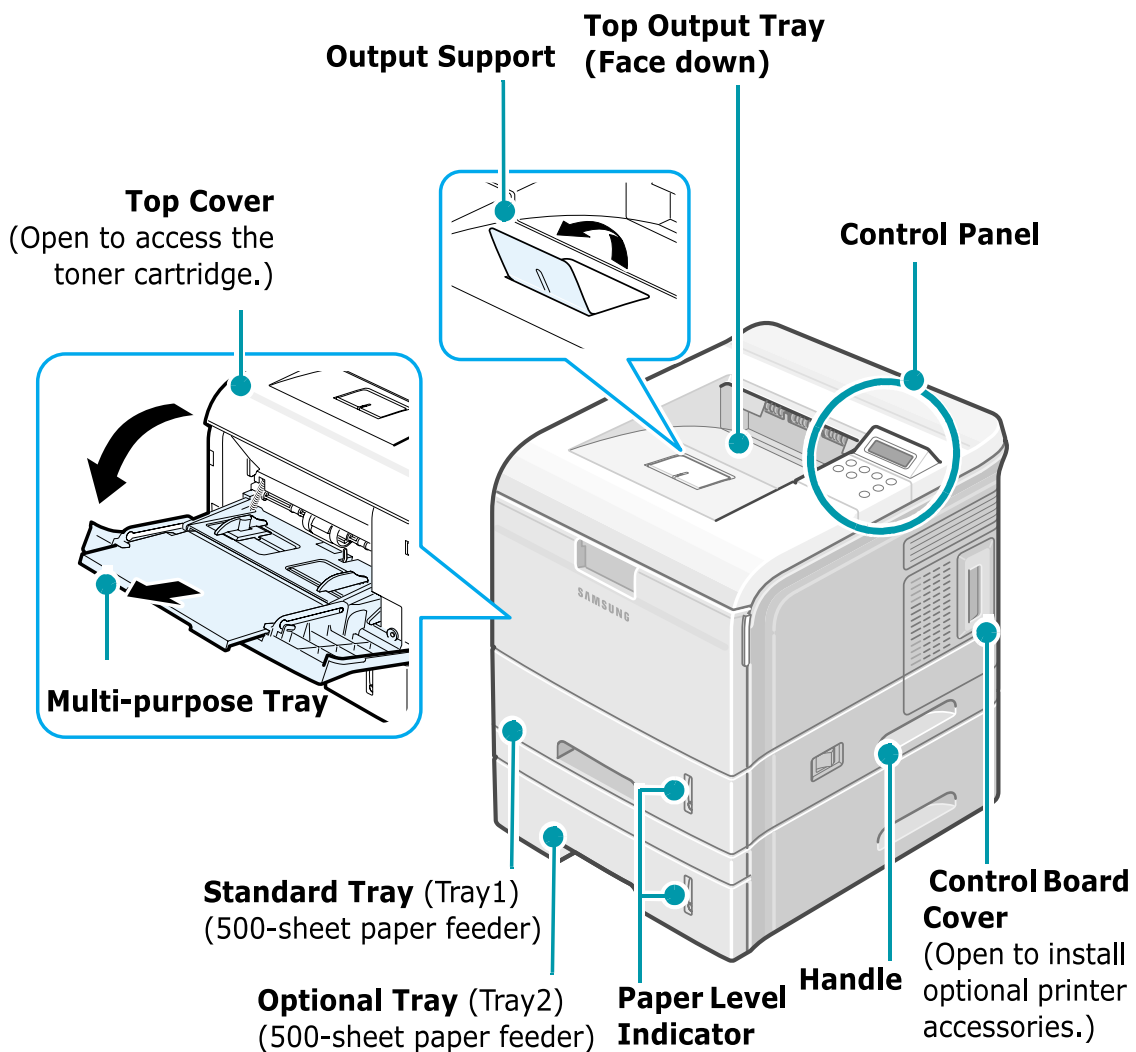


4. Summary of Product

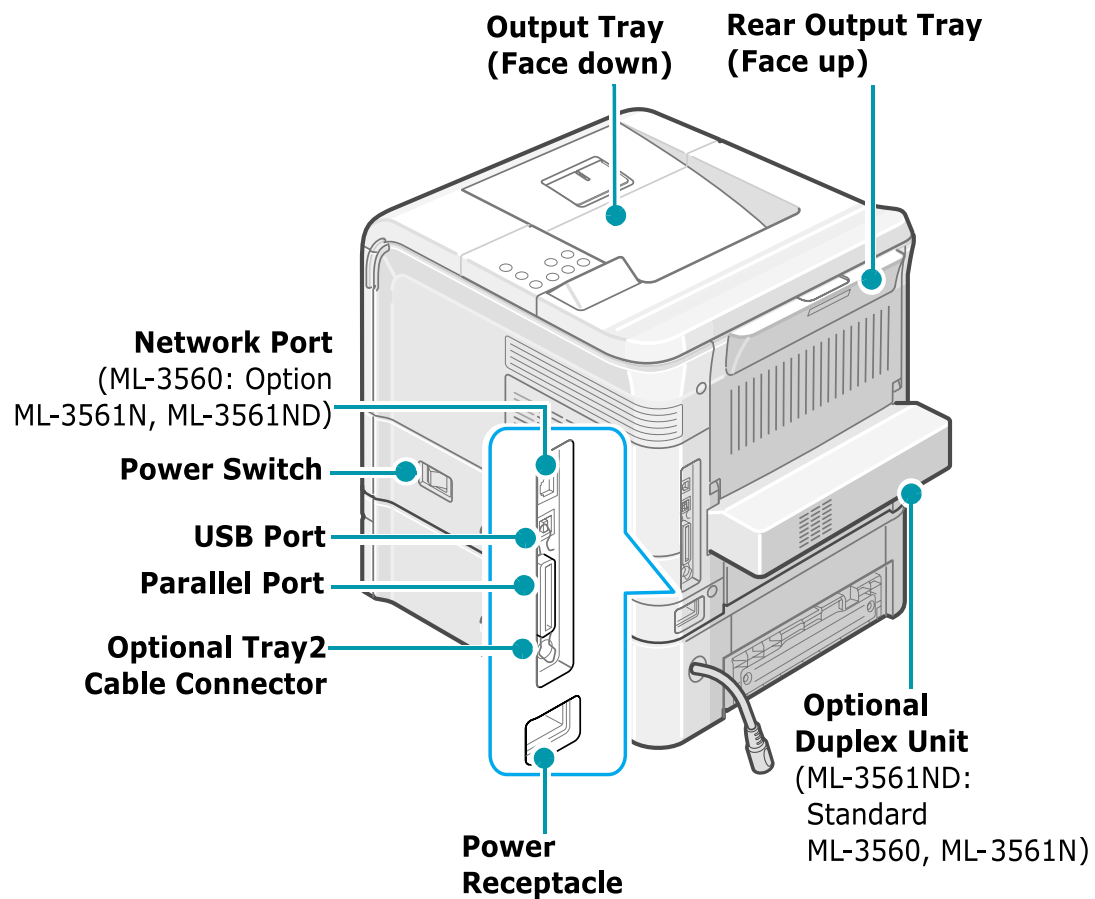
This chapter describes the functions and operating principal of the main component.

