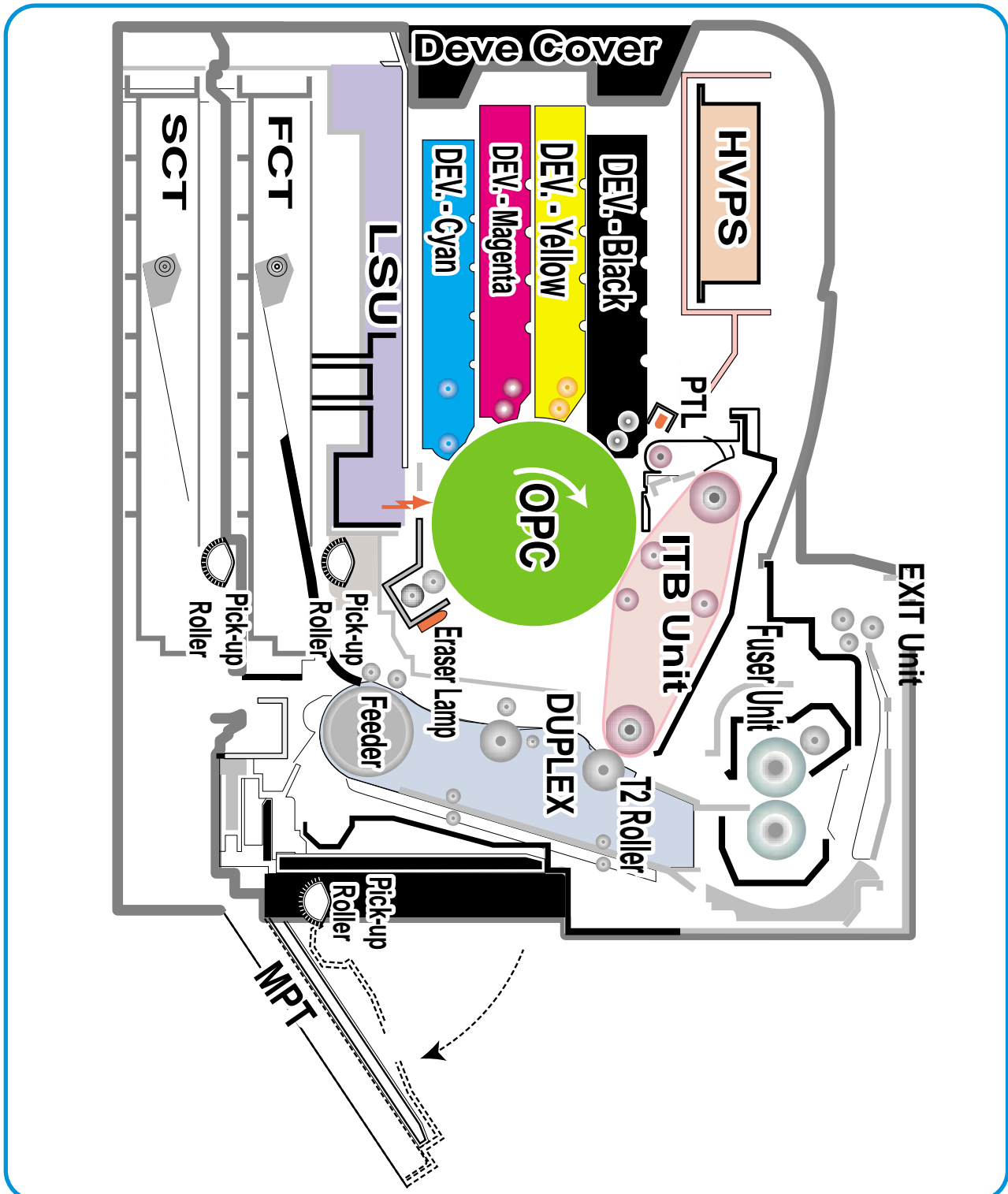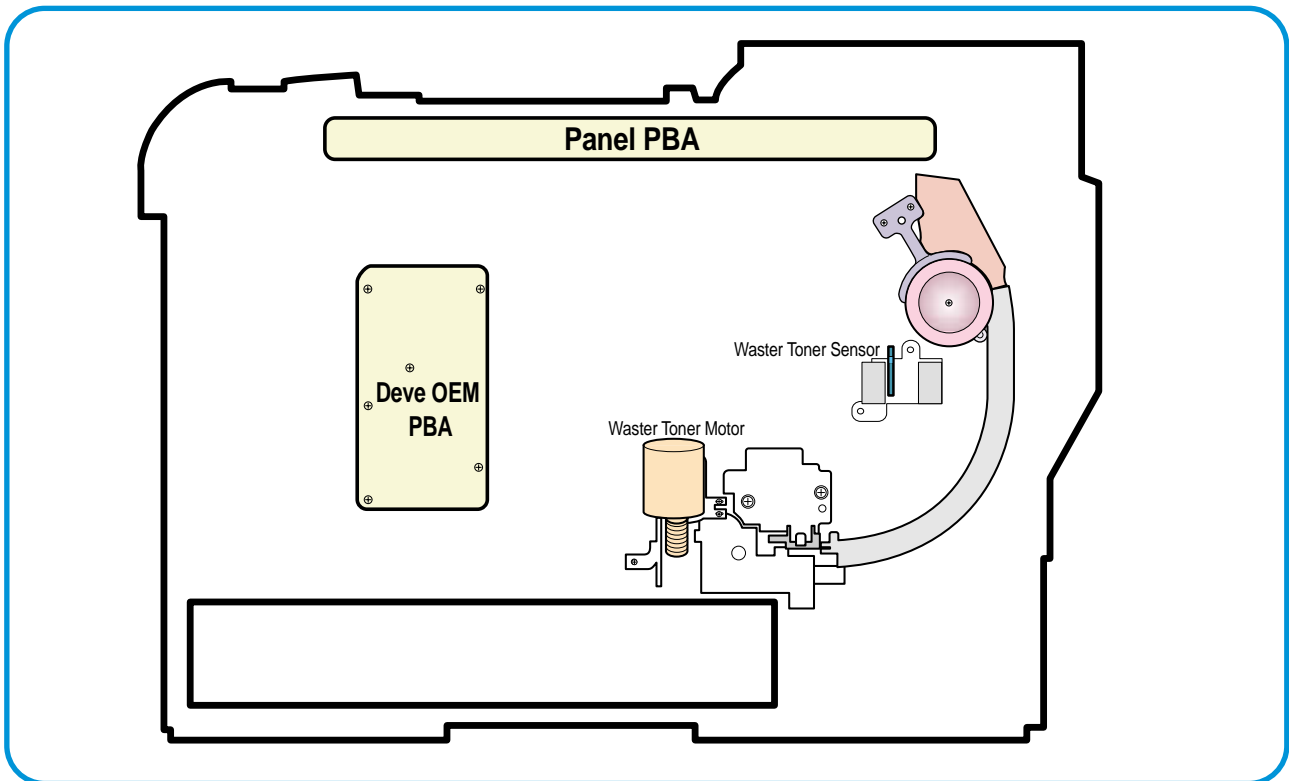# 4. Summary of Product

This chapter describes the functions and operating principals of the main components.

