PRINTER INTERFACE KIT
TYPE 80E

SERVICE MANUAL

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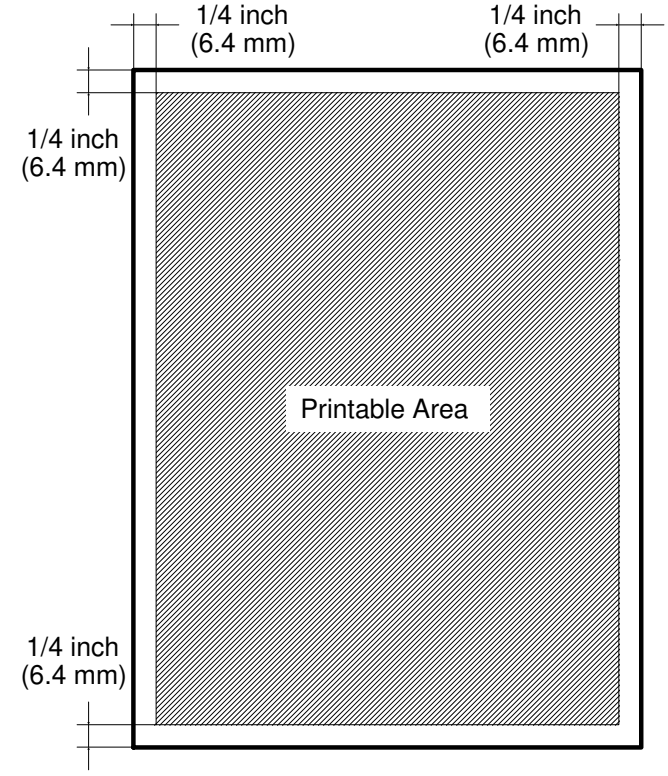
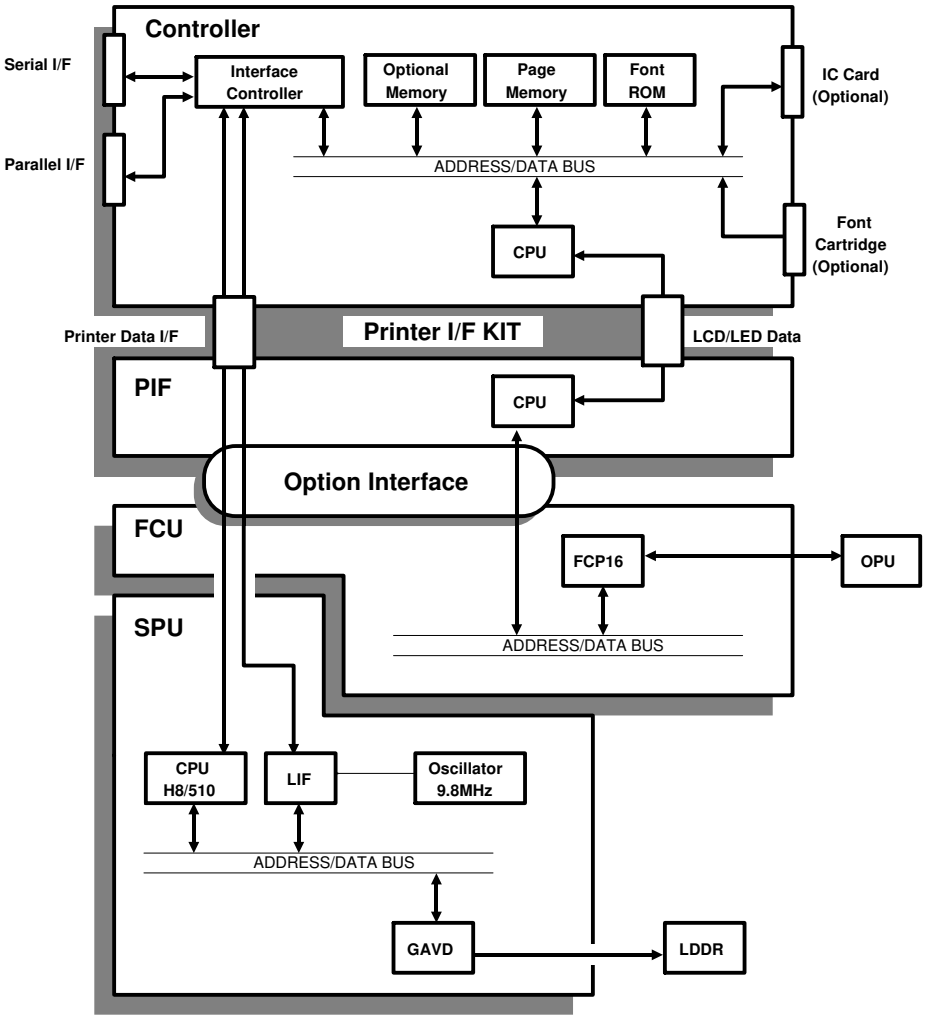
1. OVERALL INFORMATION

