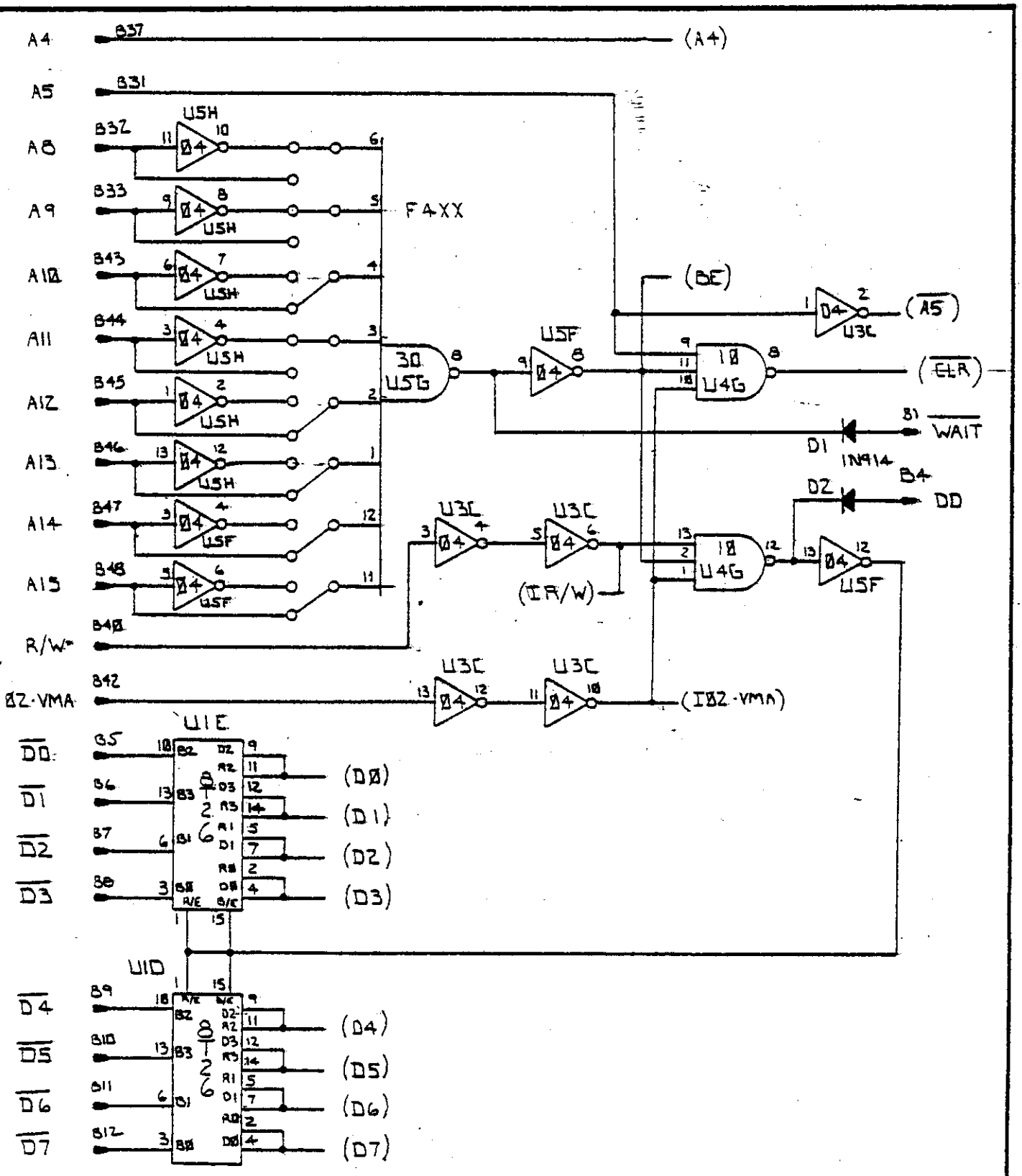
LINE PRINTER INTERFACE MANUAL

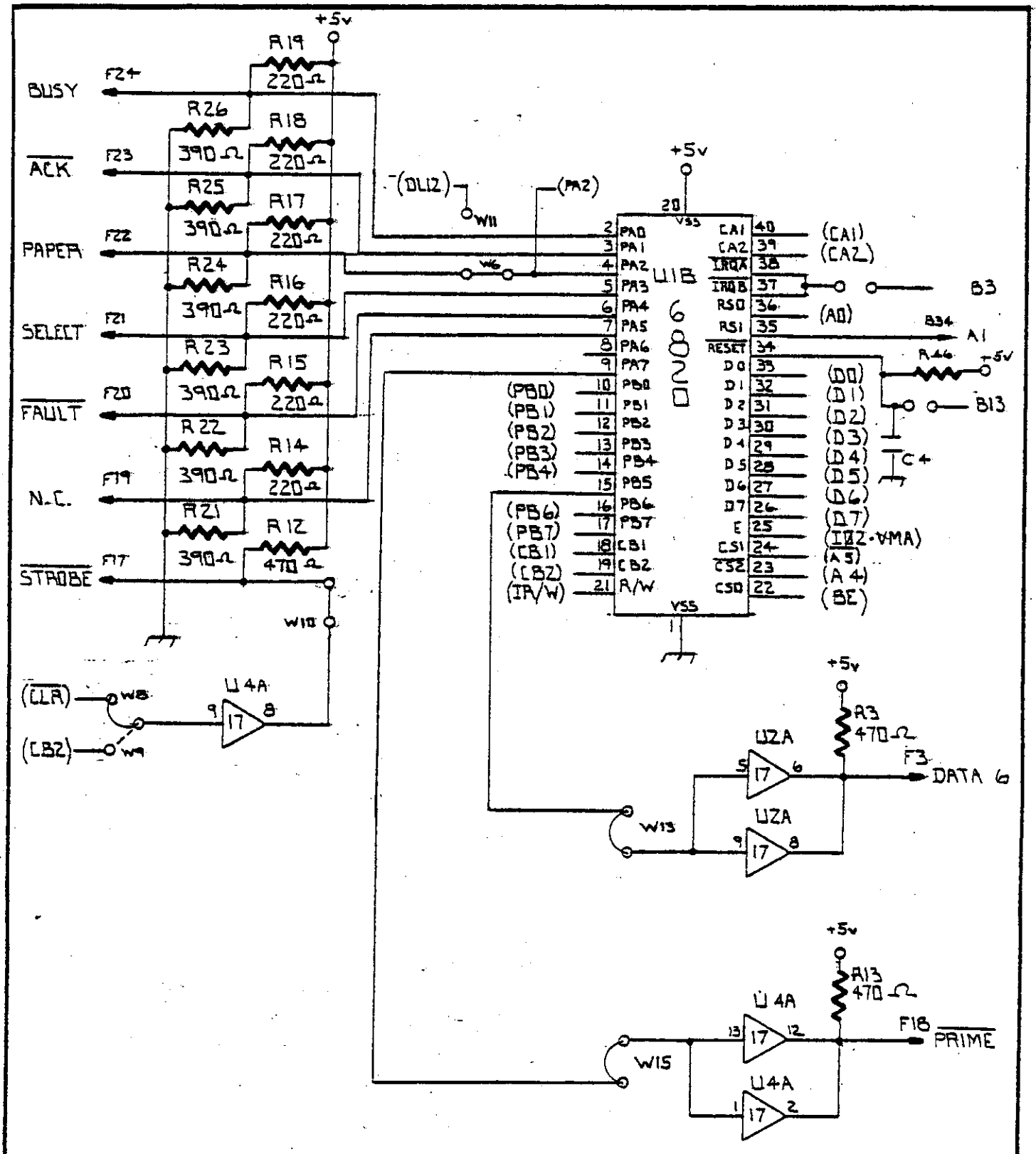
REV B	26 SEP 1979



