TOSHIBA

SERVICE MANUAL MULTIFUNCTIONAL DIGITAL SYSTEMS

e-STUDI0163/203



File No. SME05002400 R05092196100-TTEC VerB_2005-11

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GENERAL PRECAUTIONS REGARDING THE SERVICE FOR e-STUDIO163/203

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

1) Transportation/Installation

- When transporting/installing the equipment, employ two persons and be sure to hold the positions as shown in the figure.

The equipment is quite heavy and weighs approximately 30 kg (66.18 lb), therefore pay full attention when handling it.



- Be sure not to hold the movable parts or units when transporting the equipment.
- Be sure to use a dedicated outlet with AC 110 V / 13.2 A, 115 V or 127 V / 12 A, 220-240 V or 240 V / 8 A for its power source.
- The equipment must be grounded for safety.
- Select a suitable place for installation. Avoid excessive heat, high humidity, dust, vibration and direct sunlight.
- Provide proper ventilation since the equipment 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") on the rear.
- The equipment shall be installed near the socket outlet and shall be accessible.
- Be sure to fix and plug in the power cable securely after the installation so that no one trips over it.

2) General Precautions at Service

- Be sure to turn the power OFF and unplug the power cable during service (except for the service should be done with the power turned ON).
- Unplug the power cable and clean the area around the prongs of the plug and socket outlet once a year or more. A fire may occur when dust lies on this area.
- When the parts are disassembled, reassembly is the reverse of disassembly unless otherwise noted in this manual or other related documents. Be careful not to install small parts such as screws, washers, pins, E-rings, star washers in the wrong places.
- Basically, the equipment should not be operated with any parts removed or disassembled.
- The PC board must be stored in an anti-electrostatic bag and handled carefully using a wristband since the ICs on it may be damaged due to static electricity.

Caution: Before using the wristband, unplug the power cable of the equipment and make sure that there are no charged objects which are not insulated in the vicinity.

- Avoid expose to laser beam during service. This equipment uses a laser diode. Be sure not to expose your eyes to the laser beam. Do not insert reflecting parts or tools such as a screwdriver on the laser beam path. Remove all reflecting metals such as watches, rings, etc. before starting service.
- Be sure not to touch high-temperature sections such as the exposure lamp, fuser unit, damp heater and areas around them.
- Be sure not to touch high-voltage sections such as the chargers, developer, high-voltage transformer and power supply unit. Especially, the board of these components should not be touched since the electric charge may remain in the capacitors, etc. on them even after the power is turned OFF.
- Make sure that the equipment will not operate before touching potentially dangerous places (e.g. rotating/operating sections such as gears, belts pulleys, fans and laser beam exit of the laser optical unit).
- Be careful when removing the covers since there might be the parts with very sharp edges underneath.
- When servicing the equipment with the power turned ON, be sure not to touch live sections and rotating/operating sections. Avoid exposing your eyes to laser beam.
- Use designated jigs and tools.
- Use recommended measuring instruments or equivalents.
- Return the equipment to the original state and check the operation when the service is finished.

3) Important Service Parts for Safety

- The breaker, door switch, fuse, thermostat, thermofuse, thermistor, IC-RAMs including lithium batteries, etc. are particularly important for safety. Be sure to handle/install them properly. If these parts are short-circuited and their functions become ineffective, they may result in fatal accidents such as burnout. Do not allow a short-circuit or do not use the parts not recommended by Toshiba TEC Corporation.

4) Cautionary Labels

- During servicing, be sure to check the rating plate and cautionary labels such as "Unplug the power cable during service", "CAUTION. HOT", "CAUTION. HIGH VOLTAGE", "CAUTION. LASER BEAM", etc. to see if there is any dirt on their surface and if they are properly stuck to the equipment.

5) Disposal of the Equipment, Supplies, Packing Materials, Used Batteries and IC-RAMs

- Regarding the recovery and disposal of the equipment, supplies, packing materials, used batteries and IC-RAMs including lithium batteries, follow the relevant local regulations or rules.

Caution:

Dispose of used batteries and IC-RAMs including lithium batteries according to this manual. Attention:

Se débarrasser de batteries et IC-RAMs usés y compris les batteries en lithium selon ce manuel. **Vorsicht:**

Entsorgung der gebrauchten Batterien und IC-RAMs (inclusive der Lithium-Batterie) nach diesem Handbuch.

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SPECIFICATIONS / ACCESSORIES / OPTIONS / SUPPLIES 1.

Specifications 1.1

Values in [] are for e- STUDIO203 in case that the specification is different among e-STUDIO163 and e-STUDIO203.

 Copy process Type Original table Accepted originals 	Indirect electrophotographic process (dry) Desktop type Fixed type (the left rear corner used as guide to place originals) Sheet, book and 3-dimensional object. The automatic document feeder (ADF) only accepts paper which are not pasted or stapled. (Single-sided orig- inals: 50 to 127 g/m ² /13 to 34 lb. Bond) Carbon paper are not acceptable either. Maximum size: A3/LD
--	---

• Copy speed (Copies/min.)

e-STUDIO163

Dener eize	Drowor	Bypass feed		PFU
Paper size	Drawer	Size specified	Size not specified	PFU
A4, B5, LT	16	16	11	16
A5-R, ST-R	-	16	11	-
A4-R, B5-R, LT-R	15.5	15.5	11	15.5
B4, LG, FOLIO, COMPUTER	13	13	11	13
A3, LD	11	11	11	11

e-STUDIO203

Paper size	Drawer	Bypass feed		PFU
Faper Size	Diawei	Size specified	Size not specified	FFU
A4, B5, LT	20	20	11	20
A5-R, ST-R	-	20	11	-
A4-R, B5-R, LT-R	15.5	15.5	11	15.5
B4, LG, FOLIO, COMPUTER	13	13	11	13
A3, LD	11	11	11	11

* "-" means "Not acceptable".

* The copy speed in the above table are available when originals are manually placed for single side, multiple copying.

* When the ADF is used, the copy speed of 16[20] sheets per minute is only available under the following conditions:

• Original/Mode:

Single side original/A4/LT size. APS/automatic density are not selected. 16[20] or more.

• Number of sheets:

 Reproduction ratio: 100% 1

Copy speed for thick paper (Copies/min.) e-STUDIO163/203

Dener eize	Drower	Bypass feed		DELL
Paper size	Drawer	Size specified	Size not specified	PFU
A4, B5, LT	- [-]	16 [18.5]	10.5 [10.5]	- [-]
A5-R, ST-R	- [-]	16 [18.5]	10.5 [10.5]	- [-]
A4-R, B5-R, LT-R	- [-]	14.5 [14.5]	10.5 [10.5]	- [-]
B4, LG, FOLIO, COMPUTER	- [-]	12 [12]	10.5 [10.5]	- [-]
A3, LD	- [-]	10.5 [10.5]	10.5 [10.5]	- [-]

Thick 1 (81 g/m² to 105 g/m², 21.3 lb. Bond to 28 lb. Bond)

Thick 2 (106 g/m² to 163 g/m², 28 lb. Bond to 90 lb. Index)

Papar aire	Drowor	Bypass feed		PFU
Paper size	Drawer	Size specified	Size not specified	PFU
A4, B5, LT	- [-]	16 [18.5]	10.5 [10.5]	- [-]
A5-R, ST-R	- [-]	16 [18.5]	10.5 [10.5]	- [-]
A4-R, B5-R, LT-R	- [-]	14.5 [14.5]	10.5 [10.5]	- [-]
B4, LG, FOLIO, COMPUTER	- [-]	12 [12]	10.5 [10.5]	- [-]
A3, LD	- [-]	10.5 [10.5]	10.5 [10.5]	- [-]

* System copy speed

Copy mode		Se	ec.
Copy mode		e-STUDIO163	e-STUDIO203
Single-sided originals	1 set	TBD	TBD
\downarrow	3 sets	TBD	TBD
Single-sided copies	5 sets	TBD	TBD

- * The system copy speed, including scanning time, is available when 10 sheets of A4/LT size original are set on ADF and one of the copy modes in the above table is selected. The period of time from pressing [START] to the paper exit completely out of the equipment based on the actually measured value.
- * Upper drawer is selected and copying is at the non-sort mode.
- * Automatic copy density, APS/AMS are turned off.
- Copy paper

	Drawer	PFU	Bypass copy	Remarks
Size	A3, A4, A4-R B5-R, LD, LG FOLIO, COM 13"LG, 8.5" x 16K, 16K-R	, LT, LT-R, PUTER,	A3 to A5-R, LD to ST-R, FOLIO, COM- PUTER, 13"LG, 8.5" x 8.5", 8K, 16K, 16K-R (Non-standard or user-specified sizes can be set.)	
Weight	64 to 80 g/m ²	2	50 to 163 g/m ² (Single paper feeding) 64 to 80 g/m ² (Continuous feeding)	
Special paper	-		Tracing paper, labels, OHP film (thickness: 80 μm or thicker),	These special papers rec- ommended by Toshiba Tec

- First copy time Approx. TBD sec. or less (A4/LT, 100%, original placed manually)
- Warming-up time...... Approx. 25 sec. (temperature: 20°C)
- Multiple copying Up to 999 copies; Key in set numbers
- Reproduction ratio Actual ratio: 100±0.5% Zooming: 25 to 200% in increments of 1%
- Resolution/Gradation Scanning: 600 dpi x 600 dpi Printing: Equivalent to 2400 dpi x 600 dpi Gradation: 256 steps
- Eliminated portion Leading edges: 3.0±2.0 mm, Side/trailing edges: 2.0±2.0 mm (copy) Leading / trailing edges: 5.0±2.0 mm, Side edges: 5.0±2.0 mm (print)
- Paper feeding Standard drawer: 1 drawer (stack height TBD mm, equivalent to 250 sheets; 64 to 80 g/m² (17 to 22 lb. Bond))
 - Paper Feed Unit (PFU): Option (One drawer: stack height TBD mm, equivalent to 250 sheets; 64 to 80 g/m² (17 to 22 lb. Bond))
 - Bypass feeding:

Stack height TBD mm: equivalent to 100 sheets; 64 to 80 g/m² (17 to 22 lb. Bond)

• Capacity of originals in the automatic document feeder (Option)

..... A3 to A5-R, LD to ST-R:

100 sheets / 80 g/m² (Stack height 16 mm or less)

- Toner supplyAutomatic toner density detection/supply
 Toner cartridge replacing method (There is a recovered toner supply
 mechanism.)
- Density control Automatic density mode and manual density mode selectable in 7
 steps
- Weight......Approximately TBD kg (TBD lb.) (include the developer material and drum)
- Power requirements.....AC 110 V / 13.2 A, 115 V or 127 V / 12 A 220-240 V or 240 V / 8 A (50/60 Hz)
 - * The acceptable value of each voltage is ±10%.
- Power consumption 1.5 kW or less (115 V series, 200 V series)
 * The electric power is supplied to the ADF through the equipment.
- Total counter Electronical counter
- Dimensions of the equipment See the figure below (TBD)

T.B.D.

Fig. 1-1

1.2 Accessories

Unpacking/setup instruction	1 set
Operator's manual	1 pc. (except for MJD)
Operator's manual pocket	1 pc.
Power cable	1 pc.
Warranty sheet	1 pc. (for NAD)
Setup report	1 set (for NAD and MJD)
Customer satisfaction card	1 pc. (for MJD)
Drum (installed inside of the equipment)	1 pc.
Toner cartridge	1 pc. (except for NAD, MJD)
Developer material	1 pc. (except for NAD, MJD)
Blind seal	1 pc.
Rubber plug	5 pcs.
CD-ROM	4 pcs.
Transfer charger wire cleaner (installed inside of the transfer cover)	1 pc.
Toner	1 pc.

* Machine version

NAD:	North America
ASD:	Central and South America / Hong Kong
AUD:	Australia
MJD:	Europe
ASU:	Asia
SAD:	Saudi Arabia
IRD:	Iran
CND:	China
TWD:	Taiwan
JPD:	Japan

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1.3 Options

Platen Cover	KA-1640 PC
Automatic Document Feeder (ADF)	MR-2017
Paper Feed Unit (PFU)	MY-1027
Expansion Memory	GC-1240

1.4 Supplies

Drum	TBD
Toner cartridge	TBD
Developer	TBD

1.5 System List



Fig. 1-2

2. OUTLINE OF THE MACHINE

2.1 Sectional View

1) Front side



A1	Original glass	
A2	ADF original glass	
A3	Contact image sensor unit (CIS)	
A4	Scanner damp heater (Left side)	DH1
A5	Scanner damp heater (Right side)	DH2
A6	Scanner damp heater thermostat	THMO2
B1	Laser optical unit	
B2	Polygonal motor	M4
C1	Pickup roller	
C2	Separation finger	
C3	Paper empty sensor	S7
C4	Registration sensor	S4
C5	Registration roller	
E1	Bypass pickup roller	
E2	Bypass feed roller	
E3	Bypass separation pad	

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E4	Bypass paper sensor	S8
E5	Bypass tray	
F1	Needle electrode	
F2	Main charger	
F3	Main charger grid	
F4	Toner cartridge	
G1	Transfer charger wire	
G2	Separation charger wire	
G3	Transfer guide roller	
H1	Drum	
H2	Discharge LED	
H3	Drum cleaning blade	
H4	Recovery blade	
H5	Drum separation finger	
11	Developer sleeve (Magnetic roller)	
12	Mixer-1	
13	Mixer-2	
14	Mixer-3	
15	Doctor blade	
16	Auto-toner sensor	S6
17	Toner recovery auger	
18	Toner recycle auger	
19	Drum thermistor	THMS4
110	Drum damp heater	DH3
l11	Drum damp heater thermostat	THMO3
J1	Fuser roller	
J2	Pressure roller	
J3	Fuser roller separation finger	
J4	Center heater lamp	LAMP1
J5	Side heater lamp	LAMP2
J6	Center/Side/Edge thermistor	THMS1/2/3
J7	Fuser thermostat	THMO1
J8	Exit roller	
J9	Exit sensor	S5
K1	Front cover opening/closing switch	SW4
K2	Front cover opening/closing interlock switch	SW3
К3	Temperature/humidity sensor	S3
K4	Switching regulator	

2) Rear side



M1	Scan motor
M2	Toner motor
M3	Main motor
M6	Switching regulator cooling fan
S1	CIS home position sensor
S2	Platen sensor
SW5	Drawer detection switch
CLT1	Registration clutch
SOL1	Pickup solenoid
SOL2	Bypass pickup solenoid

2.2 Electric Parts Layout

[A] Scanner, control panel



Fig. 2-3



Fig. 2-4



Fig. 2-5



Fig. 2-6



Fig. 2-7



Fig. 2-8



Fig. 2-9

2.3 Symbols and Functions of Various Components

The column "P-I" shows the page and item number in the parts list. 1) Motors

Symbol	Name	Function	Remarks	P-l
M1	SCAN-MOT Scan motor	Driving the CIS	Fig. 2-3	
M2	TNR-MOT Toner motor	Supplying the toner	Fig. 2-5	
М3	MAIN-MOT Main motor	Driving the drum, developer unit, regis- tration roller, transport roller, feed roller, cleaning unit	Fig. 2-7	
M4	M/DC-POL Polygonal motor	Driving the polygonal mirror	Fig. 2-5	
M5	EXT-FAN-MOT Exhaust fan	Exhausting ozone and cooling down the equipment inside	Fig. 2-6	
M6	PS-FAN-MOT Switching regulator cooling fan	Cooling down the switching regulator	Fig. 2-4	

2) Sensors and switches

Symbol	Name	Function	Remarks	P-l
S1	HOME-SNR CIS home position sensor	Detecting CIS home position	Fig. 2-3	
S2	PLTN-SNR Platen sensor	Detecting the opening/closing of platen cover or RADF	Fig. 2-3	
S3	TEMP/HUMI-SNR Temperature/humidity sensor	Detecting the temperature and humidity inside the equipment	Fig. 2-4	
S4	RGST-SNR Registration sensor	Detecting the transporting paper at the registration roller section	Fig. 2-7	
S5	EXIT-SNR Exit sensor	Detecting the transporting paper at the exit section	Fig. 2-5	
S6	ATTNR-SNR Auto-toner sensor	Detecting the density of toner in the developer unit	Fig. 2-6	
S7	EMP-SNR Paper empty sensor	Detecting presence/absence of paper in the drawer	Fig. 2-8	
S8	SFB-SNR Bypass paper sensor	Detecting presence/absence of paper on the bypass tray	Fig. 2-9	
SW1	MAIN-SW Main switch	Turning ON/OFF of the equipment	Fig. 2-4	
SW2	ADU-COV-INTLCK-SW ADU cover opening/closing interlock switch	Controlling cutoff and supply of the 24V voltage by opening/closing of the ADU cover	Fig. 2-4	
SW3	FRNT-COV-INTLCK-SW Front cover opening/closing interlock switch	Controlling cutoff and supply of the 24V voltage by opening/closing of the front cover	Fig. 2-4	
SW4	FRNT-COV-SW Front cover opening/closing switch	Detecting the opening/closing of the front cover	Fig. 2-4	
SW5	CST-SW Drawer detection switch	Detecting presence/absence of the drawer	Fig. 2-8	

3) Electromagnetic clutches

Symbol	Name	Function	Remarks	P-I
CLT1	RGST-CLT Registration clutch	Driving the registration roller	Fig. 2-7	

4) Solenoids

Symbol	Name	Function	Remarks	P-I
SOL1	CST-SOL Pickup solenoid	Controlling the power transmission of the feed roller	Fig. 2-7	
SOL2	SFB-SOL Bypass pickup solenoid	Controlling the power transmission of the bypass pickup roller	Fig. 2-9	

