Chapter 6 Principles of Operation CONTENTS

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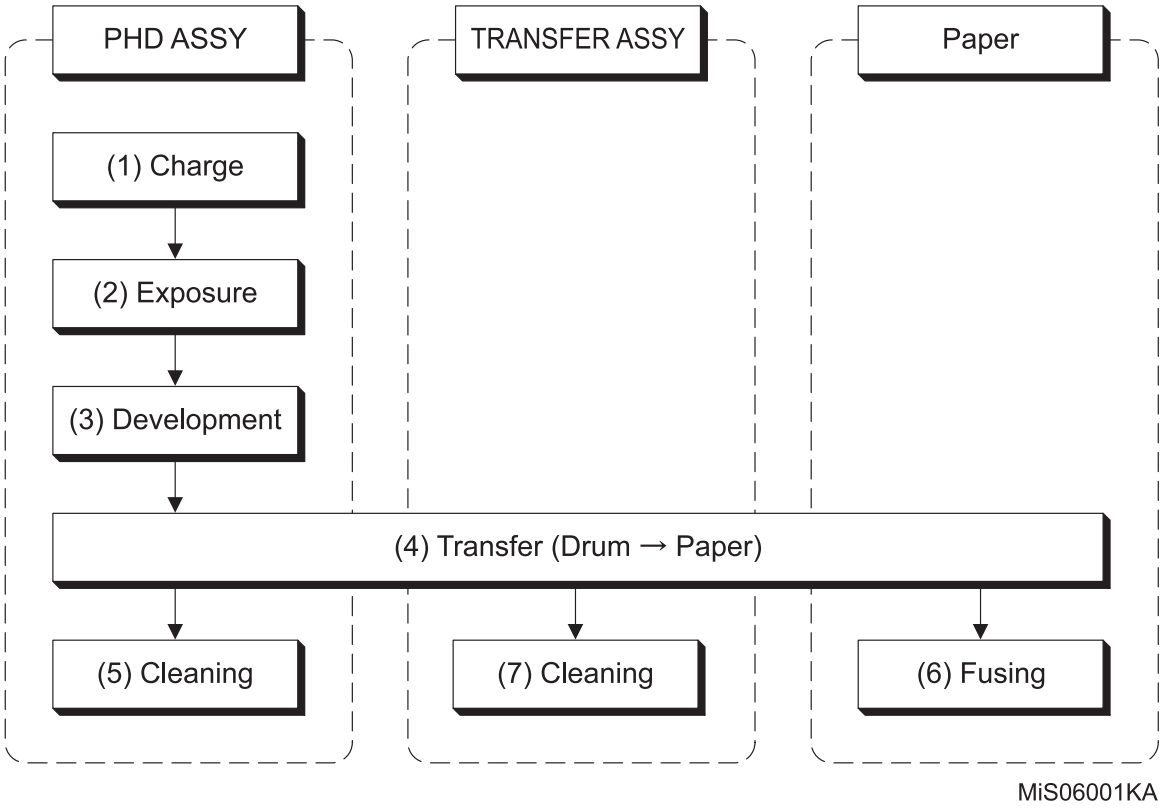
1. Printing Process

1.1 Summary of Printing Process

This printer is a "Full-color laser printer" which applies the principle of an electrophotographic recording system. The tandem system comprising the four color PHD ASSY of yellow, magenta, cyan and black (Y, M, C and K) creates the toner image.

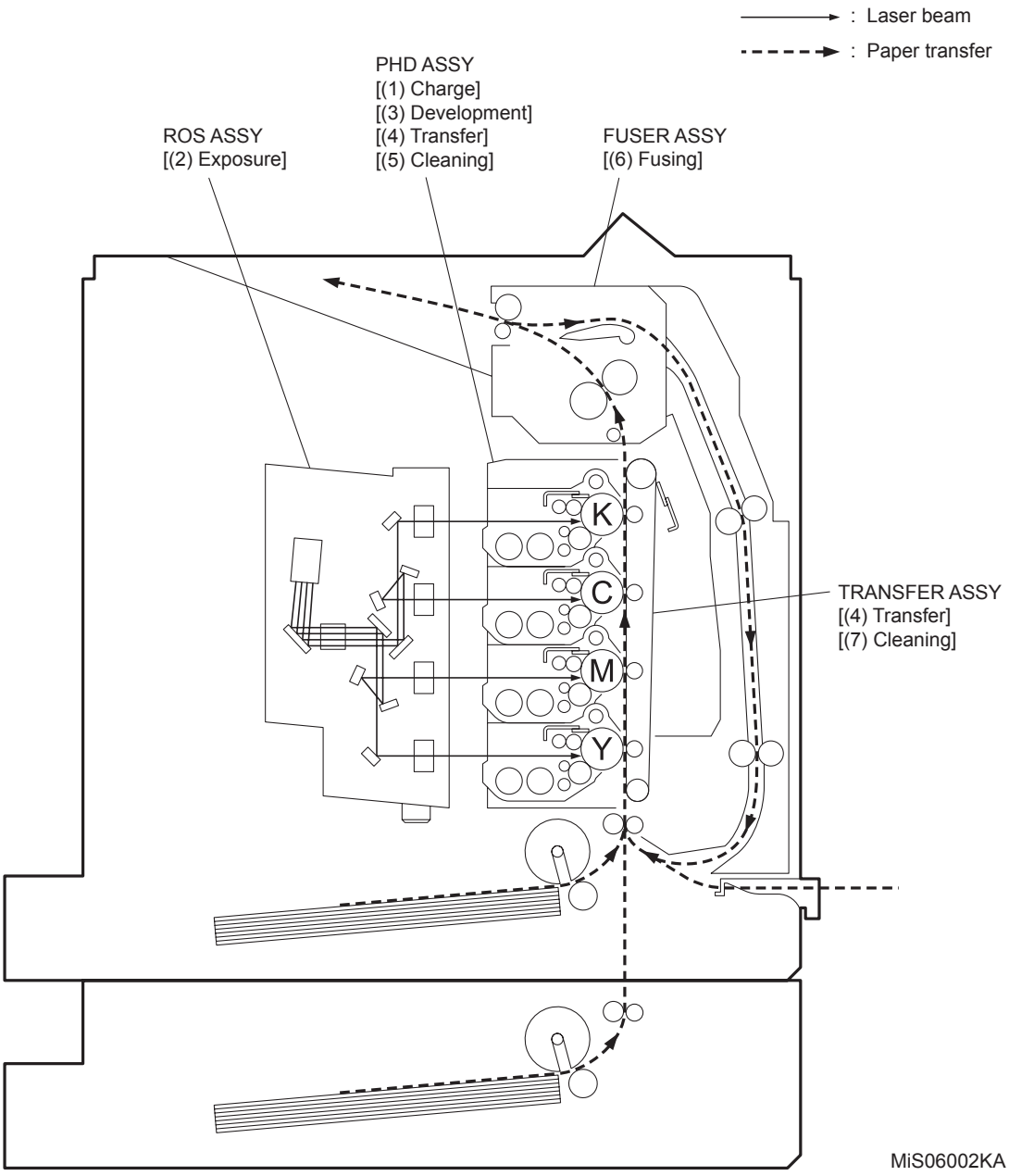
Printing processes of this printer is composed of the basic steps as follows.

(1) Charge:..... Drum surface is charged with electricity.
(2) Exposure: ..... Image unit is exposed to laser beams.
(3) Development: ..... Image is developed with toner.
(4) Transfer: ..... Four-color finished toner image on the Drum is transferred onto the paper.
(5) Cleaning: ..... Remaining toner on the drum is collected.
(6) Fusing:..... Toner on the paper is fixed by heat and pressure.
(7) Cleaning: ..... Remaining toner on the belt is collected.



1.2 Schematic Diagram for Printing Processes

Outline of printing processes is shown in the figure below.

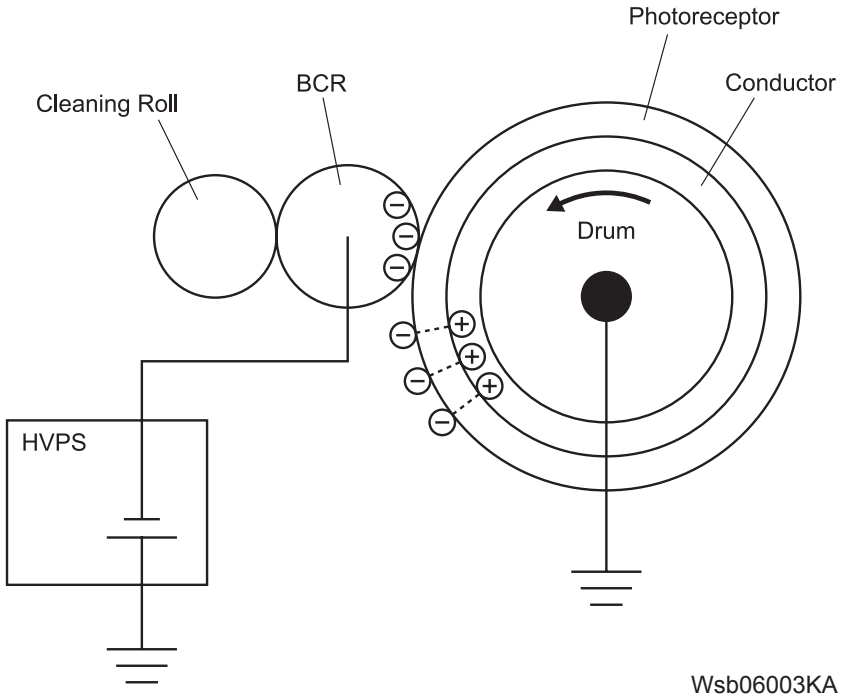


1.3 Description of Printing Process Techniques

1.3.1 Charge

In the charging process, the drum surface rotating at a constant speed is charged uniformly with negative electricity by the discharge from BCR (Bias Charge Roll).
This process is performed in parallel for yellow, magenta, cyan and black colors.

- BCR (Bias Charge Roll)
  The BCR is kept in contact with the drum and rotates following the rotations of the drum. The BCR is a conductive roll that uniformly and negatively charges the drum surface with the negative voltage applied by the HVPS.
- Drum
  The drum surface is uniformly and negatively charged with DC bias voltage.
  The drum surface consists of a photoreceptor (which is an insulator in the dark and a conductor in the light) backed with a conductor.
- Cleaning Roll
  The Cleaning Roll contacts with the BCR to remove the toner from it.



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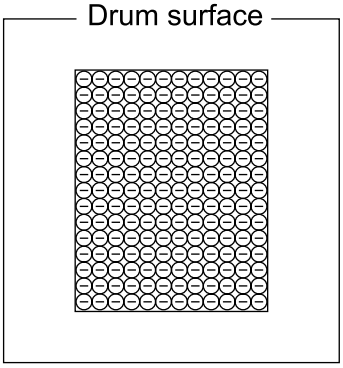

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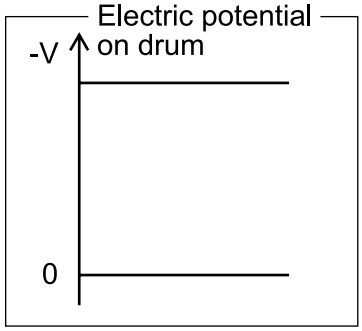

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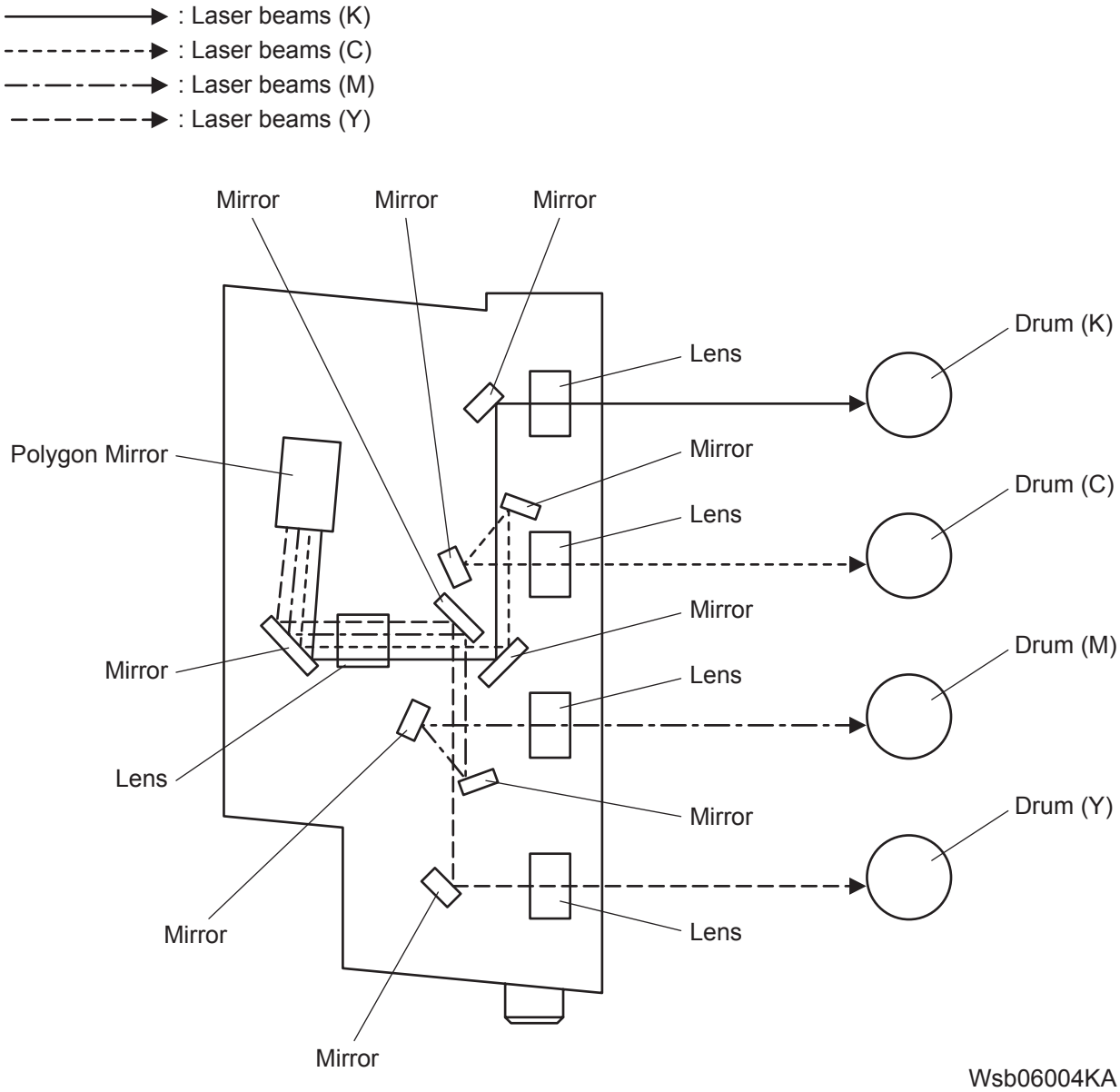
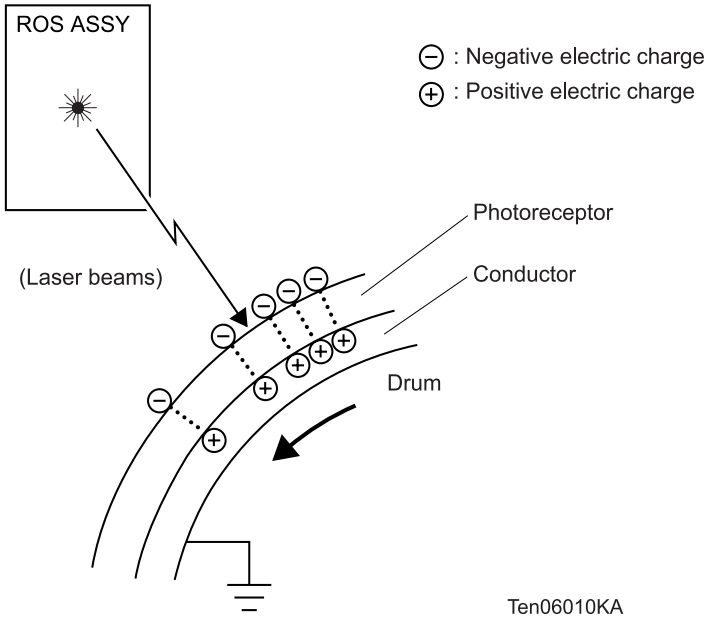
1.3.2 Exposure

The exposure process forms an invisible electrostatic latent image on the negatively charged drum surface by scanning it with laser beams.
This process is performed in parallel for yellow, magenta, cyan and black colors.

- Laser beams are emitted from the laser diode in the ROS ASSY. The surface of each color drum is scanned from end to end in the axial direction by the rotating polygon mirror, the fixed mirror, and the lens attached to the Scanner Motor Assy of the ROS ASSY.



- The laser beam is irradiated according to the printing data (image data) output from the printer controller. The laser beam is output only when printing data is pixels (micro points composing characters or pictures). (The laser diode lights up for parts to be developed by toner, and not for parts that are not to be developed.)
  The drum surface irradiated by the laser beam becomes a conductor, and the negative charge on the drum surface flows to the positive side and the charges cancel each other out so that the potential on the drum surface drops. The part on the surface where potential drops becomes the electrostatic latent image.



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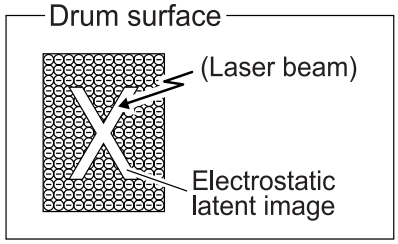

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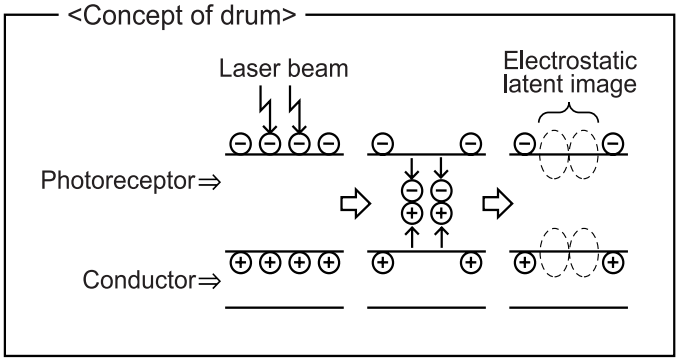

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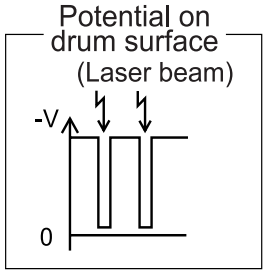

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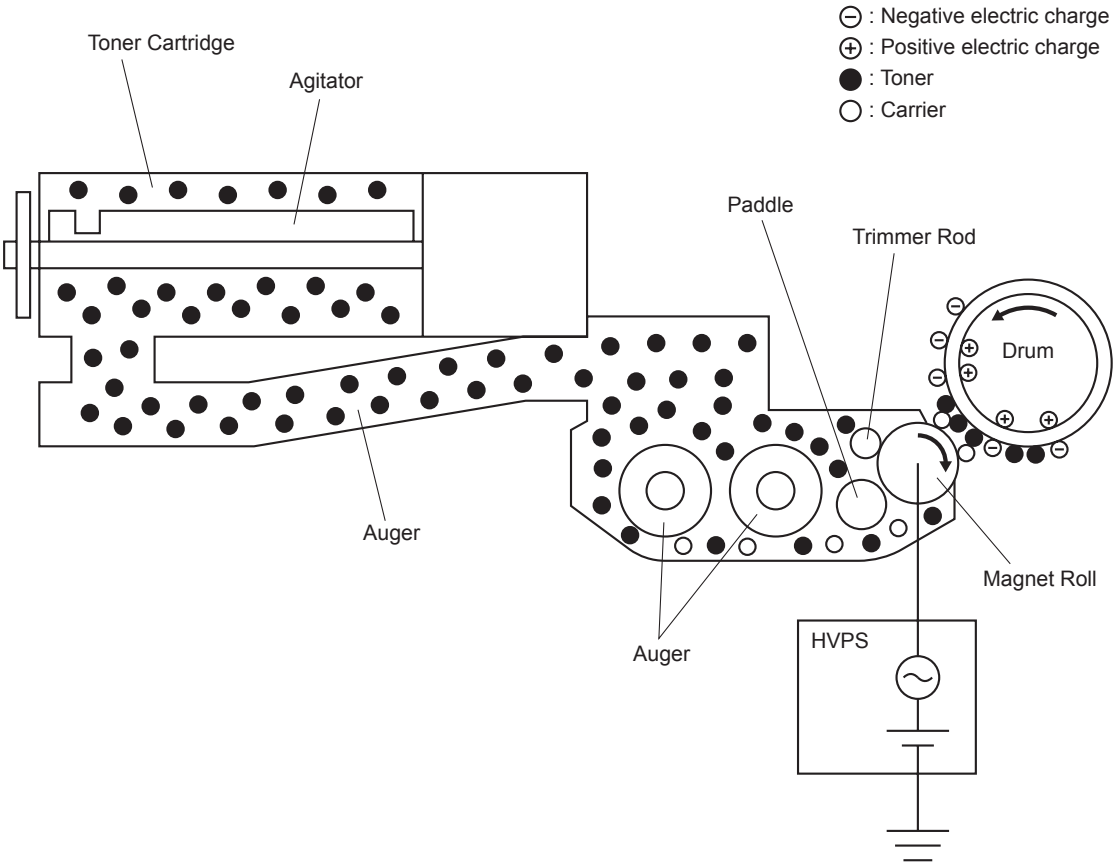
1.3.3 Development

In the development process, toner is electrically attached to the invisible electrostatic latent image on the drum surface to form visible toner image on the drum.
This process is performed in parallel for yellow, magenta, cyan and black color independently.

- The toner in the toner cartridge is agitated by the built-in Agitator and fed into the developer. The Auger is driven by the toner motor.The amount of toner to be consumed according to the print count is calculated and that amount is fed into the developer. (Refer to "Toner Dispense Mechanism".) This is called "toner dispensation", which is controlled by two types of control, "PCDC" and "ADC". (Refer to 5.3.2 Toner Density Control)

- In the developer section, the incoming toner is mixed with the existing developer (toner/carrier mixture) by the Auger, and then supplied to the Magnet Roll located near the drum surface. The toner and carrier are charged by friction due to agitation (toner in negative, carrier in positive), and they attract each other electrically. The carrier, due to its magnetic properties, is attracted to the Magnet Roll, and then uniformly leveled by the Trimmer Rod.

- The magnet roll is covered by a thin semi-conductive sleeve all over the surface. The DB (Developing Bias) voltage is supplied to this semiconductor sleeve from the High Voltage Power Supply (HVPS). The DB voltage is negative DC voltage combined with AC voltage. The DC voltage keeps the magnet roll at a constant negative voltage against the photoreceptor layer of the drum. Therefore, at the area where the negative electric charge on the drum surface does not decrease, the potential is lower than that of the magnet roll, while the potential is higher than that of the magnet roll at the area where the negative charge on the drum surface decreases. The AC voltage shakes the developer on the surface of the magnet roll so that the toner easily flies to the drum. Thus, only the portions of the drum surface where the negative charge has decreased below that of the magnet roll (electrostatic latent image) attract the toner to form an image on the drum. Once the toner is deposited on the drum, the potential and the toner-attracting force of the corresponding portion decreases because the increase of negative charge lowers the potential at that portion.



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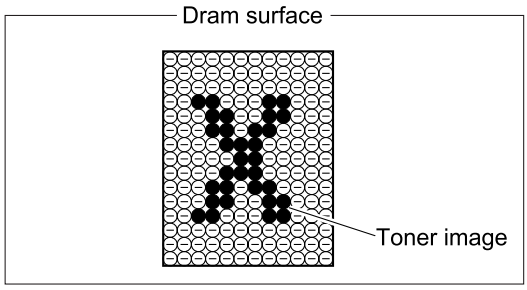

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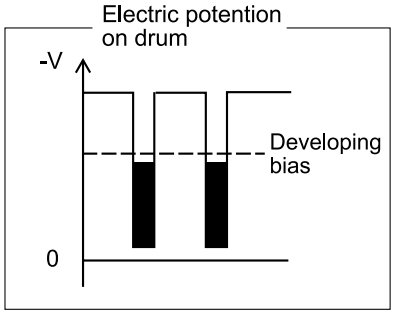

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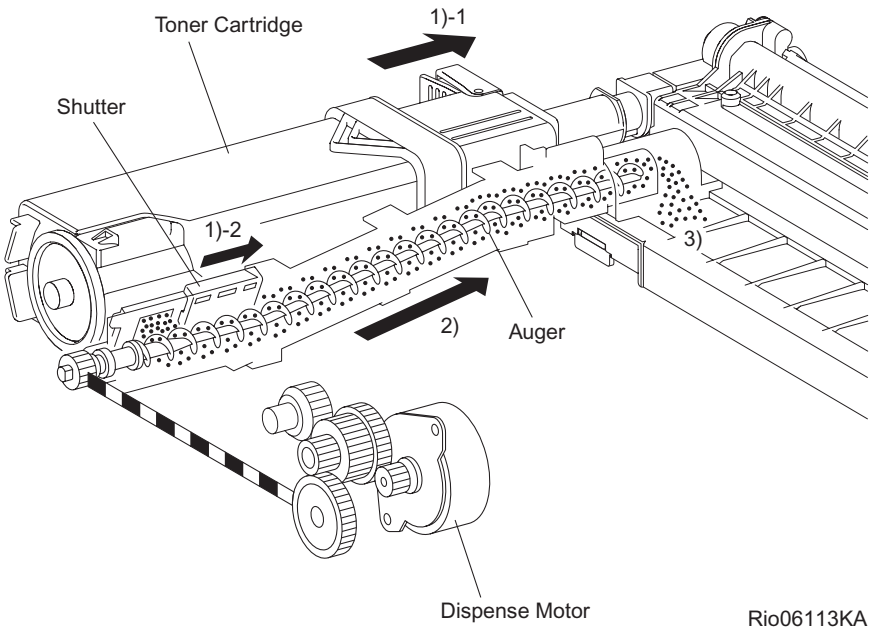
- Toner Dispense Mechanism

  The toner in the toner cartridge goes through the following steps before reaching the developer.

  Once the toner cartridge is set and the lever is moved toward the lock position, the JOINT ASSY DISP and the toner cartridge shutter move frontward, opening the toner supply port.
  The toner supplied from the toner cartridge is carried toward the developer by the Auger in the HOUSING ASSY AUGER.
  The Auger is a spiral-shaped part that carries toner forward as it rotates driven by the Dispense Motor in the FRAME ASSY MOT.
  After being carried to the front side of the HOUSING ASSY AUGER, the toner is fed to the developer via the port of the HOUSING ASSY AUGER.



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1.3.4 Transfer (Drum -> Paper)

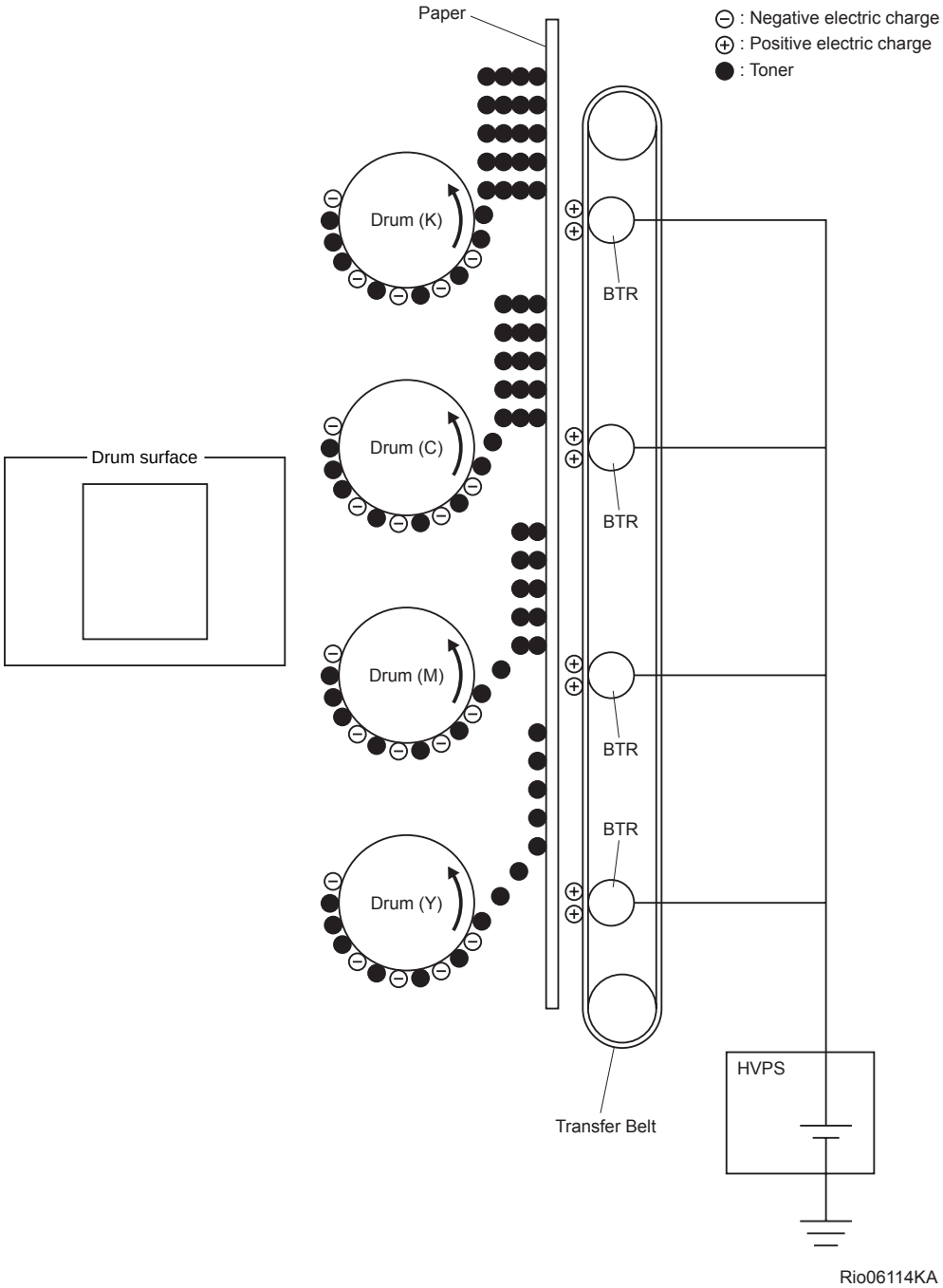
In the transfer process, toner image formed on the drum surface is transferred onto the surface of the paper. The toner is transferred onto the paper in the order of Y, M, C, and K.