OHIO SCIENTIFIC

product name/number MODEL 470
CENTRONICS PRINTER INTERFACE

date	revision	page	status	sheet
27 JUL 1979 DRAWN ~ J.L.K.				1 of 3



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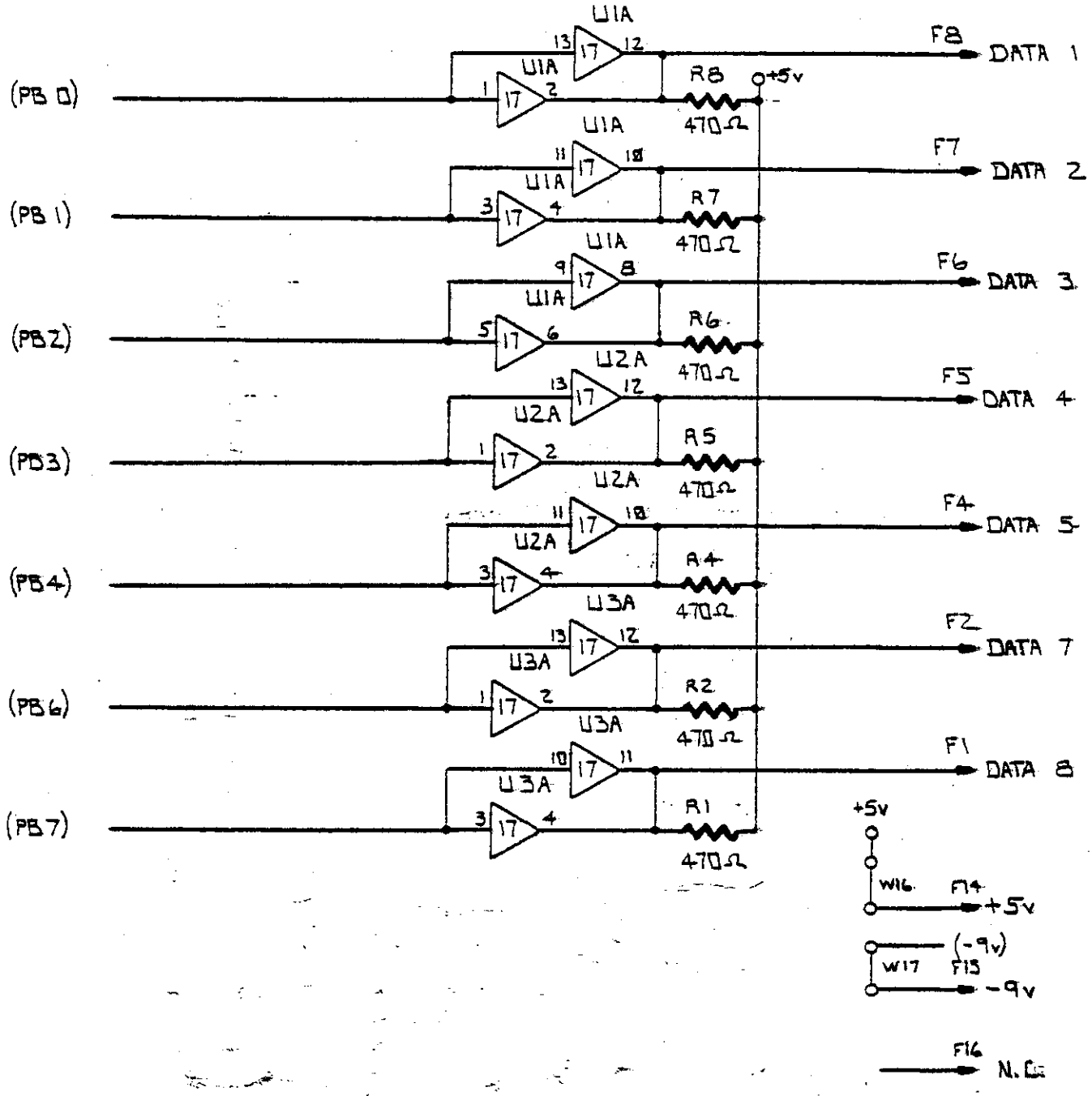