4.1 Printer Components

4.1.1 Front View

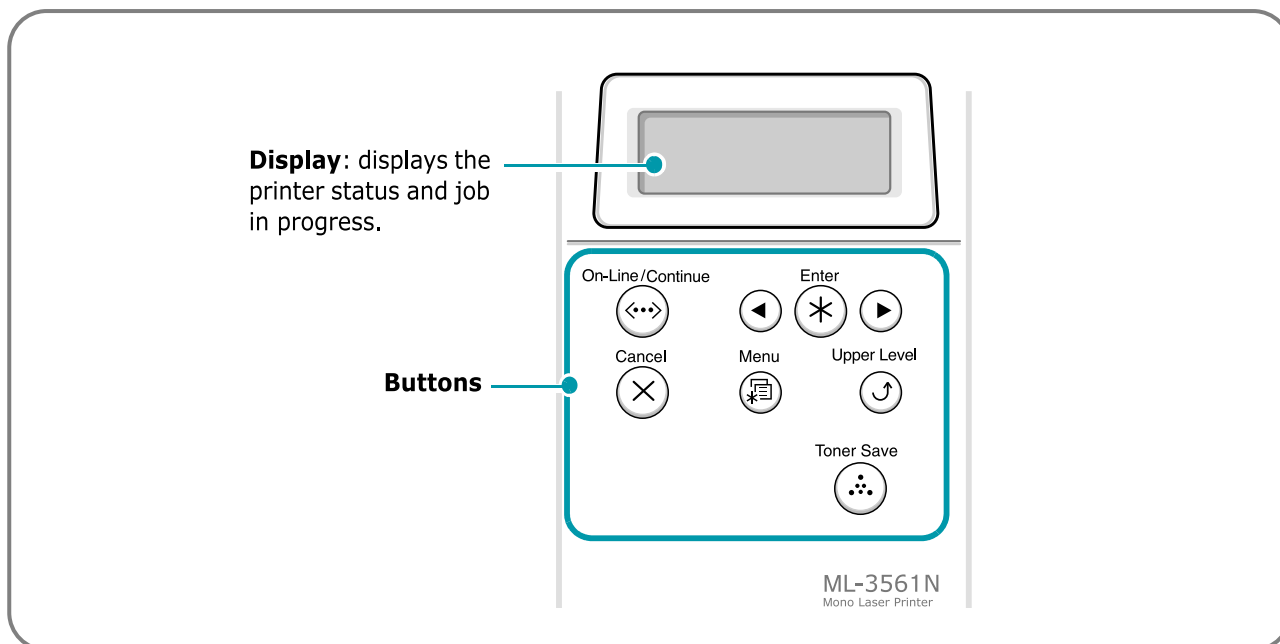


4.1.2 Rear View



4.1.3 Control Panel

The control panel on the top right side of your printer has the display and the nine buttons.

