3. System Overview

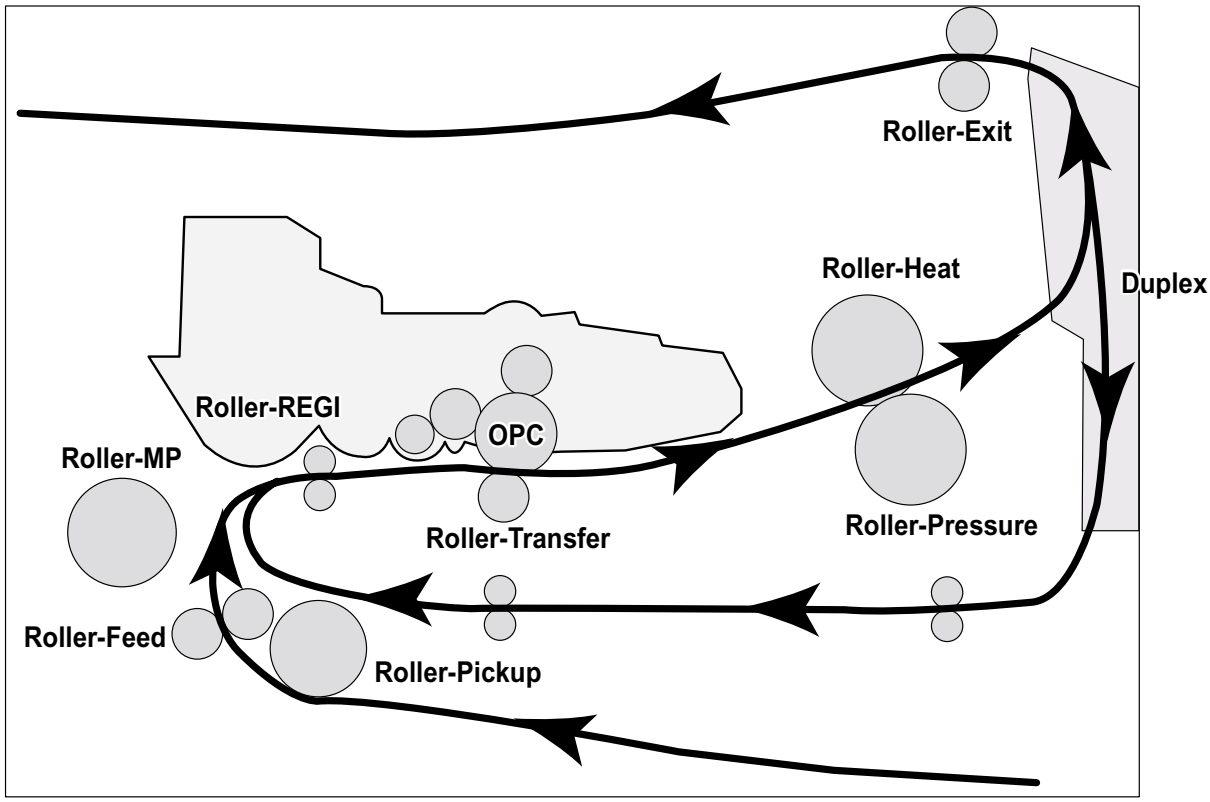
3.1 System Construction

3.1.1 SUMMARY

ML-305X is consisted of the Engine parts and F/W, and said engine parts is consisted of the mechanical parts comprising Frame, Feeding, Developing, Driving, Transferring, Fusing, Cabinet and H/W comprising the main control board, power board, operation panel, PC Interface.

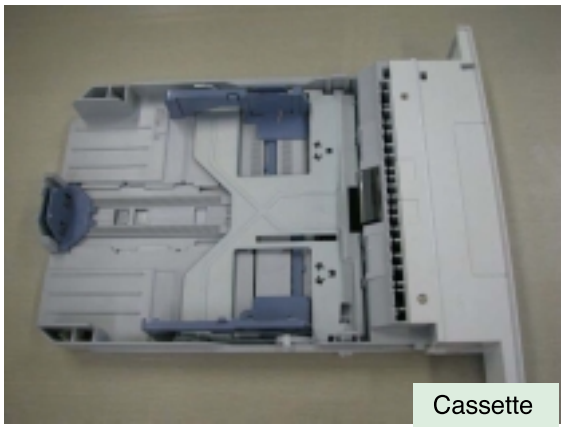
- In ML-305X, the main controller is consisted of Asic(SPGPv3) parts, Memory parts, Engine Interface parts and it functions as Bus Control, I/O Handling, drivers & PC Interface by CPU.
  Memory Access supports 16bit Operation, and Program Memory 32MB and Working Memory as well.
- In ML-305X, the paper path is consisted of 250 sheets Cassette containing friction Pad, pickup-roller, feed-roller for functioning as registration, Earth-transfer for guiding the transfer inlet, Guide-Tr for guiding sheets between transferring and fixing, Fuser, Exit Assy.
- In ML-305X, the driving device is consisted of f55 BLDC motor, OPC, Pick-up, Feed, Gear-Train connected with Mounting member. - to be changed

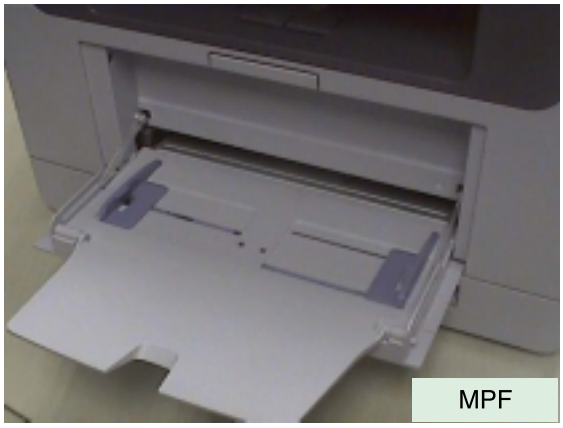
3.1.2 System Layout



3.1.2.1 Feeding Section

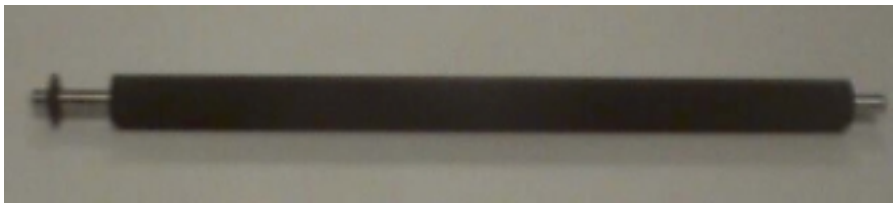
· Feeding Method : Universal Cassette Type
· Feeding Standard : Center Loading
· Feeding Capacity : Cassette 250 Sheets (75g/㎡, 20lb StandardPaper)


Cassette


MPF

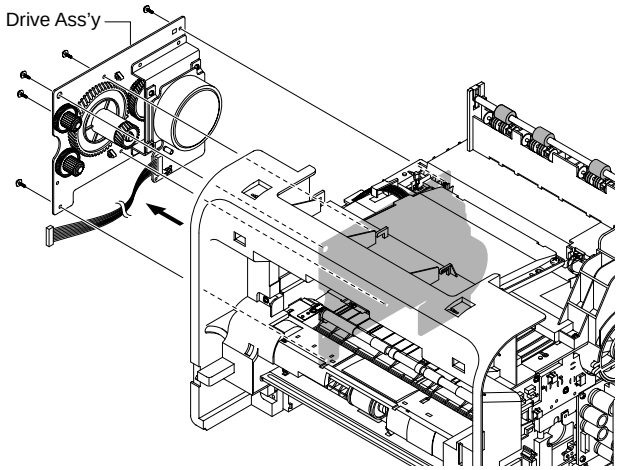
3.1.2.2 Transfer Ass'y

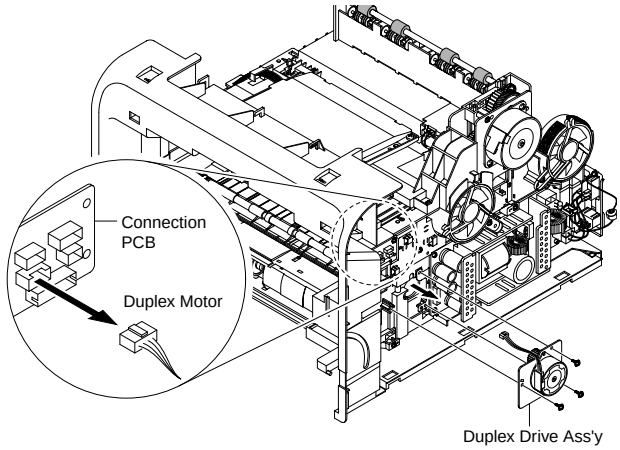
· In Warranty(Life time) : Within 70,000 sheets printing



3.1.2.3 Driver Ass'y

· MAIN Motor ass'y is for Cassette,MPF and Toner Cartridge
· EXIT Motor ass'y is for fuser,exit roller and the initial duplexing feeding
· DUPLEX Motor assembly is for duplexing feeder on the ML-3051ND only





3.1.2.4 Fuser Ass'y

· Fusing Type : E-Coil type
· Heat Roller : [ϕ28.3 with 0.1 Crown]
· Pressure Roller : [electrically conductive]
· Thermistor - Temperature Detecting Sensor
· Thermostat - Overheat Protection Device

Trouble	Temperature Control concept
Open Heat Error	50℃ below for 20sec at Warm up
Over Heat Error	240℃ over for 2sec or 220℃ over for 2sec.
Low Heat Error	Standby :130℃ below for 10sec. Printing : It 30℃ lower than target temperature for 20sec

3.1.2.5 LSU

· LSU is consist of LD(Laser Diode) and polygon motor control. When the controller generate the printing signal LD will turn on and Polygon motor starts.If the receiving part in LSU detect the beam and then Hsync is generated. When the rotation of poygon motor is steady, it is time of LSU ready status for printing. If either of two condition is not satisfied, LSU error is expected.

