BJC-4650

SERVICE MANUAL

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BJC-4650

SERVICE MANUAL

Canon

Application

This manual has been issued by Canon Inc. for qualified persons to learn technical theory, installation, maintenance, and repair of products. This manual covers all localities where the products are sold. For this reason, there may be information in this manual that does not apply to your locality.

Corrections

This manual could include technical inaccuracies or typographical errors due to improvements or changes in the products. When changes occur in applicable products or in the content of this manual, Canon will release technical information as the need arises. In the event of major changes in the contents of this manual over a long or short period, Canon will issue new editions of this manual.

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This manual was produced on an Apple Macintosh™ Power Mac 8100/100AV personal computer and Apple LaserWriter™ II NTX-J laser beam printer; final pages were printed on Agfa SelectSet Avantra 25.
A YANO 230MO drive system J230MO-*FX* with MITSUBISHI MO disk cartridge MR230M1 were used for storing large volumes of page layout and graphic data for this manual.
All graphics were produced with MACROMEDIA FREEHAND™ 5.5J.
All documents and all page layouts were created with QuarkXPress™ 3.3J.

I. ABOUT THIS MANUAL

This manual is divided into four sections, and contains information required for servicing the unit.

Part 1: Safety and Precautions

This section tells you how to service the unit safely. It is very important, so please read it.

Part 2: Product Specifications

This section outlines the product specifications.

Part 3: Operating Instructions

This section explains how to operate the unit properly, and provides information required for installation and servicing.

Part 4: Technical Reference

This section outlines printer operation so you can understand it technically.

Part 5: Maintenance

This section explains how to maintain the unit. Descriptions of assembly/disassembly, adjustment for assembly, troubleshooting procedures, and wiring/circuit diagrams are given.

Procedures for assembly/disassembly are not given in this manual. See the illustrations in the separate Parts Catalog.

II. TABLE OF CONTENTS

III. ILLUSTRATION INDEX

IV. TABLE INDEX

Part 1

SAFETY AND PRECAUTIONS

1. SAFETY PRECAUTIONS

1.1 Moving Parts

The moving parts of the printer are shown below. They include the carriage belt, idler roller, carriage, slow down gear, paper feed roller, pressure roller, eject roller, spurs, and pick-up roller. The first three parts above are driven by the carriage motor while the latter are driven by the paper feed motor. Avoid getting hair, clothing, personal ornaments, etc., caught in these moving parts.

Also note that the spurs are made of metal and have sharp edges. Avoid touching these spurs with bare hands.

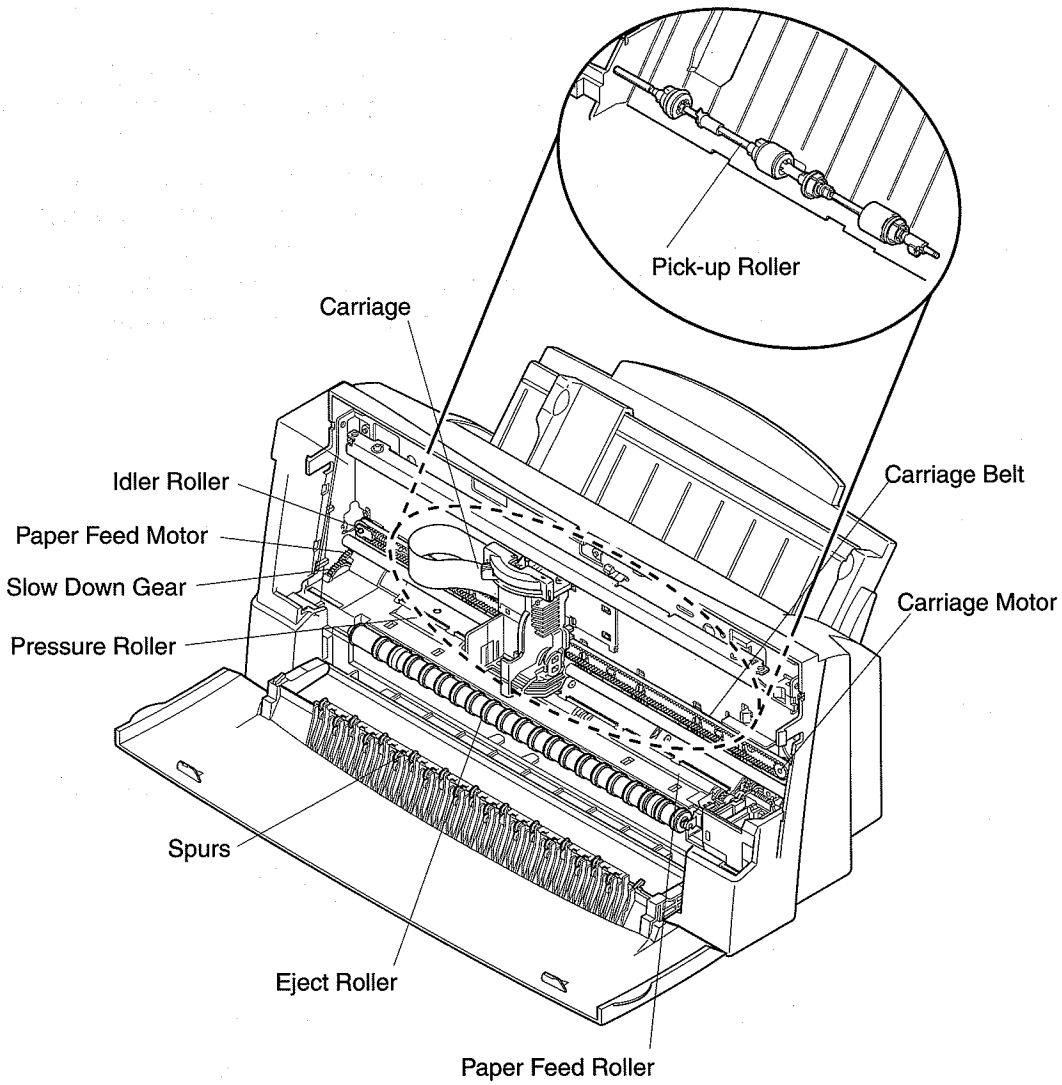


Figure 1-1 Moving Parts of the Printer

1.2 Ink Stains

1.2.1 Ink path

Do not touch areas in the ink path while servicing as the ink can stain hands, work table, clothing, etc.

The ink path consists of the BJ cartridge nozzles, head cap, head wiper, maintenance jet receiving section, and waste ink absorber.

In the case of color BJ cartridges, the cartridge's ink outlets and joint pipes are also part of the ink path.

CAUTION

Although the ink is non-toxic, it contains organic solvents. (Ethyleneglycol 107-21-1, glycerin 56-81-5, and isopropyl alcohol 67-63-0 in black ink and glycerin 56-81-5 and isopropyl alcohol 67-63-0 in color inks.)

Do not get ink in your eyes and mouth. If any ink should get into your eyes, wash out with plenty of water and consult a doctor. If a large amount of the ink is consumed, consult a doctor immediately.

Give the doctor the above details of the organic solvents. Since the ink contains dyes, any ink stains on clothing, etc., are permanent.

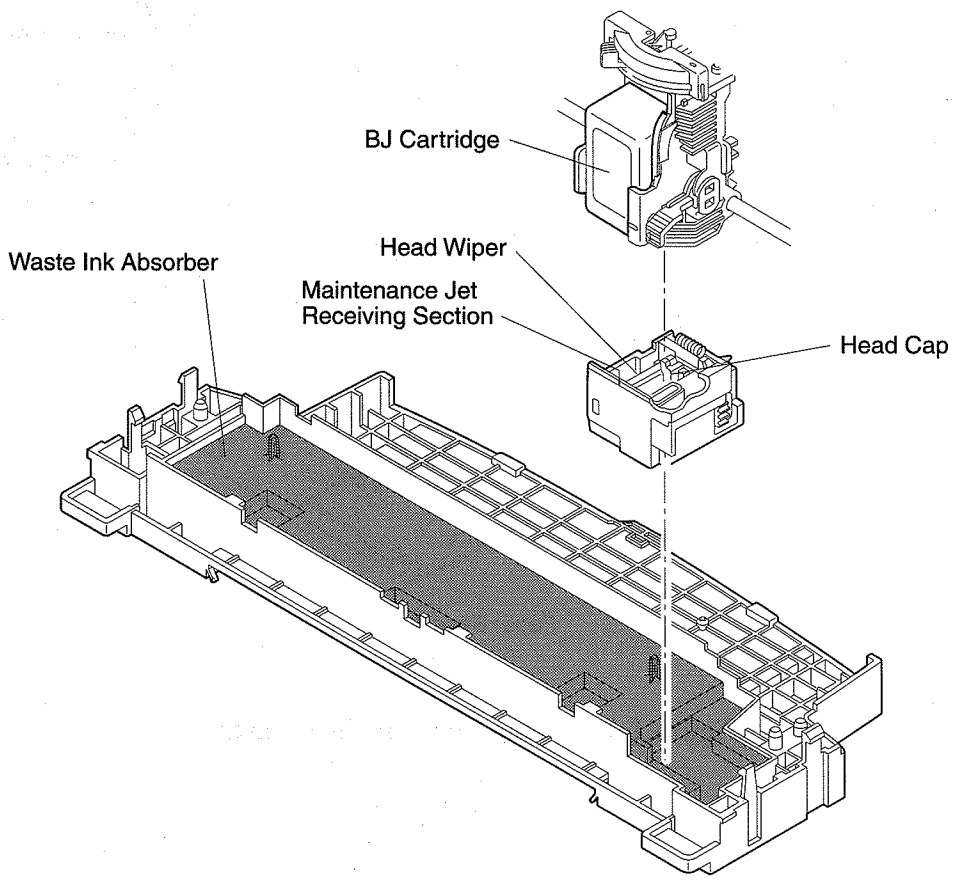


Figure 1-2 Ink Path

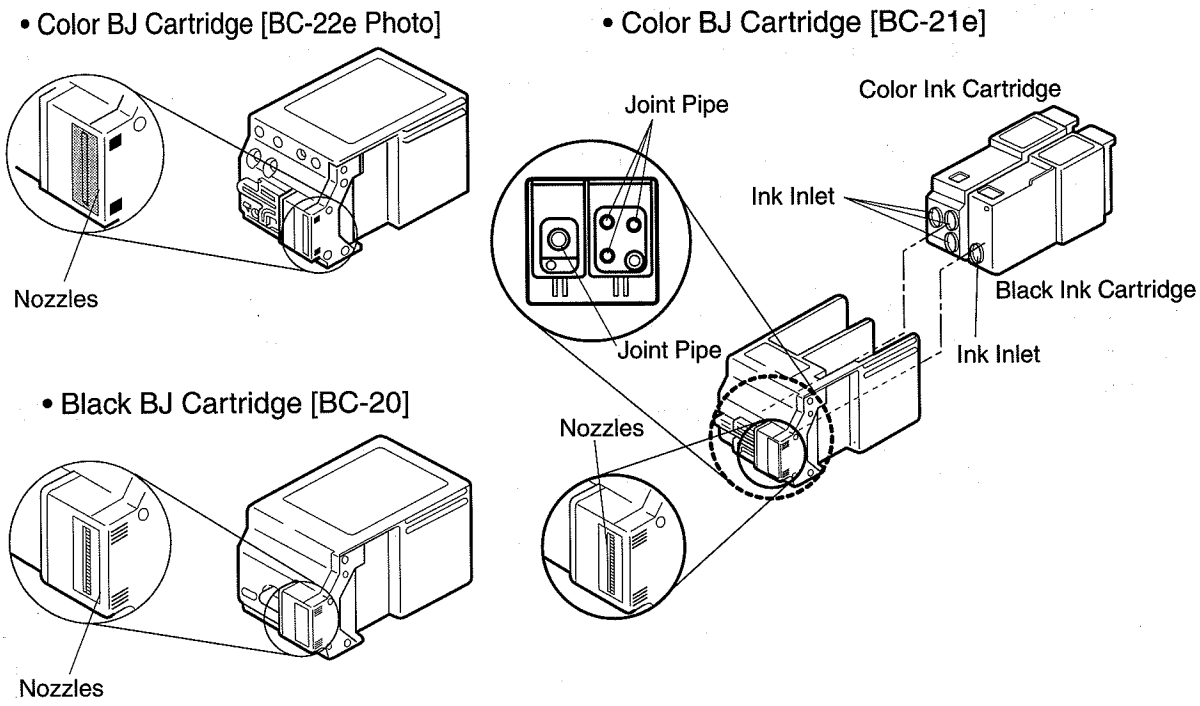


Figure 1-3 Ink Path of the BJ Cartridge

1.2.2 Ink mist

The BJ cartridge ejects ink onto the paper. During prolonged or heavy-duty use of the printer, small amount of ink mist which splatters off the paper during printing can contaminate the inside of the front cover and platen.
Clean any contaminated parts with a soft moist cloth. Ink in such areas can contaminate the back of the paper and dirty hands and clothing while servicing.

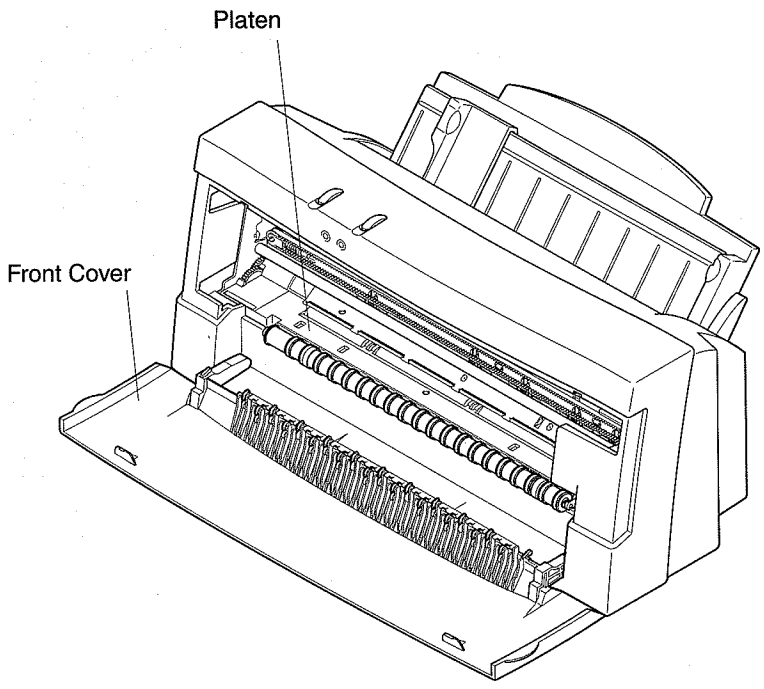


Figure 1-4 Ink Mist

1.3 Electrically Live Sections of the Printer

All electrical sections of the printer supplied with AC power are electrically live when the power cord is connected whether the printer is turned on or off using the *POWER* button.

Never disassemble the printer for servicing with the AC power supply plugged in as there is always the danger of electric shock.

CAUTION

As the AC main voltage is supplied to the primary side of the power supply unit, there is always the danger of an electric shock.

Therefore, always unplug the AC power cord before disassembling for service.

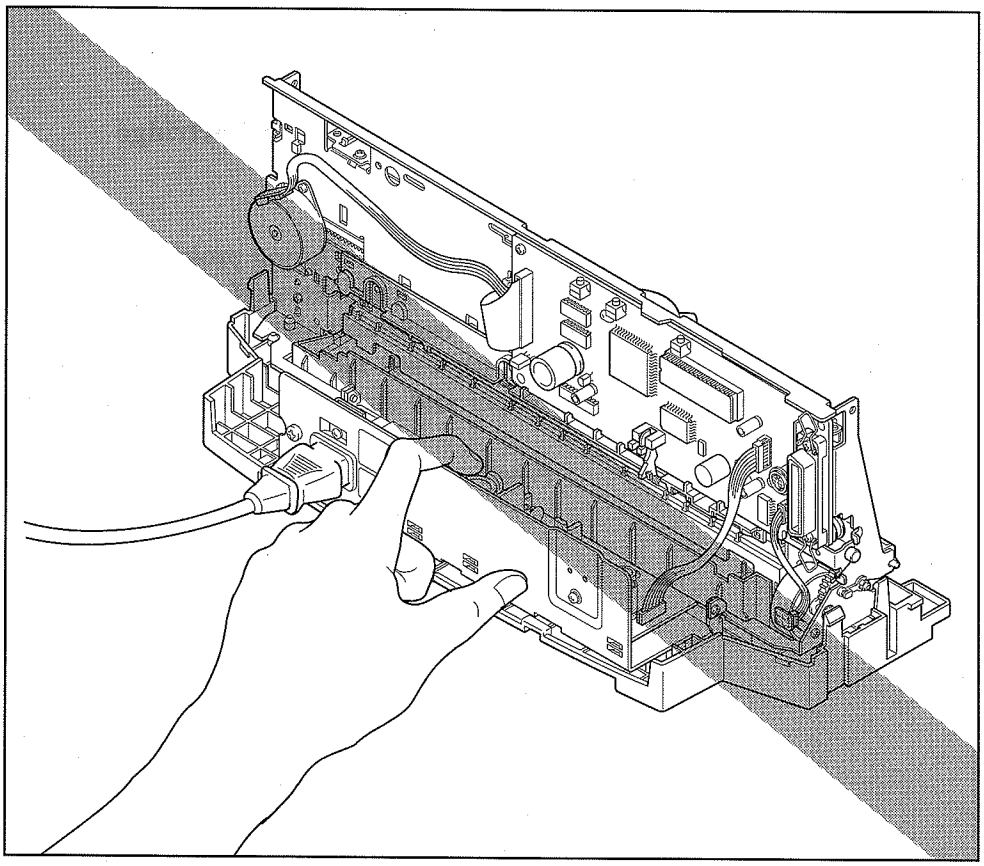


Figure 1-5 Electrically Live Sections of the Printer

1.4 BJ Cartridge Heat-Up

Do not touch the BJ cartridge's aluminum plate. The aluminum plate heats up during printing and becomes particularly hot during prolonged and continuous printing. It can overheat also if printing is continued even after the cartridge has run out of ink.

CAUTION

The aluminium plate can become very hot. Do not touch!

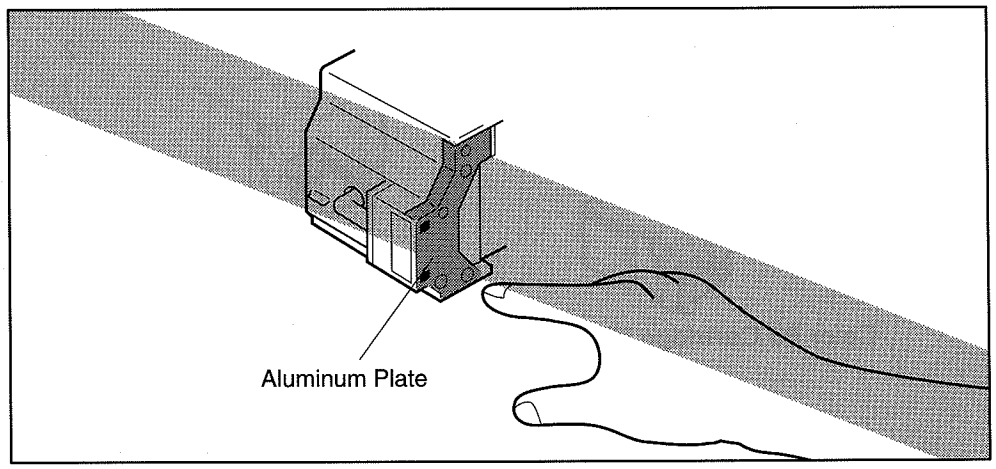


Figure 1-6 BJ Cartridge Aluminum Plate

NOTE

The printer has the following protective mechanisms to detect overheating:

1. Overheat detection when replacing cartridge
   If overheating is detected, a beeper sounds four times and the carriage is stopped to prevent the user from touching the BJ cartridge's aluminum plate. Replacement can be performed after leaving the cartridge to cool for several minutes.
2. Overheat detection during normal printing
   As a printer protection measure, the carriage is paused at the end of each line, and continues printing in uni-directional mode. If, despite this, the temperature continues to rise, the beeper sounds 8 times. The power indicator and error indicator then blink to show that printing has stopped due to a head temperature error. If the temperature remains high for a specified period of time, the beeper sounds 9 times to indicate that a head temperature sensor error has occurred.
   The only method of rectifying this error is to turn the power off then on again using the *POWER* button.

The printer will also overheat and the above protective mechanisms function if printing is continued with no ink in the cartridge.

REF.

When printing is stopped by a head temperature error or a head temperature sensor error, follow the troubleshooting procedures in *"Part 5: 6. TROUBLESHOOTING" (page 5-10).*

2. MACHINE PRECAUTIONS

2.1 Handling a BJ Cartridge

2.1.1 Unpacking the BJ cartridge

Do not unpack the BJ cartridge until it is ready to be used. Before installing the BJ cartridge in the printer, gently remove the cap protecting the nozzles and gently peel off the protective tape as shown in Figure 1-7.
Do not attempt to reuse the cap or tape, as doing so may cause print defects.

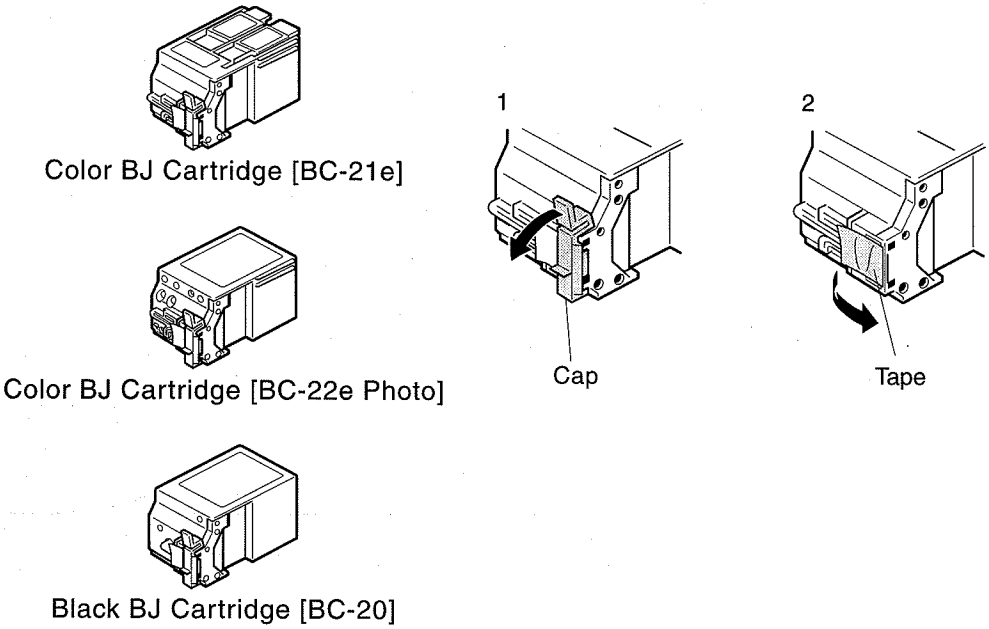


Figure 1-7 Removing the BJ Cartridge Protective Cap and Tape

NOTE

If the cap on a color BJ cartridge is replaced, there is a risk that the different colored inks may mix together on the sponge in the cap. If this occurs and the mixed colors penetrate into the ink cartridge itself, the cartridge will have to be replaced.

2.1.2 Preventing clogged nozzles

Never touch or wipe the nozzles with tissue paper, etc. to prevent them from clogging. To prevent dirt or dried ink from clogging the nozzles however, install the BJ cartridge immediately in the printer or in the cartridge container after removing the cap and peeling off the protective tape.
Do not attempt to reuse the cap or tape as doing so can cause print defects.
Do not store the color BJ cartridge with the ink cartridge removed.
BJ cartridges cannot be disassembled, reassembled, or washed.

NOTE

Clogged nozzles can cause white streaks across printed areas. If this problem persists even after the ink cartridge is cleaned by the printer, replace the BJ cartridge.

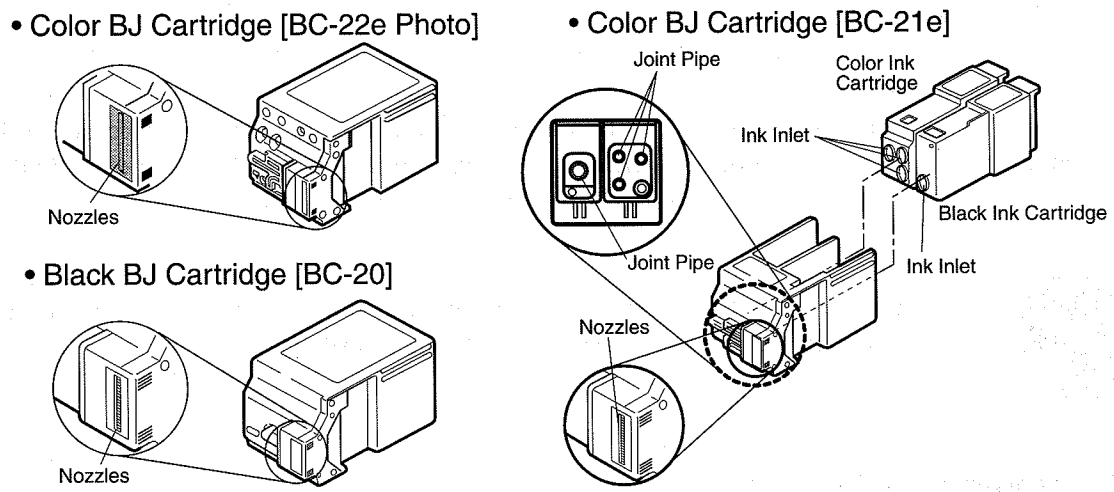


Figure 1-8 BJ Cartridge

2.1.3 Power on/off

When the printer is turned off with the *POWER* button, the printer automatically caps the BJ cartridge's nozzles for their protection and to prevent ink leakage.
If the power cord is disconnected before the printer is turned off with the *POWER* button, the printer may stop without capping the nozzles. In such cases, reconnect the power cord, start up the printer as usual, then turn off the printer with the *POWER* button before disconnecting the power cord.

CAUTION

If the nozzles are not capped, the ink may leak and dry out causing the nozzles to clog.

2.1.4 When not using the printer

Keep the BJ cartridge installed in the printer even when the printer is not in use. Also keep it installed while carrying, transporting, or storing the printer. If the BJ cartridge's package has been opened but the cartridge is not to be installed immediately, store the cartridge in the cartridge container. Similarly, leave the cartridge installed in the printer or store it in the cartridge container if the printer is to be moved, transported or placed in storage.

CAUTION

If the BJ cartridge is removed from the printer, ink may dry out and clog the nozzles. Dirt and dried ink will clog the nozzles resulting in poor quality printing.
Also, if the printer is moved or transported with the BJ cartridge removed, ink may leak from the cap.

2.1.5 Ink electroconductivity

The ink in the BJ cartridge is electroconductive. If ink leaks into the printer's mechanical parts, use a damp paper towel, etc., to wipe clean. If it leaks into the printer's electrical components, use tissue paper, etc., to wipe clean completely. If ink leaks onto the logic board or into the power supply unit and gets into the electrical components and PCB and it is difficult to clean, replace the PCB.

Never connect the power cord to the printer if ink has leaked onto electrical components, as doing so can damage the circuitry.

2.2 Handling Ink Cartridges

2.2.1 Unpacking the ink cartridge

Do not unpack the ink cartridge until it is ready to be used. Before installing it in the BJ cartridge, remove the cap covering the ink outlets.

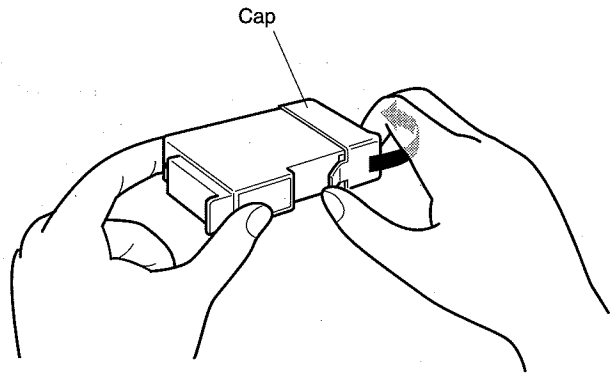


Figure 1-9 Removing the Ink Cartridge Cap

2.2.2 Preventing clogging

To prevent poor ink suction due to clogging of the joint pipes, never touch the ink cartridge's ink outlets. After removing the cap from the ink cartridge, promptly install the ink cartridge in the BJ cartridge to prevent the nozzles from clogging due to dried-out ink, dust, etc. Do not remove ink cartridges from the BJ cartridge unless you are replacing them.

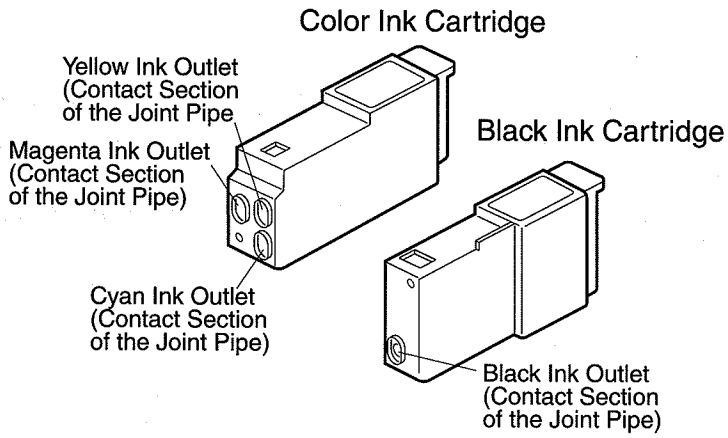


Figure 1-10 Ink Cartridge Protection

2.3 Printer Precautions

2.3.1 Spur deformation prevention

Do not deform the tips of the spurs.

The spurs come into contact with the paper after printing. As the actual contact surface is small, any ink adhering to the spurs is minute and wiped off by the spur cleaners. Therefore any ink on the spurs is not enough to contaminate the paper as it passes. However, if the spurs become deformed, their contact surface with the paper increases, causing more ink to adhere to each spur. Since the spur cleaner is unable to wipe off all the ink, a line of dotted ink may mark the printed paper.

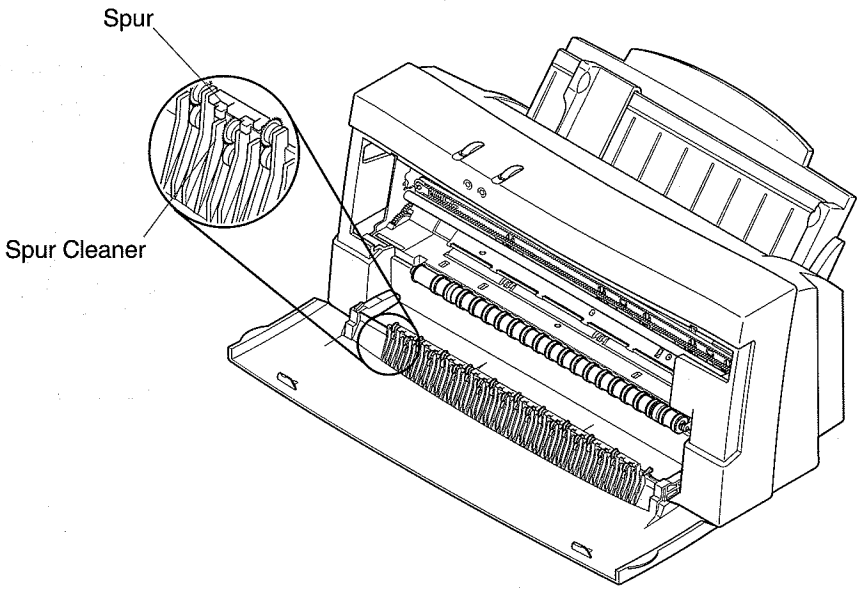


Figure 1-11 Spur and Spur Cleaner

2.3.2 Prevent damage from static electricity

The static charge that accumulates in your body from clothing can damage electrical components. Therefore, never touch the electrical contacts of the carriage ribbon cable and BJ cartridge.

Electrostatics Discharge!

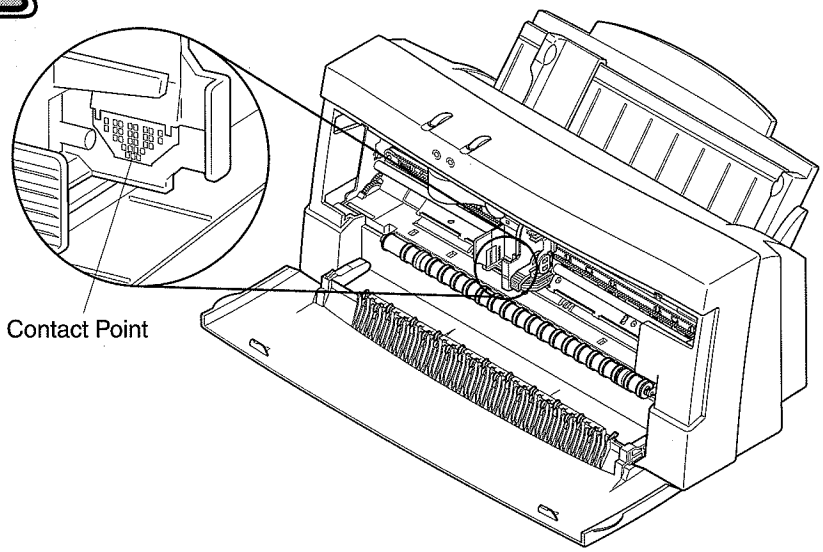


Figure 1-12 Carriage Ribbon Cable's Electrical Contacts

2.3.3 Ink leakage prevention

Do not pack, transport, or store the printer without a BJ cartridge installed. Without a BJ cartridge installed, the ink in the purge unit will leak and disperse inside the printer. When packing the printer, make sure the carriage is at the capping position (the right end of the platen).

The BJ cartridge's nozzles are capped automatically when the power is turned off with the *POWER* button. Do not disconnect the power cord before turning off the printer with the *POWER* button. Otherwise, the nozzles will not be capped.

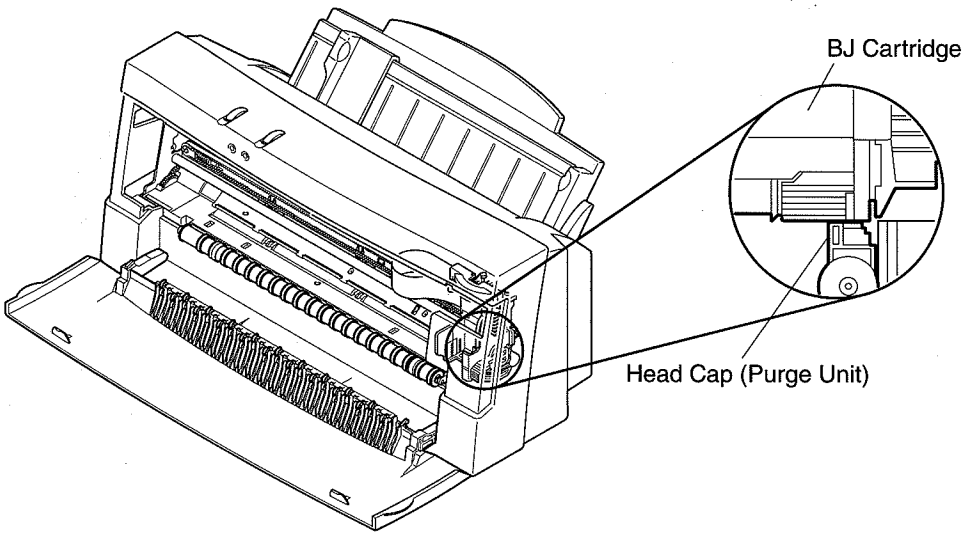


Figure 1-13 Capping Position

2.3.4 Waste ink adhesion prevention

Do not disconnect the power cord before turning off the printer with the *POWER* button.

When the printer is turned off with the *POWER* button, the printer automatically drives the gears in the purge unit (the maintenance jet receiving section) to remove any waste ink on the gears. If waste ink remains on the gears, it may dry out and affect the purge unit's operation.

Do not disconnect the power cord before turning off the printer with the *POWER* button. Otherwise, the printer will not drive the gears to remove the waste ink.

2.4 Scanner Precautions

2.4.1 Scanner cartridge protection

Do not touch the scanning head of the scanner cartridge as it may affect the quality and ability of the scanning operation. When cleaning the scanner lens, wipe gently with a soft damp cloth and wipe off any excess moisture with a soft dry cloth or paper. To avoid damages caused by miscontact or static charge, do not touch the contact terminals. Scanner cartridge cannot be disassembled, reassembled or washed.

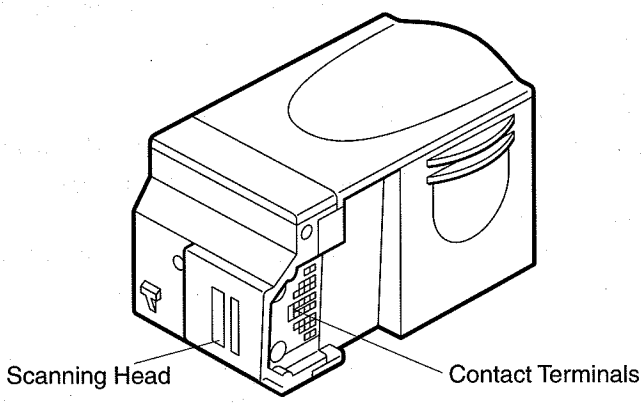


Figure 1-14 Scanner Cartridge [IS-22]

2.4.2 Scanning precautions

The scanning document should be placed between the scanning holder to prevent staining or scratching. Do not feed thick or bent paper. Also direct feed of thin paper or corner-folded paper may result in paper jamming.

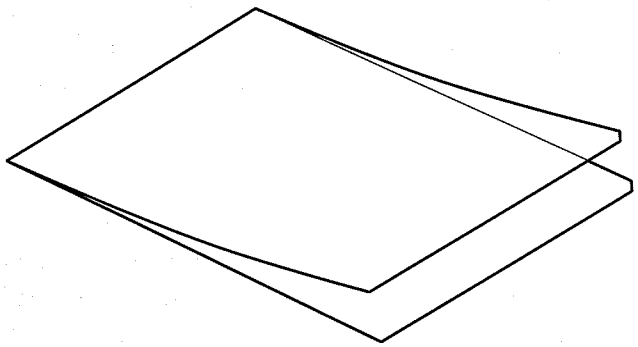


Figure 1-15 Scanning Holder

3. PRECAUTIONS FOR SERVICE

3.1 EEPROM Data Precautions

The printer keeps track of various settings, the total waste ink amount, and the total sheets printed with the black and color BJ cartridges respectively. This data are stored in the EEPROM on the logic board. Note the following precautions during servicing:

1) Before servicing

Check the EEPROM data with a test print. The total sheets printed can give you an idea of how much the printer has been used.

2) During logic board (EEPROM) replacement

Always visually check the waste ink amount absorbed by the waste ink absorbers and replace them when necessary as explained in *"Part 5: 4.3 Logic Board/Waste Ink Absorbers Replacement Cautions" (page 5-5).*

If the waste ink absorbers are not visually checked regularly, they may reach or exceed their full capacity before "waste ink full" is detected. The waste ink may therefore start leaking.

The memory data for the replacement logic board (EEPROM) is not defined. Therefore, after replacing the logic board (and EEPROM), reset the total waste ink amount to zero by clearing the data.

