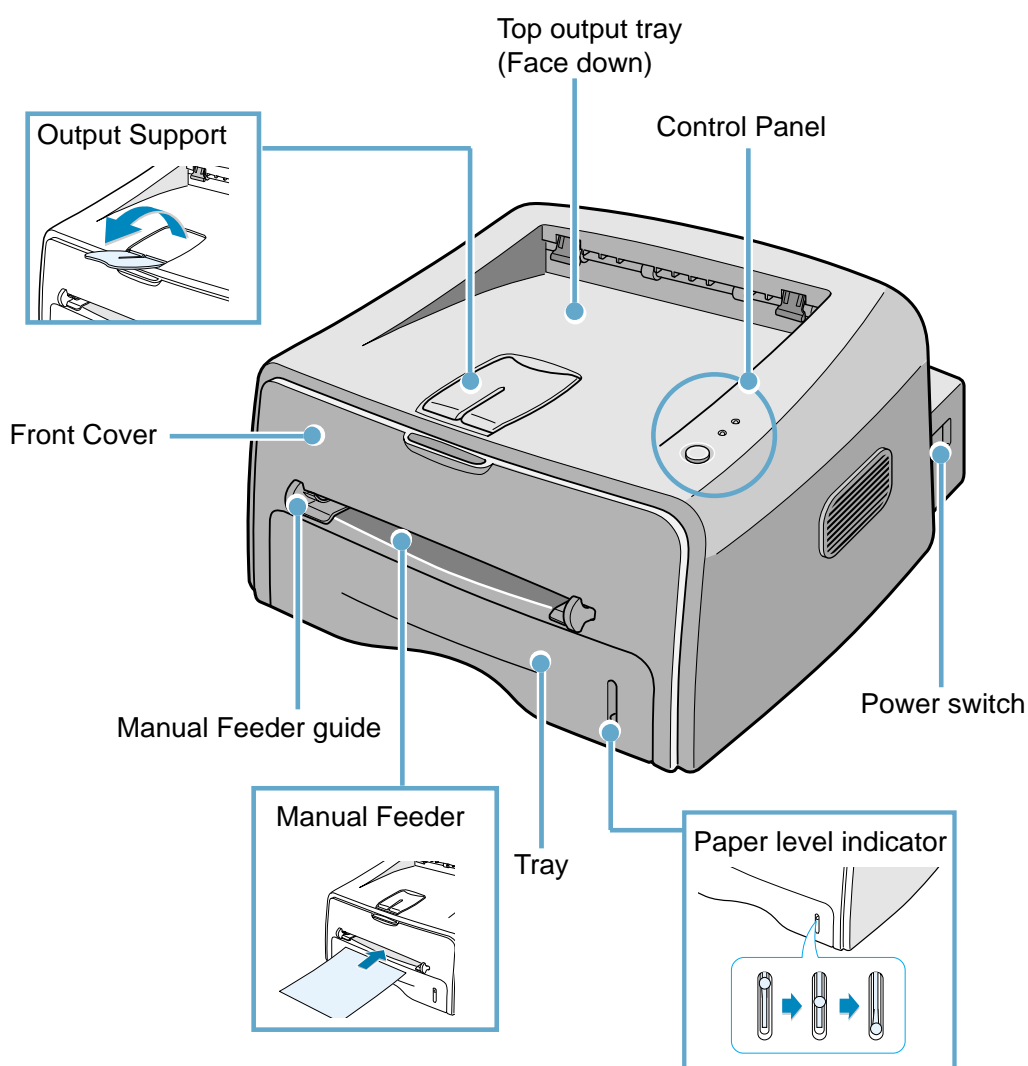


4. Summary of Product

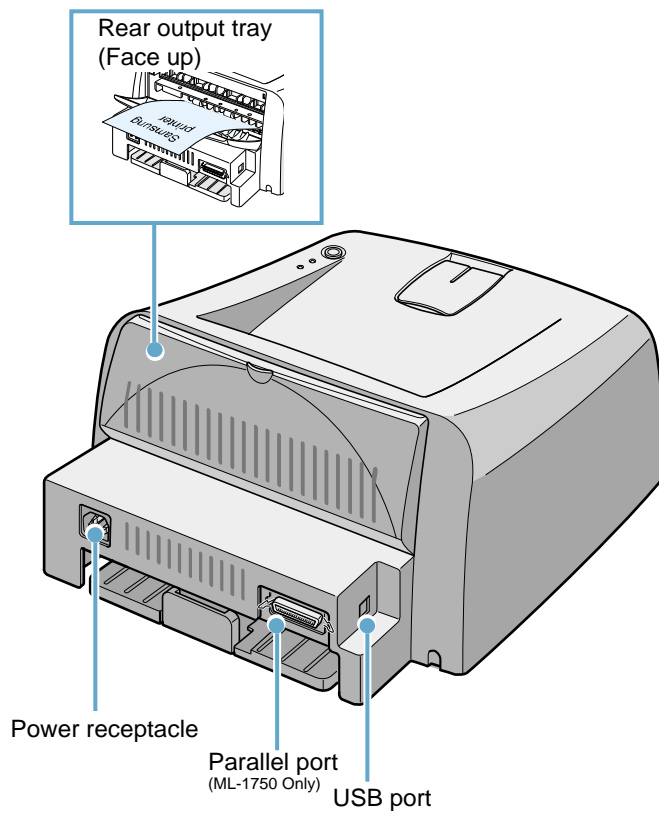
This chapter describes the functions and operating principal of the main component.