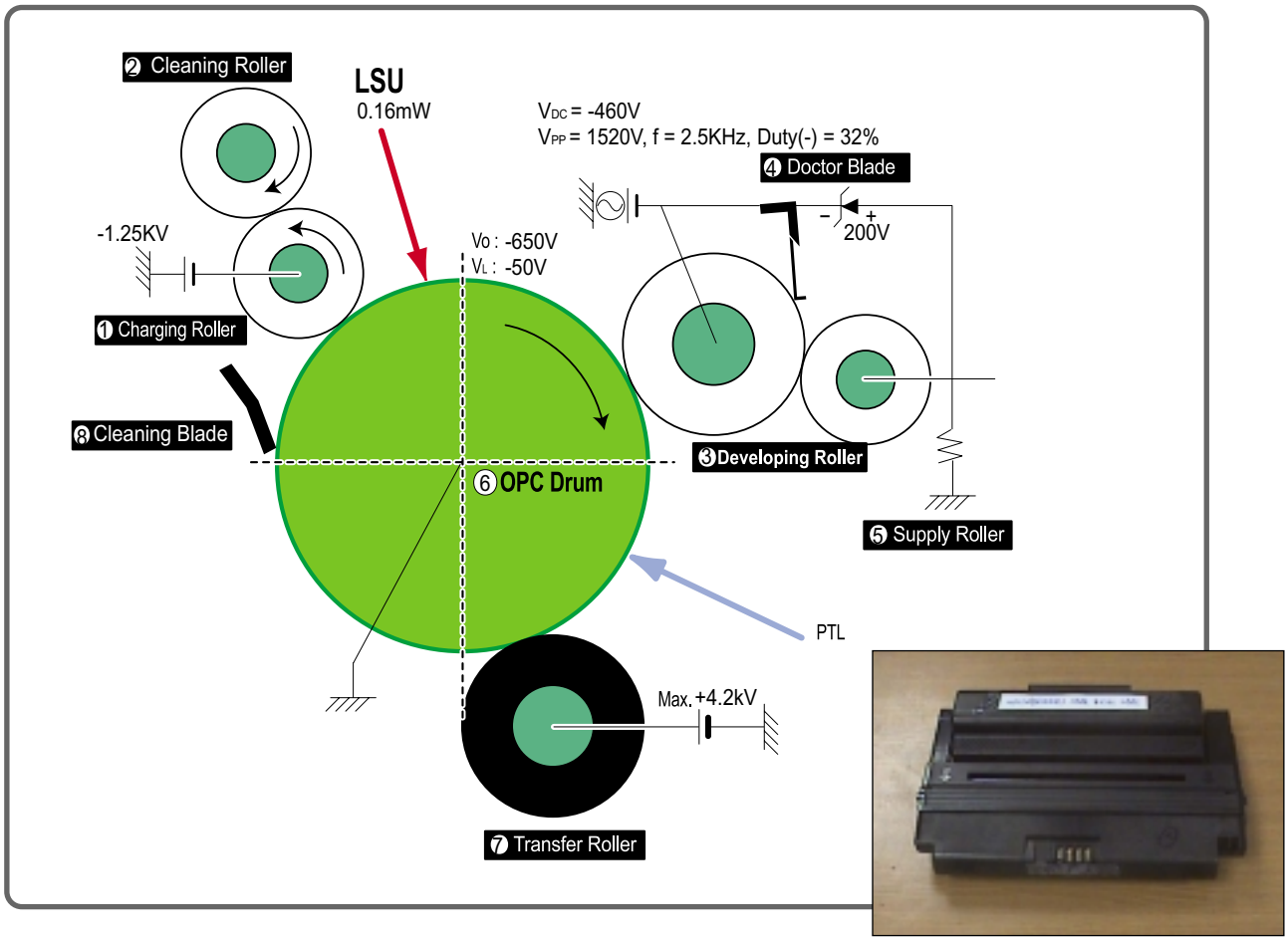
Trouble	Failure Analysis
Polygon Motor Error	No steady rotation of Polygon Motor
Hsync Error	In spite of steady rotation of Polygon Motor, There is no generation of the Hsync signal

3.1.2.6 Toner Cartridge

· OPC Cleaning :Mechanical Cleaning by the cleaning blade.

· The recycled toner : Trash room for the recycled toner

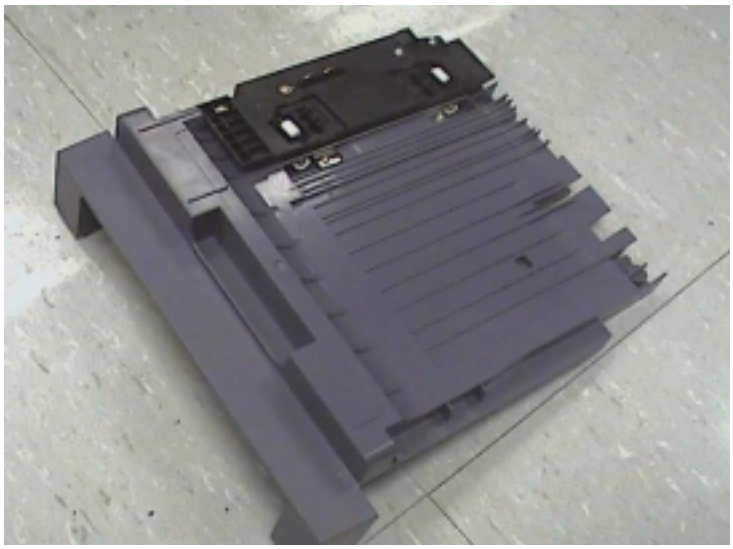
· No shutter for protecting the OPC Drum



3.1.2.7 Duplex Unit

· Duplex printing function as factory option

· Available Paper : Letter, Legal, Folio, Oficio and A4



3.1.2.8 Optional Tray (SCF)

· For customer covenience in managing paper

· Capacity : 250 sheets

3.2 Mechanical Parts Specifications

3.2.1 Frame

· Material : PC + ABS V0 NH-1000T(Cheil Industries)
· Weight : 1.0kg

3.2.2 Feeding Part

· Feeding Type : Universal Cassette Type
· Feeding Standard : Center Loading
· Feeding Qty : Cassette 250 sheets (75g/㎡, 20lb paper standard)
MPF 500 sheets (75g/㎡, 20lb paper standard)
Special Media 5 sheets in MPF (OHP, Envelope, Label, Post Card, Index Paper etc.)
· Separating Type : Cassette-Friction Pad Type
MPF-Friction Pad Type
· Driver Type : Driving by Gearing from Main Motor
· Pick Up Roller Driver : Solenoid
· Pick Up Roller Rubber Material : EPDM + IR μ= 1.6 or more
· Pick Up Velocity : 143.12 203.21mm/sec (Process : 124.95 179.7mm/sec)
· Paper detecting Sensor : Photo Sensor
Paper Size Sensor : None
· Paper Separating Pad Material : NBB 52° μ= 0.8~1.2
· Separating Pad Pressure : 190gf
· Pick Up Roller RPM 97.623 140.6RPM
· Feeding Pressure (Cassette) : 250 gf ±10% (SPRING H mm, based on 1 sheet)
320 gf ±10% (SPRING H mm, based on 250 sheet)

· Paper Exit Type : Facd Down

· Feed Roller Velocity : Feed-roller Cassette : 127.56 183.79mm/sec
Feed-roller Frame : 126.07 181.64mm/sec

· Feed Roller Driver : Solenoid

3.2.3 Transfer Ass'y

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

- Velocity : 183.02 mm/sec (Drum Velocity x 102.53%)
- TR Voltage : +1.3KV ±5% (based on 200㏁ in accordance with media area, Transfer table)
  -1.20KV ±10% (In cleaning)
- Transfer Trigger Current : 6.5㎂ ±5%
- Transfer Efficiency : 85% or more (All envirmnment : preferable media)
- Voltage System : Voltage PWM Control System
- Transfer Roller
  - Material : NBR FOAM ROLL
  - Structure : Mono layer
  - Resistance : 3E +07 ~ 8E +07Ω (N/N)
  - Hardness : 40° ±3°° (ASKER-C)
  - Validlength : 224.2 +0.5/-0mm
  - OD : φ15.0 ±0.5mm
  - SHAFT Material : SUM -24L + Non-electrolysis Ni. Coating
- Life Span : Print over 70,000 sheets (in 15~30℃)

3.2.4 Driver Ass'y

3.2.4.1 Motor

- Spec : BLDC ∅55 + PM ∅49 Motor (2-2 Bipolar) + PM ∅42 Motor (2-2 Bipolar)
- Pull-Out Torque :
  - BLDC ∅55 : 1350 gf. cm(based on actual value) or more (1342rpm, 1.2A(rms))
  - PM ∅49 : 1600 gf. cm(based on actual value) or more (714pps, 1.1A(rms))
  - PM ∅42 : 600 gf. cm(based on actual value) or more (925pps, 0.9A(rms))

- TORQUE MARGIN (Tp/0 ÷ Tsys) : BLDC ∅55 : 1350/1047 gf. cm = 1.29
  - PM ∅49 : 1600/809 gf. cm = 1.97
  - PM ∅42 : 600/210 gf. cm = 2.85

- Driving Frequency : BLDC ∅55 : 1342.6 rpm(1007 Clock)
  - PM ∅49 : 892.5 rpm(714 pps)
  - PM ∅42 : 1156.25 rpm(925 pps)

- It is a power delivery unit by gearing : BLDC Motor -> Pickup/Feeder/Devloper
  - PM ∅49 Motor -> Fuser/Exit
  - PM ∅42 Motor -> Duplex

3.2.4.2 Process Speed

· Print Speed : 28/30 PPM (based on A4/LTR)
· Opc Drum Vp : 179.7mm/sec
· Unit Relative Velocity (Paper Speed)
  - Pickup : 206.21mm/sec), 14.75% ↑ VS OPC Vp
  - Feeder (Cassette) : 183.79mm/sec, 2.28% ↑ VS OPC Vp
  - Feeder (Frame) : 181.64mm/sec, 1.08% ↑ VS OPC Vp
  - Transfer : 184.25mm/sec, 2.53% ↑ VS OPC Vp
  - Fuser : 179.3653mm/sec, 0.19% ↑ VS OPC Vp

· Jitter
  - Vertical : 3 σ0.018 or less in Vision System
  - Horizontal : within 2% of partial magnificence error

· Orthogonality : SPEC : ±1.0mm or less

3.2.4.3 Acoustic Noise

· Warming Up : 49dB or less
· Printing : 54dB or less
· Stand-by : 39dB or less

3.2.5 Fixing Part (Fuser)

The fuser is consisted of the E-Coil, Heat Roller, Pressure Roller, Thermistor and Themostat.
It adheres the toner to the paper with pressure and a heat to complete the printing job.