1.1. SPECIFICATIONS

Items	Specifications
Printing Resolution	300 dpi
Printing Speed	10 ppm (LT / A4)
First Page Printout TIme	Less than 20 s
Paper Size	Letter, Legal, A4
Controller CPU	68000 (16.6 MHz)
RAM Capacity	Standard - 1.0 MB Upgradable to 5.0 MB with an optional memory board
ROM	Font - 6.5 MB, Program - 0.5 MB
Host PC Interface	1 Serial Port - RS232C 1 Parallel Port - Centronics
Emulation Modes	HP LaserJet III (PCL5) Epson LQ, FX (ESC/P) IBM Proprinter
Printable Area	
Others	IC Card Slot - 1 Font Cartridge Slot - 1

1.2. OVERALL SYSTEM CONTROL



The printer interface kit consists of two PCBs, the printer controller board (Controller) and the printer interface board (PIF).

1.2.1. Printer Data Path

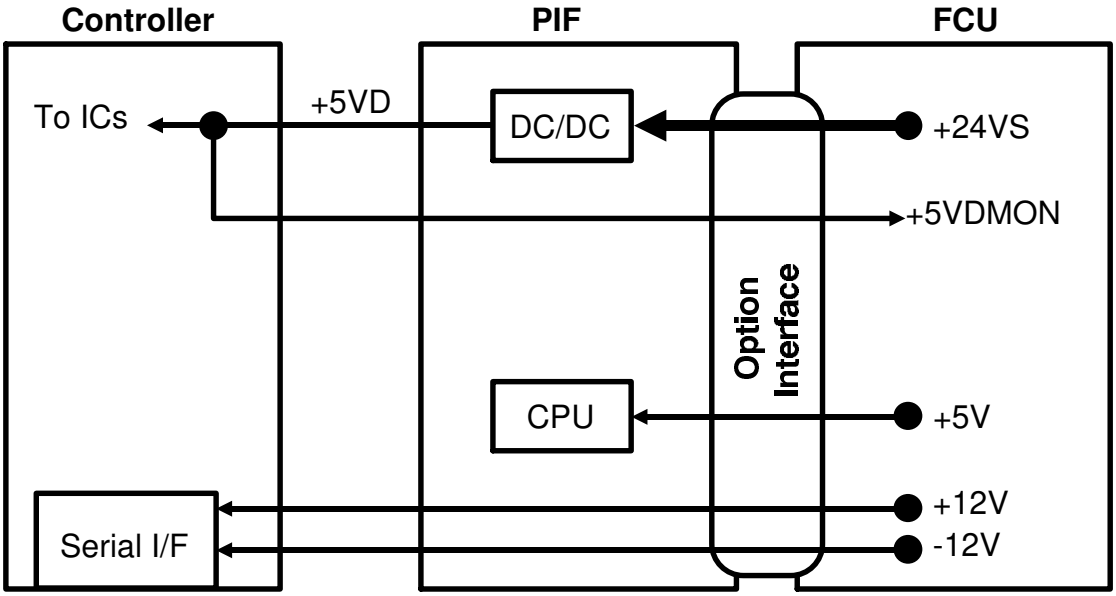
Through the serial and/or parallel interface(s), the Controller handshakes with the host(s) and receives print data, using one of the available emulation modes. Then the CPU creates an imaginary page in the memory using the fonts stored in the font ROM and the font cartridge. After one page of print data has been created, the Controller sends the video data through the video interface to the LIF on the SPU for printing. The PIF supplies the 9.8 MHz clock signal to the LIF for 300 dpi printing.

1.2.2. LCD/LED Data Path

The three LEDs on the operation panel are always dedicated to the Controller. They indicate the status during printing, and are directly controlled by the Controller.

In Printer Mode (Function 37), the LCD display and four Quick Dial keys are dedicated to the Controller to access SelecType functions. Within the SelecType functions, some settings are not available because of limitations to the machine's hardware. The CPU on the PIF monitors the function status and the settings and indicates these on the LCD. It also modifies the data if necessary (for example, Half Letter size paper will not be displayed as a possible paper size).

1.3. POWER DISTRIBUTION



The PIF generates +5VD for the Controller. The +5VD line is returned to the FCU as +5VDMON, so that the FCU can detect whether the printer interface is installed or not.