4.1 Printer Components

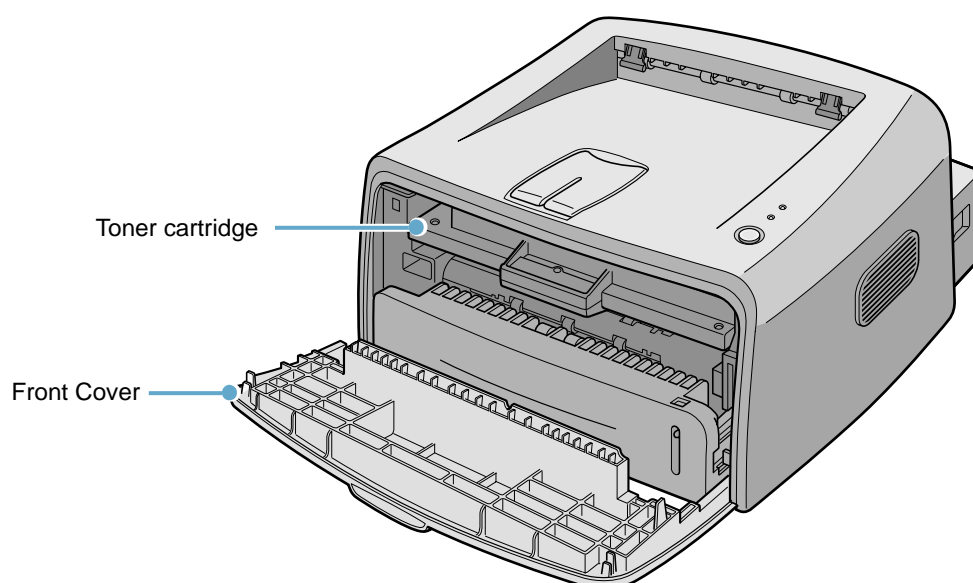
4.1.1 Front View



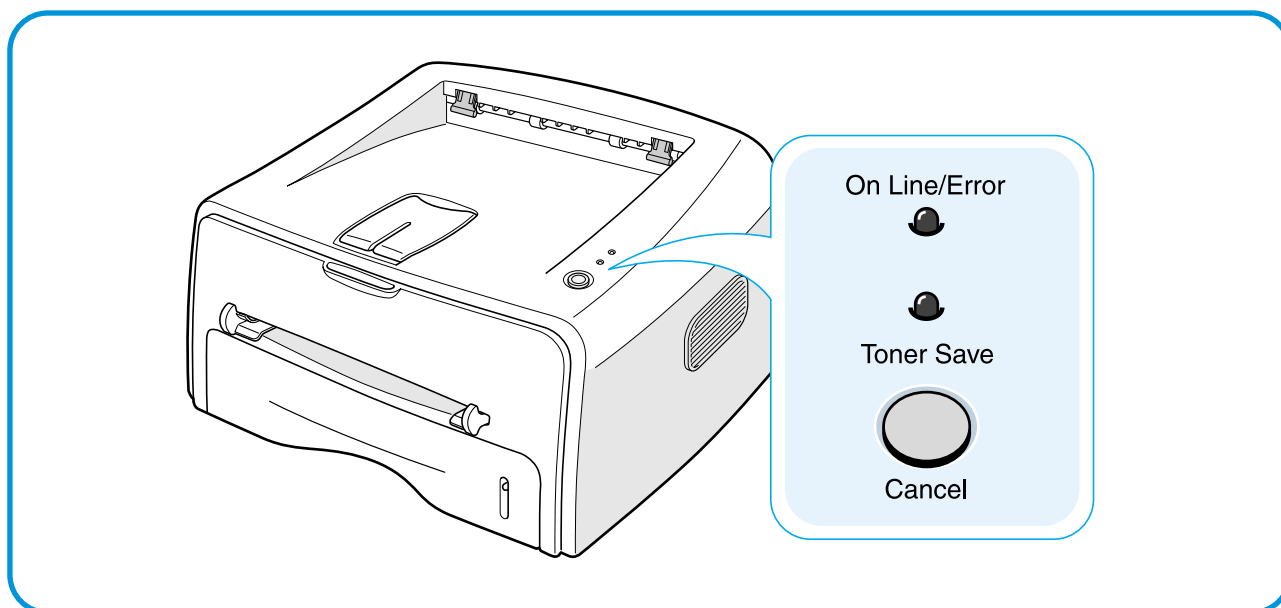
4.1.2 Rear View







4.1.3 Inside View



4.1.3 Control Panel



1) On Line/Error and Toner Save LEDs

LED	Description
On Line/Error 	<p>If the On Line/Error lights green, the printer is ready to print.</p> <p>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.</p> <p>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.</p> <p>If the printer is receiving data, the On Line/Error LED slowly blinks green.</p> <p>If the printer is printing the received data, the On Line/Error LED blinks green fast.</p>
