GENERAL PRECAUTIONS REGARDING THE INSTALLATION AND SERVICE FOR THE COPIER FC-210/310

The installation and service should be done by a qualified service technician.

1. Transportation/Installation

- When transporting/installing the copier, move it by the casters while lifting the stoppers.
  The copier is quite heavy and weighs approximately 191 kg (421 lb), therefore pay full attention when handling it.
- Be sure to use a dedicated outlet with AC 115V or 120V/20A (220V, 230V, 240V/10A) or more for its power source.
- The copier must be grounded for safety.
  Never ground it to a gas pipe or a water pipe.
- Select a suitable place for installation.
  Avoid excessive heat, high humidity, dust, vibration and direct sunlight.
- Also provide proper ventilation as the copier emits a slight amount of ozone.
- To insure adequate working space for the copying operation, keep a minimum clearance of 80 cm (32") on the left, 80 cm (32") on the right and 10 cm (4") in the rear.
- The socket-outlet shall be installed near the copier and shall be easily accessible.

2. Service of Machines

- Basically, be sure to turn the main switch off and unplug the power cord during service.
- Be sure not to touch high-temperature sections such as the exposure lamp, the fuser unit, the damp heater and their periphery.
- Be sure not to touch high-voltage sections such as the chargers, high-voltage transformer, exposure lamp control inverter, inverter for the LCD backlight and power supply unit. Especially, the board of these components should not be touched since the electirc charge may remain in the condensers, etc. on them even after the power is turned OFF.
- Be sure not to touch rotating/operating sections such as gears, belts, pulleys, fan, etc.
- Be careful when removing the covers since there might be the parts with very sharp edges underneath.
- When servicing the machines with the main switch turned on, be sure not to touch live sections and rotating/operating sections. Avoid exposure to laser radiation.
- Use suitable measuring instruments and tools.
- Avoid exposure to laser radiation during servicing.
  - Avoid direct exposure to the beam.
  - Do not insert tools, parts, etc. that are reflective into the path of the laser beam.
  - Remove all watches, rings, bracelets, etc. that are reflective.

3. **Main Service Parts for Safety**
   - The breaker, door switch, fuse, thermostat, thermofuse, thermistor, etc. are particularly important for safety. Be sure to handle/install them properly. If these parts are shorted circuit and/or made their functions out, they may burn down, for instance, and may result in fatal accidents. Do not allow a short circuit to occur. Do not use the parts not recommended by Toshiba TEC Corporation.

4. **Cautionary Labels**
   - During servicing, be sure to check the rating plate and the cautionary labels such as “Unplug the power cord during service”, “Hot area”, “Laser warning label” etc. to see if there is any dirt on their surface and whether they are properly stuck to the copier.

5. **Disposition of Consumable Parts/Packing Materials**
   - Regarding the recovery and disposal of the copier, supplies, consumable parts and packing materials, it is recommended to follow the relevant local regulations or rules.

6. **When parts are disassembled, reassembly is basically the reverse of disassembly unless otherwise noted in this manual or other related documents. Be careful not to reassemble small parts such as screws, washers, pins, E-rings, star washers in the wrong places.**

7. **Basically, the machine should not be operated with any parts removed or disassembled.**

8. **Precautions Against Static Electricity**
   - The PC board must be stored in an anti-electrostatic bag and handled carefully using a wristband, because the ICs on it may become damaged due to static electricity.

   Caution: Before using the wristband, pull out the power cord plug of the copier and make sure that there are no uninsulated charged objects in the vicinity.

Caution :	Dispose of used batteries and RAM-ICs including lithium batteries according to the manufacturer’s instructions.
Attention :	Se débarrasser de batteries et RAM-ICs usés y compris les batteries en lithium selon les instructions du fabricant.
Vorsicht :	Entsorgung des gebrauchten Batterien und RAM-ICs (inklusive der Lithium-Batterie) nach Angaben des Herstellers.

In this manual, colors are sometimes shown in abbreviations as below:
Yellow : Y ; Magenta : M ; Cyan : C ; Black : K

1. SPECIFICATIONS · ACCESSORIES · OPTIONS · SUPPLIES

1.1 Specifications

- Copy process — Indirect electrophotographic process (dry)
- Type — Console type
- Original table — Fixed table (the left rear corner used for Standard original placement)
- Acceptable originals — Type: Sheets, books and 3-dimensional objects. However, the automatic document feeder only accepts sheets of paper (64~105 g/m^2, or 17~28 lb.), excluding carbon paper, pasted sheets and stapled sheets.
  Size : A3/LD max.
- Copy speed (Copies/min.)

FC-210

Paper supply / Paper size		Cassette	Bypass feeding		LCF
			Size specification YES	Size specification NO	
Thin Paper /Normal Paper	A4, LT	21(31)	21(31)	12(14)	21(31)
	B5	21(31)	21(31)	14(16)	–
	A5-R, ST-R	21(31)	21(31)	17(24)	–
	A4-R, B5-R, LT-R	17(23)	17(19)	17(19)	–
	B4, LG	14(19)	14(16)	14(16)	–
	A3, LD	12(16)	12(14)	12(14)	–
	Full bleed (12" x 18")	–	12(12)	12(12)	–
	A6-R	–	21(24)	21(24)	–
Thick Paper 1	A4, LT	10.3(10.3)	10.3(10.3)	10.3(10.3)	10.3(10.3)
	B5, A5-R, ST-R	10.3(10.3)	10.3(10.3)	10.3(10.3)	–
	A4-R, B5-R, LT-R	9.3(9.3)	9.3(9.3)	9.3(9.3)	–
	B4, LG	8.5(8.5)	8.5(8.5)	8.5(8.5)	–
	A3, LD	7.9(7.9)	7.9(7.9)	7.9(7.9)	–
	Full bleed (12" x 18")	–	7.7(7.7)	7.7(7.7)	–
	A6-R	–	10.3(10.3)	10.3(10.3)	–
Other	Thick Paper 2(All size)	–	2~6(2~6)	2~6(2~6)	–
	Thick Paper 3(All size)	–	2~6(2~6)	2~6(2~6)	–
	OHP films (A4, LT)	3.3(3.3)	3.3(3.3)	–	–

FC-310

Paper supply / Paper size		Cassette	Bypass feeding		LCF
			Size specification YES	Size specification NO	
Thin Paper / Normal Paper	A4, LT	31(31)	24(24)	14(14)	31(31)
	B5	31(31)	24(24)	16(16)	–
	A5-R, ST-R	31(31)	24(24)	24(24)	–
	A4-R, B5-R, LT-R	23(23)	19(19)	19(19)	–
	B4, LG	19(19)	16(16)	16(16)	–
	A3, LD	16(16)	14(14)	14(14)	–
	Full bleed (12" x 18")	–	12(12)	12(12)	–
	A6-R	–	24(24)	24(24)	–
Thick Paper 1	A4, LT	10.3(10.3)	10.3(10.3)	10.3(10.3)	10.3(10.3)
	B5, A5-R, ST-R	10.3(10.3)	10.3(10.3)	10.3(10.3)	–
	A4-R, B5-R, LT-R	9.3(9.3)	9.3(9.3)	9.3(9.3)	–
	B4, LG	8.5(8.5)	8.5(8.5)	8.5(8.5)	–
	A3, LD	7.9(7.9)	7.9(7.9)	7.9(7.9)	–
	Full bleed (12" x 18")	–	7.7(7.7)	7.7(7.7)	–
	A6-R	–	10.3(10.3)	10.3(10.3)	–
Other	Thick Paper 2(All size)	–	2~6 (2~6)	2~6 (2~6)	–
	Thick Paper 3(All size)	–	2~6 (2~6)	2~6 (2~6)	–
	OHP films (A4, LT)	3.3(3.3)	3.3(3.3)	–	–

*Thin paper:64~79 g/m^2, or 17~20 lb. *Normal paper:80~105 g/m^2, or 21~28 lb.

*Thick paper 1:106~163 g/m^2, or 29lbs.~60 lb. cover/90lb. index

*Thick paper 2: 164g/m^2 ~209 g/m^2, or 91~110 lb. index

*Thick paper 3: 210~256 g/m^2, or 111~140 lb. index

* Values in parentheses ( ) are the copy speed in the black mode copying.
* "–" means "not available".
* The copy speeds listed are available when originals are manually placed for single-side, multiple copying.
* When the document feeder is used, the copy speed of 21 sheets per minute (FC-210) or 31 sheets per minute (FC-310) is only available under the following conditions:
  - Original/Mode: Single-side originals of A4/LT size, not selecting auto color, APS, automatic density and advance image enhancement mode
  - Number of sheets set: 21 or over (FC-210) , 31 or over (FC- 310)
  - Paper feeding: 2nd cassette
  - Reproduction ratio: Actual ratio
* Reverse side copying speed of the automatic duplexing unit
  (When specific paper size is selected)

  A4, B5, A5-R, LT, ST-R: 21 sheets/min. (FC-210), 31 sheets/min. (FC-310)
  A4-R, B5-R, LT-R: 17 sheets/min. (FC-210), 23 sheets/min. (FC-310)
  B4, LG: 14 sheets/min. (FC-210), 19 sheets/min. (FC-310)
  A3, LD: 12 sheets/min. (FC-210), 16 sheets/min. (FC-310)

* System copy speed

Copy mode		Copies/min.
Single-sided originals	1 set	16 [18]
↓	3 sets	19 [25]
Single-sided copies	5 sets	19 [27]
Single-sided originals	1 set	8 [9]
↓	3 sets	14 [17]
Two-sided copies	5 sets	16 [21]
Two-sided originals	1 set	7 [7]
↓	3 sets	12 [15]
Two-sided copies	5 sets	14 [18]
Two-sided originals	1 set	11 [11]
↓	3 sets	16 [19]
Single-sided copies	5 sets	18 [23]

* Values in square brackets [ ] are for FC-310.
* The copy speeds are applicable when 10 A4-sized originals are set in the automatic document feeder and are copied with any of the modes listed on the left. The first copy time is included.
* These values are attained in full color mode copying.

• Copy paper

	Cassette	Duplex copy	LCF	Bypass copy	Remarks
Size	A3~A5R LD~ST-R		A4, LT	A3~A5-R LD~ST-R	In the bypass mode, either irregular sizes or arbitrary sizes can be set.
Weight	64~163g/m^2 17lb~60lb.cover ~90lb.index	64~105g/m^2 17~28lb.	64~163g/m^2 17lb~60lb.cover ~90lb.index	64~256g/m^2 17lb~140lb.index	
Special paper	–	–	–	Recommended OHP films and sticker labels	

• First copy time ..... Approx. 9.5 seconds (A4/LT, the first cassette, 100%)
• Warming-up time ..... Approx. 4 minutes
• Multiple copying ..... Up to 999 copies;entry by digital keys
• Reproduction ratio ..... Actual ratio: 100±0.5%
Zooming: 25~400% in increments of 1%
• Resolution/Gradation ..... Read: 600 dpi (10 bit)
Write: Corresponding to 600 dpi x 600 dpi
(primary scanning only : 256 division smoothing)
• Excluded image width ..... Leading edge: 5.0±2.0 mm, Trailing edge: 2.5±2.0 mm
Side edge: 2.0±2.0 mm
• Paper feeding ..... Automatic feeding: Cassettes – 2 pieces standard (expandable up to 4 pieces by installing optional cassettes)
LCF – Optional (Stack height 165 mm : equivalent to 1500 sheets of 80 g/m^2, 20 lb.)
Bypass feeding: (Stack height 21 mm : equivalent to 130 sheets of 80 g/m^2, 20 lb.)

• Capacity for originals A4, A4-R, B5, B5-R, A5-R, LT, LT-R, ST-R: 50 sheets (64~90g/m^2) (17~24 lb.)
(Optional automatic document feeder) 40 sheets (91~105g/m^2) (25~28 lb.)
B4, Folio, LG, Comp: 35 sheets (64~90g/m^2) (17~24 lb.)
25 sheets (91~105g/m^2) (25~28 lb.)
A3, LD: 25 sheets (64~90g/m^2) (17~24 lb.)
20 sheets (91~105g/m^2)(25~28 lb.)

• Stacking capacity of sheets Paper weight 64~105 g/m^2, 17~28 lb.: 30 sheets
(Optional automatic duplexing unit)

• Toner supplying ..... Automatic toner-density detection and supply
Toner cartridge replacing method

• Density control ..... Automatic density mode and manual density mode selectable in 11 steps

• Weight ..... Approx. 187 kg/413lb.

• Power requirements ..... AC 115V/16A, AC 220 – 240V/9A

• Power consumption ..... 2.0 kW or less (115V series, 200V series)

* The automatic document feeder, automatic duplexing unit and LCF are supplied with electric power through the copier.

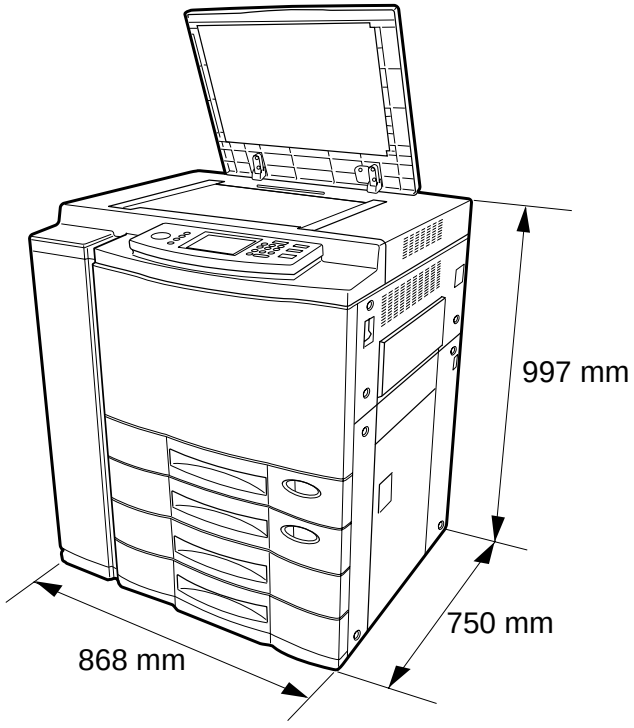
• Power consumption and warm-up time at energy saving mode

	Mode		Power Consumption	Warm-up time	Efficiency
115V series	Energy saving mode	Level 1	Approx.100W (Approx.135W)	Approx. 2 min 30 sec.	Approx. 56% (Approx. 48%)
		Level 2	Approx.160W (Approx.195W)	Approx. 1 min 15 sec.	Approx. 29% (Approx. 25%)
	Normal standby		Approx. 225W (Approx.260W)	0	0% (0%)
200V series	Energy saving mode	Level 1	Approx.100W (Approx.135W)	Approx. 2 min 15 sec.	Approx. 57% (Approx. 49%)
		Level 2	Approx.160W (Approx.195W)	Approx. 1 min 15 sec.	Approx. 30% (Approx. 26%)
	Normal standby		Approx. 230W (Approx.265W)	0	0% (0%)

* Values in parentheses ( ) are when the copier is with full options: The automatic document feeder, automatic duplexing unit, large-capacity feeder, finisher, hole punch unit, cassette modules and AI board

* Level 1: Energy saver mode with priority aim of energy saving
Level 2: Energy saver mode with priority aim of returning to standby

• Dimensions ..... See the figure below (W868 x D750 x H997mm)



1.2 Accessories

Setup instructions	1 pc.
Operator's manual	1 pc. (not available for MJD)
Color copy guide	1 pc. (not available for MJD)
PM sticker	1 pc. (for MJD)
Setup report	1 set. (for NAD and MJD)
CS card	1 pc. (for MJD)
Drum	4 pcs.
Operator's manual pocket	1 pc.
Detachable code	1 pc. (for ASD, AUD and MJD)
Copy receiving tray	1 pc.
Preventive maintenance check list	1 pc. (for MJD)
Toner bag symbol sticker	1 pc. (for MJD)
Warrantee sheet	1 pc. (for NAD)
DF level up kit	1 pc.

* Machine version

NAD: North America
MJD: Europe
AUD: Australia
ASD: Asia

1.3 Options

Platen cover	KA-2060PC
Automatic document feeder (RADF)	MR-3006A, MR-3006E
Automatic duplexing unit (ADU)	MD-5007
Cassette module	MY-1020
Slot cover	KE-FC22
Large capacity feeder (LCF)	MP-1503LT,MP1503A4
Finisher	MJ-1019, MJ-1020 (with saddle stitching function)
Hole punch unit	MJ-6002N,MJ-6002E,MJ-6002F,MJ-6002S
Staple cartridge	STAPLE-700 STAPLE-600 (for saddle stitching)
External printer controller (Fiery Z5)	GA-1130
Built-in printer controller (Fiery New X3e)	GA-1120
Video I/F kit for external controller connection	KR-8005
Control panel kit for built-in controller	KR-8006
Key copy counter, Key copy counter socket	MU-8, MU-10
Work table	KK-2460
Work table kit	KN-FC22W01
AI board	KR-2030
Damp heater kit	MF-FC22U, MF-FC22E
Operator's manual (English, French, German, Spanish, Italian)	MANUAL FC31
Color copy guide (English, French, German, Spanish, Italian)	GUIDE FC31

1.4 Replacement Units/Supplies

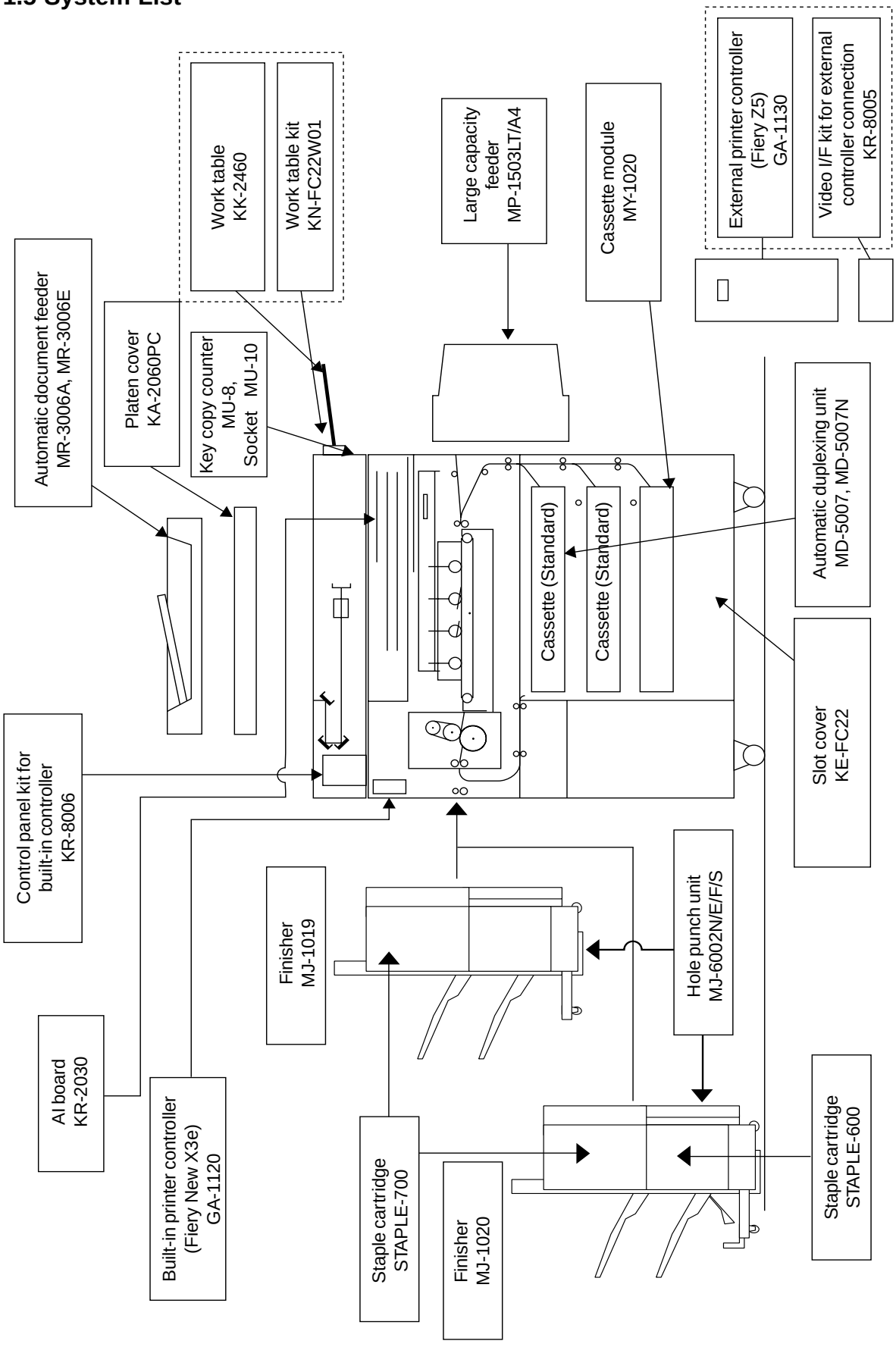
(1) Replacement units

Electrophotographic processing unit (EPU)	EPU-FC31
Transfer belt unit (TBU)	TR-BLT-FC31
Fuser unit	FUSER-FC31-115/127/200

(2) Supplies

Toner Y (Yellow)	PS-ZTFC31Y, PS-ZTFC31EY
Toner M (Magenta)	PS-ZTFC31M, PS-ZTFC31EM
Toner C (Cyan)	PS-ZTFC31C, PS-ZTFC31EC
Toner K (Black)	PS-ZTFC31K, PS-ZTFC31EK
Toner bag	PS-TBFC22, PS-TBFC22E

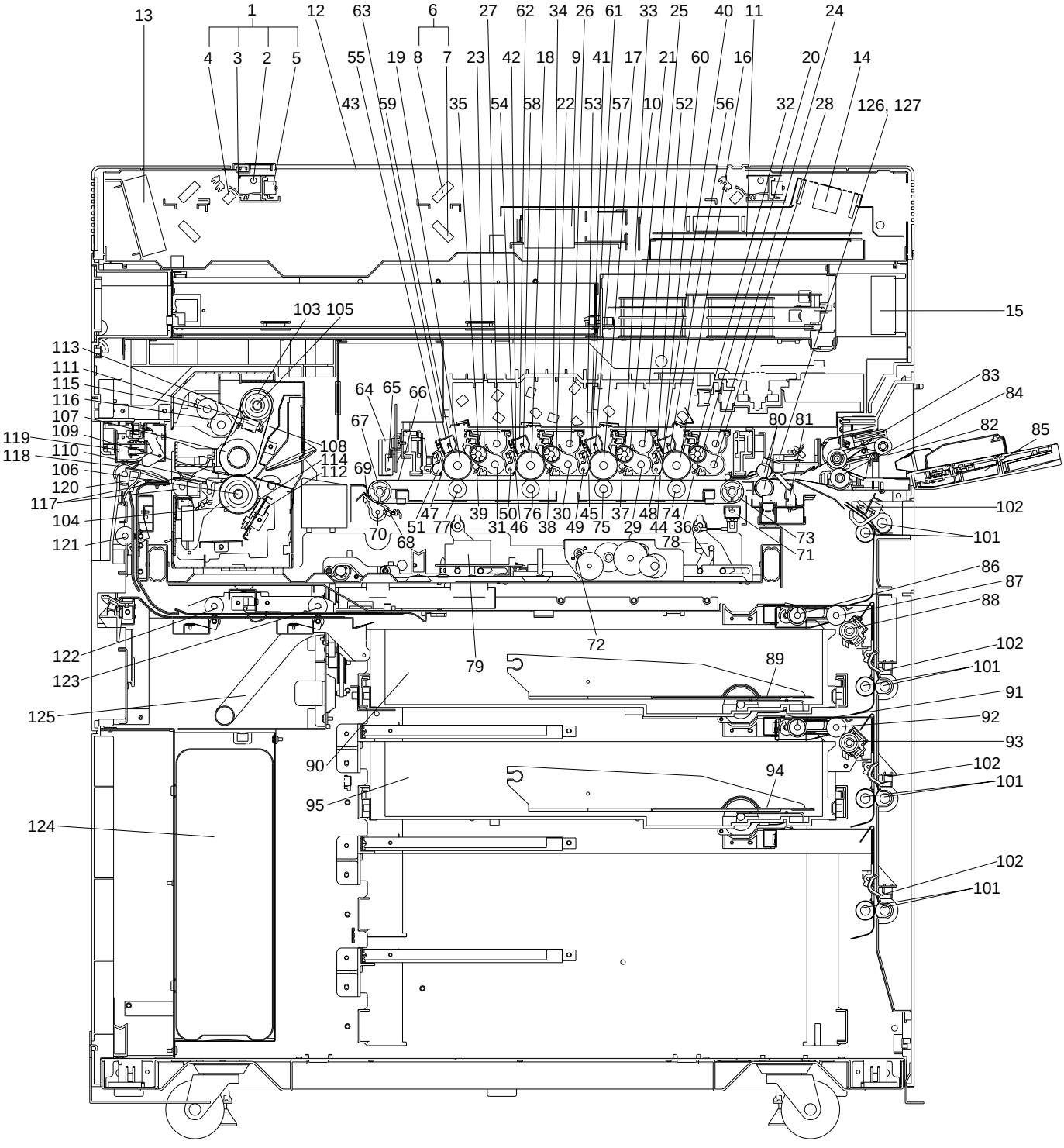
1.5 System List



2. OUTLINE OF THE MACHINE

2.1 Sectional View

[A] Front view (The drive system is illustrated in [B] and [C])



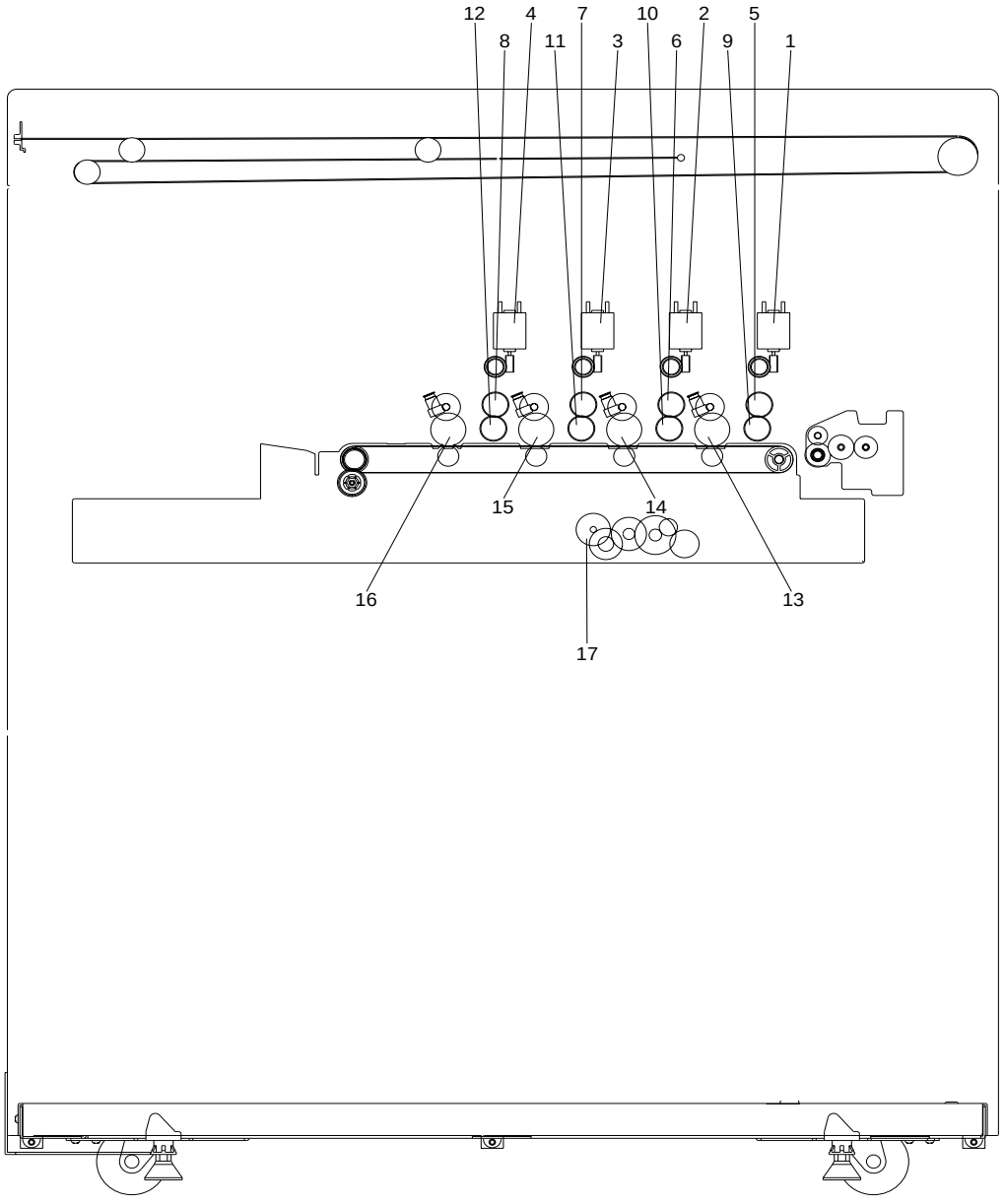
1	Carriage 1
2	Exposure lamp
3	Reflector
4	Mirror 1
5	Inverter
6	Carriage 2
7	Mirror 2
8	Mirror 3
9	Lens
10	CCD PC board
11	Scanner control board
12	Original glass
13	Carriage fan
14	SCM fan
15	Board unit cooling fan
16	Drum Y
17	Drum M
18	Drum C
19	Drum K
20	Developer sleeve (Magnetic roller) Y
21	Developer sleeve (Magnetic roller) M
22	Developer sleeve (Magnetic roller) C
23	Developer sleeve (Magnetic roller) K
24	Upper mixer Y
25	Upper mixer M
26	Upper mixer C
27	Upper mixer K
28	Lower mixer Y
29	Lower mixer M
30	Lower mixer C
31	Lower mixer K
32	Doctor blade Y
33	Doctor blade M
34	Doctor blade C
35	Doctor blade K
36	Scattered toner recovery roller Y
37	Scattered toner recovery roller M
38	Scattered toner recovery roller C
39	Scattered toner recovery roller K

40	Cleaning blade Y
41	Cleaning blade M
42	Cleaning blade C
43	Cleaning blade K
44	Recovery blade Y
45	Recovery blade M
46	Recovery blade C
47	Recovery blade K
48	Toner recovery auger Y
49	Toner recovery auger M
50	Toner recovery auger C
51	Toner recovery auger K
52	Discharge LED Y
53	Discharge LED M
54	Discharge LED C
55	Discharge LED K
56	Main charger Y
57	Main charger M
58	Main charger C
59	Main charger K
60	Charger wire cleaner Y
61	Charger wire cleaner M
62	Charger wire cleaner C
63	Charger wire cleaner K
64	Image quality sensor
65	Color registration sensor
66	Transfer belt
67	Transfer belt drive roller
68	Transfer belt cleaning blade
69	Transfer belt recovery blade
70	Transfer belt toner recovery auger
71	Suction charger
72	Transfer belt contact/release motor
73	Transfer belt driven roller
74	Transfer roller Y
75	Transfer roller M
76	Transfer roller C
77	Transfer roller K
78	Transfer belt push-up mechanism

79	Transfer transformer
80	Registration roller
81	Registration switch
82	Bypass pick-up roller
83	Bypass feed roller
84	Bypass separation roller
85	Bypass tray
86	1st cassette pick-up roller
87	1st cassette feed roller
88	1st cassette separation roller
89	1st cassette tray
90	1st cassette
91	2nd cassette pick-up roller
92	2nd cassette feed roller
93	2nd cassette separation roller
94	2nd cassette tray
95	2nd cassette
101	Transport roller
102	Cassette feed jam sensor
103	Upper heat roller
104	Lower heat roller
105	Upper heater lamp
106	Lower heater lamp
107	Fuser roller
108	Fuser belt
109	Separation guide
110	Separation finger
111	Upper thermostat
112	Lower thermostat
113	Upper thermistor
114	Lower thermistor
115	Cleaning roller
116	Oil roller
117	Fuser unit exit roller
118	Exit roller
119	Exit sensor
120	ADU/exit switching gate
121	ADU transport roller 1
122	ADU transport roller 2

123	ADU transport roller 3
124	Toner bag
125	Used toner transport unit (main unit side)
126	OHP sensor

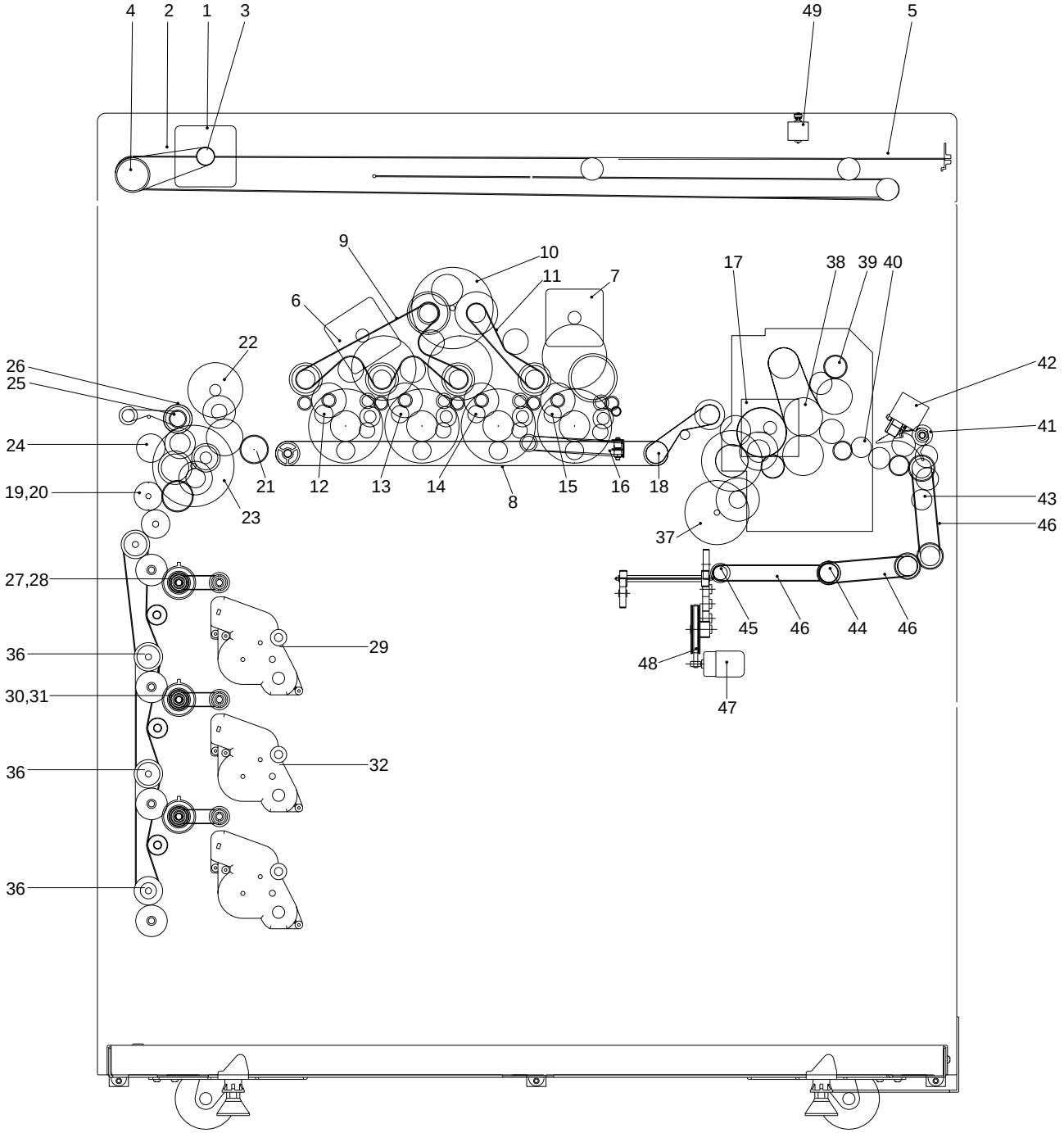
[B] Front drive system



1	Toner motor Y
2	Toner motor M
3	Toner motor C
4	Toner motor K
5	Upper mixer Y
6	Upper mixer M
7	Upper mixer C
8	Upper mixer K
9	Lower mixer Y
10	Lower mixer M

11	Lower mixer C
12	Lower mixer K
13	Wire cleaning motor Y
14	Wire cleaning motor M
15	Wire cleaning motor C
16	Wire cleaning motor K
17	Transfer belt contact/release motor

[C] Rear drive system

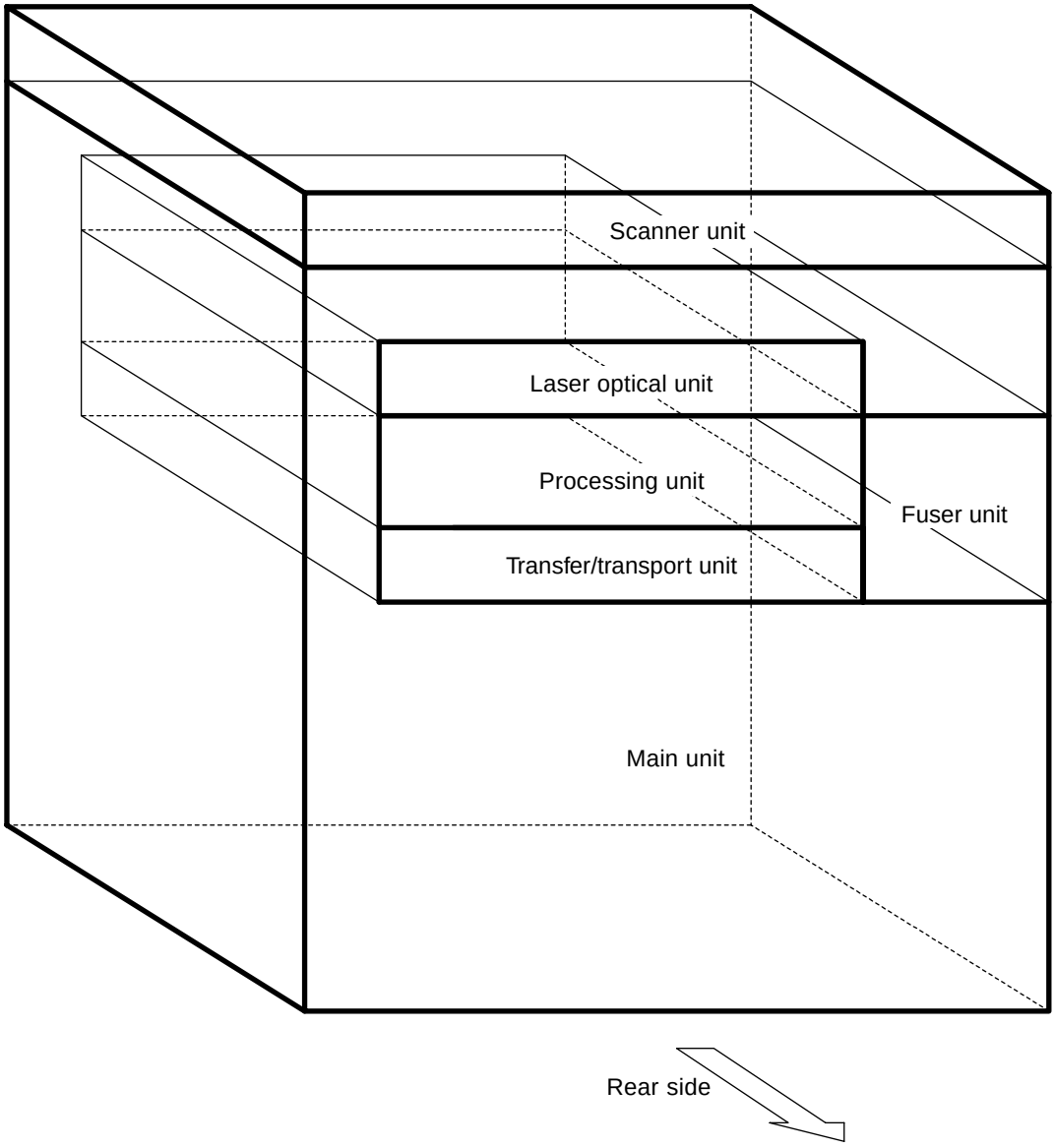


1	Scan motor
2	Drive belt
3	Drive pulley
4	Driven pulley
5	Carriage drive wire
6	Color drum motor (drum Y, M,C)
7	Black drum motor (drum K)
8	Transfer belt
9	Color developer drive belt
10	Developer motor
11	Black developer drive belt
12	Developer sleeve (magnetic roller) Y
13	Developer sleeve (magnetic roller) M
14	Developer sleeve (magnetic roller) C
15	Developer sleeve (magnetic roller) K
16	Used toner transport unit (EPU side) drive belt
17	Transfer belt motor
18	Transfer belt drive roller
19	Pre-feed clutch (F)
20	Pre-feed clutch (R)
21	Registration roller
22	Registration motor
23	Paper feed motor
24	Feed path clutch
25	Bypass feed roller
26	Bypass feed clutch
27	1st cassette feed roller
28	1st cassette feed clutch
29	1st cassette tray-up motor unit
30	2nd cassette feed roller
31	2nd cassette feed clutch
32	2nd cassette tray-up motor unit
36	Transport roller
37	Fuser motor
38	Fuser roller
39	Cleaning roller
40	Fuser exit roller
41	Exit roller

42	Paper exit gate solenoid
43	ADU transport roller 1
44	ADU transport roller 2
45	ADU transport roller 3
46	ADU transport drive belt
47	Used toner transport motor
48	Used toner transport unit (main unit side) drive belt
49	Document motor

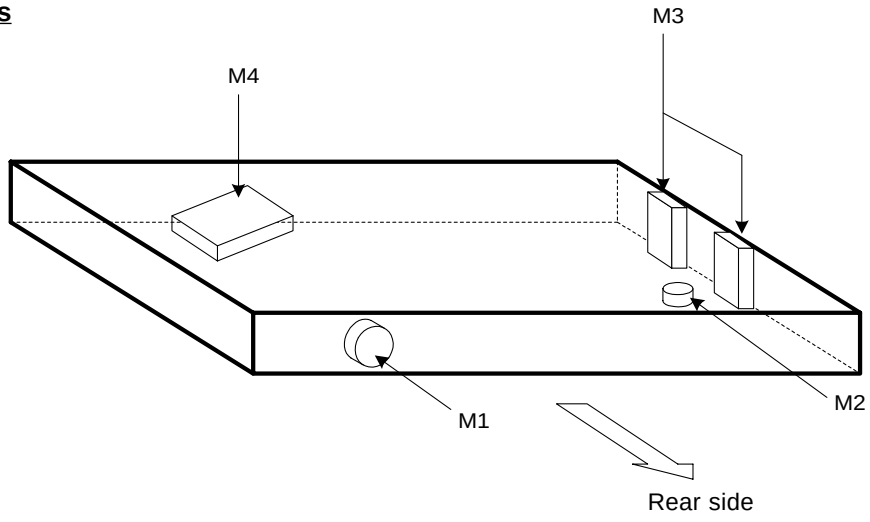
2.2 Location of Electrical Parts

[A] Arrangement of Various Units

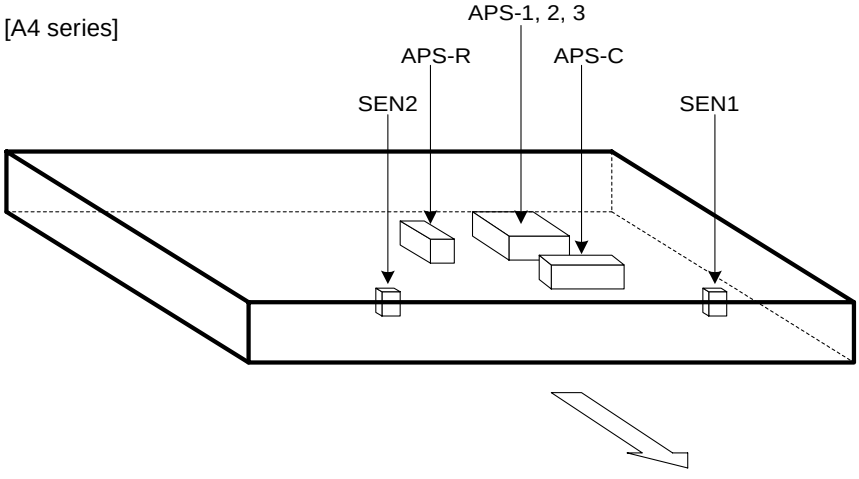


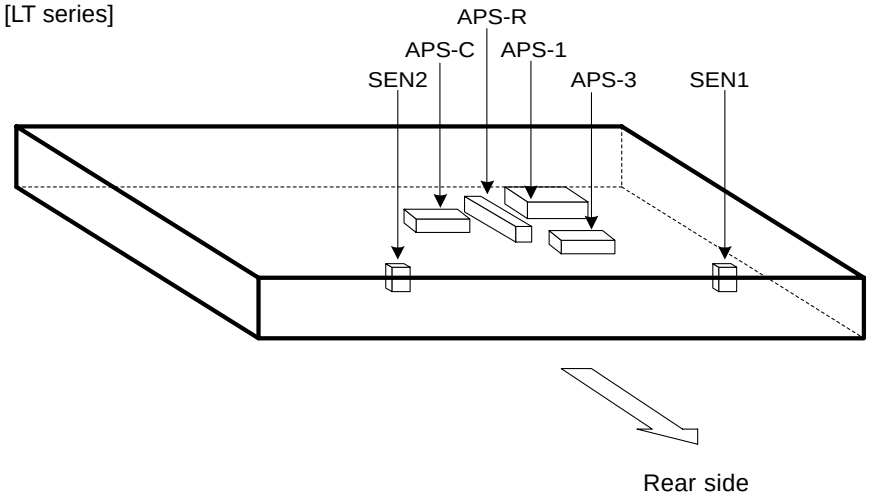
[B] Scanner unit

(B-1) Motors

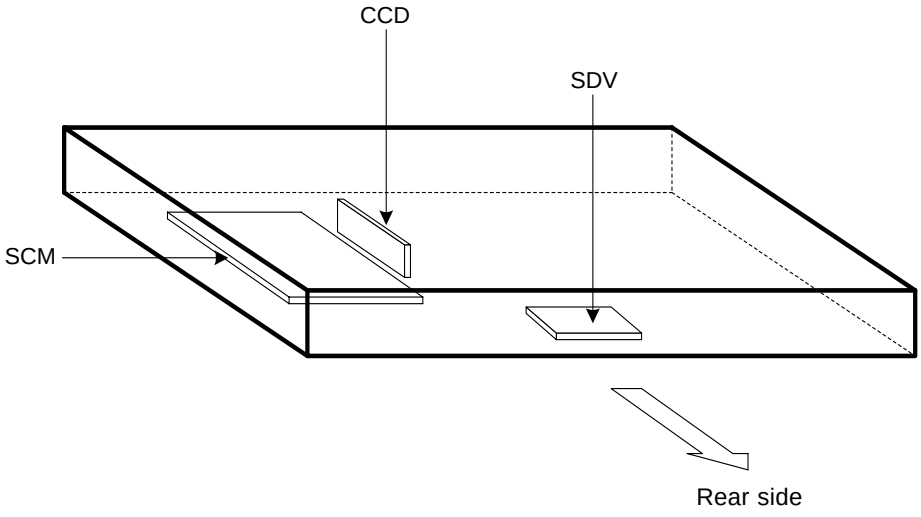


(B-2) Sensors and switches

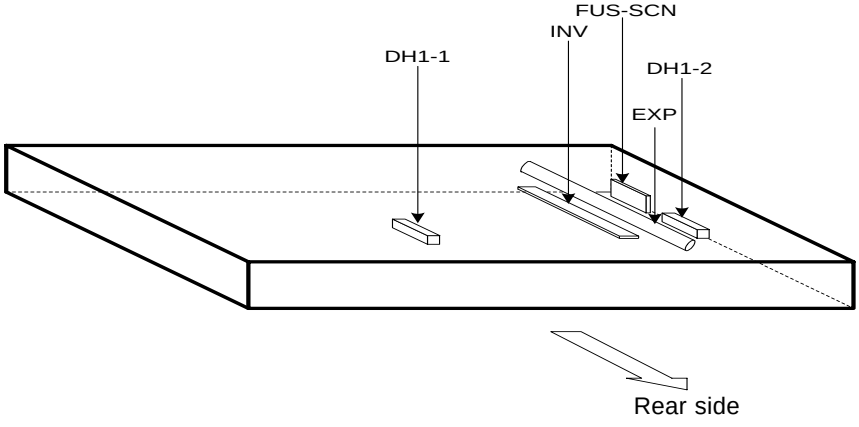




(B-3) PC boards

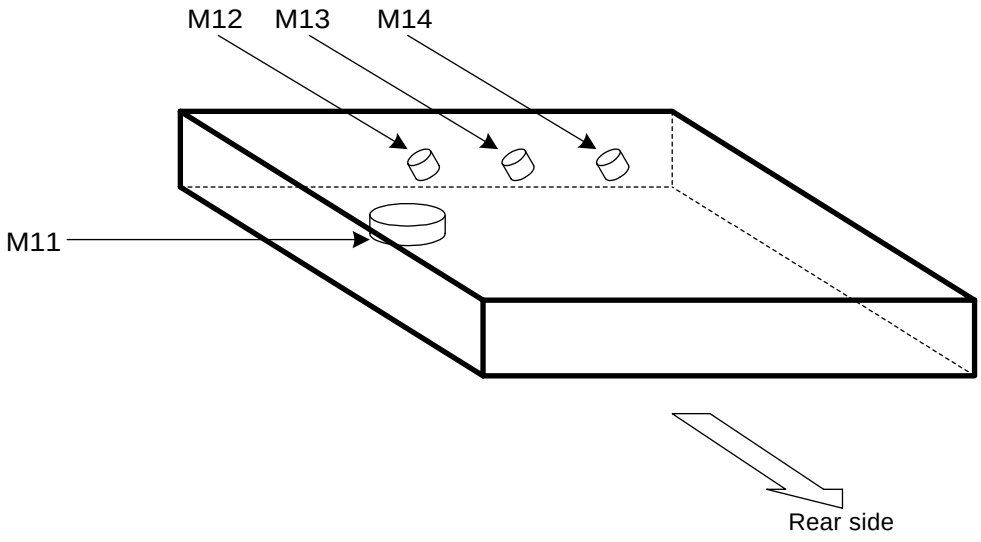


(B-4) Others

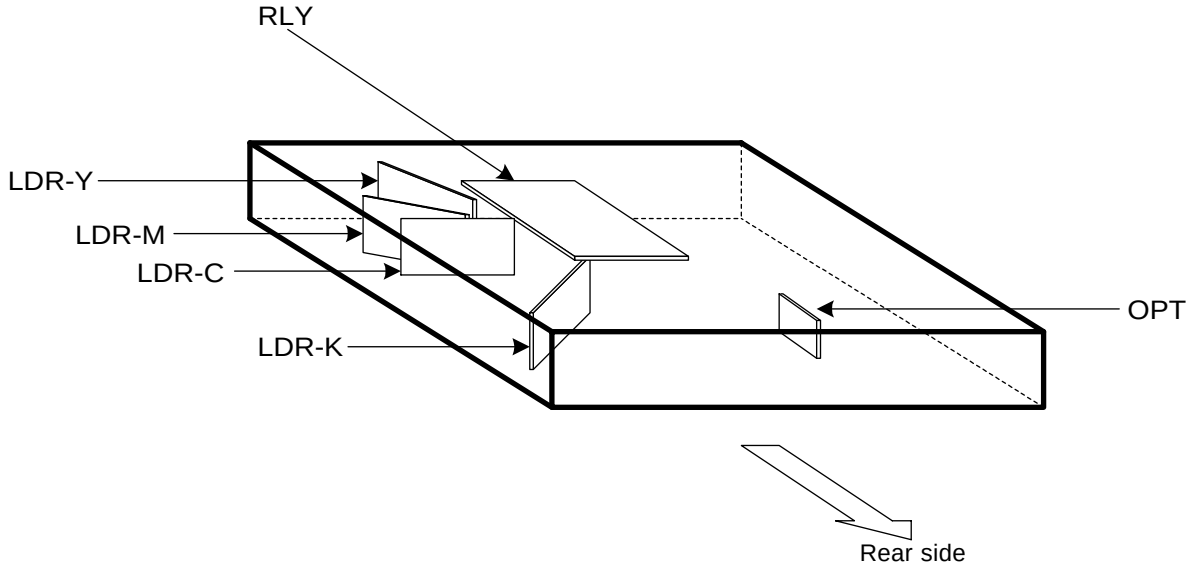


[C] Laser optical unit

(C-1) Motors

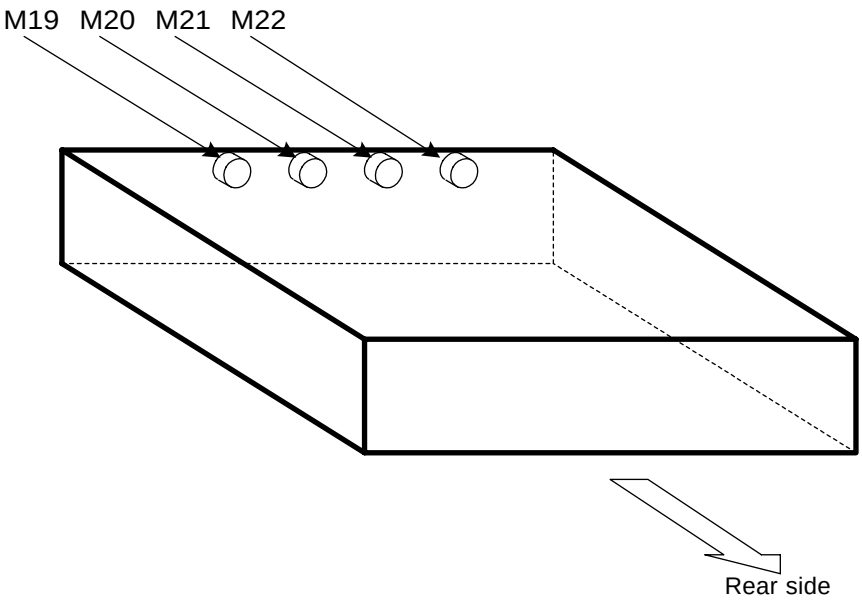


(C-2)PC boards

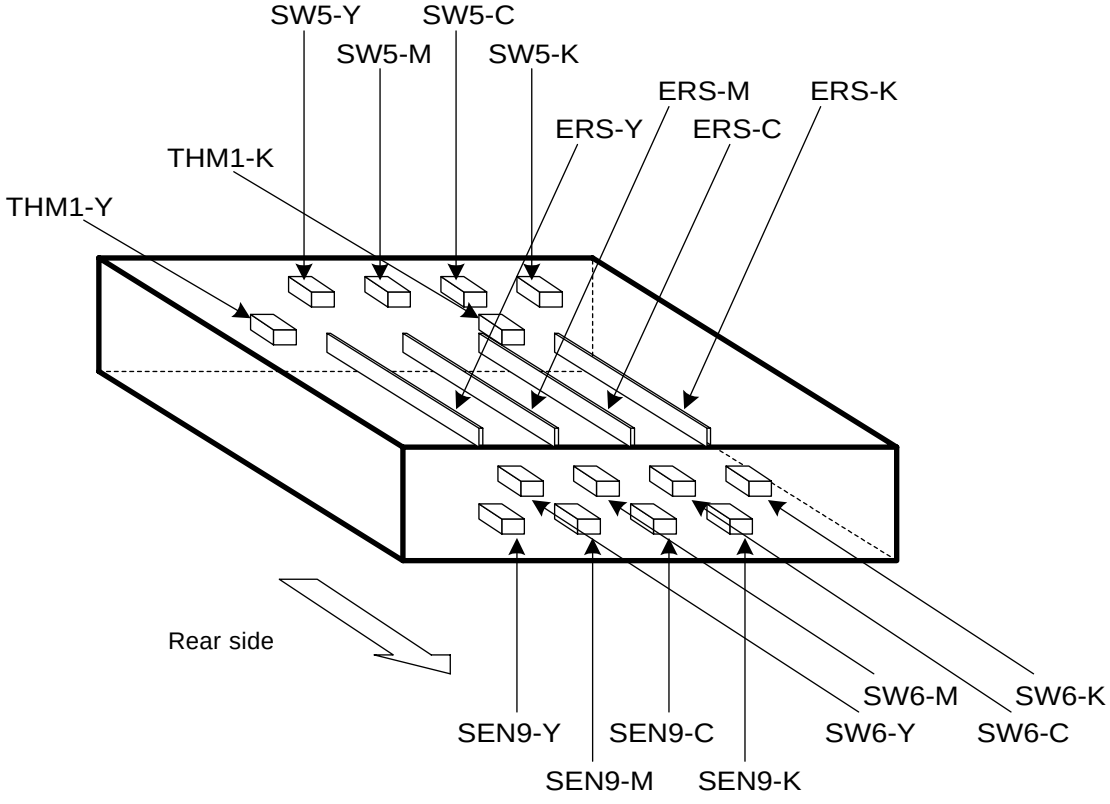


[D] Processing Unit

(D-1) Motors

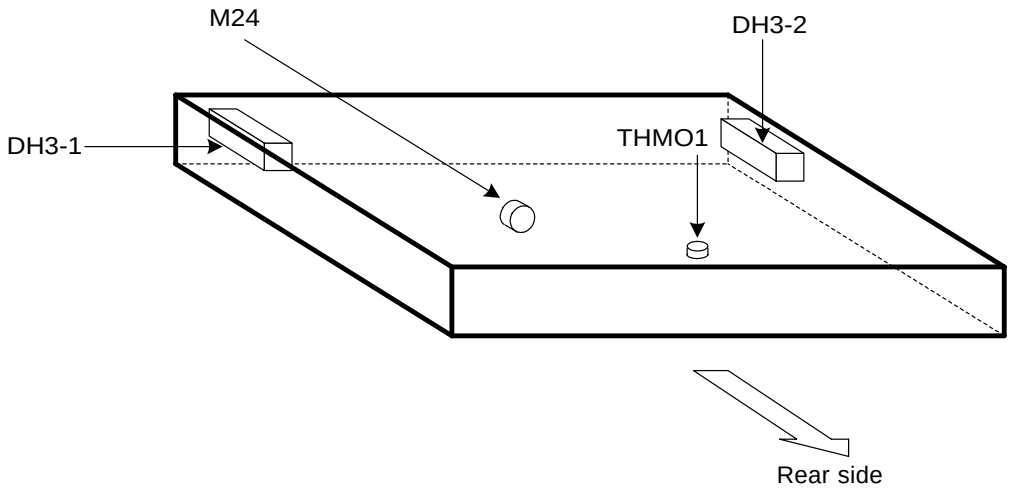


(D-2) Sensors, switches, thermistors and lamps

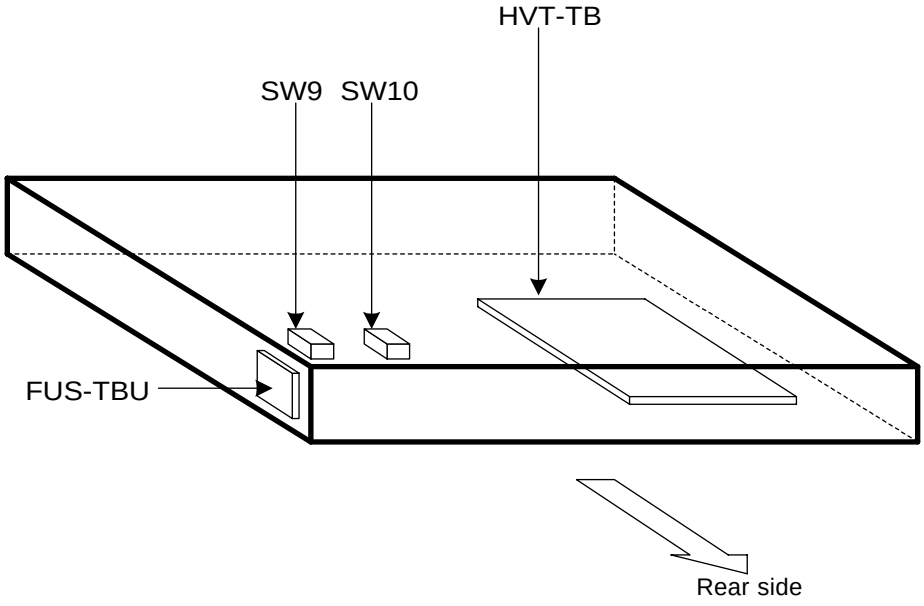


[E] Transfer/transport unit

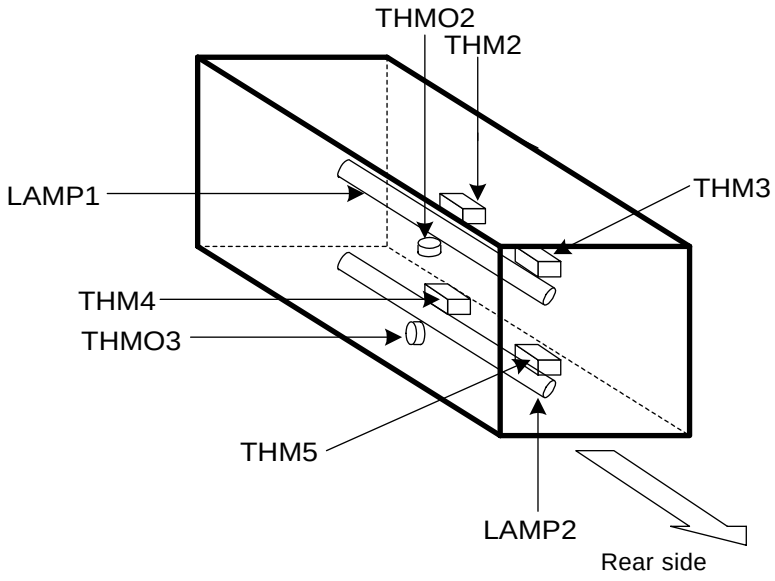
(E-1) Motors, thermostats and heaters



(E-2) Switches, PC boards and fuses

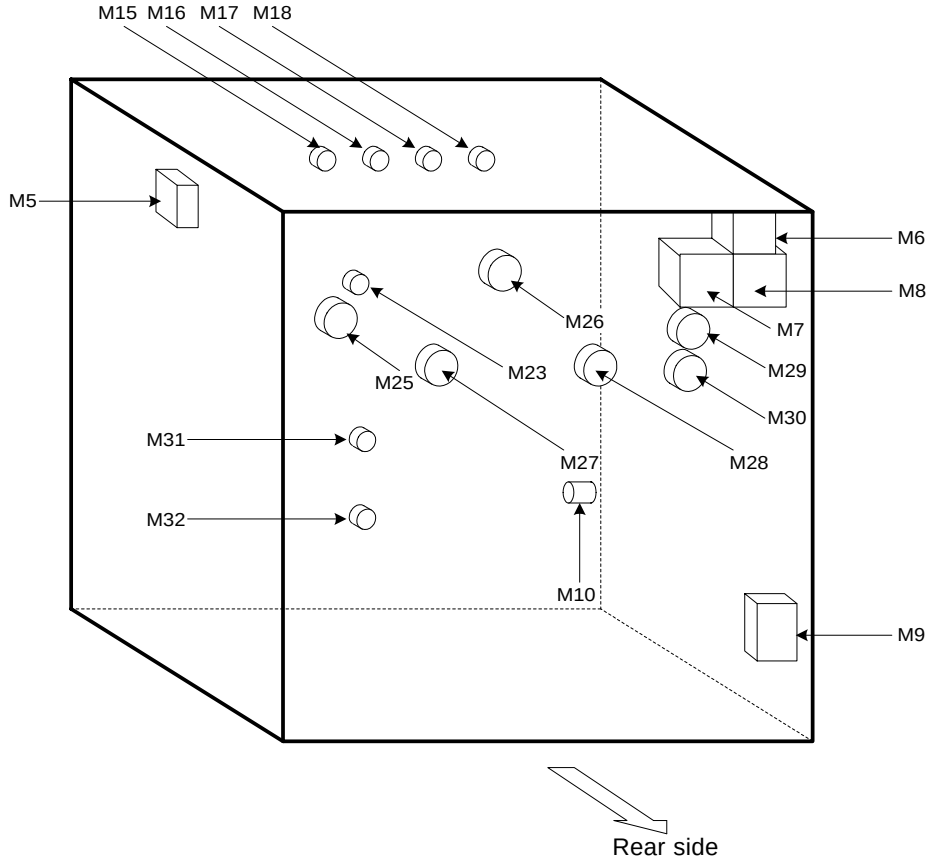


[F] Fuser unit

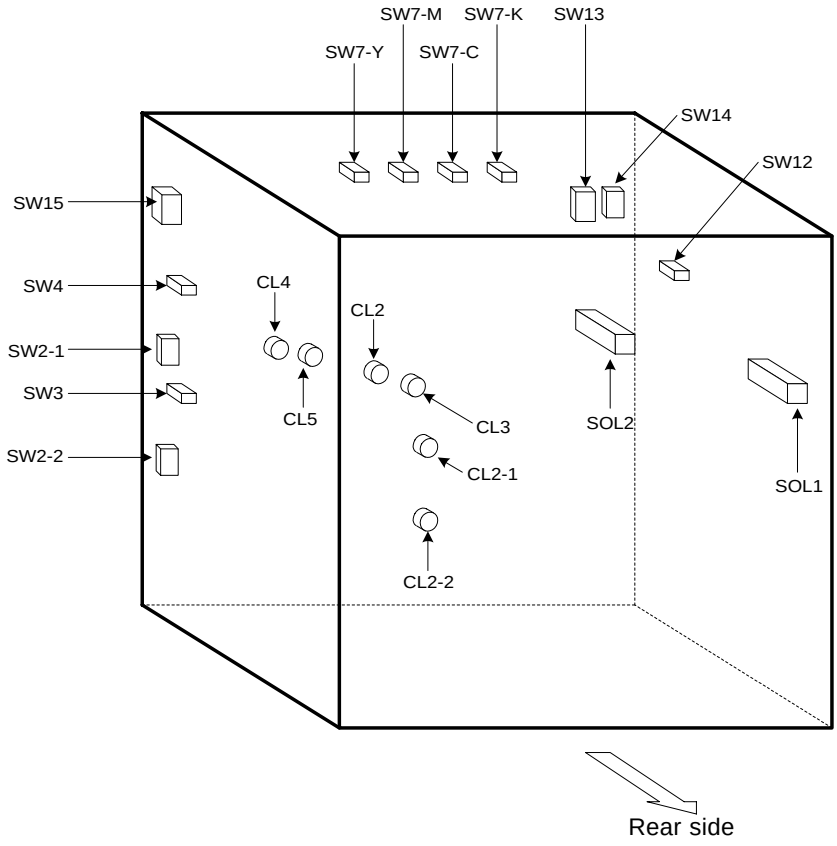


[G]Main unit

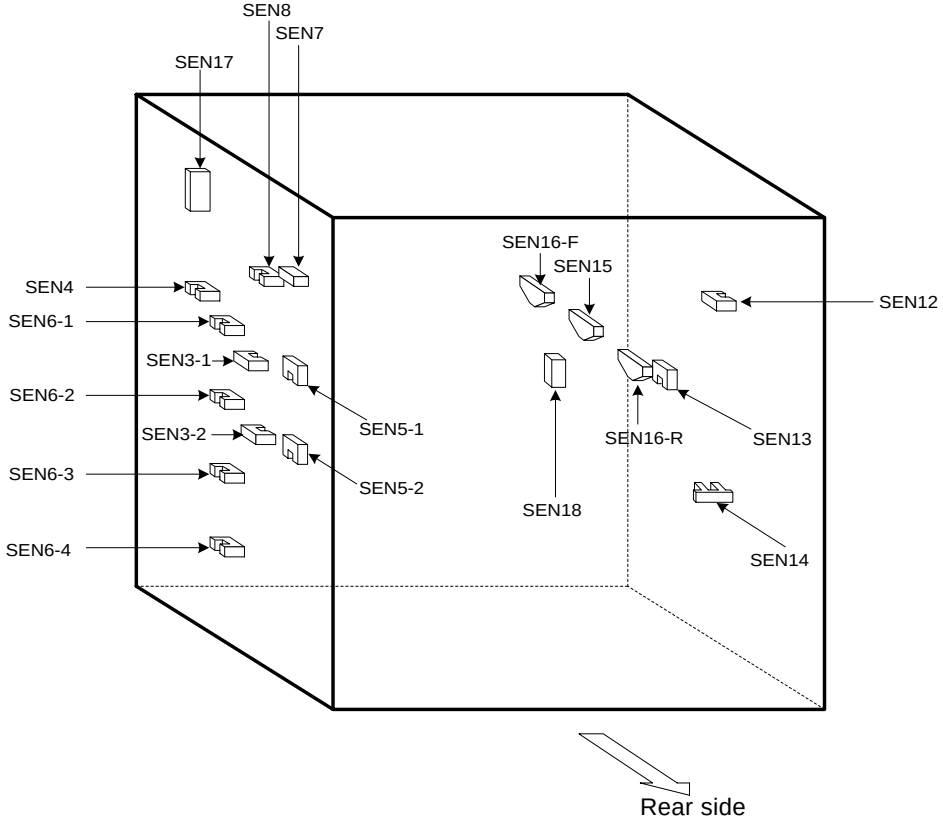
(G-1) Motors



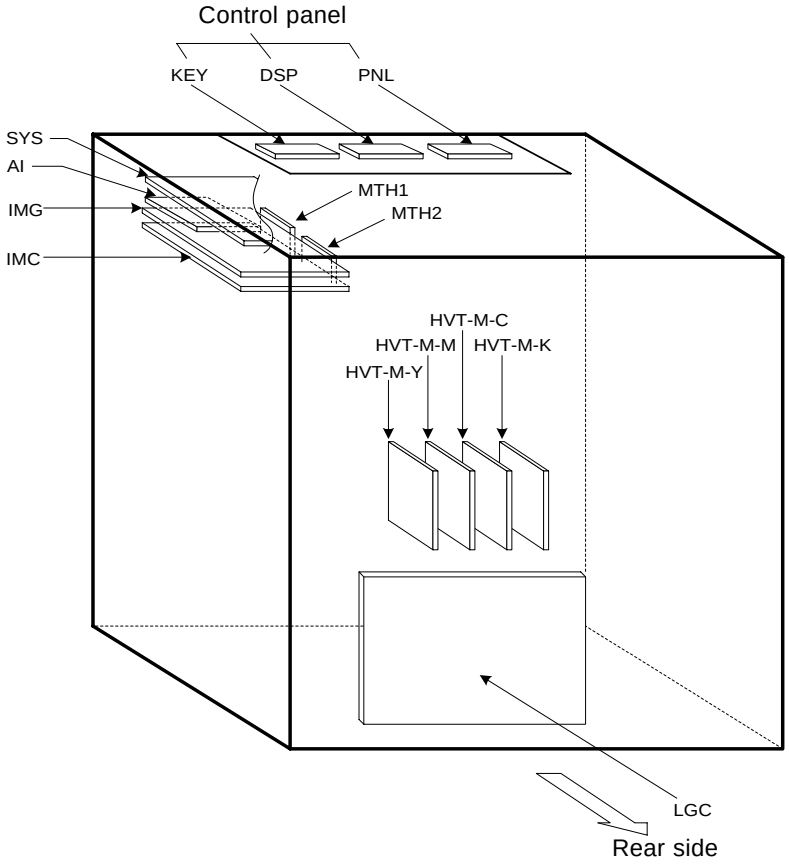
(G-2) Switches, clutches and solenoids



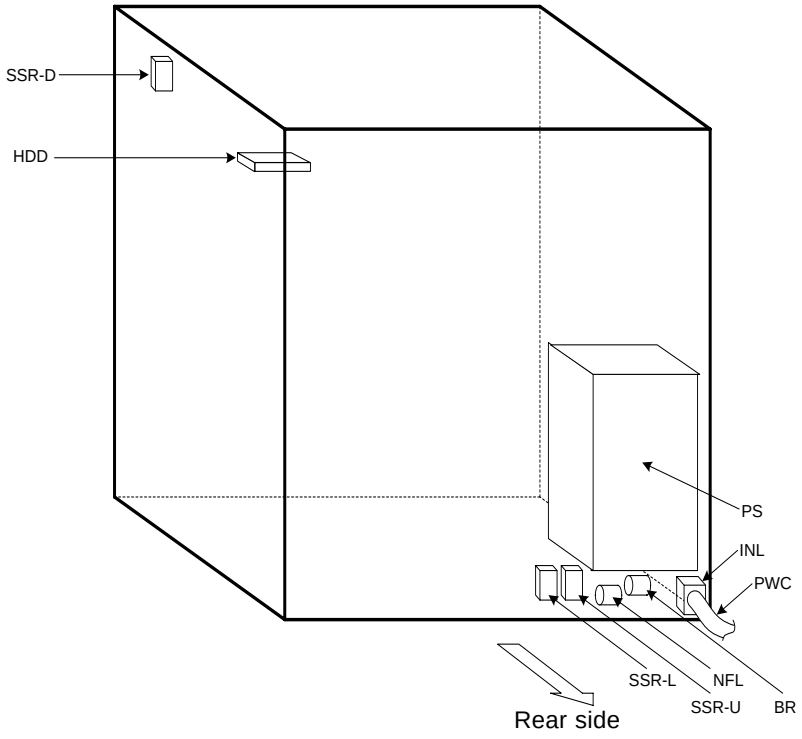
(G-3) Sensors



(G-4) PC boards



(G-5) Others



2.3 Symbols and Functions of Various Devices

The "< P - I >" under the Name column shows the page item of the Parts List.

(1) Motors

Symbol	Name	Function	Remarks
M1	SCN-MOT <P11-I3> Scan motor	Scans the carriages.	(B-1)
M2	DCM-MOT <P12-I7> Document motor	Drives the original-width indicator.	(B-1)
M3	CRG-FAN (Fan, 80 square) <P10-I30> Carriage fan motors	Cool the surroundings of the carriages. (2 pcs.)	(B-1)
M4	SCM-FAN (Fan, 80 square) <P11-I16> SCM fan motor	Cools SCM PC boards.	(B-1)
M5	IN-FAN (Fan, 60 square) <P8-I22> Board unit cooling fan motor	Cools the PC boards (suction).	(G-1)
M6	OUT-FAN (Fan, 60 square) <P29-I24> Board unit cooling fan motor	Cools the PC boards (exhaust).	(G-1)
M7	PU-FAN (Fan, 80 square) <P29-I23> Ozone exhaust fan motor	Exhausts the ozone of copier.	(G-1)
M8	EX-FAN (Fan, 80 square) <P29-I23> Fuser-unit exhaust fan motor	Cools the fuser unit.	(G-1)
M9	POW-FAN (Fan, 80 mm square) Power-unit fan motor <P9-I24>	Cools the power unit.	(G-1)
M10	USTN-MOT <P33-I16> Used toner transport motor	Transports used toner to the toner bag.	(G-1)
M11	POL-MOT <P8-I17> Polygonal motor	Drives the polygonal mirror.	(C-1)
M12	Y-TILT-MOT <P8-I17> Tilt motor Y	Drives the parallel adjustment controls of the laser optical system (Y).	(C-1)
M13	M-TILT-MOT <P8-I17> Tilt motor M	Drives the parallel adjustment controls of the laser optical system (M).	(C-1)
M14	C-TILT-MOT <P8-I17> Tilt motor C	Drives the parallel adjustment controls of the laser optical system (C).	(C-1)
M15	Y-TNR-MOT <P1-I2> Toner motor Y	Supplies toner (Y).	(G-1)
M16	M-TNR-MOT <P1-I2> Toner motor M	Supplies toner (M).	(G-1)
M17	C-TNR-MOT <P1-I2> Toner motor C	Supplies toner (C).	(G-1)

Symbol	Name	Function	Remarks
M18	K-TNR-MOT <P1-I2> Toner motor K	Supplies toner (K).	(G-1)
M19	Y-CLN-MOT <P22-I8> Wire cleaning motor Y	Drives the main charger-wire cleaner (Y).	(D-1)
M20	M-CLN-MOT <P22-I8> Wire cleaning motor M	Drives the main charger wire cleaner (M).	(D-1)
M21	C-CLN-MOT <P22-I8> Wire cleaning motor C	Drives the main charger wire cleaner (C).	(D-1)
M22	K-CLN-MOT <P22-I8> Wire cleaning motor K	Drives the main charger wire cleaner (K).	(D-1)
M23	RGST-MOT <P13-I17> Registration motor	Drives the registration roller	(G-1)
M24	LIFT-MOT <P31-I21> Transfer belt contact/release drive motor	Drives to contact/release the transfer belt to/from the drums Y, M and C.	(E-1)
M25	FED-MOT <P13-I16> Paper feed motor	Drives the paper feed roller and bypass feed roller.	(G-1)
M26	DEV-MOT <P26-I40> Developer motor	Drives the developer unit.	(G-1)
M27	C-DRM-MOT <P26-I39> Color drum motor	Drives the drums (Y,M,C)	(G-1)
M28	K-DRM-MOT <P26-I39> Black drum motor	Drives the drum (K)	(G-1)
M29	TRB-MOT <P29-I22> Transfer belt motor	Drives the fuser unit.	(G-1)
M30	FS-MOT <P29-I18> Fuser motor	Drives the transfer belt.	(G-1)
M31	TR1-MOT <P14-I36> 1st cassette tray-up motor	Drives the 1st cassette tray upward.	(G-1)
M32	TR2-MOT <P14-I36> 2nd cassette tray-up motor	Drives the 2nd cassette tray upward.	(G-1)

(2) Solenoids

Symbol	Name	Function	Remarks
SOL1	EXGAT-SOL <P35-I44> Paper-exit gate solenoid	Drives the ADU/exit switching gate.	(G-2)
SOL2	TLCV-SOL <P4-I34> Image quality sensor shutter solenoid	Drives the shutter for protecting the image quality sensor.	(G-2)

(3) Electromagnetic spring clutches

Symbol	Name	Function	Remarks
CL1	FDPS-CLT <P13-I23> Feed path clutch	Drives the paper feed unit.	(G-2)
CL2-1 CL2-2 CL2-3	CSFD-CLT (for 1st cassette) CSFD-CLT (for 1st cassette) CSFD-CLT (for 2nd cassette) Feed clutch <P14-I24>	Drives the cassette pick-up roller.	(G-2)
CL3	MNFD-CLT <P13-I23> Bypass feed clutch	Drives the bypass pick-up roller.	(G-2)
CL4	PFDCL-F <P15-I28> Pre-feed clutch (front)	Drives the paper feed unit.	(G-2)
CL5	PFDCL-R <P15-I25> Pre-feed clutch (rear)	Drives the paper feed unit.	(G-2)

(4) Switches and thermostats

Symbol	Name	Function	Remarks
SW2-1 SW2-2	CS-SW (for 1st cassette) <P5-I2> CS-SW (for 2nd cassette) Cassette detection switch	Detects if the cassette is set or not.	(G-2)
SW3	UTCV-SW <P2-I5> Side door open/close switch	Detects if the side door is open or not.	(G-2)
SW4	MNCV-SW <P17-I3> Bypass unit open/close switch	Detects if the bypass unit is open or not.	(G-2)
SW5-Y SW5-M SW5-C SW5-K	CLHOM-SW (Y) <P22-I6> CLHOM-SW (M) CLHOM-SW (C) CLHOM-SW (K) Wire cleaner home position switch	Detects the home position of the main charger wire cleaning pad.	(D-2)

Symbol	Name	Function	Remarks
SW6-Y SW6-M SW6-C SW6-K	CLLM-SW (Y) <P22-I11> CLLM-SW (M) CLLM-SW (C) CLLM-SW (K) Wire cleaner limit switch	Detects the limit position of the main charger wire cleaning pad.	(D-2)
SW7-Y SW7-M SW7-C SW7-K	DVCR-SW (Y) <P5-I22> DVCR-SW (M) DVCR-SW (C) DVCR-SW (K) Developer cartridge detection switch	Detects if the developer cartridge is set or not.	(G-2)
SW9	TBUHOM-SW <P31-I35> Transfer belt home position switch	Detects the home position of the transfer belt.	(E-2)
SW10	TBULM-SW <P31-I35> Transfer belt limit switch	Detects the limit when the transfer belt is released from drums Y, M and C.	(E-2)
SW12	EXDR-SW <P35-I19> Paper-exit unit open/close switch	Detects if the paper-exit unit is open or closed.	(G-2)
SW13	FRNCV-SW <P5-I15> Front cover switch (front door switch)	Interlock switch to shut off the AC power when the front cover is open.	(G-2)
SW14	LEFCV-SW <P5-I15> Paper-exit unit switch (left door switch)	Interlock switch to shut off the AC power when the paper-exit unit cover is open.	(G-2)
SW15	MAIN-SW <P5-I1> Main switch	Shuts off the AC power to the copier.	(G-2)
THMO1	THERMO <P31-I33> Thermostat	Turns the drum damp heater ON/OFF.	(E-1)
THMO2	K-THERMO-U-314 (U) <P28-I5> Fuser unit upper thermostat	Prevents the fuser belt (upper heat roller) from over-heating.	[F]
THMO3	THERMO-FU(L) <P27-I9> Fuser unit lower thermostat	Prevents the lower heat roller from over-heating.	[F]

(5) Sensors and thermistors

Symbol	Name	Function	Remarks
APS-1,2,3 APS-C APS-R	APS-1, 2, 3 (3-beam) <P10-I16> APS-C <P10-I3> APS-R <P10-I5> Automatic original detection sensor	Detects the size of original documents. (A4 series)	(B-2)
APS-1 APS-3 APS-C APS-R	APS-1 <P10-I3> APS-3 <P10-I3> APS-C <P11-I18> APS-R <P10-I5> Automatic original detection sensor	Detects the size of original documents. (LT series)	(B-2)
CCD	CCD-SEN <P11-I21> CCD sensor	Reads out information on originals.	(B-3)
SEN1	HP-SEN <P10-I21> Carriage home position sensor	Detects the carriage home position.	(B-2)
SEN2	PLTEN-SEN <P10-I25> Platen sensor	Detects if the platen cover is open or closed.	(B-2)
SEN3-1 SEN3-2	CSPEN-SEN (for 1st cassette) CSPEN-SEN (for 2nd cassette) Cassette paper-empty sensor <P14-I32>	Detects if there is paper in the cassette or not.	(G-3)
SEN4	MNPEN-SEN <P17-I29> Bypass paper sensor	Detects if there is paper in the bypass tray or not.	(G-3)
SEN5-1 SEN5-2	CSLIM-SEN (for 1st cassette) CSLIM-SEN (for 2nd cassette) Cassette tray-up limit sensor <P14-I32>	Detects paper inside the cassette as well as detecting if the cassette tray is at its upper limit.	(G-3)
SEN6-1 SEN6-2 SEN6-3 SEN6-4	CSJAM-SEN (for 1st cassette) CSJAM-SEN (for 2nd cassette) CSJAM-SEN (for 3rd cassette) CSJAM-SEN (for 4th cassette) Cassette-feed jam sensor<P15-I4,P2-I4>	Detects paper misfeeding.	(G-3)
SEN7	OHPC-SEN <P4-I28> OHP sensor	Detects if paper or OHP is set.	(G-3)
SEN8	RGST-SEN <P18-I13> Registration sensor	Detects if paper has reached the registration roller or not.	(G-3)

Symbol	Name	Function	Remarks
SEN9-Y SEN9-M SEN9-C SEN9-K	ATTNR-SEN (Y) <P24-I8> ATTNR-SEN (M) ATTNR-SEN (C) ATTNR-SEN (K) Auto-toner sensor	Detects the toner density.	(D-2)
THM1-Y THM1-K	DRM-THM (Y) <P22-I42> DRM-THM (K) Drum thermistor	Detects the surface temperature of the drum.	(D-2)
THM2	UHEC-THM <P28-I9> Upper thermistor (center)	Detects the surface temperature in the center of the fuser belt.	[F]
THM3	UHEE-THM <P28-I9> Upper thermistor (rear)	Detects the surface temperature at the rear of the fuser belt.	[F]
THM4	LHEC-THM <P27-I10> Lower thermistor (center)	Detects the surface temperature in the center of the lower heat roller.	[F]
THM5	LHEE-THM <P27-I10> Lower thermistor (rear)	Detects the surface temperature at the rear of the lower heat roller.	[F]
SEN12	EXIT-SEN <P35-I24> Exit sensor	Detects paper in the paper exit area.	(G-3)
SEN13	ADUPS-SEN <P34-I15> ADU path sensor	Detects paper in the exit area of the ADU paper transport path.	(G-3)
SEN14	USFUL-SEN <P33-I30> Toner bag limit sensor	Detects if the used toner bag is full as well as detecting if it is set or not.	(G-3)
SEN15	TNLVL-SEN <P4-I35> Image quality sensor	Detects the amount of toner on the patch on the transport belt.	(G-3)
SEN16-F SEN16-R	POS-SEN (front) <P-4-I22> POS-SEN (rear) Color registration sensor	Detects deviation in printed images.	(G-3)
SEN17	T&H-SEN <P1-I19> Temperature/humidity sensor	Detects the temperature and humidity inside the copier.	(G-3)
SEN18	USDSHP-SEN <P7-I23> Developer removal shutter home position sensor	Detects the home position of the developer removal shutters.	(G-1)

(6) Heaters and lamps

Symbol	Name	Function	Remarks
EXP	EXPO-LAMP <P19-I13> Exposure lamp	Exposes the original.	(B-4)
DH1-1 DH1-2	DNP-HTR (for lenses) <P11-I38> DNP-HTR (for mirrors) Damp heater	Prevents condensation in the scanner section.	(B-4)
DH3-1 DH3-2	DNP-HTR (paper feed side) DNP-HTR (paper exit side) Damp heater <P31-I34>	Prevents condensation on the drum surface.	(E-1)
LAMP1	UP-LAMP <P28-I49> Upper heater lamp	Heats the upper heat roller.	[F]
LAMP2	LOW-LAMP <P27-I28> Lower heater lamp	Heats the lower heat roller.	[F]
ERS-Y ERS-M ERS-C ERS-K	ERAS-LED (Y) <P22-I11> ERAS-LED (M) ERAS-LED (C) ERAS-LED (K) Discharge LED array	Removes residual charge on the drum surface.	(D-2)

(7) PC boards

Symbol	Name	Function	Remarks
SYS	PWA-F-SYS-314 <P8-I11> System board (SYS board)	Controls the image compression/expansion, the control panel and the entire system.	(G-4)
IMG	PWA-F-IMG-314 <P8-I9> Image processing board (IMG board)	Controls the image processing.	(G-4)
LDR-Y LDR-M LDR-C LDR-K	PWA-F-LDR-314 (Y) <P8-I17> PWA-F-LDR-314 (M) PWA-F-LDR-314 (C) PWA-F-LDR-314 (K) Laser drive board (LDR board)	Drives the lasers.	(C-2)
OPT	PWA-F-OPT-314 <P8-I17> H-Sync signal detection PC board	Detects the position of laser beams.	(C-2)
MTH1	PWA-F-MTH1-314 <P8-I8> Mother board1	Relays among IMG board, SYS board and IMC board.	(G-4)
MTH2	PWA-F-MTH2-314 <P8-I37> Mother board2	Relays between IMG board and the control.	(G-4)
LGC	PWA-F-LGC-315 (FC-210) PWA-F-LGC-314 (FC-310) Logic board (LGC board) <P9-I16>	General control of the copier.	(G-4)
IMC	PWA-F-IMC-314 <P8-I36> Printer control board (IMC board)	Controls image processing and color registration.	(G-4)
RLY	PWA-F-RLY-314 <P8-I17> Laser relay board (RLY board)	Relays between IMC board and laser drive board.	(C-2)
SCM	PWA-F-SCM-314 <P10-I34> Scanner control board (SCM board)	Controls the scanner section.	(B-3)
CCD	PWA-F-CCD-314 <P11-I21> CCD board	Controls the pre-processing of CCD image data.	(B-3)
SDV	PWA-F-SDV-230 <P10-I36> Scan motor drive board	Controls the scan motor.	(B-3)
DSP PNL KEY	PWA-F-DSP-310 <P3-I23> PWA-F-PNL-310 <P3-I22> PWA-F-KEY-310 <P3-I21> Control panel board	DSP board PNL board KEY board	(G-4)
AI	PWA-F-MAC-511 <P102-I6> AI board	Processes image discrimination.	(G-4)

(8) Transformers

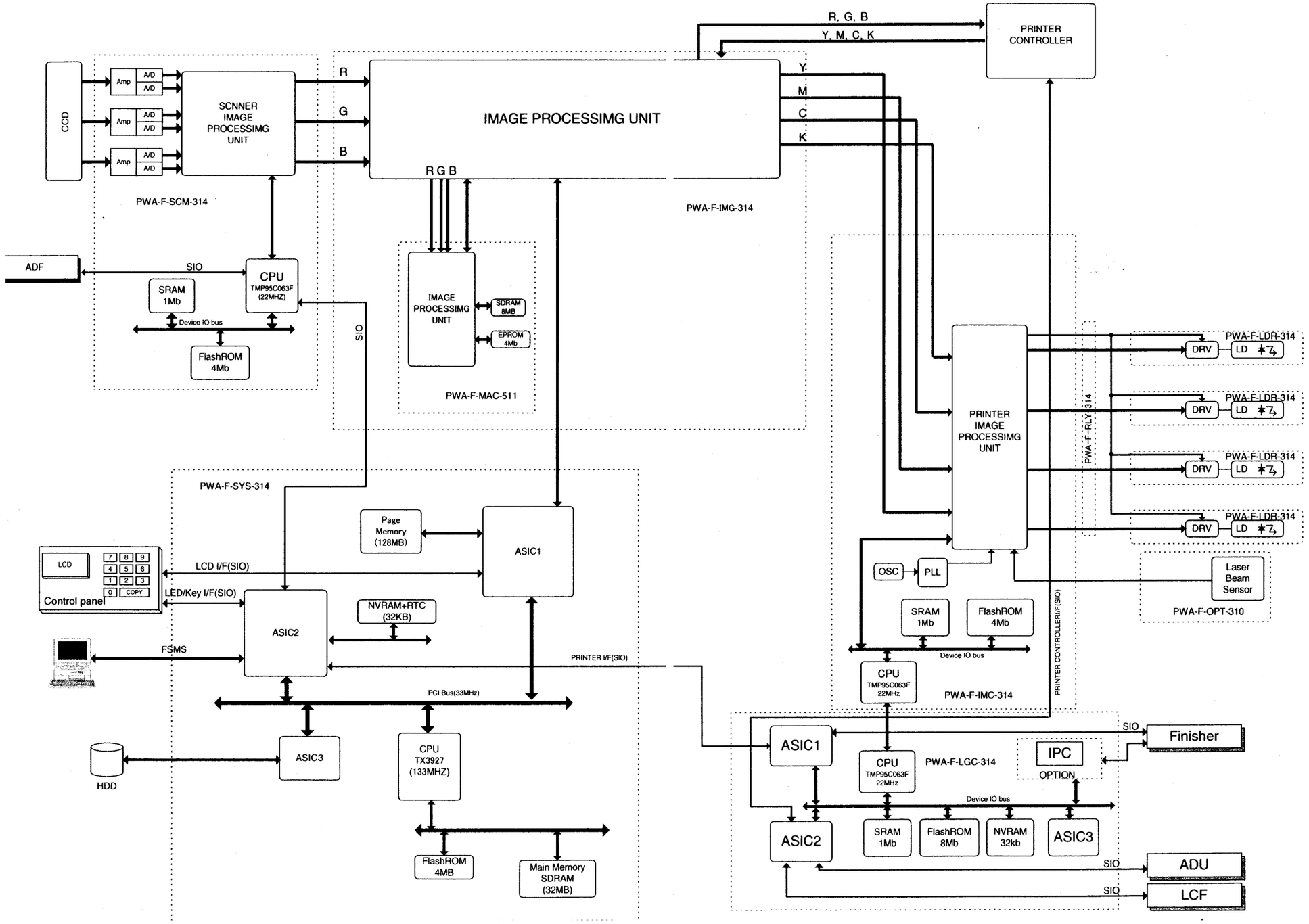
Symbol	Name	Function	Remarks
HVT-M-Y HVT-M-M HVT-M-C HVT-M-K	PS-HVT-M-314S (Y) <P9-I25> PS-HVT-M-314S (M) PS-HVT-M-314S (C) PS-HVT-M-314S (K) Main high-voltage transformer	Produces high voltages for charging, development and discharging.	(G-4)
HVT-TB	PS-HVT-TB-310 <P32-I15> Transfer transformer	Produces high voltages for transfer and suction.	(E-2)

(9) Others

Symbol	Name	Function	Remarks
SSR-U SSR-L	SSR (U) <P9-I2> SSR (L) Solid-state relay	Switches the upper and lower heater lamps ON and OFF.	(G-5)
FUS-SCN FUS-TBU	PWA-F-FUS-351 (SCN) <P11-I46> PWA-F-FUS-351 (TBU) <P31-I32> Fuse PC board	Prevents over-current to damp heaters (scanner section, transfer/transport unit).	(B-4) (E-2)
PS	PS-ACC-310JU (115V series) PS-ACC-310E (200V series) Switching power supply <P9-I24>	Provides electrical power.	(G-5)
NFL	FL-VU-220F (115V series) FILTER-ZSB2210 (200V series) Noise filter <P9-I3>	Cuts off noise.	(G-5)
BR	B-A-0701HM-20 (115v series) B-NRW10-10A-Y (200V series) Breaker <P9-I5>	Safety switch	(G-5)
INL	INLET-AP300-2A2 (200V series) Inlet <P9-I4>	Inlet	(G-5)
PWC	CBL/P-152UC-1 CBL/P-INLET-EUR/UK/AU/JPN Power cable <P9-I11>	Power cable	(G-5)
HDD	HDD <P8-I30> Hard disk drive	Stores the image data.	(G-5)
INV	INV-EXPO-314 <P19-I12> Lamp inverter		(B-4)

2.4 General Description of System

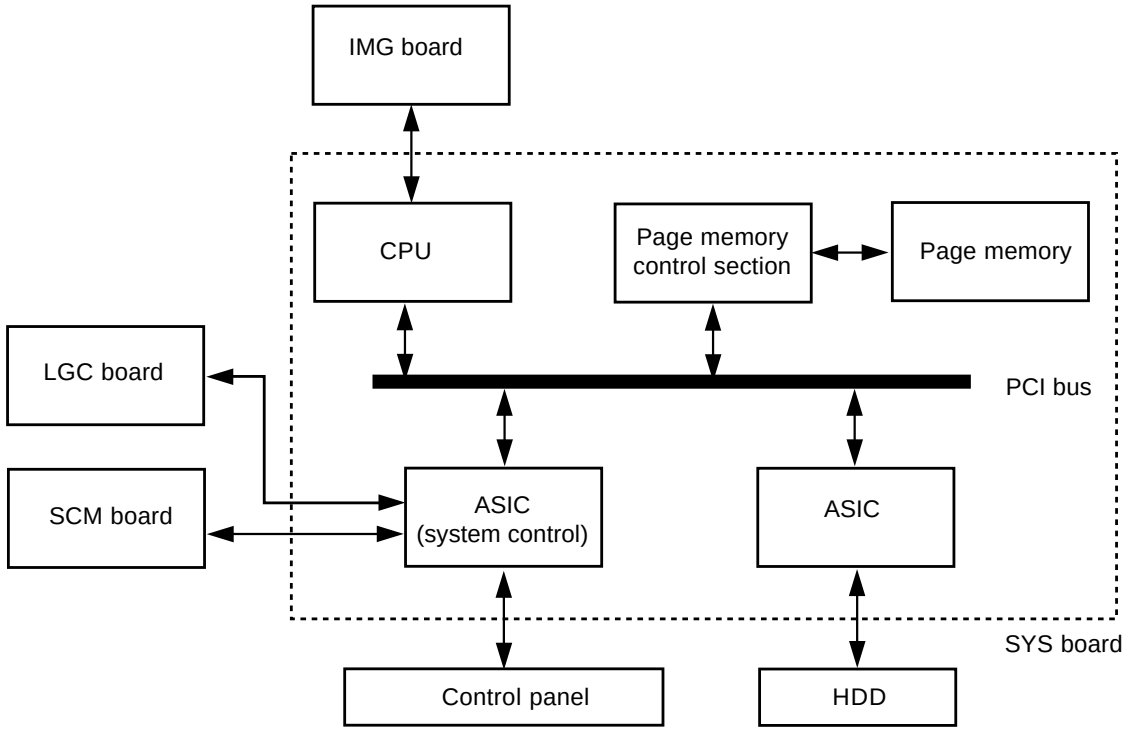
2.4.1 System block diagram



2.4.2 General description

(1) SYS board

The SYS board controls and supervises the whole system. Unlike the FC-22, in this SYS board, the image processing section operates independently while the electronic sorting function is newly added.