5) PC boards

Symbol	Name	Function	Remarks	P-I
MAIN	PWA-F-MAIN Main PC board (MAIN board)	Controlling the whole system and image processing	Fig. 2-7	
SRAM	PWA-F-SRAM SRAM PC board (SRAM board)	Storing the setting information of the equipment	Fig. 2-7	
LDR	PWA-F-LDR Laser driving PC board (LDR board)	Driving the laser diode	Fig. 2-5	
SNS	PWA-F-SNS H-sync signal detection PC board (SNS board)	Detecting the laser beam position	Fig. 2-5	
LPNL	PWA-F-LPNL Control panel PC board-L (LPNL board)	Detecting the button entry and control- ling LED on the control panel	Fig. 2-3	
CTIF	PWA-F-CTIF Toner cartridge interface PC board (CTIF board)	Interface for detecting the toner car- tridge (Detecting the CTRG board)	Fig. 2-5	
CTRG	PWA-F-CTRG Toner cartridge PC board (CTRG board)	Storing the status of the toner cartridge	Fig. 2-5	
FUS	PWA-F-FUS Fuse PC board (FUS board)	Supplying power to each damp heater	Fig. 2-6	

6) Lamps and heaters

Symbol	Name	Function	Remarks	P-I
LAMP1	CNTR-LAMP Center heater lamp	Heating the center section of the fuser roller	Fig. 2-5	
LAMP2	SIDE-LAMP Side heater lamp	Heating the section of both sides of the fuser roller	Fig. 2-5	
ERS	LP-ERS Discharge LED	Removing the residual charge from the drum surface	Fig. 2-6	
DH1	SCN-DH-L Scanner damp heater (Left)	Preventing condensation in the scan- ner unit	Fig. 2-3	
DH2	SCN-DH-R Scanner damp heater (Right)	Preventing condensation in the scan- ner unit	Fig. 2-3	
DH3	DRM-DH Drum damp heater	Preventing condensation of the drum	Fig. 2-6	

7) Thermistors and thermostats

Symbol	Name	Function	Remarks	P-I
THMS1	THMS-C-HTR Center thermistor	Detecting the surface temperature at the center of the fuser roller (for con- trolling the center heater lamp)	Fig. 2-5	
THMS2	THMS-S-HTR Side thermistor	Detecting the surface temperature at the rear side of the fuser roller (for con- trolling the side heater lamp)	Fig. 2-5	
THMS3	THMS-EDG-HTR Edge thermistor	Detecting the surface temperature at the edge of the rear side of the fuser roller (for preventing overheating)	Fig. 2-5	
THMS4	THMS-DRM Drum thermistor	Detecting the temperature on the drum surface	Fig. 2-6	
THMO1	THERMO-FSR Fuser thermostat	Preventing overheating in the fuser unit	Fig. 2-5	
THMO2	THERMO-SCN-DH Scanner damp heater thermostat	Controlling the temperature of the scanner damp heater	Fig. 2-3	
THMO3	THERMO-DRM-DH Drum damp heater thermostat	Controlling the temperature of the drum damp heater	Fig. 2-6	

8) Others

Symbol	Name	Function	Remarks	P-l
CIS	CIS Contact image sensor unit	Reading originals	Fig. 2-3	
PS	PS-ACC Switching regulator	 Generating DC voltage and supplying it to each section of the equipment Generating high voltage and supplying it to the main charger, developer, transfer and separation units Supplying AC power to the heater lamp 	Fig. 2-4	

2.4 General Description

2.4.1 System block diagram



Fig. 2-10

2.4.2 Construction of boards

[1] Construction diagram of boards

This system consists of the following including the MAIN board as a main board.



Fig. 2-11

[2] Function of each board

• MAIN board:

This is the board taking the leading part in all systems. It consists of the SoC, ASIC, memory (SDRAM, Flash ROM), etc. In the SoC (System control), which is a core of this MAIN board, the functions of the CPU, image processing, page memory control, CODEC, external interface (USB) control, etc. are embedded and performed by one chip.

Based on the data input from the control panel, the SoC controls each system, such as the ASIC, each memory, CIS unit and laser unit, and thus permitting the scanning of originals and the printing of data.

• SRAM board:

This is the board on which the SRAM for storing the user's setting information and counter value and its backup function are mounted. When the MAIN board is replaced, attaching this board to the new MAIN board can assume the data of the previous equipment.

• LPNL board:

This is the board on which each button switch and LED on the control panel are mounted.

CTRG board:

This is the board on which the IC chip for storing information about the toner cartridge (number of prints, identification data, etc.) is mounted.

· CTIF board:

This is the interface board with the CTRG board in the toner cartridge. Information written in the IC chip on the CTRG board is read into the SoC on the MAIN board through this board.

· LDR board:

This is the board on which the laser diode and the ASIC are mounted. The laser is emitted based on the image data signal output from the SoC on the MAIN board.

· SNS board:

This is the board on which the light sensor for detecting the radiating position of the laser is mounted. It outputs the H-sync signal to the SoC on the MAIN board.

• PS-ACC:

This is the unit to generate each DC (high/low) voltage, which is used in the equipment, from the external AC electric power input. This is then provided to each electric part.

· FUS board:

This is the board to provide AC electric power for driving the damp heater.

2.5 Disassembly and Replacement of Covers

[A] Front cover

- (1) Open the front cover.
- (2) Release the upper hinge.
- (3) Take off the front cover while lifting it up.



Fig. 2-12

[B] Inner tray

(1) Remove 2 screws and take off the Inner tray.



Fig. 2-13
[C] Left cover

- (1) Take off the Inner tray. P.2-18 "[B] Inner tray"
- (2) Remove 3 screws and take off the left cover.

Note:

When installing the left cover, be sure to fit in the upper insert of the cover beneath the scanner cover before fitting in the claws under the cover.



Fig. 2-14

[D] Tray rear cover

- (1) Take off the left cover. P.2-19 "[C] Left cover"
- (2) Take off the tray rear cover.



Fig. 2-15

[E] Front right cover

- (1) Take off the front cover. P.2-18 "[A] Front cover"
- (2) Pull out the toner cartridge.
- (3) Open the ADU cover.
- (4) Remove 2 screws and take off the front right cover.



Fig. 2-16

[F] Front upper cover

(1) Remove 1 screw and take off the front upper cover.



Fig. 2-17

[G] ADU cover

- (1) Open the bypass tray.
- (2) Open the ADU cover.
- (3) Open the transfer unit and release the ADU stopper on the front side.
- (4) Remove 1 screw from the ADU stopper on the rear side.

Note:

Be careful not to fall off the ADU cover when the screws are removed from the ADU stopper.



Fig. 2-18

(5) Take off the ADU cover while sliding it toward the right.



Fig. 2-19

[H] Right front cover

- (1) Take off the front cover. P.2-18 "[A] Front cover"
- (2) Open the ADU cover.
- (3) Pull out the drawer.
- (4) Remove 2 screws and take off the right front cover.



Fig. 2-20

[I] Right rear cover

- (1) Open the ADU cover.
- (2) Remove 1 screw and take off the ADU stopper on the rear side.
- (3) Take off the 2 screw and take off the right rear cover.



Fig. 2-21

[J] Rear cover

(1) Remove 6 screws and take off the rear cover.



Fig. 2-22

2.6 Disassembly and Replacement of PC boards

[A] MAIN board (MAIN)

- (1) Take off the rear cover. □ P.2-22 "[J] Rear cover"
- (2) Disconnect 14 connectors.





(3) Remove 5 screws and take off the MAIN board.



Fig. 2-24

[B] Switching regulator unit

- (1) Take off the left cover. P.2-19 "[C] Left cover"
- (2) Disconnect 14 connectors.



Fig. 2-25

Note:

Connect the connectors to the correct faston terminals on the switching regulator board. Connector Harness

- A. White White-thick _ B. White Red-thick C. White Red-thin _ D. White _ Black-thin E. Blue White-thick Black-thick
- F. Red



Fig. 2-26

(3) Remove 4 screws, 1 ground wire, slide the switching regulator unit with the whole case slightly to the front, and then lift it up to take it off.



Fig. 2-27

(4) Disconnect 2 connectors.





(5) Remove 8 screws and take off the switching regulator board.



Fig. 2-29

2.7 Removal and Installation of Options

[A] MR-2017 (Automatic Document Feeder (ADF))

- (1) Turn the power OFF and unplug the power cable.
- (2) Take off the connector cover.



Fig. 2-30

(3) Disconnect the connector.



Fig. 2-31

(4) Remove 1 screw on the rear right side.



Fig. 2-32

(5) Remove 1 screw and 1 washer on the rear left side.





(6) Open the ADF.



Fig. 2-34

(7) Remove 2 screws on the front side.



Fig. 2-35

2

(8) Slide the ADF backward and take off by lifting it up.



Fig. 2-36

[B] MY-1027 (Paper Feed Unit (PFU))

- (1) Turn the power OFF and unplug the power cable.
- (2) Take off the Rear cover. P.2-22 "[J] Rear cover"
- (3) Remove the ground wire.



Fig. 2-37

(4) Disconnect the connector.



Fig. 2-38

(5) Take off the drawer of the equipment and PFU drawer.



Fig. 2-39

(6) Remove 1 screw and take off 1 fixing brackets on the front left side.

ets on the front right side.



Fig. 2-40

(7) Remove 1 screw and take off 1 fixing brack-6

Fig. 2-41

(8) Remove 1 screw and take off 1 fixing brackets on the rear left side.



Fig. 2-42

(9) Remove 1 screw and take off 1 fixing brackets on the rear right side.



Fig. 2-43

(10) Lift up the equipment and take off the PFU.



Fig. 2-44

3. COPY PROCESS

3.1 General Description of Copying Process





- (1) Charging: Applies negative charge on the surface of the photoconductive drum.
- (2) Data reading: The images on the original are converted into electrical signals.
- ↓
 (3) Data writing: The electrical signals are con- (9) verted into light signal (laser emission) which exposes the surface of the photo-

conductive drum.

J,

- (4) Development: Negatively-charged toner adheres to the photoconductive drum and forms visible image.
- (5) Transfer bias: Improves transfer efficiency. \checkmark
- (6) Transfer: Transfers the visible toner image on the photoconductive drum onto paper.
 - \mathbf{V}

- (7) Separation: Separates paper with the toner image from the photoconductive drum.
 - ↓ tonor in
- (8) Fusing: Fuses the toner image onto the paper by applying heat and pressure.
 -) Cleaning: Scrapes off the residual toner from the drum.

 \mathbf{V}

(10) Discharging: Eliminates the residual negative charge from the surface of the photoconductive drum.

3.2 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 photoconductor has the following property: when it is exposed to light, the electrical resistance it possesses increases or decreases according to the strength of the light. Example:

- Strong light

Resistance is decreased (works as a conductor.)

- Weak light

Resistance is increased (works as an insulator.)

Photoconductive laver Base

Structure of the photoconductive drum (Example of OPC)

Fig. 3-2

[Formation of electrostatic latent image]

In the processes of charging, data reading, data writing, discharging described later, negative potential of the areas on the drum corresponding to black areas of the original are eliminated, while the areas on the drum corresponding to white areas retains the negative charge.

As this image on the drum formed by the negative potential is not visible, it is called an "electrostatic latent image."



Electric potential of the photoconductive drum

Fig. 3-3

2) Charging

Charging is the process to apply charge evenly on the drum surface.

The needle electrode produces negative corona discharge is controlled by the grid, allowing the drum surface to be evenly charged with the negative potential.

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



Fig. 3-4

3) Data reading (scanning)

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

This equipment uses the CIS (Contact Image Sensor) for data reading.

The optical image information read by the CIS is converted into electrical signals (image signals), which are then transmitted to the image processing section.





3

4) Data writing

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

Semiconductive laser element converts image signals transmitted from the image processing section into optical signal (laser emission) to expose the drum surface and form an electrostatic latent image on it.



Fig. 3-7

5) Development

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

Developer material is supplied to the photoconductive drum surface by the magnetic roller. The toner in the developer material adheres 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 method).



 Switching of developer bias polarity With the area which has no negative charge, background fogging is decreased by switching the bias to the positive polarity (approx. +150 V).

- Charging AC bias

To obtain the stable development characteristics, AC bias (approx. 1,100 V) is charged to the development bias (DC bias).

- Developer material

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



- Magnetic roller Magnetic brush development The south and north poles are arranged inside the magnetic roller as shown in the right figure. The developer material forms a brush-like fluff which contacts the photoconductive drum surface. \downarrow

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



Fig. 3-13

- Additional Explanation

The life of the toner cartridge (number of output pages) varies depending on the following condi-

tions.

Coverage of originals (printing image ratio of the original size) and density of original background

Size and density of originals

The existence of solid black when making prints (when a book is copied and the original cover is partially opened)

Temperature and humidity in the room when making prints.

Prints density and image quality mode As indicated in the figure below, the life of the toner cartridge varies depending on the copy mode and coverage of originals.

A full block in the figure below denotes approx. 5,000 output pages.

T.B.D.

Fig. 3-14

6) Transfer

Transfer is the process of transferring the toner image (visible image) formed on the drum surface onto paper.

Method: A paper passing the side of the drum is charged to the opposite polarity to the that of toner by the corona discharge of the transfer charger. $\mathbf{1}$

> The toner moves from the drum surface onto the paper.



Fig. 3-15

- For smooth transfer

In the transfer bias processing of this equipment, bias voltage (+600 VDC) is applied to the registration roller and transfer unit transport guide to prevent the charge produced by the transfer charger from flowing into the transfer unit transport guide through the paper. Output is controlled as follows to realizes the desirable transfability.

Paper position against transfer point	Transfer output
From leading edge to 11 mm from leading edge	(H) 418 µADC
From 11 mm from leading edge to 5 mm from trailing edge	(C) 445 µADC
From 5 mm from trailing edge to trailing edge	(L) 310 µADC



Fig. 3-16

3

7) Separation

Separation is the process of separating paper which is temporarily adhering to the drum due to the static electricity during the transfer process.

Method: Apply negative DC bias to the separation charger.

The positive charge on the paper is decreased. $\mathbf{\psi}$

The electrostatic adherence force between the paper and drum becomes weak.

The paper is separated from the drum by its own stiffness.





(C) -109 µADC

(L) -77 µADC

-	Output is controlled as follows to realizes the desirable separability.		
	Paper position against transfer point	Separation output	
	From leading edge to 11mm from leading edge	(H) -109 µADC	
	From 11mm from leading edge to 46mm from leading edge	(L) -77 uADC	

	<u> </u>		• •• •			
-	Output is	controlled a	as tollows to	o realizes the	e desirable	separability.

From 46mm from leading edge to 48mm from trailing edge

From 48mm from trailing edge to trailing edge

Paper may not be separated from the drum surface because of moisture or malfunction of the transfer/separation charger during printing. As the result, the paper enters into the cleaner and causes jamming. To prevent this, a separation finger is used to forcibly separate the paper which was left around the drum.



Fig. 3-18

8) Fusing

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

The melting point of the toner (main ingredi-Method: ent: resin) is 90-100°C. (Heat) Toner is melted by the heat of the surface of Pressure the fuser roller. + Fuser roller (Pressure) The pressure roller is pressed against the fuser roller by the springs to increase the adherence of the melted toner onto the paper. Paper $\mathbf{1}$ Heat and pressure are applied to the paper Fig. 3-19 when it passes between the fuser roller and pressure roller. $\mathbf{1}$ Separation finger (Fusing) The toner is fused on the paper. Cleaning roller Fuser roller (Pressure) Heater lamp Pressure roller Paper movement

Fig. 3-20

9) Cleaning

Cleaning is the process of removing the residual toner from the photoconductive drum.

The edge of the urethane rubber cleaning blade is pressed against the photoconductive drum surface to scrape off the residual toner on it. The toner is then caught by the recovery blade.



Fig. 3-21

10)Discharging

Discharging is the process of eliminating the negative charge remaining on the photoconductive drum before the next charging process.

If the residual charge is not eliminated, the following phenomenon occurs:



 \mathbf{V}

Preparation for the next printing is completed.

3.3 Comparison with e-STUDIO230/280

Process	e-STUDIO230/280	e-STUDIO163/203
 Photoconductive drum Sensitivity Surface potential 	OD-1600 (OPC ø30) Highly sensitized/durable drum -475 V	÷
2. ChargingGrid voltage	Scorotron method -495 V	÷
3. Data writingLight sourceLight amount	Semiconductor laser (Adjustment not required) 4.0 nJ/mm ²	<
 4. Development Magnetic roller Auto-toner Toner supply Toner-empty detection Toner Developer material Developer bias 	One magnetic roller Magnetic bridge-circuit method Toner cartridge Density detection method T-2320, T-2320E, T-2320D, T-2320C, T-2320T D-2320, D-2320C DC-357 V Adjustable output (during printing) AC 1100 V (Adjustment not required, during printing) DC+150 V Fixed (others)	←
5. TransferTransfer bias	Adjustable output (Constant current) +600 V (Adjustment not required)	÷
6. Separation	Adjustable output (Constant current)	÷
7. DischargeDischarging positionDischarge LED	Exposure after cleaning Red LED	÷
8. CleaningMethodRecovered toner	Cleaning blade Reuse (There is the recovered toner supply mechanism.)	÷
 9. Fusing Method Cleaning Heater 	Long-life fuser roller method Fuser roller: Thin roller coated with fluoroplastic (ø30) Pressure roller: PFA tube roller (ø30) Cleaning roller for pressure roller (ø16) Heater Jamp	← None ←
Heater	Heater lamp Turned ON/OFF by thermistor	÷

4. GENERAL OPERATION

4.1 Overview of Operation

Operation of equipment —	Operation during initializing, pre-running and ready	
	Drawer feed copying by [START] button	
	Copying operation — Bypass feed copying	
	Interrupt copying	

4.2 Description of Operation

4.2.1 Warming-up

- 1) Initialization
 - Power ON
 - \rightarrow Heater lamp ON
 - \rightarrow Set number "1" reproduction ratio "100%" are displayed (LED "START" blink)
 - \rightarrow Fan motors ON
 - \rightarrow Initialization of scanning system
 - The CIS unit moves to the home position.
 - The CIS unit moves to the peak detection position.
 - The LED of CIS is turned ON.
 - Peak detection (white color is detected by the shading correction plate)
 - The LED of CIS is turned OFF.
 - \rightarrow Ready state (LED "START" ON)
- 2) Pre-running operation

The pre-running operation is started when the temperature of the fuser roller surface reaches a certain temperature.