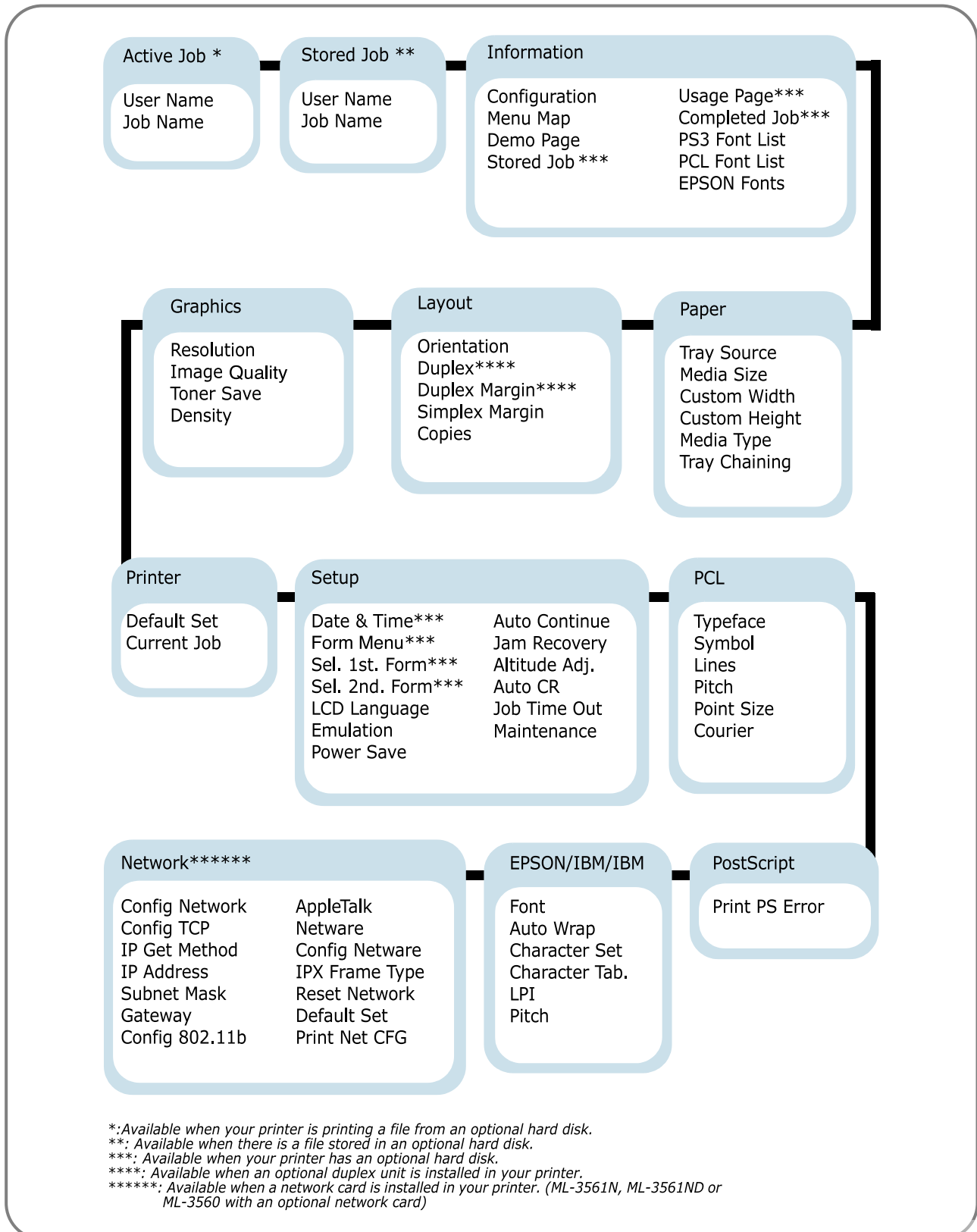


4.1.3.1 Display

| Message | Description |
|---|--|
| Ready | <ul style="list-style-type: none"> The printer is on-line and ready to print. If you press the On Line/Continue button (⋯), the printer goes to off-line. |
| Offline | <ul style="list-style-type: none"> The printer is off-line and cannot print. If you press the On Line/Continue button (⋯), the printer switches to on-line. |
| Printing XXX * xxx is the current emulation. | <ul style="list-style-type: none"> The printer is printing. If you want to stop printing, press the Cancel button (⊗). |
| Sleeping... | <ul style="list-style-type: none"> The printer is in the Power Save mode, consuming less power. When a print job is received from the computer, or if any button is pressed, the printer switches to on-line. To deactivate the Power Save mode or change the power-saving time. |

4.1.3.2 Overview of Control Panel Menus

The control panel menus are used to configure the printer for your environment.



4.1.3.3 Special Features

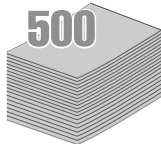
Your new printer is equipped with special features that improve the print quality, giving you a competitive edge. You can:

Print with excellent quality and high speed



- You can print at 1200 dots per inch (dpi).
- Your printer prints 35 pages-per-minute (Letter size), 33 pages-per-minute (A4 size).

Handle paper flexibly



- A 100-sheet Multi-Purpose Tray supports letterheads, envelopes, labels, transparencies, custom-sized materials, postcards, and heavy paper.
- Standard 500-sheet input tray (Tray1) and optional 500-sheet input tray (Tray2) supports all standard sizes of paper.
- Two output tray; select either the top output (face-down) or the rear output tray (face-up) for the most convenient access.
- Straight-through paper path capability from the Multi-Purpose Tray to the rear output tray.

Create professional documents



- You can customize your documents using **Watermarks**, such as "Confidential."
- Print **Booklets**. This feature enables you to easily print the pages required to create books. Once printed, all you have to do is to fold and staple the pages.
- Print **Posters**. The text and pictures of each page of your document are magnified and printed across the selected sheet of paper. After the document has printed, trim off the white edges of each sheet. Tape the sheets together to form a poster.

Save your time and money



- This printer allows you to use **Draft** to save toner.
- You can print on both sides of the paper to save paper (double-sided printing).
- You can print multiple pages on one single sheet of paper to save paper (N-Up printing).
- Preprinted forms and letterheads can be printed on plain paper.
- This printer automatically conserves electricity by substantially reducing power consumption when not printing.
- This printer meets Energy Star guidelines for energy efficiency.

Expand the printer capacity

The following printer options and supplies are available for Phaser 3500 printers:

| Item | Part Number |
|---|-------------|
| 32 Mbytes additional RAM memory | ML-05MB/SEE |
| 64 Mbytes additional RAM memory | ML-05MC/SEE |
| 128 Mbytes additional RAM memory | ML-05MD/SEE |
| 256 Mbytes additional RAM memory | ML-05ME/SEE |
| Network Interface Card (NIC) | - |
| Duplex Unit | - |
| 500-Sheet Feeder (includes tray) | - |
| Standard-Capacity Print Cartridge (6,000 pages @ 5% area coverage) | ML-3560D6 |
| High-Capacity Print Cartridge (12,000 pages @ 5% area coverage) | ML-3560DB |

Print in various environments



- You can print in Windows 95/98/Me/NT 4.0/2000/XP .
- Your printer is compatible with Linux and Macintosh .
- Your printer comes with both the Parallel and USB interfaces.

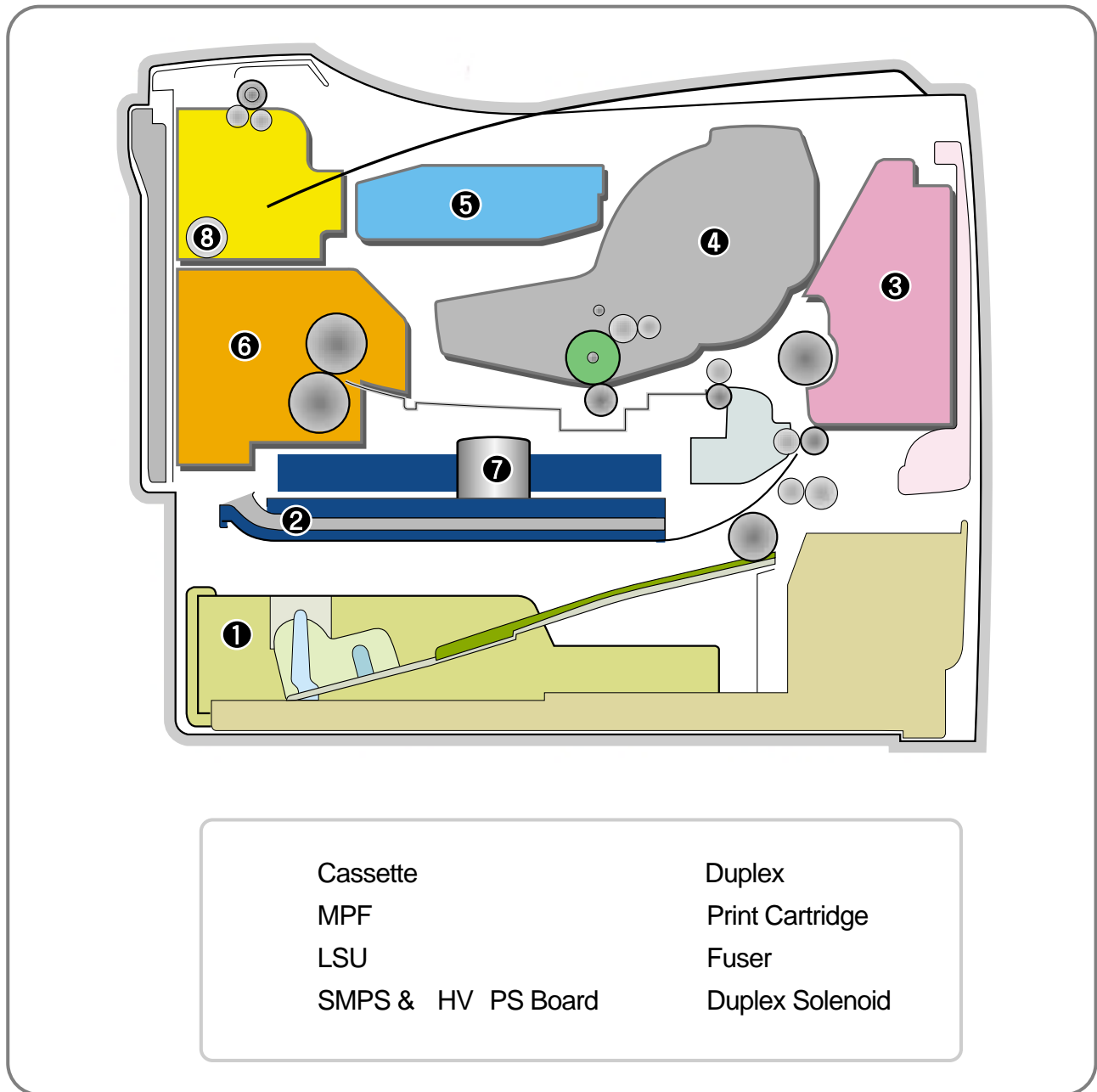
You can also use a network interface. ML-3561N comes with a built-in **network interface**, 10/100 Base TX. ML-3561N also has a wireless network interface. But, you need to add the optional network interface card to ML-3560.