+5V for the PIF CPU, and ± 12V for the serial interface on the Controller are directly supplied by the FCU.

2. DETAILED SECTION DESCRIPTIONS

2.1. INTERFACE SPECIFICATIONS

2.1.1. Parallel Interface

1. Pin Assignments

The printer has an 8-bit parallel interface. The pin assignments are as follows.

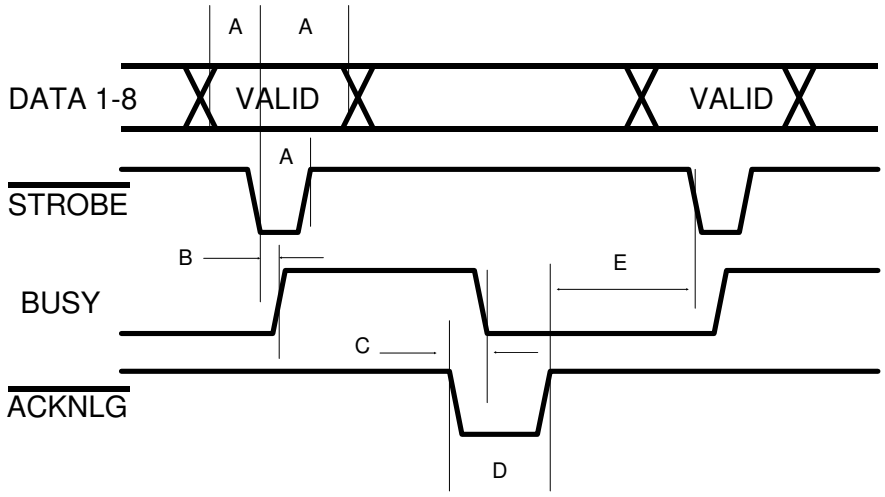
Signal Pin	Return Pin	Signal	Direct-ion	Description
1	19	$\overline{\text{STROBE}}$	IN	The strobe pulse from the host to read data in. The received pulse width must be more than 0.5 µs. Normally HIGH; data reception starts when the signal goes LOW.
2 - 9	20 - 27	DATA1-8	IN	Parallel data bits 1 to 8. A HIGH represents a '1'.
10	28	$\overline{\text{ACKNLG}}$	OUT	A 10 µs pulse. LOW indicates that data has been received and the printer is ready to receive more data. This signal is output as a pair with BUSY.
11	29	BUSY	OUT	A HIGH indicates that the printer cannot receive data. The signal is high when data is entering, when the printer is off line, and when there is a printer error.
12	30	PE	OUT	A HIGH indicates that the printer is out of paper.
13	-	SLCOUT	OUT	Pulled up to 5 V through a 3.3 kΩ resistance.
14	-	$\overline{\text{Autofeed}}$	IN	When LOW, paper is automatically fed when CR is received (the active signal level can be selected by a user adjustment). Sampling is carried out when power is on or when the printer is initialized at the operation panel.
16	-	GND	-	Logic ground
17	-	CH-GND	-	Printer's chassis ground
19 - 30	-	GND	-	Twisted pair return signal ground level
31	-	$\overline{\text{INIT}}$	IN	When this goes low, the printer controller ignores the STROBE signal.
32	-	$\overline{\text{ERROR}}$	OUT	This becomes low when the printer is out of paper, off line, or in an error condition.
33	-	GND	-	Logical ground
35	-	+ 5V	-	Pulled up to 5 V through a 3.3 kΩ resistance.
36	-	$\overline{\text{SLCIN}}$	in	The DC1/DC3 control codes are valid only when this signal is HIGH (SLCIN is OFF). This setting can be changed with a user adjustment. Sampling is only done when the power is on.

Pins 15, 18, and 34 are not used.

Notes:
- All interface conditions are based on TTL level. Both the rise and fall of each signal must take less than 0.2 µs.
- Data transfer must be carried out by observing the $\overline{\text{ACKNLG}}$ or BUSY signal. (Data transfer to the printer can be carried out only after the receipt of the $\overline{\text{ACKNLG}}$ signal or when BUSY is LOW.)
- The "Direction" column refers to the direction of signal flow as viewed from the printer.
- "Return Pin" denotes the twisted-pair return to be connected at signal ground level. For the interface wiring, a twisted-pair cable should be used for each signal and the connection should be completed on the return side. These cables should be shielded and connected to the chassis of the host computer and the printer.

2. Interface Timing

The following diagram shows the timing for the parallel interface.