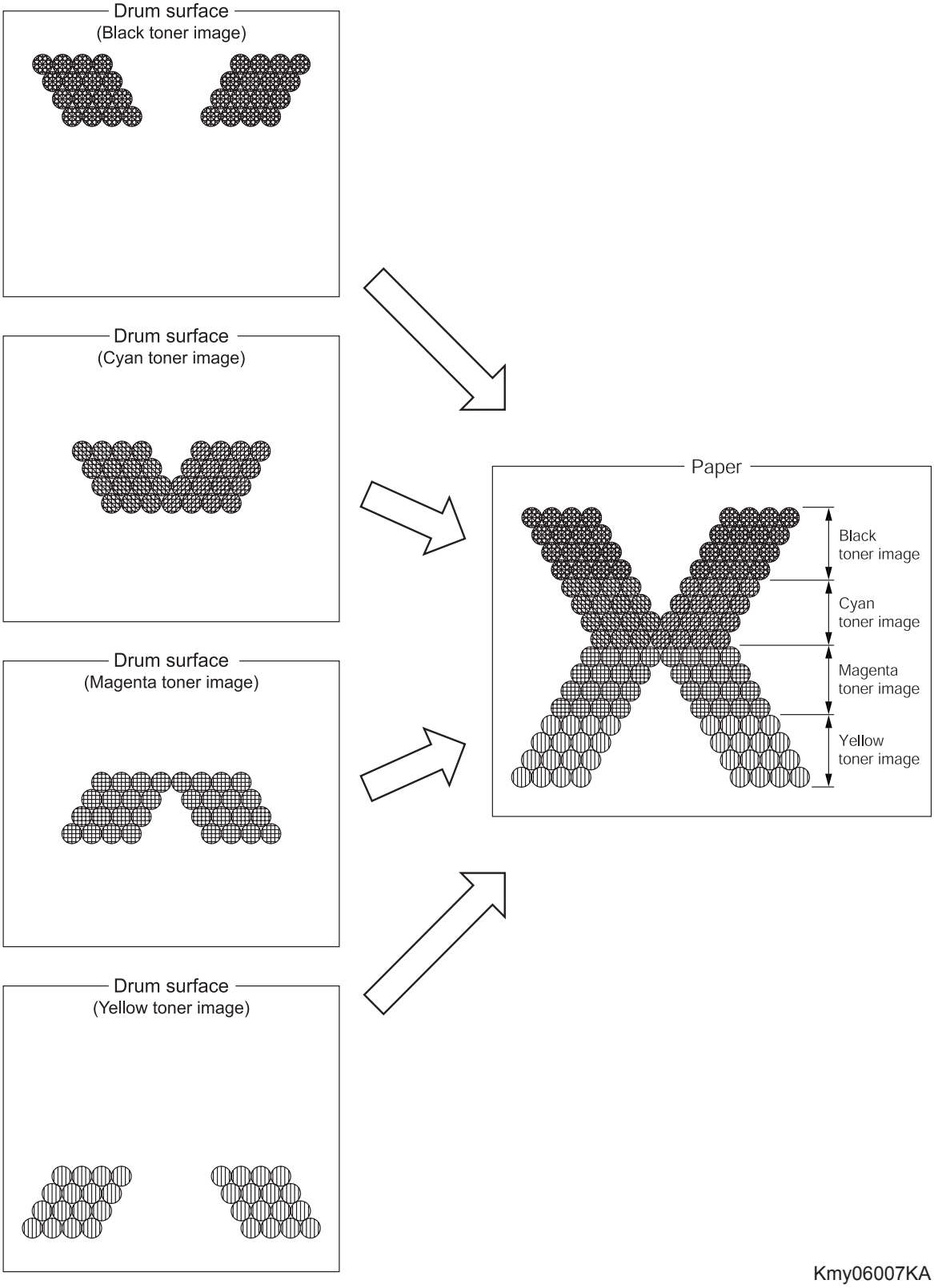
- BTR

  The BTR (Bias Transfer Roll) is a conductive roll, to which the positive voltage is applied from the High Voltage Power Supply (HVPS). The BTR contacts the rear side of the Belt and applies the positive voltage to the Belt.

- Belt

  The Belt is a conductive belt, to which the positive voltage is applied from the BTR. After the negatively charged toner image on the drum surface is drawn by the positive charge on the belt, it is transferred from the drum to the paper. The Belt feeds the paper to the direction of FUSER.




Drum surface
(Black toner image)
Drum surface
(Cyan toner image)
Drum surface
(Magenta toner image)
Drum surface
(Yellow toner image)
Paper
Black toner image
Cyan toner image
Magenta toner image
Yellow toner image
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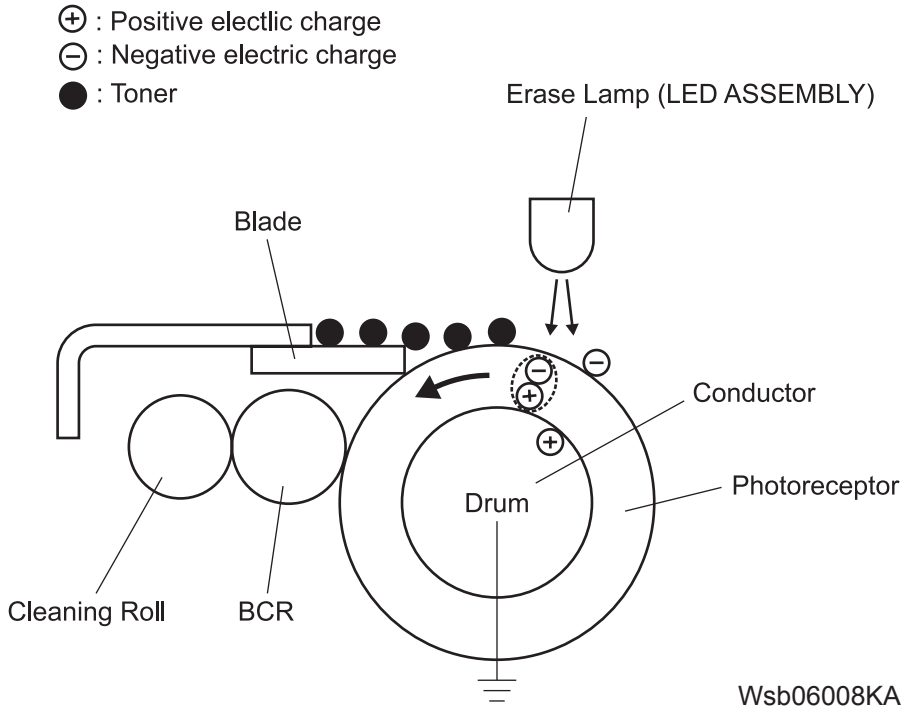
1.3.5 Cleaning (DRUM)

In the Cleaning process, excess toner and charge is removed from the drum and BCR surfaces.

- Drum cleaning
  The excess toner that was not transferred to the Transfer Belt remains on the drum surface. To prevent troubles in the subsequent processes, the excess toner is scraped off by the Cleaning Blade in contact with the drum, and then collected into the collection box as described in "1.3.8 Waste Toner Collection".
- BCR cleaning
  The excess toner remaining on the BCR is wiped off by the Cleaning Roll made of spongy material, and then collected into the collection box as described in "1.3.8 Waste Toner Collection".
- Charge cleaning
  When the drum is charged by BCR, any excess charge hinders the drum surface from being uniformly charged, which may lead to print quality problems.
  The excess charge on the surface of the drum is eliminated by irradiating the light of the Erase Lamp (LED ASSEMBLY).

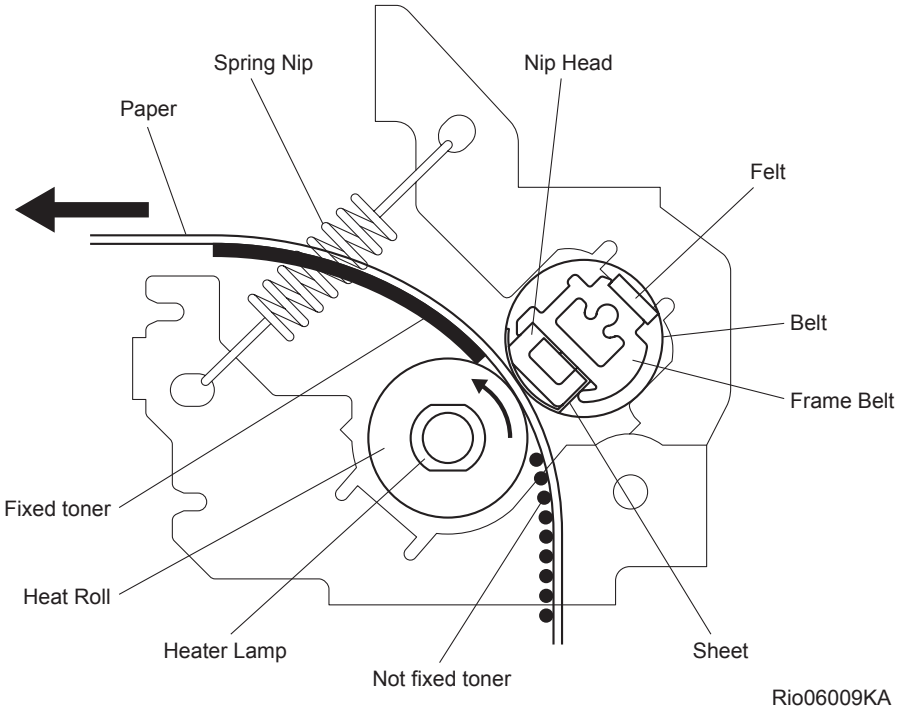


1.3.6 Fusing

In the fusing process, toner is fixed on the paper by heat and pressure.

- The toner particles are melted by the Heat Roll heated by the Heater lamp, and fused onto the print medium by the pressure between the Heat Roll and the Belt.

- The Belt friction-driven by the Heat Roll nips the print media against the Heat Roll using the pressurizing mechanism it contains.



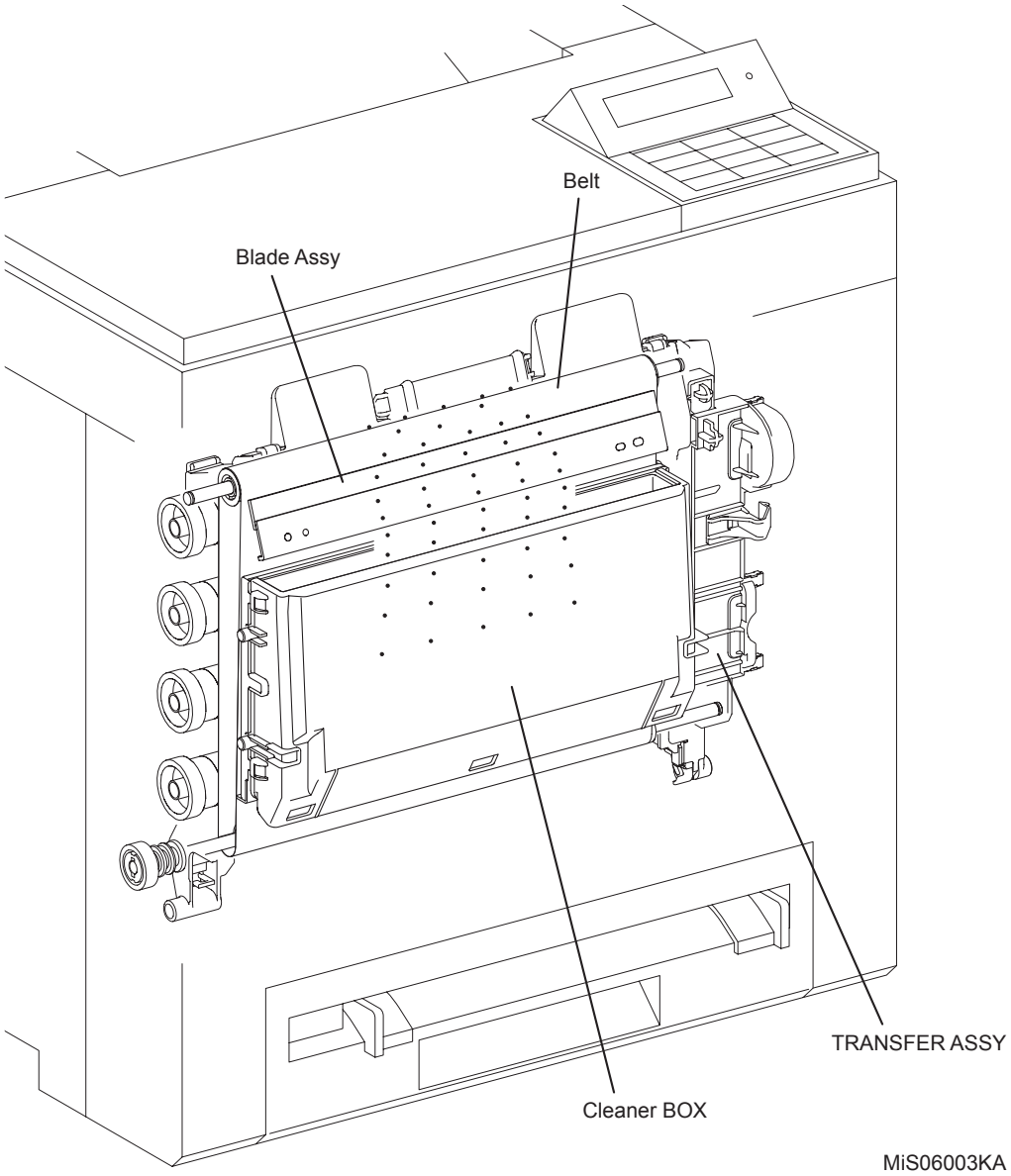
1.3.7 Cleaning (TRANSFER ASSY)

In the "Cleaning (TRANSFER ASSY)" process, the transfer belt is cleaned by removing the excess toner on its surface (for the density measurement of ADC toner patch).

- Collecting excess toner from the transfer belt

(1) Toner on the BELT is scraped off by the Cleaner Blade that is in contact with the Drum.

(2) The removed toner is dropped into the Cleaner BOX.

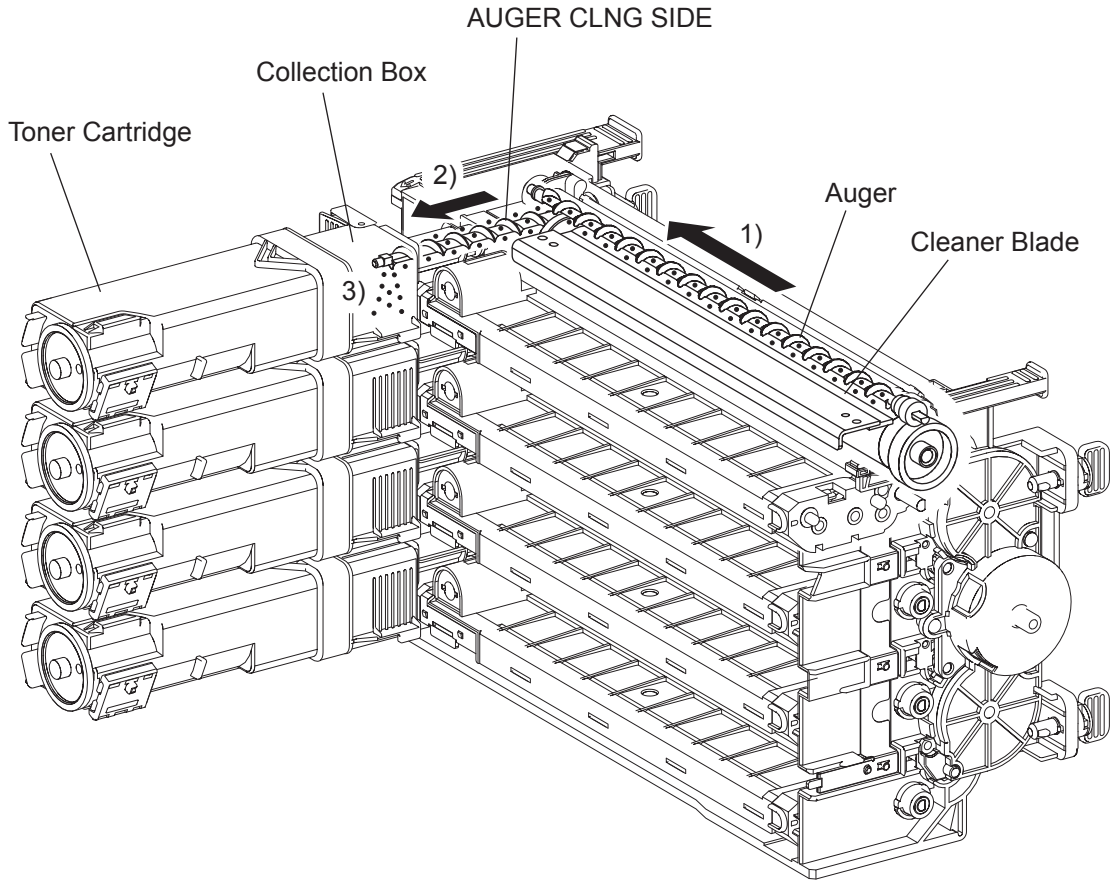


1.3.8 Waste Toner Collection

(1) The excess toner is collected by the cleaner blade contacting the drum, and then carried to the AUGER CLNG SIDE by the Auger.

(2) The toner is carried by the AUGER CLNG SIDE to the joint to the collection box in the toner cartridge.

(3) The toner then falls into the collection box in the toner cartridge.



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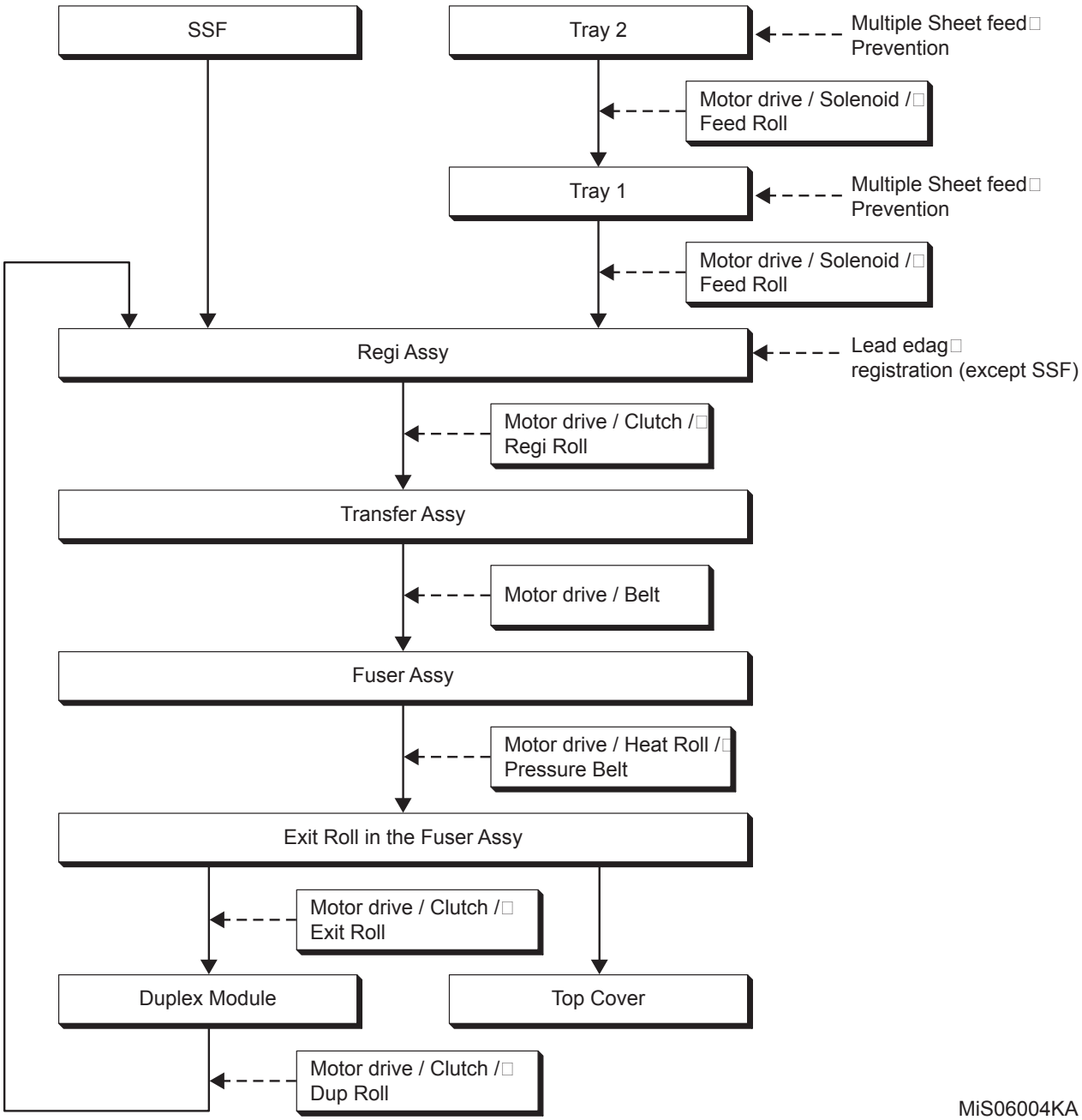
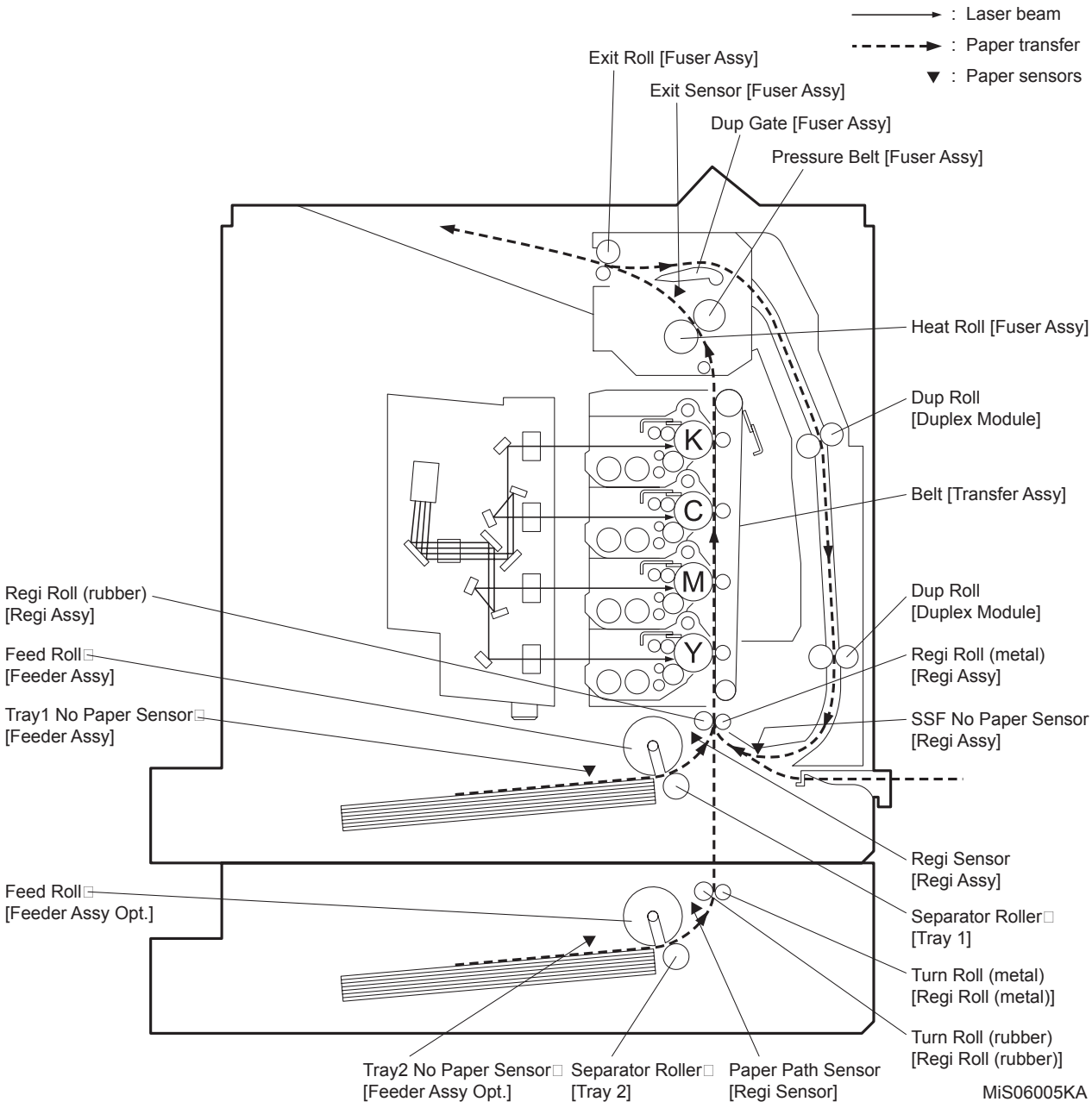
2. Paper Path

2.1 Paper Path



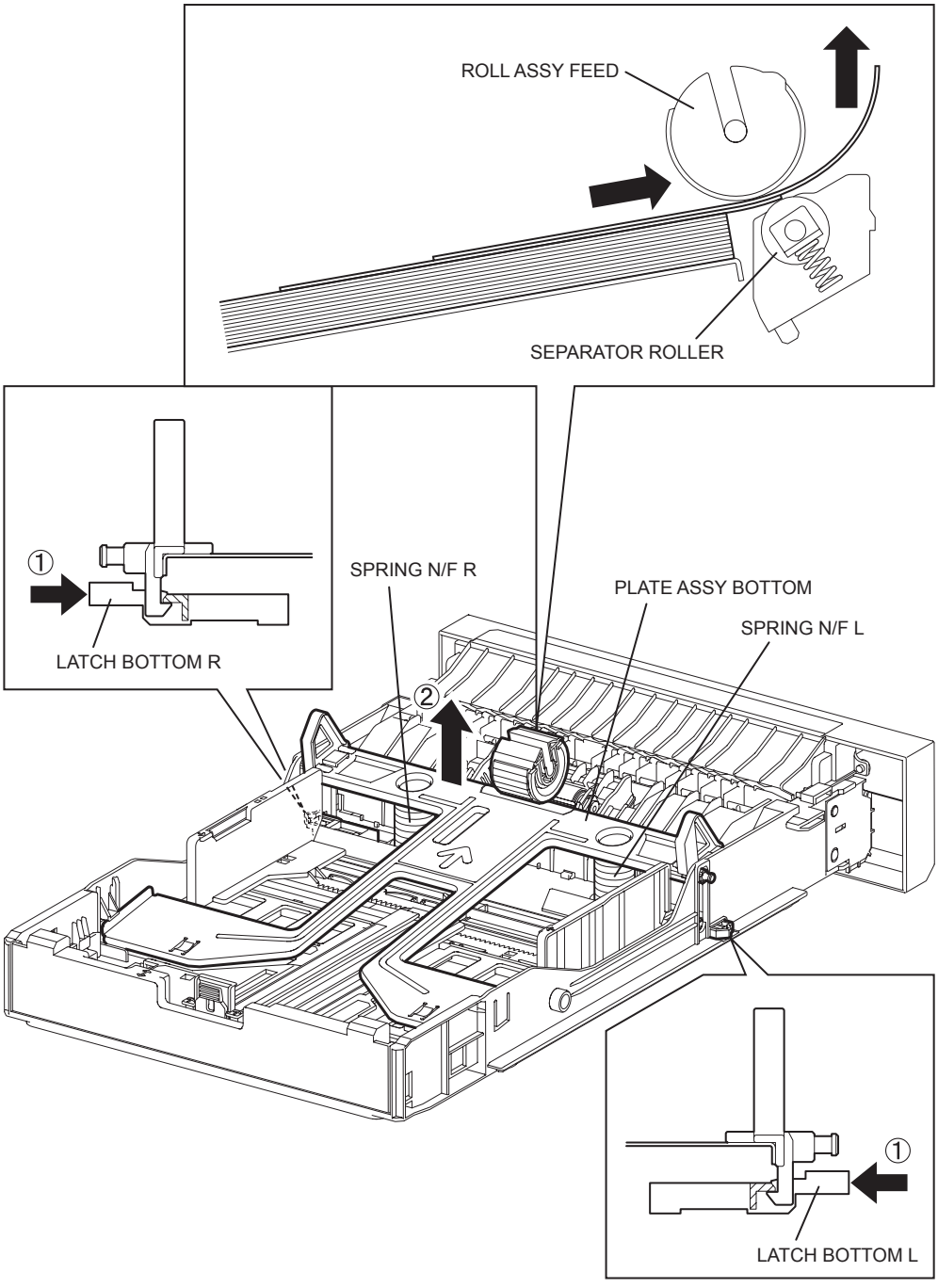
2.2 Layout of Paper Path



2.3 Feeding from Paper Cassette

When the paper cassette is inserted into the feeder section, the projections on the CHASSIS FDR L (PL3.1.8) and the CHASSIS FDR R (PL3.1.4) press the LATCH BOTTOM L (PL2.1.14) and the LATCH BOTTOM R (PL2.1.15) inward until they are unlocked.
This allows the PLATE ASSY BOTTOM (PL2.1.2) to be lifted by the spring pressure of the SPRING N/F L (PL2.1.3) and SPRING N/F R (PL2.1.4) to the position where it can feed sheets.