(2) CPU functions

The CPU on the SYS board performs the following controls.

1. ASIC control on the IMG board
2. ASIC control for the system control
   - · Communication with the LGC board
   - · Communication with the SCM board
   - · Control of the keys on the control panel
3. Page memory control
4. HDD control

(3) Page memory countrol

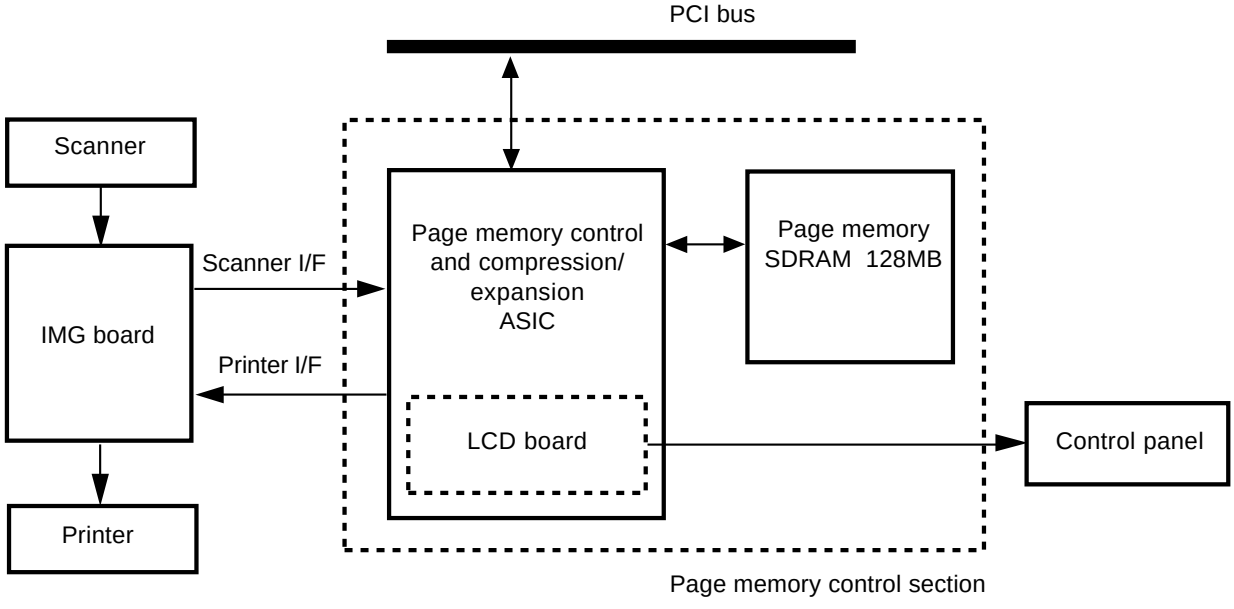
(3-1) General

The image data digitized by the IMG board can be memorized in page units and then be edited such as by rotating pages, changing the page order, etc. and be printed. The basic processings of the memory copying are as follows.

1. Scanner input processing : Writes the digitized data read from the scanner section of the main unit to the page memory.
2. Printer output processing : Outputs the image data on the page memory to the printer output section of the main unit.
3. Compression/Expansion processing : Performs the compression processing against the image data when writing the data to the page memory in the scanner input processing and performs the expansion processing against the image data when outputting the page memory in the printer output processing.

By the time-shared system, the above processings can be operated simultaneously. With the combination of these processings, functions such as electronic sorting can aslo be realized.

(3-2) Construction overview



(3-3) Interfaces

1. Scanner interface

By the external interface of the image processing section in the main unit, the digital signal data read from the scanner section is fetched and then kept in the page memory.

2. Printer interface

By the external interface of the image processing section in the main unit, the image data on the page memory is output to the laser related control section of the printer section.

(3-4) Page memory

1. Memory

A 128M-byte memory which consists of eight 128M-bite SD-RAM is mounted on the page memory.

2. Page memory control ASIC

a) Address control

Under the conditions below, an address is generated on the page memory.

· when the digital image data is written to the page memory

· when the digital image data on the page memory is read

b) Data control

· Controls the data bus of the page memory.

· Controls the image data transmission between the compression/expansion blocks inside the ASIC and the page memory.

· Processes the editing jobs such as composing the image data from the page memory and that read from the scanner section of the main unit and writing the data into the page memory.

c) Rotating/Composing control

· Through the scanner interface and the printer interface, receives and keeps the image data transmitted between the main unit and the page memory.

· When processing the page rotating, changes the order of the data on the page memory.

d) Compression/Expansion control

· Compresses the image data on the page memory and produces the signal data.

· Expands the compressed signal data on the page memory and restores the image data.

e) LCD control

· Displays the screen data saved on the page memory on the control panel.

2.5 Removal and Reinstallation of Covers, PC Boards and Roms

2.5.1 Removal and reinstallation of covers

[A] Right front cover

(1) Open the right front cover.

(2) Lift up 2 L-shaped pins out from the hinges.

[B] Left front cover

(1) Open the left front cover.

(2) Lift up 2 L-shaped pins out from the hinges.

[C] Middle inner cover

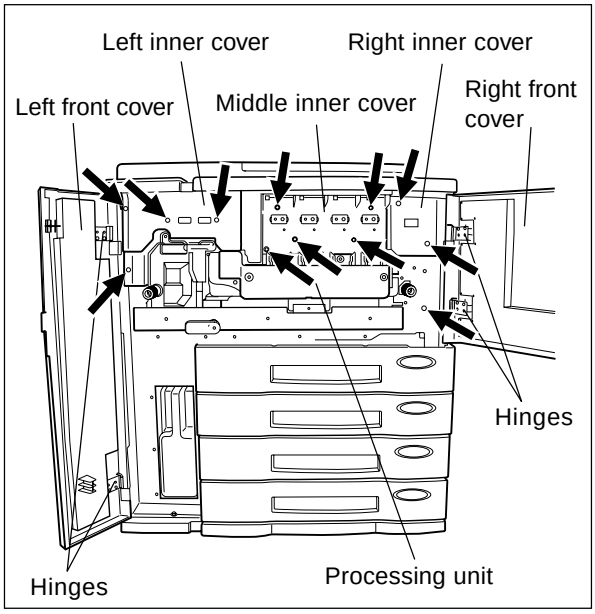
(1) Draw out the processing unit.

(2) Remove the middle inner cover (5 screws).

[D] Right inner cover

(1) Remove the right inner cover (3 screws).

(2) Disconnect the connector of the temperature/ humidity sensor.



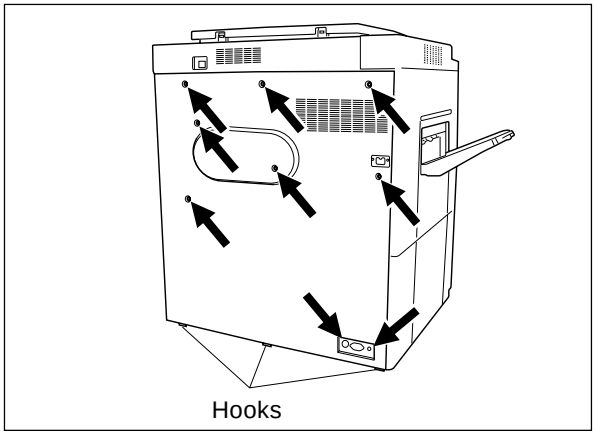
[E] Left inner cover

(1) Remove the left inner cover (4 screws).

[F] Rear cover

(1) Unscrew 9 screws.

(2) Unlock the lower 3 hooks and remove the rear cover.



[G] Feed-side upper cover

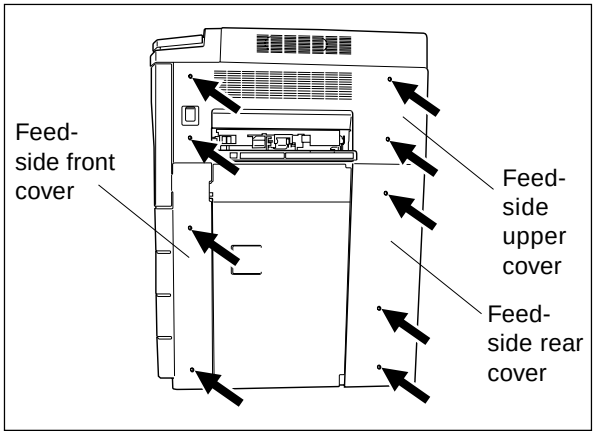
(1) Open the bypass unit.

(2) Remove the feed-side upper cover (4 screws).

[H] Feed-side front and rear covers.

(1) Remove the feed-side front cover (2 screws).

(2) Remove the feed-side rear cover (3 screws).

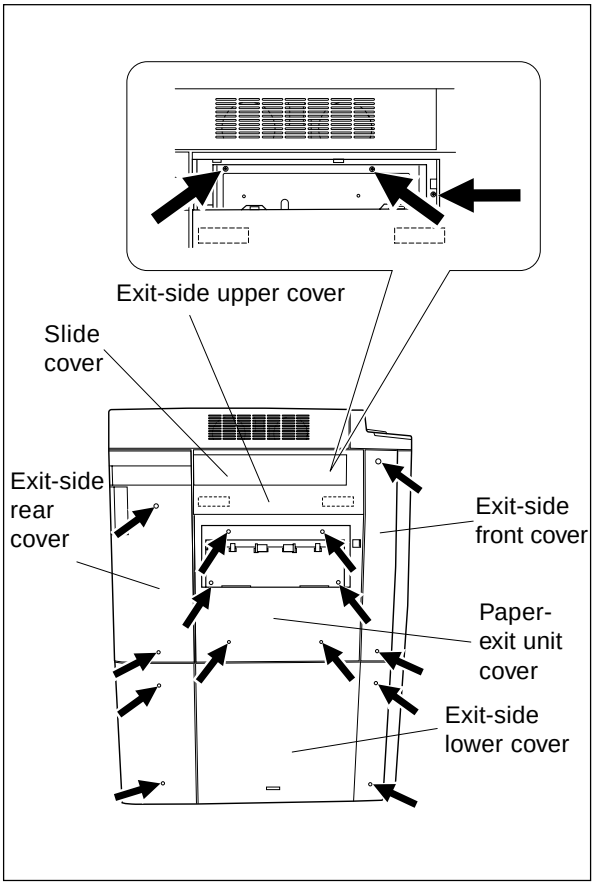


[I] Exit-side upper cover

(1) Shift the slide cover toward the rear to remove it.
(2) Unscrew 3 screws and remove the exit-side upper cover.

[J] Exit-side lower cover, front cover and rear cover, and paper-exit unit cover

(1) Remove the exit-side lower cover (4 screws).
(2) Remove the exit-side front cover (2 screws).
(3) Remove the exit-side rear cover (2 screws).
(4) Remove the paper-exit unit cover (6 screws).



[K] Right top cover

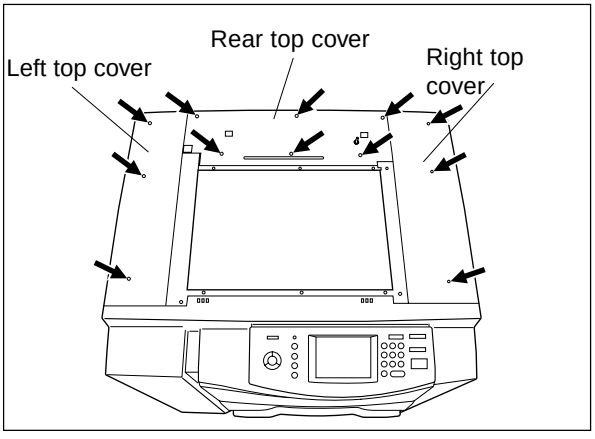
(1) Remove the right top cover (3 screws).

[L] Rear top cover

(1) Remove the rear top cover (6 screws).

[M] Left top cover

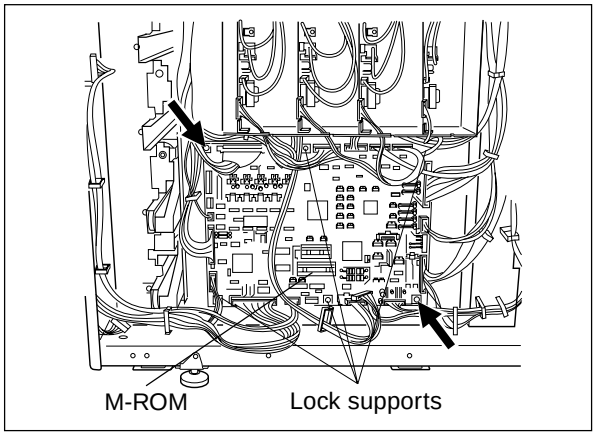
(1) Remove the left top cover (3 screws).



2.5.2 Removal of PC boards and ROMs

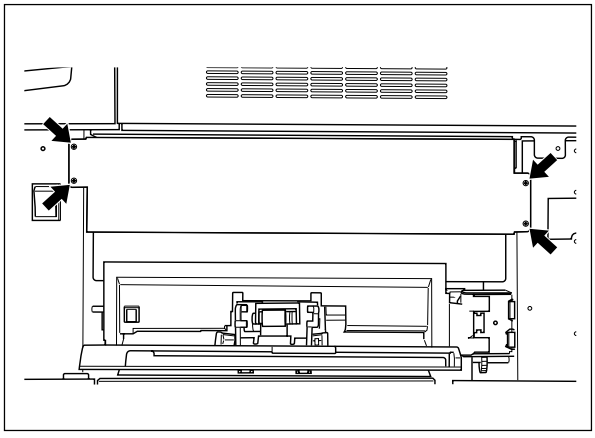
[A] LGC board

(1) Remove the rear cover.
(2) Disconnect 24 connectors.
(3) Detach the M-ROM on the LGC board.
(4) Unscrew 2 screws, remove 4 lock supports and take out the LGC board.

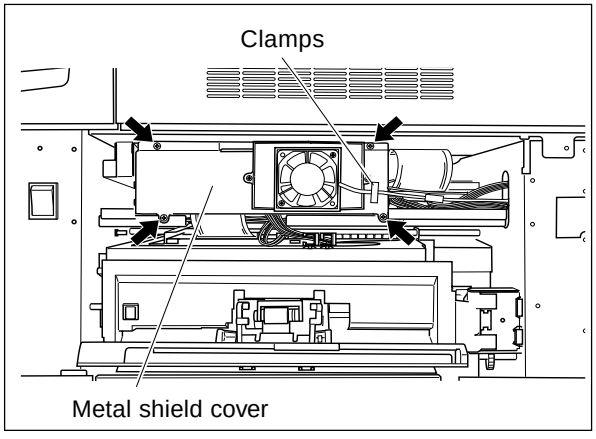


[B] SYS board/IMG board/IMC- board, Hard disk

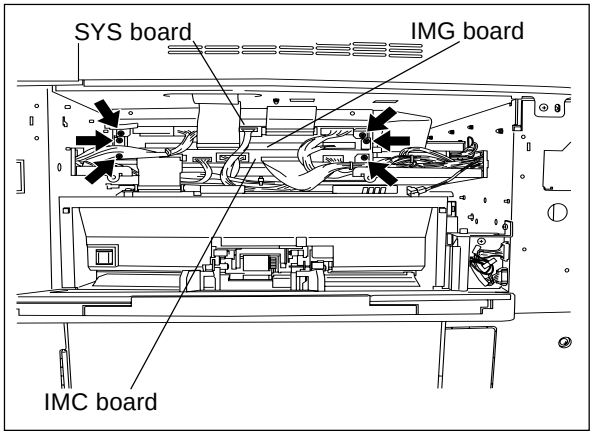
(1) Remove the feed-side upper cover and feed-side upper inner cover (4 screws).



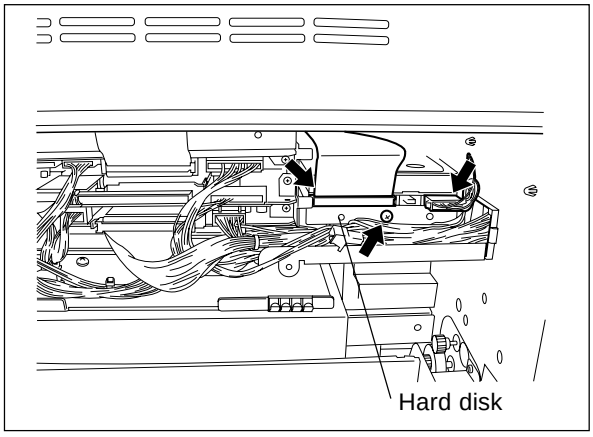
(2) Disengage the harness from the clamp.
(3) Disconnect the connector from the fan.
(4) Remove the metal shield cover (4 screws).



(5) Disconnect 2 connectors of the SYS board, unscrew 2 screws and take out the SYS board.
(6) Disconnect 5 connectors of the IMG board, unscrew 2 screws and take out the IMG board.
(7) Disconnect 5 connectors of the IMC board, unscrew 2 screws and take out the IMC board.



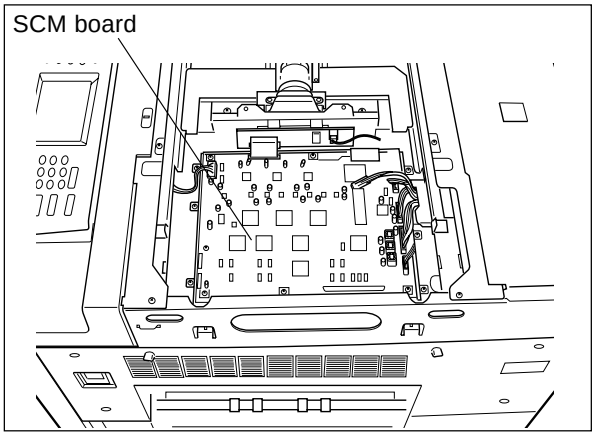
(8) Disconnect 2 connectors of the hard disk, unscrew 1 screw and take out the hard disk.



[C] SCM board (Scanner Control Board)

(1) Remove the glass retainer (2 screws).
(2) Remove the original glass.
(3) Remove the right top cover (3 screws).
(4) Remove the right top bracket (3 screws).
(5) Remove the lens cover (9 screws and 2 connectors).
(6) Detach the SCM board by disconnecting 6 connectors and unscrewing 4 screws.

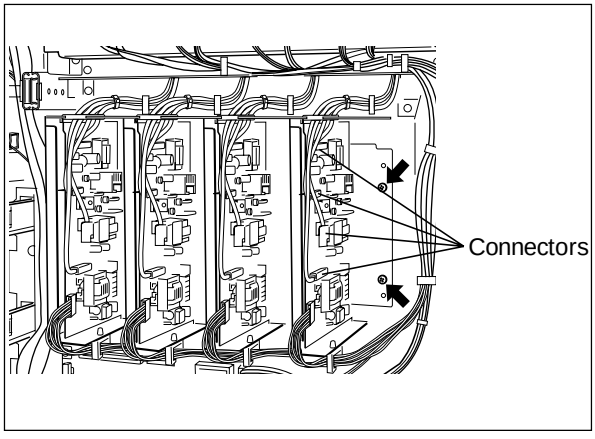
* See Chapter 9 for the details of above steps (1) to (5).



[D] Main high-voltage transformer

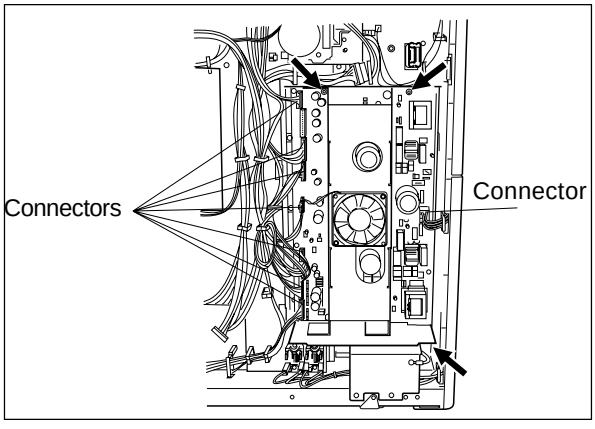
(1) Remove the rear cover.
(2) Disconnect 5 connectors.
(3) Unscrew 2 screws and remove the main high-voltage transformer together with its bracket.
(4) Remove 2 screws and 2 lock supports and take out the main high-voltage transformer.

* All 4 transformers should be removed using the same procedure.



[E] Switching power supply

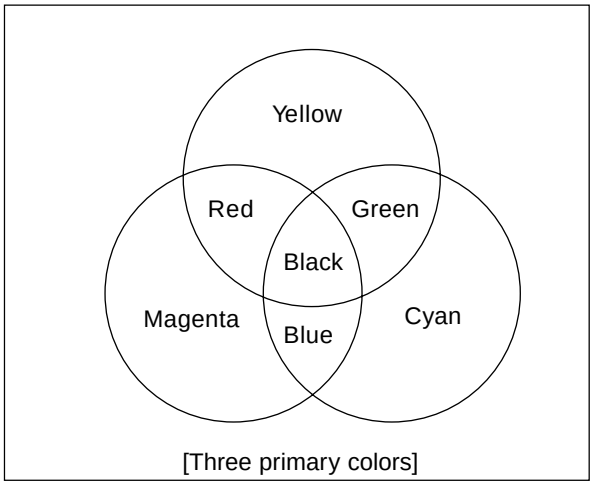
(1) Remove the rear cover.
(2) Disconnect 11 connectors.
(3) Unscrew 3 screws.
(4) Take out the switching power supply.



3. COPY PROCESS

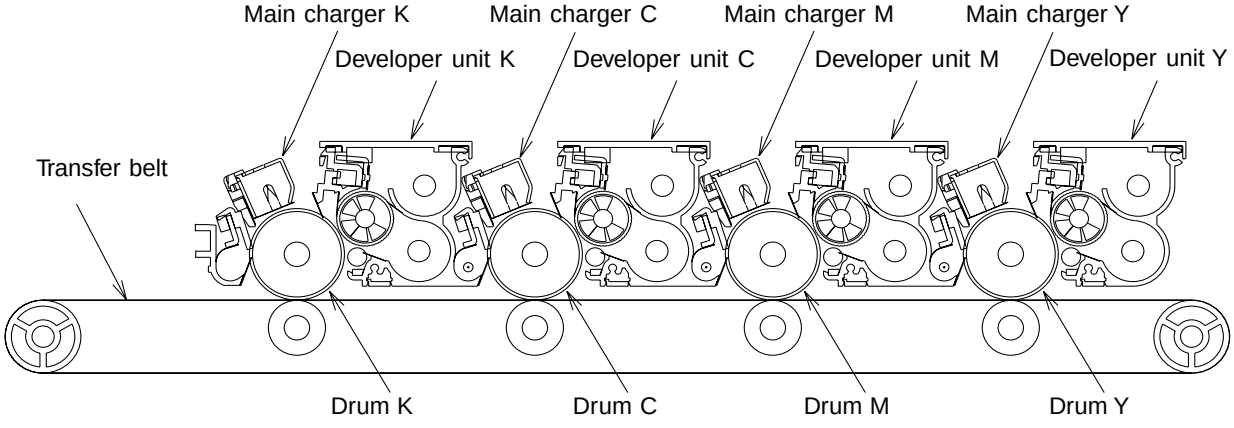
3.1 Expression of Colors and 4-Step Copy Process

A variety of colors can be expressed by mixing the three primary colors : Yellow, magenta and cyan.
Red can be created by mixing yellow and magenta; blue can be created by mixing magenta and cyan; green is created by mixing cyan and yellow; and mixing all the three primary colors allows you to obtain black.

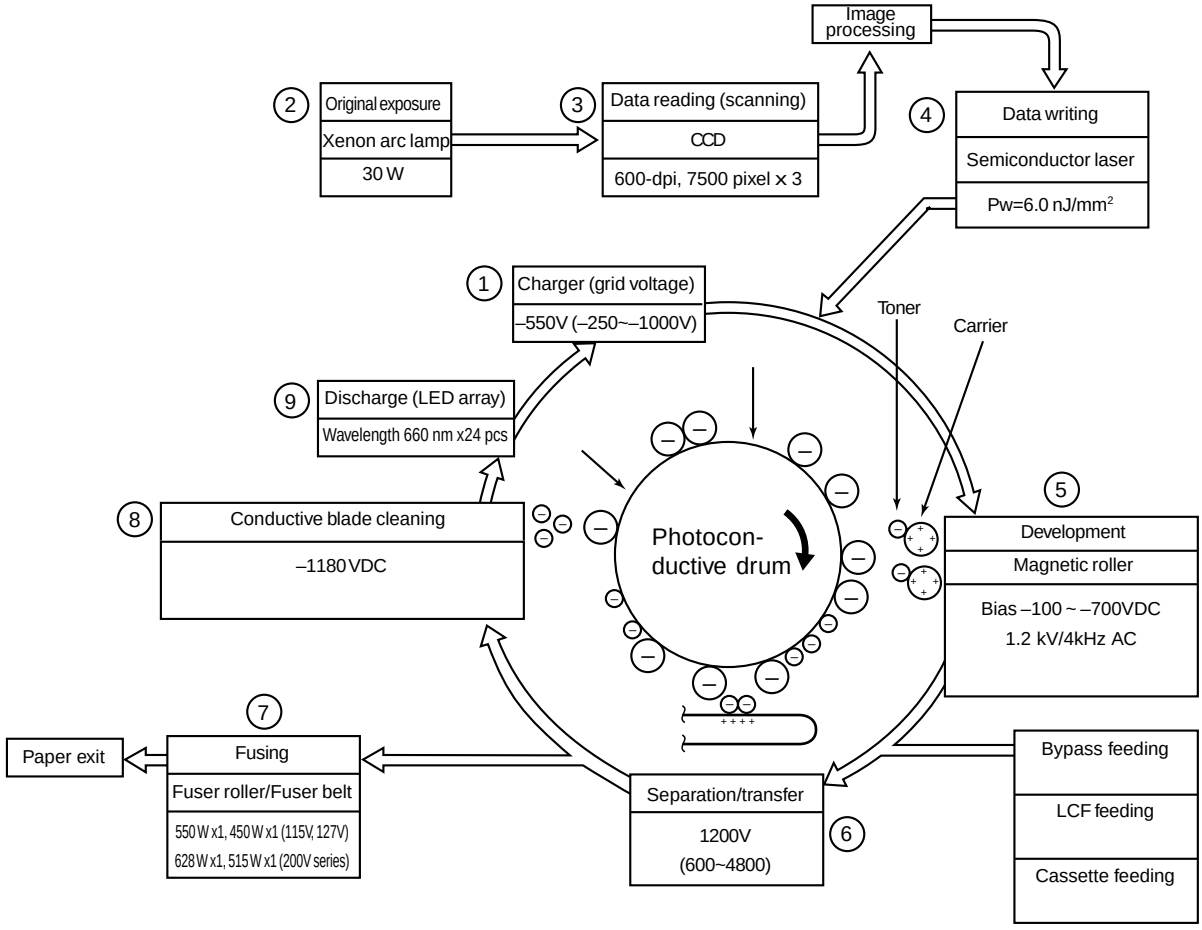


[Three primary colors]

With color copiers, a variety of colors are accomplished by mixing toners of the above three colors at proper ratios.
However, there are no coloring agents available which exhibit ideal characteristics, so if you mix all the three colors made of available coloring agents, you cannot obtain a suitable black color. To improve the reproduction of black color, black toner is added to the mixture of the three colors.
On this model, a 4-step copy process is employed to realize the color expression described above. In the 4-step copy process, four sets of the drum, developer unit, main charger, etc., corresponding to the four colors of yellow, magenta, cyan and black, are horizontally arranged along the paper path. Paper is passed through these units to allow the four colors to be overlaid for the appropriate expressions of colors.



3.2 General Description of Copying Process



1. Charging: Places a negative charge on the surface of the photoconductive drum.

↓

2. Original exposure: Converts images on the original into optical signals.

↓

3. Data reading: The optical image signals are read into CCD and converted into electrical signals.

↓

4. Data writing: The electrical image signals are changed to light signals (by laser emission) which expose the surface of the photoconductive drum.

↓

5. Development: Negatively-charged toner is made to adhere to the photoconductive drum, producing a visible image.

↓

6. Transfer/separation: Transfers the visible toner image onto paper, and separates the paper with the toner image from the photoconductive drum.

↓

7. Fusing: Fuses the toner image to the paper by applying heat and pressure.

↓

8. Conductive blade cleaning : While scraping off the residual toner from the drum, this blade also eliminates the (+) residual charge on the drum left after image transfer.

↓

9. Discharging: Eliminates the residual (–) charge from the surface of the photoconductive drum.

3.3 Details of Copying Process

(1) Photoconductive drum

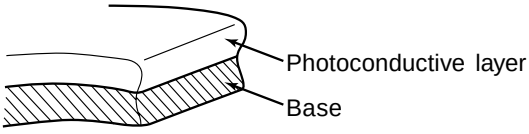
The photoconductive drum consists of two layers. The outer layer is a photoconductive layer made of an organic photoconductive carrier (OPC), and the inner layer is an aluminum conductive base in a cylindrical form.

The photoconductive carrier has a special property: when it is exposed to light, the electrical resistance it possesses increases or decreases with the strength of the light.

Example:

· Strong incident light→
  Decreases resistance (works as a conductor.)

· Weak incident light→
  Increases resistance (works as an insulator.)

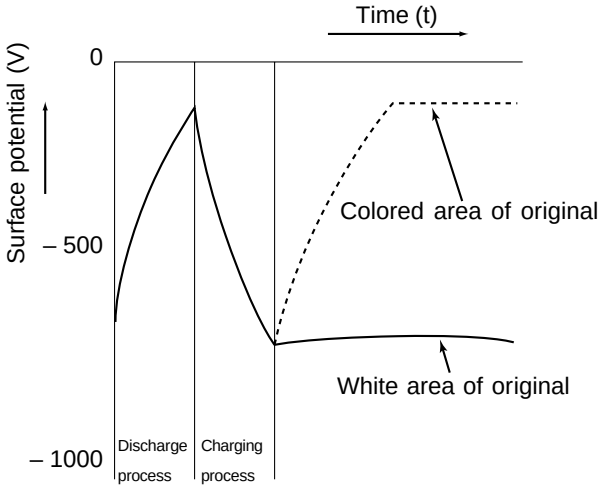


Structure of the photoconductive drum
(Example of OPC)

[Formation of electrostatic latent images]

In the processes of charging, data reading, data writing, discharging described below, the areas on the drum corresponding to colored areas on the original are deprived of negative charge, while the areas on the drum corresponding to white areas retain the negative charge, thus forming a negative charge image on the drum surface.

As this negative charge image on the drum is not visible to the human eye, it is called an “electrostatic latent image.”



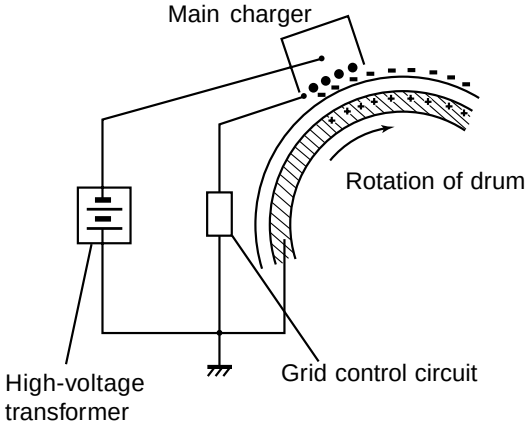
Electric potential of the photoconductive drum

(2) Charging

Charging is a process to apply some charge uniformly to the drum surface.

The charger wire produces negative corona discharge, which is controlled by the grid so that the drum surface is uniformly charged with negative potential.

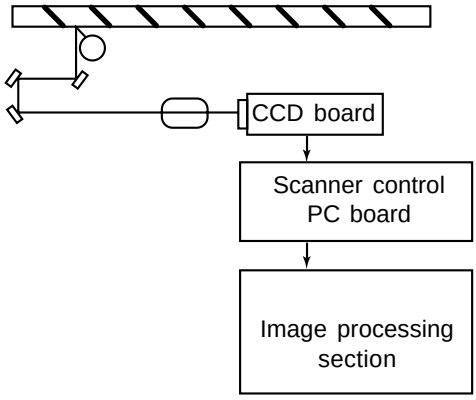
The surface potential on the drum is determined by the grid potential and is controlled to a fixed value by the grid control circuit.



(3) Data reading (scanning)

Data reading is the process of illuminating the original with light and converting the reflected light into electrical signals.

The light reflected from the original is directed to the charge coupled device (CCD) and this optical image information is converted to electrical signals (image signals), which are then sent to the image processing section via the scanner control PC board. The CCD for color processing has RGB filters provided over its surface, which allow the CCD to read the light amount in the respective ranges of wavelength. The image data corresponding to the respective RGB colors is then sent to the image processing section.



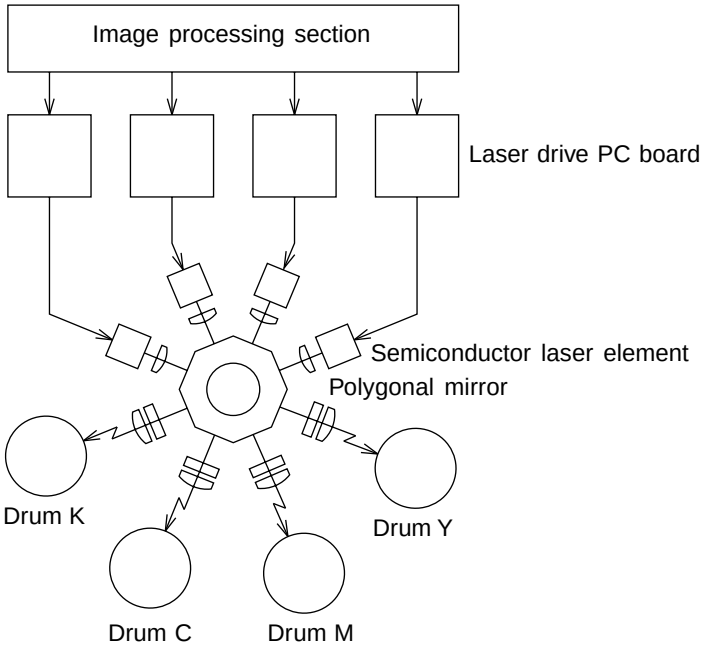
(Example)

CCD light receiving amount	Value of image signals to be output
Light	255
	Difference between "light " and "dark" is divided into 256 steps.
Dark	0

(4) Data writing

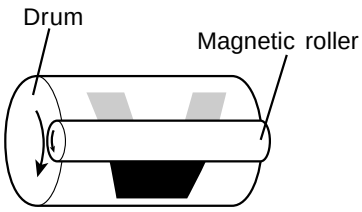
Data writing is the process of converting the image signals sent from the image processing section into light signals and exposing the drum surface with the light signal.

Namely, the image signals sent from the image processing section are converted into optical signals (laser emission) by the semiconductor laser element, which are then used to expose the drum surface, thus forming an electrostatic latent image there.

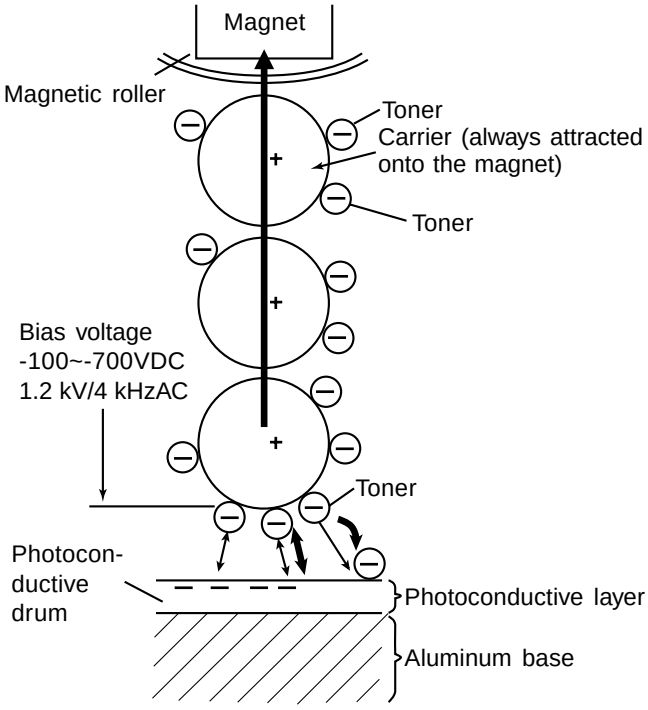


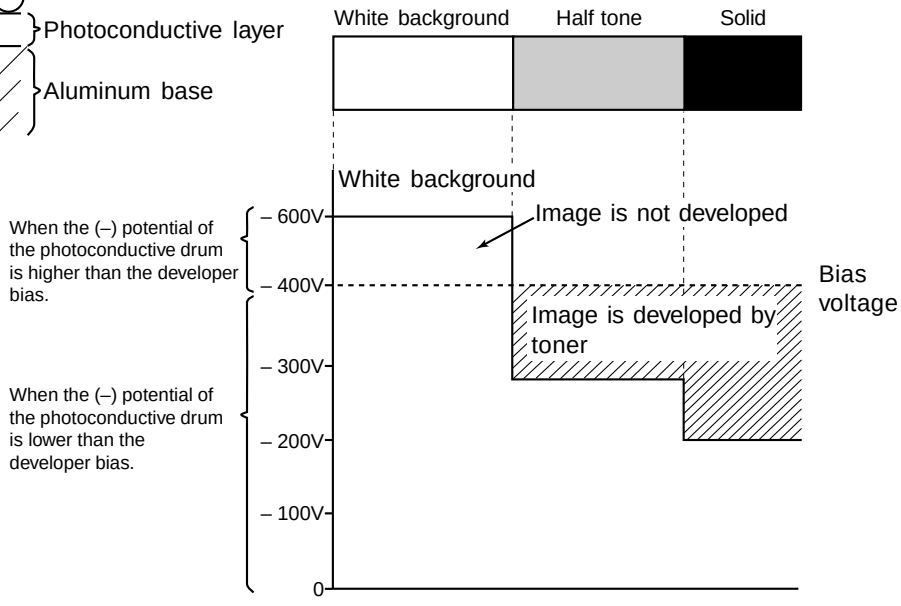
(5) Development

Development is the process of making the electrostatic latent images visible to the eye (visible image).



Developer material is supplied to the photoconductive drum surface by means of a magnetic roller, allowing the toner in the developer material to adhere to the areas on the drum surface where the potential is lower than the developer bias which is applied to the magnetic roller (reverse development).



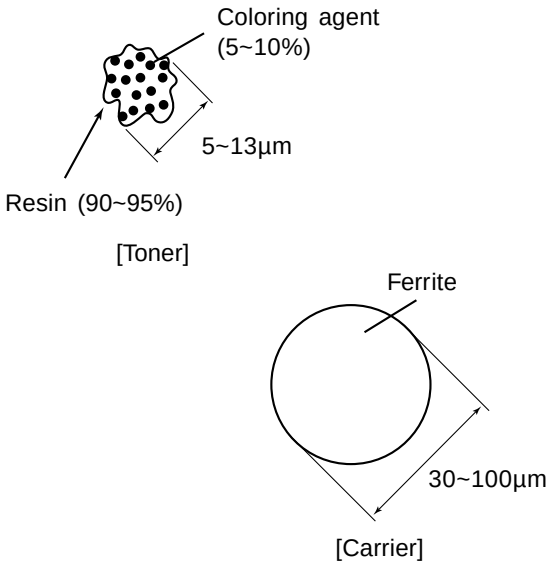


• About developer material

The developer material is comprised of a mixture of toner and carrier. The toner is charged to a negative polarity and the carrier to a positive polarity, due to the friction with each other caused by mixing.

Toner : Mainly consists of resin and coloring.

Carrier : Consists of ferrite, and over its surface resin coating to provide consistent frictional electrification.



Note:

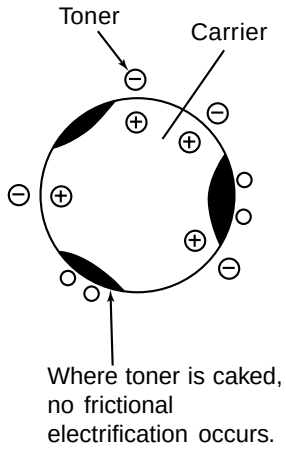
If the developer material is used for long periods of time (beyond its normal life span), toner will become caked onto the carrier.

↓

The carrier's (charging) performance is lowered.

Result: 1. Image density is lowered.
2. Toner scattering occurs.
3. Background fogging occurs.

Solution: Replace the developer material.



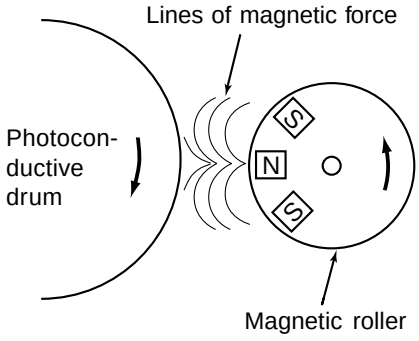
• Magnetic roller

- Magnetic brush development technique-

Inside magnetic rollers, the south and north poles are arranged as shown in the right figure. The developer material forms a brush-like fluff which contacts the photoconductive drum surface.

↓

This is caused by the lines of magnetic force between the south and north poles.



(6) Transfer/separation

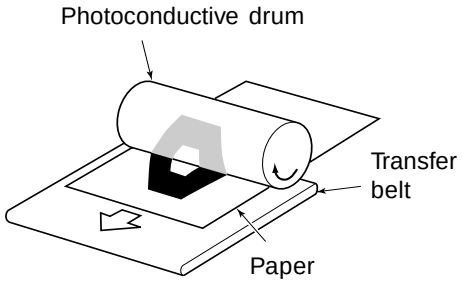
- Transfer is the process of transcribing the toner image (visible image) formed on the photoconductive drum to the copy paper.

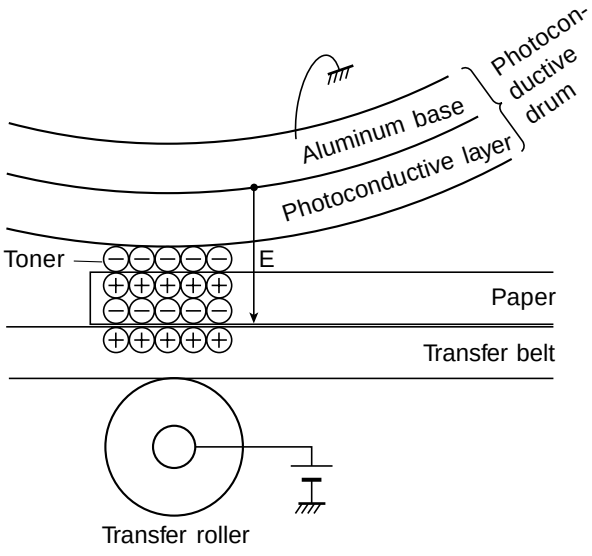
1. Transfer process

A positive bias is applied to the transfer roller, causing the transfer belt to be positively charged. This in turn helps to form an electric field E between the transfer belt (positive) and the aluminum base of the photoconductive drum (grounded), thereby making the paper electrostatically polarized, as shown in the figure.

An electrostatic attracting force occurs between the polarized charge (positive) on the upper surface of the paper and the toner (negative) on the photoconductive drum, thus making the toner image transferred to the paper.

In the 4-step copy process of this model, images are transferred, in the order of Y→M→C→K, onto the paper which is transported on the transfer belt.





2. Separation process

An electrostatic force occurs between the polarized charge (negative) on the underside of the paper and the transfer belt (positive), allowing the paper to be attracted to the belt and separated from the photoconductive drum.

(7) Fusing process

Fusing is a process of melting the toner on the paper and fixing it firmly onto the paper.

Method : The melting point of the toner (main component : resin) is 100~110^{0}C.

↓

(Heat) Toner is melted by the heat emitted from the surfaces of the heat roller and the fuser belt.

+

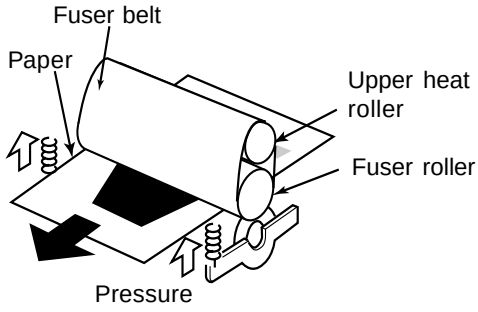
(Pressure) The lower heat roller is pressed against the fuser belt by the springs to increase adherence of the melted toner to the paper.

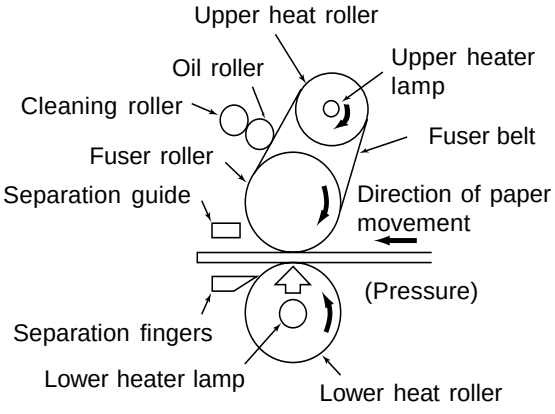
↓

The paper is subjected to the heat and pressure when passing through the lower heat roller and the fuser belt.

||

(Fusing) The toner on the paper is fused to it.



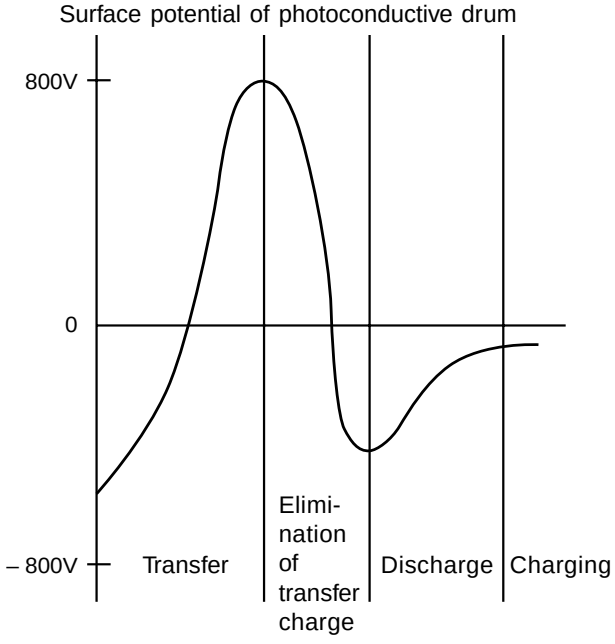


(8) Conductive blade cleaning

While eliminating the (+) charge on the photoconductive drum applied during the transfer stage, the conductive blade recovers the toner left on the drum at the same time.

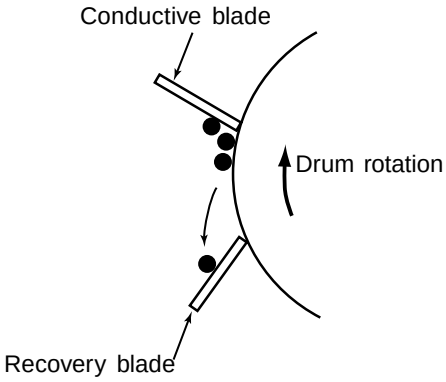
• Elimination of transfer charge

With this OPC photoconductive drum, (+) charge on their surface cannot be eliminated optically. Therefore, (–) voltage is applied to the conductive blade, which is pressed against the drum, to eliminate the (+) charge applied at the transfer stage.



• Cleaning

The edge of the conductive blade is pressed against the photoconductive drum surface to scrape off residual toner from it. The toner thus removed is then caught by the recovery blade.



(9) Discharging process

Discharging is the process of eliminating the (–) charge remaining on the photoconductive drum before the next charging process.

If the charge remaining on the photoconductive drum is not eliminated, the following phenomena would occur:

(–) charge remaining on the photoconductive drum surface causes uneven application of the charge for the next copying.

↓

The next copy will have a double image. (The preceding image will also be copied.)

To prevent this :

The entire surface of the photoconductive drum is flooded with light by the discharge LED array.

↓

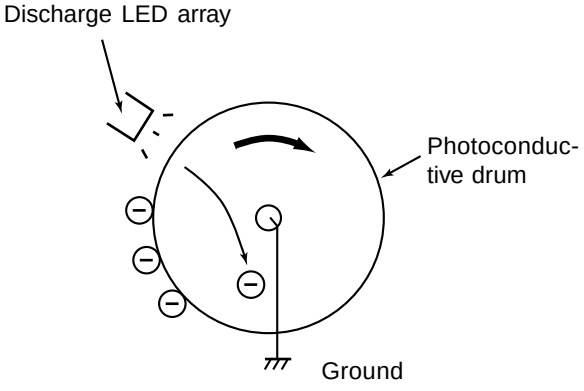
The photoconductive drum becomes electrically conductive.

↓

All of the (–) charge remaining on the photoconductive drum is conducted away to ground (However, (+) charge is eliminated by the conductive blade as mentioned in (8)).

↓

Preparation for the next copying process is completed.



3.4 List of Copying Process Conditions

Process	FC-22	FC-210/310
1. Photoconductive drum (1) Sensitivity (2) Surface potential	OD-FC22 (OPC drum) (1) Highly sensitized drum (2) -550 V (grid voltage -600 V) Scolotron method	OD-FC31 (OPC drum) (1) Same as FC-22 (2) Same as FC-22
2. Charging	-250~-1000V (grid voltage) (adjusting by image quality control)	Same as FC-22
3. Data writing (1) Light source (2) Light amount	 (1) Semiconductor laser (adjustment not required) (2) 10.4 nJ/mm^2	 (1) Same as FC-22 (2) 6.0 nJ/mm^2
4. Image control	Image quality control by sensoring toner adhesion amount	Same as FC-22
5. Development (1) Magnetic roller (2) Auto-toner detection (3) Toner supply (4) Toner-empty detection (5) Toner (6) Developer material (7) Developer bias	 (1) One magnetic roller (2) Magnetic bridge-circuit method (3) Toner cartridge replacing method (4) Density detection method (5) T-FC22-K(black), T-FC22-Y(yellow) T-FC22-M(magenta), T-FC22-C(cyan) T-FC22E-K (black), T-FC22E-Y (yellow) T-FC22E-M (magenta) , T-FC22E-C (cyan) (6) D-FC22-K(black), D-FC22-Y(yellow), D-FC22-M(magenta), D-FC22-C(cyan) (7) DC-100 ~ -700V (adjusting by image quality control) AC 1.2 kV/4 kHz	 (1) Same as FC-22 (2) Same as FC-22 (3) Same as FC-22 (4) Same as FC-22 (5) T-FC31-K(black), T-FC31-Y(yellow) T-FC31-M(magenta), T-FC31-C(cyan) T-FC31E-K (black), T-FC31E-Y (yellow) T-FC31E-M (magenta) , T-FC31E-C (cyan) (6) D-FC31-K(black), D-FC31-Y(yellow), D-FC31-M(magenta), D-FC31-C(cyan) (7) Same as FC-22
6. Transfer	Transfer belt method	Same as FC-22
7. Separation	Separation by electrostatic attraction of the transfer belt	Same as FC-22
8. Cleaning (1) Method (2) Recovered toner (3) Transfer charge removal	 (1) Blade cleaning (2) Non-reusable (3) Simultaneous cleaning and discharging by the conductive blade	 (1) Same as FC-22 (2) Same as FC-22 (3) Same as FC-22
9. Discharge	LED array (red)	Same as FC-22

Processs	FC-22	FC-210/310
10. Fusing (1) Method	(1) Long-life fuser roller system • Upper fuser roller: PFA tube roller (ø60) (Lamp rating : 500W (115V, 127V), 570W (200V series)) • Lower fuser roller: PFA tube roller (ø60) (Lamp rating : 400W (115V, 127V), 460W (200V series))	(1) Belt fusing system • Upper heat roller: metal tube roller (ø30) (Lamp rating: 550W (115V, 127V), 628W (200V series)) • Fuser roller: Silicone sponge roller (ø38) • Lower heat roller: PFA tube roller (ø40) (Lamp rating : 450W (115V, 127V), 515W (200V series)) • Fuser belt :PFA tube belt (ø70)
(2) Cleaning	(2) Oil roller method • Upper oil roller (ø22) • Upper cleaning roller (ø21) • Lower oil roller (ø18) • Lower cleaning roller (ø16)	(2) Oil roller method • Oil roller (ø22) • Cleaning roller (ø21)
(3) Heat roller temperature control	(3) ON/OFF control by thermistor (upper/lower roller independent temperature control)	(3) Same as FC-22
11. System Control	Microcomputer control	Same as FC-22
12. Drive system	Units are controlled independently by separate DC motors.	Same as FC-22

4. GENERAL OPERATION

4. 1 Overview of Operation

- Copier operation
  - Operation during warming-up, pre-running and standby
  - Copy operation
    - Automatic paper feed copying with the START key
    - Bypass paper feed copying
    - Interrupt copying

4. 2 Description of Operation

4. 2. 1 Warming-up

(1) Initializing operation

- Power ON
- Fuser lamp ON
- “WAIT WARMING UP” displayed.
- Fan motors ON
- Initializing of the scanner system:
  ~ The carriage moves to and stops at its home position.
  ~ The carriage moves to the peak detection position.
  ~ The exposure lamp ON~Peak detection (white color detection based on the shading correction plate)
  ~The exposure lamp OFF.
  ~ The original size indicator initializes, then displays the original size.
- Initialization of the paper feeding system:
  ~ The tray of each cassette rises.
  ~ The guides of the ADU (automatic duplexing unit) detect their home positions, then move to their maximum-size position.
- Initialization of the laser optical system:
  ~ The polygonal motor rotates.
- EPU initialization:
  ~ The main charger wire cleaners operate.
- Drum rotation:
  ~ When the execution of toner supply control, image quality control or color registration control is requested → drum motors ON, transfer belt motor ON and developer motor ON.
- Toner supply control:
  ~ If the toner density in any developer unit is lower than specified, the toner supply mode starts.
- Image quality control:
  ~ The heat roller performs image quality control operation at a specified temperature. Based on the reflection factors of the test patterns formed on the transfer belt, the optimal conditions are set.

- Color registration control:
  ~ The heat roller performs color registration control operation at a specified temperature. Test patterns are formed on the transfer belt and their signals are read to detect if toner is present or not. This information is used to correct registrational deviation of each color.

(2) Pre-running operation

When the heat roller reaches a certain temperature, pre-running operation is performed. (If the heat roller is already warm enough, this operation does not take place.)

- The heat roller rotates.

(3) When the heat roller reaches a temperature capable of fusing:

- Heater lamp OFF
- "READY" displayed.

4. 2. 2 Standby state (ready for copying)

- All keys on the control panel are operable.
- If no key is pressed for a certain period of time:
  ~Copy counter "1", reproduction ratio "100%" and other defaults are set.
- After the warming-up has ended and a given time has passed:
  ~Color registration control

4. 2. 3 Cassette feed copying

(1) START key ON

- Display: "READY"→ "COPYING"

(2) Carriage operation

- Exposure lamp ON→ Shading correction
- Scan motor ON→ Carriages 1 and 2 start moving forward.
- If any mode is selected, the driving operation of (3) is performed after the reading process has been finished.

(3) Driving operation

- In black copying, the transfer belt performs its release operation and the suction charger bias is turned ON.
- The main chargers, developer bias, discharge LEDs and cleaning blade bias are turned ON. The fan motor rotates and the polygonal motor rotates at high speed.
- The drum motors, developer motors, transfer belt motor and fuser motor rotate.

(4) Cassette paper feeding

- The feed motor, feed path clutch, pre-feed clutch (F) and feed clutch for the selected cassette are turned ON:
  ~ The pick-up roller, feed roller, separation roller, and transport roller rotate.
- The jam sensor for the selected cassette is turned ON, which then turns the feed clutch OFF.
- The pre-feeding of the following pages operates.
  - A sheet of paper reaches the 1st jam sensor.
    ~ Pre-feed clutch (F) OFF
  - After a given time
    ~ Pre-feed clutch (F) ON
- The paper reaches the registration roller:
  ~ Aligning operation takes place.
- When the aligning operation ends, the feed path clutch and the pre-feed clutch (F) are turned OFF.

(5) After the carriage has operated for a fixed time,

- Registration motor, feed path clutch and pre-feed clutch (R) are turned ON→Transports the paper to the transfer section.
- The copy counter operates.

(6) Carriage scanning completion

- Scan motor OFF
- Exposure lamp OFF

(7) Based on the registration motor ON

- After a fixed period, the toner supply is operated in the order of Y, M, C, K and the transfer roller bias is turned on.
- After a fixed period, the arrival of the paper is detected by the exit sensor.

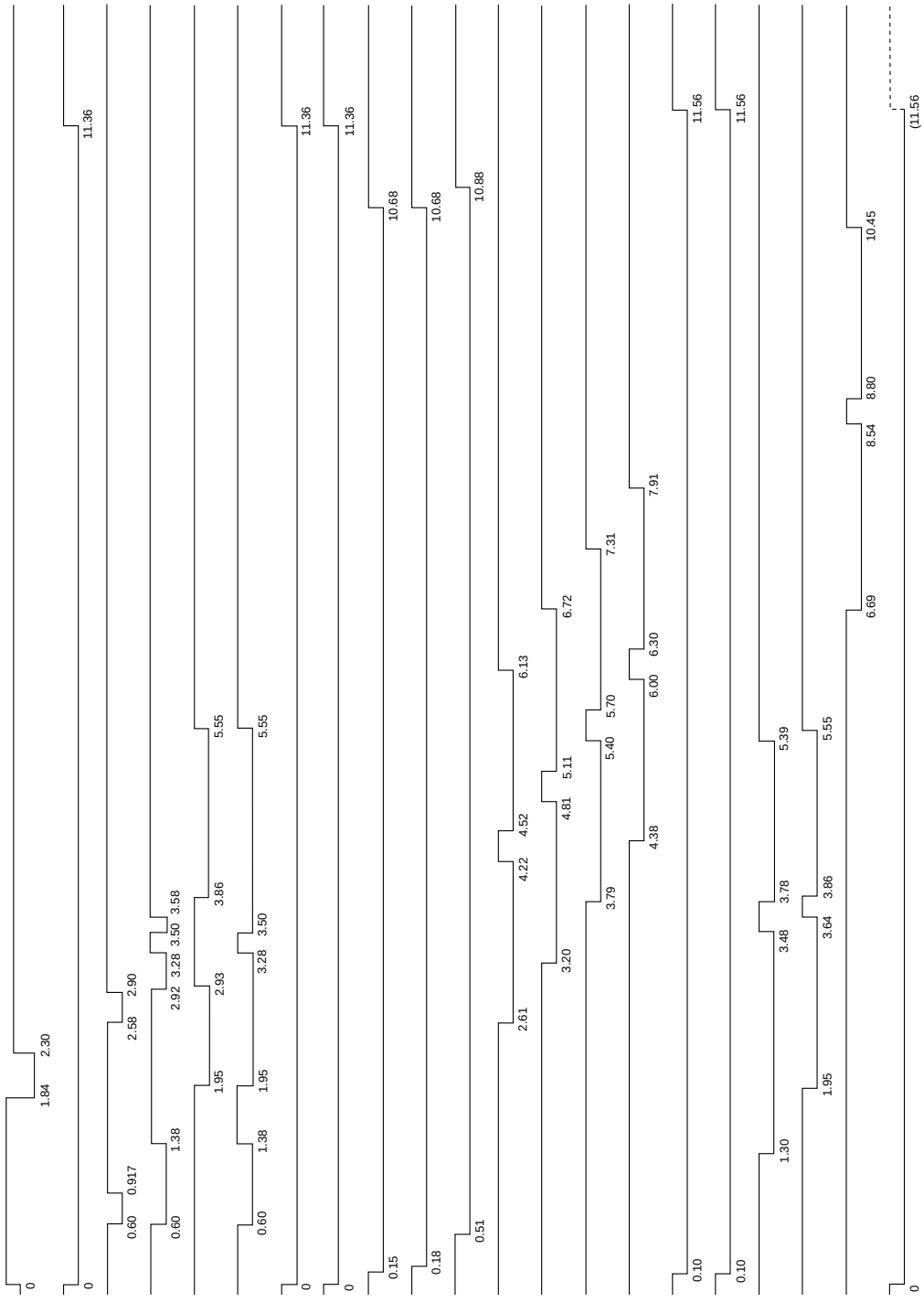
(8) After the trailing edge of the paper has passed the registration roller,

- Registration motor, feed path clutch and pre-feed clutch (R) are turned OFF.
- After a fixed period, the transfer roller bias is turned OFF in the order of Y, M, C, K.

(9) Paper exit operation

- The trailing edge of the paper is detected by the exit sensor.
- The main chargers, developer bias, discharge LEDs and cleaning blade bias are turned OFF.
- The drum motors, transfer belt motor, developer motors, feed motor stop their operations. The fan motors and polygonal motor return to their standby rotations.
- The fuser motor stops running when the heat rollers reach a given temperature.
- “READY” is displayed and the copier goes into standby status.

Timing chart for copying two A4 sized sheets fed from the 2nd cassette



4. 2. 4 Bypass feed copying

(1) Insertion of the paper in the bypass tray

- Bypass paper sensor ON:
  ~ “Ready for bypass feeding” is displayed.
- The carriage moves to its home position.

(2) Pressing of the START key

- “Ready for bypass feeding”→ ”COPYING” display

(3) Carriage operation

- Exposure lamp ON → Shading correction
- Scan motor ON → Carriages 1 and 2 start moving onward.

(4) Driving operation

- In black copying, the transfer belt performs its release operation and the suction charger bias is turned ON.
- The main chargers, developer bias, discharge LEDs and cleaning blade bias are turned ON. The fan motors rotate and the polygonal motor rotates at high speed.
- The drum motors, developer motors, transfer belt motor and fuser motor rotate.

(5) Bypass paper feed operation

- The feed motor, feed path clutch and bypass feed clutch are turned ON:
  ~ The bypass pick-up roller lowers.
  ~ The bypass pick-up roller and bypass feed roller rotate.
- When the paper arrives at the registration sensor, the bypass feed clutch is turned OFF.
- The paper arrives at the registration roller.
  ~ Aligning operation takes place.

(6) Hereafter, the same operation as described in (5) to (9) of “4.2.3 Cassette feed copying” is performed.

4. 2. 5 Interruption copying

(1) Pressing of the INTERRUPT key

- The INTERRUPT lamp is turned ON.
- The copying operation now in progress is stopped temporarily. Carriages 1 and 2 return to their preset positions.
- “Job interrupted job 1 saved” is displayed.
- The center step of manual density and the 100% reproduction ratio are set. The copy quantity does not change.

(2) Selection of the desired copy modes

(3) After interruption copying is finished,

- “Press INTERRUPT to resume job 1” is displayed.
- Pressing the INTERRUPT key turns the INTERRUPT lamp OFF, returning the copier to the condition before the interruption.
- “Ready to resume job 1” is displayed.

(4) Pressing the START key

The copying operation before interruption is resumed.

4. 3 Detection of Abnormal Conditions

When an abnormal condition occurs, the symbol corresponding to the abnormality is displayed to alert the operator.

4. 3. 1 Types of abnormality

A) Type that can be cleared without turning the door switch OFF:

(1) Add paper

(2) Paper misfeed in bypass

(3) Set key copy counter

B) Type that cannot be cleared without turning the door switch OFF:

(1) Misfeed in copier

(2) Install new toner cartridge

(3) Replace toner bag

C) Type that cannot be cleared without turning the main switch (SW15) OFF:

(1) Call for service

4. 3. 2 Description of abnormalities

A-1) Add paper

[For the copier's cassette]

When the cassette detection sensor detects that the cassette is not inserted, "Add paper" symbol flashes.

When the sensor detects that the cassette is inserted, based on the combination of the cassette tray-up motor operation and the conditions of the cassette tray-up limit sensor and cassette paper empty sensor, the CPU detects the presence or absence of paper.

∘ When the power is turned ON or when the LCF door is opened/closed, the LCF performs initialization.

↓

Detection of whether there is paper or not :

Tray-up motor ON~The tray rises.

At this time, both tray-up and LCF paper empty sensors are OFF.

→ If the tray-up sensor is not turned ON in a fixed time:

The tray is abnormal.

↕

Cleared by turning the power ON/OFF.

→ If the tray-up sensor is turned ON in a fixed time:

~The tray-up motor stops rotating.

At this time, if the empty sensor is ON: It is judged that there is paper.

OFF: It is judged that there is no paper

→The tray lowers.

↓

"Add paper" symbol flashes.

∘ During copying, after paper has been fed, and the paper source becomes low:

→The tray-up sensor is turned OFF.

→The tray-up motor is turned ON~The tray moves up.

The tray-up sensor is turned ON→The tray-up motor stops.

∘ During copying, despite of the tray-up sensor being ON, if the paper empty sensor is turned OFF:

↓

It is judged that there is no paper.

↓

"Add paper" symbol flashes.

↓

The copying operation is stopped.

A-2) Paper misfeed in bypass ( )

- During bypass copying:

  Bypass feed clutch is turned ON.

  ↓

  *If the registration sensor is not turned ON in a fixed time (E12),

  ↓

  Bypass misfeeding

  ↓

  Bypass misfeed symbol ( ) is displayed.

  ↓

  The copying operation is disabled.

  ↓

  To clear: Remove the paper from the bypass tray. The bypass paper sensor is turned OFF.

A-3) Set key copy counter

- In the case of a copier equipped with a key copy counter (option), if this is pulled out:

  "Set key copy counter" is displayed.

  ↓

  The copying operation is disabled.

- During copying, if the key copy counter is pulled out,

  copying is stopped after the paper being copied is finished and ejected.

B-1) Misfeed in copier ( )

∘ Leading-edge jam detection with the exit sensor→(E01)

The registration motor is turned ON.

↓ 5.724 sec.

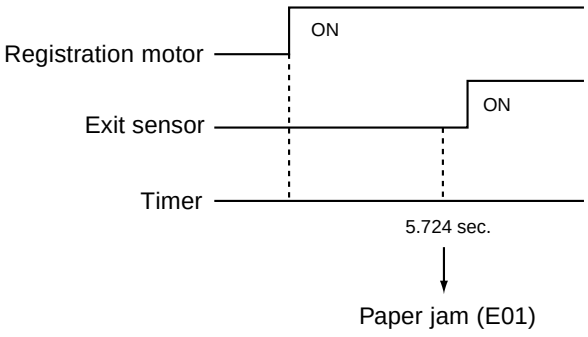
The exit sensor is turned ON.

After 5.724 sec., if the

exit sensor is not ON yet,

↓

Paper jam (E01)→ Copying operation is stopped.



∘ Trailing-edge jam detection with the exit sensor→(E02)

The registration motor is turned OFF.

↓ 5.302 sec.

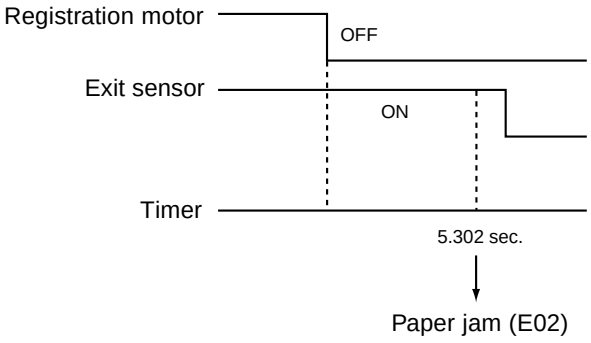
The exit sensor is tuned OFF.

After 5.302 sec., if the

exit sensor is not turned OFF yet,

↓

Paper jam (E02)→ Copying operation is stopped.



∘ Immediately after the power is turned ON:

↓

Any of the sensors in the paper transport path detects paper (ON).

↓

Paper jam (E03)

∘ During copying, the front cover is opened:

↓

Paper jam (E41)

∘ During paper feeding from ADU, a fixed time after the feed clutch has been turned ON, the cassette-feed jam sensor (1st cassette) is not turned ON,

↓

Paper jam (E11)

∘ During duplex copying, the ADU path sensor and the ADU jam sensor do not detect paper:

↓

Paper jam (E50~E52, E54)

- During paper feeding from the cassette or LCF, a fixed time after the feed clutch has turned ON, the paper jam sensor is not turned ON,

  ↓

  Paper jam (E13~E16, E19: depending on the paper sources)

B-2) Install new toner cartridge ()

The toner density has become low:

↓

Toner empty detection: Auto-toner mechanism

↓

Control circuit → "Install new toner cartridge" is displayed: Copying is disabled

To clear: Open the front cover and replace the toner cartridge.

Toner supply operation: Copying is enabled

B-3) Replace toner bag ()

The toner bag is filled with used toner to the limit.

↓

The toner bag limit sensor is turned ON.

↓

"Replace toner bag" is displayed.

- During copying, if the toner bag limit sensor is turned ON,

  ↓

  After ejecting the copy paper now in process, the copying operation is stopped.

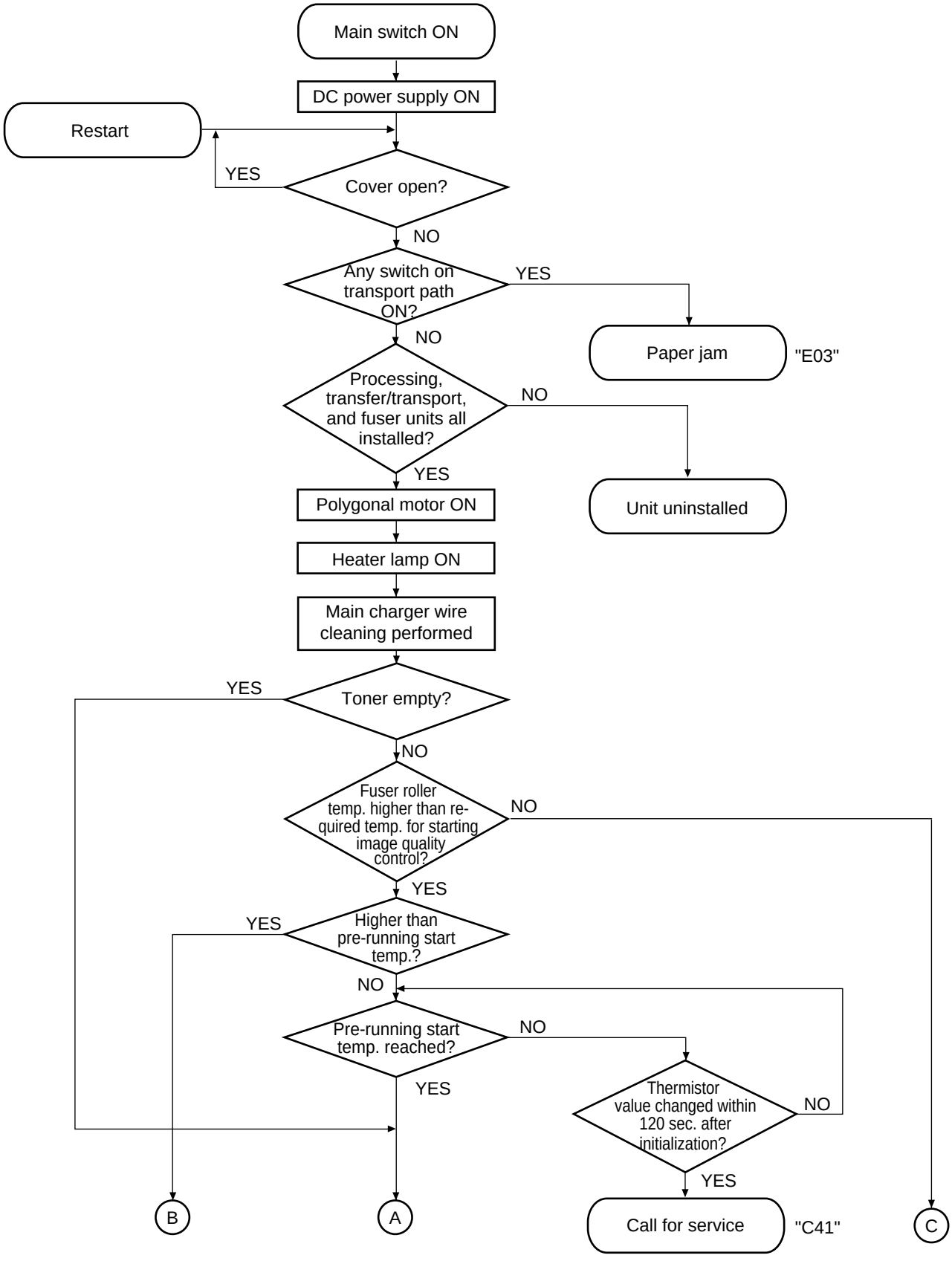
  To clear: Open the front cover, replace with a new toner bag and then close the front cover.

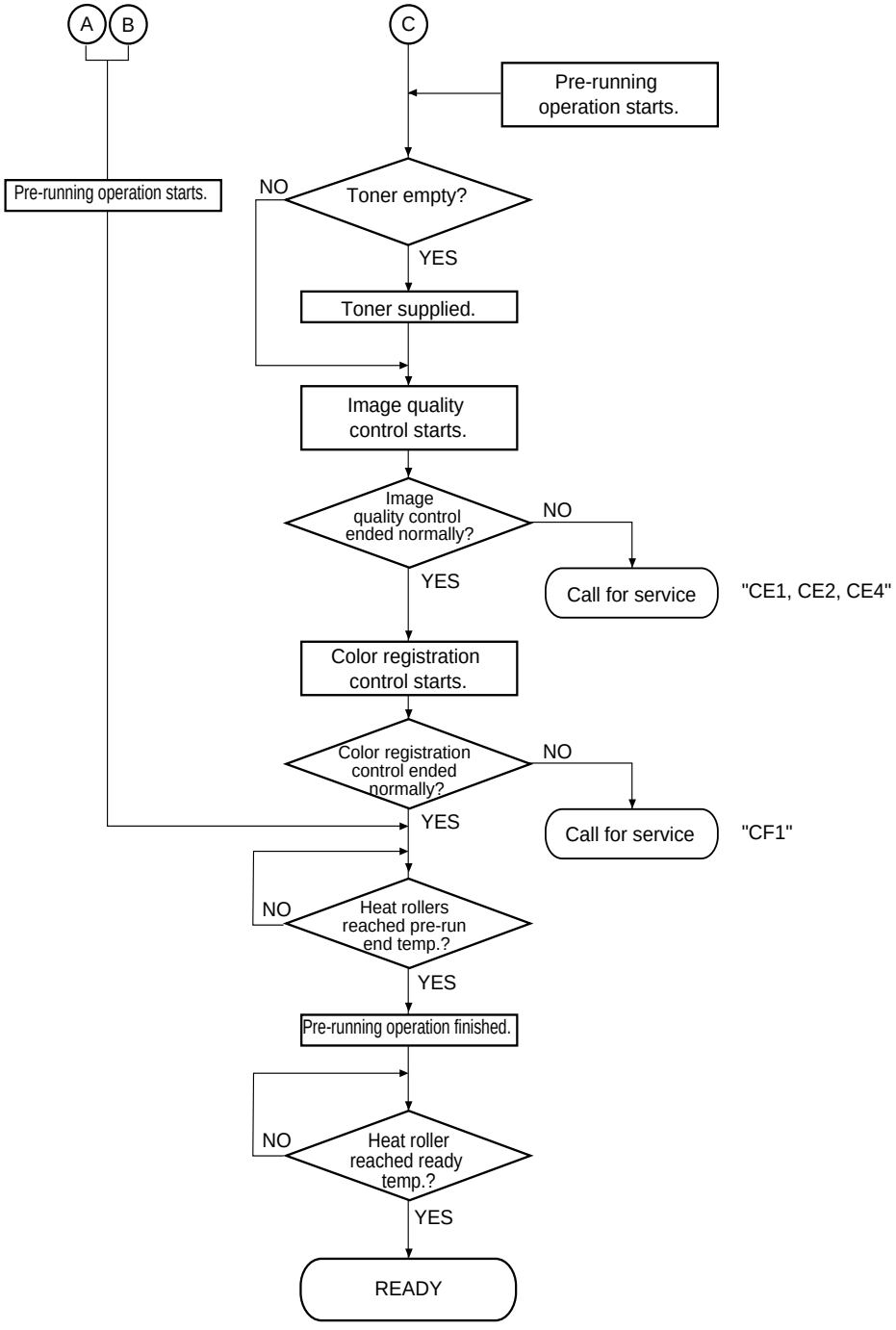
B-4) Call for service

When the "Call for service" symbol is flashing, pressing the CLEAR key and “8” key simultaneously causes an error code to be shown on the copy quantity display. Refer to the error code table in the Service Handbook.

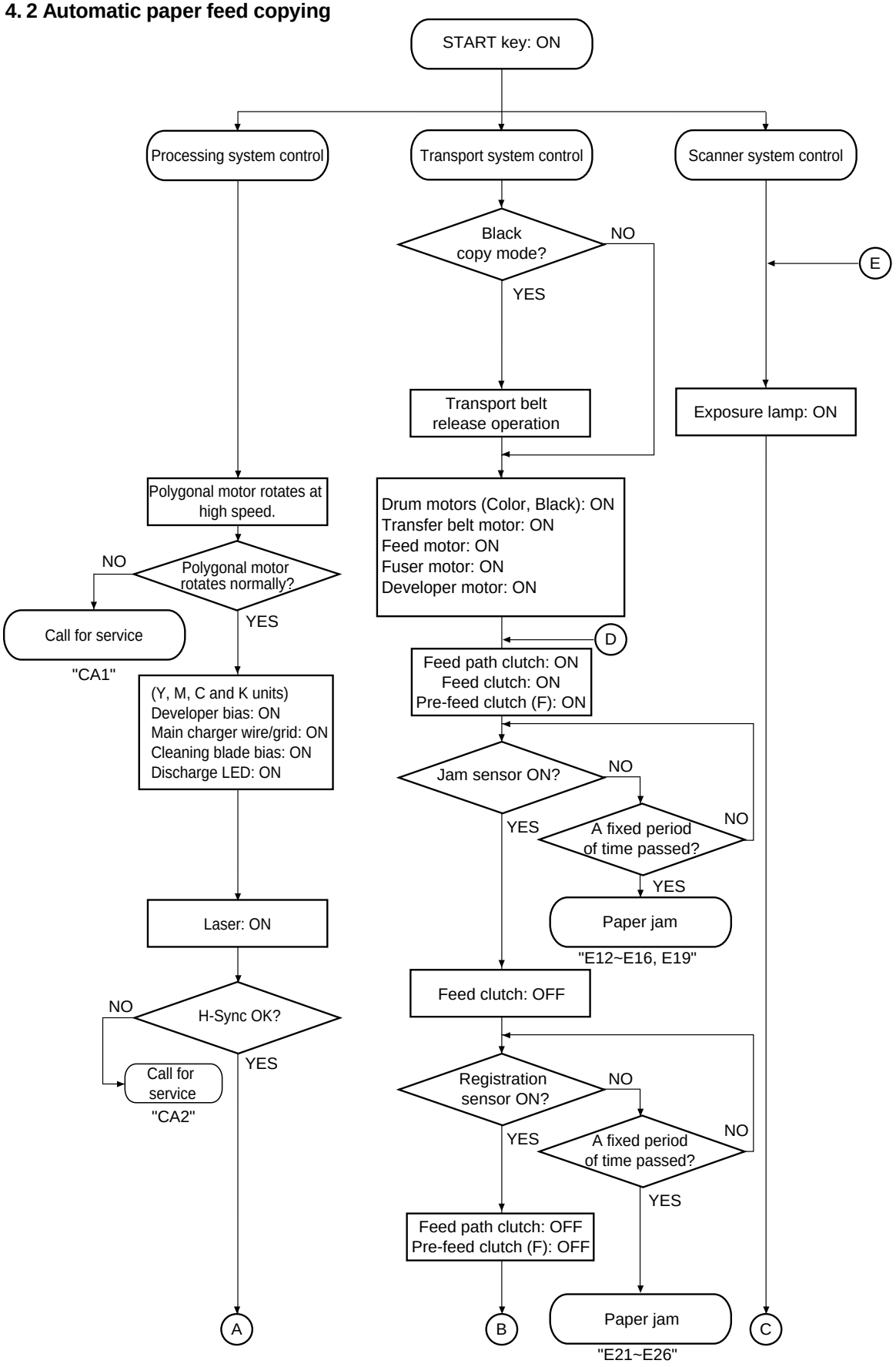
4. 4 Flowchart

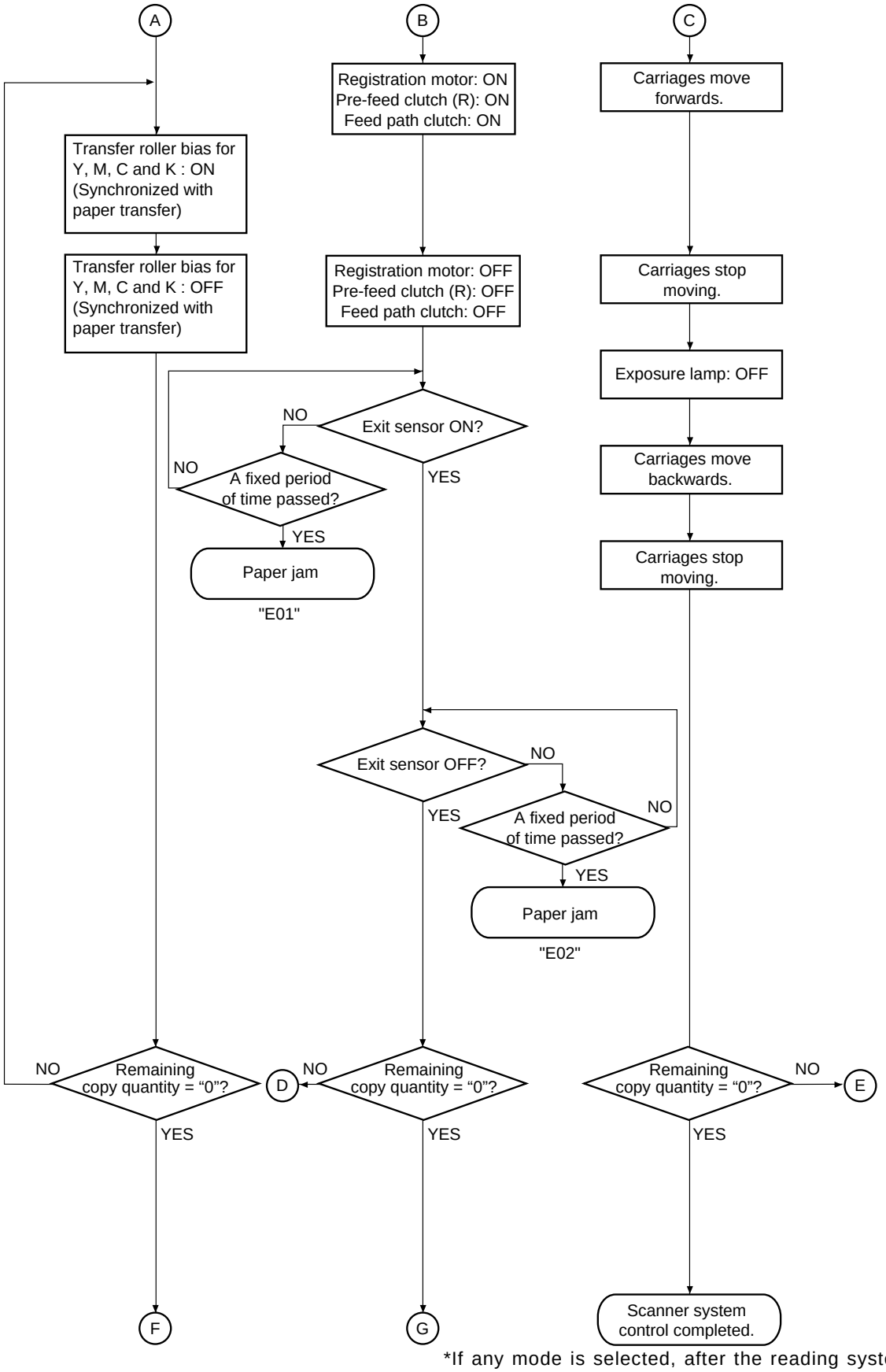
4. 4. 1 Immediately after the power is turned ON



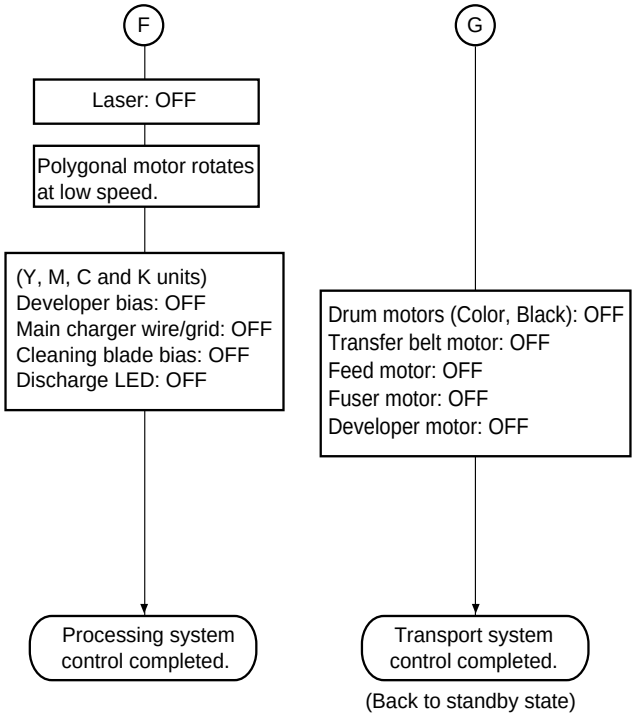

A
B
C
Pre-running operation starts.
Pre-running operation starts.
NO
Toner empty?
YES
Toner supplied.
Image quality control starts.
Image quality control ended normally?
NO
YES
Call for service
"CE1, CE2, CE4"
Color registration control starts.
Color registration control ended normally?
NO
YES
Call for service
"CF1"
NO
Heat rollers reached pre-run end temp.?
YES
Pre-running operation finished.
NO
Heat roller reached ready temp.?
YES
READY

4. 4. 2 Automatic paper feed copying





*If any mode is selected, after the reading system controlling has been finished, the operation of process system control and transport system control starts.


F
G
Laser: OFF
Polygonal motor rotates at low speed.
(Y, M, C and K units)
Developer bias: OFF
Main charger wire/grid: OFF
Cleaning blade bias: OFF
Discharge LED: OFF
Drum motors (Color, Black): OFF
Transfer belt motor: OFF
Feed motor: OFF
Fuser motor: OFF
Developer motor: OFF
Processing system control completed.
Transport system control completed.
(Back to standby state)

5. IMAGE PROCESSING

5.1 Image Processing Circuit

5.1.1 General description

This model has an original on the original table scanned optically to read its content, which is then optically converted into an electrical signal by the CCD (opto-electronic conversion device). This signal then undergoes analog-to-digital conversion and is changed into digital signal. After undergoing shading correction (correction of variance in CCD elements and the light source), this digital signal is then output as an image signal from the scanner unit.

Using this image signal from the scanner unit as an input, the image processing unit performs various image processing treatments on the signal and provides the output result to the ASIC of the laser-related control section.

ASIC stands for application specific IC, meaning an IC designed specifically for a particular application.

On this model, image processing is performed using a image processing PC board (PWA-F-IMG-314) , a system PC board (PWA-F-SYS-314) and, if necessary, an optional AI board (for image discrimination, PWA-F-MAC-511) which is connected to the image processing PC board.

(1) Image processing circuit on the image processing PC board

Five image processing ASICs are mounted on the image processing PC board, realizing the following functions.

<Functions>

ACS, color conversion, monochrome conversion, high image-quality processing, image memory editing, rectangular-area signal generation, edit processing, gamma correction, gradation processing, and fixed length compression/expansion.

(2) Image processing circuit on AI board (optional)

An ASIC and a CPU are mounted on this PC board and the following functions are accomplished.

<Functions>

The type of originals (text originals or photographic originals) is automatically discriminated and if the original has text and photographic images mixed, the respective image areas are automatically discriminated too.

(3) Image processing circuit of the controller

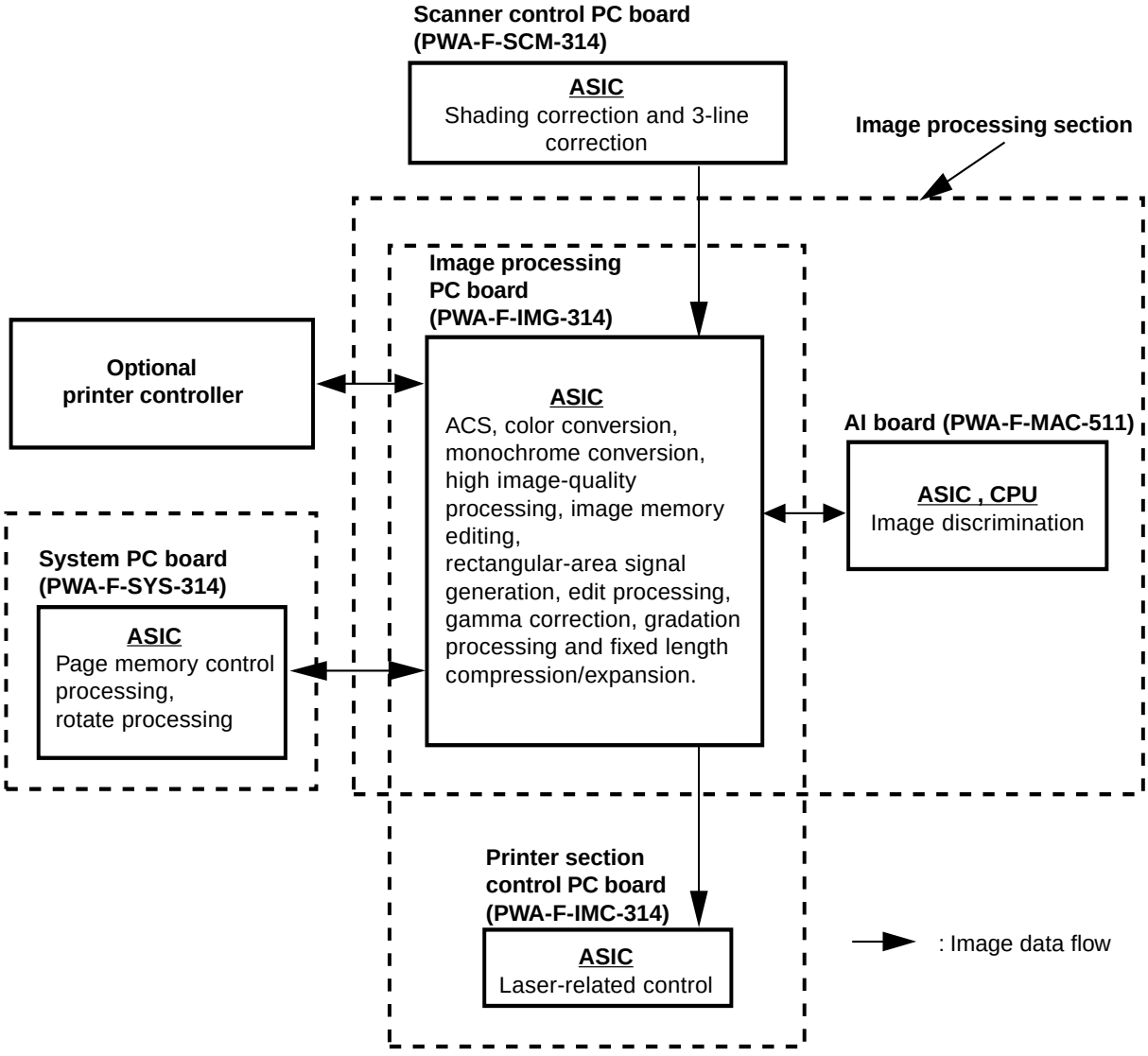
The image processing circuit of the controller has 2 types of ASIC for processing controller image mounted on its board to perform image processing against the image data input from the controller, realizing the following functions.