- \rightarrow The main motor is turned ON.
- Fuser roller rotated
- Drum rotated
- \rightarrow Pre-running operation stops after five seconds.
- 3) When the surface temperature of the fuser roller becomes sufficient for fusing, \rightarrow Ready state (LED "START" ON)

4.2.2 Ready state (ready for copying)

Buttons on the control panel enabled

- \rightarrow When no button is pressed for a certain period of time,
 - Set number "1" is displayed. Equipment returns to the normal ready state.

4.2.3 Drawer feed copying

- 1) Press the [START] button
 - \rightarrow LED "START" ON \rightarrow OFF
 - \rightarrow CIS LED ON
 - \rightarrow Scan motor ON \rightarrow CIS unit move forward
 - \rightarrow Polygonal motor rotates in high speed
 - \rightarrow Main motor and exit motor ON
 - The drum, fuser unit, developer unit and exit roller are driven.
- 2) Drawer paper feeding

 \rightarrow Main charger, developer bias and discharge LED ON. Fans are rotated in high speed. Pickup solenoid ON.

- Feed roller start to rotate.
- \rightarrow Paper reaches the registration roller.
- The registration sensor is turned ON and aligning is performed.
- \rightarrow Registration clutch OFF after a certain period of time
- 3) After the scanning operation:
 - \rightarrow Registration clutch ON after a certain period of time \rightarrow paper is transported to the transfer area.
 - \rightarrow Copy counter operates
- 4) After the registration clutch is turned ON:
 - \rightarrow Transfer charger ON after a certain period of time
 - \rightarrow Copy counter operates
- 5) Completion of scanning
 - → Scan motor OFF
 - \rightarrow CIS LED OFF

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- \rightarrow Registration clutch OFF (after the trailing edge of the paper passed the registration roller)
- \rightarrow Ready state
- 6) Paper exit
 - \rightarrow Exit sensor detects the trailing edge of the paper
 - \rightarrow Main charger, developer bias and discharge LED OFF
 - \rightarrow Polygonal motor, main motor and exit motor OFF
 - \rightarrow Drum, fuser unit and developer unit stop
 - \rightarrow Fans return to the ready rotation
 - \rightarrow LED "START" ON and the equipment enters the ready state

4



4.2.4 Bypass feed copying

- 1) Insert a sheet of paper into the bypass tray.
 - \rightarrow Bypass paper sensor ON
 - Bypass feed priority state
- 2) Press the [START] button
 - \rightarrow LED "START" ON \rightarrow OFF
 - \rightarrow CIS LED ON
 - \rightarrow Scan motor ON \rightarrow CIS unit move forward
 - \rightarrow Polygonal motor rotates in high speed
 - \rightarrow Main motor and exit motor ON
 - The drum, fuser unit, developer unit and exit roller are driven.
- 3) Bypass feeding
 - \rightarrow Main charger, developer bias and discharge LED ON. Fans are rotated in high speed.
 - \rightarrow Bypass pickup solenoid ON
 - The bypass pickup roller start to rotate.
 - The bypass pickup roller is lowered.
 - The bypass feed roller start to rotate.
 - \rightarrow Aligning operation
 - \rightarrow Paper reaches the registration roller
 - \rightarrow After a certain period of time, the bypass pickup solenoid OFF
- 4) Hereafter, the operation 3) through 6) of 🛄 P.4-3 "4.2.3 Drawer feed copying" is repeated.

4.2.5 Interruption copying

- 1) Press the [INTERRUPT] button
 - \rightarrow LED "INTERRUPT" ON
 - \rightarrow Copying operation in progress is temporarily stopped. CIS unit return to appropriate positions.
 - \rightarrow Automatic density and reproduction ratio 100% are set (The set number remains the same)
- 2) Select the desired copy condition
- 3) After the interruption copying is finished:
 - \rightarrow LED "INTERRUPT" OFF by pressing the [INTERRUPT] button
 - \rightarrow Equipment returns to the status before the interruption
- 4) Press the [START] button
 - \rightarrow The copying operation before the interruption is resumed.

4.3 Detection of Abnormality

When something abnormal has occurred in the equipment, the symbols corresponding to the type of abnormality are displayed.

4.3.1 Types of abnormality

- 1) Abnormality cleared without turning OFF the door switch
 - (A) Add paper
 - (B) Pick-up failure in bypass
- 2) Abnormality not cleared without turning OFF the door switch
 - (C) Misfeed in equipment
 - (D) Replace the toner cartridge
 - (E) Developer unit not installed properly
- Abnormality not cleared without turning OFF the main switch (F) Call for service

4.3.2 Description of abnormality

(A) Add paper

• Drawer empty sensor detects the presence or absence of paper.

[When drawer is not installed] No drawer detected ↓

LED "Add paper" ON

 \mathbf{V}

[START] button disabled

[When drawer is installed]

 \mathbf{V}

Drawer detected

 \mathbf{V}

Paper empty sensor OFF

 \mathbf{V}

LED "Add paper" ON

 \mathbf{V}

[START] button disabled

(B) Pick-up failure in bypass

 During bypass feeding Bypass pickup solenoid ON

 \mathbf{V}

Registration sensor is not turned ON in a fixed period of time

 \mathbf{V}

Clear paper symbol is displayed : E12

 \mathbf{V}

Copying operation is disabled

 \mathbf{V}

Solution: The bypass paper sensor is turned OFF by removing the paper from the bypass tray.

(C) Misfeed in equipment

• Exit sensor detects jamming of the leading edge of paper.

 \mathbf{V}

Registration clutch ON

↓ Less than 1.808 sec.

Exit sensor ON If the exit sensor is not turned ON after 1.808 sec,

 \mathbf{V}

Paper jam (E01) \rightarrow The copying operation is stopped.

T.B.D.



• Exit sensor detects jamming of the tailing edge of paper.

 \mathbf{V}

Registration clutch OFF

 $\mathbf{1}$

↓ Less than 1.759 sec. Exit sensor OFF If the exit sensor is not turned OFF after 1.759 sec,

Paper jam (E02) \rightarrow The copying operation is stopped.

T.B.D.

Fig. 4-2

• Immediately after the power ON

 \mathbf{V}

Any of all sensors on paper transport path detects paper (ON)

 \mathbf{V}

Paper jam (E03)

• Front cover is opened during copying

 \mathbf{V}

Paper jam (E41)

 Registration sensor detects jamming of the leading edge of paper: Registration sensor is not turned ON in a fixed period of time after the pickup solenoid is turned ON.

 \mathbf{V}

Paper jam (E21 and E09)

The registration sensor is not turned ON in a fixed period of time after the pickup solenoid is turned ON

 \mathbf{V}

Paper jam (E12, E13 and E14: Error code differs depending on the paper source.) Refer to the error code table in the Service Handbook.

(D) Replace the toner cartridge

· Toner density becomes low

 \mathbf{V}

Auto-toner sensor detects the absence of the toner

 \mathbf{V}

Control circuit \rightarrow "Install new toner cartridge" displayed: the copying operation disabled

Solution: Open the front cover and replace the toner cartridge with a new one. Toner is supplied \rightarrow copying operation enabled.

(E) Developer unit not installed properly

· Disconnection of the connectors of the developer unit

 \mathbf{V}

"Developer unit not installed" is displayed.

Solution: Connect the connectors of the developer unit and close the front cover.

(F) Call for service

Error code is displayed instead of the set number by pressing the [CLEAR] button and [8] button simultaneously when the "Call for service" is blinking. Refer to the error code table in the Service Handbook.

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4.4 Flow Chart

4.4.1 Immediately after the power is turned ON




Fig. 4-4

4





Fig. 4-6

5. CONTROL PANEL

5.1 Control Panel and LED Display

The control panel consists of button switches to operate the equipment and select various modes, and LEDs to display codes, values and the states (including each mode) of the equipment. The button switches and the LEDs are mounted on the control panel PC board-L (LPNL board) and are installed the inside of the control panel.

T.B.D.

5.2 Items Displayed on Control Panel

The following items are displayed in the 7-segment LED at the center of the control panel:

1) Copy quantity

The number of copies set (= copy quantities) is displayed in the normal state.

2) Reproduction ratio

The display switches from the copy quantities to the reproduction ratio of a job by pressing [%] button.

When the [25%] and [100%] buttons are pressed simultaneously, the reproduction ratio is instantly set at 25%. When the [200%] and [100%] buttons are pressed simultaneously, the reproduction ratio is instantly set at 200%.

3) Total counter

The total counter value is displayed by pressing the [#] button more than 2 seconds. The total 8 digits can be displayed; the first 2 digits of the value are displayed at first, then the next 3 digits, and then the last 3 digits are displayed in order.

e.g.) 12345678: 12 -> 345 -> 678

When the [25%] button is pressed, the digits shift to the 3 digits of next higher order. When the [200%] button is pressed, they shift to the 3 digits of next lower order.

4) ROM version

A ROM version is displayed by pressing the [*] key, the [#] key and the [START] button simultaneously. The total 8 digits can be displayed; the first 2 digits of the ROM version are displayed at first, then the next 3 digits, and then the last 3 digits are displayed in order.

e.g.) 12345678: 12 -> 345 -> 678

When the [25%] button is pressed, the digits shift to the 3 digits of next higher order. When the [200%] button is pressed, they shift to the 3 digits of next lower order.

5) Error code

When a paper jam or a service call has occurred, its error code is displayed in 3 digits by pressing the [CLEAR/STOP] button and the [8] key simultaneously.

6) Setting mode

When the equipment is in each setting mode, "Fnc" is displayed in the 7-segment LED.

- Paper size setting mode
 - The size of the copy paper in the drawer is set in this mode.

The equipment enters into the paper size setting mode by pressing the [COPY] and [DRAWER] buttons simultaneously more than 2 seconds. Press the [DRAWER] button to select the drawer. Then press the [COPY] button to select the paper size, and then press the [START] button to perform the setting. When the setting needs to be canceled halfway, press the [FUNCTION CLEAR] button.

When a size other than the ones indicated on the control panel needs to be set, press the [DRAWER] button to select the drawer, and then press the [COPY] button to select "OTHER", and then key in a code for the desired size as shown below. Then press the [START] button to perform the setting. When the setting needs to be canceled halfway, press the [FUNCTION CLEAR] button.

Paper size	Code	Paper size	Code
A3	01	LT-R	11
A4	02	ST-R	12
A4-R	03	FOLIO	13
B4	04	COMPUTER	14
B5	05	Postcard * ²	15
B5-R	06	13"LG	16
A5-R ^{*1}	07	8K ^{*3}	17
LD	08	16K ^{*3}	18
LG	09	16K-R ^{*3}	19
LT	10		

*1 *2: These codes can be set only when the bypass tray is used.

- *2: This code can be set only for JPD models.
- *3: These codes can be set only for CND models.
- Operation sound setting mode

The operation (beep) sound of this equipment is set on or off in this mode.

When the density adjustment button "light" and "dark" are pressed simultaneously more than 2 seconds, the equipment enters into the operation sound setting mode. The on or off of this operation sound is switched by pressing the [AUTO] button. When the sound is on, all of the 7 density adjustment lamps are turned on. When the sound is off, all of these lamps are turned off. When the on or off of the sound has been switched, press the [START] button to perform the setting. When the setting needs to be canceled halfway, press the [FUNCTION CLEAR] button.

5.3 Relation between Equipment State and Operation

	[START]	[CLEAR/ STOP]	[FUNCTION CLEAR]	[INTERRUPT]	[ENERGY SAVER]	Other but- tons/ keys
Waiting	Starts copying	Clears copy quantity	Clears each setting	Enters into interrupting copy	Enters into energy sav- ing mode	Operation acceptable
Warming up	Reserves auto start job	Clears copy quantity	Clears each setting			Operation acceptable
Copying		Pauses copy job		Enters into interrupting copy		
Pausing copy job	Resumes copy job	Cancels copy job	Clears each setting	Enters into interrupting copy		
Downloading firmware						
In energy sav- ing (low power) mode	Enters into waiting state	Enters into waiting state	Enters into waiting state	Enters into waiting-up	Enters into waiting state	Enters into waiting state
In sleep mode	Enters into waiting state				Enters into waiting state	Enters into waiting state
Interrupting copy job	Starts inter- rupting copy	Clears copy quantity	Cancels inter- rupting copy	Cancels inter- rupting copy		Operation acceptable
Cover open		Clears copy quantity	Clears each setting			Operation acceptable
Toner empty						Operation acceptable
Paper jam						
Service call						

5.4 Operation

5.4.1 Block diagram

The control panel is controlled by the serial data input/output to the SoC on the MAIN board. The input status of each button is output to the SoC as serial data (OPKYSI) by the parallel-serial conversion IC and detected. Each LED is controlled to be lit by the LED driver based on the information of the serial data (OPLDSO) output from the SoC.



Fig. 5-1

5.4.2 LED display circuit

<Example> Lighting circuit method of "Cover open lamp"



Fig. 5-2

FET (Q2) is turned ON when the FET control signal (C0) becomes "L" level. Then when the control signal (LEDM12) of the LED driver changes to "L" level, the current flows to the cover open lamp (LED22) to turn ON the LED.

Conditions to turn ON the LED

The LED is turned ON only when the two conditions below are met.

- 1) The FET connected to the LED anode is ON.
- 2) The cathode side of the LED is "L" level.

5.5 Disassembly and Replacement

[A] Control panel unit

(1) Remove 3 screws.



Fig. 5-3

- (2) Take off the control panel unit while lifting it up.
- (3) Disconnect 1 connector.

Note:

When installing the control panel unit, be sure not to have the harness being caught by the front right cover and the unit.



Fig. 5-4

[B] Control panel PC board (LPNL)

- (1) Take off the control panel unit. P.5-6 "[A] Control panel unit"
- (2) Remove 2 screws and take off the cover while sliding it.





(3) Take off 2 brackets by removing 2 screws each.



Fig. 5-6

(4) Remove 12 screws and take off the control panel PC board.



Fig. 5-7

6. SCANNER

6.1 General Description

In the scanning section, this equipment uses the CIS (Contact Image Sensor) for scanning the image. The surface of an original is irradiated with a light from the LED array mounted on the CIS unit and the reflected light is scanned by the CIS where the optical image data are converted into an electrical signal (digital signal), and then transmitted to the MAIN board. After various image processing necessary for image formation are performed on the MAIN board, the data are transmitted to the writing section. After that, an arithmetic operation is performed on the digital signal, which is then transmitted to the data writing section.



Fig. 6-1

6.2 Construction

Scanning section			
Original glass	Original glass		
	ADF Original glass		
CIS unit (CIS)	CIS		
	Y-G LED array		
	RGB LED array		
	Rod-lens array		
Drive section	Scan motor (M1)		
CIS home position sensor (S1)			

6.3 Functions

1) Original glass

This is a glass for placing original. Original (image) placed on the original glass is scanned by the CIS. The ADF original glass is used when original is read with the Automatic Document Feeder. Original is transported on the ADF original glass by the Automatic Document Feeder, and the transported original is read under the ADF original glass by the CIS. Do not use such solvents as alcohol when cleaning the surface of the ADF original glass, because it is coated so as not to be scratched by originals.

2) CIS unit (CIS)

The CIS unit (CIS) is a unit in which the LED array, lens array and CIS sensor of same length are closely attached and unified. An original is irradiated with the LED light source of RGB colors in order, and then the reflected light is scanned by the CIS sensor.

In the CCD method, the reflected light of the exposure lamp is led through mirrors, lens and slit to the CCD where the optical-to electrical conversion for scanned data is performed. In contrast, in the CIS method, those operations are processed by only the CIS unit.

- CIS

Scans the light reflected from an original and converts it to an electrical signal. The CIS sensor of the equipment has 7084 image pixels and 600x600-pixel resolution for scanning.

- YG-LED array

This YG-LED array works as an assist light for the RGB-LED array. Using this YG-LED array makes it possible to attain a light color which has nearly the same color effect as that of the xenon light for the light sensitivity of the CIS sensor.

Also it is used to reduce shadow of an original when scanning is performed.

- RGB-LED array

The surface of an original is irradiated with and the reflected light is scanned by the CIS. A light from the LED array mounted on the CIS unit (CIS) goes through the original glass and lights an original. And then, the reflected light from the original is scanned by the CIS. This LED alley produces the output power of 3.2W.

- Gradient index lens

This is a lens of which the index of refraction within the lens is varied. This lens enables us to produce a unified image without combining mirrors or lenses.

3) Scan motor (M1)

This is a two-phase stepping motor which drives the CIS unit (CIS). The rotation of the motor is transmitted to the CIS unit through the timing belt to move the unit form side to side.

4) CIS home position sensor (S1)

This sensor detects if the CIS unit is at its home position.

6.4 Description of Operation

6.4.1 Scanning operation

Scanning an original on the original glass
 The rotation of the scan motor (M1) is transmitted to the CIS unit through the timing belt to move the
 unit to the home position. The home position is detected when the actuator installed on the CIS case
 passes the CIS home position sensor (S1).

When the [START] button is pressed, the CIS unit starts to scan the original.

• Scanning an original on the ADF The CIS unit (CIS) stops and stays at the shading position during the shading correction, and at the scanning position during the scanning operation.

6.4.2 Scan motor drive circuit

T.B.D

6.5 Contact Image Sensor Unit Control Circuit

6.5.1 Exposure LED control circuit

The cell guide mounted on the contact image sensor (CIS) unit is the main light source of the red/green/ blue LEDs and is used to expose originals. Also mounted is the LED array which is the subsidiary light source of the yellow-green LEDs.

