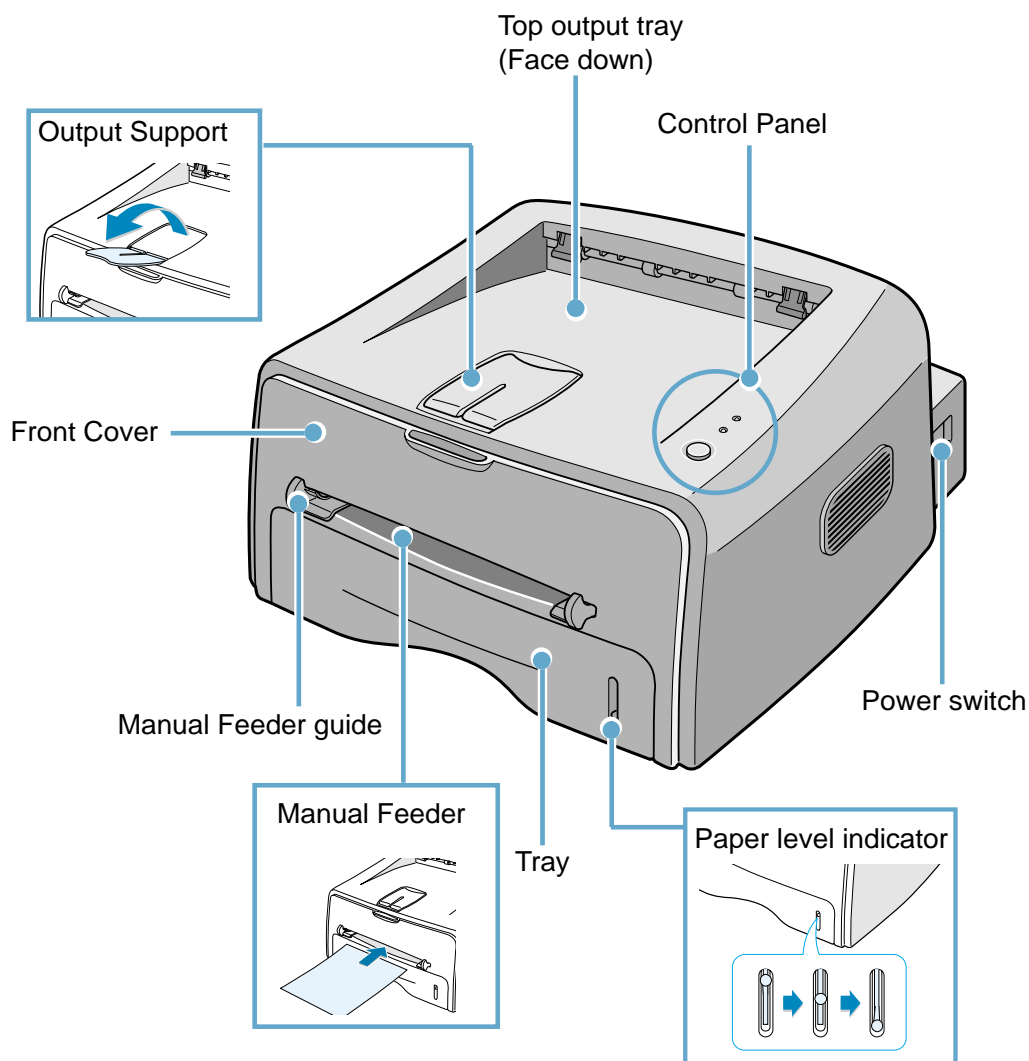# 4. Summary of Product (for ML-15XX/17XX)
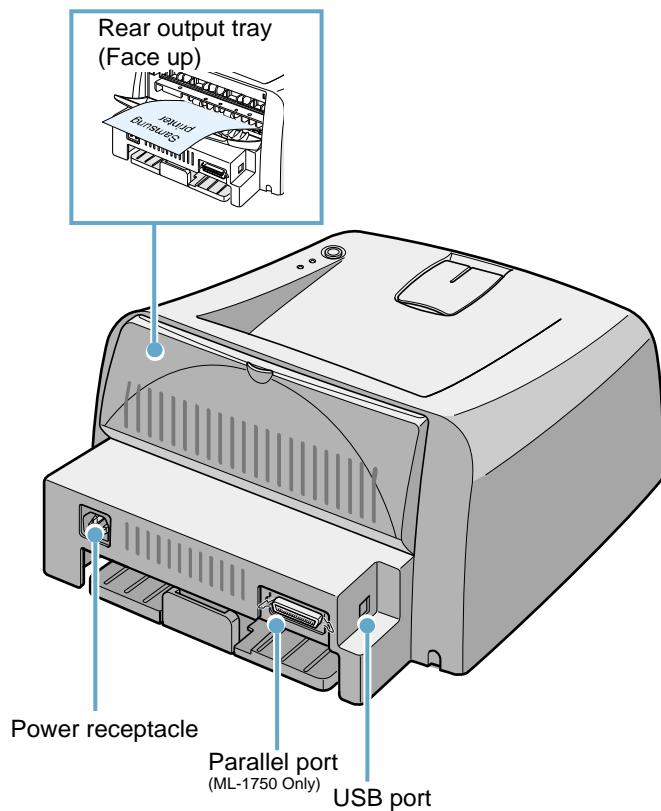
This chapter describes the functions and operating principal of the main component.

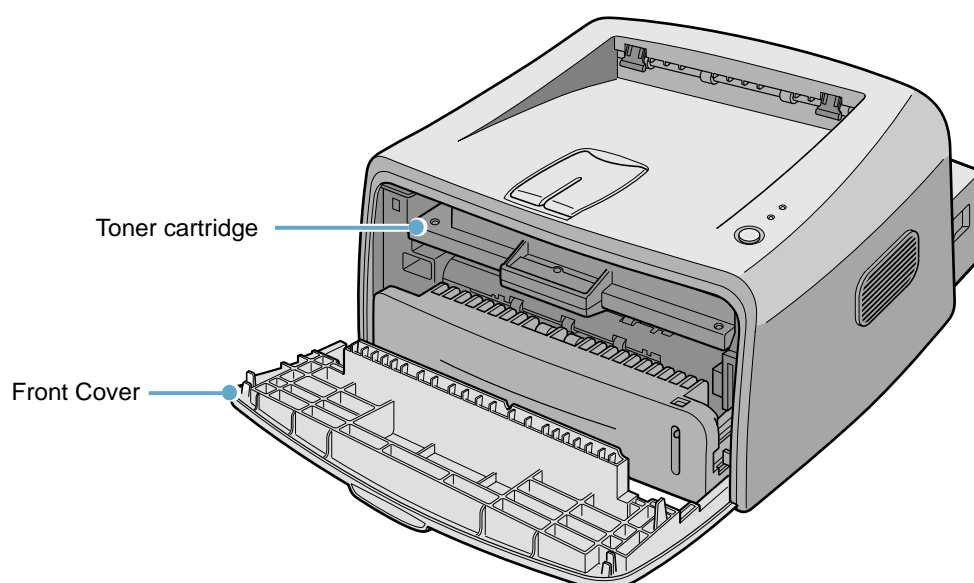## 4.1 Printer Components (for ML-15XX/17XX)

[Front View]

Output Support

Top output tray
(Face down)

Control Panel

Front Cover

Manual Feeder guide

Manual Feeder

Tray

Paper level indicator

Power switch

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[Rear View]

Rear output tray
(Face up)

Power receptacle

Parallel port
(ML-1750 Only)

USB port

[Inside View]

Toner cartridge

Front Cover

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[Control Panel]

On Line/Error

Toner Save

Cancel
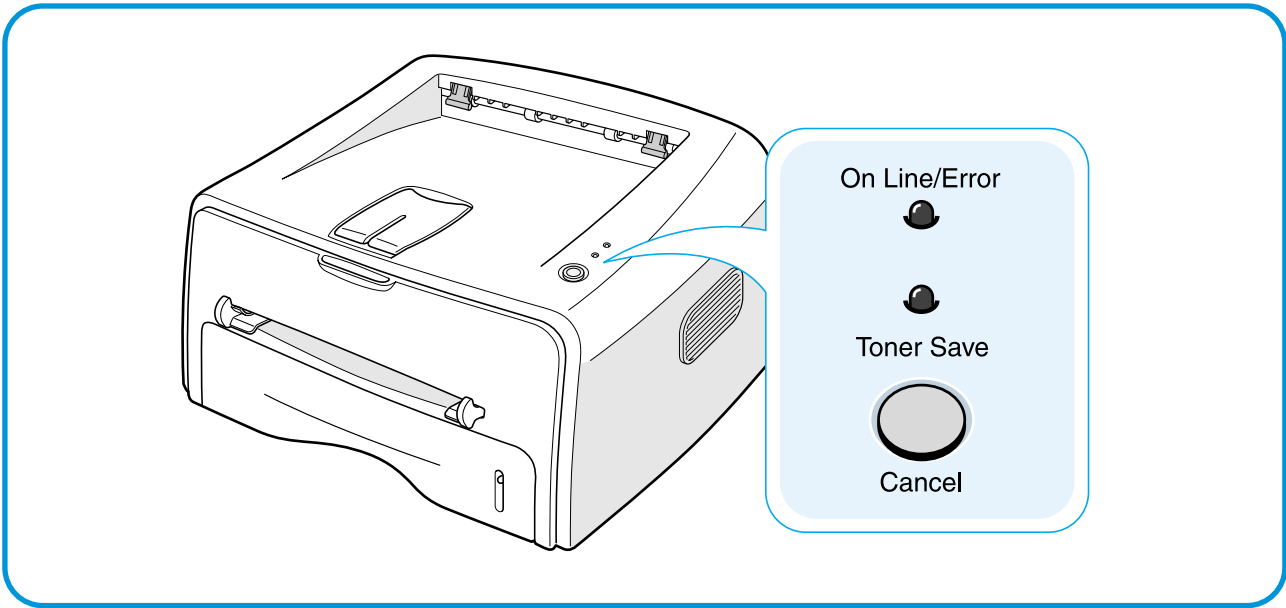
1) On Line/Error and Toner Save LEDs

