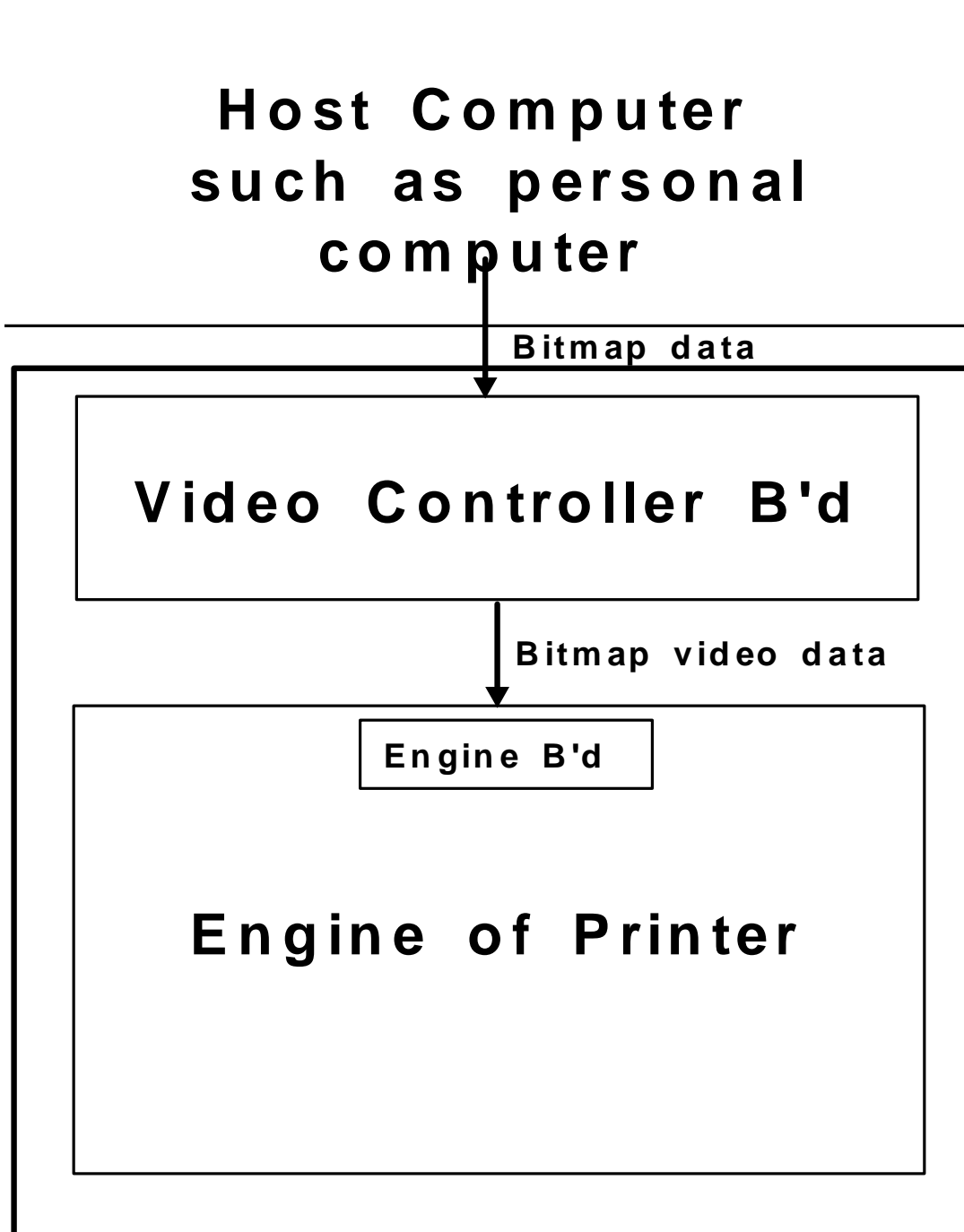




2. Product Detail Descriptions

2.1 What's the Laser (Beam) Printer ?

It is a printer which uses an electrophotography development process, as opposed to dot and ink-jet printers. It can be divided into two major sections: Video Controller Board and Engine Controller Board.



2. Product Detail Descriptions

2.1.1 Video Controller Board

(Video) Controller Board receives image data from the host computer and converts them to a bitmap(binary) image, which sent to the Engine (Controller) Board.

2.1.2 Engine Controller Board

Engine Board receives the video data from the Controller Board, and then that sends current image to LSU and controls the electrophotography process for printing.

2.1.3 Developer Cartridge

Developer (Cartridge) creates the image via the electrophotography process. The Charge Roller, OPC Drum, DEV Roller, Supply Roller and Toner constitute a single unit.

2.1.4 LSU(Laser Scanner Unit)

Under control of the Engine, controls the laser beam and the OPC Drum exposure and rotation. The OPC Drum is synchronized and rotating with the same speed as the paper. When laser beam reaches the position of the Scanning Mirror, it creates a line. Synchronization Signal(HSYNC), which is sent to the Engine Board which transfers image data to LSU and synchronizes the vertical scanning line with the printed page.

2.1.5 Transfer

It constitutes the Transfer Roller and transfers Toner on the OPC Drum to the paper.

2.1.6 Fuser

It constitutes the Heat Lamp, Heat Roller, Pressure Roller and Thermometer(thermistor, thermostat),and causes the Toner to adhere to the paper.

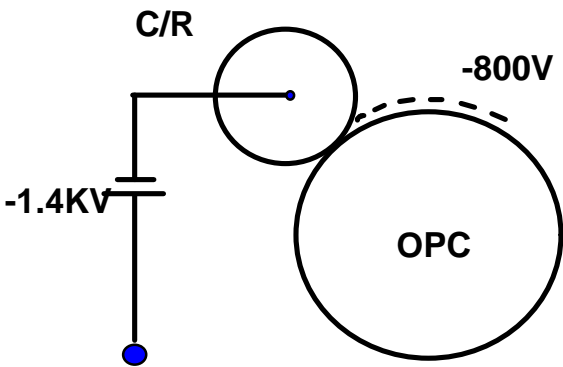
2. Product Detail Descriptions

2.2 Processing Mechanism

2.2.1 Feeding

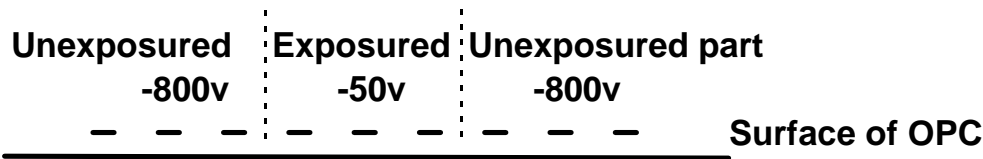
Operated by the Engine, the Feed Clutch causes the Feed Roller to rotate and feed a sheet of paper. The paper then contacts the Feeding Sensor which signals the Engine Board of the presence of paper. If the Feeding Sensor is not operated. a Paper Jam error will be indicated.

2.2.2 Charging



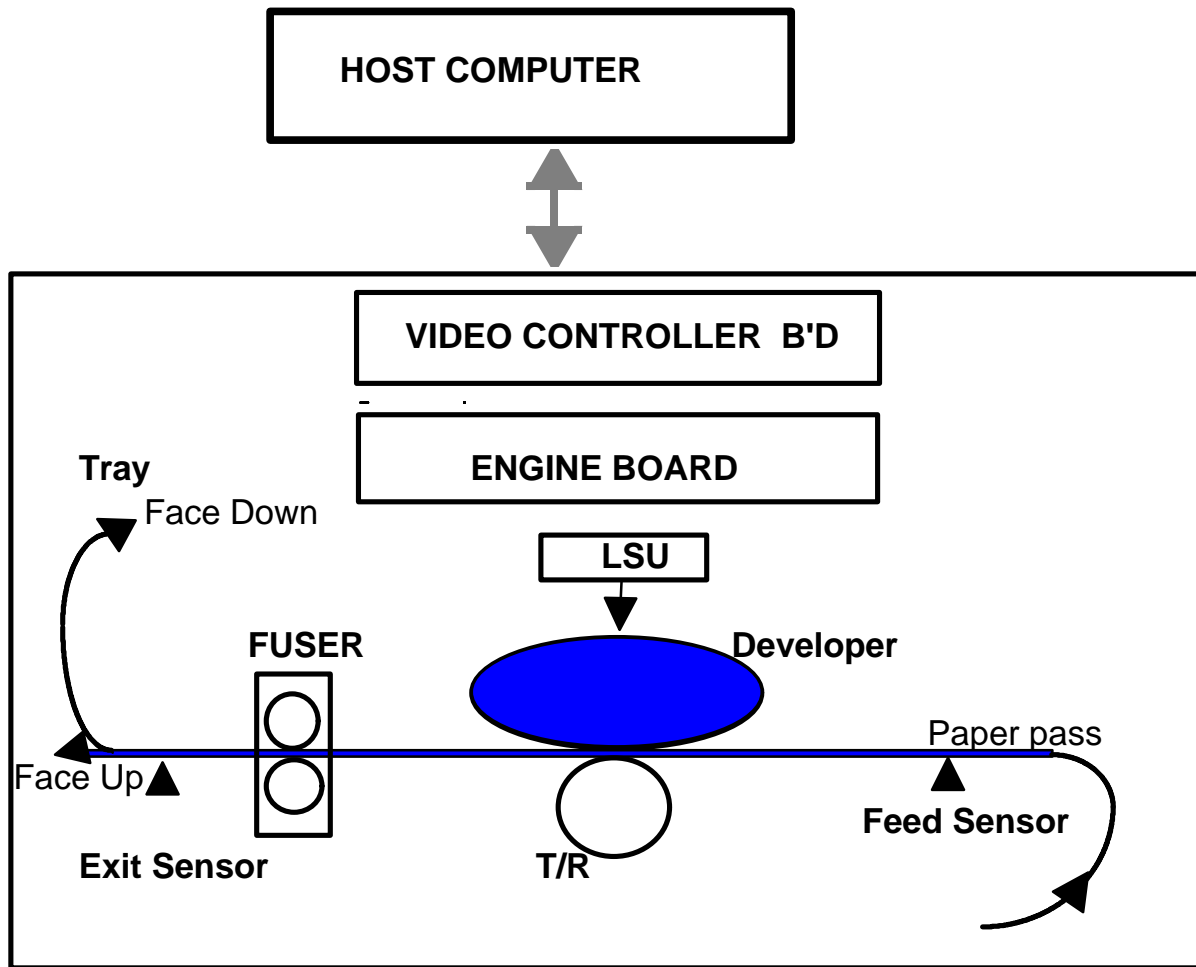
A negative voltage is applied to the surface of the OPC Drum. This is the first step in creating an electrophotograph. The high voltage section of the Engine Board supplies (-)1.4KV to the Charge Roller and transfers a charge of approximately (-)800V to the OPC Drum.