Printer Features

The table below lists a general overview of features supported by your printer.

| Features | Printer Configuration | | |
|--------------------------------------|-----------------------|---------------|---------------|
| | ML-3560 | ML-3561N | ML-3561ND |
| Maximum Print Speed Monochrome | 35 | 35 | 35 |
| Memory (Standard) | 32 Mbytes | 32 Mbytes | 64 Mbytes |
| Up to 286 Mbytes Optional | | | |
| PostScript and PCL Fonts | Yes | Yes | Yes |
| Default Resolutions (dpi) | 600 x 600 dpi | 600 x 600 dpi | 600 x 600 dpi |
| 500-Sheet Feeder | Optional | Optional | Optional |
| Network Interface | Optional | Standard | Standard |
| Automatic 2-Sided Printing (Duplex) | Optional | Optional | Standard |
| HDD | Optional | Optional | Optional |
| Wire Less N/W(802.11b) | Optional | Optional | Optional |
| Duplex Unit | Optional | Optional | Standard |

4.2 System Layout



4.2.1 Feeding

It consists of a basic cassette, an MP tray for supplying different types of media : envelope, label special paper, duplex unit, and parts related to paper transferring.

1) Separation method

Separate it from the friction pad mounted to the center of the cassette and apply retard roller that uses a spring clutch. A feed roller uses an electronic clutch to control driving power.

2) Basic cassette

It takes a center loading method and applies 'friction pad separating method.' It means that there is a paper sensor, but a paper size is detected after detecting the first paper by software.

Both the side guide and the rear guide can be adjusted for various types of papers from A5 to legal size paper.

It has a paper existence sensing function (Capacity: 500 sheets of general paper) , paper arranging function, various size papers accepting function, SCF paper path function, and displaying function of paper remaining amount.

In the front side, there is a paper level indicator.

3) Pick-up roller

It has functions such as a paper pickup function, driving control function, paper feeding function, and removing electronic static function.

4) Retard roller

It takes an arrangement method which uses a stopper roller and a weight without electric actuator. It has paper separating function, driving control function, and multi feeding prevention function.

6) Registration roller

It has a paper arranging function, paper transferring function, paper detecting function, jam removing function, and so on.

7) MP tray

It has a paper arranging function, paper transferring function, jam removing function, and so on.

It uses rubbing pad method to feed 100 sheets of general papers and 10 envelopes.

It is possible to extend to 300mm for accepting a legal size paper.

8) Duplex unit

It has paper transferring function, paper guide function, jam removing function, paper sensing function, and main board supporting function.

It is designed for basic attachment, and the duplex feeding takes a side feeding method. Usable papers are A4, letter, and legal size paper.

For removing a jam occurred in a front part, it is designed to open a cassette and a guide.

It is designed to open a rear cover to remove a jam in a rear part.

If a face up tray is open, the duplex option cannot be used.

9) SCF (Second Cassette Feeder)

It is the same method with the main cassette, and the capacity is 500 sheets.

It has a separate driving mechanism. It is designed for a common use with a main cassette.

4.2.2 Transfer

It consists of a PTL (Pre-transfer Lamp) and a transfer roller. A PTL sheds light on an OPC drum, lowers an electric potential of an OPC drum's surface, and improves the efficiency of the transfer.

A transfer roller transfers toner on an OPC drum to the paper.

Life span: Print over 150,000 sheets (In 16~27°C)

4.2.3 Driver Ass'y

By driving the motor, the system takes power. It consists of a main motor for feeding fuser and duplex reverse turn, and a deve-motor for a toner cartridge.

- Main Motor : DC 24V , Rated RPM : 1380 rpm
- Deve Motor : DC 24V , Rated RPM : 1407 rpm

4.2.4 Fuser

It is consisted of a heat lamp, heat roller, pressure roller, thermistor and thermostat. It sticks the toner on a paper by heat and pressure to complete the printing job.

- E-coil Heater : 1,300 Watt \pm 50W

1) Thermostat

When a heat lamp is overheated, a Thermostat cuts off the main power to prevent over-heating.

- Non-Contact type Thermostat

3) Heat roller

The heat roller transfers the heat from the e-coil to apply a heat on the paper. The surface of a heat roller is coated with Teflon, so toner does not stick to the surface.

4) Pressure roller

A pressure roller mounted under a heat roller is made of a silicon resin, and the surface also is coated with Teflon. When a paper passes between a heat roller and a pressure roller, toner adheres to the surface of a paper permanently.

5) Items for safety

Protecting device for overheating

- 1st protection device: Hardware cuts off when overheated
- 2nd protection device: Software cuts off when overheated
- 3rd protection device: Thermostat cuts off main power.

Safety device

- A fuser power is cut off when a front cover is opened
- Maintain a temperature of fuser cover's surface under 80(C for user, and attach a caution label at where customer can see easily when customer open a rear cover.