LED	Description
On Line/Error	If the On Line/Error lights green, the printer is ready to print.
	If the On Line/Error lights red, the printer is experiencing an error, such as jammed paper, the open cover or the empty toner cartridge.
	If you press the Cancel button while the printer is receiving data, the On Line/Error LED blinks red to cancel printing.
	In Manual Feed mode, if there is no paper in the Manual Feeder, the On Line/Error LED blinks red. Load paper into the Manual Feeder and the LED stops blinking.
	If the printer is receiving data, the On Line/Error LED slowly blinks green. If the printer is printing the received data, the On Line/Error LED blinks green fast.
Toner Save	If you press the Cancel button in Ready mode, this LED is on and the Toner Save mode is enabled. If you press this button once again, this LED is off and the Toner Save mode is disabled.
On Line/Error Toner Save	If the On Line/Error and Toner Save LEDs blink, your system has some problems.

2) Cancel button

Printing demo page   In Ready mode, press and hold this button for about 2 seconds until all LEDs blink slowly, and release.

Printing configuration sheet   In Ready mode, press and hold this button for about 6 seconds until all LEDs blink fast, and release.

Manual feeding   Press this button each time you load a sheet of paper in the manual feeder, when you select Manual Feed for Source from your software application.

Cleaning inside printer   In Ready mode, press and hold this button for about 10 seconds until all LEDs turn on, and release. After cleaning the printer, one cleaning sheet prints.

Canceling print job   Press this button during printing. The On Line/Error LED blinks while the print job is cleared from both the printer and the computer, and then return to Ready mode. This may take some time depending on the size of the print job.
In Manual Feed mode, you can't cancel the print job by pressing this button.

Toner Save mode on/off   In Ready mode, press this button to turn the Toner Save mode on or off.

4.2 System Layout (for ML-15XX/17XX)
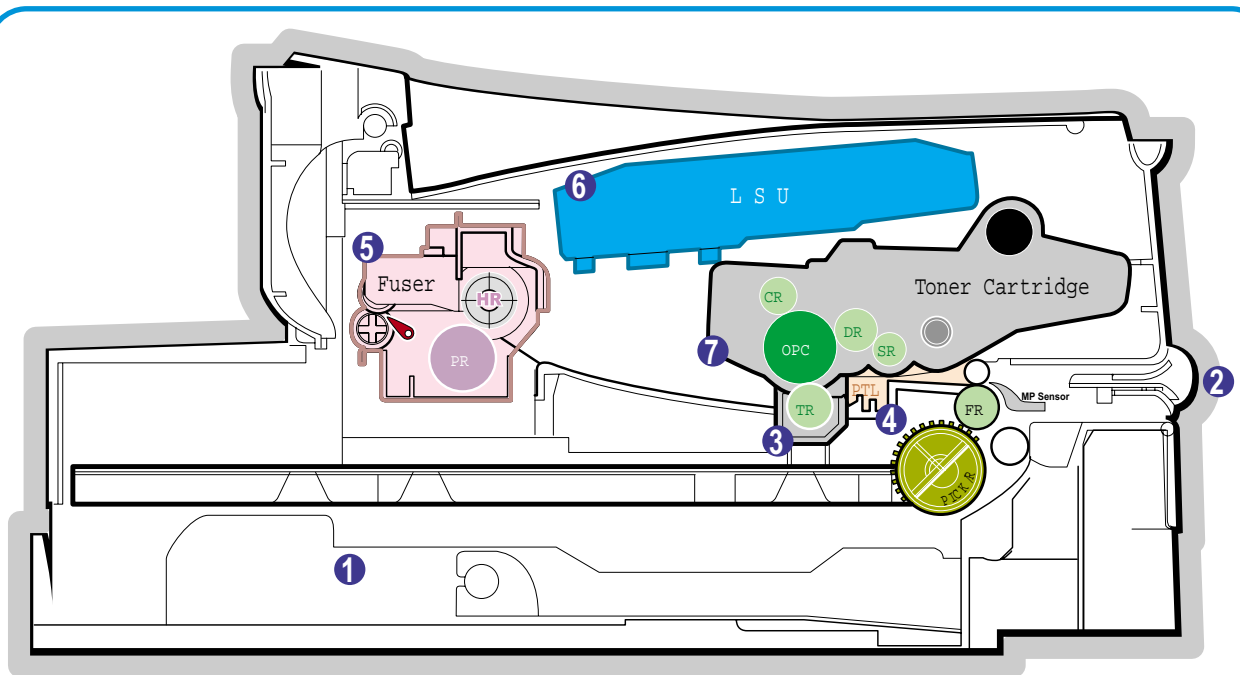
① **Cassette**   ⑤ **Fuser**

② **Manual Feeder**   ⑥ **LSU(Laser Scan Unit)**

③ **Transfer Roller**   ⑦ **Toner Cartridge**

④ **PTL(Pre-Transfer-Lamp)**

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4.2.1 Feeding Part

There are the universal cassette, which loads papers, and the manual feeder, which supplies paper one by one. The cassette has the function pad which separates paper one by one, and it has the sensor function to check the existence of the loading paper.

- Feeding Method: Universal Cassette Type
- Feeding Standard: Center Loading
- Feeding Capacity: Cassette-250 sheets (75g/m©˜, 20lb paper standard)
              Manual 1 sheet (Paper, OHP, Envelop, etc.)
- Paper detecting sensor: Photo sensor
- Paper size sensor: None

4.2.2 Transfer Ass'y

It is consisted of the PTL (pre-transfer lamp) and the Transfer Roller. The PTL sends a light to the OPC drum, makes the current on the drum surface to low, and improves the transfer efficiency.
The transfer roller delivers the toner of the OPC drum to the paper.

- The life span: Print over 60,000 sheets (in 15~30°C)

4.2.3 Driver Ass'y

It is a power delivery unit by gearing. By driving the motor, it supplies the power to the feeding unit, the fusing unit, and the distributing unit.

4.2.4 Fixing Part(Fuser)

- The fuser is consisted of the Heat Lamp, Heat Roller, Pressure Roller, Thermistor, and Thermostat. It adheres the toner to the paper with a pressure and a heat to complete the printing job.
- There are two methods, the existing method which use the Heat Lamp and the Q-PID which is developed by Samsung.
      110V : Heat Lamp type Fuser
      220V : Heat Lamp type or Q-PID type Fuser

4.2.4.1 Temperature-Intercepting Device (Thermostat)
The thermostat is the temperature-intercepting device, which cuts off the power for preventing an overheating or a fire when the heat lamp or the heat coil of the heat roller is overheated.

4.2.4.2 Temperature Detecting Sensor (Thermistor)
The Thermistor detects the surface temperature of the heat roller, and it maintains the regular temperature of the heat roller by responding to the information of the temperature.

4.2.4.3 Heat Roller
The heat roller transfers the temperature from the heat lamp or heat coil to the surface to heat the paper which passes the surface. The melted toner cannot stain the heat roller coated with Teflon.
The heating elements are heat lamp and heat coil.

4.2.4.4 Pressure roller
The pressure roller mounted right under the heat roller is made of the silicon resin, and the surface of the roller is tubed with Teflon to fuse the toner on the paper when paper passes between the heat roller and the pressure roller.

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4.2.4.5 Safety Relevant Facts
• Protecting device when overheating
- 1st protecting device: H/W cuts off when detecting an overheating
- 2nd protecting device: S/W cuts off when detecting an overheating
- 3rd protecting device: Thermostat cuts off the power
• Safety device
- The power of the fuser is cut off when the front cover is open.
- The overheating safety device for customer Maintains the surface temperature of the Fuser Cover under 80°C and attach the caution label inside of the rear cover where customer can find easily.

4.2.5 LSU (Laser Scanner Unit)

The LSU unit is controlled by the video controller. It scans the video data received from video controller with laser beam by using the rotation principal of the polygon mirror to create the latent image on the OPC drum. It is the core part of LBP.
The OPC drum rotates as the same speed as the paper feeding speed. It creates the /HS YNC signal and sends it to the engine when the laser bean of the LSU reaches the end of the polygon mirror, and the engine detects the /HS YNC signal to arrange the vertical line of the image on the paper. After detecting the /HS YNC signal, the image data is sent to the LSU to arrange the its left margin on the paper.
The one side of the polygon mirror is one line for scanning.