Toner Save 	<p>If you press the Cancel button in Ready mode, this LED is on and the Toner Save mode is enabled.</p> <p>If you press this button once again, this LED is off and the Toner Save mode is disabled.</p>
On Line/Error Toner Save  	<p>If the On Line/Error and Toner Save LEDs blink, your system has some problems. To solve the problem.</p>

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

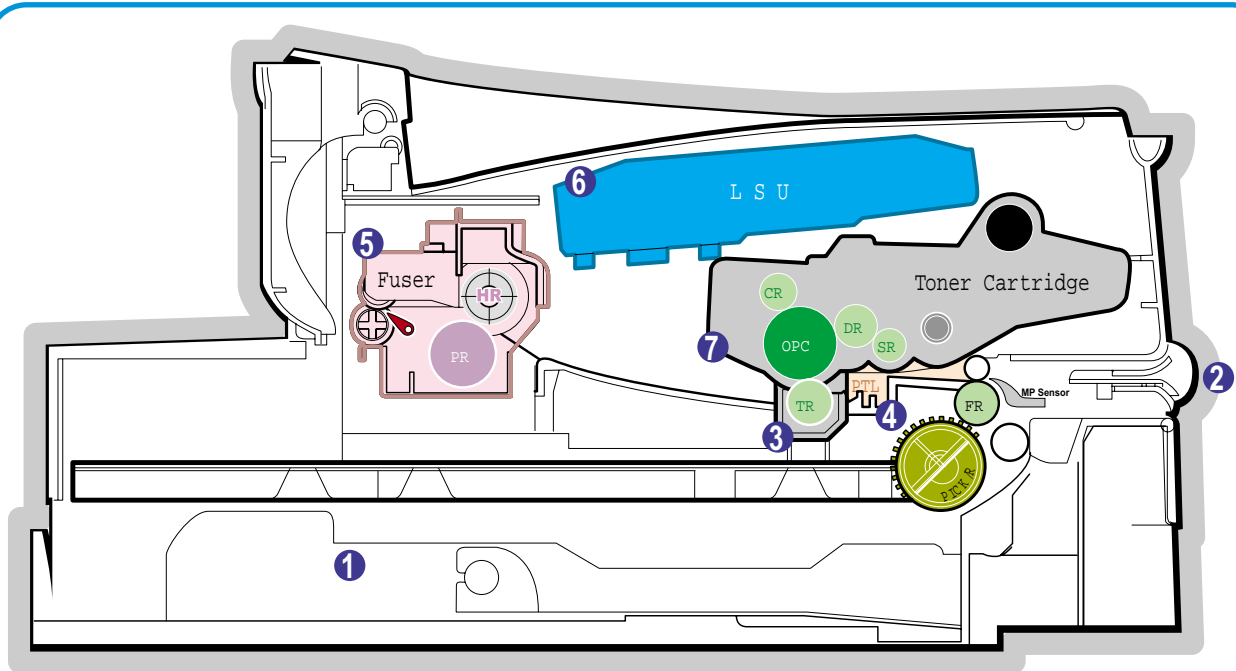
Press this button during printing. The On Line/Error LED blinks while the print job is cleared from both the printer and the computer, and then return to Ready mode. This may take some time depending on the size of the print job.