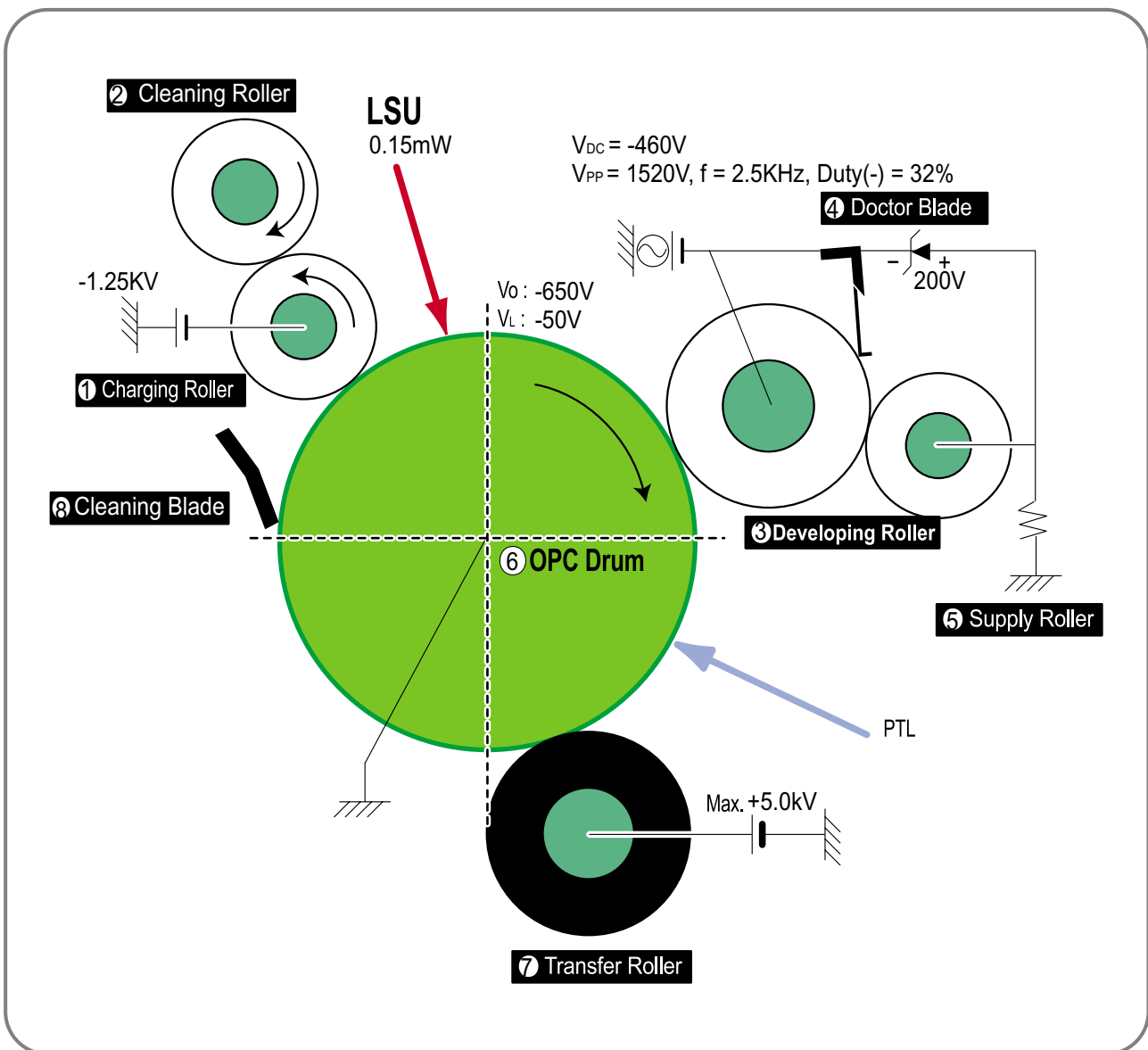
4.2.5 LSU (Laser Scanner Unit)

It is the core part of the LBP which switches from the video data received to the controller to the electro-static latent image on the OPC drum by controlling laser beam, exposing OPC drum, and turning principle of polygon mirror. The OPC drum is turned with the paper feeding speed. The /HSYNC signal is created when the laser beam from LSU reaches the end of the polygon mirror, and the signal is sent to the controller. The controller detects the /HSYNC signal to adjust the vertical line of the image on paper. In other words, after the /HSYNC signal is detected, the image data is sent to the LSU to adjust the left margin on

4.2.6 Print Cartridge

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

- Developing Method: Non-contacting method
- Toner : Non magnetic 1 component pulverized type toner
- The life span of toner : 6,000 or 12,000 pages (LSA Pattern/A4 standard)
- Toner remaining amount detecting sensor : Yes
- OPC Cleaning : Cleaning blade type
- Management of disusable toner : Collect the toner by using Cleaning Blade
- OPC Drum protecting Shutter : Yes
- Classifying device for toner cartridge : ID is classified by interruption of the frame channel.

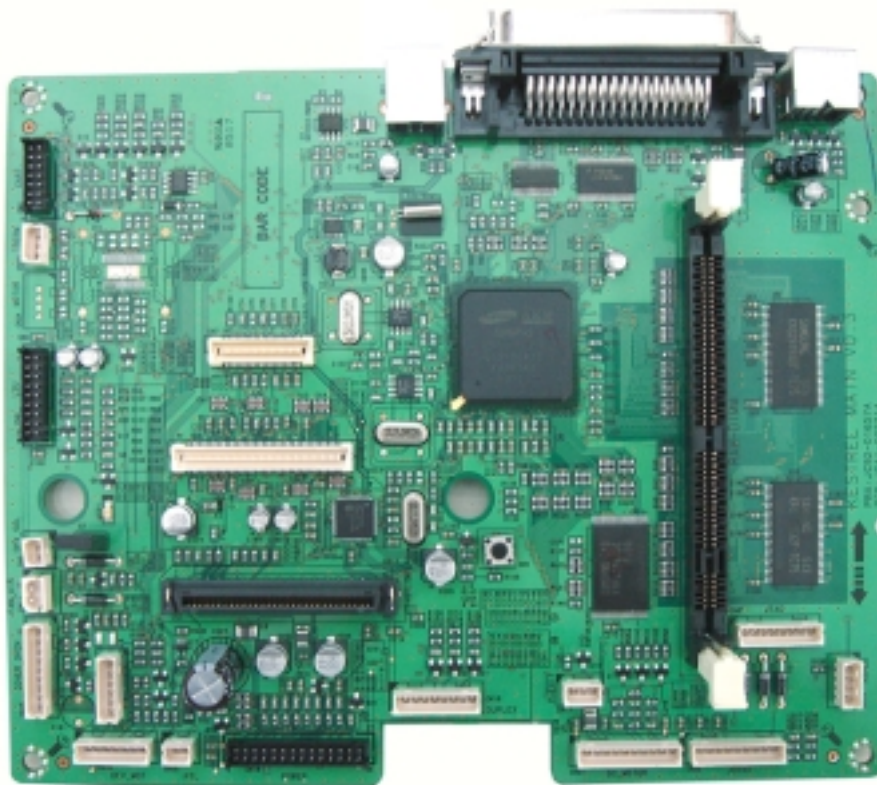


<Toner Cartridge Layout>

4.3 Engine H/W Specifications

4.3.1 ML-3560 (PCL) Main Board

The Engine Board and the Controller Board are in one united board.