3) After waste ink absorber replacement

After replacing the waste ink absorbers, reset the total waste ink amount to zero by clearing the EEPROM data.

After the EEPROM is reset, the data it contained cannot be printed out with a test printout. If you want to check the stored data, be sure to execute a test printout before resetting the EEPROM.
When the stored data is reset, the various settings, the total count of printed sheets, and the total waste ink amount will all be reset. The total sheets printed and waste ink amount cannot be input using the control panel.

Immediately after you start using the printer, it keeps track of the estimated waste ink amount based on the usage conditions. To prevent ink leakage when the waste ink amount exceeds the waste ink absorption capacity, the printer stops printing and indicates a "waste ink full" error when the waste ink absorption capacity is close to being full.
For details on checking the EEPROM data with a test printout and for clearing the data, see *"Part 3: 3.6.1 Resetting the EEPROM" (page 3-25).*
If the printer stops operating because of the waste ink full error, follow the countermeasures described in *"Part 5: 6. TROUBLESHOOTING" (page 5-10).*

3.2 Static Electricity Precautions

The static charge accumulated in the body from clothing can damage electrical components. To dispel the build-up of static electricity, touch a metallic object that is grounded. Be sure to do this before disassembling the printer for servicing. Before dispelling your static charge build-up, do not touch the electrical contacts on the logic board and on the carriage ribbon cable (see Figure 1-16) while the carriage ribbon cable is connected to the logic board.

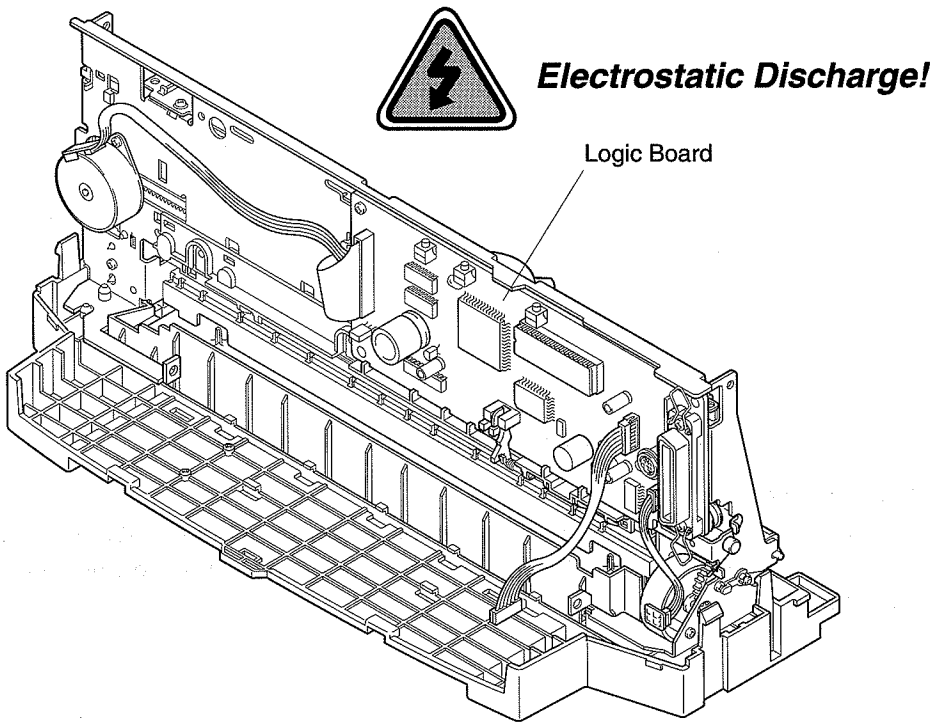


Figure 1-16 Electrical System of Printer

3.3 Disassembly and Reassembly Precautions

The printer is comprised of a large number of plastic parts. When disassembling the printer, take care not to break or bend plastic hooks.

CAUTION

Since some plastic parts contain glass fibers for extra rigidity and precision, but since their viscosity is low, plastic hooks can break easily when excessive force is used. Use precision screwdriver, and do not pull plastic hooks with excessive force while unhooking them.

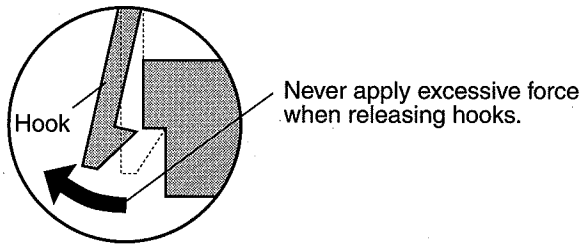


Figure 1-17 How to Release Plastic Hooks

3.4 Self-Diagnosis

The printer has a self-diagnosis feature to detect hardware defects. The results of the self-diagnosis are indicated by the indicators and the beeper. For details, see *"Part 3: 3.1 Error Indications" (page 3-14).*

Part 2

PRODUCT SPECIFICATIONS

1. PRODUCT OUTLINE

1.1 Product Outline

This full-color desktop printer targeting the personal user market is the succeeding model of the BJC-4550. This printer enjoys the realization of high image printing throught the implementation of the PhotoRealsm concept. The various new features have added value to this high performance personal printer.

One of the main features is the use of two new BJ cartridges, [BC-21e] and [BC-22e Photo], which use drop modulation technology to realize the highest quality printing on plain paper in the market. In addition, a new image processing technology, the VARIT function, in the printer driver has reduced jaggies produced when low resolution graphics images are converted.

The printer also has an optional scanner cartridge [IS-22] which can be installed to scan and input high quality images into the computer (Windows only).

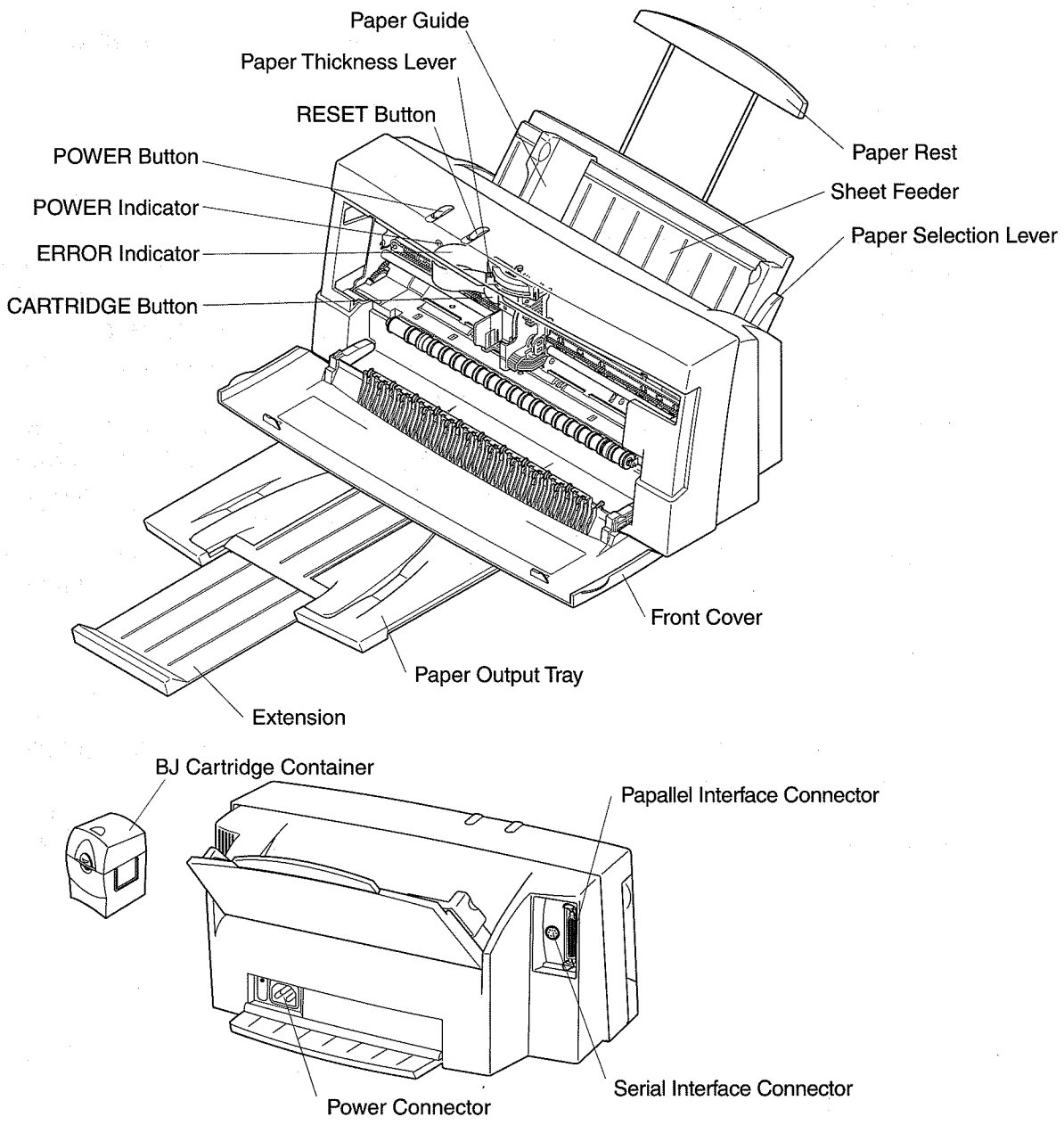


Figure 2-1 Printer Exterior

1.2 Features

1. Compact (desk-top size)
   External dimensions: 447mm (17.6") W × 253mm (10.0") D × 216mm (8.5") H
   Weight: Approx. 4.3kg (9.5lbs) (including BJ cartridge)

2. High-speed printing (burst)
   510cps (Black BJ cartridge, ANK character, HS mode)
   360cps (Black BJ cartridge, ANK character, HQ mode)

3. High quality printing of 720 × 360dpi (when using the Canon original printer driver)

4. Capable of printing A3 portrait (maximum) to envelopes (COM #10, DL) (minimum)

5. Two standard built-in printer control modes (Automatic switching)
   LQ mode (EPSON LQ printer emulation)
   BJ mode (IBM Proprinter X24E emulation)
   [Canon extended mode is supported when using the Canon original printer driver.]

6. Two standard interfaces; parallel and serial (Automatic switching)

7. Plug & Play capability with the device ID response function

8. Drop modulation technology adopted BJ cartridge

Color BJ Cartridge [BC-21e]	Has separate ink cartridges (Bk) (Y, M, C) and a head with 136 nozzles in a vertical line; 64 nozzles (Bk) +24 nozzles × 3 (Y, M, C).
Black BJ Cartridge [BC-20]	Contains black ink and a head with 128 nozzles.
Photo Color BJ Cartridge [BC-22e Photo]	Drop modulation technology adopted, has integrated ink cartridges with a head with 136 nozzles in a vertical line; 64 nozzles (Bk) +24 nozzles × 3 (Y, M, C).
Ink cartridge [BCI-21 Black]	Black ink cartridge for the BC-21e
Color ink cartridge [BCI-21 Color]	Tri-color (Y, M, C) ink cartridge for the BC-21e

9. Bult-in auto sheet feeder

10. Capable of high quality scanning using the optional color scanner cartridge [IS-22] (Windows only)

11. Cartridge container SB-21 packed the printer (for BC-20/BC-21e/BC-22e Photo)

1.3 BJ Cartridge

1.3.1 Color BJ cartridge [BC-21e]

The disposable color BJ cartridge BC-21e for color printing is comprised of a 136-nozzle print head and two replaceable ink cartridges (black and color). When the ink runs out or more than 6 months elapses after the cartridge has been removed from its package, or if the print quality does not improve even after cleaning the head over five times, replace the ink cartridge.

Furthermore, if the print quality does not improve following replacement of the ink cartridge and after cleaning is performed over five times, replace the BJ cartridge.

Since the three color inks are integrated, when one ink color runs out, the entire color ink cartridge must be replaced.

When drop modulation technology is used, small dots are printed in low density areas to minimize pixilation and large dots are used for high density areas. Using this technology allows the printer to retain its printing speed and achieve high quality printing.

The first 24 nozzles are for yellow ink, the second 24 for magenta, the third 24 for cyan, and the remaining 64 nozzles are for black. A total of 136 nozzles are lined in a vertical line.

About 160 sheets (in HQ mode with 1500-character pattern) can be printed with the black ink and about 90 sheets (in HQ mode, 7.5% duty per color pattern) with the color inks.

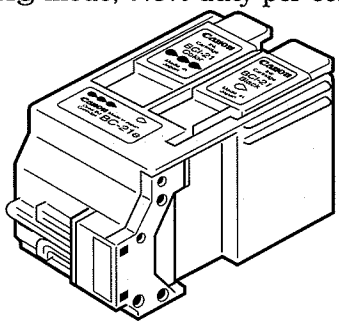


Figure 2-2 Color BJ Cartridge [BC-21e]

1.3.2 Photo BJ cartridge [BC-22e Photo]

The disposable photo BJ cartridge used for photo printing, integrates a 136-nozzle print head and four ink cartridges.

When the ink runs out or more than 6 months elapse after the cartridge has been removed from its package, or if the print quality does not improve even after cleaning the head over five times, replace it with a new photo BJ cartridge. Since the four color inks are integrated, when one ink color runs out, the entire photo BJ cartridge must be replaced.

Adopting drop modulation technology, the photo BJ cartridge prints small dots in low density areas to minimize pixilation and large dots in high density areas to retain its printing speed and achieve high quality printing.

The first 24 nozzles are for yellow ink, the second 24 for magenta, the third 24 for cyan, and the remaining 64 nozzles are for black. A total of 136 nozzles are lined in a vertical. About 50 sheets (in Photo mode) can be printed.

Use high quality special paper and Canon original printer driver for printing.

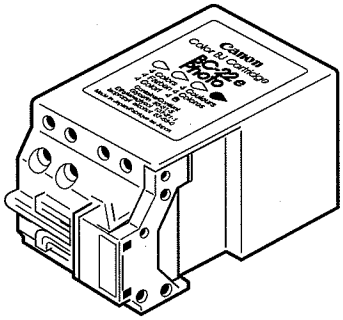


Figure 2-3 Color BJ Cartridge [BC-22e Photo]

1.3.3 Black BJ cartridge [BC-20]

The disposable BJ cartridge is used for ultra-high-speed mono-color printing. Its head has a 128 nozzles.

When the ink runs out or more than 6 months elapse after the cartridge is removed from its package or if the print quality does not improve even after cleaning the head over five times, replace the BJ cartridge.

This cartridge is capable of printing about 700 sheets (in HQ mode with 1500 characters per page).

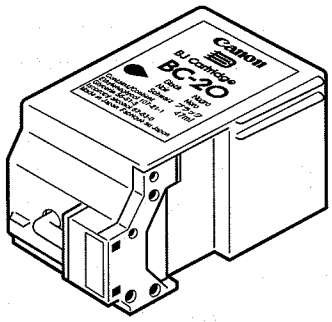


Figure 2-4 Black BJ Cartridge [BC-20]

Color BJ cartridge [BC-21] and color BJ cartridge [BC-22 Photo] that do not adopt drop modulation technology can be used except in the following modes as unidirectional printing in these modes may lead to print defects.

	Print Quality	Mode	Print Defect
BC-21	High	Super Fine	Width doubled
BC-22 Photo	High	Font Fine	Width halved

Print quality will be the same as when printing with cartridge that do not have drop modulation technology.

To prevent the nozzles clogging, install the cartridge in the printer or in the cartridge container immediately after removing from its its packaging. Note that the cap cannot be replaced on the cartridge, and that the print head nozzles must not be touched or wiped with tissue paper, etc.

1.4 BJ Cartridge Container

The cartridge container is for storing unused BJ cartridges black, color and photo to protect the head from damage. When storing a BJ cartridge in this container, be sure to close the cover. When storing a color BJ cartridge, do not remove the ink cartridges. The BJ cartridge containers can be linked together.

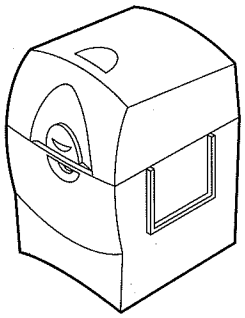


Figure 2-5 Cartridge Container

1.5 Consumables

1.5.1 BJ cartridges (BC-21e/BC-22e Photo/BC-20)

Replacement color BJ cartridges are identical to those included with the printer.

1.5.2 Ink cartridge (for BC-21)

The replacement black ink cartridge (BCI-21 Black) and color ink cartridge (BCI-21 Color) are the same as those installed in the color BJ cartridge (BC-21e).
Either cartridge can be used for half a year after the seal is opened.
Numbers of sheets printable
Black ink cartridge: Approximately 160 sheets (HQ mode) (1500 characters)
Color ink cartridge: Approximately 90 sheets (HQ mode) (7.5% duty per color)

BCI-21Black BCI-21Color

Figure 2-6 Ink Cartridges

1.6 Option

1.6.1 Color image scanner cartridge [IS-22]

This printer can be used as a color scanner when a scanner cartridge is installed. The scanner cartridge is a replaceable scanner unit that uses a one-line 128 pixel CCD. The scanner separates each of the three RGB colors of the LED by sanning the same line three times. The color image is output by 8-bit signals (256 gradation in each RGB primary color). For a monochrome image, the image is lit with a green LED and scanned once to output either a 8-bit or 2-bit signal. The maximum scanning resolution is 360dpi × 360dpi.
To stabilize LED output, the printer preheats and warms the scanner cartridge when the installed scanner cartridge remains at rest or scanning is not performed.

White calibration must be conducted using the white calibration sheet when white balance and shading correction is performed. White balance correction is needed to correct the uneven density in the horizontal direction caused by the variation of LED. Shading correction is needed to correct the uneven distribution of light transmitted through the center and the periphery of the lenses. Density variation between each vertical scanning line caused by the varying sensitivities of the CCD pixels, is also corrected.
The calibration data is retained unless there is an ambient temperature change of ±5°C or the cartridge is removed and reinstalled.
Also for monochrome printing edge emphasis processing is performed.

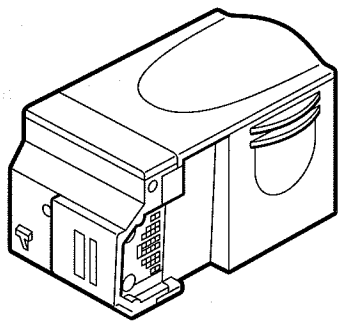


Figure 2-7 Scanner Cartiridge [IS-22]

1.6.2 Scanning holder

The scanning holder protects the scanning document from the printer's sharp spurs that may damage the document during feeding. Small documents can also be scanned using th scanning holder. When the printer is used as a scanner, the scanning holder must be used at all times.

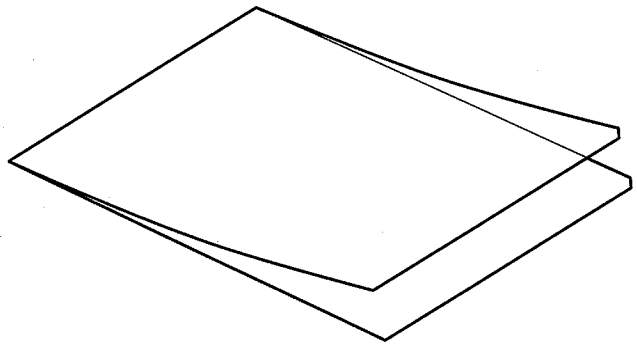


Figure 2-8 Scanning Holder

1.6.3 White calibration sheet

The printer uses a white calibration sheet to perform calibration. The white calibration sheet is set on the printer similar to the scanning holder. White calibration is performed in the initial setting of the printer driver. As the white calibration sheet is used to set the white standard value for scanning images, scanning input data may be affected if the sheet is dirty. Without damaging the sheet, use a soft moistened cloth to gently wipe off dirt. If the sheet is still dirty, use a wet towel to wipe the sheet and dry it thoroughly before use.

2. SPECIFICATIONS

2.1 Specifications

2.1.1 General specifications

1. Type

Desk-top serial color bubble jet printer

2. Paper feeding method

Auto and manual feeding

3. Cut Sheet Feeder capacity

Plain paper:	Maximum 10mm (approximately 100 pages of 64g/m^2 paper) (For A3-size paper: 50 sheets)
High resolution paper:	Maximum 10mm
Transparencies:	Maximum 50 sheets
Back print film:	Maximum 50 sheets
Envelopes:	Maximum 10 envelopes (Commercial number 10 and DL)
Glossy photo paper:	1 sheet
High gloss film:	1 sheet
Fabric:	1 sheet

4. Paper weight

Automatic feed:	64 to 90 g/m^2 (17 lbs to 24 lbs)
Manual feed:	64 to 105 g/m^2 (17 lbs to 28 lbs)

5. Print speed

Burst Color BJ Cartridge (BC-21e)*1

Approx. 2.0 ppm (HS mode)
Approx. 1.4 ppm (HQ mode)
Approx. 0.23 ppm (Fine mode)

Black BJ Cartridge (BC-20)

510 cps at 10 cpi (HS mode)
360 cps at 10 cpi (HQ mode)

*1 Print speed may vary with content of the document and the processing speed of the host computer.

6. Printing direction

Unidirectional
(Print direction automatically changes according to optimum printing directional control.)

7. Printing width

Maximum 289.6 mm (11.4")

8. Line feed speed

Approximately 120 ms/line (2/6" line)

9. Built-in printing control modes

LQ mode: Epson LQ-2550 emulation
BJ mode: IBM Proprinter X24E emulation
(Canon extended mode is supported when Canon's driver is used)

10. Line feed pitch (n: programmable)

LQ mode	1/6", 1/8", n/180", n/360"
BJ mode	1/6", 1/8", n/60", n/72", n/180", n/216" n/360"

11. Printing characters

Font	LQ mode	Prestige, Courier, Gothic, Draft (HS), Roman, Script
	BJ mode	Prestige 12 cpi (HQ)
		Courier 10 cpi, 12 cpi (HS), 17 cpi, PS (except HS mode)
Pitch	LQ mode	10, 12, 15, 17, 20 cpi, PS
	BJ mode	10, 12, 17 cpi, PS
Character matrix	HQ mode	36 (H) × 48 (V) dots
	HS mode	18 out of 36 (H) × 48 (V) dots
Character set	LQ mode	Italic character set, Graphic character set
	BJ mode	IBM character sets 1 and 2
		All character chart
		(Code pages 437, 850, 852, 860, 863 and 865)

12. Number of columns printed

Mode	Character style	Pitch	Cpl
LQ mode	10 cpi	10 cpi	114 cpl
	10 cpi double-wide	5 cpi	57 cpl
	10 cpi condensed	17 cpi	193 cpl
	10 cpi condensed/double-wide	8.5 cpi	96 cpl
	12 cpi	12 cpi	136 cpl
	12 cpi double-wide	6 cpi	68 cpl
	12 cpi condensed	20 cpi	228 cpl
	12 cpi condensed double-wide	10 cpi	114 cpl
	15 cpi	15 cpi	171 cpl
	15 cpi double-wide	7.5 cpi	85 cpl
	Proportional spacing	PS	Varies
BJ mode	10 cpi	10 cpi	114 cpl
	10 cpi double-wide	5 cpi	57 cpl
	10 cpi condensed	17 cpi	193 cpl
	10 cpi condensed/double-wide	8.5 cpi	96 cpl
	12 cpi	12 cpi	136 cpl
	12 cpi double-wide	6 cpi	68 cpl
	Proportional spacing	PS	Varies

13. Bit image

Vertical	8, 24 or 48 dots
Horizontal	60 dpi/120 dpi/180 dpi/240 dpi/360 dpi/720dpi

14. Buffer

	Input Buffer	Download Buffer
Download buffer on	Approx. 64 kB	Approx. 32 kB
Download buffer off	Approx. 64 kB	0 kB

15. Interface IEEE1284 standard parallel interface
RS-422 standard serial interface (for Macintosh)

16. BJ cartridge

Color BJ cartridge [BC-21e]

Type: Color BJ cartridge with replaceable ink cartridge (Multi drop)

Print head	136 nozzles in a vertical line Bk (64 nozzles) + Y, M, C (24 nozzles × 3)
Ink color	Black, cyan, magenta, yellow
No. of pages printed	Black: Approx. 160 pages (HQ mode)/cartridge (1500 character pattern) Color: Approx. 90 pages (HQ mode)/cartridge (7.5% duty per color pattern)
Weight	Approx. 85 g (3.0 oz) (including both ink cartridges)

Color BJ cartridge [BC-22e Photo]

Type: Color BJ cartridge with integrated ink (Multi drop)

Print head	136 nozzles in a vertical line
Ink color	Bk (64 nozzles) + Y, M, C (24 nozzles × 3)
No. of pages printed	Approx. 50 pages (HQ mode)/cartridge (7.5% duty per color pattern)
Weight	Approx. 74g (2.6 oz)

Black BJ cartridge [BC-20]

Type: Black BJ cartridge with integrated ink

Print head	128 nozzles in a vertical line
Ink color	Black
No. of pages printed	Approx. 700 pages (HQ mode)/cartridge (1500 character pattern)
Weight	Approx. 85 g (3.0 oz)

17. Detection functions

Paper out	Available
Presence of BJ cartridge	Available
Waste ink amount	Available
Paper width	None
Distinction of cartridge	Available
Ink out	None
Distinction of scanner	Available
BJ cartridge mismatch	Available

18. Noise

Approximately 45 dB (A)/HQ (Sound pressure level: According to ISO 9296)

19. Environmental requirements

	Temperture	Humidity
During operation	5°C to 35°C (41°F to 95°F)	10% to 90% RH (no condensation)
Non operation	0°C to 35°C (32°F to 95°F)	5% to 95% RH (no condensation)

20. Power supply

	Input voltage/Frequency	Power consumption	Stand-by status
USA/Canada	AC120V, 60Hz	Max. 34W	Max. 4W
UK/Australia	AC240V, 50Hz		
Europe	AC230V, 50Hz		

21. External dimensions 447mm (17.6") W × 253mm (10.0") D × 216mm (8.5") H

22. Weight Approx. 4.3kg (9.5lbs) (including BJ cartridge)

2.1.2 Scanner cartridge [IS-22] (optional)

1. Type	Cartridge replacement type color scanner
2. Image sensor	128 pixel in one line of CCD
3. Light source	3-color LED (R, G, B), (alignment of R, G, B, G, R; 5 in total) Using green LED for monochrome printing
4. Scanning metnod	Sequential RGB light source switching method
5. Scanning direction	Unidirectional
6. Picture signal output	Color 8 bit (256 gradation for each of RGB colors) Binary Grayscale 8 bit
7. Resolution	Carriage moving direction: 360/300/200/180/90dpi 300/200dpi are the resolution changed by the software. Paper feed direction: 360/180/90dpi
8. Scanning speed (reference)	7'43" (Color, 8 bit, ECP, A4, 360dpi) 3'54" (Color, 8 bit, ECP, A4, 180dpi) 3'17" (Color, 8 bit, ECP, A4, 90dpi) 0'58" (Monochrome, 1 bit, ECP, A4, 360dpi) 0'51" (Monochrome, 1 bit, ECP, A4, 180dpi) 0'49" (Monochrome, 1 bit, ECP, A4, 90dpi)
9. Interface	ECP/Nibble
10. Document feeding method	Hold the document between the scanning holder and feed it through ASF.
11. White standard	Scanning the white standard sheet corrects the shading and white balance
12. Edge emphasis	Available only in monochrome binary
13. Power consumption	Approx. 1.6W
14. External dimensions	43.8mm W × 41.8mm D × 72.2mm H
15. Weight	Approx. 60g (2.1 oz)

16. Environmental requirements

	Temperature	Humidity
During operation	5°C to 35°C (41°F to 95°F)	10% to 90% RH (no condensation)
Non operation	0°C to 35°C (32°F to 95°F)	5% to 95% RH (no condensation)

2.2 Paper Specifications

2.2.1 Paper size

A3 (297 mm × 420 mm)
A4 (210 mm × 297 mm)
A5 (148 mm × 210 mm)
B4 (257 mm × 364 mm)
B5 (182 mm × 257 mm)
Letter (8.5" × 11") (216 mm × 279 mm)
Legal (8.5" × 14") (216 mm × 356 mm)
Ledger (11" × 17") (279 mm × 432 mm)
European DL-size (220 mm × 110 mm)
Commercial number 10 envelope (9.5" × 4.1")
(Using Canon printer driver: 100 mm × 100 mm min., 297 mm × 431.8 mm max.)

2.2.2 Paper type

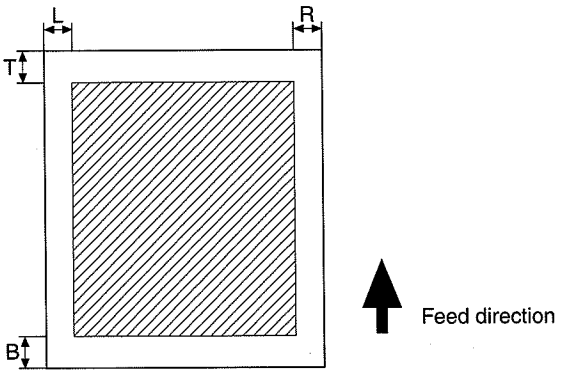
Plain paper (Letter, Legal, A3, A4, A5, B5)
Bubble jet paper (Canon Bubble Jet Paper LC-301/Letter, A3, A4)
High resolution paper (Canon High Resolution Paper HR-101)
Coated paper (Canon coated paper LC-101/Letter, A3, A4)
Transparencies (Canon transparency film CF-102/A3, A4)
BPF (Canon back print film BF-102/Letter, A3, A4)
Glossy paper (Canon glossy paper GP-101/Letter, A4)
High gloss film (Canon High Gloss Film HG-101/Letter, A3, A4)
Fabric (Fabric Sheet FS-101/Legal)
Envelopes (Commercial number 10 or European DL)

2.2.3 Sheet feeder

Plain paper:	Maximum 10 mm (approximately 100 pages of 64g/m² paper) (For A3-size paper: 50 sheets)
High resolution paper:	Maximum 10 mm
Transparencies:	Maximum 50 sheets
Back print film:	Maximum 50 sheets
Envelopes:	Maximum 10 envelopes (Commercial number 10 and DL)
Glossy paper:	1 sheet
High gloss film:	1 sheet
Fabric:	1 sheet

2.2.4 Printable area

• Plain paper and special media
A3, A4, B4, A5, B5, Letter, Legal, Ledger, and user-defined sizes



Printable Area

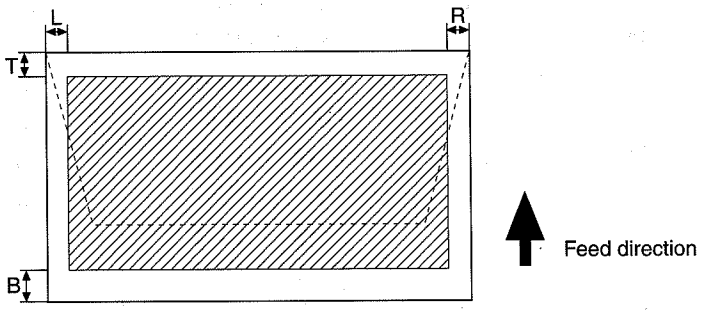
	Minimum
L	3.4mm (0.13")*1
R	3.4mm (0.13")*1*2
T	3.0mm (0.12")
B	7.0mm (0.27")

Recommended Printing Area

	Minimum
L	3.4mm (0.13")*1
R	3.4mm (0.13")*1*2
T	20.5mm (0.81")*3
B	20.5mm (0.81")

*1 When you load letter-size paper in the printer and then select LTR with the BJ setup utility program, L and R are 6.4mm (0.25") minimum.
*2 When the paper width is wider than 296.3mm (11.67"), R is set using the formula below.
R = Paper width – 293mm (11.54")
*3 When printing with the BC-22e Photo, T is 25.4mm (1.0") minimum.

• Envelopes



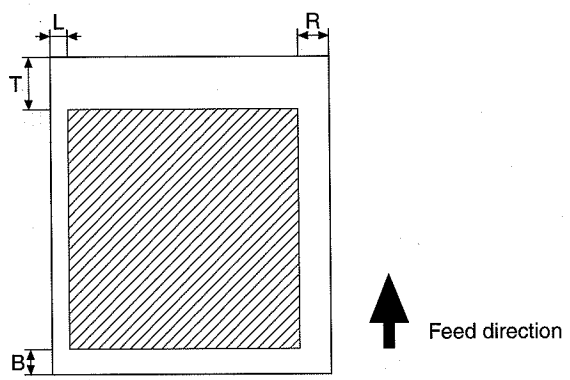
Printable Area

	Minimum
L	3.4mm (0.13")
R	3.4mm (0.13")
T	3.0mm (0.12")
B	7.0mm (0.27")

Recommended Printing Area

	Minimum
L	3.4mm (0.13")
R	3.4mm (0.13")
T	20.5mm (0.81")
B	20.5mm (0.81")

• Fabric Sheet



Printable Area

	Minimum
L	3.4mm (0.13")
R	34.4mm (1.35")
T	41.1mm (1.62")
B	27.9mm (1.10")

Recommended Printing Area

	Minimum
L	3.4mm (0.13")
R	34.4mm (1.35")
T	41.1mm (1.62")
B	27.9mm (1.10")

Figure 2-9 Printable Area

2.3 Interface Specifications

2.3.1 Parallel interface

1) Interface type

IEEE1284 compatible parallel interface

2) Data transfer

8-bit parallel interface

3) Signal voltage levels

Low: 0.0 V to +0.8 V

High: +2.4 V to +5.0 V

4) Input/output

Each signal pulled up with +5 V.

5) Interface cable

Type: Twisted-pair shielded cable

Material: AWG#28 or larger (AWG: American Wire Gauge)

Length: Up to 2.0 m (6.6 feet)

6) Interface connectors

On printer: Amphenol 57-40360 (or equivalent)

On cable: Amphenol 57-30360 (or equivalent)

7) Input/output signals and pin layout

Compatible mode

No.	Signal	I/O	No.	Signal	I/O
1	$\overline{\text{STROBE}}$	IN	19	$\overline{\text{STROBE}}$-RET*1	...
2	DATA1	IN	20	DATA1-RET	...
3	DATA2	IN	21	DATA2-RET	...
4	DATA3	IN	22	DATA3-RET	...
5	DATA4	IN	23	DATA4-RET	...
6	DATA5	IN	24	DATA5-RET	...
7	DATA6	IN	25	DATA6-RET	...
8	DATA7	IN	26	DATA7-RET	...
9	DATA8	IN	27	DATA8-RET	...
10	$\overline{\text{ACKNLG}}$	OUT	28	$\overline{\text{ACKNLG}}$-RET	...
11	BUSY	OUT	29	BUSY-RET	...
12	P.E.	OUT	30	P.E.-RET	...
13	SELECT	OUT	31	$\overline{\text{INIT}}$	IN
14	$\overline{\text{AUTO FEED XT}}$*4	IN	32	$\overline{\text{ERROR}}$	OUT
15	N.C*2	...	33	S-GND	...
16	$\overline{\text{INIT}}$-RET	...	34	N.C*2	...
17	F-GND	...	35	+5.0 V-Pullup*4	...
18	+5.0 V*3	...	36	$\overline{\text{SELECT IN}}$*5	IN

*1. -RET is connected to GND.

*2. N.C means no connection.

*3. The level is raised with +5.0 V through 390 Ω resistance.

*4. The level is raised with +5.0 V through 3.3 kΩ resistance.

Nibble mode

No.	Signal	I/O	No.	Signal	I/O
1	$\overline{\text{HOSTCLK}}$	IN	19	Signal Gnd	...
2	DATA1	IN/OUT	20	Signal Gnd	...
3	DATA2	IN/OUT	21	Signal Gnd	...
4	DATA3	IN/OUT	22	Signal Gnd	...
5	DATA4	IN/OUT	23	Signal Gnd	...
6	DATA5	IN/OUT	24	Signal Gnd	...
7	DATA6	IN/OUT	25	Signal Gnd	...
8	DATA7	IN/OUT	26	Signal Gnd	...
9	DATA8	IN/OUT	27	Signal Gnd	...
10	$\overline{\text{PTRCLK}}$	OUT	28	Signal Gnd	...
11	$\overline{\text{PTRBUSY}}$	OUT	29	Signal Gnd	...
12	ACKDATAREQ	OUT	30	Signal Gnd	...
13	XFLAG	OUT	31	$\overline{\text{INIT}}$	IN
14	HOSTBUSY	IN	32	$\overline{\text{DATAAVAIL}}$	OUT
15	Not Defined	...	33	Not Defined	...
16	INIT-RET*1	...	34	Not Defined	...
17	F.G	...	35	Not Defined	...
18	Vcc	...	36	$\overline{\text{1284Active}}$	IN

*1. -RET is connected to GND.

ECP mode

No.	Signal	I/O	No.	Signal	I/O
1	$\overline{\text{HostClk}}$	IN	19	Signal Gnd	...
2	Data1	IN/OUT	20	Signal Gnd	...
3	Data2	IN/OUT	21	Signal Gnd	...
4	Data3	IN/OUT	22	Signal Gnd	...
5	Data4	IN/OUT	23	Signal Gnd	...
6	Data5	IN/OUT	24	Signal Gnd	...
7	Data6	IN/OUT	25	Signal Gnd	...
8	Data7	IN/OUT	26	Signal Gnd	...
9	Data8	IN/OUT	27	Signal Gnd	...
10	PeriphClk	OUT	28	Signal Gnd	...
11	PeriphAck	OUT	29	Signal Gnd	...
12	AckReverse	OUT	30	Signal Gnd	...
13	Xflag	OUT	31	$\overline{\text{ReverceReq}}$	IN
14	HostAck	IN	32	$\overline{\text{PeriphReq}}$	OUT
15	N.C.	...	33	N.C.*1	...
16	Gnd	...	34	N.C.*1	...
17	Gnd	...	35	N.C.*1	...
18	Vcc	...	36	1284Active	IN

*1. N.C. means no connection.

8) Input/output signals:

Compatible Mode

$\overline{\text{STROBE}}$ [Input]

This signal is used to read DATA1 to DATA8. The signal becomes valid after BUSY signal goes Low and the printer outputs an $\overline{\text{ACKNLG}}$ signal. The host computer does not send the next signal until it receives $\overline{\text{ACKNLG}}$ signal. It is normally High, after becoming Low, the printer receives data. When the signal remains Low, the printer does not operate until it goes High.

DATA1 to 8 [Input]

The printer receives data with the $\overline{\text{STROBE}}$ signal. The state of each bit of the signal must be maintained for at least 0.5µs from the rising edge the $\overline{\text{STROBE}}$ signal.

ACKNLG [Output]

This signal is a response signal to the $\overline{\text{STROBE}}$ signal. The host computer does not send the next $\overline{\text{STROBE}}$ signal until this signal is sent. When the power is turned on or the BUSY signal goes Low for the input of the INIT signal, this signal is sent regardless of the $\overline{\text{STROBE}}$ signal.

BUSY [Output]

When this signal is High, the printer is BUSY; when Low, the printer is READY. The signal goes high when data is received, the printer is offline, or an error occurs (paper-out, paper jam).

P.E. [Output]

When the printer cannot feed paper, this signal goes High. Then BUSY signal goes High and the SELECT and FAULT signals go Low. The signal goes Low when the paper is set and the printer goes online. FAULT and SELECT signals then go High from Low. If paper is not ejected (paper jam) by executing a paper eject command, this signal and BUSY signal go High, and SELECT and FAULT go Low. In this case, the signals do not change even if the paper is ejected.