2.2.3 Exposure

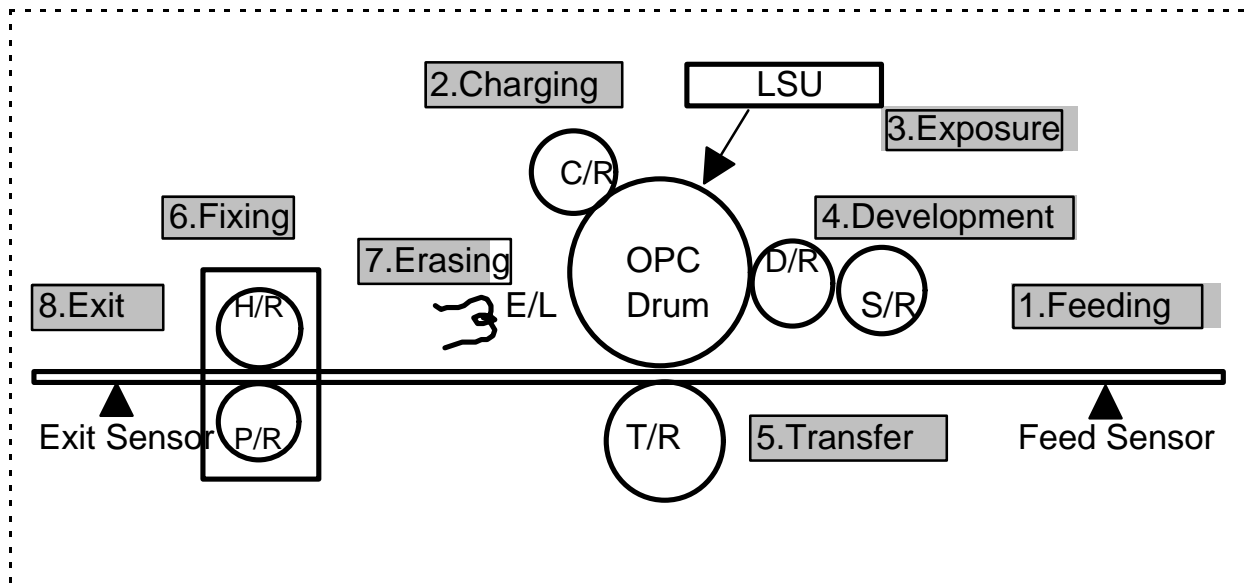


LSU receives the transferred bitmap image data from the Engine Board and turns the LSU's laser diode on and off, exposing the OPC Drum. If there is no data to print the Laser Diode remains off and the OPC Drum is not exposed. Portions of the OPC Drum exposed charged to approximately (-)50V by the laser beam while unexposed portions charge to (-)800V. The image formed by the exposed laser beam is invisible, and is called a latent image.

2. Product Detail Descriptions



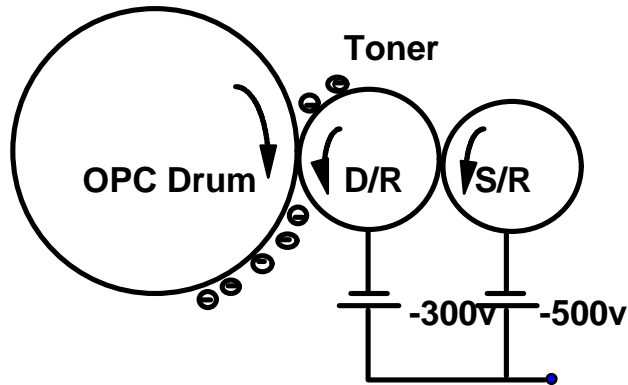
[Fig 1]



[Fig. 2]

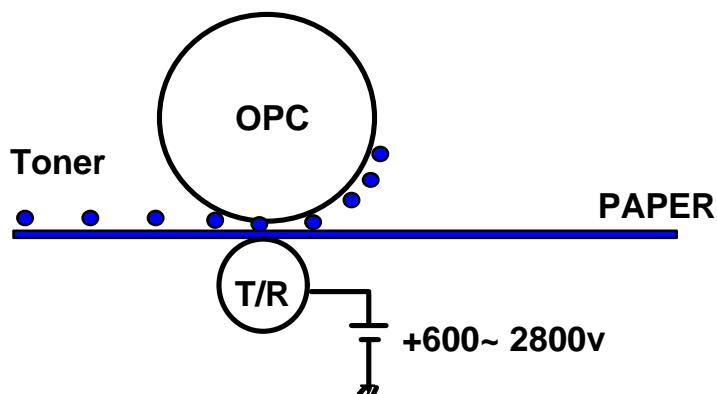
2. Product Detail Descriptions

2.2.4 Development



The Supply Roller is charged to (-)500 volts, and the DEV Roller charged to (-)300V by high voltage from the Engine Board. Both rotate in the same direction and Toner between them becomes negatively charged(triboelectric charge), due to contact. After the Toner charged, the charged surface moves between the DEV Roller and the OPC Drum. Negatively charged Toner is attracted to the high voltage(-50V) of the exposed portions of the OPC Drum and is exposed more easily than the more negative(-800V) surface voltage of unexposed areas of the OPC Drum, resulting in a latent image.

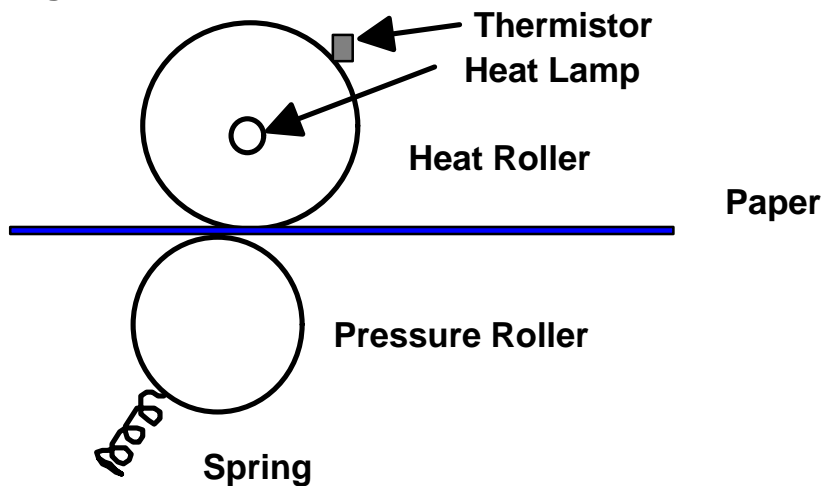
2.2.5 Transfer



Toner moves from the surface of the OPC Drum to the paper via the Transfer Roller. Toner on the surface of the OPC DRUM will be attracted by the Transfer Roller, which is charged to approximately +1.5 kV (600 ~ 2800V), depending upon temperature, and humidity. Toner then moves from the OPC DRUM to the paper.

2. Product Detail Descriptions

2.2.6 Fixing



Toner image on the surface of the paper is in a low state electronically, so it can be scattered easily. By heating the paper to a high temperature (180°C) and applying pressure (4Kg), the Toner becomes permanently fixed to the paper, and this fixed image will remain forever. The Heat Roller transfers the heat of Lamp within the Roller to the paper. The effect of Teflon-coating is to prevent the melted toner from staying on it. The lower Roller is the Pressure Roller, and is made of silicon resin. Its surface is also Teflon-coated. The thermistor senses the temperature of the surface of the heat roller, and feeds back the information to maintain 180°C while printing, and 135°C during standby. The thermostat prevents the overheat as disconnecting the main power if the Heat lamp was overheated.