A: About 0.5 microseconds minimum
B: About 4 microseconds maximum
C: Varies in accordance with the user level setting.
(0, 5, or 10 microseconds, or no change to ACKNLG signal)
D: Typically 10 microseconds
E: Always zero or greater

Signal Level: TTL Compatible

2.1.2. Serial Interface

1. Data Format

Word Length: 7 or 8 bits
Parity: None, odd, or even
Stop Bits: 1 or 2
Printer Ready Protocol: Enabled (DTR and XON/XOFF protocol set to ON)

The data format settings can be adjusted by user level features.

Baud Rate: 300, 600, 1200, 2400, 4800, 9600, 19200 bps

Signal Level: RS-232C; conforms to EIA

Connector: D-sub 25-pin connector

2. Pin Assignments

The serial interface pin assignments are described below. The direction of the signal is given relative to the printer.

Signal Pin	Signal	Direct-ion	Description
1	FG	-	Connected to the printer chassis.
2	TXD	OUT	Serial data from printer to computer.
3	RXD	IN	Serial data from computer to printer.
4	RTS	OUT	Request To Send. Held HIGH by the printer.
5	CTS	IN	Clear To Send. The computer is ready to receive from the printer. The printer will not proceed unless the signal is HIGH. The active signal level can be changed with a user adjustment.
6	DSR	IN	Data Set Ready. The computer is ready to receive from the printer. The active signal level can be changed with a user adjustment.
7	SG	-	Signal Ground. Provides a ground for all signal lines.
20	DTR	OUT	Data Terminal Ready. Indicates whether the printer is ready to receive data. If the printer ready protocol is not selected, DTR is always HIGH (always ready to receive). If printer ready protocol is selected, the printer can only accept data when DTR is HIGH. When DTR goes LOW, the computer must stop sending data within 128 characters. The active signal level can be changed with a user adjustment.

3. Handshaking

The serial interface can use DTR signal levels and XON/XOFF communication protocols either separately or in combination.

XON/XOFF Protocol

When the vacant area for data in the input buffer drops to 128 bytes, the printer outputs an XOFF code, indicating that the printer cannot receive more data. Once the vacant area for data in the buffer recovers to 256 bytes, the printer outputs an XON code, indicating that the printer is again ready to receive data. XON/XOFF protocol can be selected with a user adjustment. The factory setting is ENABLED.

DTR/DSR Protocol

When the printer can receive data, the printer sets DTR to HIGH. When the printer cannot receive data, it sets DTR to LOW. If the user's DTR on/off adjustment is set to OFF, the DTR signal is always treated as HIGH.

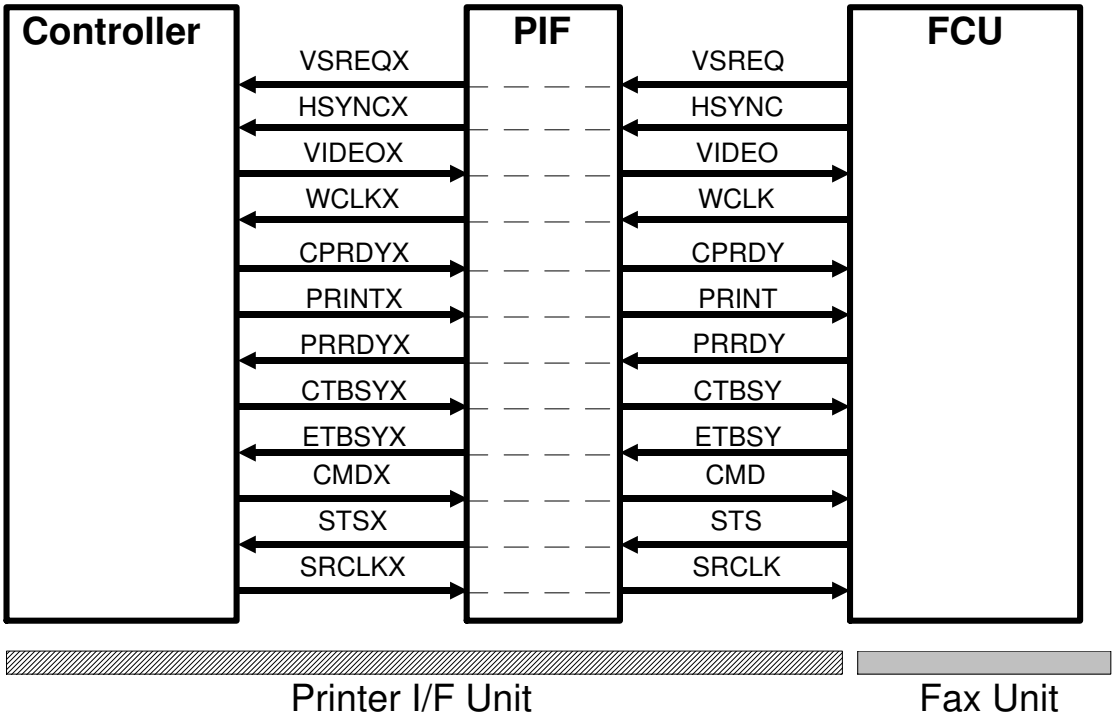
The printer sends data on TXD only when DSR is HIGH, unless the user's DSR on/off adjustment is set to OFF, in which case the DSR signal is always treated as HIGH.