4.1 System Structure
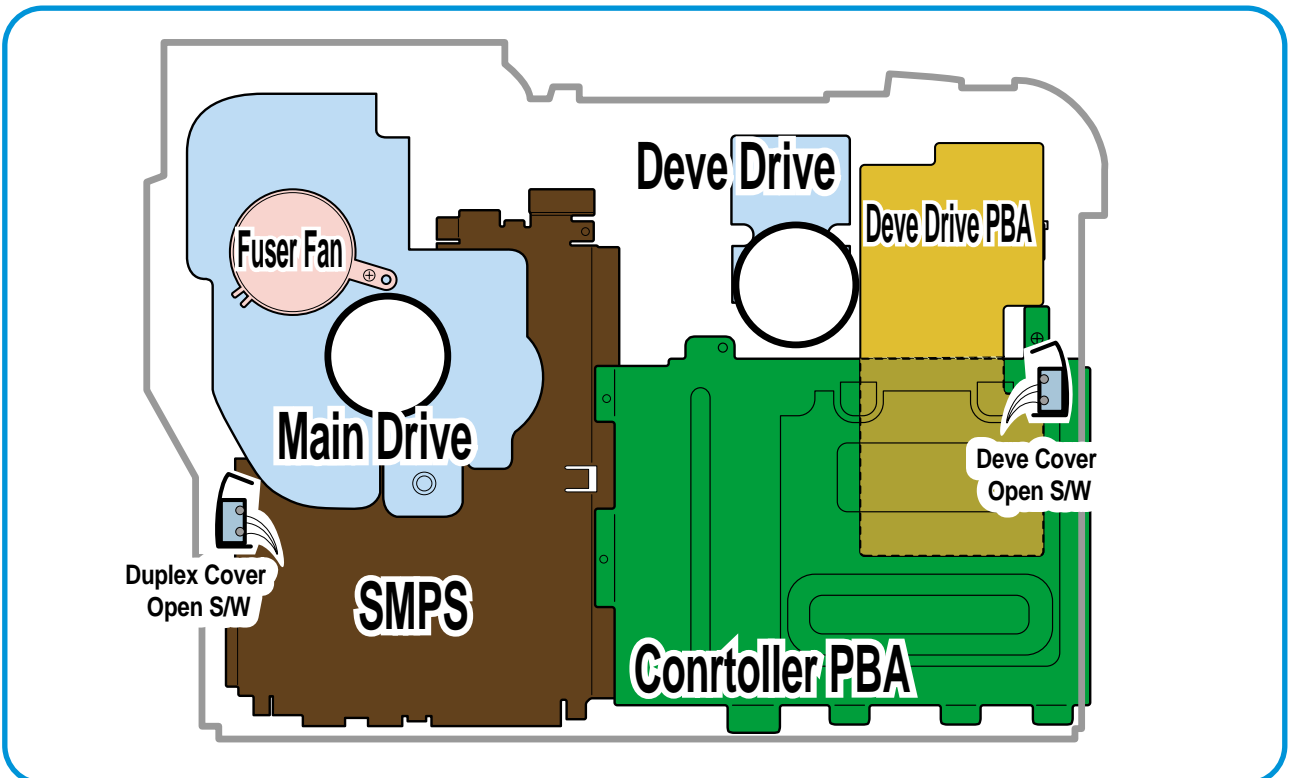
4.1.1 Main Parts of System

>> Front View

Panel PBA

Deve OEM
PBA

Waster Toner Sensor

Waster Toner Motor

>> Rear View

Deve Drive

Deve Drive PBA

Fuser Fan

Deve Cover
Open S/W

Main Drive

Duplex Cover
Open S/W

SMPS

Conrtoller PBA

1) OPC Unit

Images are created on the OPC unit using an electro-photographic process. The unit consists of:-
* OPC Drum
* Waste Toner Ass'y   used to collect waste toner remaining on the OPC drum,
* Charge Roller Assy
* Etc.

2) ITB Unit

ITB stands for Image Transfer Belt. An image developed on the OPC Drum is transferred first to the ITB. This is called the T1 Transfer (Primary Image Transfer).
Images are built up in layers on the ITB.
First the Yellow (Y) colour image is created on the OPC and transferred to the ITB
Next the Magenta (M) colour image is created on the OPC and transferred to the ITB
Followed by the Cyan (C) and Black (K) images.

3) Transfer Roller

Once the complete, full colour, image, has been built up on the ITB the Transfer Roller is used to transfer the image onto paper. This is called the T2 Transfer (Secondary Image Transfer)

4) FCT (First Cassette Tray)

It stores and automatically feeds print paper.

Pick-up Roller picks up paper, controls drive, feeds paper, removes static electricity, and so on.

> Spec.
* Paper arrange way : Side Registration
* Paper Direction : FISO (Front-in, Side-Out)
* Cassette Type : A4, Ltr
* Paper Discharge : Separation Claw
* Capacity : 250 Sheets (Standard paper 75mg/m? 20lb)
* Paper Size : A4, Letter
* Paper Weight (average) : 60~90g/m^2 (16~24lbs)
* Paper Type : General Printing Paper
* Additional Function : Paper Empty Sensor

5) SCT (Second Cassette Tray)

This additionally stores and automatically feeds printing paper. Its function is the same as the FCT (First Cassette Tray)

> Spec.
* Paper arrangement : Side Registration
* Paper Direction : FISO (Front-in, Side-Out)
* Cassette Type : A4, Ltr
* Paper Discharge : Separation Claw
* Capacity : 500 Sheets (Standard paper 75mg/m^2 20lb)
* Paper Size : A4, Letter
* Paper Weight (average) : 60~90g/m^2 (16~24lbs)
* Paper Type : General Printing Paper
* Additional Function : Paper Empty Sensor

6) MPT (Multi Purpose Tray)

The Multi-Purpose Tray not only feeds general printing paper but is also used for many other kinds of paper such as those paper sizes not supported by the cassette, envelopes, OHP, etc.

> Spec.

* Capacity : Cut Sheet : 100 Sheets (Standard paper 75mg/m^2 20lb)
* OHP : 300 Sheets
* Envelope & Label & Card Stock : 10 Sheets
* Paper Arrangement : Side Registration
* Power : Main Motor (BLDC)
* Driving Management : Solenoid
* Paper Discharge : Friction Pad Method
* Paper Size : Legal, Folio, A4, Letter, Executive, JIS B5, A5, A6
* Paper Weight (Average) : 60~163g/m^2
* Paper Type : General, Label, Post Card, Transparency, Envelope, Card Stock (Tracing Paper is not served)
* Additional Function : Paper Empty Sensor

7) Feeder

* Paper Arrangement : Side Registration.
* Power : Main Motor (BLDC)
* Paper Management : Solenoid

8) Duplex Unit

The Duplex Unit is used to reverse feed paper when printing on the second side (known as Double sided or Duplex printing). The Duplex Unit is not an optional extra, it is built-in at manufacturing time and is integral with the Transfer Roller.

> Spec.

* Power : Main Motor (BLDC)
* Paper Reverse Function: After the front side of the original document is printed, it transfers the printing paper to the duplex unit for printing the reverse side of original document which is reverse fed by the exit roller.

9) Exit Unit

The Exit Unit guides paper that is just about to leave the print engine. Printed-paper is discharged by Exit Roller and Kicker into the Output Tray.

> Spec.

