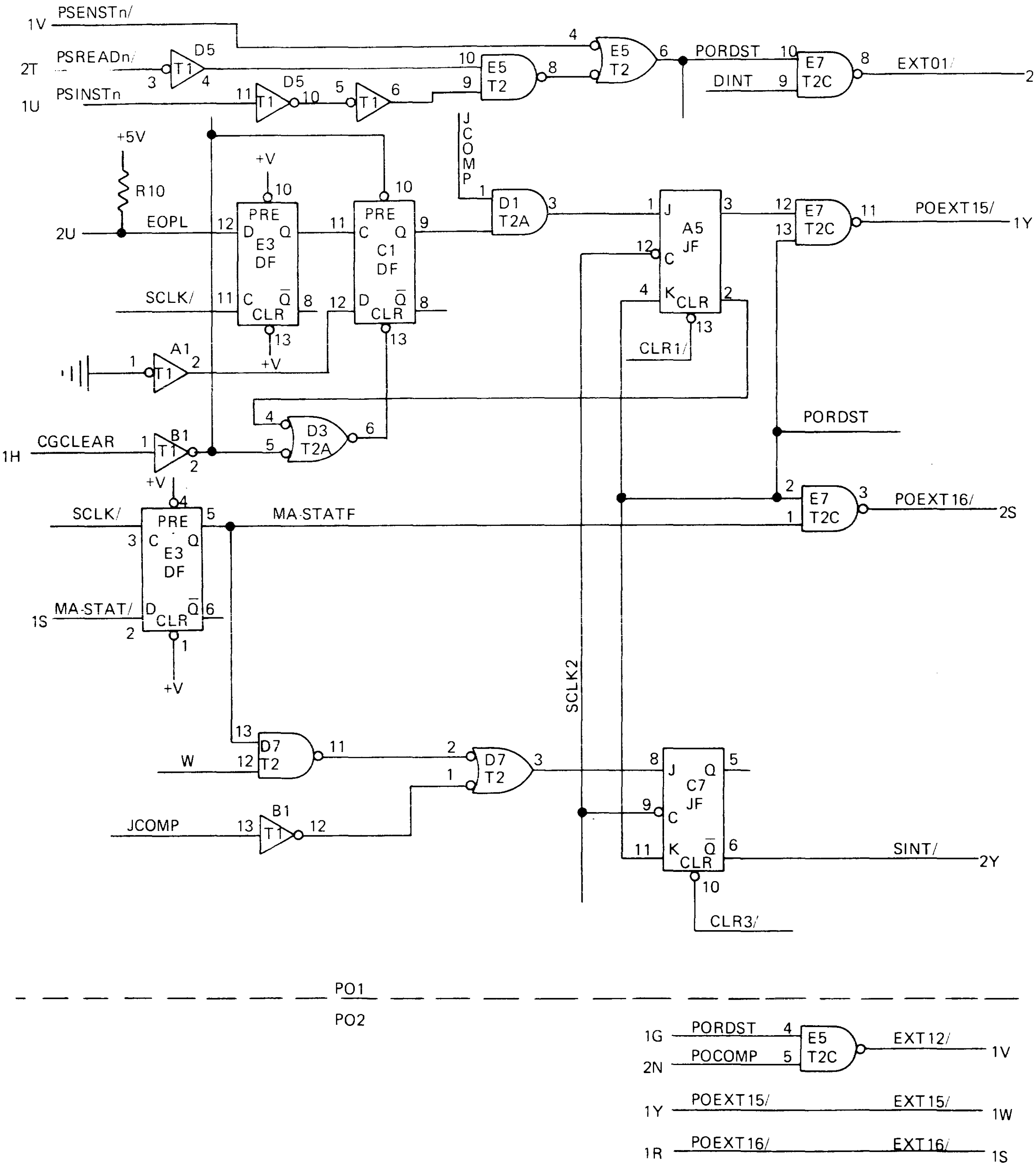


Fig. II-9 STATUS GENERATION

MAINTENANCE PHILOSOPHY

The maintenance philosophy of the B0243 IOC consists of running the appropriate MTR tape using the MTR operation instruction.

The MTR will validate the IOC and the printer.

The MTR will also detect and diagnose a failure within the IOC.

The MTR cannot diagnose a failure within the printer, but will point to a probable printer failure.

MAINTENANCE

1. When removing cards from the processor rack, always remove power.
2. When replacing failed components, always insure that all leads are seated properly in their receptacles.
3. When installing corrected card back into system, always insure that the MTR passes all tests, not just the test that failed.
4. After MTR testing is complete, run available software to insure proper system operation.

INSTALLATION OF B0243 IOC

The B0243 IOC consists of three P.C. cards, one front plane connector, and one adapter.

1. (3) P.C. Cards
2. (1) Front Plane Connector
3. (1) Adapter Cable*
4. (2) Backplane Templates
5. (1) Set of Instructions
6. (1) Set of FT & R Documents
7. (1) Decal

*Adapter cable may be substituted by an I/O cable, depending upon the cable manufacturing.

Insure that all parts are present before installation.

Before installing P.C. cards into DDP location, insure that all components are seated properly in their receptacles.

1. Install P.C. cards in the proper DDP location as listed in Table VI-1.
2. Install decal on DDP decal corresponding to the DDP location.
3. Install front plane connector on P02 and P03 card.
4. Install adapter cable into the processor backplane corresponding to the DDP location. Refer to Table VI-1.
5. Install I/O end of adapter cable into the adapter panel.
6. Write in the adapter cable type on the adapter panel decal in the corresponding block.
7. Install I/O cable to the adapter cable. If I/O cable is shipped with IOC, install I/O cable directly into processor backplane corresponding to the DDP location of the IOC. Refer to Table VI-1.
8. Check +5 volts as described in Vol. I of the Processor FT & R documents.
9. Connect I/O cable to printer.
10. Run the appropriate MTR to insure proper system operation.

TABLE VI-1

DDP NO.	CARD FUNCTION	B/P LOCATION	B0243 IOC	CABLE LOCATION
1	Control	FW6	P01	J97
	Data 9-16	FW3	P02	
	Data 1-8	FW0	P03	
	Special	FV7		
2	Control	DW6	P01	J96
	Data 9-16	DW3	P02	
	Data 1-8	DW0	P03	
	Special	DV7		
3	Control	FV4	P01	J95
	Data 9-16	FV1	P02	
	Data 1-8	FU8	P03	
	Special	FU5		
4	Control	DV4	P01	J94
	Data 9-16	DV1	P02	
	Data 1-8	DU8	P03	
	Special	DU5		
5	Control	FU2	P01	J93
	Data 9-16	FT9	P02	
	Data 1-8	FT6	P03	
	Special	FT3		
6	Control	DU2	P01	J92
	Data 9-16	DT9	P02	
	Data 1-8	DT6	P03	
	Special	DT3		
7	Control	DT0	P01	J91
	Data 9-16	DS7	P02	
	Data 1-8	DS4	P03	
	Special	DS1		

12-CHANNEL, 2-CHANNEL B0243 IOC OPTION

The B0243 IOC can accommodate either a 12-channel or a 2-channel A9249 printer. This is accomplished by installing an option on the P02 P.C. card of the B0243 IOC.

TABLE VIII-1

12-Channel	2-Channel
Add 1 Wire	Add 1 Wire
A to B	A to C

Points A, B and C are stamped as such on P02 P.C. card (see FT & R document 1449 1831, ODEC Printer Control, Sh.S.021).

Always verify option installed before installing IOC in processor.