4.2.6 Toner Cartridge

By using the electronic photo process, it creates a visual image. In the toner cartridge, the OPC unit and the developer unit are in a body. The OPC unit has OPC drum and charging roller, and the developer unit has toner, toner cartridge, supply roller, developing roller, and blade (Doctor blade)

- Developing Method: Non magnetic 1 element contacting method
- Toner: Non magnetic 1 element shatter type toner
- The life span of toner: 3,000 sheets (ISO Pattern/A4 standard)
- Toner remaining amount detecting sensor: None
- OPC Cleaning: Collect the toner by using electric static + FILM OPC
- Management of disusable toner: Collect the toner by using electric static (Clenerless Type- No disusable toner)
- OPC Drum protecting Shutter: None
- Classifying device for toner cartridge: ID is classified by interruption of the frame channel.

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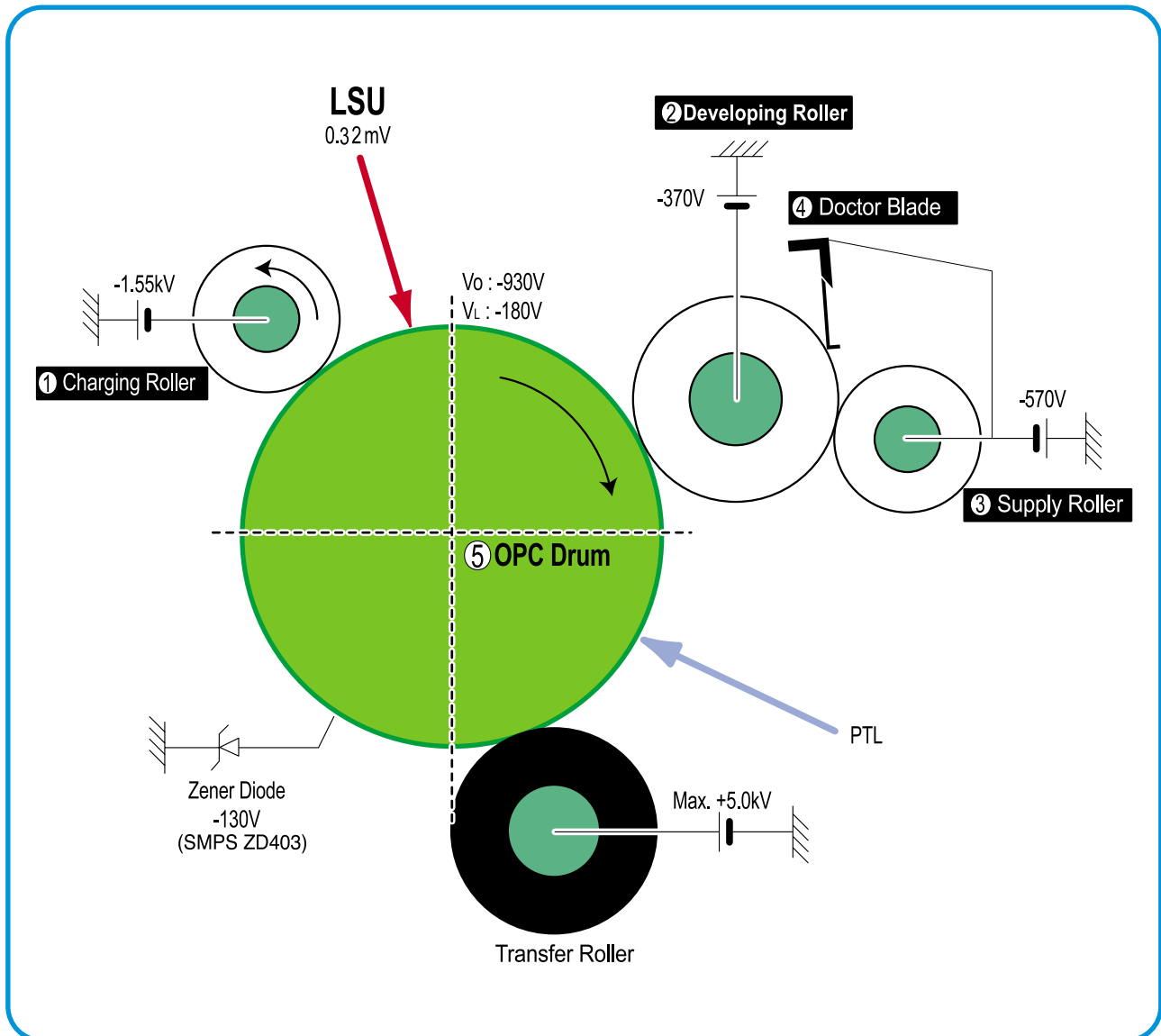
4.3 Main PBA Description (for ML-15XX/17XX)

4.3.1 Main PBA (for ML-1510/1710)

The Engine Board and the Controller Board are in one united board, and it is consisted of CPU part and print part in functional aspect. The CPU is functioned as the bus control, I/O handling, drivers, and PC interface. The main board sends the Current Image dlml Video data to the LSU and manages the conduct of Electrophotography for printing. It is consisted of the circuits of the motor (paper feed, pass) driving, clutch driving, pre-transfer lamp driving, current driving, and fan driving.
The signals from the paper feed jam sensor and paper empty sensor are directly inputted to the main board.

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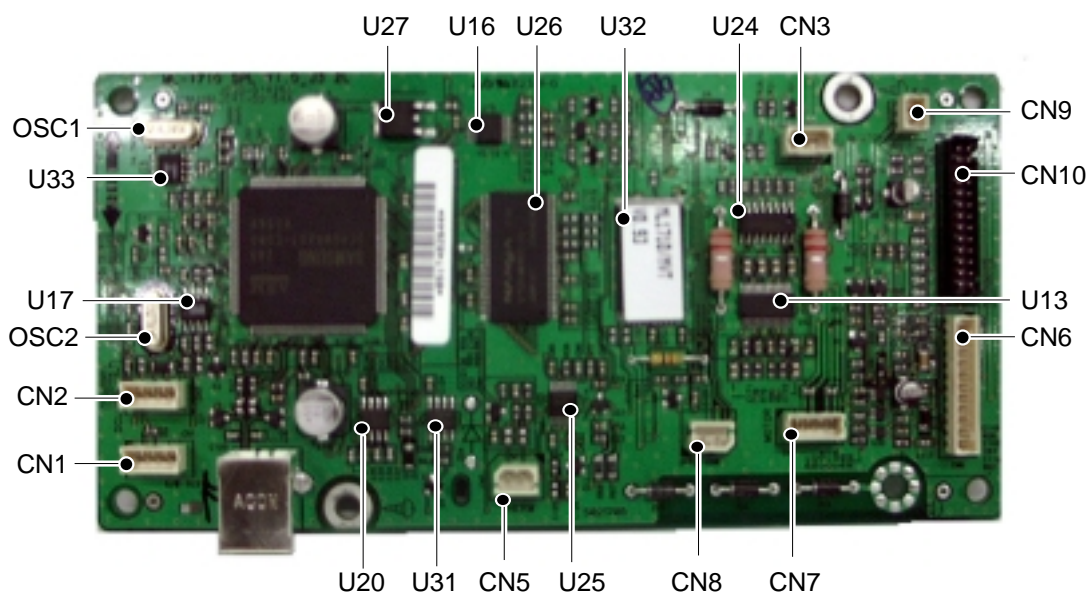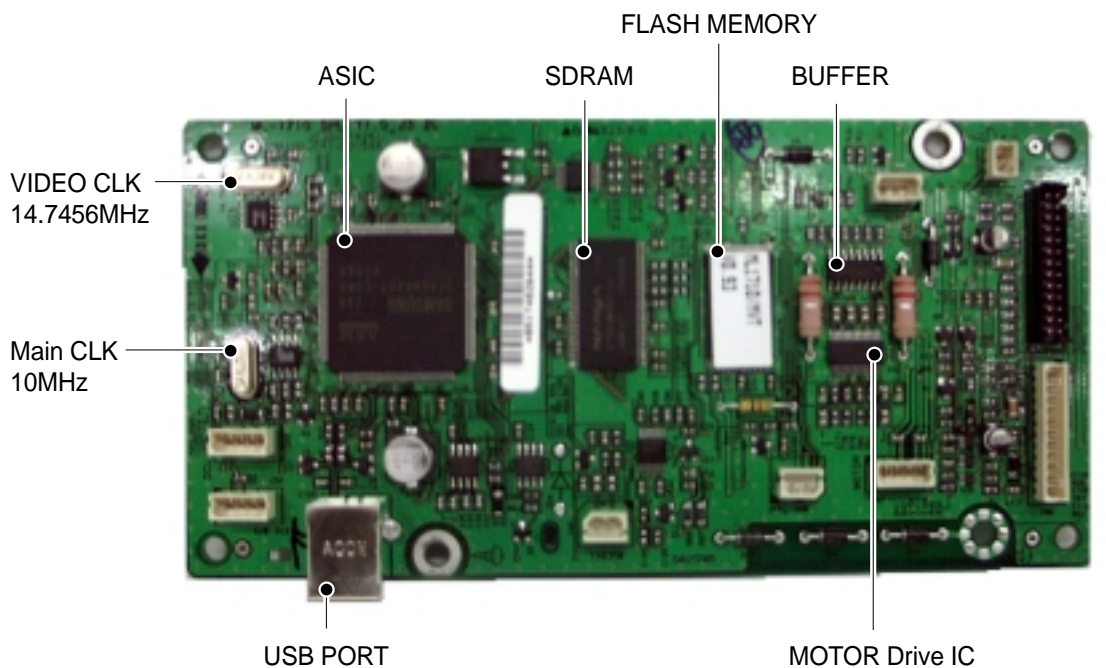
4.3.1.1 ASIC (Jupiter 4), (for ML-1510/1710)

The Jupiter IV (16Bit RISC Processor), which is the executive controller to operate the printer function, is in use, and the each operation block is driven by system program of the flash memory. The whole system is controlled by driving operation block.