SELECT [Output]

When the printer is ready, this signal is High. This signal goes Low when the printer is offline or when an error occurs (paper-out, paper jam, head error, etc.).

$\overline{\text{AUTO FEED XT}}$ [Input] (Valid in LQ mode)

When this signal is Low, automatic line feed mode (Carriage Return and Line Feed) is effective.

The printer judges the level of this signal only when it is turned on or is initialized by the INIT signal.

INIT [Input]

INIT from the system resets the printer to its initial power-on state. In BJ mode, the BUSY line goes high, and any received data is printed. In LQ mode, the BUSY line goes high, and the print buffer is cleared. When INIT goes Low, it resets the printer to the power-on default state.

FAULT [Output]

This signal goes Low when the printer is in an error state [paper-out, paper jam, etc.).

$\overline{\text{SELECT IN}}$ [Input] (Valid in LQ mode)

When this signal is High, the DC1 and DC3 codes are valid; when Low, they are invalid. The printer judges the level of this signal when it is turned on or is initialized by the INIT signal.

Nibble Mode

Host Clk [Input]

$\overline{\text{STROBE}}$ signal to read DATA1 to DATA8.

Negotiation phase:

Trigger signal to send the protocol confirmation to the printer.

DATA 1-8 [Input]

The printer receives data with the Host Clk signal.

The state of each bit of this signal must be maintained for at least 0.5µs from the rising edge of the Host Clk signal.

Ptr Cld [Output]

Reverse data transmission phase:

The printer requests the host computer to read the data by making the Ptr Clk signal Low. After finishing reading, the host computer notifies peripheral equipment of completion of data receiving by making the Host Busy signal High.

Ptr Busy [Output]

Reverse data transmission phase:

Indicates bit 3 and bit 7 of the transmission data.

Ack Data Req [Output]

- Reverse data transmission phase:
  Indicates bit 2 and bit 6 of the transmission data.
- Negotiation phase:
  Trigger signal to inform the host computer of the printer's condition (whether it supports nibble mode or not, whether there is reverse transmission data or not).

Xflag [Output]

- Reverse data transmission phase:
  Indicates bit 1 and bit 5 of the transmission data.
- Negotiation phase:
  Informs the host computer whether the printer supports nibble mode or not, synchronizing with the falling edge of the Ack data Req signal. "L" means that it supports nibble mode.

Host Busy [Input]

- Reverse data transmission phase:
  Indicates that the host is ready to receive the data from the printer by making the Host Busy signal Low. After that, it goes high to synchronize with the Low pulse of Ptr Clk signal to verify receiving data.
- Reverse idle phase:
  The Host Busy signal goes high in response to the Low pulse of the Ptr Clk signal, and enters the reverse data transmission phase again.

$\overline{\text{INIT}}$ [Input]

When this signal becomes "L", the printer's state becomes BUSY. When the signal changes from "L" to "H", it resets the printer control system to the initial state.

This signal is normally "H" and the pulse width must be at least 0.5µs at the printer side.

After initializing, the printer enters compatible mode.

$\overline{\text{DataAvail}}$ [Output]

- Reverse data transmisson phase:
  Indicates bit 0 and bit 4 of the transmission data.
- Negotiation phase:
  Informs the host computer if there is reverse transmission data or not to synchronize with the falling edge of the Ack Data Req signal. "L" means that there is reverse transmission data.

1284 Active [Input]
This signal confirms that the printer is a 1284 compatible device when 1284 Active signal goes High and Host Busy signal goes Low. It goes Low with the termination phase.

ECP Mode

Host Clk [Input]
This signal handshakes with the PeriphAck signal when data is transferred from the host computer to the printer. A Low Host Clk signal indicates that data has been output along the data buses (Data 1-8).
The signal goes High as a response to a High PeriphAck signal. It remains High during reverse data transmission.

DATA 1-8 [Input/Output]
This signal is an input signal when data is transferred from the host computer to the printer. During reverse data transmission, this is an output signal and the printer uses this data bus to send data to the host computer.

Periph Clk [Output]
When data is transferred from the printer to the host computer, this signal remains High. Periph Clk signal is lowered during reverse transmission phase and indicates that data has been sent to the host computer. This signal is also High in response to the High HostAck signal from the host computer.

Periph Ack [Output]
Periph Ack signal goes Low when the printer is ready to receive data from the host computer. Once the data is received the signal goes High. During the reverse data transmission phase, this signal indicates whether the data sent from the printer to the data bus was a "command" or "data".
Low: "Command", High: "Data"

$\overline{\text{Ack Reverse}}$ [Output]
$\overline{\text{Ack Reverse}}$ signal remains High when data is transferrd from the host computer to the printer. During the reverse data transmission phase, the signal remains Low. The Reverse Request signal from the host computer goes Low to request a switch from the forward data transmission phase to the reverse data transmission phase. In response to the Low Reverse Request signal, $\overline{\text{Ack Reverse}}$ signal goes low to indicate that the request was accepted.
When the Reverse Request signal from the host computer goes High to request a switch from the reverse data transmission phase to forward data transmission phase, $\overline{\text{Ack Reverse}}$ signal goes high to indicate the switch-over request has been accepted.

X flag [Output]
This signal remains High in ECP mode.

Host Ack [Input]
This signal indicates the nature of the signal along the data bus when data is transferred from the host computer to the printer. A Low Host Ack indicates a "command" whereas a High Host Ack indicates a "data".
During reverse data transmission, this signal handshakes with the Periph Clk signal. When the host computer is ready to accept data from the printer, this signal goes Low. After data is received the signal goes High.

Reverse Req [Input]
This signal goes Low when the recovery process (data re-transmission) is taking place during data transmission from the host computer to the printer.
In response to a Low Ack Reverse signal, Reverse Req signal goes High.
When switching from the idle state of the forward data transmission phase to the reverse data transmission phase, i,e. data is transferred from the printer to the host computer, this signal goes Low.
The Low period indicates it is in the reverse data transmission phase.
When the reverse data transmission phase is switched to the forward data transmission phase, this signal goes High.

$\overline{\text{Periph Req}}$ [Output]
If the printer requests reverse data transmission during the forward data transmission, this signal goes Low. When the host computer switches over from the forward data transmission phase to the reverse data transmission phase, together with the $\overline{\text{Ack Reverse}}$ signal, the Periph Req signal goes High in response to the host computer's Low Reverse Request signal.

1284 Active [Input]
During the negotiation phase, this signal goes High and remains High during ECP mode to indicate bidirectional operation.
After ending the ECP mode, this signal goes Low and enter the termination phase.

9) Timing

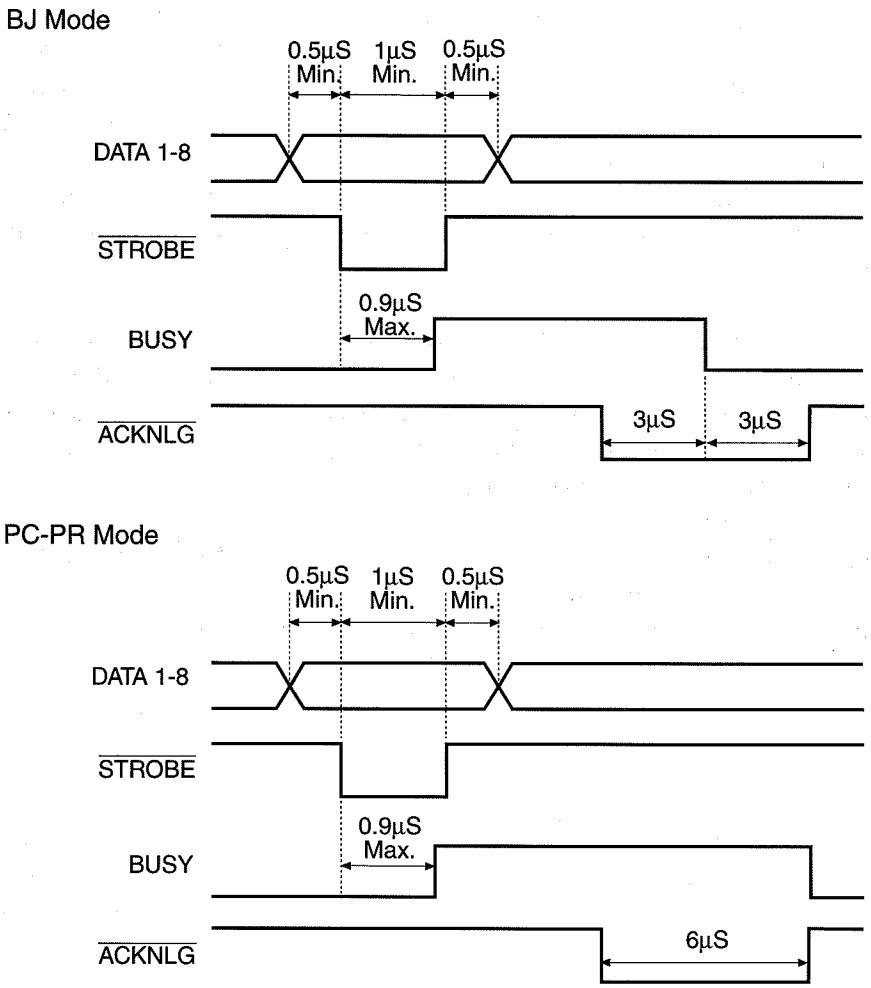


Figure 2-10 Timing Chart (Compatible Mode)

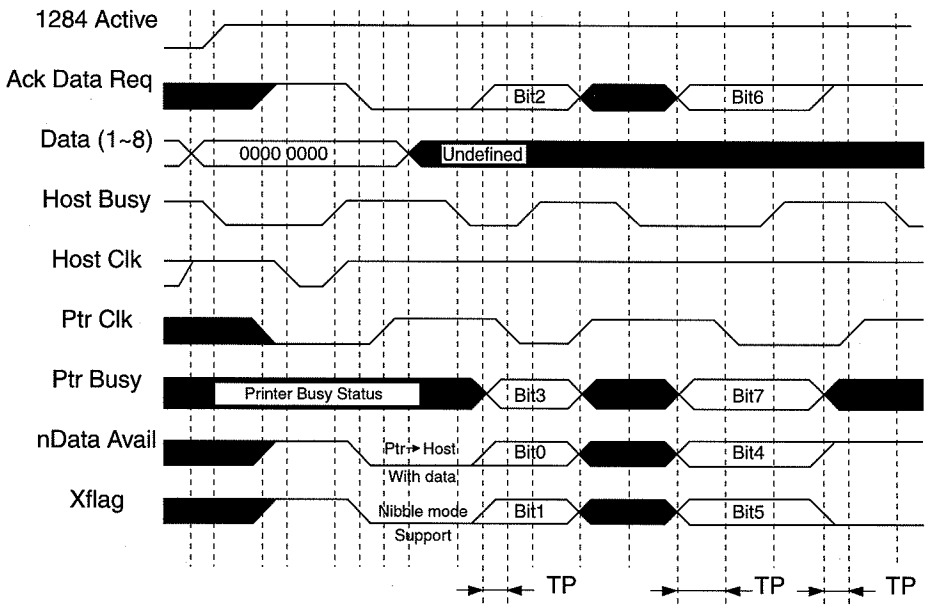


Figure 2-11 Timing Chart (Nibble Mode)

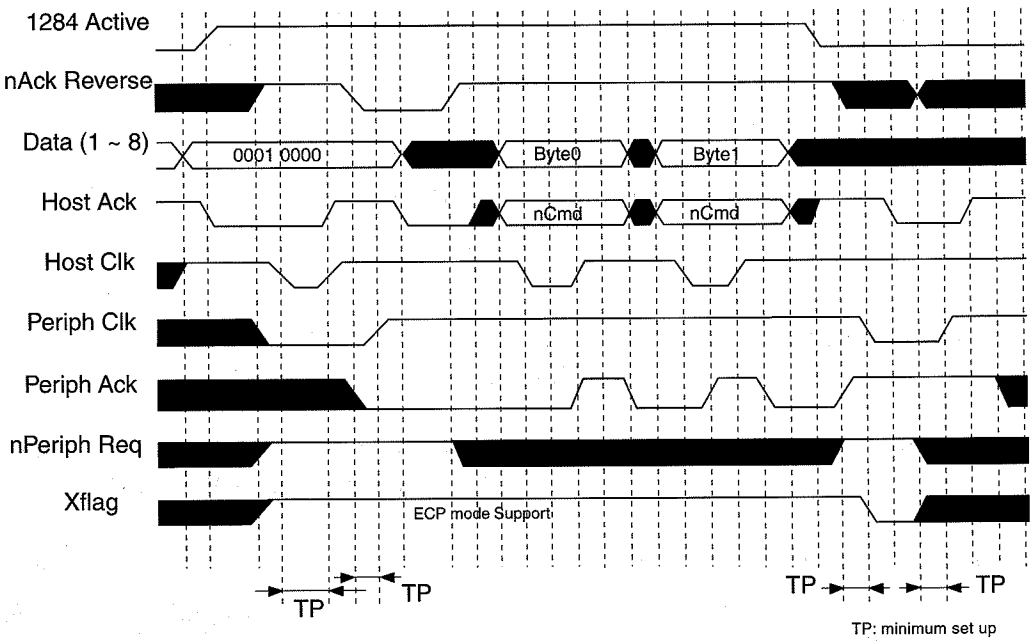


Figure 2-12 Timing Chart (ECP Mode)

2.3.2 Serial interface

1. Interface type: RS-422-compatible serial interface

2. Data transfer speed: 57.6, 442.2, or 884.4kbit/s

3. Data format:

Start bit:	1 bit
Data:	8 bits
Stop bit:	1 bit
Parity:	None

4. Signal polarity:

MARK (logical "1"):	-3V to -12V
SPACE (logical "0"):	+3V to +12V

5. Interface connectors:

On printer:	Female 8-pin mini-DIN connector
On cable:	Male 8-pin mini-DIN connector

6. Input/output signals and pin layout

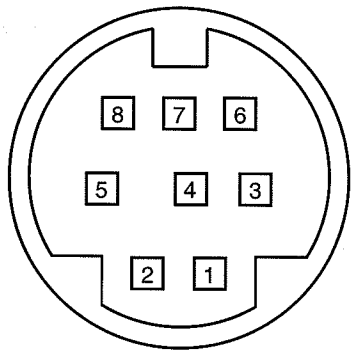


Figure 2-13 Serial Interface Connector

No.	Signal	I/O
1	SCLK	OUT
2	N.C.*1	
3	TXD–	OUT
4	S-GND	
5	RXD–	IN
6	TXD+	OUT
7	N.C.	
8	RXD+	IN
Shield	PG	

*1. N.C means no connection.

7. Description of signals

SCLK (signal clock)
This pin outputs a sync clock for data transfer speeds of 442.2 and 884.4kbps.

TXD-/TXD+ (transmitted data)
Output signals TXD- and TXD+ are the differential signals for sending data from the printer. TXD- is in the MARK state (logical "1") when no data is being sent; TXD+ is in the SPACE state (logical "0"). These signals are used to send the printer status, etc., to the host computer.

RXD-/RXD+ (received data)
Input signals RXD- and RXD+ are the differential signals for the printer to receive data. RXD- is in the MARK state (logical "1") when no data is being sent; RXD+ is in the SPACE state (logical "0"). These signals are used for receiving the control commands and print data sent from the host computer to the printer.

PG (protection ground)
PG is a low-impedance ground for the interface cable shielding.

2.4 Character Code Tables

2.4.1 LQ mode

a) Epson Italics Character Set

Hex No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	
0	NUL 0	16	SP 32	0 48	@ 64	P 80	‘ 96	p 112	NUL 128	144	SP 160	*0* 176	*@* 192	*P* 208	’ 224	*p* 240	0000
1	1	DC1 17	! 33	1 49	A 65	Q 81	a 97	q 113	129	DC1 145	*!* 161	*1* 177	*A* 193	*Q* 209	*a* 225	*q* 241	0001
2	2	DC2 18	” 34	2 50	B 66	R 82	b 98	r 114	130	DC2 146	” 162	*2* 178	*B* 194	*R* 210	*b* 226	*r* 242	0010
3	3	DC3 19	# 35	3 51	C 67	S 83	c 99	s 115	131	DC3 147	*#* 163	*3* 179	*C* 195	*S* 211	*c* 227	*s* 243	0011
4	4	DC4 20	$ 36	4 52	D 68	T 84	d 100	t 116	132	DC4 148	*$* 164	*4* 180	*D* 196	*T* 212	*d* 228	*t* 244	0100
5	5	21	% 37	5 53	E 69	U 85	e 101	u 117	133	149	% 165	*5* 181	*E* 197	*U* 213	*e* 229	*u* 245	0101
6	6	22	& 38	6 54	F 70	V 86	f 102	v 118	134	150	*&* 166	*6* 182	*F* 198	*V* 214	*f* 230	*v* 246	0110
7	BEL 7	23	’ 39	7 55	G 71	W 87	g 103	w 119	BEL 135	151	’ 167	*7* 183	*G* 199	*W* 215	*g* 231	*w* 247	0111
8	BS 8	CAN 24	(40	8 56	H 72	X 88	h 104	x 120	BS 136	CAN 152	*(* 168	*8* 184	*H* 200	*X* 216	*h* 232	*x* 248	1000
9	HT 9	EM 25	) 41	9 57	I 73	Y 89	i 105	y 121	HT 137	EM 153	*)* 169	*9* 185	*I* 201	*Y* 217	*i* 233	*y* 249	1001
A	LF 10	26	* 42	: 58	J 74	Z 90	j 106	z 122	LF 138	154	* 170	*:* 186	*J* 202	*Z* 218	*j* 234	*z* 250	1010
B	VT 11	ESC 27	+ 43	; 59	K 75	[91	k 107	{ 123	VT 139	ESC 155	*+* 171	*;* 187	*K* 203	*[* 219	*k* 235	*{* 251	1011
C	FF 12	28	, 44	< 60	L 76	\ 92	l 108	¦ 124	FF 140	156	, 172	*<* 188	*L* 204	** 220	*l* 236	*¦* 252	1100
D	CR 13	29	– 45	= 61	M 77	] 93	m 109	} 125	CR 141	157	– 173	*=* 189	*M* 205	*]* 221	*m* 237	*}* 253	1101
E	SO 14	30	. 46	> 62	N 78	^ 94	n 110	~ 126	SO 142	158	. 174	*>* 190	*N* 206	*^* 222	*n* 238	*~* 254	1110
F	SI 15	31	/ 47	? 63	O 79	_ 95	o 111	DEL 127	SI 143	159	/ 175	*?* 191	*O* 207	_ 223	*o* 239	255	1111
	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111	Binary No.

b) Epson Graphics Character Set

Hex No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	
0	NUL 0	16	SP 32	0 48	@ 64	P 80	‘ 96	p 112	Ç 128	É 144	á 160	▒ 176	└ 192	╨ 208	α 224	≡ 240	0000
1	1	DC1 17	! 33	1 49	A 65	Q 81	a 97	q 113	ü 129	æ 145	í 161	▒ 177	┴ 193	╤ 209	ß 225	± 241	0001
2	2	DC2 18	” 34	2 50	B 66	R 82	b 98	r 114	é 130	Æ 146	ó 162	▓ 178	┬ 194	╥ 210	Γ 226	≥ 242	0010
3	3	DC3 19	# 35	3 51	C 67	S 83	c 99	s 115	â 131	ô 147	ú 163	│ 179	├ 195	╙ 211	π 227	≤ 243	0011
4	4	DC4 20	$ 36	4 52	D 68	T 84	d 100	t 116	ä 132	ö 148	ñ 164	┤ 180	─ 196	╘ 212	Σ 228	⌠ 244	0100
5	5	§ 21	% 37	5 53	E 69	U 85	e 101	u 117	à 133	ò 149	Ñ 165	╡ 181	┼ 197	╒ 213	σ 229	⌡ 245	0101
6	6	22	& 38	6 54	F 70	V 86	f 102	v 118	å 134	û 150	a 166	╢ 182	╞ 198	╓ 214	μ 230	÷ 246	0110
7	BEL 7	23	’ 39	7 55	G 71	W 87	g 103	w 119	ç 135	ù 151	o 167	╖ 183	╟ 199	╫ 215	τ 231	≈ 247	0111
8	BS 8	CAN 24	(40	8 56	H 72	X 88	h 104	x 120	ê 136	ÿ 152	¿ 168	╕ 184	╚ 200	╪ 216	Φ 232	° 248	1000
9	HT 9	EM 25	) 41	9 57	I 73	Y 89	i 105	y 121	ë 137	Ö 153	⌐ 169	╣ 185	╔ 201	┘ 217	Θ 233	• 249	1001
A	LF 10	26	* 42	: 58	J 74	Z 90	j 106	z 122	è 138	Ü 154	¬ 170	‖ 186	╩ 202	┌ 218	Ω 234	· 250	1010
B	VT 11	ESC 27	+ 43	; 59	K 75	[91	k 107	{ 123	ï 139	¢ 155	½ 171	╗ 187	╦ 203	■ 219	δ 235	√ 251	1011
C	FF 12	28	, 44	< 60	L 76	\ 92	l 108	| 124	î 140	£ 156	¼ 172	╝ 188	╠ 204	▄ 220	∞ 236	n 252	1100
D	CR 13	29	– 45	= 61	M 77	] 93	m 109	} 125	ì 141	¥ 157	¡ 173	╜ 189	═ 205	▌ 221	∅ 237	2 253	1101
E	SO 14	30	. 46	> 62	N 78	^ 94	n 110	~ 126	Ä 142	Pt 158	<< 174	╛ 190	╬ 206	▐ 222	∈ 238	■ 254	1110
F	SI 15	31	/ 47	? 63	O 79	_ 95	o 111	DEL 127	Å 143	*ƒ* 159	>> 175	┐ 191	╧ 207	▀ 223	∩ 239	255	1111
	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111	Binary No.

c) International Character Set

Country \ Hex / Dec		23	24	40	5B	5C	5D	5E	60	7B	7C	7D	7E	A3	A4	C0	DB	DC	DD	DE	E0	FB	FC	FD	FE
		35	36	64	91	92	93	94	96	123	124	125	126	163	164	192	219	220	221	222	224	251	252	253	254
0	U.S.A	#	$	@	[	\	]	^	`	{	¦	}	~	#	$	@	[	\	]	^	'	{	/	}	~
1	France	#	$	à	°	ç	§	^	`	é	ù	è	¨	#	$	à	°	ç	§	^	'	é	ù	è	¨
2	Germany	#	$	§	Ä	Ö	Ü	^	`	ä	ö	ü	ß	#	$	§	Ä	Ö	Ü	^	'	ä	ö	ü	ß
3	U.K	£	$	@	[	\	]	^	`	{	¦	}	~	£	$	@	[	\	]	^	'	{	/	}	~
4	Denmark †	#	$	@	Æ	Ø	Å	^	`	æ	ø	å	~	#	$	@	Æ	Ø	Å	^	'	æ	ø	å	~
5	Sweden	#	¤	É	Ä	Ö	Å	Ü	é	ä	ö	å	ü	#	¤	É	Ä	Ö	Å	Ü	é	ä	ö	å	ü
6	Italy	#	$	@	°	\	é	^	ù	à	ò	è	ì	#	$	@	°	\	é	^	ù	à	ò	è	ì
7	Spain †	Pt	$	@	¡	Ñ	¿	^	`	¨	ñ	}	~	Pt	$	@	¡	Ñ	¿	^	'	¨	ñ	}	~
8	Japan	#	$	@	[	¥	]	^	`	{	¦	}	~	#	$	@	[	¥	]	^	'	{	/	}	~
9	Norway	#	¤	É	Æ	Ø	Å	Ü	é	æ	ø	å	ü	#	¤	É	Æ	Ø	Å	Ü	é	æ	ø	å	ü
10	Denmark ¥	#	$	É	Æ	Ø	Å	Ü	é	æ	ø	å	ü	#	$	É	Æ	Ø	Å	Ü	é	æ	ø	å	ü
11	Spain ¥	#	$	á	¡	Ñ	¿	é	`	Í	ñ	ó	ú	#	$	á	¡	Ñ	¿	é	'	Í	ñ	ó	ú
12	Latin America	#	$	á	¡	Ñ	¿	é	ü	Í	ñ	ó	ú	#	$	á	¡	Ñ	¿	é	ü	Í	ñ	ó	ú
13	Korea	#	$	@	[	₩	]	^	`	{	¦	}	~	#	$	@	[	₩	]	^	'	{	/	}	~
64	Legal	#	$	§	°	'	"	¶	`	©	®	†	™	#	$	§	°	'	"	¶	'	©	®	†	™

2.4.2 BJ mode

a) USA Code Page 437

Hex No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	
0	Ø 0	▶ 16	SP 32	0 48	@ 64	P 80	` 96	p 112	Ç 128	É 144	á 160	▒ 176	└ 192	╨ 208	α 224	≡ 240	0000
1	☺ 1	◀ 17	! 33	1 49	A 65	Q 81	a 97	q 113	ü 129	æ 145	í 161	▓ 177	┴ 193	╤ 209	ß 225	± 241	0001
2	● 2	↕ 18	" 34	2 50	B 66	R 82	b 98	r 114	é 130	Æ 146	ó 162	■ 178	┬ 194	╥ 210	Γ 226	≥ 242	0010
3	♥ 3	!! 19	# 35	3 51	C 67	S 83	c 99	s 115	â 131	ô 147	ú 163	│ 179	├ 195	╙ 211	π 227	≤ 243	0011
4	♦ 4	¶ 20	$ 36	4 52	D 68	T 84	d 100	t 116	ä 132	ö 148	ñ 164	┤ 180	─ 196	╘ 212	Σ 228	⌠ 244	0100
5	♣ 5	§ 21	% 37	5 53	E 69	U 85	e 101	u 117	à 133	ò 149	Ñ 165	╡ 181	┼ 197	╒ 213	σ 229	⌡ 245	0101
6	♠ 6	▬ 22	& 38	6 54	F 70	V 86	f 102	v 118	å 134	û 150	a 166	╢ 182	╞ 198	╓ 214	µ 230	÷ 246	0110
7	• 7	↨ 23	' 39	7 55	G 71	W 87	g 103	w 119	ç 135	ù 151	o 167	╖ 183	╟ 199	╫ 215	τ 231	≈ 247	0111
8	◘ 8	↑ 24	(40	8 56	H 72	X 88	h 104	x 120	ê 136	ÿ 152	¿ 168	╕ 184	╚ 200	╪ 216	Φ 232	° 248	1000
9	○ 9	↓ 25	) 41	9 57	I 73	Y 89	i 105	y 121	ë 137	Ö 153	⌐ 169	╣ 185	╔ 201	┘ 217	Θ 233	• 249	1001
A	◙ 10	→ 26	* 42	: 58	J 74	Z 90	j 106	z 122	è 138	Ü 154	¬ 170	║ 186	╩ 202	┌ 218	Ω 234	· 250	1010
B	♂ 11	← 27	+ 43	; 59	K 75	[91	k 107	{ 123	ï 139	¢ 155	½ 171	╗ 187	╦ 203	█ 219	δ 235	√ 251	1011
C	♀ 12	∟ 28	, 44	< 60	L 76	\ 92	l 108	| 124	î 140	£ 156	¼ 172	╝ 188	╠ 204	▄ 220	∞ 236	n 252	1100
D	♪ 13	↔ 29	- 45	= 61	M 77	] 93	m 109	} 125	ì 141	¥ 157	¡ 173	╜ 189	═ 205	▌ 221	Ø 237	2 253	1101
E	♫ 14	▲ 30	. 46	> 62	N 78	^ 94	n 110	~ 126	Ä 142	Pts 158	« 174	╛ 190	╬ 206	▐ 222	∈ 238	■ 254	1110
F	☼ 15	▼ 31	/ 47	? 63	O 79	_ 95	o 111	⌂ 127	Å 143	ƒ 159	» 175	┐ 191	╧ 207	▀ 223	∩ 239	SP 255	1111
	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111	Binary No.

b) Multilingual Page 850

Hex No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	
0	Ø 0	▶ 16	SP 32	0 48	@ 64	P 80	` 96	p 112	Ç 128	É 144	á 160	▒ 176	└ 192	ð 208	Ó 224	- 240	0000
1	☺ 1	◀ 17	! 33	1 49	A 65	Q 81	a 97	q 113	ü 129	æ 145	í 161	▓ 177	┴ 193	Ð 209	ß 225	± 241	0001
2	● 2	↕ 18	" 34	2 50	B 66	R 82	b 98	r 114	é 130	Æ 146	ó 162	■ 178	┬ 194	Ê 210	Ô 226	= 242	0010
3	♥ 3	!! 19	# 35	3 51	C 67	S 83	c 99	s 115	â 131	ô 147	ú 163	│ 179	├ 195	Ë 211	Ò 227	¾ 243	0011
4	♦ 4	¶ 20	$ 36	4 52	D 68	T 84	d 100	t 116	ä 132	ö 148	ñ 164	┤ 180	─ 196	È 212	õ 228	¶ 244	0100
5	♣ 5	§ 21	% 37	5 53	E 69	U 85	e 101	u 117	à 133	ò 149	Ñ 165	Á 181	┼ 197	ı 213	Õ 229	§ 245	0101
6	♠ 6	▬ 22	& 38	6 54	F 70	V 86	f 102	v 118	å 134	û 150	a 166	Â 182	ã 198	Í 214	µ 230	÷ 246	0110
7	• 7	↨ 23	' 39	7 55	G 71	W 87	g 103	w 119	ç 135	ù 151	o 167	À 183	Ã 199	Î 215	þ 231	¸ 247	0111
8	◘ 8	↑ 24	(40	8 56	H 72	X 88	h 104	x 120	ê 136	ÿ 152	¿ 168	© 184	╚ 200	Ï 216	Þ 232	° 248	1000
9	○ 9	↓ 25	) 41	9 57	I 73	Y 89	i 105	y 121	ë 137	Ö 153	® 169	╣ 185	╔ 201	┘ 217	Ú 233	¨ 249	1001
A	◙ 10	→ 26	* 42	: 58	J 74	Z 90	j 106	z 122	è 138	Ü 154	¬ 170	║ 186	╩ 202	┌ 218	Û 234	· 250	1010
B	♂ 11	← 27	+ 43	; 59	K 75	[91	k 107	{ 123	ï 139	ø 155	½ 171	╗ 187	╦ 203	█ 219	Ù 235	¹ 251	1011
C	♀ 12	∟ 28	, 44	< 60	L 76	\ 92	l 108	| 124	î 140	£ 156	¼ 172	╝ 188	╠ 204	▄ 220	ý 236	³ 252	1100
D	♪ 13	↔ 29	- 45	= 61	M 77	] 93	m 109	} 125	ì 141	Ø 157	¡ 173	¢ 189	═ 205	▌ 221	Ý 237	² 253	1101
E	♫ 14	▲ 30	. 46	> 62	N 78	^ 94	n 110	~ 126	Ä 142	× 158	« 174	¥ 190	╬ 206	▐ 222	Ì 238	¯ 254	1110
F	☼ 15	▼ 31	/ 47	? 63	O 79	_ 95	o 111	⌂ 127	Å 143	ƒ 159	» 175	┐ 191	¤ 207	▀ 223	´ 239	SP 255	1111
	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111	Binary No.

c) Slavic Code Page 852

Hex No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	
0	Ø 0	▶ 16	SP 32	0 48	@ 64	P 80	` 96	p 112	Ç 128	É 144	á 160	▒ 176	└ 192	đ 208	Ó 224	ˉ 240	0000
1	☺ 1	◀ 17	! 33	1 49	A 65	Q 81	a 97	q 113	ü 129	Ĺ 145	í 161	▓ 177	┴ 193	Đ 209	ß 225	´ 241	0001
2	● 2	↕ 18	" 34	2 50	B 66	R 82	b 98	r 114	é 130	ĺ 146	ó 162	■ 178	┬ 194	Ď 210	Ô 226	˛ 242	0010
3	♥ 3	!! 19	# 35	3 51	C 67	S 83	c 99	s 115	â 131	ô 147	ú 163	│ 179	├ 195	Ë 211	Ń 227	ˇ 243	0011
4	♦ 4	¶ 20	$ 36	4 52	D 68	T 84	d 100	t 116	ä 132	ö 148	Ą 164	┤ 180	─ 196	ď 212	ń 228	˘ 244	0100
5	♣ 5	§ 21	% 37	5 53	E 69	U 85	e 101	u 117	ů 133	Ľ 149	ą 165	Á 181	┼ 197	Ň 213	ň 229	§ 245	0101
6	♠ 6	▬ 22	& 38	6 54	F 70	V 86	f 102	v 118	ć 134	ľ 150	Ž 166	Â 182	Ă 198	Í 214	Š 230	÷ 246	0110
7	• 7	↨ 23	' 39	7 55	G 71	W 87	g 103	w 119	ç 135	Ś 151	ž 167	Ě 183	ă 199	Î 215	š 231	¸ 247	0111
8	◘ 8	↑ 24	(40	8 56	H 72	X 88	h 104	x 120	ł 136	ś 152	Ę 168	Ş 184	╚ 200	ě 216	Ř 232	° 248	1000
9	○ 9	↓ 25	) 41	9 57	I 73	Y 89	i 105	y 121	ë 137	Ö 153	ę 169	╣ 185	╔ 201	┘ 217	Ú 233	¨ 249	1001
A	◙ 10	→ 26	* 42	: 58	J 74	Z 90	j 106	z 122	Ő 138	Ü 154	¬ 170	║ 186	╩ 202	┌ 218	ŕ 234	· 250	1010
B	♂ 11	← 27	+ 43	; 59	K 75	[91	k 107	{ 123	ő 139	Ť 155	ź 171	╗ 187	╦ 203	▀ 219	Ű 235	ű 251	1011
C	♀ 12	∟ 28	, 44	< 60	L 76	\ 92	l 108	| 124	î 140	ť 156	Č 172	╝ 188	╠ 204	▄ 220	ý 236	Ř 252	1100
D	♪ 13	↔ 29	– 45	= 61	M 77	] 93	m 109	} 125	Ź 141	Ł 157	ş 173	Ž 189	═ 205	Ţ 221	Ý 237	ř 253	1101
E	♫ 14	▲ 30	. 46	> 62	N 78	^ 94	n 110	~ 126	Ä 142	× 158	« 174	ż 190	╬ 206	Ů 222	ţ 238	■ 254	1110
F	☼ 15	▼ 31	/ 47	? 63	O 79	_ 95	o 111	⌂ 127	Ć 143	č 159	» 175	¬ 191	¤ 207	▬ 223	´ 239	SP 255	1111
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d) Portuguese Code Page 860

Hex No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	
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1	☺ 1	◀ 17	! 33	1 49	A 65	Q 81	a 97	q 113	ü 129	À 145	í 161	▓ 177	┴ 193	╤ 209	ß 225	± 241	0001
2	● 2	↕ 18	" 34	2 50	B 66	R 82	b 98	r 114	é 130	È 146	ó 162	■ 178	┬ 194	╥ 210	Γ 226	≥ 242	0010
3	♥ 3	!! 19	# 35	3 51	C 67	S 83	c 99	s 115	â 131	ô 147	ú 163	│ 179	├ 195	╙ 211	π 227	≤ 243	0011
4	♦ 4	¶ 20	$ 36	4 52	D 68	T 84	d 100	t 116	ã 132	õ 148	ñ 164	┤ 180	─ 196	╘ 212	Σ 228	⌠ 244	0100
5	♣ 5	§ 21	% 37	5 53	E 69	U 85	e 101	u 117	à 133	ò 149	Ñ 165	╡ 181	┼ 197	╒ 213	σ 229	⌡ 245	0101
6	♠ 6	▬ 22	& 38	6 54	F 70	V 86	f 102	v 118	Á 134	Ú 150	ª 166	╢ 182	╞ 198	╓ 214	µ 230	÷ 246	0110
7	• 7	↨ 23	' 39	7 55	G 71	W 87	g 103	w 119	ç 135	ù 151	º 167	╖ 183	╟ 199	╫ 215	τ 231	≈ 247	0111
8	◘ 8	↑ 24	(40	8 56	H 72	X 88	h 104	x 120	ê 136	Ì 152	¿ 168	╕ 184	╚ 200	╪ 216	Φ 232	° 248	1000
9	○ 9	↓ 25	) 41	9 57	I 73	Y 89	i 105	y 121	Ê 137	Õ 153	ò 169	╣ 185	╔ 201	┘ 217	Θ 233	· 249	1001
A	◙ 10	→ 26	* 42	: 58	J 74	Z 90	j 106	z 122	è 138	Ü 154	¬ 170	║ 186	╩ 202	┌ 218	Ω 234	· 250	1010
B	♂ 11	← 27	+ 43	; 59	K 75	[91	k 107	{ 123	Í 139	¢ 155	½ 171	╗ 187	╦ 203	▀ 219	δ 235	√ 251	1011
C	♀ 12	∟ 28	, 44	< 60	L 76	\ 92	l 108	| 124	Ô 140	£ 156	¼ 172	╝ 188	╠ 204	▄ 220	∞ 236	ⁿ 252	1100
D	♪ 13	↔ 29	– 45	= 61	M 77	] 93	m 109	} 125	ì 141	Ù 157	¡ 173	╜ 189	═ 205	▌ 221	Ø 237	² 253	1101
E	♫ 14	▲ 30	. 46	> 62	N 78	^ 94	n 110	~ 126	Ã 142	Pt 158	« 174	╛ 190	╬ 206	▌ 222	∈ 238	■ 254	1110
F	☼ 15	▼ 31	/ 47	? 63	O 79	_ 95	o 111	⌂ 127	Â 143	Ó 159	» 175	┐ 191	╧ 207	▬ 223	∩ 239	SP 255	1111
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e) Canadian French Code Page 863

Hex No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	
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1	☺ 1	◀ 17	! 33	1 49	A 65	Q 81	a 97	q 113	ü 129	È 145	´ 161	▓ 177	┴ 193	╤ 209	ß 225	± 241	0001
2	☻ 2	↕ 18	" 34	2 50	B 66	R 82	b 98	r 114	é 130	Ê 146	ó 162	▓ 178	┬ 194	╥ 210	Γ 226	≥ 242	0010
3	♥ 3	!! 19	# 35	3 51	C 67	S 83	c 99	s 115	â 131	ô 147	ú 163	┃ 179	├ 195	╙ 211	π 227	≤ 243	0011
4	♦ 4	¶ 20	$ 36	4 52	D 68	T 84	d 100	t 116	Â 132	Ë 148	¨ 164	┤ 180	─ 196	╘ 212	Σ 228	⌠ 244	0100
5	♣ 5	§ 21	% 37	5 53	E 69	U 85	e 101	u 117	à 133	Ï 149	˙ 165	╡ 181	┼ 197	╒ 213	σ 229	⌡ 245	0101
6	♠ 6	▬ 22	& 38	6 54	F 70	V 86	f 102	v 118	¶ 134	û 150	³ 166	╢ 182	╞ 198	╓ 214	µ 230	÷ 246	0110
7	• 7	↨ 23	' 39	7 55	G 71	W 87	g 103	w 119	ç 135	ù 151	¯ 167	╖ 183	╟ 199	╫ 215	τ 231	≈ 247	0111
8	◘ 8	↑ 24	(40	8 56	H 72	X 88	h 104	x 120	ê 136	¤ 152	Î 168	╕ 184	╚ 200	╪ 216	Φ 232	° 248	1000
9	○ 9	↓ 25	) 41	9 57	I 73	Y 89	i 105	y 121	ë 137	Ô 153	⌐ 169	╣ 185	╔ 201	┘ 217	Θ 233	• 249	1001
A	◙ 10	→ 26	* 42	: 58	J 74	Z 90	j 106	z 122	è 138	Ü 154	¬ 170	║ 186	╩ 202	┌ 218	Ω 234	· 250	1010
B	♂ 11	← 27	+ 43	; 59	K 75	[91	k 107	{ 123	ï 139	¢ 155	½ 171	╗ 187	╦ 203	■ 219	δ 235	√ 251	1011
C	♀ 12	∟ 28	, 44	< 60	L 76	\ 92	l 108	| 124	î 140	£ 156	¼ 172	╝ 188	╠ 204	▄ 220	∞ 236	n 252	1100
D	♪ 13	↔ 29	– 45	= 61	M 77	] 93	m 109	} 125	‗ 141	Ù 157	¾ 173	╜ 189	═ 205	▌ 221	∅ 237	2 253	1101
E	♫ 14	▲ 30	. 46	> 62	N 78	^ 94	n 110	~ 126	À 142	Û 158	« 174	╛ 190	╬ 206	▐ 222	∈ 238	■ 254	1110
F	☼ 15	▼ 31	/ 47	? 63	O 79	_ 95	o 111	⌂ 127	§ 143	ƒ 159	» 175	┐ 191	╧ 207	▀ 223	∩ 239	SP 255	1111
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f) Norwegian Code Page 865

Hex No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	
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1	☺ 1	◀ 17	! 33	1 49	A 65	Q 81	a 97	q 113	ü 129	æ 145	í 161	▓ 177	┴ 193	╤ 209	ß 225	± 241	0001
2	☻ 2	↕ 18	" 34	2 50	B 66	R 82	b 98	r 114	é 130	Æ 146	ó 162	▓ 178	┬ 194	╥ 210	Γ 226	≥ 242	0010
3	♥ 3	!! 19	# 35	3 51	C 67	S 83	c 99	s 115	â 131	ô 147	ú 163	┃ 179	├ 195	╙ 211	π 227	≤ 243	0011
4	♦ 4	¶ 20	$ 36	4 52	D 68	T 84	d 100	t 116	ä 132	ö 148	ñ 164	┤ 180	─ 196	╘ 212	Σ 228	⌠ 244	0100
5	♣ 5	§ 21	% 37	5 53	E 69	U 85	e 101	u 117	à 133	ò 149	Ñ 165	╡ 181	┼ 197	╒ 213	σ 229	⌡ 245	0101
6	♠ 6	▬ 22	& 38	6 54	F 70	V 86	f 102	v 118	å 134	û 150	ª 166	╢ 182	╞ 198	╓ 214	µ 230	÷ 246	0110
7	• 7	↨ 23	' 39	7 55	G 71	W 87	g 103	w 119	ç 135	ù 151	º 167	╖ 183	╟ 199	╫ 215	τ 231	≈ 247	0111
8	◘ 8	↑ 24	(40	8 56	H 72	X 88	h 104	x 120	ê 136	ÿ 152	¿ 168	╕ 184	╚ 200	╪ 216	Φ 232	° 248	1000
9	○ 9	↓ 25	) 41	9 57	I 73	Y 89	i 105	y 121	ë 137	Ö 153	⌐ 169	╣ 185	╔ 201	┘ 217	Θ 233	• 249	1001
A	◙ 10	→ 26	* 42	: 58	J 74	Z 90	j 106	z 122	è 138	Ü 154	¬ 170	║ 186	╩ 202	┌ 218	Ω 234	· 250	1010
B	♂ 11	← 27	+ 43	; 59	K 75	[91	k 107	{ 123	ï 139	ø 155	½ 171	╗ 187	╦ 203	■ 219	δ 235	√ 251	1011
C	♀ 12	∟ 28	, 44	< 60	L 76	\ 92	l 108	| 124	î 140	£ 156	¼ 172	╝ 188	╠ 204	▄ 220	∞ 236	n 252	1100
D	♪ 13	↔ 29	– 45	= 61	M 77	] 93	m 109	} 125	ì 141	Ø 157	¡ 173	╜ 189	═ 205	▌ 221	∅ 237	2 253	1101
E	♫ 14	▲ 30	. 46	> 62	N 78	^ 94	n 110	~ 126	Ä 142	Pts 158	« 174	╛ 190	╬ 206	▐ 222	∈ 238	■ 254	1110
F	☼ 15	▼ 31	/ 47	? 63	O 79	_ 95	o 111	⌂ 127	Å 143	ƒ 159	¤ 175	┐ 191	╧ 207	▀ 223	∩ 239	SP 255	1111
	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111	Binary No.