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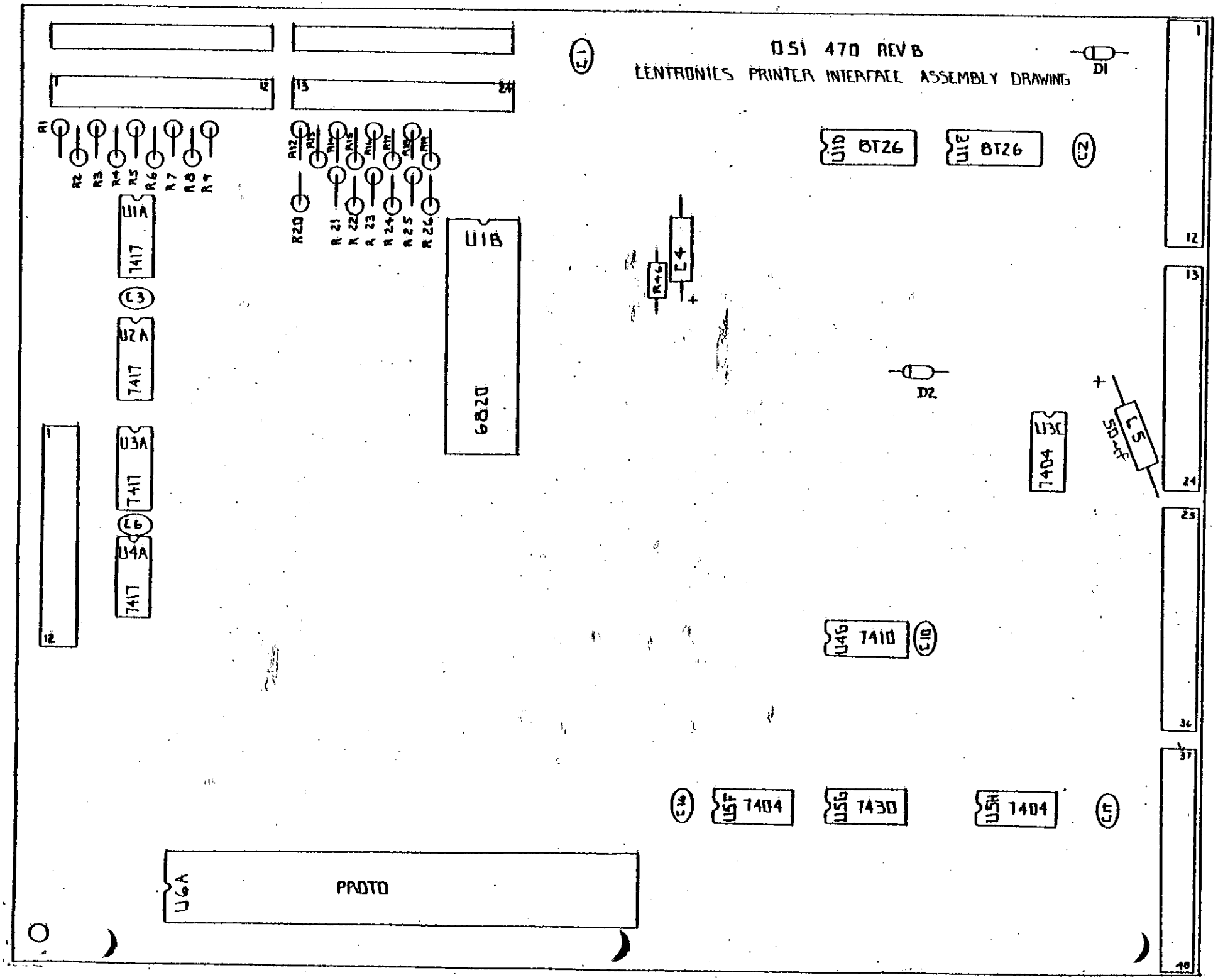
OSI 470 REV B
CENTRONICS PRINTER INTERFACE ASSEMBLY DRAWING
D1
D2
U1A 7417
U1B 6820
U2A 7417
U3A 7417
U4A 7417
U1D 8T26
U1E 8T26
U3C 7404
U4B 7410
U5F 7404
U5G 7430
U5H 7404
U6A PROTO
R1
R2
R3
R4
R5
R6
R7
R8
R9
R20
R21
R22
R23
R24
R25
R26
R46
C4
C5
50pf
C1
C2
C3
C6
C10
C11
1
12
13
24
25
36
37
48