* Capacity : 250 sheets (Standard A4, 75g/m2)
* Paper Direction : Face Down
* Exit Drive Roller : It is driven by Main Motor (BLDC), and it rotates clockwise for normal feed and antic-clockwise when reverse feeding for duplex printing.
* Bin Full Sensor : There is no Bin Full sensor fitted on this model.

10) Toner Cartridge

There are four toner cartridges, each containing a different colour ink : C (Cyan), M (Magenta), Y (Yellow) , and K (Black).
Each one of these toner cartridge is independent and can be changed independently.

11) Fuser Unit

This unit consists of 2 Heat Lamps, 2 Heat Rollers, 2 Thermostats and a Thermister. It melts and fuses the toner, transferred by the transfer roller onto the paper, by applying pressure and high temperature to complete printing job.

12) LSU

This is a core part of LBP. It forms a latent image on the surface of OPC drum using a static charge.
* Resolution: Real 600 dpi

13) Main Drive Unit

This motor drives, by way of a gearbox, the OPC unit, ITB unit, feeder unit, fuser unit, exit unit and duplex unit.

> Spec.

* Power : 40W Max (24V)
* Drives : OPC unit, ITB unit, Fuser, Feeder, Duplex unit, Exit unit

14) DEVE Drive Unit

This motor drives, by way of a gearbox, the toner cartridges and ITB cleaning cam.

> Spec.

* Power : 40W Max (24V)
* Drives : DEV (4 Color)/ITB Cleaning

15) SMPS (Switching Mode Power Supply)

This power supply uses the AC supply voltage to generate the DC voltages used by the system.
The SMPS has 3 output channels (+3.3V, +5V, +24V).
The AC Heater Control Unit that supplies power to the fuser is also located on the SMPS.

16) HVPS (High Voltage Power Supply)

The HVPS creates the high voltages (Charger, Supply, T1, T2, Developer) used for the electro photographic process. The high voltage is created from the 24V line from the SMPS. High Voltage output is supplied to the toner cartridge, OPC drum unit, ITB unit, and Transfer roller.

17) Main Controller PBA

The Main controller PBA is very important as it is the heart of printer. It has several major function blocks.

* CPU Block: This manages the printing order from the host, creates bitmap data for the engine to print and controls various devices that are needed to operate the printer.
* Engine Control Block: This manages images and controls various kinds of I/O
* Memory Block : The operating system uses this to store video data and printing orders given by host.
* ROM Block : The printer OS and PDL Interpreter are stored here.
* In addition there are USB 2.0 Block, IEEE 1284 Block, Option Block, OPE Panel, etc.

18) DEVE Drive PBA

Each toner cartridge requires the Supply HV only when that colour image is being processed. This unit takes its HV source from the HVPS and using 4 solenoids selects which cartridge is to receive the Supply voltage. This section also contains the DEVE motor, DEVE clutch, and DEVE solenoid drives. These are activated in sequence as required by the printing process.

19) DEVE OEM PBA

This detects new or used toner cartridges and also checks that cartridges are approved parts. If a toner cartridge is not suitable for the machine an error message is displayed.

20) Waste Toner Ass'y

A cleaner blade on the OPC unit cleans waste toner from the OPC drum after every image is transferred to the ITB. Once the complete image is transferred from the ITB onto paper the ITB Cleaning Solenoid activates and a cleaning blade removes waste toner from the ITB. Waste toner is transferred to the waste toner tank.
When the error message "Waste Toner Tank Full/ Not Install" is displayed on the LCD Panel replace the Waste Toner Tank immediately. Using the printer without a Waste Toner Tank or with a full tank may damage the printer.

4.1.2 Motor & Fan Layout

1. Main Motor

3. Fuser Fan

2. DEVE Motor

4. Waste Toner Motor
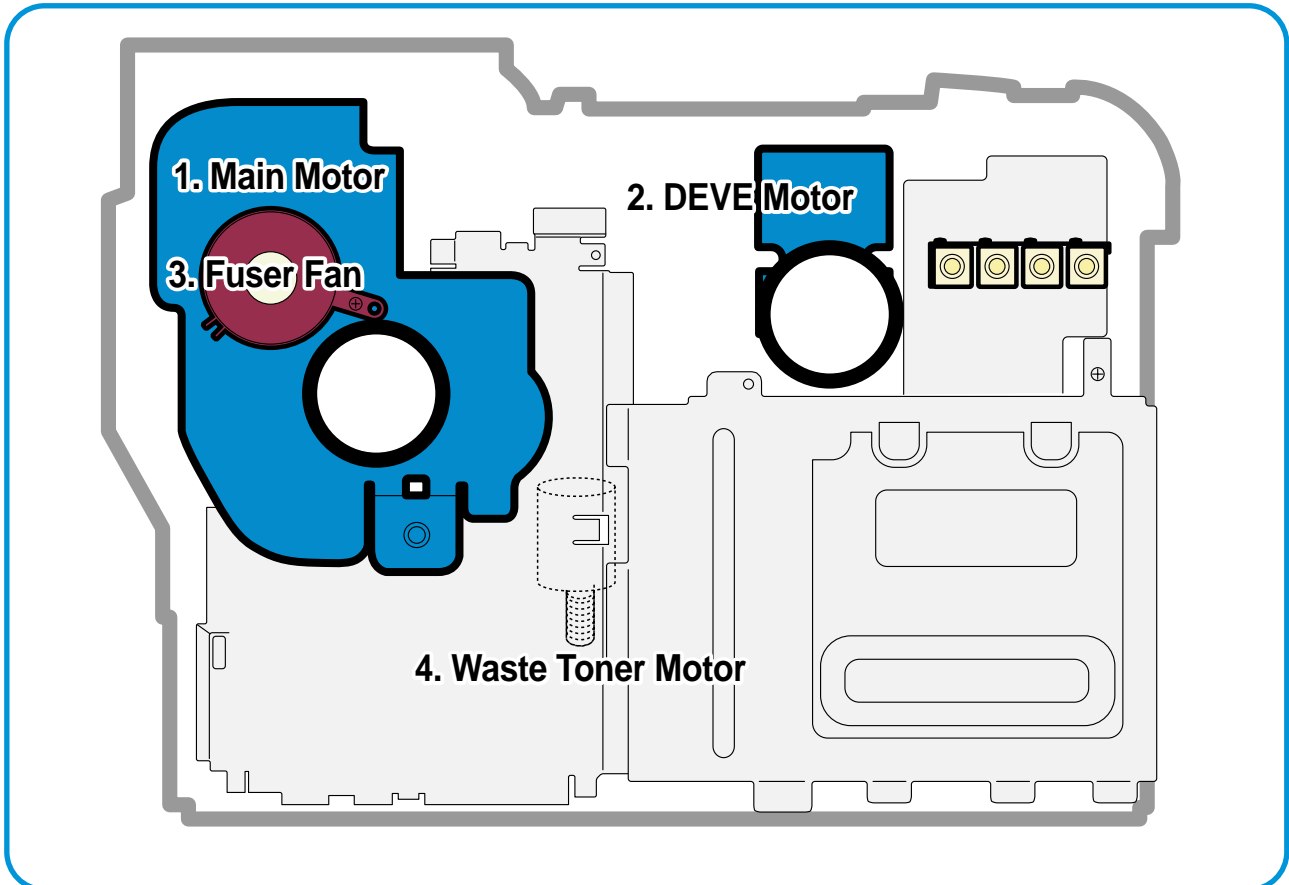
NO.	Name	Description
1	Main Motor	Drives the OPC unit, ITB unit, feeder unit, fuser unit, exit unit and duplex unit.
2.	DEVE Motor	Drives C, M, Y and K toner cartridges and ITB cleaning cam.
3.	Fuser Fan	Forces cold air into the printer and takes out heat from the fuser.
4.	Waste Toner Motor	Transfers collected waste toner from the OPC drum and ITB to the waste toner tank. (Refer to front view picture on 4-2 page)