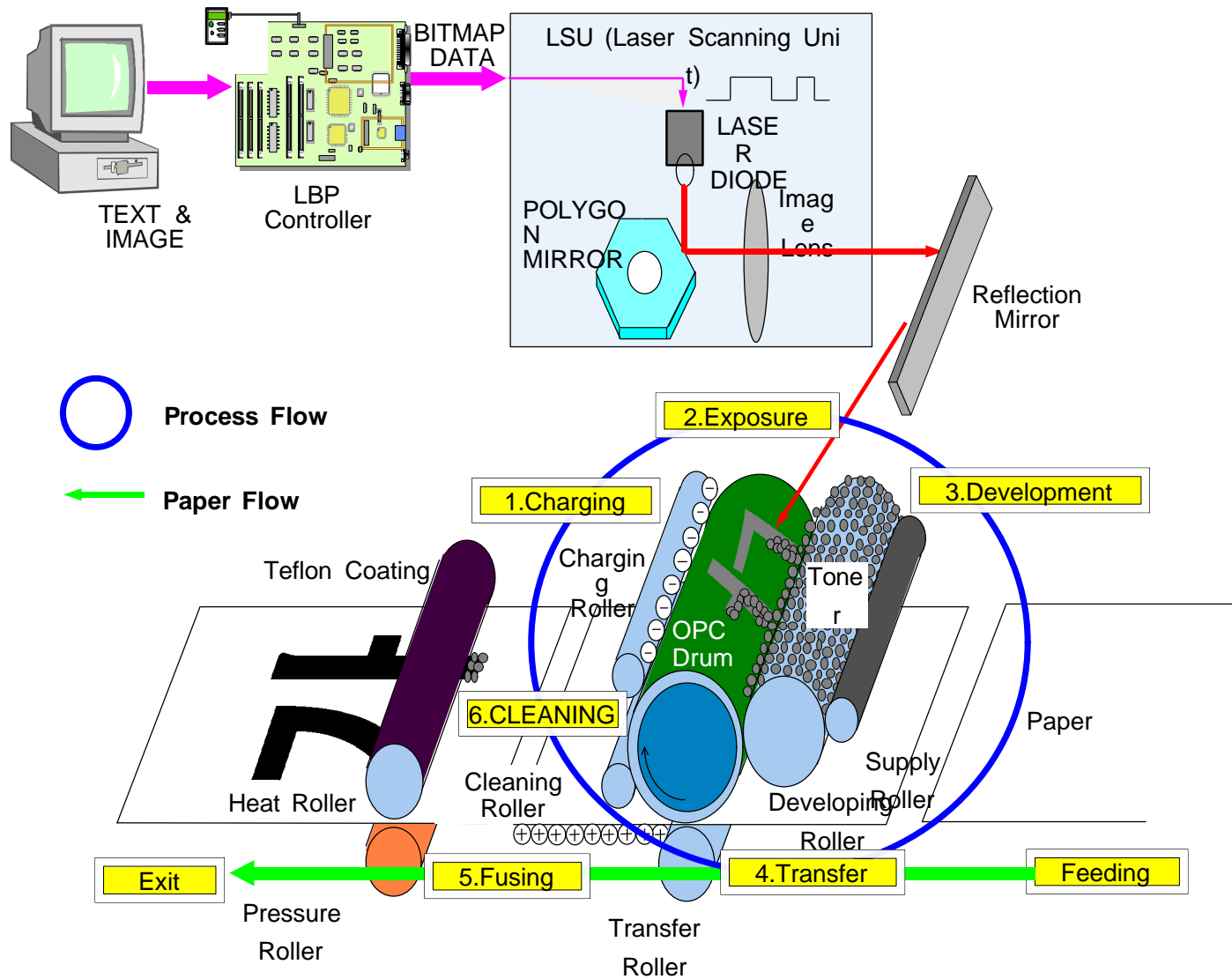
2.2.7 Erasing

After image transfer to the paper is complete, erasing removes the remaining charge from the surface of the OPC Drum. This is actually the first step of the electrophotography process and aids charging for the next cycle.

2.2.8 Exit

Printed paper passes through the Exit Sensor after the electrophotography process is completed. The paper also contacts an Actuator during printing out. This signal is transferred to the Engine Board and indicates paper position. The Actuator and Exit Sensor must report the correct position information, or a Paper Jam error will be indicated.

ML PRINTER PROCESS



1. Charging

Negative(-) voltage is applied to the surface of OPC drum.

2. Exposure

LSU receives the transferred bitmap image data from the engine board and turns the LSU's laser diode on and off, exposing the OPC Drum. The image formed by the exposed laser beam is invisible, and is called latent image.

3. Development

A process of creating image through electrophotography.

4. Transfer

Transfer roller transfers toner on the OPC drum to the paper.