4.3.1.1 Asic(SPGP V3)

- RM1020E (I-Cache : 32KB, D-Cache-32KB)
- 32-bit RISC embedded processor core
- Dual bus architecture for bus traffic distribution
 - AMBA High performance Bus (AHB)
 - System Bus with SDRAM
- SDRAMC
 - 32 Bits Only, 100MHz
 - 5 Banks (Up to 128MB per Bank)

- **ROMC** - 4 Banks (Up to 16MB per Bank)
- **IOC** - 6 Banks (Up to 16MB per Bank)
- **DMAC** - 4 Channels
- **IEEE1284 compliant parallel port interface**
- **Printer Video Controller for LBP engines**
- **Graphic Execution Unit for Banding support of Printer Languages**
- **HCT / JBIG (Encoding / Decoding)**
- **Fully Hardware Rotator, Scaler and Halftoner support**
- **Printer Video Controller for LBP engines**
 - PV C : Printer V ideo Controller without RET Algorithm
 - HPV C : Printer V ideo Controller with RET algorithm(Line Memory & Lookup Table Memory : 512 x 8,4096 x 16)
Dual / Single Beam, LV DS Pad (V DO, HSYNC)
- **PCI Controller**
 - 32Bits, 33/66MHz
 - PCI Local Bus Specification rev. 2.2 compliant
 - Host /Agent Mode (Support 4 Devices in Host Mode)
- **NAND Flash Controller**
 - 8/16 Bits, H/W ECC Generation
 - Auto Boot Mode (using internal SRAM, 4KB)
- **Engine Controller**
 - LSU Interface unit
 - Step Motor : 2 Channels
 - PWM : 8 Channels
 - ADC : 6 Channels
- **USB 2.0 Interface**
- **Package** : 496pins PBGA
- **Power** : 1.2V (Core) , 3.3V (IO) power operation
- **Speed** : 400MHz core(ARM10) operation, 100MHz bus operation

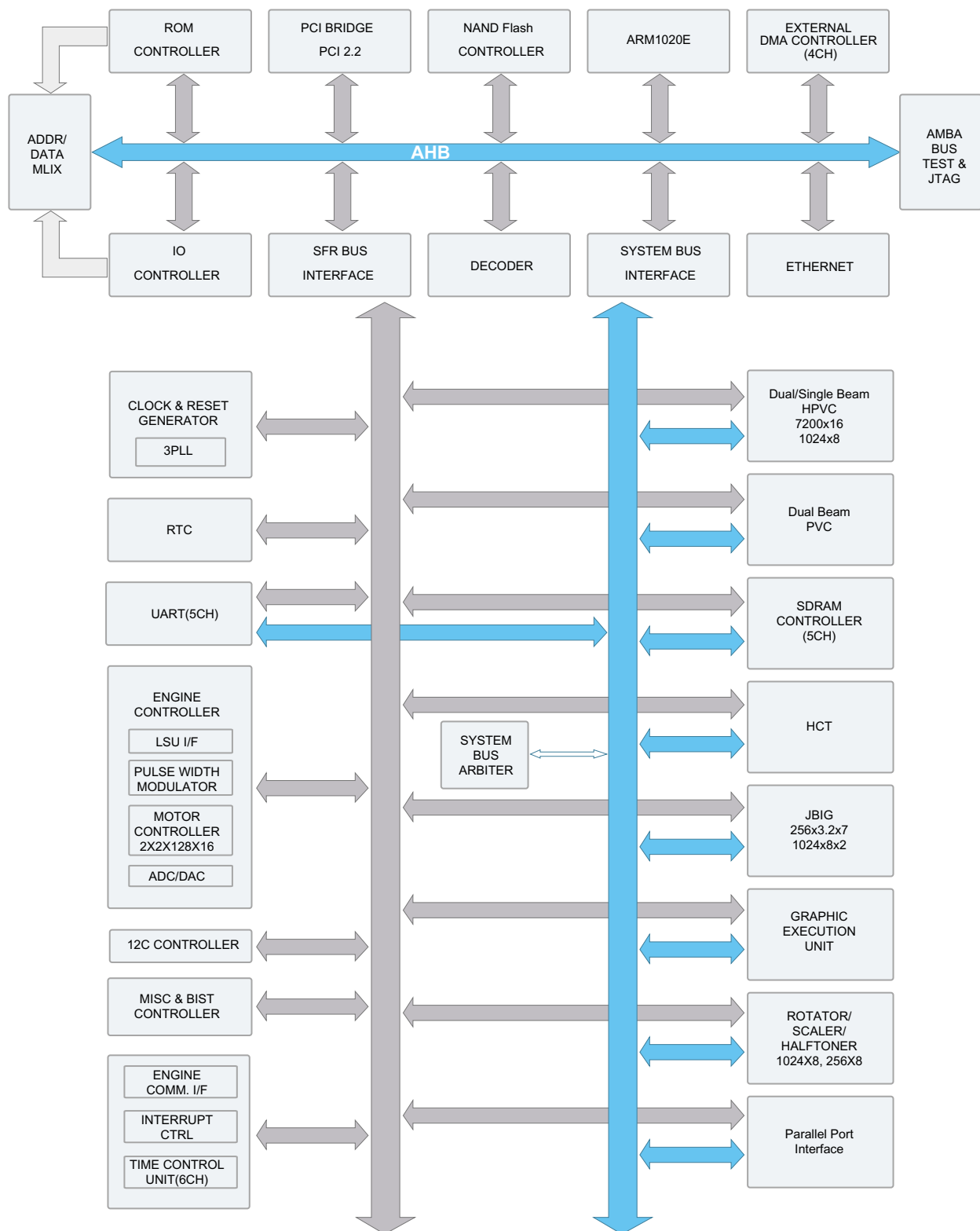
4.3.1.2 Memory

- **Nand Flash Memory** : It stores System Program and downloads the System Program through PC Interface, and in case of model for export it compresses the PCL font, then stores it.
 - Capacity : 32M byte
- **SDRAM** : It is used as Swath Buffer, System Working Memory Area, etc. when printing. It stores Font List, compressed into Flash memory, on DRAM and uses it as PCL font in case of model for export.
 - Capacity : 32M Byte(Basic) , up to 256Mbyte (User Option)
 - Type : SDRAM 100MHz/133MHz , 16bit

4.3.1.3 Others

The Option PBA can be mounted for supporting the serial communication.