<Functions>

High image-quality processing, gamma correction and gradation processing

5.1.2 Construction of Image Processing Section

The following diagram shows the image processing section of this model:



Construction of image processing section

5.2 Image Processing Circuit on Image Processing PC Board (PWA-F-IMG-314)

5.2.1 Features

(1) The image processing ASIC is controlled by the System CPU on the image processing PC board.

(2) The image processing capabilities of the System board help to realize the following functions:

- · ACS
- · Color conversion
- · Monochrome conversion
- · High image-quality processing
- · Image memory editing
- · Rectangular-area signal generation
- · Edit processing
- · Gamma correction
- · Gradation processing
- · Fixed length compression/expansion

5.2.2 Description of functions

(1) ACS (Auto Color Selection) function

This function works to determine whether the original to be copied is colored or monochrome, based on the analysis of the R, G and B signals output from the CCD.

(2) Color conversion

The RGB image data is converted to CMY image data.

The image data taken in by the scanner represents the intensities of reflection of the three primary colors of light (Red, Green and Blue). These RGB values are then color-converted to the respective amounts of toners corresponding to the three colors (Yellow, Magenta and Cyan) for the purpose of printing (= CMY image data).

Also, K (Black) signal is generated from the CMY image data. Based on this K signal, the CMY image data is corrected to suppress color hue in reproducing grays or to make the black look more real.

(3) Monochrome conversion

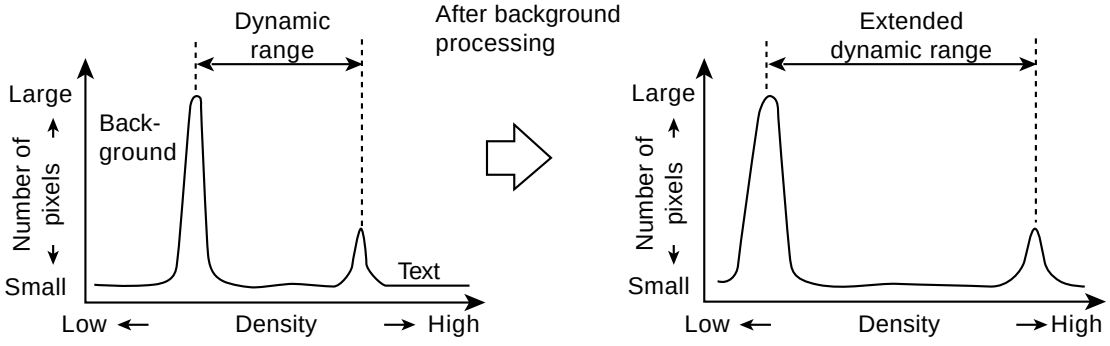
In black copying, monochrome signal is generated based on the R, G and B signals output from the CCD.

(4) High image-quality processing

(a) Background processing function

By pre-scanning, the background information of the image is read to help remove undesirable background so that the original can be reproduced appropriately. By using the background adjustment function while manually adjusting the image density, undesirable background of the original can be removed if any, and some necessary but disappeared background can be recovered. By using this function, it is possible to cut the background density down to zero when copying originals which have a certain level of background density, such as newspapers.

<Example>



(b) Image area discrimination

By determining the magnitude of density variation in a block (n x n dot), the target pixels are judged if they are text or photograph. If they are determined to be text, they are further judged if they are black or color text, using the differences in the levels of CMY signals.

(c) Filtering function

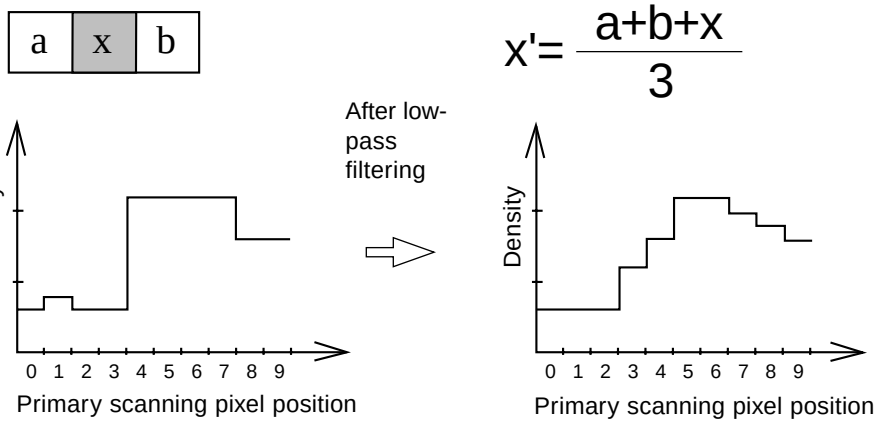
This function consists of a low-pass and high-pass filter circuits.

· Low-pass filter circuit function

This function works to remove image noise and electrical noise. Based on a matrix (m x n) of image signals existing around a target pixel, averaging operation is performed on the signals, making the result become an image signal of the target pixel after low-pass filter processing.

<Example> x is converted to x'. x' signifies the value obtained after low-pass filtering.

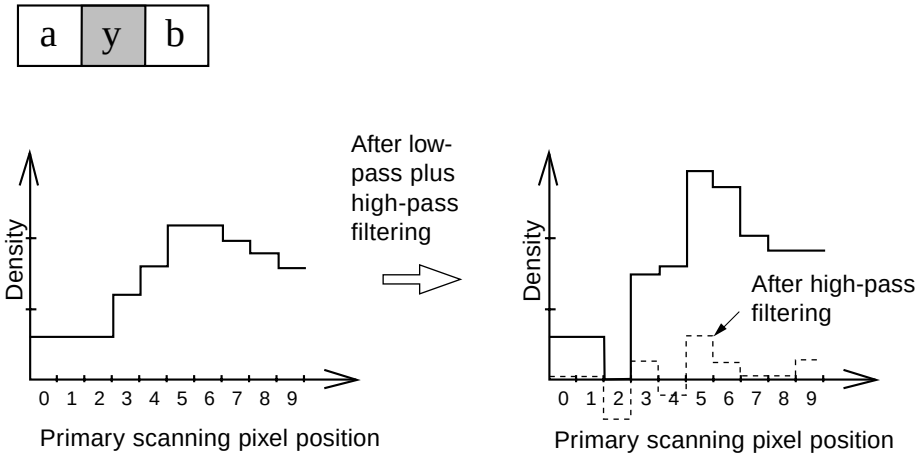
When the matrix is (3 x 1):



· High-pass filter circuit function

This function is used as a supplementation to the scanner characteristics, such as sharpening character outline. Based on a matrix (m x n) of image signals existing around a target pixel, enhancement processing is performed on the signals, and the result is output as the high-pass filtered image signals of the target pixel.

<Example> When the matrix is (3 x 1):



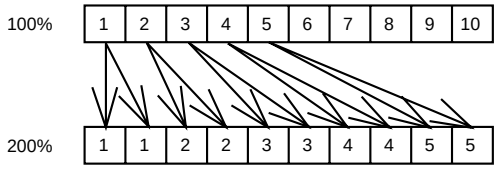
(5) Image memory editing

This function performs editing, such as enlargement/reduction, mirror imaging, image repeating, etc, using the line memory where pixel data for one line in the primary scanning direction is stored. This memory is renewed at each line.

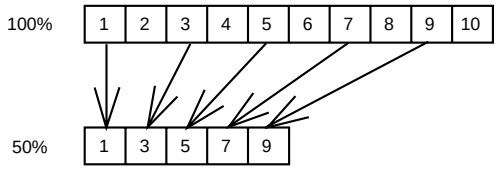
(a) Enlargement/reduction

The function of enlargement/reduction is accomplished by using the line memory control in the process of the image processing operation.

<Example> Enlargement



<Example> Reduction



(b) Mirror imaging

This feature is accomplished by reading and outputting the line memory data backwards, starting from its end.

(c) Image repeat function

The image in the selected position on the coordinates is repeated by the selected number of times in the primary scanning direction.

(6) Rectangular area signal generation

When a rectangular coordinate position is selected, the corresponding rectangular area signals are generated. Using these signals, various edit processings related to the area specification can be performed.

(7) Edit processing function

This function performs trimming, masking and negative/positive reversal.

(a) Trimming

Using rectangular area signals, the image signals inside the rectangular area are left and the other image signals outside the area are erased.

(b) Masking

Using rectangular area signals, the image data inside the rectangular area are erased.

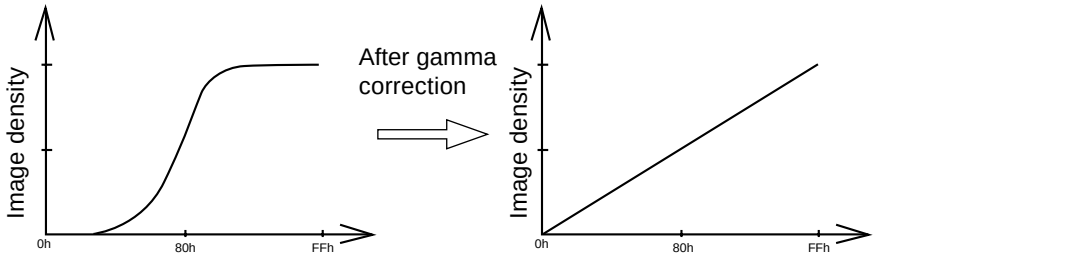
(c) Positive/negative reversal

This function reverses the entire area from positive to negative, or vice versa.

(8) Gamma correction function

This function corrects the input/output characteristics of the printer and then adjusts the image signals so that their input/output characteristics would match better with the copy mode.

<Example> Linear input/output density



[Printer input/output characteristics] [Input/output characteristics after gamma correction]

(9) Gradation processing function

Depending on the copy mode, this function switches the type of gradation processing: A type which selects the printer characteristics that give the priority to the resolution such as for text data, and another which selects the printer characteristics that give the priority to the reproducibility such as for photographic images.

(10) Fixed length compression/expansion

To lessen the data amount of the color image signals, this function effects the compression/expansion on the fixed length data.

5.3 AI Board (PWA-F-MAC-511) Image Processing Circuit

5.3.1 Features

AI board means the advance image enhancement board and AI Mode is added to the copy modes by installing it.

AI mode has two modes available for image discrimination:

– original discrimination mode to determine the type of the input signals of original (text or photograph)
– area discrimination mode, for original with texts and photographs mixed, to determine the type of each area of the original whether the area is text or photograph.

On AI board, the image layout on the original is analyzed during pre-scanning, and depending on the type of the image, one of the above modes is automatically selected and necessary discrimination is performed.

Maximum 3 seconds (A4/LT) is required for the discrimination by CPU, in addition to the time for pre-scanning.

This AI mode makes it unnecessary to select the copy mode for each original type and produces higher reproducibility of both original text and photograph than the default TEXT/PHOTO mode.

5.4 Controller Image Processing Circuit

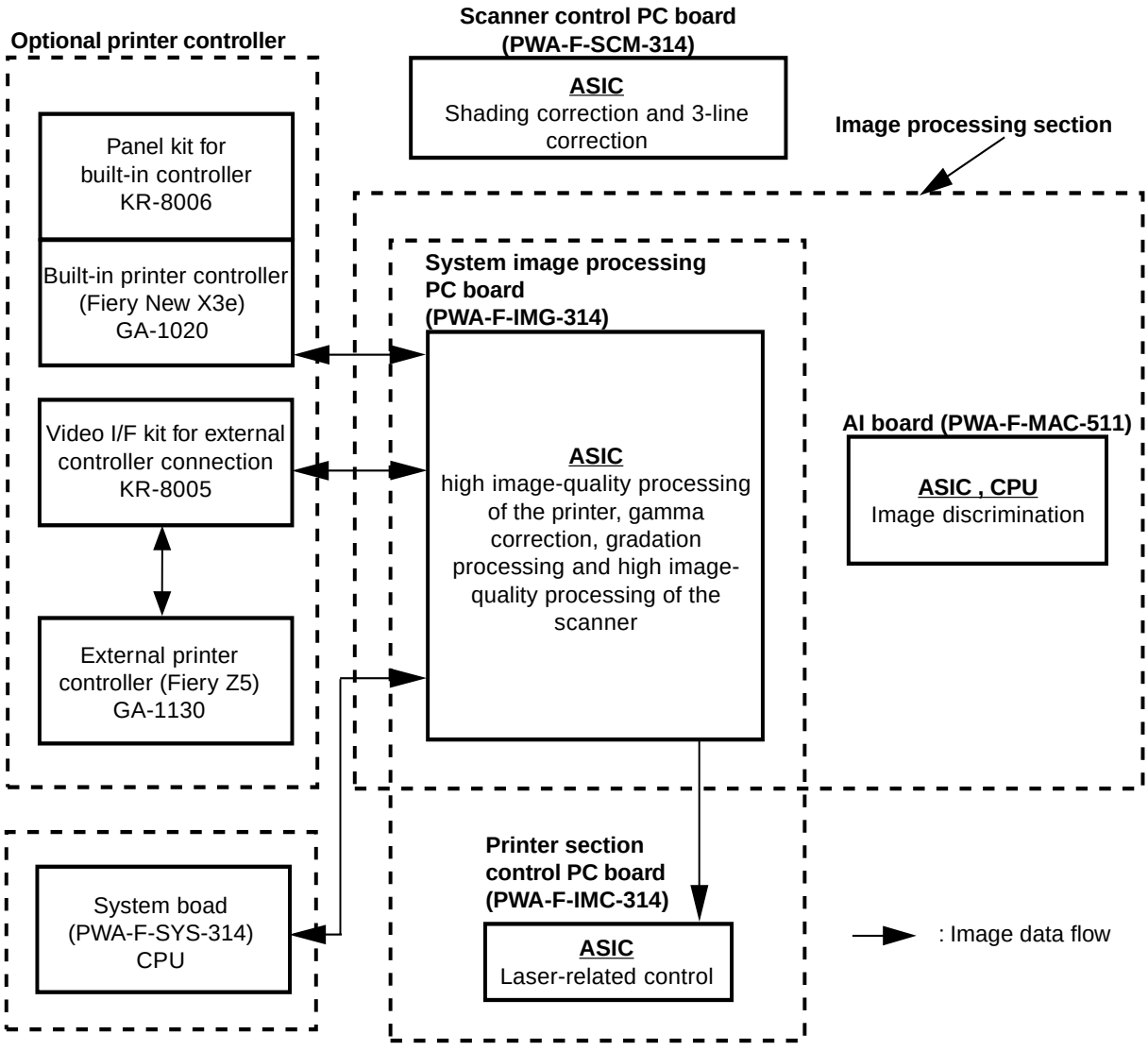
5.4.1 General description

Using the image signal from the optional printer controller as an input, the image processing unit performs various image processing treatments on the input signal and output the result to the ASIC laser-related control section. Also, using the image signal scanned by the scanner as an input, it performs various image processing treatments on the input signal and outputs the result to the controller.

When the printer controller is being connected, the image processing ASIC is controlled by the System CPU on the System board (PWA-F-SYS-314).

5.4.2 Construction of Image Processing Section

The following diagram shows the image processing section of the copier and the printer controller:



Construction of image processing section

5.4.3 Features

When the controller is being connected, the image processing ASIC is controlled by the System CPU on the system board (PWA-F-SYS-314). Two controller image processing ASICs are mounted on the controller image processing PC board, where is the only area for image processing of the image data input and output from the controller. The functions below are realized.

<Functions>

- · High image-quality processing of the printer
- · Gamma correction
- · Gradation processing
- · High image-quality processing of the scanner

5.4.4 Functions description

(1) High image-quality processing of the printer

This function reproduces the image signals output from the printer controller sharper.

(2) Gamma correction function

This function corrects the input/output characteristics of the printer and then adjusts the image signals so that their input/output characteristics would match better with the output of the printer controller.

(3) Gradation processing function

Depending on the print image, this function switches the type of gradation processing at each printing. A type which selects the printer characteristics that give the priority to the resolution such as for text data, and another which selects the printer characteristics that give the priority to the reproducibility such as for photographic images.

(4) High image-quality processing of the scannner

This function corrects the image signals scanned by the scanner and reproduces them in a higher image-quality.

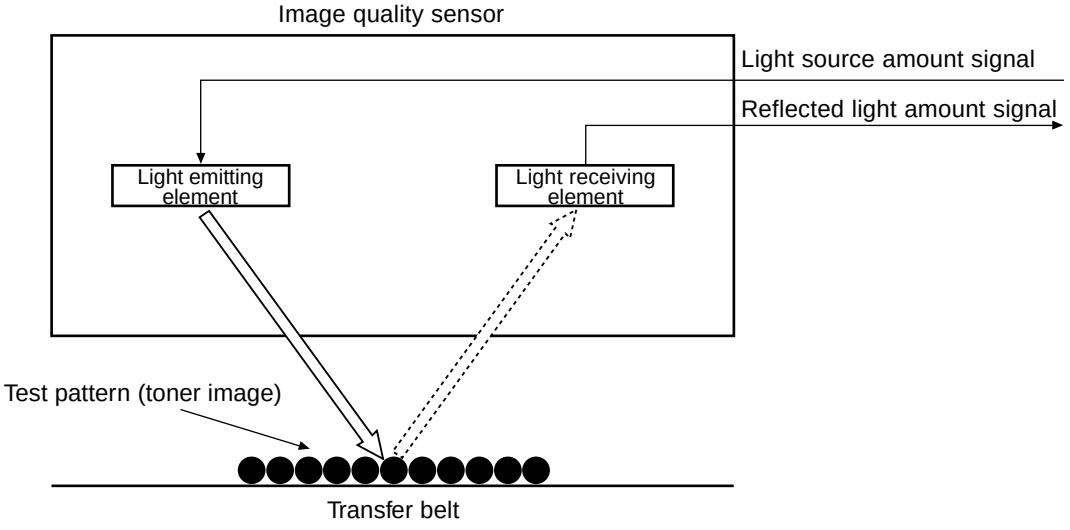
6. IMAGE QUALITY CONTROL

6.1 General Description

With this copier, image quality is controlled by the image quality sensor. In this control, image forming conditions are automatically adjusted so as to minimize the change in the image density or line width caused by the fluctuation of working environment or life of supply items. The image quality sensor works to detect the density of a test pattern developed on the transfer belt, and based on the results of the detection, image forming conditions are modified accordingly.

6.2 How the Sensor Works

Image quality sensor projects light onto the transfer belt and the toner image (test pattern) developed on the transfer belt to produce a voltage corresponding to the amount of the reflected light.
Based on the amount of reflected light obtained by the image quality sensor, a relative reflection factor is calculated, which is referred to as toner adhesion amount.



6.3 Overview of Control Procedure

Start of control procedure (During pre-running after power ON, control is performed.)

↓

[1] Reference image forming conditions are set.

↓

[2] The sensor light source is adjusted.

↓

[3] The test pattern is produced. ←

↓

[4] The image quality sensor reads in data.

↓

[5] Judgment

(Whether the toner adhesion amount of the test pattern is within the acceptable range or not)

NO → [6] Image forming conditions are modified. → Return to [3].

YES ↓

[7] Control procedure is completed.

(The determined image forming conditions will be reflected on subsequent copies.)

6.4 Construction

· Image quality sensor: Projects the amount of light corresponding to the light amount control voltage, and produces the voltage corresponding to the amount of light reflected from the transfer belt and the toner image on the transfer belt.

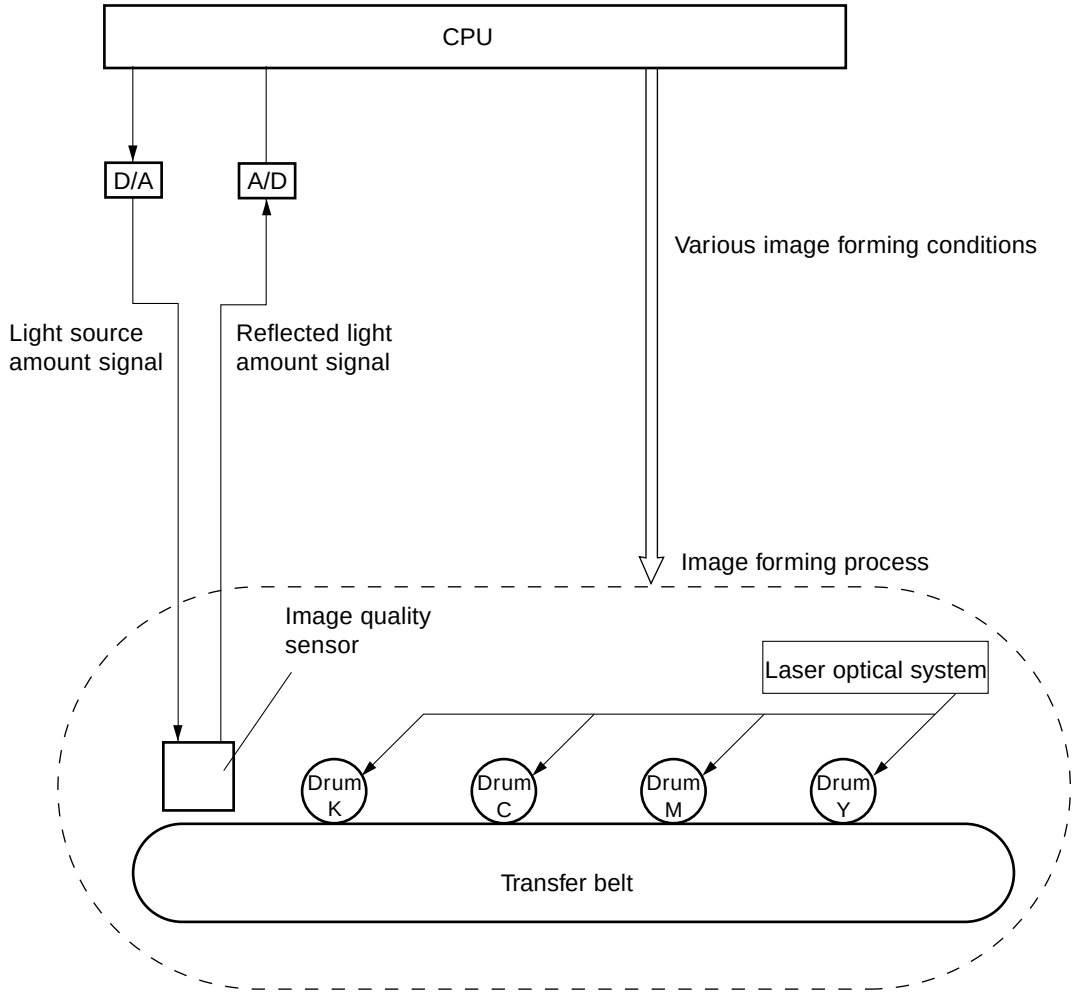
· D/A converter: Produces light source amount control voltage.

· Laser optical system: Performs test pattern exposure (for toner image formation).

· A/D converter: Converts the output voltage from the sensor into digital values and reads them into the CPU.

· Image forming process: Consists of charging, laser exposing and developing processes.

· CPU: Performs steps [1] to [7] described previously.

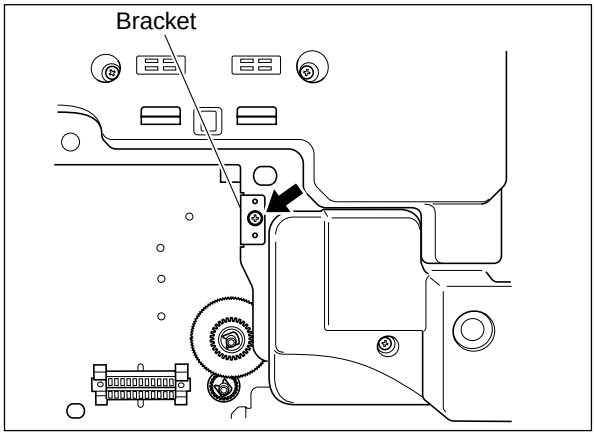


6.5 Disassembly and Replacement

[A] Image quality sensor

(1) Open the front covers, turn the lever to the right and then draw out the transfer/transport unit.

(2) Remove the bracket (1 screw).

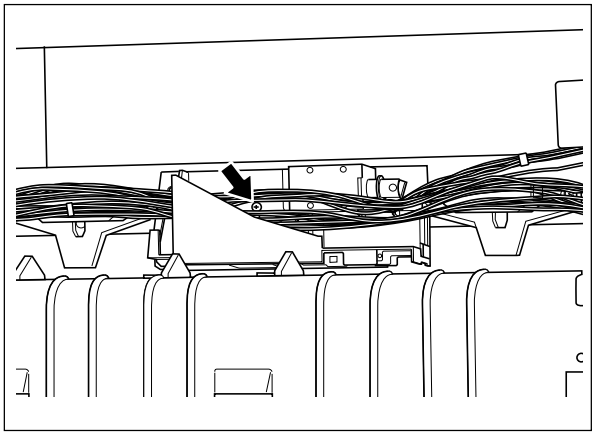


(3) Open the paper-exit unit.

(4) Disconnect the connector.

(5) Remove the bracket from the frame (1 screw).

(6) Remove the image quality sensor from the bracket (1 screw).



7. COLOR REGISTRATION CONTROL

7.1 General Description

In a color copier, four primary colors (yellow, magenta, cyan and black) are overlaid to represent particular colors. If they are not overlaid properly (or deviated from the position), the text and image obtained may look blurred.

In this model, color registration control method is used to automatically correct any registrational deviation in any of the four colors.

Color registration control in this model is performed automatically in the following order.

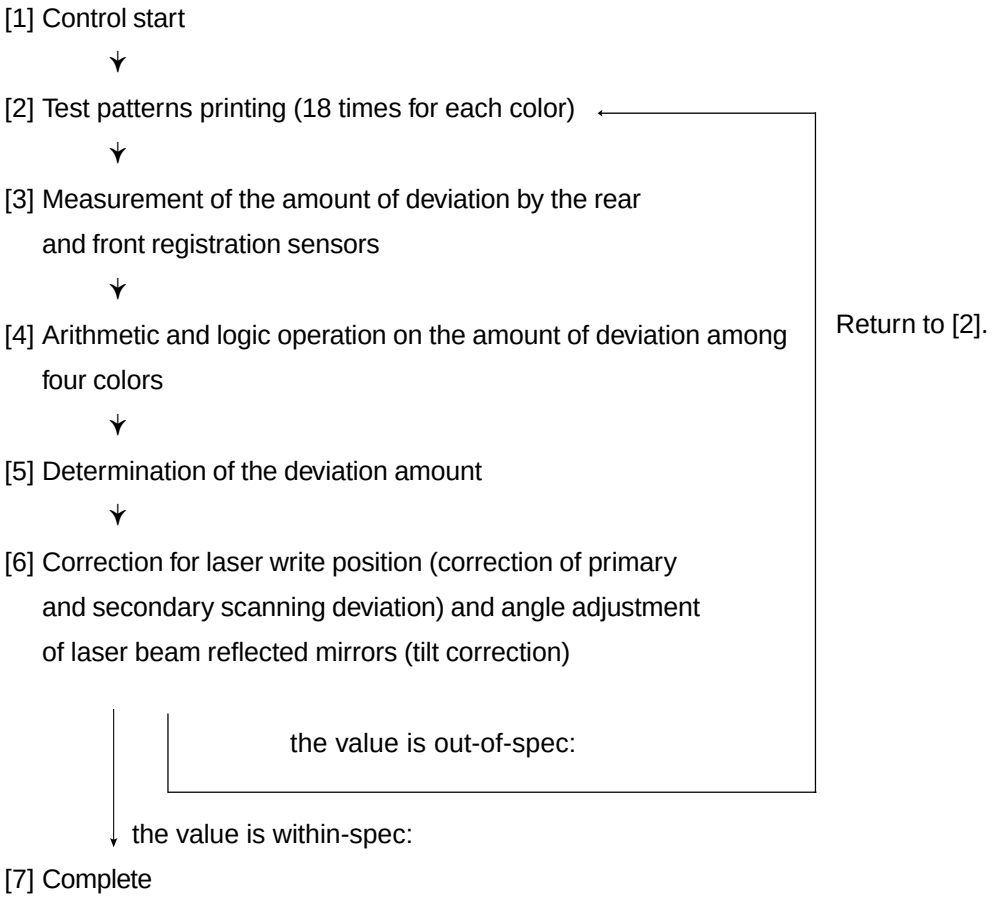
1) A built-in test pattern is printed on the transfer belt several times repeatedly.
2) Each time, this printed test pattern is read by the rear and front registration sensors to measure the amount of deviation between four colors.
3) The amount of deviation thus measured is arithmetically operated on by the microcomputer.
4) The deviation is judged and the laser write position is corrected according to the deviation amount.

This color registration control is performed during warming-up, and at a fixed schedule (10 min., 40 min. and 160 min. later) after then.

The aim of controlling at fixed intervals is to correct deviation in the relative positions of the laser optical system components caused by the rise of the temperature inside the machine after warming-up.

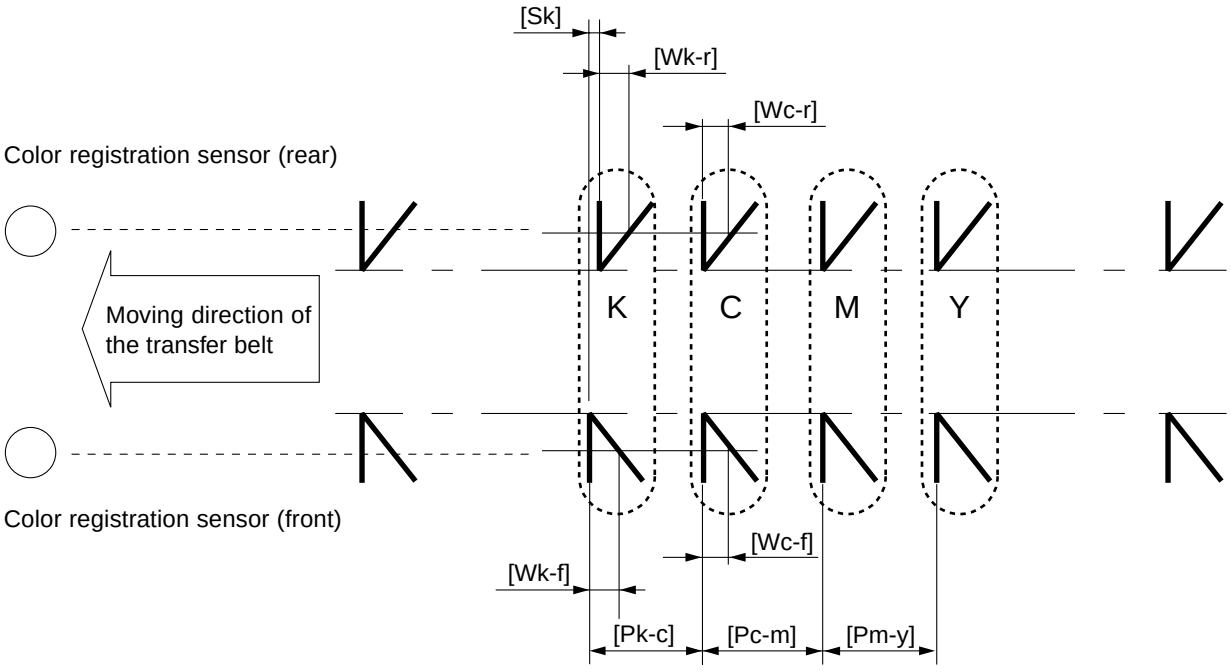
However, there are cases such as when the machine is turned on again immediately after it is turned off, it may not be necessary to correct deviation in the relative positions of the laser optical system components caused by the rise of the temperature inside the machine after warming-up. In this case, the temperature of the fuser roller in the fuser unit will be checked when the power is turned on, and if it is above the allowable temperature range, color registration control will be omitted at the warming up.

7.2 Control Procedure



* After the test patterns printing, if the specified number of data is unable to be read successfully, the error (CF1) is generated.

7.3 Control Method



The test patterns for the four colors illustrated above are regarded as one set. Several sets are printed directly onto the transfer belt, and the pitch of the test patterns is measured by the front and rear color registration sensors.

Four types of deviation are measured: horizontal deviation in the secondary-scanning direction; deviation of write start position in the primary-scanning direction; deviation of reproduction ratio in the primary-scanning direction and tilt deviation.

The measurement/calculation pitch and the objects of correction for each deviation are shown as the table below.

Deviation	Measurement/Calculation Pitch (x = y, m, c)	Object of Correction
Horizontal deviation in the secondary-scanning direction	[Pk-c],[Pc-m],[Pm-y]	Laser write start position (secondary-scanning)
Deviation of write start position in the primary-scanning direction	[Wx-f]-[Wk-f]	Laser write start position (primary-scanning)
Deviation of reproduction ratio in the primary-scanning direction	([Wx-r]-[Wx-f])–([Wk-r]-[Wk-f])	Image written frequency
Tilt deviation	[Sx]	Tilt angle of mirror in the laser unit

7.4 Deviation Unable To Be Corrected by Color Registration Control

Since the color registration control optimizes the laser write start position (including the relative position of the drum), it can correct the deviation that appears uniformly on the paper. But it cannot correct such deviation that fluctuates (including deviation generated by particular timing or deviation generated by the pitch).

The deviations unable to be corrected are as follows.

(1) Deviation caused by drum rotation errors

Eccentricity of the driving parts from the drum motor to the drum (including the drum itself) can result in deviation in the secondary-scanning direction of approximately 94 mm pitch.

(2) Deviation caused by fluctuations in transfer belt speed

Fluctuations in transfer belt speed can be caused by eccentricity of the driving parts from the transfer belt motor to the transfer belt drive roller, as well as by slippage between the transfer belt and the transfer belt drive roller. It results in a fluctuating deviation in the secondary-scanning direction.

(3) Deviation caused by meandering of the transfer belt

The transfer belt can meander because of some damages to the transfer belt edge, resulting in fluctuating deviation in the primary-scanning direction.

(4) Deviation caused by differences in the speed of units related to paper transporting

This is generated when differences occur in the transporting speed among the registration roller, the transfer belt and the fuser unit.

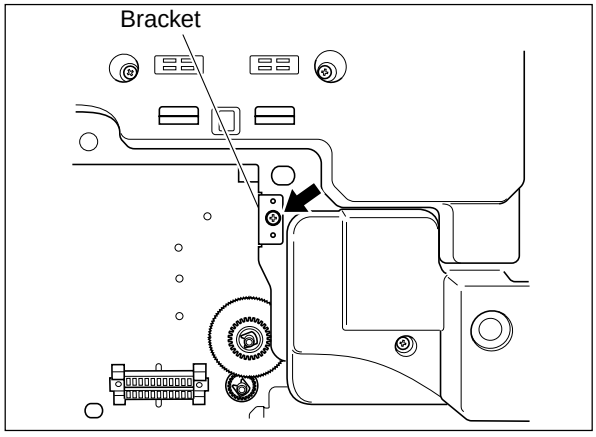
a) When the fuser unit paper transport speed is larger than the transfer belt speed
   Deviation in the secondary-scanning direction occurs in the order of Y, M, C and K from the leading edge of the paper.
b) Transfer belt speed is larger than the registration roller speed
   Deviation in the secondary-scanning direction occurs in the order of K, C, M and Y from the leading edge of the paper.
c) Transfer belt speed is smaller than the registration roller speed
   Deviation in the secondary-scanning direction occurs in M and Y at approximately 75 mm pitch in the trailing half of paper of A3, LD, etc.

7.5 Disassembly and Replacement

[A] Color registration sensor

(1) Pull out the transfer/transport unit.

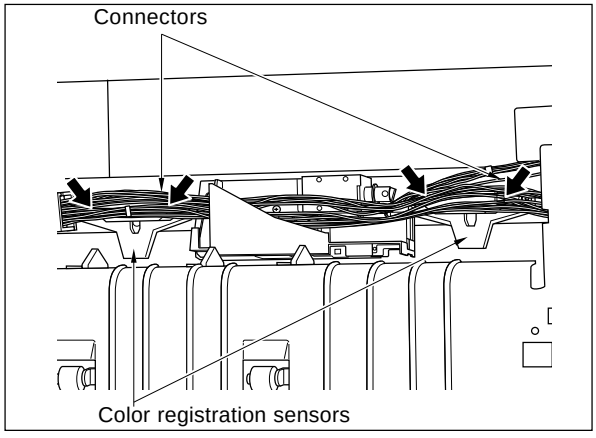
(2) Remove the bracket (1 screw).



(3) Open the paper-exit unit.

(4) Disconnect the connectors of color registration sensors.

(5) Remove 2 color registration sensors (2 screws for each).

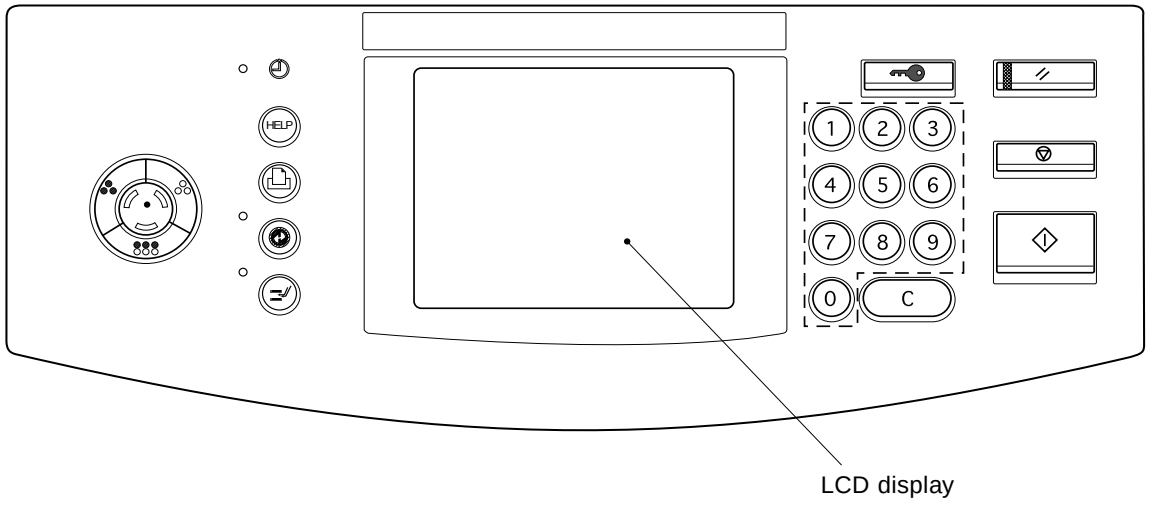


8. DISPLAY UNIT

8.1 Detailed Drawing of the Control Panel and the Display Panel

The display unit consists of key switches and touch-panel switches for copier operation/selection of each mode, LEDs and an LCD displaying the copier state or messages.

When the operator's attention is needed, a graphic symbol lights or flashes and a message indicating that particular condition is displayed on the LCD panel.



Layout of the control panel

8.2 Items Shown on the Display Panel

8.2.1 Display during normal copying

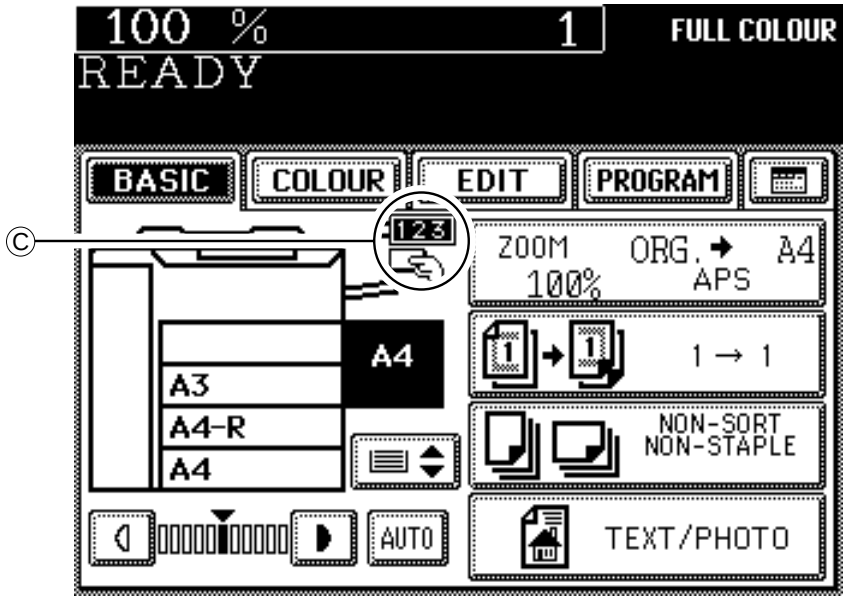


Fig. 8.2-1

No.	Message	Conditions of machine	Notes
1	Wait Warming Up	Being warmed up • Displayed after the main switch is turned ON up until the machine becomes ready for copying.	• When the main switch comes ON, the quantity and reproduction ratio of copies are indicated, for example, as “1”, “100%”.
2	READY	Standby for copying. • The machine is ready for copying and operator’s instructions on copying conditions can be input. • Returns to the default condition if no key is pressed for 45 seconds.	• Copy quantity indicator shows “1”. When a digital key is pressed, that number indicates the set quantity. • The set quantity can be cleared to “1” by pressing the CLEAR key. • Bypass copying is possible.
3	COPYING	Now copying. • Displayed by pressing the START key. • Copy quantity indicator becomes “1” and copying is completed.	• After completion of copying, the copy quantity indicator returns to the initially set number.
4	Saving energy - press START	Energy saver mode.	• Reset by pressing the ENERGY SAVER key or the START key.
5	Place next original Press PRINT (START) to copy	ADU back-side copying standby state.	• When using ADF one-sided, and when not using ADF.
6	—	Timer OFF • No message is displayed on the display panel. • Timer LED is turned ON.	• Press the START key to clear.

8.2.2 Display in the event of faulty conditions

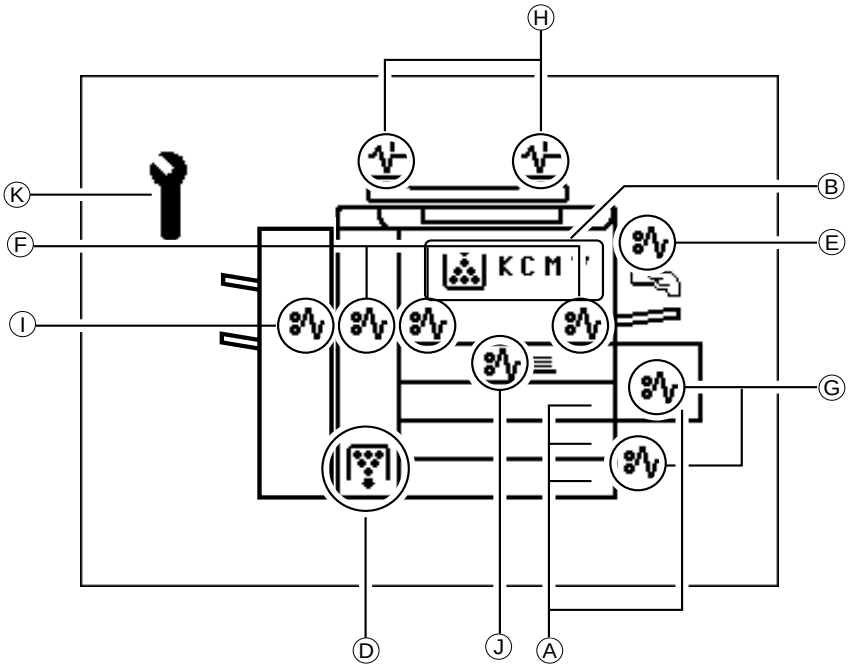


Fig. 8.2-2

No.	Message	Abnormal state & indication	Solution
7	Add Paper	Indication of lack of paper. • Flashes when there is no paper in the cassette (A in Fig. 8.2-2). • Bypass copying is possible.	• Supply paper to the selected cassette. • Select another cassette.
8	Install new X toner cartridge (X: Y, M, C, K)	Indication of lack of toner. • B in Fig. 8.2-2 is displayed when the toner in the toner cartridge becomes empty. • When this message is displayed, it is not possible to copy.	• Reset after the toner is supplied and the front cover is closed.
9	Set key copy counter	Key copy counter withdrawn. • Displayed when the key copy counter is withdrawn when the machine is READY or during copying. C in Fig. 8.2-1. • When it is removed after the pressing of the START key, the machine stops after the current copy is completed, but the counter counts it.	• Reset and return to normal conditions by inserting the key copy counter.
10	Dispose of used toner	Indication of need to replace the toner bag. • Displayed when the toner bag is full. D in Fig. 8.2-2. The copier stops.	• Open the front covers, replace the toner bag, and then close the front covers to reset.

No.	Message	Abnormal state & indication	Solution
11	Paper misfeed in bypass	Bypass paper jamming • Paper jams at the bypass guide. E in Fig. 8.2-2.	The machine returns to normal conditions automatically when the paper out is pulled from the bypass guide.
12	Misfeed in copier	Paper jammed in the machine. F in Fig. 8.2-2.	Press the HELP key and remove the paper jammed in the copier by following the messages.
13	Misfeed in copier	Cassette paper misfeed. • Paper supplied from the cassette does not reach the aligning sensor in a set time. G in Fig. 8.2-2.	Press the HELP key and remove the paper jammed in the copier by following the messages.
14	Misfeed in doc. feeder	Original jammed • An original is jammed in the ADF. H in Fig. 8.2-2.	Open the ADF jam-access cover and the ADF unit, and remove the jammed original.
15	Misfeed in finisher	Paper jammed in the finisher. I in Fig. 8.2-2.	Remove the paper jammed in the finisher and open and close the front cover for once.
16	Misfeed in duplexer	Paper jammed in the ADU. J in Fig. 8.2-2.	Press the HELP key and remove the paper jammed in the copier by following the messages.
17	Call for service	Some parts of the mechanism, motors, switches or sensors are abnormal. K in Fig. 8.2-2.	Turn OFF the machine, remove the cause of the fault and turn the machine back ON.
18	Time for periodic maintenance (XXXX) (XXXX: colo(u)r, black)	Indication of PM cycle. • Displayed when it is time for preventive maintenance and inspection. • Capable of copying.	Maintenance and inspection by a qualified service technician.

8.3 Relation between Copier Conditions and Operator's Actions

Status \ Operation	START key	CLEAR key	STOP key	Digital keys	INTERRUPT key	ENERGY SAVER key	Bypass feeding	Touch panel	COLOR MODE key	ACCESS key
Warming up	○	○	—	○	—	○	○	○	○	○
Ready for copying	○	○	—	○	○	○	○	○	○	○
Reproduction ratios being switched	—	○	—	○	○	○	○	○	○	○
Copying operation	—	—	○	—	○	○	—*1	—	—	—
Paper being added	—	○	—	○	○	○	○	○	○	○
Toner being added	—*2	○	—	○	○	○	○	○	○	○
Key copy couter not inserted	—	○	—	○	○	○	○	○	○	○
Paper misfeed in bypass copying	—	—	—	—	—	—	—	—	—	—
Toner bag being replaced	—	—	—	—	—	—	—	—	—	—
Paper jammed inside the machine	—	—	—	—	—	—	—	—	—	—
Service call indicated	—	—	—	—	—	—	—	—	—	—
Ready for interrupt copying*3	○	—	—	—	○	—	○	○	—	—
Energy saver mode activated*4	○	—	—	—	—	○	—	—	—	—

○ : Operation available. – : Operation unworkable

*1 Avoid bypass insertion during copying operation since this may result in paper jamming.

*2 Black mode is available while color toner is all used up.

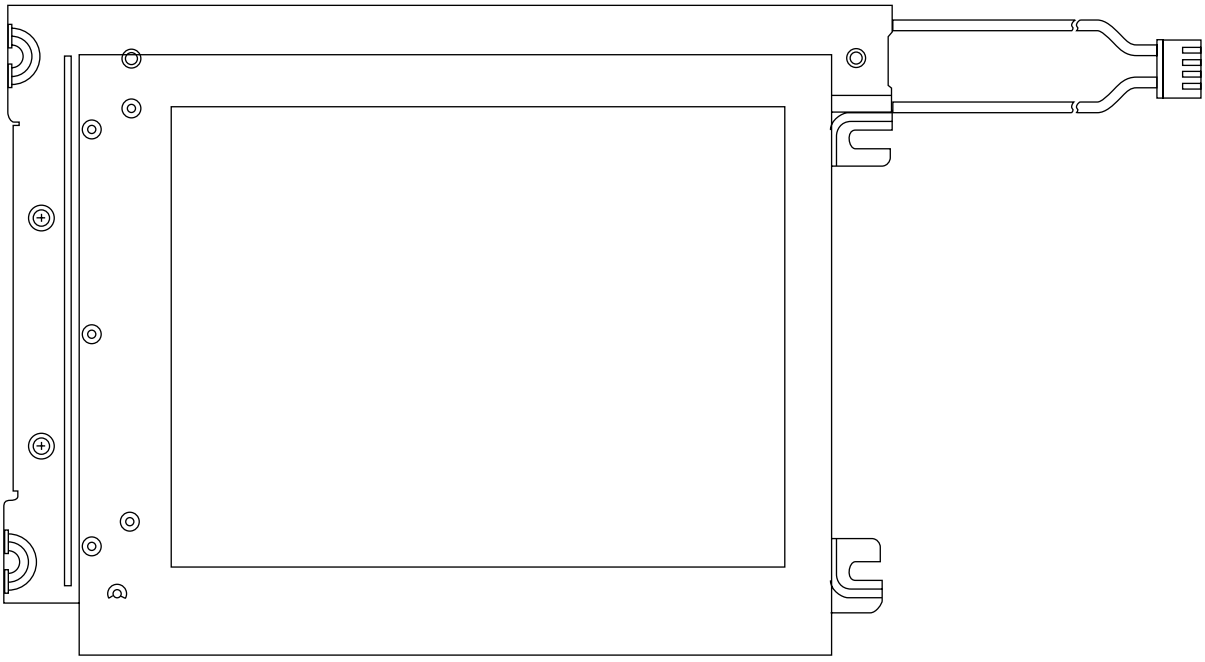
*3 Interruption condition is automatically released if the machine is not used for 45 sec.

*4 Energy saver mode is released by pressing the ENERGY SAVER key or the START key.

8.4 Description of Operation

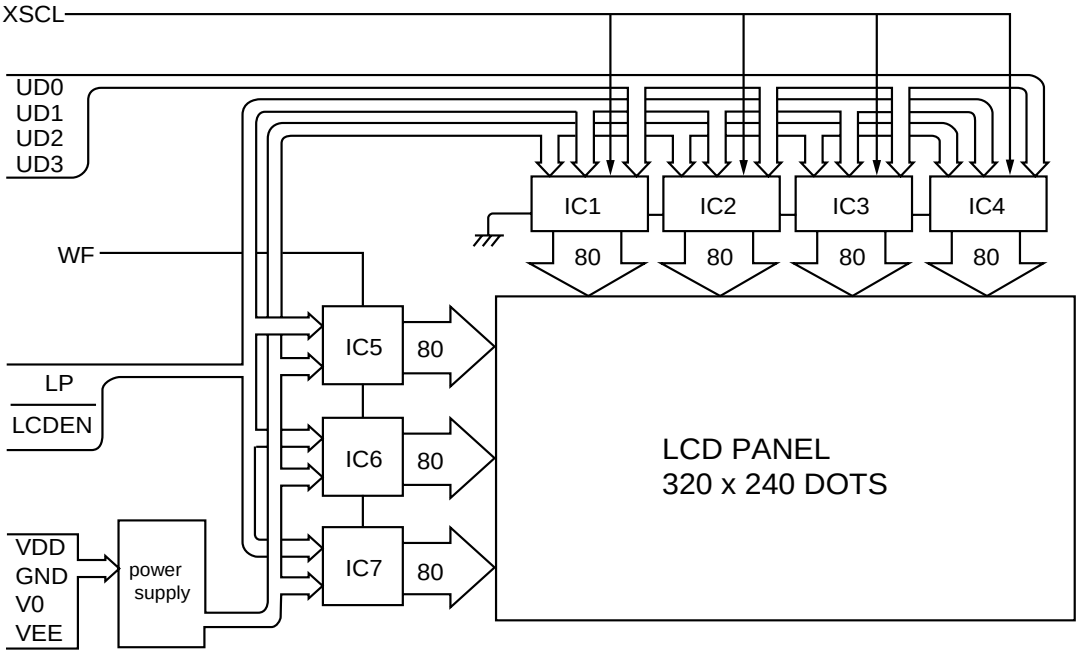
8.4.1 Dot matrix LCD circuit

(1) Structure



The DSP-LCD-230 is an STN black & white mode transmissive type LCD with a 320 x 240-dot display capacity. It includes a driver LSI, frame, printed circuit board, and lateral type CFL backlighting.
*STN: Super Twisted Nematic

(2) Block diagram



(3) LCD drive operation

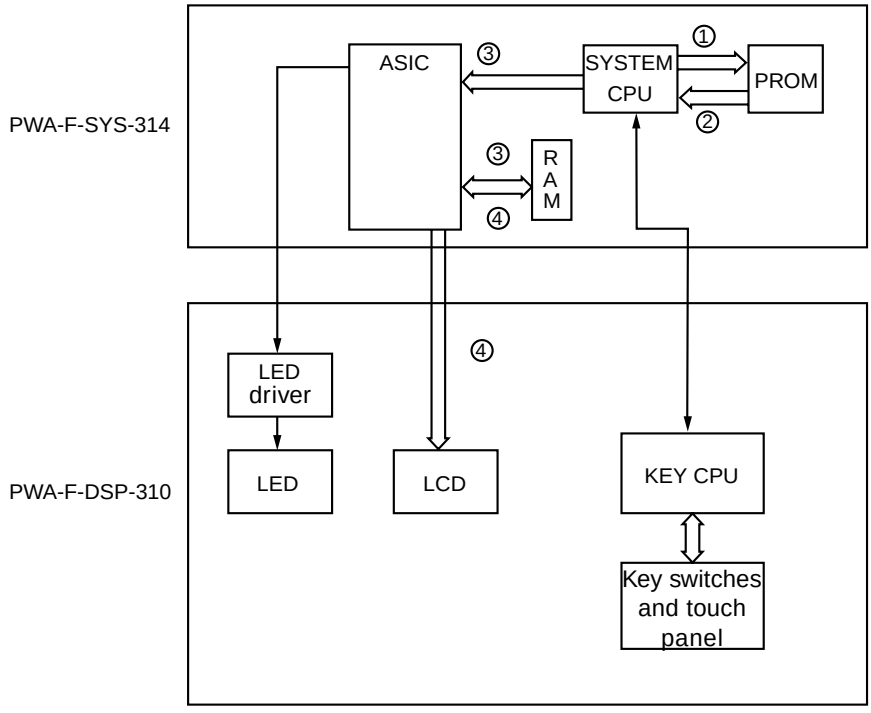
The following describes the drive operation to display the message “READY”.

① The System CPU requests the data for displaying “READY” from the PROM.

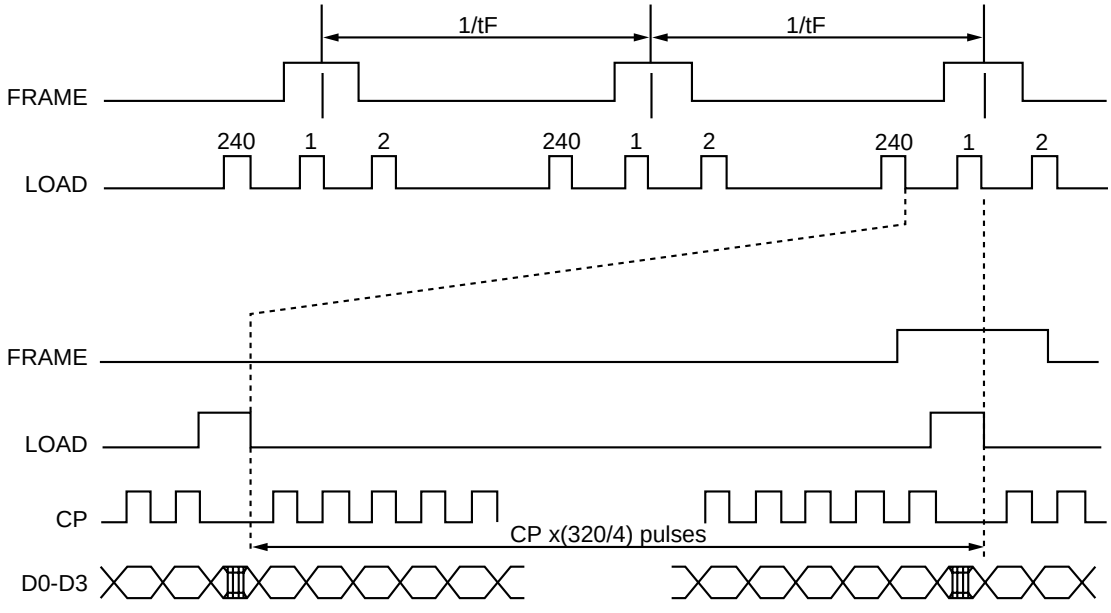
② The PROM outputs the data for displaying the message to the System CPU.

③ The System CPU writes to RAM IC1~8 the data to be displayed on the LCD.

④ The ASIC IC10 reads the display data from RAM IC1~8, and outputs the data to the LCD.



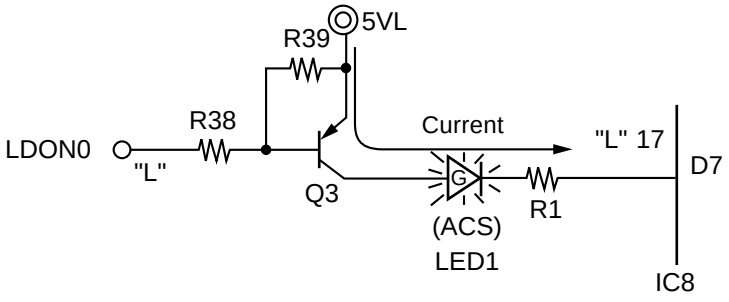
(4) Data Transmission Method



8.4.2 LED display circuit

(1) LED display method

As an example, how LED1 (ACS) for indicating “Auto color” is driven to light is as follows.



When the signal LDON0 changes to the level "L", the transistor (Q3) is turned ON.

In addition, when pin 17 (D7) of IC8 changes to the level "L", the current flows from 5VL via the transistor to LED1 (ACS), i.e. LED1 (ACS) is turned ON.

Conditions for the LED to light

① The transistor (Q3) connected to the LED anode is ON.

② The output connected to the cathode of the LED is the level "L".

The LED comes ON when both ① and ② above are satisfied.

8.5 Disassembly and Replacement

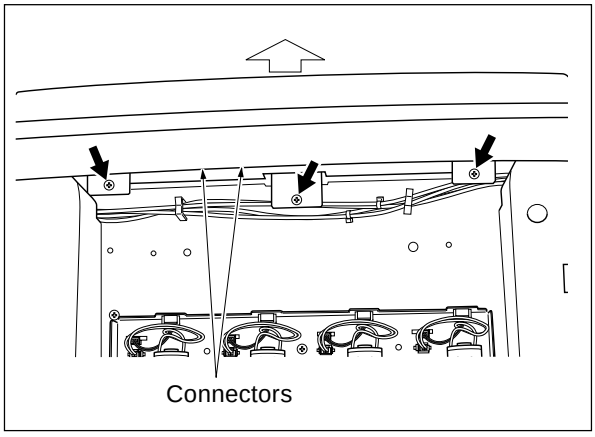
[A] Control panel

(1) Open the front covers and remove the toner cartridges.

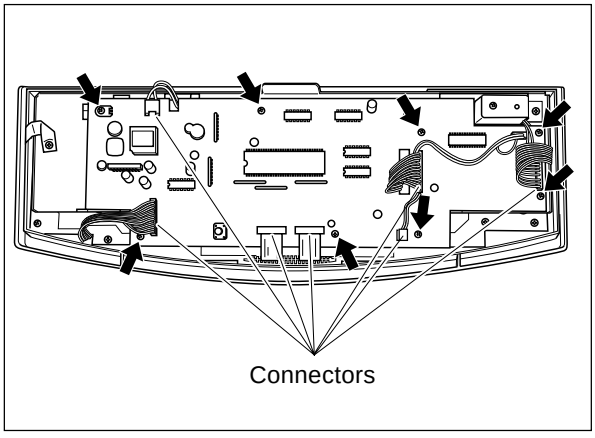
(2) Remove the processing unit (EPU). (Refer to Chapter 13.)

(3) Remove the middle inner cover.

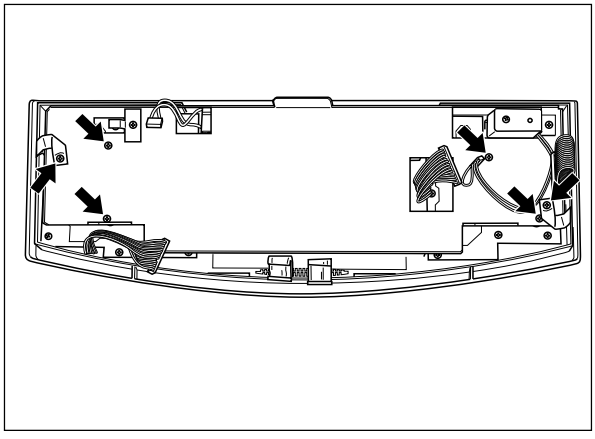
(4) Unscrew 3 screws, disconnect 2 connectors, and then raise the control panel upward to remove it.



(5) Disconnect 7 connectors, remove 1 screw and 7 lock supports, and then take out the DSP PC board.



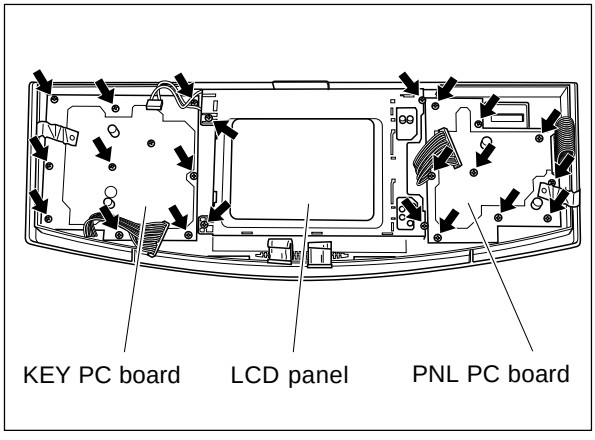
(6) Unscrew 6 screws and then remove the bracket.



(7) Remove the PNL PC board (9 screws).

(8) Remove the KEY PC board (9 screws).

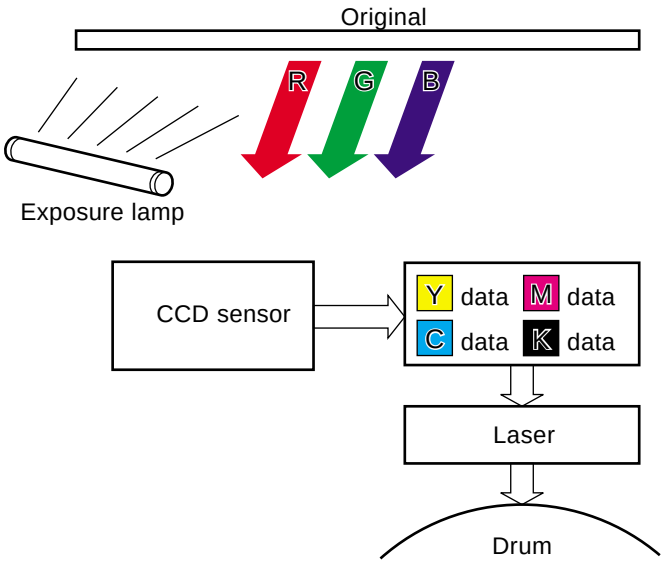
(9) Remove the LCD panel (4 screws).



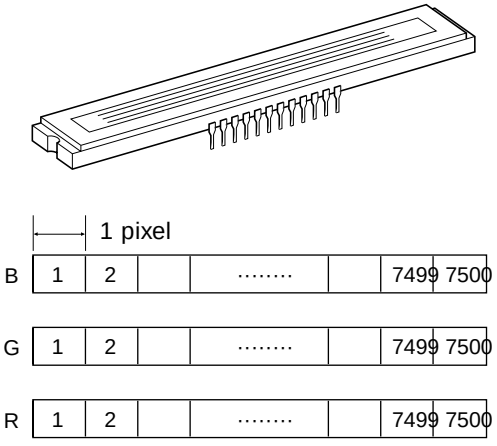
9. SCANNER

9.1 Color CCD Sensor and Color Separation

In the scanner section of digital full-color copiers, RGB filters are used to separate the light reflected from the original into primary colors, which are then changed into data of corresponding amounts of light by a CCD sensor for later processing operations.
In the image processing section, this data is used to create respective output data for Y, M, C and K for the printer. Based on this output data, the emission time of laser light are determined for writing to the drum.

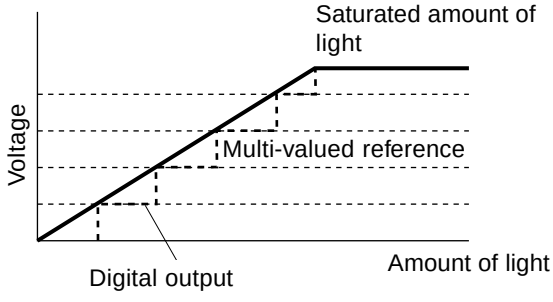


With this copier, a reduction-type CCD for color processing is used.
What this CCD differs from black-and-white CCDs is that its sensor is arranged in three lines as shown on the right, and these lines of sensor are covered with R (red), G (green) and B (blue) filters respectively. These filters work to make color separation possible.



[CCD sensor]

The diagram on the right shows variations in output voltage from a CCD as it receives light. This analog output voltage is then amplified and converted to a 10-bit digital output (1024 steps) through an analog-to-digital conversion means (A/D conversion).
In addition, based on the value read from the white shading correction plate (reference plate) and that read when the lamp is OFF, shading correction (normalization on white and black) is performed.



The following shows an example of reading a monochromatic red original on a blank background:

The sensor line covered with blue filter detects only blue light amount.
Since the text area on the red original does not reflect blue light, it is taken as “dark”, making the light receiving level (voltage) of the CCD sensor low. The background area is taken as “light”, making the light receiving level (voltage) high.

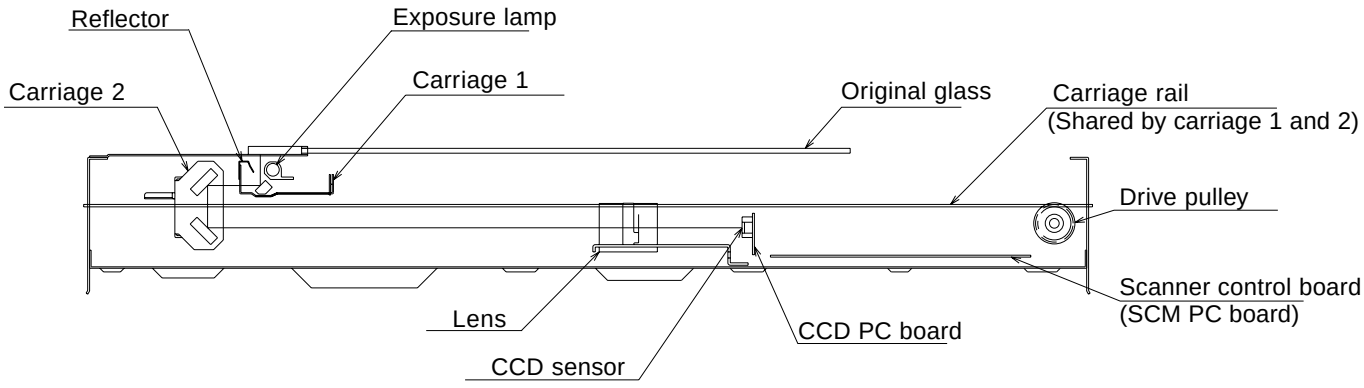
The sensor line covered with green filter detects only green light amount.
Since the text area on the red original does not reflect green light, it becomes “dark” as in the case of the blue filter, making the light receiving level (voltage) of the CCD sensor low. The background area is taken as “light”, making the light receiving level (voltage) high.

The sensor line covered with red filter detects only red light amount.
Since a red original only reflects red light, unlike in the case of blue or green filter, both the text and background areas on the original become “light”, making the light receiving level (voltage) of the CCD sensor high over the entire area.

However, the red, green and blue lines are arranged 4 lines apart from each other in the secondary scanning direction, so if all color- separated data is read simultaneously, an image 4 line apart in colors will result. To avoid this, the green and red data, after having been read, is temporarily stored in line memory. RGB colors are then synchronized by having the green data delayed by 4 lines and the red data by 8 lines, respectively.

9.2 Function

In the scanner section of this machine, the surface of an original is irradiated with a direct light and the reflected light is led through the mirrors and lens to CCD where optical-to-electrical conversion takes place, converting the optical image data into an electrical signal. This analog signal is changed to a digital signal, which then undertakes various corrective processes necessary for image formation. After that, arithmetic operation is performed on the digital signal, which is then sent to the data write section.



9.3 Construction

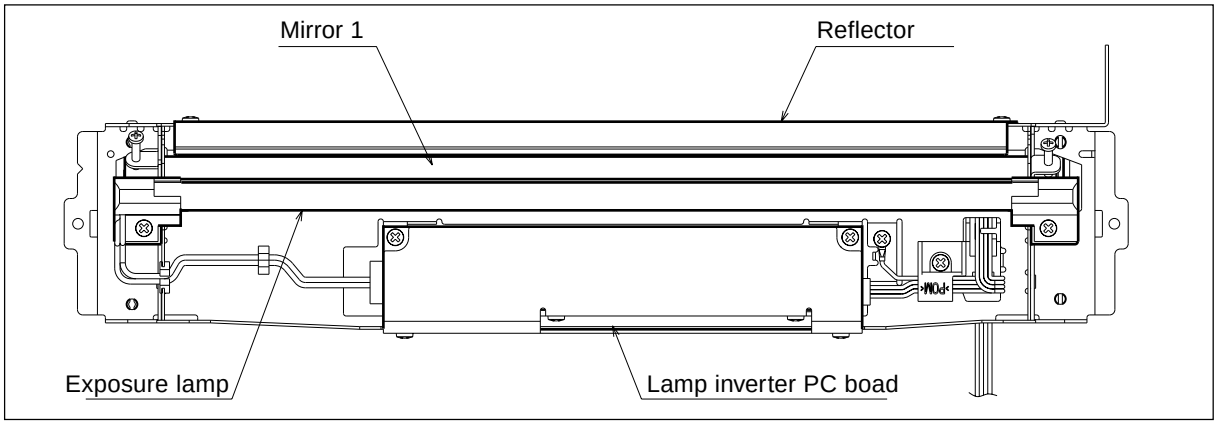
The following shows the construction and purpose of the scanner system:

(1) Original glass

This is where originals to be copied are placed. The light from the exposure lamp is irradiated to the original through this glass.

(2) Carriage 1

Carriage 1, consisting of the exposure lamp, lamp inverter PC boad, reflector, mirror 1, etc., is driven by a scan motor to scan an original on the glass.



a. Exposure lamp

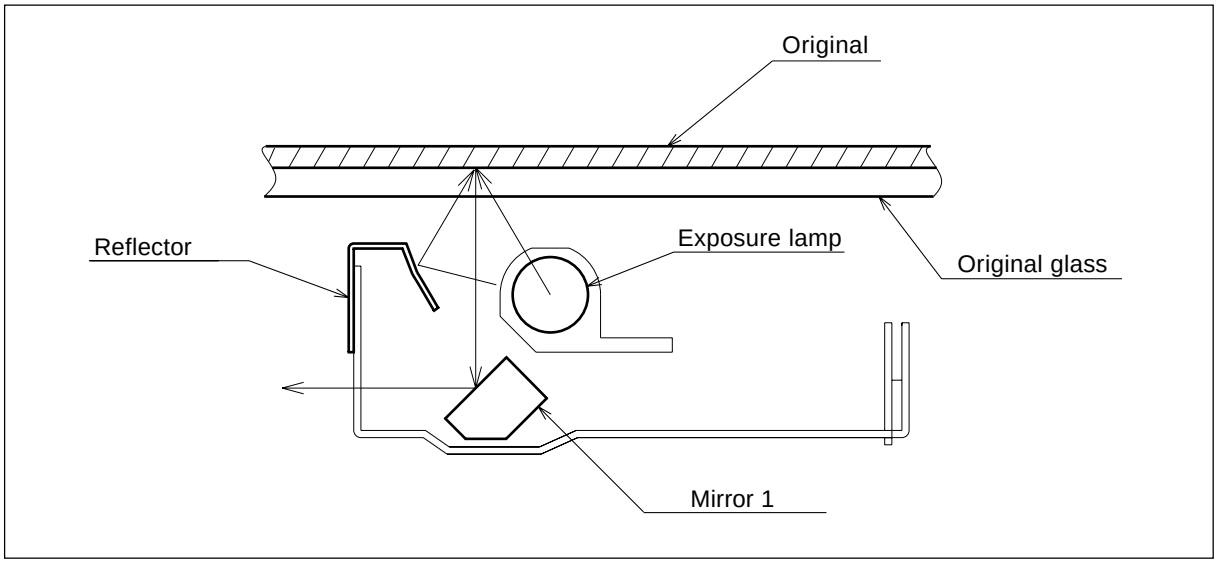
This lamp is the light source to irradiate the original on the glass. (A 30W xenon arc lamp)

b. Lamp inverter

Controls the ON/OFF switching of the xenon lamp.

c. Reflector

This provides a reflecting plate to efficiently direct the light from the exposure lamp to the surface of the original on the glass.



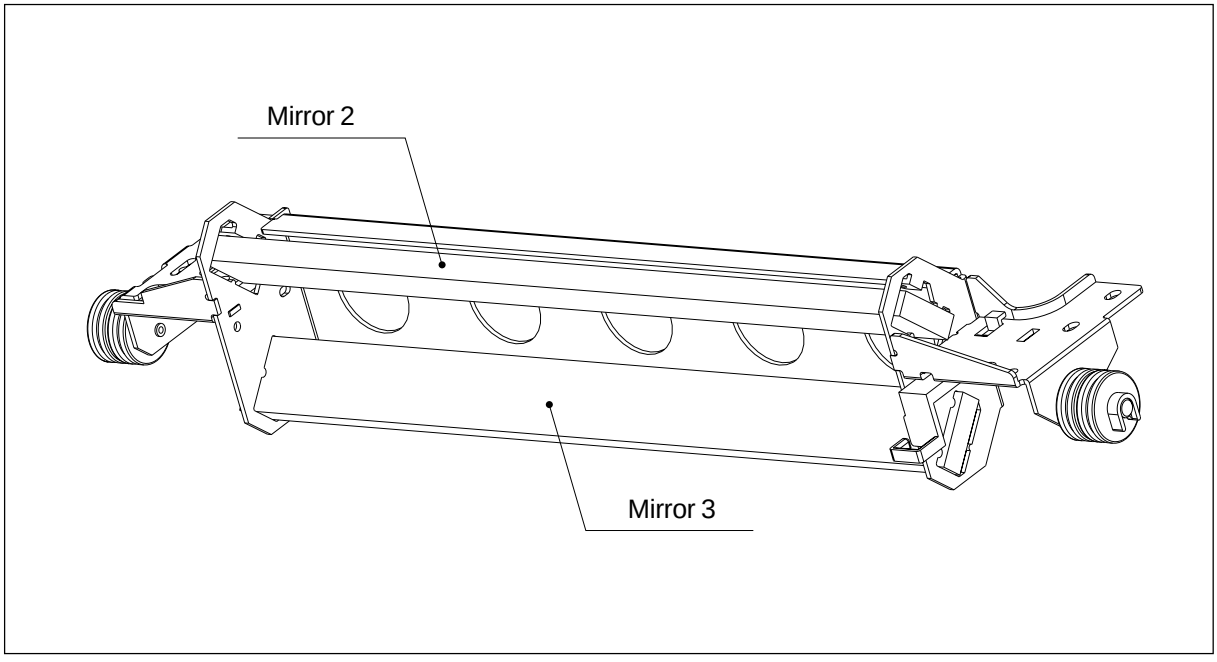
d. Mirror 1

This mirror directs the light reflected from the original to the mirror 2 described later.

(3) Carriage 2

Carriage 2, mainly comprised of the mirror 2 and mirror 3, works to direct the reflected light from the mirror 1 through the mirrors 2 and 3 up to the lens.

This carriage is driven by the same scan motor as the carriage 1 at half the scanning speed of the carriage 1 (the scanning distance is also half that of the carriage 1).

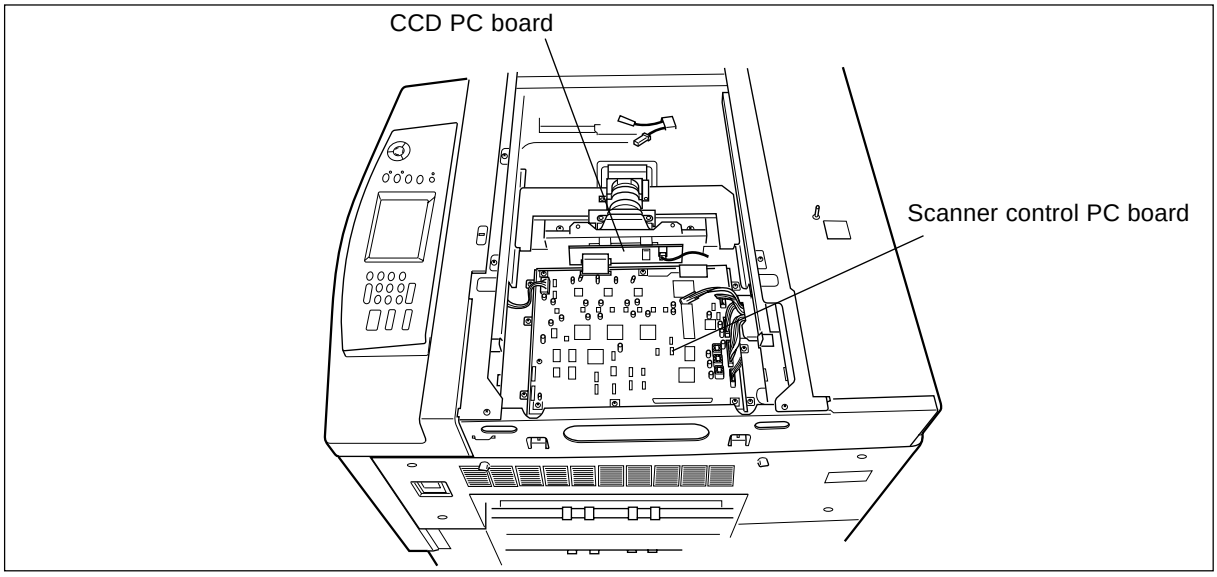


(4) Lens→CCD

The light reflected from mirror 3 is led to CCD placed at the focal point of the lens which is fixed in position.

(5) CCD PC board, scanner control PC board

Pre-processing operations for image processing, such as signal amplification, signal integration, A/D conversion and shading correction, are performed on the electrical signal which was converted by CCD.

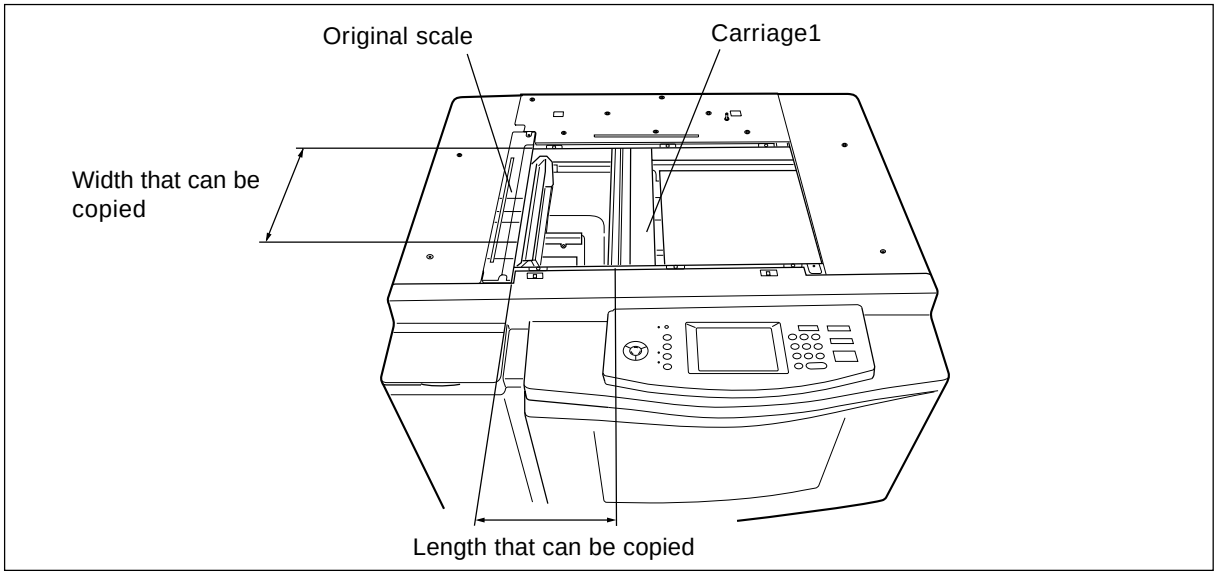


(6) Automatic original detection unit

The size of the original placed on the glass is instantly detected using the automatic original detection sensors (APS sensors) fixed on the lens cover and the base frame without having to move carriage 1.

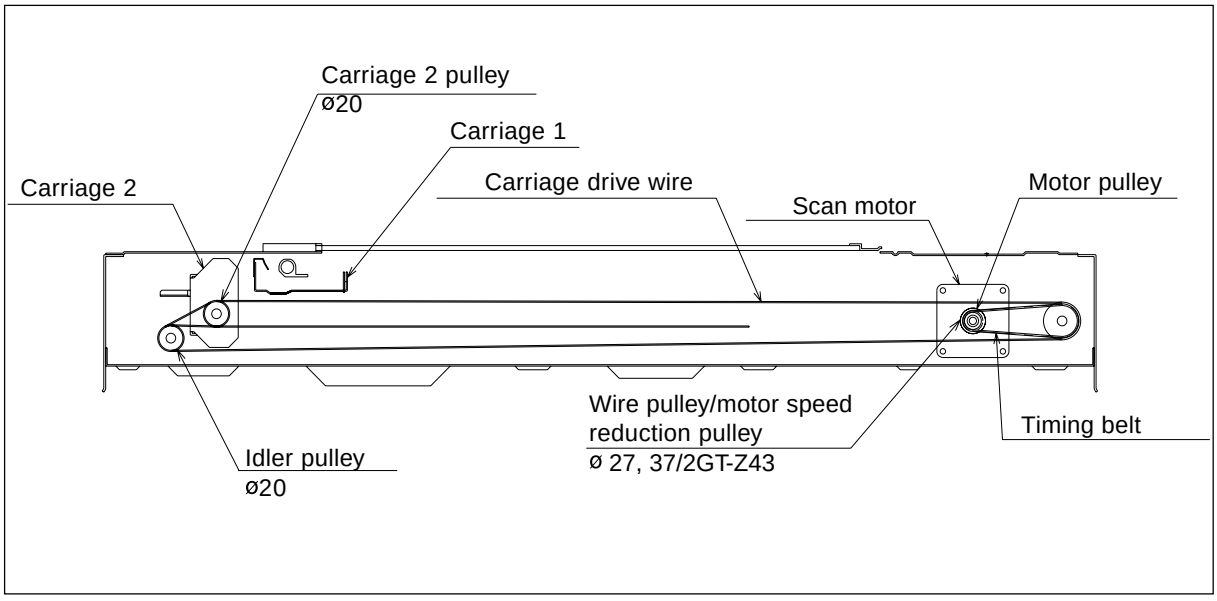
(7) Original-width indicator unit

This unit works to indicate the width of original now selected by the machine. The size of original is indicated, using an indicator in the unit and a yellow line on the carriage 1.



9.4 Description of Operation

9.4.1 Scan motor



This motor drives the carriages 1 and 2 through the timing belt and carriage drive wires as follows. First it drives the carriages 1 and 2 to their respective home positions. The home positions are detected when the carriage 1 passes the home position sensor. When the START key is pressed, both carriages start to move from their home positions and scan the original on the glass.

9.4.2 Document motor

Through the timing belts, this motor drives the original-width indicator on the front side to its home position, i.e., the maximum original width. When an original size is selected or magnification is changed, the motor moves the indicator to the selected size, indicating the original setting position on the glass.

9.4.3 Carriage fan motor

This fan motor rotates during copying and for a fixed time after copying to cool the scanner section including the original glass.

9.5 Drive of the 5-Phase Stepping Motor

9.5.1 Features

This motor has the following advantages over conventional 2-phase hybrid stepping motors with 1.8° step angle which have been considered to have the highest performance so far.

(1) Provides small step angles of 0.72 in full step and 0.36 in half step. This means that this motor has a high resolution capability 2.5 times that of conventional stepping motors. To move over the same distance, this motor can use 2.5 times as many steps, enabling high-speed positioning via optimal slow-up and slow-down control.

(2) Variation in torque during operation is extremely small, thus causing minimal vibration and providing smooth rotation. This motor is ideal for use in applications where variation in torque and/or noise must be avoided.

(3) Since vibration is small even at resonance points and special dampers are not required, the motor can be used over its entire drive range.

(4) Provides approx. 2.5 times as high self-starting frequencies as 2-phase stepping motors, and does not have any resonance area. The motor helps to realize speed control of high speed-change ratios even without taking advantage of slow-up and slow-down control.

(5) Excels in high-speed response compared with 2-phase stepping motors, and helps to realize high-speed units and machines.

(6) Provides superb damping characteristics by being driven in 4-phase or 5-phase excitation method.

(7) Provides various stepping angles such as 0.72, 0.36, 0.18, etc. by having the excitation method changed.

9.5.2 Stepping motor theory

Fundamental differences from 2-phase stepping motors are the number of main poles of the stator and the structure of its windings. While 2-phase stepping motors have the windings arranged in a 2-phase, 4-pole configuration, 5-phase stepping motors have their windings in a 5-phase, 2-pole configuration. Fig. 9.5-1 shows the relationship between the stator teeth and rotor teeth of a 5-phase stepping motor, and its structure of windings.

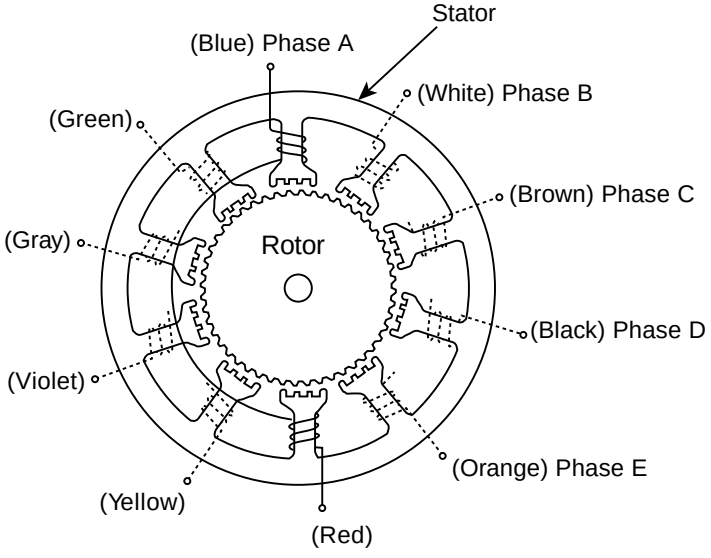


Fig. 9.5-1 Structure of a 5-phase stepping motor

The stator consists of 10 main poles, and facing two main poles each comprises one phase. Coils are so wound that the facing two main poles acquire the same polarity (S or N). The stator teeth are so arranged that, assuming the rotor tooth pitch as τ_R, the stator tooth on a main pole is shifted 0.6 τ_R from its adjacent rotor tooth. This means that the stator tooth is shifted (0.6 - 0.5) $\tau_R = \tau_R/10$ from the tooth on the rotor cup on the opposite side, which is arranged $0.5\tau_R$ shifted from that on this side of the rotor. Fig. 9.5-2 shows this relationship in an easy-to-understand fashion.

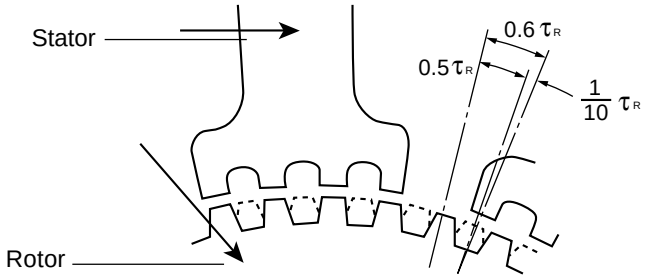


Fig. 9.5-2 Relationship between stator teeth and rotor teeth

Thus, as the stator pole is moved as shown in Fig.9.5-3, the rotor rotates clockwise at the rate of 1/10 the tooth pitch of the rotor.

$$\frac{\tau_R}{10} = \frac{360}{50} \times \frac{1}{10} = 0.72° \text{ ..... (1)}$$

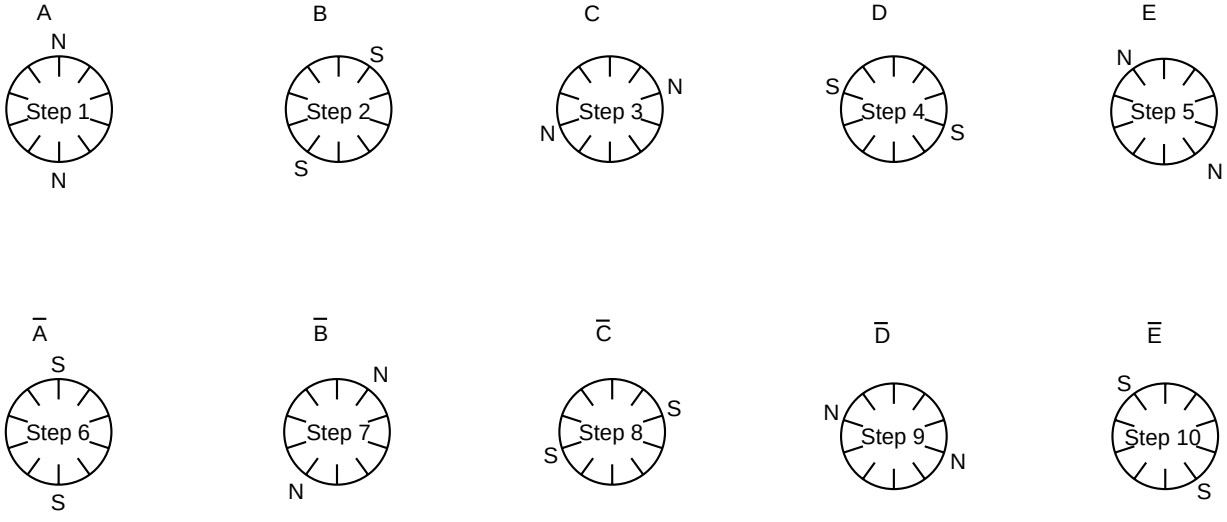


Fig. 9.5-3 Movement of poles at 1-phase excitation

9.5.3 5-Phase motor drive circuit (fixed-current type)

The drive circuit is comprised of the following main components: micro-step drive controller (IC6), pre-driver (IC3), fixed-current control IC (IC8), drivers (IC1 and IC2), and current detecting resistor (R1).