4.1.3 Clutch & Solenoid Layout
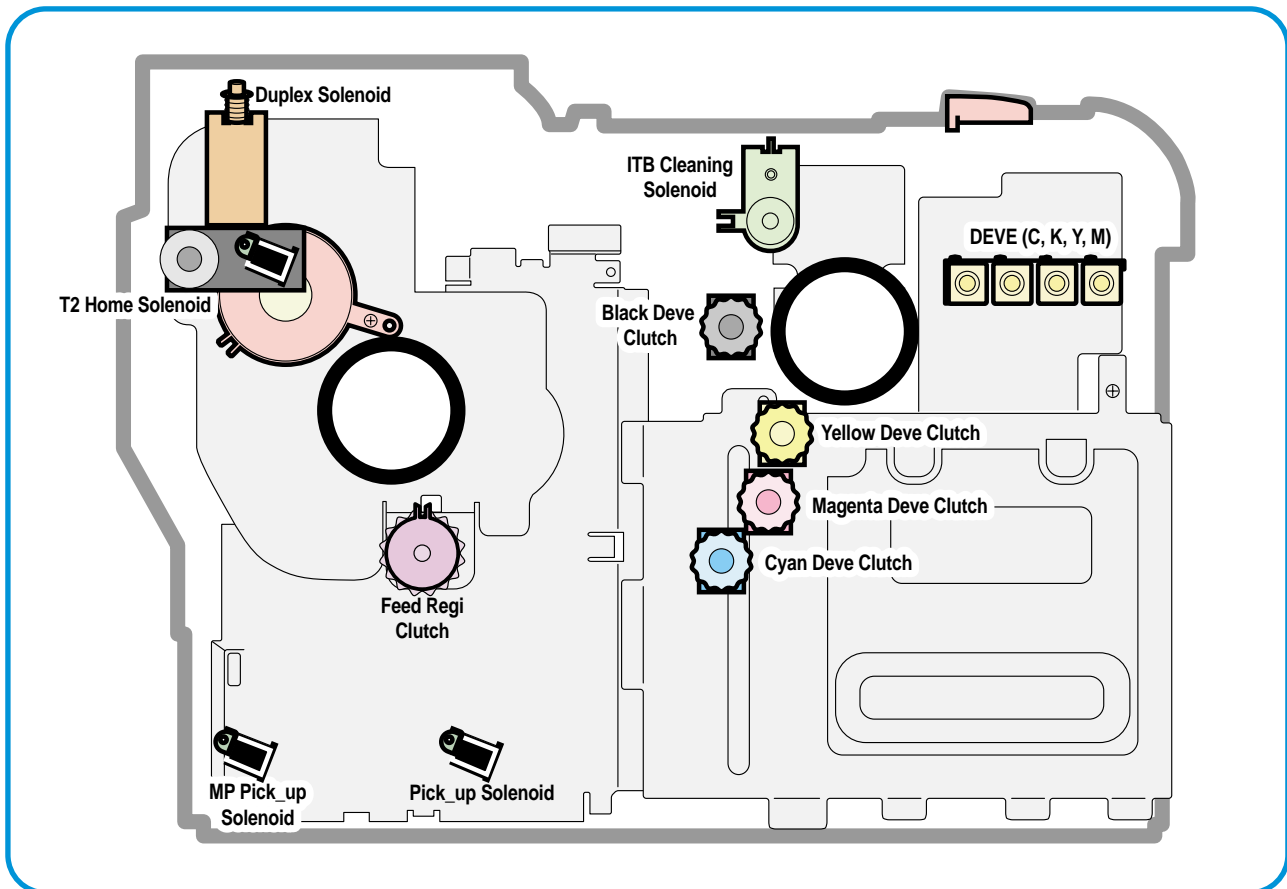
>>Solenoid

NO.	Name	Description
1.	C DEVE solenoid	Controls the High Voltage supply to the cyan cartridge.
2.	K DEVE solenoid	Controls the High Voltage supply to the black cartridge.
3.	Y DEVE solenoid	Controls the High Voltage supply to the yellow cartridge..
4.	M DEVE solenoid	Controls the High Voltage supply to the magenta cartridge.
5.	Pick-up solenoid	Controls the pick-up roller drive.
6.	MP Pick-up solenoid	Controls the MP pick-up roller drive.
7.	Duplex solenoid	When operating in duplex print mode, this reverses the direction of the main motor to feed paper into the duplex unit.
8.	T2 Home solenoid	This forces the transfer roller into contact with the ITB unit.
9.	ITB cleaning solenoid	This brings the cleaning blade into contact with the ITB unit

>>Clutch

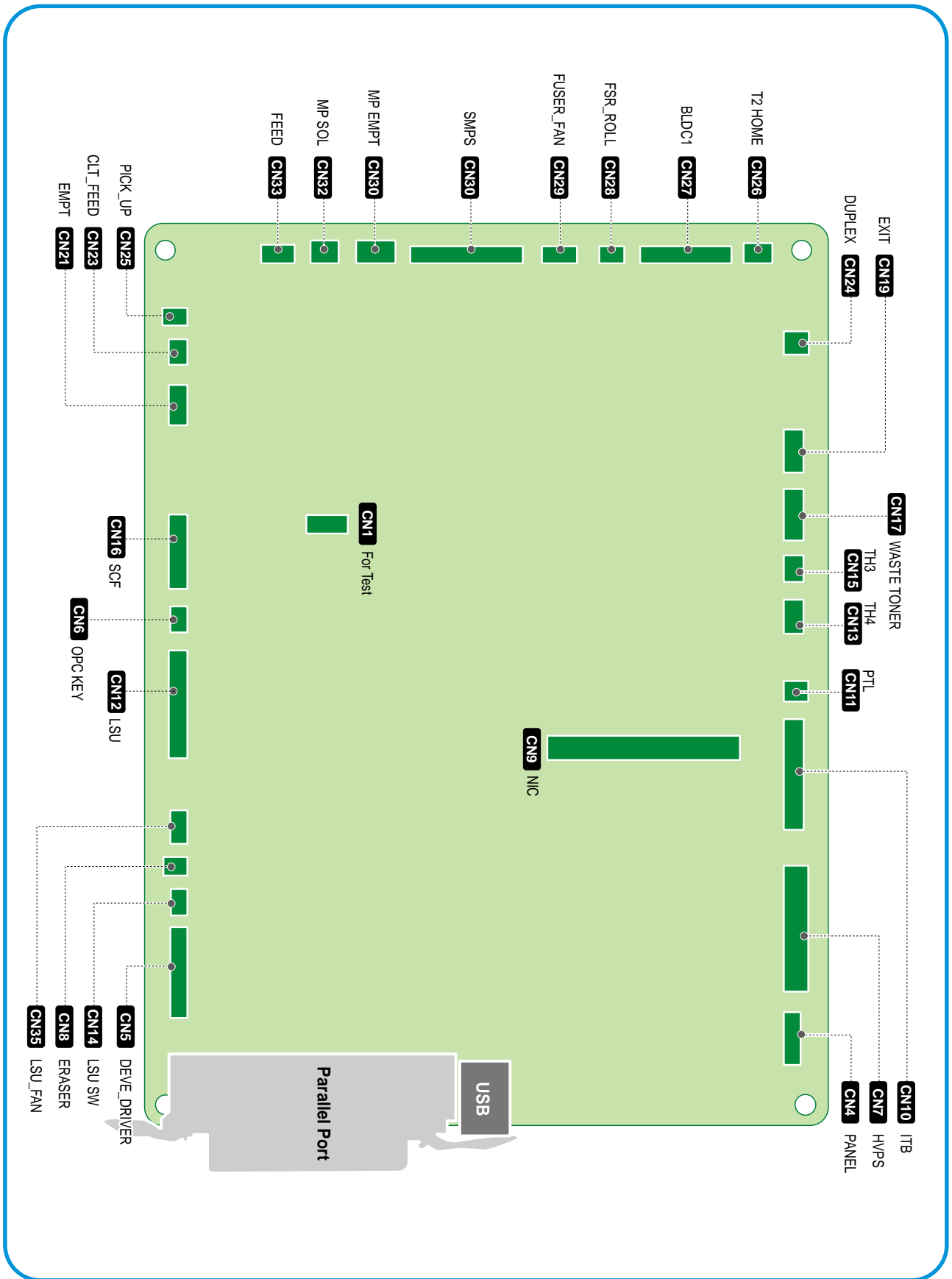| NO.	Name	Description
1.	Yellow DEVE clutch	Controls Yellow color toner cartridge drive
2.	Magenta DEVE clutch	Controls Magenta color toner cartridge drive
3.	Cyan DEVE clutch	Controls Cyan color toner cartridge drive
4.	Black DEVE clutch	Controls Black color toner cartridge drive
5.	Feed Regi. Clutch	Controls the location of picked-up paper