Upon the start of sheet feeding from the paper cassette, the ROLL ASSY FEED (PL3.2.4) starts rotating driven by the torque from the DRIVE ASSY MAIN (PL7.1.2) under control of the SOLENOID FEED MSI (PL3.1.11) to feed the sheets to the REGI ROLL (ROLL REGI METAL : PL3.2.10/ROLL ASSY REGI : PL3.2.9).



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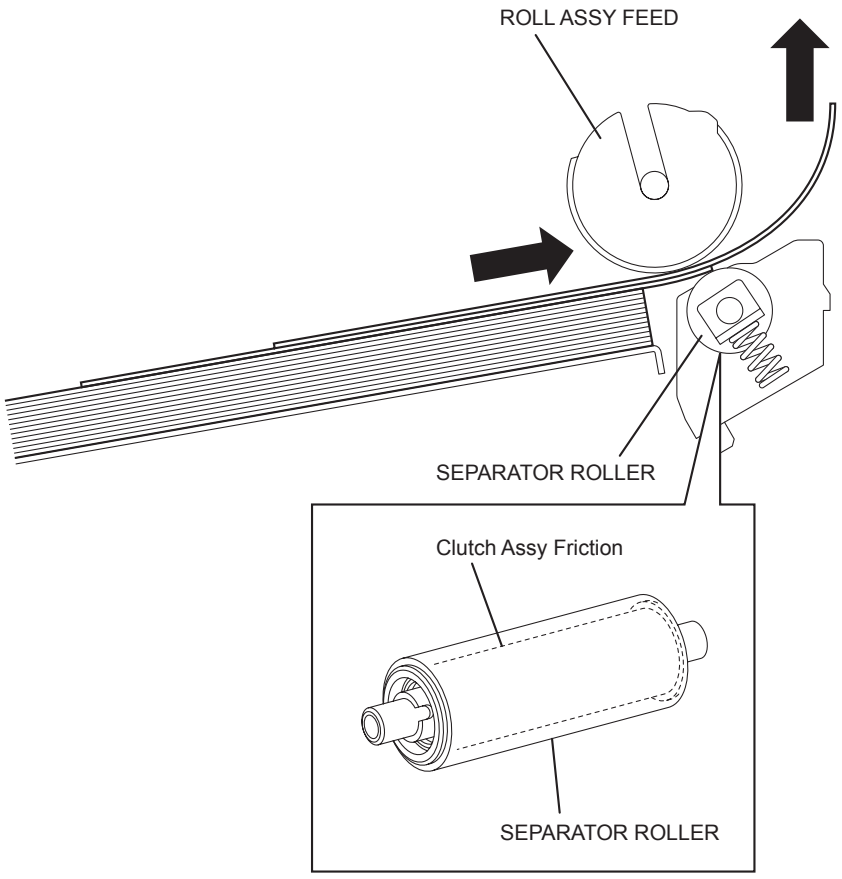
2.3.1 Multiple Sheet Feed Prevention

The sheets set in a tray or cassette is occasionally stuck together along the edges. The stuck sheets cause a multiple sheet feed or a jam. The sheets are fed by the ROLL ASSY FEED(PL3.2.4) to a position between the ROLL ASSY FEED and the SEPARATOR ROLLER(HOLDER ASSY SEPARATOR : PL2.1.5). Normally, when only one sheet is fed, both the ROLL ASSY FEED and SEPARATOR ROLLER rotate to allow the sheet to pass. However, when two sheets are fed concurrently, only the ROLL ASSY FEED rotates and the SEPARATOR ROLLER is locked thereby allowing the upper sheet to pass by being separated from the lower sheet that is stopped by the friction with the SEPARATOR ROLLER at rest.

The SEPARATOR ROLLER is being pushed toward the ROLL ASSY FEED by spring pressure, and controlled by the torque limiter (Clutch Assy Friction) with which it is coupled.



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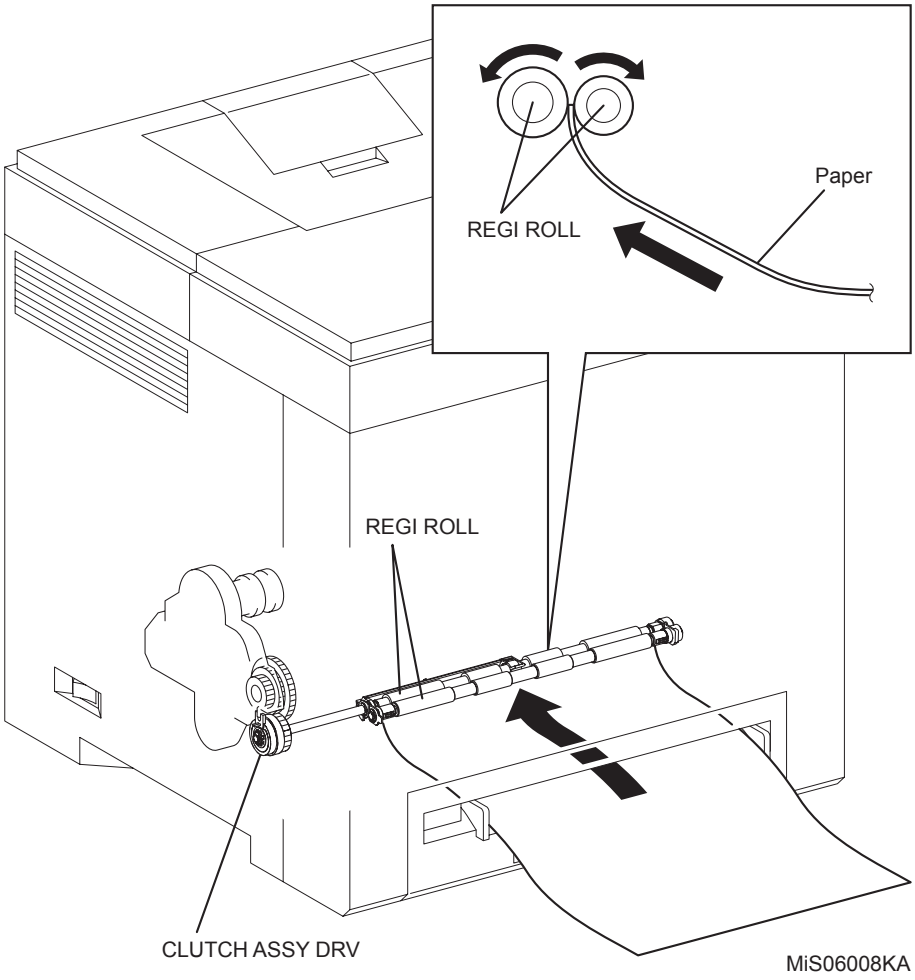
2.4 Feeding from Single Sheet Feeder (SSF)

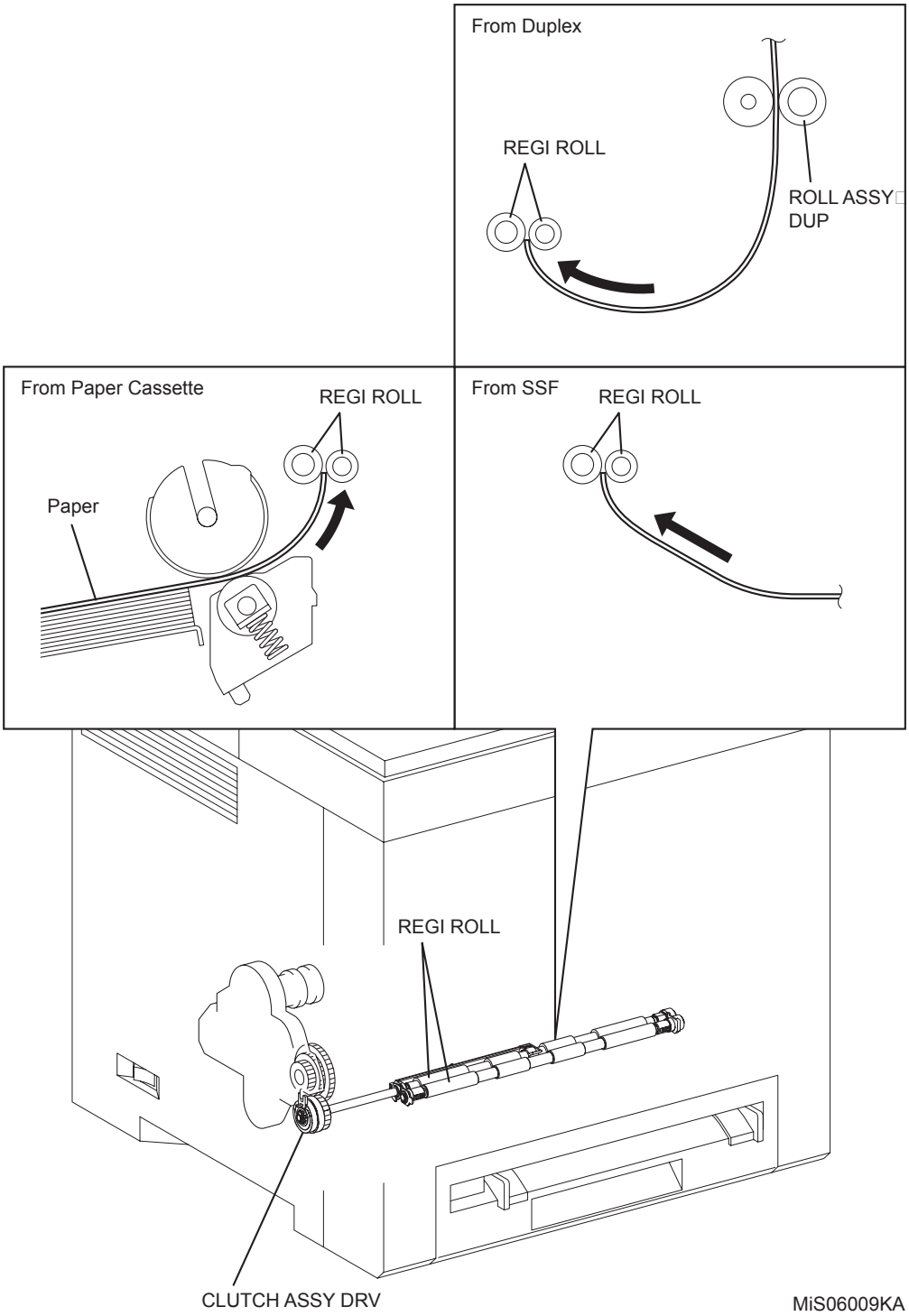
When a sheet is loaded on the SSF, the REGI ROLL (ROLL ASSY REGI : PL3.2.9) rotates by the torque from the DRIVE ASSY MAIN (PL7.1.2) under control of the CLUTCH ASSY DRV (PL3.1.1) to feed the sheet to the toner transfer section (TRANSFER ASSY : PL6.1.7).



2.5 Feeding in Registration Section

The sheet fed to the registration section from the paper cassette, SSF, or duplex section is fed to the toner transfer section (TRANSFER ASSY : PL6.1.7) by the REGI ROLL (ROLL ASSY REGI : PL3.2.9) that rotates by the torque from the DRIVE ASSY MAIN (PL7.1.2) under control of the CLUTCH ASSY DRV (PL3.1.1).

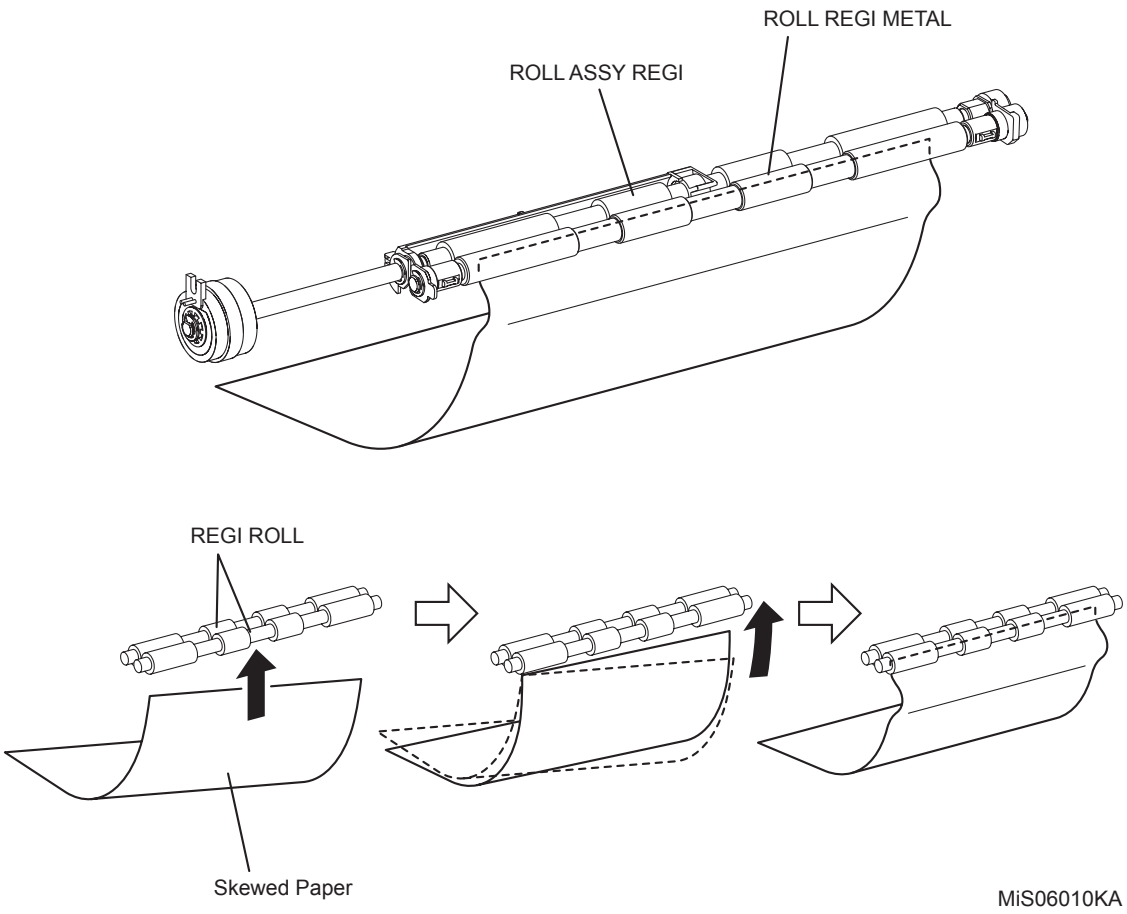
From the duplex section to the registration section, the sheet is fed by the rotation of the ROLL ASSY DUP (PL11.2.9). (Refer to "2.7 Feeding in Duplex Section")
At the registration section, the lead edge position of the sheet is corrected (Refer to "Lead-edge Registration") before the sheets are fed to the toner transfer section (TRANSFER ASSY : PL6.1.7).



2.5.1 Lead-edge Registration

When a sheet is fed from the SSF, paper cassette or Duplex to the toner transfer position, the registration of the sheet may not be correctly maintained due to such troubles as misalignment of lead edges in the paper cassette. To avoid this trouble, the lead edge position needs to be aligned at the registration section before the sheet is fed to the toner transfer position.

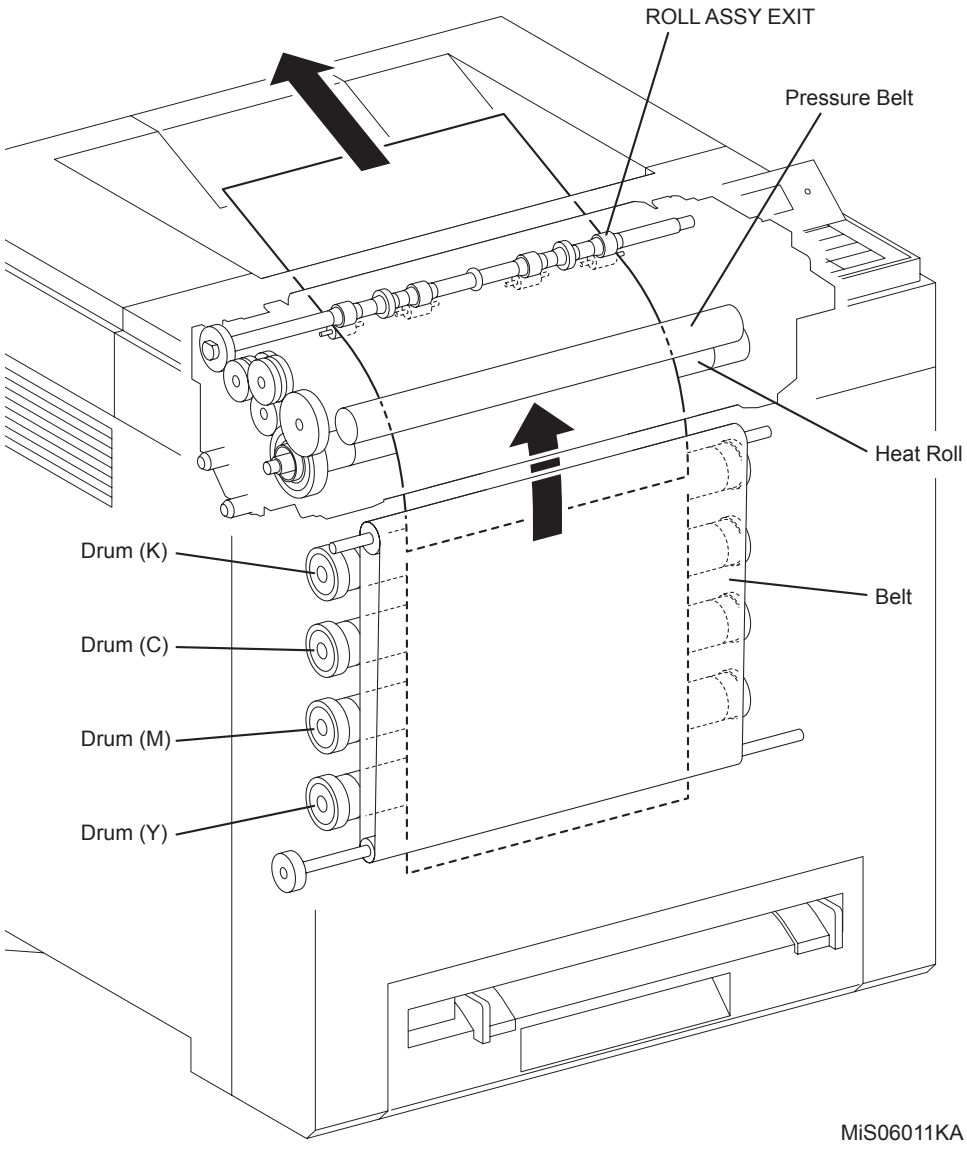
By thrusting the edge of the sheet coming out of the SSF or paper cassette against the REGI ROLL (ROLL REGI METAL : PL 3.2.10 / ROLL ASSY REGI : PL 3.2.9) that is locked, the lead edge of the sheet is registered.



2.6 Transfer/Fusing/Exit

The sheet that has passed through the REGI ROLL goes into the TRANSFER ASSY (PL6.1.7) that rotates by the torque from the DRIVE ASSY MAIN (PL7.1.2), where the toner image is transferred from the belt to the sheet. Then, the sheet is fed to the exit section while its toner image is being fused in the FUSER ASSY (PL6.1.1) by the Heat Roll that rotates by the torque from the DRIVE ASSY SUB (PL7.1.1).

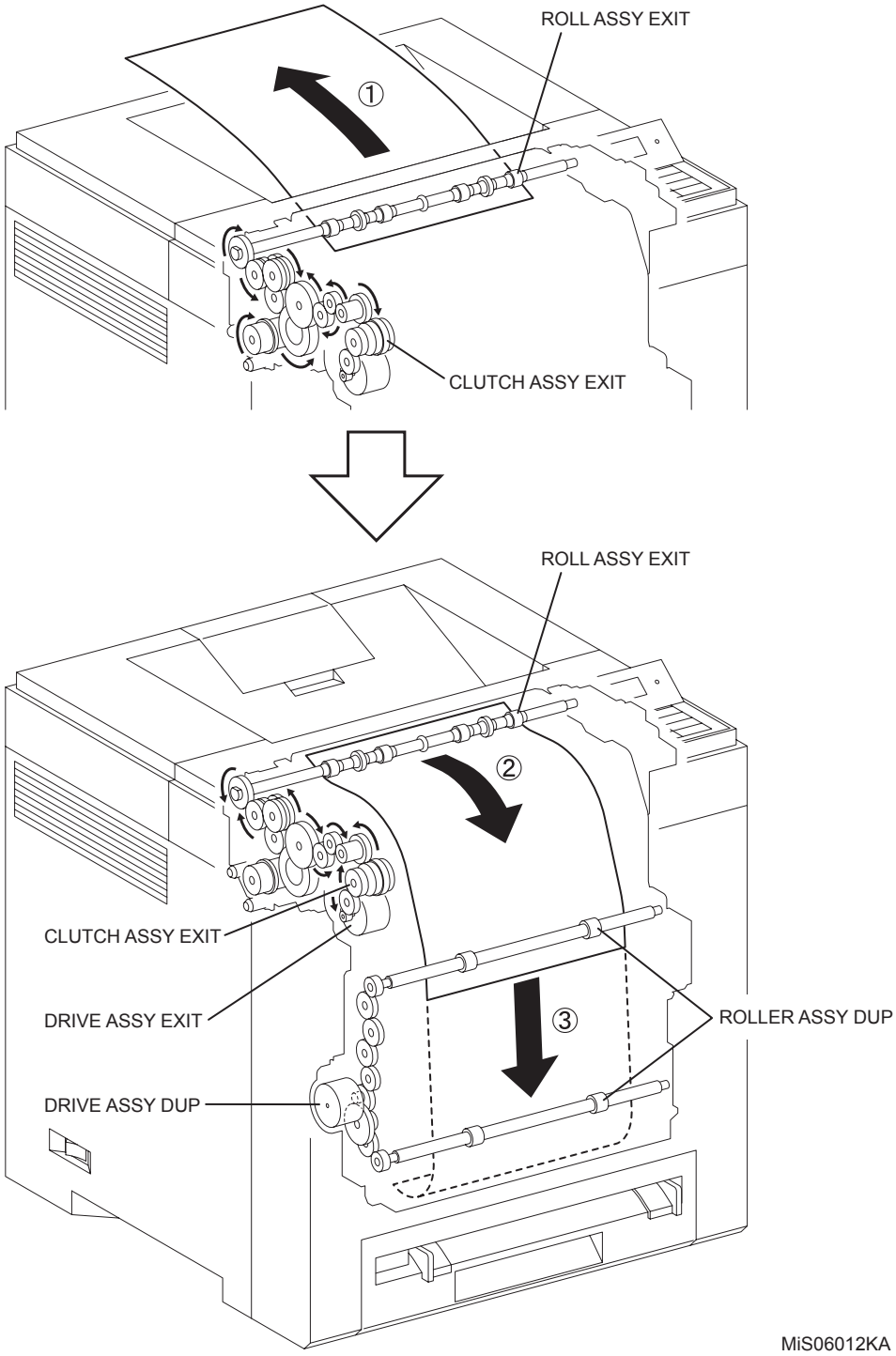
The print-completed sheet (1 side-printed or 2 side-printed) is ejected from the printer by the ROLL ASSY EXIT that rotates in the exit direction by the torque from the DRIVE ASSY SUB.



2.7 Feeding in Duplex Section

After the 1 side-printed sheet is ejected from the Fuser, the ROLL ASSY EXIT guides the sheet to the duplex section by rotating in the reverse direction by the torque from the ROLL ASSY EXIT under control of CLUTCH ASSY EXIT.

From the duplex section, the 1 side-printed sheet is fed to the registration section by the ROLLER ASSY DUP (PL11.2.9) that rotates by the torque from the DRIVE ASSY DUP (PL11.2.5).
After the printing on the side 2 is completed, the sheet exits in the same manner as it does after the printing on the side 1 is completed.



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3. Functions of Major Functional Components

Major functional components of the printer are described below with illustrations.
These components are classified into the following blocks based on the configuration of the printer.

- Paper tray
- Paper Feeder
- SSF & Regi Assy
- TRANSFER ASSY & FUSER ASSY
- ROS ASSY
- TONER CARTRIDGE & Dispenser
- PHD ASSY
- Drive
- Electrical
- Duplex
- 250 Paper Tray (Option)

3.1 Paper Tray

3.1.1 Major functions

- GUIDE SIDE ASSY R (PL2.1.8) / GUIDE SIDE L (PL2.1.6)
  The GUIDE SIDE ASSY R and GUIDE SIDE L can move in the paper transfer direction to determine the paper size.

- END GUIDE
  The END GUIDE can move in the paper transfer direction to determine the paper size.

- HOLDER ASSY SEPARATOR (PL2.1.5)
  The HOLDER ASSY SEPARATOR and the FEED ROLLER pinch the paper to prevent multiple sheet feed.

- PLATE ASSY BOTTOM (PL2.1.2)
  PLATE ASSY BOTTOM is locked to the bottom side when paper tray is pulled out from the paper feeder and unlocked when paper tray is installed to the paper feeder. Pushes the paper against the feed roll using a spring tension.