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



- | | |
|--------------------------|------------------------|
| ① Cassette | ⑤ Fuser |
| ② Manual Feeder | ⑥ LSU(Laser Scan Unit) |
| ③ Transfer Roller | ⑦ Toner Cartridge |
| ④ PTL(Per-Transfer-Lamp) | |

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/m², 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. For this product, Q-PID method with the heat coil is applied.

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 coated with Teflon to fuse the toner on the paper when paper passes between the heat roller and the pressure roller.

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.

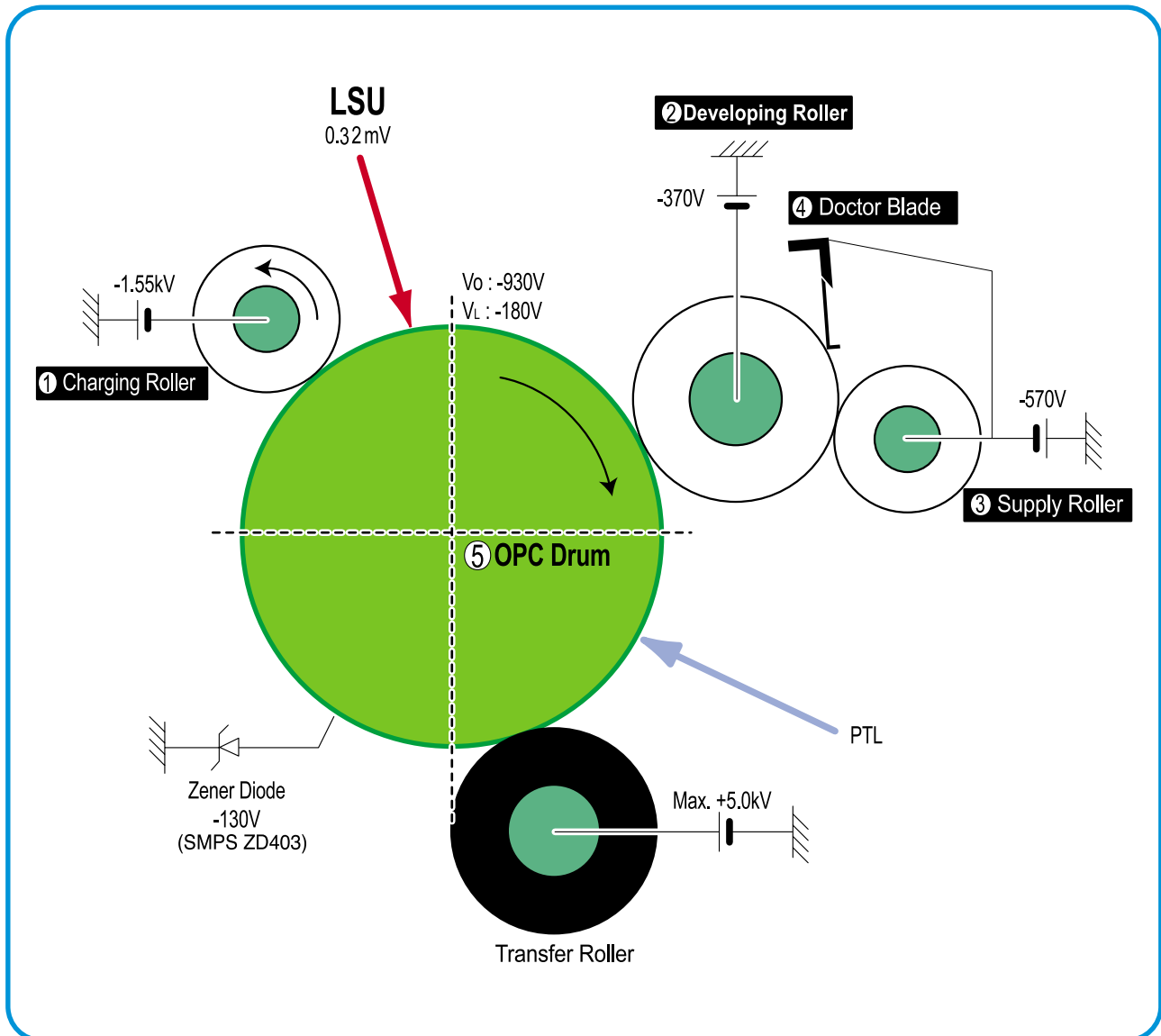
The OPC drum rotates as the same speed as the paper feeding speed. It creates the /HS YNC signal and sends it to the engine when the laser beam of the LSU reaches the end of the polygon mirror, and the engine detects the /HS YNC signal to arrange the vertical line of the image on the paper. After detecting 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