1.0-OVERALL DESCRIPTION

The parallel interface electronics are located on two printed circuit boards and contain:

1-A 132-character-by-7-bit MOS buffer.

2-An MOS character generator programmed with the standard 64-character ASCII upper-case set, a 32-character block lower case set and a 32-character script lower case set. Selection of lower case block or script is operator selectable.

3-Print controls that allow generation of double height characters, double width characters, or both on a line-by-line basis.

4-Paper feed controls that allow 1 to 31 line feeds with a single command and switch selectable 6 or 8 line/inch spacing. A ramped clock generator is used to accelerate the paper from four inch/second start-stop speed to 12 inch/second slew speed. A joystick allows the operator to vertically position the paper in 0.007" increments.

5-Electronic top of form controls that allow operator selection of 11 different forms lengths (3, 3½, 4, 5½, 6, 7, 8, 8½, 11, 12 and 14 inches) for response to form feed commands and switch enabled automatic skip over the last six lines of the form.

6-An electronic 12-channel vertical format unit (VFU) that gives the controlling equipment extensive paper formatting capabilities through the interface.

7-Two illuminated pushbutton switches for control of printer selection (on line/off line) and manual paper feed.

8-Self-test circuitry allowing continuous printing of the entire character set or any selected character.

A third printed circuit board is located within the power supply enclosure, and contains constant current drive circuitry for the print solenoids and paper feed stepper motor, and a solid state AC relay for the shuttle drive motor.

2.0-INTERFACE CONNECTOR

The interface connector is a 36-pin receptacle with ball mounts. Acceptable mating plugs are AMP 552470-1 or Amphenol 57-30360.

Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
1	$\overline{\text{STROBE}}$	10	$\overline{\text{ACK}}$	19	Ground	28	Ground
2	DATA 1	11	BUSY	20	Ground	29	Ground
3	DATA 2	12	PAPER	21	Ground	30	Ground
4	DATA 3	13	SELECT	22	Ground	31	$\overline{\text{PRIME}}$
5	DATA 4	14	Ground	23	Ground	32	$\overline{\text{FAULT}}$
6	DATA 5	15	CLOCK	24	Ground	33	Ground
7	DATA 6	16	Ground	25	Ground	34	Not Used
8	DATA 7	17	Chassis	26	Ground	35	Not Used
9	DATA 8	18	+5 VDC	27	Ground	36	Not Used

Interface Connector Pin Assignments

3.0-INTERFACE CIRCUITRY

Data lines are terminated with a 1000Ω resistor to +5 volts. $\overline{\text{STROBE}}$ and $\overline{\text{PRIME}}$ are terminated with a 470Ω resistor to +5 volts. All input drivers should be capable of sinking 16 milliamps at 0.4 volts. All output signals from the printer are driven by 7437 buffers capable of sinking 48 milliamps at 0.4 volts.