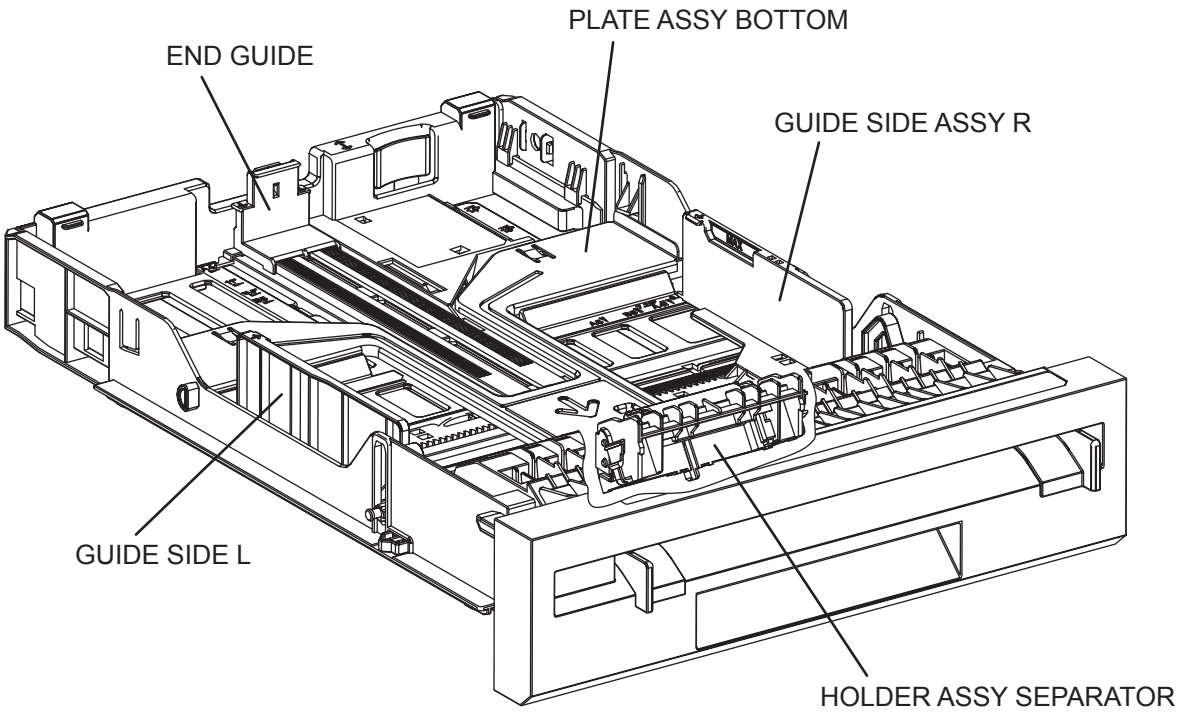
PLATE ASSY BOTTOM
END GUIDE
GUIDE SIDE ASSY R
GUIDE SIDE L
HOLDER ASSY SEPARATOR

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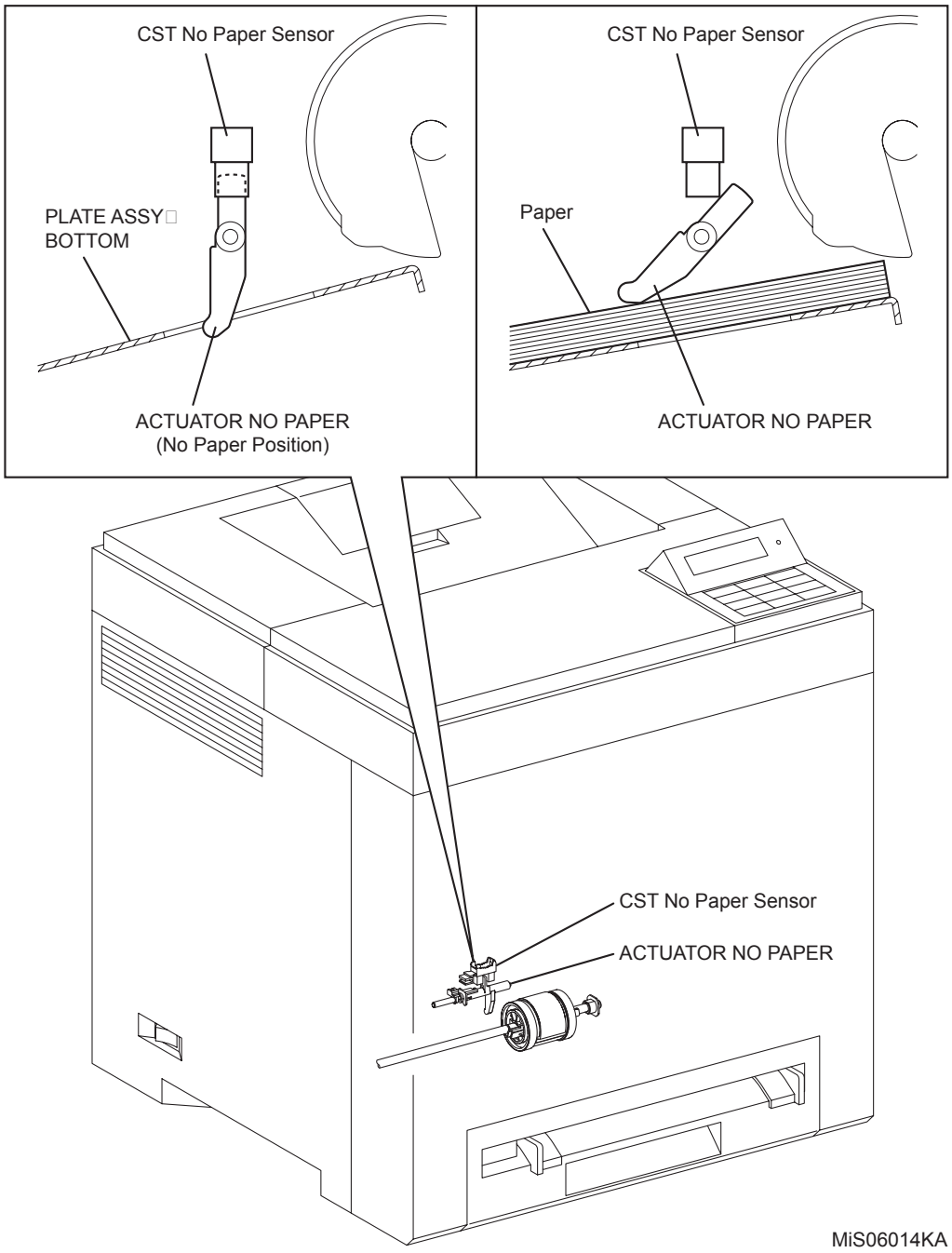
3.2 Paper Feeder

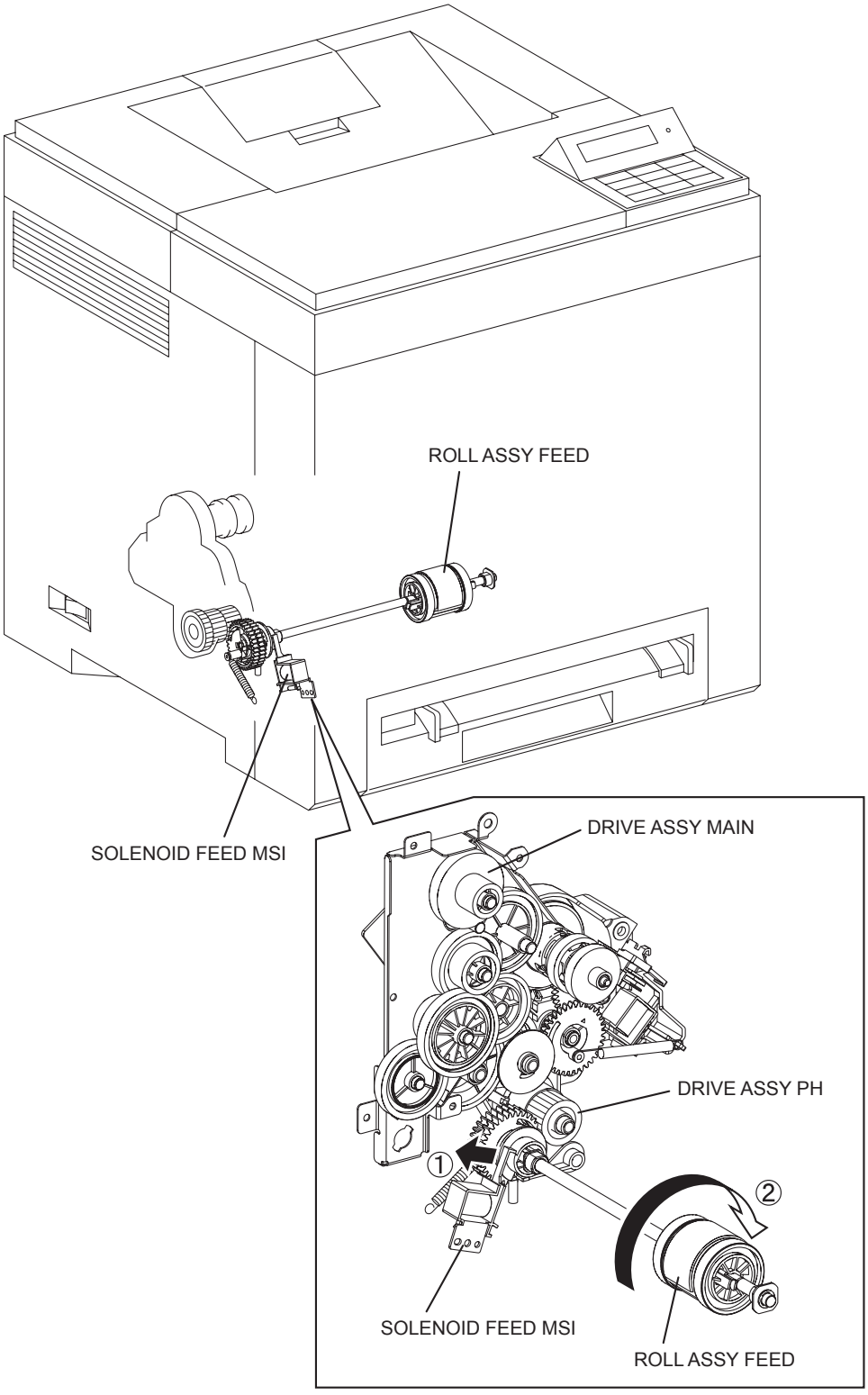
3.2.1 Major functions

- CST No Paper Sensor (SENSOR PHOTO : PL3.2.13)
  The CST No Paper Sensor detects the presence/absence of print media in the paper tray based on the position of ACTUATOR NO PAPER. (No paper: Sensor beam is blocked)



- SOLENOID FEED MSI (PL3.1.11)
  Transmits the drive from the DRIVE ASSY MAIN to FEED ROLLER. (Refer to 6.4 DRIVE ASSY SUB)

- ROLL ASSY FEED (PL3.2.4)
  When the SOLENOID FEED MSI operates, the ROLL ASSY FEED starts rotating and the ROLL ASSY FEED feeds the paper. (Refer to 6.4 DRIVE ASSY SUB)



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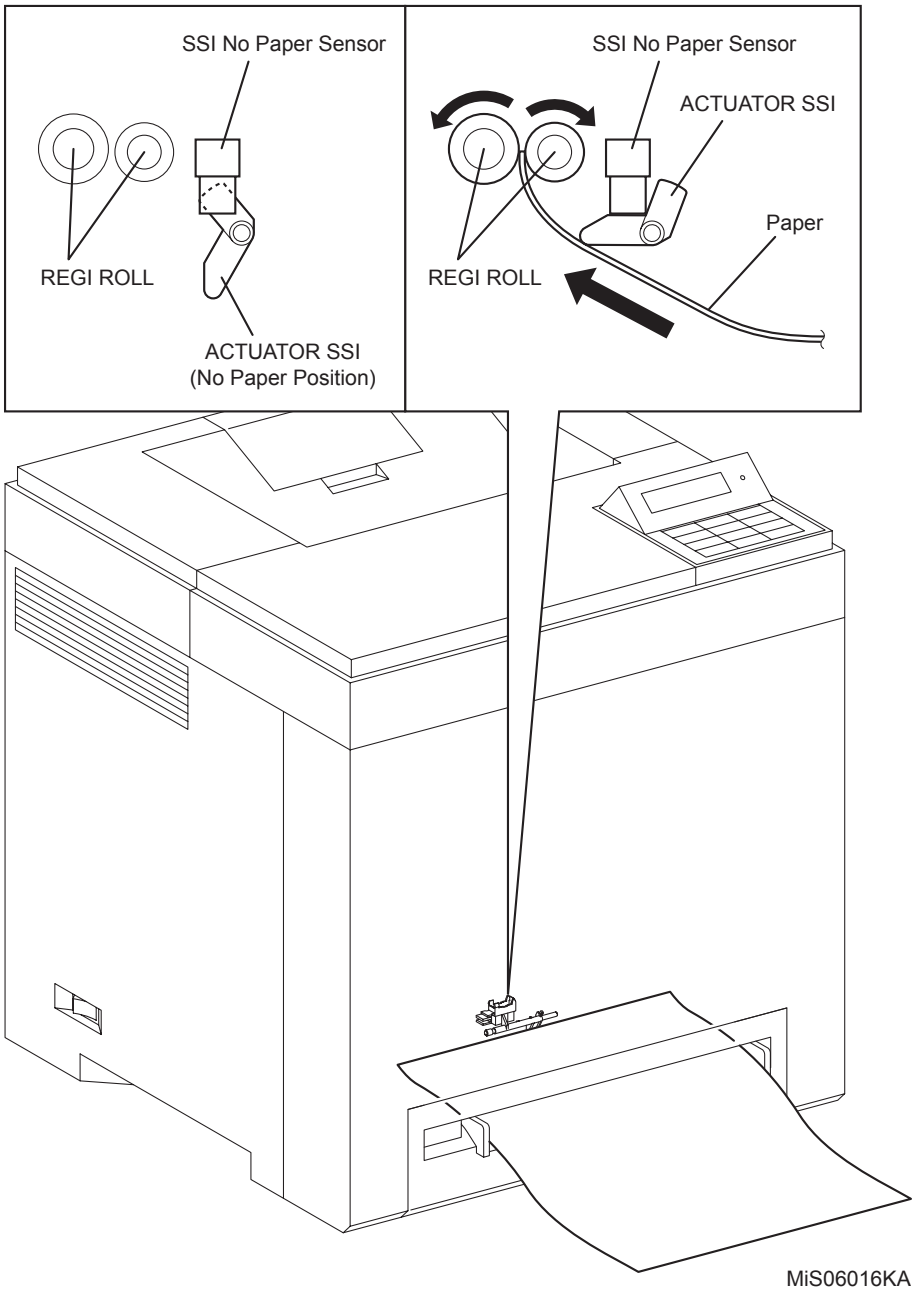
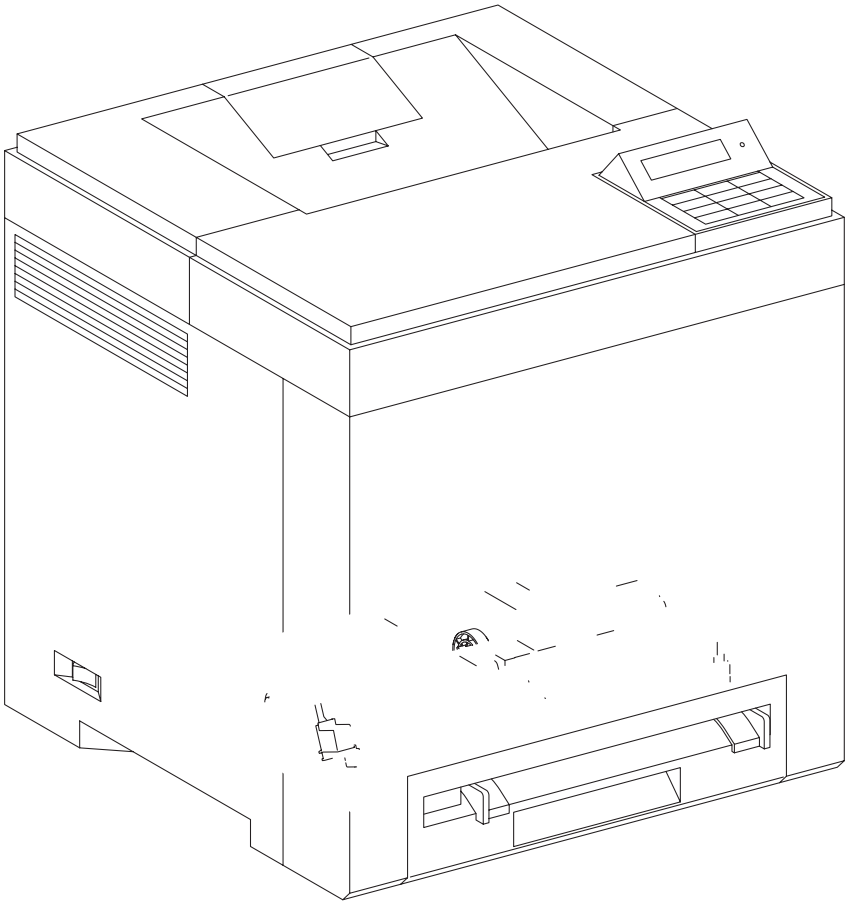
3.3 SSF & Regi Assy

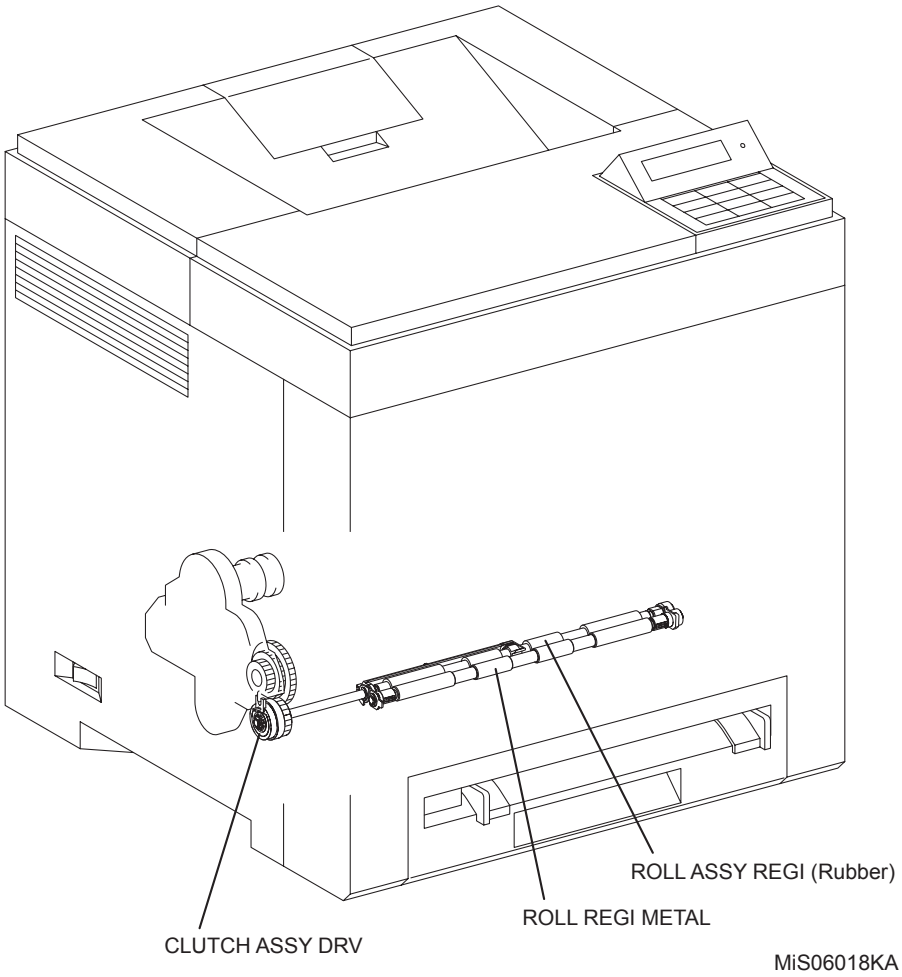
- SENSOR PHOTO (SSI No Paper Sensor : PL3.2.13)
  The SSF No Paper Sensor detects the presence/absence of print media in the SSF tray by the change in the actuator position.
  Upon detecting the sheet, the Regi Roll rotates for a predetermined duration to feed the sheet. The sheet is fixed between the Rolls so that it may not fall from the SSF.
  The Rolls stop immediately when the Regi Sensor detects the presence of paper.



- SENSOR PHOTO (Regi Sensor : PL3.2.13)
  The Regi Sensor detects that the lead edge of the print medium has reached the registration section. (No paper: Sensor beam is blocked)
  When the print medium is fed from the SSF, the Regi Sensor measures the sheet length (size).
  The duration for which the Regi Sensor is ON is converted into the paper length.



- CLUTCH ASSY DRV(PL3.1.1)
  The CLUTCH ASSY DRV transmits the driving torque from the DRIVE ASSY MAIN to ROLL ASSY REGI(PL3.2.9) to feed the print medium to the Fuser section from the paper tray, SSF, or Duplex section. (Refer to 6.1 DRIVE ASSY MAIN)
  To place the toner image at an appropriate position on the print medium, the timing of feeding from the Regi Assy is adjusted by the duration for which the CLUTCH ASSY DRV operates.

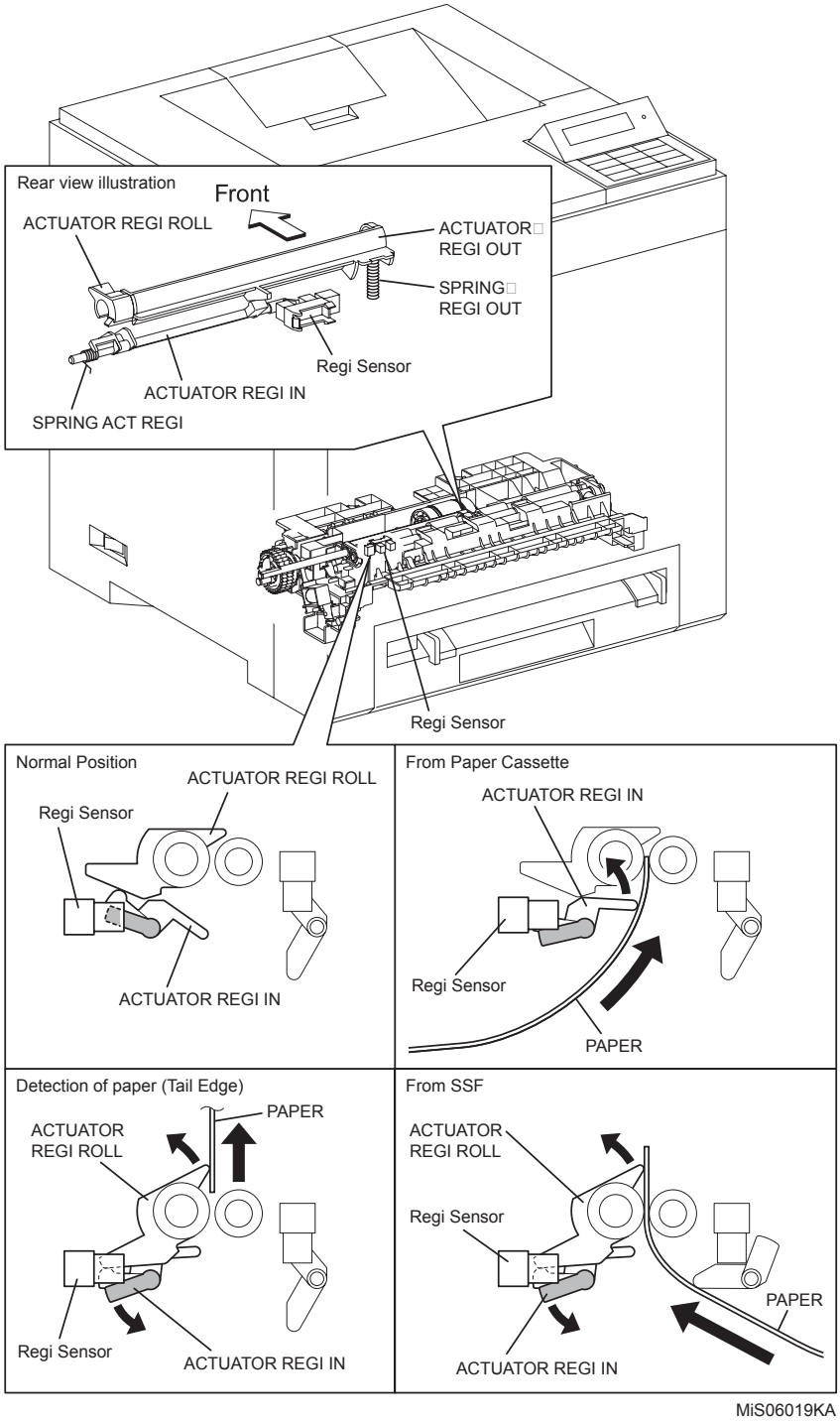


3.3.1 Control of paper size

The printer doesn't have switches for detecting paper size, and only length of paper is detected by the Regi Sensor when feeding paper. If printing data and paper size don't match, error is sent to the ESS.

3.3.2 Paper detection by the Regi Sensor

Since the paper path from the SSF to the Regi Sensor and that from the Paper Tray to the Regi Sensor are different, the Regi Sensor is provided with the ACTUATOR REGI IN (PL3.2.11) and the ACTUATOR REGI ROLL (PL3.2.8). The ACTUATOR REGI ROLL detects the sheet from the SSF and detects the tail edge of the paper from the paper tray. The ACTUATOR REGI IN detects the lead edge of the paper from the paper tray. However, the movement of ACTUATOR REGI IN does not affect that of ACTUATOR REGI ROLL.



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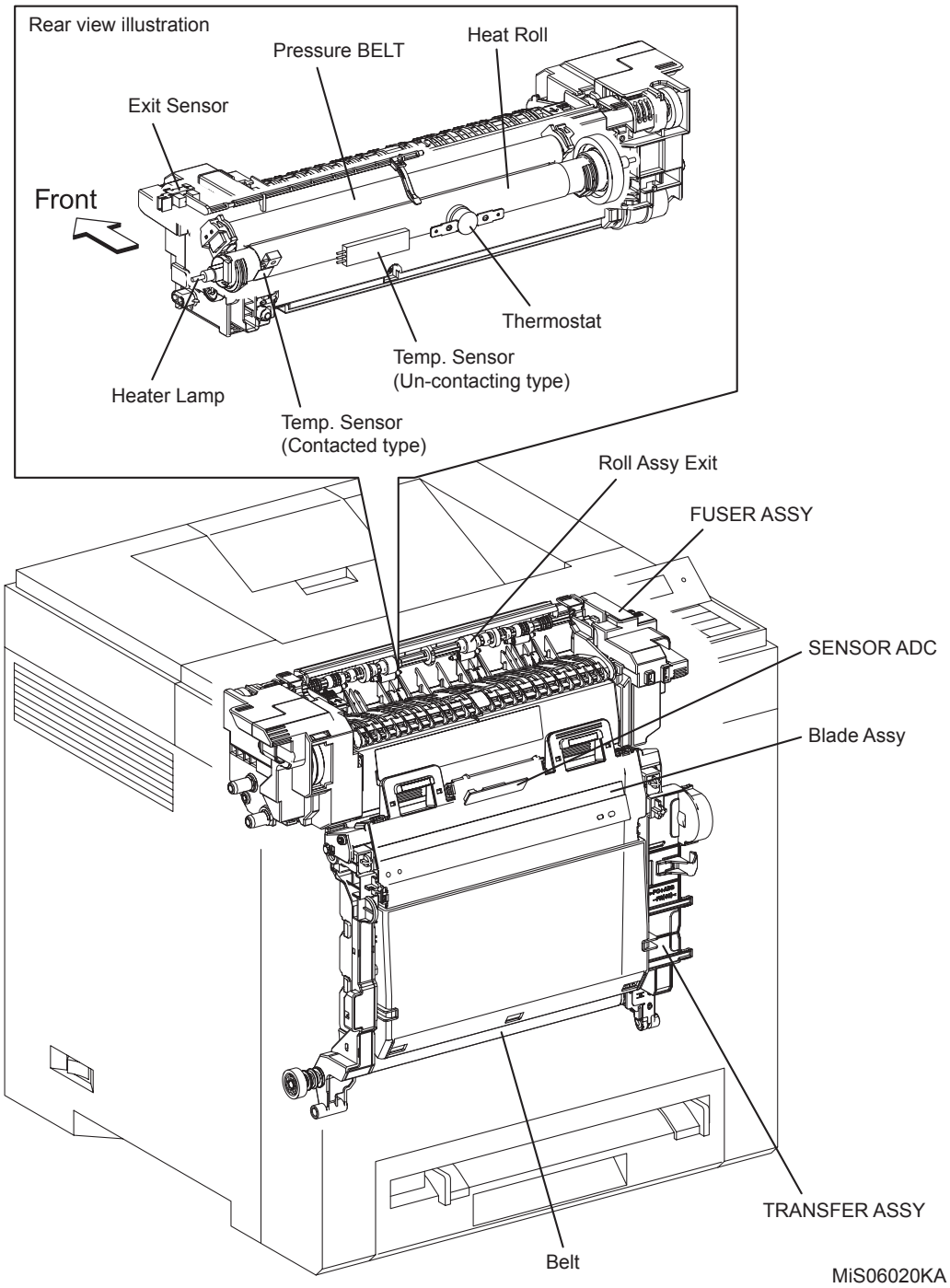
3.4 TRANSFER ASSY & FUSER ASSY

3.4.1 Major functions

- TRANSFER ASSY (PL6.1.7)
  - • Belt
    Belt feeds the paper to the direction of FUSER
  - • SENSOR ADC
    SENSOR ADC reads the toner patch on the BELT, and converts it to voltage value. Voltage value is used to control the density of toner. (Refer to 5.3.1 Potential Control)

- FUSER ASSY (PL6.1.1)
  The FUSER fixes toner which was transferred onto the paper but not fixed by the heat and pressure and feeds paper before and after being fixed.
  The FUSER mainly consists of the following parts:
  - • Heat Roll
  - • Heater Lamp
  - • Thermostat
  - • Temp. Sensor
  - • Pressure Belt
  - • Roll Assy Exit
  - • Exit Sensor
  - EXIT SENSOR
    Detects passage of print after fixed based on the change of position of the actuator.


Rear view illustration
Pressure BELT
Heat Roll
Exit Sensor
Front
Thermostat
Temp. Sensor
(Un-contacting type)
Heater Lamp
Temp. Sensor
(Contacted type)
Roll Assy Exit
FUSER ASSY
SENSOR ADC
Blade Assy
TRANSFER ASSY
Belt
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3.5 ROS ASSY

3.5.1 Major functions

- ROS ASSY

  ROS ASSY is an exposure unit that generates laser beams to form electrostatic latent image on the drum surface.

  In this manual, the ROS ASSY is referred to as ROS.

  The ROS mainly consists of the following parts:

  - LD PWB
  - Scanner ASSY
  - SOS PWB
  - Lens
  - Mirror
  - Window

• LD PWB

The LD PWB is comprised of four LDs (laser diodes) corresponding to Y, M, C, and K.
Each LD converts the electric signals of incoming image data into laser wave or pulse. In order to stabilize the laser light quantity during formation of an electrostatic latent image, the LD PWB always monitors the laser light quantity to adjust it to the appropriate level. This is called "APC (auto power control)".

• Scanner Assy

The Scanner Assy is comprised of the Scanner Motor that rotates at a constant speed and the Polygon Mirror that is mounted on the motor shaft.
The laser light output from the LD is irradiated onto the Polygon Mirror via the Mirror.
The Polygon Mirror, provided with six reflecting mirror faces, changes the reflection angle of the laser light as it rotates by the Scanner Motor, thereby allowing the laser light to scan the drum along its axial direction. Scanning is performed using one reflecting mirror face for each line.