Turning each light source ON/OFF is controlled by the control signal (SCNLEDR/G/B/ASTOFF-1) output from the ASIC on the MAIN board. According to the amount of each light source, white standard generation is performed (reading the reflected light amount of the white shading correction plate). Black standard generation is also performed (reading the light amount when the light source is turned off), and according to the result, adjustment by the light amount adjustment signal (SCNLEDVR1/2/3-1) output through the D/A converter from the SoC is made. However, the light amount of the green light source is not changed because it is the standard value of the adjustment. The other light amount is changed based on the green light source; in this way the total light amount is adjusted.



Fig. 6-2

6.5.2 CCD control circuit

On the contact image sensor (CIS) unit, CCD (Charge Coupled Device) with 7,084 effective pixels are mounted as the optoelectronic element for converting the light reflected on the original into electrical signals (analog signals). CCD is driven by the clock signals (TRCLCK, MCLCK, RSCLCK) output from the SoC on the MAIN board, and then it divides the photoelectric-converted analog signals into four output signals (CDIN0 to 3) and outputs to the AFE. The AFE converts the analog signals into 8-bit digital signals (SCNIMGA [0] to [7]) and outputs to the SoC.



Fig. 6-3

Optoelectronic conversion

The CCD is a one-chip optoelectronic conversion device, comprised of several thousand light-receiving elements arranged in a line, each one of them is a few microns square. This equipment has a CCD with 7,084 light-receiving elements.

Each element of the light-receiving section consists of semiconductive layers P and N. When the light irradiates the element, the light energy produces a minus (-) charge in the layer P; the amount of the charge produced is proportional to the energy and irradiating time. The charge produced in the light receiving section is then sent to the transfer section where it is shifted by transfer clock from left to right as shown in the figure below, and is finally output from the CCD. At this time, to increase the transfer speed of the CCD, the charge is separated into four transfer sections and output in parallel via two channels.



Fig. 6-4

Shading correction

A variation is caused by the following factors in the CCD output.

- 1) The light source has a variation in its light distribution.
- 2) Each of the 7,084 elements varies in optoelectronic conversion efficiency.

These differences need to be corrected and this correction is referred to as a shading correction. The shading correction is performed by applying a normalization process using the following formula on the black data and the white data obtained in advance to correct the lighting variance and element variation of the image data.

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

- k: Coefficient
- S: Image data before correction
- K: Black data (stored in "Black" memory)
- W: White data (stored in "White" memory)

Fig. 6-5

6.6 Disassembly and Replacement

[A] Original glass

(1) Remove 2 screws and take off the original glass holder while sliding it to the right.



Fig. 6-6

(2) Remove 2 screws and take off the original glass.

Notes:

- 1. When handling the original glass, take care not to contaminate the surface with fingerprints or such.
- 2. Do not place the original glass directly on the floor.
- 3. When installing the original glass, fit 2 guides of the original glass in the groove of the scanner top cover.
- (3) Take off the ADF original glass.



Fig. 6-7



Fig. 6-8

Notes:

- 1. Install the ADF original glass so that the attached Mylar sheet is placed on the right-hand side.
- 2. When installing the ADF original glass, place it between 2 small guides with its left-hand side pushed to the scanner top cover.





[B] Scanner top cover

- Take off the original glass.
 □□ P.6-8 "[A] Original glass"
- (2) Take off the front upper cover. P.2-20 "[F] Front upper cover"
- (3) Take off the control panel unit. P.5-6 "[A] Control panel unit"
- (4) Remove 6 screws and take off the scanner top cover.



Fig. 6-10

[C] Scan motor (M1)

- (1) Take off the scanner top cover. P.6-9 "[B] Scanner top cover"
- (2) Disconnect 1 connector.



Fig. 6-11

(3) Remove 2 screws and take off the scan motor.



Fig. 6-12

Notes:

When installing the scan motor, be sure to adjust the tension of the belt using the belt tension jig. Also, be sure to take off the right rear cover when performing the adjustment. (P.2-22 "[I] Right rear cover") The adjustment procedure is as follows. 1. Temporarily fix the screw A and B.



Fig. 6-13

- 2. Hook the belt tension jig to the motor bracket and frame.
- 3. The scan motor is pulled by the belt tension jig. Fix the screw A and then B at the stopped position.
- 4. Remove the belt tension jig.



Fig. 6-14

[D] CIS home position sensor (S1)

- Take off the original glass.
 □□ P.6-8 "[A] Original glass"
- (2) Remove 1 screw and take off the CIS home position sensor with the bracket.



Fig. 6-15

- (3) Disconnect 1 connector.
- (4) Release 3 latches and take off the CIS home position sensor.



Fig. 6-16

[E] CIS unit (CIS)

- Take off the original glass.
 P.6-8 "[A] Original glass"
- (2) Move the CIS unit to the right most position.



Fig. 6-17

Note:

Be sure to hold the CIS unit drive belt-1 to move the CIS unit.



Fig. 6-18

(3) Lift up the CIS unit, disconnect 1 connector on the bottom of the CIS unit, and then take off the CIS unit.

Note:

When handling the CIS unit, take care not to contarminate the lens with fingerprints or such.



Fig. 6-19

[F] CIS case

- (1) Take off the CIS unit. P.6-11 "[E] CIS unit (CIS)"
- (2) Remove 1 screw and take off the belt stopper.

Note:

When installing the belt stopper, install it so that the protrusion of the stopper fits in the Vgroove on the inside of the CIS unit drive belt-1.



Fig. 6-20

(3) Take off the CIS case.



Fig. 6-21

Notes:

- 1. When installing the CIS case, be sure to fit the shaft of the equipment in the shaft guide attached on the bottom of the CIS case.
- 2. When installing the CIS case, install it so that the "L" shaped portion of the bottom of the CIS case comes under the CIS unit drive belt-1.



Fig. 6-22

[G] CIS unit drive belt-1

- (1) Take off the CIS case. □ P.6-12 "[F] CIS case"
- (2) Remove the tension spring.



Fig. 6-23

6

(3) Loosen 1 fixing screw of the tension bracket.





- (4) Remove 3 clips and take off 3 pulleys.
- (5) Take off the CIS unit drive belt-1.

Note:

When assembling the CIS unit drive belt-1, assemble it while the fixing screw is loosened. Then hook the tension spring and tighten the fixing screw of the tension bracket.



Fig. 6-25

[H] CIS unit drive belt-2

- (1) Take off the scanner top cover. P.6-9 "[B] Scanner top cover"
- (2) Take off the right rear cover. P.2-22 "[I] Right rear cover"
- (3) Take off the CIS unit drive belt-1.
- (4) Loosen 2 fixing screws of the scan motor.



Fig. 6-26

- (5) Remove 1 clip and take off 1 pulley.
- (6) Take off the CIS unit drive belt-2.

Note:

When assembling the CIS unit drive belt-2, be sure to perform the tension adjustment for the scan motor.

P.6-9 "[C] Scan motor (M1)"



Fig. 6-27

6

7. IMAGE PROCESSING

7.1 General Description

The image processing section inputs the image signal from the scanning section and applies various image processing on the signal, then transmits the output result to the writing section.

Images are processed by the main board in this equipment.

The following diagram shows the process of the equipment from scanning of original to writing data on the photoconductive drum surface.



The following is the board used for image processing.

Board	Function
MAIN board	High quality image processing, image memory editing, editing processing, gamma correction, gradation processing, scanner high quality image processing and external output system interface. Smoothing processing, external input system interface, image area control, laser related control and printer high quality image processing

7.2 Configuration

The following diagram shows the image processing section of this equipment.



Fig. 7-2

7.3 MAIN Board

7.3.1 Features

- 1) The image processing section on the MAIN board is controlled by the CPU on the MAIN board.
- 2) The image processing section on the MAIN board realizes the following when functioning the equipment:
 - High quality image processing
 - Image memory editing
 - Editing processing
 - Gamma correction
 - Gradation processing
 - External output system interface
 - Smoothing processing
 - External input system interface
 - Image area control
 - Laser related control
 - Printer high quality processing

7.3.2 Functions of image processing circuit

The image processing section mounted on the SLG board realizes the followings:

1) High quality image processing

- Background processing function (Range correction)

This function removes 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>

Dynamic range Extended dynamic range After range width width adjustment Smaller 🛧 No. of pixels 🔶 Larger Smaller 🗲 No. of pixels 🔶 Larger Background Text Density Density Lower Higher Lower Higher Histogram



- Filtering

This function is enabled by low-pass filter processing and high-pass filter processing.

Low-pass filter processing

This processing removes image/electrical noise and decreases moire by performing averaging operation between the image signals of the targeted pixel and those of the neighboring pixels to enhance the reproducibility of original.

<Example>

Density of the targeted pixel position is X. Density of pixel positions at front and back of the targeted pixel are "a" and "b" respectively. X is converted to X' through the low pass filtering.

When the matrix is (3×1) :



The above averaging operation is performed for all the pixels to accomplish the high reproducibility of original.

(The following is the case that the low pass filtering is applied on the primary scanning pixel.)





High-pass filter processing

Character outline blurs when the original, such as text, with big difference in density among the pixels is optically scanned and output from the CCD. Characteristic of the lens and other factors cause this phenomenon. In this equipment, processing such as edge enhancement is applied between the targeted pixel and the neighboring pixels to eliminate this phenomenon and realize high reproducibility of original.



2) Image memory editing

This function performs editing such as enlargement/reduction, mirror imaging, etc., by using a line memory. Pixel data for one line in the primary scanning direction is stored in the line memory and the memory is renewed at each line.

- Enlargement/Reduction

Enlargement/Reduction is accomplished by using the line memory control function in the process of the image processing operation.





<Example> Reduction



Mirror imaging

This is accomplished by reading and outputting data from its end.

3) Editing processing

This function performs trimming and masking.

- Trimming

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

- Masking

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

- Negative/positive reversing This function reverses the entire date from negative to positive or vice versa.
- 4) Gamma correction

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

5) Gradation processing

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

6) External output system interface This function controls the output of the output interface. 7) Scanner high quality image processing

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

8) Smoothing processing

This function removes jaggy area, and output images after processing the smoothing the character outline.

- External input system interface This function controls the input of the input interface.
- 10)Image area control

This function sets the effective image area in horizontal and vertical directions to be output.

11)Laser related control

This function performs the APC (Auto Power Control).

12)Printer high quality processing

This function reproduces the image signals output from the printer controller sharper.
8. LASER OPTICAL UNIT

8.1 General Description

The laser optical unit radiates the laser beam onto the photoconductive drum responding to the digital image signals transmitted from the MAIN board. to create the latent image. Image signal is converted into the light emission signal of the laser diode on the laser driving PC board (LDR), then radiated on the drum through the optical elements such as cylinder lenses, polygonal mirror and θ lens. The unit must not be disassembled in the field as they are very sensitive to dust and finely adjusted at the factory.



Fig. 8-1



Fig. 8-2

8

8.2 Structure

Laser optical unit (1 beam)				
Laser emission unit	Laser diode	Wavelength: Approx.785 nm Output power rating: 5 mW		
	Fine focus lens			
	Aperture			
	Cylinder lens			
	Laser driving PC board (LDR)			
Polygonal motor unit	Polygonal motor (M4)			
	Polygonal mirror	6 planes		
	Polygonal mirror cover			
fθ lens 1				
f0 lens 2				
H-Sync returning mirror				
Slit glass				
H-sync signal detection PC board (SNS)				

1) Laser emission Unit

This unit consists of the laser diode, finite focus lens, aperture and cylinder lens.

- Laser diode

This laser diode features low droop, small laser variation and low threshold current.

Aperture determines the shape of the laser beam at laser emission position of the primary scanning and secondary scanning.

Laser diode radiates the laser beams responding to the laser emission control (ON/OFF) signals from the laser driving PC board (LDR). Laser beams which passed through the finite focus lens are focused on the drum surface.

- Laser precautions

A laser diode is used for this equipment and radiates an invisible laser beam.

Since it is not visible, be extremely careful when handling the laser optical unit components, performing operations or adjusting the laser beam. Also never perform the procedure with other than the specified manuals because you could be exposed to the laser radiation.

The laser unit is completely sealed with a protective cover. As long as only the operations of specified manuals are performed, the laser beam is not leaked and you are in no danger of being exposed to laser radiation.

The following cautionary label for the laser is attached to the front right cover (inside of the front cover).



Fig. 8-3

Cautions:

- Avoid expose to laser beam during service. This equipment uses a laser diode. Be sure not to
 expose your eyes to the laser beam. Do not insert reflecting parts or tools such as a screwdriver
 on the laser beam path. Remove all reflecting metals such as watches, rings, etc. before starting
 service.
- When servicing the equipment with the power turned ON, be sure not to touch live sections and rotating/operating sections. Avoid exposing your eyes to laser beam.
- During servicing, be sure to check the rating plate and cautionary labels such as "Unplug the power cable during service", "CAUTION. HOT", "CAUTION. HIGH VOLTAGE", "CAUTION. LASER BEAM", etc. to see if there is any dirt on their surface and if they are properly stuck to the equipment.

- 2) Polygonal motor unit This unit consists of the polygonal motor (M4), polygonal mirror and polygonal mirror cover.
- a. Polygonal motor (M4)

This motor rotates the polygonal mirror in high speed. The DC motor controls the rotation speed of the mirror motor as follows: During ready: 10,000.00 rpm

During printing : 23,562.99 rpm (600dpi)

b. Polygonal mirror

One laser beam emitted from the laser diode is reflected by this mirror. As the polygonal mirror is rotated by the polygonal motor (M4), the reflected laser light moves in sync with the rotation. The direction of the movement is the primary scanning direction of the image. One scan is performed on one plane of the polygonal mirror.

As the polygonal mirror has six planes, six scans are performed in one rotation of the polygonal mirror.



Fig. 8-4

One scan is completed by completion of steps (A) to (C). One scan is performed on one plane of the polygonalmirror. Six scans can be made with one rotation of the polygonal mirror.

3) f θ lenses 1 and 2

These two lenses perform the following adjustment on the laser beams reflected by 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 f θ lenses help to correct this difference, making all the dot-to-dot pitches equal on the drum surface.





- b. Face tilt correction The reflecting face of the polygonal mirror is tilted slightly to one side against the perfect vertical. Horizontal deviation of the laser light which is caused by the tilt is corrected.
- c. Sectional shape of laser beam The shape of the laser beam spotted on the drum is adjusted.



Fig. 8-6

4) H-Sync signal detection PC board (SNS)

The laser light which is started to be scanned from one of the reflected plane of the polygonal mirror is reflected by the H-Sync returning mirror and enters the PIN diode on the H-Sync signal detection PC board (SNS). The primary scanning synchronizing signal is generated based on this reflection.

5) Slit glass

Slit glass is located where the laser beams are output from the laser optical unit, and it protects the unit from dust.

8.3 Laser Diode Control Circuit

This equipment uses an AlGaAs type semiconductive laser with 5 mW of optical output power rating. This laser emits a beam in a single transverse mode in approx. 785 nm wavelength. PIN diode for monitoring optical output in this laser controls the laser intensity.

The relation between the forward current and optical output of a semiconductive laser is as shown below. Beam emission starts when the forward current exceeds a threshold current, and then the laser outputs a monitor current which is proportionate to the optical output. Since semiconductive lasers have an individual variability in their threshold current and monitor current, the optical output needs an adjustment to be maintained at a certain value.

The optical output of a semiconductive laser decreases as the laser temperature rises. Therefore APC (Auto Power Control) needs to be performed to maintain a constant optical output.



Fig. 8-7

A block diagram of the semiconductive laser control circuit is shown below. The semiconductive laser performs a monitor efficiency regulation (a process to control a monitor current for beam emission amount). The initial beam emission is adjusted to be approx. 1.6 mW (240 μ W on the drum surface). The voltage of the monitor output, which has been regulated by this adjustment, is then fed back to a laser power comparison circuit.

In the laser power comparison circuit, this voltage fed back and a laser power voltage set for the control circuit are compared for every scanning. As the result of this, a laser driver circuit increases its forward current when the laser power is insufficient and decreases it when the laser power is excessive to maintain a constant optical output.



Fig. 8-8

8.4 Polygonal Motor Control Circuit

The polygonal motor is a DC motor rotated by a clock signal (PMTRCLK) output from the SoC. This motor is controlled under PLL (Phase Locked Loop) to realize an accurate and constant rotation. Its rotation status is converted to a status signal (PMTRSTS-0) and then output to the ASIC. PMTRSTS-0 signal moves to a low level only when the rotation status of the motor is constant. The SoC detects the rotation status with this signal, and emits a laser beam only when the rotation status is constant.





Signal	Function	Low level	High level
PMTR-0	Polygonal motor ON signal	ON	OFF
PMTRCLK	Polygonal motor reference clock	-	-
PMTRSTS-0 Polygonal motor PLL control signal		Rotating at a constant speed	Stopping or error

8.5 Disassembly and Replacement

[A] Laser optical unit

- Take off the rear cover.
 □ P.2-22 "[J] Rear cover"
- (2) Disconnect 3 connectors from the Main control pc board.

Note:

Connect the flat harness to the MAIN board with its erectrode side down. An error "CA2" will be displayed if the connection is incorrect.



Fig. 8-10

- (3) Take off the switching regulator unit.
- (4) Remove 1 screw.
- (5) Pull out the laser optical unit while lifting it up and take it off.



Fig. 8-11

[B] Switching regulator cooling fan (M6)

- (1) Take off the left cover. P.2-19 "[C] Left cover"
- (2) Disconnect 1 connector and take off the switching regulator cooling fan while sliding it upward.



Fig. 8-12

9. DRIVE UNIT

9.1 General Description

The main motor drives the drum, developer unit, cleaner unit, fuser unit and transport rollers which transport paper (bypass feed roller, bypass pickup roller, registration roller, pickup roller and exit roller). The main motor is a brushless motor and is installed in the drive unit. The drive unit consists of gears and timing belts, and transmits the driving force of the main motor to each unit. The toner motor which drives the toner cartridge is also installed in the drive unit.