•**Main function block**
- Completely Integrated System for Embedded Applications,
- 16 Bit Risc Architecture, Efficient and Powerful ARM7TDMI CPU
- LSU Interface Module for Interfacing PVC or HPVC with LSU
- 2 Channel General Purpose DMA Controller for High Speed I/O
- Dual Memory Bus Architecture
- Operating frequency : 80MHz
- Operating power : 3.3V
- Power on reset time : under 6.6ms

4.3.1.2 Flash Memory

It stores the system program and downloads the system program through the PC interface.

- Capacity : 0.5M Byte
- Access Time : 70 nsec

4.3.1.3 SDRAM

It is used as a swath buffer, system working memory area, etc. while printing.

- Capacity :

ML-1510	ML-1710	ML-1750
2 M byte	8 M byte	8 M byte

- Access Time : 60 nsec

4.3.1.4 Sensor input circuit

1) Paper Empty Sensing
The Paper empty sensor (Photo Interrupter) on the engine board informs the state of paper to CPU whether it is empty or not with operation of the actuator.
When cassette is empty, it detects the fact by reading the D0 Bit of CPU, and then informs the fact by selecting the second LED(yellow) among the panel LEDs.

2) MP Sensing
By operation of Actuator on the frame, the MP Sensor (Photo Interrupter) on the engine board informs the state of paper to CPU whether it is empty or not. It reads the D0 Bit of CPU for recognizing paper in MP, and paper is fed from MP if there is.

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3) Paper Feeding, Toner Cartridge Sensing

When paper passes the actuator (feed sensor part), it detects the signal of Photo interrupter, informs the paper feeding state to CPU, and then sprays the image data after certain time.

If it doesn't detect the feed sensor within 1 sec. after paper is fed, paper Jam0 is occurred (Red and Yellow will be turned on among the OP panel LEDs), and the fact whether the developer is inserted or not is detected with the same principle. After the developer is mounted, the actuator is operated. The signal from the photo interrupter is detected when it is passing the actuator of the sensor part. That is the developer ID sensing.

4) Paper Exit Sensing

It detects paper state whether paper gets out from the set with operation of exit sensor on the engine board and actuator on the frame. Paper detects the on/off time of exit sensor, and the normal operation or jam information is informed to the CPU.

The paper JAM2 is informed. (Red, Yellow LED will be turned on among the OP panel LEDs)

5) Cover Open Sensing

The Cover open sensor is located on the front cover. After the front cover is opened, +24V (DC fan, solenoid, main motor, polygon motor part of LSU, HVPS), which is supplied to the each unit, is cut off.

The cover-open sensing is operated by the D0 bit of CPU, and the developer ID sensing is operated.

In this case, the red LED among OP panel LEDs will be ON for informing the facts to user.

6) DC FAN / SOLENOID Driving

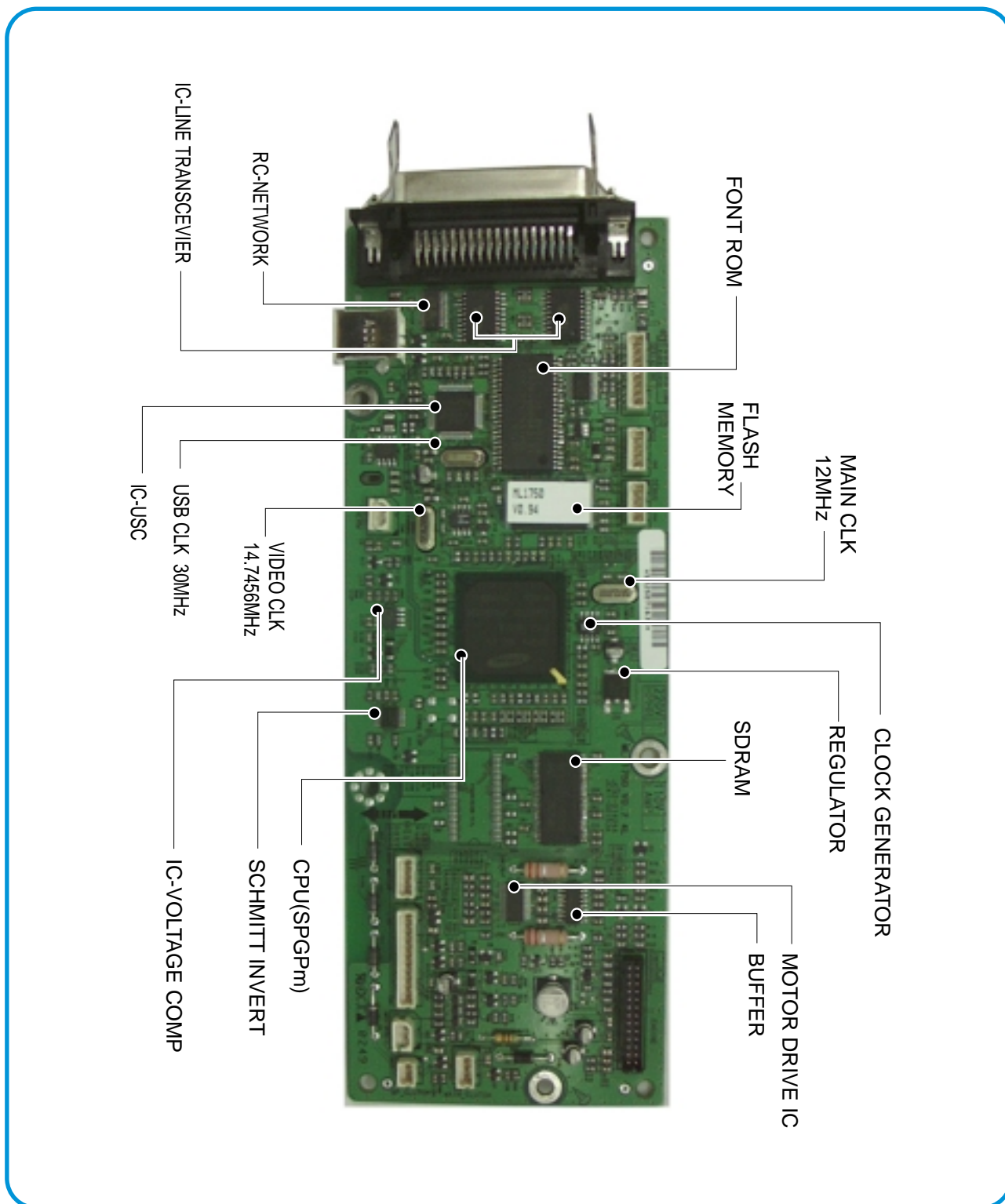It is driven by transistor and controlled by D6 bit of CPU.

When it is high, the fan is driving by turning on the TR, and it is off when the sleep mode is selected.

There are two solenoids, and they are driven by paper pick-up and MP signal. Its driving time is 300ms. The diode protects the driving TR from the noise pulse, which is flown when the solenoid is de-energizing.

7) Motor Driving

The motor driving circuit is formed when the Driver IC is selected in the first place. The A3977 (Motor driver IC) is used in this case. But, the resistance Rs value of sensing and the voltage value of the V reference can be changed by motor driving voltage value.

4.3.2 Main PBA (for ML-1750)

IC-LINE TRANSCEVIER

RC-NETWORK

FONT ROM

FLASH
MEMORY

MAIN CLK
12MHz

IC-USC

USB CLK
30MHz

VIDEO CLK
14.7456MHz

SDRAM

REGULATOR

CLOCK GENERATOR

IC-VOLTAGE COMP

SCHMITT INVERT

CPU(SPGPm)