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Part 3

OPERATING INSTRUCTIONS

1. PRINTER SETUP

1.1 Equipment Check

After unpacking the printer, make sure the items below have been included:

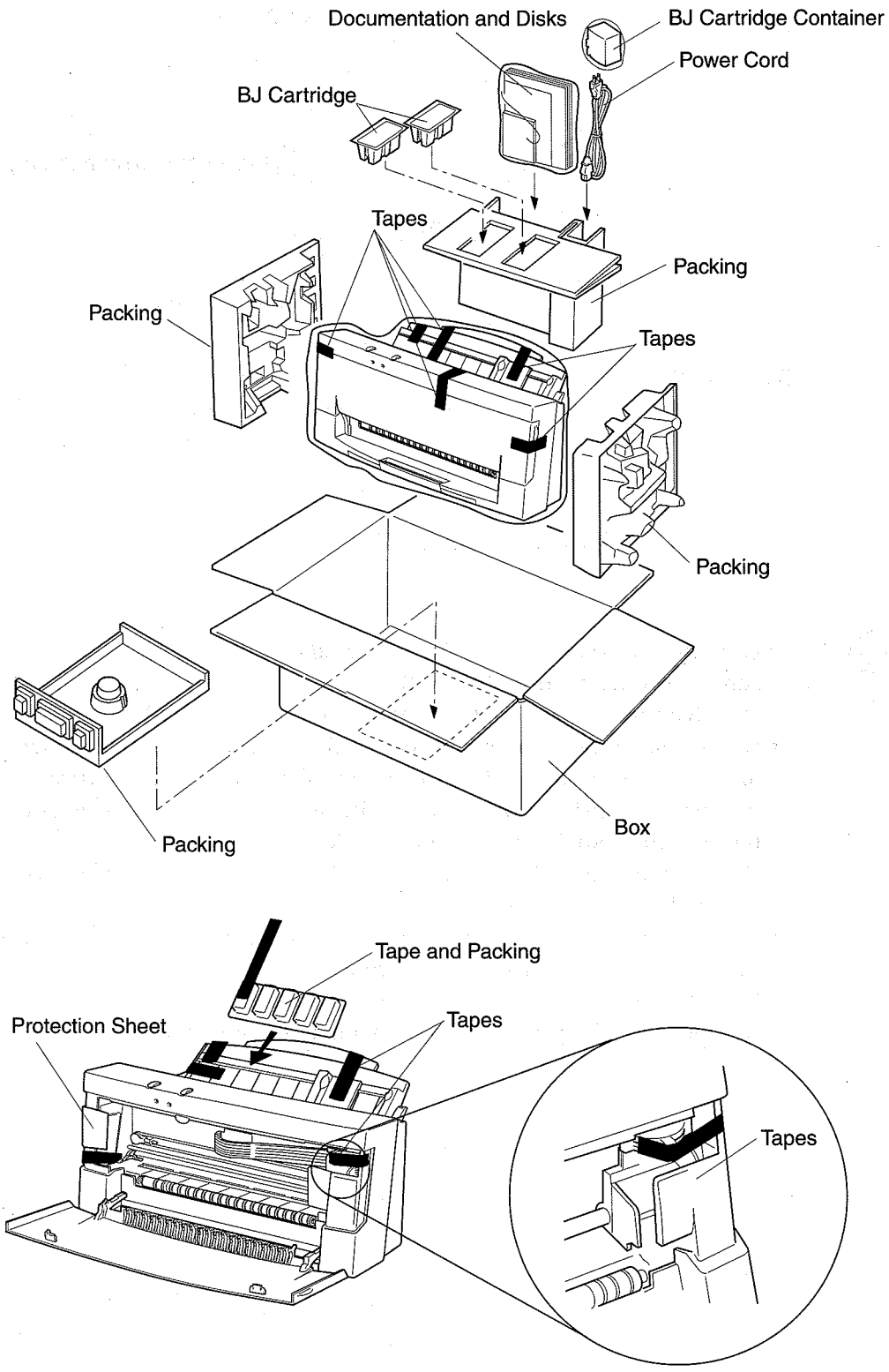


Figure 3-1 Packaging

1.2 Printer Dimensions

The printer's dimensions are shown below. Allow enough space for the printer to be used with ease.

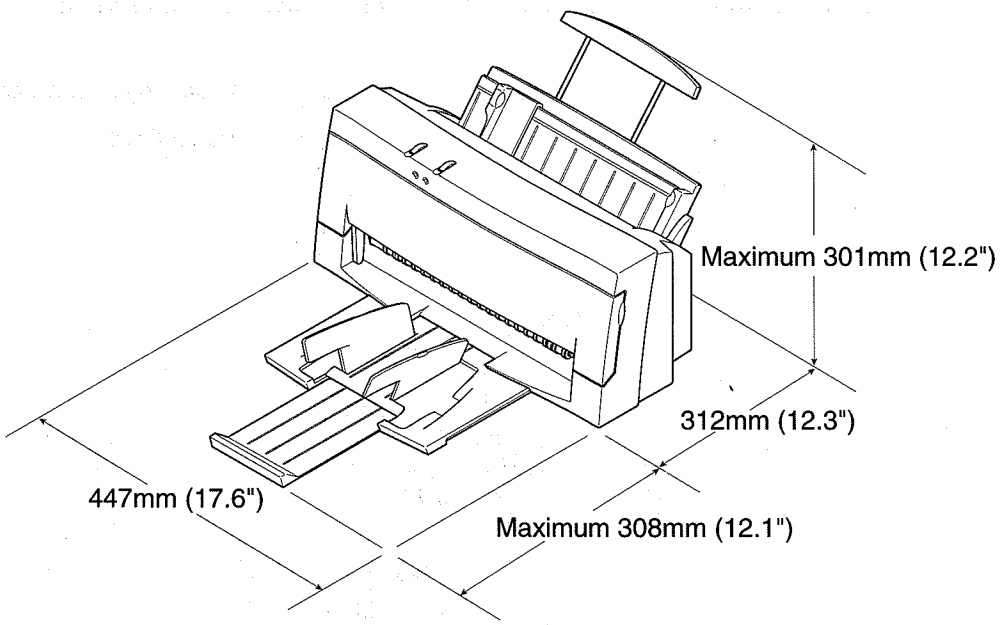


Figure 3-2 Printer Dimensions

NOTE

- Operate the printer under the following conditions:
  Ambient temperature: 5°C to 35°C
  Relative humidity: 10% to 90% (no condensation)
- Do not place the printer in direct sunlight, next to airconditioners, or in any other locations subject to sudden changes in temperature. Also, do not leave the printer where it may be subject to a sudden rise in temperature, such as in a motor vehicle.
- Do not place the printer where there is excessive dust, or where the atmosphere is salt laden.
- Do not place the printer near devices with magnets or that generate a magnetic field such as TVs or speakers.
- Place the printer on a level and stable surface.
- Do not place the printer in areas subject to vibration.

1.3 Setup Procedure

Set up the printer as follows.

1.3.1 Connecting the interface cable

1) Make sure both the printer and the computer are off.
2) Connect one end of the interface cable to the interface connector. If using a parallel interface, clip the connector in place.
3) Connect the other end of the interface cable to the interface connector on the computer.

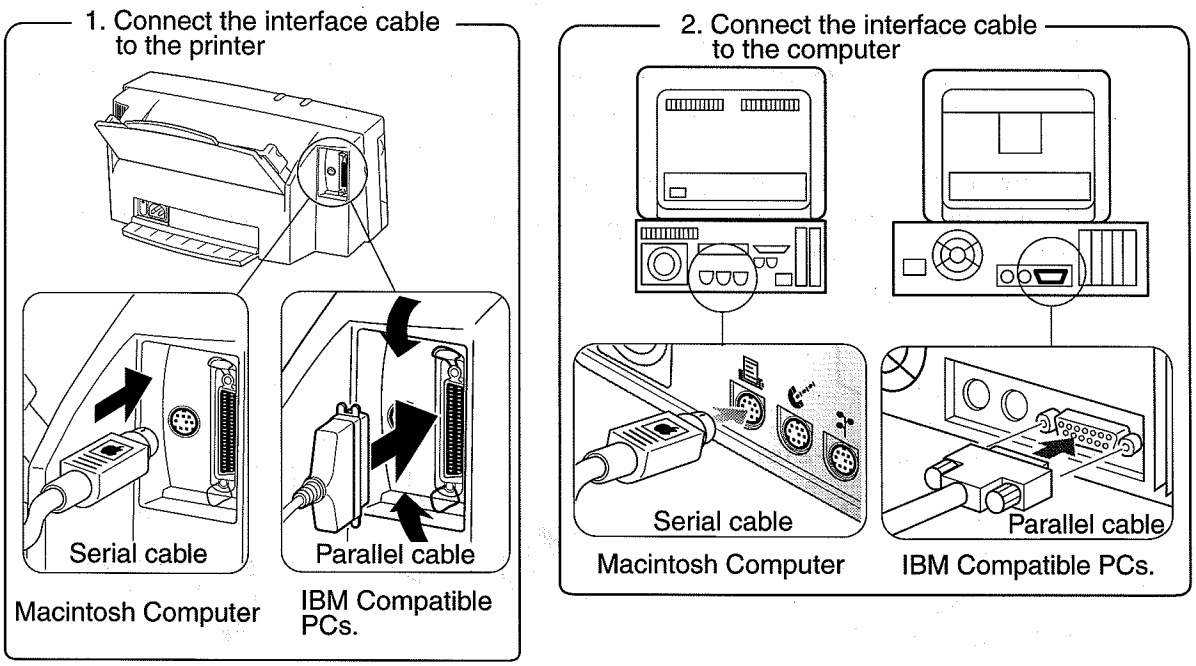


Figure 3-3 Connecting the Interface Cable

NOTE Both parallel and serial interface cables can be connected at the same time.

1.3.2 Connecting the power cord

1) Connect the power cord plug to the printer's power inlet.
2) Connect the other end of the power cord to the power outlet.

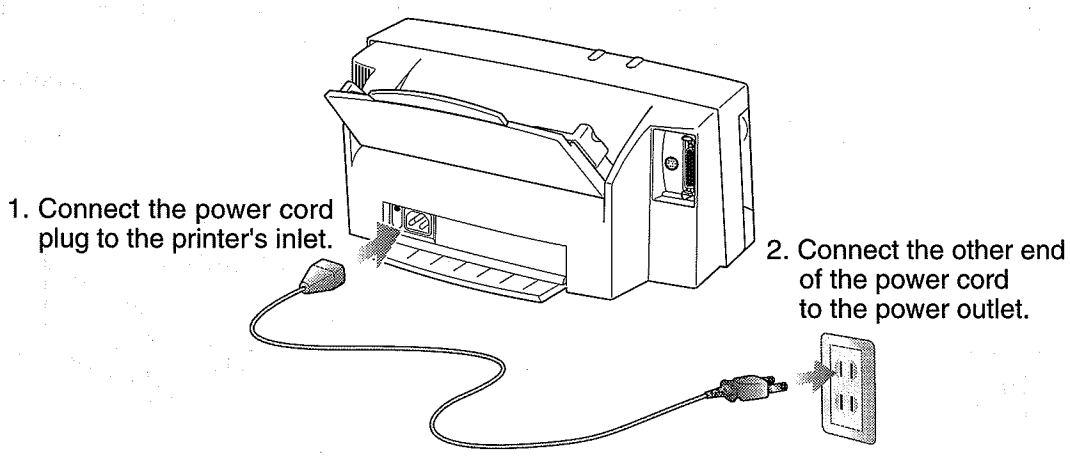


Figure 3-4 Connecting the Power Cord

1.3.3 Turning on the printer

Make sure the power cord has been connected properly, then press the *POWER* button to turn on the printer. When turned on, the printer executes initializing operations. The carriage finally stops at the cartridge replacement position and the *POWER* indicator blinks to indicate that the printer is waiting for a BJ cartridge to be installed.

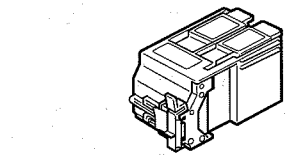
Before turning on the printer, first turn on the computer and any other peripheral equipment. If you have set up the printer to turn on automatically, the printer will do so when it receives print data.

1.3.4 Installing the BJ cartridge

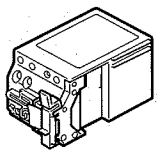
Three types of cartridges can be installed in the printer: a color BJ cartridge [BC-21e], color BJ cartridge [BC-22e Photo], and black BJ cartridge [BC-20].

1) Removing the BJ cartridge protectors

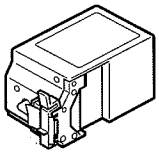
Take out the BJ cartridge from the package, then remove the cap and tape on the nozzles as shown in the figure.



Color BJ Cartridge [BC-21e]



Color BJ Cartridge [BC-22e Photo]



Black BJ Cartridge [BC-20]

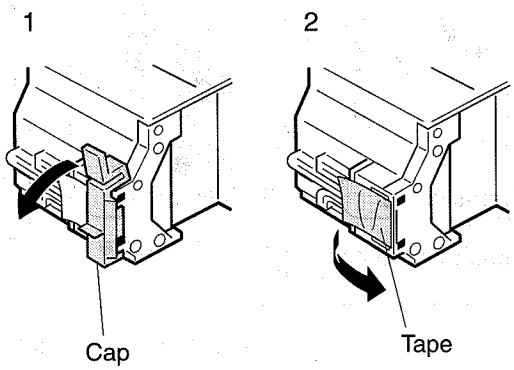


Figure 3-5 Removing the BJ Cartridge Protectors

CAUTION

Do not reuse the cap and tape as doing so can clog the nozzles or mix the ink colors.
Do not touch the nozzles when removing the tape as doing so can scratch and dirty the head face resulting in poor printing.
Do not shake the BJ cartridge after removing the cap and tape as doing so may result in ink spills.

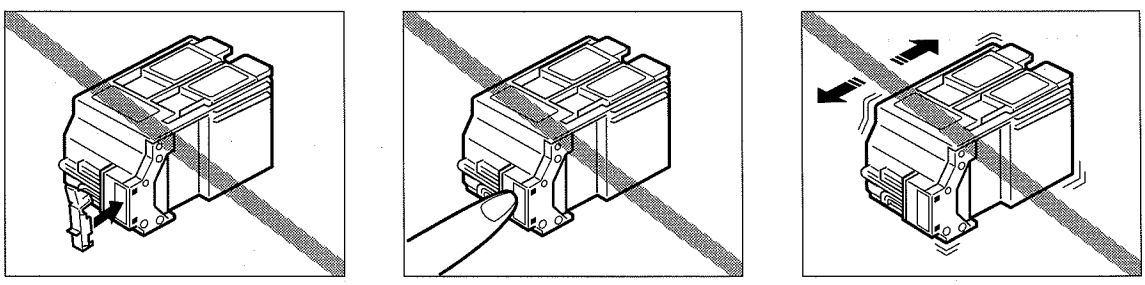


Figure 3-6 BJ Cartridge Handling Precautions

2) Installing the BJ cartridge

Open the printer's front cover and flip up the cartridge lock lever. Insert the BJ cartridge into the carriage and push down the cartridge lock lever to lock the BJ cartridge in place. When pressing the *CARTRIDGE* button, the beeper sounds once and the carriage moves to the capping position. After installing a cartridge, the carriage automatically returns to the capping position after 10 minutes if left in the cartridge replacement position.

NOTE

If the BJ cartridge is not properly installed while holding down the *CARTRIDGE* button, the beeper will sound three times and the carriage will not return to the capping position. After installing the BJ cartridge, be sure to close the front cover securely. If it is not closed properly, paper feed and printing problems may occur.

When installing the scanner cartridge, all the LEDs are lit at 75% power output at the home position for max. 100 sec., and preheated to stabilize the LED output. The computer will display a message saying "Warming up scanner cartridge. Please wait.". After the message appears, all the LEDs are lit at 50% power output for max. 600 sec. to retain the temperature. White calibration and scanning operation cannot be performed for 40 seconds after installing the scanner cartridge. Operation will resume after paper pick-up and preheating is completed.

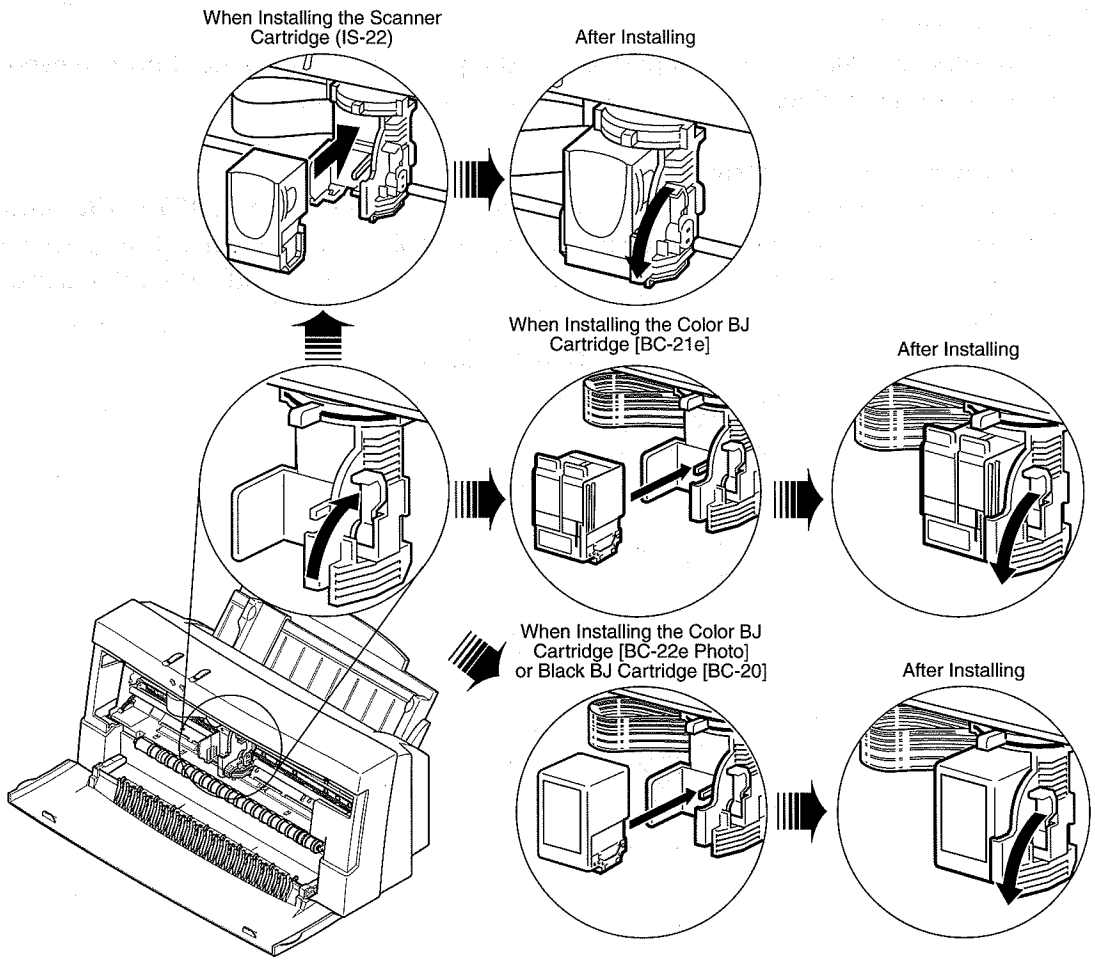


Figure 3-7 BJ Cartridge Installation

3) Replacing the BJ cartridge

Open the printer's front cover and press the *CARTRIDGE* button. The beeper sounds once and the carriage moves to the replacement position. Flip up the cartridge lock lever and remove the BJ cartridge. Install another BJ cartridge by following "Installing the BJ cartridge," above.

Always store an unused BJ cartridge in the BJ cartridge container.

If the printer has been operating for a prolonged period, the BJ cartridge's aluminum plate will be hot. When the aluminum plate is hot, the safety function works to prevent the carriage moving to the cartridge replacement position even if the *CARTRIDGE* button is pressed. The beeper sounds four times. In such cases, wait several minutes before replacing the BJ cartridge. Do not move the carriage by hand.

1.3.5 Replacing the ink cartridge

When a color BJ cartridge [BC-21e] is used, the ink cartridges can be replaced as follows.

1) When to replace the ink cartridge

Replace the ink cartridge in any of the following cases: the ink has run out, the ink cartridge has been out of its package for over six months, or the print quality does not improve even after the cartridge is cleaned five times. The color ink cartridge contains three colors. If one ink color runs out, the entire color ink cartridge must be replaced.

If an ink cartridge has been replaced but the print quality does not improve even after cleaning, replace the color BJ cartridge with a new one.

2) Removing an ink cartridge

Move the carriage to the cartridge replacement position with the *CARTRIDGE* button pressed down. Take out the ink cartridge to be replaced as shown in the figure below. Ink adheres to and around the ink cartridge's ink inlet, so handle the ink cartridge with care.

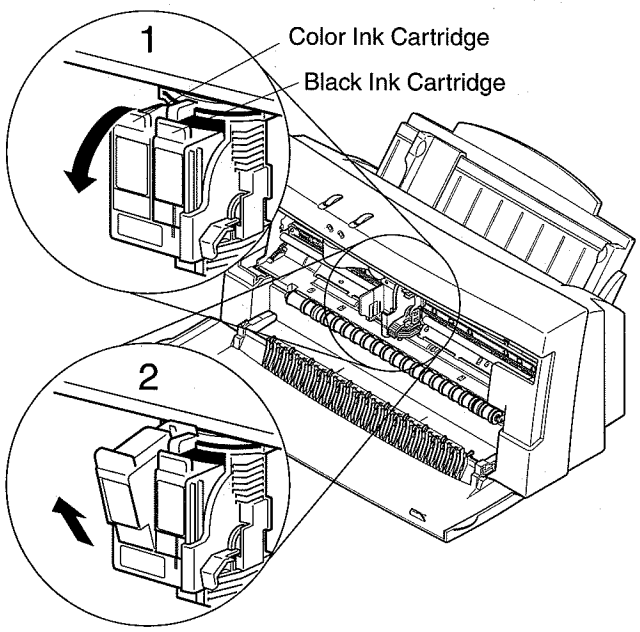


Figure 3-8 Replacing the Ink Cartridge

3) Installing an ink cartridge

Take out the new ink cartridge from its package and remove the cap as shown in the figure. Install the ink cartridge by following the removal procedure in reverse.
After installing the ink cartridge, press the *CARTRIDGE* button. The carriage returns to the capping position.

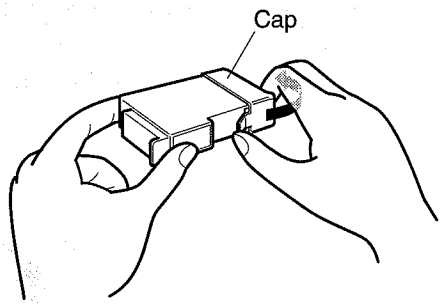


Figure 3-9 Removing the Ink Cartridge Cap

1.3.6 BJ cartridge container

A BJ cartridge container for storing the BJ cartridge is packed with the printer. Always store an unused BJ cartridge in the BJ cartridge container. Each container can store one BJ cartridge only, but several containers can be joined together.

NOTE

When storing a color BJ cartridge, make sure that the black and color ink cartridges are installed.
Do not drop or shake the container as the ink may leak from the cartridges.

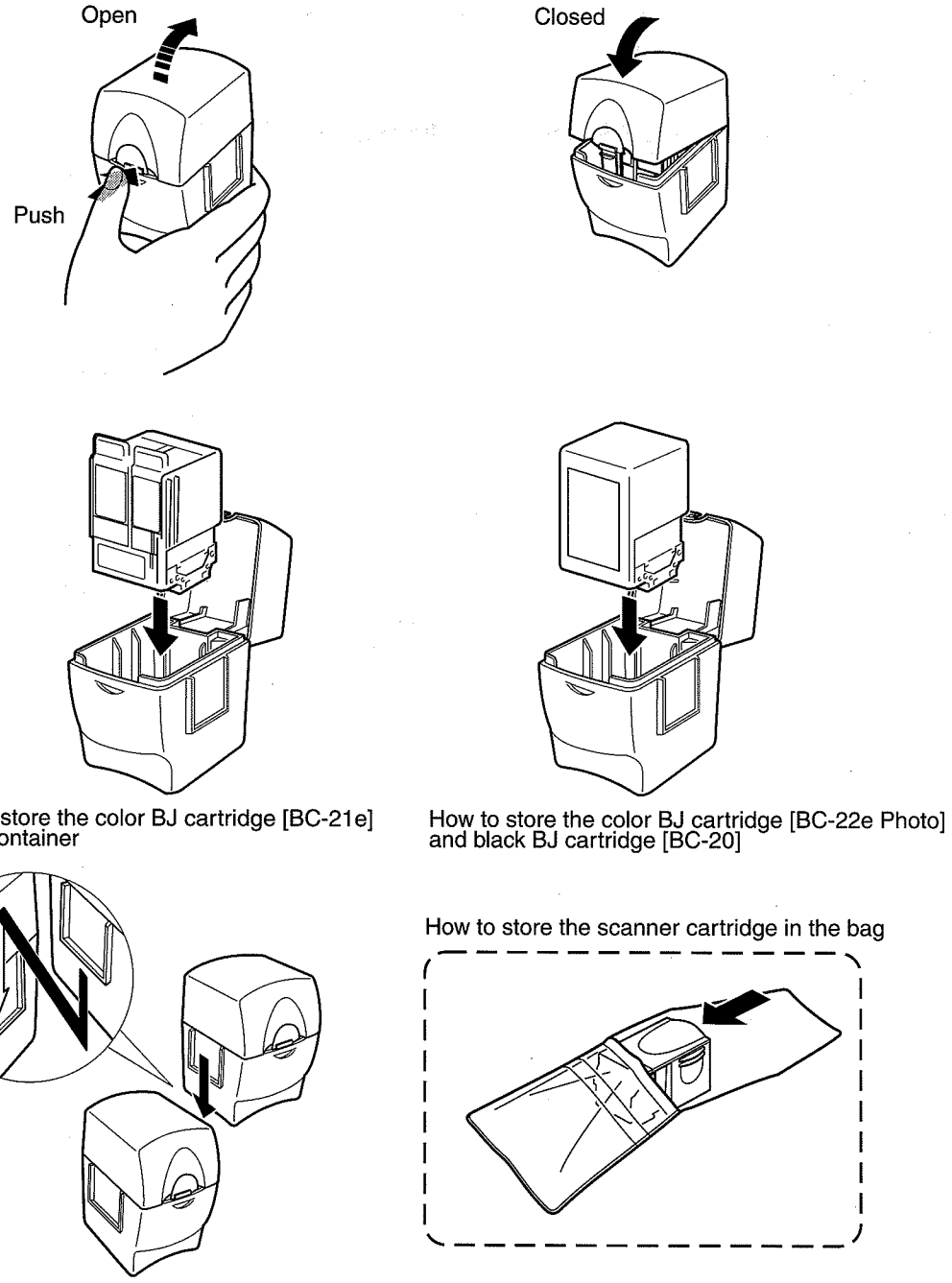


Figure 3-10 BJ Cartridge Container

1.4 Turning the Printer On/Off

1.4.1 Turning the printer on

With the printer connected to a power source, press the *POWER* button to turn on the printer. When the printer turns on, the beeper sounds once and initializing operations are executed.

If a BJ cartridge has not been installed, the *POWER* indicator blinks to indicate that a BJ cartridge must be installed.

If a BJ cartridge has already been installed, the *POWER* indicator will light to indicate that the printer is ready. When the printer is turned on after more than 72 hours have passed since the last cleaning operation, the printer automatically carries out a cleaning operation before printing or after the printer is turned on.

(When a color BJ cartridge is installed, the first cleaning is executed after 24 hours.)

The *POWER* indicator blinks while the cartridge is being cleaned.

1.4.2 Turning the printer off

To turn off the printer, press the *POWER* button. When the printer is turned off, it executes a power-off operation to cap the BJ cartridge and the blinking *POWER* indicatior shows that this operation is in progress. When the scanner cartridge is installed, the cartridge will move to the cartridge replacement position, i.e. the same position as when there is no cartridge, before the power is turned off.

When the power-off operation is completed, the *POWER* indicator turns off.

Make sure the *POWER* indicator is off before disconnecting the AC power cord.

Never turn off the printer by disconnecting the power cord without first pressing the *POWER* button. Otherwise, the printer turns off before it can cap the BJ cartridge. If the BJ cartridge is not capped, the ink may leak or dry out in the nozzles.

If the *POWER* button is pressed while the cartridge is being cleaned, the *POWER* indicator continues blinking until cleaning is completed. After cleaning is completed, the BJ cartridge is capped and the printer turns off. Any errors occurring after the power-off operation starts are ignored.

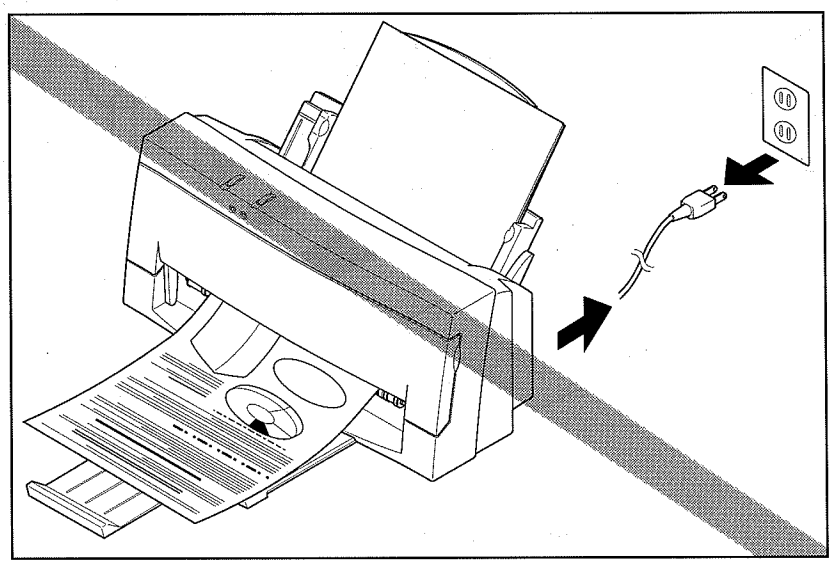


Figure 3-11 Do not Turn off the Printer without Pressing the POWER Button First

1.5 Paper Settings

For optimum printing, the printer has various paper settings to suit various types of paper. Set the paper selection lever before loading the paper.

Table 3-1 Quick Reference for Setting

Media	Paper Thickness Lever		Paper Selection Lever	Paper Rest	Paper Feed	
					Method	Limit
Plain Paper*2	Left (BC-20)	Center (BC-21e/BC -22e Photo)	Back	Up	Auto	10 mm stack (50 sheets)*1
High Resolution Paper*2	Center		Back	Up	Auto	10 mm stack
Envelopes	Right		Front	Up	Auto	10 envelopes
Transparencies	Center		Back	Up	Auto	50 sheets
Back Print Film	Center		Back (Front)*1	Up (Down)*1	Auto (Manual)*1	50 (1)*1 sheets
Glossy Paper*2	Center		Back	Up	Auto	1 sheet
High Gloss Film	Center		Front	Down	Manual	1 sheet*2
Heavy Plain Paper	Right		Front	Down	Manual	1 sheet*2
Fabric Sheet	Right		Front	Down	Manual	1 sheet*2

*1 For A3-size paper

*2 For plain paper, High Resolution Paper, and Glossy Photo Paper, the paper output guides should be raised.

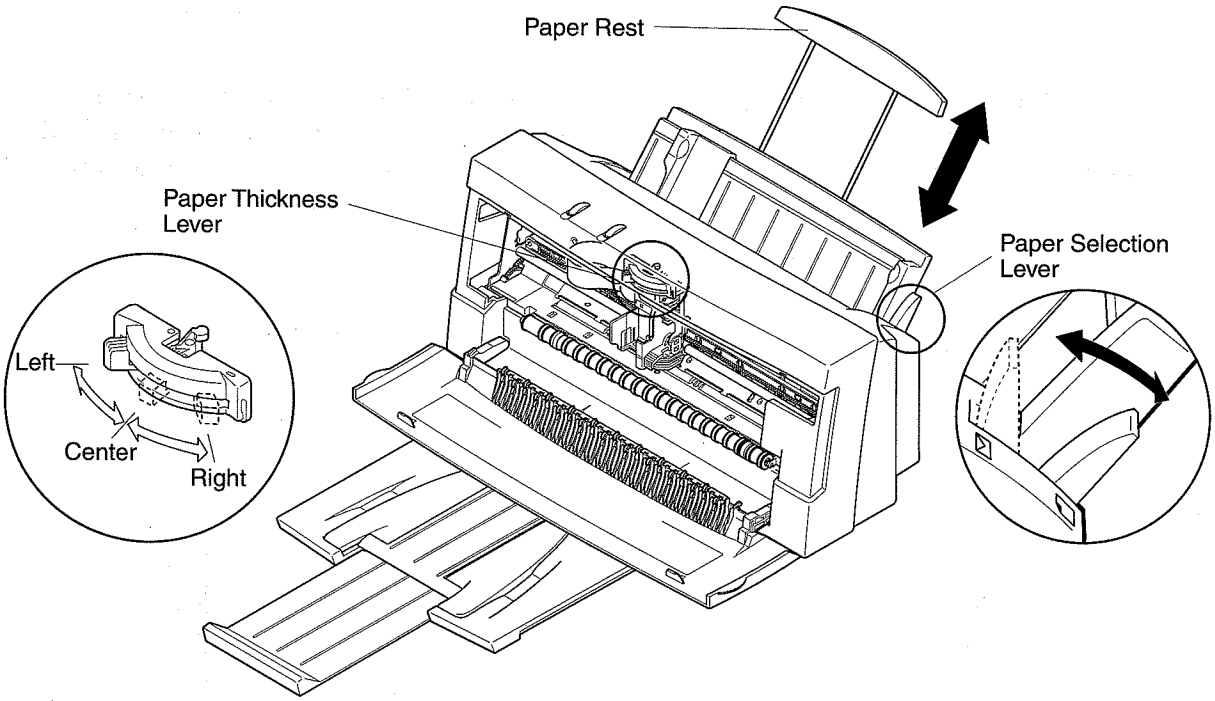


Figure 3-12 Paper Settings

1.6 Name of Parts and Their Functions

The different parts of the printer and their functions are shown below.

Paper Rest
Supports the stack of paper loaded in the sheet feeder. Before loading a stack of paper in the sheet feeder, extend the paper support. When only one sheet is manually loaded at a time, there is no need to extend the paper support.

Sheet Feeder
Holds the stack of cut sheets for automatic feeding. The paper weight and type determine how many sheets can be stacked in the sheet feeder.

Paper Guide
Aligns the cut sheets at the left edge of the sheet feeder. The paper guide ensures that the sheets do not skew as they feed into the printer.

Operator Panel
See the next page.