3.2.5.1 Halogen Lamp

· Voltage 120V : 115 ±5%
220V : 230 ±5%
· Capacity : 800 Watt ±25W
· Temp. Distribution : 120%

3.2.5.2 Temperature-Interception Device (Thermostat)

· Thermostat Type : Non-Contact type THERMOSTAT
· Control Temperature : 150℃ ±5℃
· THERMOSTAT-ROLLER Gap : 1.9 ±0.2mm

3.2.5.3 Temperature Detecting Sensor(Thermistor)

· Thermistor Type : HF-R0060 (SEMITEC 364FL Type)
· Temperature Resistance : 7㏀(180℃)
· SYSTEM Temperature SETTING
- Stand by : 165 ±5℃
- Printing : 189 ±5℃(5 minutes before)
184 ±5℃(5 minutes after)
- Overshoot : 200℃ less
- Overheat : 210℃ less

3.2.5.4 Heat Roller

· Length : 247.5mm
· Valid length : 224mm
· OD : φ26.1 + 0.05, -0.03 (Tubing incl., Crown 0.09~-0.15)
· Material : AL(AL5052) + PFA Tubing
· Thickness : 0.9mm
· Coating Material : PFA 100%
· Coating Thickness : 20um (Thickness after abrasion)
· GND Type : H/R Bearing Grounding type By SECC Fuser lower frame

3.2.5.5 Pressure Roller

· Shaft
- Length : 251.3mm
- Material : STKM
- Thickness : Ø6(Ø20---RUBBER portion)

· Rubber
- Material : Silicon Sponge (Tubing Type : Ø32)
- Length : 226.4mm
- Thickness : 6mm(one-side)

· OD : φ32.25 ±0.2(Center part Crown -0.35)

3.2.5.6 Media Separating System

Thflon Coating with PEEK Claw System

3.2.5.7 Safety Relevant Facts

· Proteciong device when overheating
- 1st protecting device : H/W cuts off when detecting an overheating
- 2st protecting device : S/W cuts off when detecting overheating
- 3st protecting device : Thermostat cuts off the power

· Safety device
- The power of Fuser is cut-off after front cover is open
- The overheating safety device for customer
- The surface temperature of the Fuser Cover is under 80 ℃

3.2.6 LSU (Laser Scanner Unit)

The LSU unit is controlled by video controller. It scans the video data received from video controller with laser beam by using the rotation principle 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 /HSYNC 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 /HSYNC signal to arrange the vertical line of the image on the paper. After detecting the /HSYNC signal, the image data is sent to the LSU to arrange the its margin on the paper.

The one side of the polygon mirror is one line for scanning.

	Item	Specification	Item
Resolution		Real 600 dpi	main direction × sub direction
Spot Size	Main	75 +20/-20㎛	-beam diameter at the level of 1/e2 of intensity -at the spot location of 0, ±100㎜ of image height
	Sub	85 +25/-25㎛	
	Variation	40㎛ /50㎛	main/sub, within image height of -100 ~ +100㎜ range
LaserProperty	Wavelength	785 +10/-15㎚	at 25℃
	Power	0.33 ㎽±0.02㎽	at the center of image on the focal plane, with stationary condition, power supplied at DC 5 volt
	Vignetting	Min 80 %	spot power variation within image height of -100 ~ +100㎜
fθProperty	Magnification error	Max 0.7 %	based on the printable area, 216 ㎜
	Partial Magnification error	max 1.5 %	based on the 2.54㎜ width within the printable area, 216㎜
Beam Position	Deviation of main scanning	±1.0 ㎜	at the center of image
	Deviation of sub scanning	±1.0 ㎜	
Scan Line Property	Bow	Max 1 ㎜	within image height
	Skew	Max 1 ㎜	-100 ~ +100㎜ range
Sync. Property	Position	136.7 ±1.0 ㎜	distance to synchronization position from the center of image
	Pulse width	Min 5.0 ㎲ec	pulse width of synchronization
Pitch Error	Neighbor line	Max 10㎛	Pitch error in sub scanning direction within image height of -105 ~ +105㎜ range
	Within 6 lines	Max 20㎛	within image height of -105 ~ +105㎜ range

	Item	Specification	Item
Unit assembly state		5°	
Motor	Control	PWM control	external clock(TTL pulse)
	Direction of rotation		CCW
	Rotational speed	31836.6 rpm	normal rotational speed (30ppm)
	Rising time	Max 6.0sec	time to stable rotational speed
Mirror	Facet number	4 faces	
	Inner diameter	φ14.14 ㎜	
Jitter	LF	Max 0.030 %	within image height of -105 ~ +105㎜ range
	RF	Max 0.020 %	
Motor Driver	Supply voltage	24 V ±10 %	application voltage to the driving circuit of polygon motor
	Starting current	Max 2.0 A	required current for acceleration
	Running current	Max 1.0 A	required current to stable rotational speed
Scanning Property	Effective scanning width	216 ㎜	
	Scanning freq.	2,122.44 ㎐	one line scanning frequency
	Scanning time		471.15 ㎲
	Scanning dot	5,102 dots	
	1 dot ON time	53.86 ㎱	time interval from falling 0.9VH to rising again 0.9VH
	Scanning effective	58.3%	
	Video freq.	18.5648 MHz	frequency of video data
	Process Speed	179.7 mm/s	Drum Speed
Environment	Acoustical noise	45dB	at normal operation condition, measuring at 1 m horizontal, 0.75m vertical apart
Use	Temperature	+10 ~ +50 ℃	
	Humidity	30 ~ 80 %	
Preservation	Temperature Humidity	-20 ~ +60 ℃ 10 ~ 90 %	
Size			W ×L ×H

3.2.7 Toner Cartridge

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 the blade.

3.2.7.1 Summary

- Developing Method : Non magnetic 1 element contacting method
- Toner : Non magnetic 1 element shatter type toner
- Charging capacity : -39.1 ±3 μC/g (KAO meas. method)
- Average OD : 8.0 ±0.5 ㎛ (Toner)
- Toner Qty : 85 gf/140gf (4k / 8k)
- The life span of toner: 4k/8k sheets (ISO 19752 5% Pattern / A4 standard)
- Toner Residual Sensor : Dot count with CRUM(CRU Monitor)
- OPC Cleaning : Collect the toner by using cleaning blade+ FILM OPC
- Handling of wasted toner : Collect the wasted toner in the cleaning frame by using cleaning blade
- OPC Drum Protecting Shutter : None
- Classifying device for toner cartridge: ID is classified by interruption of the frame channel.

3.2.7.2 Developing Roller

- Roller type : conductive elastic roller
- Rotary Speed : 203.06 mm/sec
- Roller Bias : -220V ~ -400 ±20V
- Control Type : Bias PWM Control type
- Roller material : Conductive NBR + Surface UV process
  - Structure : Mono layer
  - Resistance : 1.0E+03~ 1.5E+06 Ω (N/N Condition)
  - Hardness : 52° ±5°
  - Valid Length : 228 mm
  - OD : ϕ14.07 mm ± 0.05
  - Shaft material : SUS 303
  - Surface roughness (Ra) : Ra 2.0 ~ 2.5 ㎛ (Circular-direction)
  - Friction coefficient (u) : 0.1 ~ 0.5 (70gf, 50mm/min, OHP (3M,#CG3300))
  - Life : 8,000 sheets or more

3.2.7.3 Supply Roller

· Rotary Speed : 131.98 mm/sec
· Roller Bias : -370V ~ -550V
· Control Type : Bias
· Roller material : Silicone Sponge
- Structure : Closed cell
- Resistance : 0.6E+06 ~ 3.0E+06 Ω(N/N cond.)
- Hardness : 16 ~ 25°(Asker "C")
- Valid Length : 218 mm
- OD : φ11.2 ±0.1 mm
- Shaft material : SUM 24L Non-electrolysis Ni. Coating
- Shaft OD : φ6 mm + 0 / -0.05
- Driver : Gear Driver (in a direction opposed to D/R)
- Sponge Density : 0.45 , ±0.1 g/㎥
- Life : 8,000 sheets or more

3.2.7.4 REGULATING BLADE

· Type : Regulating toner layer by pressure
· Material : SUS 301 1/2H CSP t0.08
· Valid Length : 228mm
· Voltage : -420V ~ -600V
· Regulating edge R value : 0.3 ±0.02mm
· Pressure : 42 gf/cm

3.2.7.5 CHARGING PORTION

· Type : Conductive Roller Contact-Charge
· Rotary Velocity : 179.7 mm/sec
· Surface potential : -760 ±70V (based on OPC , N/N cond.)
· Residual potential : -130 V or less (initial)
· Control Type : Bias PWM Control
· Roller material : Conductive elastic roller (Conductive NBR + SBR)
- Structure : Mono layer (Surface UV process)
- Resistance : 0.75E+06 ~ 5.0E+06 (N/N cond.)
- Hardness : 50°±3°(Asker "A")
- Length : 230 mm
- OD : φ12.0 ±0.05 mm
- Shaft Material : SUM-24L + Non-electrolysis Ni Coating
- Shaft OD : φ6 + 0 / -0.05 mm
- Driver : Gear Driver
- Pressure : L:300 gf / R:350 gf
- Roller surface roughness : Ra 1.8 um or less (shaft direction)
- Roller life : 8,000 sheets or more
· Roller Voltage : -1.25 ~ -1.70 KV

3.3 Engine H/W Specifications

3.3.1 ML-305X (PCL) Main Board

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 of 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.