4.1.4 Sensor & Micro S/W Layout

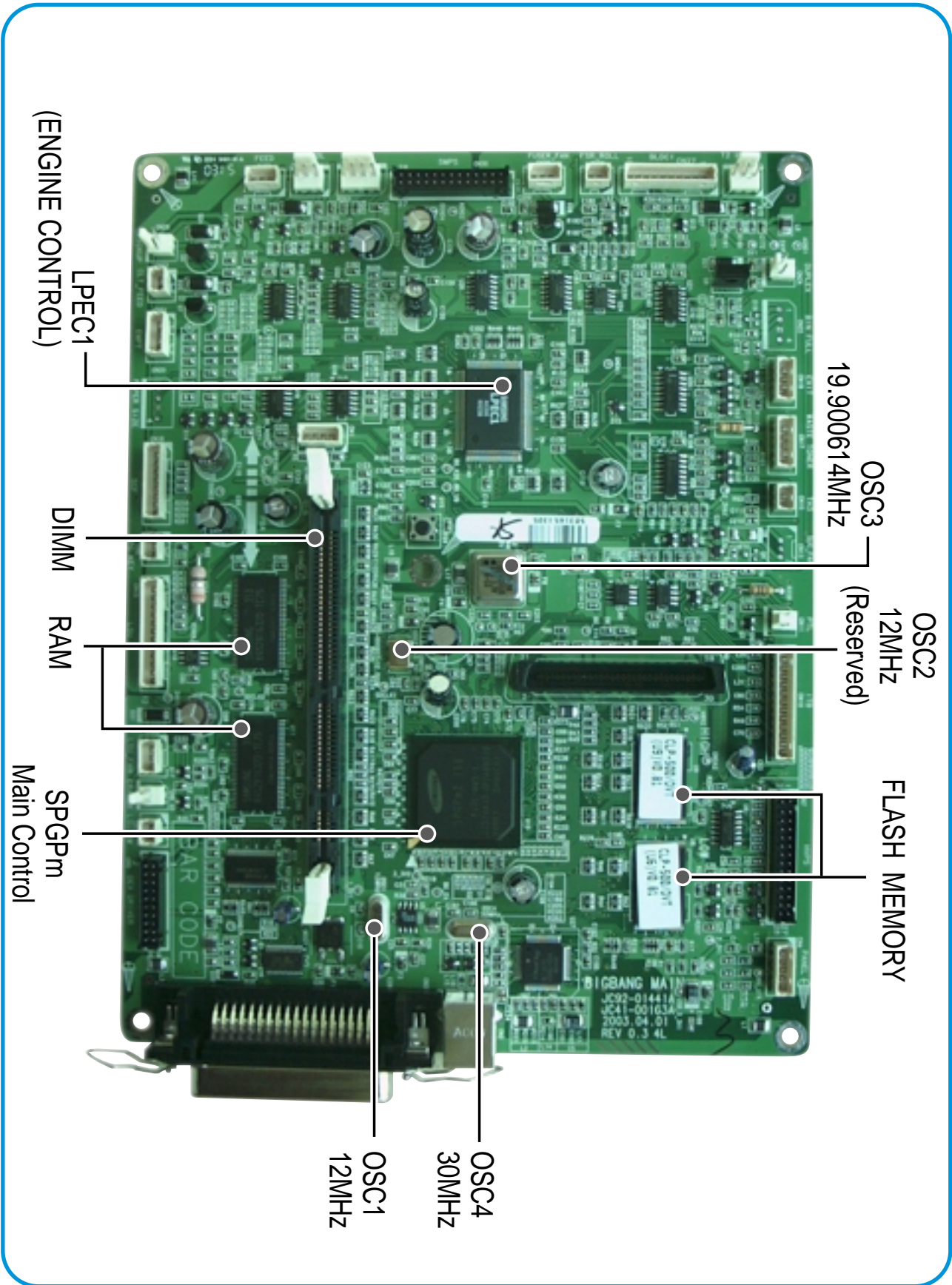| NO.	Name	Description
1.	Paper Empty Sensor(FCT)	This sensor detects paper in the first (main) cassette.
2.	Paper Empty Sensor(SCT)	This sensor detects paper in the second (optional) cassette.
3.	Paper Empty Sensor(MPT)	This sensor detects paper in the multi-purpose tray.
4.	Feed Sensor	This sensor must operate within a certain time after paper pick-up otherwise a JAM is detected
5.	ITB Home Sensor	This detects the position of the image transfer belt, and indicates the start location for image writing. It is used to ensure that all 4 colour images are correctly registered.
6.	CTD Sensor	This stands for Color Toner Density Sensor. It detects toner density of each color image that is formed on the OPC drum.
7.	Waste Toner Sensor	This detects whether the waste toner tank is mounted or not and the amount of waste toner in the tank.
8.	Exit Sensor	This detects whether printing paper is discharged or not.
9.	DEVE Cover Open S/W	This detects the open/closed status of the DEVE Cover.
10.	Duplex Cover Open S/W	This detects the open/closed status of the Duplex Cover.