A high signal is 2.8 volts minimum, 5.5 volts maximum and a low signal is 0.4 volts maximum, −0.7 volts minimum. A rising edge is a low to high transition and a falling edge is a high to low transition. Maximum transition time for any signal is 0.2 μsec.

4.0-INTERFACE SIGNAL DESCRIPTION

4.1-DATA 1-DATA 7: The 7-bit ASCII character code input for both printable characters and control commands. These lines are active high and must be stable for at least 0.2 μsec. before and after the falling edge of $\overline{\text{STROBE}}$.

4.2-DATA 8: An active high input signal that indicates the information on DATA 1-DATA 7 is not a printable character but is an immediate paper feed command. This line must be stable for at least 0.2 μsec. before and after the falling edge of $\overline{\text{STROBE}}$.

4.3-$\overline{\text{STROBE}}$: An active low input pulse that loads the information on DATA 1-DATA 8 into the printer. Minimum pulse width is 0.5 μsec., maximum pulse width is 500 μsec.

4.4-$\overline{\text{PRIME}}$: An active low input pulse that will reset all logic within the printer. Minimum pulse width is 0.5 μsec.

4.5-BUSY: An active high output signal indicating that the printer cannot accept new data. This will occur when either printing or paper movement is taking place or if the printer is deselected or out of paper. BUSY will go active within 0.5 μsec. of the rising edge of a $\overline{\text{STROBE}}$ that causes a busy condition.

4.6-$\overline{\text{ACK}}$: An active low output pulse lasting 3.25 μsec. indicating that the printer is ready to receive new data. $\overline{\text{ACK}}$ will go low within 1.7 μsec. of the falling edge of BUSY or the rising edge of a $\overline{\text{STROBE}}$ that does not cause a busy condition. The falling edge of the next $\overline{\text{STROBE}}$ should not occur for at least 0.1 μsec. after the rising edge of $\overline{\text{ACK}}$.

4.7-PAPER: An active high output signal indicating that either the yoke is open or less than 1.5" of paper remain in the printer. When this signal is active the lamp in the Feed pushbutton will blink. Depression of the Feed button will reset this signal until the next Print or Feed command is executed. This allows printing to the bottom of the last form under operator control.

4.8-SELECT: An active high output signal indicating that the printer is on line and that the Feed pushbutton has been disabled. The select/deselect condition can be changed either from the interface or by depression of the SELECT pushbutton, except that the printer cannot be manually deselected if there are any characters present in the print buffer.

4.9-$\overline{\text{FAULT}}$: An active low output signal indicating that the printer is deselected, out of paper or has received an illegal paper feed command. If the cause is an illegal command ($\overline{\text{FAULT}}$ and SELECT active, PAPER not active) the printer must be reset for operation to continue. An illegal command will also cause the SELECT pushbutton to blink.

4.10-CLOCK: A 153.6 KHz square wave that can be used by the controlling equipment. Note that this clock can generate most commonly used communication baud rates.

4.11-+5 VDC: A maximum of 0.5 amps at +5 volts are available for user interfacing.

5.0-INTERFACE OPERATION

The interface uses the following ASCII codes:

0	0	0	0	1	1	1		Bell (BEL)
0	0	0	1	0	1	0		Line Feed (LF)
0	0	0	1	0	1	1		Vertical Tab (VT)
0	0	0	1	1	0	0		Form Feed (FF)
0	0	0	1	1	0	1		Carriage Return (CR)
0	0	0	1	1	1	0		Shift Out (SO)
0	0	1	0	0	0	1		DC1
0	0	1	0	0	1	0		DC2
0	0	1	0	0	1	1		DC3
0	0	1	0	1	0	0		DC4
0	1	X	X	X	X	X	32	Printable characters ¤!"#$%&'()*+,-./0123456789:;<=>?
1	0	X	X	X	X	X	32	Printable characters @ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]↑←
1	1	X	X	X	X	X	31	Printable characters `abcdefghijklmnopqrstuvwxyz{|}~
1	1	1	1	1	1	1		DEL