3.3.1.1 Asic(SPGPv3)

· CPU Core : ARM1020E
  - 32KB instruction cache and 32KB data cache
· Operating Frequency
  - CPU Core : over 300MHz
  - System Bus : 100MHz
· SDRAMC
  - 32Bits 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
· HPVC
  - Dual/Single Beam
  - LVDS Pad(VDO, HSYNC)
· UART
  - 5 Channels (1 Channels Supports DMA Operation)
· PCI Controller
  - 32Bits, 33/66MHz
  - PCI Local Bus Specification rev2.2 Complaint
  - Host / Agent Mode (Support 4 Devices in Host Mode)
· NAND Flash Controller
  - 8/16Bits, H/W EEC Generation
  - Auto Boot Mode (Using Internal SRAM, 4KB)
· MAC
  - 10M/100Mbps
  - Full IEEE 802.3 Compatibility
· Engine Controller
  - LSU Interface Unit
  - Step Motor : 2 Channels
  - PWM : 8 Channels
  - ADC : 6 Channels
· I2C Controller
  - I2C(S-BUS) Slave Device Support(I2C Version 2.1)
· RTC
  - RTC Core Voltage : 3V
· PLL
  - 3 PLL : MAIN, PCI, PVC

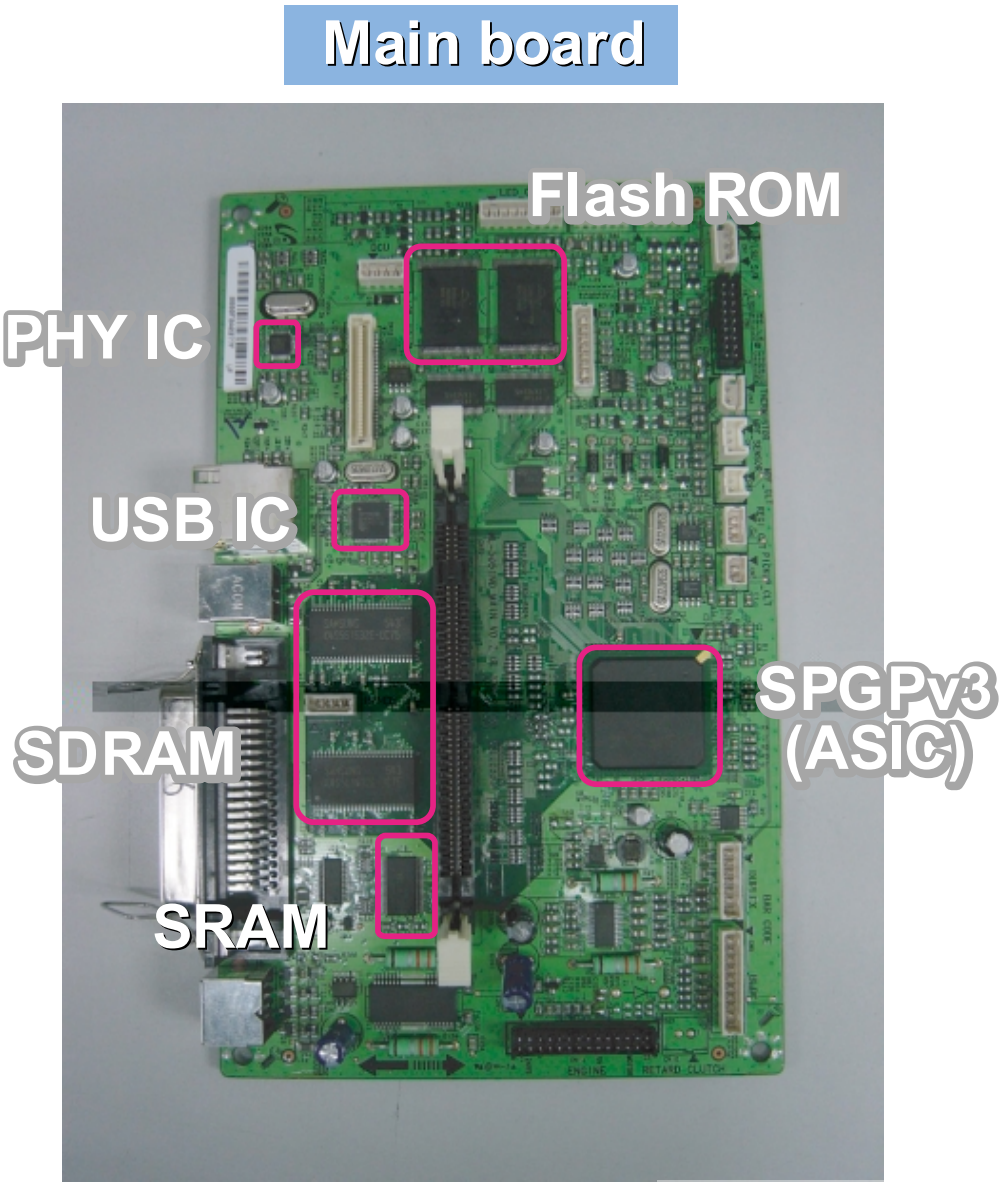
3.3.1.2 Memory

· 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 (NAND Flash)
- Random Access Time : 10 us (Max)
- Serial Page Access Time : 50ns (Min)

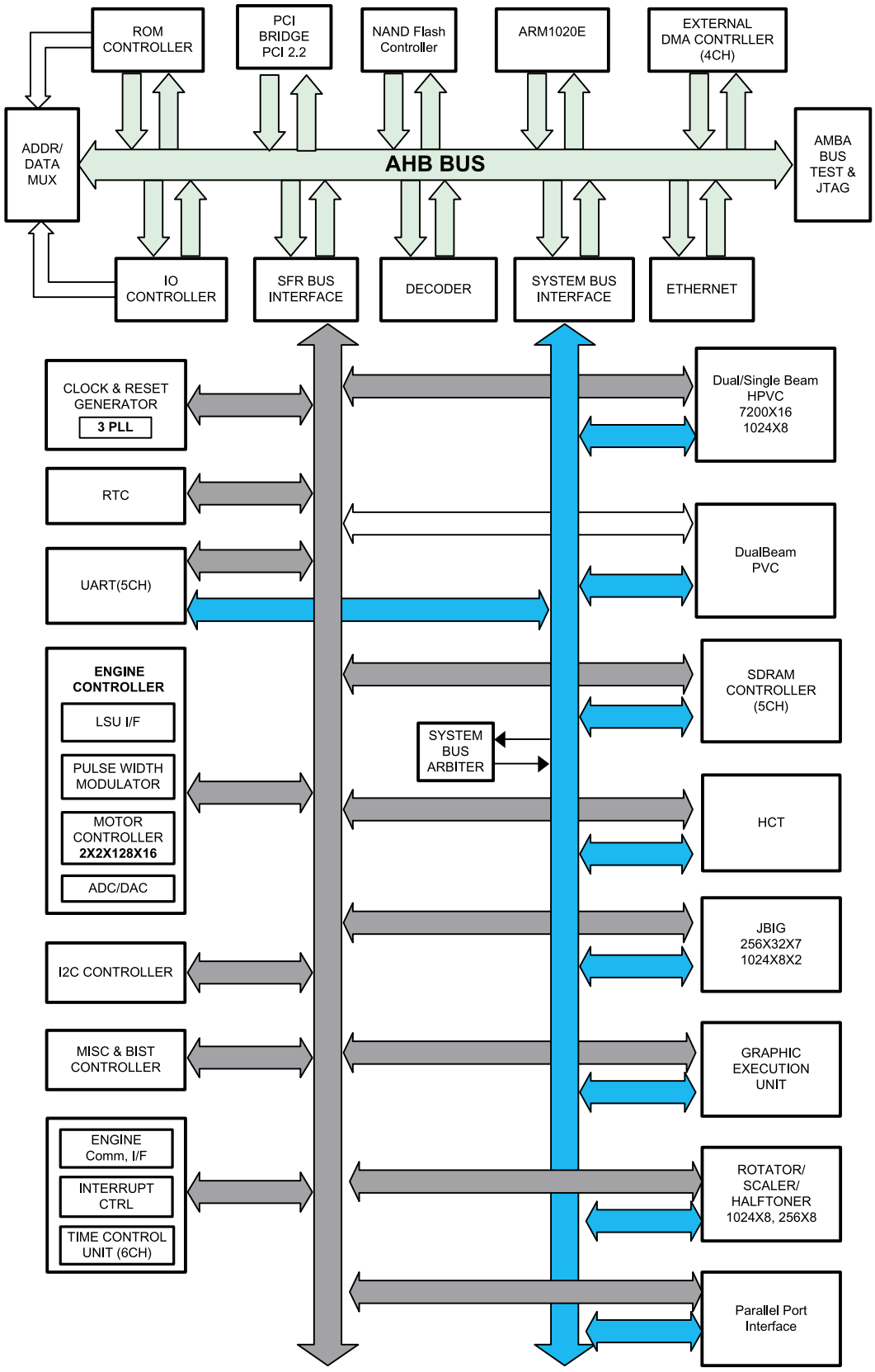
· DRAM : It is used as Swath Buffer, System Working Memory Area, etc. when printing.
It stores Font List, compressed into Flash memory, on DRAM and uses it as PCL font in case of model for export.
- Capacity : 64M Byte(Basic), up to 320Mbyte (User Option)
- Type : SDRAM 100MHz/133MHz , 16bit

3.3.1.3 Others

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



3.3.1.4 SPGPv3 Internal Block Diagram



3.3.1.5 Flash Memory

It stores the system program and downloads system program through the PC Interface.
· Capacity : 32M Byte (NAND Flash)
· Random Access Time : 10 us (Max)
· Serial Page Access Time : 50ns (Min)

3.3.1.6 SDRAM

It is used as swath buffer, system working memory area, etc. while Printing.
· Capacity : The 64M Byte is for this model (64M :Printing System Working Memory Area)

3.3.1.7 Sensor Input Circuit

3.3.1.7.1 Paper Empty Sensing

The Paper empty sensor (Photo Interruptor) on the HVPS 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 E20 of CPU, and then informs the fact by displaying the RED.

3.3.1.7.2 MP Sensing

By operation of Actuator on the frame, MP Sensor (Photo interruptor) on the HVPS informs the state of paper to CPU whether it is empty or not. It reads the D17 of CPU for recognizing paper in MP, and paper is fed from MP if there is.

3.3.1.7.3 Paper Feeding/With 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 1sec. after paper is fed, paper Jam0 is occurred (LED will be display RED color). The fact whether the developer is inserted or not is detected by CRUM. After the developer is mounted, the sub-CRUM can read the information of toner cartridge from contact with CRUM involved in toner cartridge. If the information of toner cartridge is invalid, it will show invalid sign on a LCD or LED.