• SOS PWB

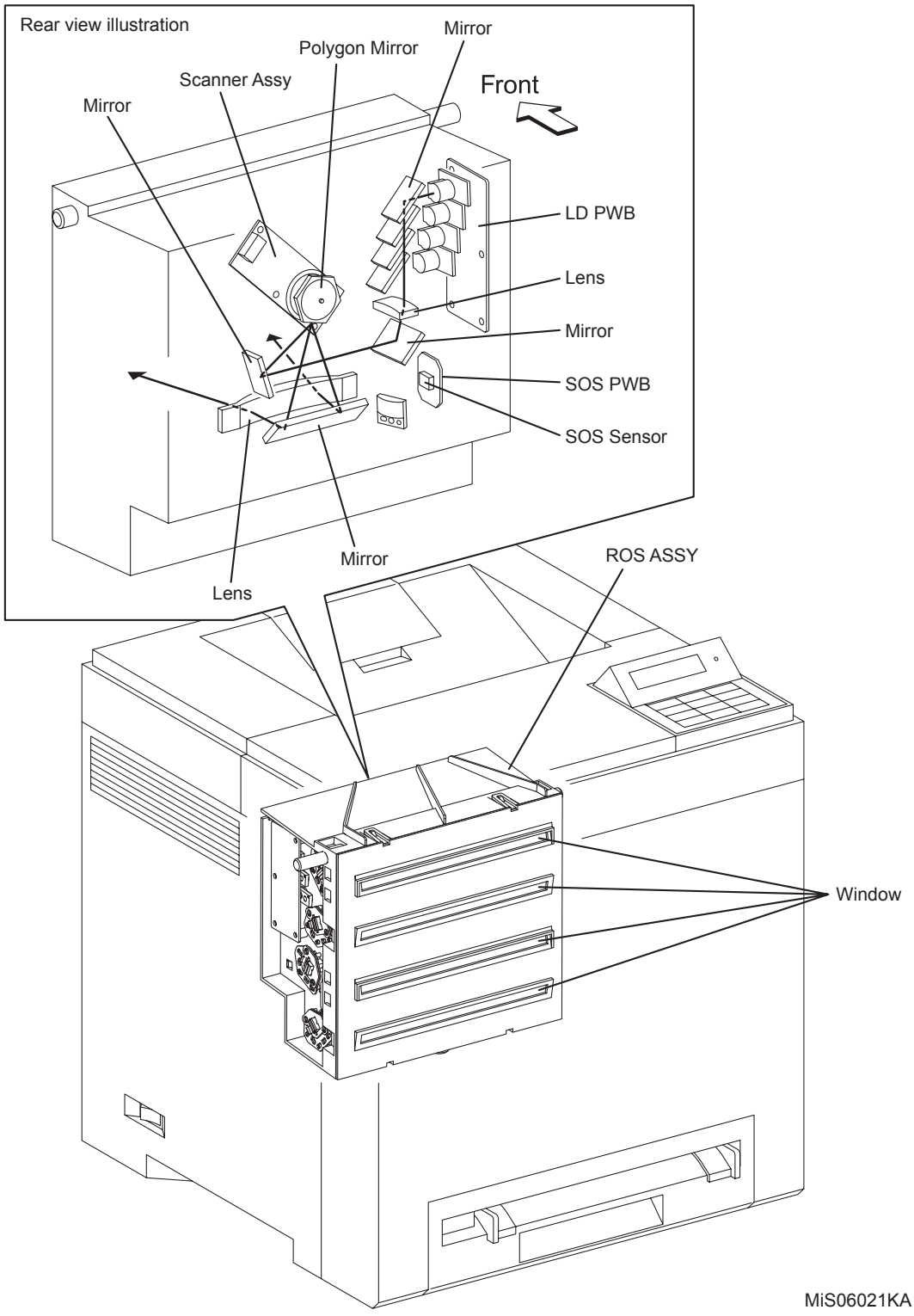
The SOS sensor on the SOS (start of scan) PWB converts an incoming laser beam, upon detection, to an electric signal as the reference signal for starting scanning and transmits this signal to the PWBA MCU.
The SOS sensor signals are used to synchronize the starting point of the laser-beam scanning with the starting point of the image writing.

• Lens

• Mirror

• Window

The laser light reflected from the Polygon Mirror reaches the drum surface via the Lens, Mirror, and Window. The Lens corrects aberration, the Mirror secures an optical path, and the Window prevents foreign matters from entering the ROS.


Rear view illustration
Mirror
Polygon Mirror
Scanner Assy
Front
Mirror
LD PWB
Lens
Mirror
SOS PWB
SOS Sensor
Mirror
ROS ASSY
Lens
Window
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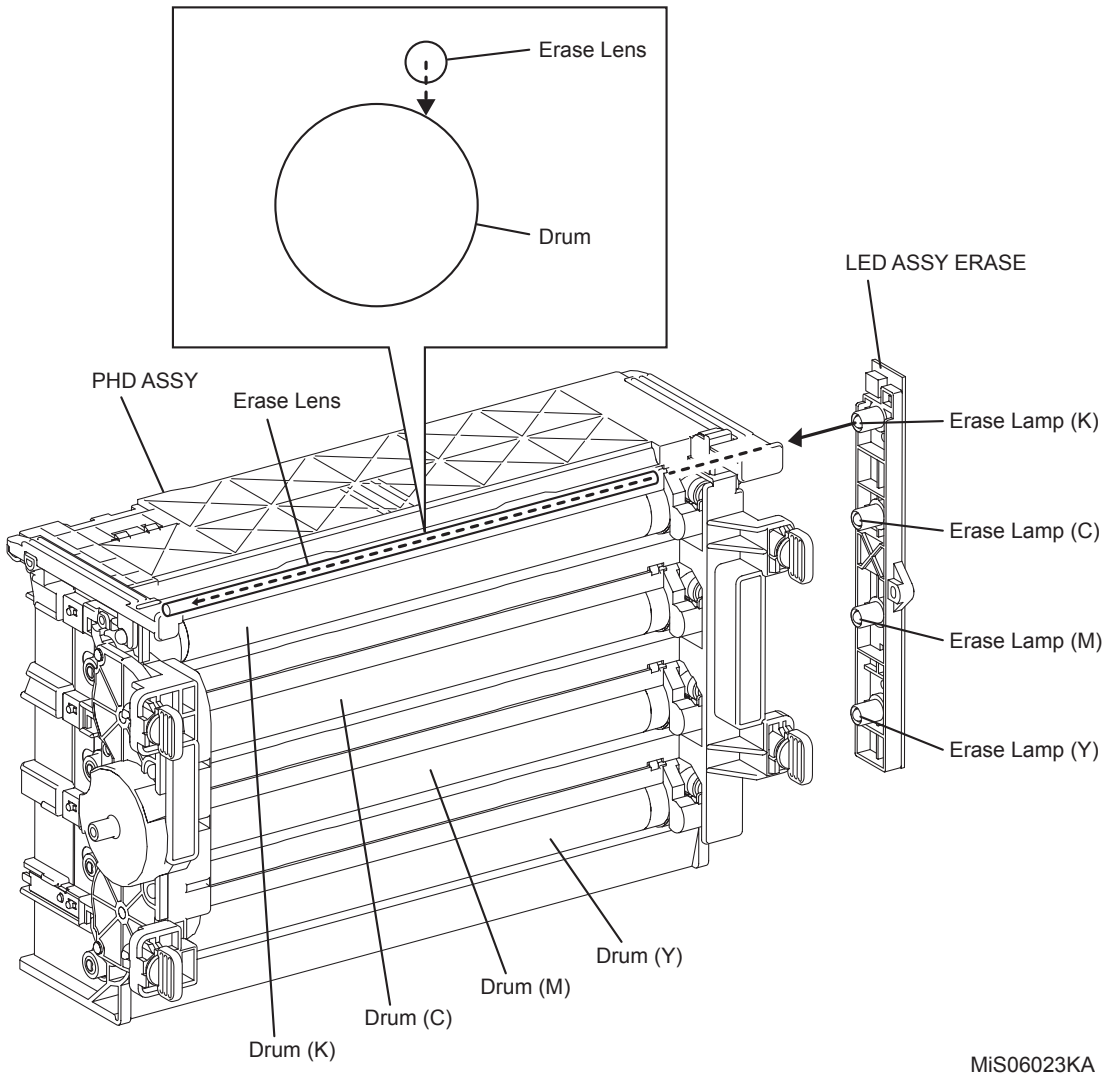
3.7 PHD ASSY

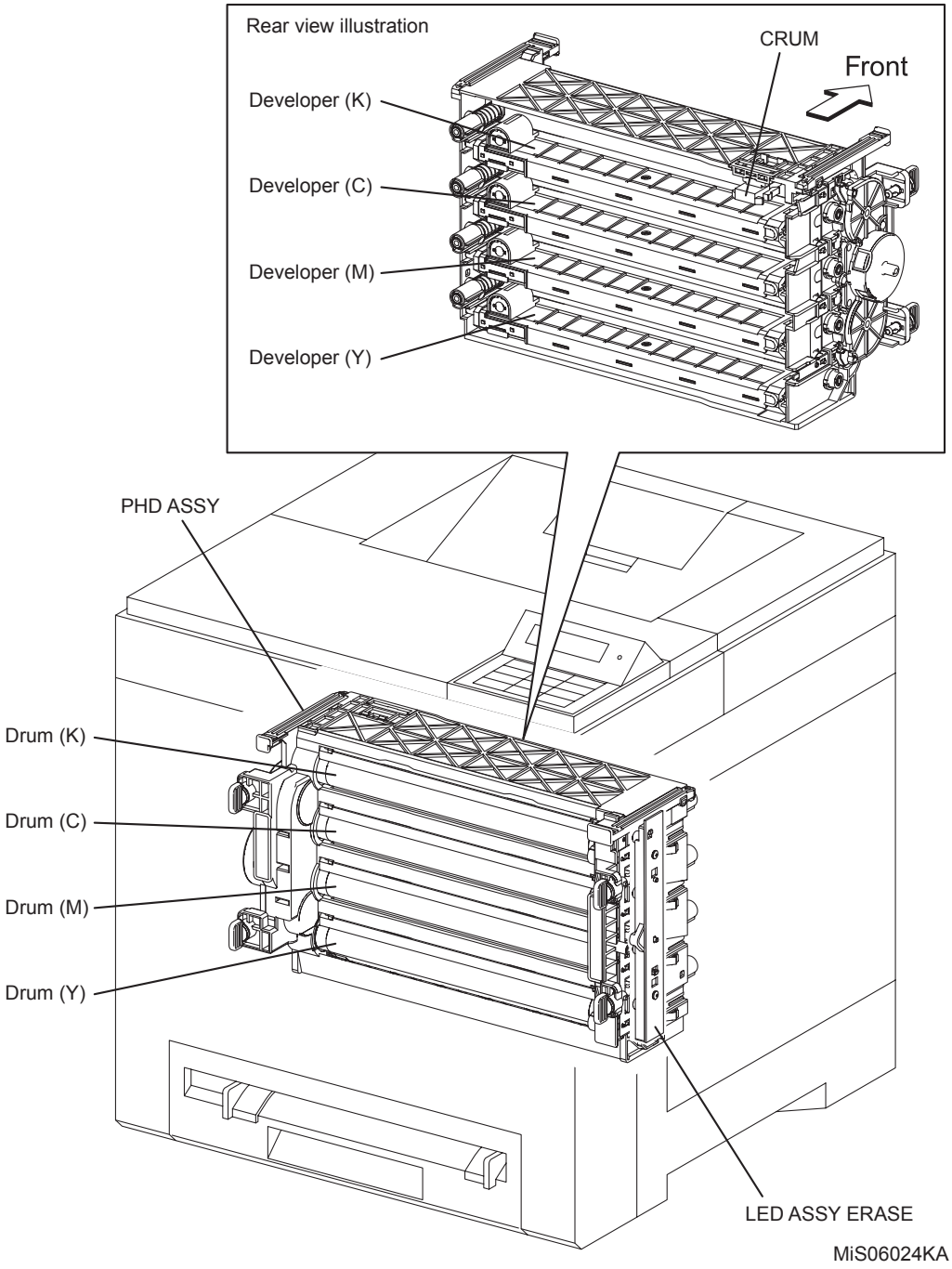
3.7.1 Major functions

- PHD ASSY (PL4.1.21)
  PHD ASSY carries out a series of operation in the print process such as charging, and transfer.
  PHD ASSY mainly consists of the following parts.
  Developer is an equipment which develops images in the print process.
  - • Drum (Y)
  - • Drum (M)
  - • Drum (C)
  - • Drum (K)
  - • Developer (Y)
  - • Developer (M)
  - • Developer (C)
  - • Developer (K)

- CRUM
  PHD specific information is stored.

- Erase Lamp (LED ASSEMBLY)
  The light of the LED is reflected by the HOLDER ASSY Erase.
  The light of the LED eliminates the charge on the drum.




Rear view illustration
CRUM
Front
Developer (K)
Developer (C)
Developer (M)
Developer (Y)
PHD ASSY
Drum (K)
Drum (C)
Drum (M)
Drum (Y)
LED ASSY ERASE
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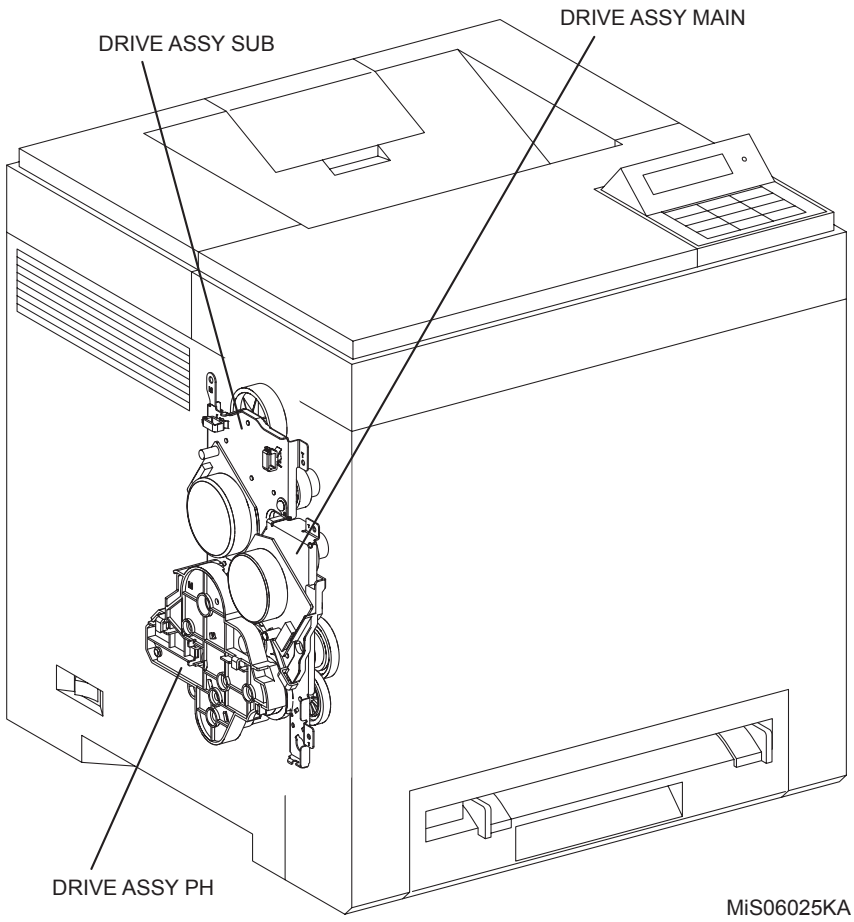
3.8 Drive

3.8.1 Major functions

- DRIVE ASSY MAIN (PL7.1.2) (Refer to 6.1 DRIVE ASSY MAIN)
  Supplies the drive to parts as follows.

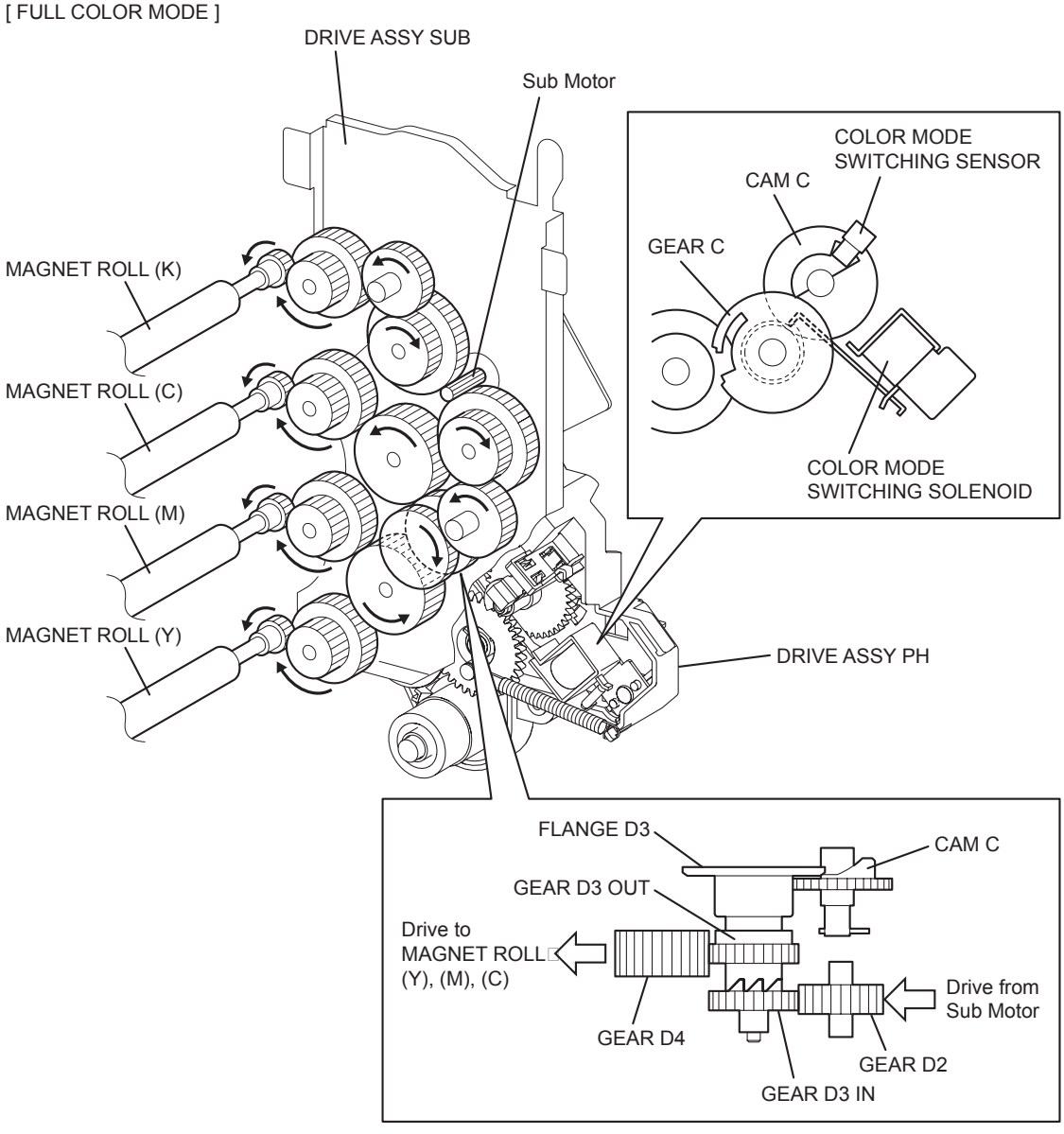
  • DRIVE ASSY PH
  • TRANSFER ASSY
  • CHUTE ASSY FDR REGI
  • PHD ASSY
  • DRUM (Y, M, C, K)

- DRIVE ASSY SUB
  Supplies the drive to parts as follows.
  • FUSER ASSY
  • DEVELOPER (YMCK)



- DRIVE ASSY PH (PL7.1.4)
  DRIVE ASSY PH transmits the driving force from the DRIV ASSY SUB (PL7.1.1) to relevant parts. The transmission channel is changed by the COLOR MODE SWITCHING SOLENOID in the DRIVE ASSY PH to allow the driving force of the DRIVE ASSY MAIN (PL7.1.2) to reach the Black Developer only.
  This is performed to ensure that the Yellow, Magenta, and Cyan Developers cannot be rotated by the DRIVE ASSY SUB during B/W printing.
  The COLOR MODE SWITCHING SENSOR detects the status of the transmission route (whether it is set for B/W or full color).

[FULL COLOR MODE]



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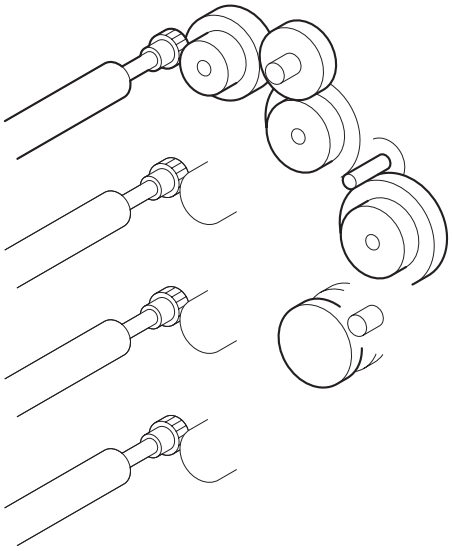

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3.9 Electrical

3.9.1 Major functions

- FAN (PL8.1.1)
  Dissipates heat out of the printer to prevent the printer from overheating.

- SWITCH
  The SWITCH turns ON/OFF the AC power supply of the printer.

- Low Voltage Power Supply (LVPS:PL8.2.1)
  The LVPS is provided in two types, 120V and 240V.
  Supplies AC power from the power source to the FUSER heater and generates and supplies stable low voltage DC power used for the logic circuit, etc.
  LVPS contains control circuit for the heater of the FUSER, in addition to the power circuit.

- Machine Control Unit (MCU:PL8.2.13)
  Controls printing operation based on the communication with the print controller and information from the sensor/switch.
  Major functions are as follows:
  - Communication with the ESS.
  - Receive of information from the sensors or switches.
  - Control of Motor in DRIVE ASSY MAIN and DRIVE ASSY SUB.
  - Distributing low voltage DC power output from LVPS to each component
  - Control of ROS ASSY

- High Voltage Power Supply (HVPS:PL4.1.19)
  Supplies high voltage to the following parts in the TRANSFER ASSY and Developer to perform charging, development, and primary transfer.
  - BCR
  - BTR
  - Developer

- PWBA EEPROM (PL8.2.16)
  Information unique to the printer is stored.

- Electronic Sub System (ESS:PL8.1.7)
  The ESS connected to the MCU controls the entire system (Diagnostic, Interface and Image processing).

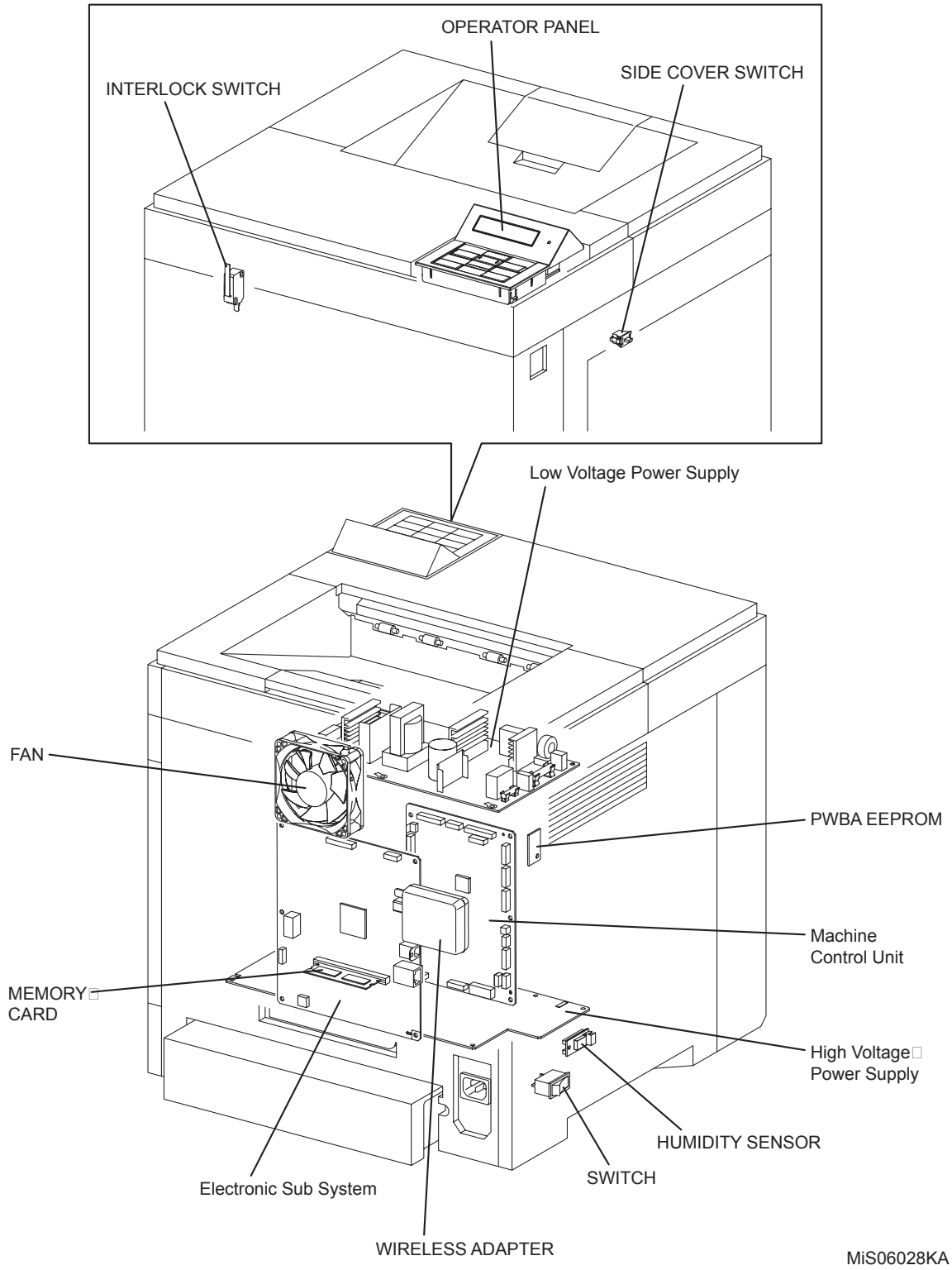
- HUMIDITY SENSOR (SENSOR HUM :PL8.2.7)
  HUMIDITY SENSOR reads the temperature/humidity within the printer and converts the values to voltage values.

- OPERATOR PANEL (CONSOLE ASSY PANEL:PL1.2.3)
  OPERATOR PANEL displays the state of the printer using LED.

- INTERLOCK SWITCH (HARN ASSY INTERLOCK:PL8.2.5)
  INTERLOCK SWITCH is a switch that cuts the +24VDC power supply to the HVPS or Motor, etc. upon the opening of the Front Cover.

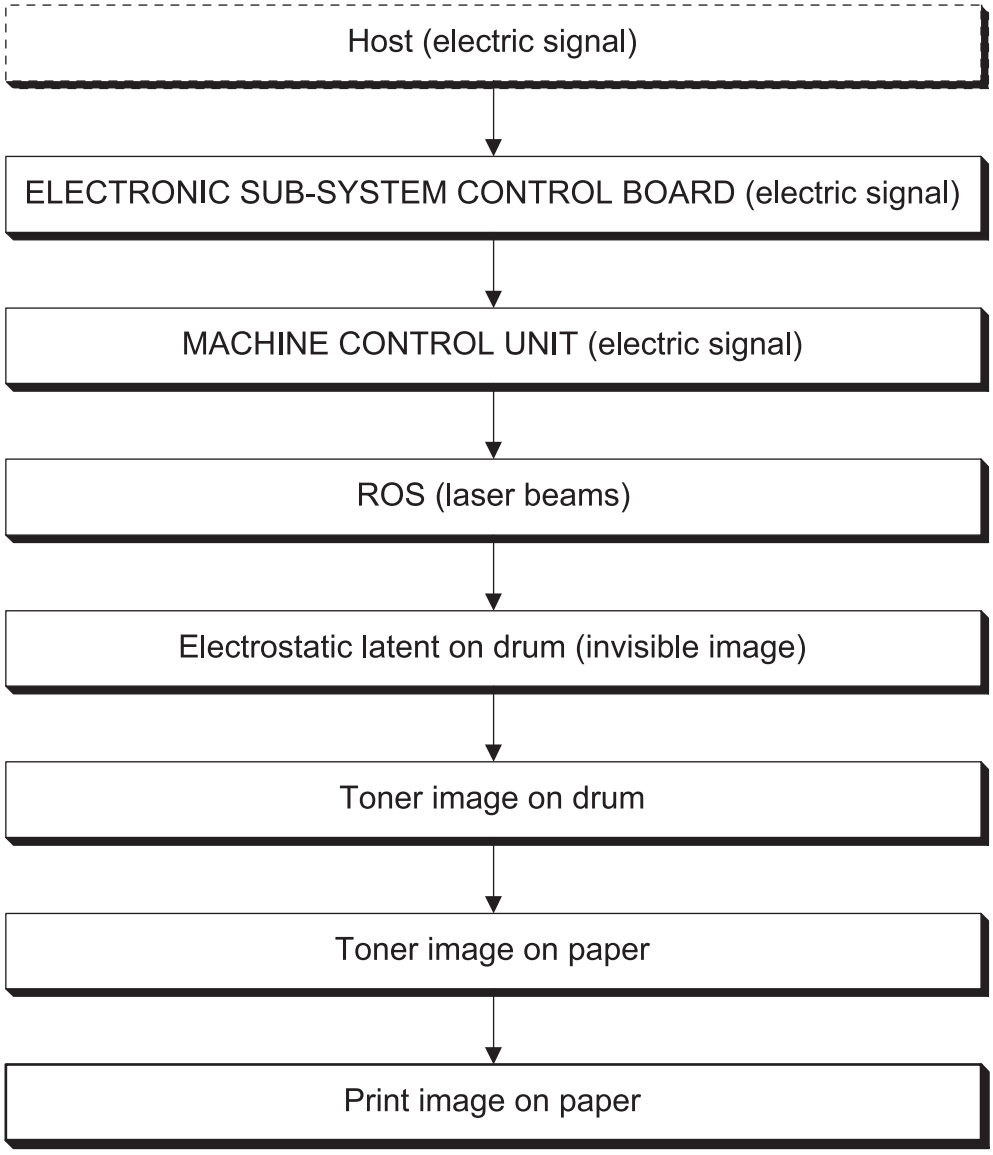
- WIRELESS ADAPTER (PL8.1.16)
  An adapter for enabling the network connectivity of the printer by wireless.

- SIDE COVER SWITCH (PL5.1.9)
  SIDE COVER SW is a switch that detects the right side cover open.



3.9.2 Data Flow

Print data (electric signal) from the printer controller flows as shown below until it is turned into a print.