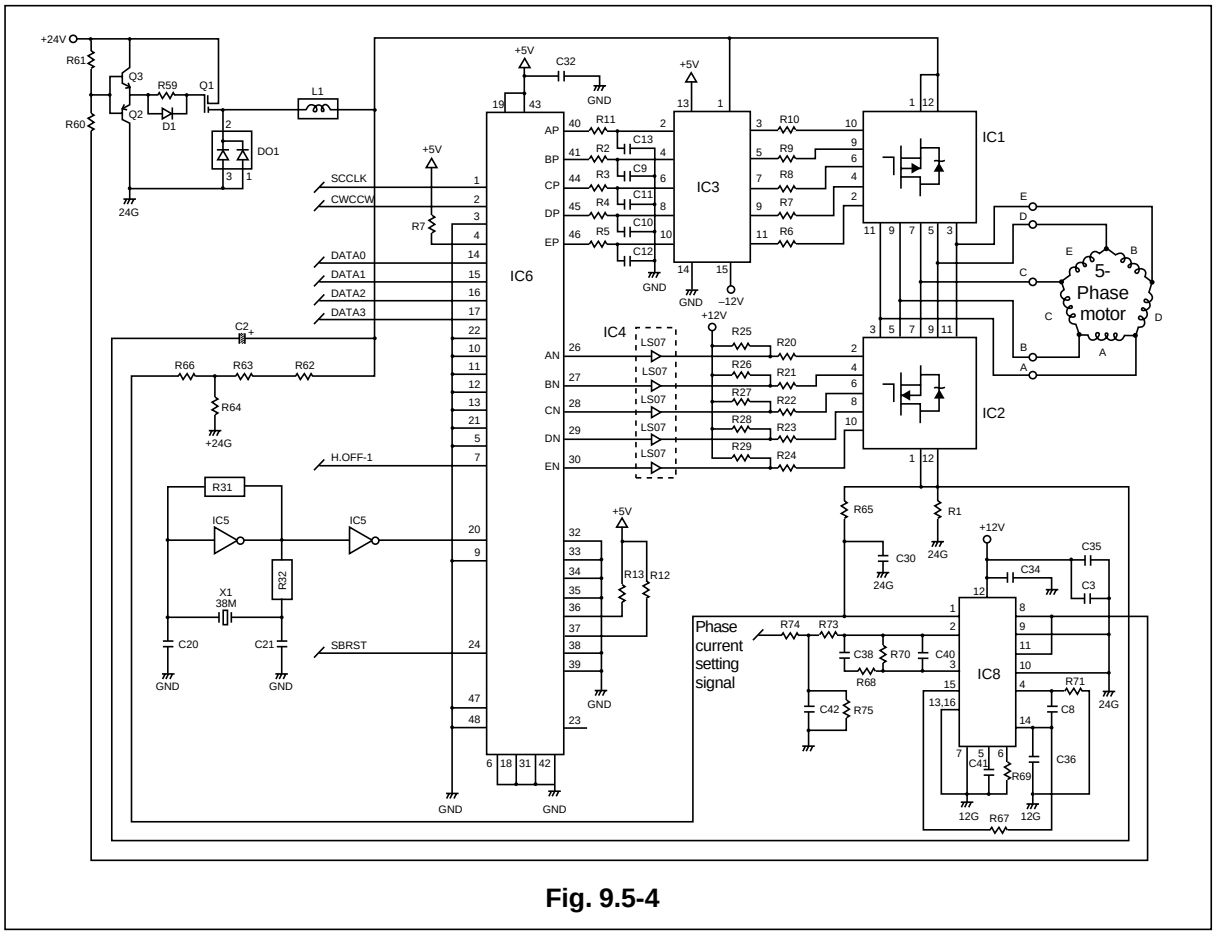


Fig. 9.5-4

– Process to excite phase A –

1 Signal H. OFF is turned ON (Low).

2 At the same time, signal CW/CCW and divided data (DATA 0~3) are input.

3 Approx. 10 ms later, SCCLK is input.

4 IC6 then outputs, from AP~EP (Pch side) and AN~EN (Nch side), excitation ON signals based on the divided data. At this time, IC3, having received these excitation signals, drives IC1 and provides current to the motor.

Note: As this motor is a new pentagon-driven type, twice as much current as the set current flows through the motor leads while it is driven in 4-5 phase or 5 phase excitation.

5 The current flowing into the motor, as a total current, runs through current detecting resistor R1. The current flowing through R1 is then compared in IC8 with the current value set by CPU. Based on the result, Q1 is turned ON or OFF, allowing the motor drive power supply to be controlled.

Operation spec.

SCCLK -0	H. OFF -1	CW/ CCW	DATA 3	2	1	0	Operation		
H	H	--	--	--	--	--	Hold OFF state (Open winding circuit)		
H	L	*	*	*	*	*	Excitation ON state		
*	L	L	*	*	*	*	Normal operation (CW)		
		H	*	*	*	*	Normal operation (CCW)		
		*	L	L	L	L	(250 division)		0.00288°
			L	L	L	H	(200 division)		0.00360°
			L	L	H	L	(125 division)		0.00576°
			L	L	H	H	(100 division)		0.00720°
			L	H	L	L	(80 division)		0.0090°
			L	H	L	H	(50 division)		0.0144°
			L	H	H	L	(40 division)		0.0180°
			L	H	H	H	(25 division)		0.0288°
			H	L	L	L	(20 division)		0.036°
			H	L	L	H	(10 division)		0.072°
			H	L	H	L	2W4–5 phase	(8 division)	0.090°
			H	L	H	H		(5 division)	0.144°
			H	H	L	L	W4–5 phase	(4 division)	0.180°
			H	H	L	H		(2.5 division)	0.288°
			H	H	H	L	4–5 phase	(2 division)	0.36°
			H	H	H	H	4 phase	(1 division)	0.72°

*: unfixed

Timing chart

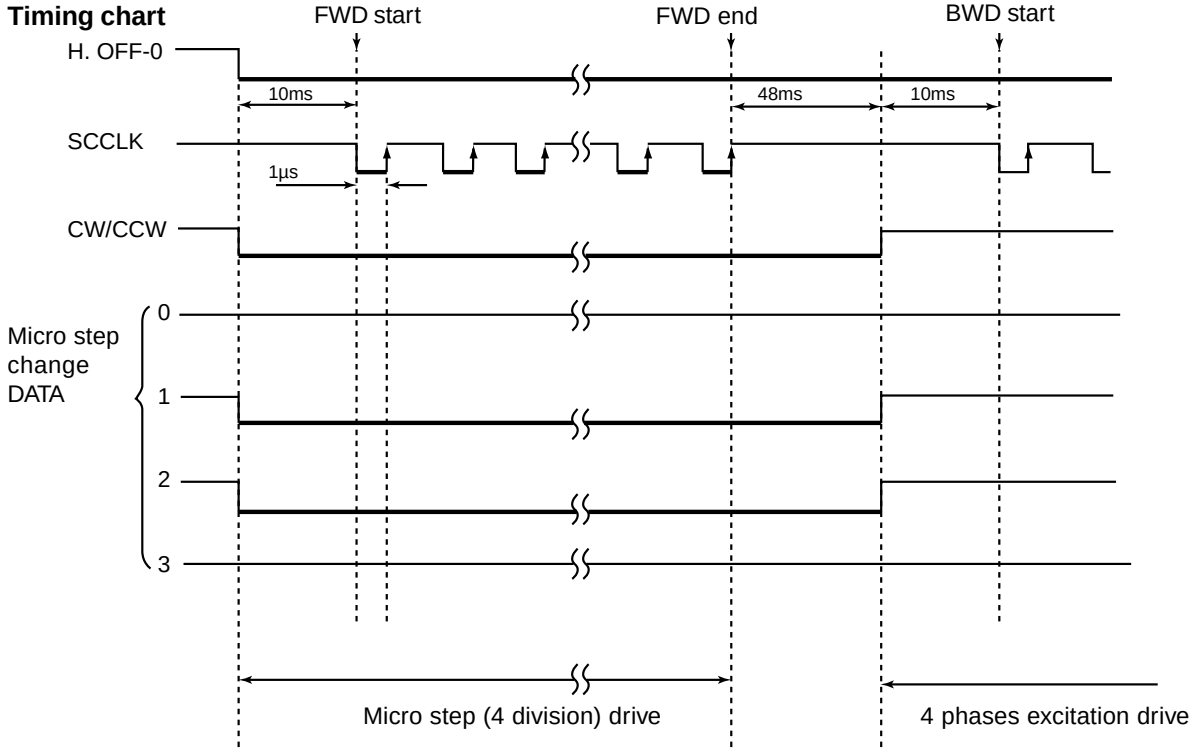


Fig. 9.5-5

The following shows the relationship among the pulse signals input to IC6, signals output from the APch and ANch, and the current flowing into the motor (micro-step 4 division).

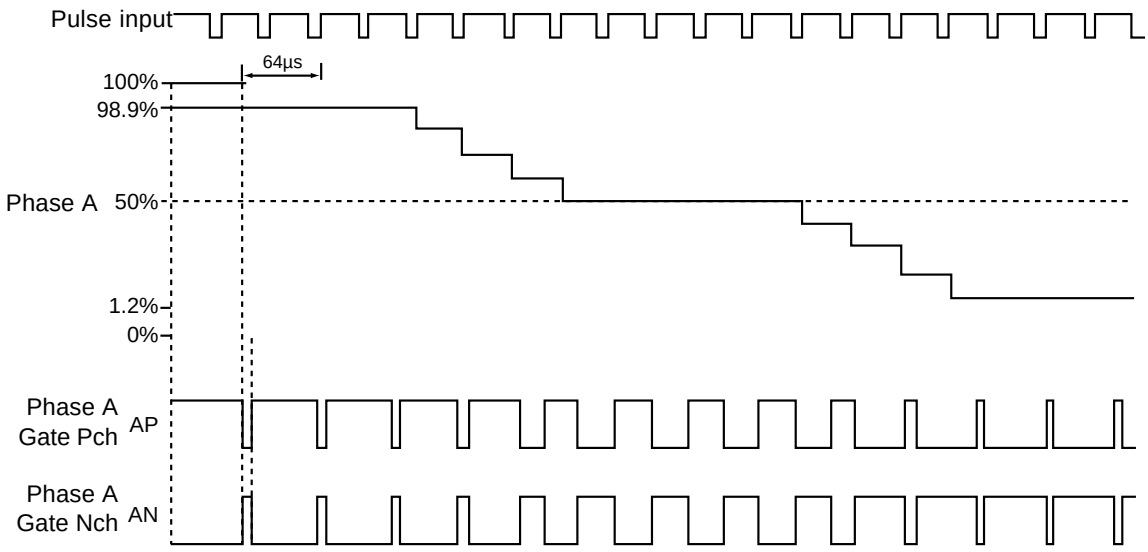


Fig. 9.5-6

9.6 Exposure Lamp Control Circuit

9.6.1 General description

[A] This control circuit is comprised of the following 3 blocks:

(1) Xenon lamp lighting device (Inverter)

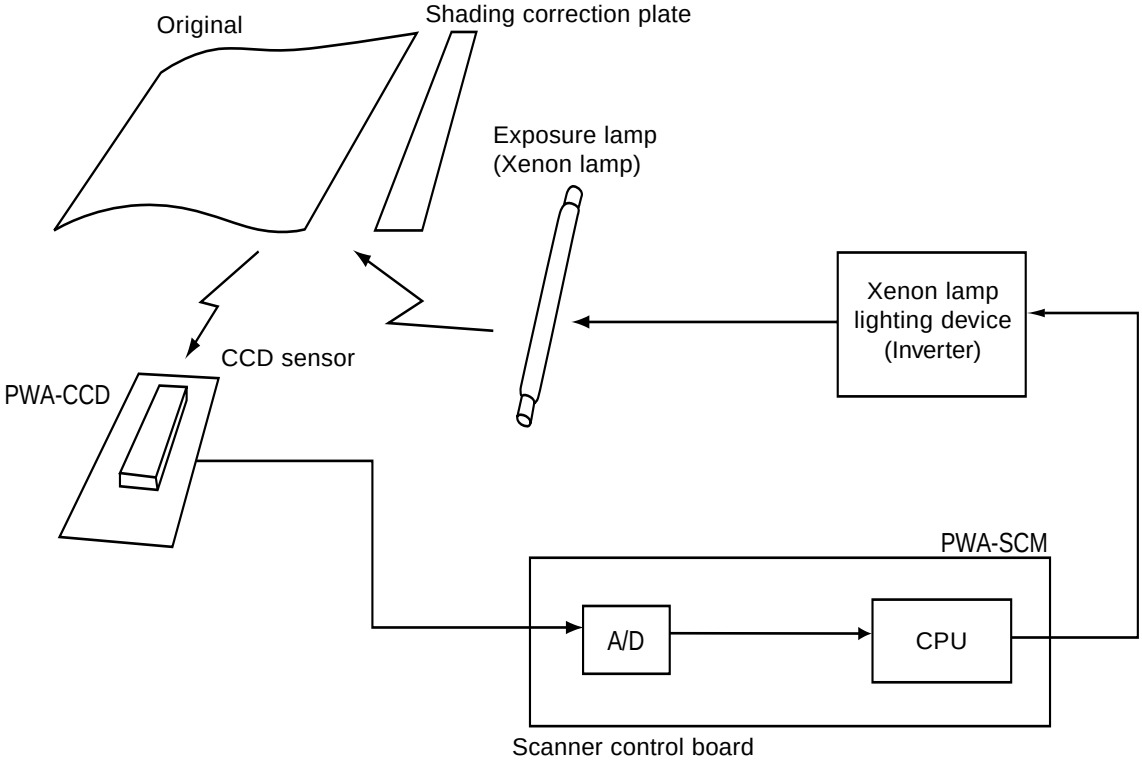
Controls the ON/OFF switching of the exposure lamp.

(2) CCD sensor circuit

Converts the reflected light amount from the original's surface or the shading correction plate to electrical signals. The reflected light amount from the shading correction plate is read to control the exposure amount.

(3) Scanner control board

The output signals from CCD are digitized to be used in a series of image processing such as gamma correction, shading correction, etc.



Construction of exposure control circuit

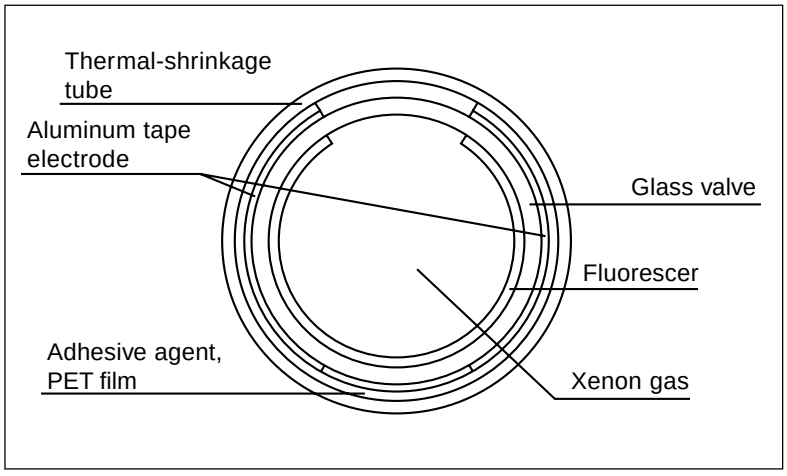
9.6.2 Exposure lamp

External electrode type Xenon fluorescent lamp is used as an exposure lamp in this copier.

(1) Structure

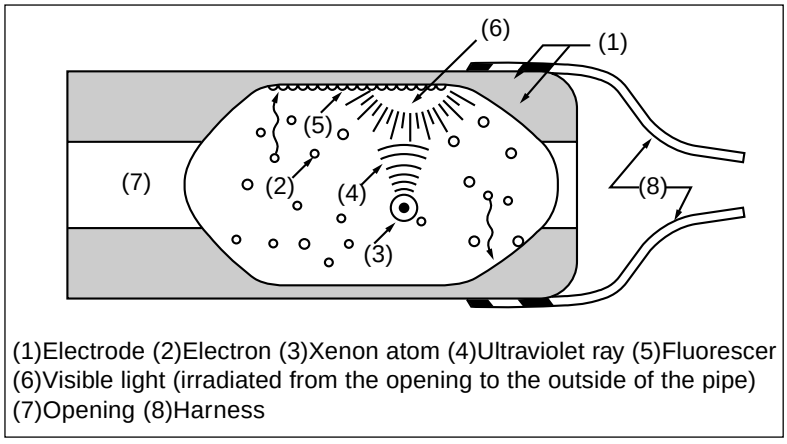
Fluorescer is applied on the inside surface of the lamp pipe (except a part to be an opening) which is filled with the Xenon gas.

A pair of the external electrodes covered by the film with the adhesive agent is attached over the pipe.



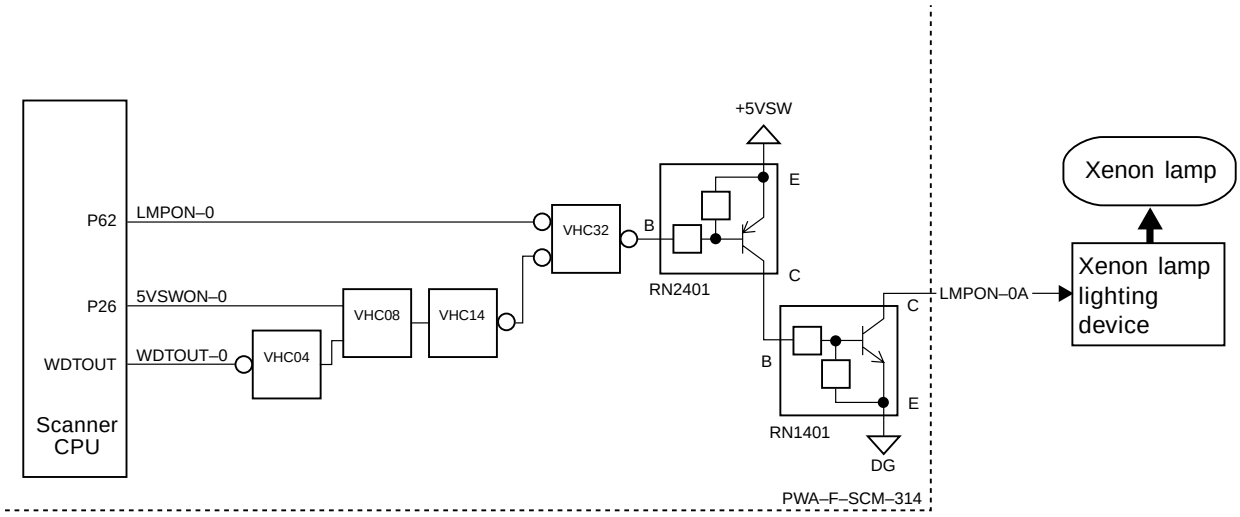
(2) Behavior inside the Lamp

The electron inside the pipe is led to the electric field by applying voltage to the pair of the external electrodes, and discharge is started. Electrons then flow and clash with the Xenon atom inside the pipe to excite them, and generate the ultraviolet ray. This ultraviolet ray converts the fluorescer into the visible light.



(1)Electrode (2)Electron (3)Xenon atom (4)Ultraviolet ray (5)Fluorescer (6)Visible light (irradiated from the opening to the outside of the pipe) (7)Opening (8)Harness

9.6.3 Control circuit for the exposure lamp



Working conditions

WDTOUT-0	5VSWON-0	**LMPON-0 (Lamp drive signal)**	+5VSW	Xenon lamp	State of copier
H	L	**H**	ON	OFF	Normal operation
H	L	**L**	ON	ON	
L	X	**X**	OFF	OFF	Scanner CPU overdriving
H	H	**X**	OFF	OFF	Call for Service

9.7 General Description of CCD Control

9.7.1 Opto-electronic conversion

In order to produce electrical signal corresponding to the reflected light amount from the original, a CCD (charge-coupled device) is employed in this model. Generally, CCD is a one-chip opto-electronic conversion device, comprised of several thousand light-receiving elements arranged in a line, each one of which is a few micron square.

Since this model is a color copier, it is equipped with a special CCD which has three lines of light-receiving elements, each line having 7,500 elements and covered with a colored filter (red, blue or green).

Each element of the light-receiving section is comprised of a pair of layers P and N of semiconductor. When light strikes the element, light energy produces a (-) charge in the P layer; the amount of the charge produced is proportional to the energy and time of lighting. The charges produced in the light-receiving section are then sent to the transfer section, where they are shifted by transfer clocks from right to left as shown in the diagram below and are finally output from the CCD. At this time, to increase the image transfer speed in the CCD, image signals in the even-number and odd-number elements are separated and made to output in parallel via two channels.

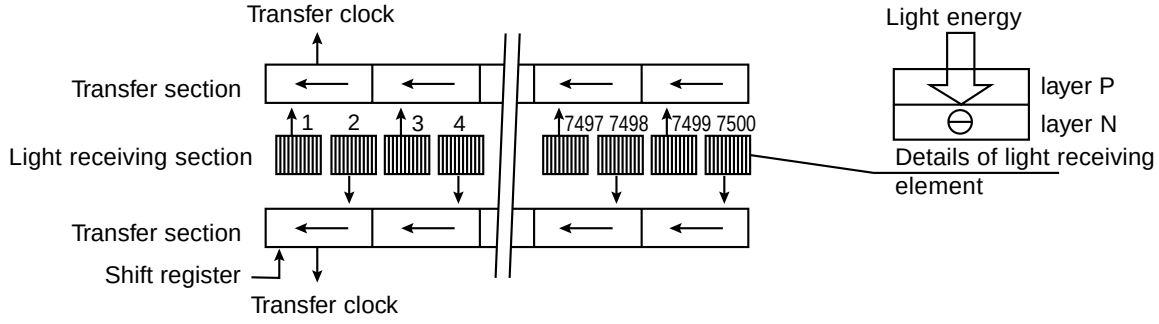


Fig. 9.7-1 Principle of opto-electronic conversion by CCD

9.7.2 Shading correction

Signal voltages read by the CCD must be corrected for variations as described below:

① Light source has a variation in its light distribution.

② Since the light beam reflected from the original is converged using a lens, the light path is the shortest at the center of the CCD, and the closer to either end of the CCD, the longer the light path becomes. This will cause a difference in the amount of light reaching the CCD (i.e. the light amount is maximum at the CCD center, gradually decreasing toward either end).

③ Each of the 7,500 elements varies in opto-electronic conversion efficiency.

These factors of variation need to be corrected. This correction is referred to as shading correction. Shading correction is performed like this. Based on the black and white data obtained in advance, raw image data is put to a normalization process represented by the following formula to correct lighting variance and element variation in the image data.

$$I = k \times \frac{(S - K)}{(W - K)}$$

where k : Coefficient
S : Pre-correction data (or raw image data)
K : Black data (stored in “black” memory)
W : White data (stored in “white” memory)

9.8 Automatic Original Size Detection Circuit

This circuit detects the size of original (standard sizes only) placed on the glass, using reflection type photo sensors arranged on the base frame of the scanner unit.

9.8.1 Principle of original size detection

Reflection type photosensors are placed in proper positions on the base frame of the scanner unit, as shown in Fig. 9.8-1. Each sensor consists of an infrared light emitting diode (LED) on the light emitting side, and a phototransistor on the light receiving side.

When there is an original on the glass, light beams from the LEDs are selectively reflected from the original and led to the matching phototransistors. This means that the size of original is detected by checking which phototransistors are turned ON or not.

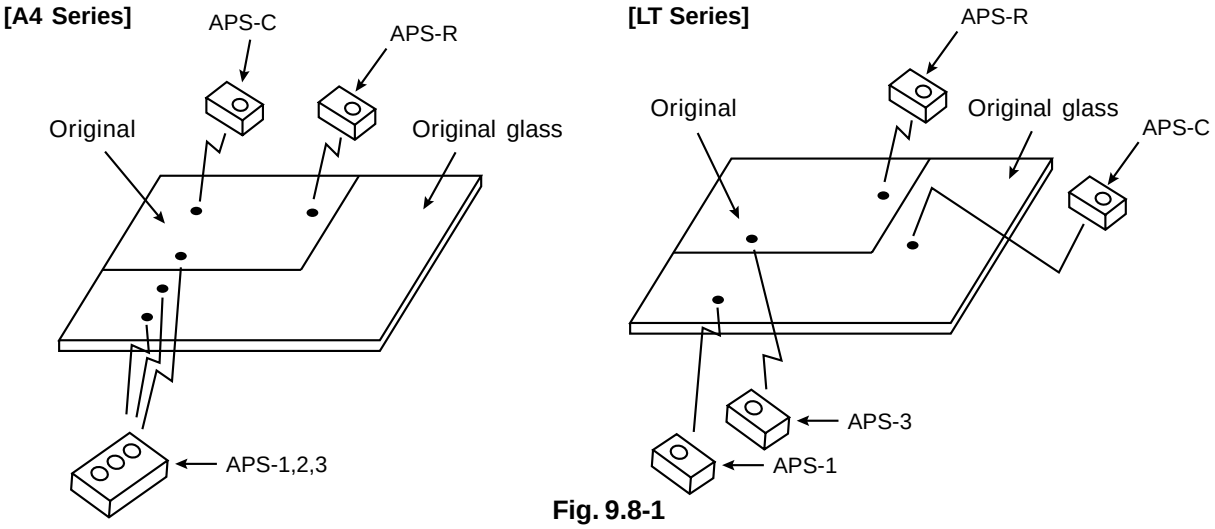


Fig. 9.8-1

9.8.2 Process of detecting original size

(1) When the copier is in the original size detection mode, carriage 1 is set at its home position.

(2) When the platen cover is opened and an original is placed on the glass, the sensors receive or do not receive the light reflected from the original; if one of the matrix conditions shown in step (4) for original sizes holds true, the size of the original is instantly detected.

(3) The output signal from each sensor is input to CPU on the SCM board to determine the size of original.

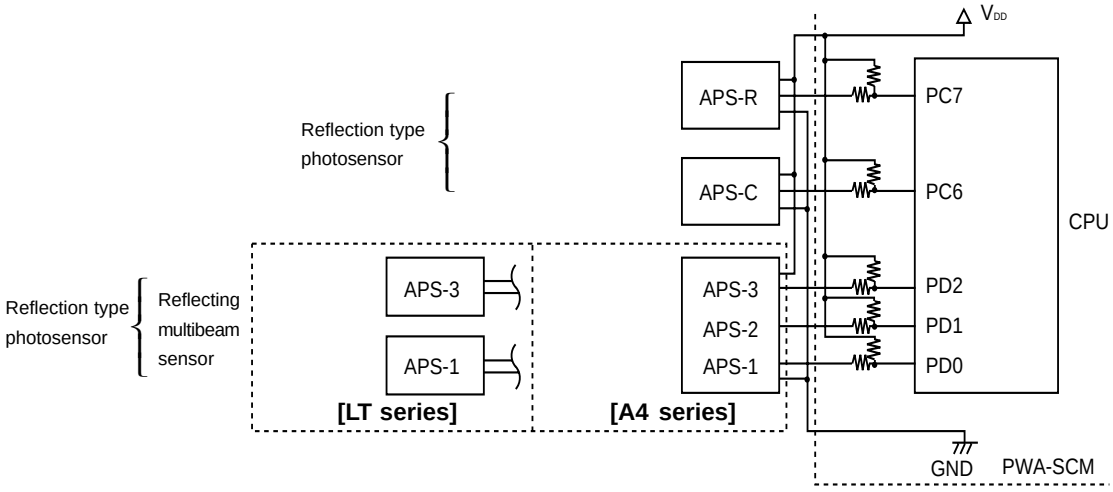
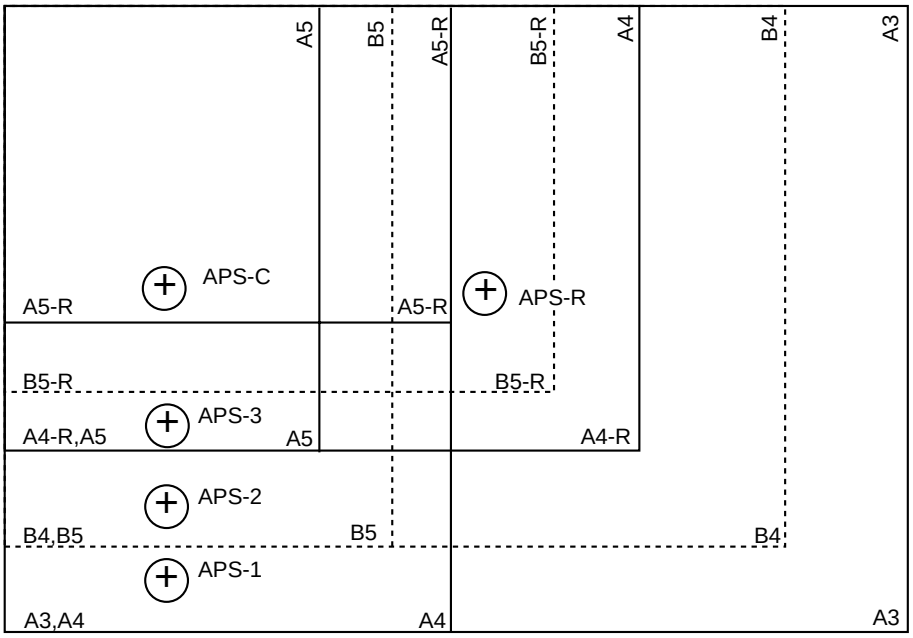


Fig. 9.8-2 Original-size detection circuit

[A4 series]



[LT Series]

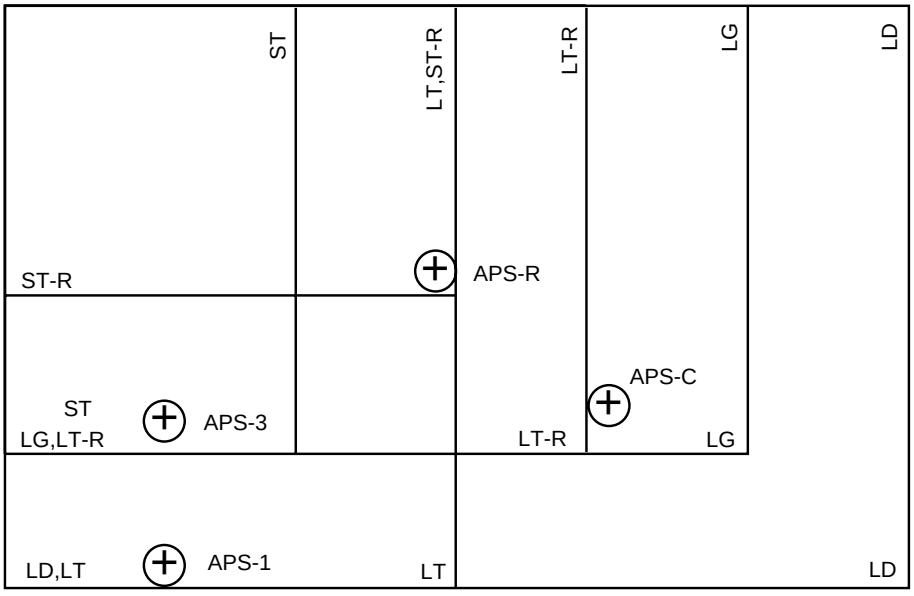


Fig. 9.8-3 Sensor detection points

(4) Original size is determined by the combination of presence/absence signal of original output at each detection point stated in step (3). Combination charts for size determination of A4 series and LT series are as follows.

[A4 Series]

No.	APS-C	APS-R	3-beam sensor			Size judgement	Handling on control
			APS-1	APS-2	APS-3		
1	1	1	1	1	1	No original	No original decision
2	1	1	1	1	0	–	Hold
3	1	1	1	0	1	–	Hold
4	1	1	1	0	0	–	Hold
5	1	1	0	1	1	–	Hold
6	1	1	0	1	0	–	Hold
7	1	1	0	0	1	–	Hold
8	1	1	0	0	0	–	Hold
9	1	0	1	1	1	–	Hold
10	1	0	1	1	0	–	Hold
11	1	0	1	0	1	–	Hold
12	1	0	1	0	0	–	Hold
13	1	0	0	1	1	–	Hold
14	1	0	0	1	0	–	Hold
15	1	0	0	0	1	–	Hold
16	1	0	0	0	0	–	Hold
17	0	1	1	1	1	A5-R	Size decision
18	0	1	1	1	0	A5	Size decision
19	0	1	1	0	1	–	Hold
20	0	1	1	0	0	B5	Size decision
21	0	1	0	1	1	–	Hold
22	0	1	0	1	0	–	Hold
23	0	1	0	0	1	–	Hold
24	0	1	0	0	0	A4	Size decision
25	0	0	1	1	1	B5-R	Size decision
26	0	0	1	1	0	A4-R	Size decision
27	0	0	1	0	1	–	Hold
28	0	0	1	0	0	B4	Size decision
29	0	0	0	1	1	–	Hold
30	0	0	0	1	0	–	Hold
31	0	0	0	0	1	–	Hold
32	0	0	0	0	0	A3	Size decision

[LT Series]

No.	APS-C	APS-R	APS-1	APS-3	Size judgement	Handling on control
1	1	1	1	1	No original	No original decision
2	1	1	1	0	ST	Size decision
3	1	1	1	1	–	Hold
4	1	1	1	0	–	Hold
5	1	1	0	1	–	Hold
6	1	1	0	0	–	Hold
7	1	1	0	1	–	Hold
8	1	1	0	0	–	Hold
9	1	0	1	1	ST-R	Size decision
10	1	0	1	0	LT-R	Size decision
11	1	0	1	1	–	Hold
12	1	0	1	0	–	Hold
13	1	0	0	1	–	Hold
14	1	0	0	0	–	Hold
15	1	0	0	1	–	Hold
16	1	0	0	0	LT	Size decision
17	0	1	1	1	–	Hold
18	0	1	1	0	–	Hold
19	0	1	1	1	–	Hold
20	0	1	1	0	–	Hold
21	0	1	0	1	–	Hold
22	0	1	0	0	–	Hold
23	0	1	0	1	–	Hold
24	0	1	0	0	–	Hold
25	0	0	1	1	–	Hold
26	0	0	1	0	LG	Size decision
27	0	0	1	1	–	Hold
28	0	0	1	0	–	Hold
29	0	0	0	1	–	Hold
30	0	0	0	0	–	Hold
31	0	0	0	1	–	Hold
32	0	0	0	0	LD	Size decision

Code	Output signal	Original
1	H	Absent
0	L	Present

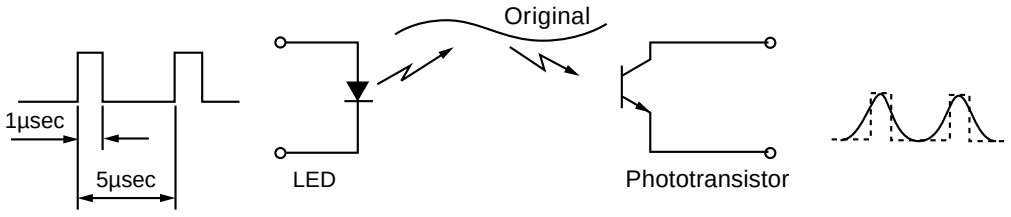
* When platen sensor is OFF
- Output signals from APS sensors determine the following.
  Size decision : Size is displayed on the control panel and a specific paper or reproduction ratio is selected.
  Hold : Retain the latest original size recognized (or no original state) until new paper size is properly recognized.
  No original : Reproduction ratio and paper are not selected
- Size change is always observed and detected if any.
- The carriage-1 stays at the standby position even when original size is changed and thus the reproduction ratio changes.

* When platen sensor is ON
Retains the latest original size (or no original state) recognized just before the platen sensor is turned ON regardless the APS sensor output signals.

Supplementary explanation

(1) Reflection type photosensor

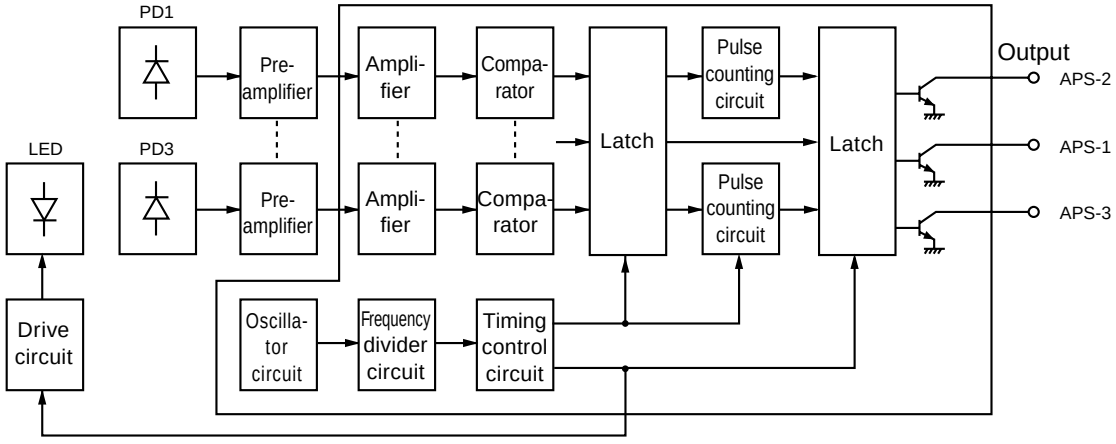
The reflection type photosensor is comprised of an infrared light emitting diode and a phototransistor. It uses pulse modulation to detect an original.



The light emitting diode is driven by a pulse having a 130-µsec period and an 8-µsec ON time. When the phototransistor receives the same signal as this pulse, it will be determined that there is an original. The pulse modulation is performed inside the reflection type phototransistor.

(2) Circuit construction of multi-beam photosensor

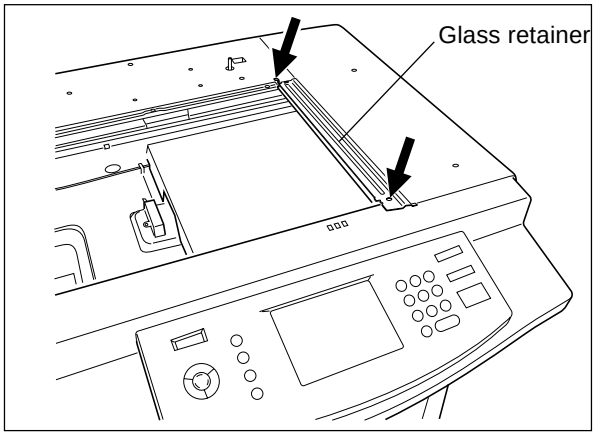
The principle of detection is the same as for the reflection type photosensor.



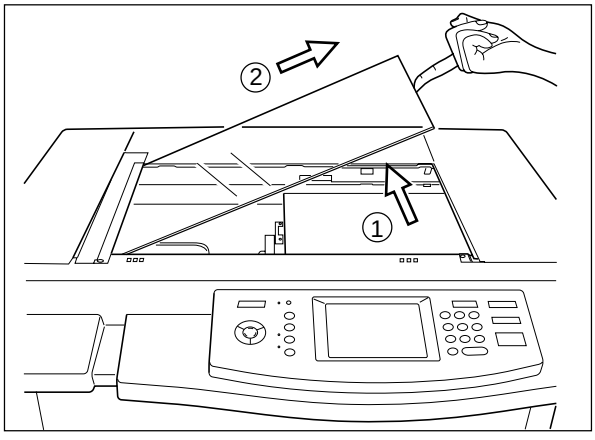
9.9 Disassembly and Replacement

[A] Original glass

(1) Remove 2 screws and then the glass retainer.



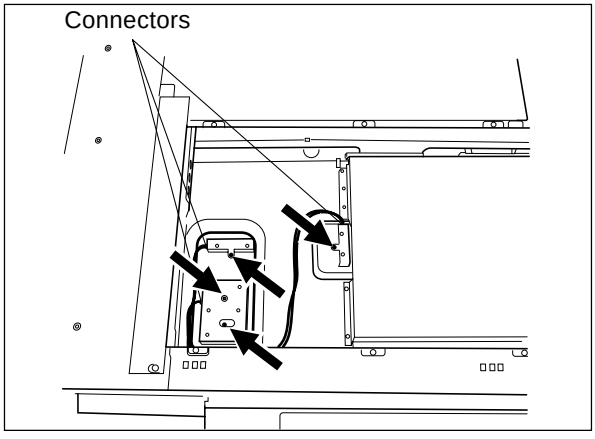
(2) Raising the feed-side end of the glass ①, take it out in the direction of arrow ②.



[B] Automatic original detection unit

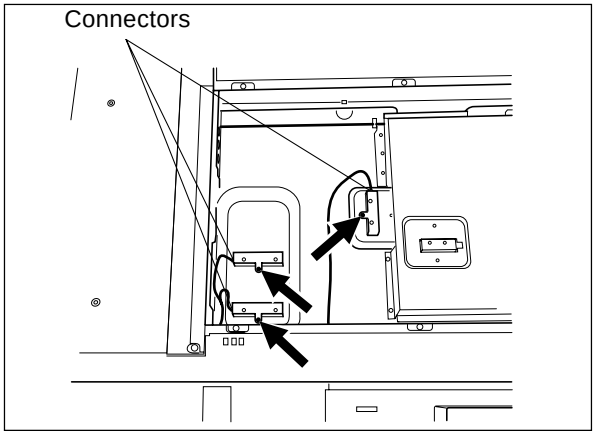
(B-1) A4 Series

(1) Remove 3 sensors on the base frame (4 screws and 3 connectors).

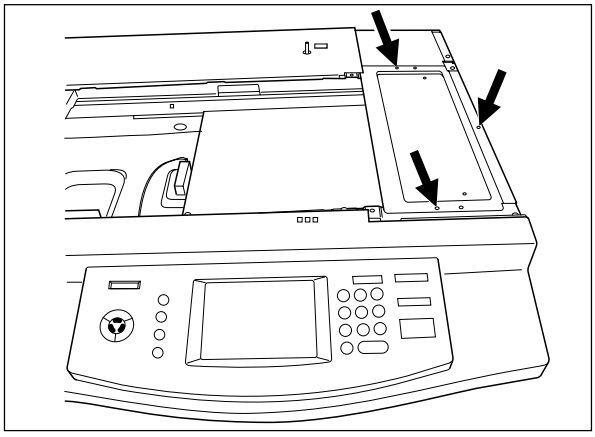


(B-2) LT series

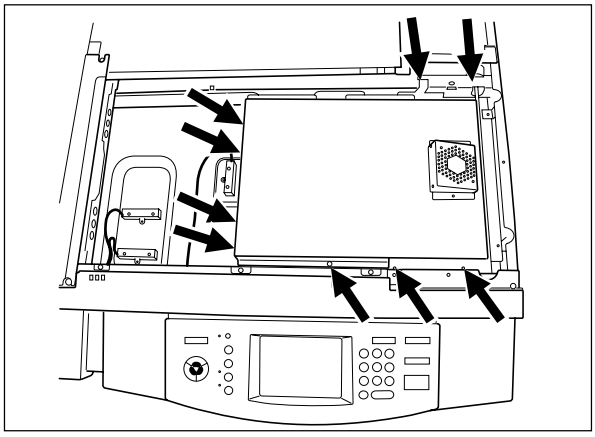
(1) Remove 3 sensors on the base frame (3 screws and 3 connectors).



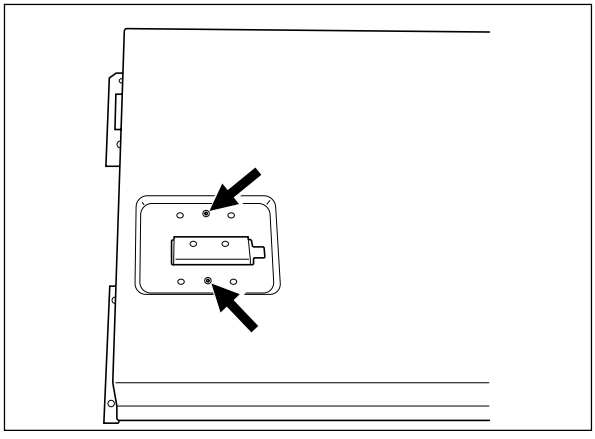
(2) Remove the right top cover and take out the right top bracket (3 screws).



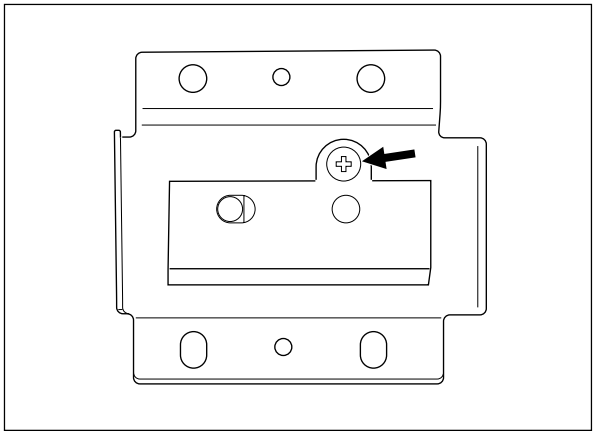
(3) Remove the lens cover (9 screws and 2 connectors).



(4) Remove the sensor bracket mounted to the lens cover (2 screws).

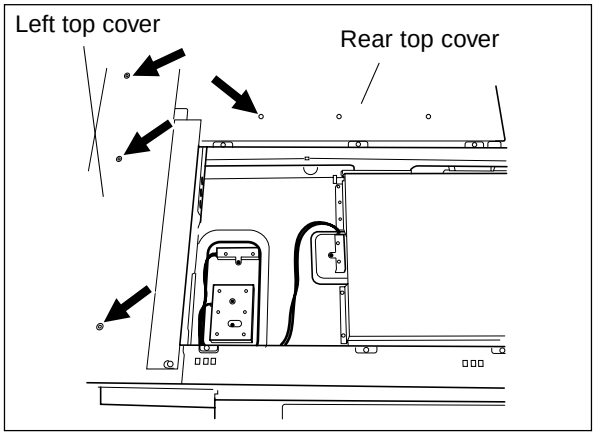


(5) Remove the sensor (1 screw).



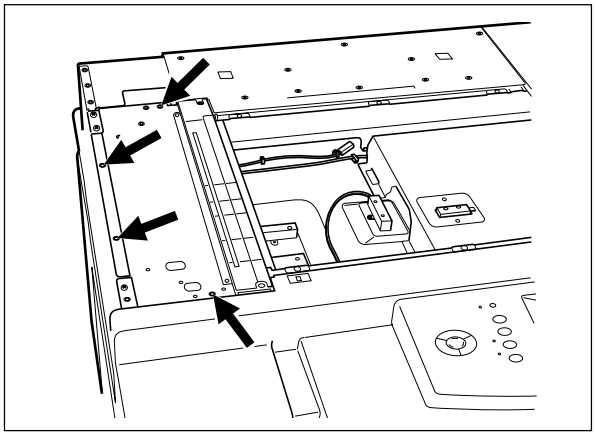
[C] Original-width indicator unit

(1) Remove the left top cover (3 screws) and then the arrowed one of the screws securing the rear top cover.



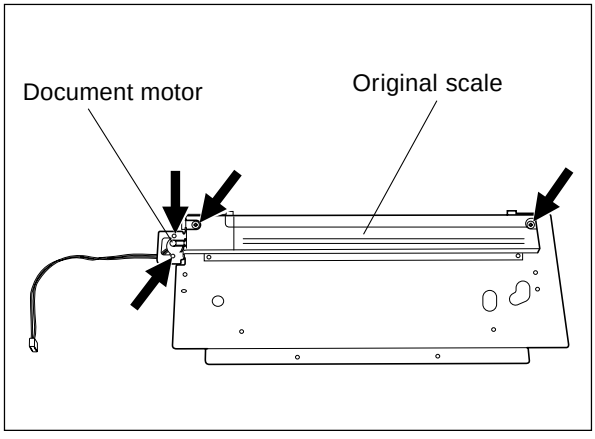
(2) Remove the indicator unit (4 screws, haraness from a harness clamp and 1 connector).

Note: Lift with your fingers the rear top cover located above the document motor to take out the indicator unit.

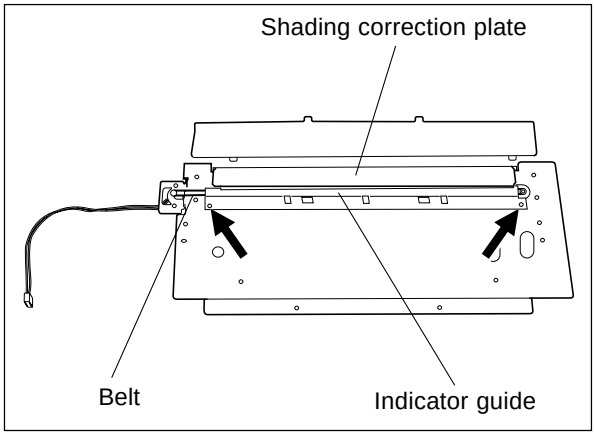


(3) Remove 2 screws and then the document motor.

(4) When removing the shading correction plate, first remove the original scale (1 screw, 1 stepped screw and 1 spring) and then take out the shading correction plate.

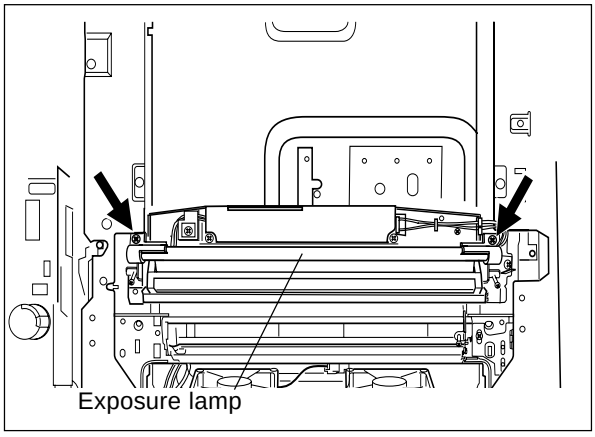


(5) When removing the belt, first remove the indicator guide (2 screws) and then remove the belt.

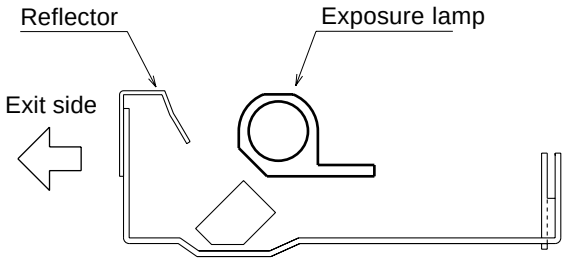


[D] Exposure lamp

(1) Remove the original glass.
(2) Remove the left top cover.
(3) Remove the indicator unit.
(4) Remove 1 connector, the harness from 2 clamps and 2 screws and then take out the exposure lamp.

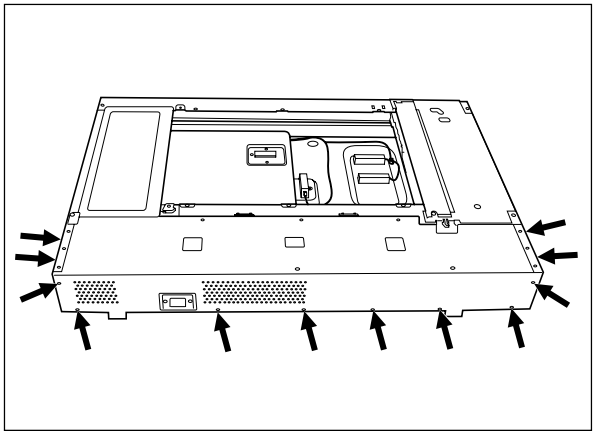


Notes: 1. When installing the exposure lamp, it should be placed as shown on the illustration on the right.
2. Do not touch the surface of the exposure lamp with bare hands.

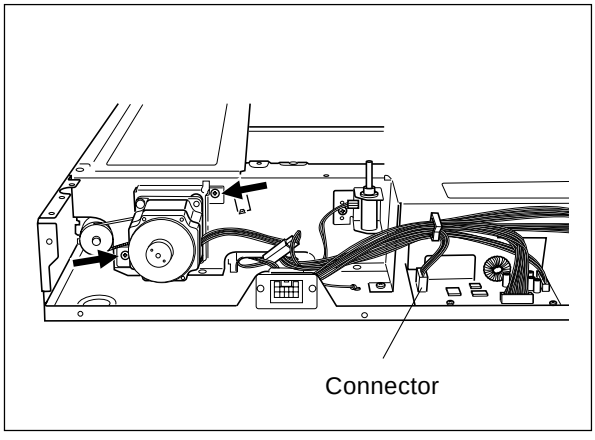


[F] Scan motor

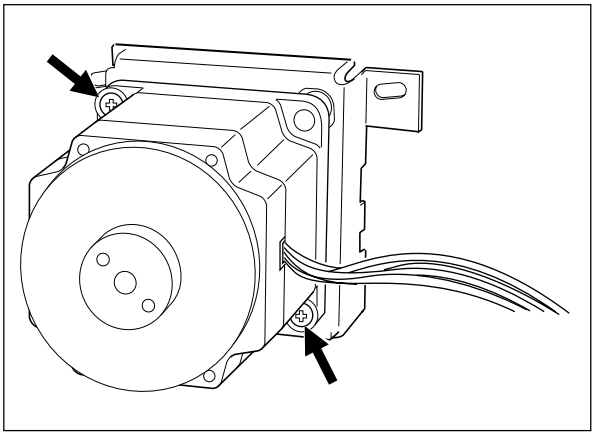
(1) Remove the left top cover, the right top cover and the rear top cover.
(2) Remove the rear-side frame (12 screws).



(3) Disconnect the connector.
(4) Remove 2 screws and then take out the scan motor bracket.

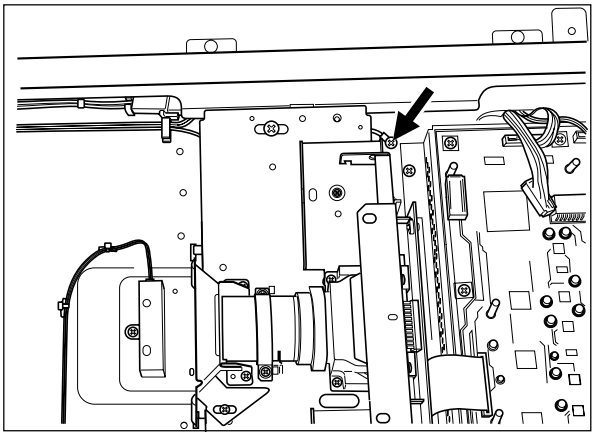


(5) Unscrew 2 screws and remove the scan motor.

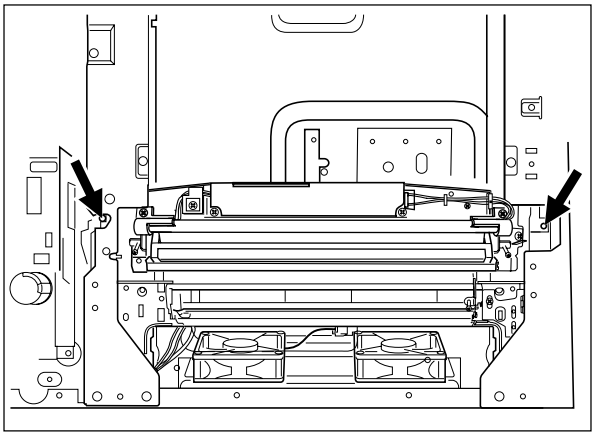


[H] Carriage 1

(1) Remove the original glass.
(2) Remove the right top cover, the right top bracket and the lens cover.
(3) Unscrew the screw which secures the ground wire.



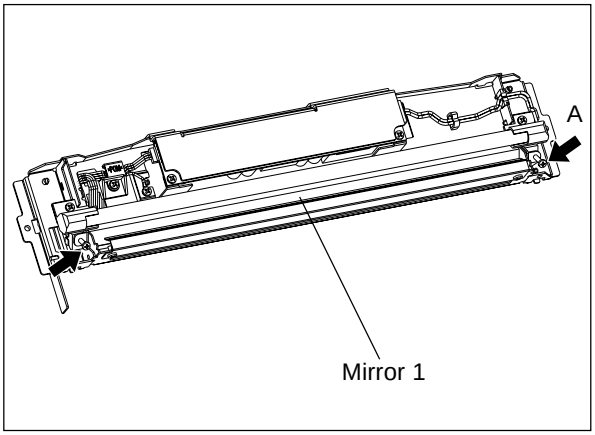
(4) Remove the rear-side frame and the indicator unit.
(5) Move the carriage to the paper exit side.
(6) Remove 2 screws securing the carriage 1 at the front and rear.
(7) Move the carriage to the center, and tilting it at an angle, pull it out upward.



[I] Mirror 1

When replacing the mirror 1, replace the carriage 1 together with the mirror inside.

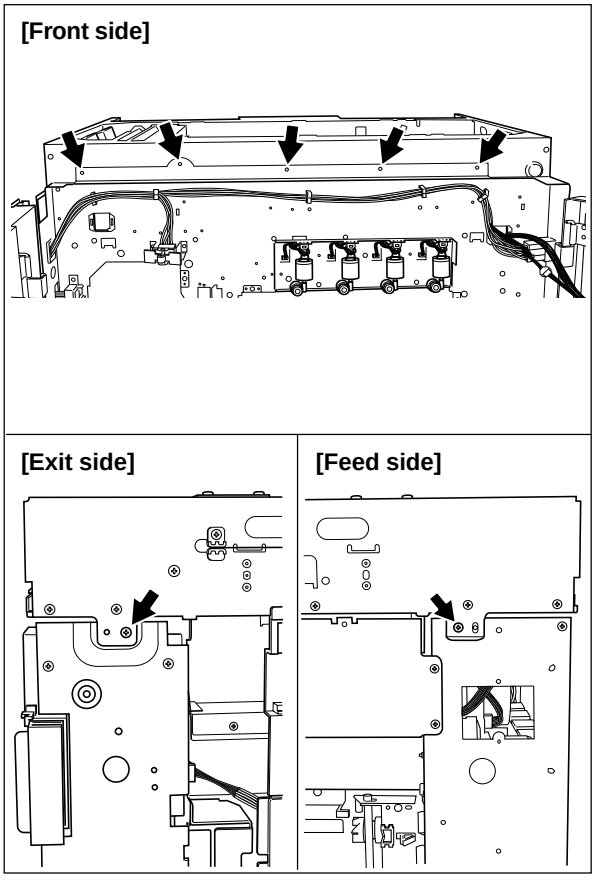
Note: Mirror 1 should not be removed in the field. When replacing the carriage 1, do not touch the 2 screws indicated with arrows. However, the screw A can be adjusted during image distortion adjustment.



[J] Carriage 2 and carriage drive wire

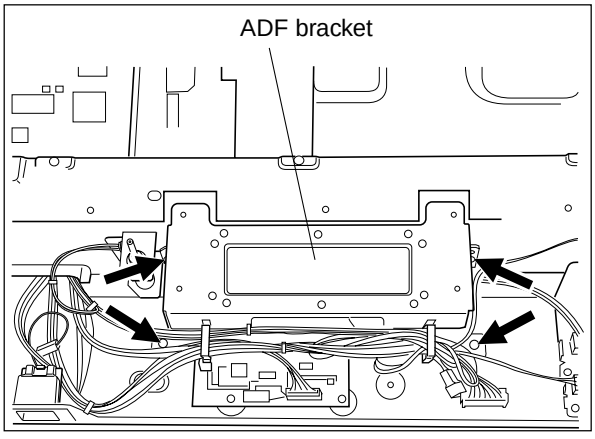
(1) Remove the original glass, feed-side cover, exit-side cover, top cover, rear cover, inner cover, control panel unit, rear frame, and front stay.

(2) Remove the scanner unit (screws: 5 at front side, 1 at feed side and 1 at exit side).



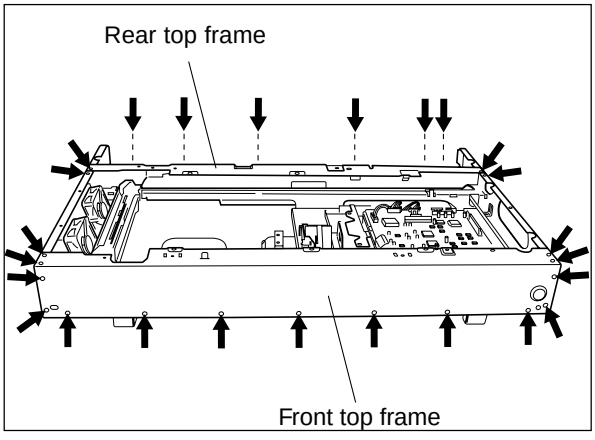
(3) Remove the scan motor.

(4) Remove the ADF bracket (4 screws).



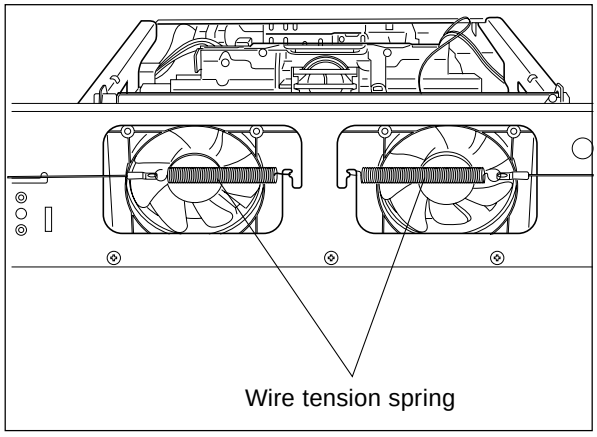
(5) Remove the carriage 1.

(6) Remove the rear top frame (10 screws) and front top frame (15 screws).



(7) Remove the wire tension spring.

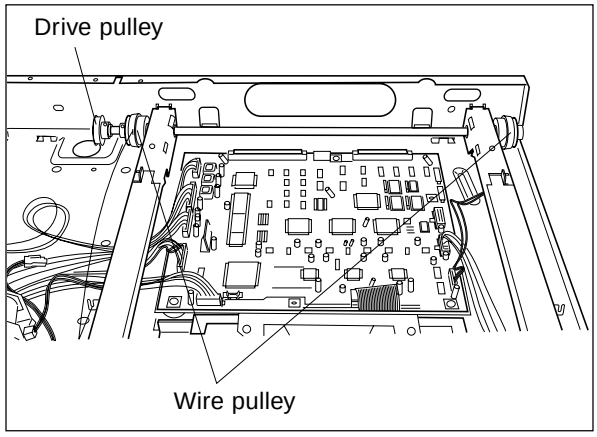
(8) Take out the carriage 2.



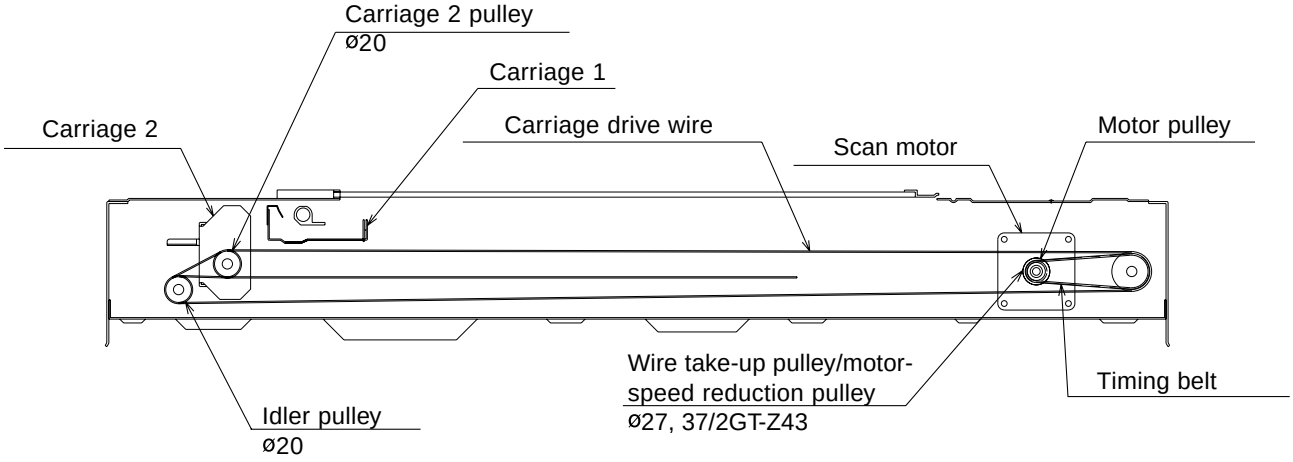
(9) Remove the drive pulley (2 setscrews).

(10) Remove 2 wire pulleys (2 setscrews for each).

(11) Remove the wires from the wire pulleys.

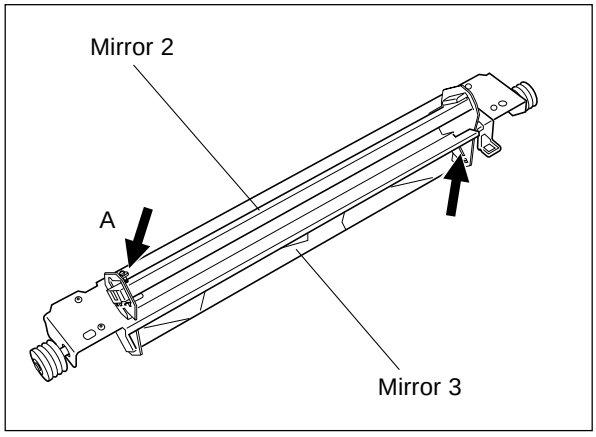


Note:
- For reassembly, the wire should be mounted as shown below.
- Refer to the Service Handbook for information about how to wind the wire around the wire pulleys.
- When reinstalling the wire and carriages 1 and 2, refer to the Service Handbook.
- When reinstalling the drive pulley and wire pulleys, the 2 setscrews must be fixed in the same direction.



[K] Mirrors 2 and 3

When replacing the mirrors 2 and 3, replace the carriage 2 together with the mirrors inside.

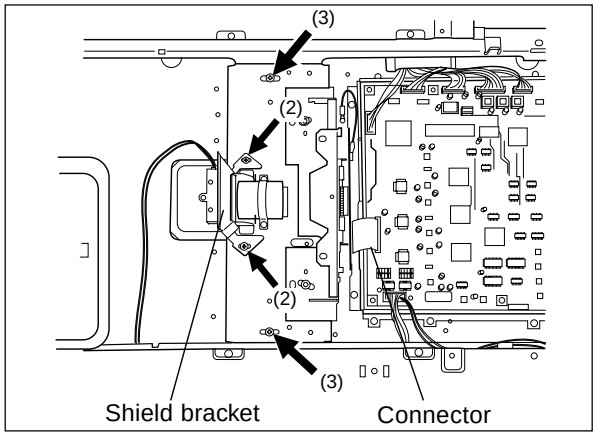


Note: Mirrors 2 and 3 should not be removed in the field. When replacing the carriage 2, do not touch the 2 screws indicated with arrows.

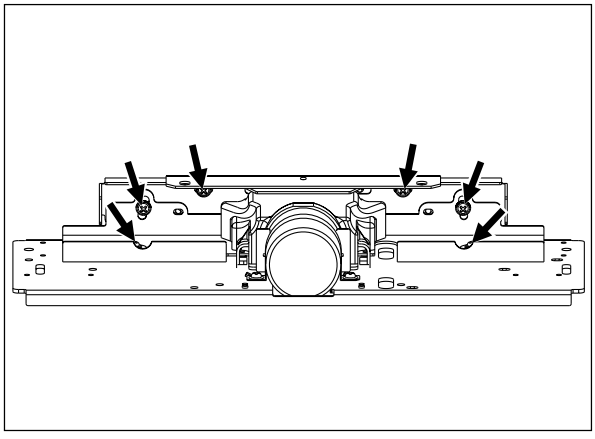
However, the screw A can be adjusted during image distortion adjustment.

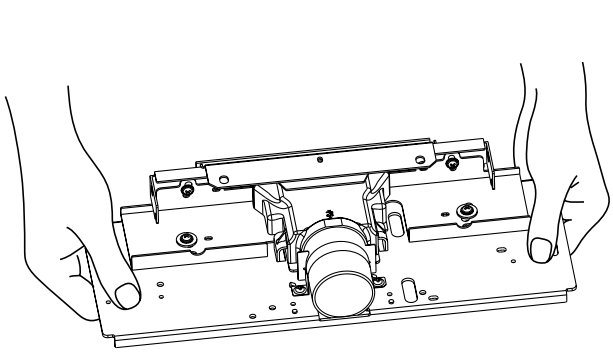
[L] Lens unit

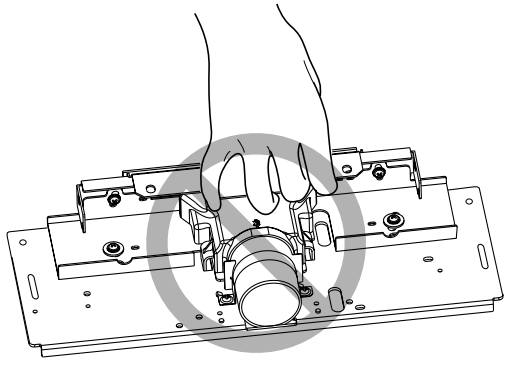
(1) Remove the lens cover.
(2) Remove the shield bracket (2 screws).
(3) Remove 2 screws and 1 connector.
(4) Remove the lens unit, pulling it upwards.



Note: 1. When replacing the lens unit, do not touch the screws indicated with arrows (6 screws paint-locked).
2. When handling the lens unit, do not touch the adjusted section and the lens.
3. When reinstalling the lens unit, be sure to use the positioning pins. (Refer to the Service Handbook.)

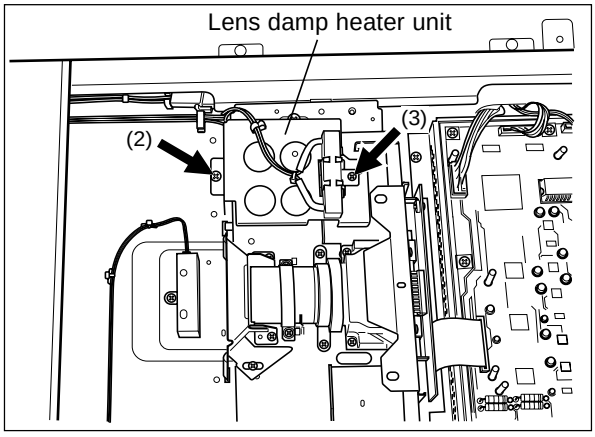




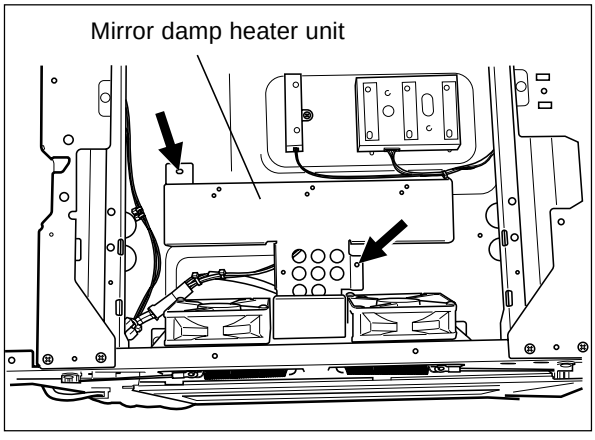


[M] Damp heater

(1) Remove the lens cover.
(2) Remove the screw and the connector. Then, take out the lens damp heater unit.
(3) Unscrew the screw, release the harness from the clamp, and then remove the lens damp heater.

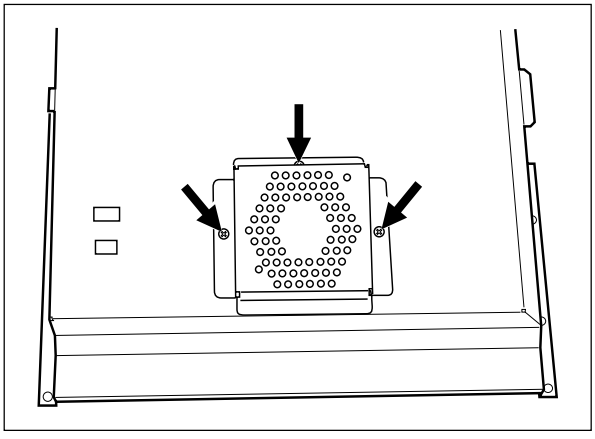


(4) Unscrew 2 screws which are securing the mirror damp heater bracket, disconnect the connector and release the clamp holding the cable.
(5) Disconnect 2 connectors and remove the cable. Then take out the mirror damp heater unit.
(6) Unscrew the screw, release the harness from the clamp, and then remove the mirror damp heater.

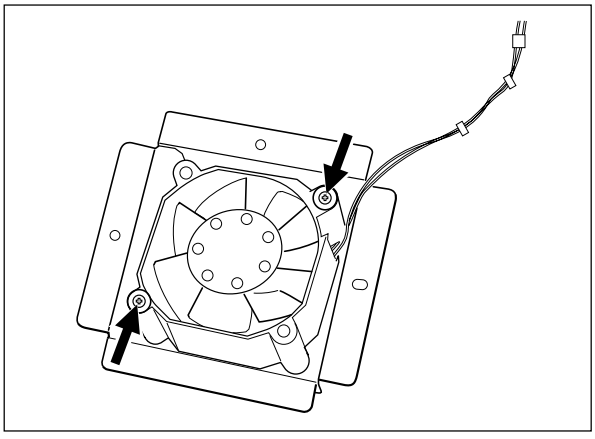


[N] SCM fan

(1) Remove the original glass and lens cover.
(2) Remove 3 screws and the connector from the lens cover. Then, detach the fan unit.

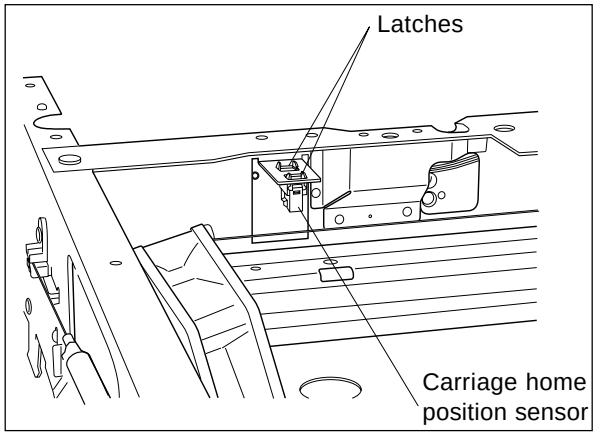


(3) Unscrew 2 screws which hold the fan in place and take out the fan.



[O] Carriage home position sensor

(1) Disconnect the connector, release 2 latches and take out the carriage home position sensor.



10. LASER OPTICAL UNIT

10.1 General Function

For the formation of electrostatic latent images, the laser optical unit works to project color-separated digital image signals (basic elements of color images) sent from the scanner section or printer controller onto the drums of yellow, magenta, cyan and black, respectively. The image signal is first changed into a light signal emitted from a laser diode via the laser drive PC board. This light signal then passes through optical elements such as a pre-deflection lens, polygonal mirror, fθ lens and other mirrors, and illuminates the surface of the drum. Since this set of optical components are very vulnerable to dirt and dust, they are assembled and precision-adjusted in a clean room at the factory. Therefore, the laser optical unit must not be disassembled in the field for any reason.

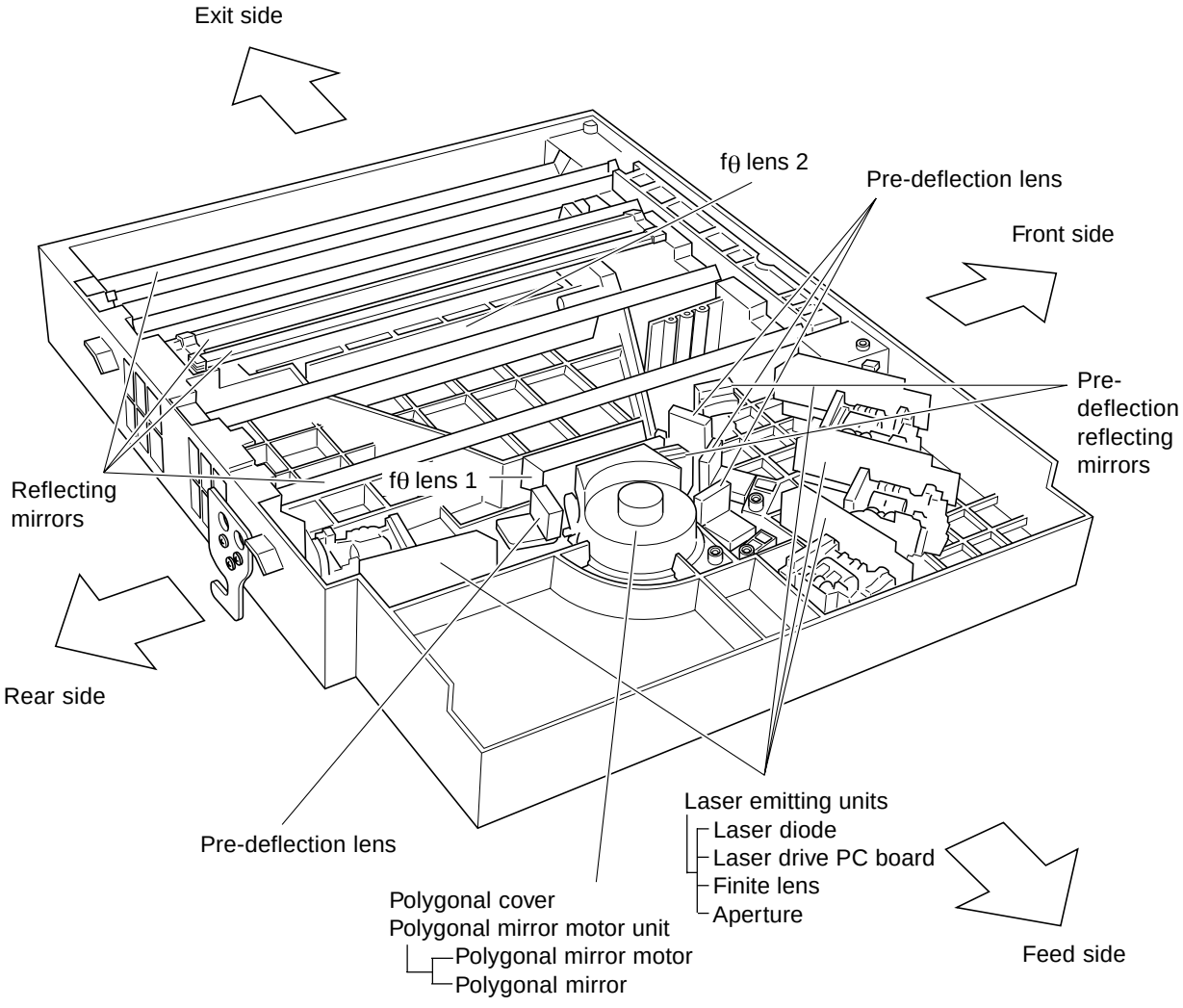


Fig. 10.1-1 General illustration of the laser optical unit

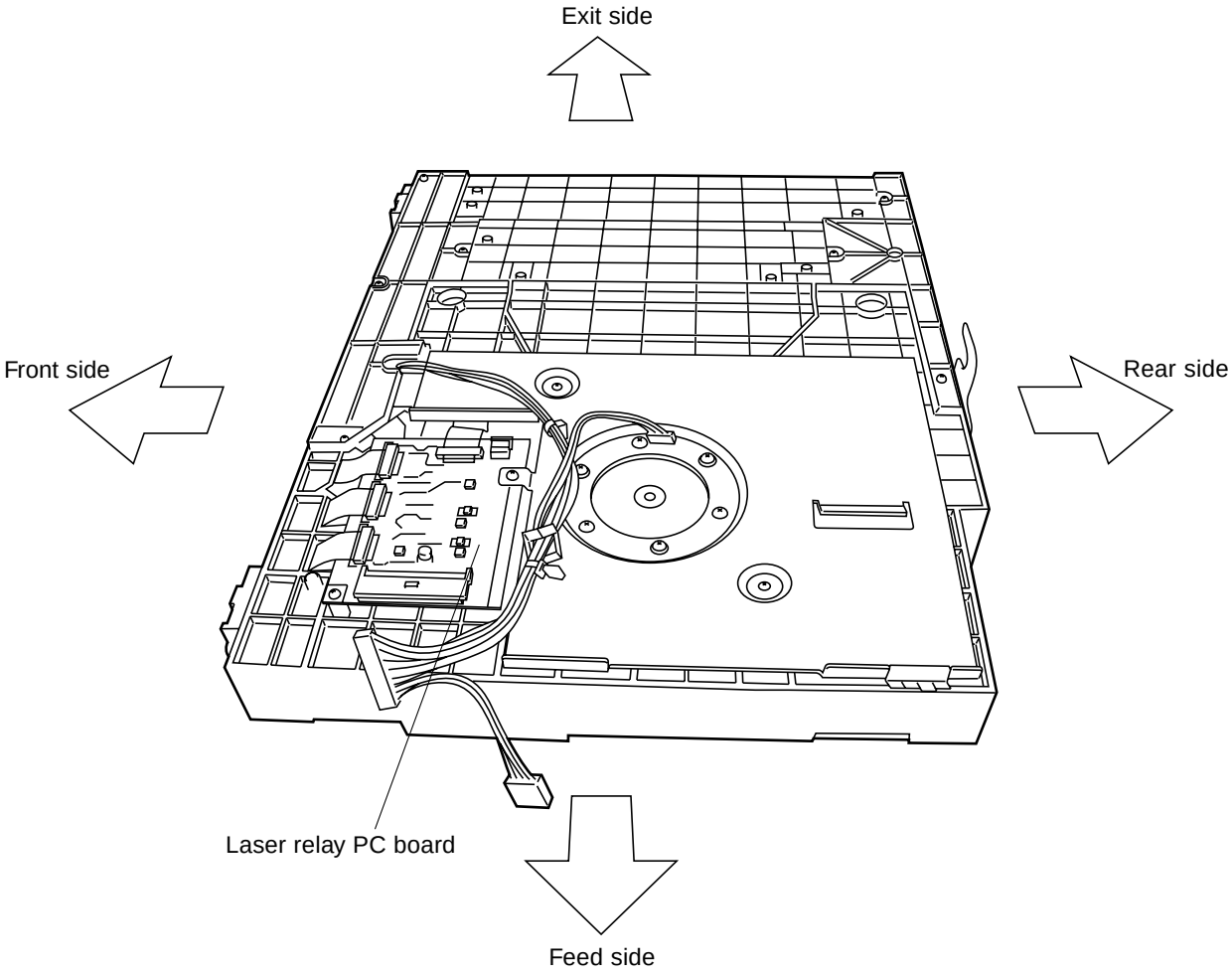


Fig. 10.1-2 Outside view of the laser optical unit

10.2 Construction

(1) Laser emitting unit

This unit is comprised of laser diodes, laser drive PC board, finite lenses, apertures, etc. There are four laser emitting units inside the laser optical unit, which are producing modulated signals corresponding to the respective colors.

(a) Laser diode

Based on a laser modulation control signal (ON/OFF) from the laser drive PC board, the laser diode emits a laser beam.

(b) Laser drive PC board

This control PC board has the following functions:

1 APC (Auto power control) function : regulates variation in the output of laser emission, which occurs due to change in temperature.

2 Laser emission control (ON/OFF) function

(c) Finite lens

Laser beams passing the finite lens form converging light rays, focusing on the drum surface.

(d) Aperture

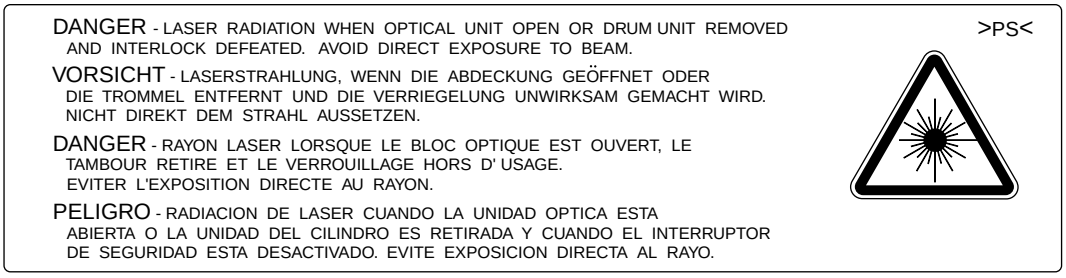
This is a slit for regulating the form of the laser beam.

(e) Laser safety

The beam of the semiconductor laser is extremely weak (about 120 mW) itself, but focusing the parallel rays results in an increase in energy to which extended exposure is hazardous.

The laser optical system of the digital plain paper copier is encased in metal which in turn is housed in the external cover. There is thus no risk of leaks during use, nor during normal servicing. Note, however, extreme care must be exercised when servicing involves focusing the laser. Such operations are hazardous and must not be attempted unless you are specifically trained to work in this area.

The warning label shown below is attached on the left side of the upper inner cover.



[CAUTION]

- Do not insert tools that are highly reflective into the path of the laser beam.
- Remove all watches, rings, bracelets, etc.

(2) Pre-deflection lens

Along with the fθ lenses, the pre-deflection lens, a combination of anamorphic plastic lens and glass lenses, serves the purpose of compensating for change in the characteristics of plastic lenses resulting from temperature change.

(3) Pre-deflection reflecting mirrors

These mirrors are so arranged that individual laser beams are led to the polygonal mirror.

(4) Polygonal cover

The polygonal cover is so constructed that it covers the polygonal mirror completely and shields the “air-cutting” sound of high-speed rotating polygonal mirror from coming out of the unit. In addition, yellow, magenta and cyan laser beams enter the unit in a direction different from the black laser beam, and each incoming-beam window has an optical filter installed which works to attenuate the light transmission factors of the laser beams. AR(anti-reflection)-coated glass is attached to each outgoing-beam window.

(a) Incoming window ND filter

The ND filter, equipped to increase the stabilization of the laser emitting characteristics, has a light transmission factor that can make the light amount on the drum surface just as specified.

(b) AR-coated glass of the outgoing window

To prevent the laser beam reflected by the polygonal mirror from being reflected back by glass in the outgoing window, AR-coating has been applied to the glass.

(5) Polygonal mirror motor unit

This unit is comprised of a polygonal mirror motor and a polygonal mirror.

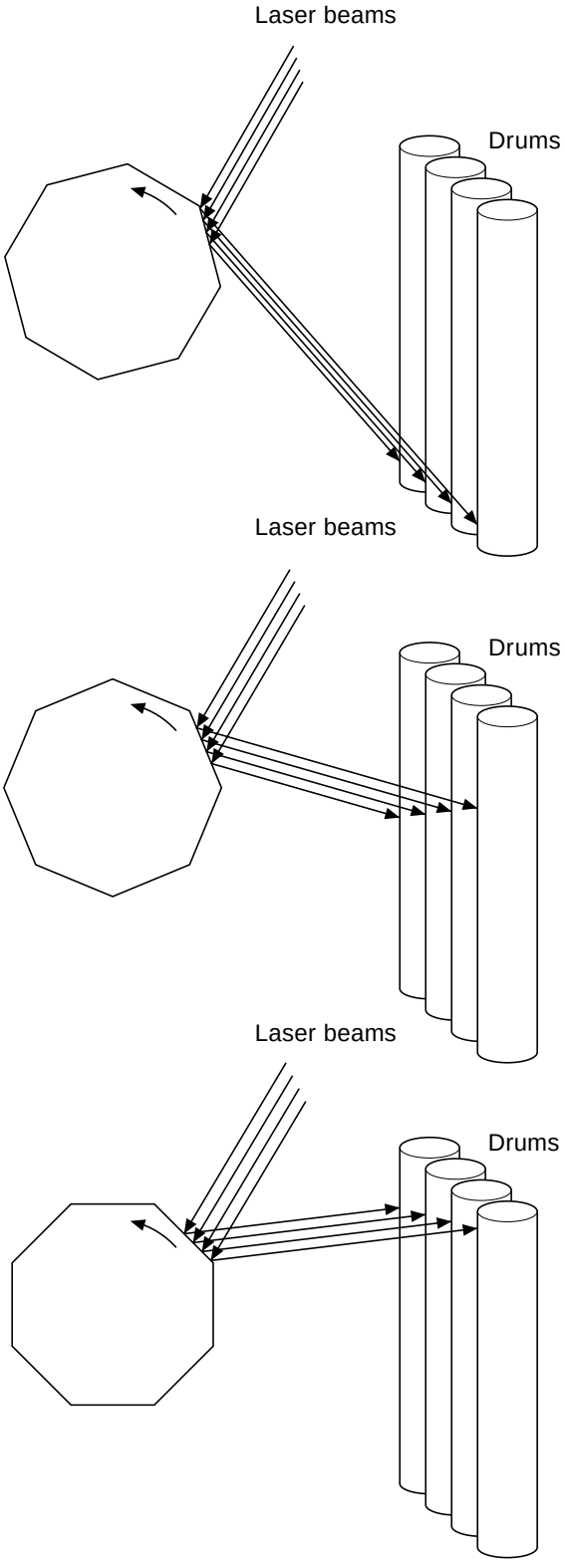
(a) Polygonal mirror motor

This motor works to rotate the polygonal mirror at the specified rotation speed (22,500 rpm). Since the motor rotates at high speed and with high accuracy, extreme care should be used not to give any impact or vibration; otherwise, an abnormal noise of motor may occur, or the life of the motor may be shortened.

(b) Polygonal mirror

As the laser beam emitted is reflected by the rotating polygonal mirror, the beam is caused to scan over the drum surface.

Four beams corresponding the respective colors come onto the polygonal mirror and follow their respective routes to scan the drums of the corresponding colors. In one rotation of the polygonal mirror, eight scanning lines are written on each drum.

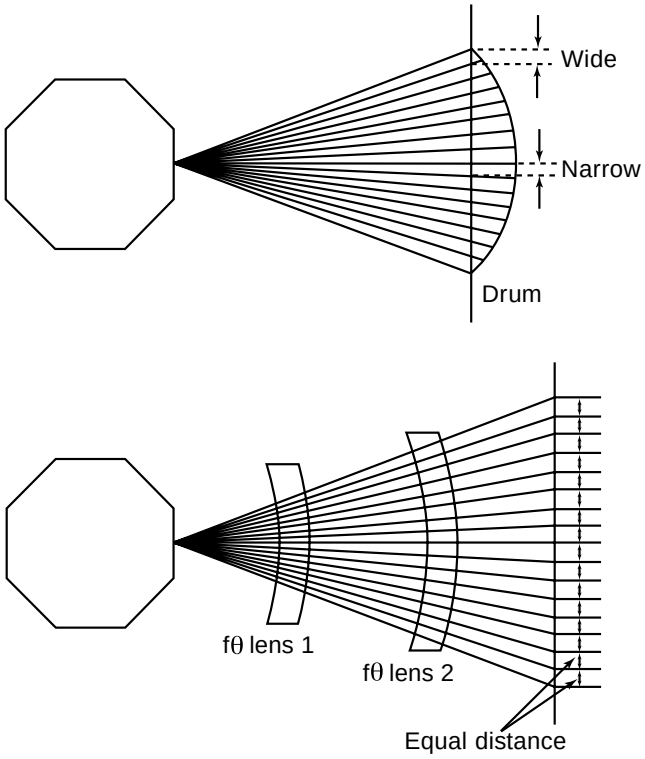


(6) fθ lenses 1 and 2

These two lenses are set to make the following corrections to the laser beams reflected from the polygonal mirror.

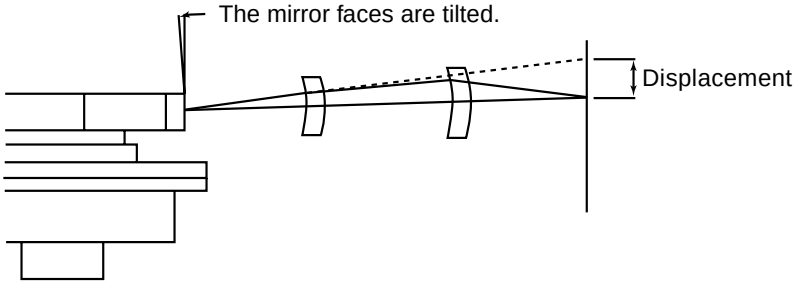
(a) Uniform-velocity scanning

Since the polygonal mirror is rotating at a uniform velocity, the laser beam reflected from the mirror scans over the drum surface at a uniform angular velocity; namely, the pitch between the dots on the drum is wider at both ends than at the center of the scanning range. The fθ lenses help to correct this difference, making all the dot-to-dot pitches equal on the drum surface.



(b) Face tilt correction

Even if assembled with precision, the reflecting faces of the polygonal mirror are tilted slightly to one side relative to the perfect vertical. The fθ lenses help to correct the displacement of the laser beam on the drum, which occurs due to the tilt of the reflecting faces.

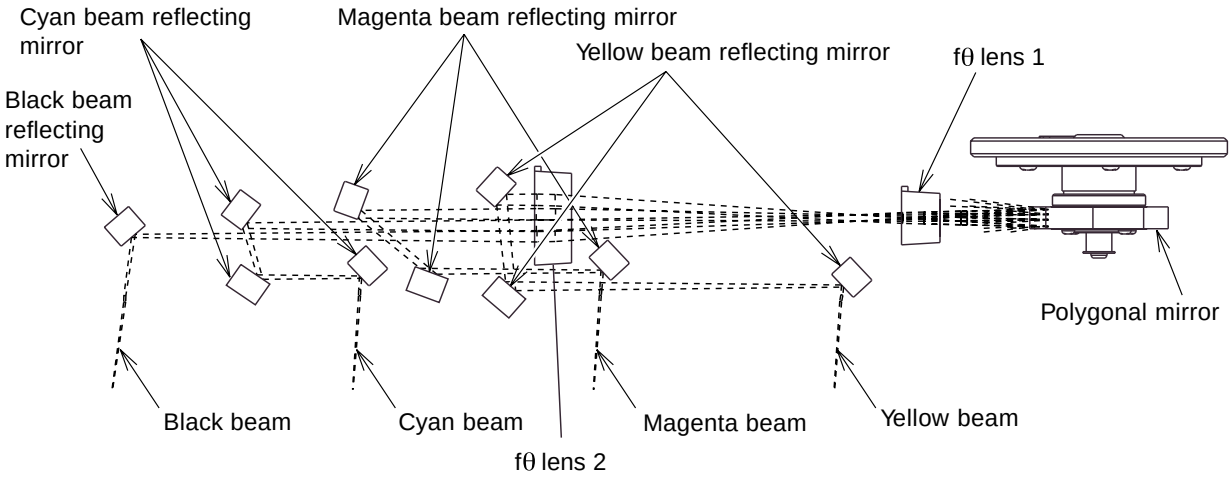


(c) Laser beam shape

The lenses help to correct the beam-spot shape of the laser beam projected onto the drum surface.

(7) Reflecting mirrors

These reflecting mirrors lead the laser beams reflected by the polygonal mirror and corrected by the fθ lenses to the drum. The laser beams of respective colors are directed to the drum by respectively different routes using ten mirrors in total, three each for yellow, magenta and cyan beams and one for black beam.