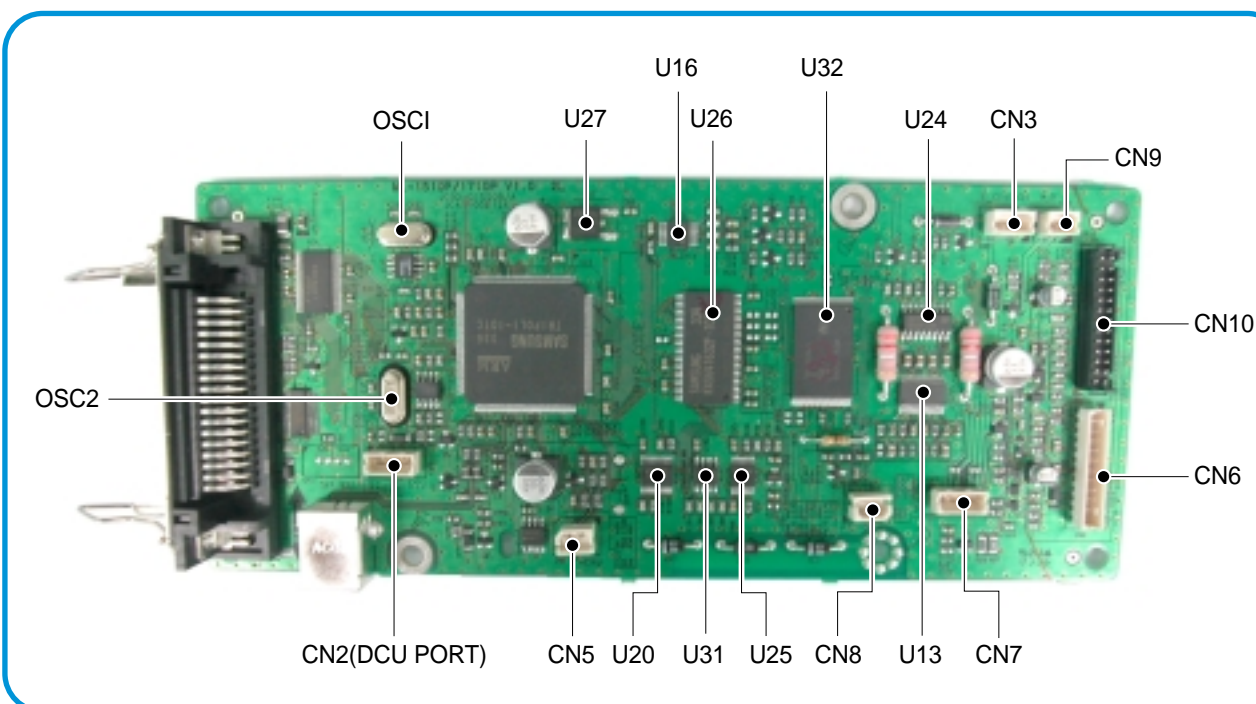
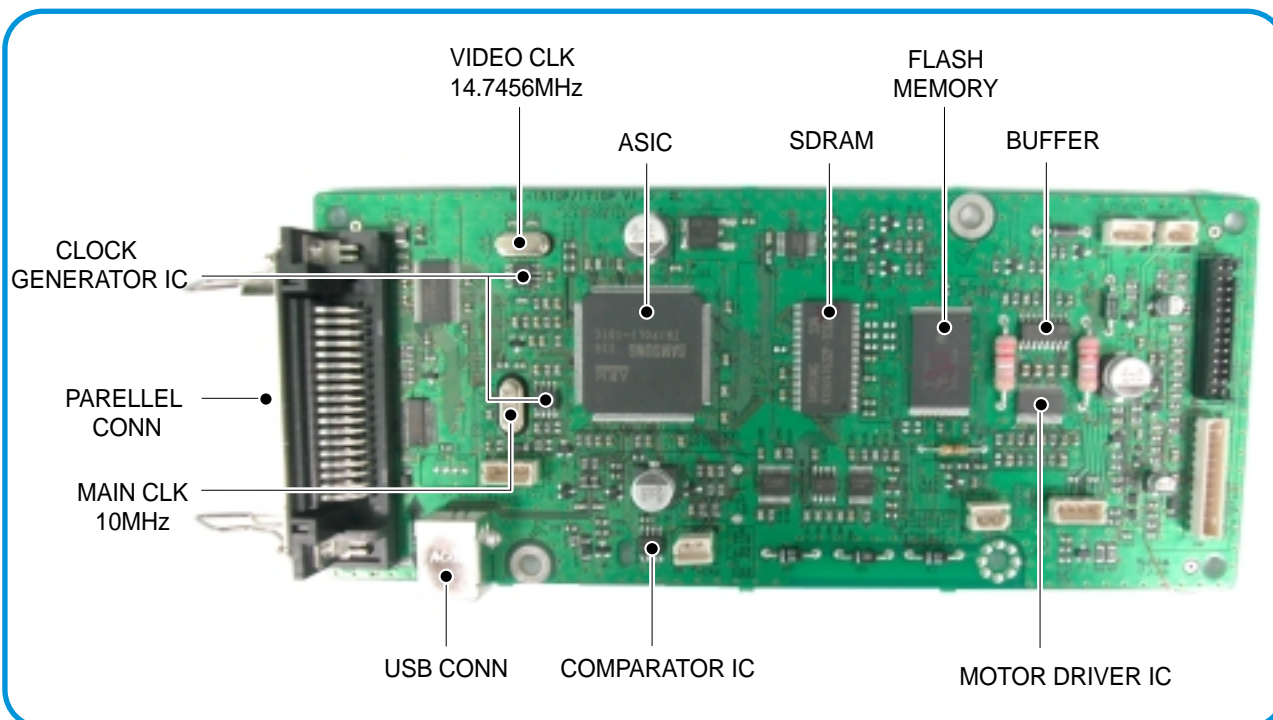
By using the electronic photo process, it creates a visual image. In the toner cartridge, the OPC unit and the developer unit are in a body. The OPC unit has OPC drum and charging roller, and the developer unit has toner, toner cartridge, supply roller, developing roller, and blade (Doctor blade)