4.3.1.4. SPGP V3 Internal Block Diagram



4.3.1.5 Sensor Input Circuit

- **Paper empty sensing**

1. Cassette paper empty(Tray1)
 - 'Empty Sensor' detects whether the paper is in the Tray1.
2. MP paper empty(MP Tray)
 - 'MP empty sensor' detects whether the paper is in the MP Tray.

- **When 'Auto' mode is Setting**

If the 'MP Tray' and 'Tray' are all empty, 'Paper empty Tray1' message is displayed on the LCD panel.

- **Feed sensing**

The feed sensor detects that the entering paper from Tray1 or Tray2.

When 'Jam at top, open top cover' message is displayed on the LCD panel, the feed sensor should be checked.

- **Paper exit sensing**

The exit sensor detects that 'Jam at exit' error.

When the paper sticks into the exit part, 'Jam at Exit Open top cover' message is displayed on the LCD panel.

- **Cover open sensing**

The cover open switch is on the top frame, it detects whether top cover is open or closed. When top cover is open, 'Close Open' message is displayed on the LCD panel.

- **Motor driving**

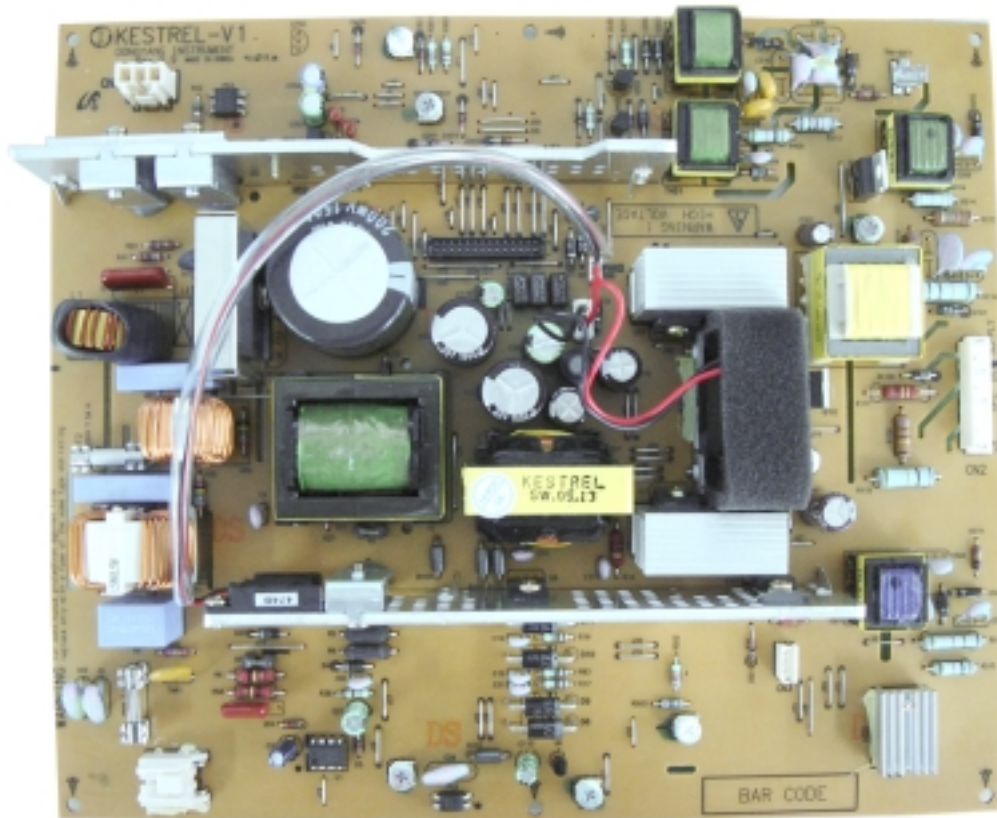
There are two BLDC motors. The one is for developer driving and the other is for other driving part operating.

- **Output tray sensor**

The output tray sensor detects that the exit paper out for output tray.

4.3.2 SMPS & HVPS board

The SMPS supplies DC Power to the System. It takes 110V /220V and outputs the +3.3V , +5V +24V to supply the power to the main board. The HV PS board creates the high voltage.



4.3.2.1 HVPS (High Voltage Power Supply)

• Transfer High Voltage (THV+)

- Input V oltag e : 24 V D~~C~~ 15%
- Output V oltag e : MAX +5.0KV \pm 5 %, (Duty V ariable)
- Input contrast of the V oltag e stability degree : under \pm 5 %(fluctuating input 21.6V ~26.4V)
- Loading contrast : \pm 5 %or less
- Output V oltag e Rising Time : 100 ms Max
- Output V oltag e Falling Time : 100 ms Max
- Fluctuating transfer voltage with environmental various : +600 V ~5 KV
- Environment Recognition Control Method : The THV -PWM ACTIV E is transfer active signal. It detects the resistance by recognizing the voltage value, F/B, while permits the environmental recognition voltage.
- Output V oltag e Control Method : Transfer Output V oltag e is outputted and controlled by changing Duty of THV PWM Signal.

• Charge Voltage (MHV)

- Input V oltag e : 24 V D~~C~~ 15%
- Output V oltag e : -1.1KV ~ -1.6KV B~~C~~3%
- Output V oltag e Rising Time : 50 ms Max
- Output V oltag e Falling Time : 50 ms Max
- Output Loading range : 30 M Ω ~1000 M Ω
- Output Control Signal(MHV -PWM) : CPU is HV output when PWM is Low

• Cleaning Voltage (THV-)

- The (+) Transfer V oltag e is not outputted because the THV PWM is controlled with high.
- The (-) Transfer V oltag e is outputted because the THV -Enable Signal is controlled with low
- The output fluctuation range is big because there is no Feedback control.
- Output V oltag e : -1.0KV \pm 15%(when cleaning, 200M Ω)

• Developing Voltage (DEV)

<DC>

- Input V oltag e : 24 V D~~C~~ 15%
- Input contrast of the output stability degree : \pm 3 % or less Loading contrast : \pm 3 % or less
- Output V oltag e Rising Time : 50 ms Max
- Output V oltag e Falling Time : 50 ms Max
- Output Loading range : 10M Ω ~1000 M Ω
- Output Control Signal (DEV ~~dev~~ PWM) : the CPU output is HV output when PWM is low.

<AC>

- Input V oltag e : 18V
- Output V oltag e : PWM Control (p~~p~~, V_{AC})
- Input Contrast : \pm 3 %
- Output Control Signal : The CPU is HV Output when Dev ~~dev~~ V_{p-p}, DEV AC ph/M, ~~dev~~ On-Off is low.