2.1.3. Printer Data Interface

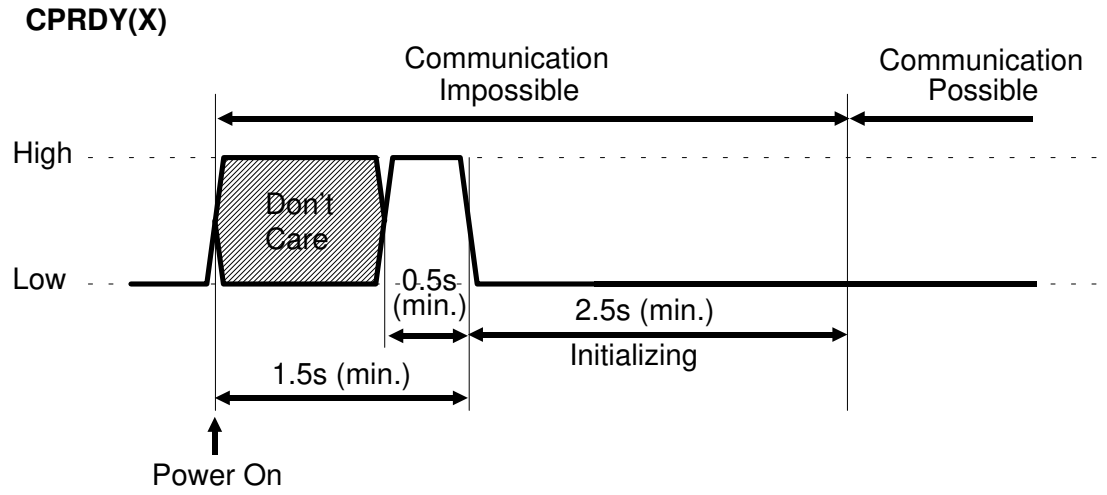
1. Signals

Name	Description
VSREQ(X)	Active (low) while the controller transfers one page of image data to the FCU.
HSYNC(X)	Clock signal for synchronizing each line of image data.
VIDEO(X)	Raster data for printing.
WCLK(X)	Clock signal for synchronizing raster data.
CPRDY(X)	Inactive (high) when initializing or resetting the printer mechamism.
PRINT(X)	Active (low) before transferring one page of image data to the FCU.
PRRDY(X)	Active (low) while the printer mechanism is in standby status. Inactive (high) while the printer is busy or has a problem.
CTBSY(X)	Active (low) while the controller is sending a command to the FCU.
ETBSY(X)	Active (low) while the FCU is sending status data to the controller.
CMD(X)	Command data (8 bit serial).
STS(X)	Status data (8 bit serial).
SRCLK(X)	Clock signal for synchronizing commands and status data.