MOTOR DRIVE IC

BUFFER

TONER
Samsung Electronics
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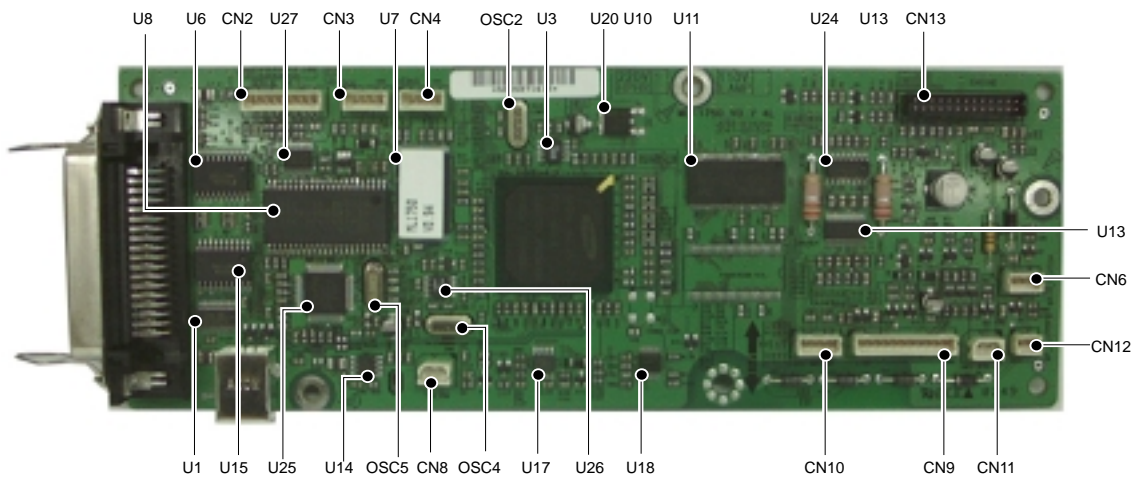
	ML-1710 (ML-1510)	ML-1750
Processor	Samsung Jupiter4 90MHz	Samsung SPGPm 166MHz
PC Interface	USB 1.1 USB	USB 2.0 USB/IEEE1284 (Parallel)
Emulation	SPL (Samsung Printer Language)	SPL, PCL6, IBM ProPrinter, EPSON
OS Compatibility	Win 98/Me/2000/XP Various Linux OS, Mac (Mac OS 8.6 ↑)	Win 9x/NT/4.0/Me/2000/XP Various Linux OS, Mac (Mac OS 8.6 ↑)
pcb	FR-4, 2Layer	FR-4, 4Layer

4.3.2.1 Asic (SPGPm), (for ML-1750)

1) ARM946ES
- 32-bit RISC embedded processor core
- 16KB instruction cache and 16KB data cache
- No Tightly Coupled Memory
- Memory Protection Unit & CP15 control program

2) Dual bus architecture for bus traffic distribution
- AMBA High performance Bus (AHB)
- System Bus with SDRAM

3) IEEE1284 compliant parallel port interface

4) Printer Video Controller for LBP engines

5) Graphic Execution Unit for Banding support of Printer Languages

6) Printer Video Controller for LBP engines
- PVC : Printer Video Controller without RET Algorithm
- HPVC : Printer Video Controller with RET algorithm
        (Line Memory & Lookup Table Memory : 512 x 8 , 4096 x 16)

7) Engine Controller
- Motor Control Unit
- Motor Speed Lookup Table Memory (128 x 16 x 2)
- Pulse Width Modulation Unit
- 4 Channels are supported
- ADC Interface Unit
- 3 ADC Channels are available
- ADC Core (ADC8MUX8) maximum clock frequency : 3 MHz

8) USB 2.0 Interface

9) Package : 272 pins PBGA

10) Power : 1.8V(Core), 3.3V(IO) power operation

11) Speed : 166MHz core(ARM946ES) operation, 60MHz bus operation

4.3.2.2 Memory (for ML-1750)

1) Flash Memory
- It stores the System Program, downloads the System program through PC Interface, and compresses the PCL font, then stores it.
- Capacity : 2M Byte
- Access Time : 70 nsec

2) DRAM
- It is used as Swath buffer, System working memory area, etc. when printing. It stores the font list, compressed into flash memory, on DRAM and uses it as PCL font.
- Capacity : 8M Byte (Basic), upto 64M Byte (Factory Option)
- Type : SDRAM 100MHz/133MHz , 16bit

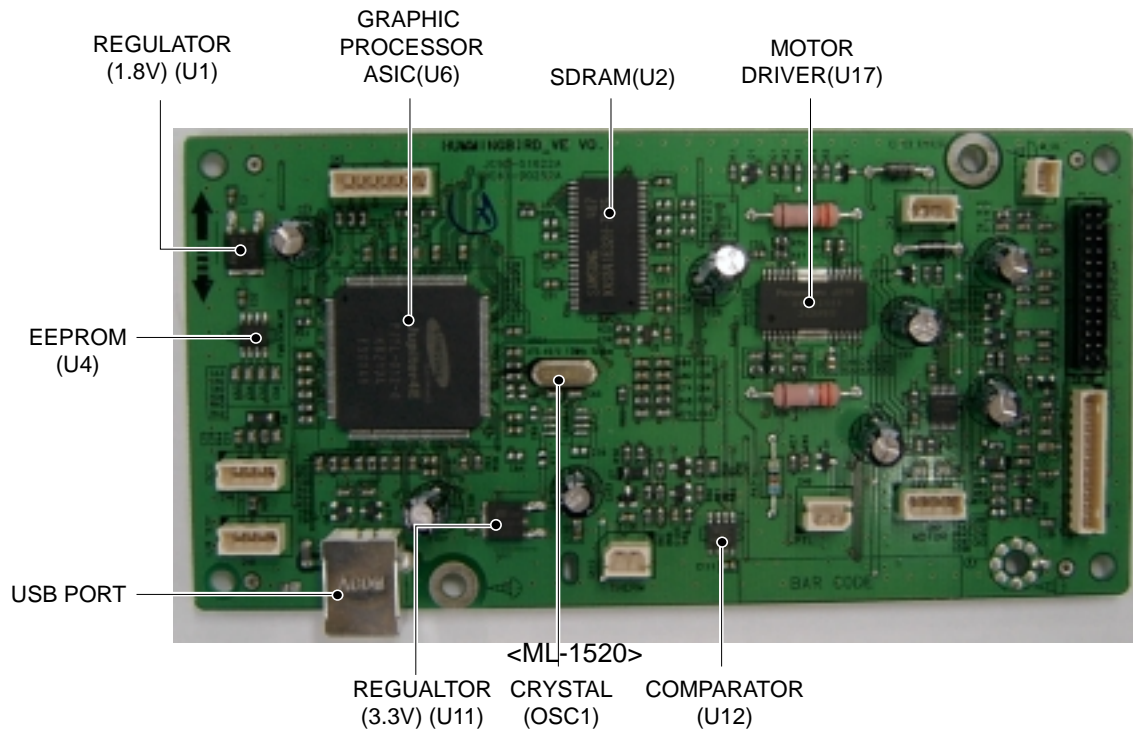## 4.3.2.3 SPGPm Internal Block Diagram (for ML-1750)
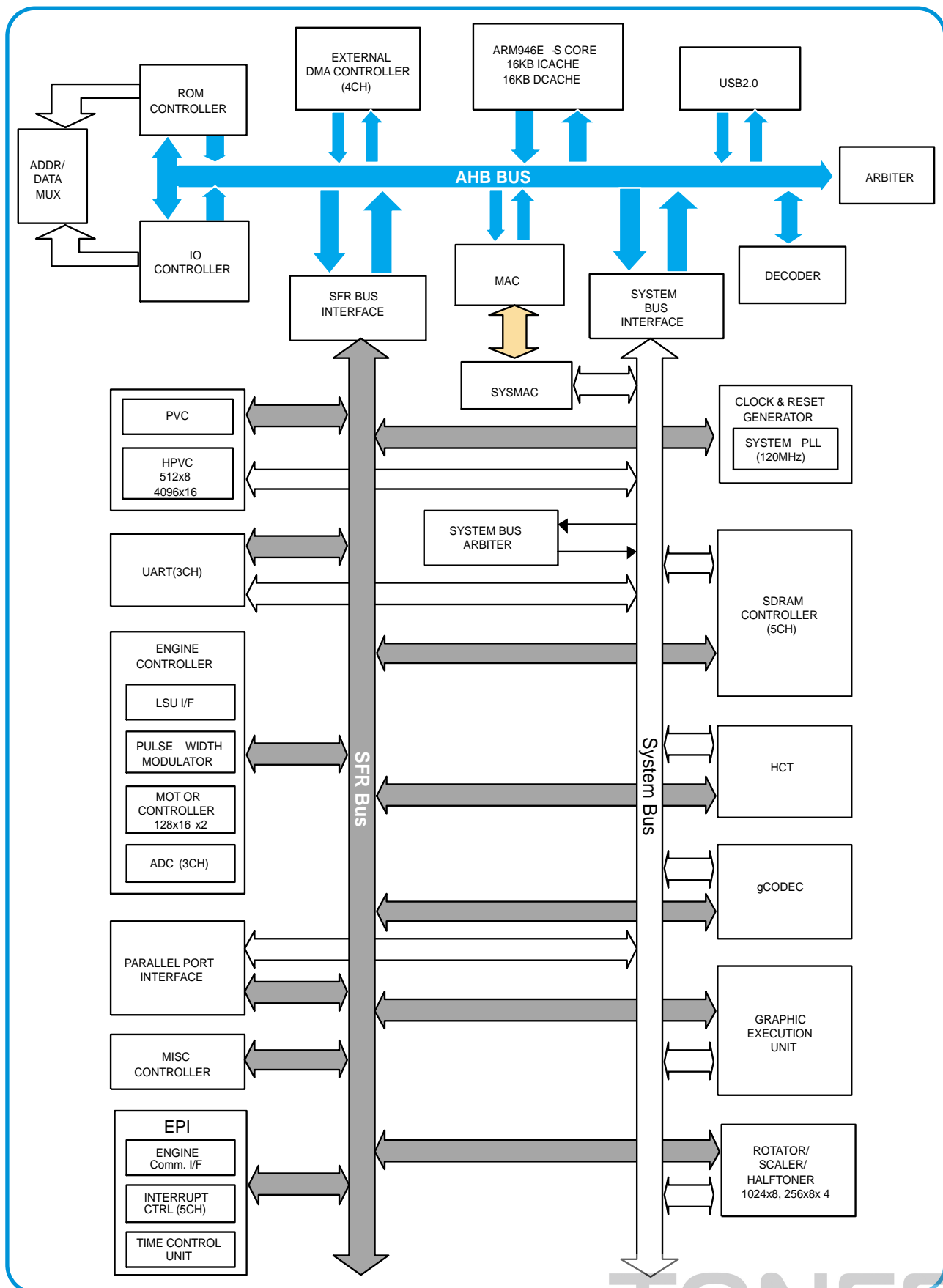
4.3.3 Main PBA (for ML-1520)

The Engine Board and the Controller Board are in one united board, and it is consisted of CPU part and print part in functional aspect. The CPU is functioned as the bus control, I/O handling, drivers, and PC interface.
The main board sends the Current Image dlml Video data to the LSU and manages the conduct of Electrophotography for printing. It is consisted of the circuits of the motor (paper feed, pass)
driving, clutch driving, pre-transfer lamp driving, current driving, and fan driving.
The signals from the paper feed jam sensor and paper empty sensor are directly inputted to the main board.