- Developing Method: Non magnetic 1 element contacting method
- Toner: Non magnetic 1 element shatter type toner
- The life span of toner: 3,000 sheets (IDC 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.



4.3 Main PBA(SPL Model)

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 dlmI 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.



4.3.1 ASIC (Jupiter III)

The Jupiter III (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

4.3.2 Flash Memory

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

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

4.3.3 SDRAM

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

- Capacity :

ML-1710
8 M byte

- Access Time : 60 nsec

4.3.4 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.

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

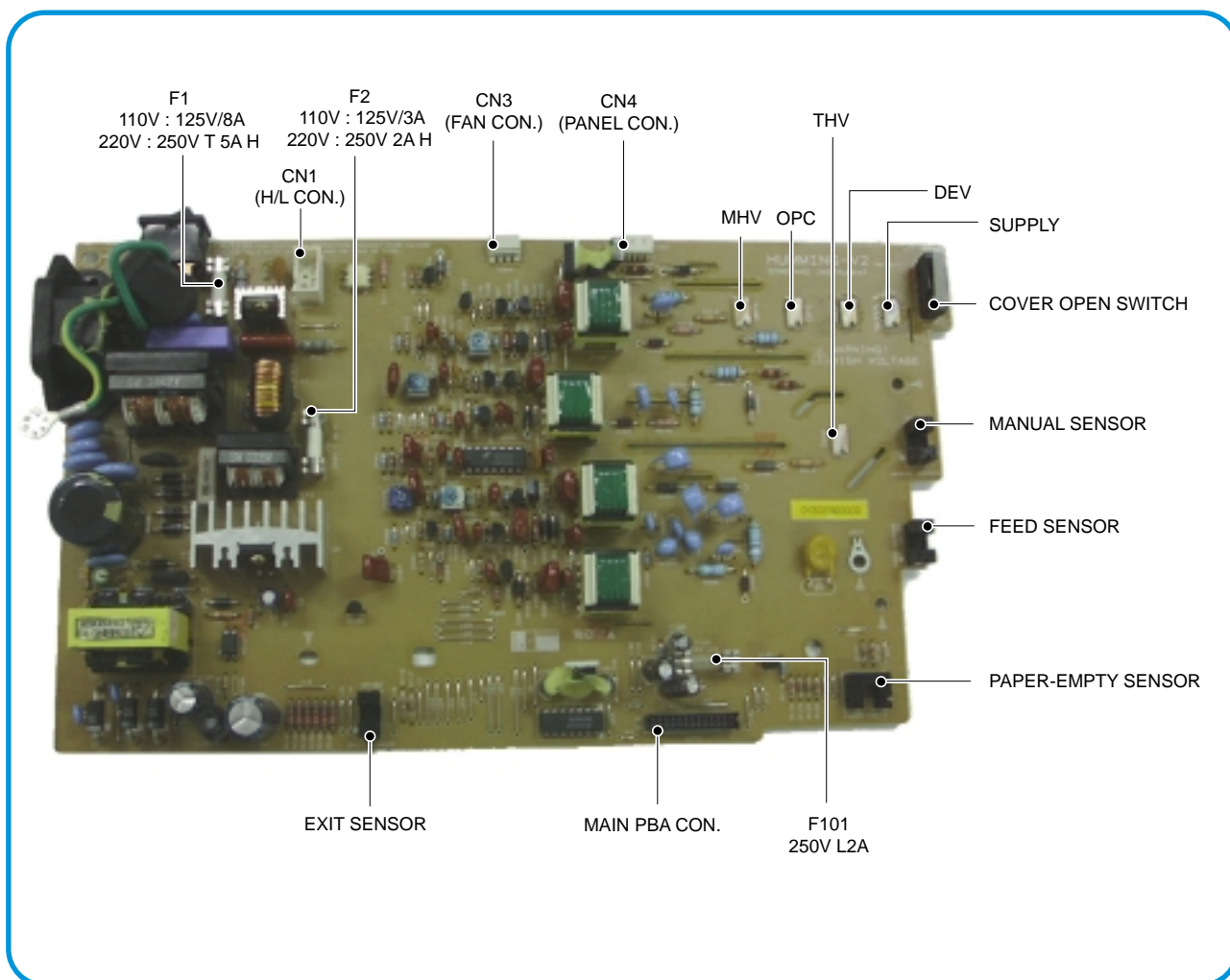
The motor driving circuit is formed when the Driver IC is selected in the first place. The A3977 (Motor driver IC) is used in this case. But, the resistance Rs value of sensing and the voltage value of the V reference can be changed by motor driving voltage value.