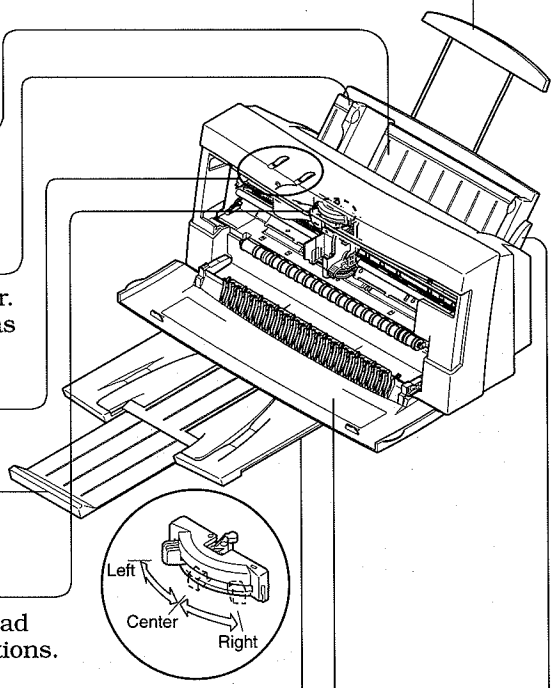
Paper Output Tray Extension
Supports long pages after they have been printed and ejected from the printer.

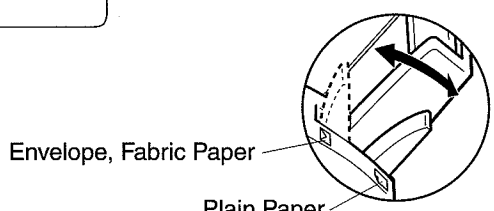
Paper Thickness Lever
Selects the gap between the paper and BJ cartridge head according to the weight of paper. There are three positions. (See *"1.5 Paper Settings" (page 3-10)*.)

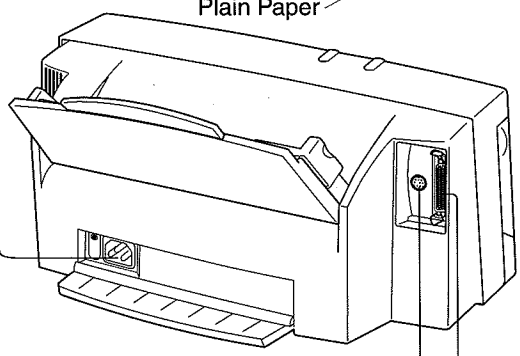
Paper Output Tray
Pulls out to receive the printed sheets.

Front Cover
Open to install or remove the BJ cartridge, set the paper thickness lever, or remove jammed paper.

Paper Selection Lever
Selects the proper paper setting. For details, (see *"1.5 Paper Settings" (page 3-10)*.)







Power Connector
For connecting the power cord

Serial Interface Connector
For connecting the printer to an Apple Macintosh computer

Parallel Interface Connector
For connecting the printer to the parallel port on IBM-compatible PCs

Figure 3-13 Names of Parts and Their Functions (1)

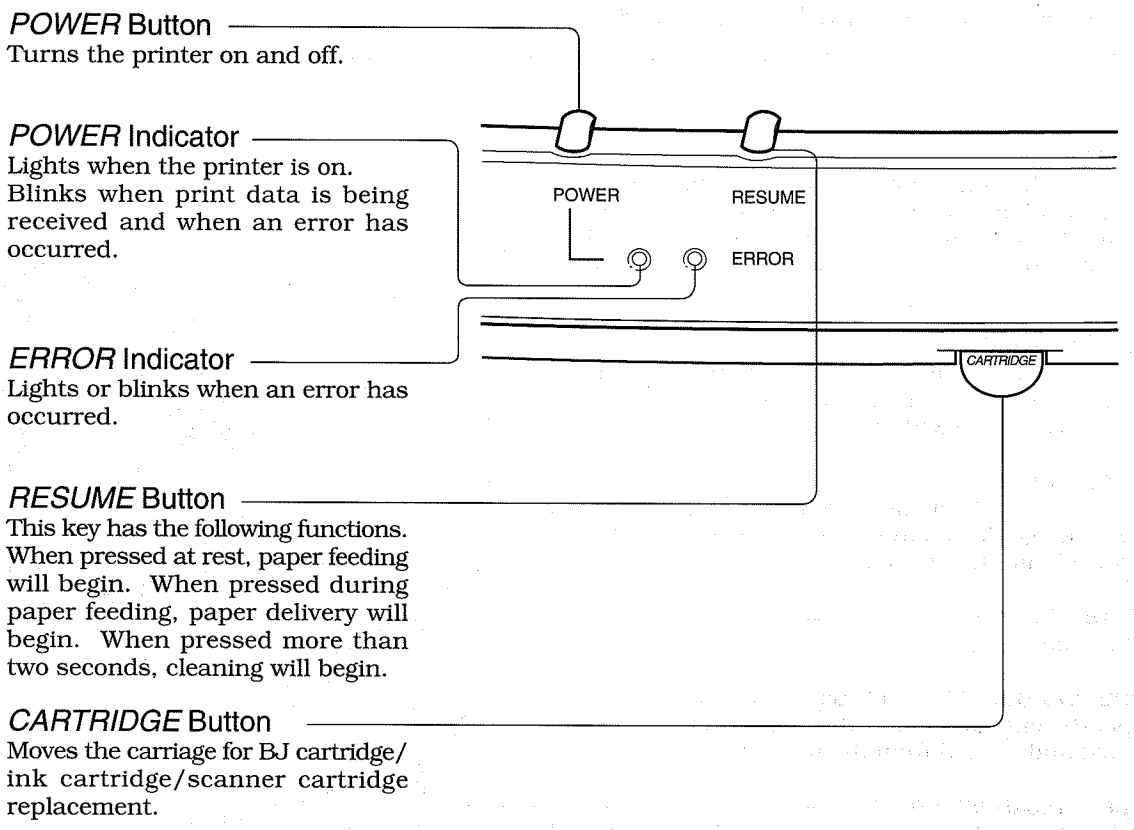


Figure 3-14 Names of Parts and Their Functions (2)

2. TRANSPORTING THE PRINTER

When carrying or transporting the printer, keep the BJ cartridge installed in the printer or stored in the BJ cartridge container.
This prevents the ink from leaking and drying out in the nozzles.

2.1 Carrying the Printer

Follow the procedure below when carrying the printer.

1) Press the *POWER* button to turn off the printer. When the power turns off, the *POWER* indicator turns off.
2) Disconnect the interface cable.
3) Disconnect the power cord from the power outlet.
4) Disconnect the power cord from the printer.
5) Check that the BJ cartridge is at the capping position (the right end of the printer). If the cartridge is not at the capping position, move the carriage belt by hand until the cartridge reaches the capping position.

CAUTION

Never turn off the printer by disconnecting the power cord without first pressing the *POWER* button. Do not carry the BJ cartridge by itself when removed from the printer. If the BJ cartridge is not capped, ink may leak or dry out in the nozzles.

2.2 Transporting the Printer

Follow the procedure below when transporting the printer.

1) Disconnect the interface cable and power cord as described above in 2.1 Carrying the printer.
2) Check that the BJ cartridge is at the capping position (the right end of the printer). If necessary, move it to the capping position by hand.
3) Repack the printer in its original box and packing materials. (Tape the carriage at the right hand side to prevent it moving.)

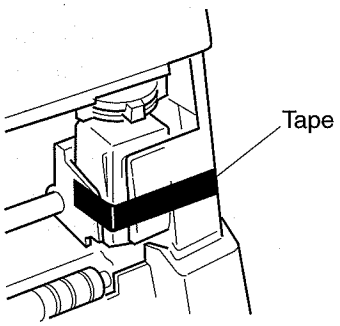


Figure 3-15 Fastening the Carriage

NOTE

If you do not have the original packing materials, use a sufficient amount of shock-absorbent material.

3. PRINTER SERVICING FUNCTIONS

3.1 Error Indications

The indicators in combination with the beeper indicate the nature of errors.

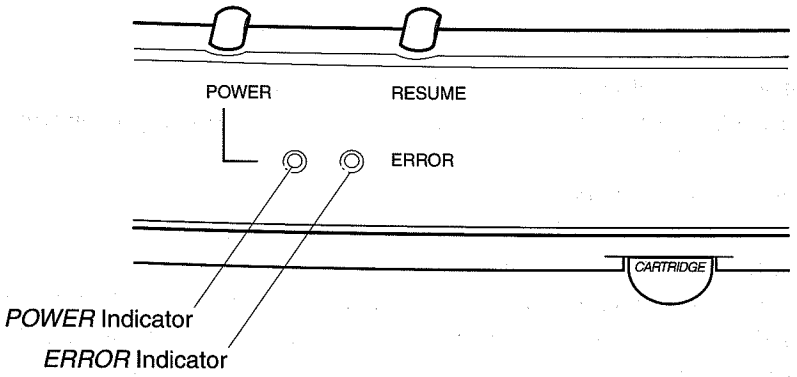


Figure 3-16 Operator Panel

Table 3-2 Error Indications

State	POWER	ERROR	Beeper
[User-correctable errors]			
Paper pick-up error	On	On	Once
Paper jam	On	On	Twice
Cartridge mode mismatch	On	On	5 times
[User-uncorrectable errors]			
ROM error	Blinks	Blinks	Once
RAM error	Blinks	Blinks	Twice
BJ cartridge displacement error	Blinks	Blinks	3 times
Home position error	Blinks	Blinks	4 times
Waste ink full error	Blinks	Blinks	5 times
Temperature sensor error	Blinks	Blinks	6 times
Printing position correction error	Blinks	Blinks	7 times
Head temperature error	Blinks	Blinks	8 times
Head temperature sensor error	Blinks	Blinks	9 times
Cleaning error	Blinks	Blinks	10 times
Scanner cartridge error	Blinks	Blinks	11 times

The errors listed in Table 3-2 are described below.

• User-correctable errors (Correctable by removing the paper and pressing the *RESUME* button).

1) Paper pick-up error
Occurs when the paper cannot be fed properly.

2) Paper jam
Occurs when the printed paper cannot be ejected.

3) Cartridge mismatch error
Occurs when a scanning operation is performed while a BJ cartridge is installed.
Occurs when a printing operation (including test prints) is performed while a scanner cartridge is installed.

• User-uncorrectable errors. (Press the *POWER* button to turn off the power.)

4) ROM error
Occurs when the ROM check during the initializing operation fails.

5) RAM error
Occurs when the RAM check during the initializing operation fails.

6) BJ cartridge displacement error
Occurs when the printer does not detect the BJ cartridge other than during BJ cartridge replacement.

7) Home position error
Displayed when the home position can not be detected.

8) Waste ink full error
Occurs when the "waste ink amount" recorded by the EEPROM exceeds the prescribed limit.

9) Temperature sensor error
Occurs when the temperature sensor's (TH1) reading on the logic board is irregular (broken wire etc.).

10) Printing position correction error
Occurs when the print position correction cannot be detected.

11) Head temperature error
Occurs when the temperature detected by the diode sensor in the BJ cartridge head exceeds the prescribed level.

12) Head temperature sensor error
Occurs when the diode sensor in the BJ cartridge head is assessed as irregular.
A head temperature error always occurs before this error occurs.

13) Cleaning error
Occurs when the cleaning operation detection at the capping position is irregular.

14) Scanner cartridge error
Occurs when the communication between the scanned and the computer is disabled.
Occurs when the calibration data from the computer is not correct.

3.2 Function Settings

Printer functions cannot be set with the printer. Use the Windows driver or BJ setup utility program for MS-DOS to set the function settings. (Details of the BJL commands used by the BJ controller are not available to users.)
The five default setting modes can be set with the *POWER* button after the printer is turned on.

3.2.1 Setting the default setting mode

The default setting mode can be set as follows:
When turning on the printer, hold down the *POWER* button until the beeper sounds the specified number of times. In this way, one of the following five default setting modes can be set.
Note that the waste ink count and the total printed page count for each BJ cartridge are not reset by this operation.

Table 3-3 Default Setting Modes (1)

Default Setting	Beeper	Remarks
USA-LQ	6 times	Default setting for USA model
USA-BJ	7 times	
Europe, Asia-LQ	8 times	Default setting for the models excluding USA model
Europe-BJ	9 times	
Asia, UK-BJ	10 times	

Table 3-4 Default Setting Modes (2)

State	USA-LQ	USA-BJ	Europe, Asia-LQ	Europe -BJ	Asia, UK -BJ
Printer control mode	LQ	BJ	LQ	BJ	BJ
Paper selection	LTR	LTR	A4	A4	A4
Print mode	HQ	HQ	HQ	HQ	HQ
Smoothing	Disabled	Disabled	Disabled	Disabled	Disabled
Automatic power on	Disabled	Disabled	Disabled	Disabled	Disabled
Automatic power off	Disabled	Disabled	Disabled	Disabled	Disabled
Font	Roman	Courier	Roman	Courier	Courier
Code page	437	437	437	850	437
Page length	22"	11"	22"	12"	12"
Character set	Graphics	SET1	Graphics	SET2	SET2
Text scale	Disabled	Disabled	Disabled	Disabled	Disabled
Download buffer	Disabled	Disabled	Disabled	Disabled	Disabled
Receive buffer size	64kB	64kB	64kB	64kB	64kB
Automatic line feed	CR=CR	CR=CR	CR=CR	CR=CR	CR=CR
Automatic carriage return (BJ mode)	...	LF=LF	...	LF=LF	LF=LF
Alternate graphics mode (BJ mode)	...	Disabled	...	Disabled	Disabled
International character set (LQ mode)	USA	...	USA	...	...
I/F timeout	10 sec.	10 sec.	10 sec.	10 sec.	10 sec.

3.2.2 BJ setup utility program

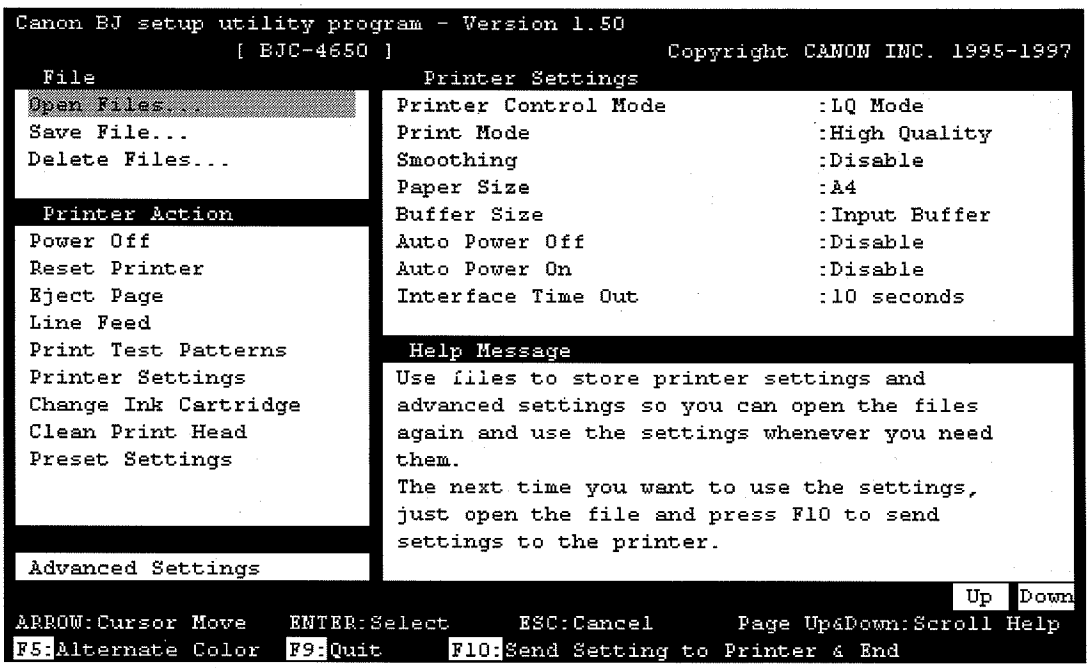


Figure 3-17 BJ Setup Utility Program (Sample)

Function settings which can be set with the BJ setup utility program.
Here is a quick summary of the BJ setup utility program features. For details, type BJ on the command line to start the utility program and scroll through the on-line help.

Advanced Settings
Includes all the settings for either BJ or LQ mode. The advanced settings are all on the second screen of the BJ setup utility program.

AGM
Turns alternate graphics mode (AGM) on and off in BJ mode.

Auto Carriage Return
Sets how the printer performs a carriage return in BJ mode.

Auto Line Feed
Sets how the printer conducts line feed in BJ or LQ mode.

Auto Power Off
Sets the printer to turn itself off automatically when it has not received data for a specified period of time.

Auto Power On
Sets the printer to turn itself on automatically after it receives data.

Buffer Size
Allows the user to change the allocation of available space in the buffer.

Change Ink Cartridge
Moves the cartridge holder to the center of the platen so you can change the BJ cartridge or the ink cartridge.

Character Set
Code pages and character sets may vary according to the make of the computer and printer. In BJ mode, Character Sets 1 or 2 can be selected. In LQ mode, Epson Italic or Graphics Set can be selected.

Clean Print Head
Cleans the BJ cartridge print head. If white streaks or other flaws appear on the printed page, clean the print head.

Code Page
Allows you to select a code page in either BJ or LQ mode. Code pages are tables that show how characters, symbols, and numbers are coded.

Delete File
Deletes a file and its settings. Delete files that are no longer needed.

Eject Page
Ejects paper or other media currently loaded in the printer.

Font Typeface
Allows the selection of 5 typefaces: Roman, Gothic, Courier, Prestige, Script in either BJ or LQ mode. This setting is ignored when the software application specifies a font.

Interface Time Out
Sets the minimum time needed between data inputs of the two interfaces.

International C.S.
Allows you to select a character set, characters and symbols specific to each country in LQ mode.

Line Feed
Sends a line feed (LF) instruction to the printer and the printer feeds the loaded sheet one line.

Open File
Opens a saved file and retrieves the printer and advanced settings that it holds. After opening a file, press F10 to send the settings to the printer and close the BJ setup utility program.

Page Length
Sets the page length for BJ or LQ mode.

Paper Size
Sets the paper size. Selections include A4, Letter, #10 Envelope, DL Envelope.

Power Off
Turns off power to the printer.

Preset Settings
Allows you to select one of six preset settings. You can select LQ or BJ mode for USA, Europe, or Asia.

Print Mode
Sets the print mode for HQ (high quality), HS (high speed), or Fine.

Print Test Patterns
Prints a test pattern so you can check printer operation with the new settings made. Before you execute this command, be sure the printer is loaded with A4 or Letter-size paper. You can print a Demonstration of printer features, Test Print A (repeating ripple pattern), and a Nozzle Pattern Print.

Printer Control Mode
Sets the emulation mode for the printer: BJ mode, LQ mode, Automatic mode.

Printer Port
The printer is attached to parallel port LPT1 by default. To connect your printer to a different port, make a selection from: LPT1, LPT2, and LPT3.

Printer Settings
Prints a list of all the current printer settings. Be sure to use Letter-size or A4 paper to print this list.

Reset Printer
Uses the new printer and advanced settings you have just made and stores them as the new default settings for the printer.

Save File
Saves a file with the settings made in the menus.

Smoothing
Smoothing removes the ragged edges that appear on characters and curved lines. These so called "jaggies" are caused by a stair-stepping effect caused by assembling characters and lines with individual dots when they are printed.
(The smoothing feature cannot be used from DOS when color BJ cartridge is installed.)

Text Scale Mode
Provides compatibility with software that assumes 66 lines will fit on each page in either BJ or LQ mode.

3.3 Control Buttons

This printer has two control buttons, which are used for cleaning the BJ cartridge.

3.3.1 Cleaning the BJ cartridge

If the print quality is unsatisfactory due to drop out and white lines, etc., print a nozzle check pattern to see if the nozzles of the BJ head are blocked. If so, carry out the procedure below to clean the BJ cartridge and clear the nozzles.

1) Turn on the printer. Hold down the *RESUME* button for two seconds or more. The cleaning starts when the *POWER* indicator blinks.
2) When the cleaning is completed, the blinking stops and the indicator stays on. The cleaning time is approximately 22 seconds.
   After the cleaning, execute a test printout of the nozzle check pattern to check the print quality. (With the printer turned on, hold down the *POWER* button until the beeper sounds five times, then release the button to start printing. The test stops when the *RESUME* button is pressed.

The printer cleans the BJ cartridge automatically at the following times:

1) When the printer is turned on for the first time after the power cord has been connected.
2) After the BJ cartridge is replaced.
3) After an ink cartridge is replaced.
4) After the printer has been on for 72 hours following the last cartridge cleaning with a black BJ cartridge installed. When the color BJ cartridge is installed, only the first cleaning is carried out automatically after 24 hours (after that, cleaning is carried out at an interval of 72 hours).
5) After printing a prescribed number of dots without any cleaning being performed.

3.4 Self-Test Printout

This printer has built-in self-test functions which can be executed without any connection to a computer. The off-line, self-test operations are described below. After turning on the printer, hold down the *POWER* button until the beeper sounds the specified number of times, then release the button. The self-test printout stops when the *RESUME* button is pressed or when the printer is turned off.

Table 3-5 Self-Test Print Modes

Test Mode	Beeper	Pages Printed
Demonstration print	Once	Continuous printing
Printer status information print	Twice	1 page
ASCII character print	3 times	Continuous printing
Nozzle check pattern	4 times	1 page

NOTE

All self-test prints require A4-size paper. Using a smaller size paper for a self-test print will result in parts of the printout being printed directly on the platen.

3.4.1 Demonstration print

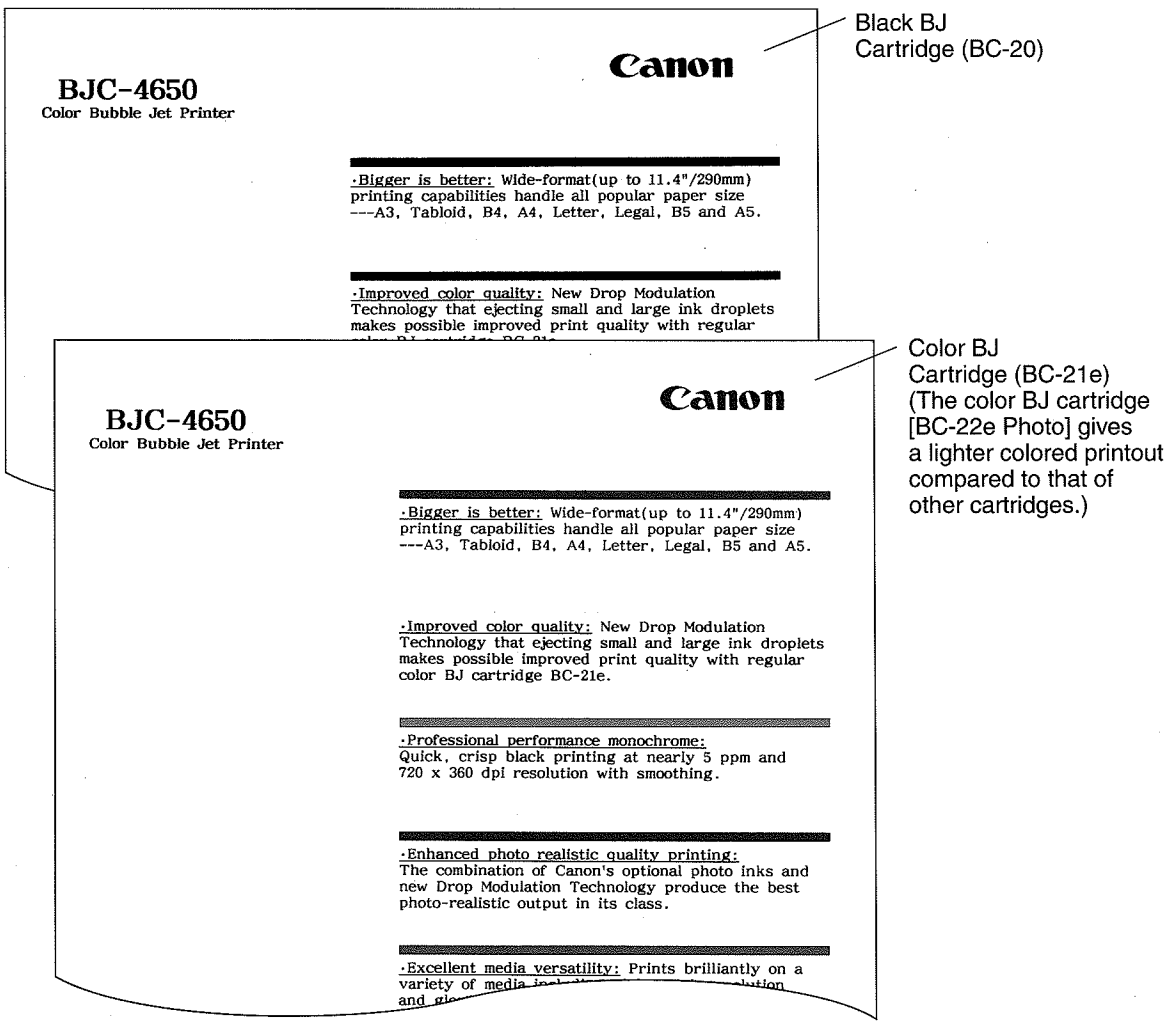
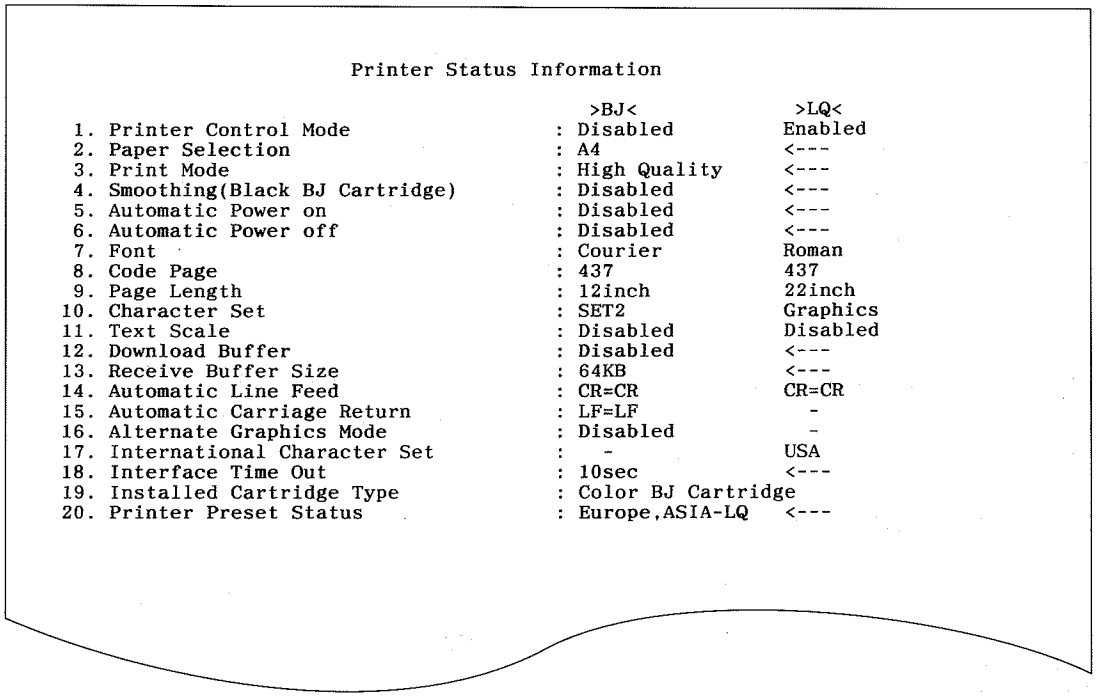


Figure 3-18 Demonstration Print (Sample)

3.4.2 Printer status information print

The printer status is printed as shown below. The same printout is printed for all cartridges, color BJ cartridge [BC-21e], color BJ cartridge [BC-22e Photo] and black BJ cartridge [BC-20]. The printout using a color BJ cartridge [BC-22e Photo] is lighter compared to other printouts.



Printer Status Information

	>BJ<	>LQ<
1. Printer Control Mode	: Disabled	Enabled
2. Paper Selection	: A4	<---
3. Print Mode	: High Quality	<---
4. Smoothing(Black BJ Cartridge)	: Disabled	<---
5. Automatic Power on	: Disabled	<---
6. Automatic Power off	: Disabled	<---
7. Font	: Courier	Roman
8. Code Page	: 437	437
9. Page Length	: 12inch	22inch
10. Character Set	: SET2	Graphics
11. Text Scale	: Disabled	Disabled
12. Download Buffer	: Disabled	<---
13. Receive Buffer Size	: 64KB	<---
14. Automatic Line Feed	: CR=CR	CR=CR
15. Automatic Carriage Return	: LF=LF	-
16. Alternate Graphics Mode	: Disabled	-
17. International Character Set	: -	USA
18. Interface Time Out	: 10sec	<---
19. Installed Cartridge Type	: Color BJ Cartridge	
20. Printer Preset Status	: Europe,ASIA-LQ	<---

Figure 3-19 Printer Status Information Print (Sample)

3.4.3 ASCII character print (ripple pattern)

The same patterns are printed for the color BJ cartridge [BC-21e], color BJ cartridge [BC-22e Photo] and black BJ cartridge [BC-20]. The color BJ cartridge [BC-22e Photo] pattern is lighter than other patterns. The printer control mode, control ROM version and function settings are printed out in the header as shown below.

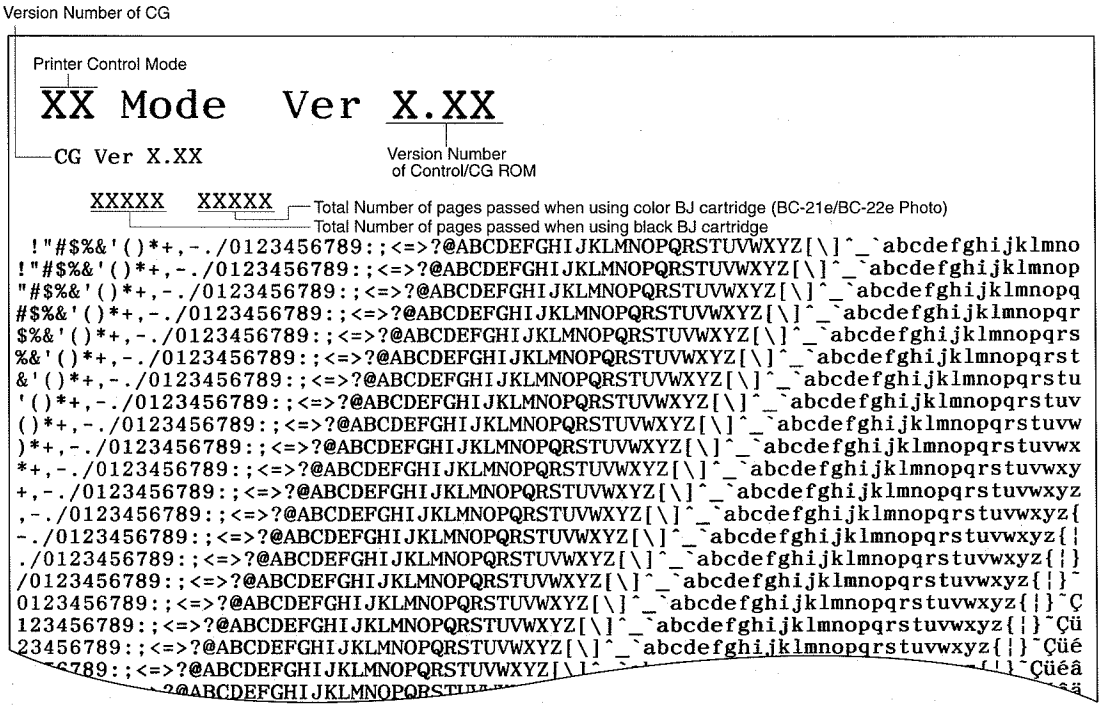


Figure 3-20 ASCII Character Printout (Sample)

3.4.4 Nozzle check pattern

Printout this pattern using all nozzles of the BJ cartridge. In the event that print defect appears, perform a cleaning operation of the head. If the print quality does not improve even after the cartridge is cleaned five times, replace the BJ cartridge or the ink cartridge.

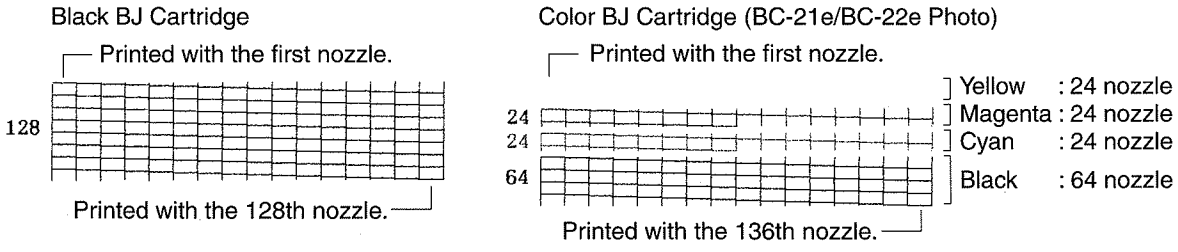


Figure 3-21 Nozzle Check Pattern

3.5 Hexadecimal Dump Test Printout

This printer can execute a hexadecimal dump test printout. The hexadecimal dump test prints the data sent from the computer to the printer (hexadecimal data).
Turn on the printer and hold down the *POWER* button until the beeper sounds five times. Then release the button to execute the hexadecimal dump test printout. The printout stops when the printer is turned off. The hexadecimal dump test printout cannot be terminated with the *RESUME* button.
This function can be execute in parallel interface mode.

Table 3-6 Hexadecimal Dump Test Print

Test mode	Beeper
Hexadecimal dump test	5 times

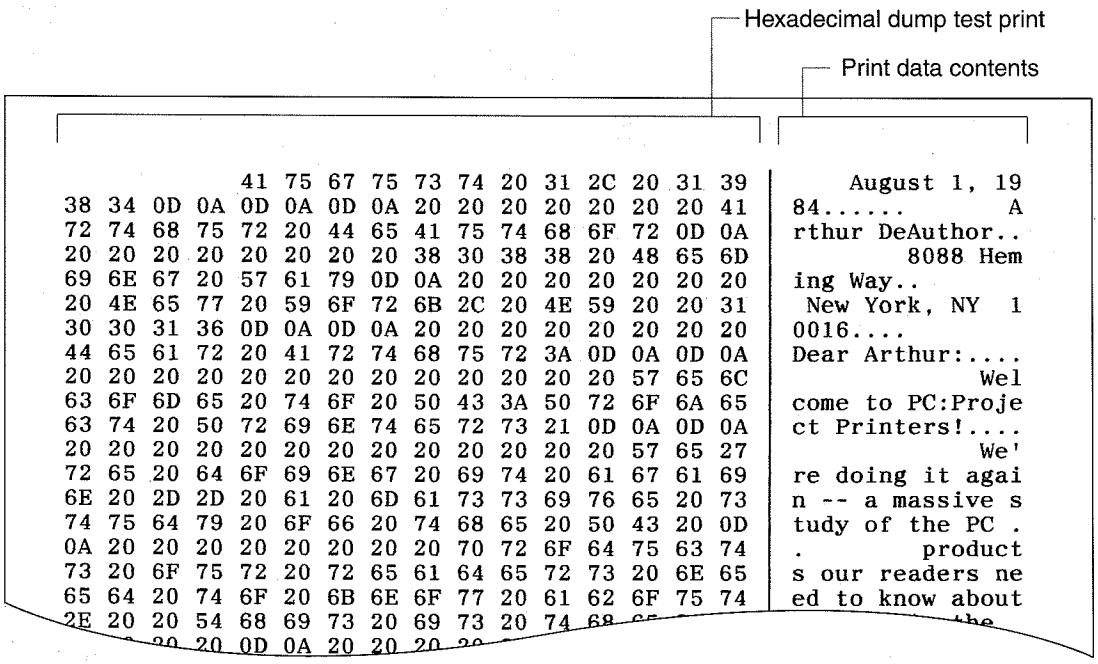


Figure 3-22 Hexadecimal Dump Test Printout (Sample)

3.6 EEPROM

The EEPROM records various settings, the total numbers of sheets printed and the total waste ink absorption amount for the color and black ink cartridges respectively. The total numbers of sheets printed and total waste ink absorption amount can serve as a reference for how much the printer has been used.

The EEPROM must be reset when the logic board or the waste ink absorber is replaced. For details, see *"Part 5: 4.3 Logic Board and Waste Ink Absorber Replacement Cautions" (page 5-5).*

3.6.1 Resetting the EEPROM

"Waste ink full" is detected with the total waste ink absorption amount recorded in the EEPROM. When the waste ink absorber is replaced, the total waste ink absorption amount in the EEPROM must be reset.

Furthermore, when the logic board is replaced, the new logic board's EEPROM must be reset and the waste ink absorber must also be replaced at the same time.

Use the following procedure to reset the data on the EEPROM.

1) Press and hold down the *POWER*, *RESUME*, and *CARTRIDGE* buttons, then plug the power cord into the printer and release all the buttons.
2) Press and hold down the *RESUME* and *CARTRIDGE* buttons, then press the *POWER* button. (All indicators light and the beeper then sounds one long tone and one short tone. The *ERROR* indicator lights and the *POWER* indicator turns off.)
3) Press the *CARTRIDGE* button as shown in the table below to select the default setting. (The beeper sounds once each time you press the *CARTRIDGE* button.)

Table 3-7 Default Settings when Resetting the EEPROM

Times CARTRIDGE button pressed	Indicator		Default setting	Remarks
	ERROR	POWER		
Once	Off	On	USA-LQ	Default setting for USA model
Twice	On	Off	USA-BJ	
3 times	Off	On	Europe, Asia-LQ	Default setting for the models excluding USA model
4 times	On	Off	Europe-BJ	
5 times	Off	On	Asia, UK-BJ	

4) Release the *RESUME* button to clear the EEPROM and set the printer to the selected default settings. (The beeper sounds one long tone and one short tone. The *ERROR* indicator lights and the *POWER* indicator turns off.)
5) Disconnect the power cord from the printer, then reconnect it. (If you do not once disconnect the power cord, you will not be able to print normally or make self-test printouts.)

Note that, if you reset the EEPROM, the data is permanently lost and cannot be recovered.

3.6.2 Printing the EEPROM data

The following data recorded by the EEPROM can be printed out as described below:

1) Function setting:
Execute the self-test printout Printer status information print.
See *"3.4 Self-Test Printout" (page 3-21).*

2) Total waste ink absorption amount and total numbers of sheets printed for the color and black ink cartridges respectively.
Print out the total waste ink absorption amount and total numbers of sheets printed for color and black ink cartridges as follows:

1. Install a black BJ cartridge in the printer. (EEPROM data cannot be printed out with the color BJ cartridge installed.)
2. Press and hold down the *POWER*, *RESUME*, and *CARTRIDGE* buttons, then plug the power cord into the printer and release all the buttons.
3. Set a sheet of paper into the printer.
4. While pressing the *RESUME* button, turn on the printer. After the beeper sounds once, the total waste ink absorption amount will be printed out.
5. After the printout has been made, disconnect the power cord from the printer, then reconnect it. (If you do not once disconnect the power cord, you will not be able to print normally or make self-test printouts.)