Fig. 9-1

9.2 Configuration

	Unit to be driven	Drive transmission
Main motor	Drum	Gears
	Developer unit	Gears
	Cleaner unit	Timing belt, gears
Fuser unit Tir		Timing belt, gears
	Rollers	Timing belt, gears
Toner motor	Toner cartridge	Gears

9.3 Functions

1) Main motor

The main motor is a brushless motor which is controlled by control signals output from the MAIN board. The driving force of the main motor is transmitted to the drum, developer unit, cleaner unit, fuser unit and the rollers which transport the paper, via gears and timing belts.

2) Toner motor

The main motor is a DC motor which is controlled by control signals output from the MAIN board. The driving force of the toner motor is transmitted to the toner cartridge via gears.

9.4 Main Motor Control Circuit

The main motor, which is a DC motor driven by control signals from the MAIN board, drives the drum, developer unit, feed roller, transport roller and registration roller. A driving PC board is embedded in this motor to perform the following controls.





- 1) The ASIC outputs the control signals for the main motor rotation. (MMTR-0 signal: Motor rotation command, MMTRCCW-1 signal: Rotation direction)
- 2) The main motor is rotated by the excitation phase-switching section exciting each phase of the main motor.
- 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. (The motor keeps rotating by repeating from 2 to 4.)
- 5) An FG (Frequency Generator) pulse is generated by the rotation of the motor.
- 6) The FG pulse and the reference clock (MMTRCKA) from the SoC are compared in terms of the phase and speed, and the difference is added to the excitation phase-switching section. Fluctuations in the power supply voltage are also added to the value.
- 7) According to the result of step 6, the switching timing of the excitation phase-switching section is changed and the FG pulse and the reference clock are controlled to make them equal. This will make the main motor rotate at a constant speed. (Lock range)
- 8) When the motor is in the lock range, the excitation phase-switching section outputs the MMTRPLL-1 signal in the "L" level to the ASIC.
- 9) When MMTRBK-0 signal from the ASIC becomes "L" level, the motor is braked. When the MMTR-0 signal becomes "H" level, the motor is stopped.

Control signal of main motor

• MMTR-0 signal:

This signal switches the ON/OFF of the main motor. When this signal becomes "L" level, the motor starts rotating, and when it becomes "H" level, the motor stops.

• MMTRCCW-1 signal:

This signal switches the rotation direction of the main motor. When this signal becomes "L" level, the motor rotates clockwise seen from the rear side, and the drum and developer unit, etc. start driving.

- MMTRCKA signal: This signal is a reference clock which keeps the main motor rotation at a constant speed.
- MMTRPLL-1 signal:

This is a signal to show that the main motor rotation is in the lock range. When the cyclic change of the FG pulse period against the reference clock is within (6.25%, this is defined as a lock range (the normal rotation of the motor) in the main motor. When it is within this range, this signal becomes "L" level.

• MMTRBK-0 signal:

This signal applies a brake on the main motor. When this signal becomes "L" level, a brake is applied to the rotation of the motor.

9.5 Disassembly and Replacement

[A] Main motor (M3)

- (1) Take off the rear cover. P.2-22 "[J] Rear cover"
- (2) Disconnect 1 connector, remove 2 screws, and then take off the main motor.



Fig. 9-3

[B] Toner motor (M2)

- (1) Take off the rear cover. P.2-22 "[J] Rear cover"
- (2) Disconnect 1 connector, remove 2 screws, take off the toner motor with the bracket, and then remove 1 bushing and 1 gear.



Fig. 9-4

(3) Remove 1 screw and take off the toner motor.



Fig. 9-5

[C] Main motor drive unit

- (1) Take off the Process unit. P.11-9 "[A] Process unit"
- (2) Take off the toner motor with the bracket.
- (3) Remove 2 screws and take off the registration roller holder.

Note:

When installing the registration roller holder, align the arm of the registration roller clutch with the stopper of the registration roller holder.





(4) Remove 1 clip and take off the bushing.



Fig. 9-7

(5) Remove 3 screws and take off the main motor drive unit.





(6) Loosen 1 tensioner fixing screw and remove the tension spring.



Fig. 9-9

(7) Take off the gear and timing belt from the main motor drive unit.





Note:

Assemble the main motor drive unit with the tensioner fixing screw loosened. And then, tighten it after hooking the tension spring.



Fig. 9-11

10. PAPER FEEDING SYSTEM

10.1 General Description

The purpose of this system is to pick up a sheet of paper from the drawer or bypass tray and transport it to the transfer position. The paper feeding system mainly consists of the pickup roller, registration roller, bypass sensor, paper empty sensor, registration sensor and the drive system for these components.



Fig. 10-1

	Item	
1	Pickup roller	
2	Separation pad	
3	Registration roller (Rubber)	
4	Registration roller (Metal)	
5	Bypass pickup roller	
6	Bypass feed roller	
7	Bypass separation pad	
8	Paper empty sensor	
9	Registration sensor	
10	Bypass sensor	

10.2 Configuration

Paper feeding system				
Drawer	Pickup roller	Periodic replacement part		
	Pickup solenoid (SOL1)			
	Drawer pickup clutch			
	Paper empty sensor (S7)			
Bypass unit	Bypass pickup roller	Periodic replacement part		
	Bypass feed roller	Periodic replacement part		
	Bypass separation pad	Periodic replacement part		
	Bypass sensor (S8)			
	Bypass pickup solenoid (SOL2)			
	Bypass pickup clutch			
	Bypass feed clutch			
Registration roller				
Registration roller clutch (CLT1)				
Registration sensor (S4)				
Drawer detection switch (SW5)				

10.3 Functions

1) Pickup roller

This roller, which has a semicircle shaped roller section, draws out a sheet of paper from the drawer and transport it to the registration roller. One rotation of the pickup roller transports one sheet of paper to the registration roller.

2) Pickup solenoid (SOL1)

The solenoid which starts transmitting the drive to the drawer pickup clutch. The driving force is not transmitted to the drawer pickup clutch when the pickup solenoid (SOL1) is turned OFF, and transmitted when turned ON. The pickup solenoid (SOL1) rotates one turn for every one turn of the pickup roller.

3) Drawer pickup clutch

Spring-type (mechanical) one-way clutch which used to transmit the drive from the main motor (M4) to the pickup roller. When the pickup solenoid (SOL1) is turned OFF, the spring tension of the one-way clutch is decreases to cut off the drive.

4) Paper empty sensor (S7)

This is a transmissive-type sensor and detects the availability of paper in the drawer. When there is no paper in the drawer, the actuator blocks the light path of the sensor, and the sensor determines that there is no paper.

5) Bypass pickup roller

This roller draws out a sheet of paper from the bypass tray, and transports it to the bypass feed roller. The roller goes down and starts rotating when the drive is transmitted.

6) Bypass feed roller

This roller transports the paper from the bypass pickup roller to the registration roller.

7) Bypass separation pad

When two sheets of paper or more are transported from the bypass pickup roller, the resistance force of the separation pad is larger than the frictional force between the sheets. As the result, the lower paper is not transported any further.

8) Bypass sensor (S8)

This sensor detects whether paper is set in the bypass tray or not. When the paper is set in the bypass tray, bypass feeding is performed in preference to drawer feeding. And it also detects whether paper has been transported from the bypass tray or not (i.e. whether the leading/trailing edge of paper has passed the bypass feed roller or not.). The sensor is also used to detect the jams such as paper misfeeding in the bypass unit.

9) Bypass pickup solenoid (SOL2)

The solenoid which starts transmitting the drive to the bypass pickup clutch and bypass feed clutch. The driving force is not transmitted to the bypass pickup clutch and bypass feed clutch when the bypass pickup solenoid (SOL2) is turned OFF, and transmitted to rotate the bypass pickup roller and bypass feed roller when turned ON.

10)Bypass pickup clutch

Spring-type (mechanical) one-way clutch which used to transmit the drive from the main motor (M4) to the bypass pickup roller. When the bypass pickup solenoid (SOL2) is turned OFF, the spring tension of the one-way clutch decreases to cut off the drive.

10

11)Bypass feed clutch

Spring-type (mechanical) one-way clutch which used to transmit the drive from the main motor (M4) to the bypass feed roller. When the bypass pickup solenoid (SOL2) is turned OFF, the spring tension of the one-way clutch decreases to cut off the drive.

12)Registration roller

Paper transported from the pickup roller or bypass feed roller is pushed against the registration roller which aligns the leading edge of the paper. Then, the registration rollers rotate to transport the paper to the transfer position

13)Registration roller clutch (CLT1)

Electromagnetic clutch which drives the registration roller. When the registration roller clutch (CLT1) is turned ON, the drive is transmitted from the main motor (M4) to rotate the registration roller.

14)Registration sensor (S4)

This sensor detects that the leading edge of the paper has reached the registration roller and the trailing edge of the paper has passed the registration roller.

15)Drawer detection sensor (SW5)

The switch to detect whether the drawer is closed or not.

10.4 Operation

10.4.1 Drawer

[A] Operation of pickup roller

When the drawer is inserted to the equipment, the lock located in the center of the drawer is released, and the tray in the drawer is lifted up by the spring. This makes paper set in the tray to be contacted by the pickup roller when it is rotated.

The driving force of the main motor (M4) is transmitted through the pickup clutch to the pickup roller. Also the drawer pickup clutch transmits the drive when the pickup solenoid (SOL1) is turned ON. The pickup roller rotates one turn by this driving force to pull out a sheet of paper from the drawer. The pickup roller stops at its home position for each rotation. Therefore, when multiple sheets of paper are fed, the pickup solenoid is turned ON by each rotation.

One rotation of the pickup roller, which is semicircle shaped, can transport a paper to the registration roller.

This feeding system has no detection mechanism for the transported paper. Therefore, whether the paper has been transported to the registration sensor within a specified time or not is substituted for the paper jam detection.

T.B.D.

Fig. 10-2

[B] Paper separation

This model is equipped with the separation claws which work to prevent multiple paper feeding. Two separation claws are installed to hold 2 corners of the leading edge of paper in the drawer. When feeding starts, the pickup roller rotates. Since the friction between the pickup roller and paper is greater than the friction between two sheets, the pickup roller tries to send out a sheet of paper from the top of the stack. On the other hand, because both corners of the paper stack are held by the separation claws, the paper is bent. When the picking up force of the roller increases, one sheet of paper is finally released from the claws. The sheet released from the separation claws is directly transported to the registration roller by the pickup roller.

T.B.D.

Fig. 10-3

10

10.4.2 Bypass tray

[A] Operation of drawer pickup roller

When a paper is set on the bypass tray, the bypass sensor (S8) detects it and judges that there is paper on the bypass tray, and the bypass feeding is performed in preference to drawer feeding. When the bypass pickup solenoid (SOL1) is turned ON, the driving force of the main motor (M4) is transmitted to the bypass pickup clutch and bypass feed clutch. The bypass pickup roller starts to be rotated and lifted down by the drive from the bypass pickup clutch, and the paper on the bypass tray is transported to the bypass feed roller.



Fig. 10-4

[B] Paper separation

This model is equipped with a separation pad which works to prevent multiple paper feeding. The separation pad is pushed to the bypass feed roller by the spring force. The bypass feed roller is rotated synchronously with the bypass pickup roller. When more than two sheets of paper are fed from the bypass pickup roller, since the friction between two sheets of paper is smaller than that of between a sheet and the separation pad, the lower sheets are not transported any further while the uppermost paper is transported by the feed roller.

The paper transported by the bypass feed roller reaches the registration roller. After the paper is aligned with the registration roller, the bypass pickup solenoid (SOL2) is turned OFF to stop the bypass pickup roller and bypass feed roller, and the bypass pickup roller returns to its original position.



Fig. 10-5

10.4.3 General operation

[A] From power ON to standby status

- When the equipment is turned ON, if the paper empty sensor (S7) is turned OFF (L), it is judged that there is no paper in the drawer. With the sensor (S7) being ON (H), it is judged that there is paper in the drawer.
- When the drawer is not completely inserted when the equipment is turned ON, it is judged by using the drawer detection switch (SW5) that the drawer has not been inserted. Paper detection in the drawer cannot be performed unless the drawer is fully inserted.
- If either of the sensors; registration sensor (S4) or exit sensor (S5) is ON (meaning there is paper on the transport path) when the equipment is turned ON, it is determined that a paper jam has occurred and no operation is enabled until the paper is removed.

[B] Standby status

 After the availability of paper is checked as described above, the equipment enters the standby state.

[C] Bypass feeding

- The bypass sensor (S8) detects the availability of paper.
- When the bypass pickup solenoid (SOL2) is turned ON, the bypass pickup clutch arm and bypass feed clutch arm are pulled away from each clutch.
- The driving force of the main motor (M4) is transmitted to the bypass pickup clutch and bypass feed clutch to rotate the bypass pickup roller and bypass feed roller. At this time, the bypass pickup roller rotates and goes down simultaneously.
- Feeding starts and a sheet of paper is transported to the registration roller. The paper stops at the registration roller and the leading edge of the paper turns ON the registration sensor (S4).
- The bypass pickup solenoid (SOL2) is turned OFF, and the bypass pickup clutch arm and bypass feed clutch arm come in contact with each clutch. The drive for the bypass pickup roller and bypass feed roller is cut off, and the bypass pickup roller unit is lifted up.
- The registration clutch (CLT1) is turned ON and the paper aligned with the registration roller is transported to the transfer unit.

[D] Drawer feeding

- When the pickup solenoid (SOL1) is turned ON, the driving force of the main motor (M4) is transmitted to the drawer pickup clutch to rotate the pickup roller one turn. Then, a sheet of paper is fed and transported to the registration roller.
- The paper stops at the registration roller and the leading edge of the paper turns ON the registration sensor (S4).
- The registration clutch (CLT1) is turned ON and the paper aligned with the registration roller is transported to the transfer unit.

10.5 Disassembly and Replacement

[A] Bypass unit

- (1) Take off the ADU cover. P.2-21 "[G] ADU cover"
- (2) Disconnect 1 connectors.



Fig. 10-6

(3) Remove 2 screws, and take off the bypass unit by lifting it up.

Note:

When installing the bypass unit, place the guide behind the transfer unit.



Fig. 10-7

[B] Bypass tray

(1) Open the bypass tray slightly and lift it upward a little.





(2) Open the bypass tray while it is lifted.



(3) Hold the tray straight up, slide its front and rear arms to the cutout portion of the tray to release them, and then take off the bypass tray.







[C] Bypass separation pad

- (1) Take off the bypass unit. □ P.10-8 "[A] Bypass unit"
- (2) Remove 2 screws and take off the bypass separation pad unit.





(3) Remove 1 screw on the bottom of the bypass separation pad unit, and take off the cover.



Fig. 10-12

(4) Release 2 latches and take off the bypass separation pad.





[D] Bypass roller unit

- (1) Take off the bypass unit. P.10-8 "[A] Bypass unit"
- (2) Remove 2 screws, and take off the cover.



Fig. 10-14

(3) Remove 1 spring and 2 screws. Then take off the bracket.

Note:

When installing the bracket, engage the Ushaped part of each head on both front and rear arms with each protrusion on the bypass roller unit.



Fig. 10-15

(4) Remove 1 clip, and take off the bypass roller unit while sliding it to the front side.

Note:

When installing the bypass roller unit, insert the shaft into the bushing and the coupling on the rear side.



Fig. 10-16

[E] Bypass pickup roller

- (1) Take off the bypass roller unit.
 P.10-11 "[D] Bypass roller unit"
- (2) Take off the bypass pickup roller and the shaft.



Fig. 10-17

[F] Bypass feed roller

- (1) Take off the bypass roller unit.□ P.10-11 "[D] Bypass roller unit"
- (2) Remove 1 clip. Then pull out the shaft and remove 1 pin.
- (3) Take off the bypass feed roller.



Fig. 10-18

[G] Bypass sensor (S8)

- (1) Remove 2 screws on the bottom of the equipment.
- (2) Disconnect 1 connector and take off the bypass sensor with the bracket.





(3) Release 2 latches and take off the bypass sensor.



Fig. 10-20

[H] Bypass pickup solenoid (SOL2)

- (1) Take off the bypass unit. P.10-8 "[A] Bypass unit"
- (2) Remove 1 screw.



Fig. 10-21

(3) Slide the bypass pickup solenoid upward, and take off the bypass pickup solenoid with its spring.



Fig. 10-22

[I] Bypass pickup clutch / Bypass feed clutch

- (1) Take off the bypass unit. P.10-8 "[A] Bypass unit"
- (2) Remove 1 E-ring, 1 bushing and 2 screws. Then take off the 2 gears and the bracket.





(3) Remove 1 E-ring, and take off the bypass pickup clutch with its shaft.



Fig. 10-24

(4) Remove the gear, spring, cover and cam out of the shaft.





(5) Remove 1 E-ring, and take off the bypass feed clutch.



Fig. 10-26

(6) Remove the gear, spring, cover and cap.



Fig. 10-27

[J] Paper Empty sensor (S7)

- (1) Take off the drawer.
- (2) Take off the process unit. P.11-9 "[A] Process unit"
- (3) Remove 1 screw and take off the dump heater cover.



Fig. 10-28

(4) Disconnect 1 connector, remove 1 screw, and take off the paper empty sensor with the bracket.



Fig. 10-29

(5) Release 2 latches and take off the paper empty sensor.



Fig. 10-30

[K] Pickup roller

- (1) Take off the drawer.
- (2) Take off the process unit. P.11-9 "[A] Process unit"
- (3) Rotate the pickup roller shaft counter-clock-wise.

Note:

Because the tension is applied to the pickup roller shaft by the pickup clutch when it is rotated counter-clockwise, be sure to hold the shaft while replacing the roller.

(4) Release 2 latches each to take off 2 pickup rollers.