4.4 SMPS & HVPS

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.



4.4.1 HVPS(High Voltage Power Supply)

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 $\pm 5\%$ (Duty changeable, unload)
- 1.0KV $\pm 15\%$ (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 $\pm 50V$
- 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 $\pm 20V$
- 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 $\approx 50V$ (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.

4.4.2 SMPS(Switching Mode Power Supply)

It 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 \pm 5% (3.2 ~ 3.4V)	+5V \pm 5% (4.75 ~ 5.25V)	+24V \pm 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 \pm 50mm

5) Power Switch : Use

6) Feature

- Insulating resistance : over 50MΩ (at DC500V)
- Insulating revisiting pressure : Must be no problem within 1min. (at 1500Vzc, 10mA)
- Leaking voltage : under 3.5mA
- Running voltage : under 40A peak (at 25°C, Cold start) Under 60A peak (in other conditions)
- Rising Time : Within 2Sec
- Falling Time : Over 20ms
- Surge : Ring Wave 6KV-500A (Normal, Common)

7) Environment Condition

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

8) EMI Requirement : CISPR ,FCC, CE, MIC, C-Tick,**9) Safty Requirement**

- IEC950 UL1950, CSA950, C-UL,NOM,TUV,Semko,Nemko,iK,CB, CCC(CCIB),GOST, EPA,

4.4.3 Fuser AC Power Control

Fuser (HEAT LAMP) gets heat from AC power. The AC power controls the switch with the Triac, a semiconductor switch. The 'On/Off control' is operated when the gate of the Triac is turned on/off by Photo triac (insulating part).

In the other words, the AC control part is passive circuit, so it turns the heater on/off with taking signal from engine control part.

When the 'HEATER ON' signal is turned on at engine, the LED of PC1 (Photo Triac) takes the voltage and flashes. From the blinking light, the Triac part (light receiving part) takes the voltage, and the voltage is supplied to the gate of Triac and flows into the Triac. As a result, the AC current flows in the heat lamp, and heat is occurred.

On the other hand, when the signal is off, the PC1 is off, the voltage is cut off at the gate of Triac, the Triac becomes off, and then 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

4.5 Engine F/W

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

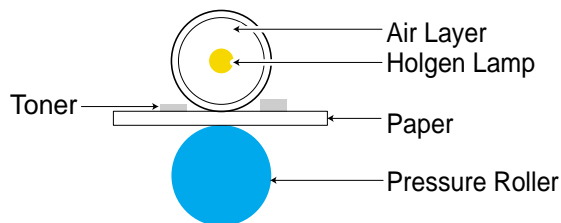
Error	Description	DCU	LED Displat
Open heat error	When warming up, it has been lower than 68°C over 28 seconds	60	All LED are blinking.
Lower heat error	<ul style="list-style-type: none"> • Standby: It has been lower than 80°C over 10 seconds • Printing: - 2 consecutive pages: it has been lower than 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

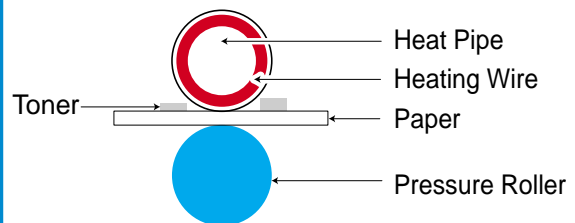
Error	Description	DCU	LED Displat
Open heat error	When preheating, it has been lower than 68°C over 15 seconds.	60	All LED are blinking
Lower heat error	<ul style="list-style-type: none"> • After finishing the preheating stage, it has not reached 100°C (preheating stop temperature) during 15 seconds since the temperature is over 68°C. • Printing <ol style="list-style-type: none"> 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	<ul style="list-style-type: none"> • 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

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 reat-tempting 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