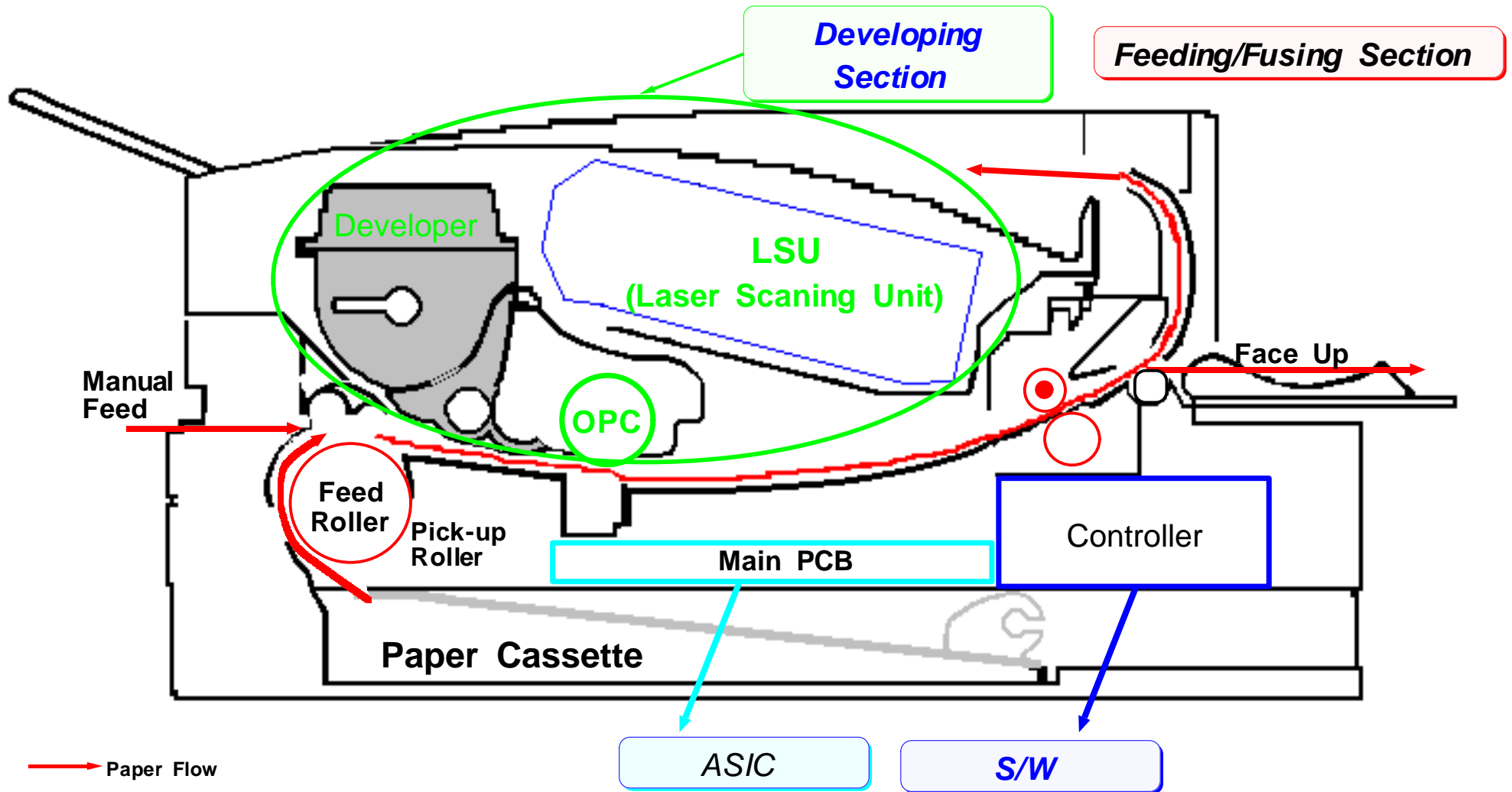
5. Fusing

A process of applying pressure and heat to adhere toner to paper

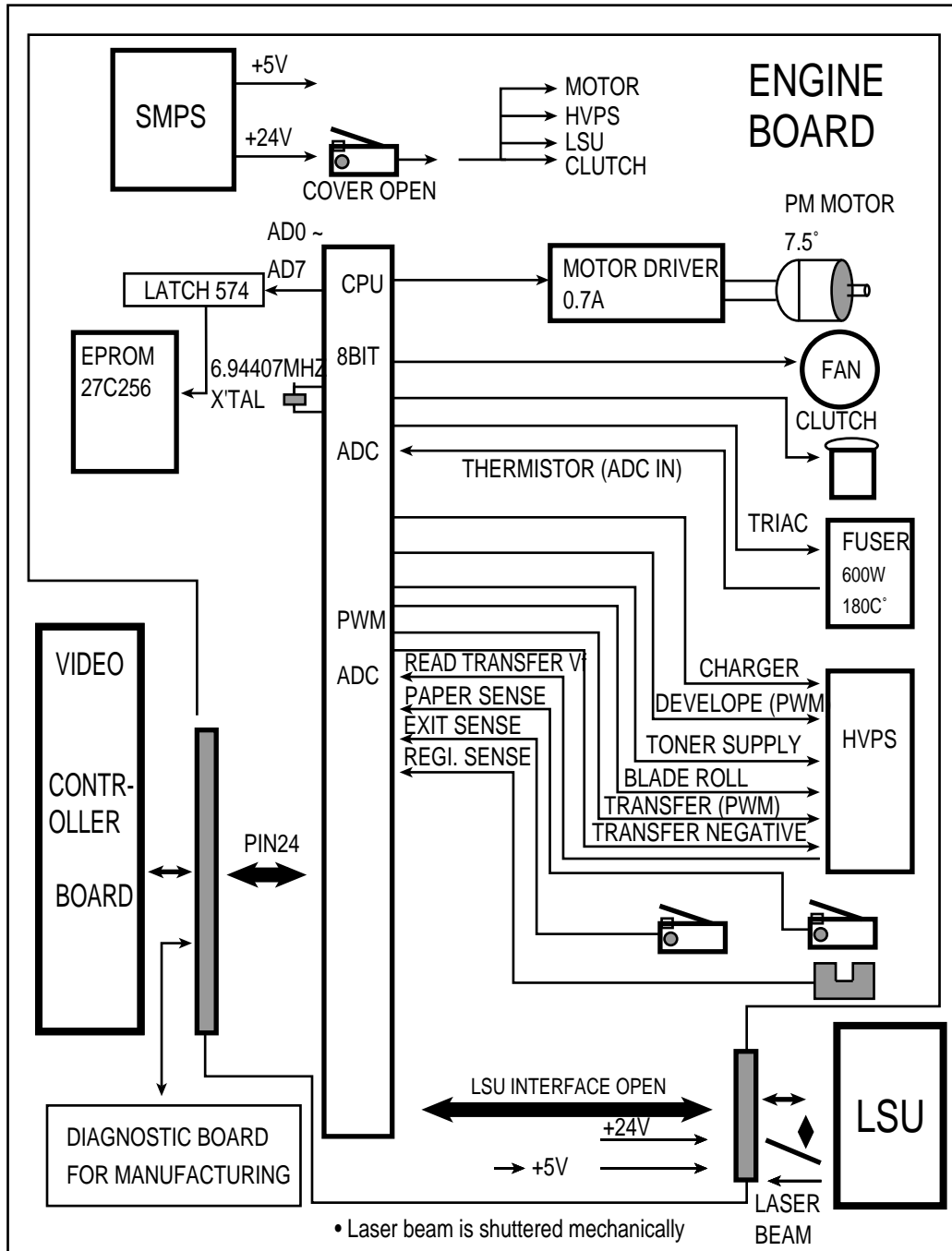
6. Cleaning(Erasing)

A process of removing the remaining charge from the surface of the OPC drum after the image transfer is complete.

ML PRINTER PROCESS



2-3 Descriptions Of Engine Board



2. Product Detail Descriptions

2.3.1 CPU(+5V)

The used CPU is a 8bit microprocessor, KS88C4316(U3), manufactured by SAMSUNG. This is operated at 6.944MHz and controls all ICs. The shape is a 64pin DIP type.

2.3.2 EPROM(+5V)

The EPROM, 27C256(U2), has the storage capability of 256KBits and the access time is 150ns. The EPROM stores the program data that controls the Engine part.

2.3.3 Reset(+5V)

The reset circuit initializes the CPU(U3) at power on and prevents unstable operation due to power fluctuations. It consists of LM393(U5) - voltage comparator-, and RC for reset timing.

When a DC 3.8V or higher are applied to LM393's pin #3, the 'RESET' signal goes 'HIGH' and the CPU begins the initialization procedure, 'RESET' is active for approximately 122ms.

2.3.4 Motor Driving(+24V)

The Motor Driver, SLA7029M(U1), is used to drive the Main Stepping Motor. An SLA7029M(U1) receives Motor Drive Enable and two phase signals from the CPU. It then generates a constant-current unipolar pulsed signal for Motor driving, delivered to the Motor through R5(1 Ω ,5%,3W) and R6 (1 Ω ,5%,3W).

2.3.5 Solenoid Clutch(+24V)

The Solenoid controls the paper Pick-up Clutch. The Solenoid receives control signal from CPU's pin #22. KSC1008-Y(Q4) is the driving transistor, and 1N4003(D1) protects KSC1008-Y(Q4) from the noise pulse generated by deenergizing the Solenoid.

2. Product Detail Descriptions

2.3.6 Fuser Control(+24V, AC Power)

The Fuser Temperature Control circuit reads the Heat Roller's Thermister voltage at CPU's pin #45, and turns the Fuser unit on and off via CPU's pin #38 and KSC985(Q3) and off via CPU's pin #38 and Q3.

If CPU pin #38 or LM393's pin #7 are 'LOW', KSC985 is off and the Fuser Lamp is off. LM393's pin #5 is proportional to fixing unit's temperature.

LM393's pin #6 is the "OVERHEAT" signal. If LM393's pin #5 is less than its pin #6, its pin #7 output is 'LOW', keeping the fixing unit off.

The 'Fuser on' signal of Q3 turns the Triac through the Photo LED on inside the Photo Coupler(PC151). And PC151's trigger input signal supplies into the Triac Thyristor(Q101), then the Fuser's Heat Lamp turns on.

2.3.7 Cover Open Sensing(+24V)

CPU's pin #48 will be 'HIGH' with the cover closed.

2.3.8 Paper Sensing(+5V)

There are three Sensors in the Printer:

1) Feeding Sensing

When paper is present at the Sensor, the Photo-optic Feed Semsor sends a 'LOW' to CPU's pin #46.

2) Exit Sensing

This Leaf Switch which sends a 'LOW' to CPU's pin #47 when operated by paper.

3) Paper Empty Sensing

A Photo-optic Sensor, it sends a 'HIGH' to CPU's pin #49 when there is no paper in the cassette.

2. Product Detail Descriptions

2.3.9 SMPS(Switching Mode Power Supply)

The SMPS supplies two DC voltage source, +5V, +24V, to operate the Engine Mechanism and the Controller Board and it supplies an AC voltage source to operate the Fuser's Heat Lamp.

1) SMPS' Specifications

Items		Specifications	
Used Group		European	American
Input (AC)	AC Voltage Normal	220V	120V
	Minimum	198V	90V
	Maximum	264V	132V
	AC Current Maximum	1.5Arms	2.5Arms
Inrush Current(20ms) Maximum		35Ap-p	
Output (DC)	Line Regulation 24V	24V $\pm 3\%$	
	5V	5V $\pm 2\%$	
	Load Regulation 24V	24V -3% ~ +10%	
	5V	5V $\pm 3\%$	
	Ripple Noise 24V	120mV (Peak 400mV)	
	5V	50mV (Peak 100mV)	
	Over Current Protect 24V	2.7A $\pm 10\%$	
	5V	5A (Fuse)	
	Over Voltage Protect 25V	33V	
	5V	5.6V	

2) SMPS Output For Applications

Output	Applications	Remarks
+5V (DC)	Logic Parts	Engine Board, Panel Controller Board
	LSU	
+24V (DC)	Main Motor Solenoid HVPS Heat Lamp Driving Circuit LSU Motor	Engine
AC	Heat Lamp	AC Power Source

2. Product Detail Descriptions

3) Switching Control

When power turns on, starting current flows into the PWM Control IC (U101)'s pin #6 passing through R106(100K Ω) for AC 120V or ZD101 (1N5274B,130V) for AC 220V and R107(100K Ω): R106 and R107 are Starting Resistors. And then the Gate of the Switching FET(Q102) connected with IC's pin #5 turns on. When the current passes through Q102, the current passing through the primary winding(N_p) of the Transformer(T101) generates inducted to the auxiliary winding(N_a) of T101. The current passing through N_d increases the Gate current(I_g) of Q102, then the Drain current(I_d) of Q102 increases radically up to saturation region and the voltage induced by this process to the secondary winding(N_s) dose not pass through. After that time I_d reaches at critical point of Q102's H_{fe} after voluntary time because I_d increases in proportional time. That's $H_{fe}=I_c/I_b$ what Q102 can't keep up on state. This is named current insufficient region of Gate. By this characteristics of the transistor, Drain voltage of Q102 proceeds to unsaturation region from saturation region. Voltage of the N_p goes low,too. Then Q102 turns off radically. When Q102 turns off, each winding of T101 generates reverse electromotive voltage, this voltage flows to load of the secondary parts. Few current in the N_s generates inducted voltage to the N_p . And Q102 turns on. This switching movement repeated to the required DC voltage.

4) DC Output And Feedback Circuit

+5V : Inducted voltage to the secondary winding is by the D152, C151 and flows to the output load.

+24V : Inducted voltage to the secondary winding is by the D153, C156 and flows to the output load.

In order to constant output voltage, the output circuit is composed feedback circuit with R153, R154, PC152.

When overvoltage is applied to the output current flows through each Zener Diode to the PC153. Then SMPS is disabled(OVP).