Signal Directions

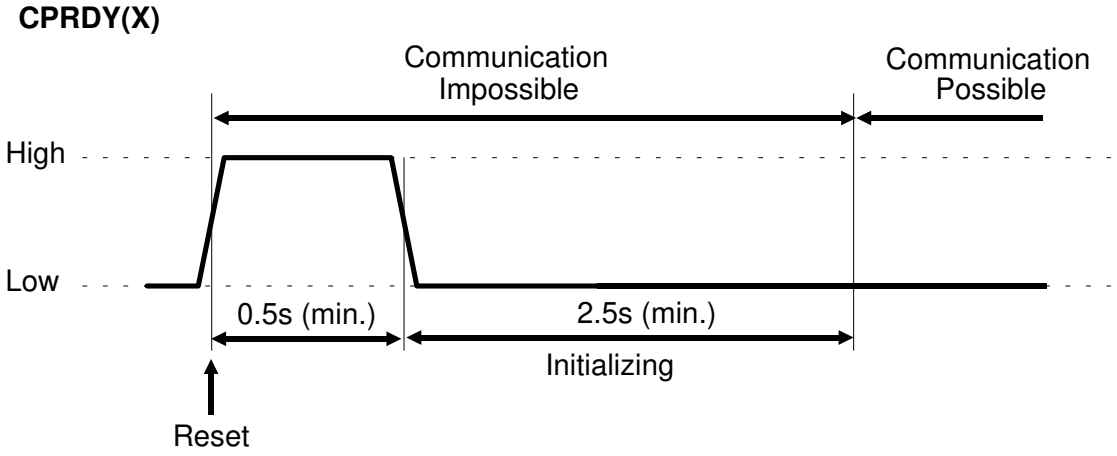


2. Power-On Timing



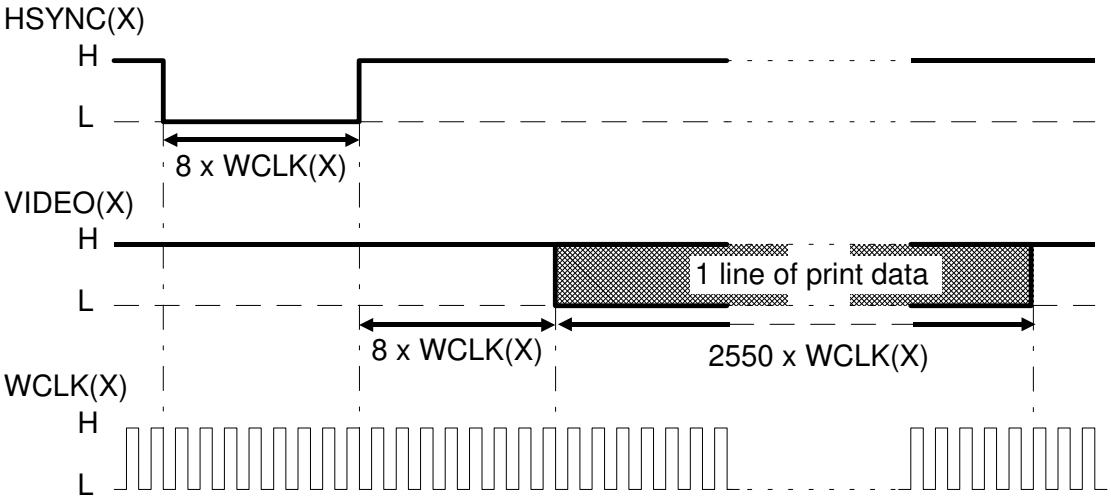
When the power is switched on, the controller raises CPRDY(X) to high for at least 0.5 s, then initializes itself within 2.5 s. After initializing is completed, the controller will be ready to communicate with the host PC(s) and the FCU.