Notes:

- Be sure to install the pickup roller in the correct direction when reassembling it.
- The pickup roller also can be taken off in the following procedure.
 - Take off the process unit.
 P.11-9 "[A] Process unit"
 - 2. Take off the drawer.
 - 3. Remove 1 screw and take off the dump heater cover.



Fig. 10-31



Fig. 10-32

4. Take off 2 pickup rollers by releasing 2 latches each.



Fig. 10-33

[L] Registration roller clutch (CLT1)

- (1) Take off the rear cover. P.2-22 "[J] Rear cover"
- (2) Remove 2 screws and take off registration roller holder.

Note:

When installing the registration roller holder, engage the arm of the registration roller clutch with the stopper of the registration roller holder.



Fig. 10-34

(3) Disconnect 1 connector and take off the registration roller clutch.



Fig. 10-35

[M] Pickup solenoid (SOL1)

- Take off the registration roller clutch.
 P.10-18 "[L] Registration roller clutch (CLT1)"
- (2) Disconnect 1 connector, remove 1 screw, and then take off the pickup solenoid.



Fig. 10-36
[N] Drawer pickup clutch

- (1) Take off the pickup solenoid.
 P.10-18 "[M] Pickup solenoid (SOL1)"
- (2) Remove 1 E-ring, and take off the drawer pickup clutch.





(3) Take off the cover-A, spring, cover-B and flange.



Fig. 10-38

[O] Registration roller (rubber)

- Take off the transfer/separation charger.
 P.11-16 "[L] Transfer/Separation charger"
- (2) Remove 1 E-ring, 1 clip, and take off 1 gear and the registration roller (rubber) while sliding them to the front side.



Fig. 10-39

(3) Remove 1 E-ring, 1 gear, and 1 pin from the registration roller.



Fig. 10-40

[P] Registration roller (metal)

- (1) Take off the Process unit.
- (2) Take off the transfer unit. P.11-17 "[N] Transfer unit"
- (3) Take off the registration roller clutch.
 P.10-18 "[L] Registration roller clutch (CLT1)"
- (4) Remove 1 clip, 1 bushing and then take off the registration roller (metal) while sliding it to the rear side.









Fig. 10-42

[Q] Feed gear unit

- (1) Take off the main motor drive unit. P.9-7 "[C] Main motor drive unit"
- (2) Take off the registration roller clutch.
 P.10-18 "[L] Registration roller clutch (CLT1)"
- (3) Disconnect 1 connector, remove 2 screws, and then take off the feed gear unit.

Note:

Set the gear-A in the installation position of the equipment before installing the feed gear unit.



Fig. 10-43

(4) Remove 1 screw and take off the pickup solenoid from the feed gear unit.



Fig. 10-44

11. DRUM RELATED SECTION

11.1 General Description

This chapter explains about the area around the drum, drum itself, image processing, their parts and control circuits.



Fig. 11-1

11.2 Configuration

Drum cleaner unit	Drum		PM parts
	Drum separation finger		PM parts
	Drum cleaning blade		PM parts
	Recovery blade		PM parts
	Drum thermistor (THM4)		
Discharge LED (ERS)			
Main charger	Needle electrode		PM parts
	Main charger grid		PM parts
Transfer unit	Transfer/Separation charger	Transfer charger wire	PM parts
		Separation charger wire	PM parts
	Exhaust fan (M6)		
	Ozone filter		PM parts
	Transport guide		
Temperature/humidity sensor (S3)			
Switching regulator (PS)			

11.3 Functions

1) Drum

The drum is made of a cylindrical aluminum base coated with thin film of organic photoconductive substance.

The photoconductive object becomes insulative (the electrical resistance is high) when it is not exposed to the light and electrically conductive (the electrical resistance is low) when it is exposed to the light. This object is called a photoconductor.

2) Main charger

The main charger in this equipment consists of a metal rod with U-shaped section, insulated blocks at both ends of the rod and a needle electrode attached between them.

When a high voltage is applied to the needle electrode, the air around it is charged (ionized). The ionized air then flows into the drum causing it to be charged. This phenomenon is called "corona discharge". At the same time, a control bias is applied to the main charger grid to control the charging amount.

In a dark place, negative charge is evenly applied onto the drum surface by the corona discharge and this grid. In addition, a cleaner is installed to clean up the dust attached on the needle electrode.

- Needle electrode

The needle electrode has aligned needles and their points perform the corona discharge. These points (electrodes) discharge toward the drum in one direction to realize the more efficient discharging comparing to the charger wire which discharges in a radial direction. Therefore, the needle electrode enables to reduce the ozone amount.



Fig. 11-2

11

3) Drum cleaner

- Cleaning blade

This blade is pressed against the drum surface and scrapes off the residual toner from the drum surface.

- Recovery blade

This blade catches the toner scraped off by the cleaning blade.

Toner recovery auger

This auger carries the residual toner scraped off to the developer unit and reuses the toner.

4) Transfer/Separation charger

Transfer guide

This guide leads the paper transported from the feeding unit to the transfer section. Positive (+) bias voltage is applied to the registration roller and post-transfer guide to prevent the transferability from being lowered under conditions such as high humidity.

- Transfer charger

The transfer charger applies a charge (positive (+) charge) which is contrary to the charging polarity of the toner to the back of the paper. The toner image is transferred electrostatically on the paper by performing this corona discharge.

- Separation charger

After the transfer process, the corona discharge applies a negative charge (DC) on the back of the paper to separate the paper adhering to the drum surface by an electrostatic force.

5) Exhaust fan (M6)

The exhaust fan (M6) cools down the inside of the equipment. The air to exhaust includes the ozone generated by the corona discharge, and this ozone is removed by the ozone filter. The exhaust fan (M6) also helps the paper separation by absorbing the paper to post-transfer guide.

6) Discharge LED (ERS)

Discharging is a process to decrease or eliminate the electrical potential of the drum surface. The electrical resistance of the photosensitive layer is decreased by the light irradiation, and the residual charge on the drum surface is neutralized and eliminated. The electrical potential of the drum surface is fixed to a certain amount before the drum is charged.

7) Drum thermistor (THMS4)

The drum thermistor (THMS4) detects the drum surface temperature, and thus the rotation speed of the exhaust fan (M6) is controlled when the equipment is in the ready status.

8) Switching regulator (PS)

This is a board to generate the output control voltage of the main charger, main charger grid, transfer charger, separation charger, developer bias and pre/post-transfer guide bias.

9) Temperature/Humidity sensor (S3)

This sensor and drum thermistors (THMS1,THMS2) detect the temperature and humidity inside of the equipment since the drum, developer material and paper are affected by environmental elements such as temperature or humidity. Thus the main charger grid, transfer/separation charger, transfer guide bias, developer bias, laser output and auto-toner output are controlled to be at their optimum states.

11.4 High-Voltage Output Control Circuit

11.4.1 General description

In this equipment, the high-voltage generation circuit is included in the switching regulator. It is controlled by the ON/OFF signal of each bias output from the ASIC on the MAIN board and reference voltage Vc of each bias output from the SoC via the D/A converter. It generates the output current and voltage of each bias according to the +24VD input from the low-voltage generation circuit of the switching regulator.



Fig. 11-3

11.4.2 Description of Operation

The function and operation of each signal are as follows:

ON/OFF signals (HVTM-0, HVTAC-0, HVTT-0, HVTSP-0, HVTGB-0):

These are for the charge grid (needle electrode / grid), developer bias (AC), transfer charger, transfer guide bias and separation charger. When these signals become "L" level, the generation circuit of each bias on the switching regulator is turned ON to generate an output current/voltage.

* The negative DC component of the developer bias is turned ON/OFF by switching the reference voltage (HVDTR-0) separately. The positive DC component of the developer bias is output only when the reference voltage (HVDTR-0) is 0.6 V or less and also the developer bias ON/OFF signal (HVTAC-0) is ON.

Reference voltages Vc (HVMVR-1, HVDTR-1, HVTVR-1, HVSAV-1):

These are analog voltages which are the reference of each output of the charge grid, developer bias, transfer charger and separation charger. Each bias output can be linearly changed by switching these reference voltages.

The output operation of the reference voltage is as follows:

- 1) The adjustment values of the main charger, developer, transfer and separation bias in the Flash ROM are output to the SoC.
- 2) The reference voltage data are output from the SoC to D/A converter.
- 3) Converted to analog data by the D/A converter
- 4) The reference voltage Vc of each bias is output to the high-voltage generation circuit.
- 5) The high-voltage generation circuit generates the output current/voltage which is proportional to the reference voltage.
- * The reference voltage is adjusted in the Adjustment Mode (05).
- * The output values of the main charger and transfer guide bias are fixed when the high-voltage transformer is shipped from the factory.

Developer bias (AC) generation clock (HVCLK-0): This clock signal is a reference of the AC component of the developer bias.

High-voltage generation circuit leakage detection signal (HVSDWN-0):

This signal is for leakage detection of the high-voltage generation circuit. This signal becomes "L" level at the occurrence of such an abnormality.

11.5 Drum Temperature Detection Circuit

11.5.1 General description

To prevent the print quality from varying depending on the temperature, the temperature of the drum surface and around the drum is detected by the drum thermistor. Based on the result of the detection, this circuit corrects the output of the main charger bias, developer bias, transfer bias and separation bias as well as the output of the auto-toner sensor and the laser.

11.5.2 Circuit configuration

The configuration of the drum surface temperature detection circuit is shown below. The voltage output from the drum thermistor is converted by the A/D converter in the Main board and is input into the SoC. The drum thermistor is a device whose resistance decreases as the temperature rises; thus, the voltage input to the A/D converter becomes smaller along with the rise of the temperature.



Fig. 11-4

11.6 Temperature/Humidity Detection Circuit

11.6.1 General Description

To prevent the print quality from varying depending on the temperature and humidity of the place where the equipment is installed, the temperature and humidity of the outside air taken into the equipment are detected. Based on the result of the detection, this circuit corrects the output of the main charger bias, developer bias, transfer bias and separation bias as well as the output of the auto-toner sensor and the laser.

11.6.2 Circuit configuration

The configuration of the temperature/humidity detection circuit is shown below. The voltage output from the temperature/humidity sensor is converted digitally by the A/D converter on the MAIN board and is input into the SoC. The higher the temperature or the humidity is, the higher the output voltage of this sensor becomes.



Fig. 11-5

11.7 Disassembly and Replacement

[A] Process unit

- (1) Open the ADU cover and transfer unit.
- (2) Open the front cover and take off the toner cartridge.
- (3) Disconnect 1 connector. Loosen 2 screws and pull out the process unit.

Note:

When installing the process unit, make sure that the connector (harness) is not caught under the developer unit.



Fig. 11-6

[B] Drum cleaner unit

- (1) Take out the process unit. P.11-9 "[A] Process unit"
- (2) Disconnect 2 connectors and remove 2 screws.
- (3) Release 1 latch. Then pull out the process unit front cover and take it off.



Fig. 11-7

Note:

When installing the process unit front cover, wire the harness correctly in order not to contact the gears and harness of the process unit front cover each other.



Fig. 11-8

(4) Lift up the drum cleaner unit and take it off.

Notes:

1. Be careful not to touch or scratch the drum surface at this time.





2. Do not deform the Guide Mylar by touching this.





[C] Discharge LED (ERS)

- (1) Take off the drum cleaner unit. P.11-10 "[B] Drum cleaner unit"
- (2) Release 1 latch and take off the discharge LED unit.

Note:

Be careful not to touch or scratch the drum surface at this time.



Fig. 11-11

(3) Release the harness from the harness clamp and pull out the discharge LED.



Fig. 11-12

[D] Main charger

- (1) Take off the discharge LED unit.P.11-11 "[C] Discharge LED (ERS)"
- (2) Pull out the main charger and take it off by sliding it to the rear side.

Note:

Be careful not to touch or scratch the drum surface at this time.



Fig. 11-13

[E] Main charger grid 🖾

- (1) Take off the main charger. P.11-12 "[D] Main charger"
- (2) Remove the spring and take off the main charger grid.

Note:

Do not touch the mesh area of the grid.





[F] Main charger cleaner

- (1) Take off the main charger.□ P.11-12 "[D] Main charger"
- (2) Release the hook of the cleaning shaft. Then rotate the shaft at 90 degrees to take it off.



Fig. 11-15

[G] Needle electrode PM

- (1) Take off the main charger grid and main charger cleaner.
 P.11-12 "[E] Main charger grid"
 P.11-13 "[F] Main charger cleaner"
- (2) Take off the terminal covers of both front and rear sides.





(3) Remove the terminal and spring. Then take off the needle electrode.

Notes:

- 1. Do not touch the needle electrode directly with bare hands.
- 2. Make sure not to hold or bend the needle electrode.





[H] Drum 🖭

- (1) Take off the main charger. □ P.11-12 "[D] Main charger"
- (2) Rotate the lever while pushing its latch and pull it out.
- (3) Take off the drum.

Notes:

- 1. Be careful not to touch, spit or scratch the drum surface.
- Avoid direct light. Place the drum in a dark place immediately after taking off.
- 3. Be careful not to touch or scratch the edge of the cleaning blade.



Fig. 11-18

[I] Drum cleaning blade 🖭

- (1) Take off the drum. P.11-14 "[H] Drum"
- (2) Remove 2 screws and take off the drum cleaning blade.

Note:

Be careful not to touch or scratch the edge of the drum cleaning blade.



Fig. 11-19

[J] Drum separation finger (2M)

- (1) Take off the drum. P.11-14 "[H] Drum"
- (2) Take off 2 drum separation finger units by removing 1 screw each.

Note:

When replacing the drum separation fingers, make sure that the drum has been taken off first since the fingers may scratch the drum surface.





(3) Remove the spring and take off the drum separation fingers.

Note:

When the drum separation fingers have been replaced, check if the pressure movement is normal by moving them with your hands.



Fig. 11-21

[K] Recovery blade PM

- (1) Take off 2 drum separation finger units.
 □ P.11-15 "[J] Drum separation finger"
- (2) Remove 2 screws, and take off the whole recovery blade with the bracket.



Fig. 11-22

11

[L] Transfer/Separation charger

- (1) Open the ADU cover and transfer unit.
- (2) Release the latch and take off the transfer and separation chargers.



Fig. 11-23

[M] Charger wire 💷

- * Length: 353 mm (tungsten wire), diameter: 0.06 mm
- (1) Take off the transfer/separation charger. P.11-16 "[L] Transfer/Separation charger"
- (2) Release 9 latches and take off the separation supporter.



Fig. 11-24

- (3) Release 2 latches and take off the terminal cover on the front side.
- (4) Release 1 latch and take off the terminal cover on the rear side.



Fig. 11-25

- (5) Remove the terminal and spring. Then take off the transfer charger wire.
- (6) Remove the cushioning material, disconnect the terminal and remove the spring. Then take off the separation charger wire.

Notes:

- Insert the wire securely into the Vgrooves of the front and rear sides.
- 2. Do not twist the wire.
- 3. Do not touch the wire directly with bare hands.



Fig. 11-26

[N] Transfer unit

Note:

When taking off the transfer unit, take off the process unit first to prevent the drum from light.

(1) Open off the ADU cover.

(3) Disconnect 1 connector.

(2) Take off the transfer unit while pulling the lever.



Fig. 11-27



Fig. 11-28

11

(4) Take off the transfer unit while lifting it up.



Fig. 11-29

[O] Ozone filter 🖭

- (1) Open the ADU cover.
- (2) Release 1 latch and take off the rear side guide.



Fig. 11-30

- (3) Remove 1 screw and take off the ozone filter cover.
- (4) Take off the ozone filter.



Fig. 11-31

[P] Exhaust fan (M5)

- (1) Take off the transfer unit. P.11-17 "[N] Transfer unit"
- (2) Release 1 latch and take off the rear side guide.





- (3) Take off the transfer/separation charger. P.11-16 "[L] Transfer/Separation charger"
- (4) Remove 1 screw and take off the post transfer guide.



Fig. 11-33

(5) Remove 4 screws.



Fig. 11-34

(6) Release the harness from the harness clamp and take off the exhaust fan with the duct.



Fig. 11-35

(7) Release the harness from the harness clamp, remove the two-sided tape and take off the exhaust fan.



Fig. 11-36

[Q] Temperature/humidity sensor (S3)

- (1) Take off the left cover. P.2-19 "[C] Left cover"
- (2) Disconnect 1 connector, remove 1 screw, and then take off the temperature/humidity sensor.



Fig. 11-37

12. DEVELOPMENT SYSTEM

12.1 General Description

Development is the process of converting electrostatic latent images into visible images. The developer material is supplied onto the photoconductive drum surface by the developer sleeve (magnet roller). Then the toner in the developer material adheres to this drum surface to form images. This process is performed in the developer unit.

This chapter explains about the units, parts and control circuits related to development.

The developer unit in this equipment has a recovered toner supply mechanism which recycles the recovered toner scraped off by the drum cleaning blade. The developer unit is driven by the main motor (M3) to rotate the mixers and the developer sleeve.



Fig. 12-1

12.2 Construction

Developer unit	Developer material	Periodic replacement required
	Mixers-1, -2 and -3	
	Developer sleeve (Magnet roller)	
	Doctor blade	
	Auto-toner sensor	S6
	Drum thermistor	THMS4
	Recovered toner supply mechanism (Toner recycling auger)	
Toner cartridge	Toner cartridge PC board	CTRG
	Toner cartridge interface PC board	CTIF
Toner motor		M2 (Ch. 9)

12.3 Functions

12.3.1 Function of each unit

[1] Developer unit

• Developer material

This consists of carrier and toner. The carrier is electrically conductive ferrite whose particle size is $30-100 \ \mu m$, and the toner is resin whose particle size is $5-20 \ \mu m$. The developer material requires a periodic replacement since it deteriorates with long-term use.

• Mixers-1, -2 and -3

Mixing the developer material generates a friction of the carrier and the toner. The carrier is then positively charged and the toner is negatively charged, and the charged carrier and toner adhere on the drum surface by their static electricity. The mixer-3 is mounted exclusively for the recovered toner to mix it in a sufficient period of time.