Note: * *ITB Home Sensor and CTD Sensor are located in the ITB unit. If they develop a fault replace the ITB unit.*
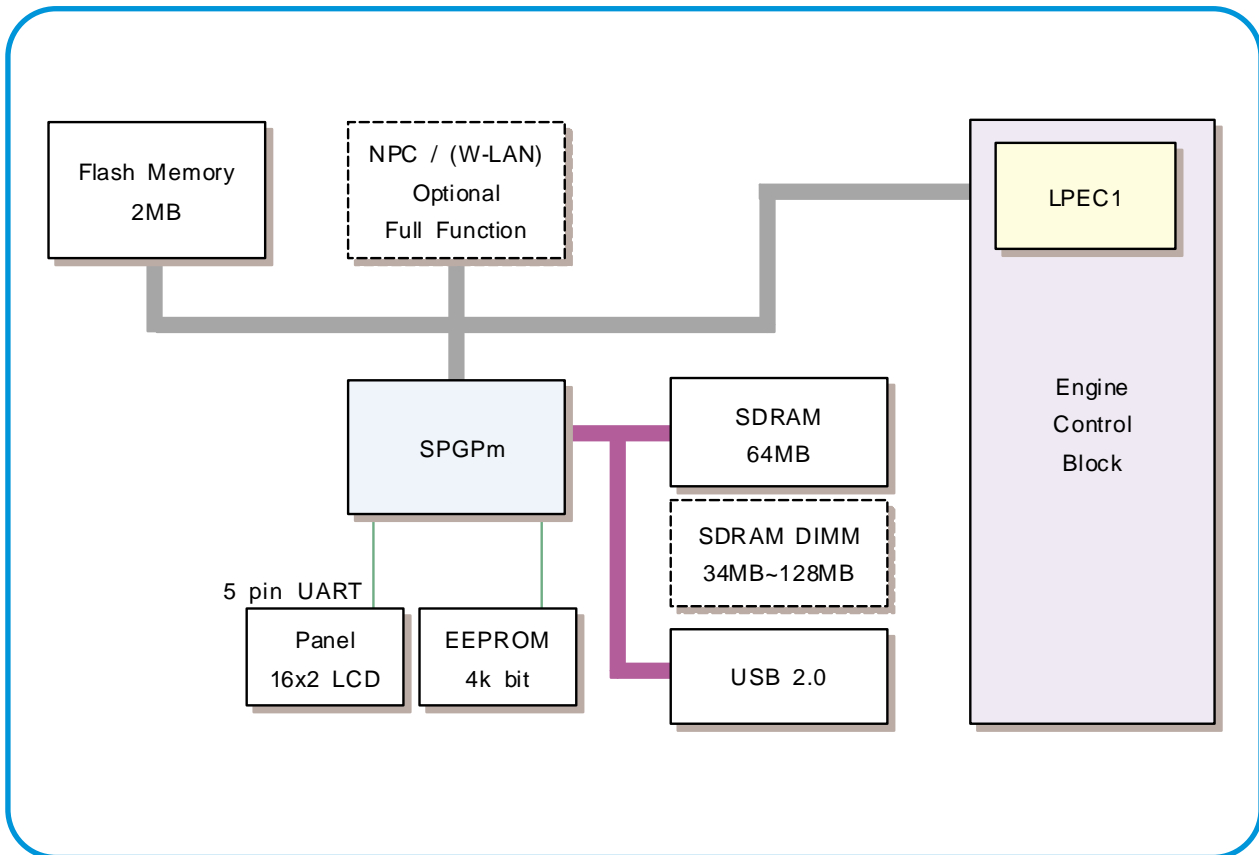* *Please, refer to the Chap. 7 Arrangement and Adjustment, "Paper Path diagram", for the location of the paper empty sensor, feed sensor, and exit sensor.*
* *Please, refer to page 4-2 for the location of the waste toner sensor, DEVE cover open S/W, and duplex cover open S/W.*

4.1.5 Main Controller PBA

LPEC1
(ENGINE CONTROL)

DIMM

RAM

SPGPm
Main Control

OSC3
19.900614MHz

OSC2
12MHz
(Reserved)

FLASH MEMORY

OSC1
12MHz

OSC4
30MHz

1) CPU BLOCK

This is the heart of the machine. A 120MHz - 32bit RISC processor is used to manage commands and data supplied by the host. This is converted into a bitmap image which is passed to the engine block for printing. The CPU is also used to control various other devices e,g, the USB 2.o Interface chip.

2) SPGPm overview

* Package
- 272 pins PBGA

* Power
- 1.8V(Core), 3.3V(IO) power operation
- P1284 inputs : 5V tolerant

* Speed
- 120MHz core(ARM946ES) operation, 60MHz bus operation
- Supportable Engine Speed : under 30ppm

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

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

* Direct connection up to 4 Flash ROM banks
  - Burst capability
  - Programmable timing per bank
  - Up to 16MB address per bank (Limited to 8MB per bank when nDREQ0 is enabled)

* Direct connection up to 6 I/O banks & 4 DMA I/O banks
  - Programmable timing per bank
  - Programmable recovery timing per bank for slow devices
  - Up to 16MB address per bank (Limited to 8MB per bank when nDREQ0 is enabled)

* Direct connection up to 5 SDRAM arrays
  - SDRAM controller supports PC-66, PC-100 and PC-133 SDRAMs running at 60MHz
  - Up to 128MB per array, up to 512MB totally
  - Wide supports for various SDRAM configurations, including programmable band and column address
  - Programmable SDRAM refresh time interval

* 4 General Purpose DMA controllers
  - Extensible architecture allows peripheral devices such as scan devices to have access to SDRAM arrays through DMA channels
  - 8bits, 16bits and 32bits Data Transfer Modes are supported
  - IO to Memory, Memory to IO, Memory to Memory transfer support

* IEEE1284 compliant parallel port interface
  - Compatible ECP communications are supported
  - Direct support for IEEE1284 compliant data transceivers

* RSH
  - Fully Hardware Rotator, Scaler and Halftoner support
  - Variable Image Scaler and Image Halftoning Unit for PCL6
  - Pattern & Gamma Table Memory : 1024 x 8, 256 x 8 x 4

* Graphic Execution Unit for Banding support of Printer Languages
  - Support up to 256 Bit Block Transfer
  - Scan Line Transfer
  - Polygon Filling
  - Enhanced Graphic Order

* Compression / Decompression
  - CODEC : Simplified JBIG algorithm for band compression / decompression
  - HCT : Halftone Compression Technology (Byte Run-Length Type)
  - Independent use of both Codec, but enabling only one Codec is desirable for bus traffic

* UART
  - 3 Independent Full Duplex UART channels
  - Max 16 bytes FIFO to handle SIR Bit Rate Speed
  - DMA support for RX and TX of Channel0

* Printer Video Controller for LBP engines
  - 20MHz video rate are targeted
  - Two different kinds of Printer Video Controller (Selected by Software)
        - 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)
  - High performance DMA based Interface to Printer Engine

- 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
        - Coversion time : 4.3us (@3MHz)
  - LSU Interface Unit

* Timer
- 3 Independent Programmable Timers
- Watch Dog Timer for S/W Trap and Tone Generator for MFP Application

* Up to 5 External Interrupts support
- High active interrupt signals
- FIQ/IRQ Interrupt mode selectable

* Ethernet Controller (MAC)
- Full compliance with IEEE standard 802.3, 802.3u specification
- Support 10/100 Mbps data transfer rates
- DMA engine with burst modes (4 words burst and 8 words burst are supported)