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3.10 Duplex 2150cdn : Standard / 2150cn : Option

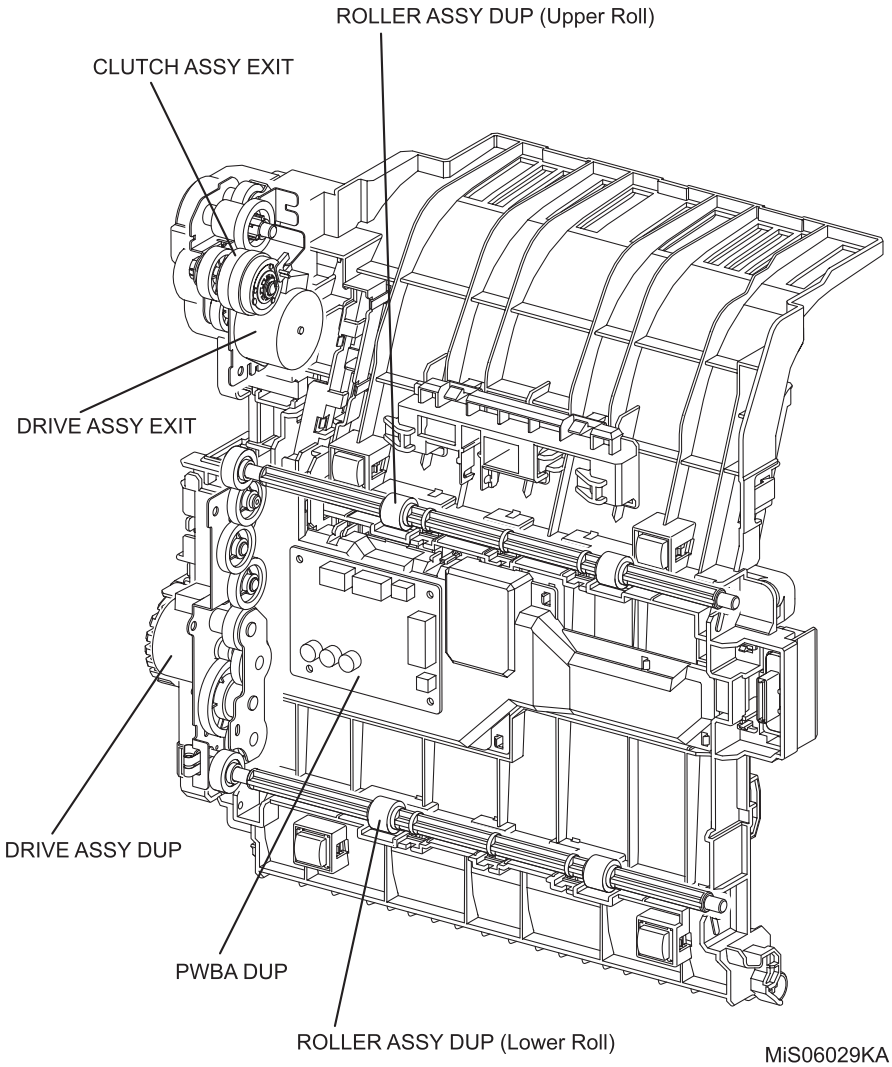
3.10.1 Major functions

- CLUTCH ASSY EXIT
  Transmits the drive from the DRIVE ASSY EXIT to Roll Assy Exit in the FUSER.
  When the clutch operates, the Roll Assy Exit rotates in the reverse direction.
  The clutch is stopped when the paper reached the Duplex.

- DRIVE ASSY DUP (PL11.2.5)
  The DRIVE ASSY DUP supplies the driving power to the Lower Roll (ROLLER ASSY DUP) and Upper Roll (ROLL ASSY DUP1). (Refer to 6.5 DRIVE ASSY DUP)

- DRIVE ASSY EXIT (PL11.2.2)
  The DRIVE ASSY EXIT supplies the driving power to the Roll Assy Exit in the FUSER. (Refer to 6.5 DRIVE ASSY DUP)

- PWBA DUP (PL11.1.16)
  The PWBA DUP controls motor and clutch.



3.11 250 Paper Tray

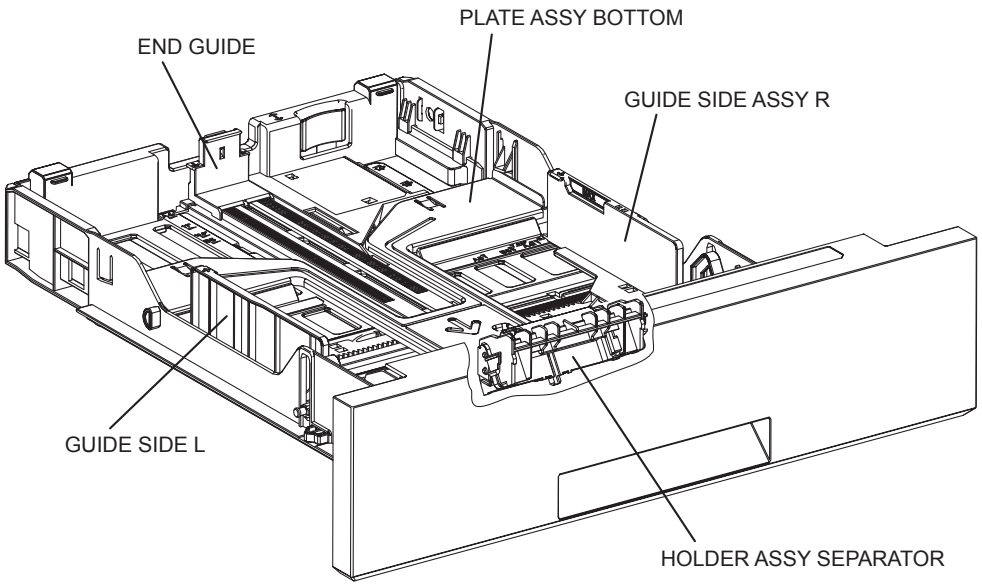
3.11.1 Major functions 250 Paper Tray

- GUIDE SIDE ASSY R (PL12.5.8) / GUIDE SIDE L (PL12.5.6)
  The GUIDE SIDE ASSY R and GUIDE SIDE L can move at a right angle to the paper transfer direction to align the paper width.

- END GUIDE
  The END GUIDE can move in the paper transfer direction to determine the paper size.

- HOLDER ASSY SEPARATOR (PL12.5)
  The HOLDER ASSY SEPARATOR and the FEED ROLLER pinch the paper to prevent multiple sheet feed.

- PLATE ASSY BOTTOM (PL12.5.2)
  PLATE ASSY BOTTOM is locked to the bottom side when paper tray is pulled out from the paper feeder and unlocked when paper tray is installed to the paper feeder. Pushes the paper against the feed roll using a spring tension.



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3.11.2 Major functions (Paper Feeder)

- SENSOR PHOTO (No Paper Sensor:PL12.4.13)
  Detects the presence/absence of paper in the paper tray based on the position of ACTUATOR NO PAPER (PL12.4.19). (No paper: Sensor beam is intercepted)

- SOLENOID FEED MSI (PL12.2.15)
  Transmits the drive from the MOTOR ASSY SUB (PL12.2.16) to ROLL ASSY FEED. (Refer to 6.6 MOTOR ASSY SUB)

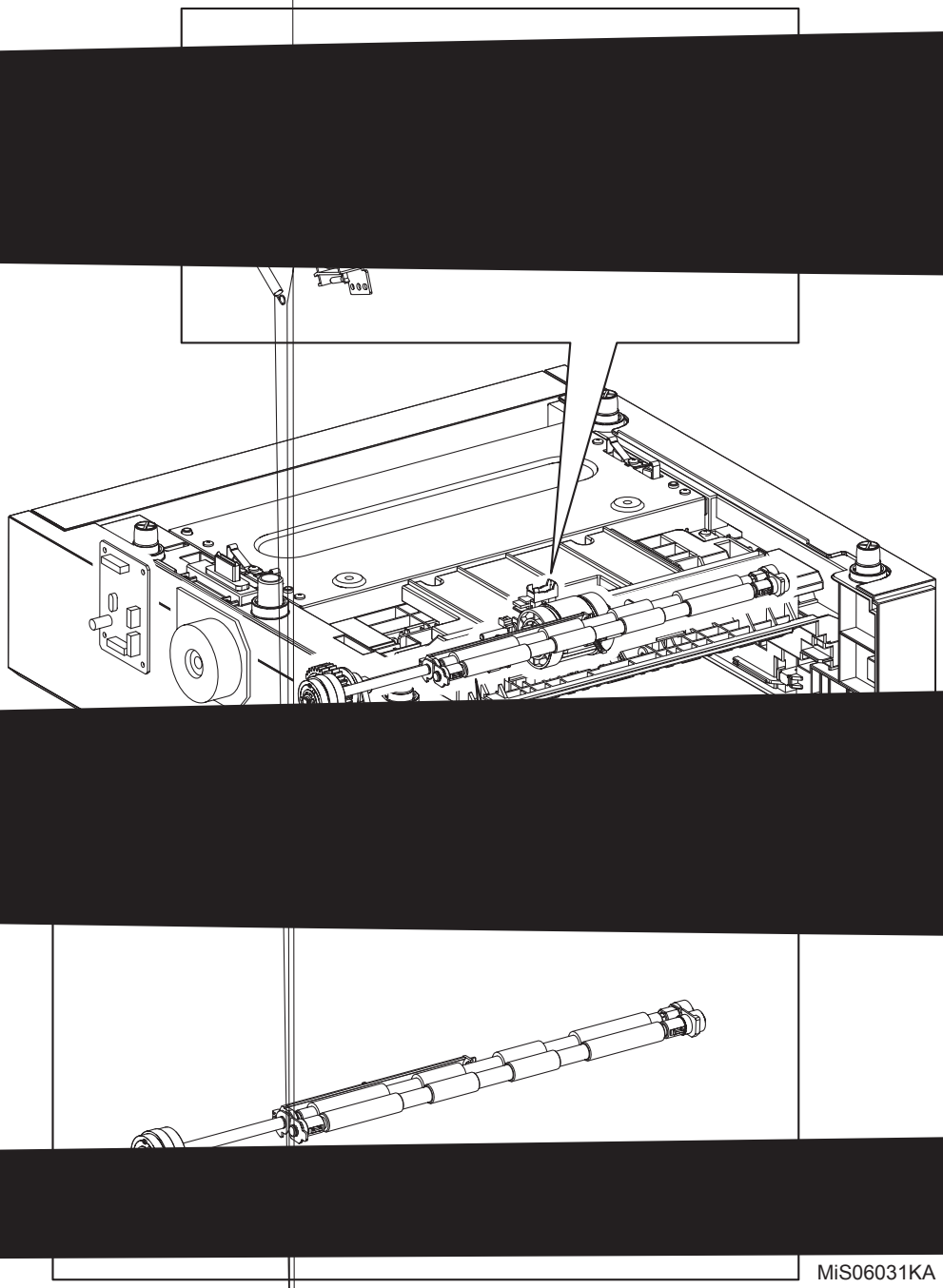
- ROLL ASSY FEED (PL12.4.4)
  When the SOLENOID FEED MSI operates, the ROLL ASSY FEED starts rotating and the ROLL ASSY FEED feeds the paper. (Refer to 6.6 MOTOR ASSY SUB)

- SENSOR PHOTO (PAPER PATH SENSOR:PL12.4.13)
  It detects when the paper front end reaches the CHUTE ASSY TURN (PL12.4.1).
  ON: The paper activates the actuator.

- CLUTCH ASSY DRV (PL12.2.6)
  Transmits the drive from the MOTOR ASSY SUB (PL12.2.16) to ROLL ASSY REGI (PL12.4.9) and ROLL REGI METAL (PL12.4.10).

- MOTOR ASSY SUB (PL12.2.16)
  The MOTOR ASSY SUB is driving the rolls of the option feeder. (Refer to 6.6 MOTOR ASSY SUB)

- PWBA FEED H (PL12.2.1)
  The PWBA FEED H controls motor, sensor and clutch.



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4. Operation Modes / Consumables and Periodic Replacement Parts

4.1 Operation Modes

For the operation of the printer, the following four modes are provided.

- READY mode
  The printer is ready for printing.
- PRINTING mode
  The printer is under printing.
- Sleep mode (Energy star)
  The printer is under power saving.
- Deep sleep mode
  The printer is under power saving.

4.2 Replacement Timing of Consumables and Periodic Replacement Parts

4.2.1 Types of Consumables and Periodic Replacement Parts

Listed below are the consumables and periodic replacement parts for this printer (including options).

	Product Name	Lifespan (approximate)*1
Consumables	TONER CARTRIDGE (K) (Starter capacity)	1,200 pages
	TONER CARTRIDGE (YMC) (Starter capacity)	1,200 pages
	TONER CARTRIDGE (K) (Standard capacity)	3,000 pages
	TONER CARTRIDGE (YMC) (Standard capacity)	2,500 pages
Periodic Replacement Parts	FUSER ASSY	50,000 pages
	PHD ASSY	24,000 pages
	SEPARATOR ROLL (HOLDER ASSY SEPARATOR)	50,000 pages

*1: The page counts are for reference only.
The actual page count may vary greatly depending on conditions such as print settings, document contents, or power-on/off frequency.

4.2.2 Replacement Timing of Consumables

When a consumable part is about to reach its replacement period, one of the following messages appears on the Operator Panel:

	Message	Meaning	Detection device
TONER CARTRIDGE (YMCK)	<Near Life> Ready to Print 093-XXX*1 ⇕ Flip YYY*1 Cartridge Is close to life	The TONER CARTRIDGE (Y, M, C, or K) is near its replacement period. Have ready a new TONER CARTRIDGE (Y, M, C, or K). You can still print approximately another 150 pages in K,and 125 pages in Y, M, and C.	The TONER CRUM detects the replacement period from the remaining toner amount.
	<Life Over> Replace Cart. 093- XXX*2 ⇕ Flip Replace YYY*2 Cartridge	The TONER CARTRIDGE (Y, M, C, or K) has reached its replacement period. The printer stops operating. Immediately replace the TONER CARTRIDGE (Y, M, C, or K) with a new one.	

*1-*4: XXX/YYY in the message denotes the following.
*1: 23/Yellow, 424/Magenta, 425/Cyan, 426/Black
*2: 930/Yellow, 931/Magenta, 932/Cyan, 933/Black

4.2.3 Replacement Timing of Periodic Replacement Parts

When a periodic replacement part is about to reach its replacement period, one of the following messages appears on the Operator Panel:

NOTE

No message is displayed regarding the replacement timing of the SEPARATOR ROLL.

	Message	Meaning	Detection device
FUSER ASSY	<Near Life> Ready to Print 010- 421 ⇕ Flip Ready to Print Contact Support	The FUSER ASSY is near its replacement period. Have ready a new FUSER ASSY. You can still print approximately another 5,000 pages before the Life Over message appears.	The replacement period is detected with the operation counter of the FUSER ASSY.
	<Life Over> Replace FUSER 010- 351 ⇕ Flip Replace FUSER Contact Support	The FUSER ASSY has reached its replacement period. You can still print some more pages, but the print quality will not be assured. It is recommended that you replace the FUSER ASSY with a new one immediately.	
PHD ASSY	<Near Life> Ready to Print 091- 402 ⇕ Flip Ready to Print Contact Support	The PHD ASSY is near its replacement period. Have ready a new PHD ASSY. You can still print approximately another 2,400 pages before the Life Over message appears.	The replacement period is detected with the operation counter of the PHD ASSY.
	<Life Over> Replace PHD 091- 935 ⇕ Flip Replace PHD Contact Support	The PHD ASSY has reached its replacement period. You can still print some more pages, but the print quality will not be assured. It is recommended that you replace the PHD ASSY with a new one immediately.	

5. Control

5.1 Control of Paper Size

The printer doesn't have switches for detecting paper size, and only length of paper is detected by the Regi Sensor when feeding paper. If printing data and paper size don't match, error is sent to the ESS.

5.2 ROS Light Quantity Control

The image data are entered to the laser diodes in the ROS as electric signals (data are expressed with high and low voltage values), and the laser diodes convert the image data from electric signals to optical signals (data are expressed with blinking laser beams).
Variations in light quantity of laser beams or variations in optical system (such as lenses) or drum sensitivity cannot attain a proper electrostatic image, therefore, the laser beam light quantity is monitored and controlled by the laser diodes.
The ROS in this printer has four laser diodes for yellow, magenta, cyan, and black respectively, and the light quantity is automatically adjusted for each color.

5.3 Process Control

For a stable printing, the parameters related to the image forming must be corrected as necessary. The control of the entire printing process including parameter correction control is called "process control". Mainly, the process control is performed in the following two methods, both of which are performed after every 25 cumulative prints upon termination of a print run or during a continuous run.:

- Potential control
- Toner density control

To supplement these two controls, the following controls are provided:

- High Area Coverage Mode
- Admix Mode

5.3.1 Potential Control

To attain stable printing image density, the drum charging voltage, the developing DC voltage and the ROS light amount are adjusted according to the developing capability of each color carrier that varies momentarily. The adjusted drum charging voltage, the developing DC voltage and the ROS light amount are fed back to keep the printing image density constant.

The outline of control is as follows.

1) The HUMIDITY SENSOR (temperature and humidity sensor) detects the temperature and humidity.
2) The patches of respective colors (yellow, magenta, cyan, and black) for the potential control are generated and transferred on the Belt.
3) The ADC Sensor (density sensor) detects the density of the patch on Belt.
4) The drum charging voltage, the developing DC voltage and the ROS light amount are adjusted for each color according to the detected patch density.

5.3.2 Toner Density Control

The toner density must be kept constant to attain stable printing image. The control system for this purpose is called toner density control.

1) PCDC (Pixel Count Dispense Control)

The quantity of the toner to be consumed in the developing process is calculated by counting the video signals entered to the ROS. The quantity of the toner to be consumed is calculated by the toner dispensing time. The toner motor is driven based on the calculated toner dispensing time when supplying the toner to the developer.

2) ADC (Auto Density Control)

The patches of respective colors (yellow, magenta, cyan, and black) for the toner density control are generated under specified potential condition, and transferred on the Belt. The ADC Sensor measures this density. The measured value is compared with the reference value. If the toner density is lower, the toner dispense quantity is increased at the next printing, or if the toner density is higher, the toner dispense quantity is reduced at the next printing. The toner dispense quantity is calculated by the toner dispense time. This calculation is made for each color.

5.3.3 High Area Coverage Mode

A continuous printing of any image of area coverage exceeding extra toner dispense capability causes the toner density in the developer to be lowered.

The High Area Coverage Mode postpones the next page feed and dispenses the toner during this time, if the toner dispense time reached the specified value during a continuous printing.

5.3.4 Admix Mode

This mode prevents the toner density from being lowered, whenever the value of the toner density control patch measured by the ADC Sensor falls far below the standard value, by performing extra toner dispensation. If the toner density level cannot be recovered even after this operation, it is judged that the toner has run out.

5.3.5 ADC Sensor Adjustment

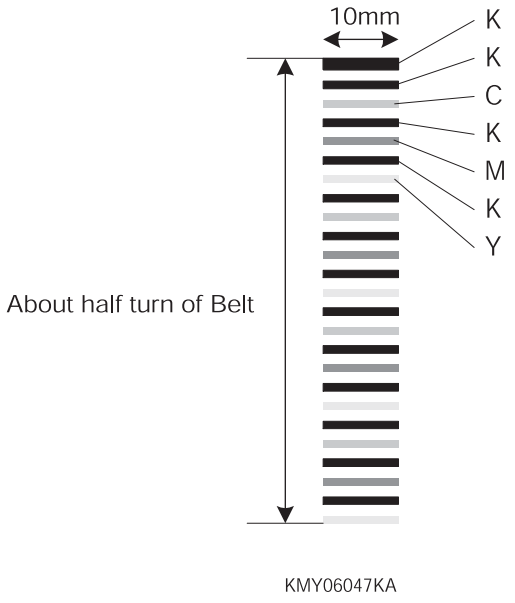
The ADC Sensor is a reflection type sensor that irradiates the light from its LED onto the target and detects the reflected light at its photoreceptor and outputs electric signals responsive to the amount of the detected light. To ensure an accurate patch density measurement, the surfaces of the ADC Sensor is cleaned to remove soil due to toner, etc., and the light amount adjustment is made so that the reflected light amount satisfies the prescribed value, when creating the patch for potential control and toner density control.

5.4 Color Registration Control

The printer uses a tandem system where the drums and developers are arranged respectively for each of yellow, magenta, cyan, and black colors. Since the images are formed on the drum of each color to be overlaid one another, a color shift may occur. The color registration control calculates how much the registration is shifted, and adjusts the ROS write timing.
The lateral registration control adjusts all of four colors in lateral directions.

The color registration control is made from a change in inside temperature and the print count at the execution of the process control.
The control is outlined below:

1) With no toner on the Belt, the output value of ADC Sensor is measured to determine the threshold value.
2) The patches for color registration control are generated on the Belt. These patches are composed of 10mm lines of K, C, K, M, K, and Y in this order.



3) The density of patches generated by the ADC Sensor is read.
4) The shift correction amount is calculated from the threshold value determined in 1) and the patch density measured in 3).
5) The ROS write timing is changed according to the shift correction amount.

5.5 Fuser Control

5.5.1 Fuser temperature control

As for the fuser temperature control, the target temperature is set, then the Heat Roll surface temperature is controlled so that it can meet the target value by turning on/off the Heater Lamp.

Temperature of individual area of the Heat Roll is detected by the Fuser Non-Contact Sensor (NCS) in the middle of the Heat Roll and the Temp Sensor at the edge of it. When the temperature detected is higher than the target value, the Heater Lamp will be turned OFF. When the temperature is below the target value, the Heater Lamp will be turned ON.

The target temperature setting varies depending on the time of Warm-up, Printing, or Process Control. The target temperature varies according to such environmental factors as the interior temperature detected by the Sensor Hum Temp.

5.5.2 Cooling down

As the printing continues, the temperature distribution in the Heat Roll becomes uneven both in the paper feed and non-paper feed areas. Cooling Down suspends paper feeling for a certain period of time so that the Heat Roll temperature distribution can be uniform.
When the temperature of the Heat Roll edge is high, cooling down is performed to lower the temperature to the target value.

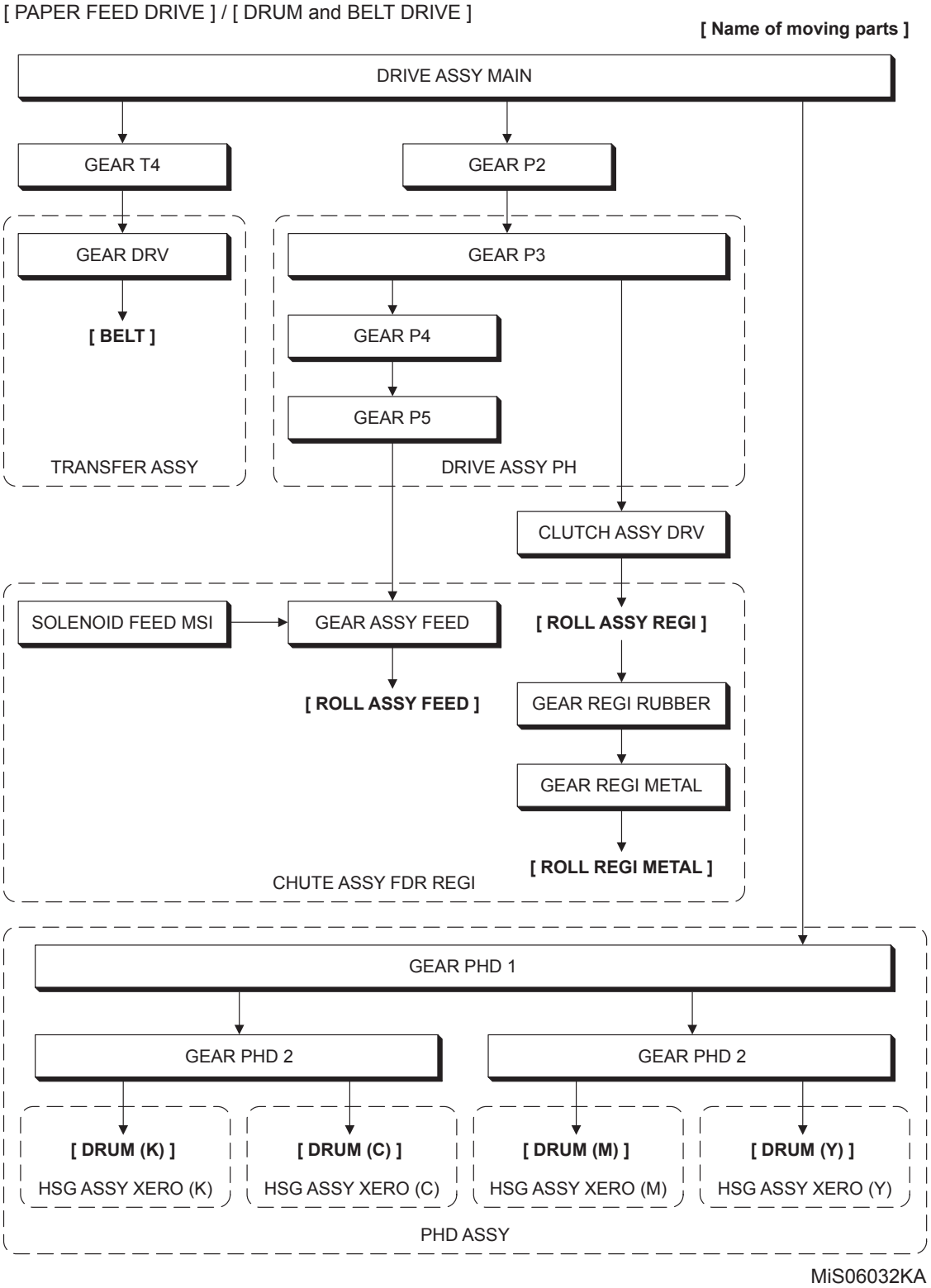
5.5.3 Sensor Warm-up

The Fuser NCS (Non Contact Sensor) at the center of the Heat Roll will be lose its accuracy of detecting temperature when the temperature of the Sensor itself is below -5°C. Therefore, the Sensor will be warmed up when the temperature is below -5°C. This action is called Sensor Warm-up.

6. Drive Transmission Route

6.1 DRIVE ASSY MAIN

Rotation power of the DRIVE ASSY MAIN is transmitted through the route below.

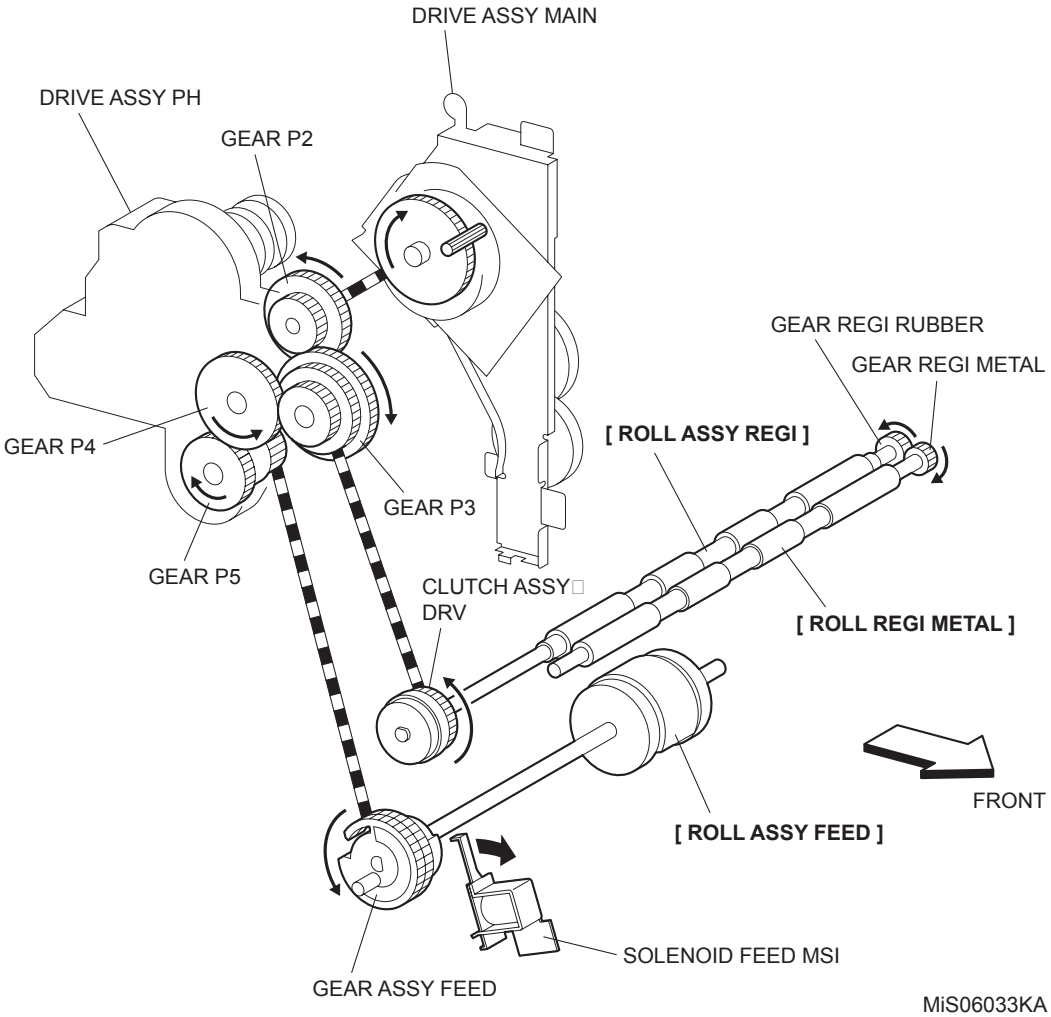


MiS06032KA

[PAPER FEED DRIVE]

[Name of moving parts]

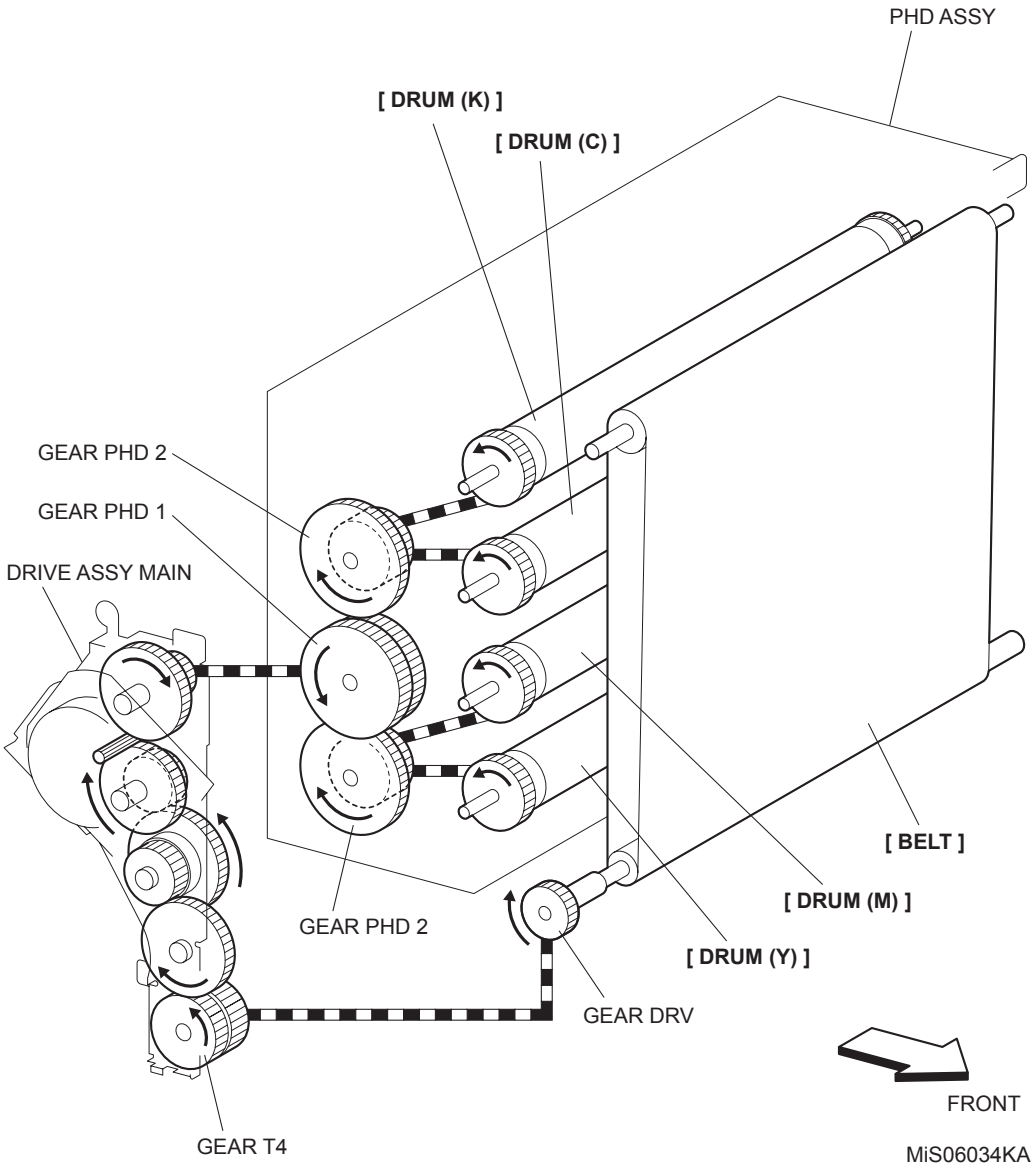
: Indicates the engagement of gears.