2. Product Detail Descriptions

2.3.10 HVPS(High Voltage Power Supply)

1) Output Specifications

Items	Printing / Initial	DCU
Supply Voltage	-500V	-500V
Bias Voltage	-300V	-300V
THV(Transfer High Voltage) Negative	-1KV	-1KV
THV(Transfer High Voltage) Positive	Variable	+900V
MHV(Main High Voltage)	-1.4KV	-1.4KV

2)Transfer High Voltage

THV output is constitutes positive output and negative output.

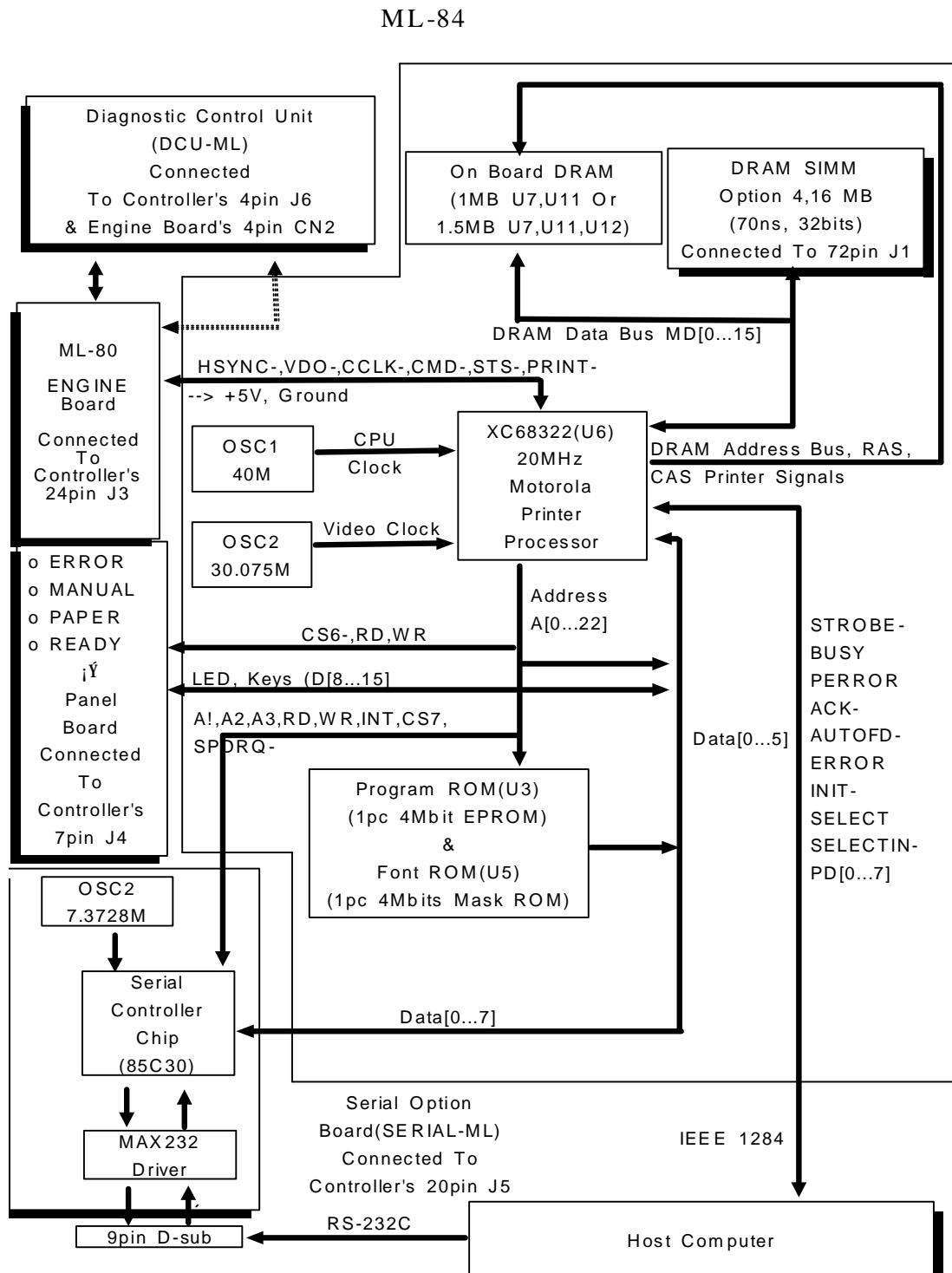
Negative output is for cleaning the OPC Drum and positive output is for drawing the Toner on the paper.

Q202(KSD526Y) is turned on by a 'LOW THV ENABLE', which activates the negative output. Switching transistor Q203(KSD526Y) supplies PWM input, switching the negative output to positive. 'BIAS/MHV' operates similary.

2. Product Detail Descriptions

2.4 Descriptions Of Controller Board

2.4.1 ML-84 Controller Board



2. Product Detail Descriptions

1) CPU

The Microprocessor, MC68322, offers the following features.

- * Completely integrated system for embedded applications.
- * Static EC000 Core Processor (256MB address range)
- * RISC Graphic Processor (RGP)
- * General purpose DMA Controller module
- * IEEE 1284 Parallel Port Controller Module
- * 8 programmable chip selects

For more information refer to MC68322 integrated Printer Processor user's manual by Motorola.

2) Clock

The Controller Board contains two Oscillators. A 40MHz Oscillator(OSC1) supplies the 2X system clock. A 30.075MHz Oscillator is connected to MC68322 Microprocessor and provides 4X signal appropriate for the SEC ML-80 Engine serial video data stream.

These two signals are TTL level compatible.

3) Reset

The Controller Board uses TI7705(U13) to provide power-up a reset time. This IC(U13) supplies an active row reset pulse on power-up.

The asynchronous reset pulse output of 7705 is supplied to the reset input of MC68322 Microprocessor.

4) EPROM

There are four 4Mbit(27C4096) 44pin DIP EPROM on the Controller Board for the program and font of ML-84 Laser Printer's Controller Board.

5) EEPROM

EEPROM(non-volatile RAM) is an KM93C66GD (U1:4Kbits) with two signal lines, serial clock and serial address/data line. The KM93C66GD is a 4Kbit read/write non-volatile memory that can save page counts, power saver time, emulation mode etc.

2. Product Detail Descriptions

6) DRAM

There are 1MB or 1.5MB DRAMs as standard (on Controller Board) and up to 17.5MB DRAM as an option(72pin DRAM SIMM).

If the minimum size of DRAM is 1.5Mbytes, it is expandable up to 17.5MB by adding DRAM SIMM to DRAM SIMM connector(J1) on Controller Board. The DRAM acts as data storage, including frame buffer and the method of refresh is CAS before RAS refresh. 4 RASs are allocated for optional SIMM - 4, 16 MB.

7) Panel Interface

The display panel has one key and four LEDs. The ML-84 Controller Board indicates the state of operation, such as, Ready, Receiving Data, Error(Paper Empty, Paper Jam, Engine Error), etc.

The Display Panel uses four discrete LED Lamps.

The interface is capable of driving up to 12mA on each LED.

The exact current for such LED is determined by the LED characteristics and series limiting resistors mounted on the Display Panel.

The Display Panel interface controls light-on/light-off for individual indicators(LED) on the Operating Panel.

LED 1: READY	----- green
LED 2: PAPER EMPTY)	----- amber
LED 3: MANUAL	----- amber
LED 4: ERROR	----- red
KEY (Online, Offline, Test Print)	

8) Parallel Interface

The parallel interface is a bidirectional parallel port that provides communication between the Printer and the Host Computer.

Through this interface, the Host can check the status of the Printer and send commands or data to the Printer for printing.

The main Processor, MC68322, contains a direct connect, fully IEEE 1284 level 2 compatible, bidirectional parallel port interface(PPI). The PPI supports four IEEE 1284 communication modes: compatibility, nibbly, byte, and IEEE 1284 EPP communication mode is not supported

2. Product Detail Descriptions

9) Serial Interface

The Zilog Z85C30 Serial Controller Chip is used for Serial Interface Option Board.

Used Oscillator is 7.3728MHz for the operating of Z85C30.

The maximum baud rate is 115,200bps.

10) Engine Interface

The Engine interface is based on the SEC Engine(ML-80) interface.

The Engine interface handles the communication, such as command, status and error handling, for the Printer Mechanical Controller.

For more detailed information about this interface, refer to the following.

/CBSY (Command Busy)

'/CBSY' indicates that the Controller Board is sending the command data to the Engine Board. When this signal is active, the command data synchronized by the '/CCLK' is sent to the Engine Board.

/CCLK (Command Clock)

'/CCLK' is the synchronizing signal the Controller Board sends the command data to the Engine Board and/or receives the status from the Engine Board.

/CMMSG (Command Message)

'/CMMSG' is for receiving one byte command from the Controller Board, synchronized by the /CCLK. The command from the Controller Board is sent from the MSB(Most Significant Bit).

/EBSY (Engine Busy)

'/EBSY' signal indicates the Engine Board is on sending response to the Controller Board's command. When this signal is active, the status data synchronized by '/CCLK' is sent.

2. Product Detail Descriptions

/EMSG (Engine Message)

'/EMSG' is for sending one byte data as reponse(called 'STATUS') to the command from the Controller Board.

The Engine Board sends the 'STATUS' synchronized by '/CCLK' when '/EBSY' is active.