3.3.1.7.4 Paper Exit Sensing

It detects paper state whether paper gets out from the set with operation of exit sensor on the HVPS and actuator on the frame. Paper detects the on/off time of exit sensor by reading D22 of CPU, and the normal operation or jam information is informed to the CPU.
The paper JAM2 is informed. (LED will be display RED color)

3.3.1.7.5 Cover Open Sensing

The Cover open sensor is located on the HVPS. After the front cover is opened, +24VS (DC fan, Solenoid, Main Motor, Polygon motor part of LSU and HVPS), which is supplied to the each unit, is cut off. The cover-open sensing is operated by the D23 of CPU.
In case, the red will be ON for informing the facts to user.

3.3.1.7.6 DC FAN / SOLENOID Driving

It is driven by transistor and controlled by D14(FAN MAIN), E16(FAN DUPLEX), C23(PICK-UP CLUTCH), C18(REGI CLUTCH), D15(MPF CLUTCH) 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 three solenoids, and they are driven by paper pick-up, regi and MPF signal. It is turned on or off by C23, C18, D15 of CPU. The diode protects the driving TR from the noise pulse, which is flown when the solenoid id de-energizing.
FAN Driving Circuit is driven by Transistor, and controlled by D14, E16 of CPU.

3.3.1.7.7 Motor Driving

The main motor driving circuits is on the BLDC Motor Ass y'Unit. Main Controller has the interfacing circuits. There is motor driver IC on the motor control board of Motor Ass y'Unit.

The exit motor driving circuits is formed when the driver IC is selected. The AN44060A Motor Driver IC is used in this case. The resistance Rs value for sensing and voltage value for the V reference can be changed by motor driving voltage value. The motor driving voltage is calculated with the following formula.

IN 0, 2	IN 1, 3	Output Current
L	L	Vref / (10*Rs) = Iout
H	L	Vref / (15*Rs) = Iout * 2/3
L	H	Vref / (30*Rs) = Iout * 1/3
H	H	0

The motor driving circuit is formed when the Driver IC is selected. The A3977 Motor Driver IC is used in this case. The resistance Rs value for sensing and voltage value for the V reference can be changed by motor driving voltage value. The motor driving voltage is calculated with the following formula.
I = Vref / Rs, wherein Vref is (R1 ×5V) / (R1+R2).

3.3.2 SMPS & HVPS board

The SMPS supplies DC Power to the System.
It takes 110V/220V and outputs the +5V, +24V to supply the power to the main board. The HVPS board creates the high voltage of THV/MHV/Supply/Dev and supplies it to the developer part for making 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.

3.3.2.1 HVPS (High Voltage Power Supply)

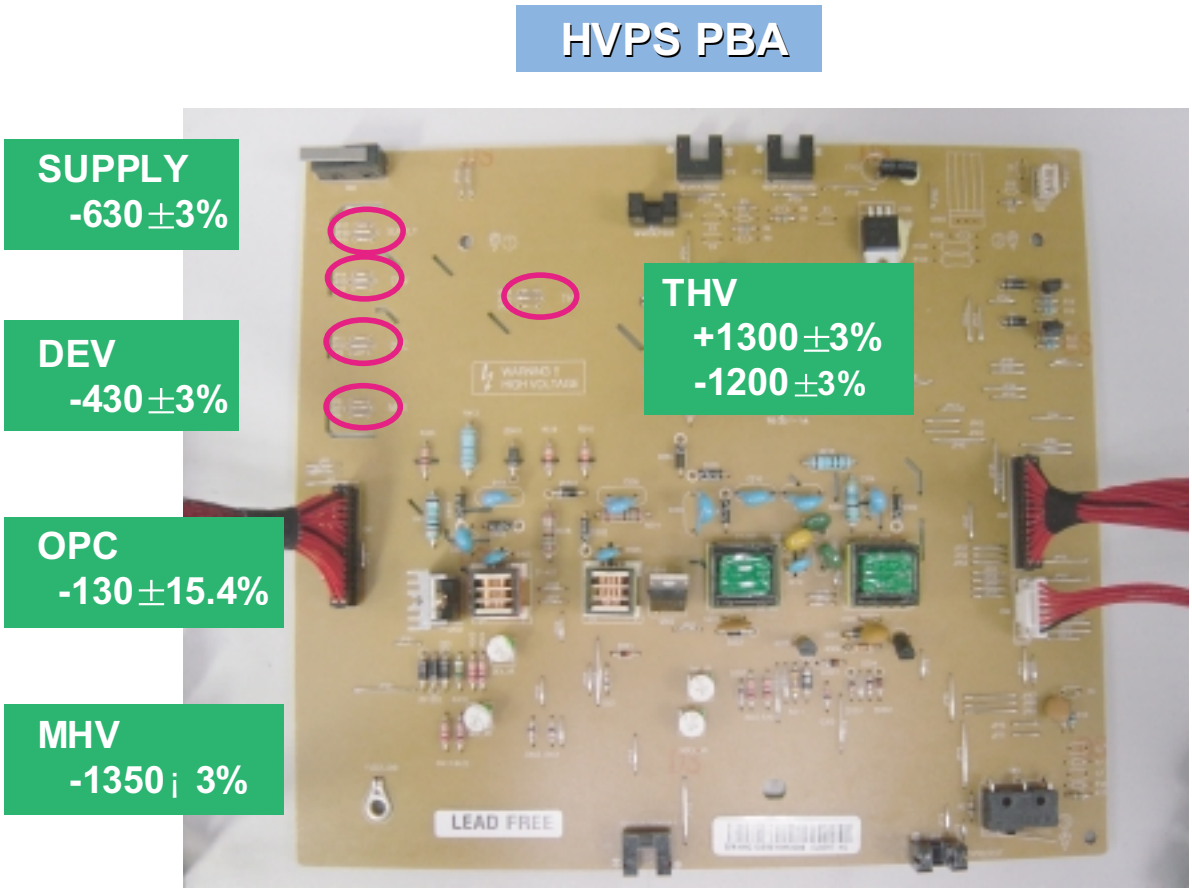
· Transfer High Voltage (THV+)
- Input Voltage : 24 V DC ± 15%
- Output Voltage : MAX +5.0KV ± 5 %,(Duty Variable, no loading)
  ->1.2KV ±15% (when cleaning,200 MΩ)
- Output Voltage Trigger : 6.5 μA
- Input contrast of the Voltage stability degree :under ± 5 % (fluctuating input 21.6V ~26.4V)
  Loading contrast : ± 5 % or less
- Output Voltage Rising Time : 100 ms Max
- Output Voltage Falling Time : 100 ms Max
- Fluctuating transfer voltage with environmental various : +650 V(Duty 10%) ~ 5 KV (Duty 90%)
- Environment Recognition Control Method : The THV-PWM ACTIVE is transfer active signal. It detects the resistance by recognizing the voltage value, F/B, while permits the environmental recognition voltage.
- Output Voltage Control Method : Transfer Output Voltage is outputted and controlled by changing Duty of THVPWM Signal. 10% Duty : +650V, 90% Duty : +5KV ±5%

· Charge Voltage (MHV)
- Input Voltage : 24 V DC ± 15%
- Output Voltage : -1.3KV ~ -1.8KV DC ± 50V
- Output Voltage Rising Time : 50 ms Max
- Output Voltage Falling Time : 50 ms Max
- Output Loading range : 30 MΩ ~ 1000 MΩ
- Output Control Signal(MHV-PWM) : CPU is HV output when PWM is Low

· Cleaning Voltage (THV-)
- The (+) Transfer Voltage is not outputted because the THV PWM is controlled with high.
- The (-) Transfer Voltage is outputted because the THV-Enable Signal is controlled with low
- The output fluctuation range is big because there is no Feedback control.

· Developing Voltage (DEV)
- Input Voltage : 24 V DC ± 15%
- Output Voltage: -200V ~ -600V DC ±20 V
- Output Voltage Fluctuation range: PWM Control
- Input contrast of the output stability degree : ± 5 % or less
  Loading contrast : ± 5 % or less
- Output Voltage Rising Time : 50 ms Max
- Output Voltage Falling Time : 50 ms Max
- Output Loading range : 10MΩ ~ 1000 MΩ
- Output Control Signal (BIAS-PWM) : the CPU output is HV output when PWM is low.

· Supply
- Output Voltage : -400 V ~ -800V DC ±50 V(ZENER using, DEV)
- Input contrast of the output stability degree : under ± 5 %
  Loading contrast : ± 5 % or less
- Output Voltage Rising Time : 50 ms Max
- Output Voltage Falling Time : 50 ms Max
- Output Loading range : 10 MΩ ~ 1000 MΩ
- Output Control Signal (BIAS-PWM) : the CPU is HV output when PWM is low.



3.3.2.2 SMPS (Switching Mode Power Supply)

It is the power source of entire system. It is assembled by an independent module, so it is possible to use for common use. It is mounted at the side 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 two output channels. Which are +5V and +24V.

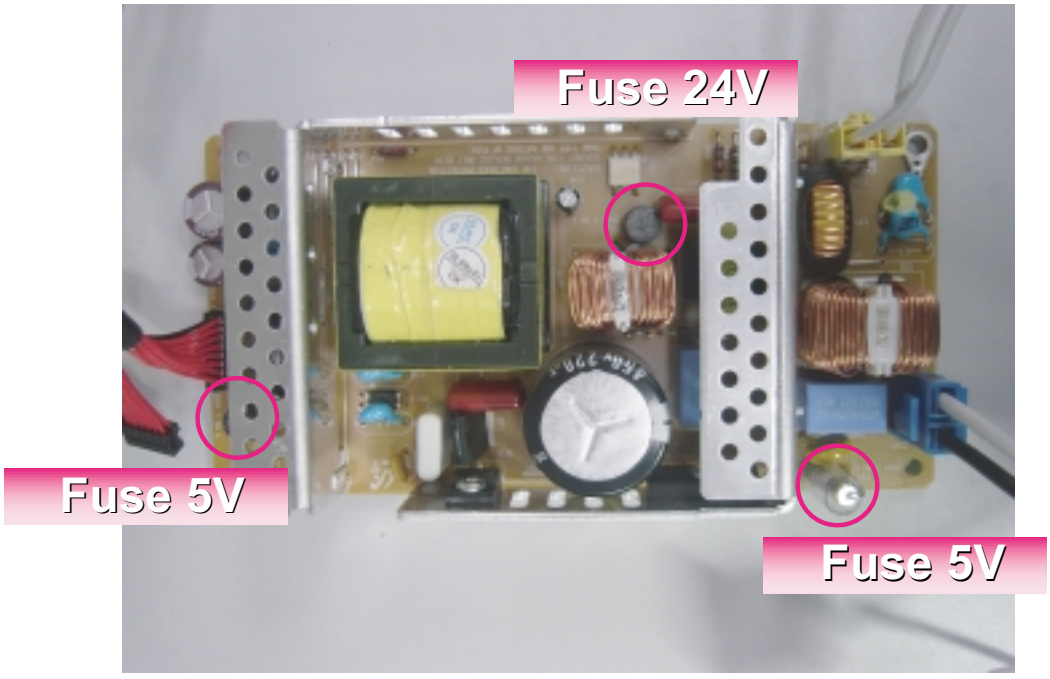
· AC Input
- Input Rated Voltage : AC 220V ~ 240V AC 110V ~ 127V
- Input Voltage fluctuating range : AC 198V ~ 264V AC 99V ~ 135V
- Rated Frequency : 50/60 Hz
- Frequency Fluctuating range : 47 ~ 63 Hz
- Input Current : Under 4.0Arms / 2.0Arms (But, the status when e-coil is off or rated voltage is inputted/outputted)