[DRUM and BELT DRIVE]

[Name of moving parts]

: Indicates the engagement of gears.



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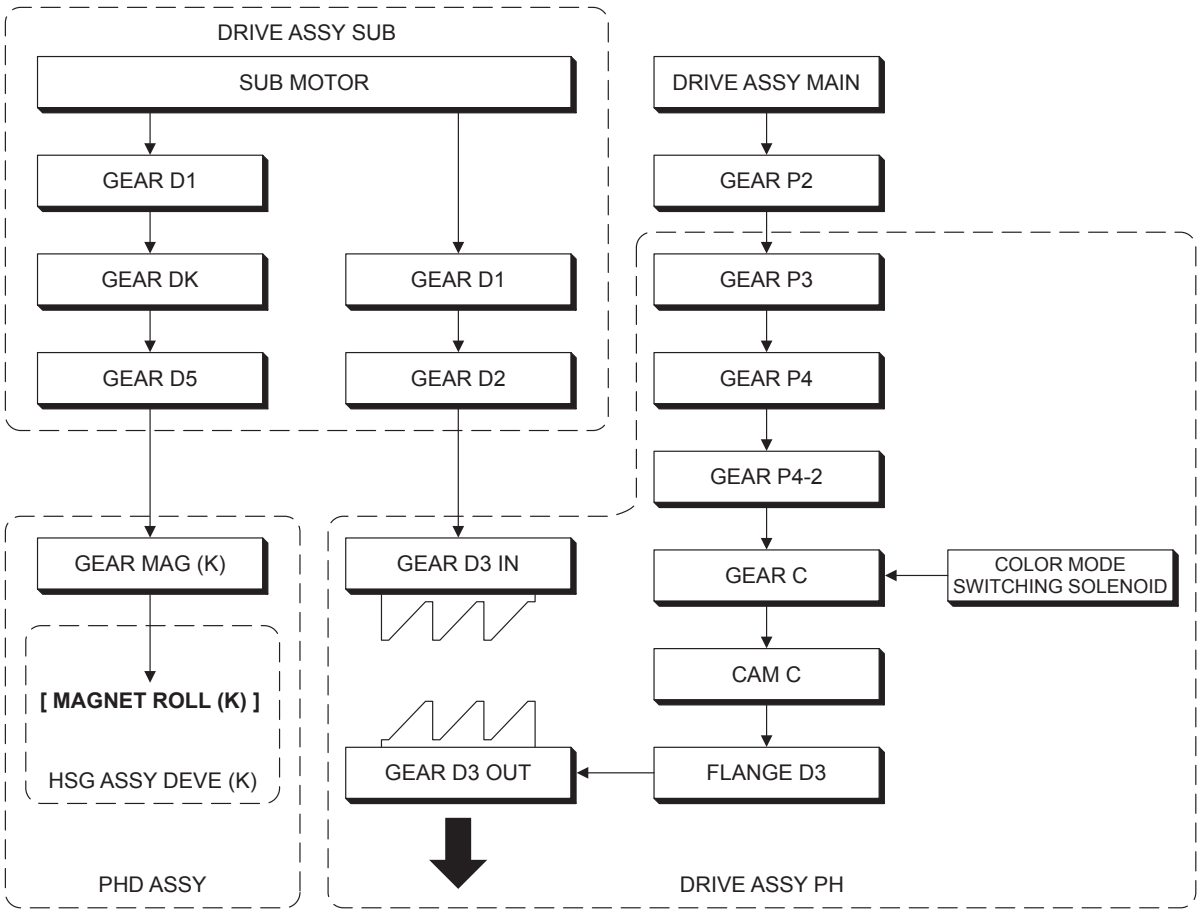
6.2 DRIVE ASSY MAIN and DRIVE ASSY SUB DRIVE

Rotation power of the DRIVE ASSY MAIN and DRIVE ASSY SUB are transmitted through the route below.

[BLACK and WHITE MODE]

[Name of moving parts]

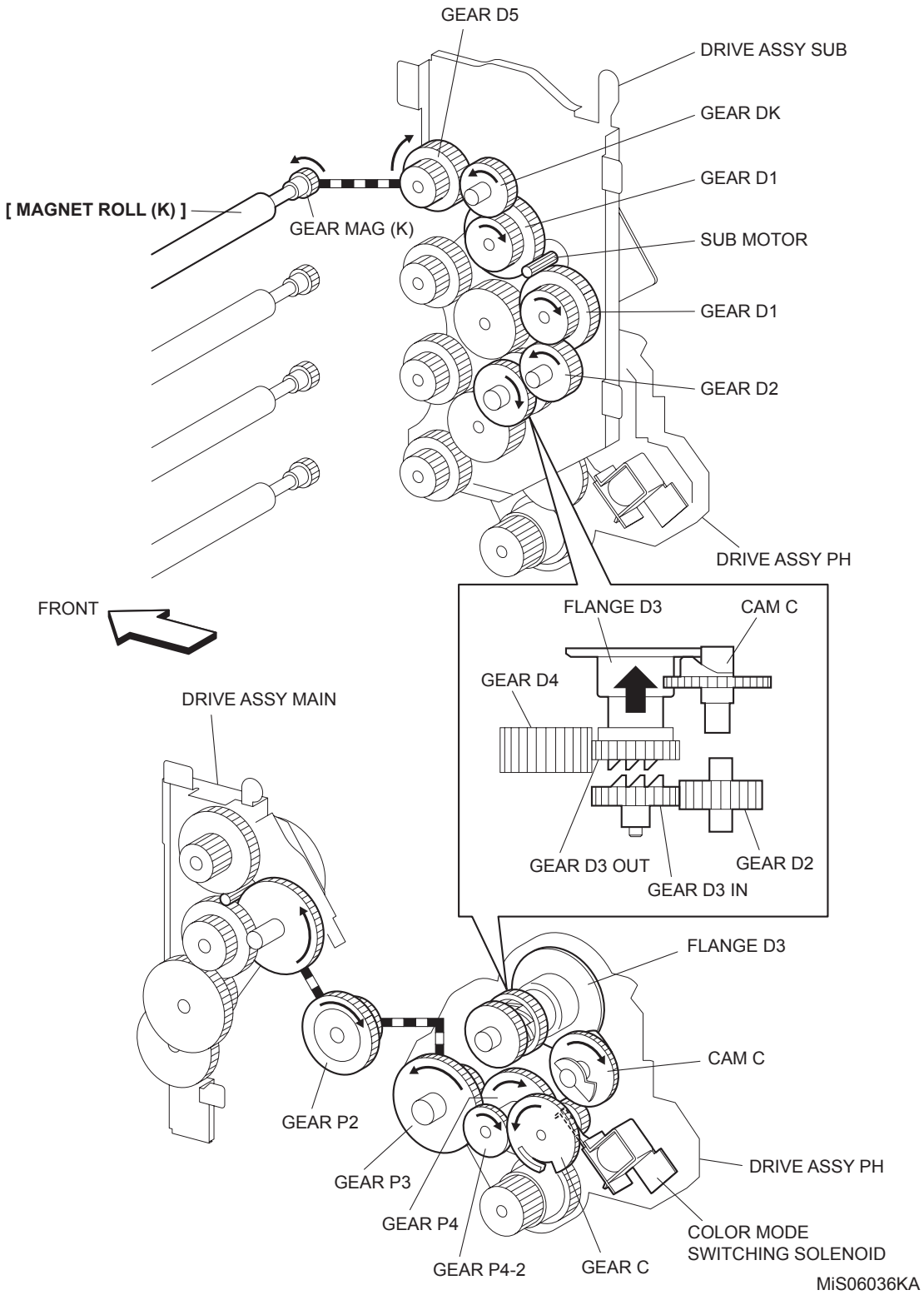


MiS06035KA

[BLACK and WHITE MODE]

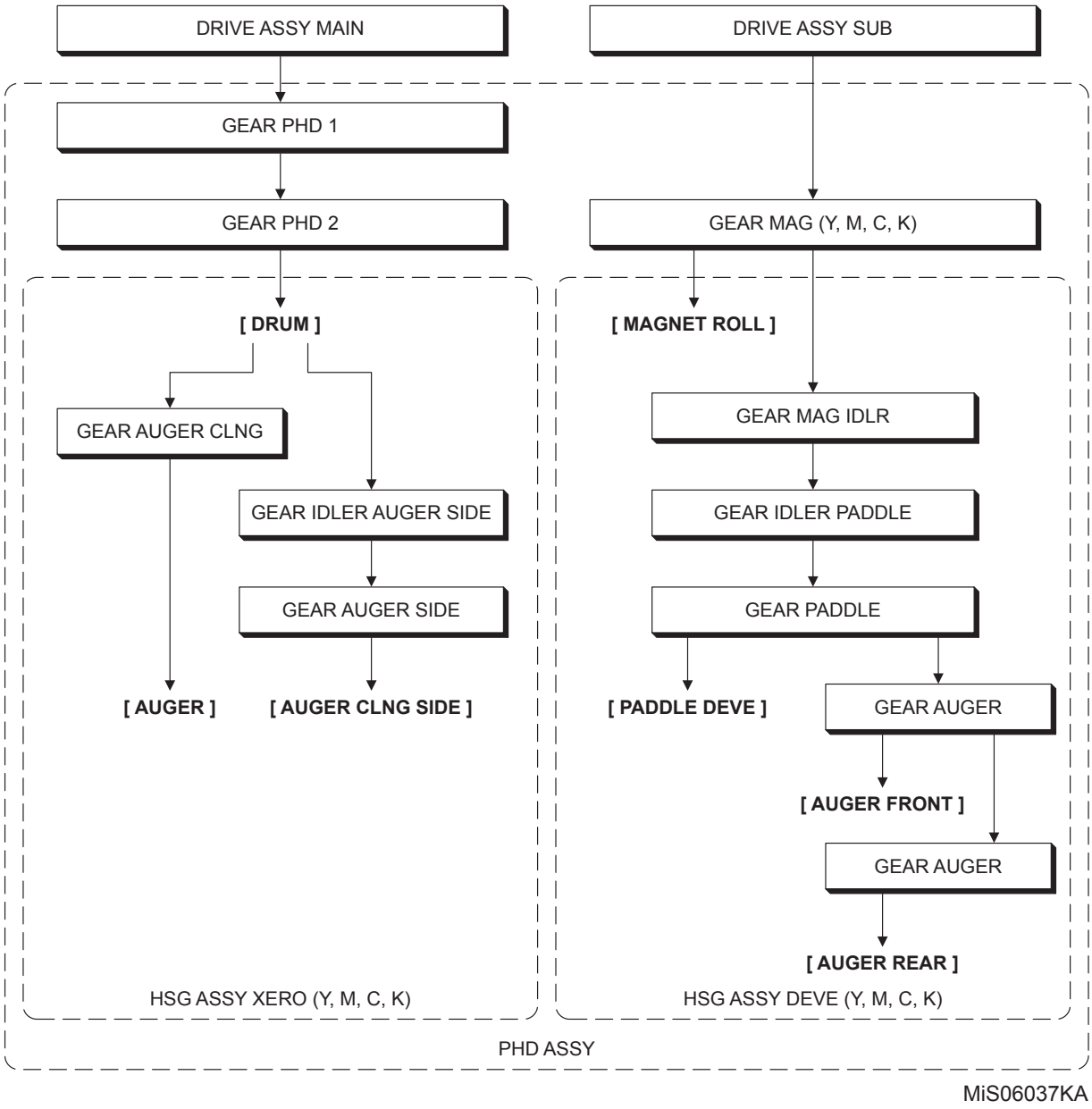
[Name of moving parts]

: Indicates the engagement of gears.



[DEVELOPMENT and EXCESS TONER COLLECTING]

[Name of moving parts]

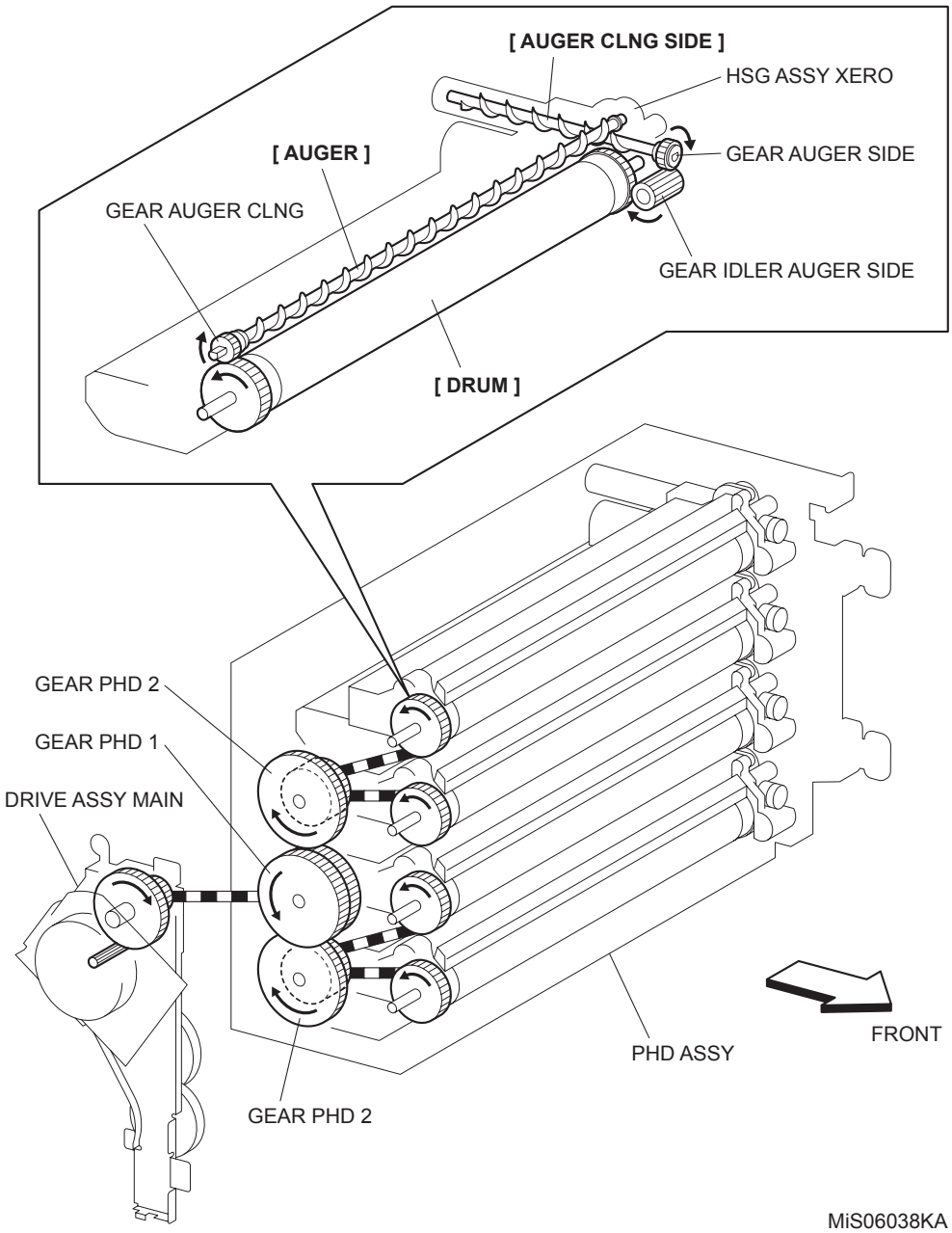


MiS06037KA

[EXCESS TONER COLLECTING DRIVE]

[Name of moving parts]

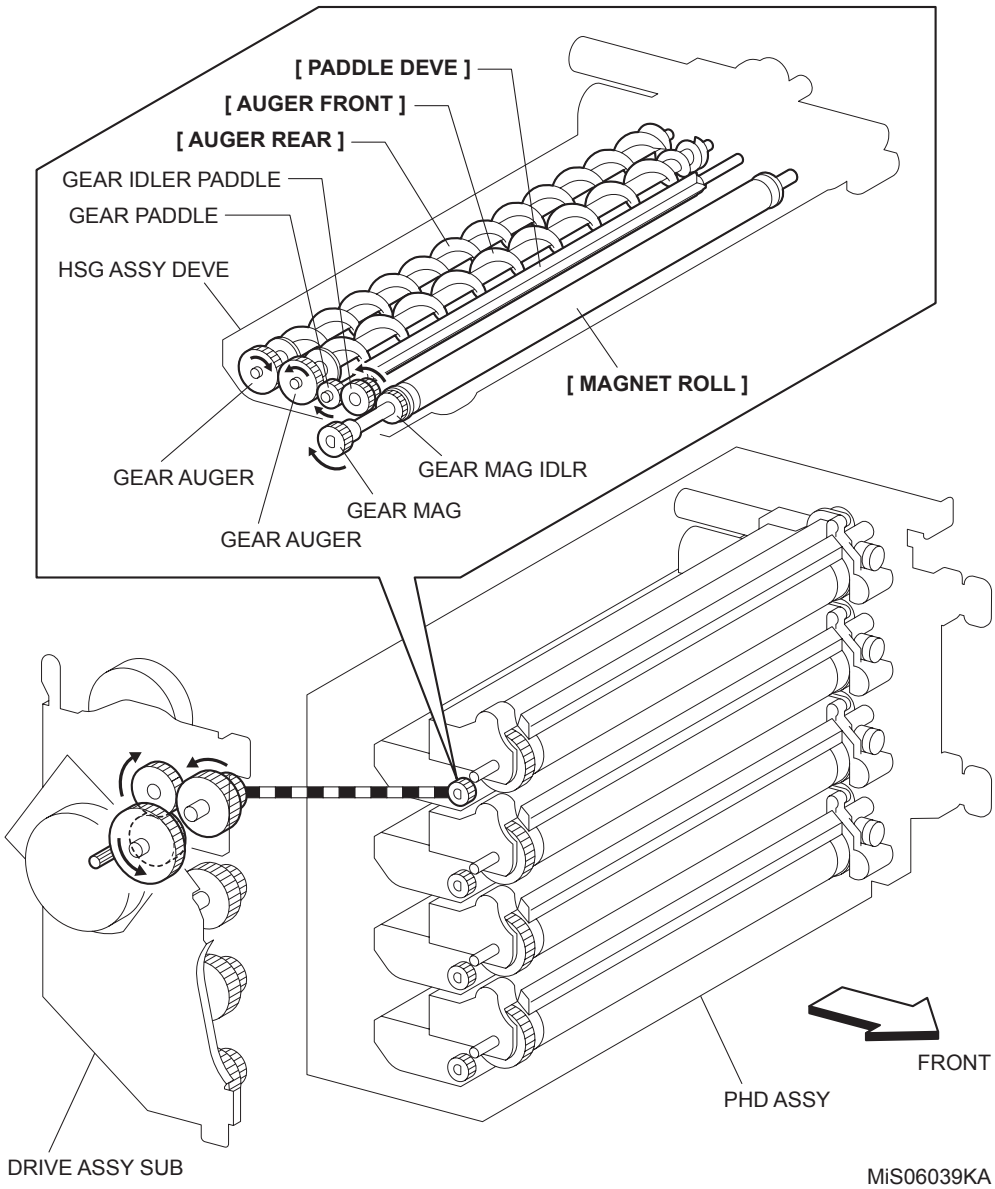
: Indicates the engagement of gears.



[DEVELOPMENT DRIVE]

[Name of moving parts]

: Indicates the engagement of gears.



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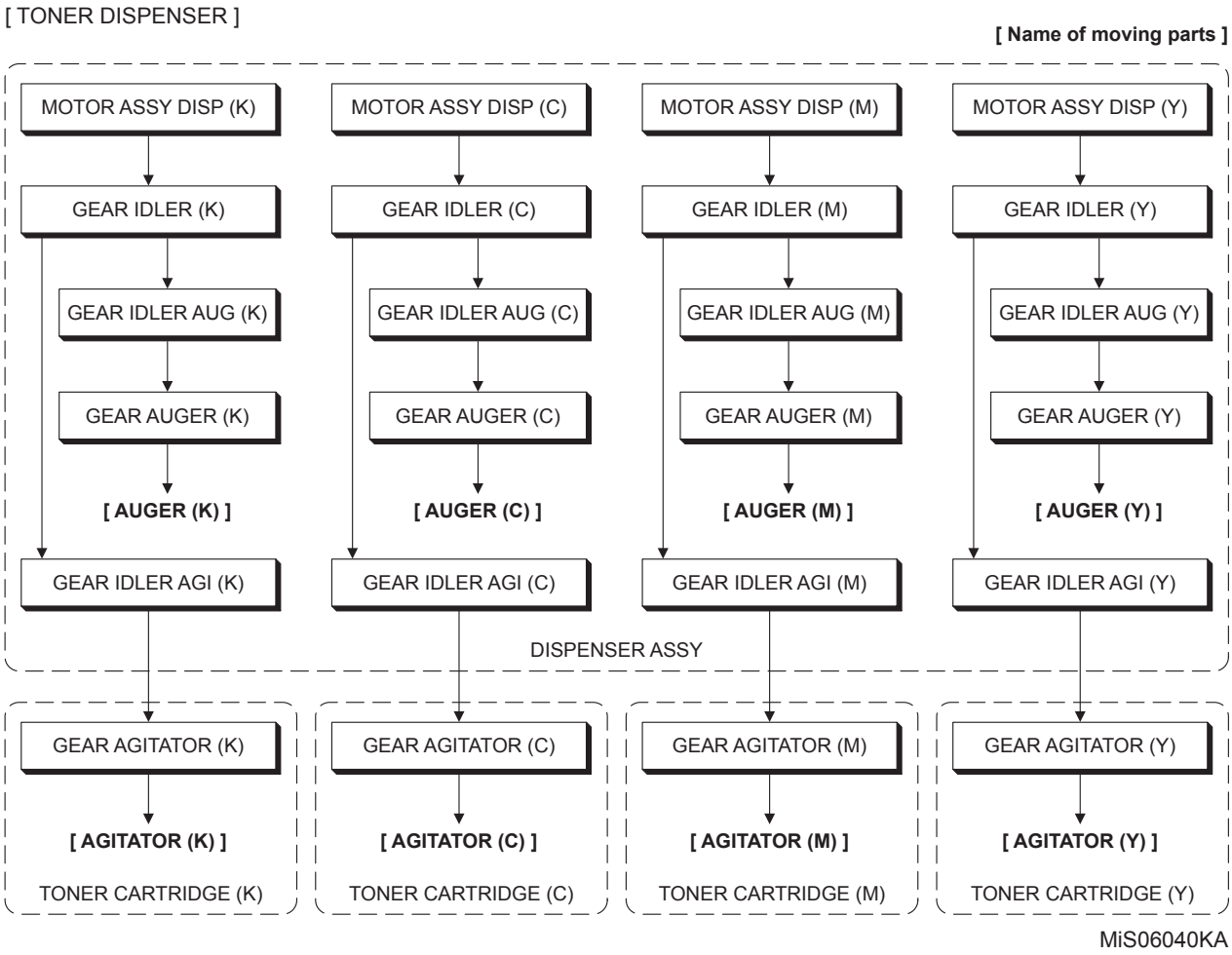
6.3 TONER DISPENSER (Y, M, C, K)

Rotation power of the TONER DISPENSER drives the agitator and the auger in the TONER CARTRIDGE.

[TONER CARTRIDGE]



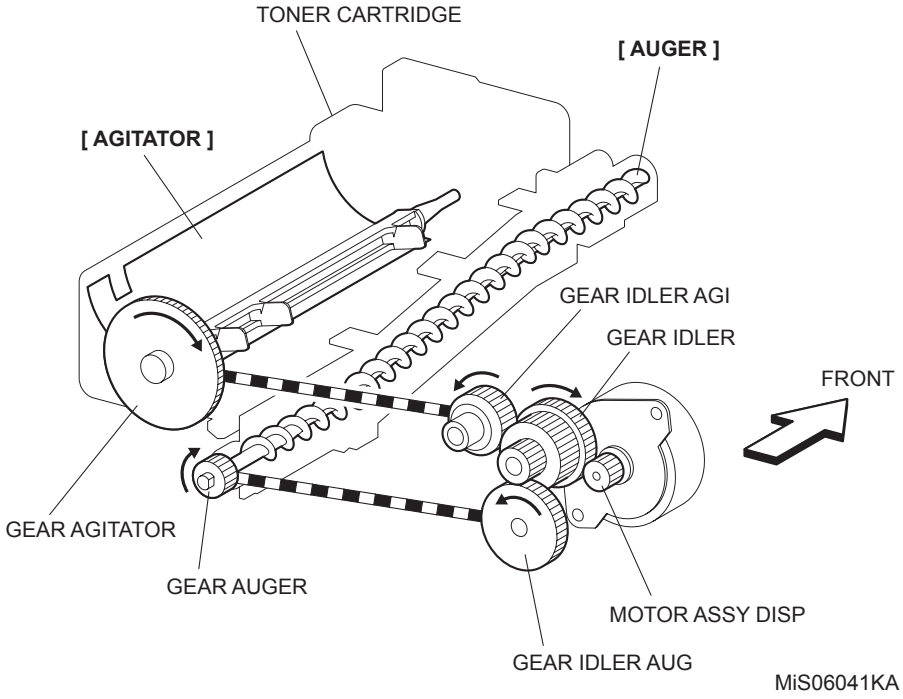
MiS06040KA

[TONER CARTRIDGE]

[TONER DISPENSER]

[Name of moving parts]

: Indicates the engagement of gears.