(8) Tilt correction device

At the front end of each of the third mirrors for yellow, magenta and cyan beams, a tilt correction mechanism is provided. This mechanism works to make the four beams corresponding to the respective colors parallel in the following manner:

1 A position-error detection pattern is marked on the transfer belt. This is read by a sensor to recognize the current error in position.
2 With the black scanning line as a standard, a tilt motor installed at the end of each of the yellow, magenta and cyan beam mirrors is operated to automatically adjust the degree of beam parallelization by inclining the mirror in the lengthwise direction.

(9) Slit glass

The laser optical unit has slit glasses installed in a position from which the laser beams are output to shield the unit from dirt and dust.

(10) H-Sync (Horizontal Synchronization) signal detection PC board

A sensor is employed to detect the signal for determining the starting position for writing scanning lines. The signal is detected for each scanning line, and a fixed period of time after the detection, image writing is started.

The H-Sync signal is only detected for black beams (reference beam), and then other color beams start being written in positions relative to that of the reference beam; namely, the color registration test pattern on the transfer belt mentioned previously is first read, and the time to start writing images is determined so that other beams are aligned with the reference beam.

(11) Laser relay PC board

Signals on the laser drive PC board for yellow, magenta, cyan and black beams, and those on the H-Sync signal detection PC board are collected on this relay PC board, and then those signals are sent to the IMC PC board.

The relay PC board has a variable resistor attached to adjust the laser power output, but this resistor is to be handled only at the factory. Don't touch it in the field.

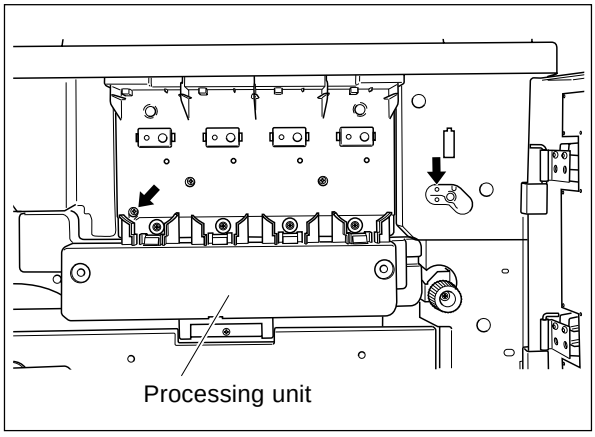
10.3 Disassembly and Replacement

[A] Laser optical unit

(1) Open the front covers.

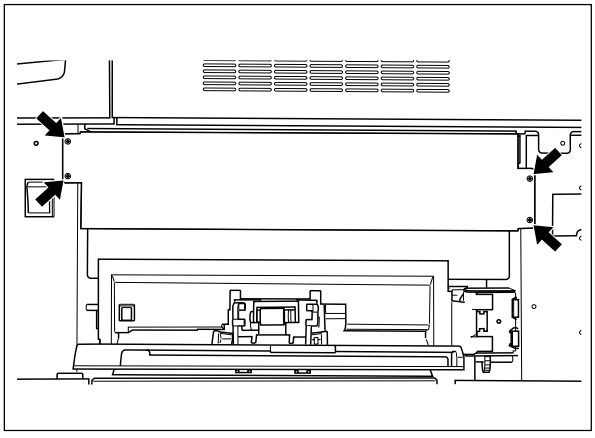
(2) Remove the processing unit (EPU). (► Chapter 13)

(3) Unscrew 2 screws which hold the laser optical unit in place.



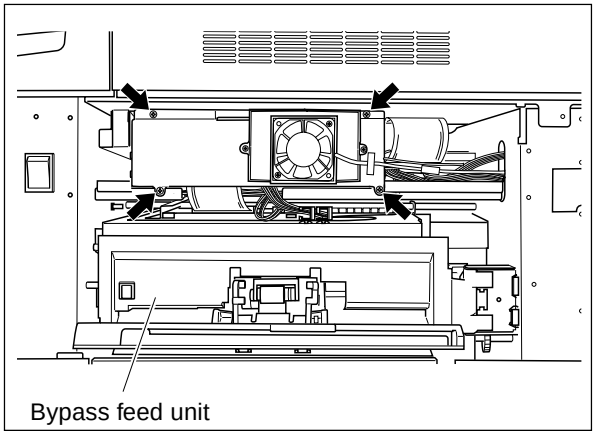
(4) Remove the feed-side upper cover.

(5) Remove the feed-side upper inner cover (4 screws).



(6) Remove the bypass feed unit. (► Chapter 12)

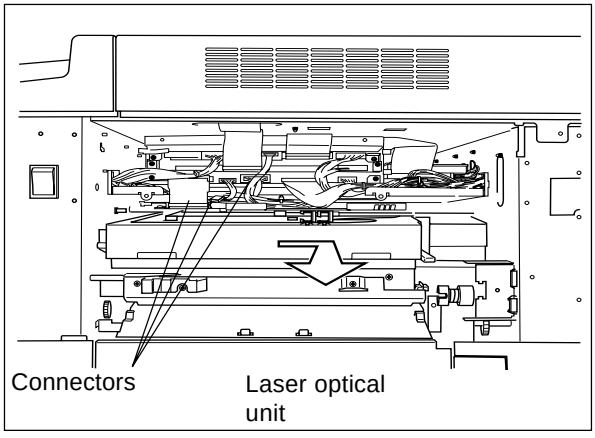
(7) Remove the metal shield cover (4 screws).



(8) Disconnect 3 connectors.

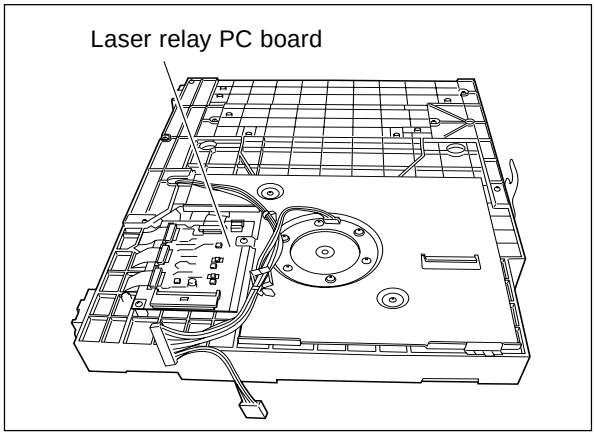
(9) Shift the laser optical unit slightly toward the rear, before drawing it out completely.

* Disengage the 2 front-side bosses from the front frame, and then while releasing the hooks from the shaft which runs through the front and rear frames, take out the unit.



Notes: 1. To avoid an undesirable load being applied to the removed laser optical unit, place it with the laser relay PC board facing upward. At this time, since the 4 slit glasses, through which light beams come out, face downward, put a clean sheet of paper under the unit to protect them from dust.

2. Be careful to prevent the slit glasses from being stained, such as with fingerprints.
3. Since the laser optical unit is a precision mechanism, handle the unit with extreme care so as not to impart any impact or vibration to it.
4. Since the laser optical unit is precision-adjusted and therefore should be protected against dust and stain, never disassemble the unit in the field.



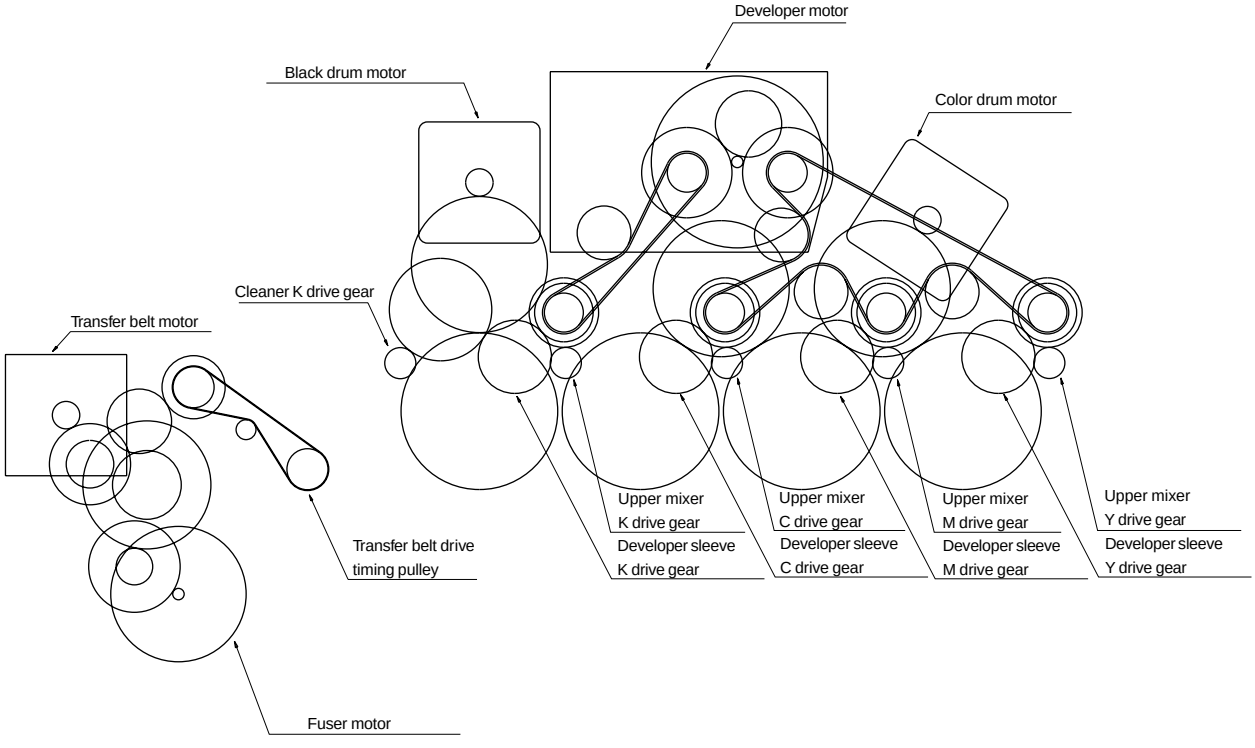
11. DRIVE SYSTEM

11.1 Construction of the Drive System

The drive system is so constructed as to provide drive to the following units: the drums, developer units, cleaners, transfer belt, fuser and exit rollers.

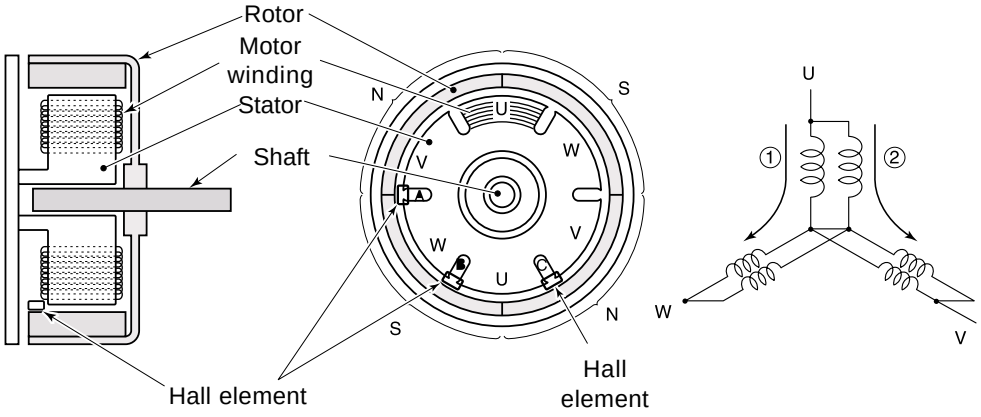
11.2 Description of Functions

- Drum drive — Drives the drums by transmitting the rotation of the drum motors through gears and couplings to the drums.
- Developer-unit drive — Drives the developer units by transmitting the rotation of developer motors through gears and timing belts to the developer-unit gears.
- Cleaner drive — Drives the cleaners by transmitting the rotation of the developer motors through gears and timing belts to both cleaner drive and developer-unit gears.
- Transfer belt drive — Drives the transfer belt drive rollers by transmitting the rotation of the transfer belt motor through gears and timing belts to transfer belt drive rollers.
- Fuser-unit drive — Drives the fuser unit by transmitting the rotation of the fuser motor through gears to the heat rollers, fuser rollers and exit rollers.



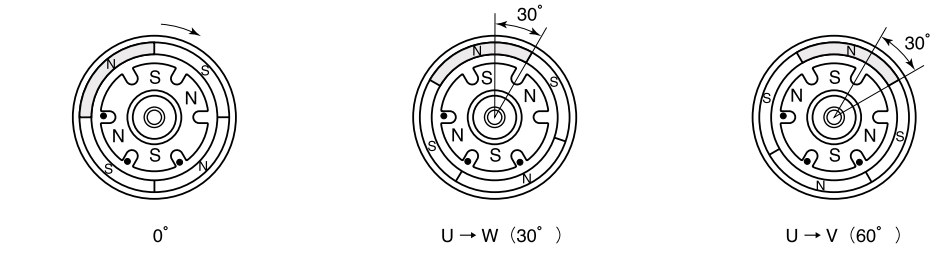
11.3 Motor Driving

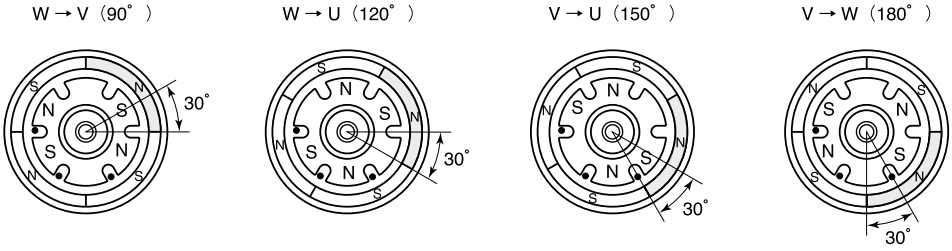
11.3.1 Brushless DC motors

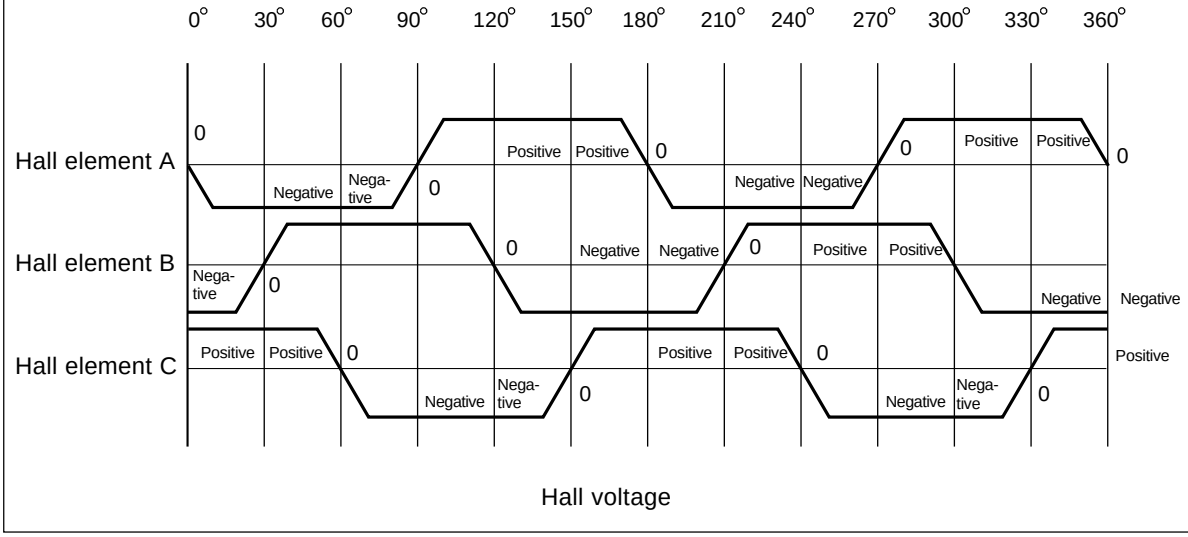


Construction of an brushless DC motor

Equivalent circuit of the motor winding

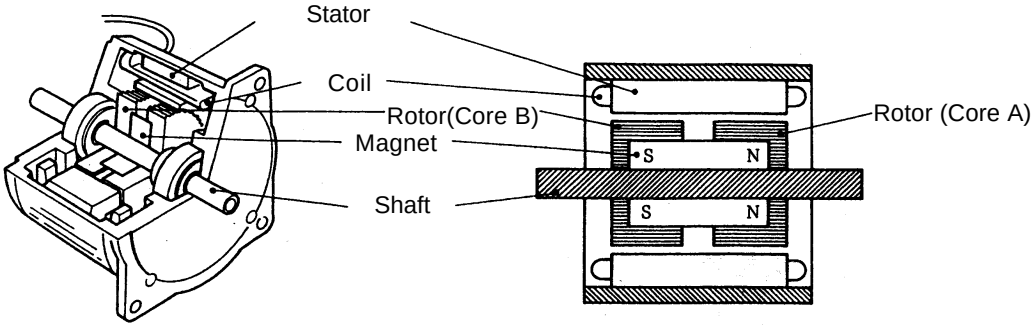


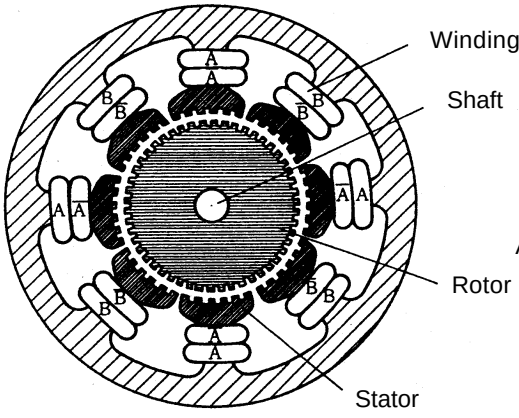




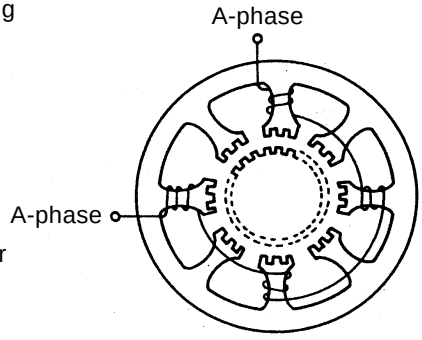
Hall voltage

11.3.2 HB type stepping motors

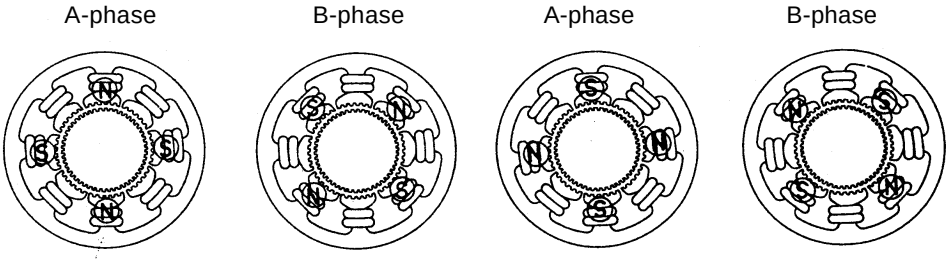




Cross-section of the motor at right angles to the shaft



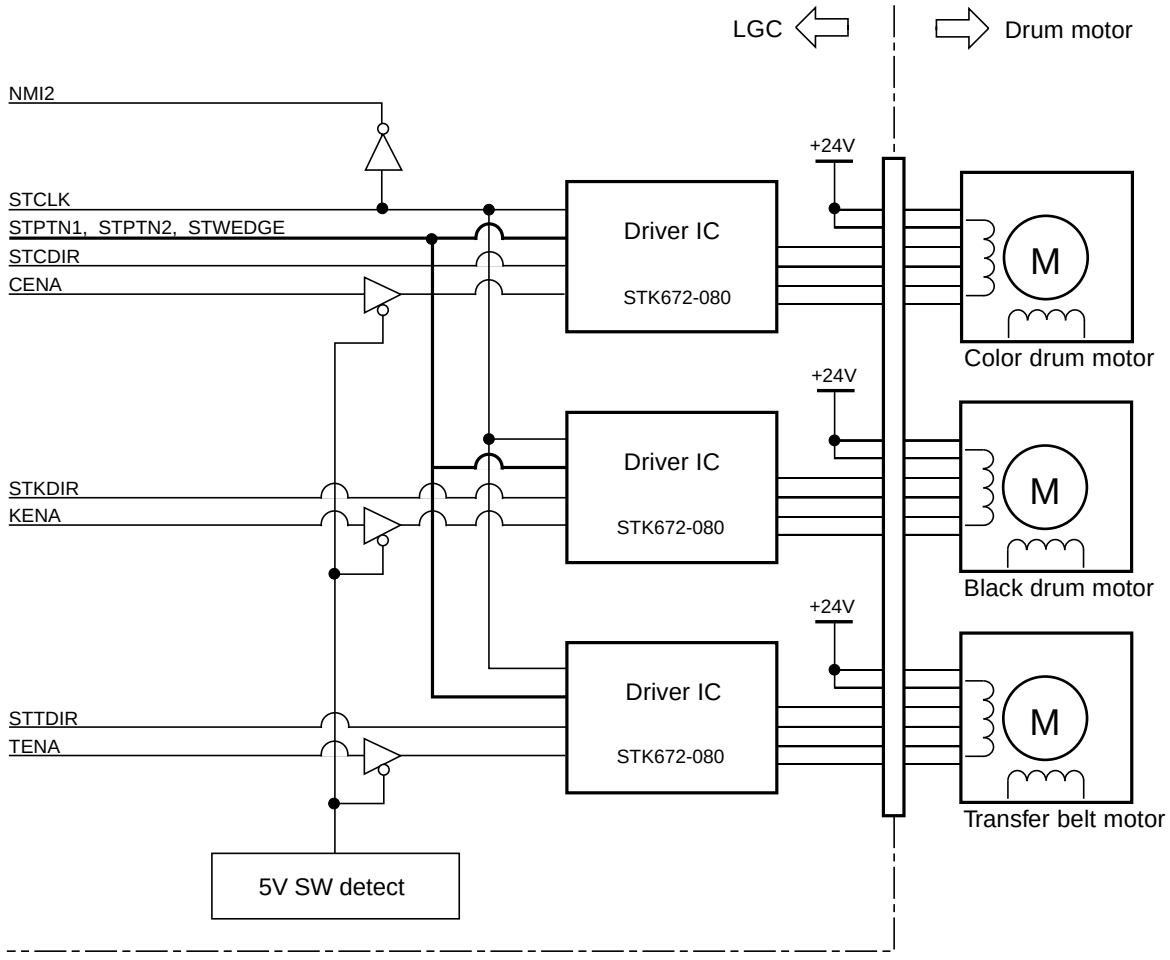
Winding condition of A-phase



Condition of the poles when phases are excitied

11.3.3 Driving of drum motors and transfer belt motor

Drum motors consist of a Y, M, C driven color motor and a K drum driven black motor. Both drum motors and transfer belt motor are 2-phase HB type stepping motors. Their construction is as illustrated below:



The durm motors and the transfer belt are controlled by the LGC board. The general of the control system is as follows:

(1) LGC outputs signals to control the rotation movement and rotation direction of the motors.
CENA, KENA, TENA : Motor rotation command
STCDIR, STKDIR, STTDIR : Motor rotation direction setting

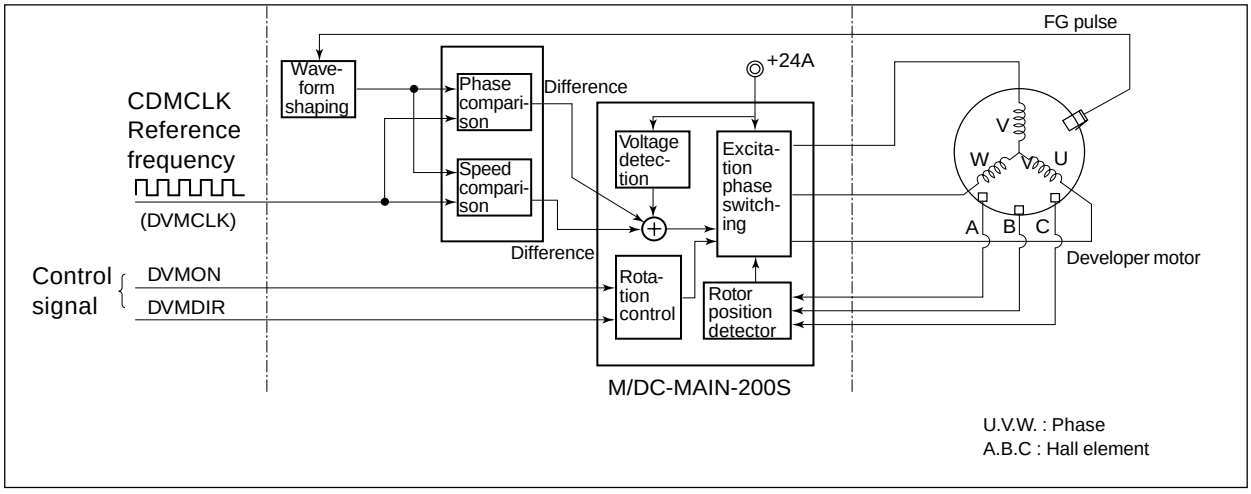
(2) The motor rotation frequency, after having been made synchronized with the clock signal,is controlled.
STCLK : Control clock signal
NM12 : Observation of the control clock signal

(3) The excitation mode is set.
STPTN1, STPTN2, STWEDGE : Excitation mode signal

(4) LGC observes each door switch and performs the stop control of the motors if one of the doors is open.

11.3.4 Developer motor driving

Developer motor is an IC motor and the LGC board controls its speed and ON/OFF switch.



The control and driving system of developer motor is summarized as follows:

(1) LGC provides a signal to control the rotation of the developer motor so that the color developer mode can be switched.
DVMDIR = "L" : Color developement mode
DVMDIR = "H" : Black developement mode

(2) The excitation phase switching section works to excite each phase of the developer motor. → The developer motor starts rotating.

(3) Hall elements A, B and C detect the rotation position of the motor (rotor).

(4) The excitation phase switching section switches the excitation of each phase of the motor.
(The steps (2) to (4) being repeated, the motor continues to rotate.)

(5) Rotation of the developer motor causes FG pulses to be generated.

(6) The FG pulse and the reference frequency are compared in terms of phase and speed, and the difference is added. Deflection in the power supply voltage is also added to the resultant signal (signal generation). The reference frequency of the color developer motor is supplied from LGC, while that of the black developer motor is generated inside the motor.

(7) Based on the signal obtained in step (6), the switch timing of excitation phase switching section is changed:
= Control is performed to make the FG pulse and the reference frequency equal → The developer motor rotates at a fixed speed (locked range).

(8) When DVMON signal from LGC comes to the level "H", the developer motor comes to a stop.

<Control signal>

(1) DVMCLK signal

This is a reference clock signal to make the developer motor rotate at a fixed speed. The frequency of the reference clock is 420 Hz.

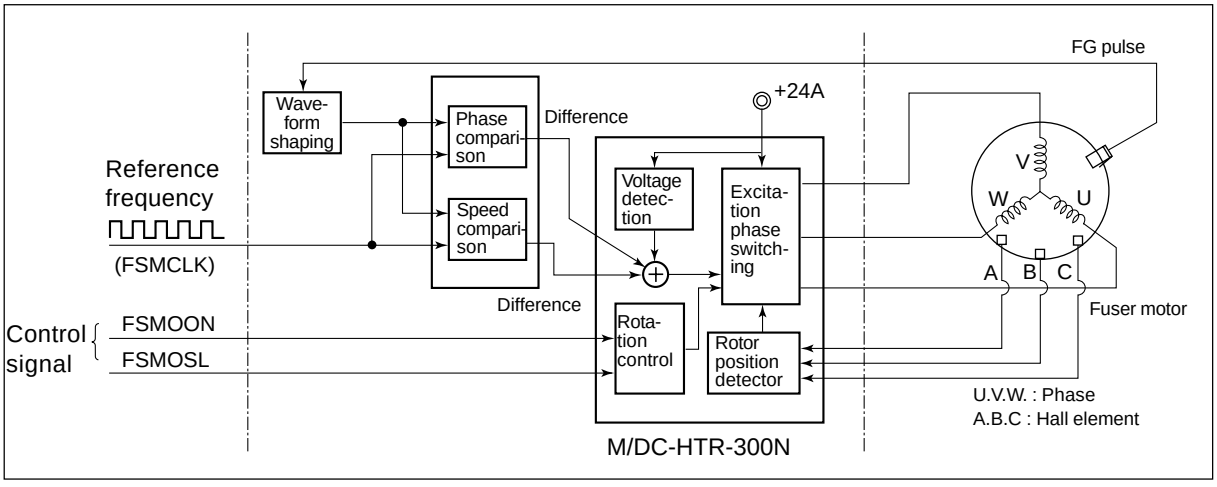
When the period of the FG pulse is within ±6.25% that of the reference frequency, it is specified that the motor is in a locked range (normal rotation), and this signal comes to the level "L". LED 'LP1' also lights.

Signal levels of developer motor circuit:

Signal name	Level "H"	Level "L"
DVMCLK	Reference clock (420 Hz)	
DVMON	Motor OFF	Motor ON
DVMDIR	Black development mode	Color development mode

11.3.5 Fuser motor driving

Fuser motor is an brushless DC motor and the LGC board controls its speed and ON/OFF switch.



The control and driving system of fuser motor is summarized as follows:

(1) LGC provides a signal to control the rotation of the fuser motor:
(FSMOON : Motor rotation command)

(2) The excitation phase switching section works to excite each phase of the fuser motor.→The fuser motor starts rotating.

(3) Hall elements A, B and C detect the rotation position of the motor (rotor).

(4) The excitation phase switching section switches the excitation of each phase of the motor.
(The steps (2) to (4) being repeated, the motor continues to rotate.)

(5) Rotation of the fuser motor causes FG pulses to be generated.

(6) The FG pulse and the reference frequency from LGC are compared in terms of phase and speed, and the difference of both is added. Deflection in the power supply voltage is also added to the resultant signal (signal generation).

(7) Based on the signal obtained in the step (6), the switch timing of excitation phase switching section is changed:
= Control is performed to make the FG pulse and the reference frequency equal→The fuser motor rotates at a fixed speed (locked range).

(8) When FSMOON signal comes to the level "H", the fuser motor comes to a stop.

(9) During the OHP mode, FSMOSL signal comes to the level "L", and making the motor rotate at 1/4 the normal speed.

<Control signal>

(1) FSMCLK signal (LGC→MOT : Input)

This is a reference clock signal to make the fuser motor rotate at a fixed speed. The frequency of the reference clock is 1087 Hz.

(2) FSMOSL signal (LGC→MOT : Input)

This signal is used to turn the fuser motor ON and OFF at slow speed. When this signal comes to the level “L”, the fuser motor rotates at a low speed.

(3) FSMOON signal (LGC→MOT : Input)

This signal is used to turn the fuser motor ON and OFF. When this signal comes to the level "L", the fuser motor is turned ON.

Signal levels of fuser motor circuit:

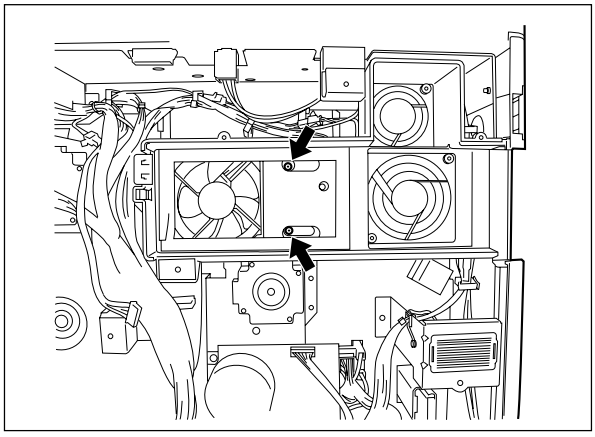
Signal name	Level "H"	Level "L"
FSMCLK	Reference clock	
FSMOSL	Motor OFF	Motor ON at low speed
FSMOON	Motor OFF	Motor ON

11.4 Disassembly and Replacement

[A] Drum drive unit

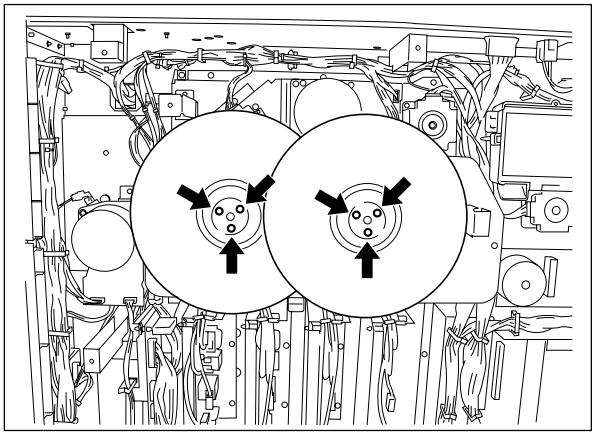
(1) Remove the rear cover.

(2) Remove the ozone filter and take out the fan (3 connectors and 2 screws).

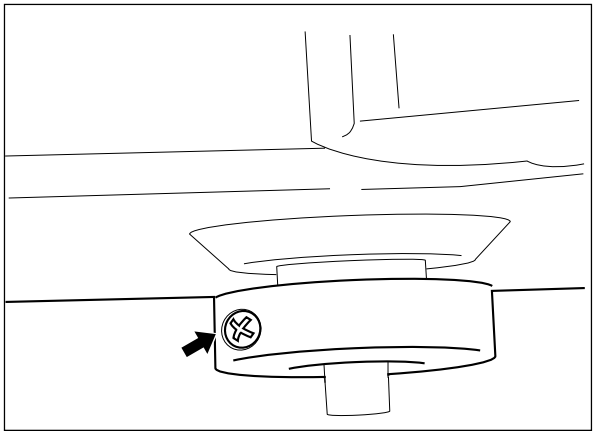


(3) Detach 2 flywheels (3 screws for each).

Note: With the EPU being installed, be careful not to allow the flywheels to rotate when detaching them.



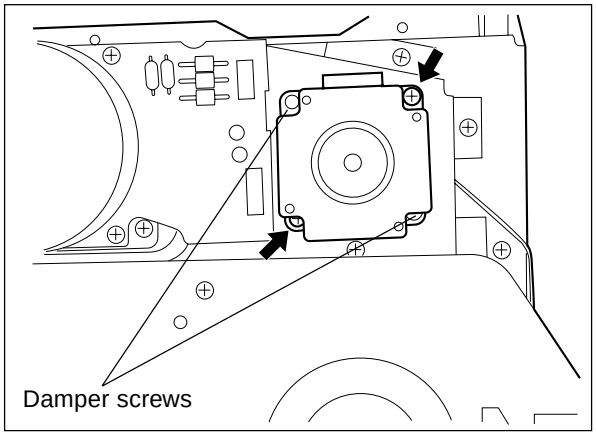
(4) Detach 2 flywheel holders (1 screw for each).



(A-1) Black drum motor

(1) Disconnect 1 connector of the black drum motor , and then remove the motor (2 screws).

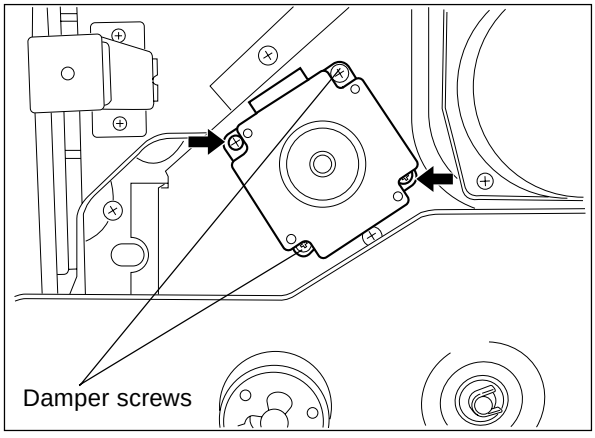
Note: When removing the black drum motor, do not loose the damper screws.



(A-2) Color drum motor

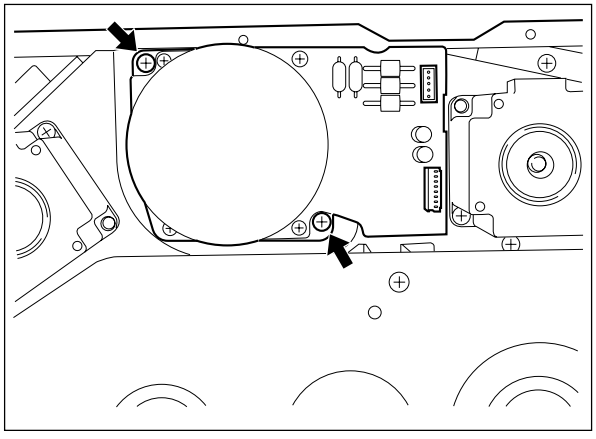
(1) Disconnect 1 connector of the color drum motor , and then remove the motor (2 screws).

Note: When removing the color drum motor, do not loose the damper screws.



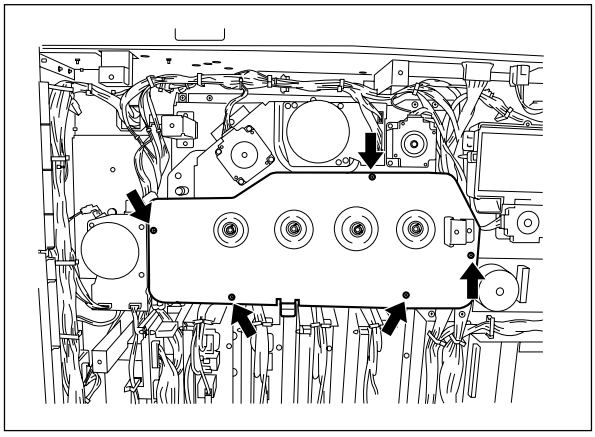
(A-3) Developer motor

(1) Disconnect 1 connector of the developer motor and remove the motor (2 screws).

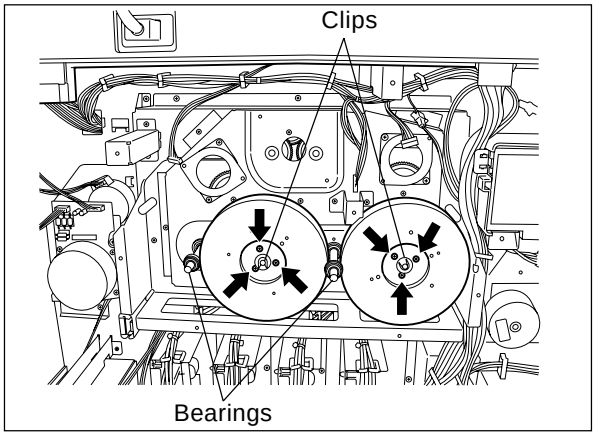


(A-4) Drive gears and pulleys

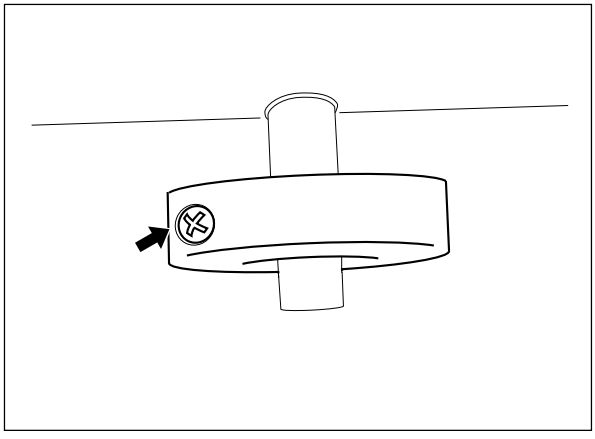
(1) Remove the drive unit cover (5 screws).



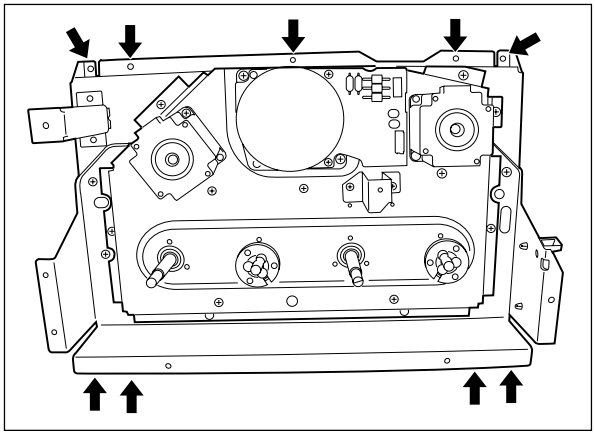
(2) Remove two bearings, two clips, and then detach two flywheels (3 screws for each).



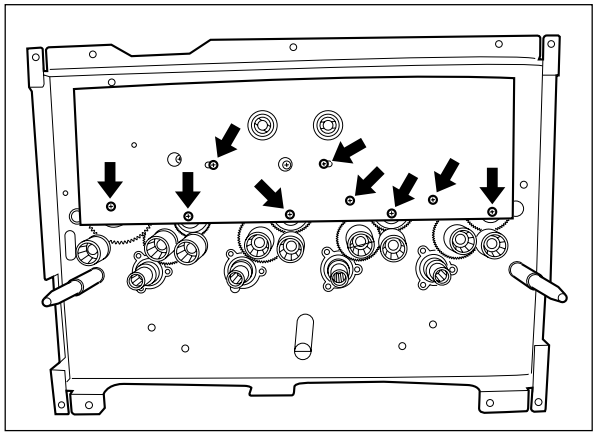
(3) Remove two flywheel holders (1 screw for each).



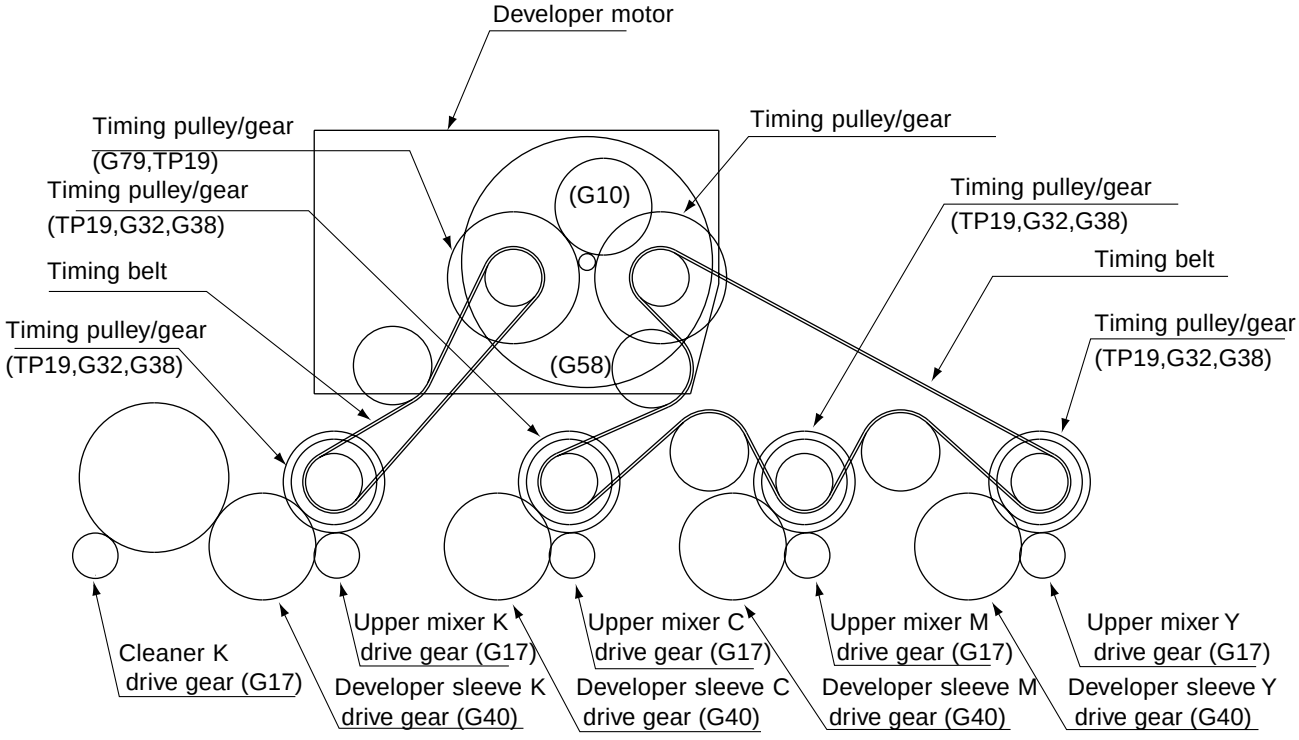
(4) Remove the drive unit (9 screws).



(5) Remove the developer drive unit cover (9 screws).

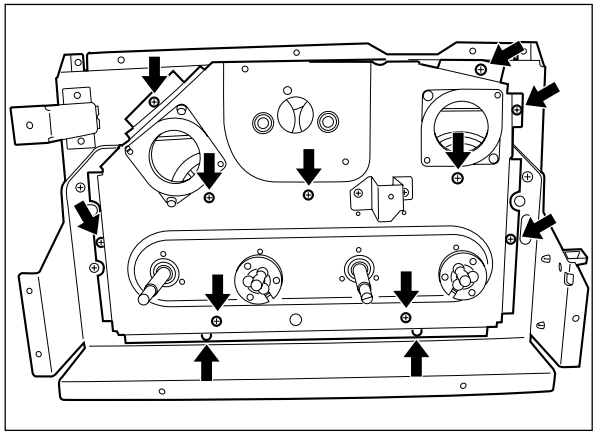


(6) Referring to the following diagram, remove the developer drive gears and pulleys.

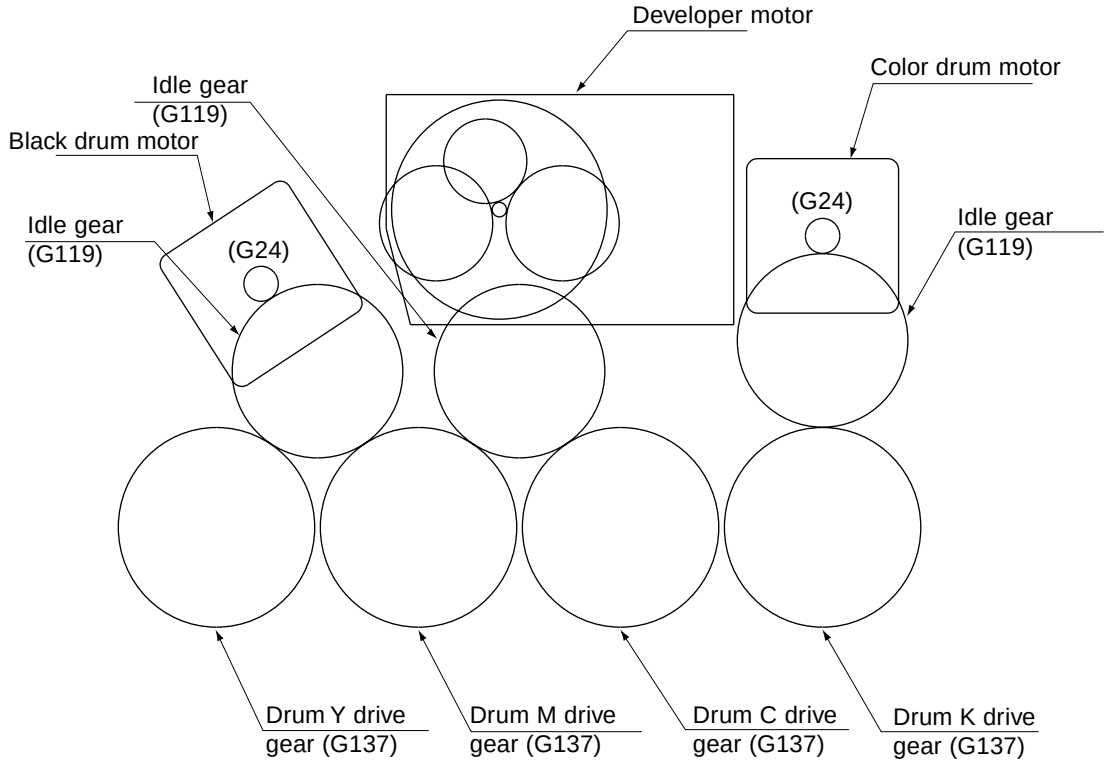


(7) Unscrew 7 setscrews on the cover, and unscrew 6 setscrews on the shaft. Then remove the cover.

Note: Be careful once the setscrews on the shaft have been unscrewed, the gears will also drop out of the cover.



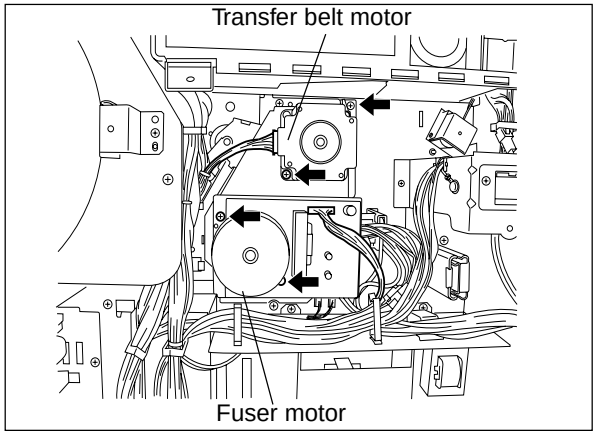
(8) Referring to the following diagram, remove the developer drive gears and pulleys.



[B] Transfer belt/fuser drive unit

(B-1) Transfer belt motor

(1) Disconnect 1 connector on the transfer belt motor and remove the transfer belt motor (2 screws).



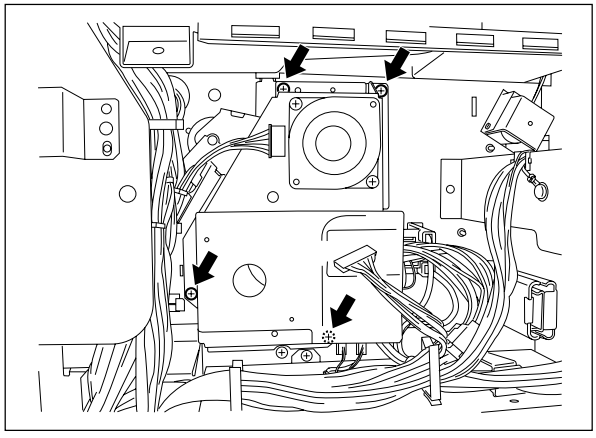
(B-2) Fuser motor

(1) Disconnect 1 connector on the fuser motor and remove the fuser motor (2 screws).

(B-3) Transfer belt/fuser drive unit

(1) Open the front cover and draw out the transfer/ transport unit.

(2) Remove the transfer belt/fuser drive unit (4 screws).

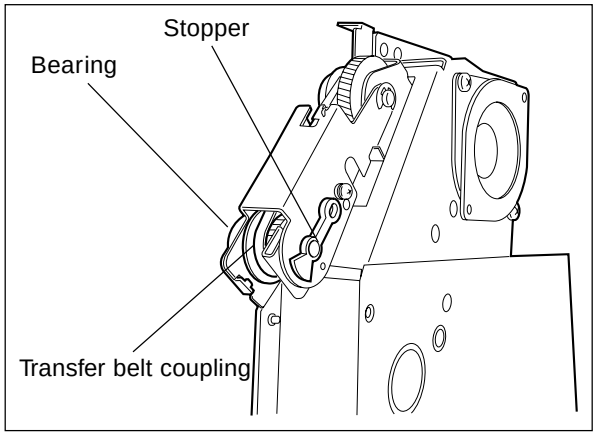


(B-4) Transfer belt coupling

(1) Rotate the stopper 90° to remove it. (Be careful not to break it.)

(2) Separate the transfer belt coupling from its bearing, draw out the transfer belt coupling along with the belt, and finally take out the transfer belt coupling.

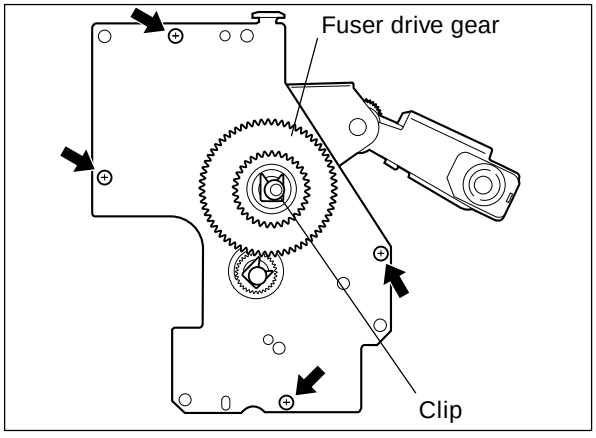
Note: The belt will remain in the assembly.



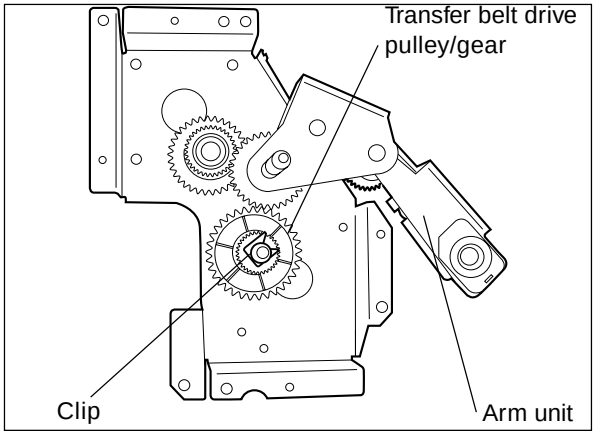
(B-5) Transfer belt/fuser drive gear

(1) Remove 1 clip and then take out the fuser drive gear.

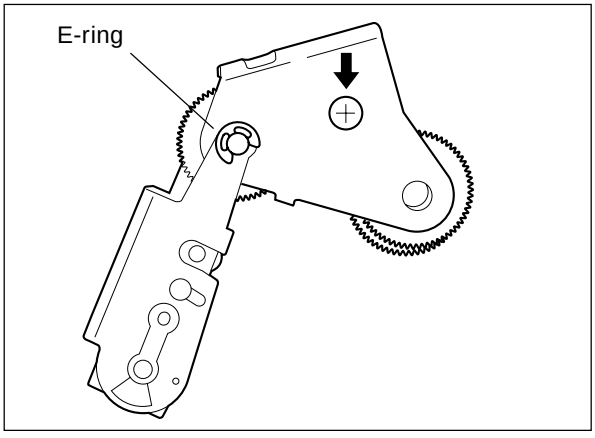
(2) Detach the cover of the transfer belt/fuser drive unit (4 screws).



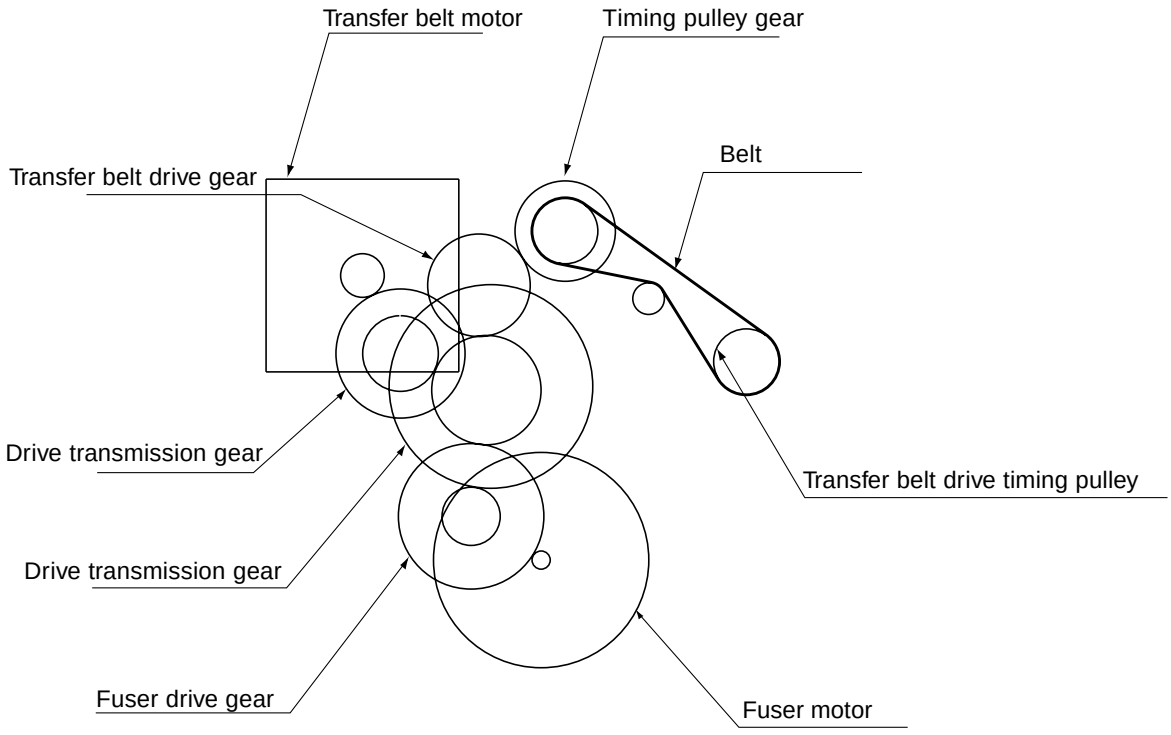
(3) Detach the clip and then take out the transfer belt drive pulley gear and the arm unit.



(4) Unscrew 1 screw and remove the e-ring. Then take out the arm unit drive transmission gear, timing belt, etc.



(5) Referring to the following diagram, remove the transfer-belt/fuser drive gears and pulleys.



12. PAPER FEEDING SYSTEM

12.1 Function

This system works to pick up paper, sheet by sheet, from the cassette or the bypass tray and send it to the transfer/transport unit.
The paper feeding system is mainly comprised of the pick-up roller, paper feed roller, separation roller, registration rollers, bypass paper sensor, cassette paper-empty sensor, cassette-feed jam sensor, registration sensor, and their drive mechanism.

(1) Pick-up roller
These rollers work to draw out a sheet of paper from the cassette or bypass tray and send it to their respective feed roller. For this purpose, they are raised up and down.

(2) Paper feed roller
Mounted against the separation roller, this roller transports the paper from the pick-up roller to the registration rollers.

(3) Separation roller
Mounted against the paper feed roller, this roller works to prevent double feeding. If two sheets or more are sent from the pick-up roller, the frictional force between the sheets is smaller than the separating force of the separation roller. Thus, the sheet in contact with the separation roller cannot advance any further. When only one sheet is sent from the pick-up roller, the separation roller is forced to follow the paper feed roller.

(4) Transport rollers
These rollers transport the paper sent from the paper feed roller to the registration rollers.

(5) Registration rollers
The paper sent from the paper feed roller is pushed against the registration rollers, which align the leading edge of the paper. Then, the upper and lower registration rollers start rotating to carry the paper to the transfer/transport unit.
To prevent paper dust from adhering to the registration rollers, a brush is provided in contact with the lower registration roller.

Next explanation is about the various sensors for detecting paper size, presence or absence of paper, and the position of the paper transported to enable the rollers to be controlled ON and OFF.

(6) Bypass paper sensor
This sensor works to detect whether paper is set in the bypass tray. If paper is set there, bypass feeding is selected in preference to cassette feeding.

(7) Cassette paper-empty sensor
This is a transmission type sensor, using an actuator to detect whether or not paper is set in the cassette. If there is no paper in the cassette, the actuator works to block the optical path of the sensor, allowing it to determine that there is no paper.

(8) Cassette-feed jam sensor

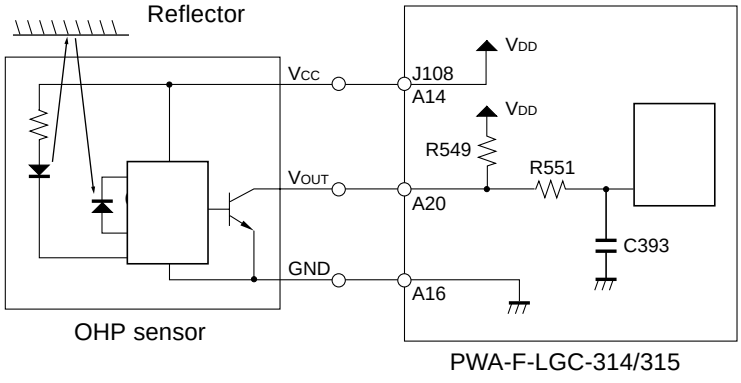
This switch detects when the leading or trailing edge of paper passes the paper feed roller. It is also used for detecting jams such as paper misfeeding.

(9) Registration sensor

This switch detects that the leading edge of the paper has arrived at the registration rollers. It also detects the passage of the trailing edge of the paper. When the leading edge has been detected, it is determined that the aligning of the paper by the registration rollers has been finished.

(10) OHP sensor

The fusing temperature and speed for OHP film copying are different from those for normal paper. A modulating reflector photo interrupter, resistant to external light interference, is equipped in this machine to discriminate OHP films from normal paper when films are fed.

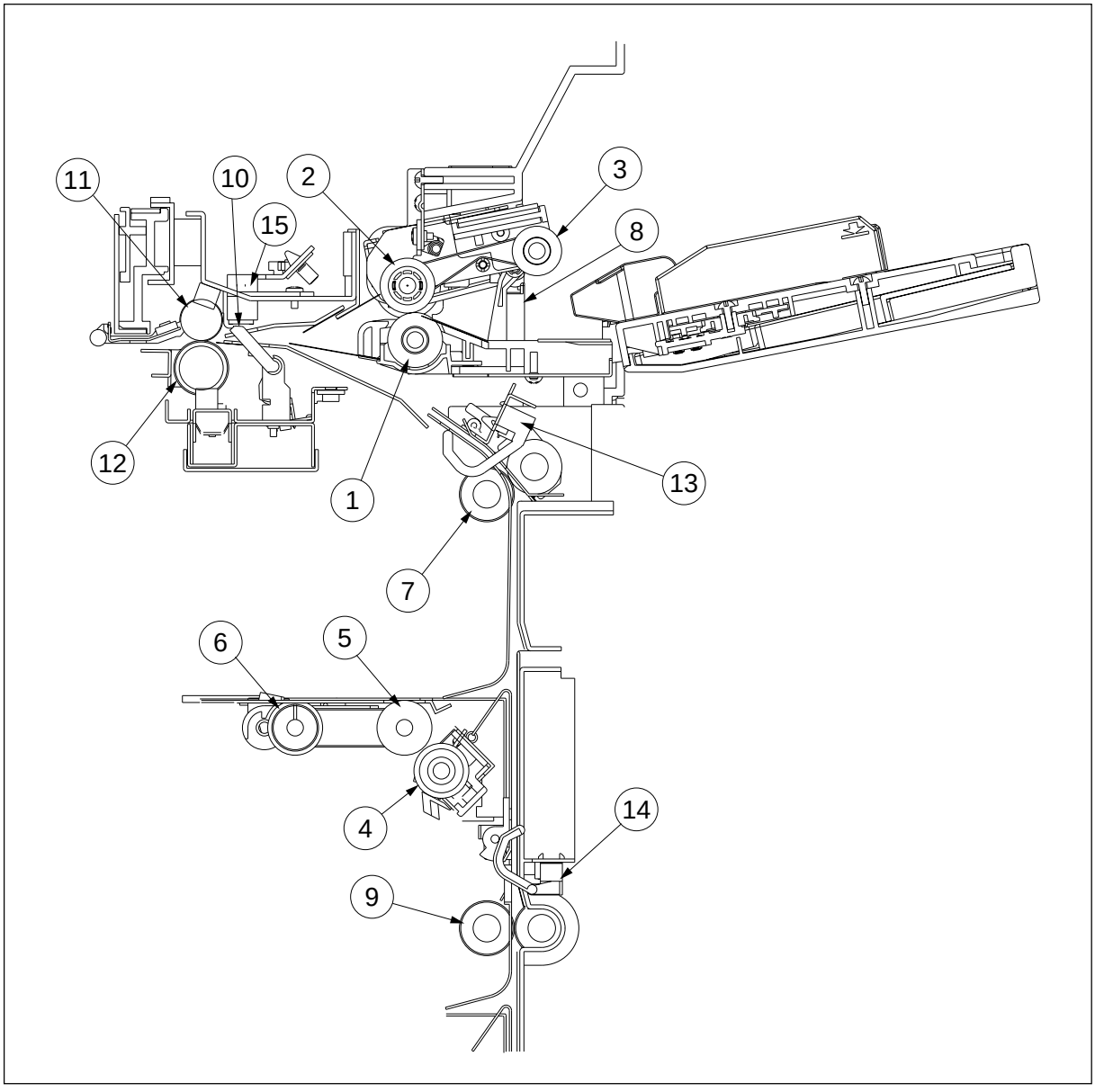


[OHP film detection circuit]

The OHP film detection circuits are as shown above. The sensor output is pulled up by the LGC board and its Vout varies according to the type of paper fed, as shown in the table on the right.

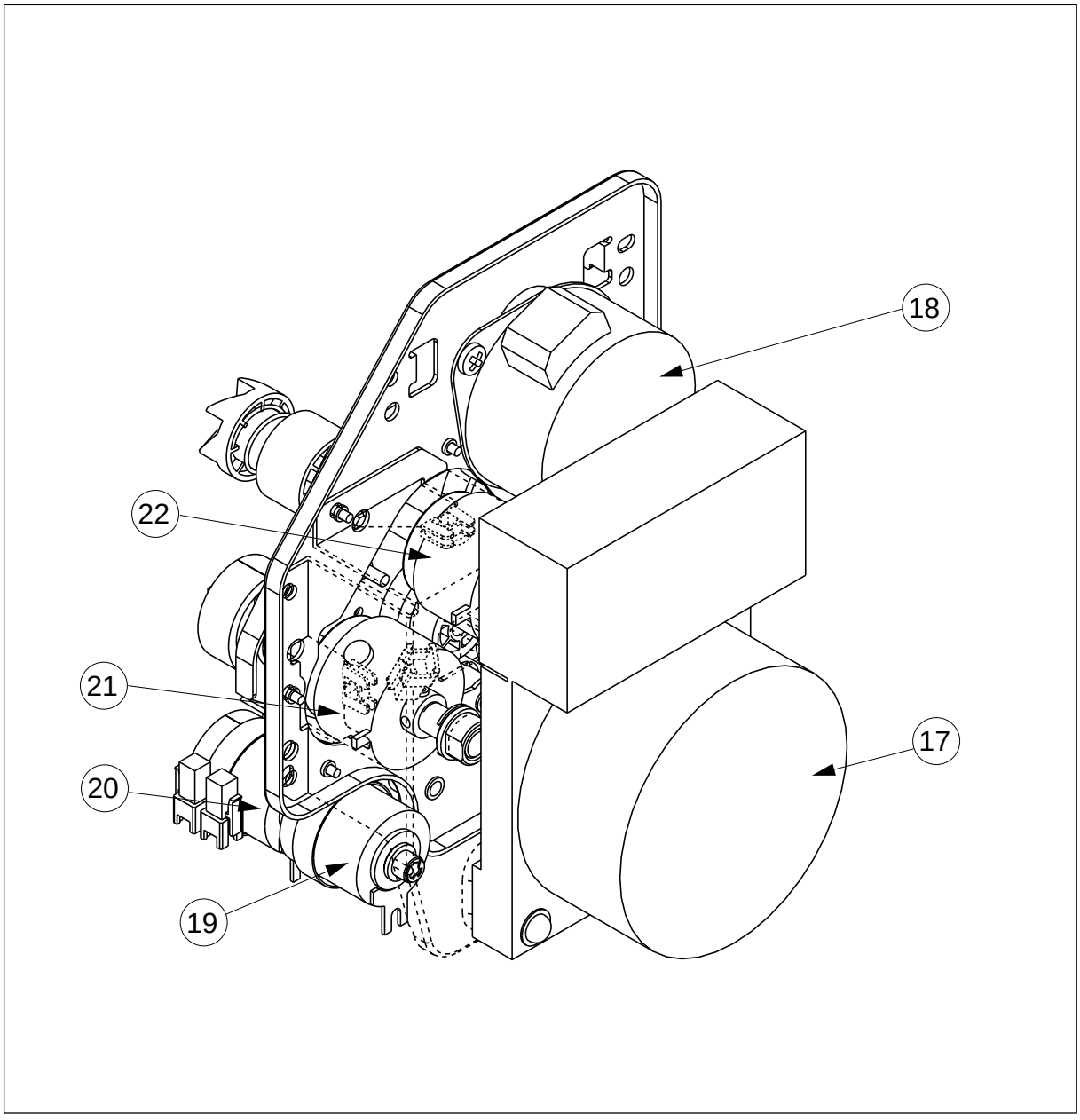
OHP sensor output is transmitted to CPU, providing information on the type of paper fed.

Paper type	Vout
OHP film (transparent area)	H
Normal paper	L



Sectional view (Front side)

No.	Name	No.	Name
①	Bypass separation roller	⑨	Transport roller 2
②	Bypass feed roller	⑩	Registration sensor
③	Bypass pick-up roller	⑪	Registration roller 1
④	Cassette separation roller	⑫	Registration roller 2
⑤	Cassette feed roller	⑬	Cassette-feed jam sensor (1st cassette)
⑥	Cassette pick-up roller	⑭	Cassette-feed jam sensor (2nd cassette)
⑦	Transport roller 1	⑮	OHP sensor
⑧	Bypass paper sensor		

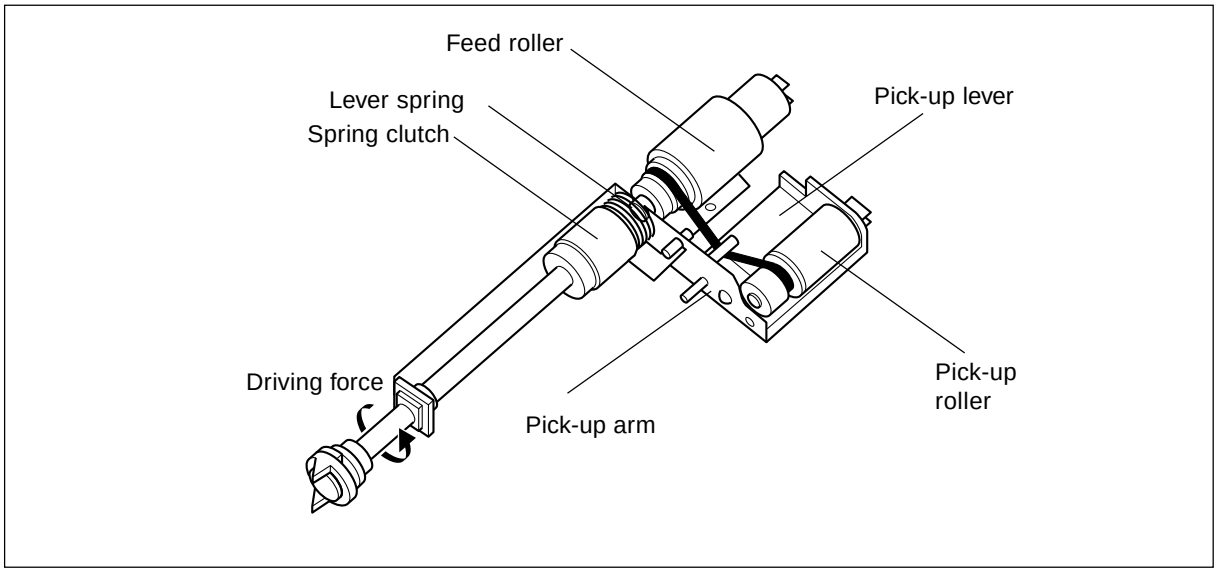


Paper feeding drive system (Rear side)

No.	Name	Note
⑰	Paper feed motor	
⑱	Registration motor	
⑲	Pre-feed clutch (Rear)	
⑳	Pre-feed clutch (Front)	
㉑	Feed path clutch	Shaft dia: ø8, gear teeth: 28
㉒	Bypass feed clutch	Shaft dia: ø8, gear teeth: 28

12.2 Description of Operation

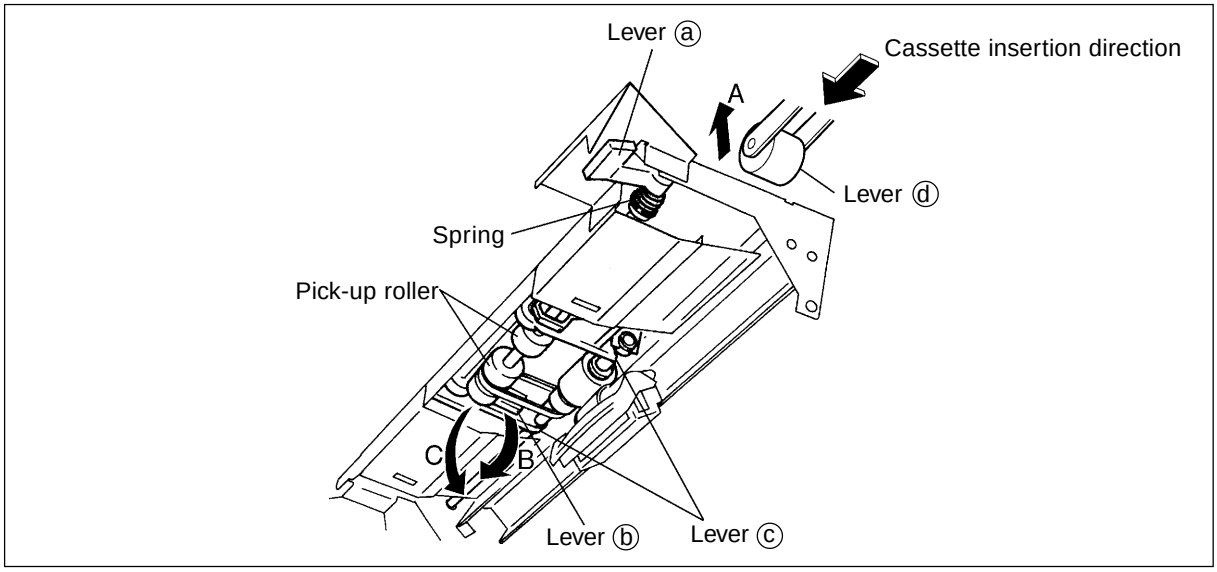
12.2.1 Operation of the bypass pick-up roller



When a driving force is applied to the paper feed roller shaft, the rotational force is transmitted via the spring clutch to the pick-up lever, allowing the pick-up arm to fall by its own weight. The pick-up lever is stopped when the spring clutch comes to the stopper.

When the driving force is removed from the paper feed roller shaft, the lever spring forces up the pick-up lever, and thus the pick-up arm is also lifted up.

12.2.2 Operation of the cassette pick-up roller

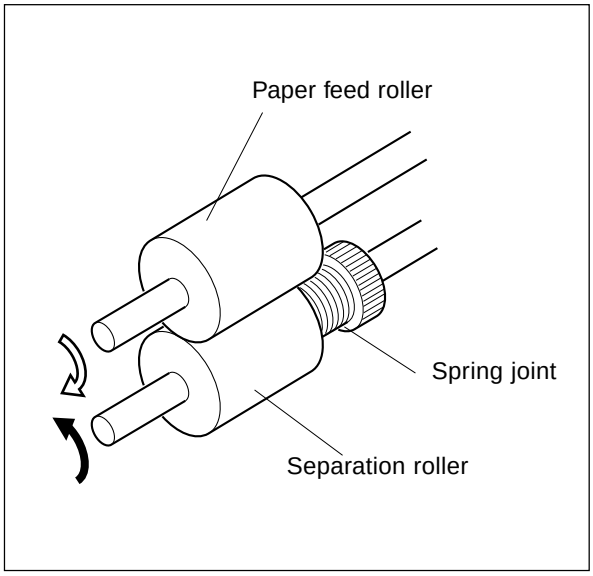


When the cassette is inserted, the lever (a) is moved up in the direction of A by the lever (d) attached to the cassette. This causes the link mechanism comprised of levers (b) and (c) to allow the pick-up roller to move down by its own weight.

12.2.3 Operation of paper separation

This model is equipped with a paper separation roller in the paper feed section to prevent multiple paper feeding. As shown on the right, the separation roller mechanism is mainly comprised of a paper feed roller, separation roller, and spring joint. The paper feed roller is so arranged that it rotates in the direction of ↷ via a feed clutch at the same timing as the pick-up roller rotation.

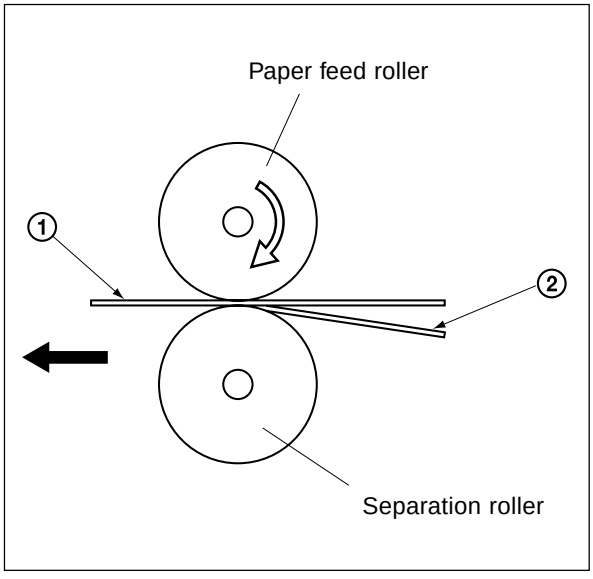
The diagram on the bottom right shows how the double feeding is prevented: since the friction between two sheets is small, the lower sheet is not transported any further by the separation roller, and only the upper sheet is moved by the paper feed roller in the direction of ←.



Example:

When a single sheet ① enters between the rollers: since the transporting force of the paper feed roller is greater than the braking force of the separation roller, the separation roller is forced to follow the paper feed roller, making the sheet go forward to the registration rollers.

When two sheets ① and ② enter between the rollers simultaneously: since the transporting force of the paper feed roller and the braking force of the separation roller are greater than the frictional force between two sheets, the upper sheet ① is transported by the paper feed roller in the direction of ←. The lower sheet ② is braked by the separation roller and is not carried any further.



12.2.4 Description of general operation

[A] From power ON up until the copier becomes ready:

(1) When the copier is turned ON, each cassette tray-up motor is energized, causing each cassette tray to start moving up. When the cassette tray-up limit sensor is turned ON (L→H), the cassette tray-up motor is de-energized, causing the cassette tray to stop. At this time, if the cassette paper-empty sensor is turned ON (H), it is determined that there is paper in the cassette. Otherwise, it is determined that there is no paper. Whether or not there is paper in the cassette, the tray moves up and stops at the upper position.

(2) If a cassette is withdrawn when the copier is turned ON, the corresponding cassette tray-up motor remains OFF. Only after the cassette is reinserted, the cassette tray moves up to check whether there is paper in the cassette.

(3) When the copier is turned ON, if any of cassette-feed jam sensor is ON (i.e. paper remaining on the paper path), it is determined that a jam has occurred, and no operation is performed until the jam is removed.

[B] During standby

(1) After each cassette tray has moved up and checked whether there is paper or not, as described above, the copier goes into a standby state. During this state, the tray remains in the upper position.

(2) If a cassette is removed and reinserted during standby, the corresponding cassette tray moves up again to check if there is paper or not.

[C] Bypass feeding operation

· The bypass paper sensor detects the presence of paper.

· The bypass-feed clutch is turned ON, causing the bypass pick-up and paper feed rollers to rotate.

· The bypass pick-up roller moves down to start feeding paper.

· The leading edge of the paper turns ON the registration sensor, causing the paper to be aligned by the registration roller.

· The bypass feed clutch is turned OFF, causing the bypass pick-up and bypass feed rollers to stop rotating. The bypass pick-up roller moves up.

· The registration motor is turned ON, causing the paper to be sent toward the transfer/transport unit.

* Depending on the paper type, when the registration motor is ON, the feed path clutch may also be turned ON in an instant and cause the bypass pick-up and bypass feed rollers to rotate.

[D] Cassette feeding

· The cassette feed clutch, feed path clutch and pre-feed clutch (F) are turned ON, and the paper feed and transport rollers rotate, causing the paper to start being fed.

· When the leading edge of the paper turns ON the cassette-feed jam sensor, the feed clutch is turned OFF.

· The feed path clutch and the pre-feed clutch(F) are ON, causing the transport roller to rotate for once.

· The leading edge of the paper turns ON the registration sensor, and the paper is aligned by the registration rollers.

· The feed path clutch and the pre-feed clutch(F) are turned OFF, causing the transport roller to stop.

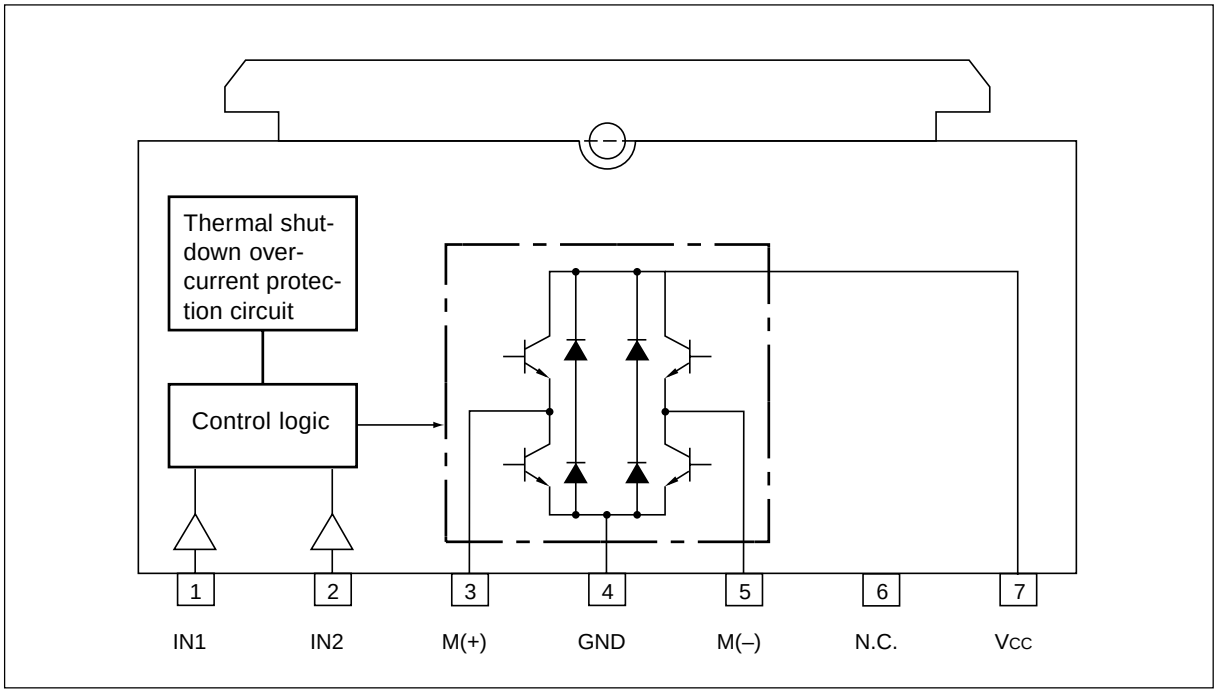
· The registration clutch and the pre-feed clutch(R) are turned ON to send the paper toward the transfer/transport unit.

12.3 Motor Drive Circuit

12.3.1 Brush motor drive circuit

Cassette tray-up motor (T-UP-MTR) : Driven by IC21 for the 1st cassette and IC34 for the 2nd cassette (TA8428K on the LGC PC board).

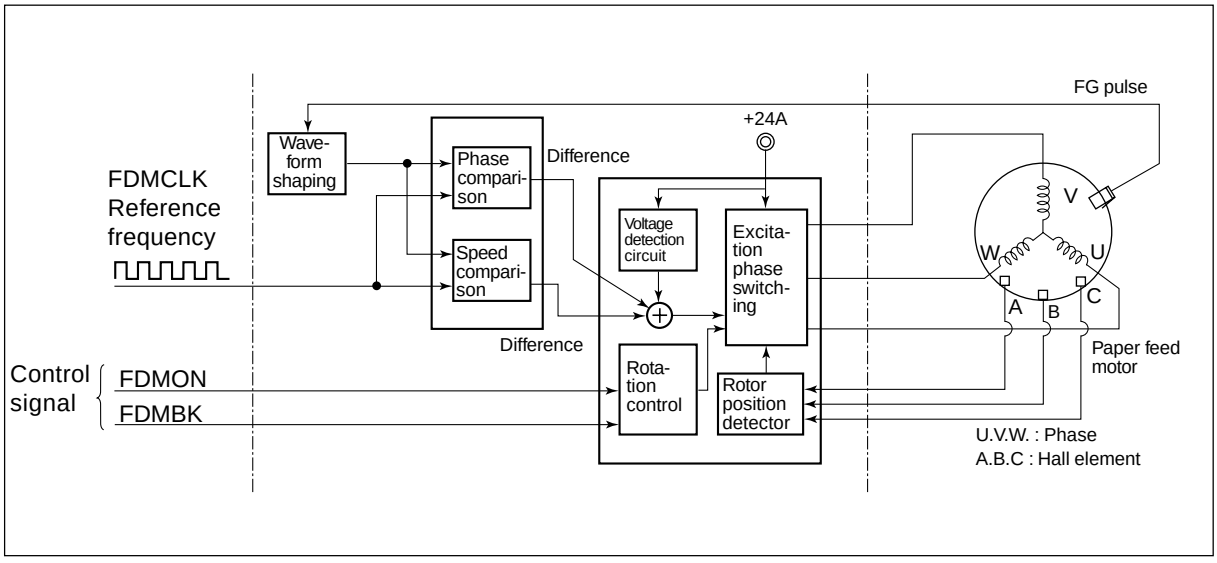
The following shows the block diagram of TA8428K.



IN1 and IN2 are input terminals to receive signals from the microcomputer. The control logic, based on signals from the microcomputer, controls the CW/CCW rotation and ON/OFF of the motor.

Input		Output		Remarks
IN1	IN2	M (+)	M (–)	
H	H	L	L	BRAKE
L	H	L	H	CCW (upward)
H	L	H	L	CW (downward)
L	L	OFF (High impedance)		STOP

12.3.2 Drive system of paper feed motor (Brushless DC motor)



(1) LGC provides a signal to control the rotation of the paper feed motor:
(FDMON: Motor rotation command)

(2) The excitation phase switching section works to excite each phase of the paper feed motor→The paper feed motor starts rotating.

(3) Hall elements A, B and C help to detect the rotational position of the motor (rotor).

(4) The excitation phase switching section switches the excitation of each phase of the motor.
(With the steps (2) to (4) repeated, the motor continues to rotate.)

(5) Rotation of the paper feed motor causes FG pulse to be generated.

(6) The FG pulse and the reference frequency from LGC are compared in terms of phase and speed, and the differences are added. Deflection in the power supply voltage is also added to the resultant signal (signal generation).

(7) According to the signal thus obtained in the step (6), the timing of the excitation phase switching is changed:
= Control is performed to make the FG pulse and the reference frequency equal→The paper feed motor rotates at a fixed speed (locked range).

(8) When FDMON signal from LGC comes to the level "H", the paper feed motor comes to a stop. And when FDMBK signal comes to the level "L", the brake function which is for stopping the motor in the shortest time works.

<Control signal>

(1) FDMCLK signal (LGC→FED-MOT : Input)

This is a reference clock signal to make the paper feed motor rotate at a fixed speed. The frequency of the reference clock is 419 Hz.

When the period of the FG pulse is within ±6.25% that of the reference frequency, it is provided that the motor is within a locked range (normal rotation), and the signal comes to the level "L". At this time, LED 'LD1' is lighted.

(2) FDMON signal (LGC→FED-MOT : Input)

This signal is used to turn the paper feed motor ON and OFF. When this signal comes to the level "L", the motor is turned ON.

(3) FDMBK signal (LGC→FED-MOT : Input)

This signal is used to stop the paper feed motor in the shortest time. When this signal comes to the level "L", the brake works to control the motor.

Signal levels of paper feed motor circuit:

Signal name	Level "H"	Level "L"
FDMCLK	Reference clock (419 Hz)	
FDMON	Motor OFF	Motor ON
FDMBK	Brake OFF	Brake ON

12.4 Disassembly and Replacement

[A] Bypass feed unit

(A-1) Bypass feed unit

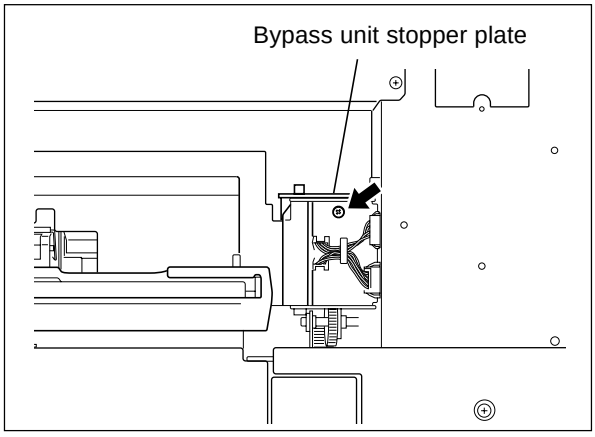
(1) Remove the feed-side upper cover.

(2) Remove the feed-side upper inner cover.

(3) Unscrew the screw and remove the bypass unit stopper plate.

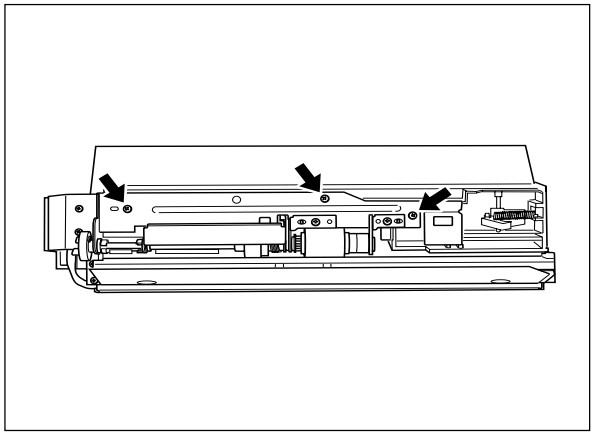
(4) Pull out the ø6 shaft upward.

(5) Disconnect 2 connectors, take out the harness from the clamp and remove the bypass feed unit.

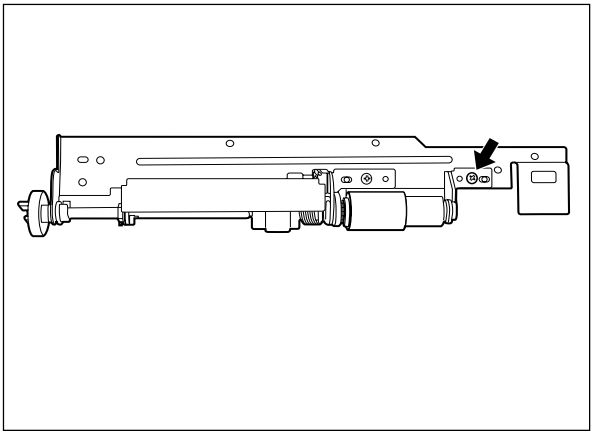


(A-2) Bypass feed roller

(1) Unscrew 4 screws and remove the roller unit.



(2) Unscrew 1 screw and remove the bracket, then remove bypass feed roller.



(A-3) Bypass pick-up roller

(1) Remove the clip.

(2) Pull out the ø6 shaft in the direction of arrow.

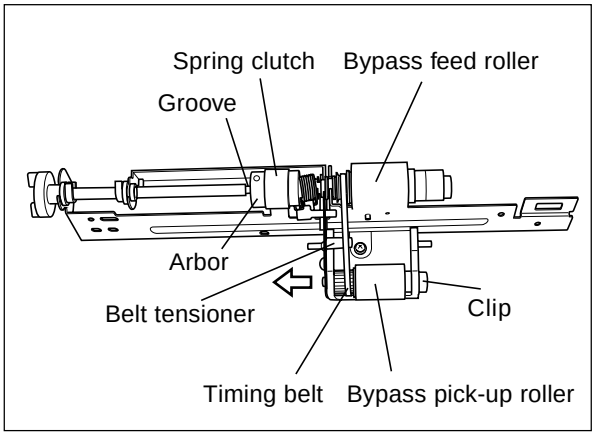
Note:

Pay attention to the following points when reassembling the bypass pick-up roller and the bypass feed roller:

1. Set the timing belt securely on the pulleys and the belt tensioner.
2. Set the timing belt on the correct position (especially for the bypass pick-up roller).
3. Fit the clips securely into the groove of the shaft.
4. Confirm that there is no stain of oil etc. on the surface of timing belt, pulleys and rollers.
5. In case the spring clutch is removed, screw the arbor properly to the groove edge of the shaft to reinstall.
6. Pay attention to the color of rollers.

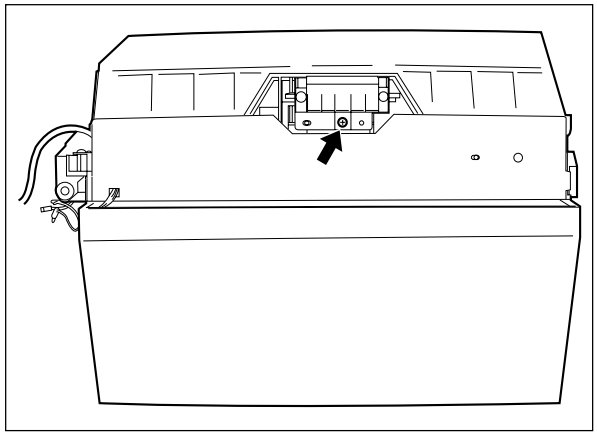
   Paper feed roller: Semitransparent

   Separation roller: Blue

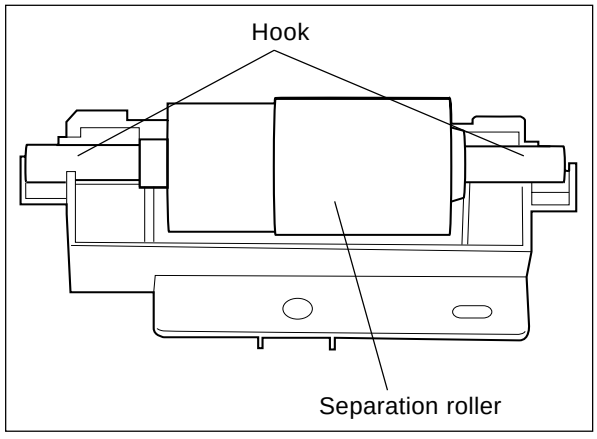


(A-4) Bypass separation roller

(1) Remove the lower bracket (separation roller bracket) (1 screws).