If /EBSY is active, the STATUS must be sent within 1 μ ~ 10msec.

/READY (Engine Ready)

'/READY' indicates that the Engine Board can print.

/HSYNC (Horizontal Synchronizing)

'/HSYNC' is the synchronizing signal for the horizontal scanning direction. A new line starts by this signal.

The Controller Board send the 1-row data to the Engine Board on keeping synchronizing with the '/VDATA'.

The period of the '/HSYNC' is 889 usec. To print 2mm left margine.

Regardless of paper size, '/VDATA' send synchronizing with the the '/VDATA' timing is 37.615 μ s/mm.

The left margin can be changed in 3.1346 usec/mm.

For example, if the left margin is 5mm then the result should be 47.019 μ s.

/PRINT (Print)

'/PRINT' is a print command from the Controller Board. On active this command, the Engine Board starts printing. The Controller Board keeps the '/PRINT' on active until the '/PSYNC' becomes inactive.

/PSYNC (Page Synchronizing)

'/PSYNC' is the synchronizing signal to vertical scanning direction.

And '/PSYNC' tells the Controller Board that the paper is passing the Feed Sensor.

The Controller Board must be send the '/HSYNC' -synchronized image data after 475.6msec from the '/PSYNC'. In this case, the print top margin will be 2mm regardless of the papersize.

To move the print top margin down , the timing mentioned above must be increased by the unit of 21 msec/mm.

2. Product Detail Descriptions

/VCLK (Video Clock)

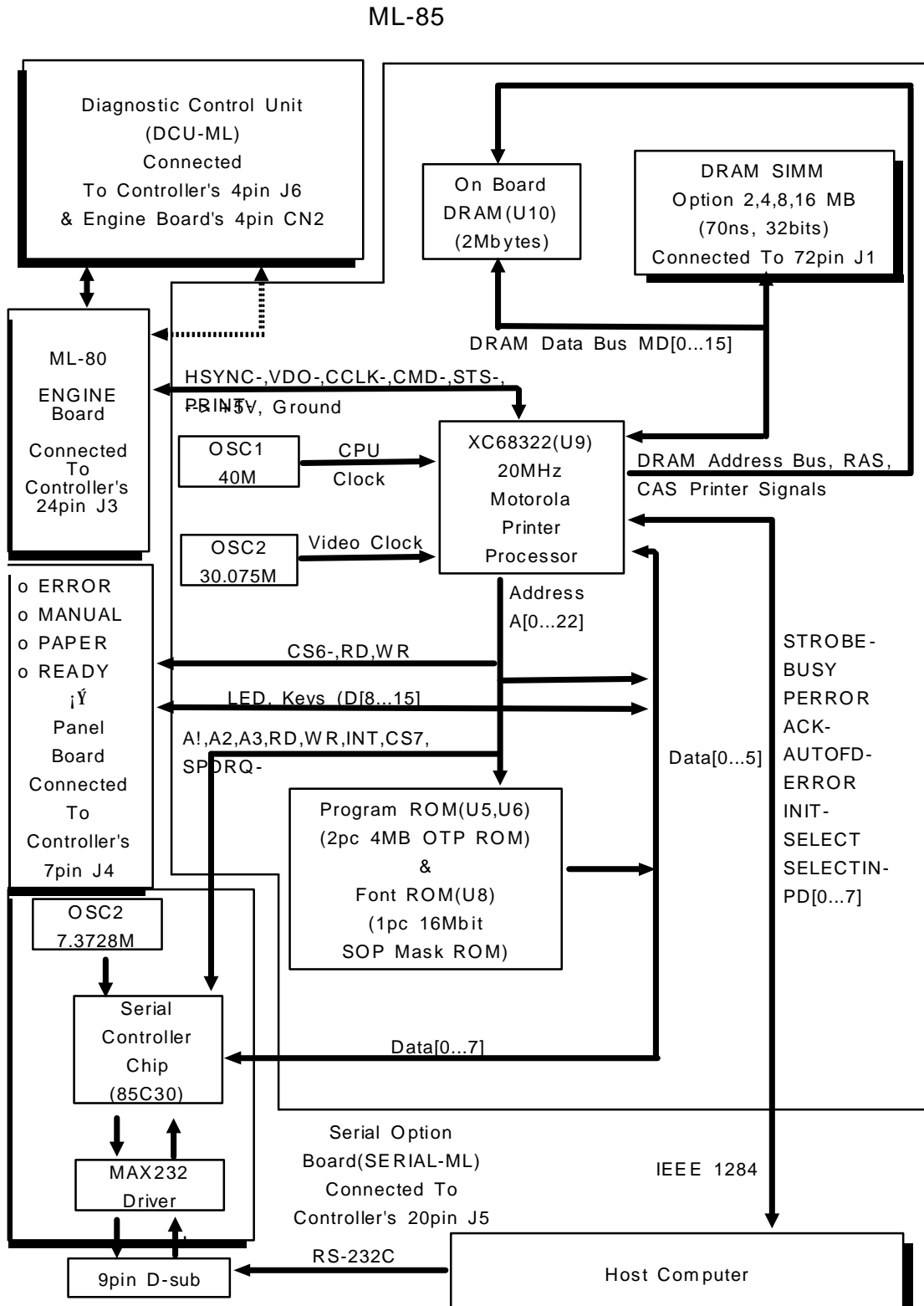
'/VCLK' is the synchronizing signal for the '/VDATA'. It is generated as many as data needed in a row.

/VDATA (Video Data)

'/VDATA' comes the actual image data to be printed. The Engine Board prints black image when the '/VDATA' is "TRUE" and white image when the '/VDATA' is "FALSE". The '/VDATA' must be synchronized with the '/PSYNC' for vertical and with the '/HSYNC' for horizontal scanning. The '/VDATA' should be sent to the Engine Board.

2. Product Detail Descriptions

2.4.2 ML-85 Controller Board



2. Product Detail Descriptions

1) CPU

The Microprocessor, MC68322, offers the following features.

- * Completely integrated system for embedded applications.
- * Static EC000 Core Processor (256MB address range)
- * RISC Graphic Processor (RGP)
- * General purpose DMA Controller module
- * IEEE 1284 Parallel Port Controller Module
- * 8 programmable chip selects

For more information refer to MC68322 integrated Printer Processor user's manual by Motorola.

2) Clock

The Controller Board contains two Oscillators. A 40MHz Oscillator(OSC1) supplies the 2X system clock. A 30.075MHz Oscillator is connected to MC68322 Microprocessor and provides 4X signal appropriate for the SEC ML-80 Engine serial video data stream.

These two signals are TTL level compatible.

3) Reset

The Controller Board uses TI7705(U13) to provide power-up a reset time. This IC(U13) supplies an active row reset pulse on power-up.

The asynchronous reset pulse output of 7705 is supplied to the reset input of MC68322 Microprocessor.

4) OTP(One Time Programmable) ROM & Mask ROM

There are two 4Mbit(27C4096) 44pin PLCC OTP ROM or one 16Mbit Mask ROM on the Controller Board for the program and font ML-85 Laser Printer Video Controller.
Board.

5) EEPROM

EEPROM(non-volatile RAM) is an KM93C66GD (U1:4Kbits) with two signal lines, serial clock and serial address/data line. The KM93C66GD is a 4Kbit read/write non-volatile memory that can save page counts, power saver time, emulation mode etc.

2. Product Detail Descriptions

6) DRAM

There is a 2MB DRAM as standard (on Controller Board) and up to 18MB DRAM as an option(72pin DRAM SIMM).

If the minimum size of DRAM is 2MB, it is expandable up to 18MB by adding DRAM SIMM to DRAM SIMM connector(J1) on Controller Board.

The DRAM acts as data storage, including frame buffer and the method of refresh is CAS before RAS refresh. 4 RASs are allocated for optional SIMM - 2, 4, 8, 16 MB.

7) Panel Interface

The display panel has one key and four LEDs. The ML-84 Controller Board indicates the state of operation, such as, Ready, Receiving Data, Error(Paper Empty, Paper Jam, Engine Error), etc.

The Display Panel uses four discrete LED Lamps.

The interface is capable of driving up to 12mA on each LED.

The exact current for such LED is determined by the LED characteristics and series limiting resistors mounted on the Display Panel.

The Display Panel interface controls light-on/light-off for individual indicators(LED) on the Operating Panel.

¡ LED 1: READY	----- green
¡ LED 2: PAPER EMPTY)	----- amber
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8) Parallel Interface

The parallel interface is a bidirectional parallel port that provides communication between the Printer and the Host Computer.

Through this interface, the Host can check the status of the Printer and send commands or data to the Printer for printing.

The main Processor, MC68322, contains a direct connect, fully IEEE 1284 level 2 compatible, bidirectional parallel port interface(PPI). The PPI supports four IEEE 1284 communication modes: compatibility, nibbly, byte, and IEEE 1284 EPP communication mode is not supported

2. Product Detail Descriptions

9) Serial Interface

The Zilog Z85C30 Serial Controller Chip is used for Serial Interface Option Board.

Used Oscillator is 7.3728MHz for the operating of Z85C30.

The maximum baud rate is 115,200bps.

10) Engine Interface

The Engine interface is based on the SEC Engine(ML-80) interface.

The Engine interface handles the communication, such as command, status and error handling, for the Printer Mechanical Controller.

For more detailed information about this interface, refer to the following.