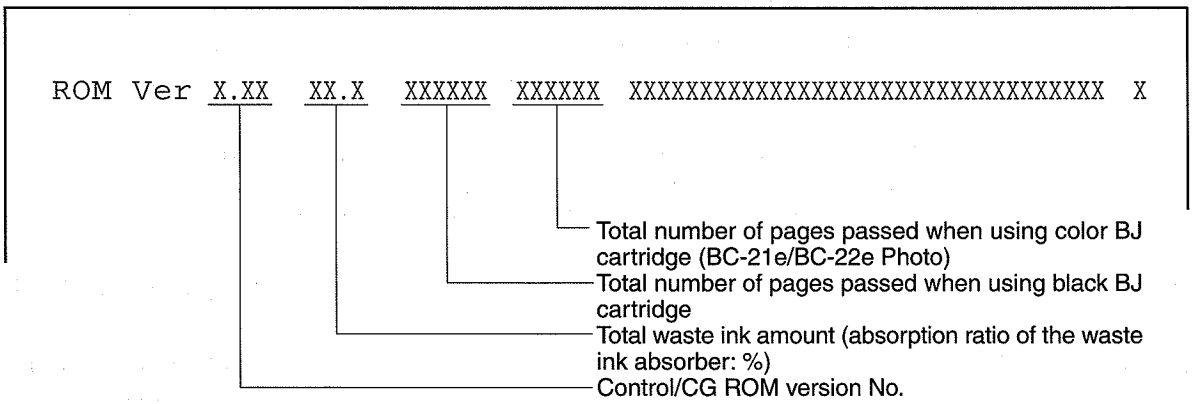


Figure 3-23 Sample Printout of EEPROM Data

Part 4

TECHNICAL REFERENCE

1.2 Initial Flowchart

The initial flowchart below shows the process from when the printer is turned on to when it goes online.

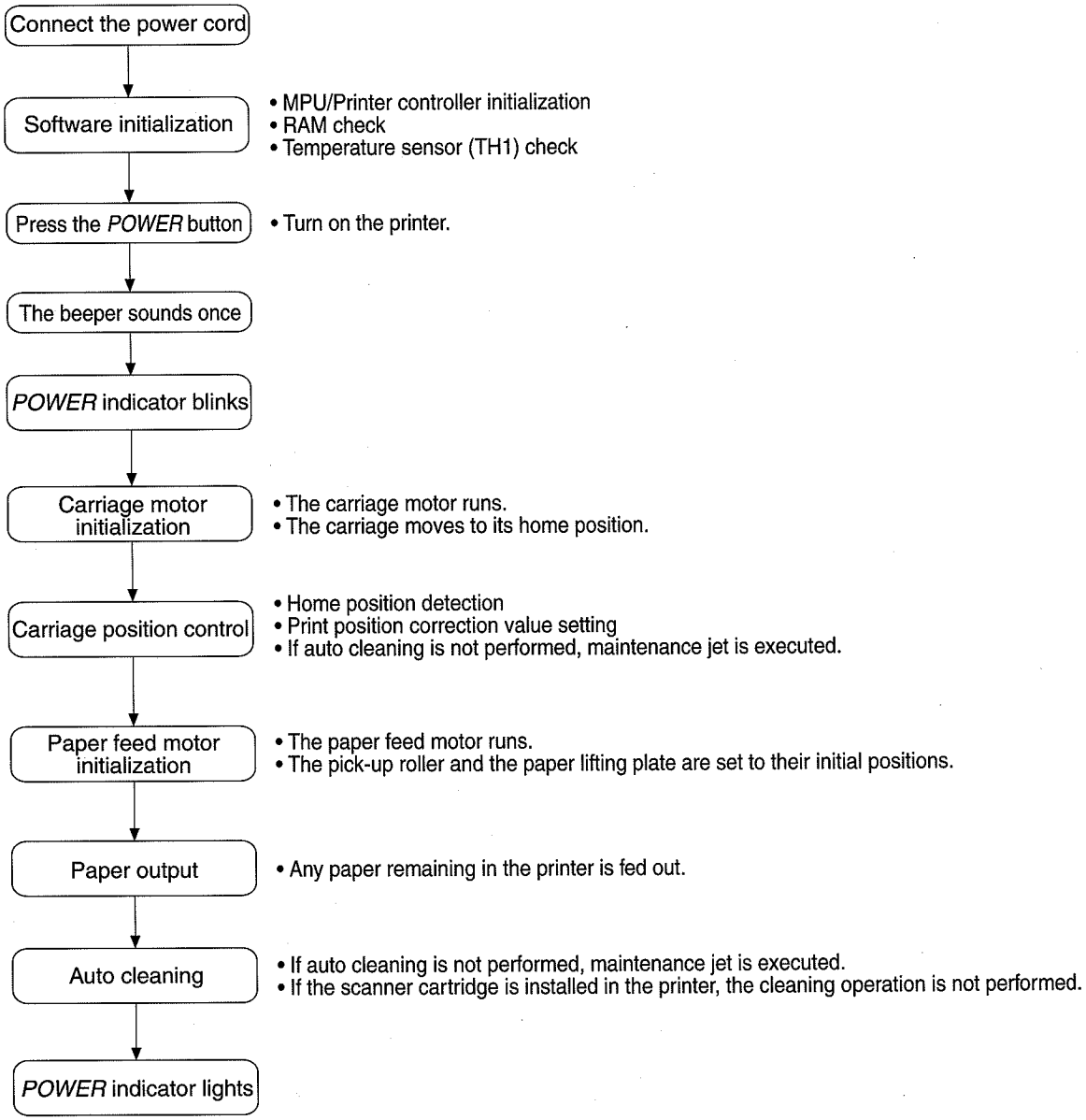


Figure 4-2 Initial Flowchart

1.3 Print Signal Flow

The print signal flow from when the printer receives the print data to when printing is executed is described below.

a) The print data (including the control signals) output by the computer is received by the printer controller through the parallel interface, which is controlled by the printer controller on the logic board. Through the dedicated bus between the printer controller and DRAM, print data is stored in the DRAM's receive buffer area.

b) The print data in the receive buffer is sent to the MPU and separated into control commands and print data based on the data stored in the control/CG ROM. The control commands are processed in the MPU.

c) The print data is stored in the DRAM's print buffer.

d) When the printer controller receives the command from the MPU to start printing, it receives print data (by DMA transfer) stored in the DRAM's print buffer.

e) The printer controller converts the print data into serial data as print drive signals and outputs the serial data to the bubble jet head. In the bubble jet head, the print data is converted from serial signals to parallel print data for each printed line. Printing is executed while the printer controller is controlled by the print control signals.

f) The MPU controls the entire printing process by controlling the printer controller, control/CG ROM, and motor drivers and monitoring the status of the bubble jet head and printer.

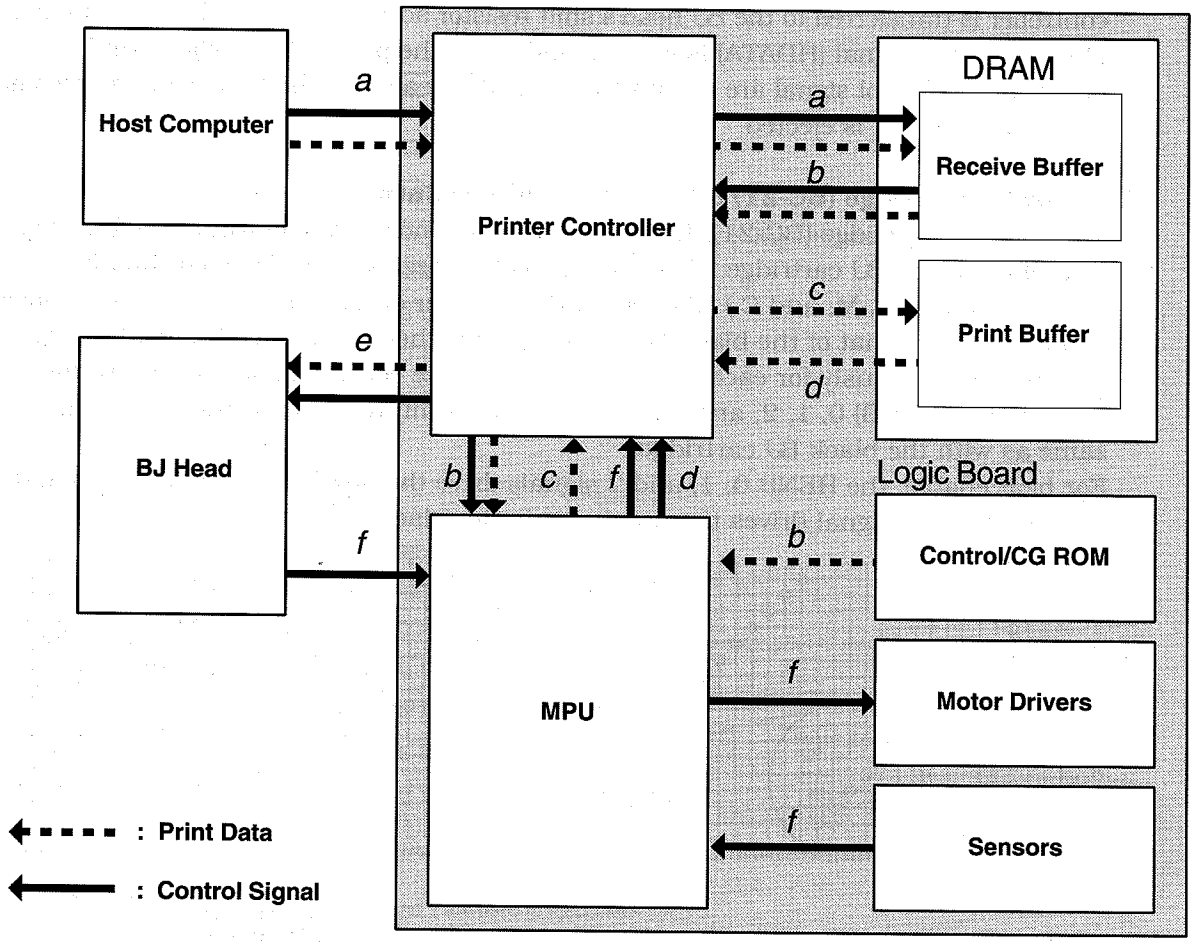


Figure 4-3 Print Signal Flow

1.5 Power Off Flowchart

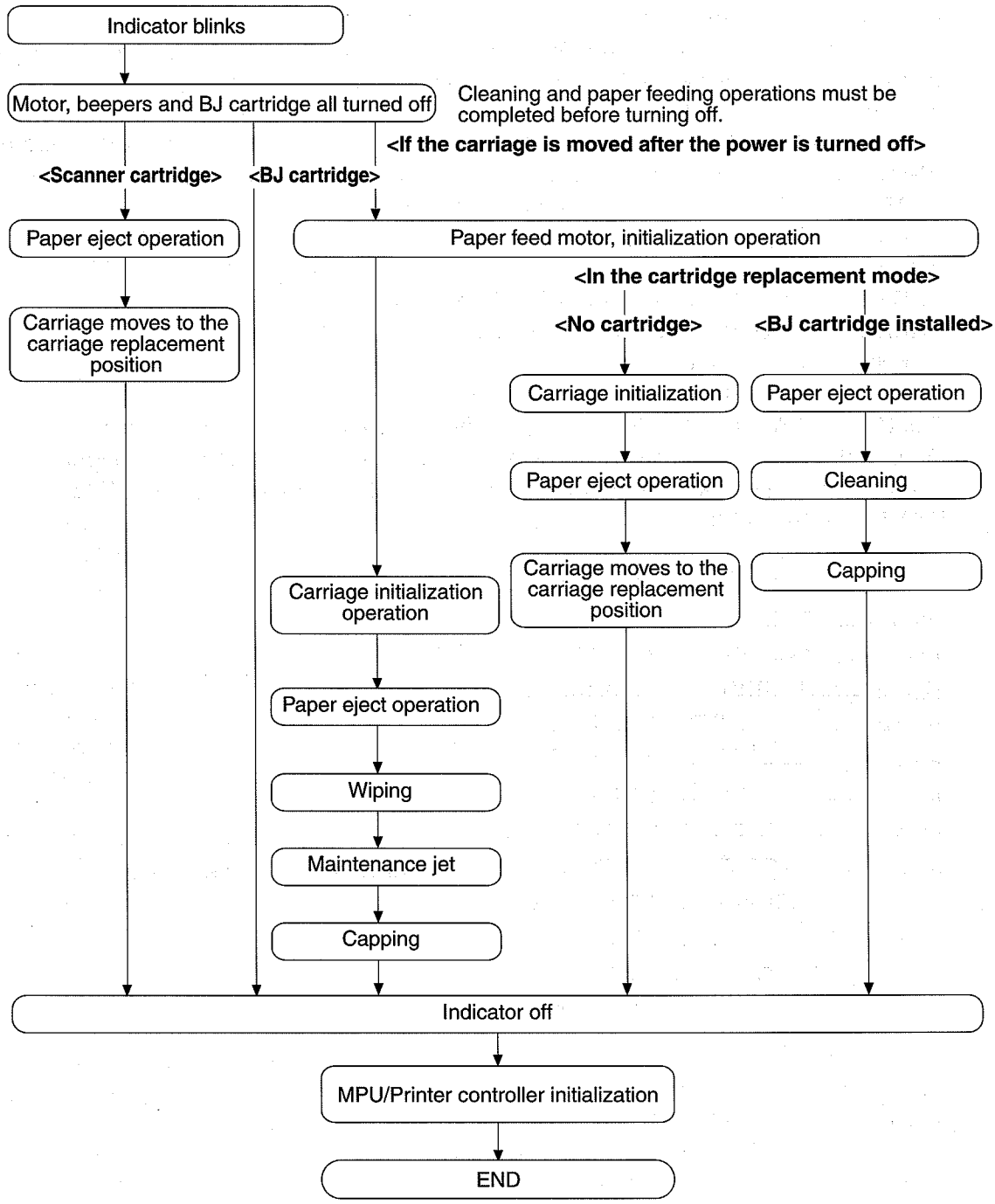


Figure 4-6 Power off Flowchart

CAUTION

If the DC power cord or AC adapter is unplugged before the printer is turned off using the *POWER* button, the cartridge head might not be capped. In this case, plug the DC power cord again, start up the printer, then turn off the printer with the *POWER* button. The DC power cord or AC adapter may then be unplugged.

2. FIRMWARE

2.1 Interface

The printer supports parallel and serial interfaces.
The parallel interface is compatible with the bidirectional Centronics interface-standard (IEEE 1284) and supports compatible, nibble, and ECP modes.
Compatible mode is the same as the Centronics interface-standard protocol.
The nibble mode and the ECP mode which supports high speed data transfers have bidirectional compatible databuses. These modes are used to transfer status data such as device ID and printer status as well as scanned data read by the optional scanner cartridge. However the host computer must be set to nibble mode or ECP mode to be applicable.
The serial interface is compatible with the high speed RS422 serial interface and supports Canon's standard protocol.
The data transfer timing for each parallel interface mode is described below:

2.1.1 Compatible mode

The parallel interface for the compatible mode transfers data in 8-bit units. Data is transferred with the $\overline{\text{STROBE}}$, BUSY, and $\overline{\text{ACKNLG}}$ handshake signals.
When the printer receives the data (Data 1-8) and $\overline{\text{STROBE}}$ signal from the host computer and the $\overline{\text{STROBE}}$ signal is low, the printer controller (which controls the parallel interface) outputs the BUSY signal and latches the data. After the BUSY signal is output, the printer controller sends the latched data from the DRAM bus to the receive buffer in the DRAM. After the data is completely written in the receive buffer in the DRAM, the printer controller outputs the $\overline{\text{ACKNLG}}$ signal and sets the BUSY signal to "Low." Then it waits for the next data input from the host computer.

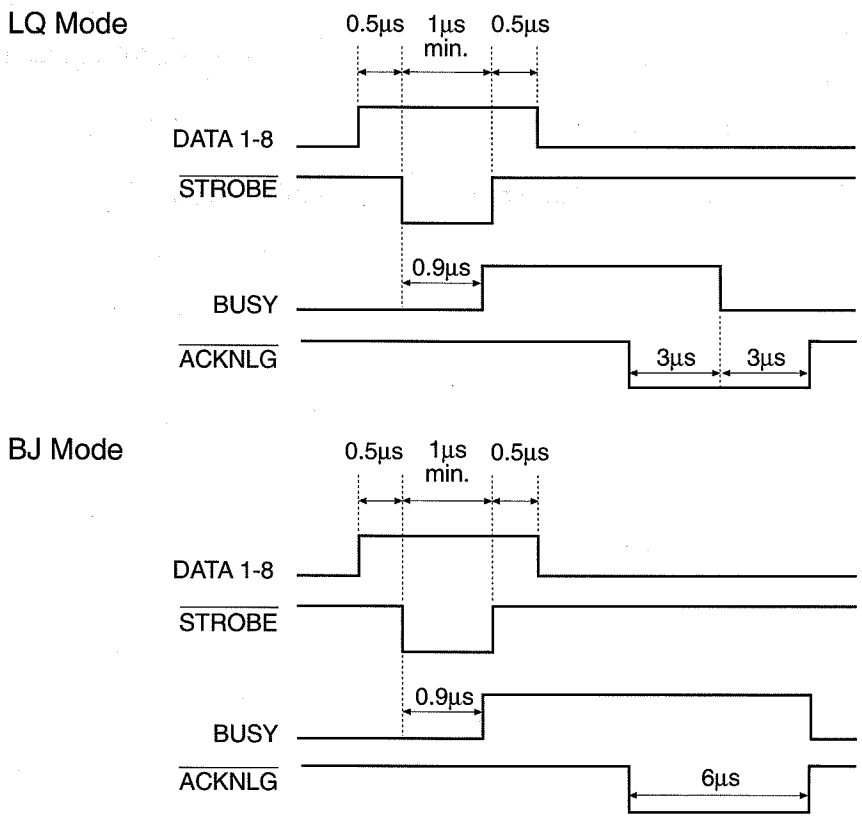


Figure 4-7 Interface Timing (Compatible Mode)

2.2 720 dpi Printing/ Smoothing Feature

2.2.1 Canon extension mode

In the Canon extension mode, the printer driver creates 720 dpi data for the horizontal axis and sends it to the printer, resulting in high-quality printing.

With a black BJ cartridge installed, the printer driver smooths the printed character's edges at 720 dpi along the horizontal axis. The 720 dpi data for the horizontal axis is sent to the printer and the edges are smoothed at a high resolution.

When a color BJ cartridge (BC-21e/BC-22e Photo) is installed, the multi-value pixel data of the pixels processed by the printer driver for color correction, is classified into one of the three values (no printing, single-dot printing, two-dot printing). In the case of two-dot printing, the second dot is printed in the 720 dpi position. As a result, this method enables the printer to achieve high degree gradation.

2.2.2 Emulation mode

When a black BJ cartridge is installed, the printed character's edges can be smoothed at a high resolution of 720 dpi along the horizontal axis. Dots along the character's edges are added or deleted for smoothing the edges. Along the horizontal axis, dots are also overlapped by a half-dot space. This eliminates jaggies and doubles the equivalent horizontal resolution.

This smoothing feature greatly improves 180dpi low-resolution, characters. However, it does not noticeable improve True Type fonts and illustrations.

Note that with a color BJ cartridge (BC-21e/BC-22e Photo) installed, the emulation mode's smoothing feature cannot be used.

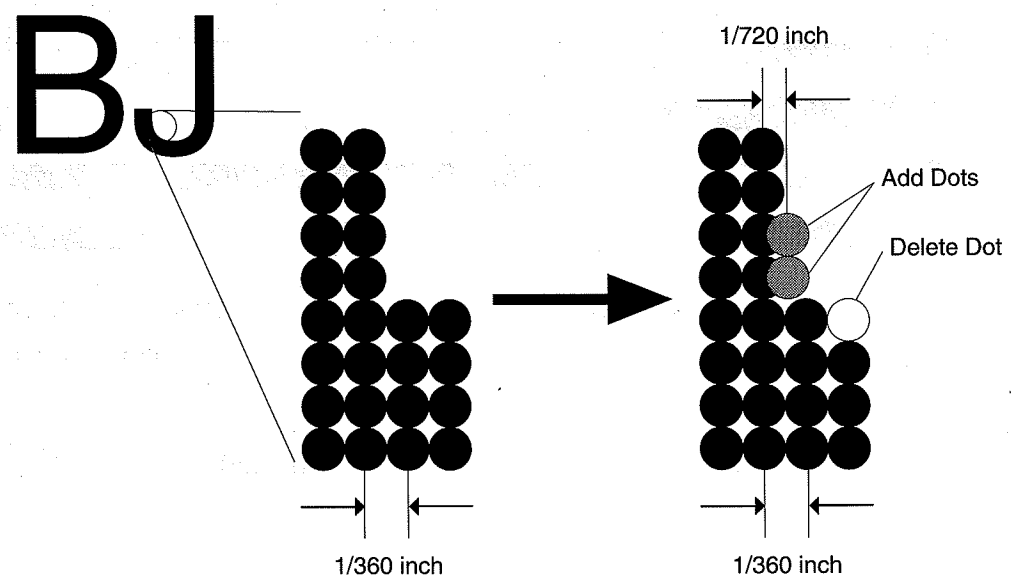


Figure 4-10 720 dpi Printing/ Smoothing Feature

2.3 Printing Modes

2.3.1 Printing modes

The printer selects the carriage operation and bubble jet head driving frequency on the basis of the media and print quality selected by the driver, and the print data that is received from the host computer. This enables the printer to achieve optimum print quality, free of smears and fragmentaion.
When the 720 dpi printing/smoothing feature is used, the carriage feed pitch is set to 1/720 inch. Although this slows down the carriage speed, the bubble jet head's drive frequency (heat frequency) is increased so that the overall printing throughput decreases slightly.

During color printing at a single pass, the different colors printed at the same time overlap, often causing the colors to run. By printing with three passes, color bleeding is less prone to occur since the color printed immediately before is stable by the time the next color is printed over it.
When print data is processed internally by the printer, the data is recognized and the number of ink nozzles to be used by the black ink is changed automatically.
For color printing when Color-Normal2, or Color-HS2 which specified 720 dpi, is selected, processing is executed in such a way to prevent the color and black inks from running at their mutual borders and to prevent white mist.
This processing is executed as follows:
During internal processing by the printer, the borders where the color and black inks meet are identified. Cyan and black ink are mixed or reduced at the printed black portion to suit the state of the distance and density of the black and color dots.
The printing method for the respective printing modes are listed below.

2.3.2 Photo print mode

Photo print mode can be used to obtain a high level gradation print when the color BJ Cartridge [BC-22e Photo] is used. By printing dots over one another and layering the light colored photo ink, fine gradated and low pixilated images are obtained.
The printer driver divides the pixel data into 4 types of data (not printed, print 1 dot, print 2 dots and print 3 dots) enabling each pixel to be printed in 4 different gradations. The printer, therefore, makes three passes for each printed line using at the most 4 times the ink of an ordinary print job.
Printing with the color BJ cartridge [BC-22e Photo] requires an exclusive printer driver and high quality paper HR-101.

The exclusive printer driver outputs multi-drop print data to the printer for photo printing. If for some reason an ordinary color BJ cartridge [BC-21e] is used to photo print, the printed image will be doubled and elongated in the horizontal direction. On the other hand, if color printing is performed with a color BJ cartridge, [BC-22e Photo], not only will the printed images appear light but the image will be halved. These print image distortions indicate the mismatch between the installed printer cartridge and selected print mode.

2.3.3 Multi drop print mode

When a color BJ cartridge [BC-21e] or [BC-22e Photo] using drop modulation technology is installed, a Canon exclusive driver must be used. By selecting the drop modulation modes such as fine or photo mode, large and small ink droplets can be printed. When large and small dots are used efficiently, the pixilation of the light areas can be improved. To avoid slowdown, large and small droplet printing is not used for emulation, HQ and HS modes as these modes do not give a gradation.

2.4 Optimum Printing Direction Control

To prevent vertical misalignment of the printed characters, when print data is printed continuously in the direction of the paper feeding direction, printing is executed with the carriage moving from only one direction.
However, when printing in the paper feed direction is not continuous, since vertical misalignment is not so noticeable, the printing direction is alternated so that printing is also executed from the opposite carriage direction. This improves the throughput.
If four or more successive null rasters are detected in the lower (in the direction of paper ejection) 64 nozzles (24 nozzles with a color BJ cartridge (BC-21e/BC-22e Photo)) for the print data in the printer buffer during single-pass printing, printing is executed up to the null raster. Starting from the null raster onward, printing is executed to the opposite carriage direction. Then from the next raster onward, printing is executed to the same carriage direction until the direction changes again.

2.5 Automatic Emulation Switching

The printer analyzes the control command received from the host computer and determines whether it is in BJ or LQ mode. The emulation mode is thereby switched automatically. The BJ setup utility program can be used to turn on or off the automatic switching of the emulation mode.

Control command recognition

By recognizing the control command received from the host computer, the printer can determine which emulation mode to set. The printer determines the emulation mode when the control command is received at any of the following times: after the power is turned on and no print data has been received, when no print data has been received for over 10 seconds, or when the printer has no print data.

Switching the emulation mode

The emulation mode is switched automatically at any of the following times:
when the printer has received over 512 bytes of data, when the data reception (even for data less than 512 bytes) has been interrupted for over 3 seconds, when the power has been turned off before more than 512 bytes of data is received or before over 3 seconds of data reception.

Upon shipment from the factory or when the EEPROM is reset, it is set as "Invalid". Immediately after being set to "Valid", the emulation mode that was set immediately before will be valid.

There are control commands which the printer cannot determine the emulation mode. If the emulation mode set automatically is not the correct one, use the BJ setup utility program or the manual default setting to cancel the automatic switching of the emulation mode and set the emulation mode manually.

2.6 Ink Smear Control

Immediately after the printed sheet is ejected from the printer, the ink has enough time to dry naturally on the paper output tray. If the next printed sheet is ejected before the ink dries on the preceding sheet on the paper output tray, the ink may be smeared when the sheet slides over the preceding one. To prevent this, a wait period is applied during printing so that the sheet is delayed before being ejected, giving more time for the ink on the preceding sheet to dry.

When a black BJ cartridge is used (whose printing speed is faster) and high duty printing is completed, the printer automatically detects the high duty printing position and the time elapsed from which the printing starts.

There is no need to execute ink smear control when a color BJ cartridge (BC-21/BC-22 Photo) is used.

2.7 Head Overheat Protection Control

If the ink has run out and the printing operation is continued, the bubble jet head can get extremely hot. If the head temperature sensor in the bubble jet head detects a temperature above the temperature limit, head overheating protection control is executed.

Protection level 1:

This level prevents the user from touching the bubble jet head's hot aluminum plate when the bubble jet head is to be replaced. Depending on the protection level, the user may even be prevented from replacing the cartridge until after a set period of time passes. (when the cartridge *REPLACEMENT* button is pressed, 4 beeps will sound as warning)

Protection level 2:

If a higher temperature is detected, the carriage is returned to the home position for 3.5 seconds after each line is printed. This continues for over 20 minutes to suppress the raised bubble jet head's temperature.

Protection level 3:

If the temperature continues to increase, a head temperature error occurs, and printing operation is stopped. If this still does not lower the head temperature, the sensor will be deemed faulty and a head temperature sensor error will be indicated.

2.8 Auto Power ON/OFF

This printer is turned on with print signals sent from the host computer and is automatically turned off when print signals are not received after a specified period of time. These settings can be made separately from the printer driver or BJ setup utility program.

When the auto-power on function is set as valid, the STROBE signal or the INIT signal turns the printer on. Therefore the interface is constantly valid even when the power is off.

With the auto-power off setting as valid, the printer is turned off if print data is not received for a set period of time.

The valid times can be set from 5 to 60 minutes at 5 minute intervals.

3.2 BJ Cartridge

3.2.1 Color BJ cartridge [BC-21e] structure

The color BJ cartridge [BC-21e] has a print head equipped with 136 nozzles through which the four ink colors are ejected (24 nozzles each for yellow, magenta, and cyan; 64 nozzles for black). The ink cartridges (one for black and one for the other three colors) are removable and replaceable.

1) Air intake plate

As the ink is consumed, the pressure inside the cartridge decreases in relation to the atmospheric pressure. This makes it more difficult for the ink to be supplied to the head. To prevent this, the ink cartridge has an air intake for maintaining a constant pressure inside the cartridge body.

2) Ink sponges

Each ink color (black, cyan, yellow, magenta) is soaked in its own respective sponge. The cyan, yellow, and magenta ink sponges are compressed and stored in the same color ink cartridge body.

3) Ink suppliers

These supply the ink from the ink sponges to the cartridge's joints at a constant pressure.

4) Ink cartridge body

This is a plastic case which links the ink sponge with the color BJ cartridge via the ink suppliers.

5) Rubber sheet

This sheet seals the joints between the ink cartridge and BJ cartridge.

6) Ink passage section

This is a passage through which the ink flows from the ink cartridge to the head unit.

7) Bubble jet head unit

From the ink cartridges, the four ink colors are supplied separately to the 136 bubble jet nozzles. Ink for the four colors is ejected through the 136 bubble jet nozzles, according to the print signals received through the signal contacts.

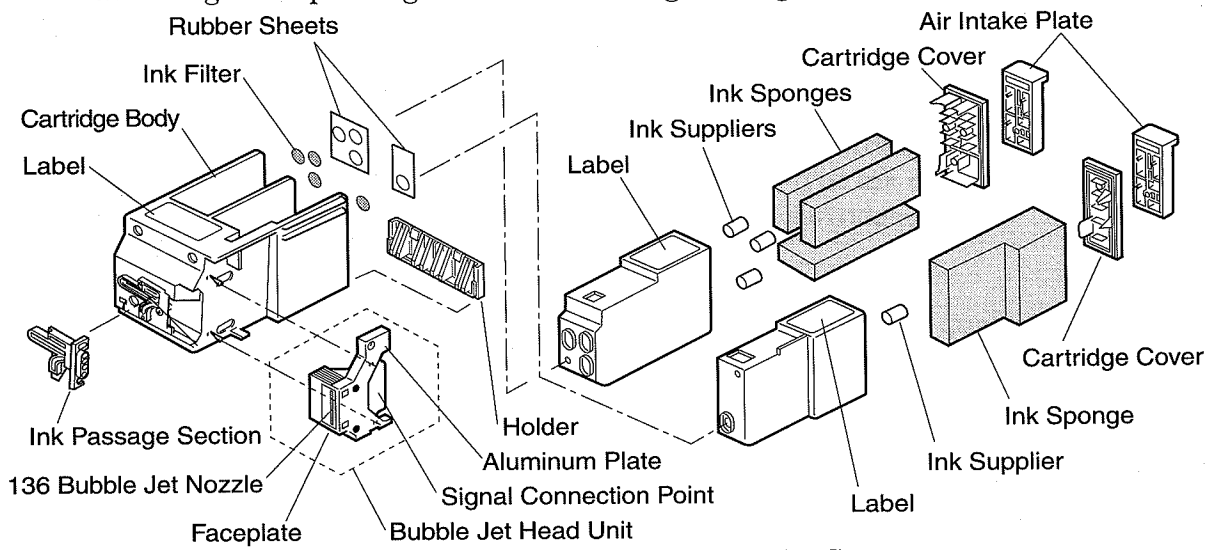


Figure 4-12 Color BJ Cartridge [BC-21e] Structure

3.2.2 Color BJ cartridge [BC-22e Photo]

The color BJ cartridge, BC-22e Photo, has a print head with 136 nozzles through which the four ink colors are ejected (24 nozzles each for yellow, magenta, and cyan; 64 nozzles for black). As the ink cartridges for the color BJ cartridge BC-22e Photo are integrated with the print head, the entire color BJ cartridge must be replaced if one of the colors runs out.

1) Air intake plate

As the ink is consumed, the pressure inside the cartridge decreases in relation to the atmospheric pressure. This makes it more difficult for the ink to be supplied to the head. To prevent this, the ink cartridge has an air intake for maintaining a constant pressure inside the cartridge body.

2) Ink sponges

Each ink color (black, cyan, yellow, magenta) is soaked in its own respective sponge. The cyan, yellow, and magenta ink sponges are compressed and stored in the cartridge body.

3) Rubber sheet

This sheet seals the joints between the ink cartridge and BJ cartridge.

4) Ink passage section

This is a passage through which the ink flows from the ink cartridge to the head unit.

5) Bubble jet head unit

From the ink cartridges, the four ink colors are supplied separately to the 136 bubble jet nozzles. Ink for the four colors is ejected through the 136 bubble jet nozzles, according to the print signals received through the signal contacts.

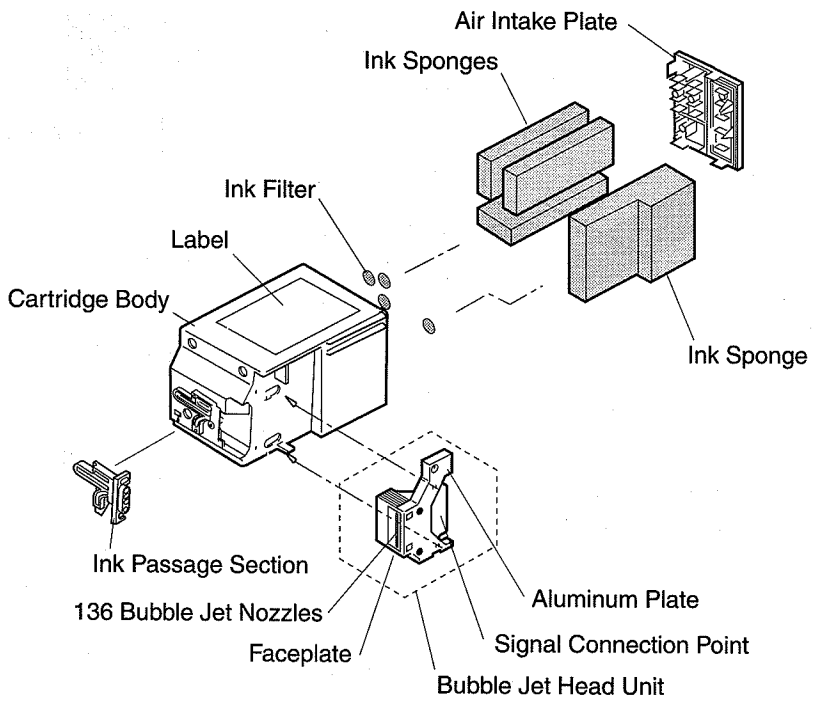


Figure 4-13 Color BJ Cartridge [BC-22e Photo] Structure

2) Nozzle arrangement

The bubble jet nozzles are arranged 1/360 inch apart in a vertical array. The black BJ cartridge has 128 nozzles. On the color BJ cartridge (BC-21e/BC-22e Photo), the first 24 nozzles are for yellow ink, the second 24 nozzles are for magenta ink, the third 24 nozzles are for cyan ink, and the remaining 64 nozzles are for black. The color BJ cartridge has a total of 136 nozzles.

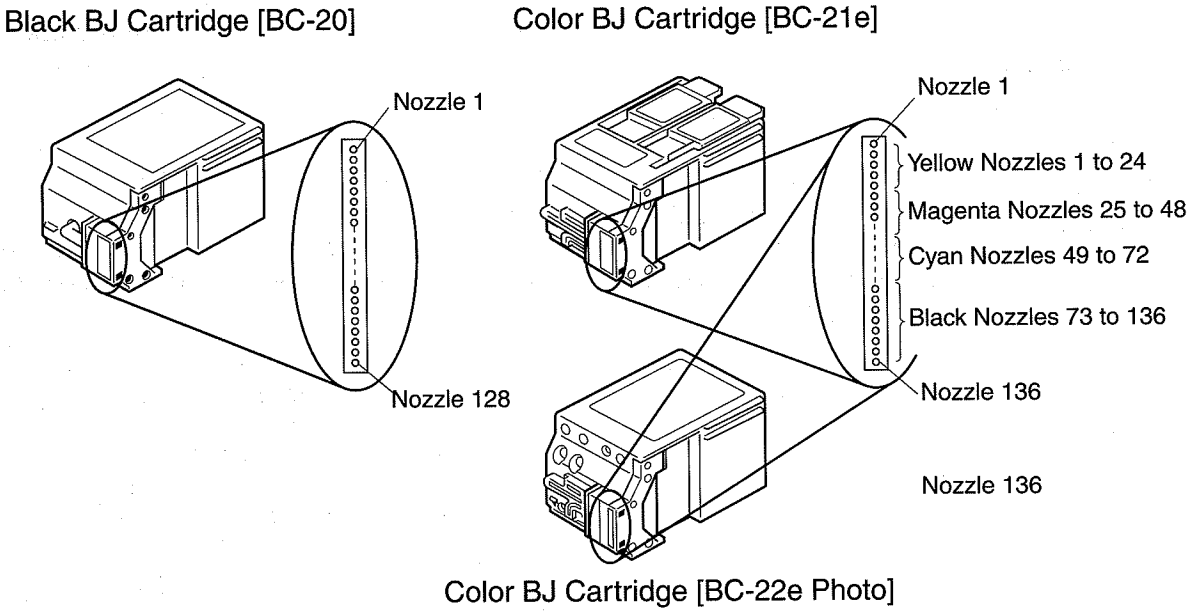


Figure 4-16 Nozzle Arrangement

3) Signal connection point (contact pad)

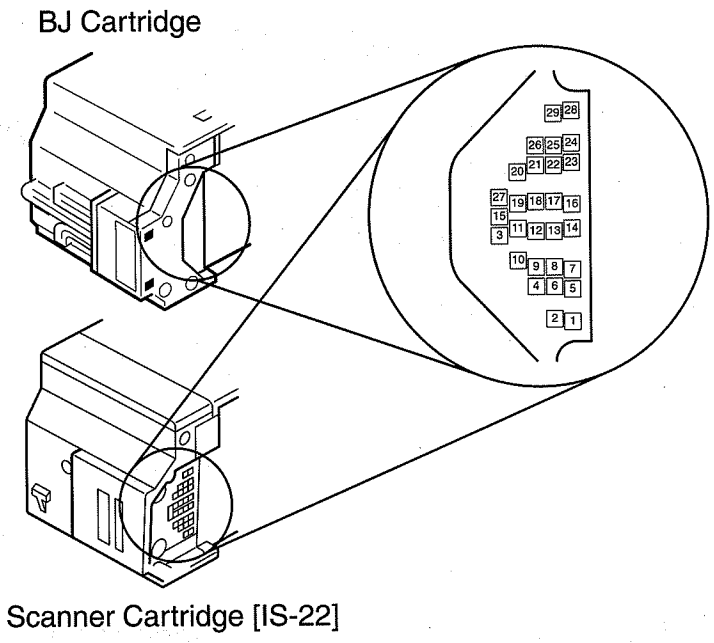


Figure 4-17 Contact Pad

Table 4-2 List of BJ Cartridge Signal Contacts

No.	Signal	Type	Description
1, 2	VHG	GND	GND for head driver voltage VH
3	HT0	IN	Temperature control heater drive signal
4	HT1	IN	Temperature control heater drive signal
5, 6	HVH	OUT	Head drive voltage (ink ejection heater, temperature control heater, sub heater driver)
7	W-HT	OUT	Sub heater drive signal
8	INKS1	...	Not used
9	TOP	IN	Rank resistance detection signal
10	DIODEA	OUT	Head temperature sensor (diode) anode
11	ID0	IN	Cartridge detection and recognition signal
12	ID1	IN	Cartridge detection and recognition signal
13	INKS2	IN/OUT	Cartridge detection and recognition signal
14	HVss	GND	Head's logic drive voltage HVdd GND
15	HENB0	OUT	Heat enable
17	HENB1	OUT	• Black BJ cartridge: Uses only pin No. 15 and 17 • Color BJ cartridge (BC-21e/BC-22e Photo): Uses all pins (The respective color is shown in parentheses.)
27	HENB2	OUT	
18	HENB3	OUT	
16	Even ENB	OUT	Even nozzle heat enable
19	Odd ENB	OUT	Odd nozzle heat enable
20	BENB1	OUT	Block enable decoder's output generation signal
21	BENB2	OUT	Block enable decoder's output generation signal
22	BENB3	OUT	Block enable decoder's output generation signal
23	HVdd	OUT	IC driver voltage (+5V)
24	HCLK	OUT	Print data transfer signal
25	HLATCH	OUT	Shift resistor print data latch timing signal
26	HRES	OUT	Latch reset signal
28	HDATA	OUT	Printing data
29	DIODEK	OUT	Head temperature sensor (diode) cathode

• Pin No. 8 is unused.