· Rated Output Power

NO	ITEM	CH1	CH2	Remark
1	CHANNEL NAME	+5V	+24.0V	
2	CONNECTOR PIN	CON 35V PIN: 11,13,15 GND PIN: 12,14,16	CON 324V PIN:3,5,7,9 GND PIN:4,6,8,10	
3	Rated Output	+5V ±5%(4.75~5.25V)	+24V ±10%(21.6~26.4V)	
4	Max. Output Current	3 A	4.4 A	
5	Peak Loading Current	3.6 A	5.3 A	1ms
6	RIPPLE NOISEVoltage	100mVp-p	Under 500mVp-p	
7	Maximum output	15W	105.6W	
8	Peak output	18W	127.2W	1ms
9	Protection for loading shortage and overflowing current	Shut down or Fuse Protection	Shut down or Output Voltage Drop	

· Consumption Power

NO	ITEM	System
1	Stand-By	Less than 150W
2	PRINTING	Less than 400W
3	Sleep-Mode	Less than 11W



· Length of Power Cord : 1830±50mm
· Power Switch : Use
· Feature
- Insulating Resistance : 100㏁ or more (at DC 500V)
- Withstanding Voltage : Must be no problem within 1 min.
(at 1000V-LV model / 1500Vac-HV model,10mA)
- Leaking Current : under 3.5mA
- Running Current : under 40A PEAK (AT 25℃, COLD START)
under 60A PEAK (In other conditions)
- Rising Time : within 2Sec
- Falling Time : over 20ms
- Surge : Bi-Wave 3kV ? Normal, 6KV - Common
· Environment Condition
- Operating temperature range : 0℃~40℃
- Maintaining temperature range : -25℃~85℃
- Preserving Humidity Condition : 30% ~90% RH
- Operating atmospheric pressure range : 1atm
· EMI Requirement : CISPR ,FCC, CE, MIC, C-Tick,
· Safty Requrement :IEC950 UL1950, CSA950, C-UL,NOM, TUV, Semko, Nemko, iK, CB, CCC(CCIB), GOST, EPA, Power Save

3.3.2.3 FUSER AC POWER CONTROL

Fuser(e-coil) gets heat from AC power. The AV 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 Phototriac (insulting part).
In 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 PC501 (Photo Triac) takes the voltage and flashes. From the flashing 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 e-coil, and heat is occurred.
On the other hand, when the signal is off, the PC501 is off, the voltage is cut off at the gate of Triac, the Triac becomes off, and then the e-coil is turned off.

· Triac (Q501) feature : 24A-LV model / 16A-HV model, 600V SWITCHING
· Phototriac Coupler (PC501)
- Turn On If Current : 15mA~50mA(Design: 16mA)
- High Repetive Peak Off State Voltage : Min 600V

3.3.3 Engine F/W

3.3.3.1 Control Algorithm

3.3.3.1.1 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. While paper moves, occurrence of Jam is judged as below.

ITEM	Description
JAM 0	- After picking up, paper cannot be entered due to paper is not fed. - 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, 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	- 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	- After the trailing edge of the paper passes the feed sensor, the paper cannot pass the exit sensor after certain time.

3.3.3.1.2 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. Each voltage value is controlled according to 3.3.3.2 Timing Chart.

3.3.3.1.3 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.

· Open Heat Error

When the engine operates the warm-up process, if the temperature of the fixing unit is not higher than a specified temperature, the engine defines Open Heat Error. When this error is broken out, the engine stops all functions and keeps the error state. Also, the engine informs the error status of the main system. And then the error message is displayed at LCD window or LED informing the error status of the user.

· Low Heat Error

When the engine is at stand-by, printing or warm-up mode, if the temperature of the fixing unit is lower than the specified temperature at each state and the lower temperature state is maintained during the specified time, the engine defines Low Heat Error. When this error is broken out, the engine stops all functions and keeps it at the error state. Also the engine informs the error status of the main system. And then the error message is displayed at LCD window or LED informing the error status of the user.

· Over Heat Error

For overall engine state, if the temperature of the fixing unit is higher than the specified temperature and the temperature state is kept during the specified time, the engine defines Over Heat Error. When this error is broken out, the engine stops all functions and keeps it at the error state. Also, the engine informs the error status of the main system. And then the error message is displayed at LCD window or LED to inform the error status of the user.

** To recover the heat error: The heat error recovery is operated automatically when the error is only caused by Low Heat Error, not the Heat Errors in Warm-up state and the Over Heat Error. If an error happens, then the engine memorizes a present temperature. In case of Low Heat Error, the maximum heat is supplied to the fixing unit. When a specified time is elapsed, the engine detects the temperature again. If the present temperature is higher than the memorized temperature, the error is recovered. In case of Over Heat Error, no heat is supplied to the fixing unit. When a specified time is elapsed, the engine detects a present temperature again. If the present temperature is a specified degree lower than the memorized temperature, the error is recovered.*

3.3.3.1.4 LSU

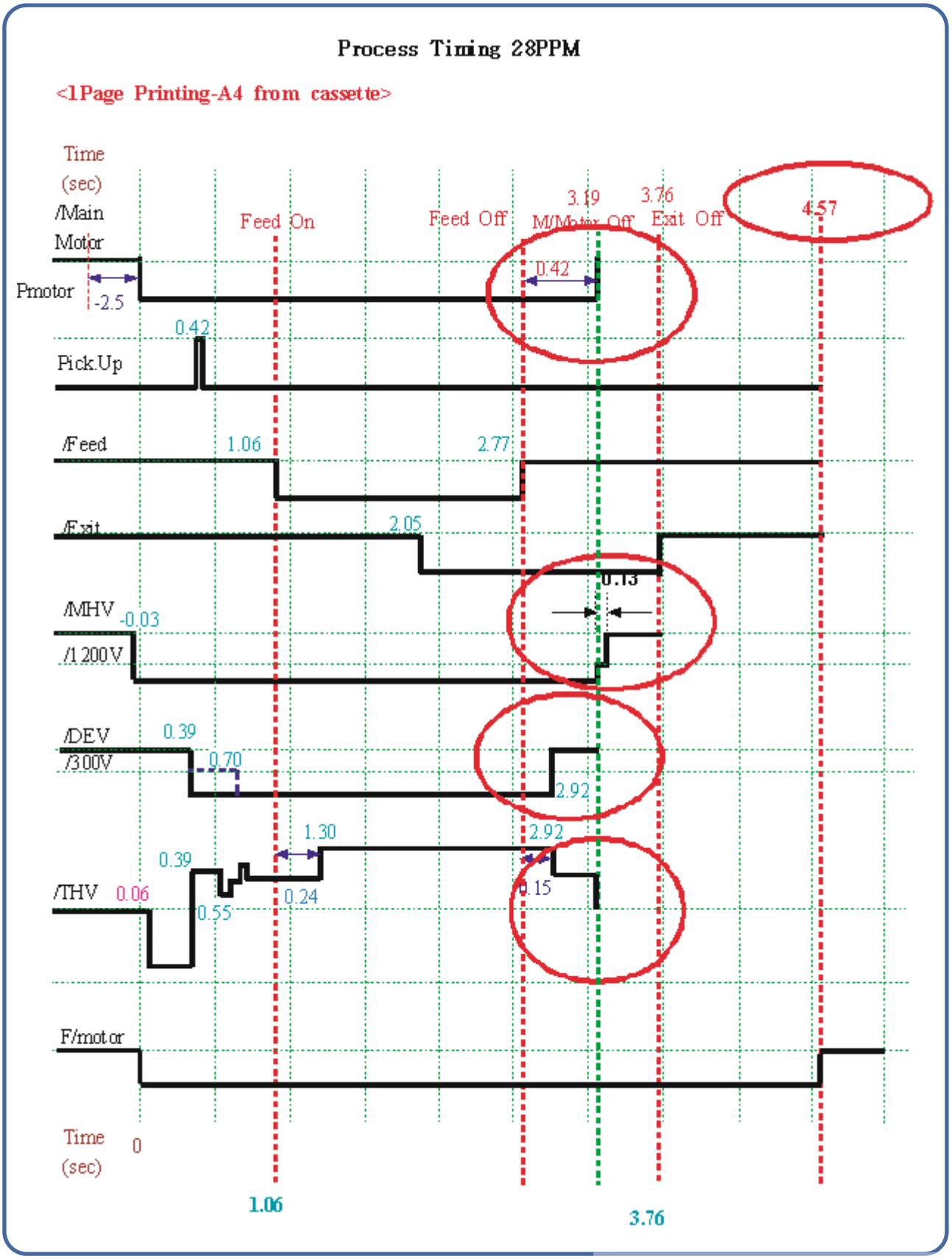
LSU receives the image data from PVC or HPVC and make the latent image on OPC surface.
It uses the dual beam, LD1 and LD2. But the control method of them is the same.
Just in comparison with the single beam, the dual beam has the half of lsu s'frequency.
->The frequency of the dual beam = the frequency of the single beam /2.
The errors related to LSU are as follows:

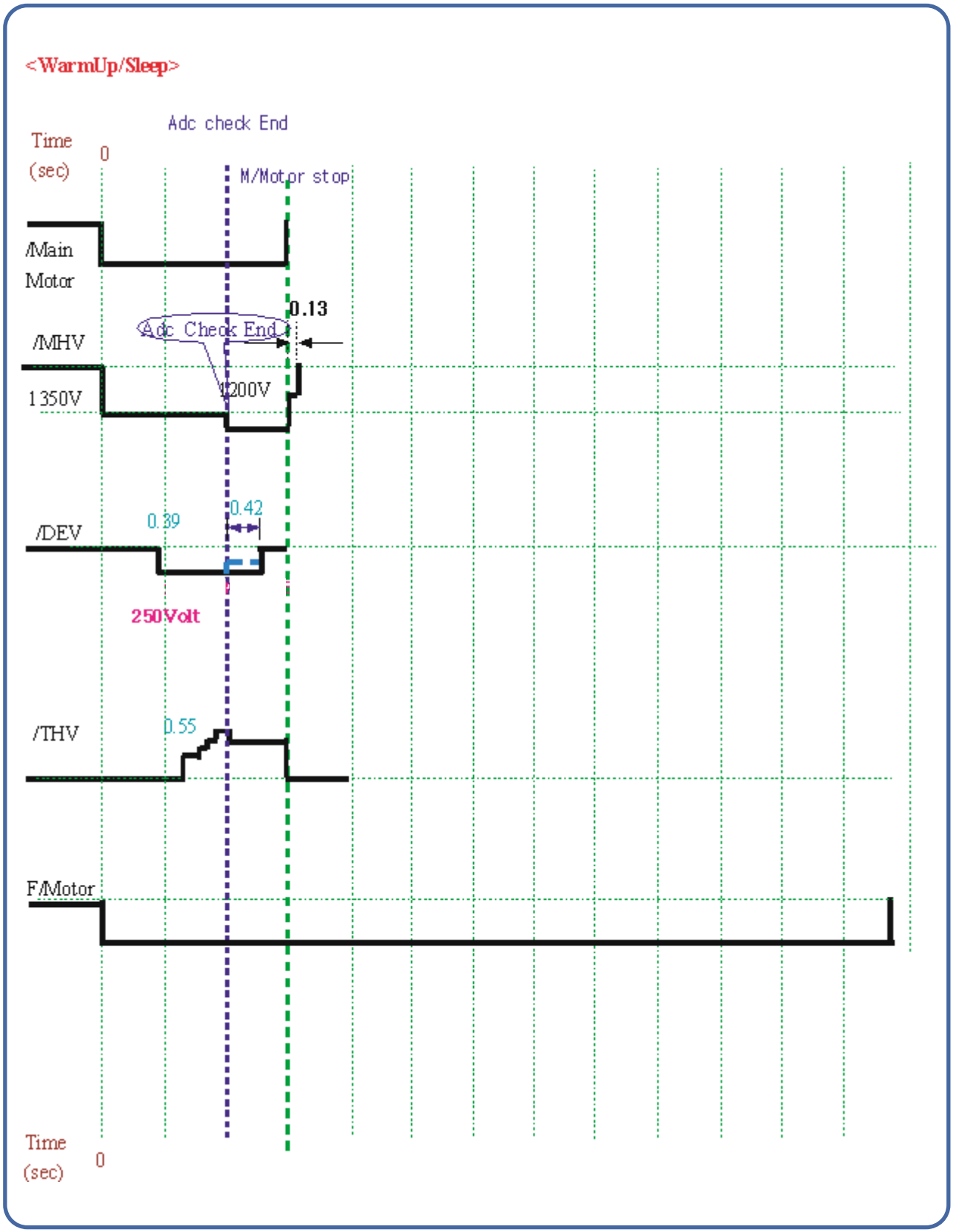
* *By LReady: When the printing is started, the engine drives the polygon motor of LSU. After the specified time is elapsed, if the motor is not in a ready status, the engine detects the error that the polygon motor is not in a ready status. If this error happens, the engine stops all functions and keeps it at the error state. Also, the engine informs the error status of the main system and the error message is displayed at LCD window to inform the error status of the user.*

* *By Hsync: When the polygon motor is ready, the LSU sends out the signal called Hsync and used to synchronize with each image line. So, if the engine does not detect consecutively the signal for a fixed time, it defines the Hsync Error. If this error happens, the engine stops all functions and keeps it at the error state. Also, the engine informs the error status of the main system and then the error message is displayed at LCD window to inform the error status of the user.*

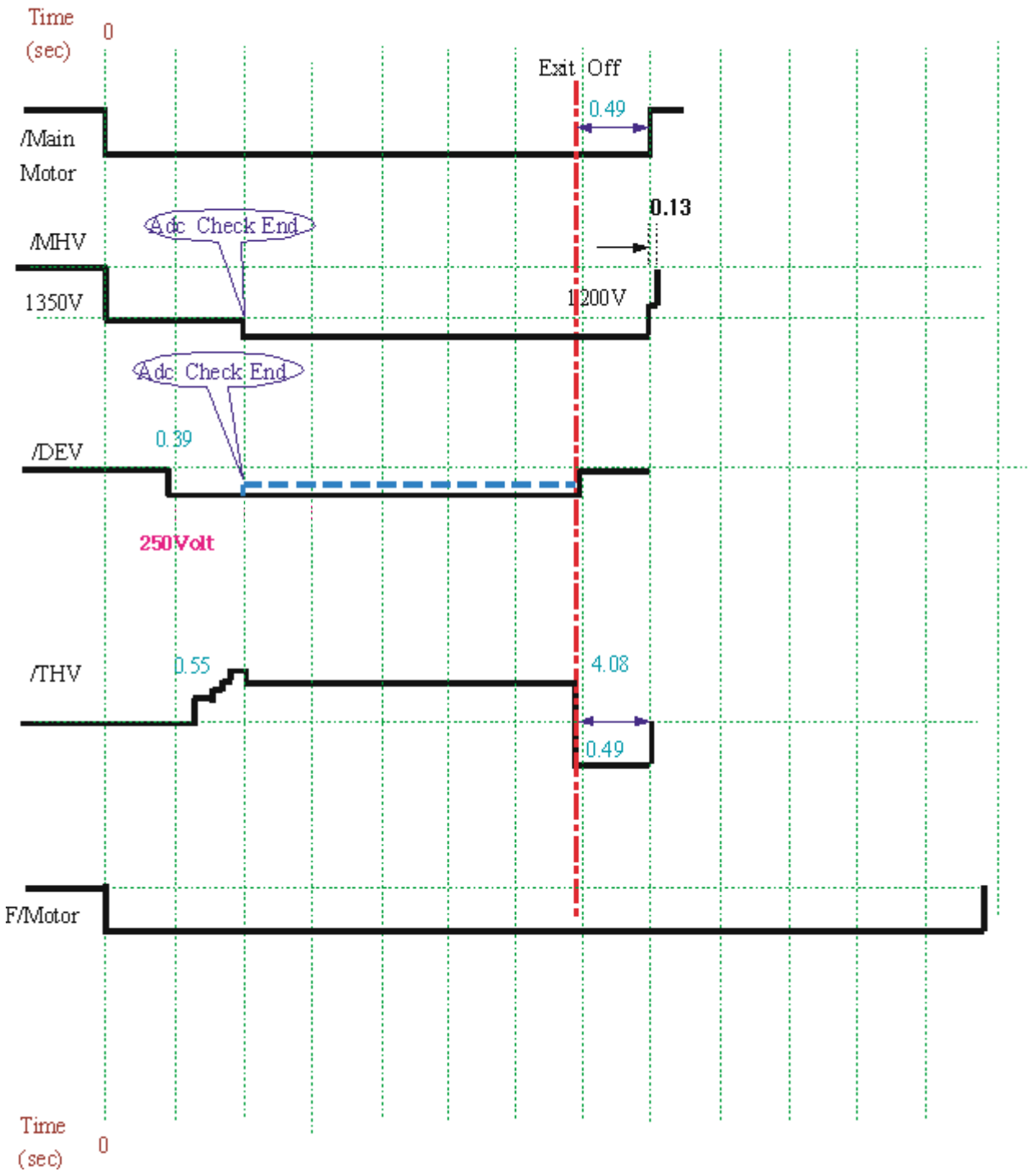
LSU Error Recovery: If the LReady or Hsync error happens, the paper exits out beforehand. The engine mode is changed to recovery mode and the engine informs the main system of the engine mode. And the engine checks the LSU error. If the error doesn t happen, the printing job will be proceeding.