3. Reset Timing

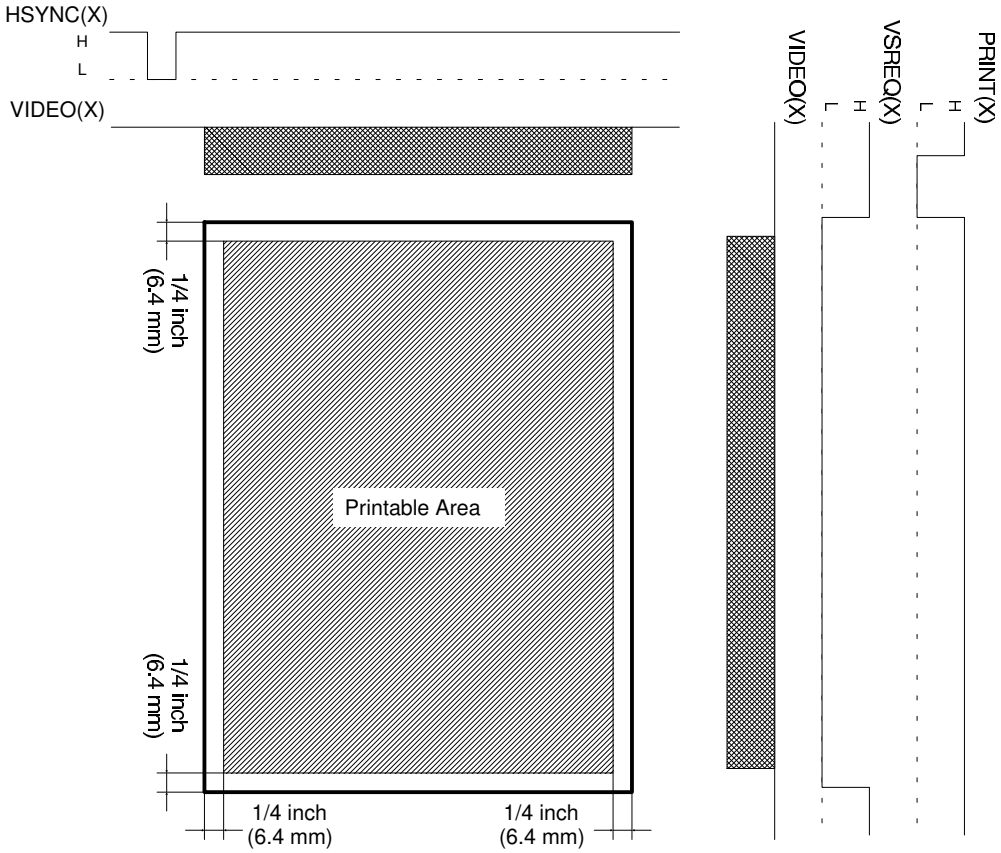


When the user resets the printer using function 35, the controller activates CPRDY(X) for at least 0.5 s, then the controller initializes itself and the printing process is canceled. After initializing is completed, the controller will be ready to communicate with the host PC(s) and the FCU.

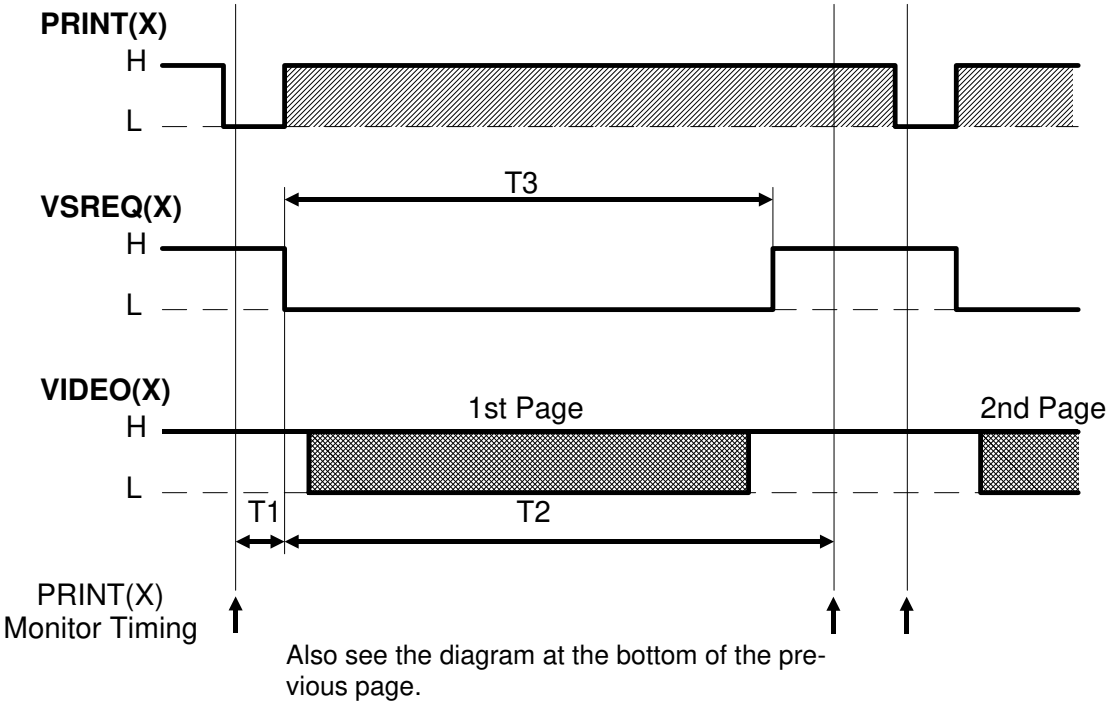
4. Image Data Synchronization (Horizontal)



The FCU drops HSYNC(X) to low for eight WCLK(X) clock cycles before receiving each line of image data. Then, after the next eight cycles of WCLK(X) has passed, the controller starts to transfer one line of image data.
The frequency of the WCLK(X) clock is between 1.3 MHz and 1.96 MHz.



5. Image Data Synchronization (Vertical)



Also see the diagram at the bottom of the previous page.