5.1-PRINT CONTROL

Each printable character received at the interface will be loaded into the print buffer. If a CR is then received, the printer will go busy and print the data in the buffer. If 132 characters are received with no CR, the printer will go busy upon receipt of the 132nd character and

print the full line. If a CR is later received with the buffer empty, it will be acknowledged but no printing will occur. To print a line of double width characters a SO must be received before any characters are loaded in the buffer, and then no more than 66 characters can be loaded. To print a line of double height characters, a DC2 must be received. Receipt of both a SO and a DC2 will cause a line of double height and width characters to be printed when a CR or the 66th print character is received.

5.2-PAPER CONTROL

Receipt of a LF will cause the printer to immediately go busy and advance the paper one line. Since the printer automatically advances the paper one line during printing, it is not necessary to issue a LF after each line of print. For compatability with existing software, a jumper on the interface board can cause the first LF received after each line of print to be ignored.

Receipt of a FF will cause the printer to go busy and advance the paper to the top of the next form. Computation of the top of form location is done by electronics that is initialized when the operator positions the first print line of a new form at the platen, selects one of 11 form lengths and actuates the Forms Set switch. If the crease skip switch is on, the paper will automatically advance to top of form whenever there are six or fewer lines between the print line and the next top of form.

Receipt of a VT will cause the next character received to be interpreted as an extended paper feed command. Alternatively, if DATA 8 is high, the character on DATA 1-DATA 7 will be interpreted as an extended paper feed command. See the extended paper feed command character set (below). For compatibility with existing software, a jumper on the interface board can cause VT to be interpreted as a skip to channel 11 rather than the first character of a two character paper feed command.

5.3-VERTICAL FORMAT UNIT CONTROL

The electronic VFU is a 256-character memory which is loaded from the interface with a single string of characters and can emulate any 12-channel format tape. This memory must be loaded before any skip to channel X commands can be issued. The rules for VFU loading are as follows:

a) The first character in the string must be a DC4.
b) The last character in the string must be a ?
c) Each line in the format is represented by a sequential 0 in the string.
d) Each channel stop number is inserted in the string immediately preceding the 0 that represents the line where the stop is to occur.

For example, an 8 line format with a channel 1 stop on line 1, channel 2 and 3 stops at line 3 and a channel 9 stop at line 8 would be loaded as shown.

String:	DC4	1	0	0	2	3	0	0	0	0	0	9	0	?
Line:			1		2		3		4	5	6	7	8	

The VFU will be synchronized to paper motion if the paper is at top of form when the VFU is loaded or if the operator actuates the Form Set switch after the VFU is loaded and the paper has been positioned to top of form.

If the printer ever receives a command to skip to a channel that cannot be located in the VFU, the FAULT line will go active and the SELECT pushbutton will blink. The printer must be reset for operation to continue.

5.4-MISCELLANEOUS CONTROL

Receipt of a DC1 will cause the printer to become selected. Receipt of a DC3 will cause the printer to become deselected and it will ignore all future commands except DC1. Receipt of a DEL will reset the printer exactly as if a PRIME signal had been received, except that the ON-LINE control will not be reset. Receipt of a BEL will cause a two-second audible tone to be generated with an optional speaker.

5.5-OPERATOR CONTROLS

Alternate actuations of the leftmost illuminated pushbutton will select and deselect the printer. Actuation of the rightmost pushbutton will reset a paper-out condition and, if the printer is deselected, advance the paper one line. If this button is held depressed longer than 0.5 seconds, the paper will then start to advance continuously until either top of form is reached or the button is released.

Illumination of the leftmost lamp indicates the printer is selected. Blinking of this lamp indicates an illegal paper feed command has been received. Illumination of the rightmost lamp indicates the printer is deselected. Blinking of this lamp indicates a paper out or yoke-open condition.

There are seven additional switches located on a panel beneath the cabinet lid.