REGULATOR (1.8V) (U1)
GRAPHIC PROCESSOR ASIC(U6)
SDRAM(U2)
MOTOR DRIVER(U17)
EEPROM (U4)
USB PORT
<ML-1520>
REGUALTOR (3.3V) (U11)
CRYSTAL (OSC1)
COMPARATOR (U12)

4.3.3.1 ASIC (Jupiter 4E), (for ML-1520)

Jupiter4E is one chip Micro-controller which is developed for Low-end Laser Beam Printers.

• Block Diagram (Jupiter 4E)
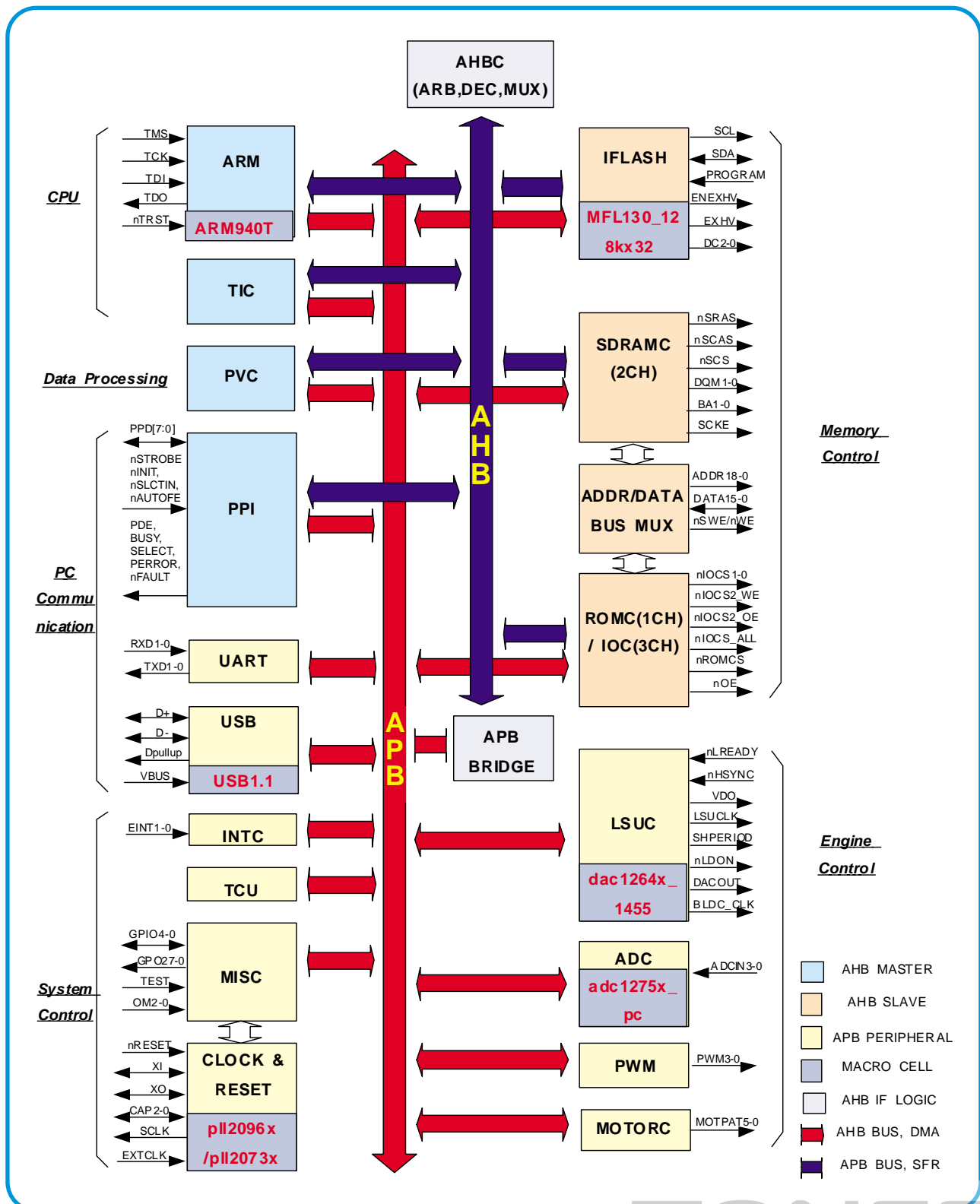
- **One Chip Laser Beam Printer Controller**
    - GDI only
    - AMBA AHB used for high speed bus transactions between masters and slaves
    - AMBA APB used for low speed bus transactions between ARM core and peripherals
    - 3 PLLs (2 Dithered PLL and 1 General PLL)
    - first for CPU(150MHz), AHB(75MHz), APB(75MHz),
    - second for USB(48MHz)
    - third for PVC(80MHz)
    - 75MHz system operation
    - 1.8V power operation
    - 3.3V tolerant input and bi-directional I/Os
    - SDRAM, FLASH(ROM) and IO Address / Data signals multiplexing

- **Integrated ARM940T 32-bit RISC embedded processor core**
    - 75MHz core frequency operation
    - Harvard Architecture Cache : 4KByte Instruction cache, 4KByte Data cache
    - Single memory bus architecture

- **Built in Flash Memory**
    - 4MBits (128Kx32bits)
    - Serial programming mode using flash programmer tool
    - Internally flash memory read / write operation support
    - Programmable access timing control

- **32MB Special Function Register Area**

- **Directly connected to 3 external IO banks (IOC)**
    - 1 MB Area size in each IO bank
    - Programmable setup, access, hold timing
    - Programmable recovery time for slow devices
    - Allows to access peripheral devices such as GPIO control logic
    - bus wait permitted

- **Directly connected to 1 external ROM bank (ROMC)**
    - 1 MB Area size for one ROM bank.
    - Max 1 MB size.
    - One external Flash(ROM) memory attachable.

- **Directly connected to two SDRAM banks (SDRAMC)**
    - Extensible architecture
    - Two external SDRAMs attachable
    - SDRAM Controller supports PC-100 and PC-133 SDRAM running at 75MHz
    - Up to 32MB per bank
    - Support for SDRAM configurations including programmable column address
    - Programmable refresh interval

- **Interrupt Controller (INTC)**
    - FIQ or IRQ mode operation selectable
    - Programmable interrupt enable/disable
    - 2 External interrupt source acceptable

• USB interface
- Version 1.1
- Four 128x8 FIFOs for Data transmission.
- Interrupt based input / output interface, no DMA based interface support
- USB wrapper for AHB interface
- AHB Bus interface

• Serial port interface (UART)
- Programmable Baud Rate
- 2 channel Independent Full Duplex UART
- Polling, Interrupt based operation support
- Max 16 byte FIFO to handle SIR Bit Rate Speed

• Printer video controller for LBP engines (PVC)
- 20MHz video rate (Hummingbird 2 : letter - 21 ppm, A4 : 20ppm)
- Video data transmitted through LSU Controller
- Two selectable Video Clock sources , one PLL output, the other External Video Clock Oscillator.

• Laser Scan Unit (LSU) Controller
- Laser Scan Unit (LSU) Interface for Laser Diode turn on/off timing control
- Sample & hold period generation.
- Auto Power Control for Laser Diode with PID control method using internal 10 bits DAC.
- LSU clock generation
- Brushless DC motor control clock generation

• ADC Interface
- 4 channels ADC interface for analog devices such as temperature sensor.
- Programmable ADC Clock Cycle.
- Automatic or Manual AD Conversion support.
- 4 Special Function Registers for monitoring the ADC results for 4 channels.

• PWM Controller
- 4 PWM output ports - THV, BIAS, FAN control and AC ELECTRIFICATION

• Bi-polar Stepper Motor controller (MOTORC)
- Phase generation for the purpose of paper feeding
- fixed hardware phase and current table
- programmable phase and interval time
- Interrupt based phase change operation
- Muxed with 6 GPO ports.

• Timer
- 3 Independent Programmable Timers
- Watch Dog Timer for S/W Trap

• Miscellaneous
- Mux controlled 24 GPI, 28 GPO & 5 GPIO ports
- Mutual exclusive GPO/GPIO ports control by the port control enable register
- Programmable Bus Master Priority.
- Project code added.