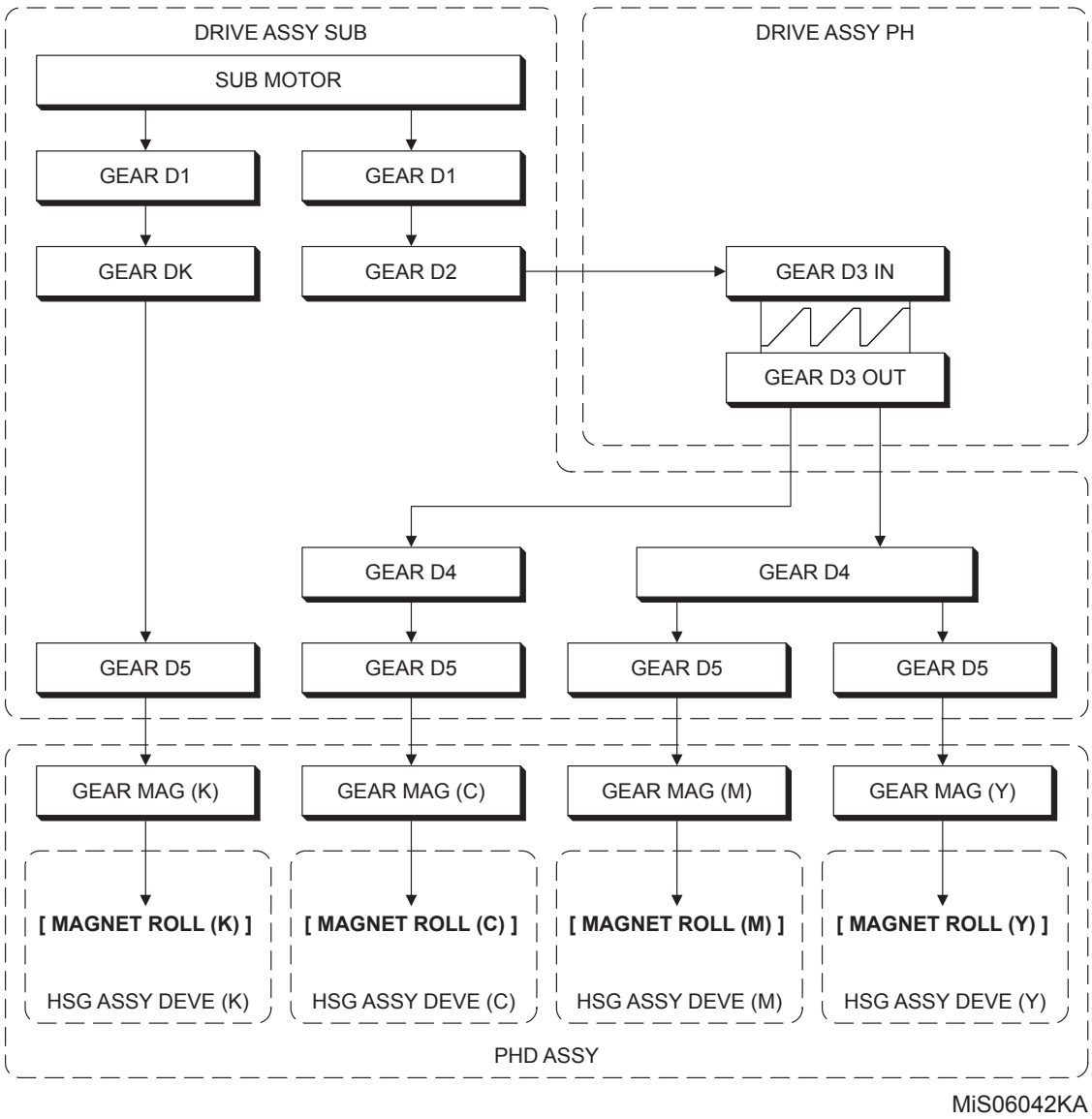
6.4 DRIVE ASSY SUB

Rotation power of the DRIVE ASSY SUB is transmitted through the route below.

[PAPER HANDLING]

[FULL COLOR MODE]

[Name of moving parts]



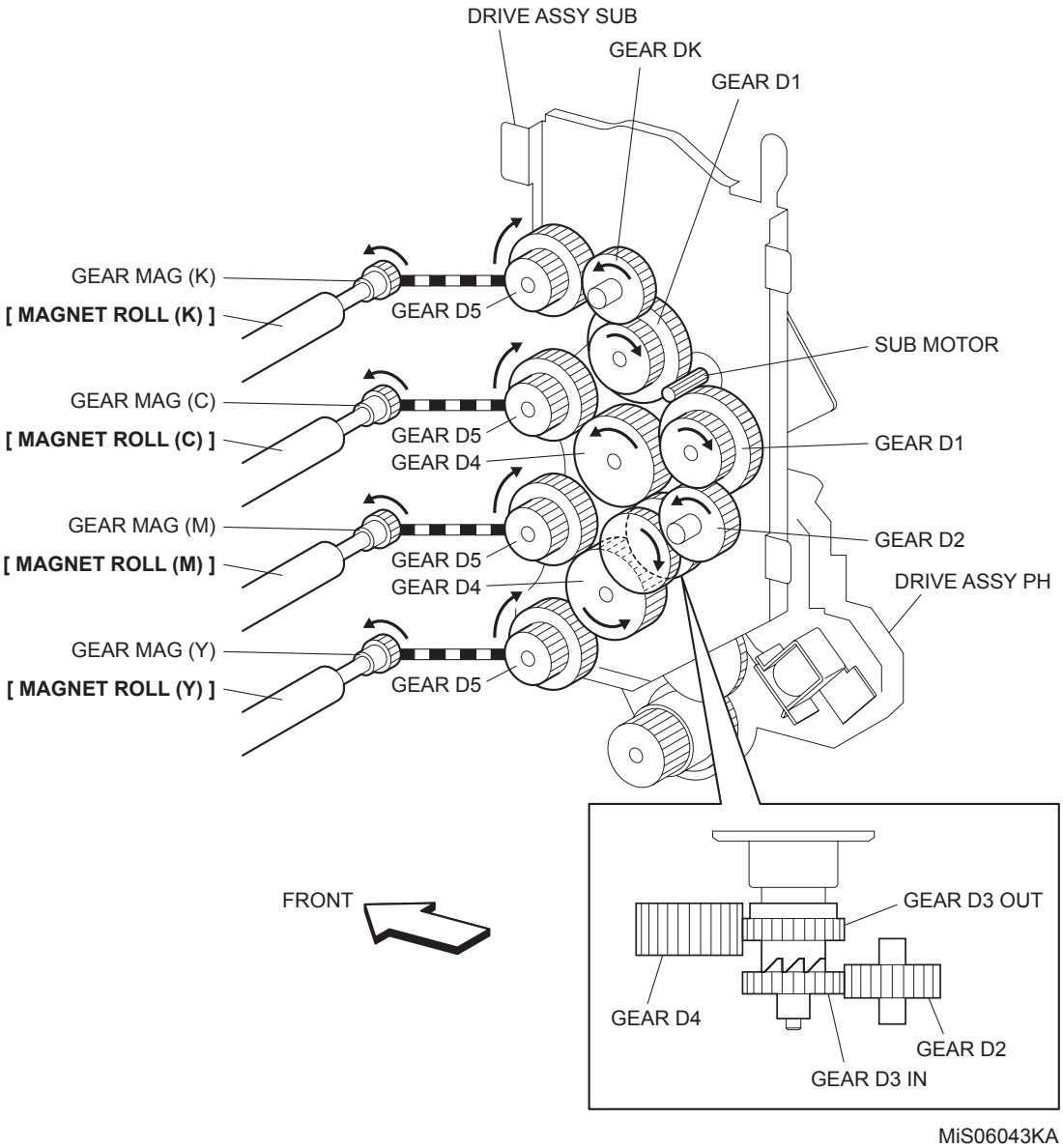
MiS06042KA

[PAPER HANDLING]

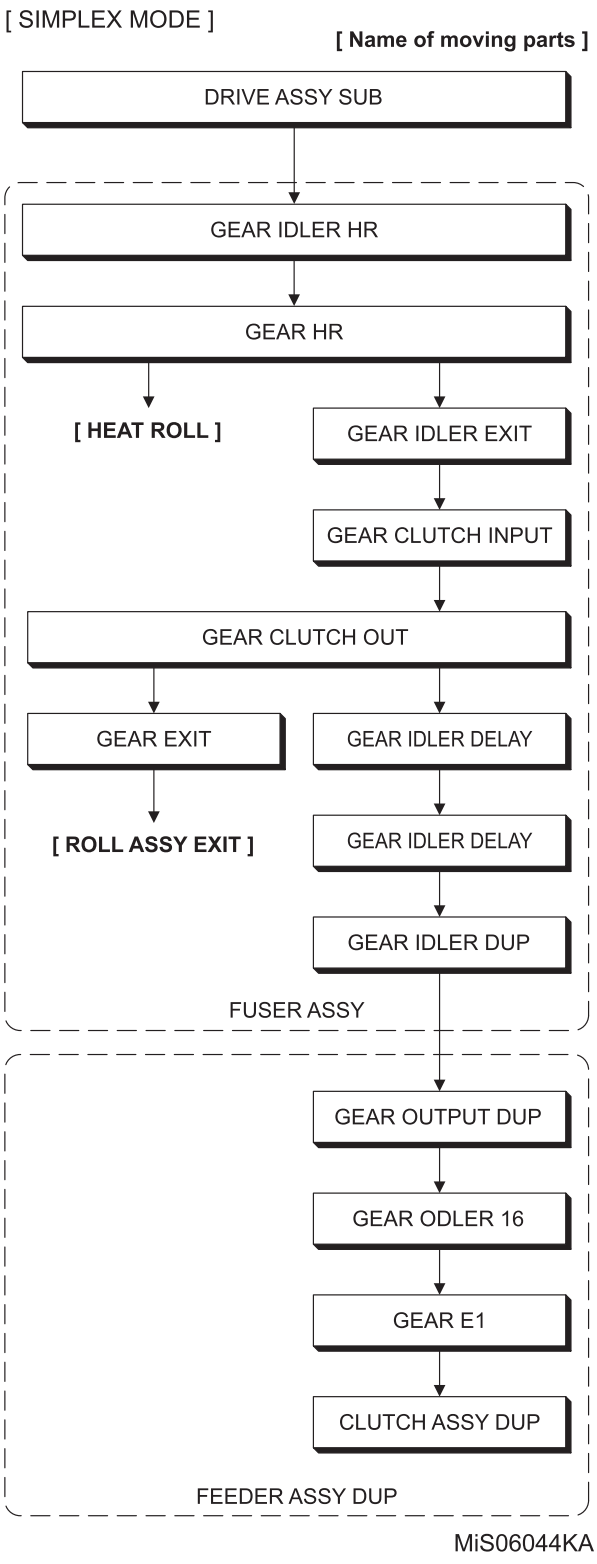
[FULL COLOR MODE]

[Name of moving parts]

: Indicates the engagement of gears.



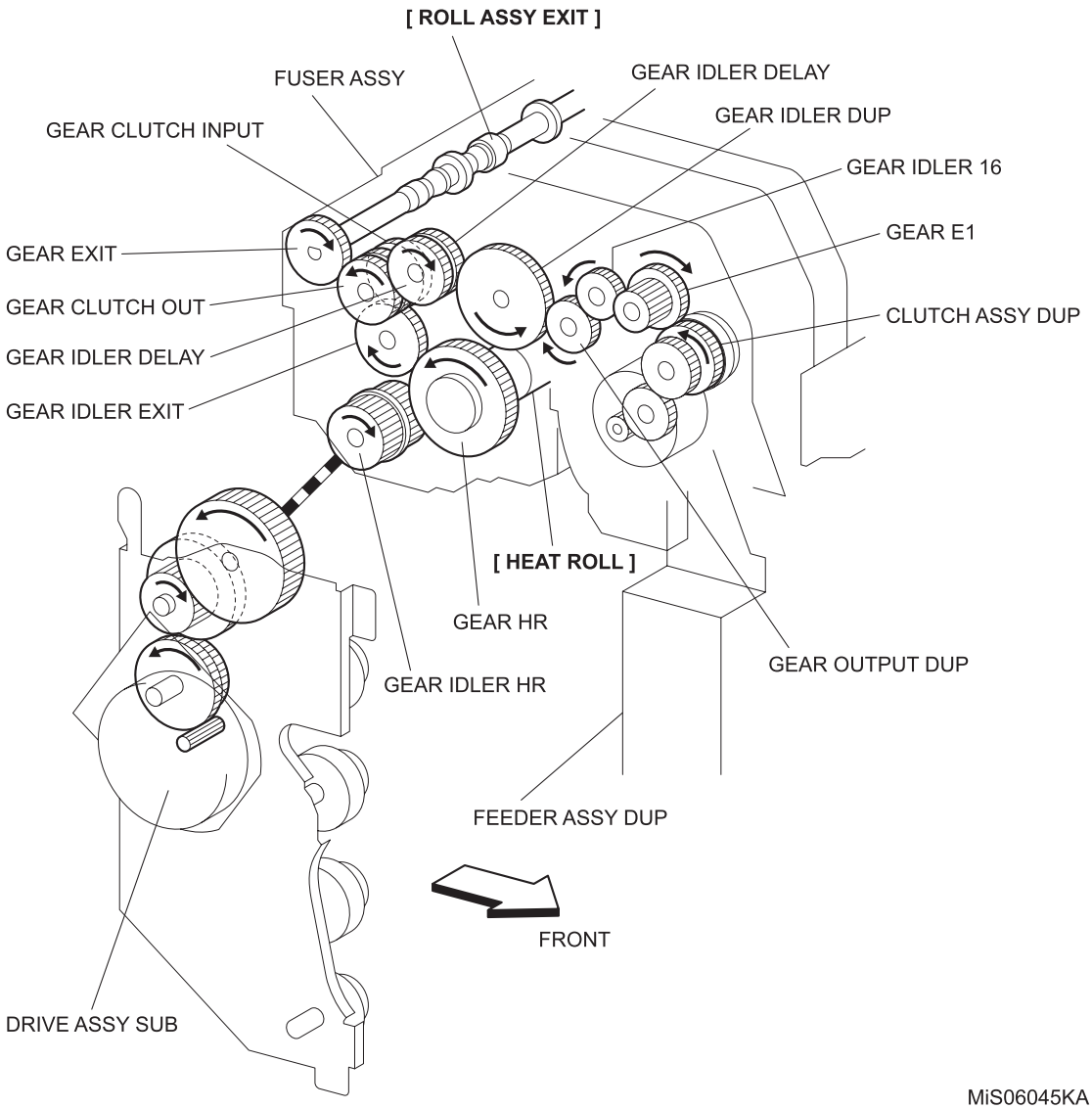
MiS06043KA


[SIMPLEX MODE]
[Name of moving parts]
DRIVE ASSY SUB
GEAR IDLER HR
GEAR HR
[HEAT ROLL]
GEAR IDLER EXIT
GEAR CLUTCH INPUT
GEAR CLUTCH OUT
GEAR EXIT
GEAR IDLER DELAY
[ROLL ASSY EXIT]
GEAR IDLER DELAY
GEAR IDLER DUP
FUSER ASSY
GEAR OUTPUT DUP
GEAR ODLER 16
GEAR E1
CLUTCH ASSY DUP
FEEDER ASSY DUP
MiS06044KA

[SIMPLEX MODE]

[Name of moving parts]

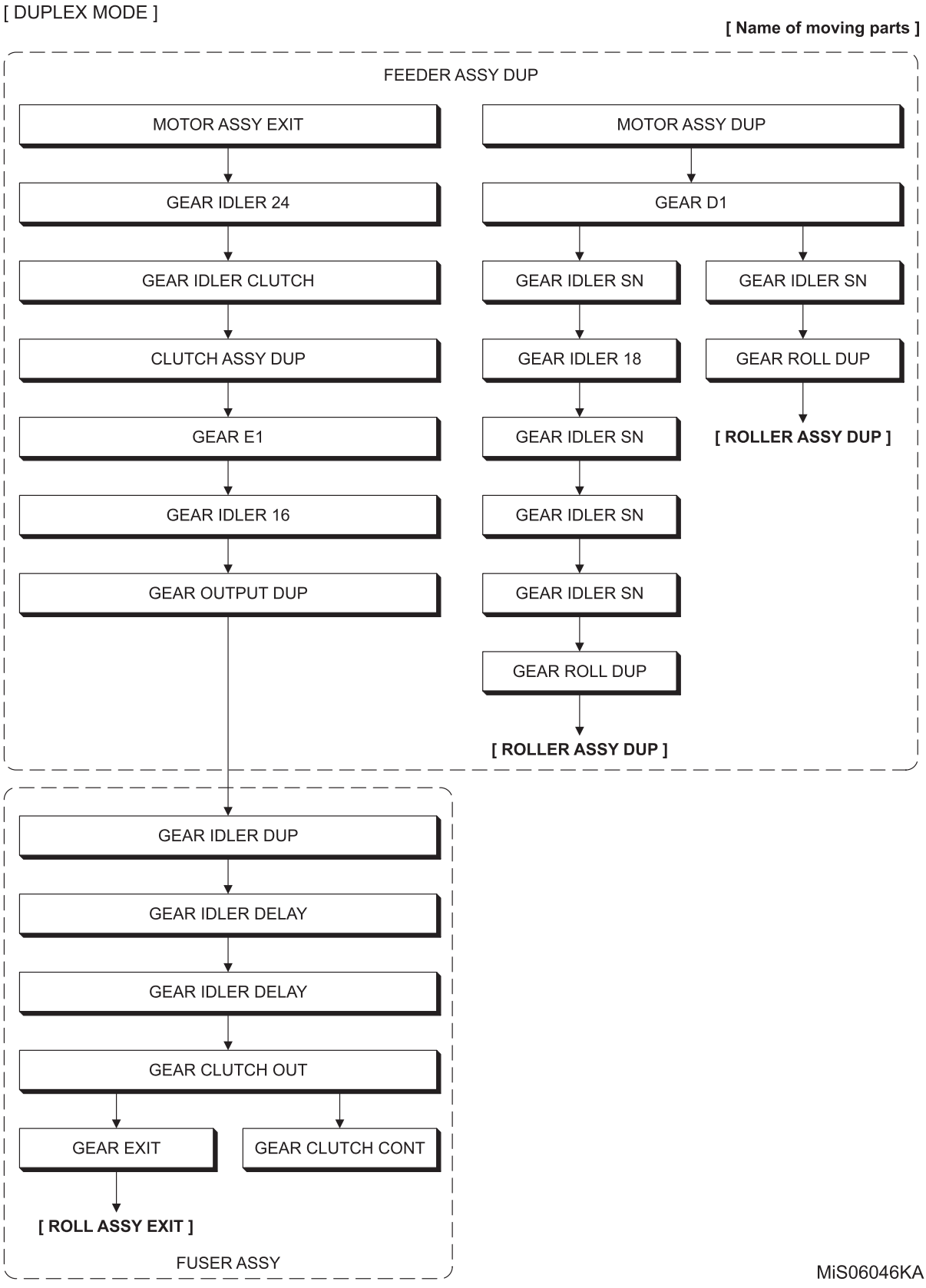
: Indicates the engagement of gears.



MiS06045KA

6.5 DRIVE ASSY DUP

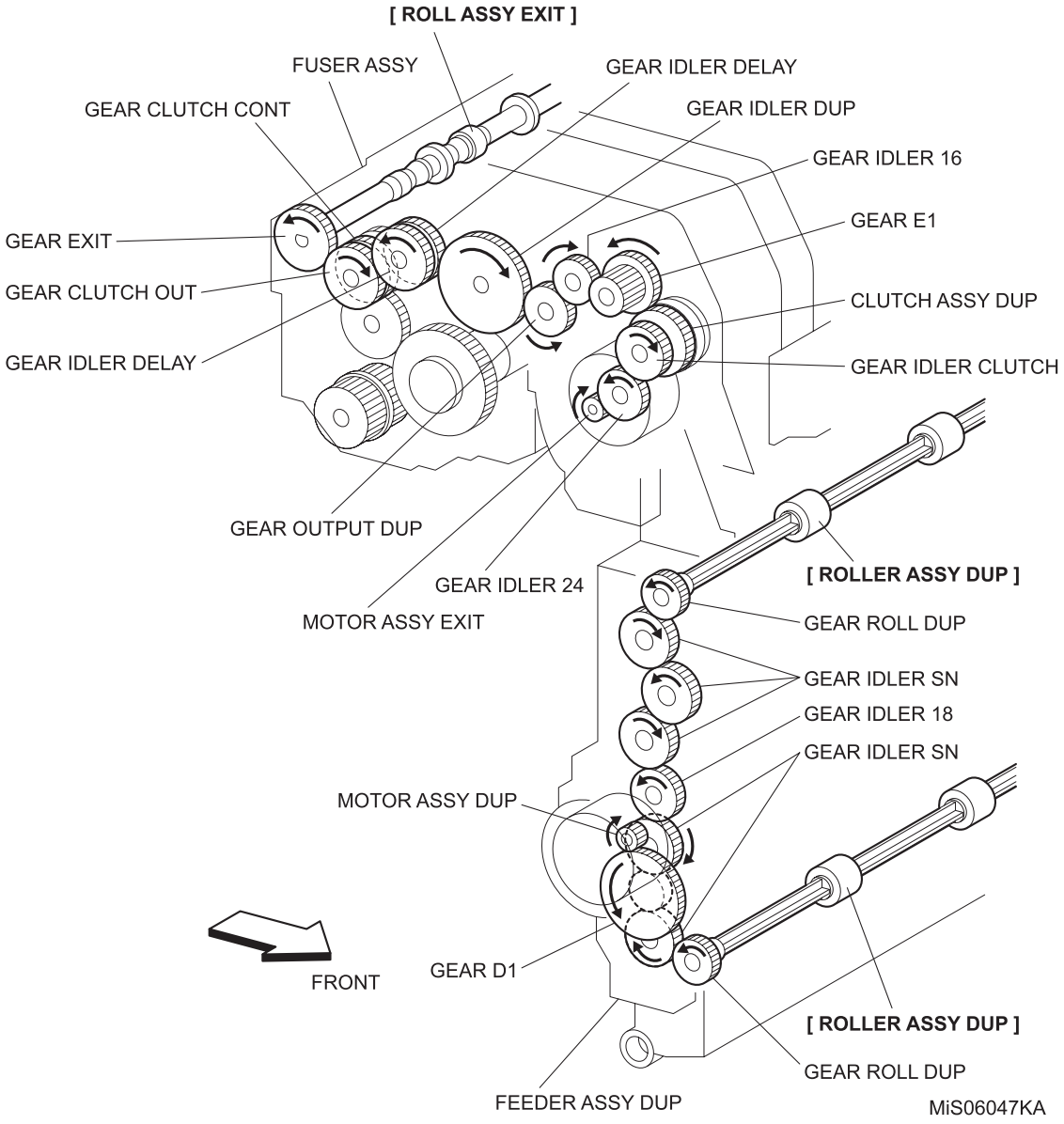
Rotation power of the DRIVE ASSY DUP is transmitted through the route below.



[DUPLEX MODE]

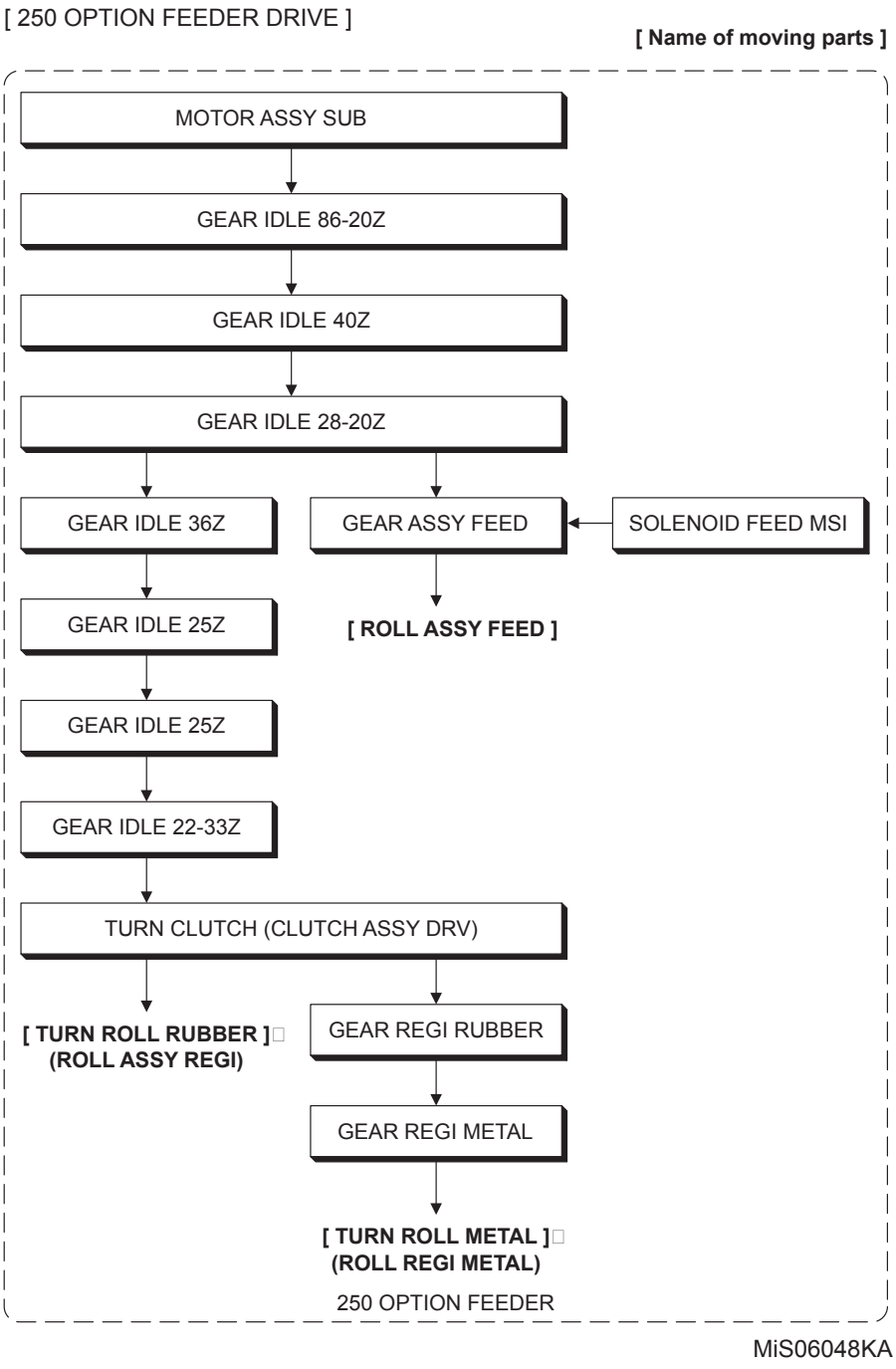
[Name of moving parts]

: Indicates the engagement of gears.



6.6 MOTOR ASSY SUB

Rotation power of the MOTOR ASSY SUB is transmitted through the route below.

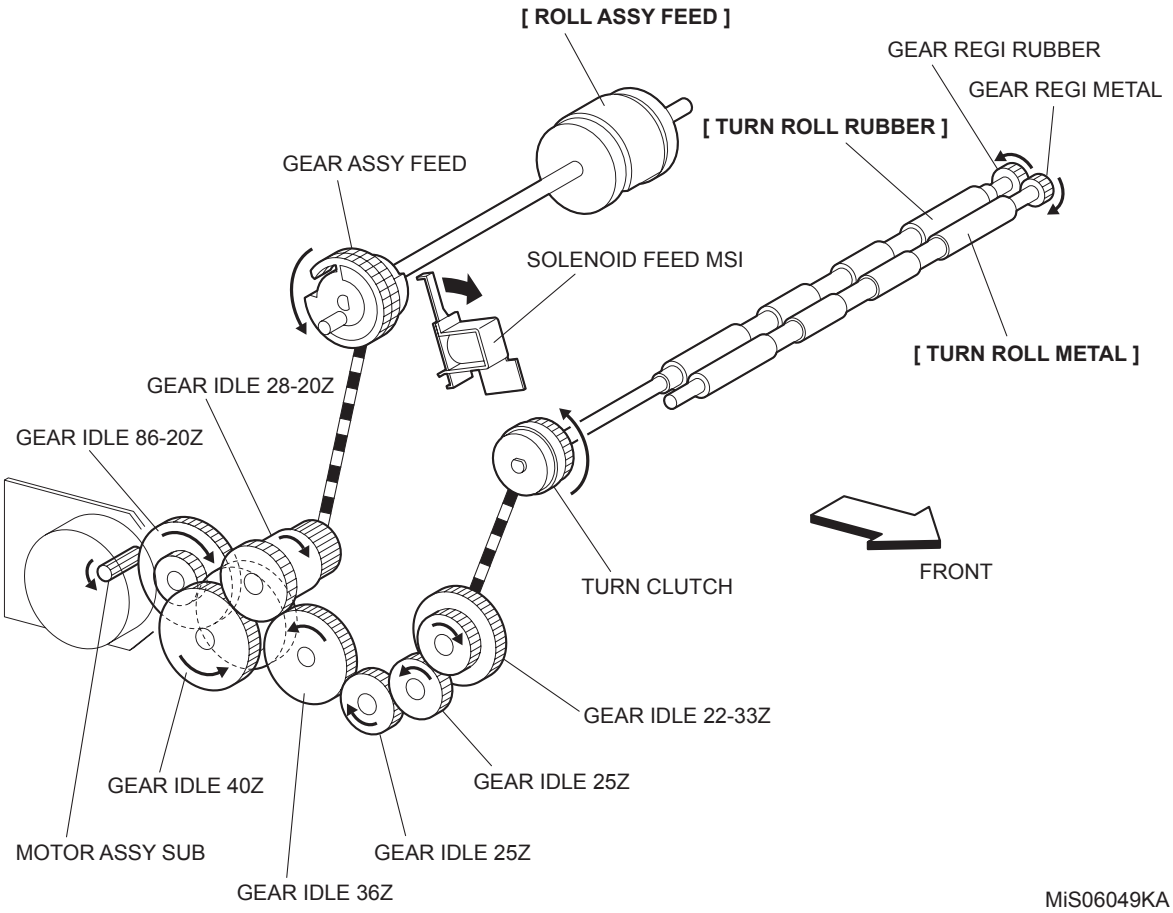


MiS06048KA

[250 OPTION FEEDER DRIVE]

[Name of moving parts]

: Indicates the engagement of gears.



MiS06049KA