* USB 2.0 interface
- USB 1.1 backward compatible
- UDC(USB Device Controller) block and USB Physical block are integrated
- Both of High Speed(480Mbps) and Full Speed(12Mbps) are supported
- 2 DMA channels support : one RX Channel and one TX Channel
- Interrupt transfer support up to 6 Endpoints
- EP0 In/Out (Control transfer), EP1 In/Out (Bulk transfer), EP2 In/Out (Bulk transfer)

* Debug support
- Only MultiICE logic support from ARM9 series
- 5 JTAG connections : TCK, TnRST, TMS, TDI, TDO
- Internal logic for synchronizing TCK and high speed CLK
- Maximum TCK frequency : 20MHz (CLK x 1/6)

3) Memory Block

The operating program runs from memory (see below). It is used to store video data and printing jobs from the host. Standard factory fitted memory is 64MB, and can be expanded using a DIMM module mounted in the SODIMM connector. This is a user fit option, DIMMs from 64Mb - 128MB can be used giving a total of up to 192MB of memory. DIMM modules are non standard - only Samsung product should be used.

The memory controller is located in the SPGPm controls the SDRAM memory connected using a 32 bit 60 MHz bus.

4) ROM Block

An 2MB flash ROM is used to store the OS. The ROM controller is contained in the SPGPm processor. When initializing after power on the contents of ROM are downloaded into memory and the OS is run from within memory.

5) USB 2.0 Block

A Netchip Co. NET2270 is used to provide support for USB2.0 and is capable of interface speeds up to 480Mbps. Under control of the SPGPm chip DMA is used to transfer incoming data directly into memory.

6) IEEE 1284 Block

An IEEE 1284 controller is controlled directly by the SPGPm processor. ECP mode is supported.

7) Option Block

An Ethernet card can be attached using the 100 pin connector. It is connected directly to the SPGPm processor and communicates using a 16bit bus.

8) OPE Panel

The OPE panel is controlled by a UART Block located in the SPGPm and it displays printer status and helps the user to setup the printer. Various data is transferred using a serial interface between a Mycom located in the OPE panel and the UART in the SPGPm.

9) Memory

There are two types of memory, program memory that uses flash and a working memory that uses SDRAM. When printing working memory is used as band memory.

10) Sensor

Various sensors are used to detect various conditions during the printing process. These include paper empty sensor, feed sensor, exit sensor, CTD sensor, ITB sensor, etc.

11) Actuator Control

This section drives the various motors and clutches that are required for the paper feed and printing process. These include DEVE cartridge clutches (4 off), Feed Regi clutch, DEVE solenoids (4 off), Pick solenoids (2 off), Duplex solenoid, ITB and T2 solenoids.

12) ADC

The ADC unit is used to sense a number of analog parameters used in the set. These include Fuser and Set temperatures, OPC, ITB and Toner OEM resistors, Waste Toner tank full / present, Waste Toner Motor and T1 / T2 / Charge currents, CTD sensor.

13) DAC

The DAC is used to control the light intensity emitted by the CTD LED.

4.1.6 SMPS (Switching Mode Power Supply) PBA

The SMPS unit supplies DC power for driving the whole system, it also contains an AC heater control unit that supplies power to the fuser.
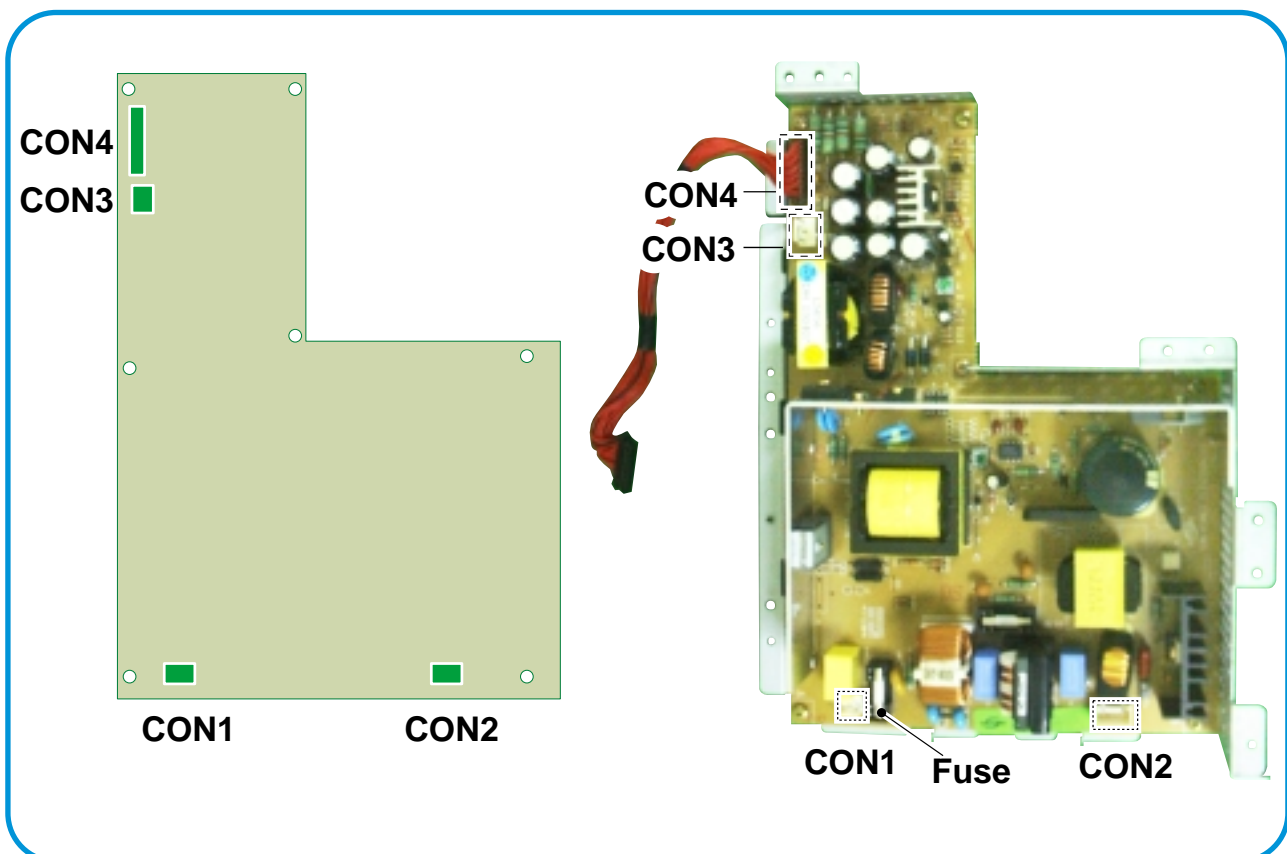
1) DC output
- Main controller PBA, OP panel, SCF, Developer driver PBA

2) AC output
-Fuser unit (Heat lamp, Thermostat)

3) Output voltage

NO	Item	CH1	CH2	CH3	CH4
1	Channel name	+3.3V	+5V	+24.0V	+24.0VF
2	Rated outputting voltage	3.3V ± 4%	+5V ± 4%	+24V + 15%/-10%	+24V + 15%/-10%
3	Uses	MICOM,CMOS LOGIC	MICOM,CMOS LOGIC	MOTOR,FAN	MOTOR,FAN