• Developer sleeve (Magnet roller)

This aluminum roller includes a magnet inside. The developer sleeve absorbs the developer material using this magnet to form a magnetic brush. The magnet is fixed therefore the only sleeve is rotated. This rotation makes the magnetic brush of the developer sleeve sweep over the drum surface, and thus development is performed.

Doctor blade

This controls the amount of the developer material transported from the developer sleeve so that the magnetic brush of the developer material can properly contact with the drum surface.

• Auto-toner sensor (S6)

To print out normal images, a constant ratio of the carrier and the toner in the developer material (= toner density) must be maintained. The auto-toner sensor (S6) detects the content ratio of the toner in the developer material with its magnetic bridge circuit. When this sensor detects the insufficient status of the toner, it drives the toner motor (M2) to supply the toner from the toner cartridge.

- Drum thermistor (THMS4) This is installed in the developer unit to detect the ambient temperature of the drum.
- Recovered toner supply mechanism (Toner recycling auger) The recovered toner, transported from the drum cleaner, is then transported into the developer unit by the toner recycling auger mounted on the front side of this unit. The drive of the toner recycling auger is transmitted from the mixer-3.

[2] Toner cartridge

This is filled with the toner and this supplies the toner to the developer unit by the drive of the toner motor (M2). The toner cartridge in this equipment mounts the toner cartridge PC board (CTRG), and the data identifying genuine TOSHIBA toner cartridges and the counter values determining that the cartridge is nearly empty are written in this board. These data are read out by the toner cartridge interface PC board (CTIF) in this equipment, and data related to toner supply are also written in the toner cartridge PC board (CTRG). The toner cartridge interface PC board (CTIF) also detects whether the toner cartridge is installed or not.

[3] Toner motor (M2)

This drives the toner cartridge with gears.

12.3.2 Functions of the toner cartridge PC board (CTRG)

The toner cartridge in this equipment mounts the toner cartridge PC board (CTRG). An IC chip is embedded in this board, and the data identifying genuine TOSHIBA toner cartridge and thresholds determining that the cartridge is nearly empty are written in this chip.

To measure the toner amount remaining in the toner cartridge, when the value of the toner cartridge drive counter (08-1376) is updated, this equipment writes the updated value into the toner cartridge PC board (CTRG).

These data written in the toner cartridge PC board (CTRG) enable the functions below, and accordingly this equipment operates as shown below. Data reading is performed every time the power of this equipment is turned ON and the front cover is closed.

[Data read by the toner cartridge PC board (CTRG)]

- Data to identify genuine TOSHIBA toner cartridges
- Thresholds to determine that the toner cartridge is nearly empty
- Toner cartridge drive counter values

[Functions]

- Cartridge detecting function (including detection of the use of a genuine TOSHIBA toner cartridge)
- Toner remaining check function

[Operations]

Toner cartridge	Genuine cartridge	Genuine cartridge refilled with new toner	Non-genuine cartridge		
Cartridge detecting function	Enabled (The toner lamp blinks when no cartridge is installed.)	Enabled (The toner lamp blinks when no cartridge is installed.)	Disabled (The toner lamp blinks to show that no cartridge is installed, even if a car- tridge is installed. Printing is enabled.)		
Toner remaining check function	Enabled (The toner lamp is lit when the cartridge is nearly empty.)	Disabled (The toner lamp is lit when the cartridge is still installed.)	Disabled		

A sign of the status that the toner cartridge is nearly empty (= the behavior of the toner lamp) appears when the value of the toner cartridge drive counter has exceeded the thresholds previously written in the toner cartridge PC board (CTRG). When a used cartridge refilled with new toner is used, therefore, the toner cartridge drive counter value in the toner cartridge PC board (CTRG) had already exceeded the threshold to determine the near-empty status of the toner at this moment, so the sign of the near-empty status appears immediately after the installation of this cartridge. When a non-genuine toner cartridge is used, the toner lamp blinks by the cartridge detecting function because its data cannot be read out.

Since the difference between the toner cartridge drive counter values and the remaining amount of the toner is unstable, the toner near-empty status threshold setting (08-****) is provided to adjust this difference.

The toner near-empty status threshold setting (08-****)

- 0: The period from the appearance of the toner near-empty sign to the actual complete consumption of the toner is set long.
- 1: Normal (Default)
- 2: The period from the appearance of the toner near-empty sign to the actual complete consumption of the toner is set short.
- 3: The sign of the status that the cartridge is nearly empty does not appear.

However, the shorter the period described above is set, the more frequently the toner in the cartridge may run out before the sign of the near-empty status of the toner appears because the way the toner remains in the cartridge differs every time.

When the value of the toner near-empty status threshold setting (08-****) is set at "3", neither of the cartridge detecting function (including detection of the use of a genuine TOSHIBA cartridge) and the toner remaining check function is enabled.

12.3.3 Recovered toner supply mechanism

The toner scraped off by the drum cleaning blade is transported by the toner recovery auger and the toner recycling auger to be recycled, and then returned into the developer unit. Then the recovered toner in the developer unit is mixed by the developer material using the mixer-3. The mixer-3 is mounted exclusively for the recovered toner to mix it in a sufficient period of time. On the other hand, the (fresh) toner transported from the toner cartridge into the developer unit is mixed by the mixer-2. Then the (fresh) toner and the recovered toner are mixed together and further transported to the mixer-1. They are further mixed by the mixer-1 and transported to the developer sleeve.



Fig. 12-2

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12.4 Toner Motor Control Circuit

The toner motor, which a DC motor driven by control signals from the ASIC on the MAIN board, supplies toner to the developer unit by means of rotating the paddle and anger in the toner cartridge. The toner motor is driven when the ON/OFF signal (TNRMTON-0) output from the ASIC becomes "L" level.



Fig. 12-3

12.5 Auto-Toner Circuit

12.5.1 General description

- 1) Function of the auto-toner circuit
 - Detects the toner density in the developer material, and supplies toner when the density is lowered to a certain level.
 - Detects that there is no toner left in the cartridge (toner-empty detection).
- 2) The auto-toner circuit consists of the following:
 - Auto-toner sensor: Detects the toner density.
 - Control section: Controls the toner density so that the toner in the developer material is fixed to certain ratio.
 - Toner motor: Supplies toner to the developer material.
 - Control panel: Indicates toner-empty information.
 - Recovered toner supply section: The main motor supplies the recovered toner to the developer unit from the recovered toner supply mechanism.





12.5.2 Function of auto-toner sensor

- 1) Function
 - Initialization adjustment function At the first use of the equipment or when the developer material is replaced with a new one.
 Automatically adjusts the output value of the auto-toner sensor responding to humidity (input value to the A/D converter) for the toner density of the new developer material so that it stays in range of 2.34 to 2.46 V.
 - Stabilizing the toner density During the printing operation Maintains the toner density to a certain ratio as follows.

Toner is consumed.

- \rightarrow The toner density is lowered.
- \rightarrow Change in the auto-toner sensor output responding to humidity is detected.
- \rightarrow The toner motor is driven.
- \rightarrow Toner is supplied from the toner cartridge to the developer unit.
- Toner-empty detection and recovery:

Detects that there is no toner in the toner cartridge: The toner motor is driven.

- \rightarrow The auto-toner sensor output does not change.
- \rightarrow The toner density does not change.
- \rightarrow It is determined there is no toner in the cartridge (toner empty).

Recovering from the toner-empty state:

The toner motor is driven.

- \rightarrow Toner is supplied from toner cartridge.
- \rightarrow The auto-toner sensor output changes.
- \rightarrow The toner density returns to normal value.
- \rightarrow The toner-empty state is cleared.

- 2) Function of auto-toner sensor
 - The auto-toner sensor consists of the following circuits:

Drive winding:

A magnetic head (primary side) with a high-frequency magnetic field, which forms a magnetic circuit in the developer material.

Detection winding:

Receives the change in the magnetic resistance of the developer material through the magnetic circuit (secondary side).

DC conversion circuit:

Converts a high-frequency output from the detection winding into a DC signal (auto-toner output V_{ATS}).





When the toner density is low

The ratio of the toner against the carrier in the developer material decreases.

- \rightarrow The magnetic resistance decreases.
- \rightarrow The detection output increases.
- \rightarrow The auto-toner output V_{ATS} increases.
- When the toner density is high

The ratio of the toner against the carrier in the developer material increases.

- \rightarrow The magnetic resistance increases.
- \rightarrow The detection output decreases.
- \rightarrow The auto-toner output V_{ATS} decreases.

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12.6 Disassembly and Replacement

[A] Developer unit

Note:

Make sure to perform "T.B.D" and take off the process unit before the developer material is replaced.

- (1) Take off the Process unit. P.11-9 "[A] Process unit"
- (2) Take off the drum cleaner unit from the process unit so that only the developer unit will be left.

P.11-10 "[B] Drum cleaner unit"

Notes:

1. Be careful not to touch or scratch the drum surface at this time.





2. Do not deform the Guide Mylar by touching this.



Fig. 12-7

[B] Removing developer material

- Take out the developer unit
 P.12-10 "[A] Developer unit".
- (2) Remove 2 screws and slide the developer unit upper cover to the direction of the arrow and take it off.





Note:

When installing the developer unit upper cover, make sure that the side seal comes between the developer unit upper cover and rubber seal on the cover.





(3) Remove the developer material from rear side.

Note:

When removing the developer material, be careful not to drop the developer material on the gears of the developer unit.





[C] Filling developer unit with developer material

- (1) Install the developer nozzle jig on the developer bottle.
- (2) Rotate the gear on the rear side of the developer unit to the direction of the arrow while filling the developer unit with the developer material. Spread out the developer material over the developer sleeve.



Fig. 12-11

[D] Auto-toner sensor (S6)

- Remove the developer material.
 P.12-11 "[B] Removing developer material"
- (2) Place the developer unit upside down. Disconnect 1 connector, release 1 latch, and then rotate the auto toner sensor counterclockwise to take it off.



Fig. 12-12
[E] Drum thermistor (THMS4)

- Remove the developer material.
 P.12-11 "[B] Removing developer material"
- (2) Disconnect 1 connector, remove 1 screw and take off the drum thermistor.



Fig. 12-13

[F] Guide roller / Developer sleeve

- Remove the developer material.
 P.12-11 "[B] Removing developer material"
- (2) Remove 2 screws and take off the recovered toner supply unit.



Fig. 12-14

(3) Remove 1 screw. Disconnect 1 connector while taking off the recovered toner drive unit. Remove 1 gear.



Fig. 12-15

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(4) Remove 2 plate springs fixing the doctor sleeve on its both ends.



Fig. 12-16

(5) Remove 2 screws on both ends of the doctor sleeve and remove 2 coil springs.

Note:

When the screws on both ends of the doctor sleeve are removed, be sure to adjust the doctor sleeve gap (0.45±0.05 mm) after assembling.

(Refer to Service Handbook Chap.3.8)



Fig. 12-17

(6) Remove 1 screw and take off the polarity adjustment lever.

Note:

Make a note of the position where the polarity adjustment lever is pointing. (Mark the position if needed.) When reassembling, match the polarity adjustment lever with the previously marked position on the scale.



Fig. 12-18

(7) Remove 3 screws and take off the bracket.





(8) Remove 1 E-ring and take off the guide roller on the front side.





(9) Remove 1 screw and the gear.



Fig. 12-21

(10) Remove 3 screws. Take off 1 bearing and the bracket.



Fig. 12-22



Fig. 12-23



Fig. 12-24

(11) Take off 4 gears and 1 timing belt.

- (12) Remove 1 E-ring, 1 pin and 1 pulley.
- (13) Take off the guide roller on the rear side.

(14) Remove the seal on the front side. Remove 1 E-ring and 1 bushing.





Developer sleeve



[G] Mixer

- Take off the developer sleeve.
 P.12-13 "[F] Guide roller / Developer sleeve"
- (2) Take off the doctor sleeve.

(15) Take off the developer sleeve.



Fig. 12-27

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- (3) Remove 1 screw and take off the tensioner bracket.
- (4) Remove 2 screws and take off the holder.





(5) Remove 2 bushings and 2 oil seals from the holder.
 (Replacement of Oil seal: P.12-20 "[H] Replacement of Oil Seal")



Fig. 12-29

(6) Take off the mixers-2 and -3.



Fig. 12-30

(7) Remove 2 bushings and 2 oil seals on the rear side.
 (Replacement of Oil seal: P.12-20 "[H] Replacement of Oil Seal")

(8) Remove the end section of the mixer-1.(9) Remove the bushing and oil seal.

Replacement of Oil Seal")

(Replacement of Oil seal: P.12-20 "[H]



Fig. 12-31



Fig. 12-32

(10) Take off the mixer-1.



Fig. 12-33

12

- (11) Remove the bushing on the rear side.
- (12) Remove the oil seal.(Replacement of Oil seal: P.12-20 "[H] Replacement of Oil Seal")



Fig. 12-34

[H] Replacement of Oil Seal

- (1) Insert a fine screwdriver into the depression of the oil seal to take it out.
- (2) Push in a new oil seal parallel to the frame or bushing (shown figure at right).
- (3) Apply the grease (Alvania No.2; amount of 2 rice grains) on entire surface of the oil seal evenly.

Note:

Wipe off the excessive grease.



Fig. 12-35

13. FUSER / EXIT UNIT

13.1 General Description

In the equipment, the fuser unit which fuses toner on the paper and the paper exit section (exit roller) which outputs the paper with the fused toner to the inner tray are combined together to make up the fuser/exit unit.

In the fuser unit, toner is fused by applying heat and pressure on the transferred image on the transported paper. The paper is then transported to the exit tray after the completion of fusing. The fuser/exit unit is driven by the main motor to rotate the fuser roller and the exit roller.

Other than the above rollers, the fuser/exit unit consists of the heater lamps, separation fingers, thermistors (THMS1/THMS2/THMS3), fuser thermostat (THMO1), paper transport guide and the exit sensor which detects the status of the paper transport, etc.



Fig. 13-1

13.2 Configurations

Fuser / exit unit				
Pressure roller unit	Pressure roller	PFA tube sponge roller (\u00f625) Periodic replacement part		
	Exit sensor (S5)			
Fuser roller unit	Fuser roller	Fluoro-plastic coated roller (\u00f630) Periodic replacement part		
Heater lamp (LAMP1, LAMP2)		564W+564W		
	Thermistor (THM1, 2, 3)			
	Thermostat (THMO1)	Non-contact type (190°C)		
	Separation finger	Periodic replacement part		
	Exit roller			

13.3 Functions

1) Pressure roller

The pressure roller is a sponge roller which assures the nip amount of the fuser roller. The pressure from the spring presses the paper onto the fuser roller to fuse toner onto the paper efficiently.

2) Exit sensor (S5)

The exit sensor detects if the leading or trailing edge of the paper is passing through the pressure roller and the fuser roller. This sensor is used for the detection of paper jams in the fuser/exit unit as well.

3) Fuser roller

The fuser roller applies heat onto the paper and is heated by the heater lamps installed inside of the fuser roller. The heat from this roller fuses toner onto the paper. The fuser roller in this equipment is a thin roller which enhances heat conduction, and thus the warming-up time is shortened.

4) Heater lamp (LAMP1/LAMP2)

The heater lamps are halogen lamps to apply heat to the fuser roller. The fuser unit in this equipment has 2 heater lamps (564W+564W) with different functions each other. One has a coil wound up on its center and this part generates heat. The other one has coils wound up on its both ends and these parts generate heat. The one has a coil on its center is called the center heater lamp (LAMP1) and the one has coils on its both ends is called the side heater lamp (LAMP2). The heater lamps are fixed on the inside of the fuser roller to heat it up. The heater lamps do not

rotate even when the fuser roller is rotating.

5) Sensor thermistor (THMS1) / Side thermistor (THMS2)

This thermistor detects the temperature of the fuser roller to maintain it in a certain temperature range (actually around 180°C) between the lower limit causing the poor fusing and the upper limit causing the high temperature offsetting. When the temperature of the fuser roller is lower than the preset temperature, it turns ON the power supply to the heater lamps, and when it is higher than the preset temperature, it cuts off the supply.

The center thermistor (THMS1) detects the temperature of the center part of the fuser roller, and the side thermistor (THMS2) detects the temperature of one side of fuser roller and control the both sides.

6) Edge thermistor (THMS3)

Both the ends of the fuser roller may be overheated without heat absorption by the paper since it does not pass through this area. The edge thermistor (THMS3) detects any temperature abnormality of this area caused by overheating of the fuser roller. Therefore this thermistor is not used for temperature control of the fuser roller.

7) Fuser thermostat (THMO1)

The fuser thermostat (THMO1) cuts off the power supply to the heater lamps (LAMP1/LAMP2) by opening itself if the fuser roller becomes abnormally hot as a result of the problem such as thermistor malfunction. The fuser thermostat (THMO1) for this equipment is used to prevent abnormal operation. When the fuser thermostat (THMO1) detects any abnormality, it must be replaced as well as the other damaged parts in the fuser unit.

8) Separation finger

Five separation fingers are installed above the fuser roller, in order to separate paper adhereing to each roller.

9) Exit roller

The exit roller, which transports the paper to the inner tray, is driven by the main motor (M3).

13.4 Operation

The fuser roller is pressed by the pressure roller with the spring force. The fuser roller is rotated by the main motor drive, and the pressure roller is rotated by the rotation of the fuser roller. In addition, the heater lamps in the fuser roller do not structurally rotate.

2 heater lamps having different functions are installed; one applies heat to the center part of the fuser roller and the other applies heat to both ends of the roller. In this equipment, the surface temperature of the fuser roller at any paper size can be maintained by controlling the turning ON/OFF of the 2 heater lamps. The thermistors control the temperature of the fuser roller and detect temperature abnormalities. If the temperature becomes excessively high, the thermostat is opened to stop the power supply to the heater lamps.