(2) Unlock both sides of the separation roller to remove it from the bracket.

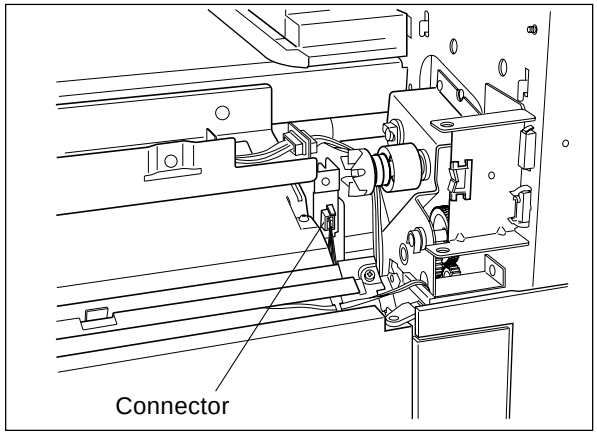


[B] Registration unit/OHP unit

(B-1) Registration unit

(1) Remove the bypass feed unit.

(2) Disconnect the registration sensor connector.

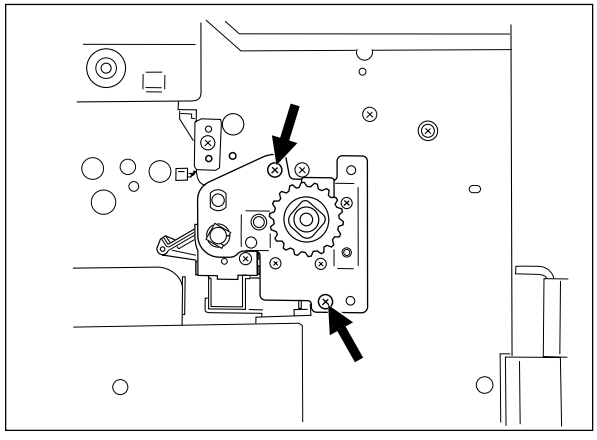


(3) Open the front cover and turn the lever to move down the transfer belt unit.

(4) Remove the processing unit (► Chapter 13).

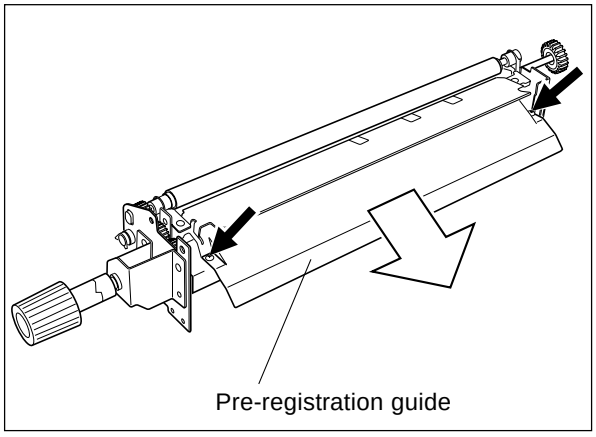
(5) Remove the right inner cover (3 screws, 1 connector).

(6) Unscrew 2 screws and slide out the registration unit toward the front.

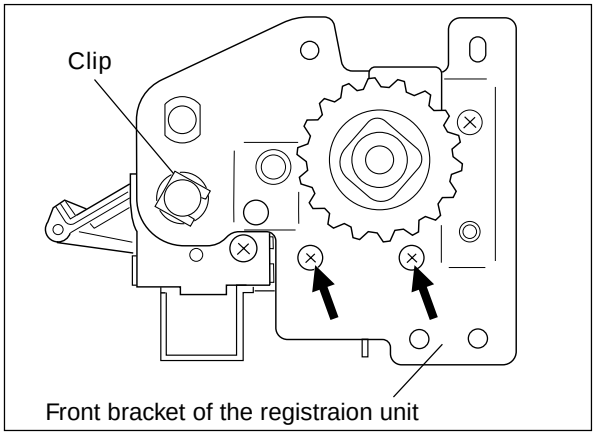


(B-2) Upper and lower registration rollers

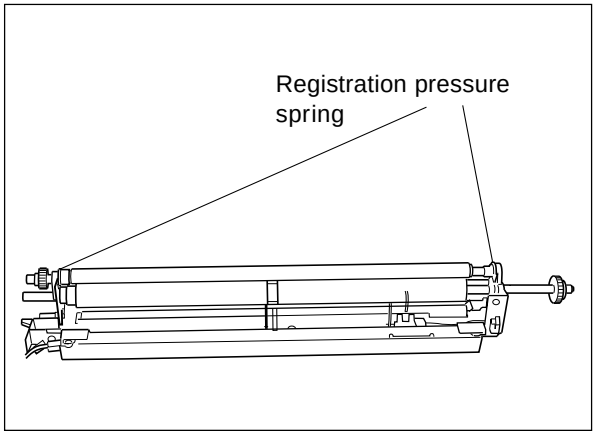
(1) Unscrew 2 screws, and remove the pre-registration guide.



(2) Remove 2 screws and the clip, and then the front bracket of the registration unit.



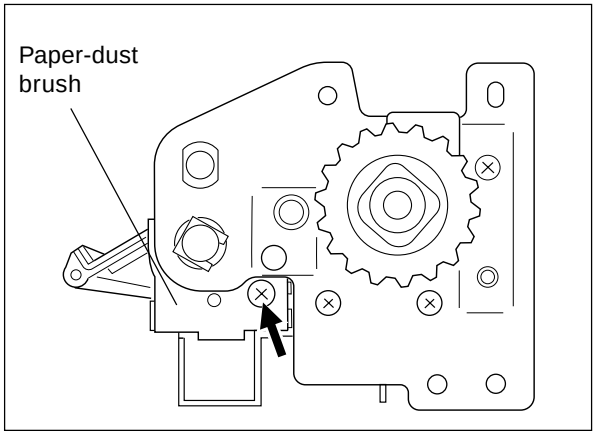
(3) Remove the front and rear registration pressure springs.
(4) Remove 2 bushings and the upper registration roller.
(5) Remove 2 bushings and the lower registration roller.



(B-3) Paper-dust brush

(1) Unscrew the screw, and pull out the brush toward the front.

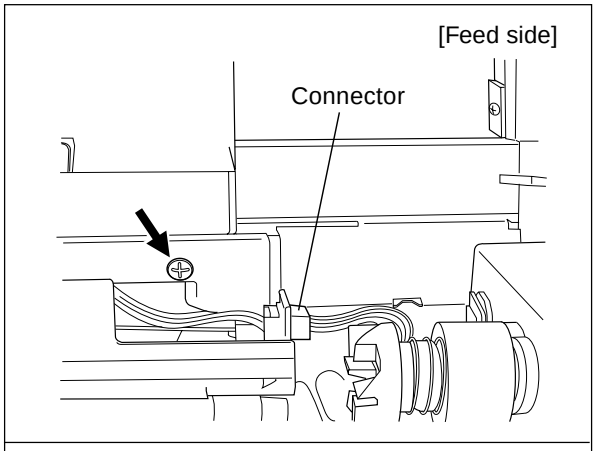
(The paper-dust brush can be removed with the registration unit installed.)

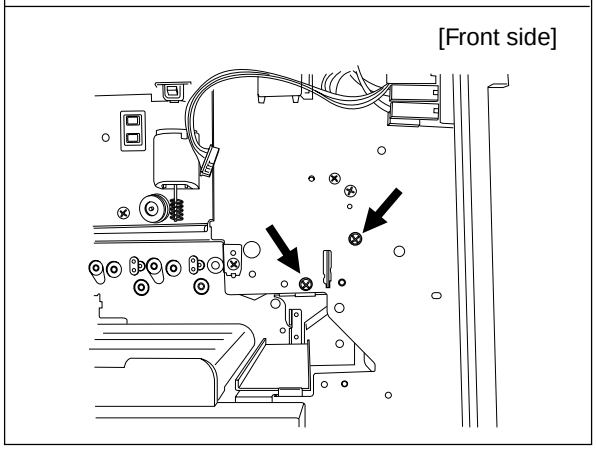


(B-4) OHP unit

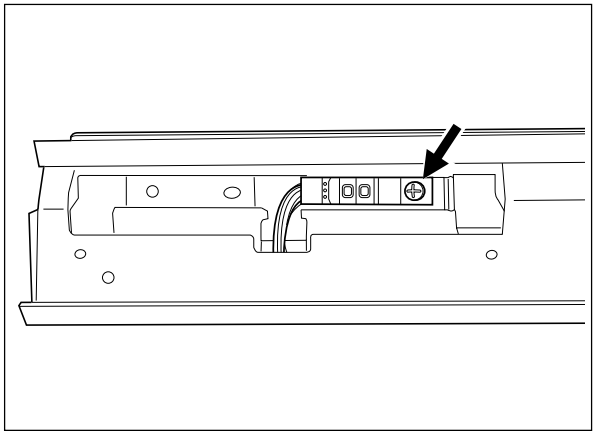
(1) Disconnect the connector of OHP sensor.

(2) Remove the OHP unit (1 screw on the feed side, 2 screws on the front side).





(3) Remove the OHP sensor (1 screw).



[C] Cassette feed section

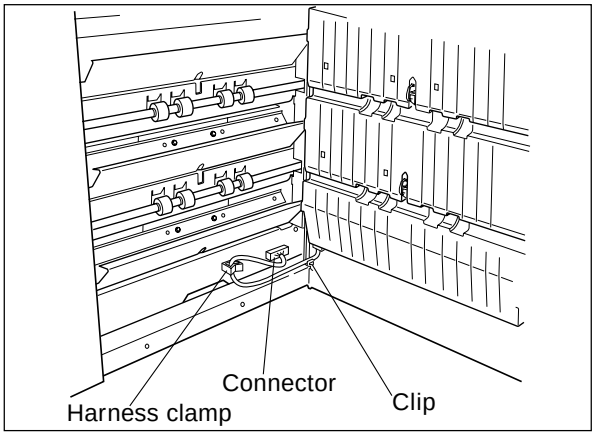
(C-1) Cassette feed unit

(1) Open the side door.

(2) Remove the clip.

(3) Remove the side door.

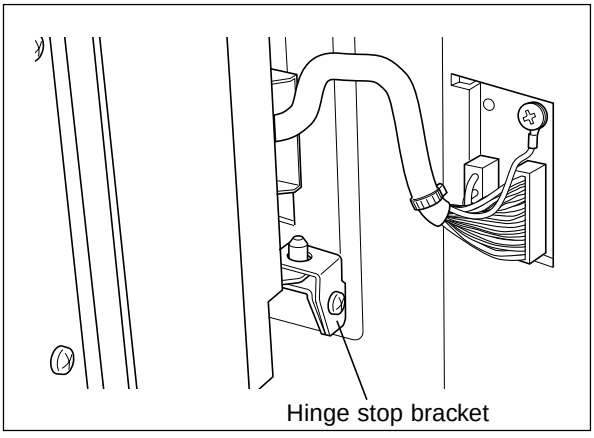
(4) Disconnect the connector and disengage the harness from the clamp.



Note:

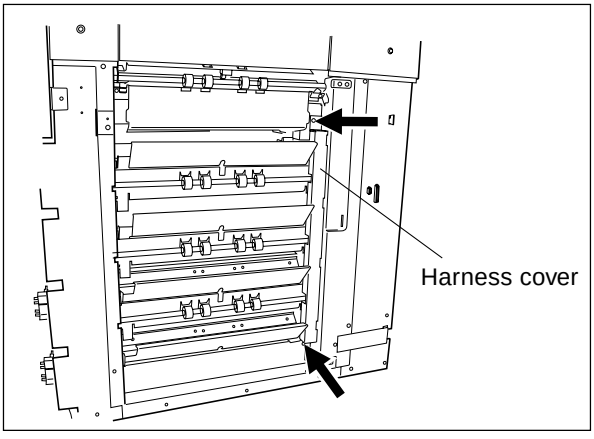
When the copier is equipped with LCF (MP-1503), use the procedure below to remove the LCF and the side door:

1. Remove the feed-side rear cover.
2. Disconnect 2 connectors and remove the groundwire (1 screw).
3. Remove the hinge stop bracket (1 screw).
4. Disconnect the connector (see step (4) above).
5. Remove the side door together with LCF.

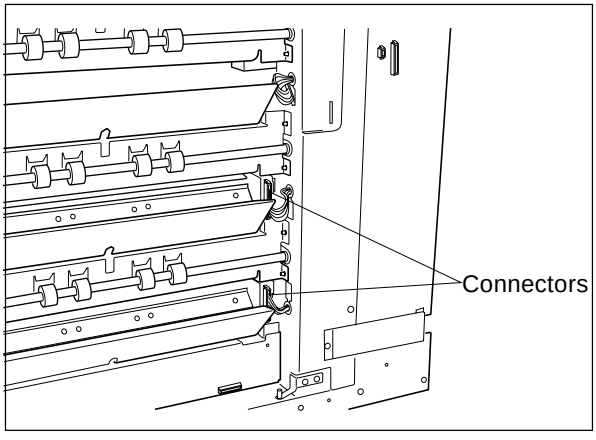


(5) Remove the feed side covers (front and rear).

(6) Unscrew 2 screws and remove the harness cover.



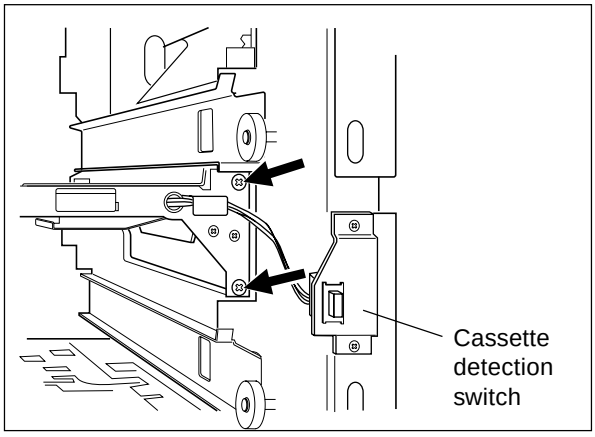
(7) Disconnect the connector from the paper feed unit.



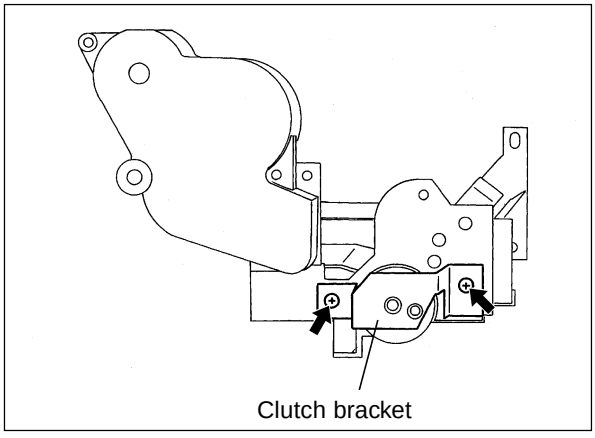
(8) Slide out the cassette.

(9) Disconnect the connector of the cassette detection switch.

(10) Unscrew 2 screws and draw out the paper feed unit toward the front.



(11) Remove the clutch bracket (2 screws).

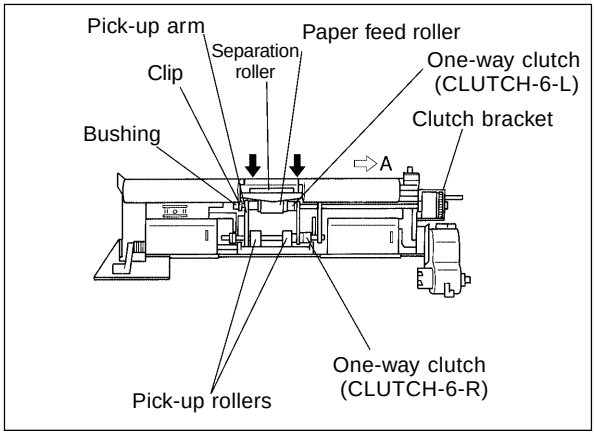


(12) Remove the separation roller holder (2 screws).

(13) Remove the pick-up roller from the arm.

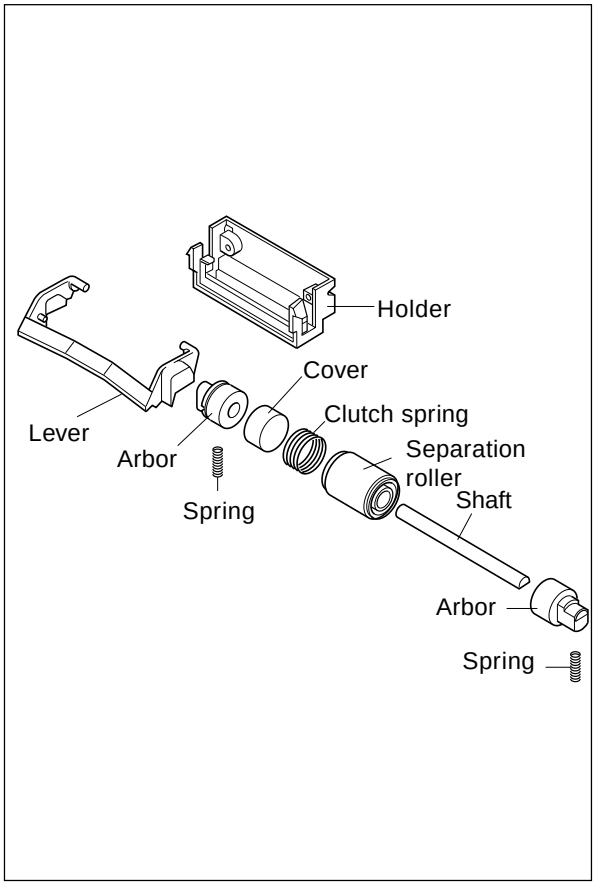
(14) Slide the paper feed roller in the direction of arrow A and pull out its shaft from the bushing.

(15) Remove the clip and pick-up arm from the shaft, and pull out the paper feed roller.



(16) Remove the lever from the holder and take out the separation roller along with its shaft.

(17) Remove the cover, arbor, clutch spring and then separation roller from the shaft.

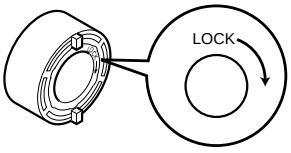


Note:

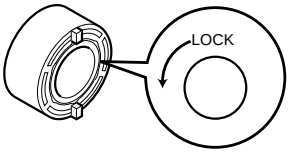
When reassembling the rollers for pick-up, paper feed and separation, pay attention to the following points:

1. Fit the pin into the pulley.
2. Set the timing belt securely on the pulleys.
3. Be careful as the “lock” direction of each one-way clutch is different.

CLUTCH-6-L



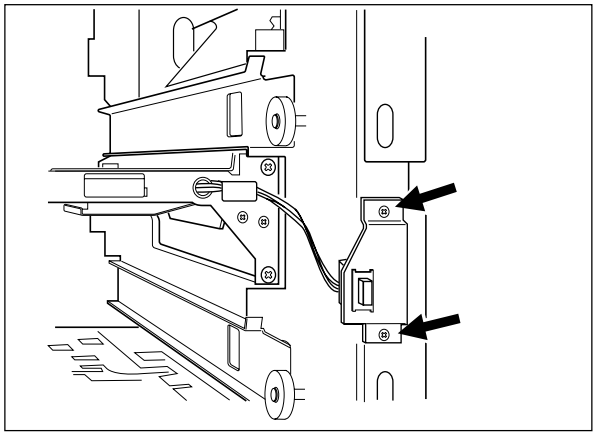
CLUTCH-6-R



4. Fit the clips securely into the groove on the shaft.
5. Confirm that there is no stain of oil etc. on the surface of the timing belt, pulleys, and rollers.
6. Pay attention to the color of rollers.
   Paper feed roller: Yellow
   Separation roller: Blue

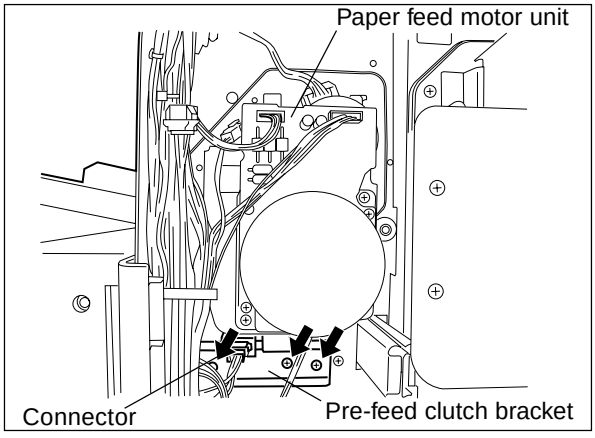
(C-2) Cassete detection switch

(1) Disconnect the connector and unscrew 2 screws. Then remove the cassette detection switch.

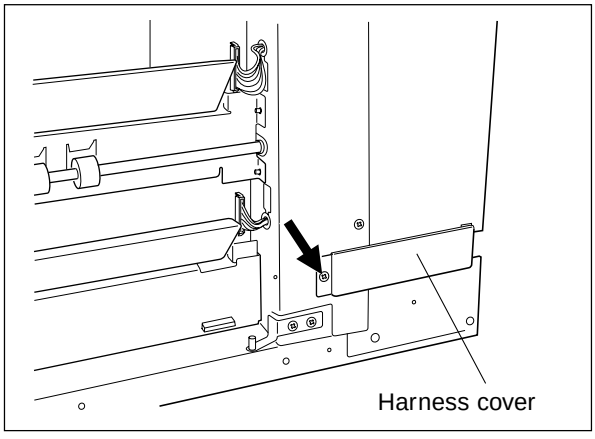


(C-3) Cassette feed transport unit

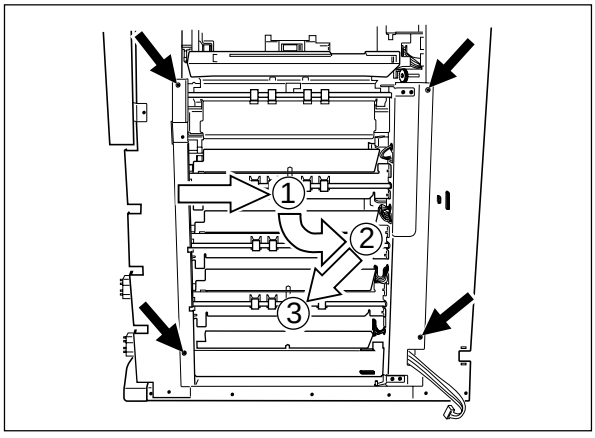
(1) Remove the cassette feed unit.
(2) Remove the rear cover.
(3) Remove the paper feed motor unit. (Refer to [D])
(4) Disconnect the connector of the pre-feed clutch, and remove the pre-feed clutch bracket (3 screws).



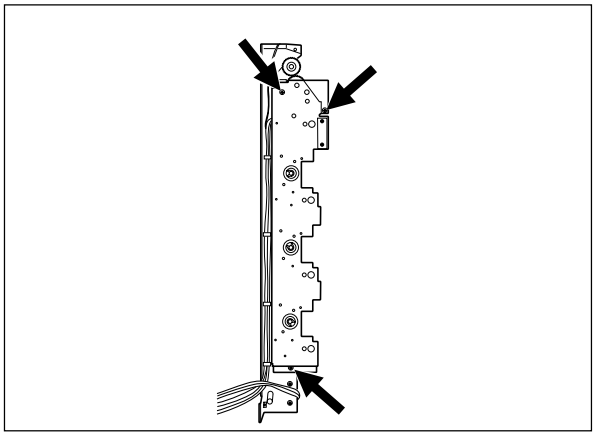
(5) Unscrew the screw and remove the harness cover.
(6) Disconnect 4 connectors.



(7) Unscrew 4 screws, and shift the cassette-feed transport unit toward the rear. While turning the left side of the unit to the front, pull it out toward you.



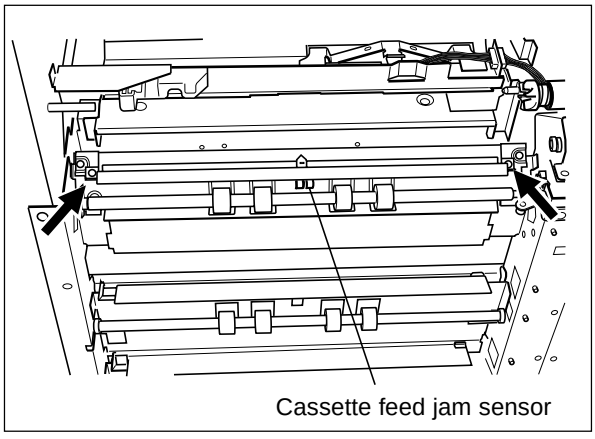
(8) Unscrew 3 screws and remove the gear unit.



(C-4) Cassette feed jam sensor

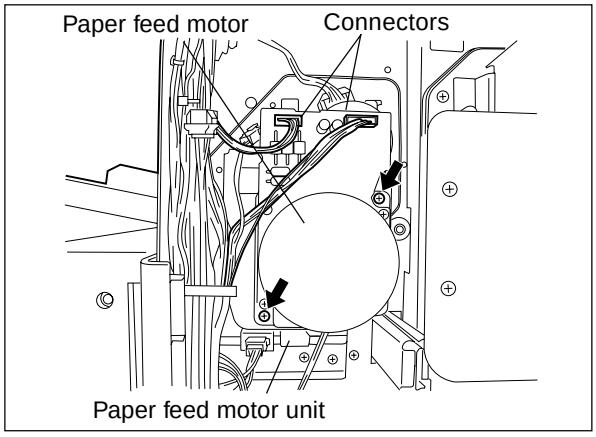
(1) Unscrew 2 screws and remove the sensor unit.

(2) Disconnect the connector and remove the cassette feed jam sensor.



[D] Paper feed motor unit

(1) Remove the rear cover.



(D-1) Paper feed motor

(2) Disconnect 2 connectors.

(3) Unscrew 2 screws and remove the paper feed motor.

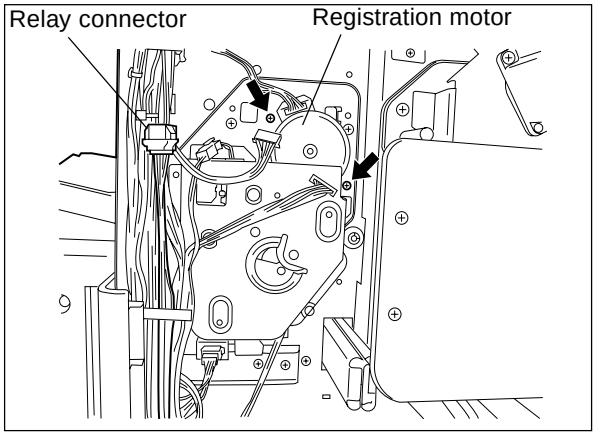
(D-2) Registration motor

(1) Remove the paper feed motor.

(2) Disconnect the relay connector.

(3) Unscrew 2 screws and remove the registration motor.

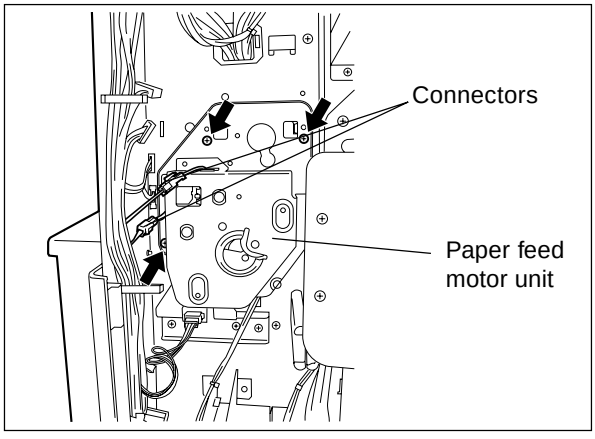
Pull out the registration motor first and then lift it up to take it out.



(D-3) Paper feed motor unit

(1) Disconnect 2 connectors.

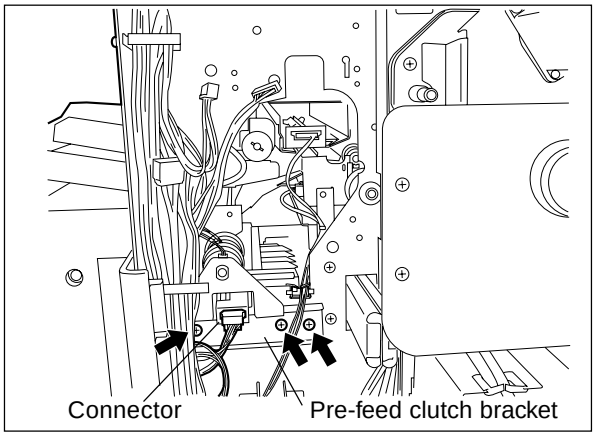
(2) Unscrew 4 screws and remove the paper feed motor unit.



(D-4) Pre-feed clutch bracket

(1) Disconnect the connector.

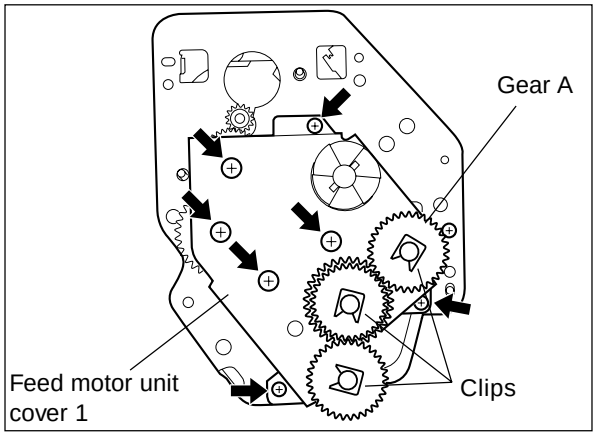
(2) Unscrew 3 screws and remove the pre-feed clutch bracket.



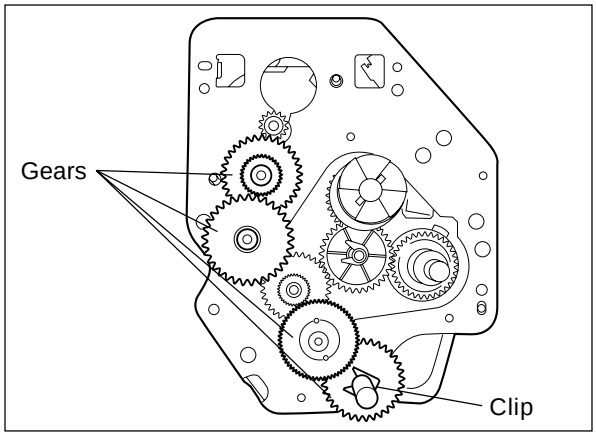
(D-5) Drive gears

(1) Detach 3 clips and remove 3 gears.
Be careful not to loss the pin inserted into the gear A.

(2) Unscrew 7 screws, and remove the feed motor unit cover 1.

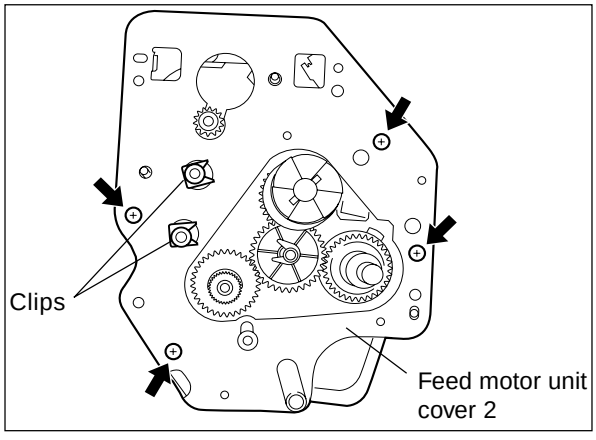


(3) Detach the clip, and remove 4 gears.

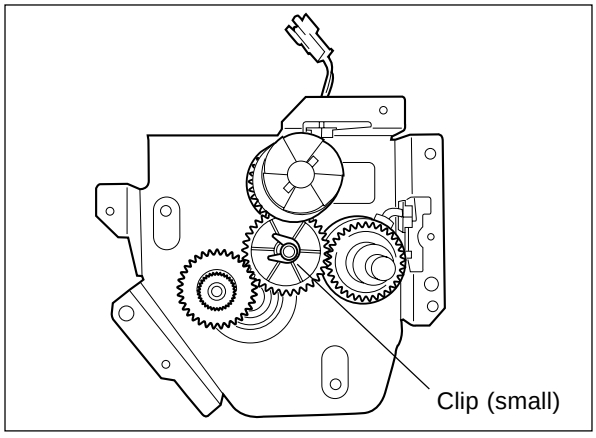


(4) Remove 2 clips and unscrew 4 screws to remove the feed motor unit cover 2.

Note: When reassembling, pay attention to the correct direction of the clips.



(5) Remove the clip (small), gears and electro-magnetic clutches.



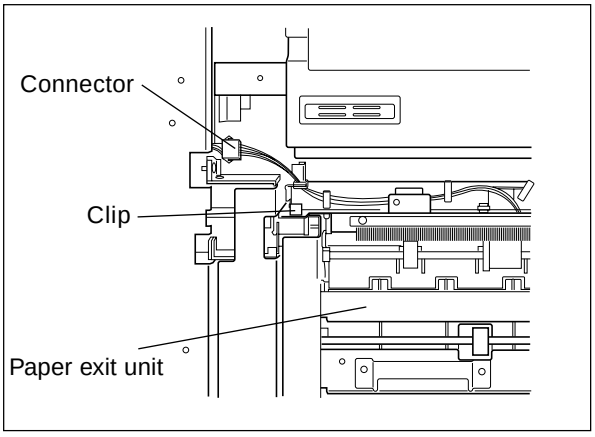
[E] Paper-exit/ADU transport section

(E-1) Paper exit unit

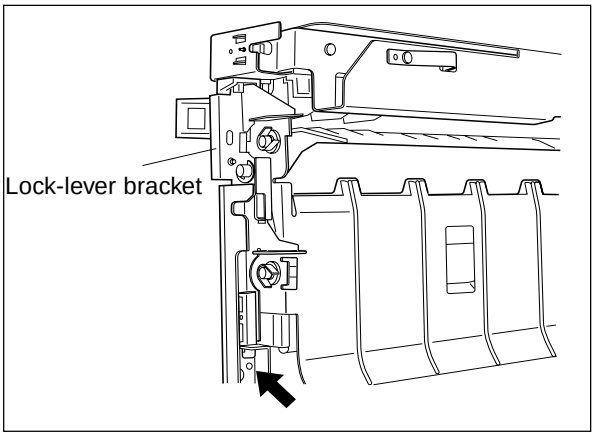
(1) Remove the paper exit unit cover and exit-side rear cover.

(2) Disconnect the connector.

(3) Remove the clip and take out the paper exit unit.

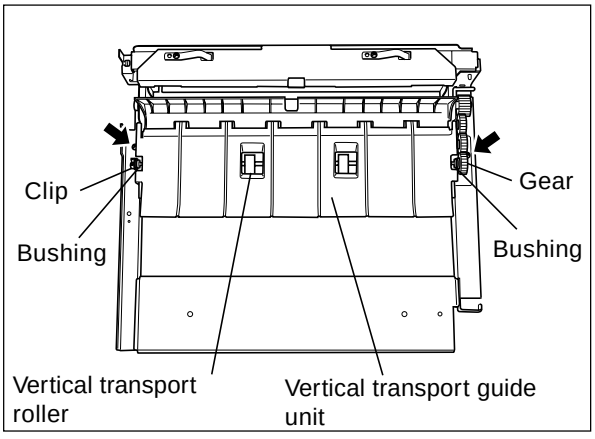


(4) Unscrew the screw and remove the lock-lever bracket.

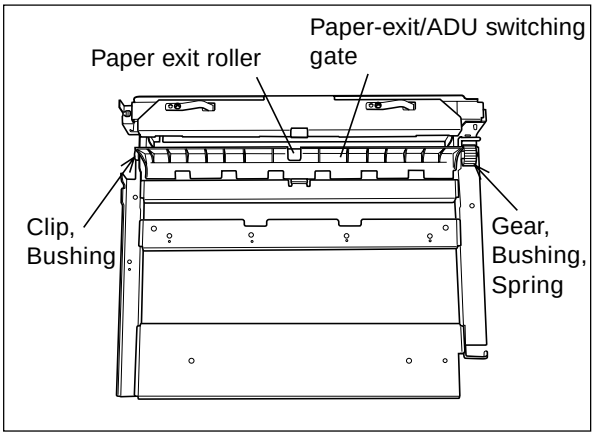


(5) Unscrew 2 screws and remove the vertical transport guide unit.

(6) Remove the clip and bushing on the front side, as well as the gear and bushing on the rear side, and then remove the vertical transport roller.

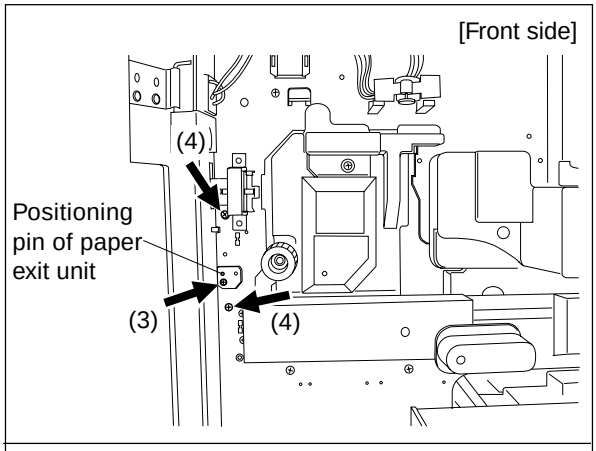


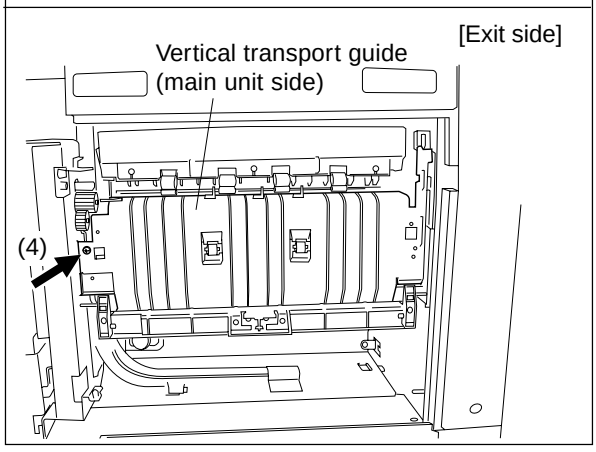
(7) Remove the clip and bushing on the front side, as well as the gear, bushing and spring on the rear side, and then remove the paper-exit/ADU switching gate and paper exit roller.



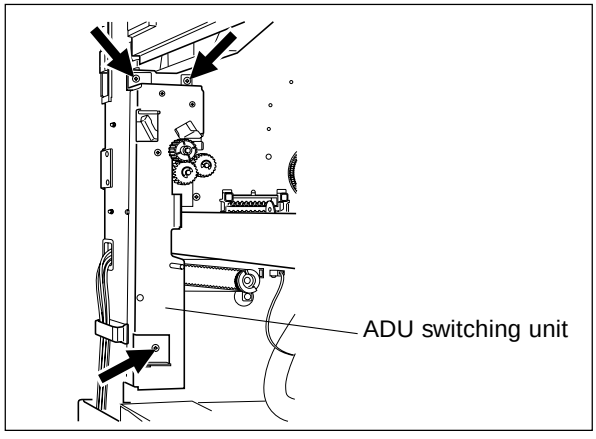
(E-2) ADU switching unit

(1) Open the front covers and pull out the transfer/ transport unit.
(2) Remove the left inner cover.
(3) Disengage the positioning pin of the paper-exit unit (1 screw).
(4) Unscrew 3 screws (2 on the front side and 1 on the exit side) and remove the vertical transport guide (main unit side).

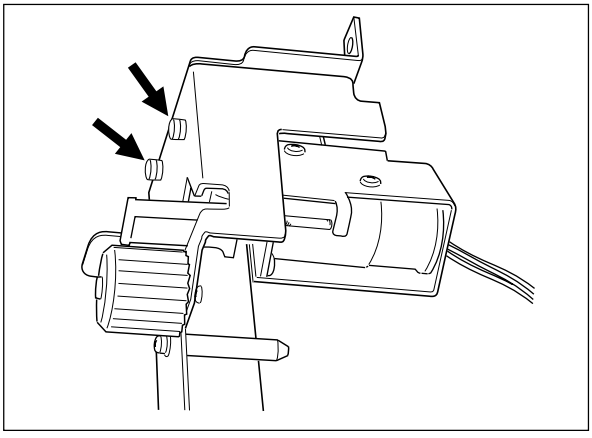




(5) Remove the rear cover.
(6) Unscrew 3 screws and remove the ADU switching unit.

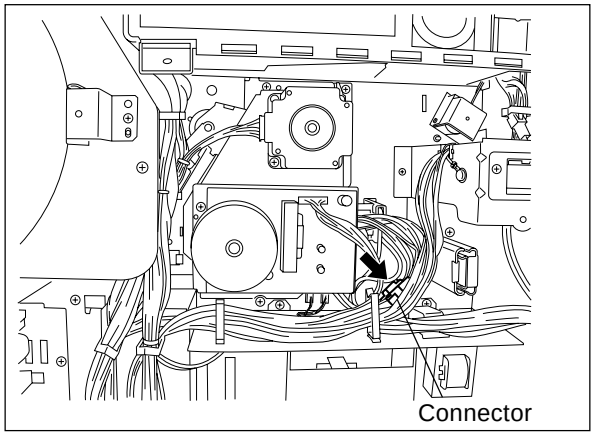


(7) Unscrew 2 screws and remove the gate solenoid (the screws must be removed from the inside of the bracket).

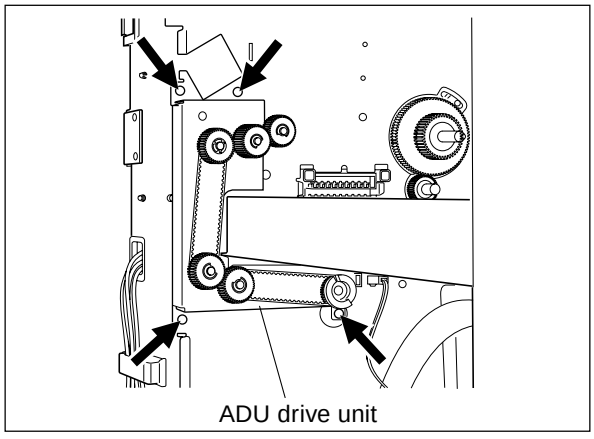


(E-3) ADU drive unit

(1) Disconnect the connector.

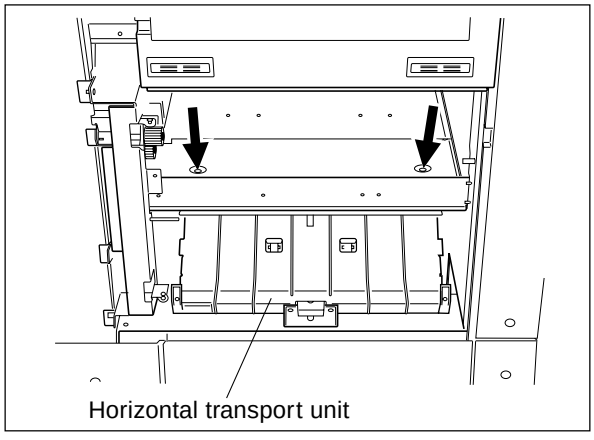


(2) Unscrew 4 screws and remove the ADU drive unit.



(E-4) Horizontal transport unit

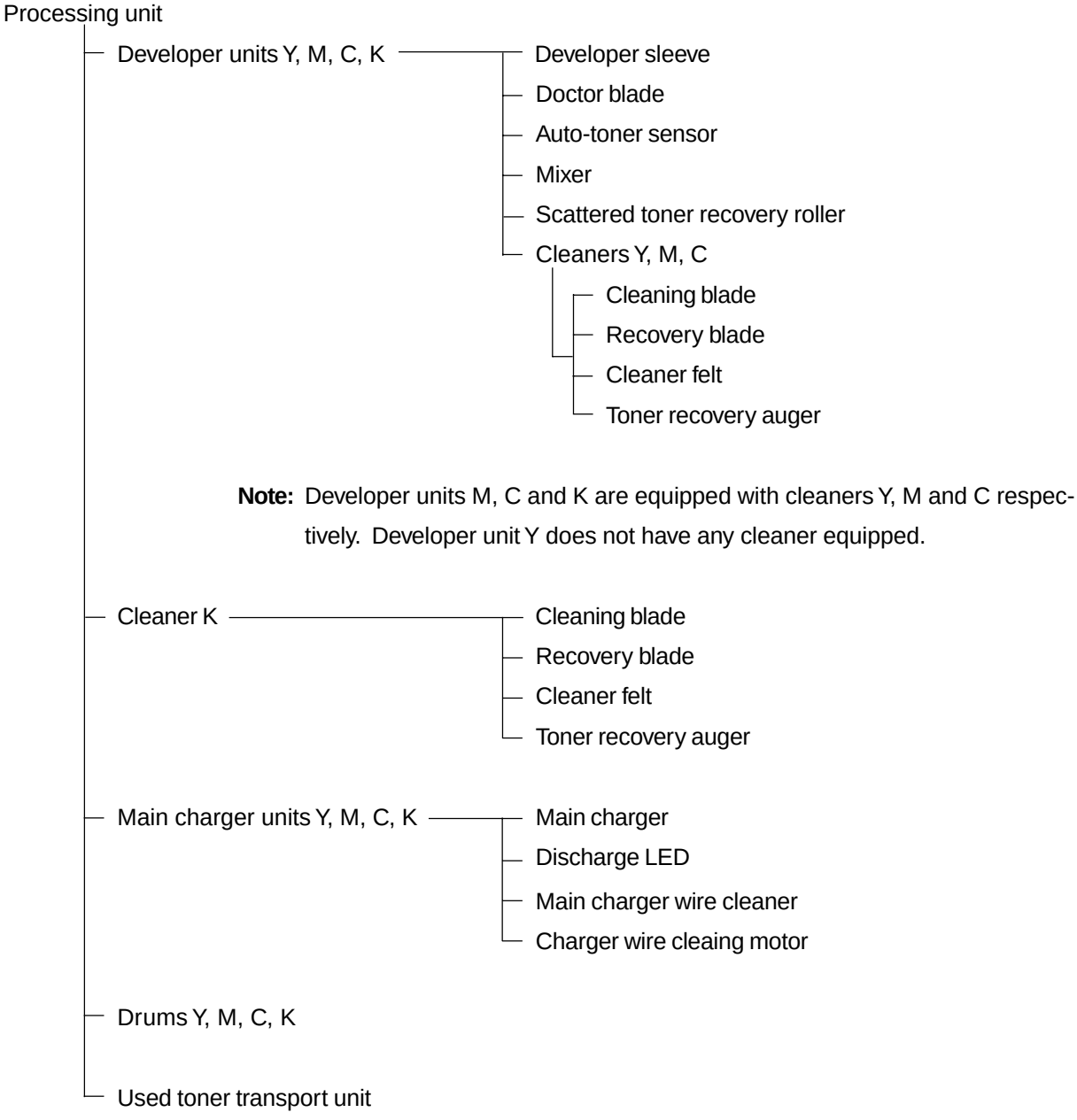
(1) Open the front covers and draw out the transfer/ transport unit.
(2) Remove the left inner cover.
(3) Unscrew 2 screws, disconnect the connector and remove the horizontal transport unit.



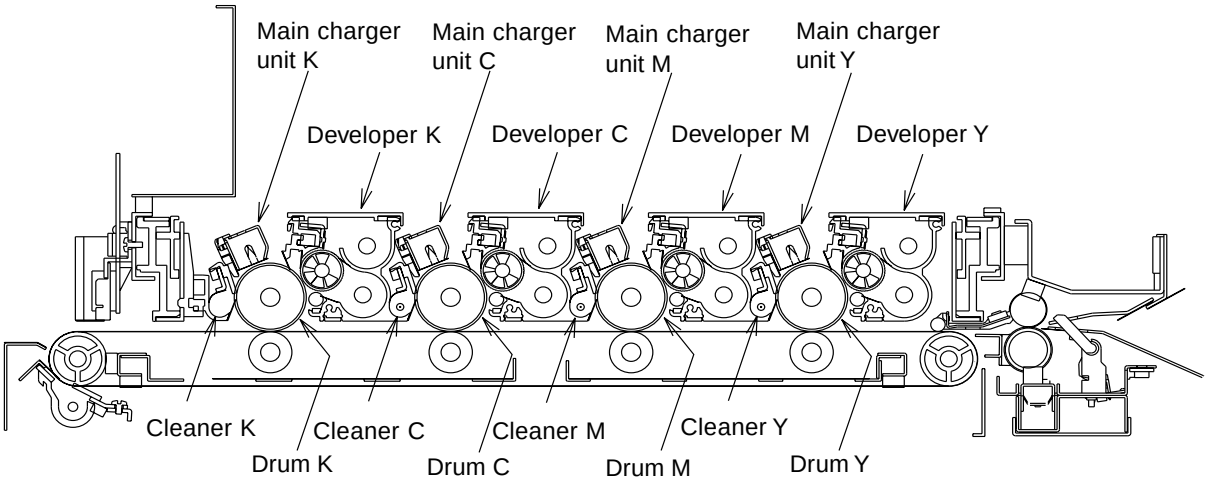
13. PROCESSING UNIT (EPU)

13.1 Construction

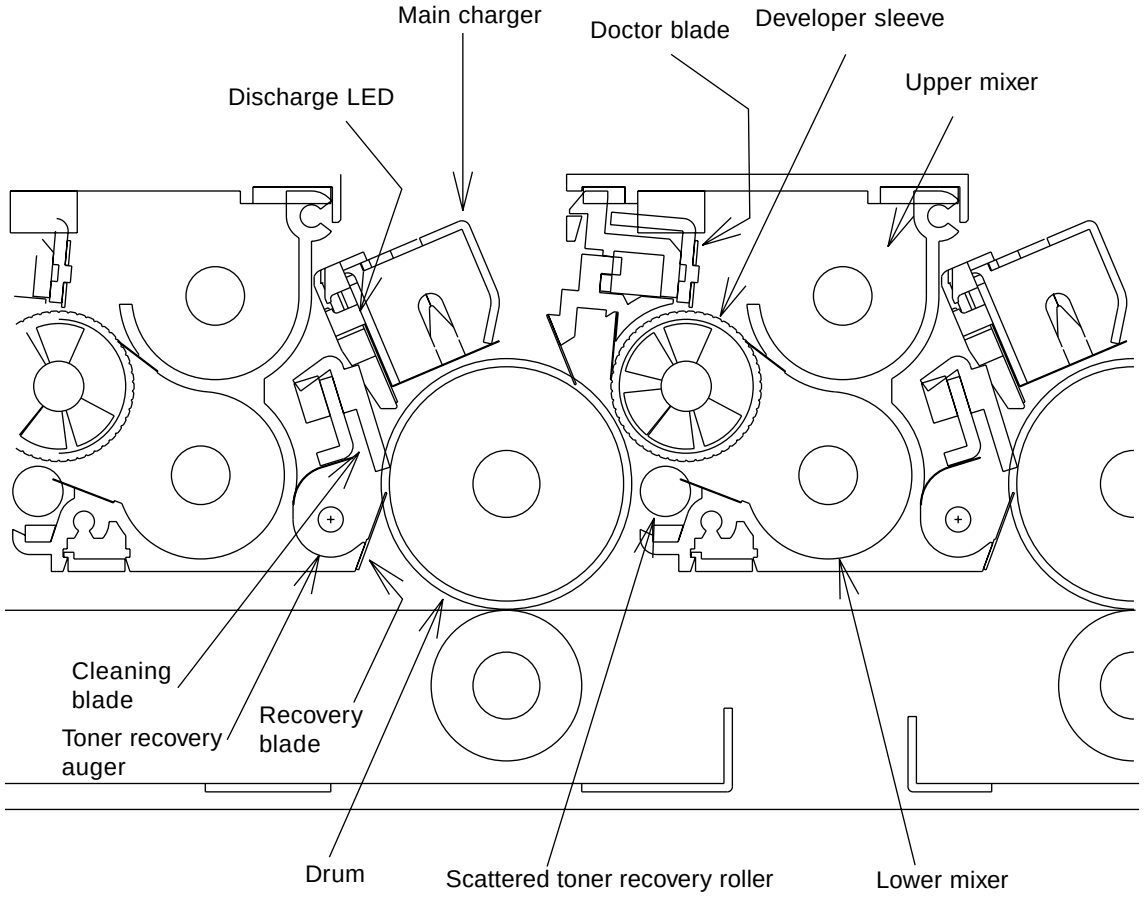
This chapter describes about the processing unit (electrophotographic processing unit: EPU) which is comprised as shown below.



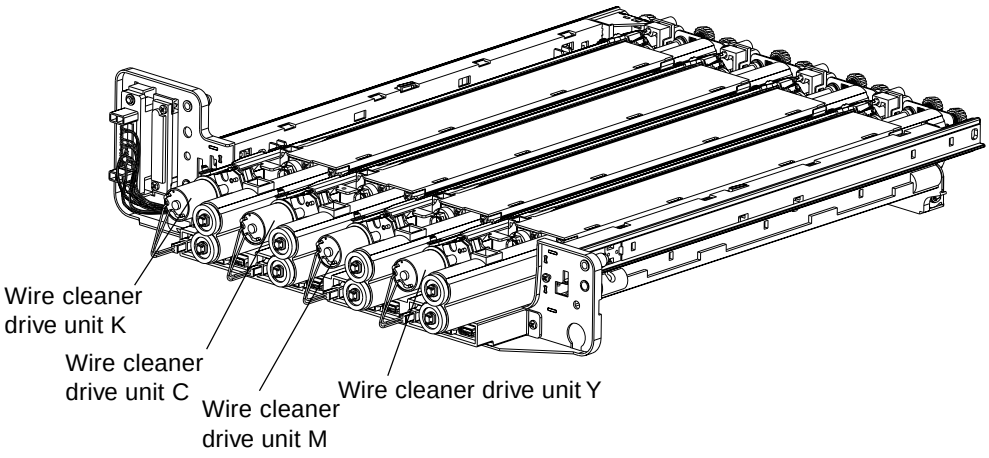
Note: Developer units M, C and K are equipped with cleaners Y, M and C respectively. Developer unit Y does not have any cleaner equipped.



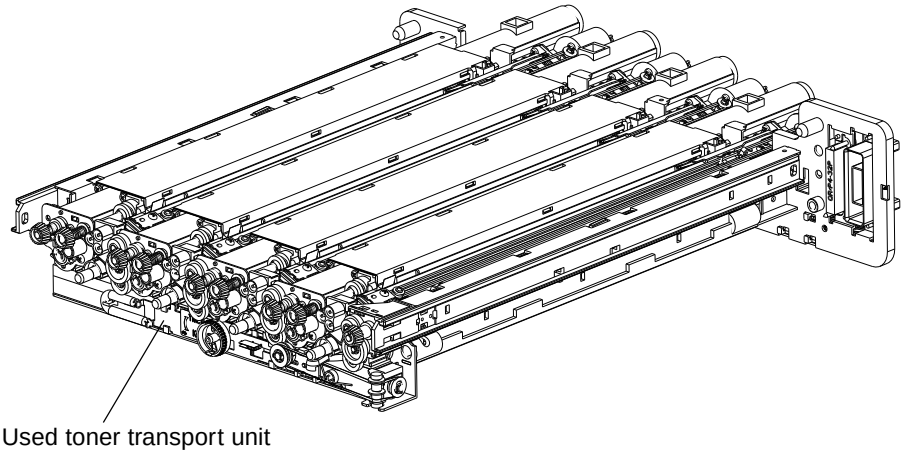
[Sectional view]



[Detailed sectional view]



[Front side view (EPU cover removed)]



[Rear side view]

13.2 Description of Functions

(1) Drums

Comprised of a cylindrical aluminum substrate on which an organic photoconductive substance is coated in a thin film. Photoconductivity is a characteristic which certain substances possess. When such substance is illuminated with light, the lighted area acts as an electric conductor and shows decrease of the electrical resistance; while the other area which is not illuminated (unexposed area) behaves as an insulator. Substances possessing such a characteristic as this are called photoconductors.

(2) Main charger

Comprised of a U-shaped metal component, on each end of which an insulation block is provided and a charger wire placed between both blocks.

When high voltage is applied to the charger wire, the air around it is charged (or ionized), and the ionized air flows to the drum to make it charged. This phenomenon is called corona discharge. A uniform minus (negative) charge is applied to the surface of the drum by corona discharge from the main charger.

(3) Main charger wire cleaner

When the power is turned on, or when the door switch is turned on, or when 1000 copies or more have been made in total since the previous cleaning, the wire cleaner moves to the other end and then back to clean the charger wire.

(4) Discharge LED array

Discharging is a process in which electrostatic force formed on the surface of a drum is reduced or eliminated.

The discharge LED array performs two purposes: cleaning effect by lighting the drum surface to reduce its electric resistance and neutralize (or erase) the residual charge on the drum surface, and “pre-exposure” effect by maintaining the surface potential of the drum surface at a uniform level prior to subsequent exposure.

(5) Developer material

The developer material is comprised of carrier and toner.

The carrier consists of approx. 30 – 100 µm particles of iron powder and is electrically conductive.

The toner is made of approx. 5 – 13 µm resin particles.

The ratio of toner by weight in the developer material is about 7.0%.

Since the developer material degrades in quality after long time use, it needs to be replaced periodically.

(6) Mixing unit (mixer)

Mixes carrier and toner to make them rub against each other, causing the carrier to get charged to plus (positive) and the toner to minus (negative) potential, respectively. This will cause the toner to adhere to the carrier by electrostatic force.

(7) Developer sleeve (magnetic roller)

This is an aluminum roller with magnets inside it. These magnets attract developer material over its surface to form a magnetic brush for development. The magnets are fixed in place and the sleeve rotates around them. This rotation causes the magnetic brush on the sleeve to sweep the drum surface gently like a broom and accomplish development.

(8) Doctor blade

Controls the amount of developer material delivered by the sleeve so that the magnetic brush of the developer material makes proper contact with the drum surface.

(9) Scattered toner recovery roller

Works to recover the toner scattered to the area beneath the sleeve and return it to the developer case.

(10) Auto toner sensor

To obtain copies with proper density image consistently, it is necessary to maintain a constant ratio of toner to carrier in the developer unit. The auto toner sensor is set to detect the toner content in the developer material by means of a magnetic bridge circuit, and supply toner from a toner cartridge if the toner ratio decreases to a certain level.

(11) Cleaning blade

Pressed against the drum surface with a constant force by springs, this blade works to scrape residual toner off the drum surface.

(12) Recovery blade

Works to catch the residual toner scraped off by the cleaning blade.

(13) Toner recovery auger

Works to transport the residual toner scraped off to the toner bag through the used toner transport unit.

(14) Cleaner felt

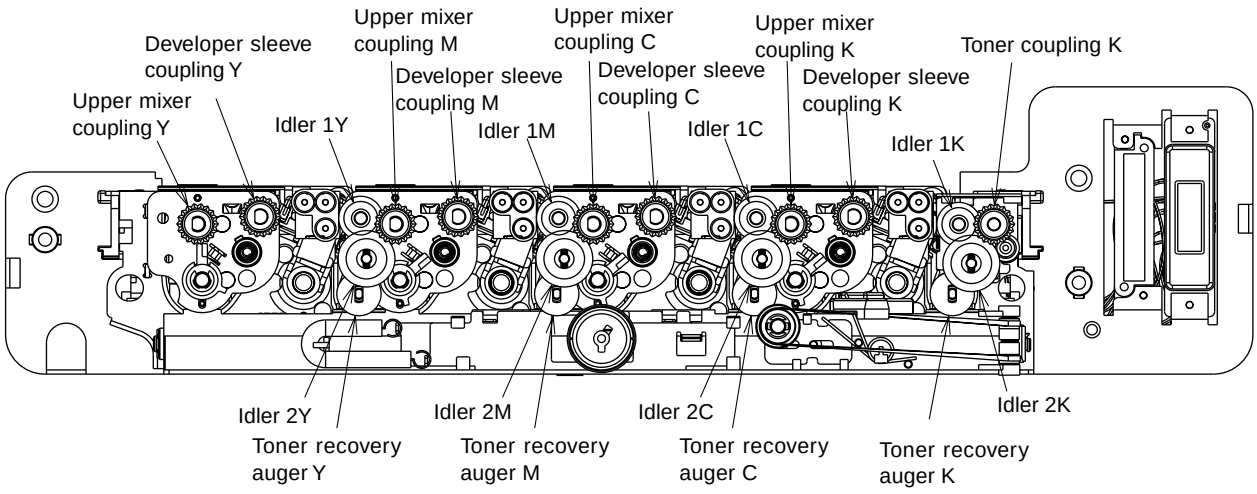
Works to prevent the toner scraped off by the cleaning blade from dropping over the edges of the drum into areas outside the cleaner unit.

(15) Drum thermistor

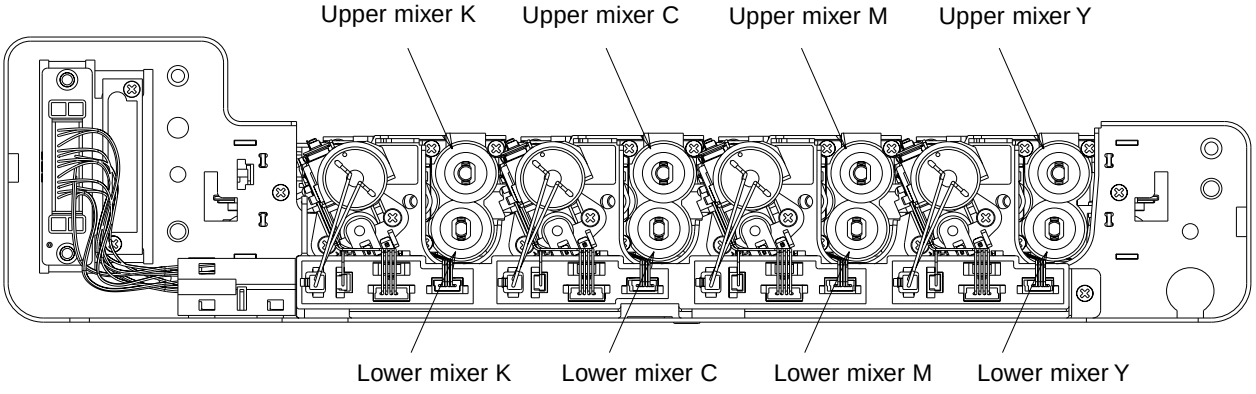
The amount of charge placed on a drum varies greatly with its surface temperature. So, a thermistor is employed to detect the temperature of the drum surface so that the amount of charge placed on the drum surface can be controlled and maintained at a consistent level.

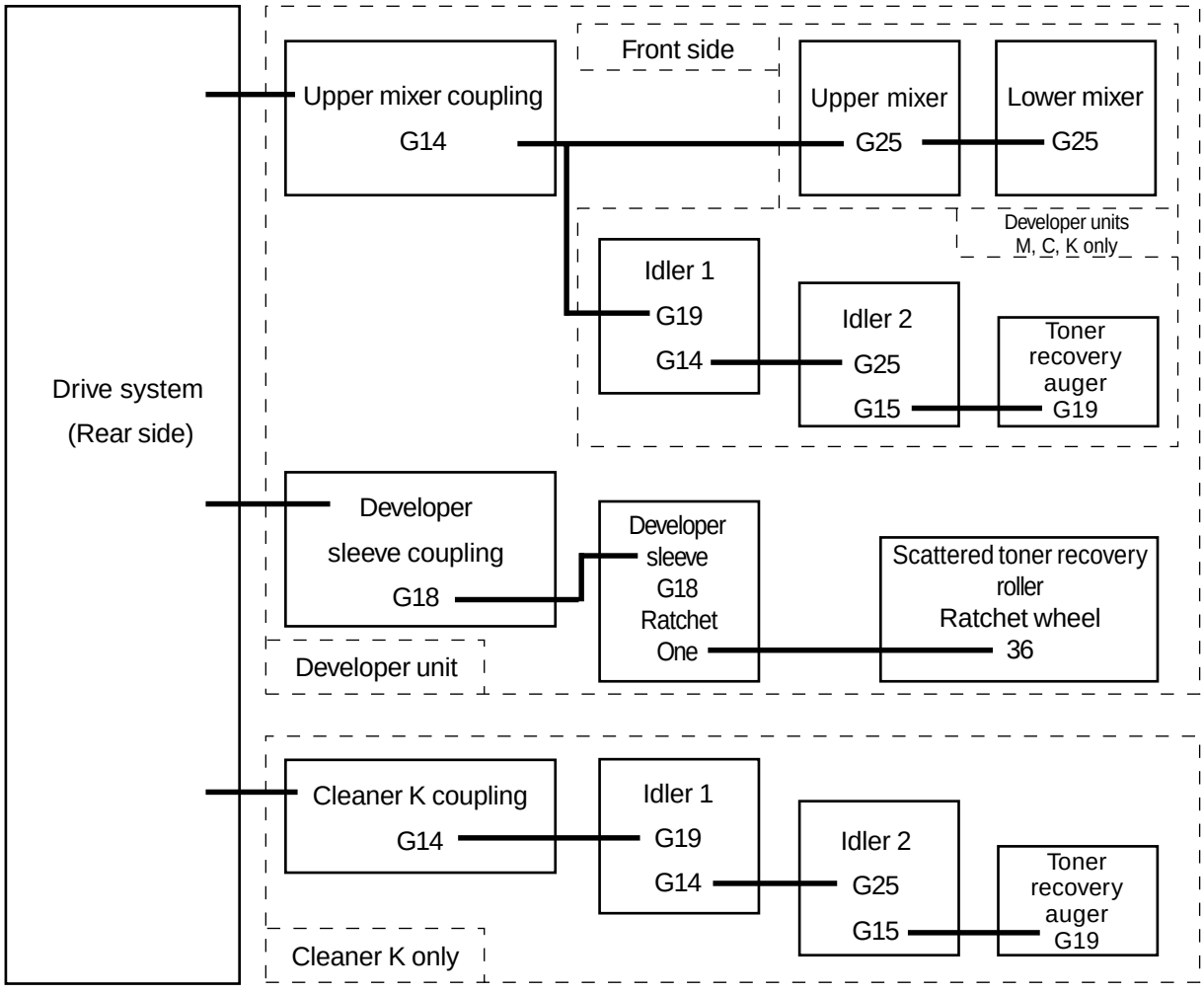
13.3 EPU Drive

[Rear side]



[Front side]




Drive system
(Rear side)
Front side
Upper mixer coupling
G14
Upper mixer
G25
Lower mixer
G25
Developer units
M, C, K only
Idler 1
G19
G14
Idler 2
G25
G15
Toner
recovery
auger
G19
Developer
sleeve coupling
G18
Developer
sleeve
G18
Ratchet
One
Scattered toner recovery
roller
Ratchet wheel
36
Developer unit
Cleaner K coupling
G14
Idler 1
G19
G14
Idler 2
G25
G15
Toner
recovery
auger
G19
Cleaner K only

13.4 Auto Toner Circuit

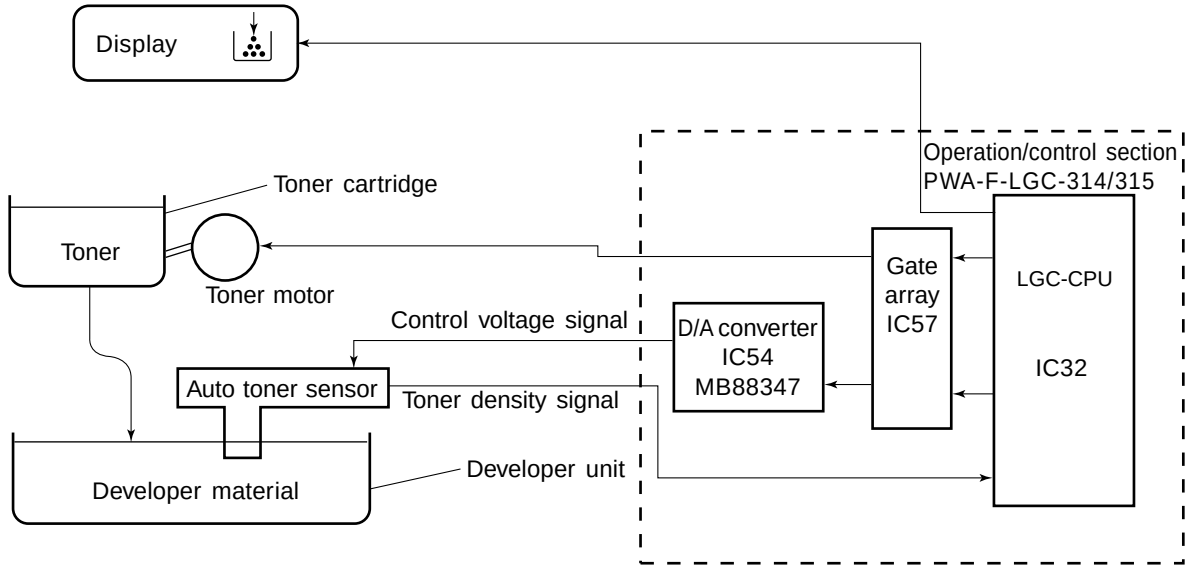
13.4.1 General description

(1) Function of the auto toner circuit

- Detects the toner density in the developer material, and supplies toner when the density decreases below a certain level.
- Detects when the toner cartridge has run out of toner (toner-empty detection).

(2) Construction of the auto toner circuit

- Auto toner sensor : Detects the toner density.
- Control section : Controls so that the toner density in the developer material is maintained at a constant value.
- Toner motor : Supplies toner to the developer material.
- Display : Indicates the toner-empty condition.



13.4.2 Operation of the auto toner sensor

(1) Funcion of the Auto Toner Sensor

1 Initialization adjustment function —During unpacking or developer-material replacement

Automatically adjusts the output value of the auto toner sensor (input value from the LGC-CPU), which corresponds to the toner density of the new developer material, so that the output value of the sensor falls within 3.50 to 4.50V, depending on the relative humidity.

2 Toner density stabilization function —During copying operation

Maintains the toner density at a constant value in the following flow of events:

The toner is consumed.
→The toner density decreases.
→Change in the toner sensor output is detected.
→The toner motor is driven.
→Toner is supplied from the toner cartridge to the developer unit.

3 Toner-empty detection and clearing function

Detects the emptiness of toner in the toner cartridge:

The toner motor is driven.
→The auto toner sensor output does not change.
→The toner density does not change.
→It is determined that no toner is available (toner empty).

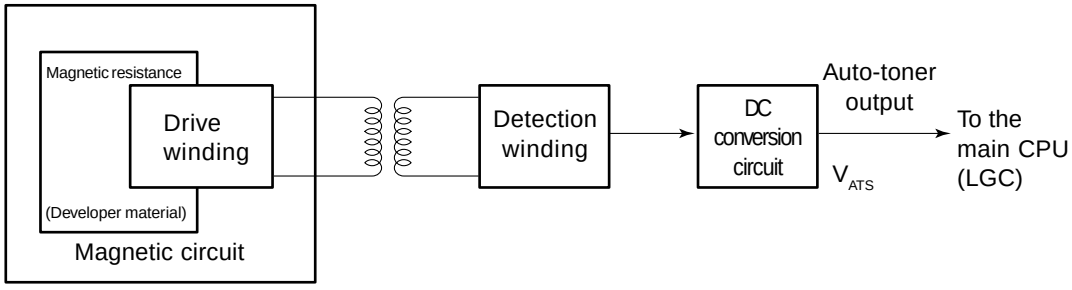
The toner-empty state is cleared:

The toner motor is driven.
→Toner is supplied.
→The auto toner sensor output changes.
→The toner density returns to the normal value.
→The toner-empty state is cleared.

(2) Auto-toner sensor operation

The auto toner sensor is comprised of the following circuits:

- · Drive winding : A magnetic head provided with a high-frequency magnetic field (primary), which helps to form a magnetic circuit in the developer material.
- · Detection winding : Receives the change in magnetic resistance of the developer material through the magnetic circuit (secondary).
- · DC conversion circuit : Converts a high-frequency output produced from the detection winding into a DC signal (auto toner output V_{ATS}).



—When the toner density becomes low—

The ratio of the toner to the carrier in the developer material decreases.
→The magnetic resistance decreases.
→The detected output increases.
→Auto-toner output V_{ATS} increases.

—When the toner density becomes high—

The ratio of the toner to the carrier in the developer material increases.
→The magnetic resistance increases.
→The detected output decreases.
→Auto-toner output V_{ATS} decreases.

13.5 Control Circuit for Main Charger Wire Cleaner

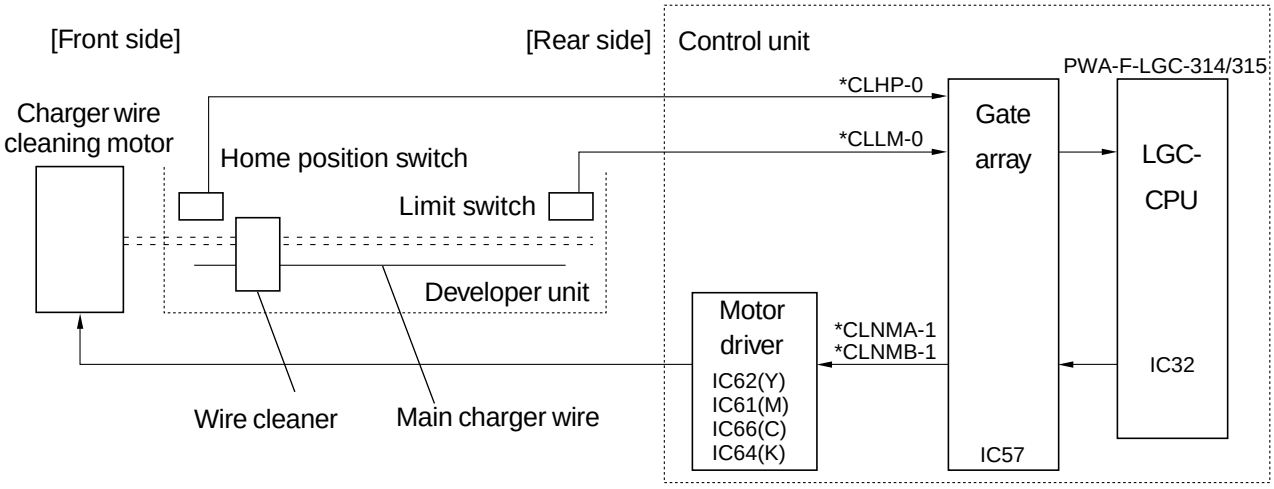
(1) Purpose of the main charger wire cleaning circuit

- To avoid defective and uneven drum charging, the wire cleaner is periodically operated to make a reciprocating motion to clean the main charger wire.

(2) Structure of the main charger wire cleaning circuit

- Charger wire cleaning motor : Works to drive the wire cleaner.
- Cleaner home position switch : Detects when the wire cleaner returns to its home position (front side).
- Cleaner limit switch : Detects when the wire cleaner reaches its limit position (rear side).
- Control section : Controls the cleaner drive unit so it performs wire cleaning.

Note: "Signal name" shown in the following chart and tables is actually preceded with Y, M, C or K, according to its color. (Examples: YCLNMA-1; YCLHP-0)



Drive unit control signals

	Signal name		Condition
	*CLNMA-1	*CLNMB-1	
Charger wire cleaning motor	Level "L"	Level "L"	OFF
	Level "H"	Level "L"	Reverse rotation (Home position→limit)
	Level "L"	Level "H"	Forward rotation (Limit→home position)
	Level "H"	Level "H"	Brake

Input signals from the home-position/limit switch

Signal name	Condition	
	Level "H"	Level "L"
*CLHP-0 (Home position switch)	Undetected	Detected
*CLLM-0 (Limit switch)	Undetected	Detected

(3) Main charger wire cleaner operation

The main charger wire cleaner makes a reciprocating motion to clean the charger wire either when the power is turned on, or when the door switch is turned on, or when 1000 copies or more have been made in total since the previous cleaning and that copying operation stops.

· Detailed operation of the wire cleaning

A sequence of operation ① to ③ is performed:

① Initializing operation

The drive unit is driven in a forward direction until the home position switch detects the wire cleaner. However, if the home position switch does not detect it for 20 seconds after the drive unit has started, the drive unit will be stopped and a CALL SERVICE message will be displayed.

② Cleaning operation (forward)

After the detection of the home position, the drive unit is driven in a reverse direction until the limit switch detects the wire cleaner. However, if the limit position switch does not detect it for 20 seconds after the drive unit has started, the drive unit will be stopped and a CALL SERVICE message will be displayed.

③ Cleaning operation (return)

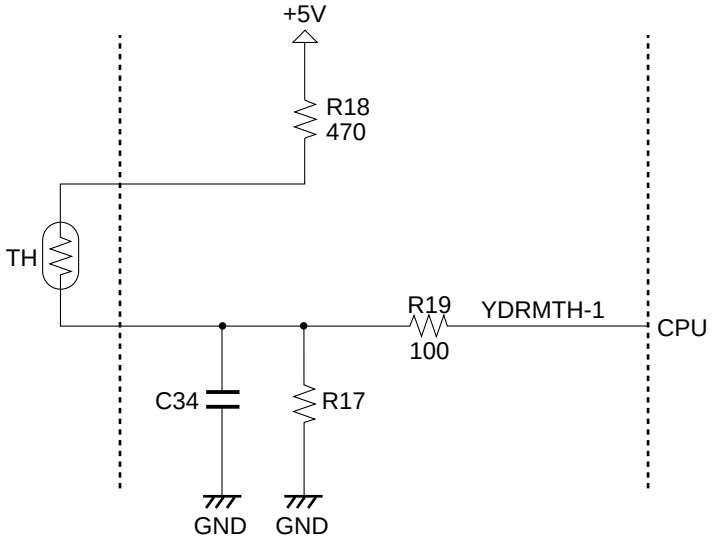
After the detection of the limit position, the drive unit is driven in a forward direction until the home position switch detects the wire cleaner. However, if the home position switch does not detect it for 20 seconds after the drive unit has started, the drive unit will be stopped and the message "Call for service" will be displayed.

13.6 Drum Temperature Detection Circuit

(1) Purpose of the drum temperature detection circuit

The amount of charge on the drum surface varies greatly with the surface temperature of the drum. So, a control method is provided whereby the drum surface temperature is detected to make the amount of charge on the drum surface consistent.

(2) Construction of the drum temperature detection circuit



Drum temperature detection circuit

As a drum temperature detection circuit, the circuit shown above is provided for each of Y (yellow), and K (black) drums. Here, the circuit for the Y drum is explained as an example.

The voltage developed across R18, thermistor and R17 is input via an analog multiplexer (IC48) to the temperature signal terminal of the microcomputer.

13.7 Disassembly and Replacement

Unless otherwise specified, you can use the same procedures to disassemble and replace each of units Y , M, C and K, and their components.

[A] Developer material

With this model, the removing and filling of the developer material is performed automatically by operating the control panel. The old developer material is removed into the toner bag, and new developer material is filled into the developer unit from the developer cartridge.

<<Replacing procedure>> (► Service Handbook for the details.)

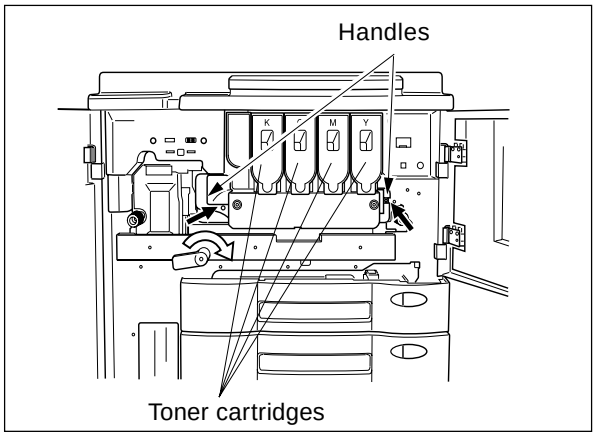
(1) Open the front cover and remove the toner cartridge.
(2) Detach the processing unit (EPU) from the main unit to open the developer removal shutter. Then reinstall the processing unit to the main unit.
(3) On the control panel, select the automatic developer removing mode and execute it.
(4) Shake a developer cartridge well and install it into the machine.
(5) On the control panel, select the automatic developer filling mode and execute it.
(6) Remove the developer cartridge and reinstall the toner cartridge.
(7) Detach the processing unit (EPU) from the main unit to close the developer removal shutter. Then reinstall the processing unit to the main unit.

[B] Processing unit (EPU)

(1) Remove the toner cartridge.

(2) Turn the lever to the right and lower the transfer belt unit .

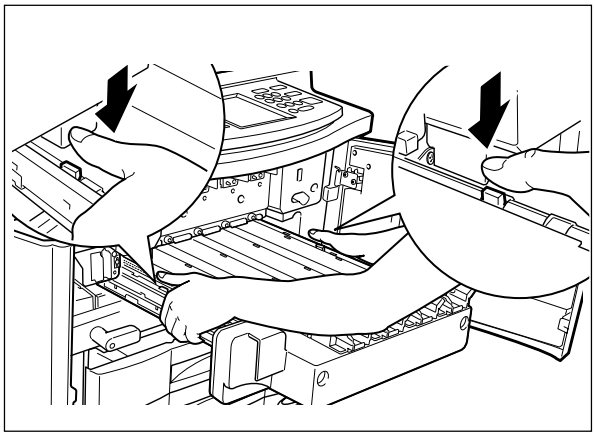
(3) Unscrew 2 screws, and draw out the processing unit by holding its handles.



(4) After having drawn it out to the lock position, hold on both sides of the processing unit, and while pressing the blue lock button with your thumb, draw out the unit completely. Then, place it on a flat table.

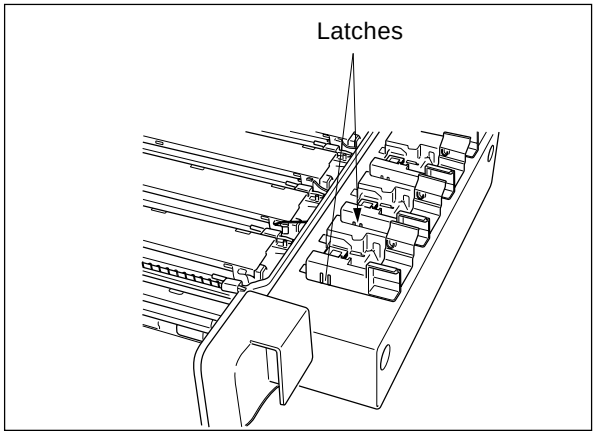
Note: When removing the processing unit, make sure that the transfer belt unit is already lowered.

The processing unit is as heavy as about 10 kg. Be careful when handling it.

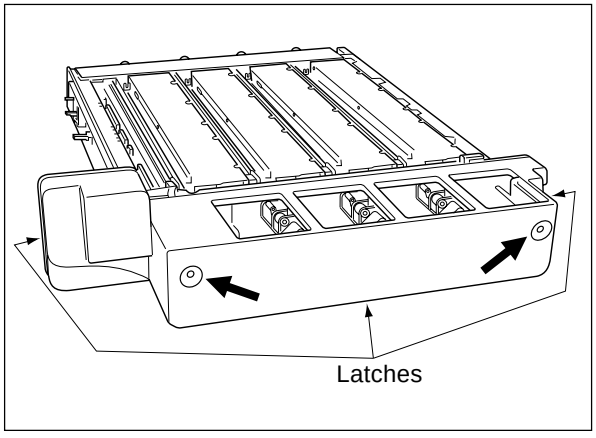


[C] Main charger unit

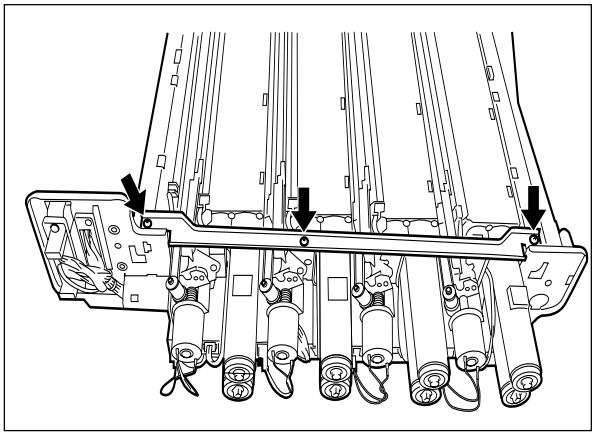
(1) Disengage 2 latches for each and remove the toner cartridge holders (4 pieces in total).



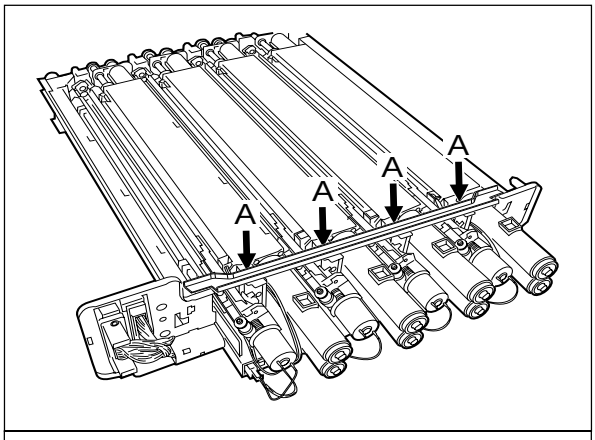
(2) Unscrew 2 screws, disengage 3 latches, and remove the EPU cover. (Disengage the latches one by one by pressing the cover.)

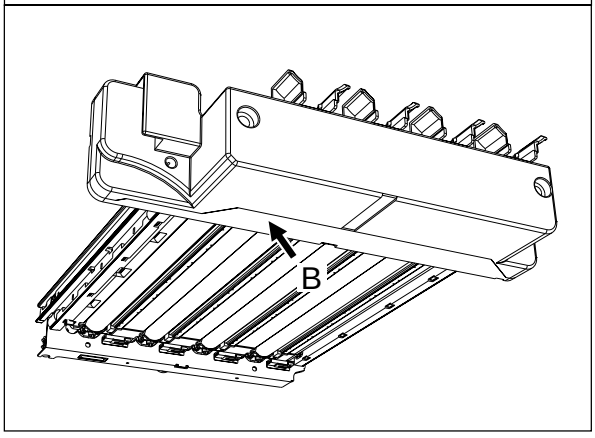


(3) Remove the auxiliary metal plate (3 screws).

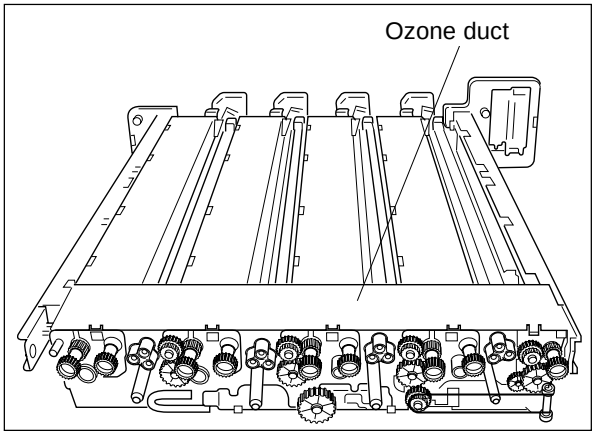


Note: Do not allow the harness to get caught in between when assembling. (See A and B in the figures on the right hand side.)



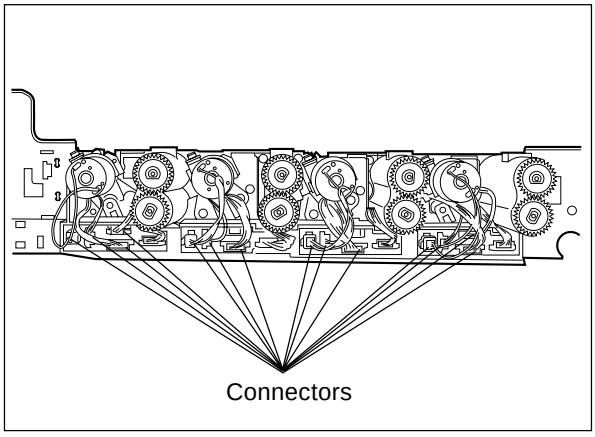


(4) Disengage 5 latches and detach the ozone duct by removing the rear side cover (when disengaging the latches, bend and lift them one by one in sequence starting from the one at the end).

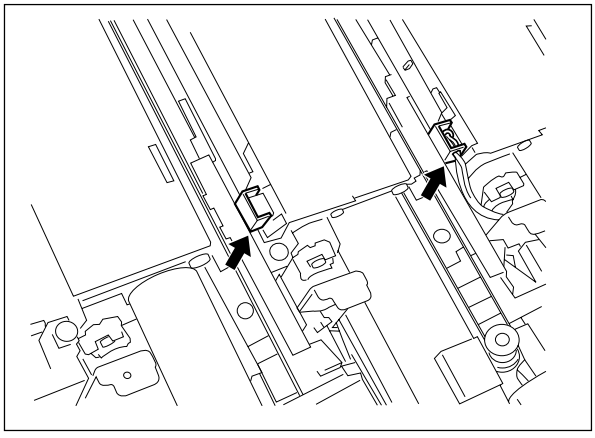


(5) Disconnect the connector.

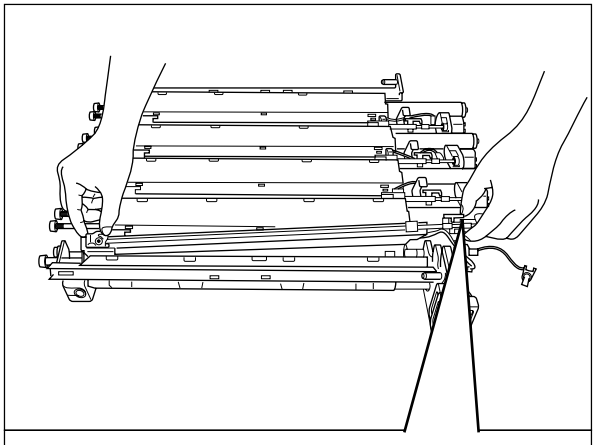
Note: There are 4 connectors in Y and K, and 3 connectors in M and C.



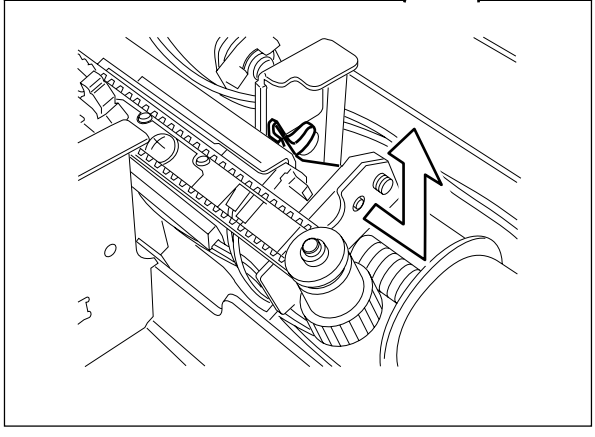
(6) Pull the holders upward and take them out (Y, M, C and K).



(7) While lifting the knob, pull the charger to the front side to release the lock.
Holding the front and rear plastic parts of the charger, lift the front end and pull out the charger toward the front side to remove it.

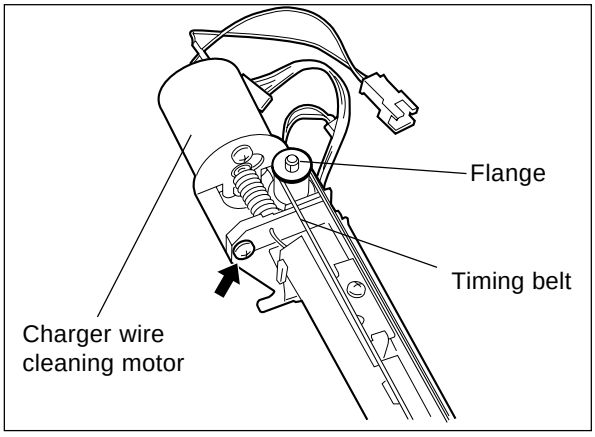


Note: Be careful not to allow the shape of the main charger grid to become deformed.
After installing the main charger unit, make sure that the wire cleaner limit switch or the home position switch are connected properly, and that the actuator is correctly connected.