4.4 SMPS and HVPS Description (for ML-15XX/17XX)

4.4.1 General (for ML-1510/1710/1750)

The SMPS supplies the DC power to the system.
It takes 110V/220V and outputs the +3.3V, +5V and +24V to supply the power to the main board and ADF board.
The HVPS part creates the high voltage of THV/MHV/Supply/Dev and supplies it to the developer part for making the best condition to display the image. The HVPS part takes the 24V and outputs the high voltage for THV/MHV/BIAS, and the outputted high voltage is supplied to the toner, OPC cartridge, and transfer roller.

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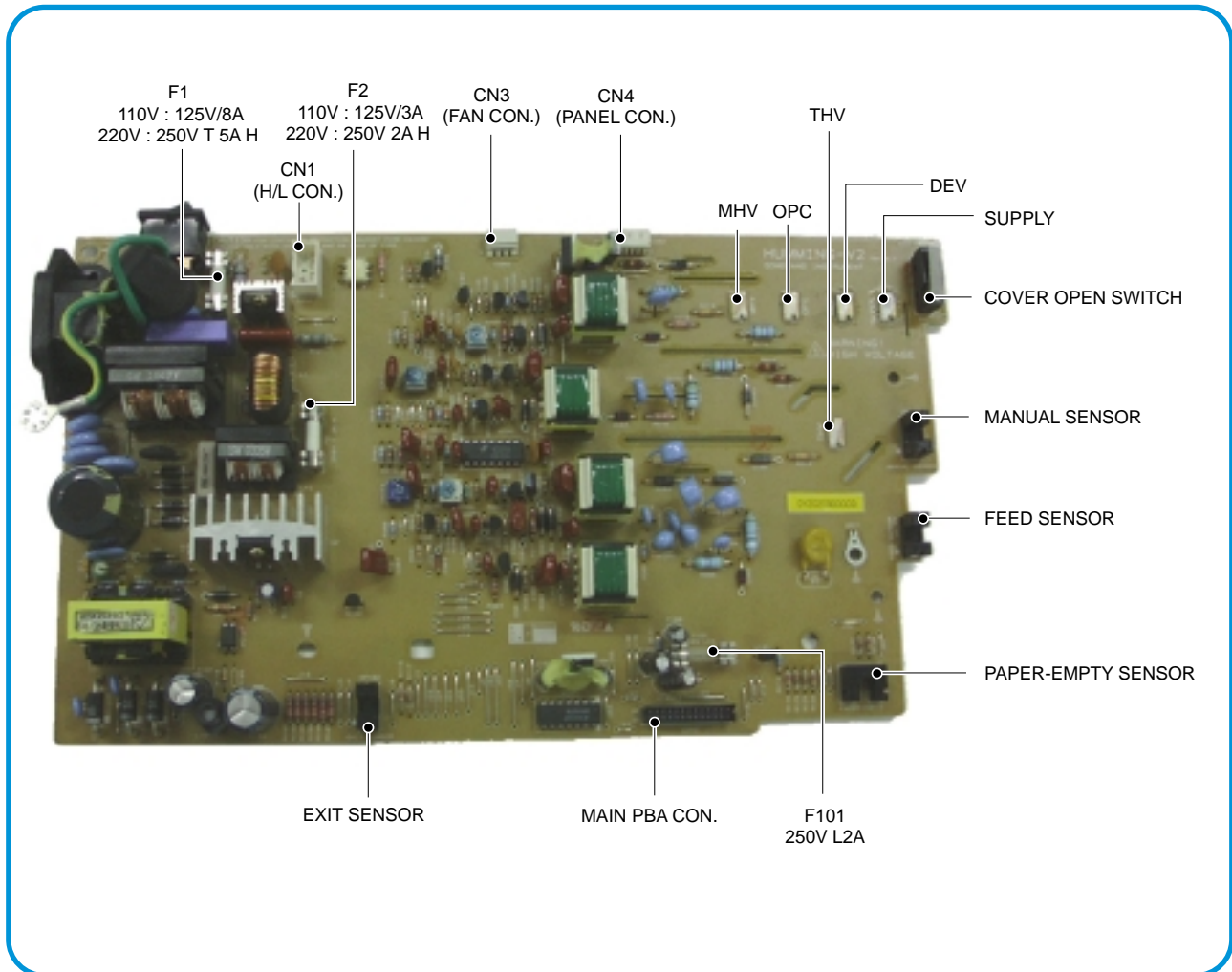
4.4.2 HVPS (High Voltage Power Supply), (for ML-15XX/17XX)

1) Transfer High Voltage (THV+)
- Function: It is a voltage to transfer a toner developed on OPC drum to a paper.
- Output voltage: Maximum +5.0KV ±5% (Duty changeable, unload)
- 1.0KV ±15%(When cleaning, 200MOhm)
- Error: If THV (+) doesn't output, a ghost status (same character is printed after one cycle (76mm) of OPC) with a low density occurs due to a toner on OPC drum cannot normally transfer to a paper.

2) Charge Voltage (MHV)
- Function: It is a voltage to charge entire surface of OPC with -900V ~ -1000V.
- Output voltage: -1.3KV ~ 1.8KV DC ±50V
- Error: If MHV doesn't output, a black paper is printed out because toner on developing roller moves to OPC drum due to the surface of OPC is not charged.

3)Cleaning Voltage (THV-)
- Function: It removes a dirty on a surface by sending a minus toner in a transfer roller to an OPC drum to recover toners.
- Output Voltage: There is no feedback control, so change range of output is big up to load.
- Error: Toner contamination occurs at a backside of a printed-paper.

4) Developing Voltage (DEV)
- Function: It is a voltage to develop a toner with using a difference of electronic potential on an exposed part by LSU (Laser Scanning Unit).
- * Generally, the electronic potential of exposed OPC is -180V and exposed developer is -350V when printing, so toner with minus (-) is developed on an exposed part.
- Output voltage: -200V ~ 600V DC ±20V
- Error: 1. If DEV is GND, a density is going significantly down.
         2. If DEV is floating due to instable contacting point of terminal, and etc., a density is significantly going up.

5) Supply Voltage(SUP)
- Function: It is a voltage to supply toner to a developing roller.
- Output voltage: : -400V ~ 800V DC °æ 50V(Use ZENER, DEV gear)
- Error: 1. If SUP is GND, a density is dramatically going down.
         2. If SUP is floating due to instable contacting point of terminal, and etc., a density is significantly going down as much as it cannot be recognized with eyes.

4.4.3 SMPS (Switching Mode Power Supply), (for ML-1510/1710/1750)

t is the power source for the whole system. It is an independent module, so it is possible to use for common use. It is mounted at the bottom of the set.

It is consisted of the SMPS part, which supplies the DC power for driving the system, and the AC heater control part, which supplies the power to fuser. SMPS has three outputting channels (3.3V, +5V and +24V). There are three kinds of power, 120V exclusive (America), 220V exclusive (Europe), and 220V for china (nations with instable power supply).

1) AC Input
- Inputting rated voltage : AC 220V ~ 240V AC 120V / AC 220V
- Inputting voltage fluctuating range : AC 198V ~ 264V AC 90V ~ 135V / AC 198V ~ 264V
- Rated frequency : 50/60 Hz
- Frequency fluctuating range : 47 ~ 63 Hz
- Inputting voltage : Under 4.0Arms/2.0Arms
  (The state when lamp is off or rated voltage is inputted/outputted)

2) Rated Power Output

NO	Item	CH1	CH2	CH3	Remark
1	Channel name	+3.3V	+5V	+24.0V	
2	CONNECTOR PIN	CON 3 3.3V PIN: 3, 4 GND PIN: 5, 6	CON3 5V PIN : 8 GND PIN: 7	CON 3 24V PIN: 11, 12, 13 GND : 9. 10	
3	Rated outputting voltage	3.3V ± 5% (3.2 ~ 3.4V)	+5V ± 5% (4.75 ~ 5.25V)	+24V ± 10% (21.6 ~ 26.4V)	
4	Maximum outputting voltage	1.0 A	0.14A	2.0 A	
5	Peak loading voltage	1.5 A	0.14A	2.0 A	1ms
6	Ripple noise voltage	100mVp-p	100mVp-p	500mVp-p	
7	Maximum output	3.3W	0.35W	48W	
8	Peak output	4.95W	0.7W	60W	1ms
9	Uses	Logic part	LSU LD	Main Motor HVPS Solenoid Fan	

3) Consumption Power

NO	Item	CH1 (+3.3V)	CH2 (+5V)	CH3 (+24V)	System
1	Stand-By	1.0 A	0.07A	0.4 A	AVG : 55 Wh
2	PRINTING	1.0 A	0.14A	2.0 A	AVG : 250 Wh
3	Sleep-Mode	0.8A	0.01A	0.4A	AVG : 10 Wh

4) Length of Power Cord : 1830 ± 50mm

5) Power Switch : Use

SMPS (Switching Mode Power Supply), (for ML-1520)

This is the power source for the whole system. It is an independent module so that it is possible to use it for common use. It is mounted at the bottom of the set.

It consists of the SMPS section, which supplies the DC power to drive the system, and the AC heater control part, which supplies the power to the fuser. The SMPS has four output channels (+5V and +24VS).

There are three kinds of power, 120V exclusive (America), 220V exclusive (Europe), and 220V for China (nations with unstable power supply).