Then the paper transported to the fuser unit is held between the fuser roller and pressure roller, and toner is fused on the paper with heat and pressure. After this, the separation fingers separate the paper from the fuser roller. Then the paper is transported to the inner tray through the exit roller. The paper transport status of the fuser/exit unit is detected by the exit sensor.

When the power is turned ON, the warming up of the fuser unit is started: the heater lamps are turned ON and the fuser roller is rotated. If the temperature of the fuser roller does not reach or exceeds a specified temperature within a specified period of time, it is judged that the heater is abnormal. When the specified temperature has been reached normally, the equipment goes into the ready state. When printing is not performed within a specified period of time during ready, the equipment enters the Auto Power Save Mode and turns the 2 heater lamps OFF or ON/OFF alternately to save power consumption. And if printing is not performed within another specified period of time after the equipment has entered the Auto Power Save Mode, the equipment then enters the Auto Shut Off mode to turn OFF the 2 heater lamps.

13.5 Fuser Unit Control Circuit

13.5.1 Configuration

In this equipment, the surface temperature of the fuser roller is controlled by turning ON/OFF 2 heater lamps (center and side) which have different heat-generating positions with the command from the SoC on the MAIN board. The surface temperature of the fuser roller is detected by 3 thermistors (center, side and edge) and then the information of the temperature is transmitted to the SoC and each control circuit. Based on the detected temperature, the SoC transmits the control signal of the heater lamp to the control circuit (TRC: Triac) of each heater lamp on the switching regulator. The power supply to each fuser roller is thus controlled by driving TRC. The SoC detects the overheating of the fuser roller. In case that the surface temperature of the fuser roller has exceeded the specified temperature, the SoC turns the heater lamp OFF.

If the SoC does not function for some reason and the fuser roller is abnormally overheated as the result, a forcible power-OFF circuit transmits a reset signal to the power switch to turn the power OFF forcibly. In addition, if these control circuits do not function with thermistor abnormality or other reasons and the fuser roller is abnormally overheated as the result, thermostat shut off the power supply to the heater lamps to protect the equipment.



Fig. 13-2

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13.5.2 Temperature detection section

To maintain the surface temperature of the fuser roller at a certain level, 3 thermistors (center, side and edge) detect the surface temperature of the fuser roller to turn ON/OFF and control 2 heater lamps (center and side).

1) Relation between the thermistor output voltage and surface temperature of the fuser roller

Output voltages of thermistors [V]	Surface temperatures of fuser roller [°C]		
Approx. T.B.D	40		
Approx. T.B.D	100		
Approx. T.B.D	170		

2) Control of the surface temperature of the fuser roller





Remark:

During warming-up, 2 heater lamps (center and side) are turned ON to raise the surface temperature of the fuser roller. During ready and printing status, each heater lamp is turned ON/OFF alternately to maintain the surface temperature of the fuser roller at a certain level (setting temperature of each status).

3) Temperature control for the both ends of the fuser roller

During continuous printing, the temperature of the end of the fuser roller (area where the paper does not pass on) generally tends to be higher than that of other areas (areas where the paper passes on). For this reason, the edge thermistor detects the temperature of the end of the fuser roller. When this thermistor detects the abnormal temperature (225°C), the heater lamp is turned OFF regardless of the temperature of the area where the paper passes on.

4) Temperature control at Energy Saving Mode

This equipment has the following two types of temperature control for saving energy and returns to ready status to perform printing in each mode upon printing request.

The period of time from the printing request to this mode can be set in "xxx" or by xxx.

Setting procedure:

T.B.D

Auto Power Save Mode (T.B.D):

When the printing is not performed in a specified period of time (default setting: 15 min.) after the previous printing is completed, the equipment enters to Auto Power Save Mode to turn OFF the heater lamp.

Auto Shut Off Mode (T.B.D):

When the printing is not performed in a specified period of time (default setting: 10 min.) after the equipment entered to Auto Power Save Mode, the equipment then enters to Auto Shut Off Mode to turn OFF the heater lamp.



Fig. 13-4

- 5) Fuser unit error status counter control
 - To enhance the safety of the fusing section unit, SoC provides the following protection: When the third [C41] error has occurred after two consecutive [C41] errors, the heater lamp is not turned ON and error [C41] is displayed immediately even if an operator turns OFF the power and back ON. However, if the equipment goes into a ready state normally with the fuser unit error status counter "1" or below, the counter is cleared to "0".
 - If the error codes [C41] to [C46] are displayed and still not cleared even though the thermistor, thermostat and heater lamp have been repaired (and the power ON/OFF does not clear the error), check the Setting Mode (08-400) to set the fuser unit error status counter to "0".

Remark:

- The fuser unit error status counter (Setting Mode (08-400)) never has values other than 0-20.
- If the heater lamp does not turn ON and the service call [C41] is displayed immediately after the power is ON, ensure the fuser unit error status counter is "2" or over. If it is "2" or over, be sure to check the thermistor, thermostat and heater lamp. Reset the counter to "0" after repairing them, then turn ON the power.
- If the fuser unit error status counter is "20" or over (e.g., 31), the data in SRAM or SRAM itself
 may possibly have been ruined due to causes such as leakage from the chargers. Check the
 bias, high-voltage transformers and charge wires to see if any of them is defective, and also
 look through all the data in the SRAM.
- When the thermistors detect overheating, the SoC decides the error code and counter value of the fuser unit error status. After turning OFF each output (the heater lamp, exposure lamp, control panel display, motors and so on), the SoC turns OFF the power to protect the fuser unit.

Error code: C44 ([CLEAR/STOP] and [8]) Counter value of the fuser unit error status: 9 (08-400)

Thermistors continue detecting the abnormal temperature even after the error codes and counter values are decided. Even if the power is turned ON immediately, it is automatically turned OFF again when the surface temperature of the fuser roller is still higher than the abnormal temperature detected.

Wait until the surface temperature of the fuser roller is lowered enough, and turn ON the power to check the counter value while it is turned OFF again. After confirming that it is the fuser unit abnormality, correct the abnormality and reset the counter value (08-400) to "0" to start up the equipment normally.

6) Temperature detection configuration

Thermistor is a device whose resistance decreases as it detects a higher temperature. Thus its input voltage to A/D converter changes and then SoC judges whether this change is normal or abnormal. If one of the fuser roller thermistors is broken, the control circuit judges that the fuser roller temperature is extremely low and keeps turning the heater lamp ON. As a result, the fuser roller temperature rises, and possibly activates the thermostat which is a safety protection device. To prevent this in advance, SoC works to detect whether each thermistor is broken or not.

Also, the thermistors constantly check the temperature of heater lamp to prevent it from excessive heating by MAIN circuit abnormality or thermistor abnormality. The thermistors automatically turn OFF the power when the temperature of heater lamp exceeds the specified temperature.





7) Abnormality detection by the thermistors

The following table shows the conditions judging the fuser roller temperature abnormality and detecting timing.

Checking	Priority	Temperature judged			Error-	Error
timing		Center thermistor	Side thermistor	Edge thermistor	judging timing	code
Power ON	1	T.B.D°C or above	-	-	Power ON	T.B.D
		-	T.B.D°C or above	-		
	2	T.B.D°C or below	T.B.D°C or above	-		T.B.D
		T.B.D°C or above	T.B.D°C or below	-		
		-	T.B.D°C or below	T.B.D°C or above		
Detecting 40°C	1	T.B.D°C or above	-	-	On usual	T.B.D
		-	T.B.D°C or above	-		
	2	T.B.D°C or below	-	-	Specified	T.B.D
		-	T.B.D°C or below	-	time	
Detecting 100°C	1	T.B.D°C or above	-	-	On usual	T.B.D
		-	T.B.D°C or above	-	-	
	2	T.B.D°C or below	T.B.D°C or above	-	-	T.B.D
		T.B.D°C or above	T.B.D°C or below	-	-	
	3	T.B.D°C or below	-	-	Specified	T.B.D
		-	T.B.D°C or below	-	time	
Detecting ready	1	T.B.D°C or above	-	-	On usual	T.B.D
temperature		-	T.B.D°C or above	-	-	
	2	T.B.D°C or below	T.B.D°C or above	-	-	T.B.D
		T.B.D°C or above	T.B.D°C or below	-	-	
		-	T.B.D°C or above	T.B.D°C or below	-	
	3	Ready temp. or below	-	-	Specified time	T.B.D
		-	Ready temp. or below			
During ready sta-	1	T.B.D°C or above	-	-	On usual	T.B.D
tus / In Energy		-	T.B.D°C or above	-	-	
Saving Mode	2	T.B.D°C or below	T.B.D°C or above	-	-	T.B.D
		T.B.D°C or above	T.B.D°C or below	-	-	
	3	T.B.D°C or below	-	-	-	T.B.D
		-	T.B.D°C or below	-	-	
During printing		T.B.D°C or above	-	-	On usual	T.B.D
		-	T.B.D°C or above	-	-	
	1	-	-	T.B.D°C or above	-	
		T.B.D°C or below	-	-	-	
		-	T.B.D°C or below	-	-	
	2	-	-	T.B.D°C or below		T.B.D
At paper jam	1	T.B.D°C or above	-	-	On usual	T.B.D
-		-	T.B.D°C or above	-	1	
In Self-diagnosis	1	T.B.D°C or above	-	-	On usual	T.B.D
Mode		_	T.B.D°C or above	_	-	

* The figures in the "priority" section denote the priority of error checking.

13.6 Disassembly and Replacement

[A] Fuser/Paper exit unit

- Take off the right rear cover.
 □ P.2-22 "[I] Right rear cover"
- (2) Lay down the transfer unit.
- (3) Disconnect 3 connectors, remove 2 screws, and then take off the fuser/paper exit unit.

Note:

Do not touch the fuser/paper exit unit because it is hot.



Fig. 13-6

[B] Pressure roller unit / Fuser roller unit

- (1) Take off the fuser/paper exit unit. P.13-11 "[A] Fuser/Paper exit unit"
- (2) Remove 1 spring and 2 screws.
- (3) Separate the pressure roller unit from the fuser roller unit.



Fig. 13-7

[C] Exit roller

- Take off the fuser roller unit.
 P.13-11 "[B] Pressure roller unit / Fuser roller unit"
- (2) Release the latch and take off the gear-A.







Fig. 13-9

(4) Remove the bracket.

(3) Take off the gear-B.



Fig. 13-10

- (5) Remove 1 clip and 1 bushing.
- (6) Take off the exit roller by sliding it to the rear side.



Fig. 13-11

[D] Exit sensor (S5)

- (1) Take off the fuser/paper exit unit. P.13-11 "[A] Fuser/Paper exit unit"
- (2) Remove the spring with the upper side of its hook from the guide.



Fig. 13-12

(3) Open the guide and slide it to the front side. Then slide its rear hinge downward.

Note:

Keep the guide being slid to the front side during the steps (3) and (4).



Fig. 13-13

(4) Lay down the guide, and then take off the guide by sliding its rear hinge to the right side.



Fig. 13-14

(5) Remove 1 spring and take off the guide while the guide is being slid to the rear side.



Fig. 13-15

(6) Disconnect 1 connector, release 2 latches, and then take off the exit sensor.



Fig. 13-16

[E] Separation finger

- Take off the fuser roller unit.
 P.13-11 "[B] Pressure roller unit / Fuser roller unit"
- (2) Remove 5 springs.

(3) Take off 5 separation fingers.







Fig. 13-18

[F] Center heater lamp / Side heater lamp (LAMP1/LAMP2)

- Take off the fuser roller unit.
 P.13-11 "[B] Pressure roller unit / Fuser roller unit"
- (2) Remove 2 screws on each terminal of both center heater lamp and side heater lamp.





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(3) Pull out the center heater lamp and side heater lamp.



Fig. 13-20

Notes:

• When installing the heater lamps, be sure not to mix up the upper heater lamp and the lower heater lamp.

The upper heater lamp has a coil wound up on its center part, and the lower heater lamp has coils wound up on its both edges.

- When installing the heater lamps, be sure to face up their weld sides.
- Do not touch the lamps directly with your hands.
- Connect the harness of the terminal M3 to the center heater lamp, and connect the harness of the terminal M4 to the side heater lamp.

Upper side : center heater lamp

Fig. 13-21

[G] Fuser roller

Take off the center heater lamp and the side heater lamp.
 P.13-15 "[F] Center heater lamp / Side

heater lamp (LAMP1/LAMP2)"

- (2) Take off the separation fingers. P.13-15 "[E] Separation finger"
- (3) Take out the fuser roller upward.

Notes:

- When installing the fuser roller, slide each bearing on both edges of the roller outward so that the bearings will engage with the frame and the installation will be secured.
- Do not apply force onto the roller because it may be deformed.



Fig. 13-22

- (4) Remove 1 C-ring and 1 bearing on the front side of the fuser roller.
- (5) Remove 1 C-ring, 1 gear and 1 bearing on the rear side of the fuser roller.



Fig. 13-23

[H] Pressure roller

- Take off the pressure roller unit.
 P.13-11 "[B] Pressure roller unit / Fuser roller unit"
- (2) Remove 3 screws, and then take off the fuser unit entrance guide.



Fig. 13-24

(3) Remove 2 springs.

Note:

When installing the spring, be sure to hang the spring on the upper hook.



Fig. 13-25

(4) Take off each 1 pressure lever on both front and rear sides.





(5) Take off 2 bushings and then take off the pressure roller.

Note:

Do not drop the pressure roller when you lift it up because it is quite heavy.



Fig. 13-27

[I] Center thermistor / Side thermistor / Edge thermistor (THMS1/THMS2/THMS3)

- (1) Take off the fuser roller. P.13-16 "[G] Fuser roller"
- (2) Remove each 1 screw of the thermistors, and then take off each thermistor by releasing its harness out of the harness clamp.





Note:

When installing the thermistors, do not mix up the installation positions of the side thermistor and the edge thermistor by telling them apart by the length of their harnesses.



Fig. 13-29

[J] Fuser thermostat (THMO1)

- (1) Take off the fuser roller. P.13-16 "[G] Fuser roller"
- (2) Remove 2 screws and take off the fuser thermostat.



Fig. 13-30

14. POWER SUPPLY UNIT

14.1 Construction

The power supply unit consists of the AC filter, insulated-side DC output circuit, and high-voltage output circuit.

1) AC filter

Eliminates noise from the outside and prevents the noise generated by the equipment from leaking to the outside.

- DC output circuit (Low-voltage output circuit) Converts AC voltage input from outside to DC voltage and supplies it to each electric part. The DC voltage is divided into the following two lines.
 - a.Main switch line: Power supply used in the entire equipment during the image forming process. Two kinds of voltage (+5V and +24V) are output when the main switch of the equipment is turned ON.
 b.Cover switch line: Power supply used in the entire equipment during the image forming process. It is supplied via the cover switch. This voltage is output only when both the main switch of the equipment and the cover interlock switches are turned ON (when the front and ADU covers are closed).
- 3) High-voltage output circuit Generates the output currents/voltages for the charger, developer, transfer and separation biases, based on the +24V voltage which is generated by the DC output circuit. For details of the high-voltage output circuit, see the following.
 III P.11-5 "11.4 High-Voltage Output Control Circuit"

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14.2 Operation of DC Output Circuit

1) Starting line output

When the power of the equipment is turned ON, all the voltages start being supplied. However, they start being supplied only when both the front cover and the ADU cover are closed.

2) Stopping line output

When the power of the equipment is turned OFF, the power-OFF (PWRDWN-1) signal is output after the end of the instantaneous outage insurance time (20 ms or more), and then the supply of each voltage stops. If the supply of voltage of the +5VB line stops earlier than the 24V line does, it may cause damage to the electron device on each control circuit. To prevent this, the supply of the +5VB voltage stops after the power-OFF signal is output and the minimum retaining time (50 ms or more) has elapsed.

3) Output protection

Each output system includes an overcurrent and overvoltage protection circuit (a fuse and internal protection circuit). This is to prevent defects (damage or abnormal operation of the secondary circuit) which may be caused by an overcurrent due to a short circuit or an overvoltage resulting from short-circuiting between different voltages. If the protection circuit is activated (except when the fuse is blown), repair the causes such as short-circuiting. Turn ON the power again 1 minute later to clear the overcurrent protection.

14.3 Output Channel

The following are 2 output channels for the main switch line.

1)	+5V +5V:	CN104 Pin 1 Output to the MAIN board
	+5VB:	CN104 Pins 6, 7 and 8 Output to the MAIN board
2)	+24V +24V:	CN104 Pins 15 and 16 Output to the MAIN board
	+24VDF:	CN104 Pins 17 and 18 Output to the ADF (via MAIN board)

The following is an output channel for the cover switch line.

1) +24V

+24VD:	CN104	Pins 21 and 22
	Output to	o the MAIN board, PFU (via MAIN board)

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14.4 Fuse

When the power supply secondary fuse is blown out, confirm that there is no abnormality with each part using the following table.

Voltage	Board/Unit	Part		Fuse type	
+24V	MAIN board	Scan motor M1 F203		F203: T.B.D	
		Polygonal motor	M4		
		Switching regulator cooling fan	M6		
		Main switch	SW1		
		Registration clutch	CLT1		
		Pickup solenoid	SOL1		
		Bypass pickup solenoid	SOL2		
		Contact image sensor unit	CIS		
	PFU				
+24VDF	ADF			F202: T.B.D	
+24VD	MAIN board	Toner motor	M2	F201: T.B.D	
		Main motor	M3		
		Exhaust fan	M5		
		Auto-toner sensor	S6		
		Discharge LED	ERS		
	Coin controller				

14.5 Configuration of Power Supply Unit



14.6 Power Supply Sequence



Fig. 14-2



15. PC BOARDS

1) PWA-F-MAIN



Fig. 15-1

2) PWA-F-SRAM



Fig. 15-2

3) PWA-F-LDR



Fig. 15-3

4) PWA-F-SNS



Fig. 15-4

5) PWA-F-LPNL



Fig. 15-5



Fig. 15-6

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