5) Cartridge detection and identification function

The rank resistance of connector pin 9 (TOP) and the value of connector pin 10 (DIA.S) are used to detect whether or not a cartridge is installed.
The value of connector pin 9 (TOP) is also used to make a distinction between a BJ cartridge and a scanner cartridge.
Connector pins 11, 12 and 13 (ID0, ID1 and INKS2) are used to recognize and identify BC-21e, BC-22e Photo, BC-20 and IS-22.

If the printer is turned on with no cartridge installed, the carriage automatically moves to the cartridge replacement position regardless of its previous position. Also if the cartridge is removed other than during the cartridge replacement mode while the printer is on, an error will occur.

Table 4-3 Cartridge Installation and Signal Detection

	TOP	ID0	ID1	INKS2	DIA.S
Color BJ cartridge [BC-21e] installed	Approx. 57.9 to 745Ω	High	Low	Low	0Ω or more
Color BJ cartridge [BC-22e Photo] installed	Approx. 57.9 to 745Ω	High	High	Low	0Ω or more
Black BJ cartridge [BC-20] installed	Approx. 57.9 to 745Ω	Low	High	Low	0Ω or more
Scanner cartridge [IS-22] installed	Approx. 0 to 57.8Ω	High	High	High	0Ω or more
Color BJ cartridge [BC-21] installed	Approx. 57.9 to 745Ω	(High)	(Low)	(High)	0Ω or more
Color BJ cartridge [BC-22 Photo] installed	Approx. 57.9 to 745Ω	(High)	(High)	(High)	0Ω or more

High: Signal detected
Low: No signal detection (by printer)

3.3 Purge Unit

3.3.1 Purge unit functions

1) Capping function

The purge unit's cap is pressed against the face of the print head to prevent the ink from drying out or leaking.

If print data is not received for over 60 seconds during a print operation, the purge unit wipes the print head face. If print data is still not received for a further 60 seconds, the purge unit caps the print head.

Other than during a print operation, if print data is not received after a certain period of time (varies between 5 to 20 seconds) or if the *POWER* button is pressed to turn off the printer, the purge unit caps the print head.

2) Cleaning function

To maintain high print quality, the purge unit cleans the print head at the following times:

When the power is turned on for the first time after the power cord is connected.

After the BJ cartridge is replaced.

After the ink cartridge has been replaced.

When the power is turned on and it has been 72 hours since the last time the head was cleaned (or first 24 hours have since the more a color BJ cartridge was first installed and performed initial cleaning).

When the printed dot count exceeds the specified amount.

When the color BJ cartridge is left at the cartridge replacement position for over 10 minutes.

When the color BJ cartridge is at the cartridge replacement position and the printer is turned off with the *POWER* button.

When cleaning is executed with a button operation.

The cleaning operation includes the wiping of paper bits and ink residue adhering to the print head's face plate. It also sucks out ink from the print head to refresh the inside of the nozzles with fresh ink.

Table 4-4 Ink Consumption During Cleaning (as a standard)

With a Color BJ Cartridge (BC-21e/BC-22e Photo)	Approximate Ink Consumption
During color BJ head replacement	0.3g
First-time power on after power cord connection	0.3g
Power on after 72 hours since last cleaning	0.3g
(also after the first 24 hours as for the initial cleaning)	0.3g
During ink cartridge replacement	0.6g
When left at cartridge replacement position for over 10 minutes	0.6g
When turned off at the cartridge replacement position	0.6g
When the dot count exceeds the specified count	0.6g
Button pressed for cleaning	0.3g

With a Black BJ Cartridge (BC-20)	Approximate Ink Consumption
During black BJ head replacement	0.15g
First-time power on after power cord connection	0.15g
During black BJ cartridge replacement	0.15g
Power on after 72 hours since last cleaning	0.15g
When dot count exceeds the specified count	0.15g
Button pressed for cleaning	0.15g

3.4.2 Carriage structure

1) BJ cartridge attachment section

The cartridge holder moves with the locking lever which secures the BJ cartridge into the carriage.

When a BJ cartridge is secured into the carriage, the ribbon cable signal contacts are pressed against the bubble jet head signal contacts, enabling signals to be transmitted from the logic board.

2) Carriage driver

The stepping-type carriage motor drives the carriage horizontally across the paper with the carriage belt. After the photo interrupter's home position sensor behind the carriage detects the home position edge as the initial position, the carriage is controlled by the stepping pulse sent to the carriage motor.

The carriage motor is driven by a one to two-phase exciter at a fixed current. Furthermore, if a vertically-oriented line, etc., is printed from both carriage directions, it will appear to be crooked or misaligned due to mechanical reasons. However, if the vertically-oriented line is disjointed or not continuous, any misalignment will be un-noticeable and so printing is executed from both carriage directions. The slightly-off timing of the detected home position edge is adjusted with software and thereby corrected automatically. During the initial operation, HQ mode is corrected. For the other modes, the misalignment is measured and corrected before printing starts.

3) Paper thickness setting

If envelopes or thick paper is fed for printing, the paper will rub against the head face causing possible damage and paper contamination. This can be prevented by making the proper paper thickness setting.

The gap between the head and paper must be set to the optimum setting (one of three settings) to match the thickness of paper being fed. This gap is adjusted by changing the angle of the carriage guide frame and the carriage attachment angle. The gap between the platen and head thereby changes.

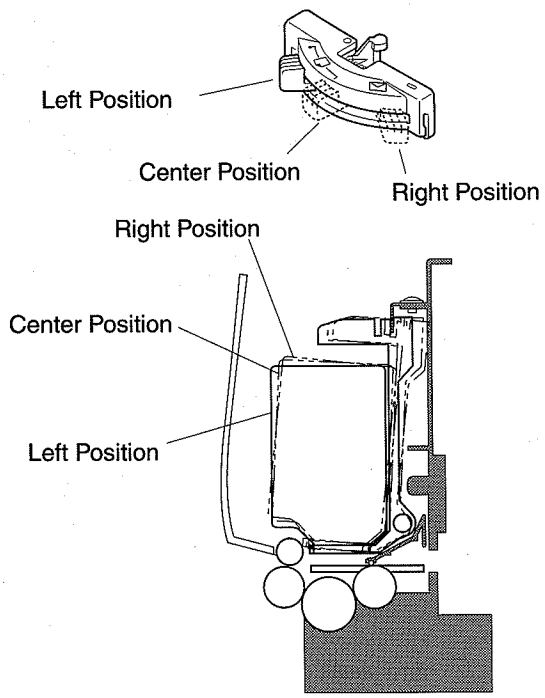


Figure 4-22 Paper Thickness Setting

4) Switching the paper feed motor drive transmission

The paper feed motor drives either the paper feed, purge unit or sheet feeder according to the position of the carriage.

When the carriage is not at the right end, the slide arm is locked by the purge unit slide lock pin. In this condition, paper feed is driven by the feed roller. When the carriage is at the capping position, the slide arm is unlocked and the paper feed motor drives the purge unit and sheet feeder.

When the slide arm is unlocked and the feed roller is rotated in the feeding direction, the slide arm rotates until it reaches the sheet feeder gear to drive the gear.

When the slide arm is unlocked and the feed roller is rotated in the opposite direction of the feeding direction, the slide arm rotates until it reaches the purge drive gear to drive the gear.

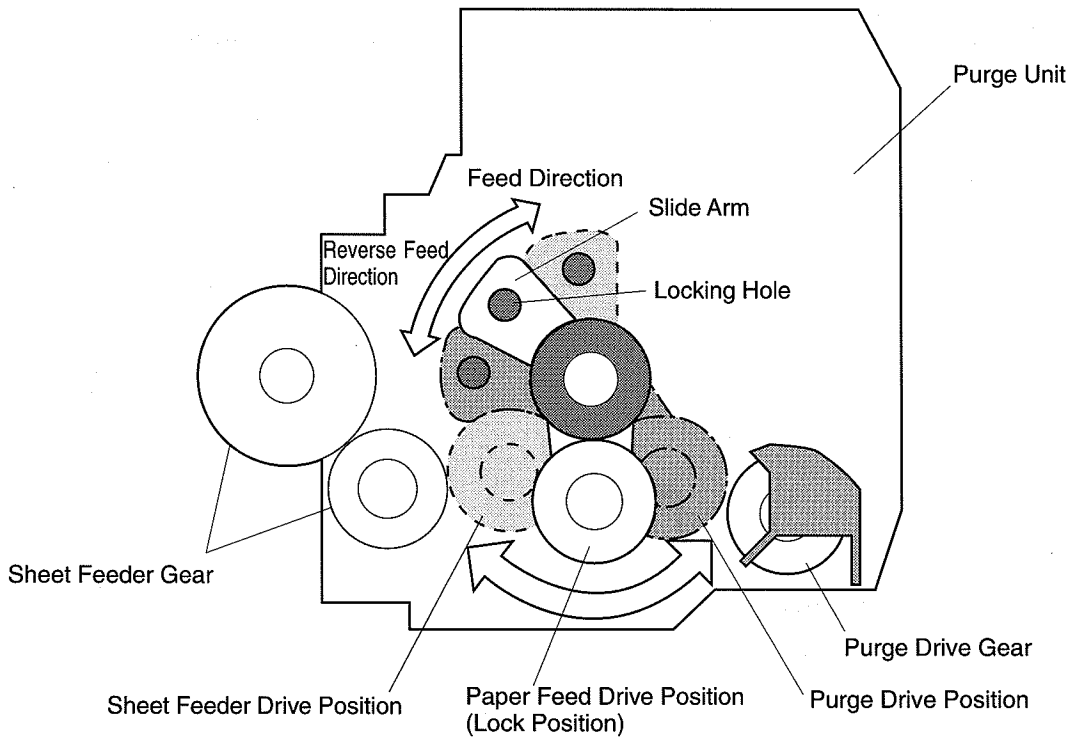


Figure 4-23 Paper Feed Motor Drive Transmission

3.5 Paper Feed and Sheet Feeder

3.5.1 Paper feed and sheet feeder functions

1) Paper feed functions

The paper feed mechanism can supply paper from the sheet feeder automatically or manually.

The built-in sheet feeder is driven by the paper feed motor. The sheet feeder holds a stack of paper which is fed automatically.

When printing transparencies, back print paper, etc., each printed sheet must be removed from the paper output tray immediately. This is to prevent the sheets from sticking to each other.

2) Paper feed operation

Paper feed operations are executed by the *RESUME* button. The paper is ejected when the paper and sensor detects paper.

The paper is fed when the paper end sensor does not detect paper.

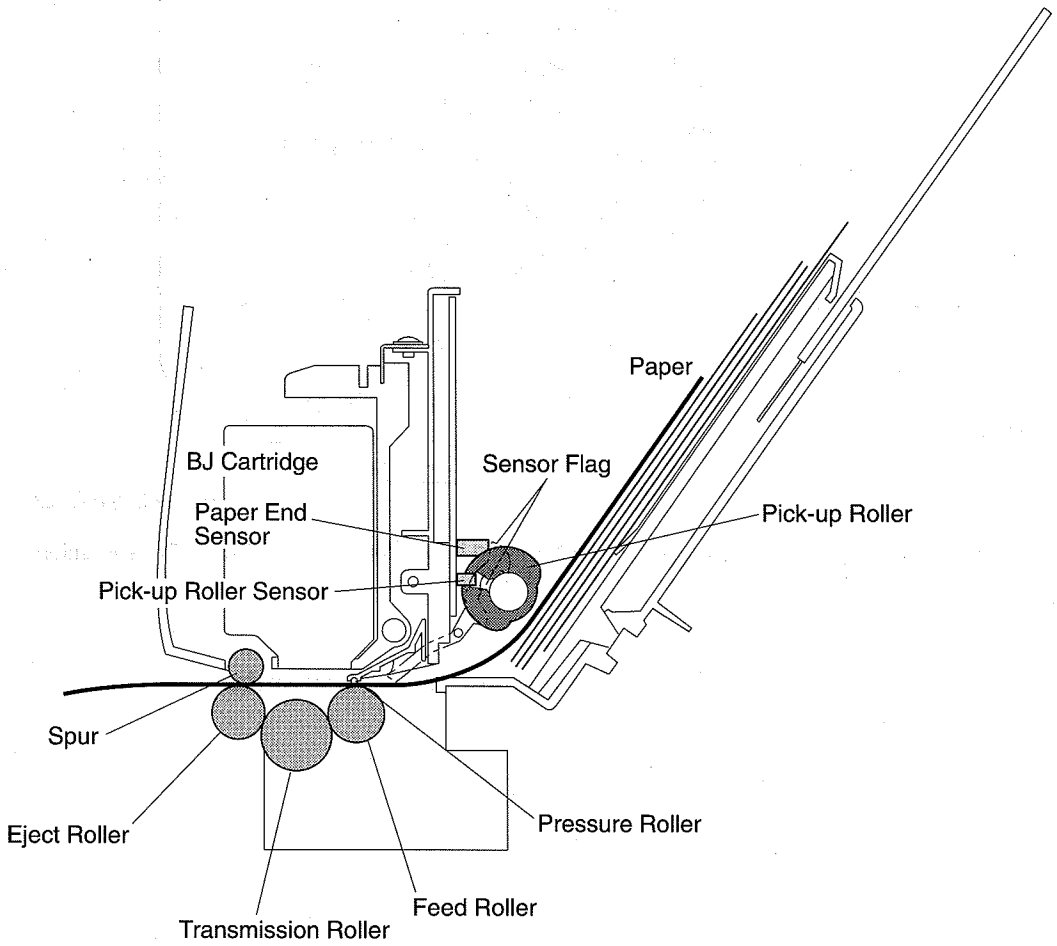


Figure 4-24 Paper Feed Mechanism

3.5.2 Sheet feeder structure

The paper selection lever, which is coupled to the corner arm, is set to suit the type of paper being used. See *"Part 3: 1.5 Paper Settings" (page 3-10).*

In the plain paper position, the paper is loaded while being held by the corner arm. When printing starts, the paper feed motor rotates the pick-up roller, feeding paper into the paper feed mechanism.

The pick-up roller's initial position is set when it is sensed by the photo interrupter pick-up roller sensor on the logic board.

When the paper is sensed by the photo interrupter paper end sensor, the paper is fed automatically to the starting position for printing.

If the paper is not sensed even when paper feeding is executed, paper feeding is executed again. If the paper is still not sensed, a paper feed error occurs.

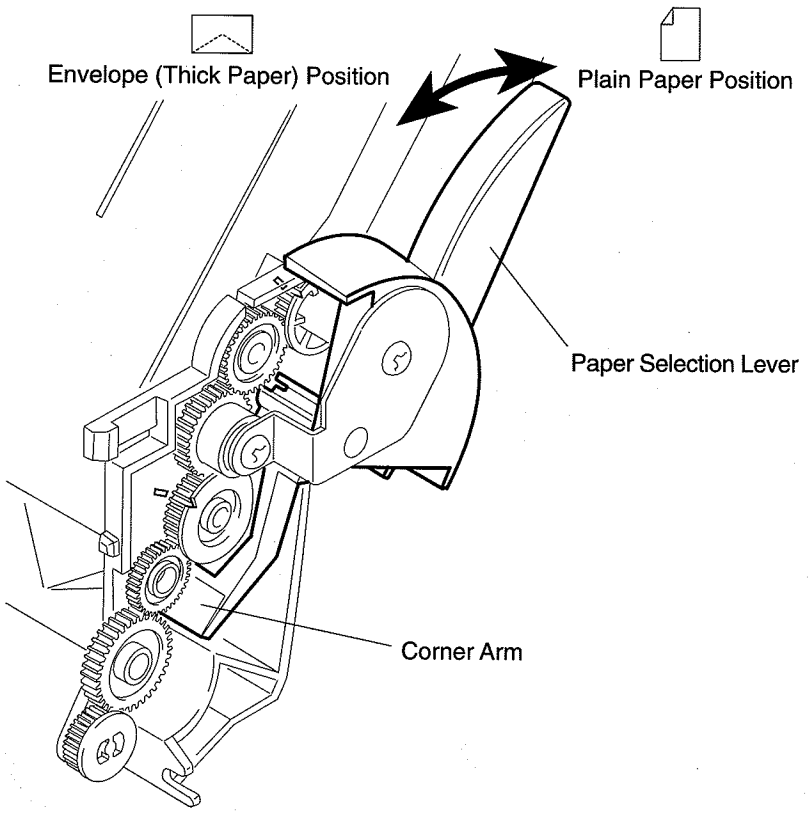


Figure 4-25 Paper Selection Lever

When the paper selection lever is set to the envelope (thick paper) position, envelopes are loaded and fed without being held by the corner arm.
When paper is manually fed and the paper selection lever is set to the envelope (thick paper) position, the paper is fed into the paper feed mechanism without being held by the corner arm.
The manual feeding auxiliary sheet, which is coupled to the paper support, enables manually fed paper to be fed easily into the paper feed mechanism. It is set when the paper support is pushed in, and released when the paper support is pulled out.
When the manual feeding auxiliary sheet is set and paper is automatically fed, multiple feeding is likely to occur. Therefore, keep the paper support extended when executing automatic paper feeding.
When the paper is fed into the paper feed mechanism, it is sensed for over a second by the paper sensor and then fed to the starting position for printing.

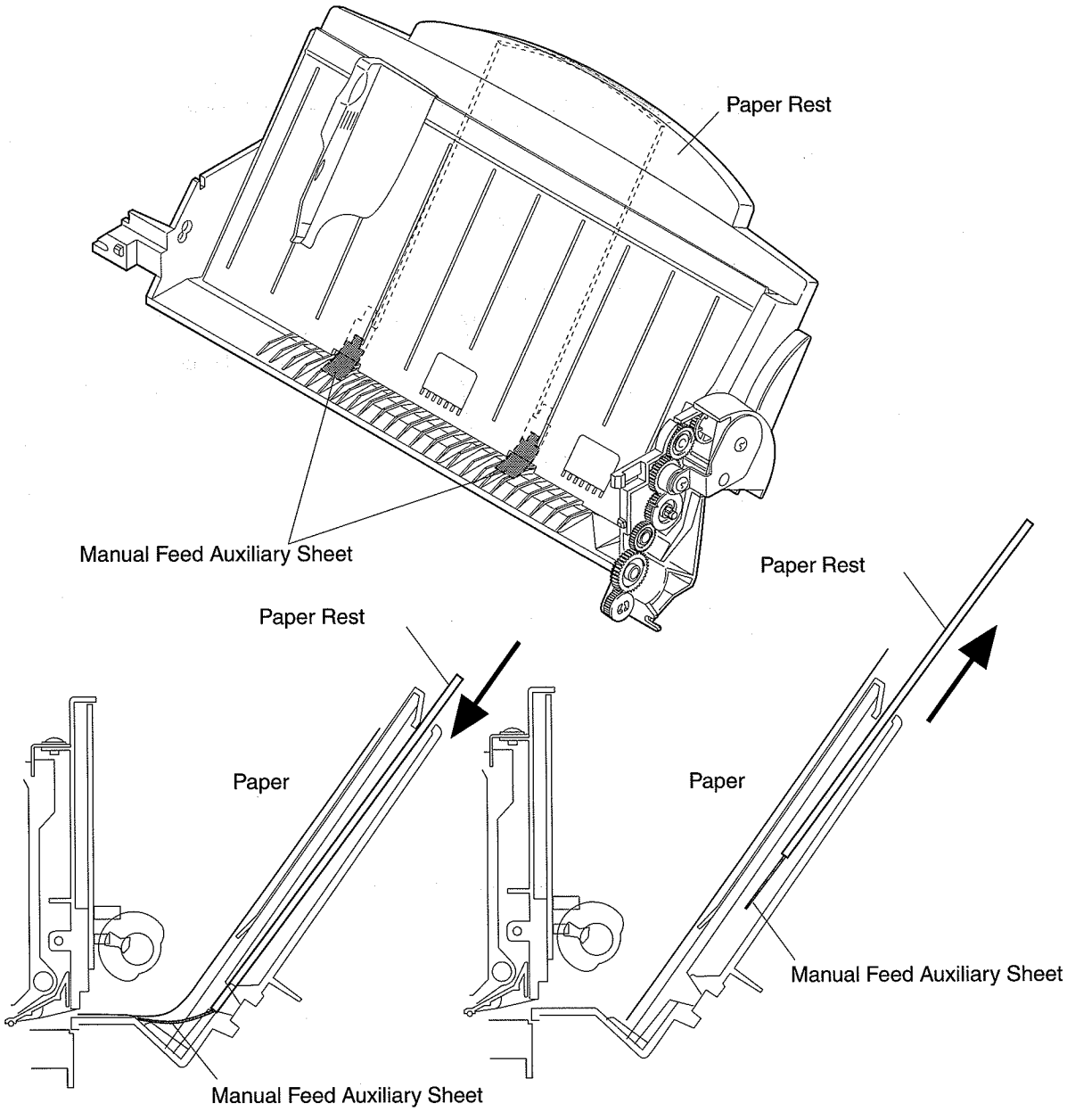


Figure 4-26 Manual Auxiliary Assist Sheet

4. PRINTER ELECTRICAL SYSTEM

4.1 Overview

The electrical system functions are handled by the logic section or power supply. The logic section converts the data from the interface into print signals or printer operation signals and drives the BJ cartridge and all the motors while monitoring the status of the sensors.

The power supply converts the AC power from the power inlet into drive power for the logic board, motors, head, etc.

When AC power is input via the power cord (soft-power off), all of the hardware components are active except for the following, which are inactive: All buttons except the *POWER* button, the photo interrupter's sensor, and the interface's I/O signals.

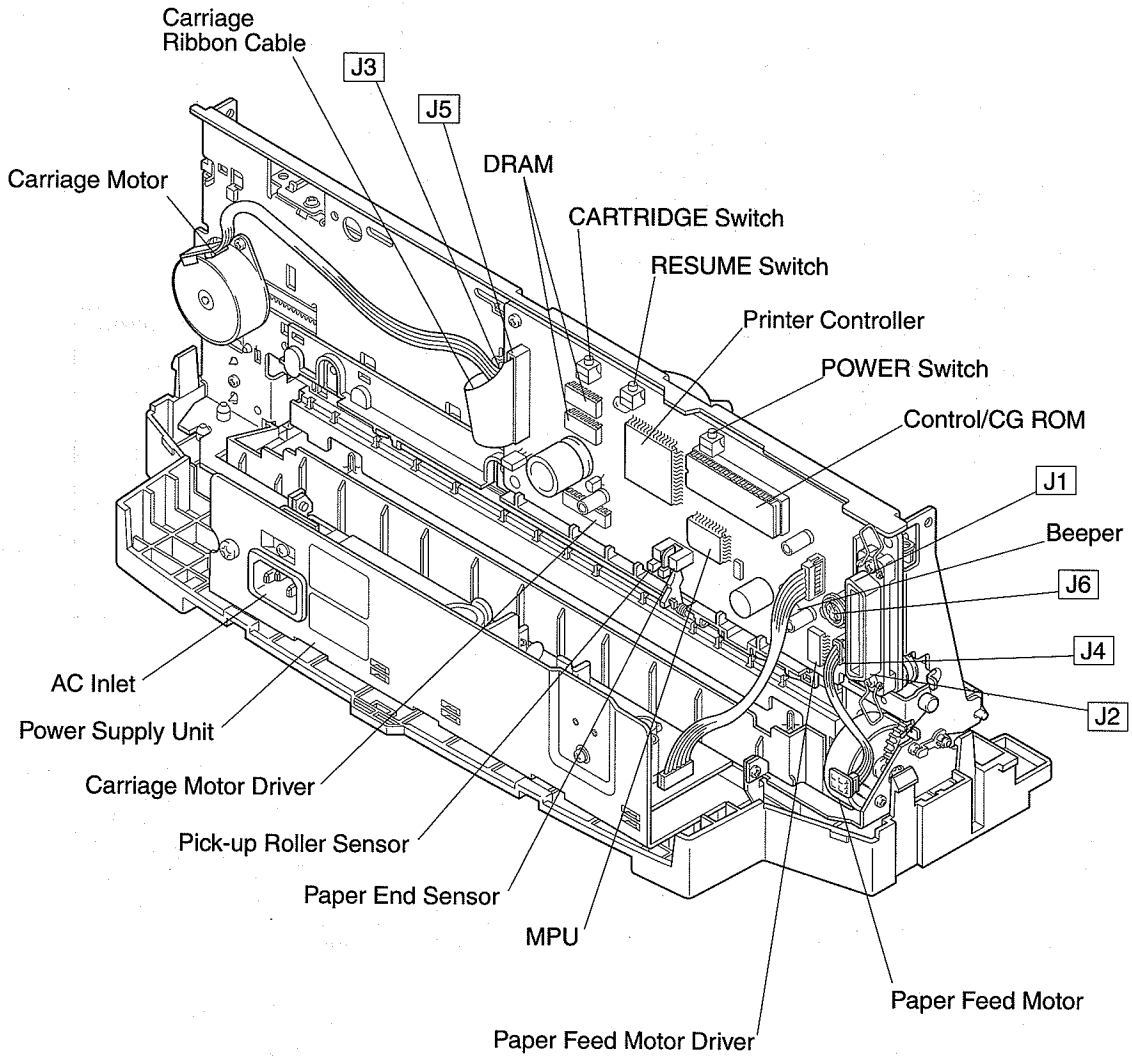


Figure 4-27 Printer Electrical System

2) Printer controller (IC3)

The printer controller contains the interface controller, print head controller, buffer controller, DRAM controller, EEPROM controller, I/O ports, etc. It operates in synchronization with an external 22.11 MHz external clock input.

Interface controller

The interface controller receives from the computer, 8-bit parallel data which is synchronized with the data strobe pulse ($\overline{\text{STROBE}}$) through the BUSY/$\overline{\text{ACKNLG}}$ handshake. It also controls other interface signals.
The data received through the interface is stored in the DRAM's receive buffer and analyzed by the MPU.
When the printer initialization signal $\overline{\text{INIT}}$ is input through the interface to the printer controller, the printer controller outputs a BUSY signal. Also, after INT1 is output to the MPU and print data in the print buffer is printed, the printer is initialized.

DRAM controller

The DRAM controller is a DRAM-specific bus separate from the MPU bus. It controls the 4 M bit DRAM's 10-bit address/16-bit data bus and also executes read/write control, RAS/CAS control, and refresh control.

Buffer controller

The buffer controller automatically writes the received data to the receive buffer on the DRAM, manages the receive buffer's remaining capacity, automatically reads the print buffer, and clears the data after it is read.

Print head controller

The print head controller converts the print data read from the DRAM's print buffer from parallel to serial and sends it to the print head. At the same time, the printed dots are counted for the variable control of the Heat-enable (H ENB) signal's pulse width.
The head-driving signals consist of the block enable signals (B ENB 1, 2, 3), odd/even enable signals (OddENB/EvenENB), and heat enable signals (H ENB 0, 1, 2, 3). The block enable signals and odd/even enable signals specify the block for time-shared drive. The heat enable signals control the eject heater's conduction time.

I/O port

The I/O ports sense the *RESUME* and *CARTRIDGE* buttons' input status. The output ports control the lighting of the *POWER* and *ERROR* indicators.

3) Control/CG ROM (IC4)

The 16MB control/CG ROM contains the program and bitmap font data for printer control.

4) DRAM (IC7 and IC8)

Controlled by the printer controller, the 4 M-bit DRAM is used as a receive buffer, download buffer, print buffer, and working area.

5) Reset IC (IC1)

This IC detects the power voltage when turning on the power or instantaneous power failures, and resets the MPU and printer controller.

6) EEPROM (IC6)

Controlled by the printer controller, the 1 K-bit EEPROM (Electrically Erasable and Programmable ROM) stores various function settings, the total count of printed sheets, and the total waste ink amount.

7) Paper feed motor driver (IC13)

Controlled by the MPU, the paper feed motor driver drives the paper feed motor (controlled by the two-phase exciter) with a constant-voltage unipolar drive. The driving IC has four identical circuits.

8) Carriage motor driver (IC12)

Controlled by the MPU, the carriage motor driver drives the carriage motor (controlled by the one to two-phase exciter) with a fixed current bipolar drive. In accordance with the switching signal from the MPU, the peak current value is set to five steps and driven. The driving IC has two identical circuits.

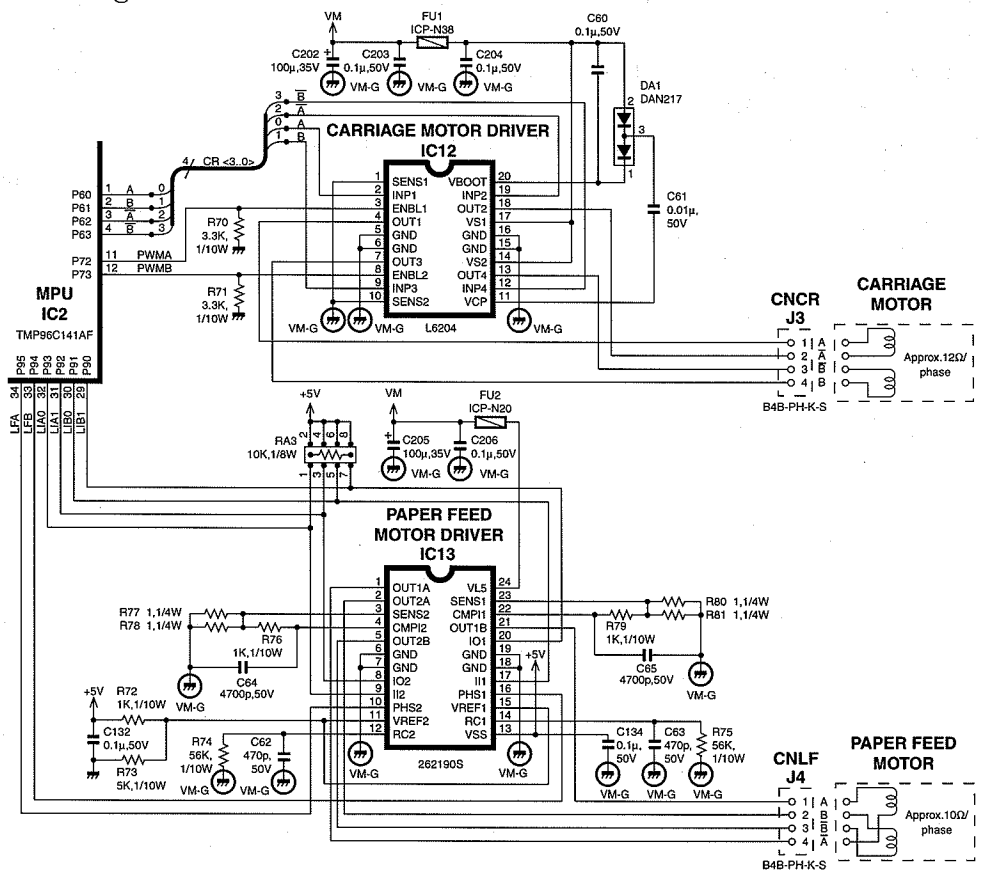


Figure 4-30 Motor-Driving Circuit

4.3 Power Supply

The power supply is a switching regulator that converts the input AC to the respective DC voltages, and supplies them to the logic board.

4.3.1 Power supply block diagram

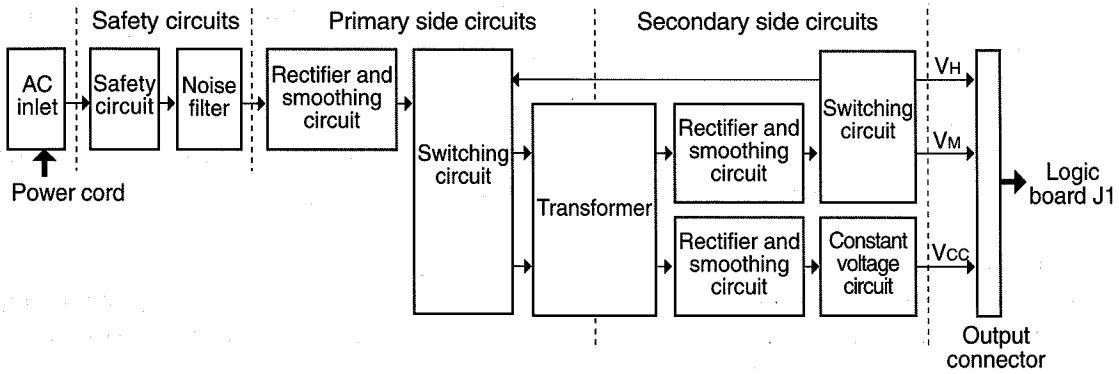


Figure 4-31 Power Supply Block Diagram

4.3.2 Power supply components

1) AC inlet

The AC inlet incorporates a GND pin. The input voltage is as follows:

120V Model: 85V (100V-15%) to 123V (120V+10%)

220/240V Model: 187V (220V-15%) to 264V (240V+10%)

2) Internal circuits

Safety circuits

The safety circuits protect the internal circuits from overvoltages and eliminate noise. The safety circuits are provided with a fuse which blows to protect the internal circuits in the event of an overvoltage input.

The fuse is installed in a fuse holder, and can be replaced if it blows due to an overvoltage.

Primary side circuits

The primary side circuits rectify and smooth the input AC voltage, which is then converted by the DC-DC converter and supplied through the switching circuit to the primary side of the transformer.

Secondary side circuits

The respective voltages are generated from the voltage at the transformer's secondary voltage. VH and VM are generated by the switching circuit. VCC is generated by the constant voltage circuit.

3) Output connectors

The following lists the output voltages at the connector on the secondary side of the power supply.

VCC: Voltage for driving ICs and LSIs: +5 V ±0.25 VDC

VH: Voltage for driving head: +24.0 V ±0.25 VDC

VM: Voltage for driving motors: +24.0 V ±1.2 VDC

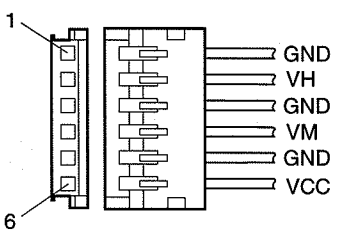


Figure 4-32 Output Connector

5. SENSOR FUNCTIONS

The printer has a pick-up roller sensor, paper end sensor, home position sensor (purge sensor), printer temperature sensor, and head temperature sensor.
Furthermore, the EEPROM counts and records the waste ink absorption amount. When the waste ink absorber becomes full, the waste ink absorption amount indicates an error.

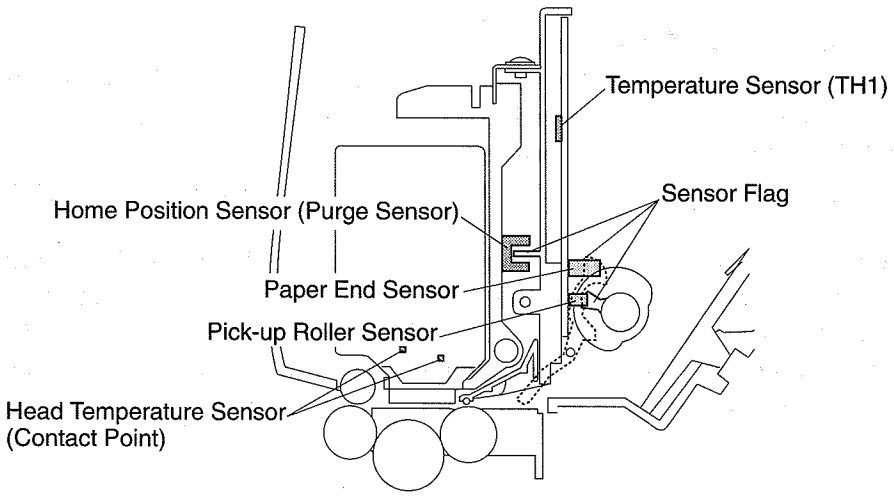


Figure 4-33 Sensors

5.1 Pick-up Roller Sensor

The photo interrupter-type pick-up roller sensor detects the initial position of the sheet feeder's pickup roller. When the initial position is detected, the flag interrupts the sensor.

5.2 Paper End Sensor

The photo interrupter-type paper end sensor detects with the paper sensor arm flag the presence of paper when the edge of the paper passes through the paper feeding mechanism. When there is no paper the sensor is closed, however the sensor is opened when paper is detected.

5.3 Home Position Sensor (Purge Sensor)

The photo interrupter-type home position sensor senses the home position edge and detects the carriage position. After the edge is detected, the carriage moves to the right. The position where the maintenance jet is executed becomes the home position.
Also, at the capping position, the on/off of the purge sensor flag during the recovery operation is detected.

5.4 Temperature Sensor

The temperature sensor is a thermistor which detects the printer's internal temperature. The thermistor resistance fluctuates with any temperature changes. The change in resistance is detected as a change in the voltage by the MPU. The analog value input to the MPU is converted into a digital value by the internal A-D converter to detect the temperature. After the printer temperature is detected, the head-driving and head temperature adjustment signals are controlled accordingly.

5.5 Head Temperature Sensor

The head temperature sensor in the print head is a diode sensor which detects the head's internal temperature. Temperature changes in the head are detected by the MPU as voltage-level changes.

The analog value input to the MPU is converted into a digital value by the A-D converter. This digital value is used for stopping dot ejection if there is an abnormal temperature increase.

5.6 Waste Ink Amount Detection

Waste ink is discharged for head maintenance and absorbed by the waste ink absorber. If the amount of waste ink discharged exceeds the absorption capacity of the waste ink absorber, ink might leak from the printer.

To prevent ink from leaking, the waste ink absorber capacity is estimated and detected when full.

The waste ink is discharged during maintenance jet and cleaning. The amount of waste ink discharged is estimated by counting the number of maintenance jet and cleaning operations. Then the waste ink amount is calculated taking into consideration the evaporated ink amount. When the calculated waste ink amount exceeds the capacity of the waste ink absorber, a waste ink-full error occurs.

Table 4-5 List of Sensor Functions

Sensor Function	Description	Status
Paper detection	Detected by the paper end sensor	Provided
Paper width detection		Not provided
Home position detection	Detected by the home position sensor	Provided
BJ cartridge detection	Detected by the head's rank resistance and head temperature sensor	Provided
Ink cartridge detection		Not provided
BJ cartridge identification	Identified by the head's ID0, ID1 and INKS2	Provided
Waste ink amount detection	Calculated with the maintenance jet dot count	Provided

6. SCANNER CARTRIDGE

6.1 Scanner Cartridge Overview

The scanner cartridge is a replaceable scanner unit that carries a one-line 128 pixel CCD. The scanner separates each of the three RGB primary colors of the LED by scanning the same line three times. The color image is output by 8-bit signals, 256 gradation in each RGB primary color. For a monochrome image, the image is lit with a green LED and scanned once to output either a 8-bit or 2-bit signal. The maximum scanning resolution is 360 dpi × 360 dpi.