1) AC Input

- Inputting rated voltage : AC 220V ~ 240V AC 110~127V
- Inputting voltage fluctuating range : AC 198V ~ 264V AC 90V ~ 135V
- Rated frequency : 50/60 Hz
- Frequency fluctuating range : 47 ~ 63 Hz
- Inputting Current : Under 4.0Arms/2.0Arms (when heat lamp is off)

2) Rated Power Output

NO	Item	CH1	CH2	Remark
1	Channel name	+5V	+24VS	
2	Connector Pin	CON 4 5V PIN: 3, 4 GND PIN: 5, 6, 8 ,9,10	CON 4 24V PIN: 11, 12 GND : 8, 9, 10	
3	Rated Output Voltage	+5V ± 5% (4.75 ~ 5.25V)	+24VS - 10/15% (21.6 ~ 27.46V)	
4	Max. Output current	1.0 A	1.5 A	
5	Peak Loading voltage	1.5 A	2.5 A	1ms
6	Ripple noise voltage	Under 150m Vp-p	Under 500m Vp-p	
7	Maximum output	5.0W	36W	

3) Consumption Power

NO	Item	CH1 (+5V)	CH2 (+24VS)	System
1	Stand-By	0.2 A	0.14 A	AVG : 60 Wh
2	PRINTING	1.0 A	1.5 A	AVG : 300 Wh
3	Sleep-Mode	0.2A	0.05A	AVG : 10 Wh

4) Length of Power Cord : 1830 ± 50mm

5) Power Switch : Fitted

6) Feature
- Insulation resistance : over 50M Ω (at DC500V)
- Insulation retest pressure : Must be no problem within 1min. (at 1500Vzc, 10mA)
- Leakage voltage : under 3.5mA
- Running voltage : under 40A peak (at 25°c, Cold start) Under 60A peak (in other conditions)
- Rise Time : Within 2Sec
- Fall Time : Over 20ms
- Surge : Ring Wave 6KV-500A (Normal, Common)

7) Environment Condition
- Operating temperature range : 0°c ~ 40°c
- Storage temperature range : -25°c ~ 85°c
- Storage humidity range : 30% ~ 90% RH
- Operating atmospheric pressure range : 1

4.4.3 Fuser AC Power Control

The Fuser (HEAT LAMP) is heated using AC power. The AC power is controlled by a Triac (THY1), a semiconductor switch. 'On/Off control' is achieved when the gate of the Triac is turned on/off by a Photo triac (PC1), this is an insulting part.
In the other words the AC control part is a passive circuit. It turns the heat lamp on/off by taking a signal from the engine control section. When the 'HEATER ON' signal is activated by the engine the LED of PC1 (Photo Triac) flashes. The flashing light causes the Triac (PC1) to switch and a voltage is supplied to the gate of Triac THY1. As a result AC current flows in the heat lamp, and heat is produced. On the other hand, when the signal is off, PC1 is off, the voltage is cut off at the gate of Triac THY1, this Triac is therefore off, and thus the heat lamp is turned off.

1) Triac (THY1) feature
- 12A,600V SWITCHING

2) Phototriac Coupler (PC3)
- Turn On If Current : 15mA ~ 50mA(Design: 16mA)
- High Repetive Peak Off State Voltage : Min 600V

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4.5 Engine F/W (for ML-15XX/17XX)

4.5.1 Feeding

If feeding from a cassette, the drive of the pickup roller is controlled by controlling the solenoid. The on/off of the solenoid is controlled by controlling the general output port or the external output port. If feeding from a manual feeder, decide to insert the paper according to the operation of the manual sensor, and by driving the main motor, insert the paper in front of the feed sensor. While paper moves, occurrence of jam is judged as below. (Refer to the [6.2 Paper Transfer rout])

4.5.1.1 Jam 0
• After picking up, paper cannot entered due to paper didn't feed.
• After picking up, paper entered but it cannot reach to the feed sensor in certain time due to slip, etc.
• After picking up, if the feed sensor is not on, repack up. After repacking up, if the feed sensor is not on after certain time, it is Jam 0.
  - It is a status that the leading edge of the paper doesn't pass the feed sensor.
• Even though the paper reaches to the feed sensor, the feed sensor doesn't be on.
  - It is a status that the leading edge of the paper already passes the feed sensor.

4.5.1.2 Jam 1
• After the leading edge of the paper passes the feed sensor, the tailing edge of the paper cannot pass the feed sensor after certain time. (The feed sensor cannot be Off)
• After the leading edge of the paper passes the feed sensor, the paper cannot reach the exit sensor after certain time. (The exit sensor cannot be On)
  - The paper exists between the feed sensor and the exit sensor.

4.5.1.3 Jam 2
• After the tailing edge of the paper passes the feed sensor, the paper cannot pass the exit sensor after certain time.

4.5.2 Drive

By gearing, the main motor drives the rollers such as feeding roller, developing roller, fuser roller, and distributing roller. The step motor is controlled for the sections, acceleration section and fixed speed section. In the initial stage of the motor run, appoint the acceleration section to prevent the isolation of the motor. It is controlled by the A3977 motor driver IC. The step signal and the enable signal are sent to make the phase for driving the motor in CPU.

4.5.3 Transfer

The charging voltage, developing voltage and the transfer voltage are controller by PWM (Pulse Width Modulation). The each output voltage is changeable due to the PWM duty. The transfer voltage admitted when the paper passes the transfer roller is decided by environment recognition. The resistance value of the transfer roller is changed due to the surrounding environment or the environment of the set, and the voltage value, which changes due to the environments, is changed through AD converter. The voltage value for impressing to the transfer roller is decided by the changed value.

4.5.4 Fusing

The temperature change of the heat roller's surface is changed to the resistance value through the thermistor. By converting the voltage value, which impressed to the resistance, to the digital value through the AD converter, the temperature is decided. The AC power is controlled by comparing the target temperature to the value from the thermistor. If the value from the thermistor is out of the controlling range while controlling the fusing, the error stated in the table occurs. (For the domestic model, the Q-PID method has been applied.)

4.5.4.1 Heat Lamp Method

| Error	Description	DCU	LED Displat
Open heat error	When warming up, it has been lower than 68°C over 28 seconds	60	All LED are blinking.

Lower heat error	• Standby:
	  It has been lower than 80°C over 10 seconds
	• Printing:
	  - 2 consecutive pages: it has been lower than 145°C over 4 seconds.
	  - 3 consecutive page; it has been 25°C lower than the fixed fusing temperature over 4 seconds.
		62	All LED are blinking

Over heat error	It have been higher than 220°C over 3 seconds	68	All LED are blinking

4.5.4.2 Q-PID Method (Not use model : ML-1520)

Error	Description	DCU	LED Displat
Open heat error	When preheating, it has been lower than 68°C over 15 seconds.	60	All LED are blinking
Lower heat error	• After finishing the preheating stage, it has not reached 100°C (preheating stop temperature) during 15 seconds since the temperature is over 68°C. • Printing 1) When the main motor is on and after 0.92 second, it has not reached the 160°C during 20 seconds. 2) From the 2 consecutive pages, it has been 20°C lower than the fusing temperature over 4 seconds.	62	All LED are blinking
Over heat error	• the error is not displayed immediately when it has been over 220°C over 3 seconds. The temperature after the 3 seconds is checked. If it is over 240°C, it is error. • If the temperature has been higher than 220°C over 25 seconds, it is an error even through the temperature doesn't reach 240°C.	68	All LED are blinking

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4.5.4.3 What is the Q-PID Method?

The Q-PID is developed by Samsung, and it saves the preheating time in half in comparison with the existed method. It saves not only the printing time for initial print but also it saves the printing speed for the reattempting print after for a while.
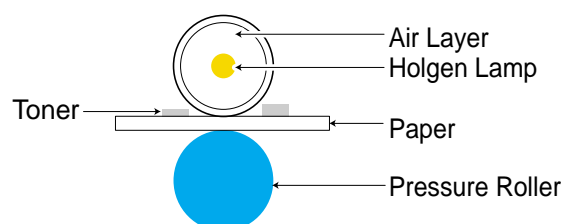
- After heating the air layer, transfer the heat to the surface
- It takes long time to heat it until it reaches the proper temperature.
- The high temperature is needed when it is stand-by status.
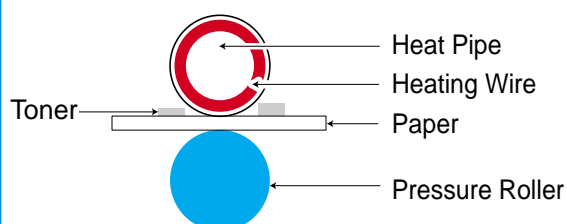
- The heat conductivity of the heat pipe is 100~150 times higher than cooper's.
- It is possible to raise the temperature in an instant
- It saves the dissipation of power in the standby status due to high accumulation of heat.

4.5.5 LSU

The LSU is consisted of the LD (Laser Diode) and the polygon motor control. When the printing signal occurs, it turns the LD and drives the polygon motor. When the receiving light part detects the beam, Hsync occurs. When the polygon motor speed becomes a normal, LReady occurs. If two conditions are satisfied, the status bit of the LSU controller register becomes 1 to be judged that the LSU is ready. If two conditions are not satisfied, the error shown in below occurs.

Error	Description	DCU
Polygon motor error	When the polygon motor's speed doesn't become a normal	95
Hsync error	The polygon motor's speed is normal, but the Hsync signal is not created.	96

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