/CBSY (Command Busy)

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/CCLK (Command Clock)

'/CCLK' is the synchronizing signal the Controller Board sends the command data to the Engine Board and/or receives the status from the Engine Board.

/CMMSG (Command Message)

'/CMMSG' is for receiving one byte command from the Controller Board, synchronized by the /CCLK. The command from the Controller Board is sent from the MSB(Most Significant Bit).

/EBSY (Engine Busy)

'/EBSY' signal indicates the Engine Board is on sending response to the Controller Board's command. When this signal is active, the status data synchronized by '/CCLK' is sent.

2. Product Detail Descriptions

/EMSG (Engine Message)

'/EMSG' is for sending one byte data as response (called 'STATUS') to the command from the Controller Board.

The Engine Board sends the 'STATUS' synchronized by '/CCLK' when '/EBSY' is active.

If '/EBSY' is active, the STATUS must be sent within 1 μ ~ 10msec.

/READY (Engine Ready)

'/READY' indicates that the Engine Board can print.

/HSYNC (Horizontal Synchronizing)

'/HSYNC' is the synchronizing signal for the horizontal scanning direction. A new line starts by this signal.

The Controller Board sends the 1-row data to the Engine Board on keeping synchronizing with the '/VDATA'.

The period of the '/HSYNC' is 889 μ sec. To print 2mm left margin.

Regardless of paper size, '/VDATA' sends synchronizing with the the '/VDATA' timing is 37.615 μ s/mm.

The left margin can be changed in 3.1346 μ sec/mm.

For example, if the left margin is 5mm then the result should be 47.019 μ s.

/PRINT (Print)

'/PRINT' is a print command from the Controller Board. On active this command, the Engine Board starts printing. The Controller Board keeps the '/PRINT' on active until the '/PSYNC' becomes inactive.

/PSYNC (Page Synchronizing)

'/PSYNC' is the synchronizing signal to vertical scanning direction.

And '/PSYNC' tells the Controller Board that the paper is passing the Feed Sensor.

The Controller Board must send the '/HSYNC' -synchronized image data after 475.6msec from the '/PSYNC'. In this case, the print top margin will be 2mm regardless of the paper size.

To move the print top margin down, the timing mentioned above must be increased by the unit of 21 msec/mm.

2. Product Detail Descriptions

/VCLK (Video Clock)

'/VCLK' is the synchronizing signal for the '/VDATA'. It is generated as many as data needed in a row.

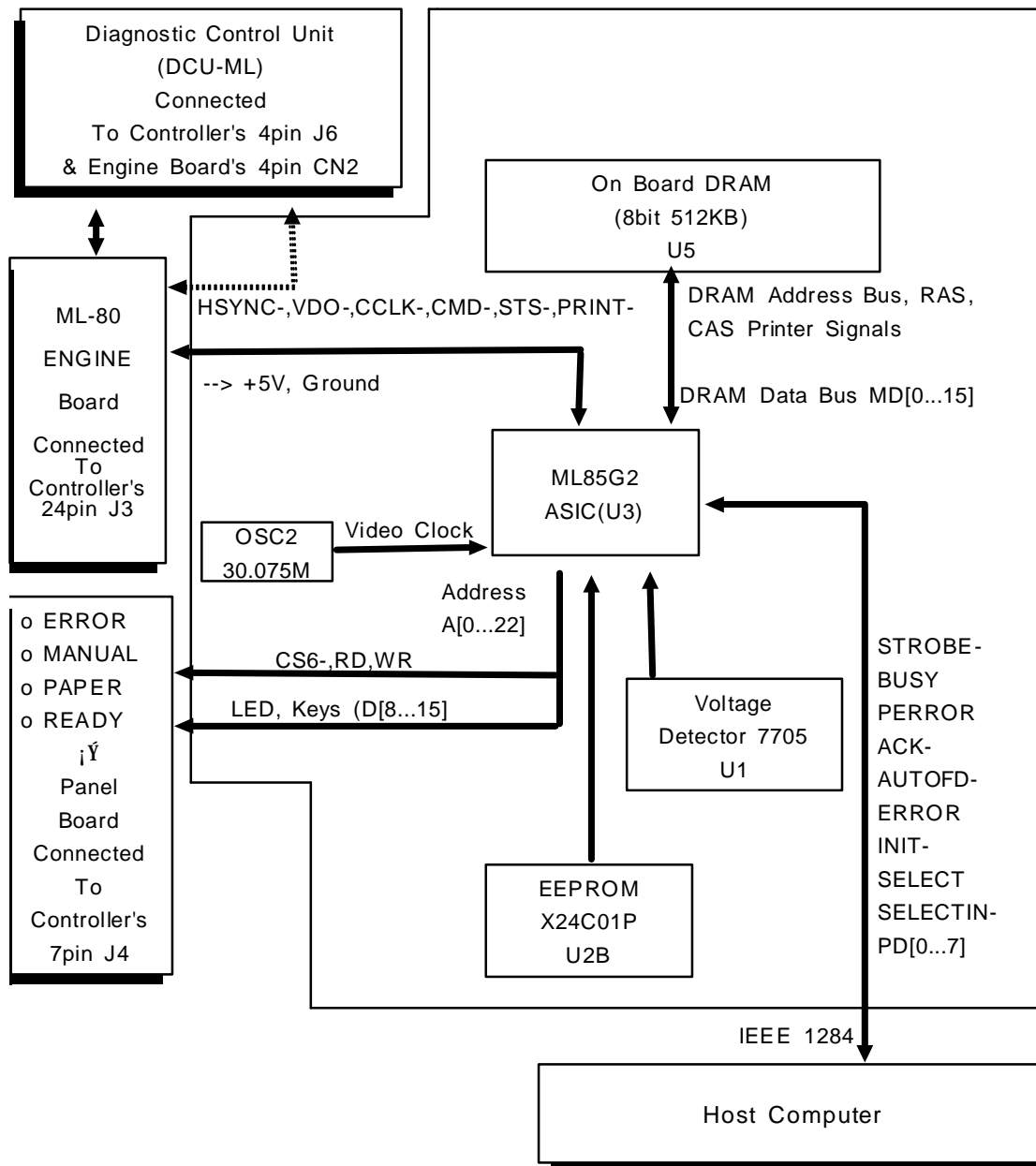
/VDATA (Video Data)

'/VDATA' carries the actual image data to be printed. The Engine Board prints black image when the '/VDATA' is "TRUE" and white image when the '/VDATA' is "FALSE". The '/VDATA' must be synchronized with the '/PSYNC' for vertical and with the '/HSYNC' for horizontal scanning. The '/VDATA' should be sent to the Engine Board.

2. Product Detail Descriptions

2.4.3 ML-85G Controller Board

ML-85G



2. Product Detail Descriptions

1) ASIC

There are three main functional blocks :

- * IEEE 1284 Parallel Port Controller Module
- * Memory Controller
- * Laser Engine Controller

For more information refer to the System Adaptation Kit Hardware volume (Microsoft Windows Printing System for Host-Based Printers)

2) Clock

The Controller Board contains one Oscillator.

A 30.075MHZ Oscillator is connected to ASIC and provides 4x signal appropriate for the SEC ML-80 Engine serial video data stream.

This signal is TTL level compatible.

3) Reset

The Controller Board uses TI7705(U1)IC to provide power-up a reset time.

This IC(U1) supplies an active row reset pulse on power-up.

The asynchronous reset pulse output of 7705 is supplied to the reset input of ASIC.

4) EEPROM

EEPROM(non-volatile RAM) is an X24C01P (U2B:1Kbit) with serial clock and serial data line.

The X24C01P is a 1Kbit read/write non-volatile memory but it only be read in this Printer for device ID string of 64bytes.

5) DRAM

There is a 0.5MB DRAM(4Mbits) as standard (on main board).

The minimum size of DRAM is 0.5Mbyte and expandable up to 1MB by adding DRAM to the U6 on main board.

The DRAM acts as data storage, including frame buffer and the method of refresh is CAS before RAS refresh.

- Refresh cycle should be 2K or below than 2K.

2. Product Detail Descriptions

6) Panel Interface

The display panel has one key and four LEDs. The ML-85G Controller Board indicates the state of operation, such as, Ready, Receiving Data, Error(Paper Empty, Paper Jam, Engine Error), etc.

The Display Panel uses four discrete LED Lamps.

The interface is capable of driving up to 12mA on each LED.

The exact current for such LED is determined by the LED characteristics and series limiting resistors mounted on the Display Panel.

The Display Panel interface controls light-on/light-off for individual indicators(LED) on the Operating Panel.

¡ LED 1: READY	----- green
¡ LED 2: PAPER EMPTY)	----- amber
¡ LED 3: MANUAL	----- amber
¡ LED 4: ERROR	----- red
¡ KEY (No Function)	

7) Parallel Interface

The parallel interface is a bidirectional parallel port that provides communication between the Printer and the Host.

Through this interface, the host can check the status of the Printer and send commands or data to the Printer for printing.

The main ASIC contains a direct connect, IEEE 1284 compatible, bidirectional parallel port interface. The PPI supports three IEEE 1284 communication modes: Peppy, ECP, Nibble.

8) Engine Interface

The Engine interface is based on the SEC Engine(ML-80) interface.

The Engine interface handles the communication, such as command, status and error handling, for the Printer Mechanical Controller.