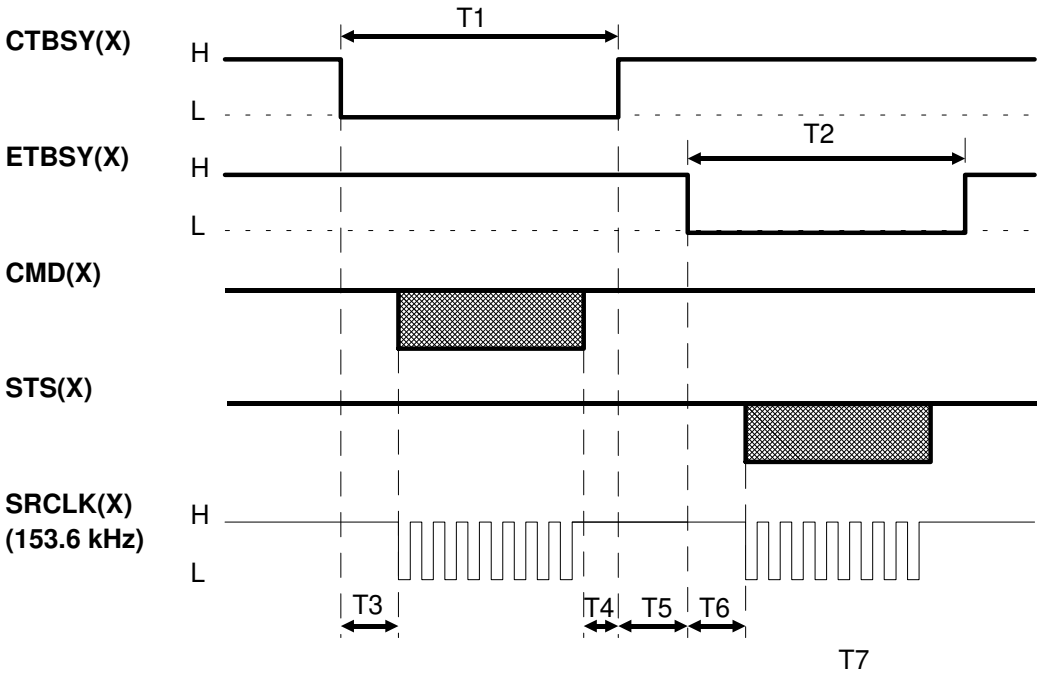
The FCU monitors the PRINT(X) signal from the controller every 2 ms to detect if a print request is coming from the controller or not. After T1 has passed since the FCU detected the PRINT(X) signal to be active (low), the FCU drops VSREQ(X) to low so that the controller can acknowledge that the printer is ready to receive one page of image data. After one page of data has been received from the controller, the FCU inactivates the VSREQ(X) signal until PRINT(X) is activated again for printing the next page.

The times T1, T2 and T3 vary depending on the following conditions.

Parameter	Time	Condition
T1	1.0 s	When the hexagonal mirror motor is active.
	6.0 s	When the hexagonal mirror motor is inactive.

Parameter	Paper Size	Time
T2	Letter	8.5 s
	Legal	10.6 s
	A4	9.0 s
T3	Letter	7.58 s
	Legal	9.64 s
	A4	8.06 s

6. Command / Status Signal Timing



STS informs the controller of status information, such as the current paper size and any mechanical problems that are encountered.

The FCU informs the controller of the printer status (STS) in an 8 bit serial format, in response to a command (CMD) from the controller. If a status signal (STS) is not received within T5 (100 ms) after the controller sends a command, the controller will resend the command to the FCU.

Refer to the above diagram and to the following table below for the timing.

Parameter	Time
T1	62.7 µs
T2	Less than 30 ms
T3	9.77 µs
T4	4.07 µs
T5	Less than 100 ms
T6	9.77 - 10.58 µs

3. SERVICE TABLES AND PROCEDURES

3.1. SERVICE LEVEL FUNCTIONS

There are no special service operations. Refer to the operation manual for all printer operation procedures.

3.2. SERVICE RAM ADDRESSES

0802BE
Data wait time after the last page has been printed, when printing from the printer interface. (Hex; unit 1s)

4. TROUBLESHOOTING

4.1. ERROR CODES

The following error messages may appear on the screen while the printer interface is in operation.

Code	Cause	Required Action
C0002	Bus error	Switch the printer off, wait a few seconds, and switch back on. If the error occurs again, change the FCU or the printer interface board.
C0003	Address error	
C0004	Illegal instruction	
C0005	Division by zero	
C0006	CHK instruction execution	
C0007	TRAPV instruction execution	
C0008	Privilege violation	
C0009	Trace mode execution	
C0010	Implemented instruction	
C0011	Implemented instruction	
C0015	Uninitialized interrupt	
C0024	Spurious interrupt	
C1110	ROM error (0 - 80 KH)	
C1130	ROM error (100 - 180 KH)	
C1140	ROM error (100 - 200 KH)	
C1200	EEPROM write error	
C1300	No ready task	
C1310	Re-generation of existing task	
C1400	Auto vector interrupt level 7	
C9999	Undefined area emancipation	