4.1.7 HVPS (High Voltage Power Supply) PBA

The HVPS PBA uses the 24V created by the SMPS to generate the high voltages used by the charger, supply, T1,T2 and DEVE processes. For bests quality images these high voltages must be , controlled accurately to maintain the print quality. The high voltages produced are supplied to toner, OPC cartridge, ITB unit, and transfer roller.
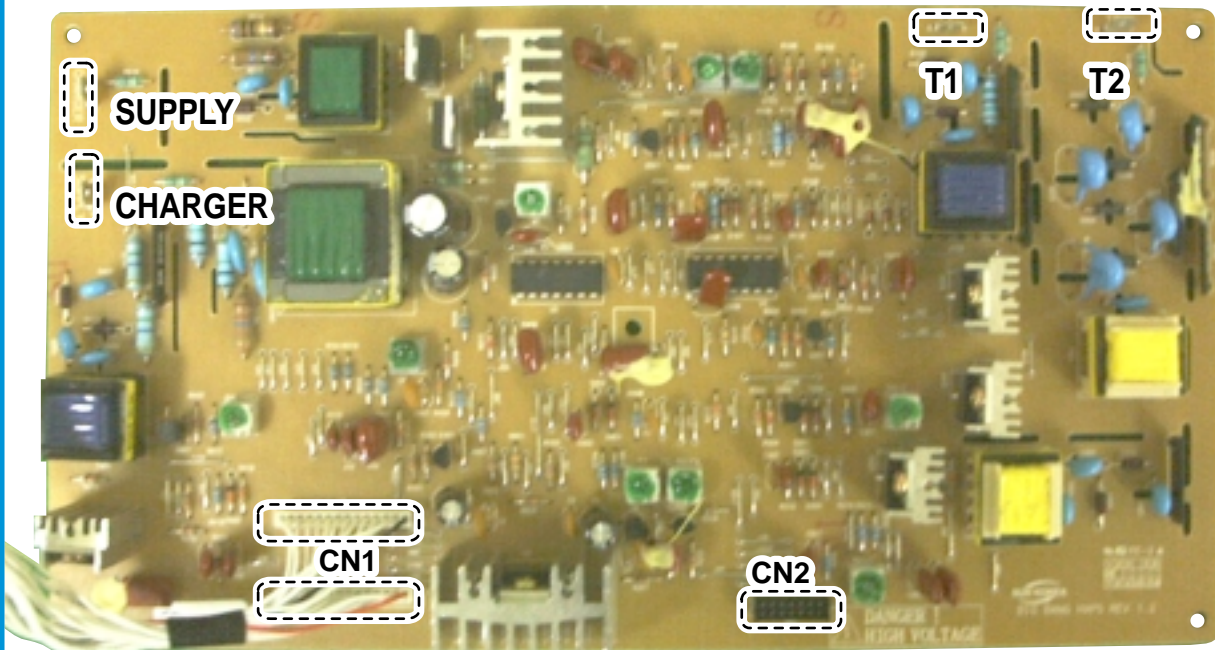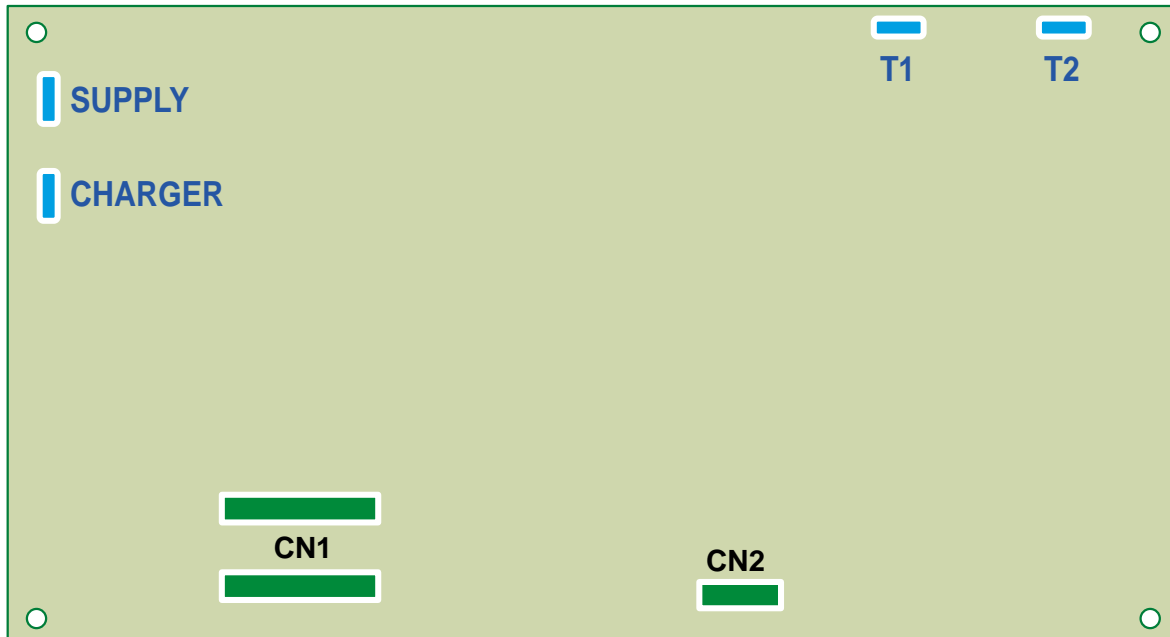
1) Charging Voltage: Charger
* Function : This high voltage is used to charge the surface of the OPC to about -500volt~800volt.
* Output voltage : -200V~-2.0KV DC +/- 3% (Duty is changeable, no loading)
* Error type :If MHV was not present, the surface of the OPC is not charged. As a result, toner on the developer roller is transferred over to the OPC drum: therefore, black paper could be printed out.

2) Transfer high voltage: T1(+)
* Function : This high voltage is used to transfer toner from the OPC drum to the ITB unit.
* Output voltage : +400V~ +3.5KV DC +/- 3% (Duty is changeable, no loading)
* Error type : If T1 was not present, it is not possible to transfer toner from the OPC drum to the ITB. As a result, printer output could be faint.

3) Transfer High Voltage: T2 (+)
* Function : this high voltage is use to transfer toner from the ITB to the paper.
* Output voltage : +400V~ +5KV DC +/- 3% (Duty is changeable, no loading)
* Error type : If T2 was not present, it is not possible to transfer toner from the ITB to the paper. As a result, printing output could be faint

4) Cleaning voltage: T2 (-)
* This high voltage is used to transfer (-)toner, remains on transfer roller, from the Transfer Roller to the ITB unit.
* Output voltage : There is no feedback control, and it outputs a fixed voltage (-900V).
* Error type : Toner contamination occurs on the reverse side of the printed-paper.

5) Supplying voltage: Supply
* Function : Supply the duplicated (AC+DC) voltage from the HVPS to the Deve Drive Board.
* Output voltage
   AC Voltage f : 1 Khz ~ 3Khz (Duty is changeable)
   AC Voltage V_{p-p} : 1KV ~ 3KV
   DC : -100V ~ -1000V

* Error type: 1. If this voltage is GND, print density is extremely low.
           2. If this voltage is floating due to unstable contact point at the HV terminal, density becomes so low as that printing results are not visible to the naked eye.