For more detailed information about this interface, refer to the next pages.

2. Product Detail Descriptions

/CBSY (Command Busy)

'/CBSY' indicates that the Controller Board is sending the command data to the Engine Board. When this signal is active, the command data synchronized by the '/CCLK' is sent to the Engine Board.

/CCLK (Command Clock)

'/CCLK' is the synchronizing signal the Controller Board sends the command data to the Engine Board and/or receives the status from the Engine Board.

/CMSG (Command Message)

'/CMSG' is for receiving one byte command from the Controller Board, synchronized by the /CCLK. The command from the Controller Board is sent from the MSB(Most Significant Bit).

/EBSY (Engine Busy)

'/EBSY' signal indicates the Engine Board is on sending reponse to the Controller Board's command. When this signal is active, the status data synchronized by '/CCLK' is sent.

/EMSG (Engine Message)

'/EMSG' is for sending one byte data as reponse(called 'STATUS') to the command from the Controller Board.

The Engine Board sends the 'STATUS' synchronized by '/CCLK' when '/EBSY' is active.

If /EBSY is active, the STATUS must be sent within 1 μ ~ 10msec.

/READY (Engine Ready)

'/READY' indicates that the Engine Board can print.

2. Product Detail Descriptions

/HSYNC (Horizontal Synchronizing)

'/HSYNC' is the synchronizing signal for the horizontal scanning direction. A new line starts by this signal.

The Controller Board send the 1-row data to the Engine Board on keeping synchronizing with the '/VDATA'.

The period of the '/HSYNC' is 889 usec. To print 2mm left margin.

Regardless of paper size, '/VDATA' send synchronizing with the the '/VDATA' timing is 37.615us/mm.

The left margin can be changed in 3.1346 usec/mm.

For example, if the left margin is 5mm then the result should be 47.019us.

/PRINT (Print)

'/PRINT' is a print command from the Controller Board. On active this command, the Engine Board starts printing. The Controller Board keeps the '/PRINT' on active until the '/PSYNC' becomes inactive.

/PSYNC (Page Synchronizing)

'/PSYNC' is the synchronizing signal to vertical scanning direction.

And '/PSYNC' tells the Controller Board that the paper is passing the Feed Sensor.

The Controller Board must be send the '/HSYNC' -synchronized image data after 475.6msec from the '/PSYNC'. In this case, the print top margin will be 2mm regardless of the papersize.

To move the print top margin down , the timing mentioned above must be increased by the unit of 21 msec/mm.

/VCLK (Video Clock)

'/VCLK' is the synchronizing signal for the '/VDATA'. It is generated as many as data needed in a row.

/VDATA (Video Data)

'/VDATA' comes the actual image data to be printed. The Engine Board prints black image when the '/VDATA' is "TRUE" and white image when the '/VDATA' is "FALSE". The '/VDATA' must be synchronized with the '/PSYNC' for vertical and with the '/HSYNC' for horizontal scanning. The '/VDATA' should be sent to the Engine Board.

2. Product Detail Descriptions

2.5 Descriptions Of Option Boards

The Serial Board or the SIMM Board are useful for ML-84 and ML-85 except ML-85G. These Boards are optional upgrade modules.

2.5.1 Description Of Serial (Interface) Board

If you use only the WPS(Windows Printing System), you will need not but if you intend to use this Printer with the other machines, like UNIX Workstations, you will need optional RS232C serial interface module.

The Serial Board lets you communicate with the Host Computer up to at maximum speed of 115,200bps.

The data format used in serial transmission is fixed as 8data bits, 1 stop bit and parity.

The flow control can be either of the following

- DTR signal (hardware wised)

- XON/XOFF (software wised)

Apart from the 'XON/XOFF' flow control, you can select whether 'XON' protocol which lets the Printer keep sending the 'XON' signal repeatedly within a preset interval(every 1sec).

The transmission speed and 'Robust XON' can be selected by the EEPROM setting.

2.5.2 Description Of SIMM (Module) Board

There are 2 available SIMMs for ML-84(4, 16 MB) or 4 for ML-85(2, 4, 8, 16 MB) you can choose from, and you can increase the Printer memory up to a total of 17.5MB for ML-84 and 18MB for ML-85.

All SIMMs are 72pin 32bit memory, they are of size of:

- for ML-84, 4MB, 16MB

- for ML-85, 2MB, 4MB, 8MB, 16MB

All you have to do is to choose an appropriate size of memory, and to install it into the SIMM slot.

The Controller Board automatically detect the SIMM memory and increase the Printer buffer.

2. Product Detail Descriptions

2.6. Software

2.6.1 Software Compatibility Test Results

a) Microsoft test applications

- > Lotus AMI PRO 3.01 or later
- > Corel Draw 4.0 or later
- > Harvard Graphics 2.0 or later
- > Lotus 1-2-3 4.0 or later
- > MS Access 2.0 or later
- > MS Excel 5.0 or later
- > MS Publisher 2.0 or later
- > MS Power Point 4.0 or later
- > MS Word 6.0 or later
- > MS Works 3.0 or later
- > WordPerfect 6.0 or later

b) Genoa test applications

- > Lotus AMI PRO 3.01 or later
- > Corel Draw 4.0 or later
- > Harvard Graphics 2.0 or later
- > Lotus 1-2-3 4.0 or later
- > MS Excel 5.0 or later
- > MS Power Point 4.0 or later
- > MS Word 6.0 or later
- > WordPerfect 6.0 or later
- > Aldus PageMaker 5.0 or later
- > PhotoShop 3.0 or later
- > Designer 4.0 or later
- > Xpress 3.3x or later

2. Product Detail Descriptions

2.6.2 ML-84/85 Comparison between WPS and PCL

a) WPS

Merits

- > Displays status on screen (User Friendly)
- > Simple command to send data to printer
- > Faster graphics printing
- > Less memory use when printing graphics

Demerits

- > Cannot be used under DOS
- > No resident fonts
- > Slow text print speed
- > Relies heavily on performance of PC
- > Provides continuous source of royalties to Microsoft

b) PCL

Merits

- > May be used under DOS or Windows
- > Resident fonts provide faster text print speed
- > May be replaced by HP driver

Demerits

- > Follows HP development
- > PC CPU controls print speed
- > Slow printing of complex graphics

2. Product Detail Descriptions

2.6.3 ML-85G

A Host-based Windows printing system featuring increased performance, functionality, image quality, and usability, structured for a printer without a CPU. ML-85G provides high performance and low cost by using the host to perform rasterization (converting data to dots), font rendering, and Printer control.

a) Technology

All processing and control previously performed by the Printer is performed in the PC. The Printer only needs to contain a relatively small FIFO register to hold data from the PC to the Printer. Since data is being sent to the Printer while paper is in motion, a key feature of this software is its ability to render and send the bitmap at a rate roughly matching that of the paper's motion through the printer, arriving just in time to print.

Since the paper cannot be stopped after being set in motion, the host PC must insure that data is sent to the Printer in time.

b) Environment

b.1) Hardware:

Minimum spec	Microprocessor: up to i386SX 16MHz Memory: 4 MB Minimum 3.7 MB HDD space required.
Recommended	Microprocessor: up to i486SX 25MHz Memory: 8 MB

b.2) Software

Operating System	Windows 3.1 (enhanced mode) Windows for Workgroups 3.11 Windows95
Network	Windows for workgroups Windows95

2. Product Detail Descriptions

2.6.4 Installation Guide

a) Windows95

Start Microsoft Windows95

Insert the first Microsoft Windows Printing System diskette (Disk 1 of 2) into disk drive 'A:' or 'B:' and press OK.
Follow the instructions on the screen.

When the installation is complete, Windows Printing System folder will contain the correct icon.

b) Windows 3.1x

For Windows Printing System installation, insert the first Microsoft Windows Printing System Diskette (Disk 1 of 2) into drive 'a:' or 'b:' and run - a:\setup.exe - from the File Menu in 'PROGRAM MANAGER'.

.ML-85G

1. WINDOWS 95

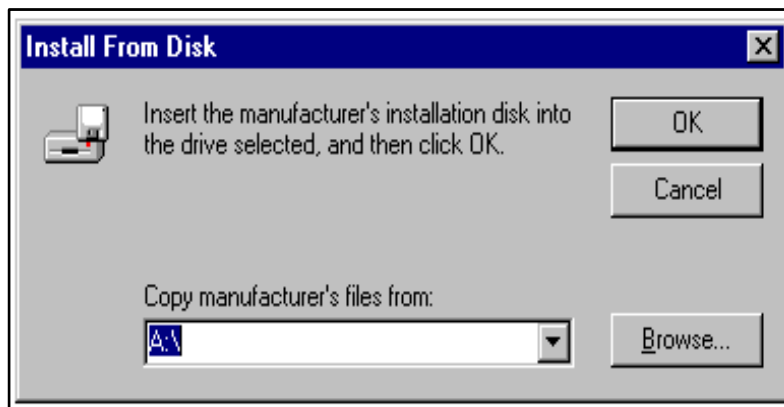
Turn on your computer and open Microsoft Windows 95
You can see this screen, just click O.K.



2. Product Detail Descriptions

Insert the first Microsoft Windows Printing System diskette (Disk 1 of 2) into the disk drive A (or your desired drive) and press O.K.

Minimum 3.7 MB on your HDD space require.



Follows the instruction on the screen like the followings.