[D] Charger wire cleaning motor

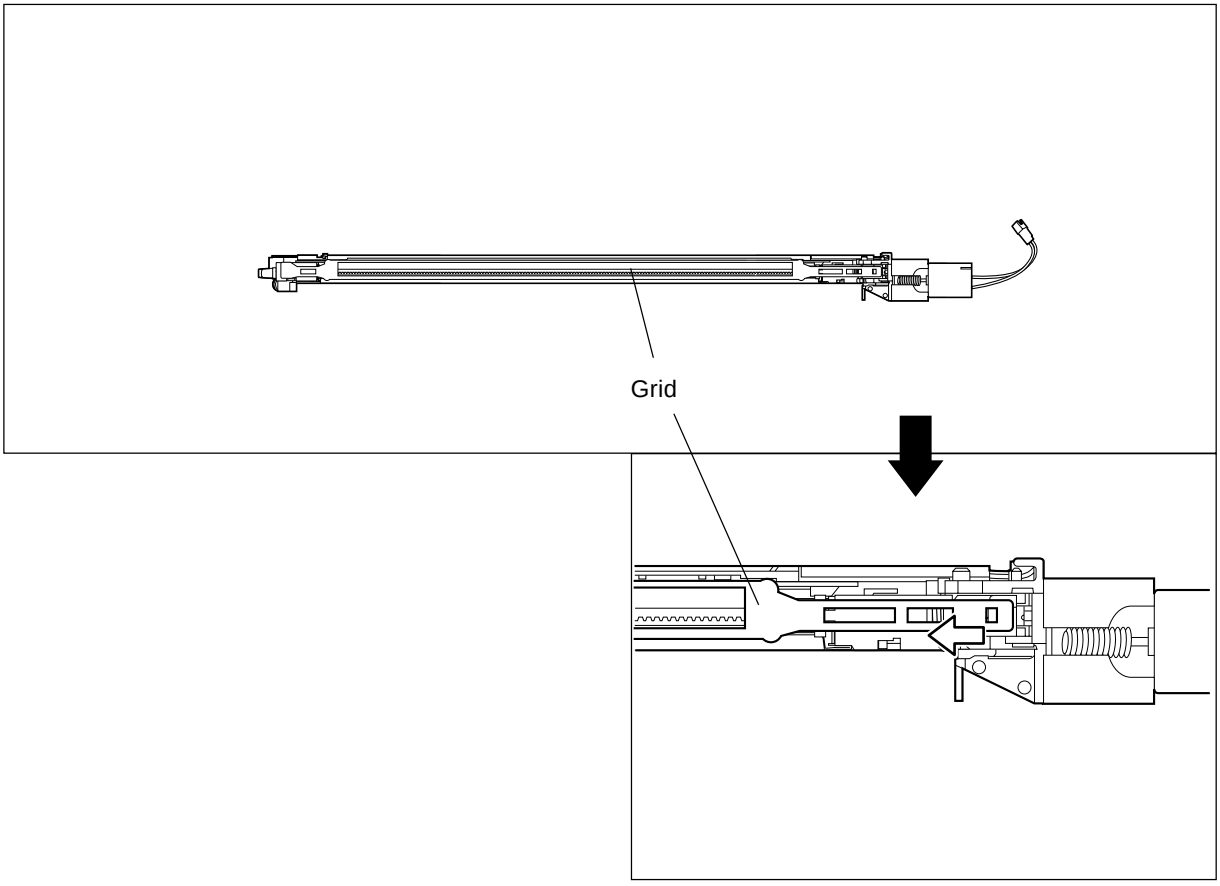
(1) Remove the flange of the drive pulley on the main charger wire.
(2) Detach the timing belt from the pulley.
(3) Unscrew 1 screw and take out the motor together with the bracket.



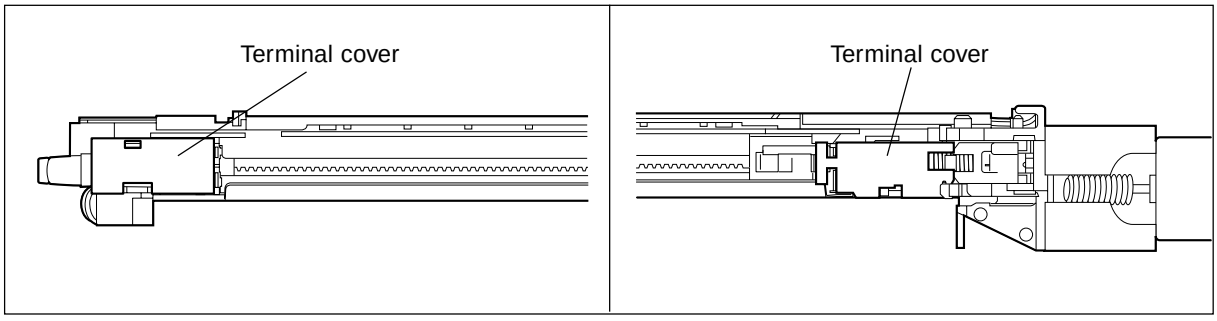
[E] Charger wire

• Main charger wire: Length (387.5 mm); diameter (0.06 mm); material (tungsten oxide).

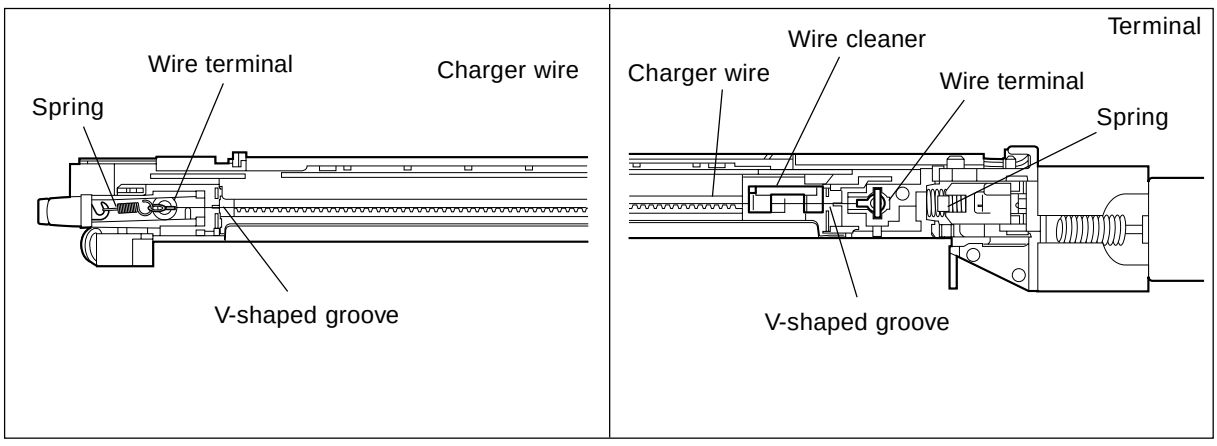
(1) Remove the grid. When removing the grid, slide it in the direction of the arrow as show on the figure below.



(2) Remove the terminal covers.



(3) Remove the wire.



Precautions for stringing the wire

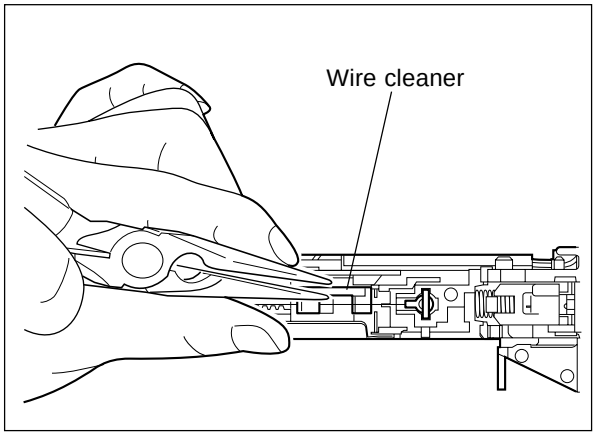
1. Fit the wire in the V-shaped grooves at both front and rear.
2. Do not allow the wire to twist or kink.

3. Do not touch the wire directly with your hand.

[F] Main charger wire cleaner

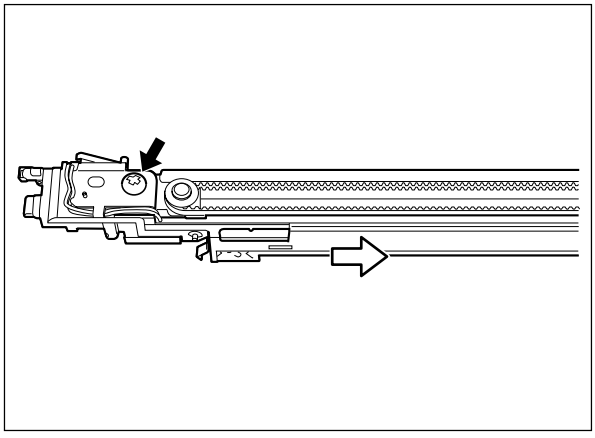
(1) Remove the main charger wire.
(2) Remove the wire cleaner.
(Grip and tilt the mounted wire cleaner slightly with the radio pliers to pull it out.)

Note: When reassembling, the wire should be strung so that it runs on the side of the pad. The wire cleaner should be moved to and left at the front side.



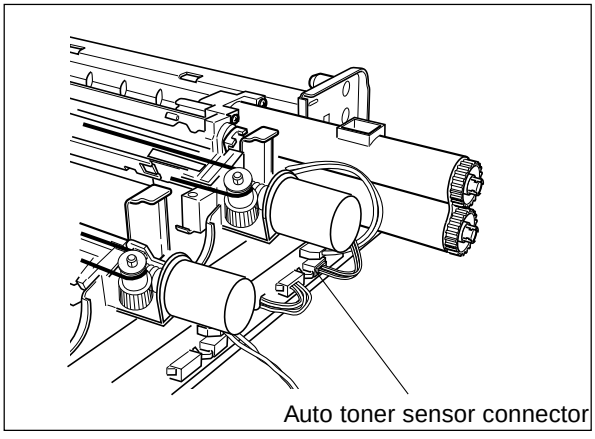
[G] Discharge LED array

(1) Remove the main charger unit.
(2) Unscrew the screw.
(3) Slide and remove the discharge LED together with the holder.



[H] Developer unit

(1) Remove the main charger unit.
(2) Disconnect the auto toner sensor connector.



(3) Rotate the lower mixer shutter knob on the rear up to the stopper, with radio pliers, to close the developer removal shutter.

Notes: 1. When removing the developer unit, be sure to close the developer removal shutter to prevent the developer material from spilling out.

2. When turning the shutter knob, pull it slightly while turning.

3. When reinstall the developer unit, be sure to open the developer removal shutter to carry out "automatic removing of developer material" correctly.

(4) Unscrew 4 screws to separate the developer unit from the EPU frame, and place the developer unit on a flat table.

Notes: 1. The removed developer units must be installed back to the previous place respectively. Remember to attach the cleaner stoppers for each color.

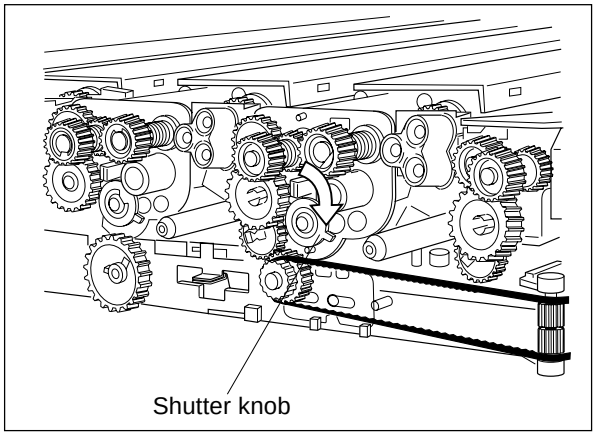
2. When installing the developer unit, ensure that the stain of the drum would not attach to the toner scattering prevention seal.

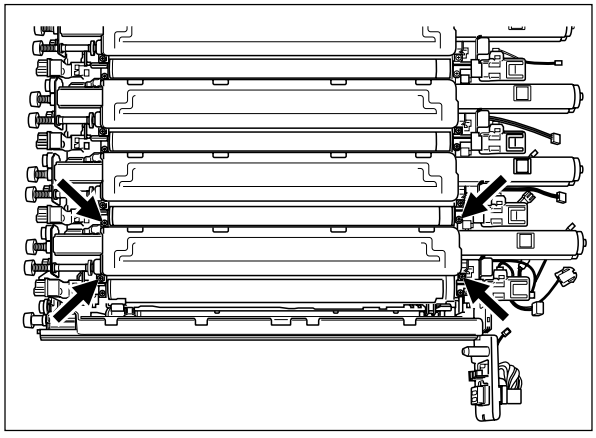
3. Install the developer unit in the order below:

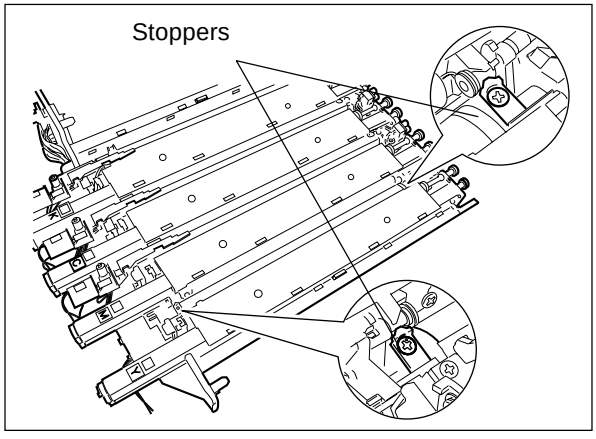
   Cleaner K → developer unit K → developer unit C→ developer unit M → developer unit Y

4. Before installing the developer unit K, C or M, apply patting powder onto the surface of the drum C, M or Y. After installing it, be sure to rotate the drum to see that the cleaning blade would not peel off and cleaning can be performed properly. After checking the above, start installing next developer unit.

5. Before installing a developer unit, first rotate its corresponding drum and remove stains from the drum surface.



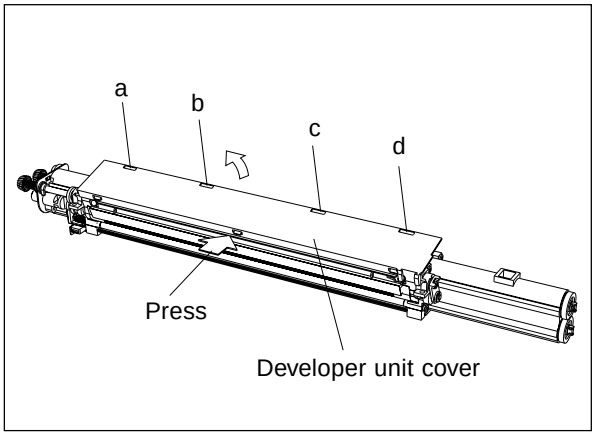




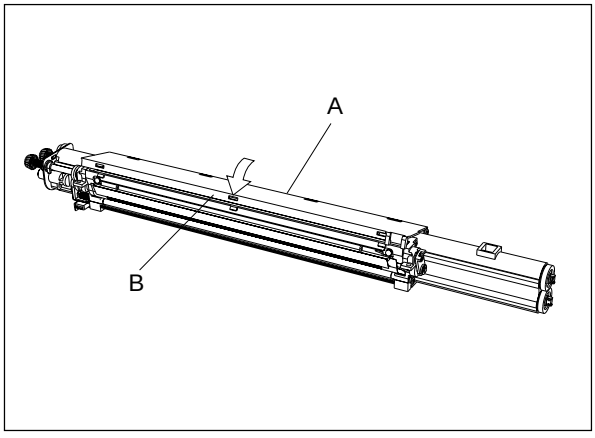
[I] Doctor blade and developer sleeve

(1) Remove the developer unit cover (4 latches).

Notes: 1. While pressing the developer unit cover in the direction of the arrow, bend the latches to the outside and release them in the order of a, b, c to d.



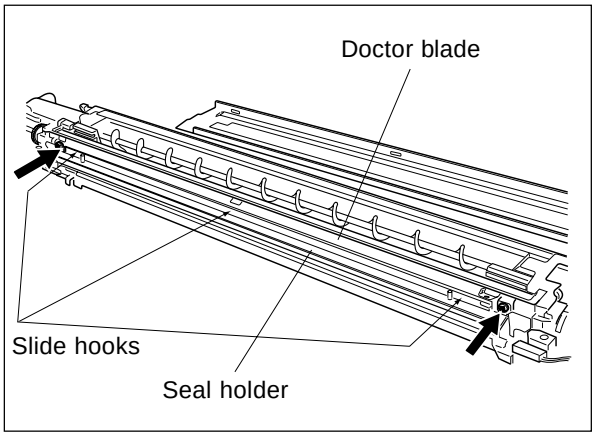
2. When installing the developer unit cover, first attach the latches on the side A, and then lock the others on the side B.



(2) Remove the toner scattering prevention seal holder by sliding it toward the front side (3 slide hooks; be careful not to cause damage to the hooks).

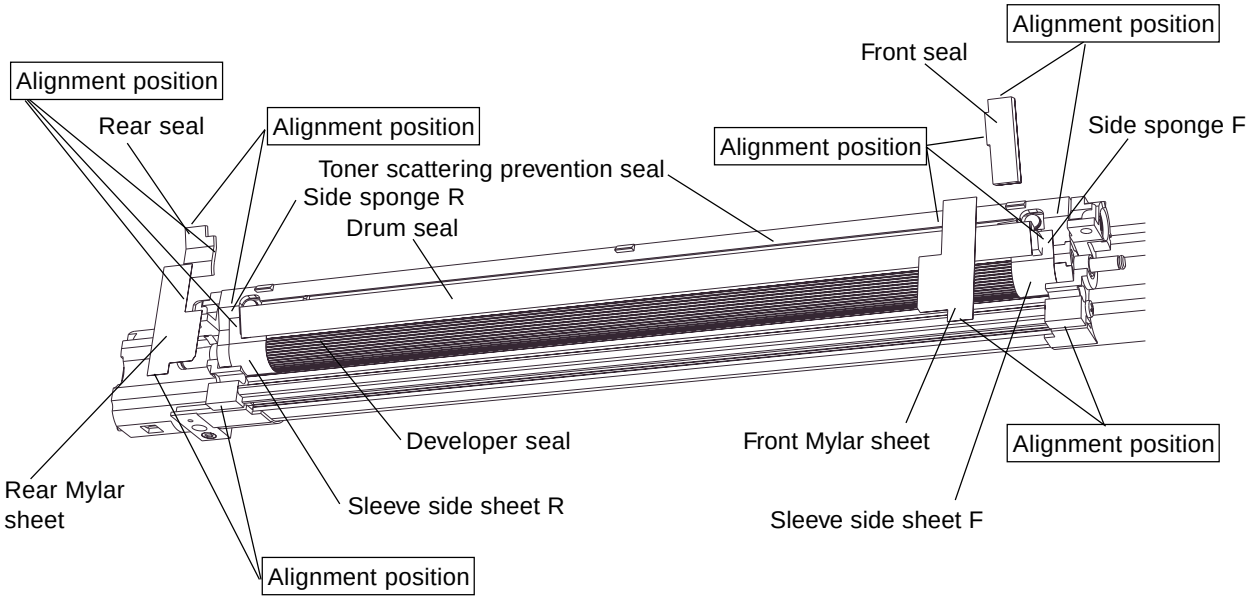
(3) Remove the doctor blade (2 screws).

Note: Be careful not to deform the urethan seal or the sponge seal set along the toner scattering prevention seal holder when you install the holder back in place.

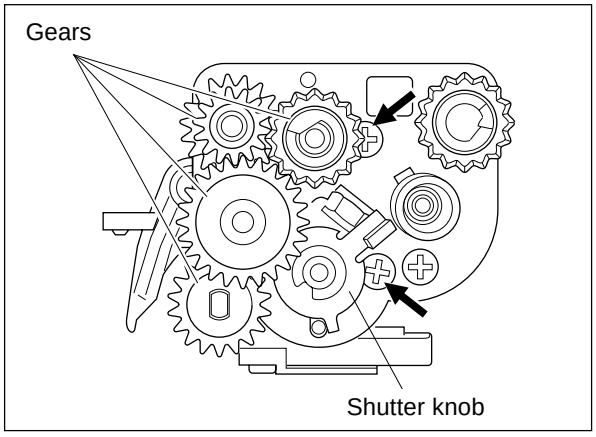


Note: Attach the seals to the developer unit in the following procedure.

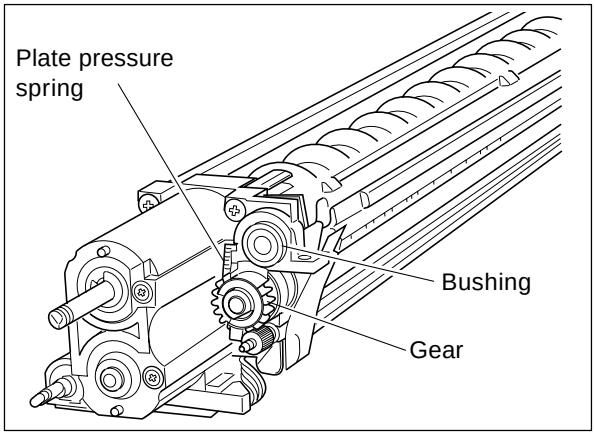
1. Insert the top of the sleeve side sheets F/R between the developer seal and the side sponges F/R.
2. Place the front seal and the front Mylar sheet against the side sponge F and stick them there.
3. Place the rear seal and the rear Mylar sheet against the side sponge R and stick them there.



(4) Remove the stopper and latches and then remove 4 gears.
(5) Remove the stopper and take out the shutter knob.
(6) Unscrew 2 screws and remove the drive unit bracket.



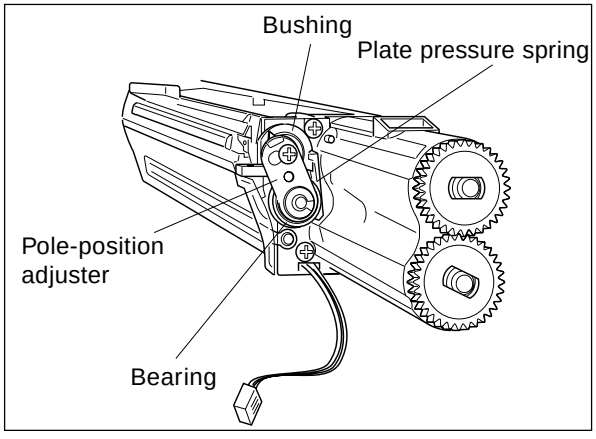
(7) Remove the stopper and take out the gear, bearing and collar.
(8) Remove the bushing and plate pressure spring.



(9) Remove the front pole-position adjuster (1 screw and 1 stopper).

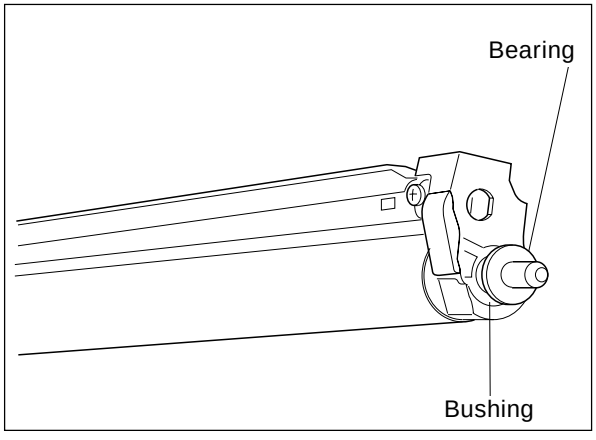
Note: Before removing the pole-position adjuster, be sure to mark its position.

(10) Remove the plate pressure spring and bushing.
(11) Remove the developer sleeve along with the sub-unit.



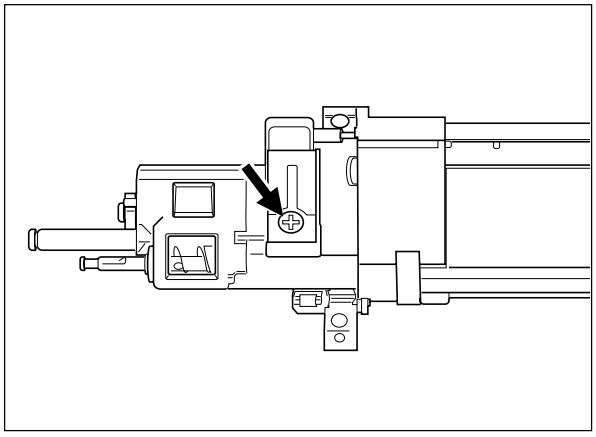
(12) Remove the bearing and bushing, and then pull out the developer sleeve.

Note: When cleaning off the developer material and/or toner adhering around the sleeve using a vacuum cleaner or air blower, be sure to remove the bearing first to prevent developer material and/or toner getting into it.



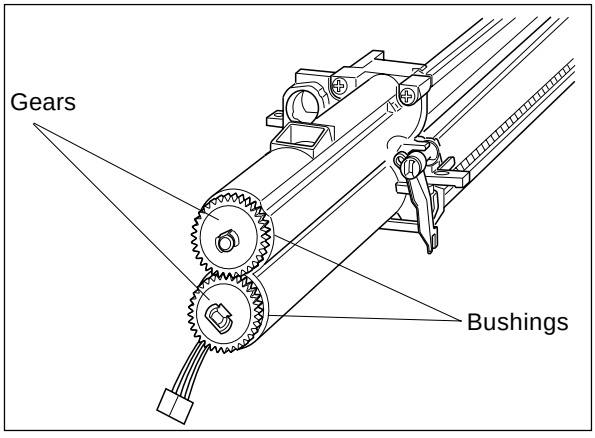
[J] Auto toner sensor

(1) Remove the developer unit.
(2) Remove the auto toner sensor (1 screw).

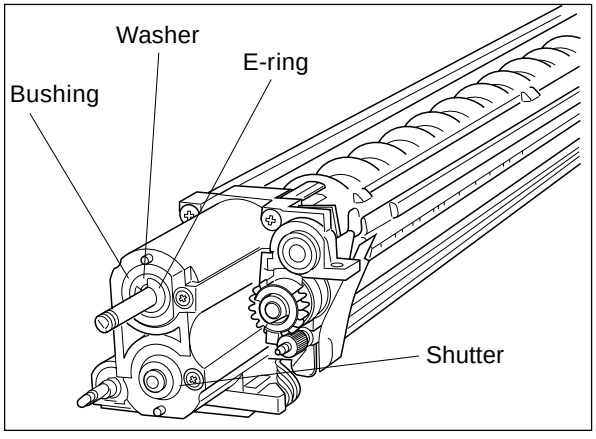


[K] Mixer bushing (oil seal)

(1) Disengage the latches and remove 2 gears on the front.
(2) Remove 2 bushings.



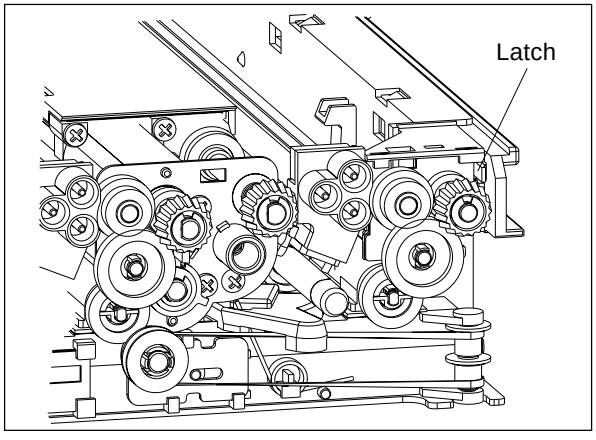
(3) Remove the E-ring and washer on the rear.
(4) Pull out the upper and lower mixers from the front.
(5) Remove the bushing and shutter (1 each; pull out the shutter from the front).



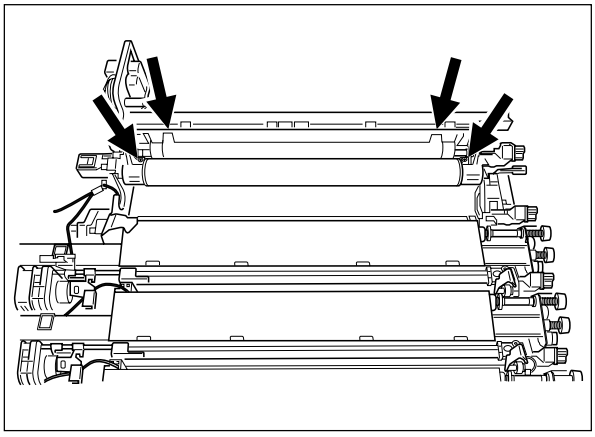
[L] Cleaner K

Note: Cleaners Y, M and C are joined together with developer units M, C and K, respectively.

(1) Remove the main charger unit K.
(2) Bend the latch and remove the cleaner K drive unit sliding it out from the rear.



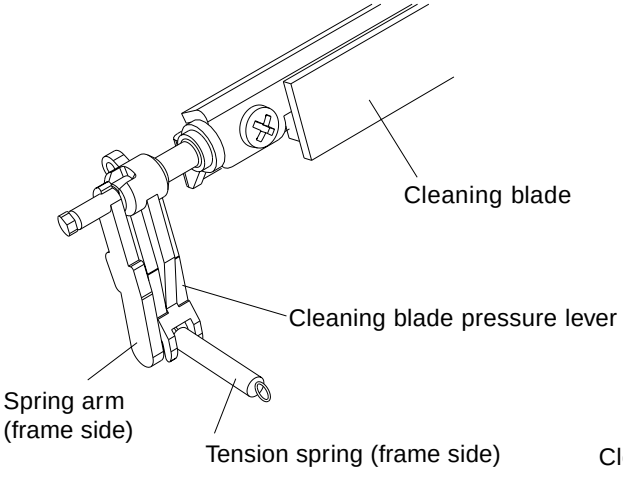
(3) Unscrew 4 screws and remove the cleaner K.



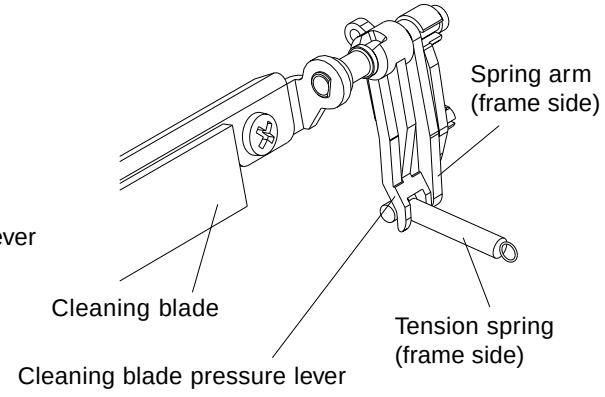
Note: Before installing the cleaner K, apply patting powder onto the surface of the drum K. After installing it, be sure to rotate the drum to see that the cleaning blade would not peel off and cleaning can be performed properly.

Note: When the developer units M, C and K and the cleaner K are installed in the EPU frame, the cleaning blade pressure lever will become as shown below. Check that the blade is always pressurized by the tension spring.

Front side

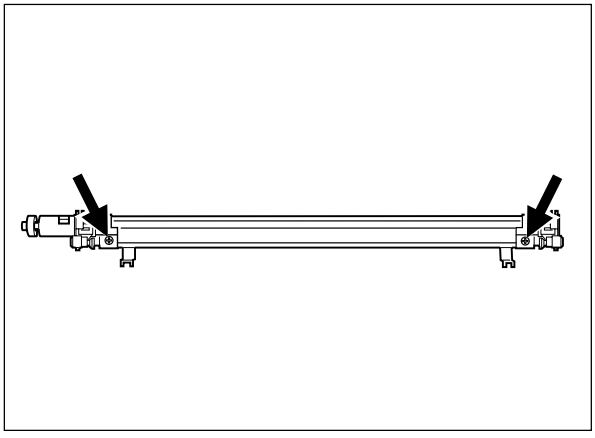


Rear side



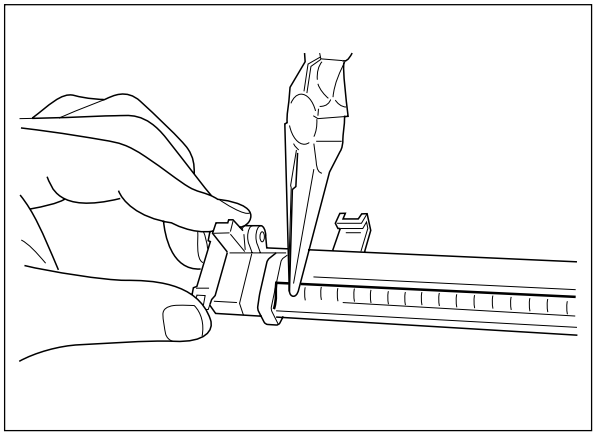
[M] Cleaning blade

(1) Unscrew 2 screws and remove the cleaning blade.

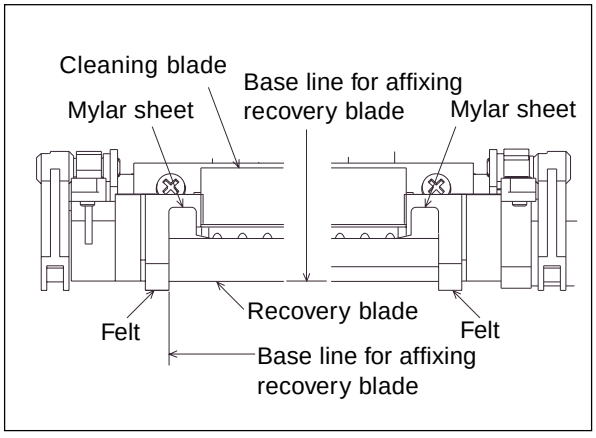


[N] Recovery blade

(1) Peel off the recovery blade.

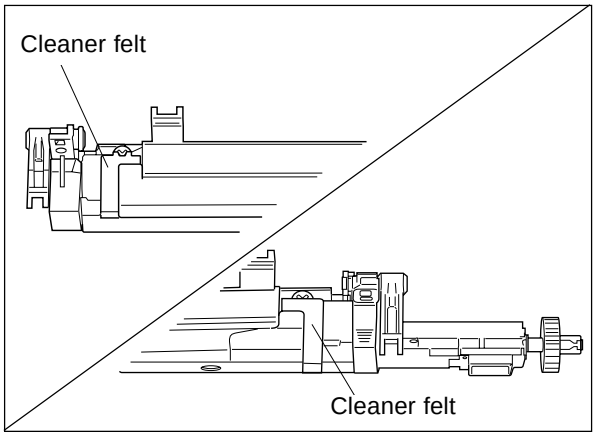


Notes: 1. The recovery blade is affixed with double-sided tape. Peel off the blade and the tape cleanly before affixing a new blade.
2. When affixing a recovery blade, align its edge with the position shown in the illustration.
3. As any wave in the recovery blade can cause the recovered toner to drop, be sure to install the blade flatly.

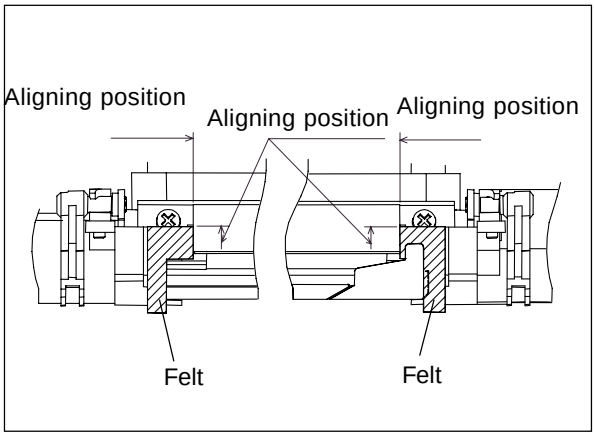


[O] Cleaner felt

(1) Peel off the cleaner felt.



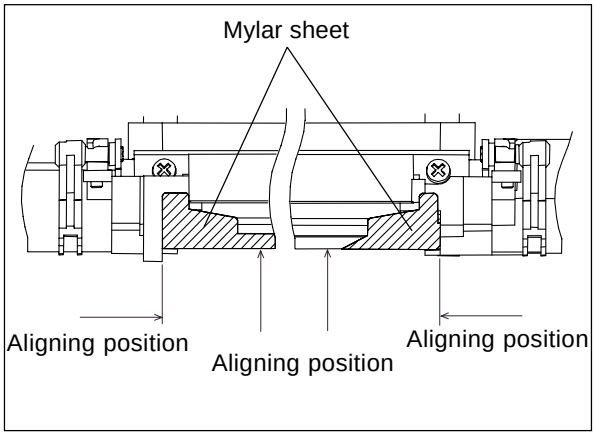
Notes: 1. The cleaner felt is affixed with double-sided tape. Peel off the cleaner felt and the tape cleanly before affixing a new felt.
2. When affixing a cleaner felt, align its edge with the position shown in the illustration.



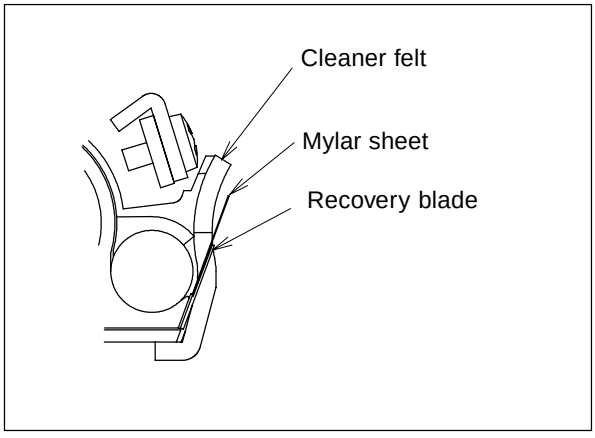
[P] Mylar sheet

Notes: 1. The mylar sheet is affixed with double-sided tape. Peel off the mylar sheet and the tape cleanly before affixing a new mylar.

2. When affixing a mylar sheet, align its edge with the position shown in the illustration.

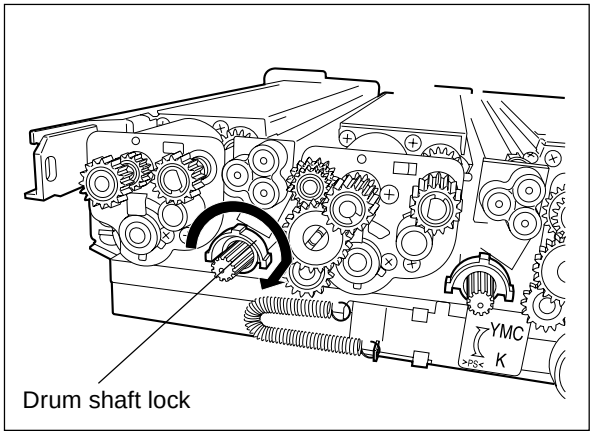


Note: After affixing the recovery blade, cleaner felt and mylar sheet, check their position shown in the illustration.

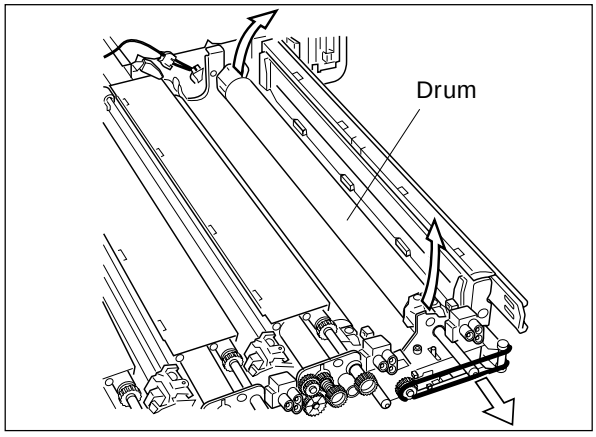


[Q] Drum

(1) Turn the drum shaft lock to the right to pull it out.



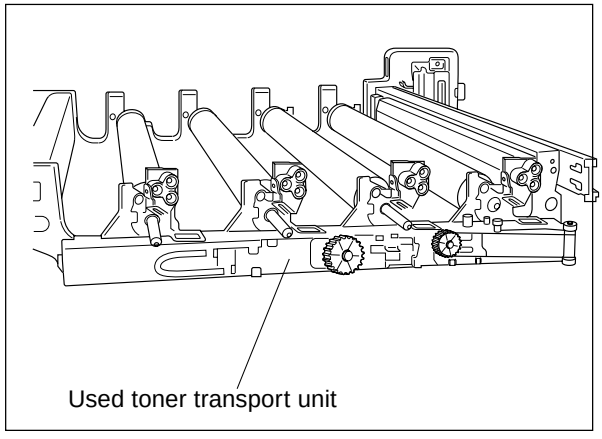
(2) Pull out the drum shaft toward the rear.
(3) Remove the drum. (Holding both sides of the drum, lift it out.)



Notes: 1. When inserting or pulling out the drum shaft, do not do it forcefully so as to avoid the EPU frame being deformed.
When inserting the drum shaft back in place, wipe off any stain from its surface before reinserting it.
2. After replacing the drum, apply patting powder onto the drum surface before installing the cleaner K or any developer unit (to prevent the cleaning blade from peeling off).

[R] Used toner transport unit (EPU side)

(1) Remove 4 main charger units, 4 developer units and the cleaner K.
(2) Remove the used toner transport unit.



14. UNITS AROUND THE PROCESSING UNIT

14.1 Construction

This chapter describes the units arranged around the processing units.

They are as follows:

· Toner cartridge

· Toner cartridge drive unit

· Developer removal shutter open/close detection unit

· Used toner transport relay unit

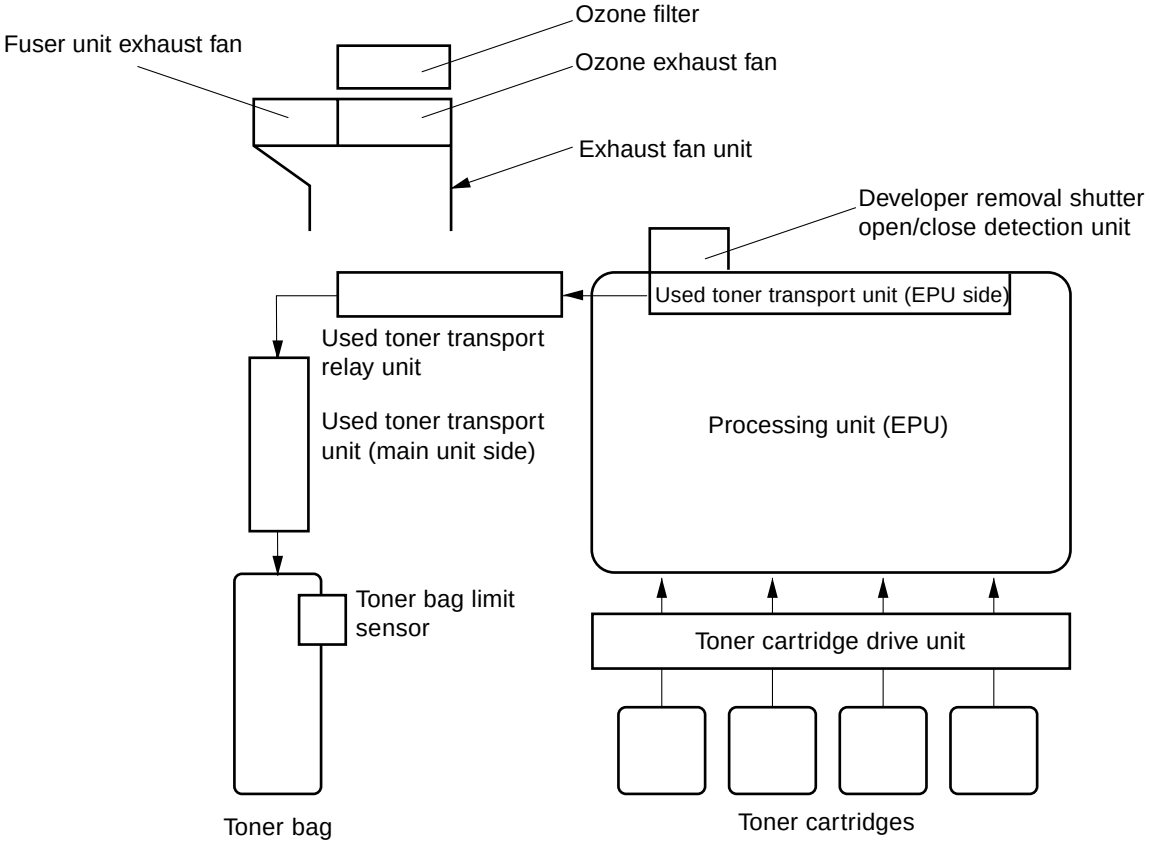
· Used toner transport unit (main unit side)

· Toner bag

· Toner bag limit sensor

· Exhaust fan unit

· Ozone filter



[Outline construction diagram]

14.2 Description of Functions

(1) Toner cartridge

The toner cartridge has a set of claws to be fitted into the corresponding projection pattern of the middle inner cover. Their coupling pattern depends on the color of the toner cartridge to prevent wrong installation.

Note: In such times as maintenance when the middle inner cover is removed, be sure to check the toner color before installing the cartridge.

(2) Toner cartridge drive unit

This unit rotates the auger and paddles of the toner cartridge to supply toner to the developer unit.
In addition, when filling the developer unit with developer, this unit detects the presence of the developer cartridge by the developer cartridge detection switch and drives it.

(3) Developer removal shutter open/close detection unit

This unit detects if the developer removal shutter inside the used toner transport unit (EPU side) is opened or closed when the developer is automatically removed.

(4) Used toner transport relay unit

This is a relay unit for transporting used toner and developer from the EPU to the used toner transport unit (main unit side).

(5) Used toner transport unit (main unit side)

This unit transports used toner and developer to the toner bag.

(6) Toner bag

The used toner scraped off the drum by the cleaning blade and the used developer automatically removed from the developer unit are collected into this bag through the used toner transport unit (EPU side), used toner transport relay unit, and used toner transport unit (main unit side).

(7) Toner bag limit sensor

A transmitting type, this optical sensor monitors the volume inside the toner bag, and detects when the bag is filled with a certain amount of used toner and developer.

(8) Exhaust fan unit

This unit is comprised of an ozone exhaust fan which discharges the ozone generated from the EPU to the outside, a fuser-unit exhaust fan which cools the area around the fuser unit, and exhausts duct.

(9) Ozone filter

The ozone generated by corona discharge from the main charger is collected by an ozone exhaust fan and goes into this filter to be dissolved by the catalyst in the filter.

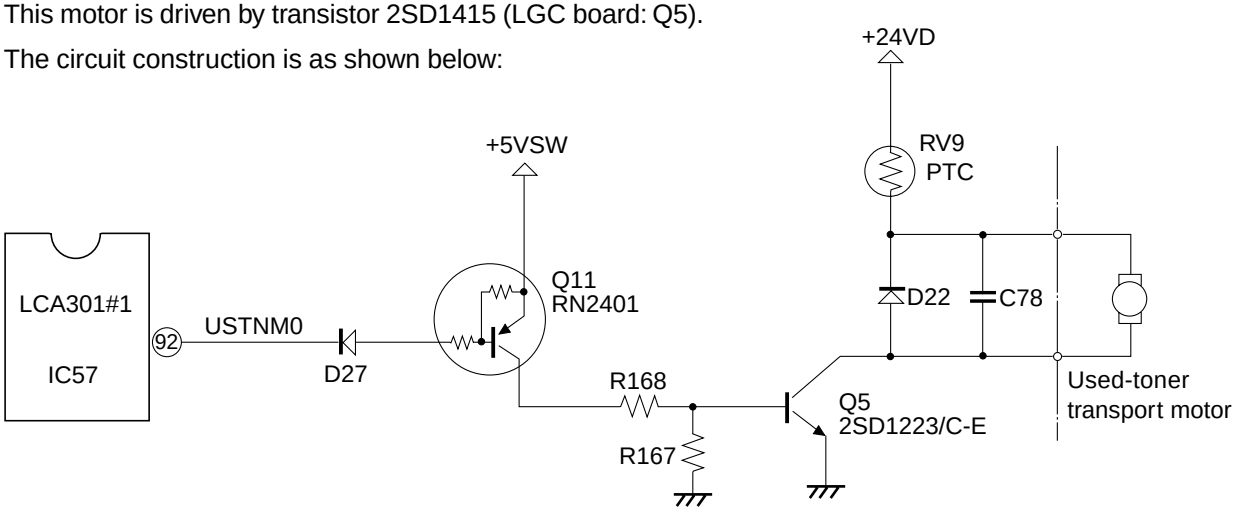
14.3 Brush Motor Drive Circuit

14.3.1 Drive circuit for used-toner transport motor

The used-toner transport motor helps to transport the used toner and developer removed from the processing unit to the toner bag.

This motor is driven by transistor 2SD1415 (LGC board: Q5).

The circuit construction is as shown below:



· The motor winding has its (+) terminal connected to +24V and (–) terminal to the collector of Q5.

— When (92) pin (USTNM0 signal) of LCA301 comes to the level "L",

· Q11 is turned ON→ Q5 is turned ON.

· A current flows from the +24V power supply through the motor winding to Q5→ The motor rotates.

— When the USTNM0 signal comes to the level "H",

· Q11 goes OFF→ Q5 goes OFF.

· The current that was flowing through the motor winding now flows through the diode D22.

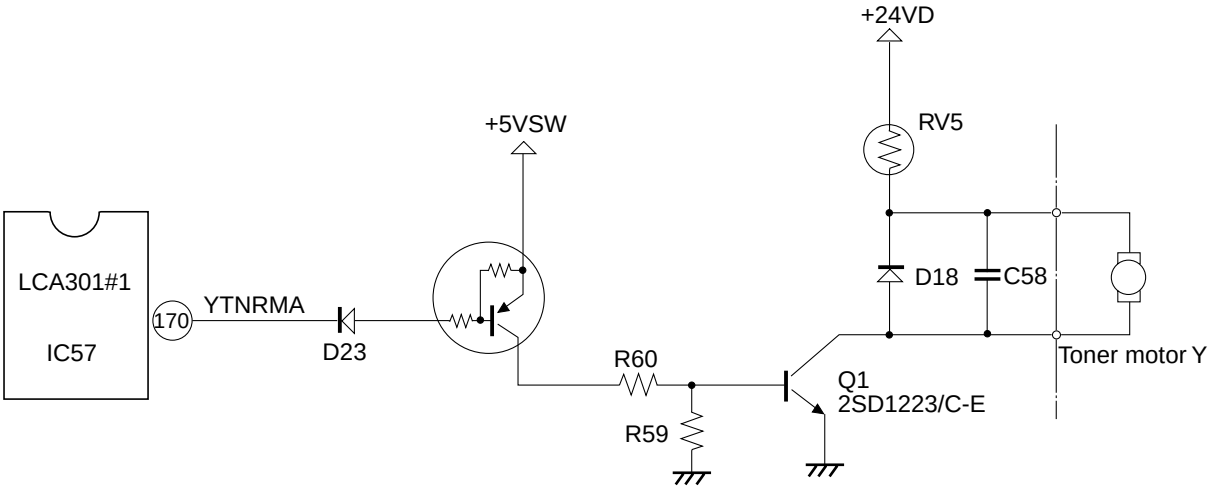
~ This current gradually decreases according to the time constant determined by the inductance and resistance of the motor winding.

· The motor finally stops.

14.3.2 Toner motor drive circuit

The toner motor works to load new developer material and add toner to the developer unit as well. Each motor is driven independently for its respective color by the driving transistor.

The circuit construction of toner moter Y is shown below as an example:



· LGC provides a control signal to rotate the toner motor.

The following shows a truth table for motor control:

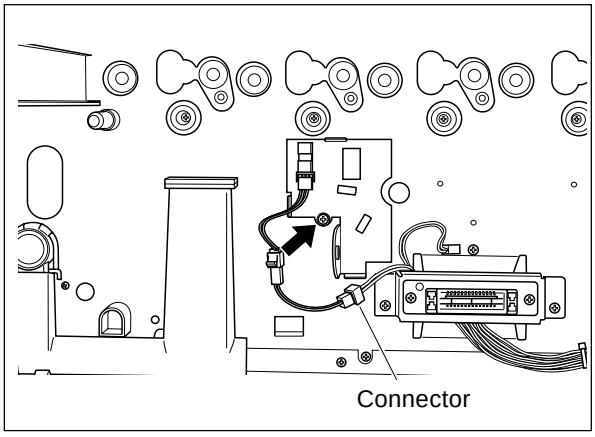
	signal	conditions	
Toner motor *	* TNRMA	L	H
		ON	OFF

Note: The above * stands for the color name (Y, M,C or K).
e.g. Toner motor Y , YTNRMA

14.4 Disassembly and Replacement

[A] Developer removal shutter open/close detection unit

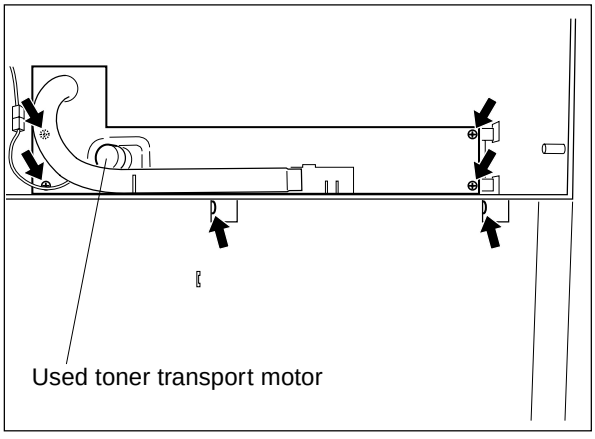
(1) Remove the processing unit (EPU).
(2) Draw out the transfer/transport unit.
(3) Unscrew the screw, disconnect the connector, and remove the developer removal shutter open/close detection unit.



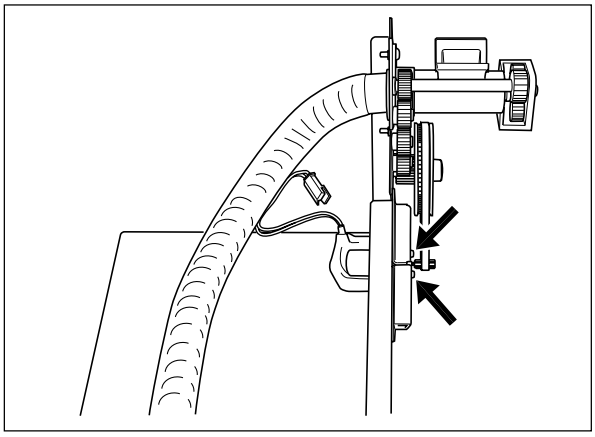
[B] Used toner transport unit (main unit side)

(1) Draw out the transfer/transport unit.
(2) Remove the exit-side rear cover, exit-side lower cover, and paper exit unit cover.
(3) Remove the paper exit unit (1 clip and 1 connector).
(4) Remove the left inner cover, and take out the positioning pin (1 screw) for the paper exit unit.
(5) Remove the vertical transport guide (main unit side) (3 screws).
(6) Remove the ADU switching unit (3 screws).
(7) Remove the ADU drive unit (1 connector and 4 screws).
(8) Remove the horizontal transport unit (2 screws and 1 connector).
(9) Disconnect the connector of the used toner transport motor.
(10) Unscrew 6 screws and remove the used toner transport unit (main unit side).

Note: For the details about the above steps (3) to (8) ► "12. PAPER FEEDING SYSTEM".

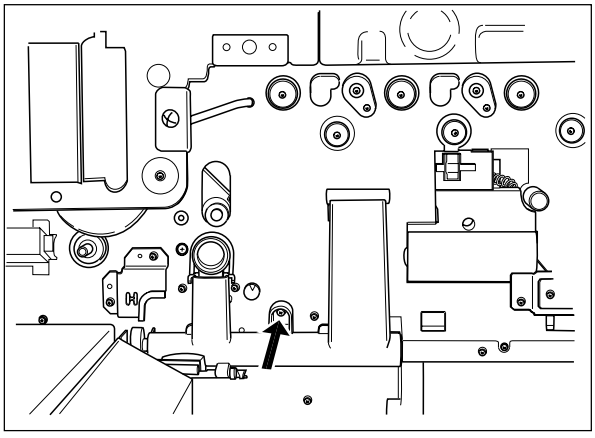


(11) Remove the motor (2 screws).



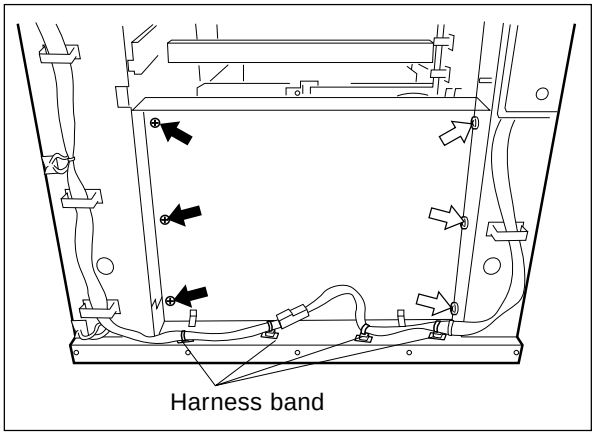
[C] Used toner transport relay unit

(1) Remove the used toner transport unit (main unit).
(2) Unscrew the screw and remove the used toner transport relay unit.

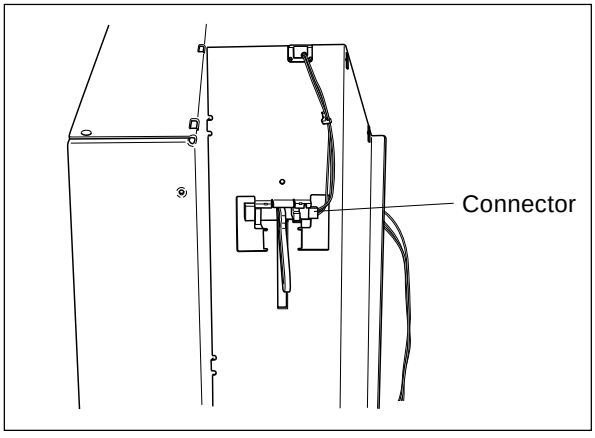


[D] Toner bag limit sensor

(1) Remove the used toner transport unit (main unit side).
(2) Remove the harness from the base frame (disengage the hooks of the 4 harness bands).
(3) Remove the exit-side lower inner cover (6 screws).
*Screws indicated with the ⇨ marks should be unscrewed from the front side.



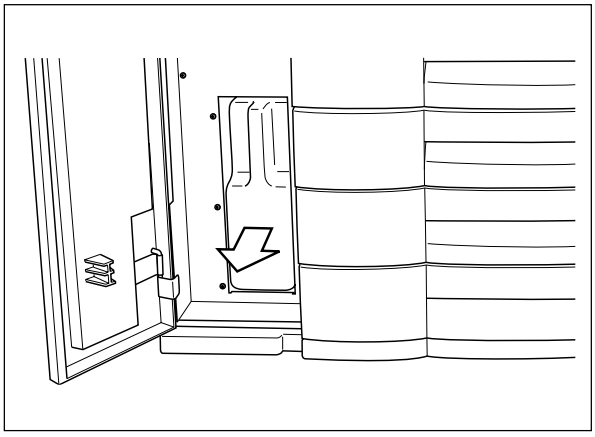
(4) Disconnect the connector and disengage the latches to remove the sensor.



[E] Toner bag

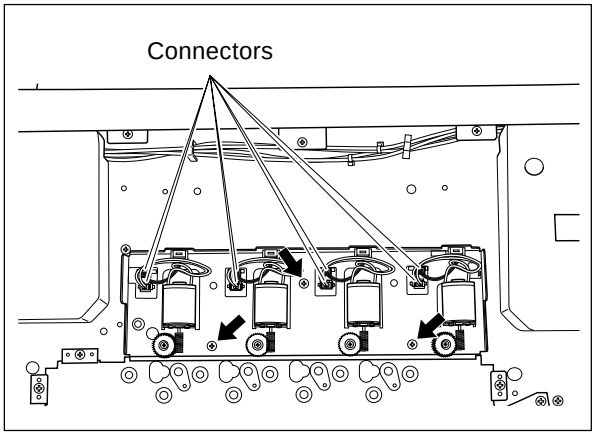
(1) Open the left front cover.
(2) Take out the toner bag.

Note: Before installing a new toner bag in the machine, make sure that its cap has been removed.

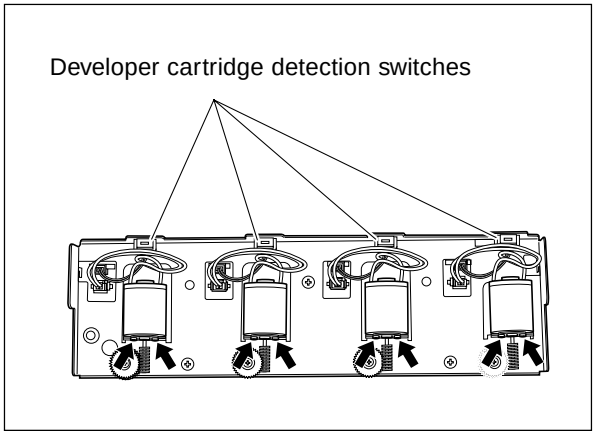


[F] Toner cartridge drive unit

(1) Remove the toner cartridge.
(2) Lower the transfer belt unit.
(3) Remove the processing unit (EPU).
(4) Remove the middle inner cover (4 screws).
(5) Disconnect 8 connectors, unscrew 3 screws and remove the toner cartridge drive unit.

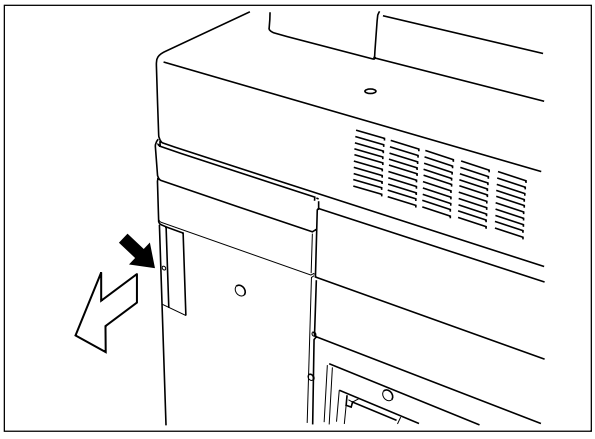


(6) Remove the motors (2 screws for each).
(7) Disengage the latches and remove the developer cartridge detection switches.



[G] Ozone filter

(1) Unscrew the screw and pull out the ozone filter holder.
(2) Remove the ozone filter from the holder.

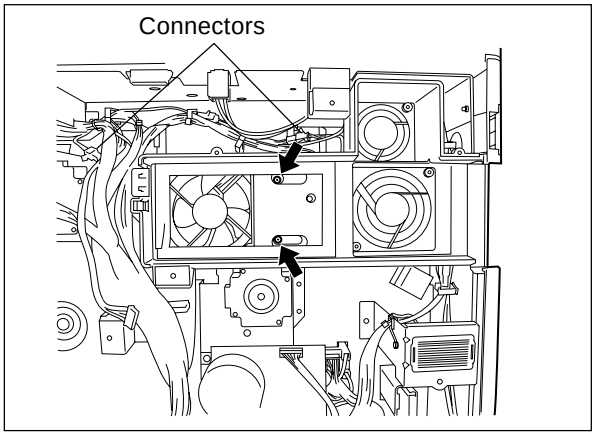


[H] Ozone exhaust fan/fuser unit exhaust fan

(1) Remove the rear cover.

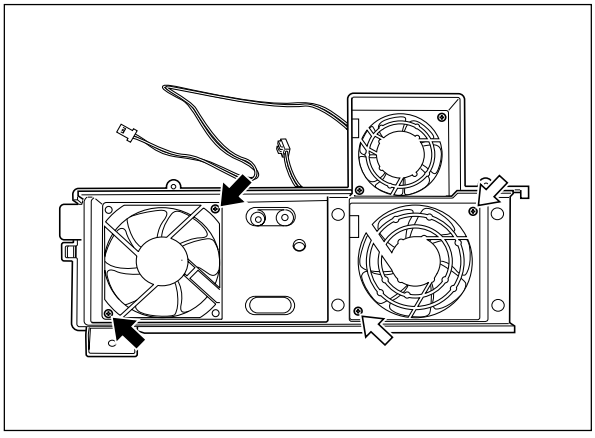
(2) Pull out the ozone filter holder.

(3) Disconnect 3 connectors, unscrew 2 screws, and remove the exhaust fan unit.



(4) Unscrew the screws from the ozone exhaust fan and the fuser unit exhaust fan (2 screws for each) to remove them.

*Screws indicated with the ⇨ marks should be unscrewd from the back side.

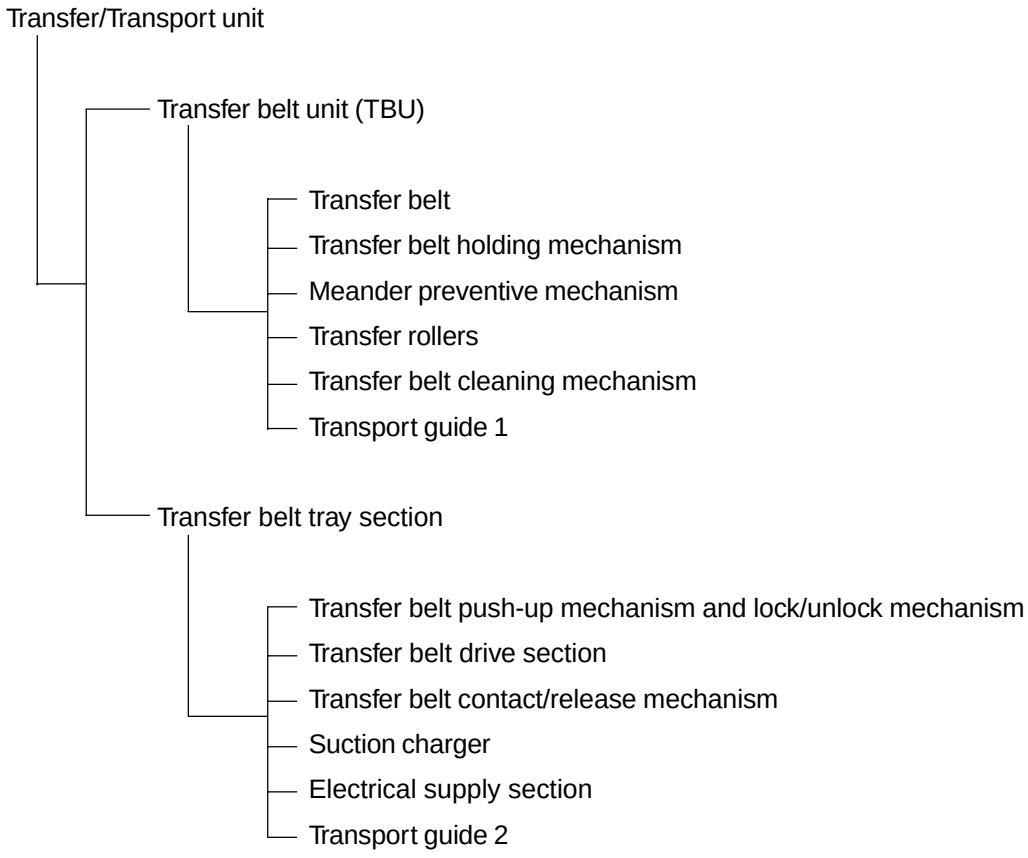


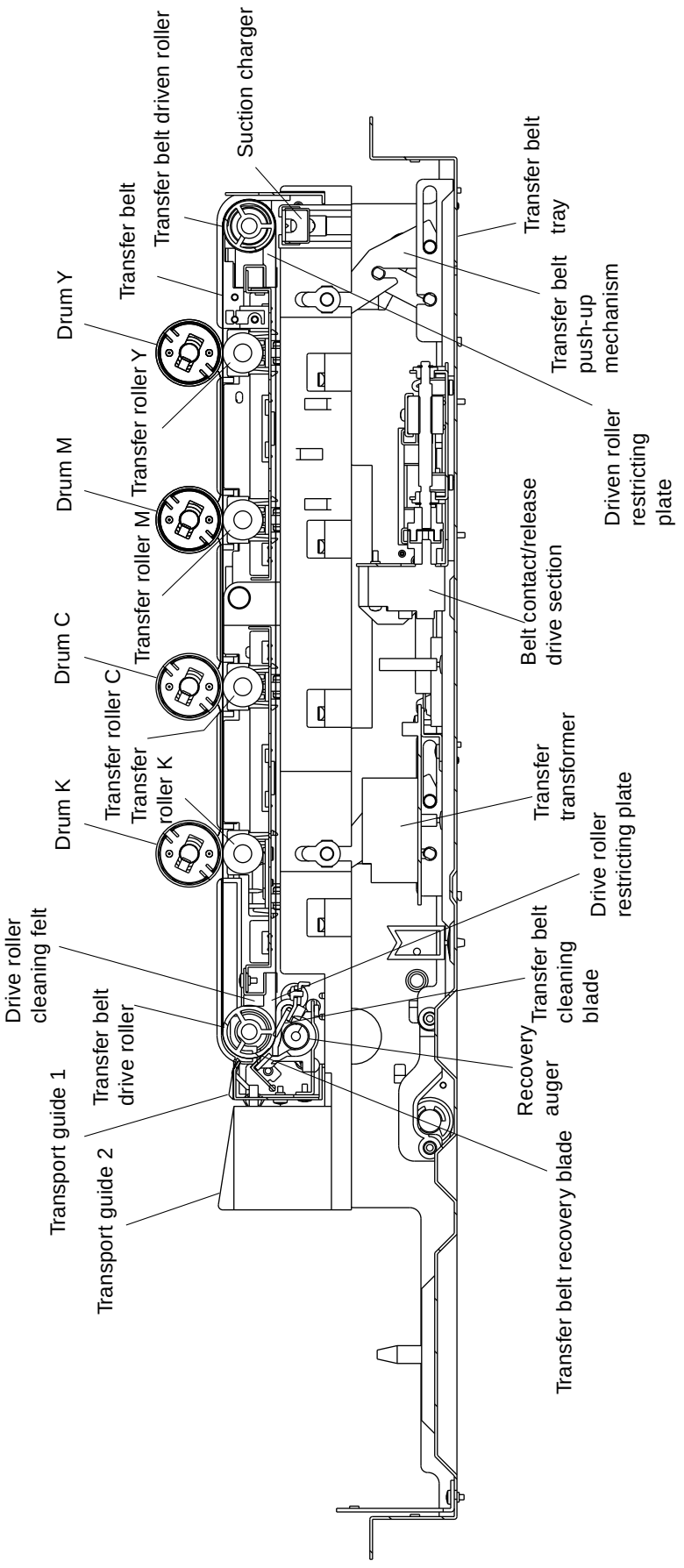
15. TRANSFER/TRANSPORT UNIT

15.1. Construction

This unit is designed to perform the following three functions: to transfer the toner image on the photoconductive drum onto the paper; to separate the paper from the drum; and to transport the paper to the fuser unit.

This unit is comprised of the following elements.





[Sectional view of transfer/transport unit]

15.2 General Description of Operation

(1) The transfer belt makes the paper adhere to it electrostatically, allowing the transfer, separation and paper transport processes to be performed in sequence.
(2) The transfer belt is charged by the suction charger beneath the driven roller to cause the paper to adhere onto the belt.
(3) The transfer belt is provided with voltage from transfer transformer through the transfer roller.
(4) The paper is transported from the transfer roller Y to the transfer roller K, thus allowing toner images to be transferred onto the paper.
(5) During color copying, the transfer belt runs in contact with all the four drums.
(6) During black copying, the transfer belt unit is tilted approx. 1° clockwise around a point near the transfer roller K, allowing the belt to separate from the drums Y, M and C (approx. 5 mm at the transfer roller Y).

15.3 Description of Functions

(1) Transfer belt unit

a. Transfer belt

Molded with high precision from resin which has a specified level of electrical resistance, the transfer belt has functions to retain and transport the paper sent from the feeding section, as well as to help transfer the toner on the drum surface onto the paper.

b. Transfer belt holding mechanism

Holds the transfer belt on the drive/driven rollers, applying some tension to the driven roller to add a certain level of tension to the transfer belt.

c. Meander restricting mechanism

Meander restricting plates are provided at the front and rear sides of the transfer belt, forcing the belt move inside the plates to prevent it from shifting out of position.

d. Transfer rollers

The four transfer rollers(Y,M,C and K) are mounted between the drive roller and the driven roller to transfer the toner on the drums onto the paper by means of the potential difference from the drums. Each transfer roller is supplied with 1100V of the bias voltage for plain paper copying at normal temperature and humidity.
High-voltage probe is required to measure this voltage.

e. Transfer belt cleaning mechanism

The transfer belt cleaning blade scrapes off residual toner from the transfer belt surface. Scraped toner is recovered by the recovery auger and then transported to the used-toner transport unit (on the main unit).

f. Transport guide 1

Transport guide 1 separates from the transfer belt the paper which is electrostatically adhering to the belt, and guides it to the transport guide 2. To perform the separation by means of dielectric force, the guide is made of a grounded metal plate and the ribs on the guide surface are made of insulating material such as resin.

(2) Transfer belt tray section

a. Transfer belt push-up mechanism and lock/unlock mechanism

Transfer belt push-up mechanism is a system to raise up and down the transfer belt unit by 25 mm to make the belt contact the drum.

The lock/unlock mechanism is provided to lock the unit to prevent it from sliding out of position, as well as to allow the unit to be unlocked, lowered and pulled out during jam clearing.

- Facing the front side, turn the lever clockwise to the right (until 3 o'clock) and the unit can be drawn out.
- After reinstalling the transfer/transport unit properly into the machine, turn the lever counter-clockwise to the left (until 9 o'clock) as seen from the front and the unit moves up to be locked securely.
- If the transfer/transport unit is not properly installed into the machine, the lever cannot be turned counter-clockwise to the left.

The push-up mechanism can be operated independently on its paper exit side and feed side to allow the transfer belt unit perform the release movement during black mode copying.

b. Transfer belt drive section

The transfer belt unit has its drive roller shaft end formed like a spline, which has its counterpart in the main unit and allows the unit to be securely connected when installed.

The drive unit is located on the rear side of the main unit and equipped with the transfer belt motor and the fuser motor.

The transfer drive section transmits the driving force of the transfer belt motor through the timing belt and gears to the transfer belt drive roller. The connection to the drive roller is so structured that the up-and-down movement of the transfer belt unit can be accommodated.

c. Transfer belt contact/release mechanism

When the black mode is selected, the drums Y, M and C do not rotate, so if the transfer belt is not separated from them, the drums will be damaged. To protect against the damage, the transfer belt contact/release mechanism allows the transfer belt unit to turn approx. 1° clockwise around a point near transfer roller K, separating the belt from those three drums (about 5mm gap between the drum Y and the transfer roller Y).

- The drum Y side of the transfer belt push-up mechanism is moved up and down with an arm which is driven by the transfer belt contact/release motor in the transfer belt tray section.
- The contact position and release position of the transfer belt are controlled by the transfer belt home position switch and transfer belt limit switch.

d. Suction charger

The suction charger charges the transfer belt by corona discharge to allow the belt to attract the paper transported from the paper feeding section.

e. Electrical supply section

Supplies power to the transfer rollers and suction charger, applying bias voltage.

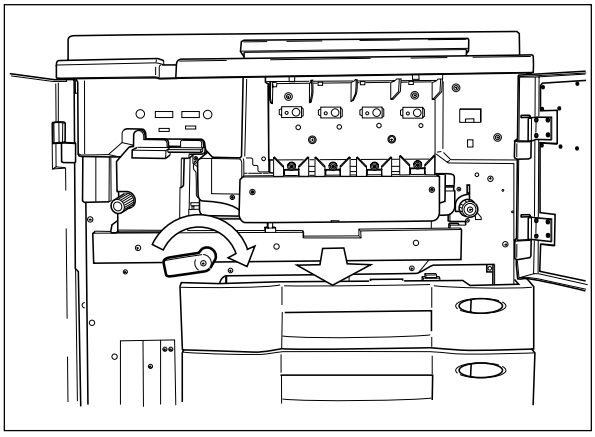
f. Transport guide 2

Guides the paper sent from the transport guide 1 up to the fuser unit. It is made of material which prevents the occurrence of frictional electrification of the paper.

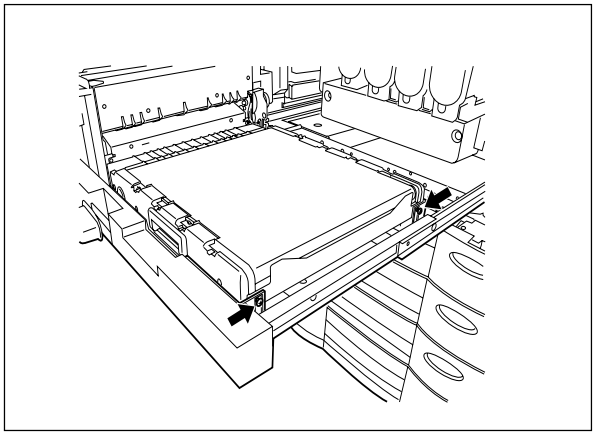
15.4 Disassembly and Replacement

[A] Transfer belt unit

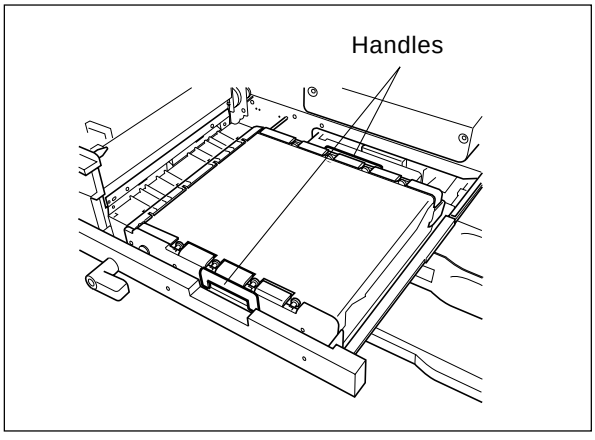
(1) Turn the lever to the right to lower the transfer belt unit, and draw out the transfer/transport unit.



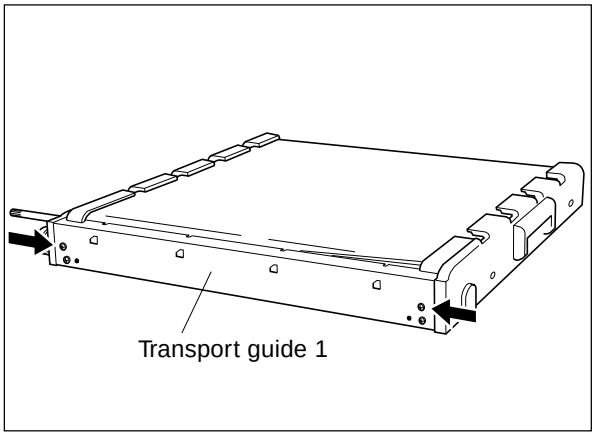
(2) Unscrew 2 screws.



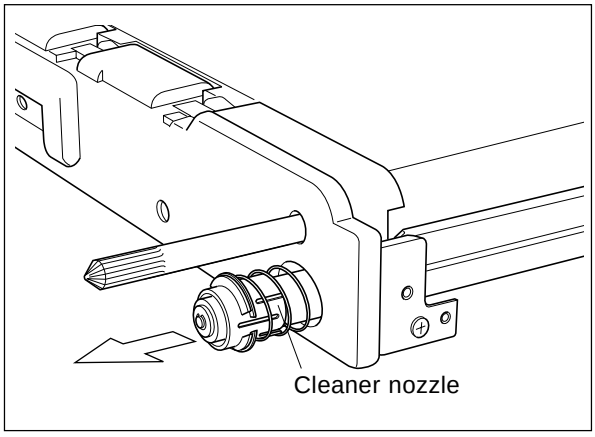
(3) Take out the transfer belt unit by holding its handles.



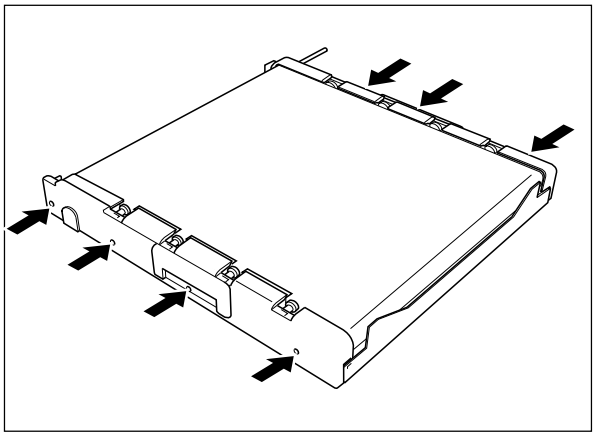
(4) Remove the transport guide 1 (2 screws).



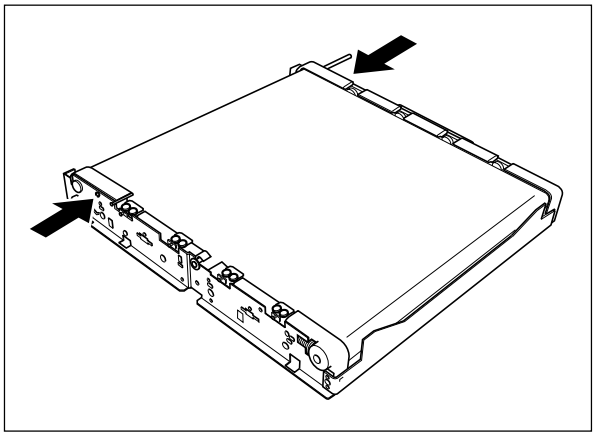
(5) Remove the cleaner nozzle using a minus type screwdriver.



(6) Remove the transfer belt unit covers (4 screws for the front side cover, and 3 screws for the rear side cover).

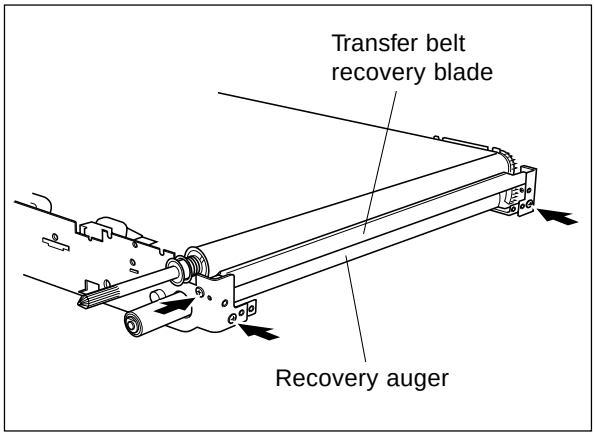


(7) Remove the front and rear aluminum covers (1 screw for each).



(8) Remove the transfer belt recovery blade (1 screw).

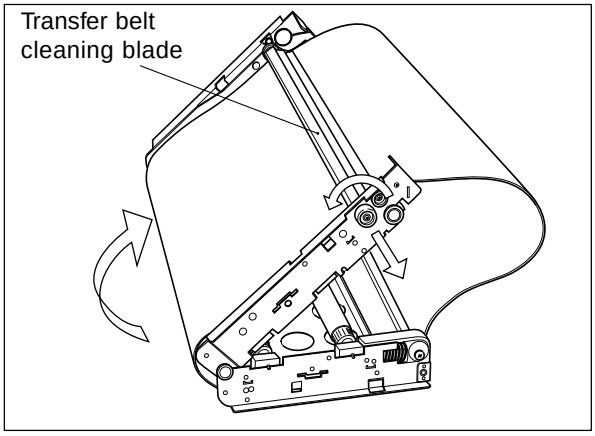
(9) Remove the recovery auger (2 screws).



(10) Lift up the drive side of the frame and fold it about 120°.

(11) Remove the transfer belt cleaning blade. Turn it counter-clockwise as seen from the front side and pull it out toward the front.

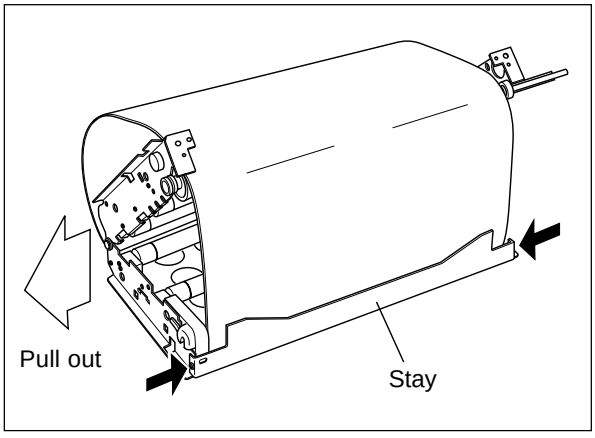
Note: Pull out the cleaning blade pressure spring together with the blade.



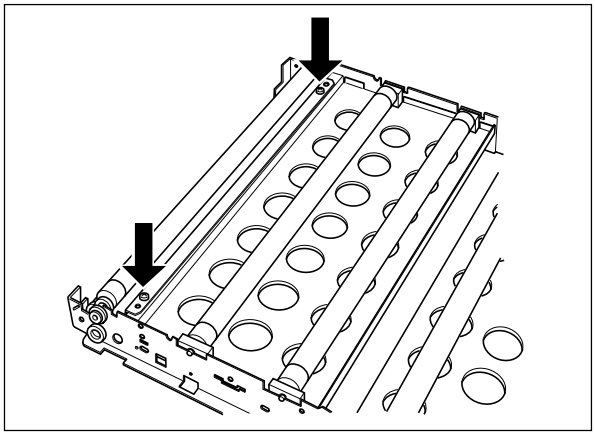
(12) Remove the stay (2 screws).

(13) Pull out the transfer belt from the front side of the frame.

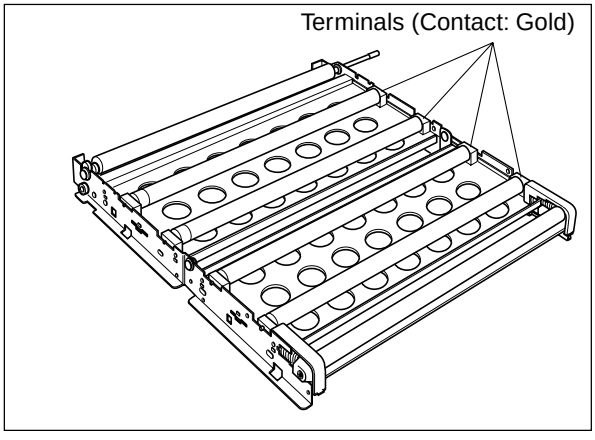
Note: When pulling it out, be sure not to damage the belt with the drive/driven rollers restricting plates.



(14) Unscrew 2 screws and remove the drive roller cleaning felt, pulling it out downwards.



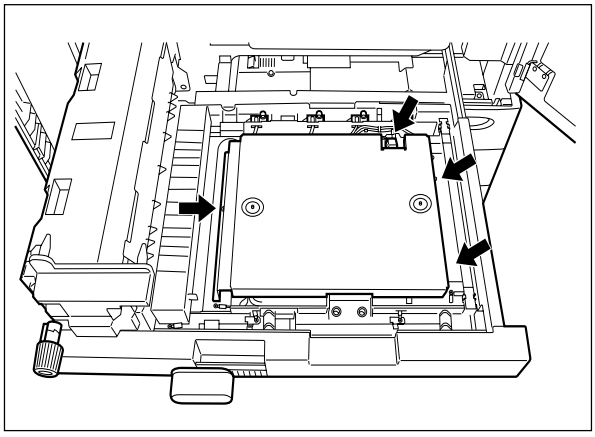
(15) Disengage the terminal latches on the back side of the unit and remove the transfer rollers.



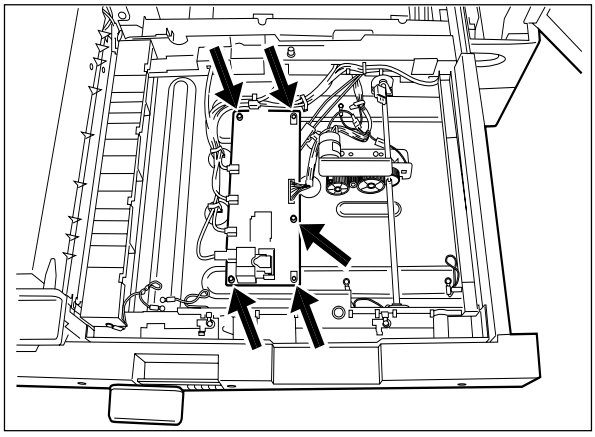
[B] Transfer transformer

(1) Remove the transfer belt unit.

(2) Disconnect the connector, unscrew 3 screws to remove the dump heater.(115V series)



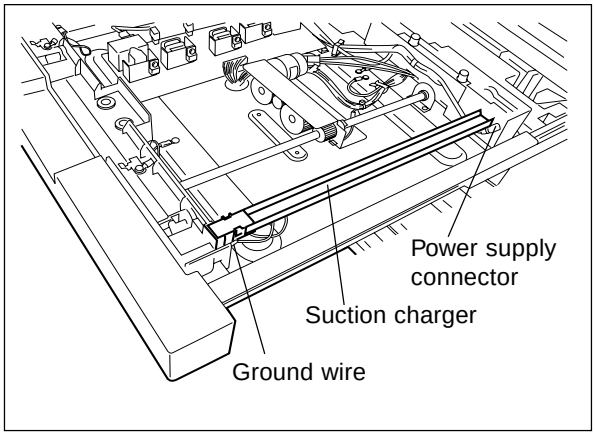
(3) Unscrew 2 screws and unlock the PC board from 3 lock supports to remove it.



[C] Suction charger

(1) Remove the transfer belt unit.

(2) Disconnect the power supply connector, remove the fixing pin and the groung wire (1 screw). Then take out the suction charger.

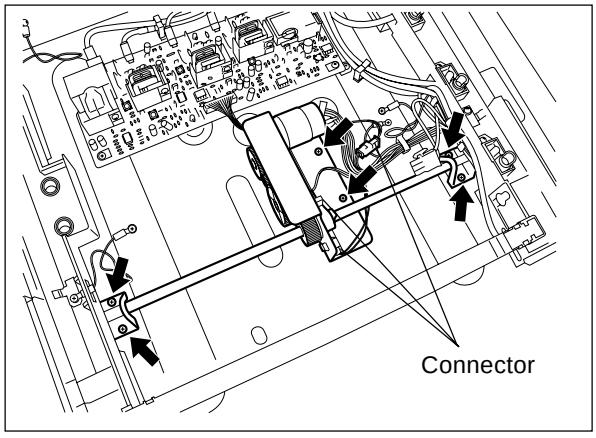


[D] Transfer belt contact/release motor/switch

(1) Remove the transfer belt unit.

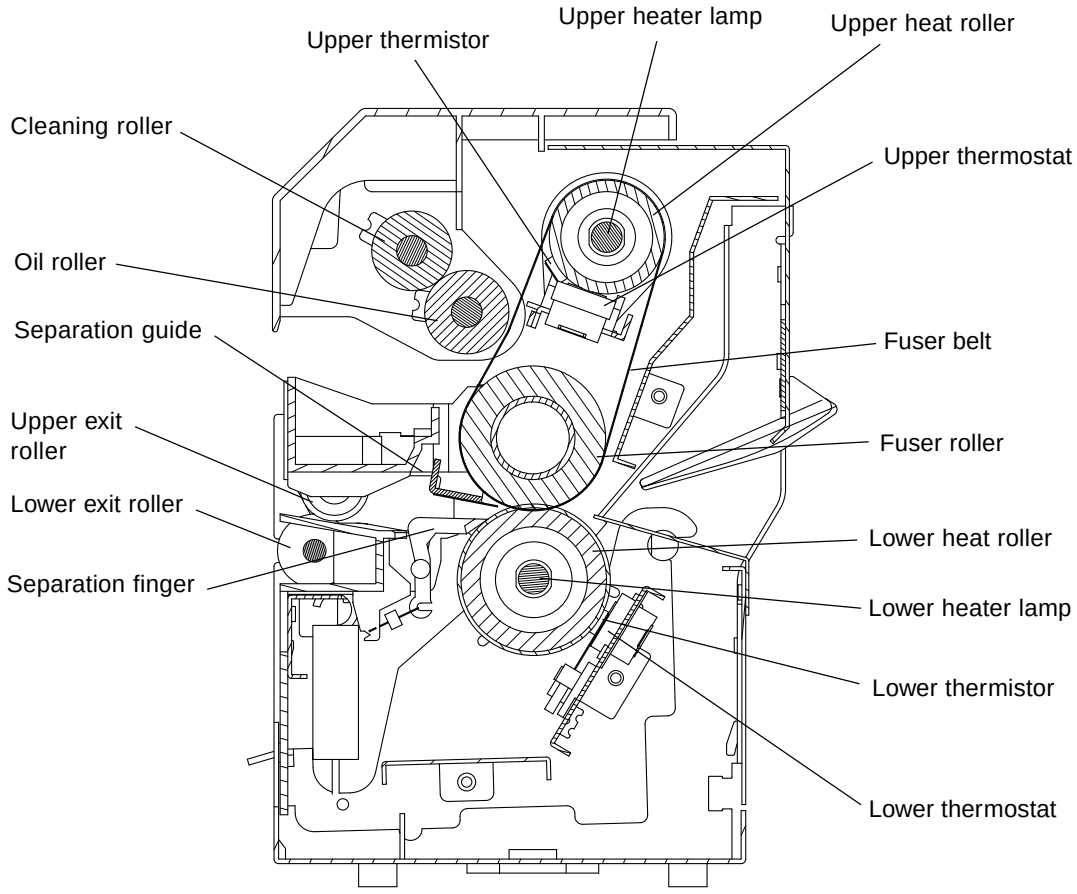
(2) Disconnect the connector, unscrew 3 screws and remove the dump heater.(115V series)

(3) Unscrew 6 screws and disconnect 3 connectors to remove the transfer belt contact/release motor/switch unit.



16. FUSER UNIT

16.1 Construction



Heat and pressure are applied to the paper separated from the transfer belt to have the toner fused to the paper. The paper then exits through the exit section into the receiving tray.

The fuser unit is comprised of upper/lower heater lamps, upper/lower heat rollers, fuser roller, fuser belt, separation guide, separation fingers, oil roller, cleaning roller, upper/lower thermistors, upper/lower thermostats, upper/lower exit rollers, etc.