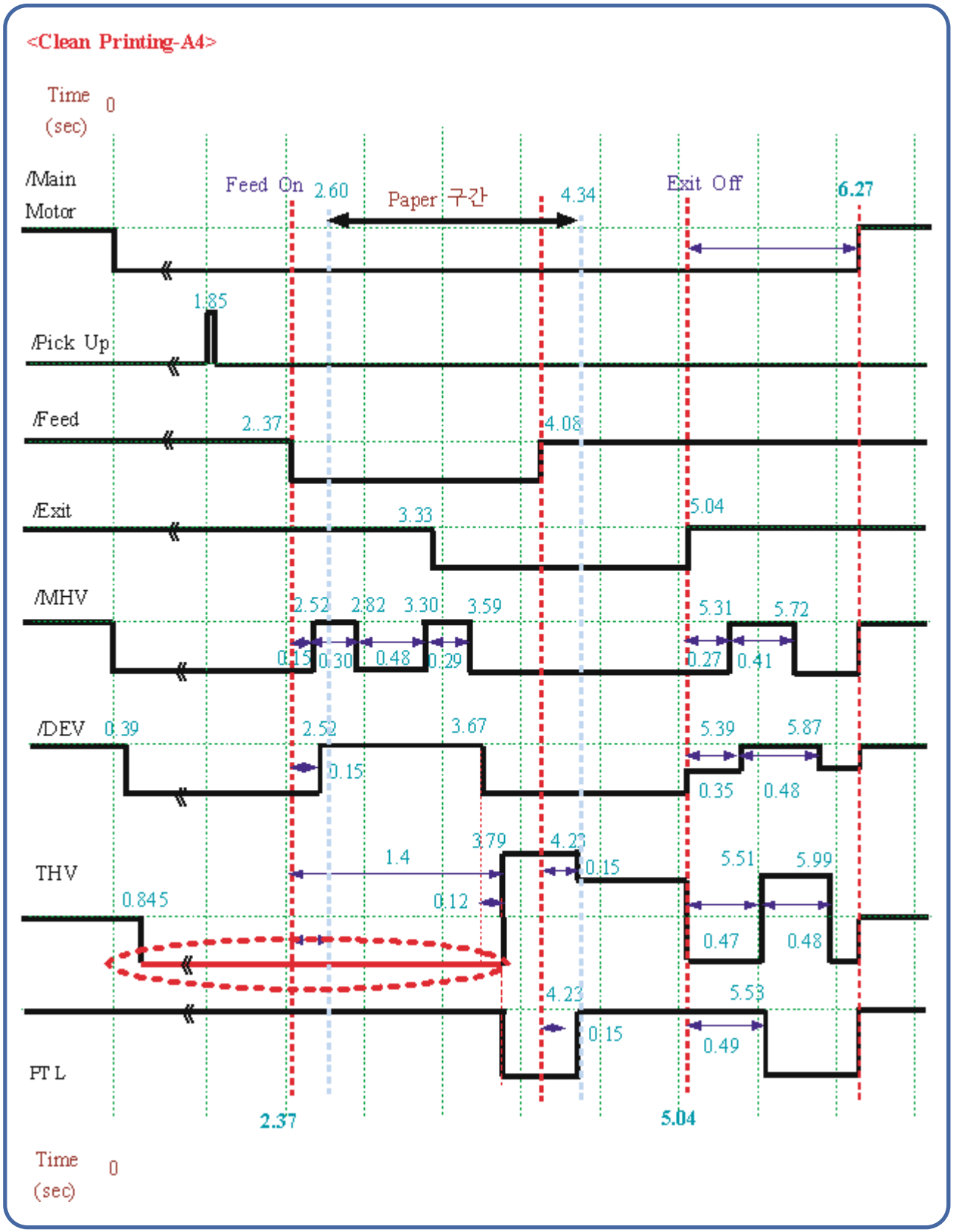
3.3.3.2 Timing Chart





<Jam remove>





3.4 S/W Descriptions

3.4.1 Overview

The software of Dove system is constructed with

1) Host Software part that the application software operated in Window and Web Environment, and

2) Firmware parts that is a Embedded software controls printing job.

3.4.2 Architecture

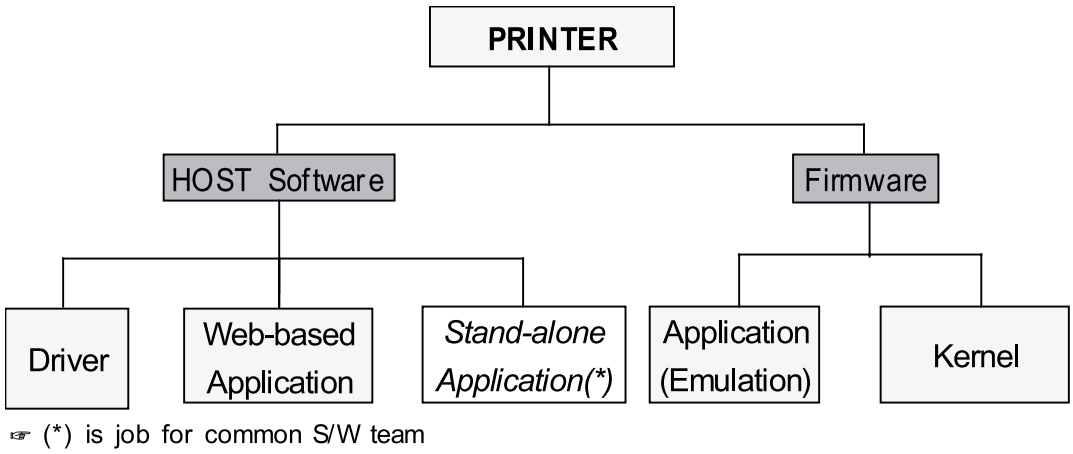


Fig. 3.4-1 SW Tree Structure

Host Software is made up of

1. Graphic User Interface that offers the various editing functions to user in Host,
2. Driver that translates the received document to a Printing Command language which printer can understand and transfers data to spooler,
3. Stand-alone Application that offers the various printing application, DMS(Document Management System), RCP(Remote Control Panel), Printer Status Monitor, Network Management in Window system,
4. Web-based-Application that offers the same functions as Stand-alone Application and RDC(Remote Diagnosis Control) in Web environment.

Firmware is made up of

1. Application (Emulation) that is a interpreter translate data received from Host to a printing language (PCL, PS, GDI, etc.) to be able to make the user to take same output as originally one what composed in Host.
2. Kernel that control and management the whole procedure include of Control flow and Printing Job before transfer to Engine system.

3.4.3 Data and Control Flow

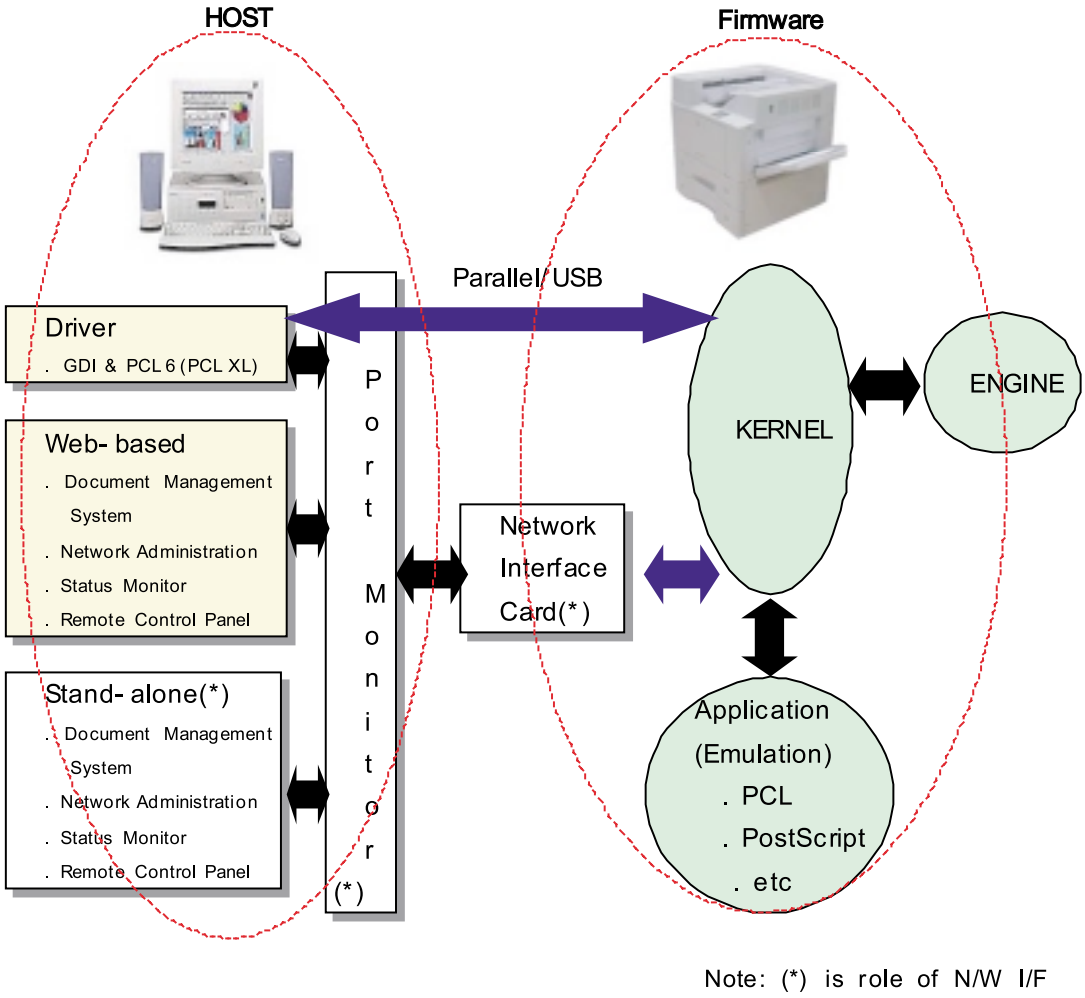


Fig. 3.4-2 Data and Control Flow

The above Block Diagram is explained that:

Host Side is made up of

1. Driver that is Windows application software translate printed data to one of printer language and create spooler file,
2. Web-based Application that offer a various printer additional functions, management of printing job, printer administration, Status monitor to monitoring the printer status by real time in Web, independent environment on OS.
3. Stand-alone Application that is a similar Window software as same as above 2,
4. Port Monitor that manages the network communication between spooler and Network Interface Card, or various additional application and Network Interface Card,(this is, at first, make communication logical port, manage the data, transfer them from spooler to network port, and offer the result of printing).

Firmware Side is made up of

1. Network Interface Card is that relay the communication between Host and kernel using various network protocol,
2. Kernel is that manages the flow control of emulation procedure, receiving data from Host or Network card and printing with engine & rendering job,
3. Emulation is that interprets the various output data from selected emulation,
4. Engine is that prints rendered bit-map data to paper with required size and type by Kernel.

And then, for Job Spooling function for Multi-User, Multi-Printing that is occurred in Network printing and various additional printing functions, this Kernel use max. 10 Queuing systems in a memory.

In Printing, the two procedures are

(1) Case of using Parallel or USB Port

① After user start to print the wanted document to PCL string or compressed GDI bit-map data, Driver translate the all graphic data of it and send data to host spooler. And then the spooler sends the data stream to the printer via parallel port or USB port.

② Kernel receives this data from Host, and then select emulation fit to data and start selected one. After emulation job end, Kernel sends the output bit-map data to Engine using Printer Video Controller (by clock type for LSU).

③ Engine print the received data to required paper with the sequential developing process.

(2) Case of using Network Interface Card

① After user start to print the wanted document to PCL string or compressed GDI bit-map data, Driver translate the all graphic data of it and send data to host spooler.

② If so, Port monitor managing network port receives data from spooler and sends a data stream to the Network Interface Card.

③ Network interface card receives it and send to Kernel part,

④ Kernel receives this data from Host, and then select emulation fit to data and start selected one. After emulation job end, Kernel sends the output bit-map data to Engine using Printer Video Controller (by clock type for LSU).

⑤ Engine print the received data to required paper with the sequential developing process.

The additional printing function are realized in

(1) Web environment

(2) Window environment.

On addition, Kernel informs a status of printing status and printer status to user made printing job with the Status Monitor.