Actuation of the Test switch will cause continuous printing of the complete character set.

The Font switch allows selection of either block or script lower case characters.

The LPI switch allows selection of either 6 or 8 line/inch spacing.

The Paper switch is a bidirectional joystick that allows the form to be vertically positioned in .007" increments.

The Form Set switch should be actuated when the first print line of a newly loaded form has been positioned at the platen and the correct form length has been selected. This will synchronize the top of form logic and the electronic VFU.

The Skip switch enables automatic skipping of the last six lines (the crease area) of each form.

The Form Length switch allows selection of 11 different form lengths for the top of form logic.

Character	Command	Character	Command	Character	Command	Character	Command
@	Skip 1 line	K	Skip 12 lines	V	Skip 23 lines	1	Skip to Channel 1
A	Skip 2 lines	L	Skip 13 lines	W	Skip 24 lines	2	Skip to Channel 2
B	Skip 3 lines	M	Skip 14 lines	X	Skip 25 lines	3	Skip to Channel 3
C	Skip 4 lines	N	Skip 15 lines	Y	Skip 26 lines	4	Skip to Channel 4
D	Skip 5 lines	O	Skip 16 lines	Z	Skip 27 lines	5	Skip to Channel 5
E	Skip 6 lines	P	Skip 17 lines	[	Skip 28 lines	6	Skip to Channel 6
F	Skip 7 lines	Q	Skip 18 lines	\	Skip 29 lines	7	Skip to Channel 7
G	Skip 8 lines	R	Skip 19 lines	]	Skip 30 lines	8	Skip to Channel 8
H	Skip 9 lines	S	Skip 20 lines	↑	Skip 31 lines	9	Skip to Channel 9
I	Skip 10 lines	T	Skip 21 lines			:	Skip to Channel 10
J	Skip 11 lines	U	Skip 22 lines			;	Skip to Channel 11
						<	Skip to Channel 12

Extended Paper Feed Command Characters
(Following VT or accompanied by DATA 8)

6.0-COMMAND TIMING

COMMAND	DURATION OF BUSY
BEL, SO, DC1, DC2, DC4 or DEL	0 msec.
CR or 132nd Print Character	480 msec. normal printing 600 msec. if line contains lower case descenders Double these times for double height printing. Add 500 msec. for motor turn-on if line is first line printed in last 30 seconds.
LF	45 msec. at 6 lines/inch 35 msec. at 8 lines/inch

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```
 10 0000          ;         OSI LINE PRINTER INTERFACE SUBROUTINE
 20 0000          ;
 30 0000          ;
 40 0000           DRA=$F400     ; PRINTER STATUS PORT
 50 0000           CRA=$F401     ; PIA CONTROL PORT FOR THE A SIDE
 60 0000           DRB=$F402     ; PRINTER DATA PORT
 70 0000           CRB=$F403     ; PIA CONTROL PORT FOR THE B SIDE
 80 0000           STROBE=$F420  ; ADDR. USED TO STROBE CHAR. INTO PRINTER BUFF
 90 0000           DATA=$22CD    ; LOC. OF NEXT CHAR. TO BE OUTPUT
100 0000          ;
110 0000          ;
120 0000 AD00F4 ENTER   LDA DRA      ; TEST PRINTER READY STATUS
130 0003 4A             LSR A        ; PRINTER  READY  FLAG INTO CARRY
140 0004 B0FA           BCS ENTER    ; PRINTER IS READY WHEN C=0
150 0006 ADCD22         LDA DATA     ; GET THE CHAR. TO BE OUTPUT
160 0009 297F           AND #$7F     ; MASK THE CHAR TO 7 BITS
170 000B 8D02F4         STA DRB      ; STORE THE CHAR. AND STROBE IT ...
180 000E AD20F4         LDA STROBE   ; ... INTO THE PRINTER'S BUFFER.
190 0011 60             RTS          ; RETURN TO THE CALLING ROUTINE
```