16.2 Description of Operation

(1) Fuser unit

Applies heat and pressure to the paper separated and transported by the transfer belt to have the toner fused to the paper.

With the fuser belt in between, the fuser roller and the lower heat roller are constantly spring-loaded and are rotated by the driven force from the fuser motor. The fuser belt is also rotated at the same time and that leads to the rotation of the upper heat roller.

The upper and lower heat rollers each has a heater lamp installed. The lower heat roller applies heat from the lower side to the paper while the upper heat roller applies heat from the upper side via the fuser belt to have the toner fused on to the paper. The paper, after having fused, is smoothly separated from the lower heat roller and the fuser belt by the separation fingers and the separation guide. The temperature detection section consists of the thermistors to control the temperature of both heat rollers, and the thermostats to shut out the power to the heater lamps if the temperature becomes abnormally high.

(2) Paper exit section

The paper which has finished the fusing is exited to the receiving tray through the upper and lower exit rollers of the fuser unit, the ADU/exit switching gate and the exit rollers.

16.3 Functions of Various Components

(1) Heater lamps

Placed inside each of the heat rollers, these heater lamps, which are halogen lamps, work to heat both rollers. They stay fixed even while the heat rollers are rotating.

(2) Upper heat roller

The upper heat roller, which coated by fluorine with aluminum of a relatively high heat conductivity underneath, is heated by the upper heater lamp. The upper heat roller is pressed against the fuser belt and transfers the heat to the fuser belt. When the fuser belt is pressed against the paper, the toner is fused and is absorbed into the fibers of the paper for fusing.

(3) Fuser belt

The fuser belt transfers the heat to the paper from the upper heat roller. By using a very thin fuser belt, a low heat capacaity of the heat roller is made possible while the warm-up time or the copy mode switching time can be shortened.

(4) Lower heat roller

The lower heat roller, aluminum of a relatively high heat conductivity encircled by a silicone rubber and a fluororesin tube over it, is heated by the lower heater lamp. The lower heat roller is pressed against the fuser belt. To prevent the phenomenon of toner adhering to the fuser belt (called offsetting) and to facilitate toner separation from the lower heat roller, the lower heat roller has a coating over its surface. In addition, the hardness of the lower heat roller is made harder than that of the fuser roller so that the paper can come out of the rollers, slightly curling downward.

(5) Fuser roller

The toner is fused by the heat from the lower heat roller and the fuser belt (upper heat roller). When the lower heat roller is pressed against the fuser roller, the generated pressure can increase the heat conductivity and also enable the toner to be absorbed into the fibers of the paper. Besides, to improve the fusing ability, the surface is made with sponge allowing a wider nipping area in between the rollers.

(6) Separation fingers/guide

The separation fingers and the separation guide work to prevent the paper from sticking to the lower heat roller or the fuser belt.

(7) Oil roller

The oil roller, impregnated with silicone oil, is installed in contact with the fuser belt. By allowing silicone oil to be deposited to the surface of the fuser belt by heat, the oil roller helps to prevent toner offsetting and also facilitate cleaning off toner and paper dust adhering to the fuser belt surface during the fusing process.

(8) Cleaning roller

The cleaning roller is installed in contact with the oil roller to clean off the toner and paper dust from the oil roller, which the oil roller has removed from the fuser belt.

(9) Exit rollers

The paper coming out from between the fuser belt and the lower heat roller is ejected into the receiving tray through the respective exit rollers of the fuser and reversing units.

(10) Upper thermistor (center)

The upper heat roller temperature is detected by a upper thermistor (center) so that it can be maintained within a certain range, the lower limit of which is slightly higher than that which will cause poor fusing, and the upper limit of which is slightly lower than that which will cause toner offsetting. When the temperature has decreased below a specified value, the thermistor causes the heater lamp to energize to raise the temperature, and vice versa.

(11) Upper thermistor (rear)

The temperature distribution over the upper heat roller surface can differ significantly between the center and end points along the lengthwise direction, due to various conditions. The temperature on the rear is also detected by the upper thermistor (rear).

When either the center or rear thermistor detects a temperature that is higher than the specified temperature, the heater lamp is turned OFF to always provide a controlled temperature.

(12) Lower thermistor (center)

To maintain the lower heat roller temperature within a certain range, the temperature is detected and controlled by the lower thermistor (center). When the temperature has decreased below a specified value, the thermistor causes the heater lamp to energize to raise the temperature, and vice versa.

(13) Lower thermistor (rear)

The temperature distribution over the lower heat roller surface can differ significantly between the center and end points along the lengthwise direction, due to various conditions. The temperature on the rear is detected by the lower thermistor (rear).

When either the center or rear thermistor detects a temperature that is higher than the specified temperature, the heater lamp is turned OFF to always provide a controlled temperature.

(14) Upper and lower thermostats

They are set to shut off the power to the heater lamp if the temperature of the lower heat roller or the fuser belt (upper heat roller) rises abnormally high due to a broken thermistor, etc. The upper/lower thermostats are abnormal operation protective type; i.e. when it detects an abnormal condition, it turns itself OFF to shut off the power to the heater lamps, but cannot reset to be reused. So, the thermostat must be replaced along with the part(s) which has caused the abnormal condition.

16.4 Heater Control Circuit

16.4.1 Temperature detection section

To keep the heat roller temperature constant, thermistors are used to detect its temperature and control the heater lamp ON and OFF. The abnormality of the thermistors and the heater can also be detected by the output of the thermistors.

(1) Abnormality detection during warming up

About 40 sec. after the heater lamps have been turned ON, if the temperature does not rise 5°C or more above the temperature when the heater lamps were turned ON (i.e. the thermistor output voltage does not increase approx. 0.1V above the voltage when the heater lamps were turned ON), a service call (C41) is displayed.

(2) Abnormality detection during standby

After the copier has become ready, if a temperature below 70°C (which corresponds to a thermistor output voltage of approx. 0.7V) is detected for more than one sec. continuously, a service call (C43) is displayed.

(3) Thermistor/heater status counter control

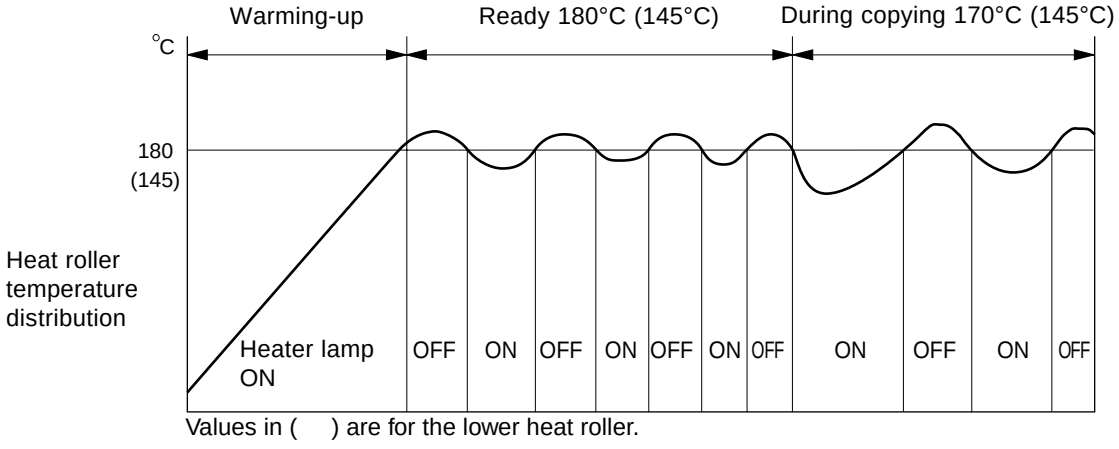
- To enhance the safety of the fuser unit, CPU works to provide the following protection: after two consecutive C41 errors, if a third C41 error has occurred, the heater lamp cannot be turned on again no matter the power is OFF or ON and a C41 error will be displayed at once.
  However, if the copier becomes ready normally with the thermistor/heater status counter displayed “1” or below, the counter will be cleared to “0”.
- After service calls C41 to C48 occurred and the thermistor or the heater lamp have been repaired or replaced, if turning the power ON does not turn the heater lamp ON and an error occurs again, use code 700 in the 08 mode to check the thermistor/heater status counter, and clear it to “0” if necessary.
  Upper heat roller surface temperature: 180°C (Thermistor resistance: 1128 Ω)
  Lower heat roller surface temperature: 145°C (Thermistor resistance: 2630 Ω)

Reference

1. Relationship between the thermistor output voltage and heat roller temperature:
   Approx. 3.21V when the temperature is 180°C, approx. 2.66V when the temperature is 145°C and approx. 0.25V when the temperature is 40°C.
2. Relationship between the upper/lower heat rollers surface temperature and upper/lower thermistors (center) resistance:

Values in ( ) are for the lower thermistor (center).

Temperature	Thermistor resistance	Heater lamp state
180 (145)°C or below	1128 Ω (2630 Ω) or over	ON
180 (145)°C	1128 Ω (2630 Ω)	The previous state kept intact
180 (145)°C or over	1128 Ω (2630 Ω) or below	OFF

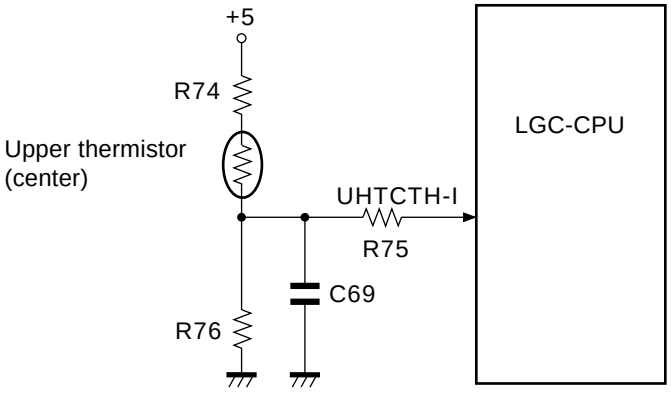


3. Temperature control for the upper/lower heat rollers ends
   During multicopying, the temperature on the ends of the upper/lower heat rollers (non-paper passage areas) generally tends to become higher than that on the paper passage areas. This temperature is detected by the upper and lower thermistors (rear); i.e. when it detects a temperature of 220°C or over, the heater lamp is set to automatically turn itself OFF, regardless of the temperature on the paper passage areas.

16.4.2 Detection of open-circuited thermistors

· A thermistor is a device whose resistance decreases when it detects a high temperature. Therefore, if the heat roller thermistor becomes open-circuited, the control circuit would determine that the heat roller temperature is extremely low, and allow the heater lamp to continue being energized. As a result, the heat roller temperature would rise extremely high, possibly triggering the thermostat which is a safety protection device. To prevent this possibility in advance, CPU is set to detect if the thermistor is open-circuited or not.

* All the upper and lower thermistors (center and rear) use the same circuit. The following explanation is about the circuit of the upper thermistor (center).



· The input voltage is obtained by dividing the +5V among R74, upper thermistor (center) and R75.

· The surface temperature of the upper heat roller varies.

↓

The resistance of the upper thermistor (center) changes.

↓

The input voltage changes.

· The LGC-CPU detects this change to determine if the thermistor is abnormal or not.

16.5 Heat Roller Temperature in Thick Paper/Thin Paper/OHP Mode

Depending on the thickness of the paper, different modes are available for thick paper/thin paper/OHP as below, and the heat roller temperature setting is different in each mode.

The following table shows the heat roller temperature setting for the different paper modes.

Mode	Paper Thickness	Heat roller temperature setting
THIN	64~79g/m^2	Approx. 150°C
	17~20lb.	
THICK 1	106~163g/m^2	Approx. 200°C
	29~60lb.cover / 90lb.index	
THICK 2		Approx. 205°C
	164~209g/m^2	
THICK 3	91~110lb.index	Approx. 205°C
	210~256g/m^2	
OHP FILM	-----	Approx. 150°C

Notes:

1. It takes 30 to 90 seconds to switch between either two modes among "PLAIN", "THICK 1", "THICK 2", "THICK 3" and "OHP FILM" for adjustment.
2. It takes 30 to 240 seconds to switch between "THIN" and other modes for adjustment.
3. In the OHP FILM mode, the paper is printed at normal speed until the K toner transfer onto OHP film is finished in the transfer section. At the point where the trailing end of the OHP film leaves the transfer section K, the speed of the fuser unit, transfer belt and all drums drops to 1/4 of the normal speed, and at this speed, the toner is fused onto the OHP film.
   Copy speed in the OHP FILM mode is approx. 3.3 sheets per minute to enable this speed control.

16.6 Disassembly and Replacement

[A] Fuser unit

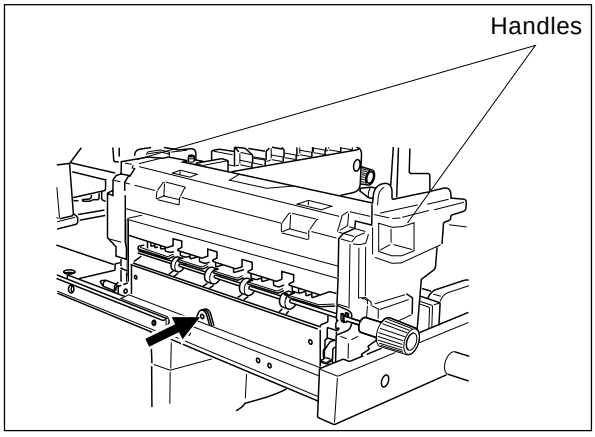
(1) Draw out the transfer/transport unit.

(2) Unscrew the screw.

(3) Lift the fuser unit up horizontally and take it out.

Notes: 1. When removing or installing the fuser unit, use the handles on the front and rear sides.

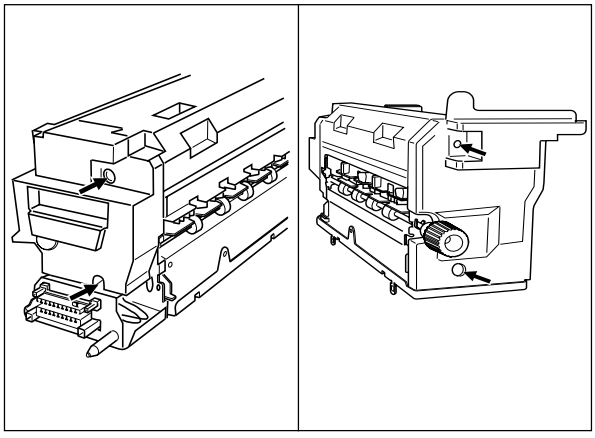
2. Be careful when handling the fuser as it may become very hot.



[B] Fuser covers (front and rear)

(1) Unscrew 2 screws and remove the fuser cover (front).

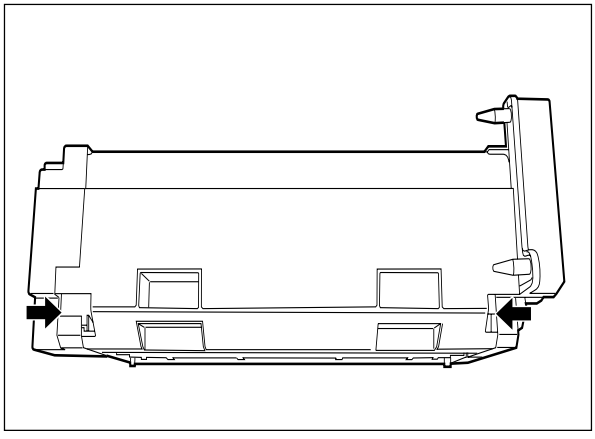
(2) Unscrew 2 screws and remove the fuser cover (rear).



[C] Oil roller/ Cleaning roller

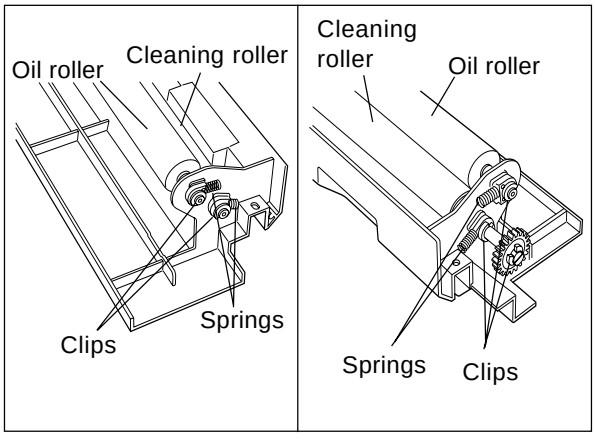
(1) Remove the fuser covers (front and rear).

(2) Unscrew 2 screws and remove the fuser cover (top).



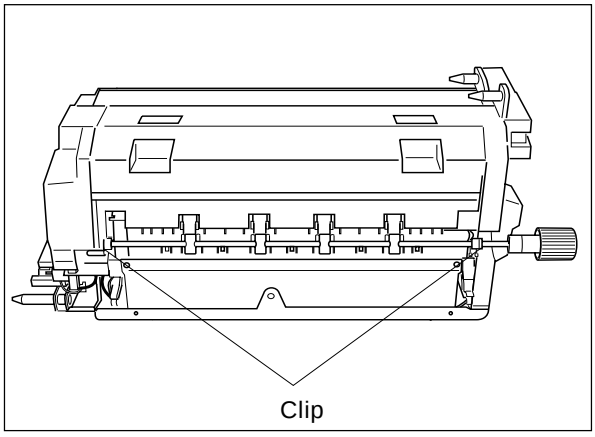
(3) Remove 2 clips, 2 bushings, 2 springs, and then take out the oil roller.

(4) Remove 3 clips, 1 gear, 2 bushings and 2 springs, and then take out the cleaning roller.

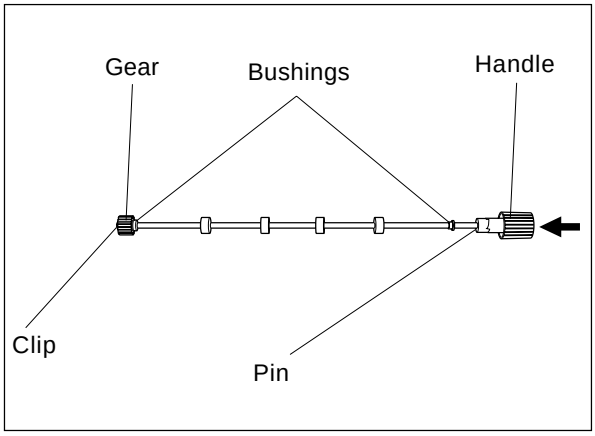


[D] Lower exit roller

(1) Remove the clip and then the lower exit roller.

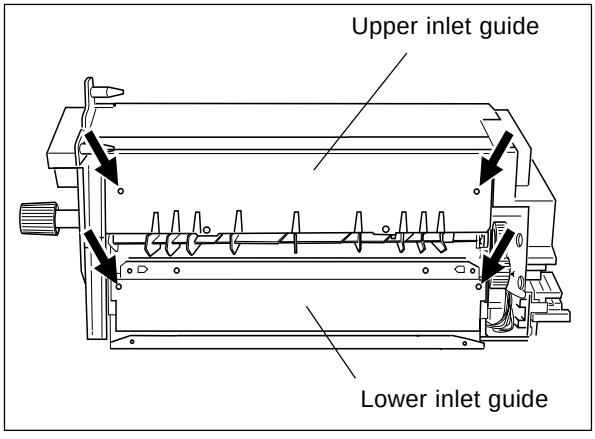


(2) Remove the clip, gear, screw, handle, pin and 2 bushings from the shaft, and then replace the rollers.

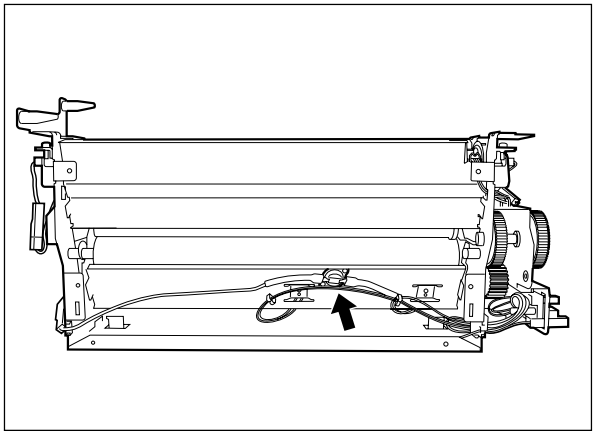


[E] Lower Thermostat

(1) Remove the fuser covers (front, rear and upper).
(2) Remove the upper inlet guide (2 screws).
(3) Remove the lower inlet guide (2 screws).



(4) Disconnect 2 faston terminals and unscrew 2 screws. Then remove the lower thermostat.



[F] Heater lamps

(F-1) Upper heater lamp

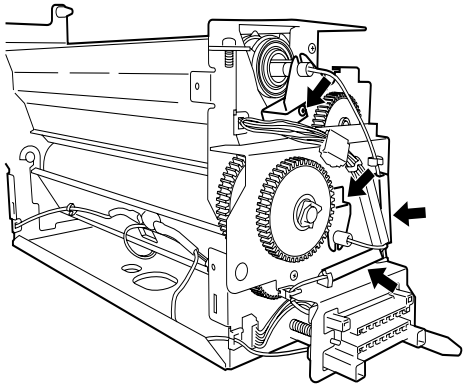
(1) Remove the fuser covers (front and rear).
(2) Remove the front lamp bracket (1 screw) and disconnect the front upper heater lamp connector.
(3) Remove the rear lamp bracket (1 screw) and disconnect the rear upper heater lamp connector.
(4) Draw out the heater lamp.

(F-2) Lower heater lamp

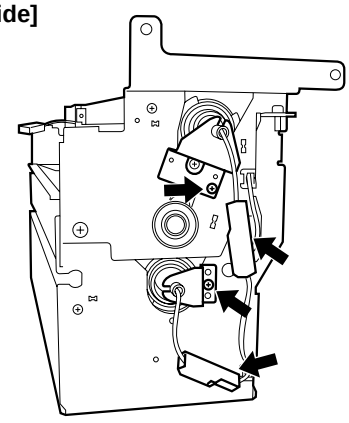
(1) Remove the fuser covers (front and rear).
(2) Remove the front lamp bracket (1 screw) and disconnect the front lower heater lamp connector.
(3) Remove the rear lamp bracket (1 screw) and disconnect the rear lower heater lamp connector.
(4) Draw out the heater lamp.

Notes: 1. When installing the upper/lower heater lamps, make sure that the end of the heater lamps with red harness should be to the rear side.
2. When installing the upper and lower heater lamps, check the rating indicated on the lamps, and then install them correctly. To distinguish the upper heater lamp from the lower one, note that the edge of the upper one is in orange color.
3. Do not touch the lamp directly.

[Rear side]

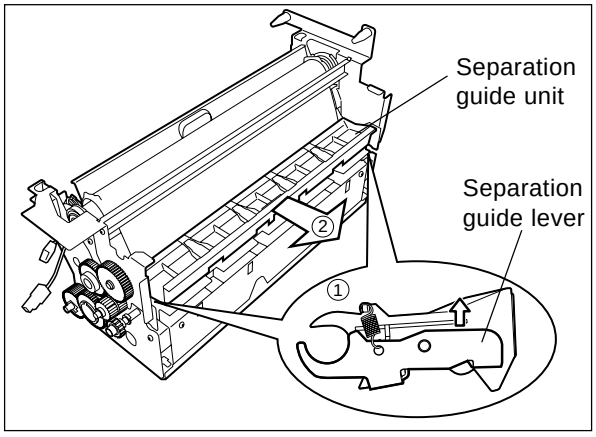


[Front side]

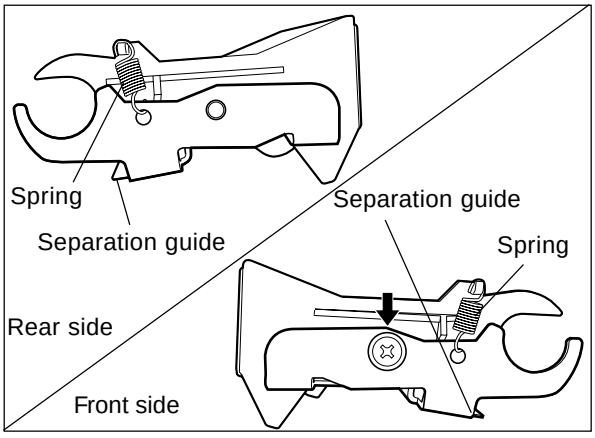


[G] Separation guide / Exit roller

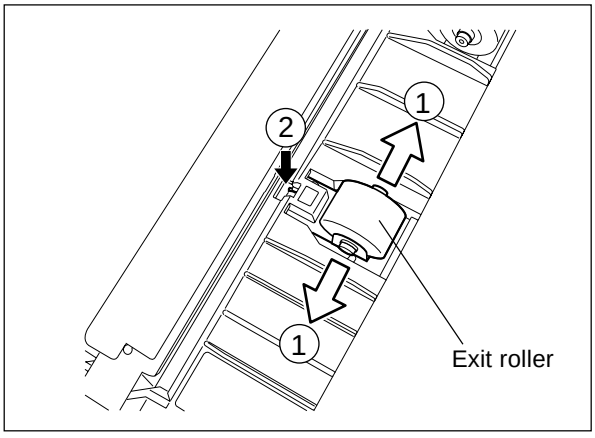
(1) While lifting up the separation guide lever, draw it out in the direction of the arrrow.



(2) Unscrew 1 setscrew and remove 2 springs to take off the separation guide.



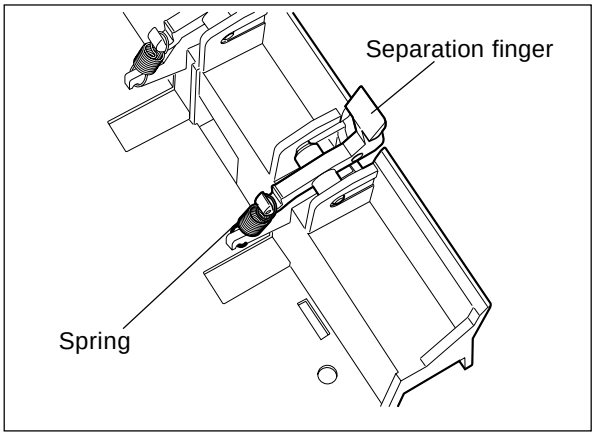
(3) Exit roller: ① Unfold the plate spring slightly to take off the exit roller.
Plate spring: ② Hold on the fingers and remove the plate spring.



[H] Separation fingers

(1) Take off the lower inlet guide.

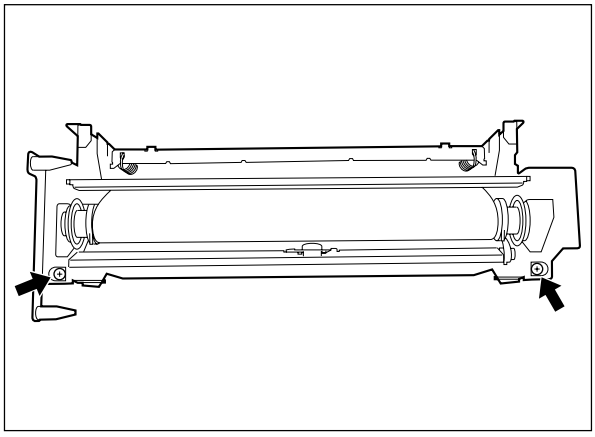
(2) Remove the spring to take off the separation fingers.



[I] Upper fuser unit

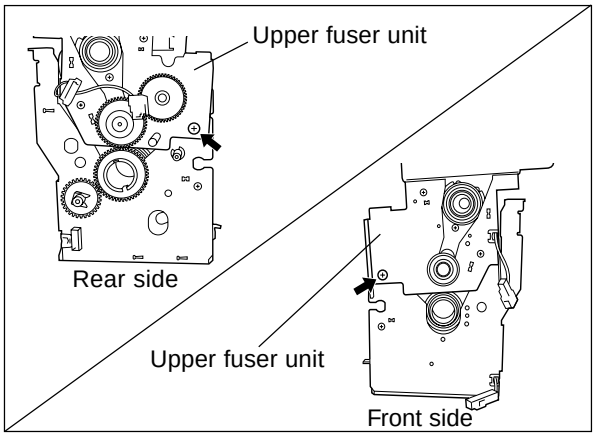
(1) Remove the fuser cover (upper) and the heater lamp.

(2) Unscrew 2 screws. (Note that the unit is pressurized at that moment.)



(3) Unscrew 1 screw for each side (front and rear).

(4) Lift the upper fuser unit to remove it.

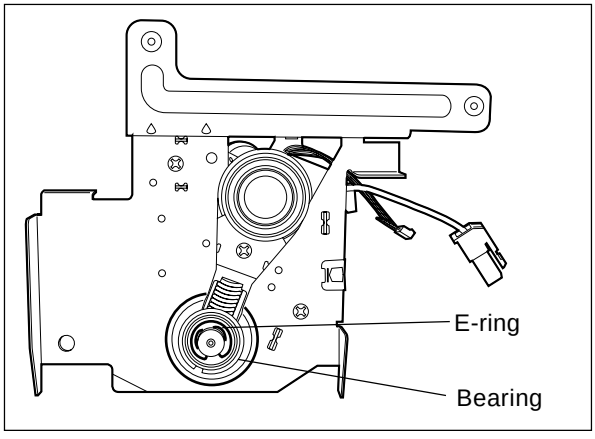


[J] Fuser belt

(1) Take out the upper fuser unit.

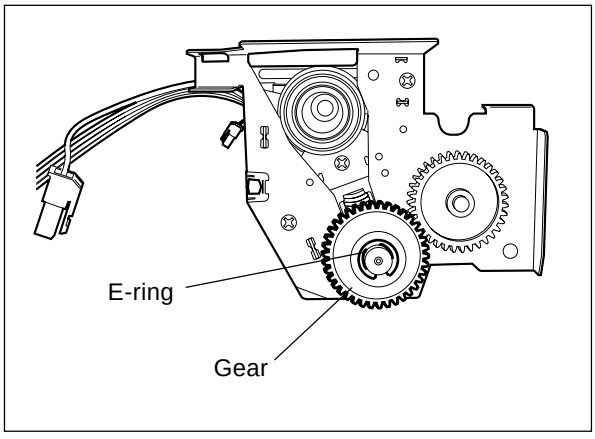
Notes: 1. Be careful not to damage the fuser belt. The belt may crack and be broken.

2. Do not allow any dirt to attach on the fuser belt. When handling the belt, be careful not to touch it directly. Sheets of paper should also be laid on the working table or the ground to protect the belt from sticking any dirt.

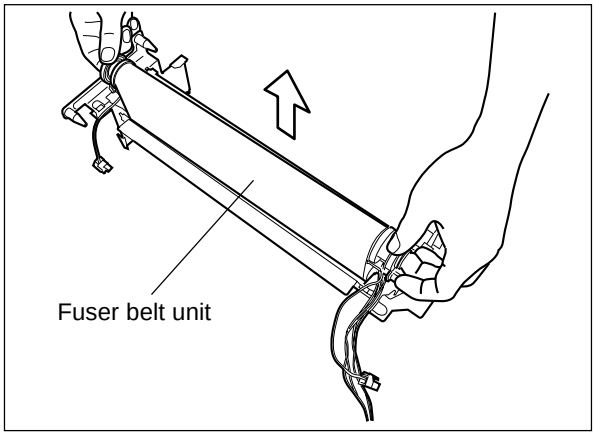


(2) Remove the E-ring on the front side of the upper fuser unit and take off the bearing.

(3) Remove the E-ring on the rear side of the upper fuser unit and take off 1 gear and 1 bearing.



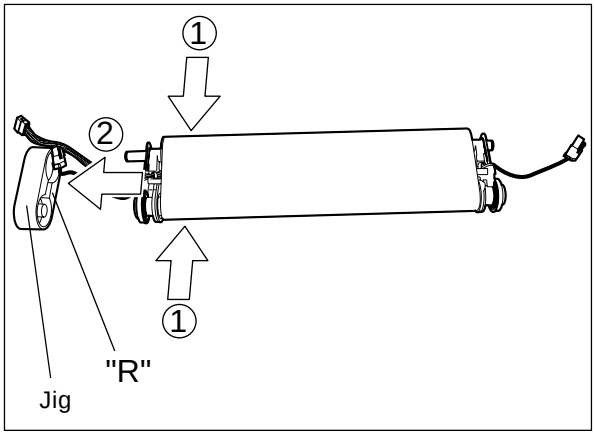
(4) Take off the fuser belt unit.



(5) Install the jig.

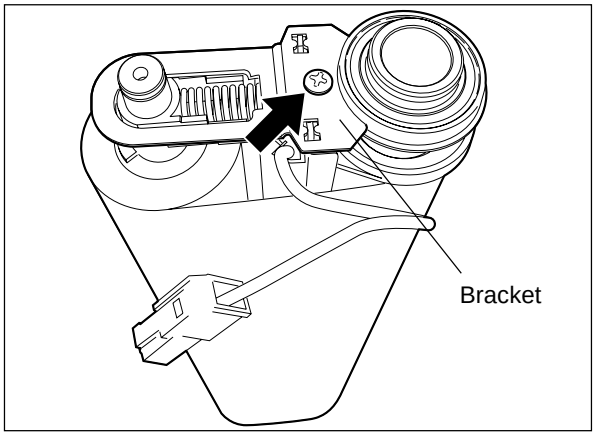
· Hold the jig with its R-marked side pointed to the front and insert it to the R side of the fuser belt unit.

· Before inserting the jig into the fuser roller unit, shorten the distance between the shafts of the upper heat roller and the fuser roller.



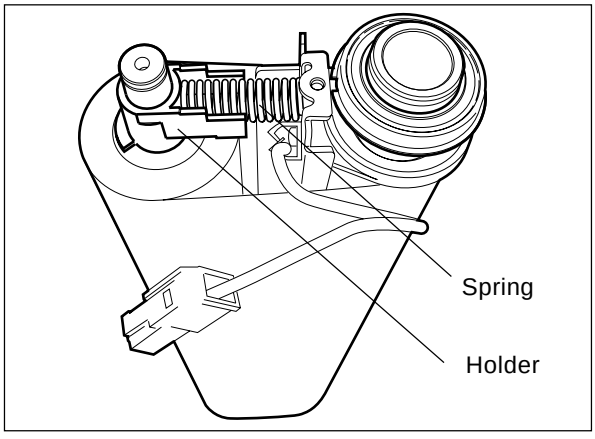
(6) Unscrew 1 screw to remove the bracket.

Note: When assembling, be careful not to mistaken the installing direction of the bracket.

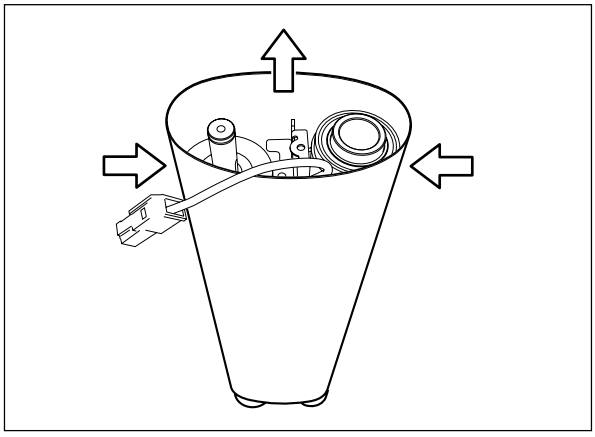


(7) Remove the spring and the holder.

Note: Take care of the holder as it is very fragile. When assembling, be careful not to mistaken the direction of the bearing.



(8) Make the fuser roller and the upper heat roller come closer to each other and then take out the fuser belt.



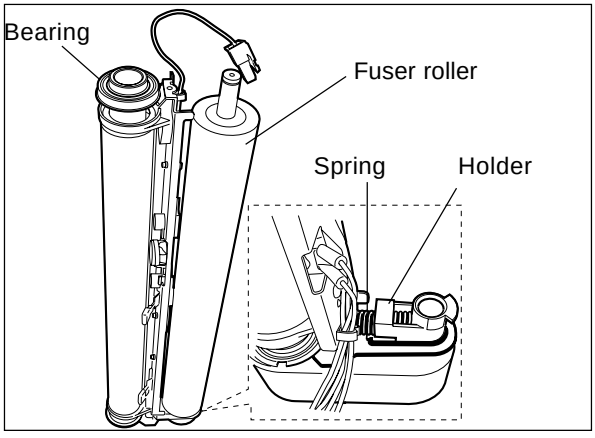
Note: Be careful not to damage the fuser belt. The belt may crack and be broken.
When replacing a new fuser belt, make sure it does not have any damage or fold on its surface and edges.

[K] Fuser roller, upper heat roller, upper thermistor and upper thermostat

(1) Remove the fuser belt and the bearing.

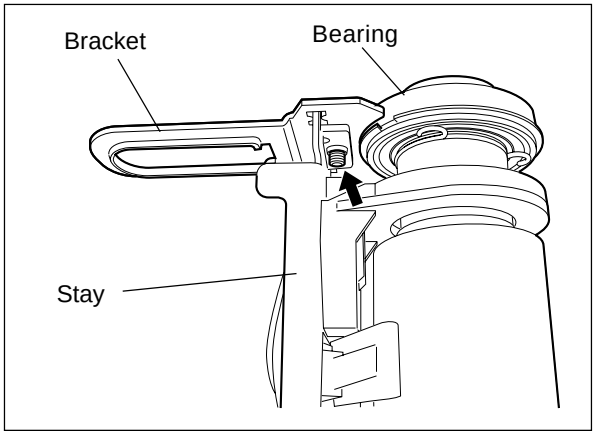
(2) Remove the fuser roller and then the spring and holder on the opposite side.

Note: Take care of the holder as it is very fragile.

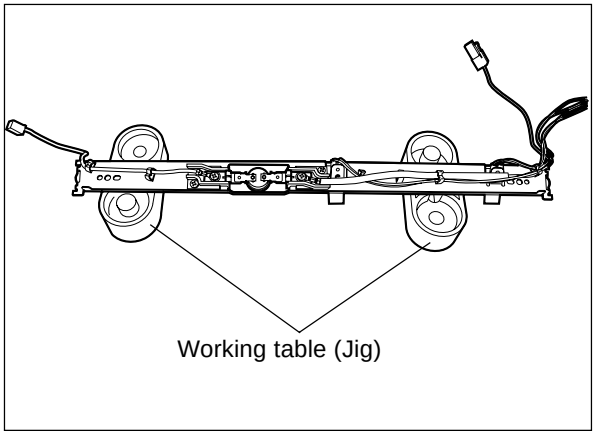


(3) Remove the bracket (1 screw), stay (2 screws) and the bearing from the upper heat roller.

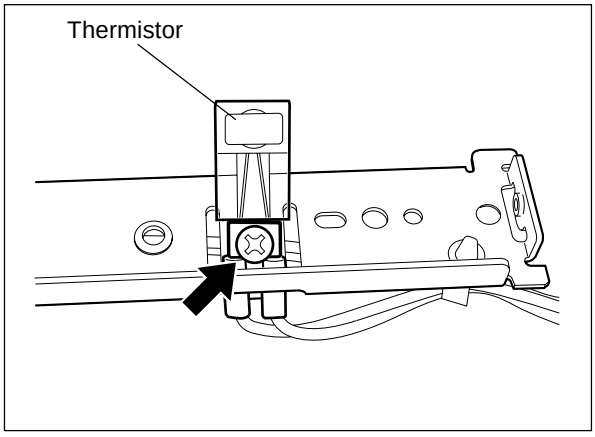
Note: When assembling, be careful not to mistaken the direction of the bearing and the bracket.



(4) To prevent the thermostat from distorting, use a jig or something like that to place the stay on a working table.

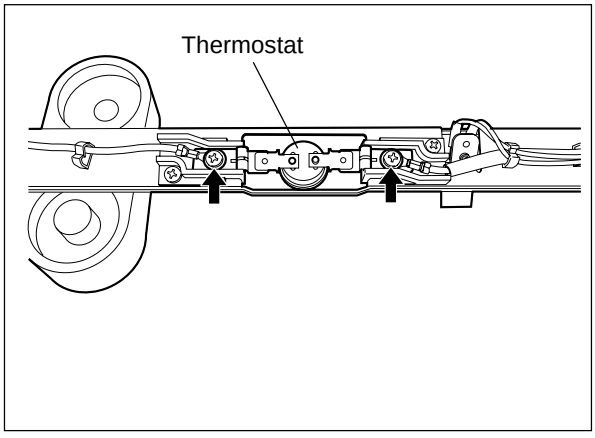


(5) Remove the upper thermistor (1 screw).



Note: Be careful not to have the upper thermistor distorted.

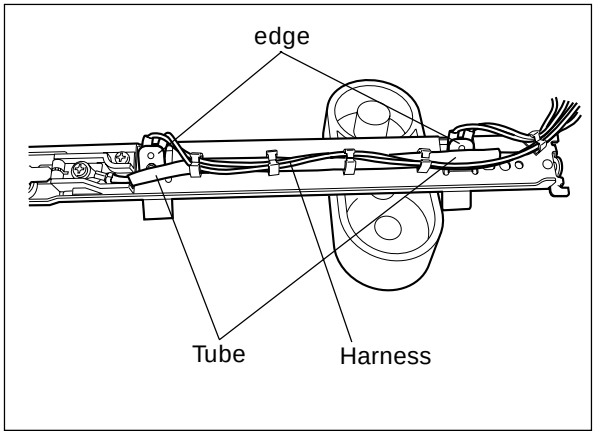
(6) Remove the upper thermostat (2 screws).



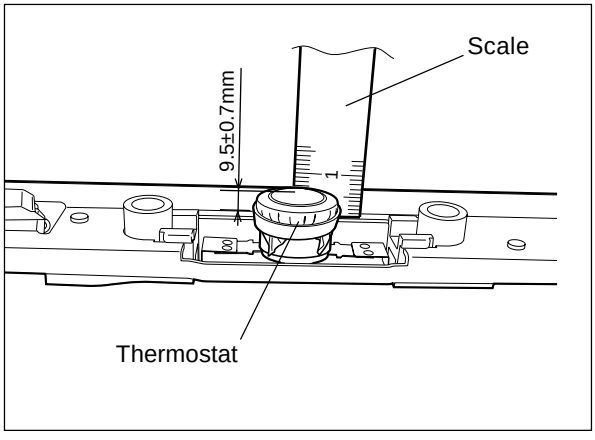
Note: Be careful not to have the upper thermostat distorted.

Note: When assembling the upper thermostat and the upper thermistor, pay attention to the follows:

- Be careful not to have the upper thermistor and the upper thermostat distorted.
- Do not let the harness of the upper thermistor contact with the edge of the metal plate.
- To avoid the harness of the upper thermostat from contacting the edge of the metal plate, make sure to cover the tube properly.



- The thermostat should be installed so that its contact surface is at a distance of 9.5±0.7mm from the stay as the illustration shown on the right.

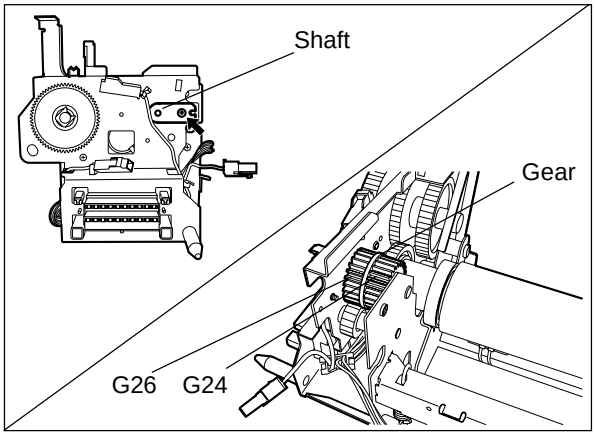


[L] Lower heat roller

(1) Remove the upper fuser unit.

(2) Unscrew 1 screw and pull out the shaft of the drive gear. Then remove the gear.

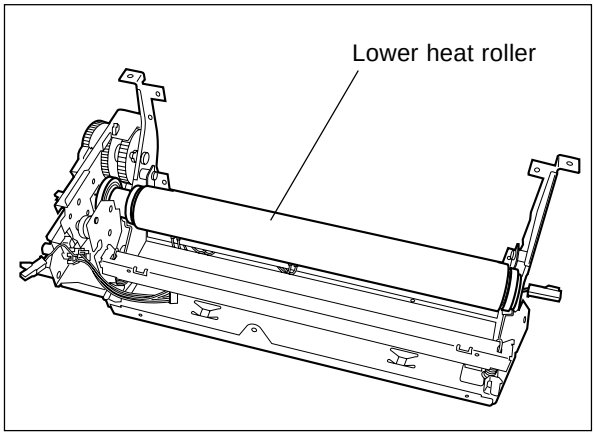
Note: When assembling, be careful not to mistaken the direction of the gear.



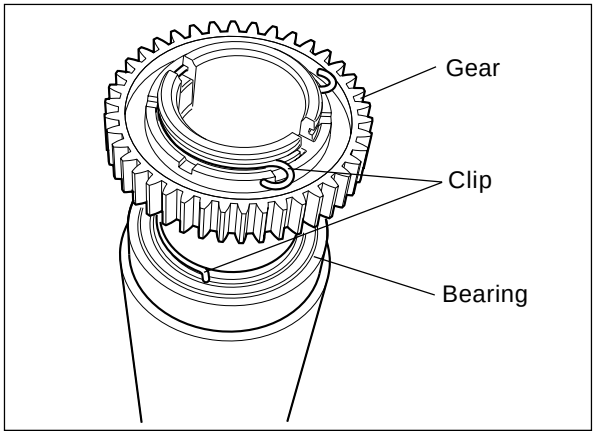
(3) Remove the lower heater lamp.

(4) Remove the lower heat roller.

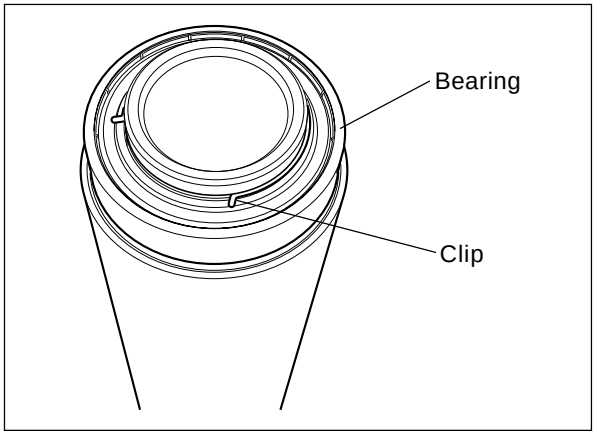
Note: To protect the lower heat roller from being damaged, wrap a sheet of paper around it.



(5) Remove the clip and take out the gear and the bearing.



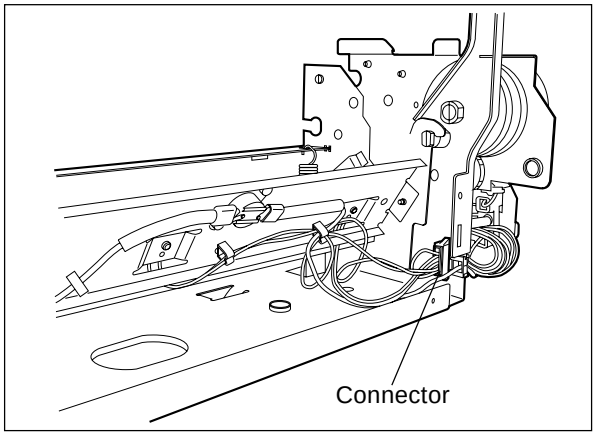
(6) Remove the clip and take out the bearing.



[M] Lower thermistor

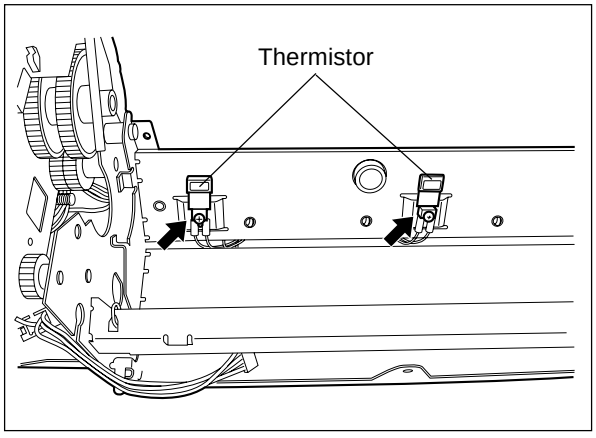
(1) Remove the lower heat roller.

(2) Disconnect the connector.



(3) Unscrew 1 screw, remove the thermistor.

Note: Be careful not to have the lower thermistor distorted.

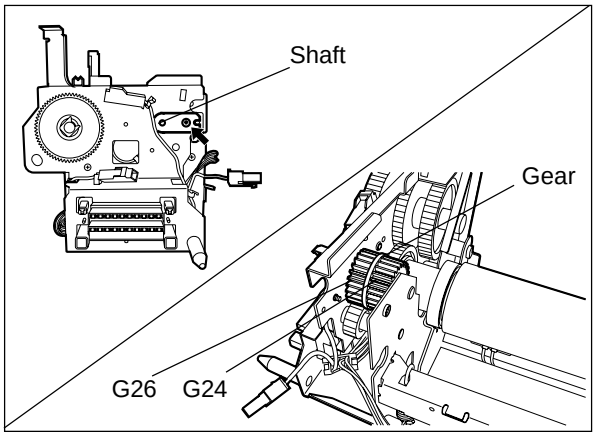


[N] Drive unit

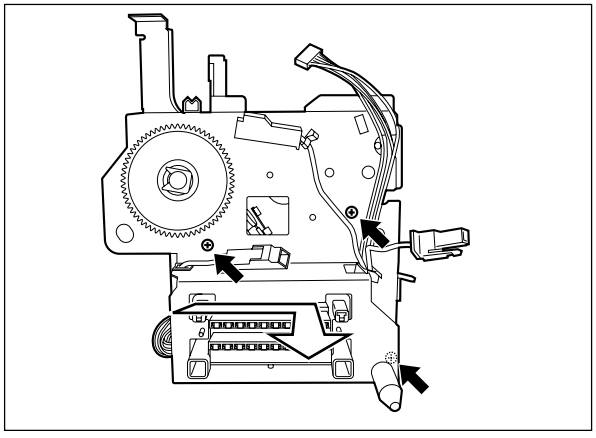
(1) Remove the upper fuser unit.

(2) Unscrew 1 screw and pull out the shaft of the drive gear. Then remove the gear.

Note: When assembling, be careful not to mistaken the direction of the gear.

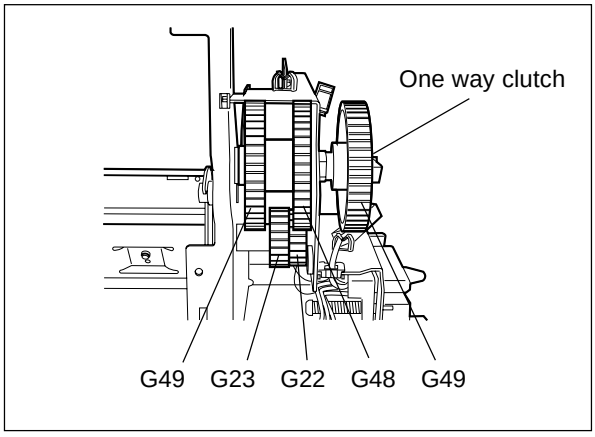


(3) Unscrew 3 screws and shift the drive unit to the right to pull it out to the front.

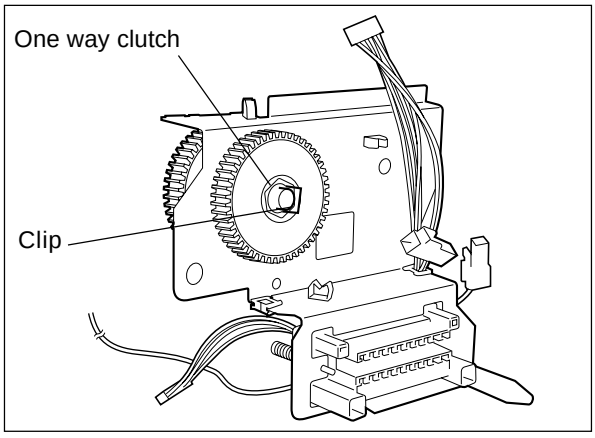


Note: When installing gears, make sure they are oriented and installed correctly (the one way clutch should be at the outside).

· The gears should be placed in the order as shown on the right.



(4) Remove the clip and take out the gear.



17. POWER SUPPLY UNIT

17.1 Construction

The power supply unit is comprised of an AC filter and insulation type DC output circuits.

(1) AC filter

Eliminates noise from the outside and prevents the noise generated by the copier from leaking to the outside.

(2) DC output circuits

The DC outputs are roughly divided into two lines of outputs:

① Main system : Power supply used during image forming processes, consisting of the outputs of four voltages (+3.3V, +5.1V, +12V and +24V) which start up when the main switch is turned ON.

② Door switch system : Power supply used by the entire machine during image forming processes and supplied via the door switch, consisting of the outputs of two voltages (+5.1V and +24V) which start up when the main switch is turned ON with the two door switches ON.

17.2 Operation of DC Output Circuits

(1) Start of operation

When the main switch of the copier is turned ON and if the door is closed, all the power supply systems start up at the same time.

(2) Stop of operation

When the main switch of the copier is turned OFF, a power-OFF signal (PWR-DN) is output after an instantaneous outage insurance time (20 ms mini.) has elapsed. After the power-OFF signal has been output, the main system power supply is allowed to retain its rated voltages for the minimum retaining time (10 ms or more) and then lets them start dropping.

(3) Output protection

Each output system includes an over-current protection circuit (a fuse and internal protection circuit) and an over-voltage protection circuit. This is to prevent abnormal operation or damage to the secondary circuit which may be caused by an over-current due to a shorted load or an over-voltage due to a short-circuit between different voltages.

If the protection circuit has been activated and the fuse is not blown out, remove the cause of the short-circuit and turn ON the power again to clear the circuit.

17.3 Output Channel

There are four output channels which are not linked with the door switches, as shown below.

(1) 3.3V(M) — For MPU on the SYS board, the image processing circuit, etc.

3.3VA : Pins 4 and 5, J707
Output to: IMC board, SYS board, AI board (via the IMG board), IMG board

3.3VB : Pin 1, J708
Output to: SCM board

(2) 5.1V(M) — For mechanical control circuits on the LGC board, IMC board, SCM board,etc.

5.1VA : Pins 3, 4 and 5, J706
Output to: LGC board

5.1VB : Pins 6 and 7, J707
Output to: IMC board, SYS board, RLY board (via the IMC board),
AI board (via the IMG board), IMG board

5.1VC : Pins 1, 2, 3 and 4, J710
Output to: built-in printer controller (optional)

5.1VD : Pins 3 and 4, J708
Output to: SCM board

(3) 12V(M) — Mainly for analog circuits and the HDD (e.g. image quality sensor, color registration sensor)

12VA : Pin 10, J706
Output to: LGC board, IMC board (via the LGC board),
image quality sensor (via the LGC board),
registration sensor (via the LGC board)

12VB : Pin 7, J708
Output to: SCM board, SDV board (via the SCM board), HDD

12VC : Pins 9, 10, 11 and 12, J710
Output to: built-in printer controller (optional)

(4) 24V(M) — For RADF, the finisher, fans, etc.

24VH : Pin 1, J706
Output to: LGC board

24VI : Pin 9, J708
Output to: SCM board

24VJ : Pins 1 and 3, J709
Output to: finisher

There are two output channels which are linked with the door switches.

(1) 5.1V(D) — For the laser diodes and the laser drivers

5.1VA : Pin 7, J702
Output to: LGC board

5.1VB : Pin 3, J705
Output to: IMC board, RLY board (via the IMC board), LDR board (via the IMC board)

(2) 24V(D) — For the motors, clutches, solenoids, fans, etc.

24VA~C : Pins 1, 2 and 3, J702
Output to: LGC board, paper feed motor (via the LGC board),
fuser motor (via the LGC board),
main high-voltage transformer (via the LGC board),
transfer transformer (via the LGC board)

24VD : Pins 1, 2 and 3, J703
Output to: developer motor

24VE : Pins 6 and 7, J703
Output to: paper feed motor

24VF : Pins 1 and 2, J704
Output to: SCM board

24VG : Pin 1, J705
Output to: IMC board, polygonal motor (via the IMC board), tilt motors (via the IMC board)

24VK : Pins 1, 3, 5, 7, 9, 11, 13, 15, 17 and 19, J711
Output to: LGC board

<Output connector>

Not linked with the door switch:

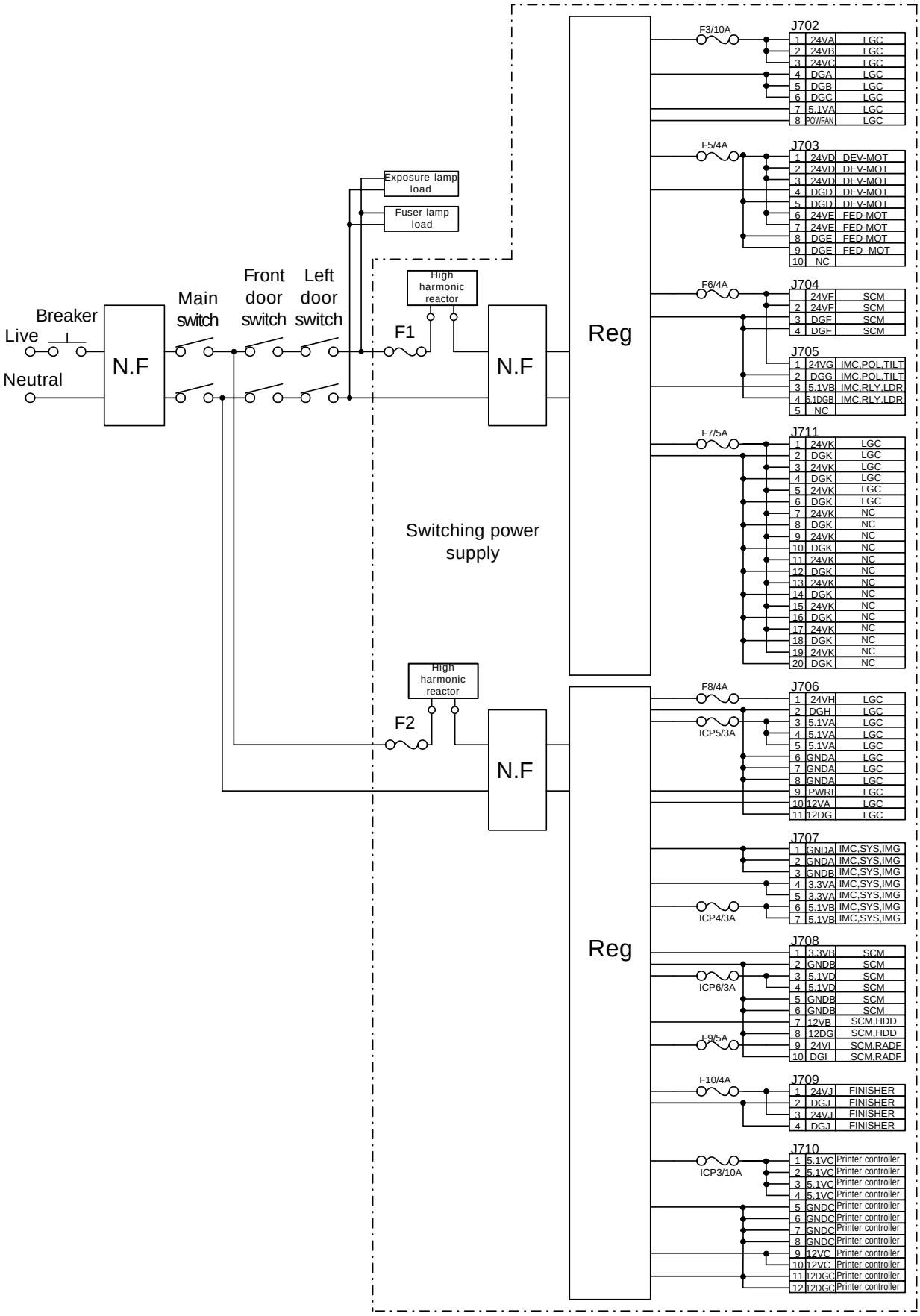
J706	for the LGC board
J707	for the IMC board, SYS board, RLY board and IMG board
J708	for the scanner and RADF
J709	for the finisher
J710	for the built-in printer controller (optional)

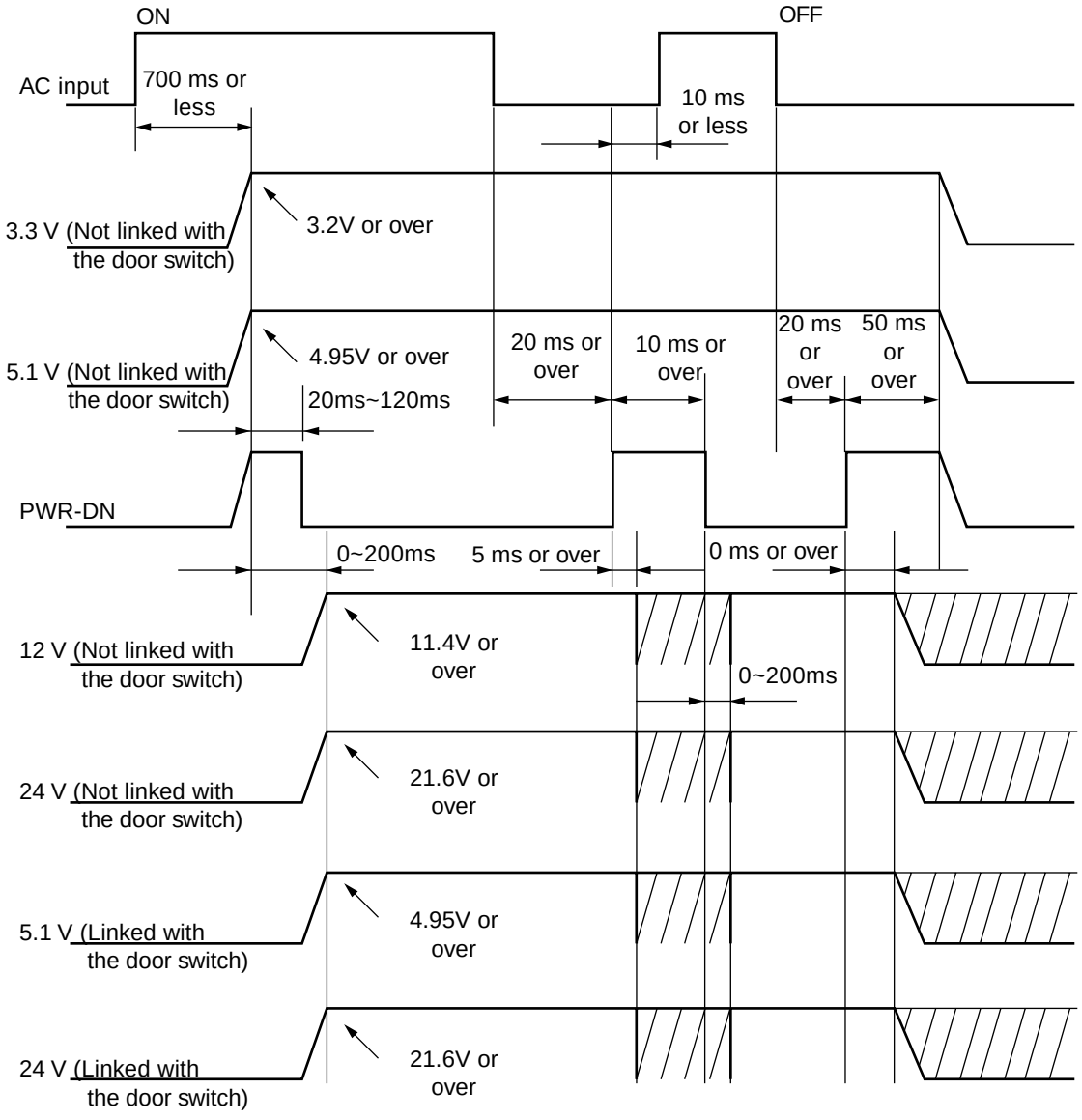
Linked with the door switch:

J702	for the LGC board
J703	for the developer motor and the paper feed motor
J704	for the scanner
J705	for the IMC board, RLY board, LDR board and the polygonal motor
J711	for the drum motors, the transfer belt motor and the LGC board

<Fuse rating>

F 1	12A/125V	Primary side
F 2	12A/125V	
F 3	12A/125V	Secondary side
F 5	4A/125V	
F 6	4A/125V	
F 7	5A/125V	
F 8	4A/125V	
F 9	5A/125V	
F10	4A/125V	
ICP3	12A/125V	
ICP4	3A/125V	
ICP5	3A/125V	
ICP6	3A/125V	

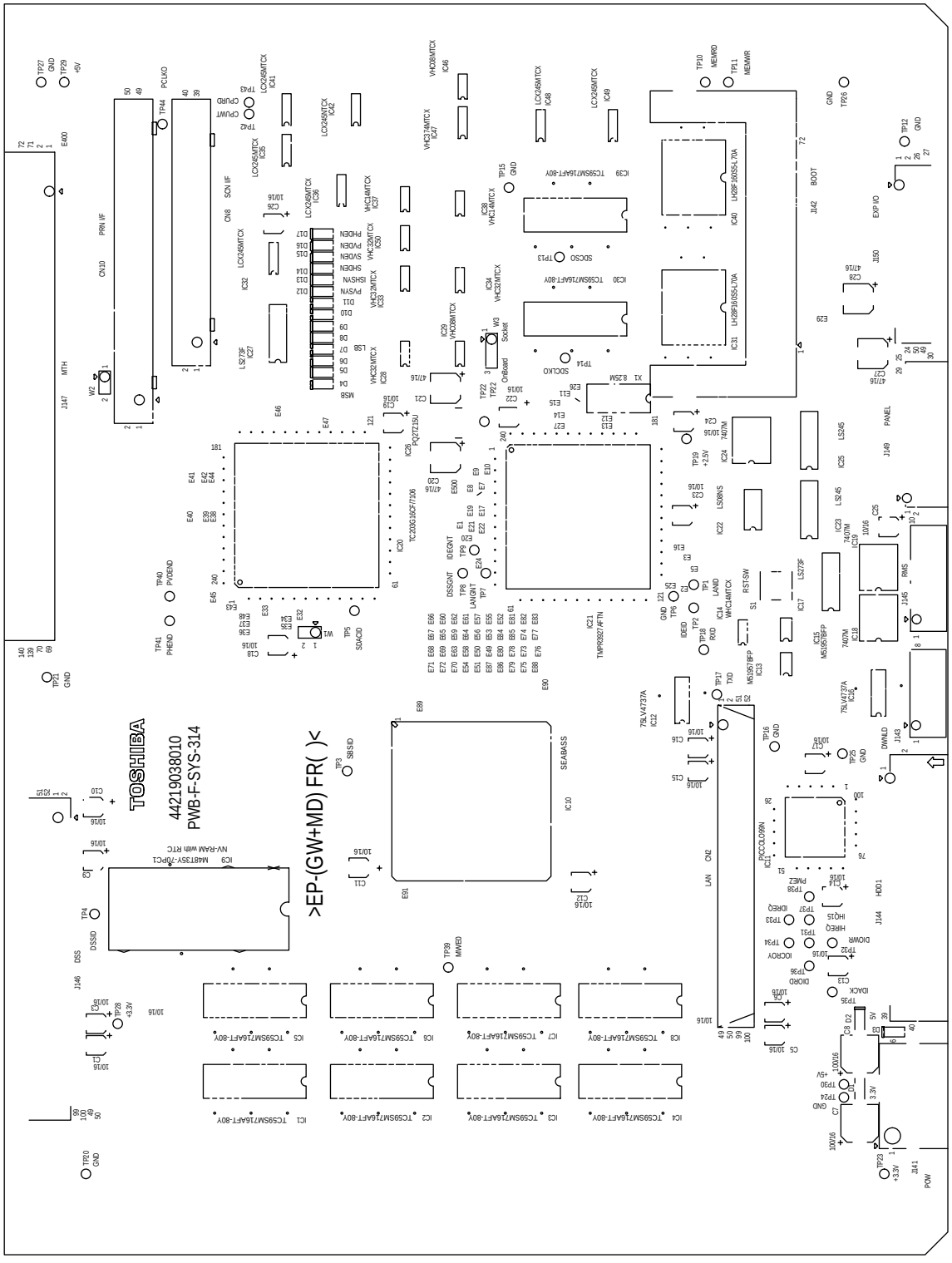

Breaker
Live
Neutral
N.F
Main switch
Front door switch
Left door switch
Exposure lamp load
Fuser lamp load
High harmonic reactor
F1
N.F
Reg
F3/10A
J702
1 24VA LGC
2 24VB LGC
3 24VC LGC
4 DGA LGC
5 DGB LGC
6 DGC LGC
7 5.1VA LGC
8 POWFAN LGC
F5/4A
J703
1 24VD DEV-MOT
2 24VD DEV-MOT
3 24VD DEV-MOT
4 DGD DEV-MOT
5 DGD DEV-MOT
6 24VE FED-MOT
7 24VE FED-MOT
8 DGE FED-MOT
9 DGE FED -MOT
10 NC
F6/4A
J704
24VF SCM
2 24VF SCM
3 DGF SCM
4 DGF SCM
J705
1 24VG IMC,POL,TILT
2 DGG IMC,POL,TILT
3 5.1VB IMC,RLY,LDR
4 5.1DGB IMC,RLY,LDR
5 NC
F7/5A
J711
1 24VK LGC
2 DGK LGC
3 24VK LGC
4 DGK LGC
5 24VK LGC
6 DGK LGC
7 24VK NC
8 DGK NC
9 24VK NC
10 DGK NC
11 24VK NC
12 DGK NC
13 24VK NC
14 DGK NC
15 24VK NC
16 DGK NC
17 24VK NC
18 DGK NC
19 24VK NC
20 DGK NC
Switching power supply
High harmonic reactor
F2
N.F
Reg
F8/4A
J706
1 24VH LGC
2 DGH LGC
3 5.1VA LGC
4 5.1VA LGC
5 5.1VA LGC
6 GNDA LGC
7 GNDA LGC
8 GNDA LGC
9 PWRD LGC
10 12VA LGC
11 12DG LGC
ICP5/3A
J707
1 GNDA IMC,SYS,IMG
2 GNDA IMC,SYS,IMG
3 GNDB IMC,SYS,IMG
4 3.3VA IMC,SYS,IMG
5 3.3VA IMC,SYS,IMG
6 5.1VB IMC,SYS,IMG
7 5.1VB IMC,SYS,IMG
ICP4/3A
J708
1 3.3VB SCM
2 GNDB SCM
3 5.1VD SCM
4 5.1VD SCM
5 GNDB SCM
6 GNDB SCM
7 12VB SCM,HDD
8 12DG SCM,HDD
9 24VI SCM,RADF
10 DGI SCM,RADF
ICP6/3A
F9/5A
F10/4A
J709
1 24VJ FINISHER
2 DGJ FINISHER
3 24VJ FINISHER
4 DGJ FINISHER
J710
1 5.1VC Printer controller
2 5.1VC Printer controller
3 5.1VC Printer controller
4 5.1VC Printer controller
5 GNDC Printer controller
6 GNDC Printer controller
7 GNDC Printer controller
8 GNDC Printer controller
9 12VC Printer controller
10 12VC Printer controller
11 12DGC Printer controller
12 12DGC Printer controller
ICP3/10A



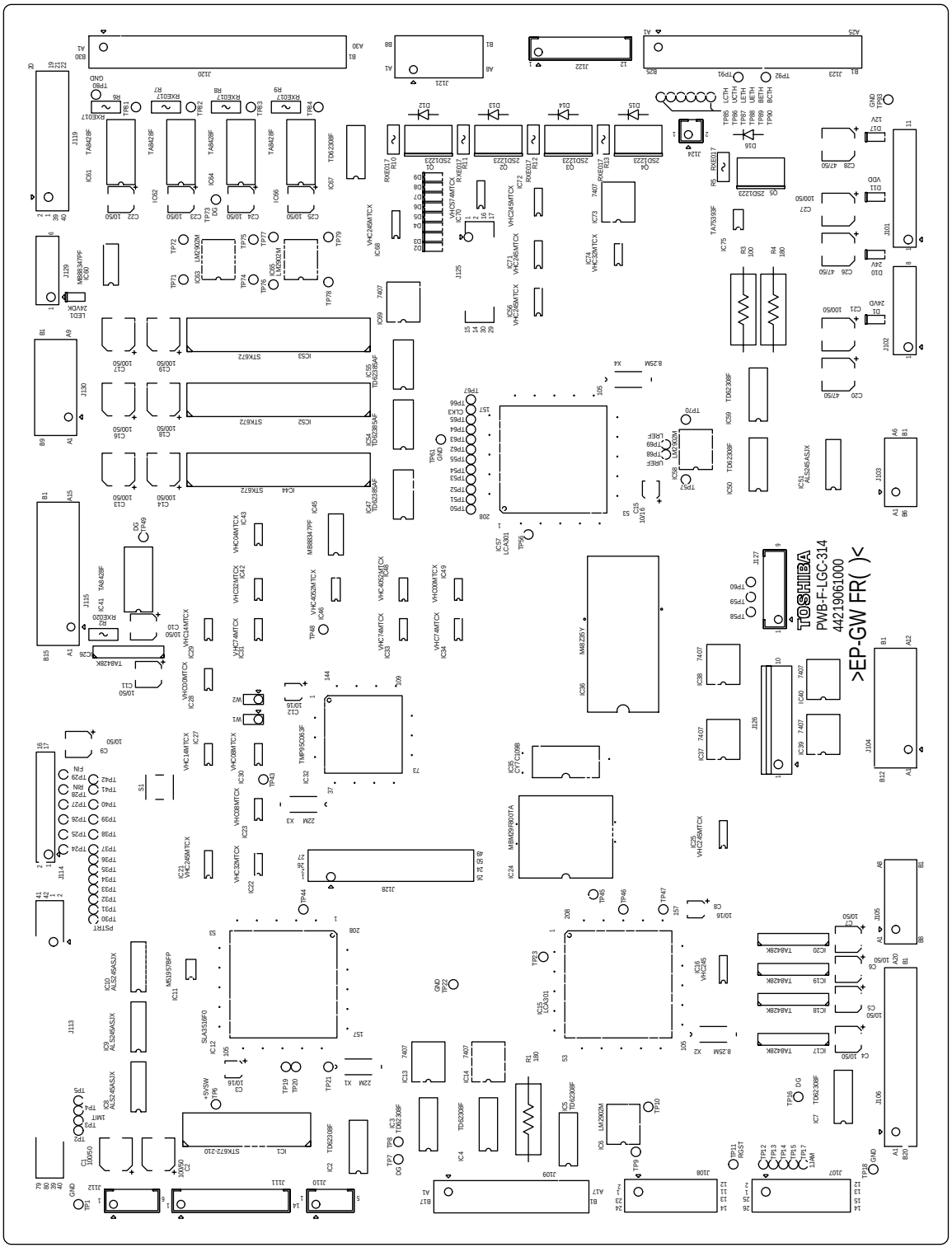
[Power supply sequence]

18. PC BOARDS

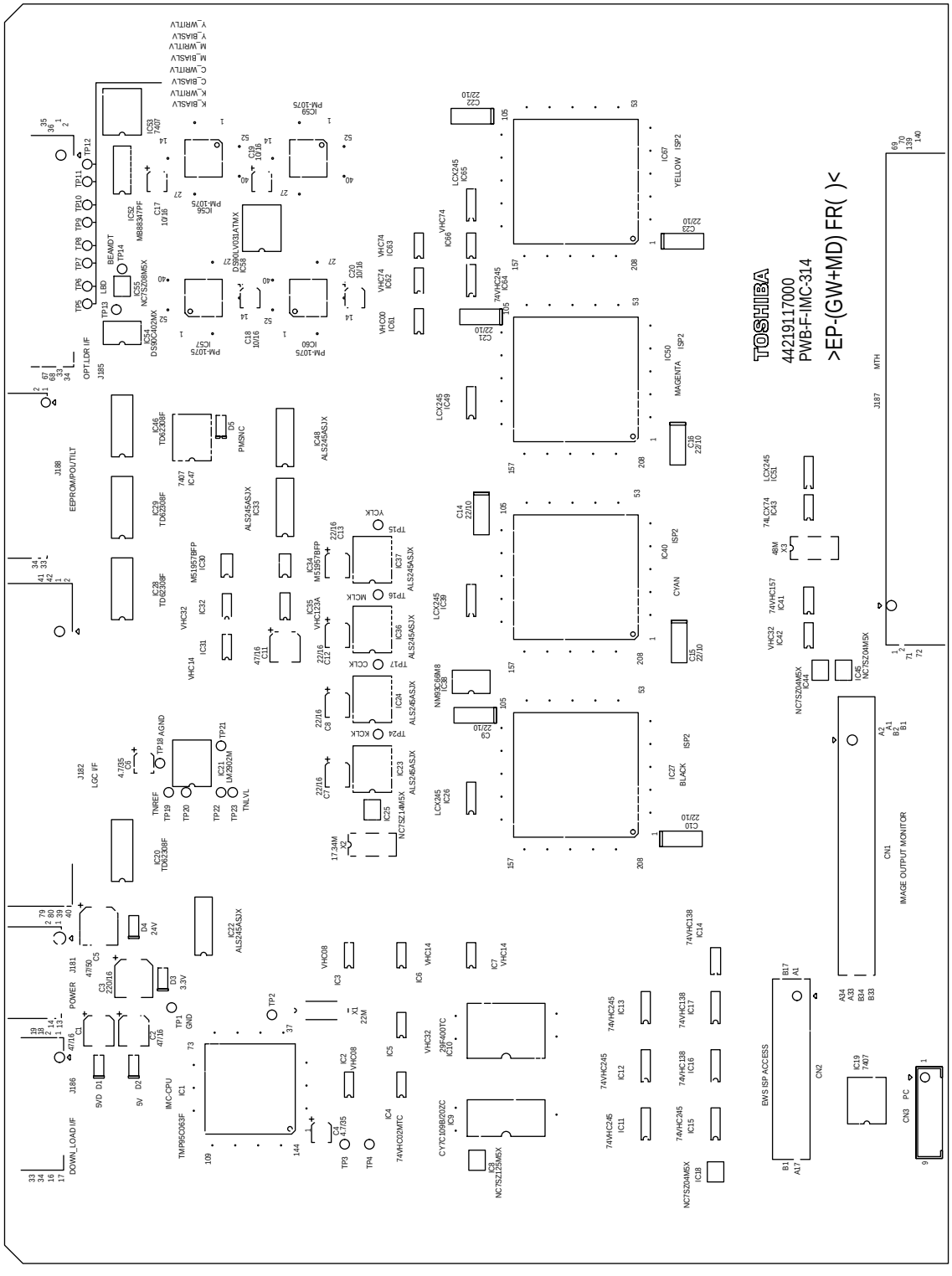
(1) PWA-F-SYS-314



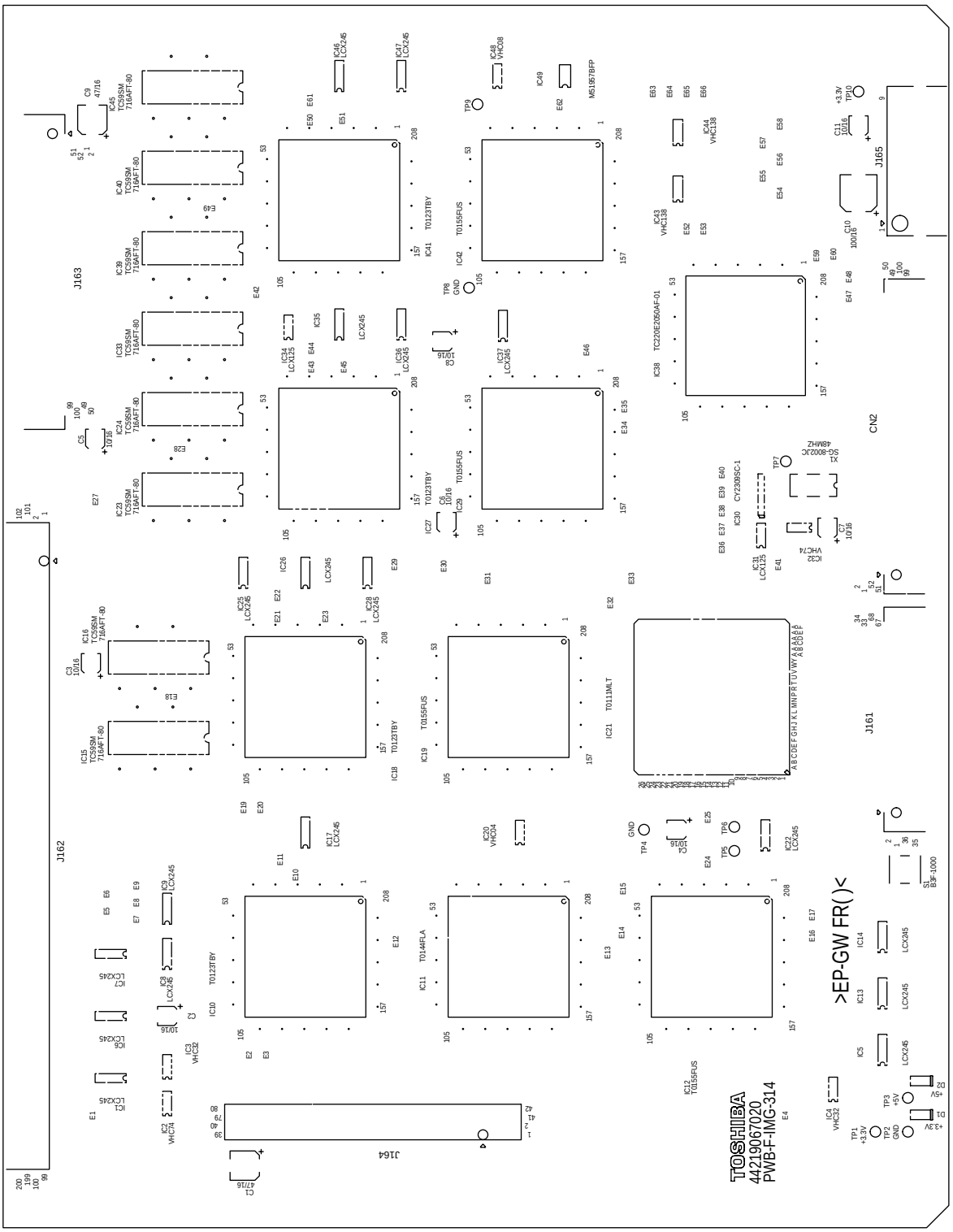
(2) PWA-F-LGC-314



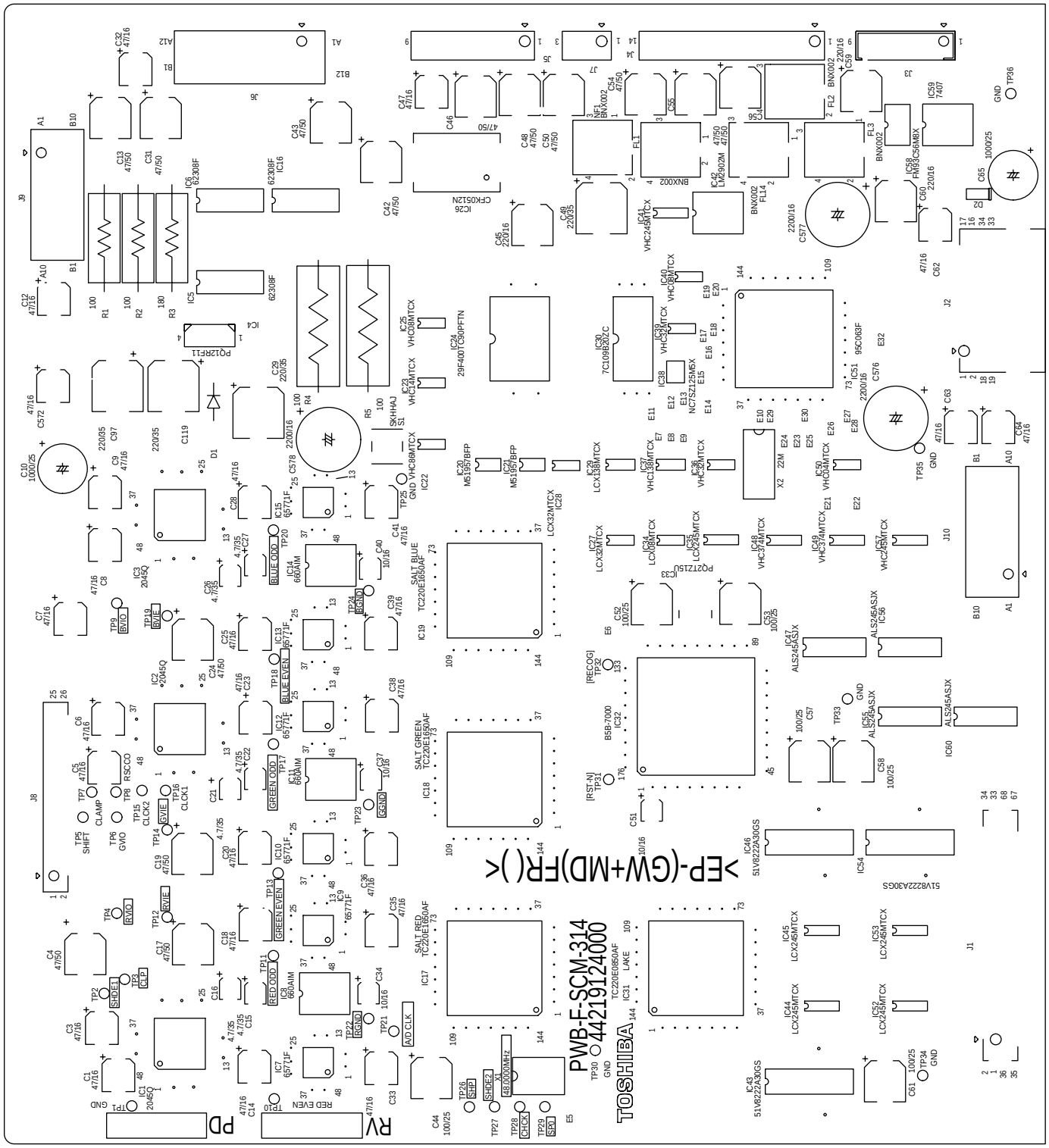
(3) PWA-F-IMC-314



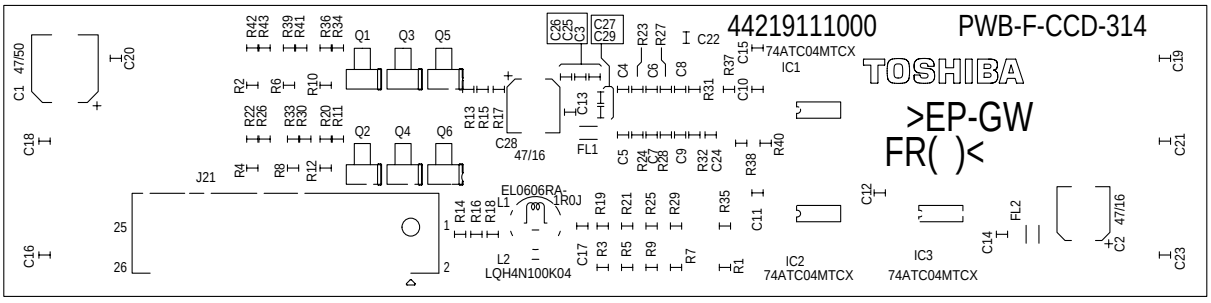
(4) PWA-F-IMG-314



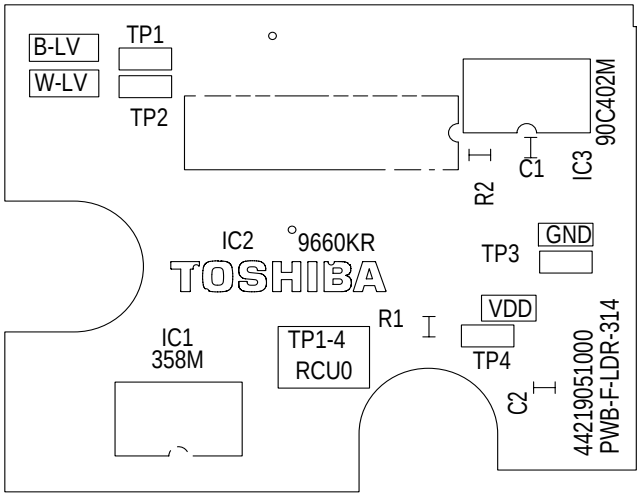
(5) PWA-F-SCM-314



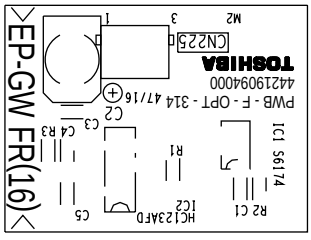
(6) PWA-F-CCD-314



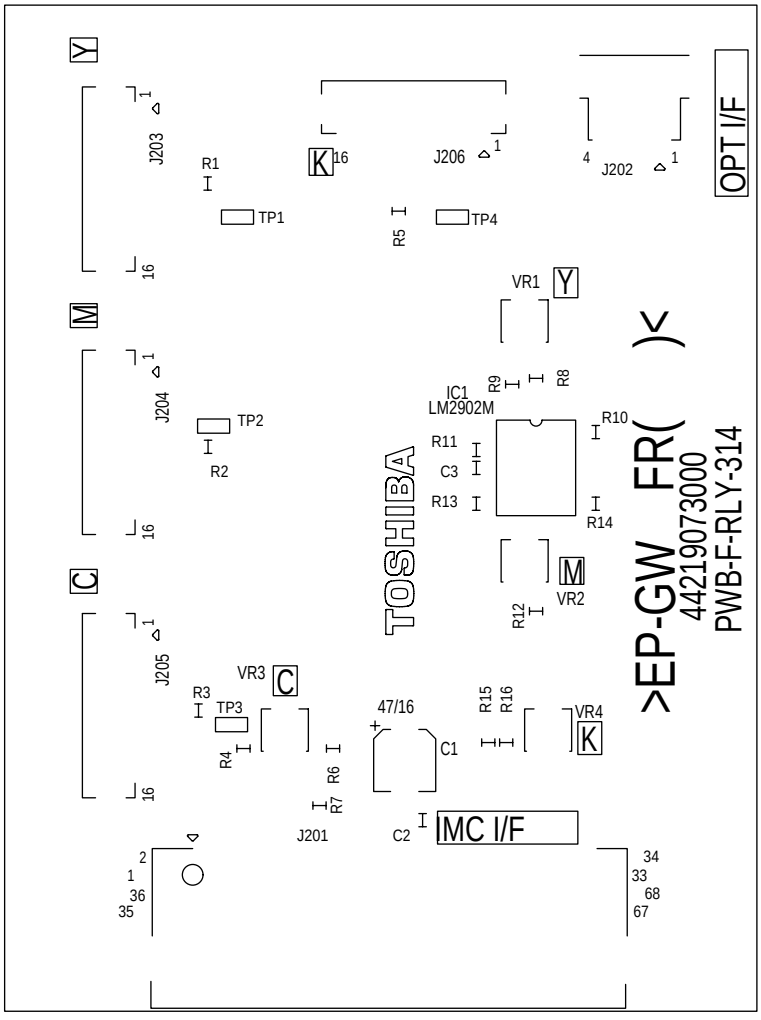
(7) PWA-F-LDR-314



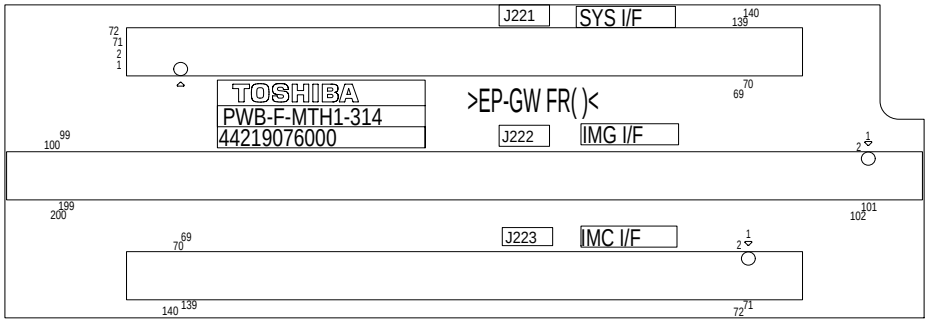
(8) PWA-F-OPT-314



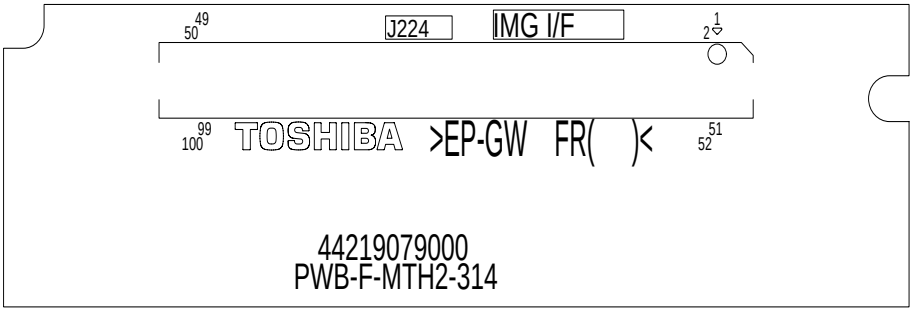
(9) PWA-F-RLY-310



(10) PWA-F-MTH1-314



(11) PWA-F-MTH2-314



(12) PWA-F-MAC-511