• Supply

- Output V oltag e : ZENER using, DEV
- Input contrast of the output stability degree : under \pm 3 % Loading contrast : \pm 3% or less
- Output V oltag e Rising Time : 50 ms Max
- Output V oltag e Falling Time : 50 ms Max
- Output Loading range : 10 M Ω ~1000 M Ω
- Output Control Signal (DEV ~~dev~~ PWM) : the CPU is HV output when PWM is low.

4.3.2.2 SMPS (Switching Mode Power Supply)

It is the power source of entire system. SMPS has three output channels. Which are 3.3V , +5V and +24V .

• AC Input

- Input Rated Voltage : 220 ~ 240V AC / 110 ~ 127V AC
- Input Voltage fluctuating range : 198 ~ 254V AC / 99 ~ 135V AC
- Rated Frequency : 50/60 Hz
- Frequency Fluctuating range : 47 ~63 Hz

• Rated Output Power

| NO | ITEM | CH1 | CH2 | CH3 | CH4 |
|----|---|---|-------------------------------------|--|---------------------------------|
| 1 | CHANNEL NAME | +3.3V | +5V | +24.0V S | 24.0V F |
| 2 | CONNECTOR PIN | CON 3 3.3V PIN:9,11,13 GND PIN:21 | CON 3 5V PIN:15,17 GND PIN:19 | CON 3 24V PIN:1,3,5 GND PIN:23,25,27 | |
| 3 | Rated Output | 3.3V $\pm 5\%$ (3.13~3.47V) | +5V $\pm 5\%$ (4.75~5.25V) | +24V -10%+15% (21.6~27.6V) | +24V -10%+15% (21.6~27.6V) |
| 4 | Max.Output Current | 2.0A | 1.0 A | 3.8A | 0.7A |
| 5 | Peak Loading Current | 2.5 A | 1.5 A | 4.0 A | 1.0A |
| 6 | RIPPLE NOISE Voltage | Under 100mV p-p | Under 150mV p-p | Under 500mV p-p | Under 500mV p-p |
| 7 | Maximum output | 6.6W | 4.0W | 67.2W | 16.8W |
| 8 | Peak output | 6.6W | 5.0W | 91.2W | 16.8W |
| 9 | Protection for loading shortage and overflowing current | Fuse Protection or Shut down (2.5~5.0A) | Regulator short protection | Fuse Protection, Shut down (5.5~7.5A) , Drop(Trip -10%) | Short protection |

• Power Consumption

| NO | Item | System |
|----|------------|-----------------------------------|
| 1 | Stand-By | AV G : 80 Wh |
| 2 | PRINTING | AV G : 600 Wh |
| 3 | Sleep-Mode | AV G : 12 Wh under (Basic model) |

• Length of Power Cord :1830 \pm 50mm

• Power Switch :Use

• Feature

- Insulating Resistance :50MΩ or more (at DC 500V)
- Insulating revisiting pressure : Must be no problem within 1 min.(at 1500V ac, 10mA)
- Leaking Current : under 3.5mA
- Running Current : under 40A PEAK (AT 25°C, COLD START) under 60A PEAK (In other conditions)
- Rising Time : within 2Sec
- Falling Time : over 20ms
- Surge : Bi-wave 6kV 12ohm (Com)
Bi-wave 3kV 2ohm (Nor)

• Environment Condition

- Operating temperature range :0°C~ 40°C
- Maintaining temperature range :~25°C~ 85°C
- Preserving Humidity Condition :30% ~ 90%RH
- Operating atmospheric pressure range : 1atm

4.3.2.3 Fuser control

- When the power voltage of the machine is too high or too low Fuser on is stopped to protect the fuser.
- When the AC is not applied to the fuser control circuit, the fuser does not work then 'Fuser low heat error' would be occurred.
- When the temperature of the fuser is too high, 'Engine over heat' error occurs if the cooling operation is not sufficient.

4.3.3 Engine F/W

4.3.3.1. Control Algorithm

• 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.

| ITEM | Description |
|--------------|--|
| JAM 0 | <ul style="list-style-type: none"> - After pick up, paper cannot be entered due to paper is not fed. - After pick up, paper entered but it cannot reach to the feed sensor in certain time due to slip, etc. - After pick up, if the feed sensor is not on, re-pick up. After re-picking 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 |
| JAM 1 | <ul style="list-style-type: none"> - After the leading edge of the paper passes the feed sensor, the trailing edge of the paper cannot pass the feed sensor after a 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 |
| JAM 2 | <ul style="list-style-type: none"> - After the trailing edge of the paper passes the feed sensor, the paper cannot pass the exit sensor after certain time. |
| DUPLEX JAM 1 | <ul style="list-style-type: none"> - After the trailing edge of the paper passes the exit sensor, the leading edge of the paper cannot reach the duplex sensor after certain time. |
| DUPLEX JAM 2 | <ul style="list-style-type: none"> - After the leading edge of the paper passes the duplex sensor, the leading edge of the paper cannot reach the feed sensor after certain time. |

• Driver

By gearing, the main motor drives the rollers such as feeding roller, driven by deve-Motor, fuser roller, and exiting roller. The step motor is controlled for the such acceleration section and steady section. In the initial stage of the motor run, appoint the acceleration section to prevent the step-out of the motor. It is controlled by the A 3977 motor driver IC. The step signal and the enable signal are sent to make the phase for driving the motor in CPU.

• Transfer

The charging voltage, developing voltage and the transfer voltage are controlled 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.

• 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 controller by comparing the target temperature to the value from the thermistor. If the value from the thermistor is out of controlling range while controlling the fusing, the error stated in the below table occurs.

• Lamp Method

| Error | Description | LCD Display |
|-----------------|--|------------------------|
| Open Heat Error | When warming up, it has been lower than 60 over 35 seconds | Engine Fuser Error |
| Low heat Error | - Standby It has been lower than 130°C over 10 seconds - Printing Up to 2 consecutive pages : It has been lower than 155 over 7 seconds. From 3 consecutive pages : It has been 25°C lower than the fixed fusing temperature over 7 seconds. | Engine Low Heat Error |
| Over Heat Error | It has been higher than 230°C over 10 seconds | Engine Over Heat Error |

=>This can be changed in the future.

• LSU

The LSU is consisted of the LD (Laser Diode) and the polygon motor control. When the printing signal occurs, it turns on the LD and drives the polygon motor. When the detector detects the beam, Hsync occurs. When the polygon motor speed becomes strady, Lready occurs. If two conditions are satisfied, the status are not satisfied, the error shown in below occurs.

| Error Type | Description | LCD Display |
|---------------------|--|---------------|
| Polygon Motor Error | Whenthe polygon motor speed doesn't become steady | LSU not Ready |
| Hsync Error | The polygon motor speed is steady but the Hsync is not generated | HSYNC Errorr |

Memo