The light source LED within the scanner lights up and illuminates the document on the platen. The light rays hit the image and using an imaging lens the reflected light rays are converged onto the CCD sensors. The converged light rays are converted to analog signals by the CCD. After the analog signals have been converted to digital signals by the scanner controller, the scanned image is processed and the image data is sent to the computer via the printer's bidirectional centronics interface.

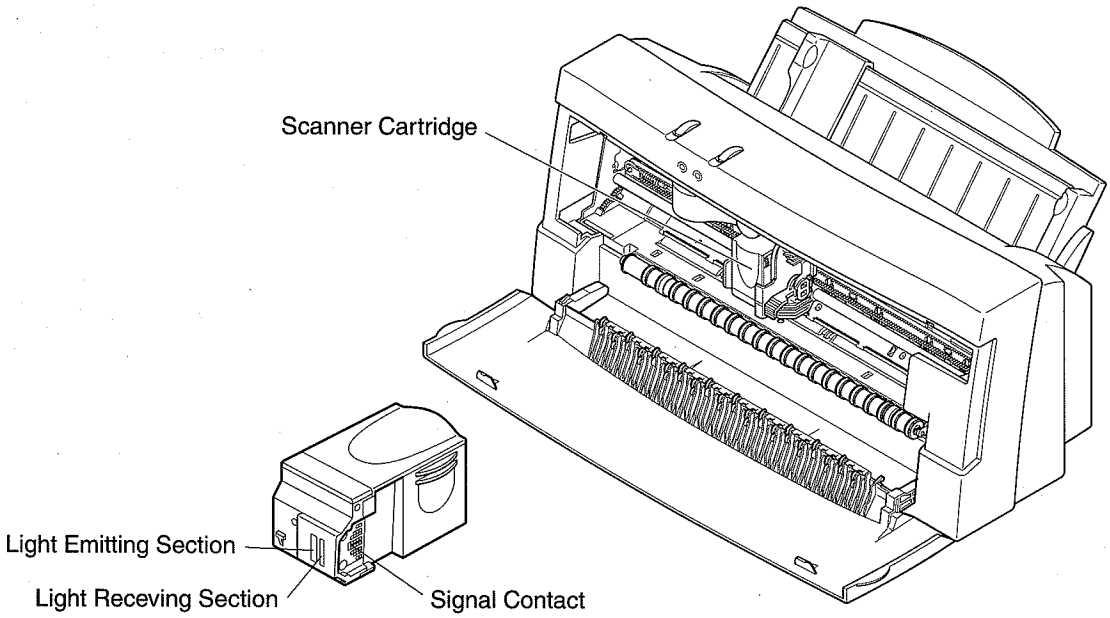


Figure 4-34 Scanner Cartridge

6.1.1 Block Diagram

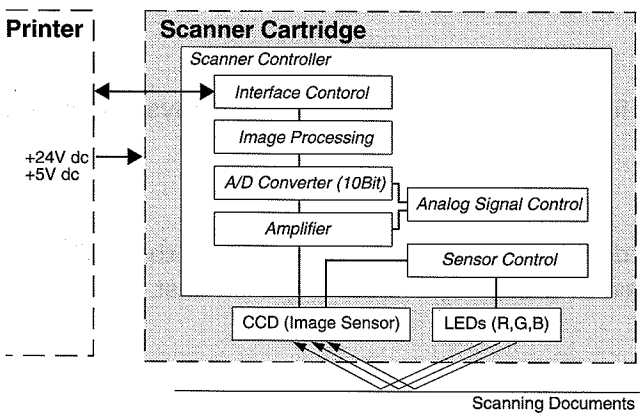


Figure 4-35 Block Diagram

6.2 Scanner Cartridge Structure

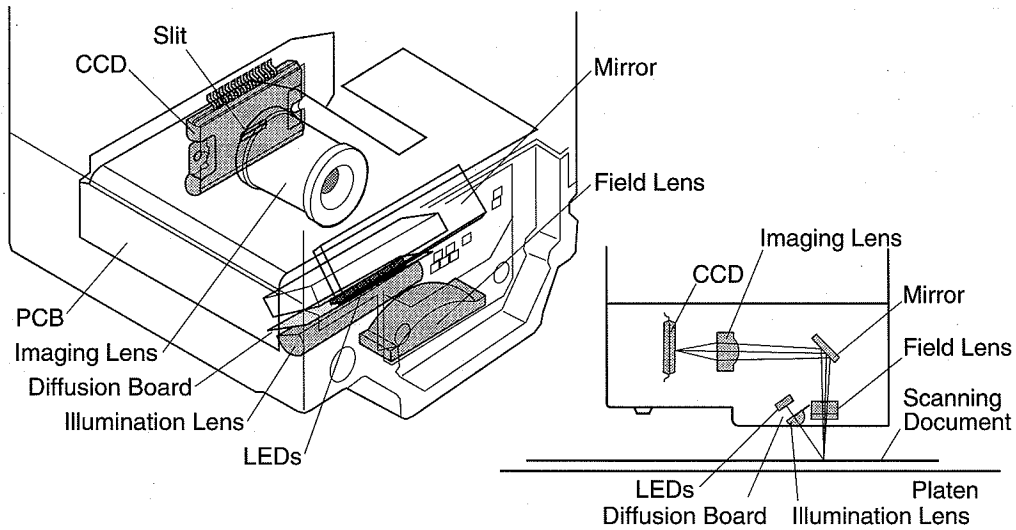


Figure 4-36 Scanner Cartridge

1) LED

Red, green and blue LEDs are used to illuminate the scanning document. To compensate for the low intensity of the red and green LED's, two red and green LEDs have been incorporated and a total of five LEDs are mounted on the scanner. Only the green LED is used for monochrome scanning.

2) Illumination lens

This "D" shaped lens converges the light from the LED light source.

3) Diffusion board

The light intensity of the LED is brighter at the center than at the ends. The diffusion board allows even distribution of light onto the document.

4) Field lens

This lens prevents any magnification reduction caused by paper gaps when scanning a lifted or bent document.

5) Imaging lens

This lens is used for forming an image of the light rays converged by the field lens onto the CCD.

6) Shading board

The shading board with a slit at the front surface of the CCD is used to prevent crosstalk generated in areas adjacent to high contrast areas.

7) CCD

The scanner cartridge uses a semiconductor type, one-line 128 pixel CCD (Charge Coupled Device). Depending on the light amount of the image formed on the CCD, electric voltage signals are sent to the scanner controller as image signals.

8) Scanner controller

The scanner controller is an IC that controls the CCD and processes the analog signal output from the CCD. The scanner controller also controls the following image processing:

- Black Level Correction
  The black level is set to maximum CCD output.
- A/D Converter
  The A/D converter converts the image signals to 10 bits image data.
- Shading Correction
  The variation of the image signal is corrected by the shading correction. Due to (i) the variation of the sensitivities of the CCD sensor elements and (ii) the uneven distribution of light transmitted through the center and the periphery of the lenses, the intensity of each scanned line is not uniform. The scanned data is compared against a standard white data to even out and correct the density.
- Carriage Scanning Direction Resolution Converter
  The carriage scanning direction resolution converter converts the resolution of the output in the scanning direction according to the carriage direction.
- Edge Emphasis
- Binary Image Processing Function
  The scanner controller has a built-in SRAM used for output buffer memory.

The imaging lens used for focusing the image on the CCD is pre-adjusted before shipping to a fixed position as focusing cannot be conducted during servicing please do not disassemble the scanner cartridge.

6.3 Signal Contacts

The scanner cartridge is recognized by TOP.S, DIAS and CCHK signals. The scanned image output to the printer is transmitted with a SCLOCK signal in sync with a SDATA signal. The scanner is controlled by the internal register setting signals, CMD0, 1, 2 and 3.

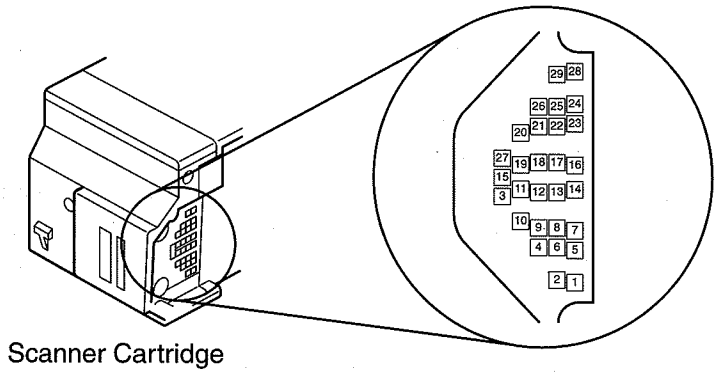


Figure 4-37 Contact Pad Layout

Table 4-6 List of Scanner Cartridge Signal Contacts

No.	Signal	Type	Description	(Ref. BJ Cartridge)
1, 2	LAMP G	...	GND for LED	VHG
3	N.C.	...		HT0
4	N.C.	...		HT1
5, 6	V LAMP	...	LED drive voltage (+24Vdc)	HVH
7	N.C.	...		W-HT
8	N.C.	...		INKS1
9	TOP. S	OUT	Scanner detection signal	TOP
10	DIA. S	...	Scanner detection signal	DIODEA
11	ID0	IN	Not used	ID0
12	ID1	IN	Not used	ID1
13	N.C.	...		INKS2
14	Vss	GND	GND for logic drive voltage	HVss
15	N.C.	...		HENB0(Y)
16	N.C.	...		Even ENB
17	N.C.	...		HENB1(M)
18	N.C.	...		HENB3(B)
19	COM 0 (REN)	IN	Register enable	Odd ENB
20	COM 1 (RWR)	IN	Register write clock signal	BENB1
21	COM 2 (RDT)	IN	Register data signal	BENB2
22	COM 3 (N.C.)	...	Not used	BENB3
23	Vdd	...	IC drive voltage (+5Vdc)	HVdd
24	S CLOCK	OUT	Scan data transfer signal	HCLK
25	S SYNE	IN	Line start signal	HLATCH
26	S RES	OUT	System reset signal	HRES
27	N.C.	...		HENB2(C)
28	S DATA	OUT	Scan data	HDATA
29	C. CHK	OUT	HScanner detection OPEN	DIODEK

6.4 Scan Mode

Table 4-7 List of Scan Mode

Scanning Resolution	Scanning Image Pixel Width			Carriage Speed
	Color	Black & White		
	Multi Value	Multi Value	Binary	
360 × 360	48	48	128	4.88 KHz
300 × 360	48	48	128	5.2 KHz
200 × 360	64	112	128	5.2 KHz
200 × 180	64	128	128	5.2 KHz
180 × 180	64	128	128	6.5 KHz
90 × 90	64	128	128	9.19 KHz

6.5 Calibration

The process of sampling and collecting data such as the printer's internal temperature, black level and white standard data is referred to as calibration.
The scanner application retains the past 5 calibration data and saves them in a file. When a scanning operation is performed, a value from the compiled temperature data that is within ±5°C of the printer's internal temperature at the time is downloaded to the scanner controller. The scanner application requests calibration when there is no compiled data within ±5°C.

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Part 5

MAINTENANCE

5.3.2 Adjustment

1) Set the paper thickness lever to the right and place the gap gauge at position B.
2) Move the carriage to position B.
3) Set the paper thickness lever to the left.
4) Loosen screw A gradually until the carriage guide frame moves forward under the carriage's own weight with screw B as a pivot.
   If the carriage guide frame does not move after loosening screw A, screw B is too tight. And if it moves on the screw B end as well, screw B is too loose. Repeat the procedure from step 3) on the previous page.
5) Lightly push the screw A end of the carriage guide frame once or twice and check that the carriage guide frame moves around screw B as shown by the arrows.
   If it does not return to the original position, screw B is too tight. And if it moves on the screw B end as well, screw B is too loose. Repeat the procedure from step 3) on the prevous page.
6) Lightly tighten screw A.
7) Set the paper thickness lever to the right and move the carriage to position A. Then place the gap gauge at position C.
8) Move the carriage to position C.
9) Set the paper thickness lever to the left.

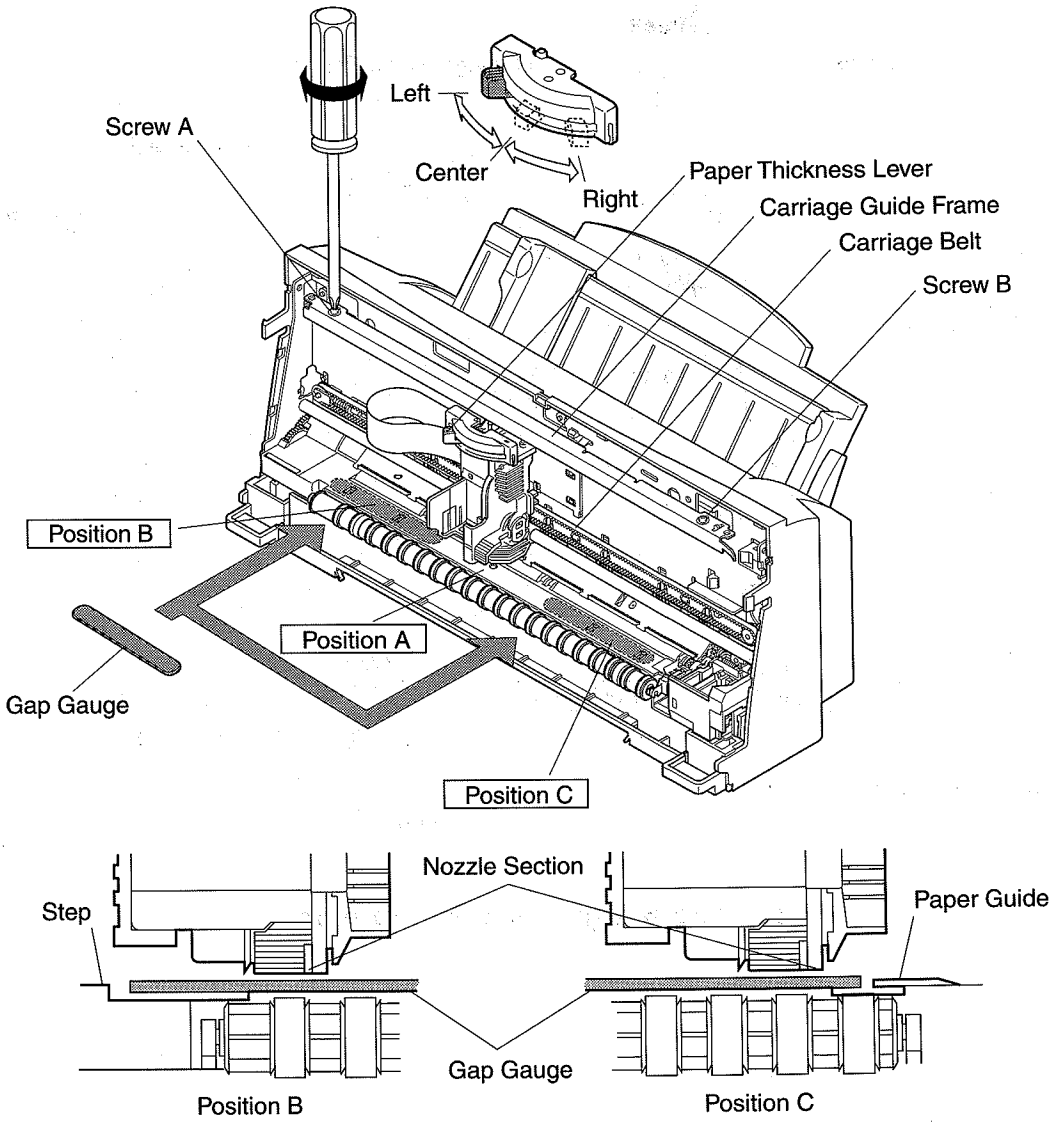


Figure 5-7 Head Gap Adjustment (1)

10) Loosen screw B until the carriage guide frame moves forward under the carriage's own weight around screw A.
If the carriage guide frame does not move after loosening screw B, screw A is too tight. And if it moves on the screw A end as well, screw A is too loose. Repeat the procedure from step 3) on the previous page.
11) Lightly push the screw B end of the carriage guide frame once or twice and check that the carriage guide frame moves around screw A as shown by the arrows.
If it does not return to its original position, screw A is too tight. And if it moves on the screw A end as well, repeat the procedure from step 3) on the previous page.
12) Tighten screw B lightly.
13) Set the paper thickness lever to the right and move the carriage to position A. Then place the gap gauge at position B.
14) Repeat steps 2) through 13) twice.
15) Tighten screws A and B alternately for final tightening.

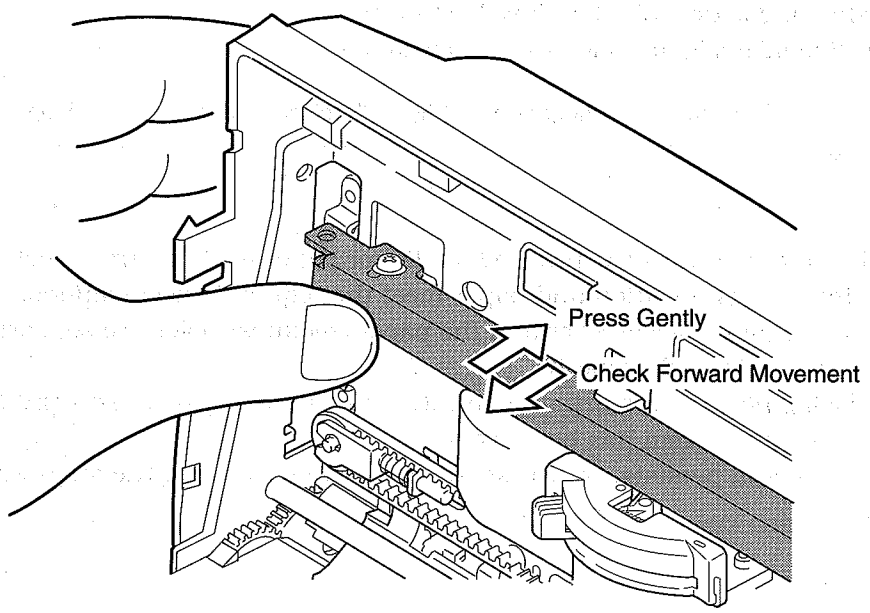


Figure 5-8 Head Gap Adjustment (2)

CAUTION

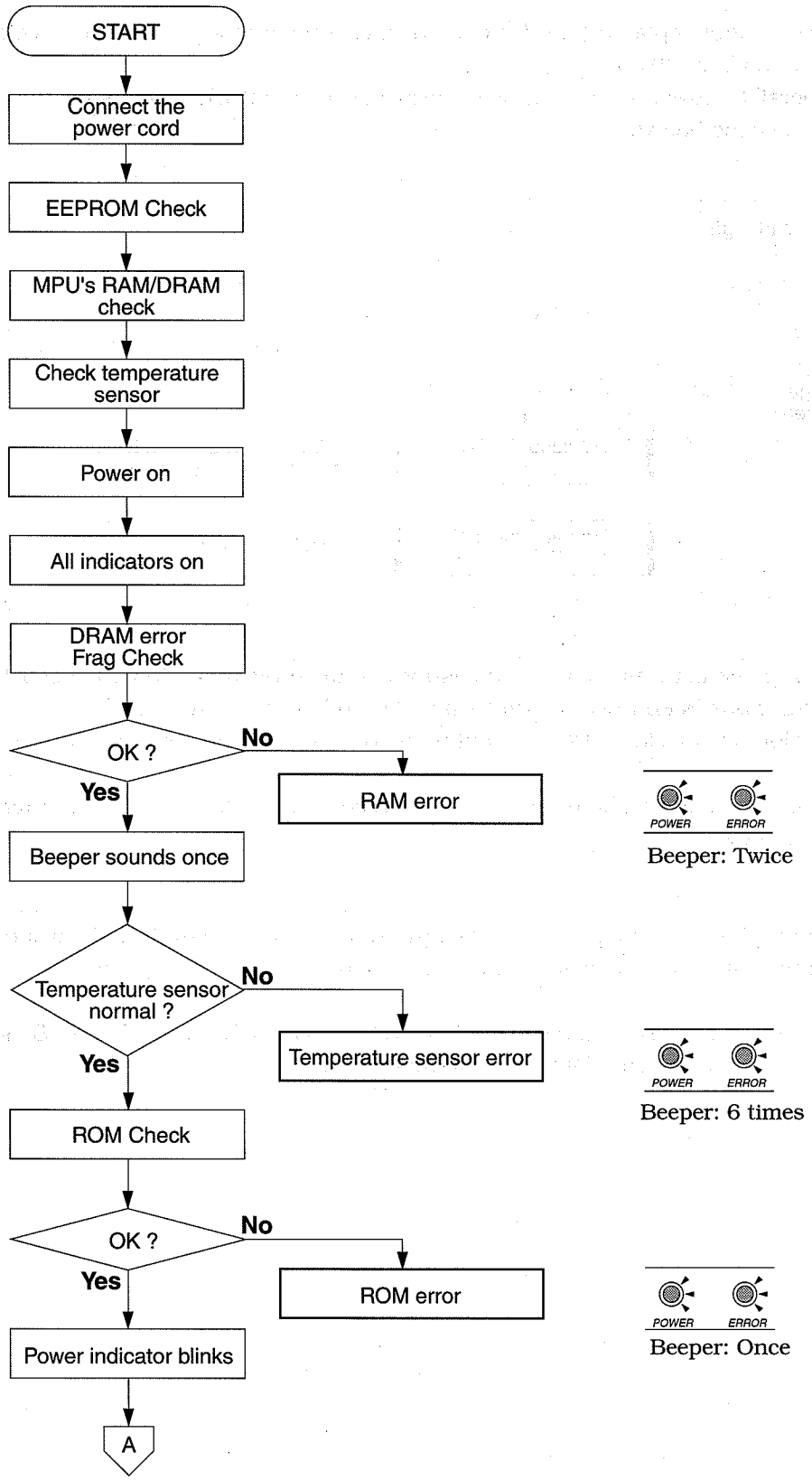
Do not use your hand to move the carriage. It may cause the carriage guide frame to shift. To move the carriage, use the carriage belt instead. On the platen, there is an elevated step and paper guide. If the gap gauge is placed on either part, an accurate measurement will not be obtained.

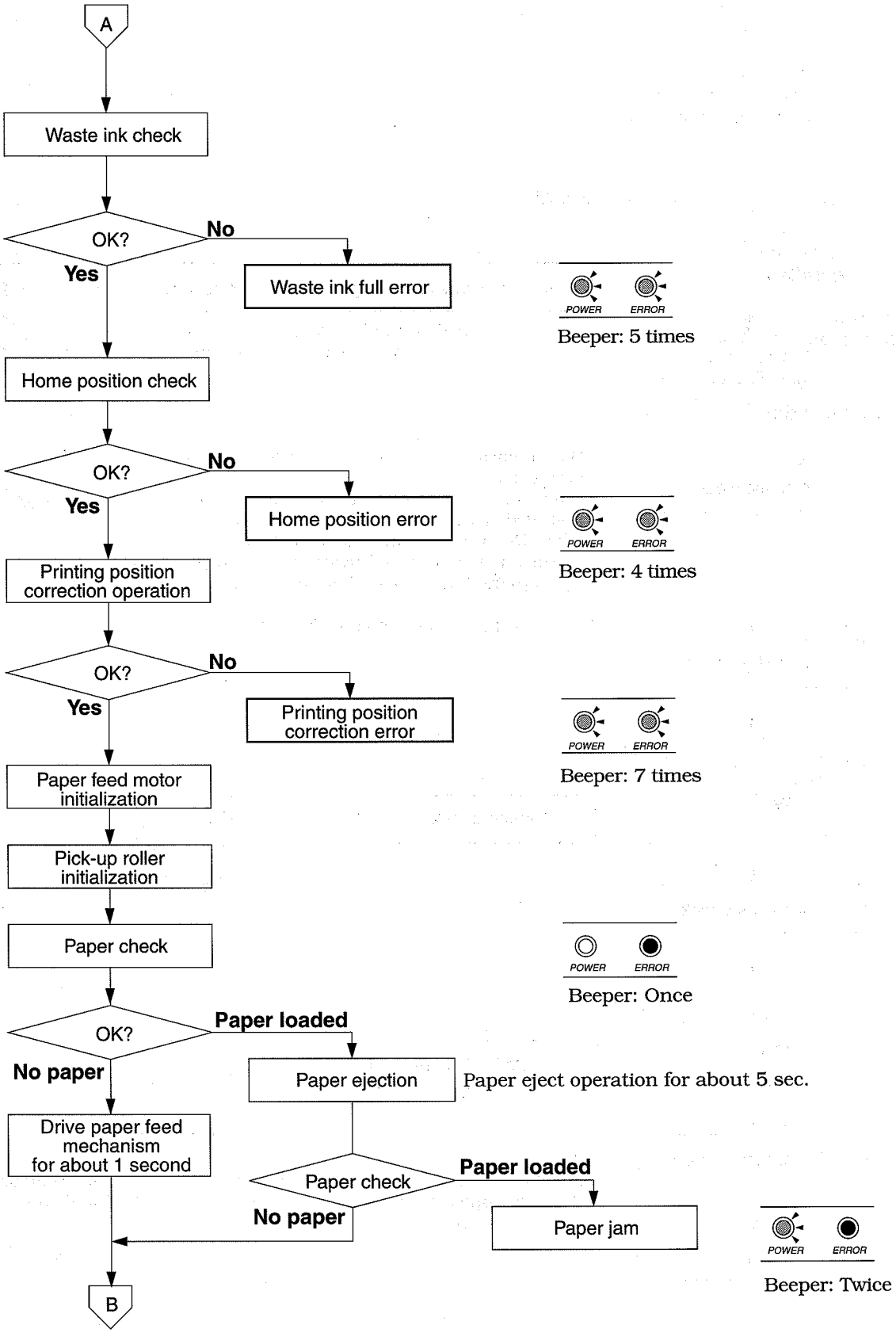
6.2 Error Condition Diagnosis

6.2.1 Initial self check

Errors are indicated by the indicators as follows:

● : On ◎ : Blinking ◎ : Off




A
Waste ink check
OK?
No
Yes
Waste ink full error
POWER
ERROR
Beeper: 5 times
Home position check
OK?
No
Yes
Home position error
POWER
ERROR
Beeper: 4 times
Printing position correction operation
OK?
No
Yes
Printing position correction error
POWER
ERROR
Beeper: 7 times
Paper feed motor initialization
Pick-up roller initialization
Paper check
POWER
ERROR
Beeper: Once
OK?
Paper loaded
No paper
Paper ejection
Paper eject operation for about 5 sec.
Drive paper feed mechanism for about 1 second
Paper check
Paper loaded
No paper
Paper jam
POWER
ERROR
Beeper: Twice
B

3. Cartridge Displacement Error

<Cause> The cartridge is not installed correctly in the cartridge replacement position.

<Suspected Parts> Cartridge, control board, carriage connector

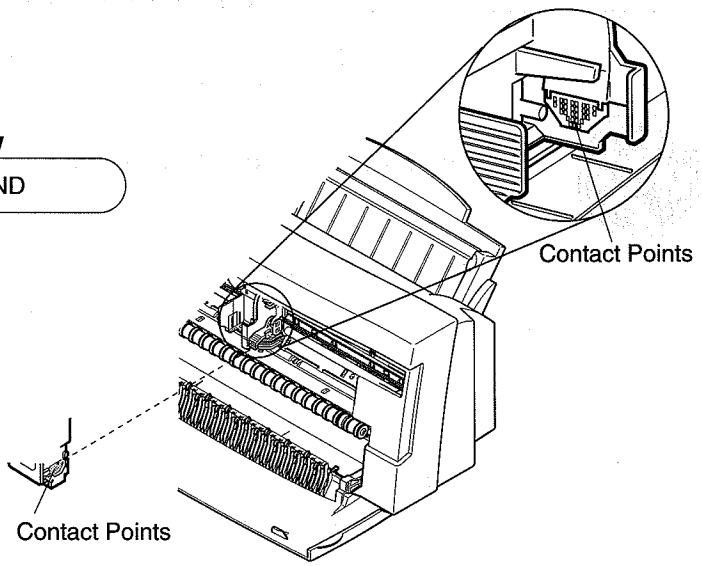
<Measure>

Remove then reinstall the BJ cartridge.

Any error occurring? **No** → END

Yes

Clean contacts.



Clean the cartridge and printer contacts using a soft dry cloth.

Error recurs? **No** → END

Yes

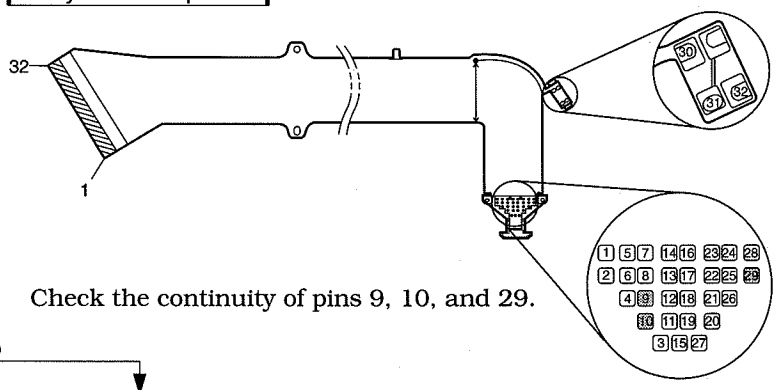
Check carriage ribbon cable installation.

Check if the cable is torn, damaged, cut, or if the contacts are loose. Also check that it is correctly connected to the logic board.

OK? **No** → Repair or replace any defective parts.

Yes

Check carriage ribbon cable continuity.



Check the continuity of pins 9, 10, and 29.

OK? **No** → Replace the carriage ribbon cable.

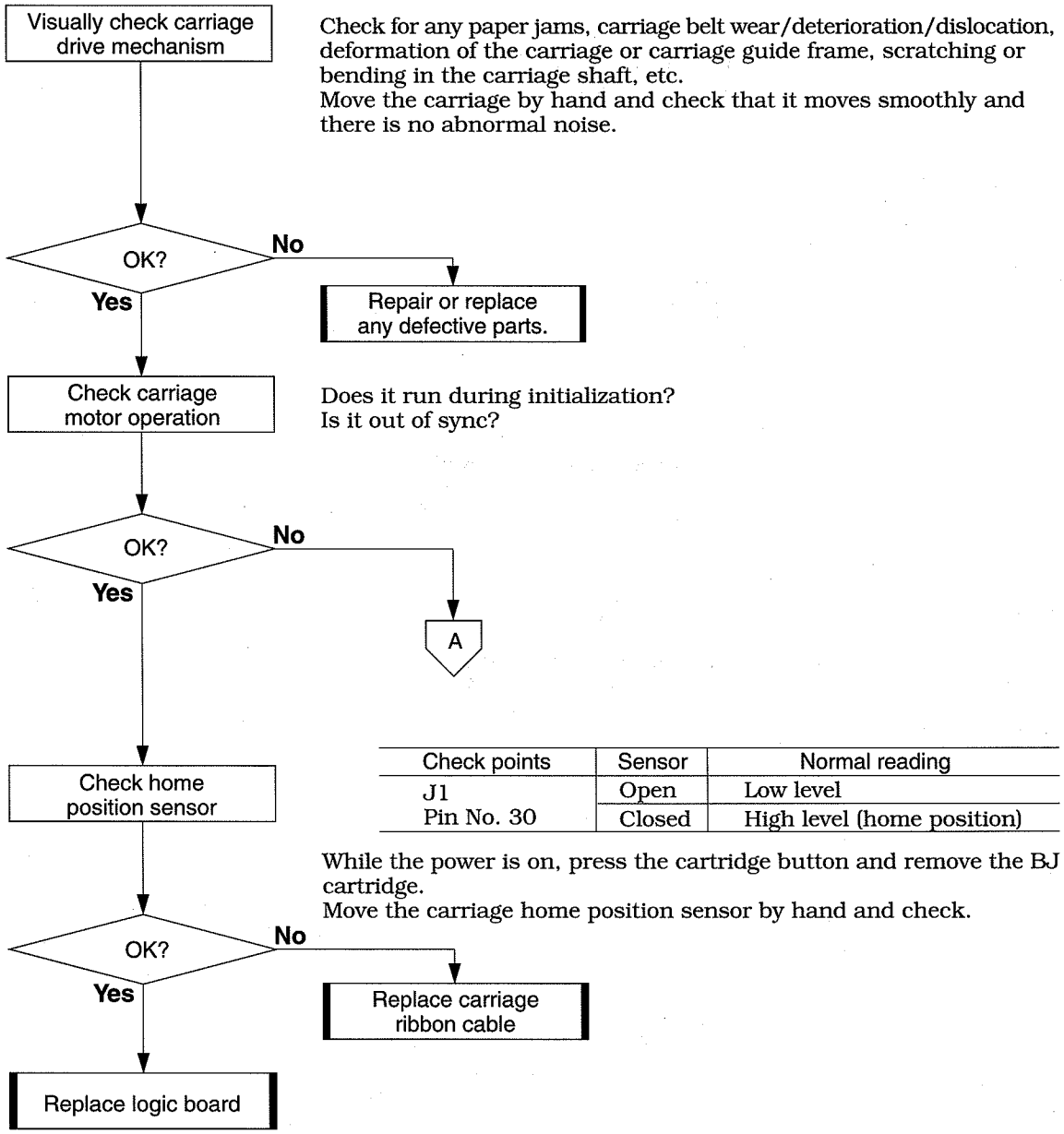
Yes

Replace logic board.

4. Home Position Error

<Cause> The home position cannot be detected.
<Suspected Parts> Home position sensor, carriage motor, logic board, carriage ribbon cable

<Measure>

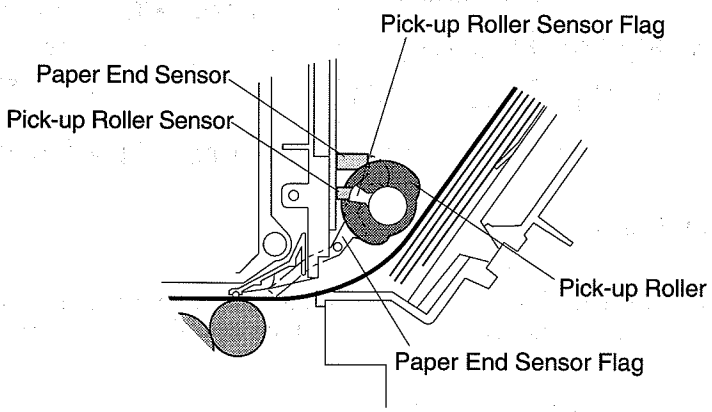


Check points	Sensor	Normal reading
J1 Pin No. 30	Open	Low level
	Closed	High level (home position)

While the power is on, press the cartridge button and remove the BJ cartridge.
Move the carriage home position sensor by hand and check.

A

Check pick-up roller sensor flag



Any deformation or damage?

OK? — No → Replace pick-up roller shaft

Yes

Check pick-up roller sensor

Check points	Sensor	Normal reading
MPU Pin No.65	Open	Low level
	Closed	High level (initial position)

Check by moving the pick-up roller by hand while the power is on.

OK? — No → Replace logic board

Yes

Check paper end sensor arm

Check for any deformation or wear.

OK? — No → Replace paper end sensor arm or repair or replace the defective part

Yes

Check paper sensor

Check points	Sensor	Normal reading
MPU Pin No.71	Open	Low level (paper loaded)
	Closed	High level (no paper)

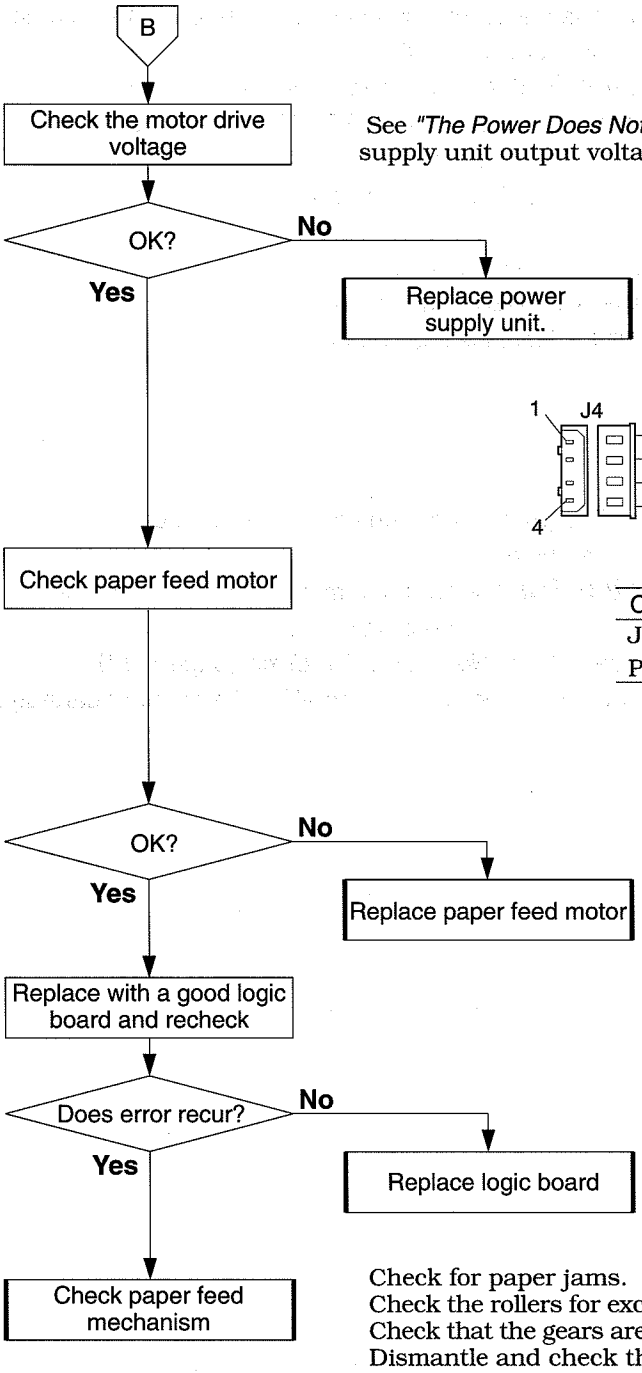
Check by moving the paper end sensor arm by hand while the power is on.

OK? — No → Replace logic board

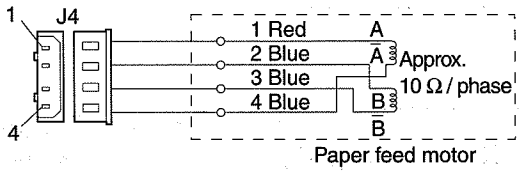
Yes

Check paper feed mechanism

Check for paper jams.
Check the rollers for excessive dirt or deterioration.
Check that the gears are not deformed or damaged.
Dismantle and check the paper feed mechanism.



See *"The Power Does Not Turn On" (page 5-28)*, and check the power supply unit output voltage (VM).



Check point		Normal reading
J4 Pin No.	1-4	Approx. 10 Ω
	2-3	

Check for paper jams.
Check the rollers for excessive dirt or deterioration.
Check that the gears are not deformed or damaged.
Dismantle and check the paper feed mechanism.

6. Waste Ink Full Error

<Cause> The waste ink absorbers' estimated waste ink amount has reached 100%.
<Suspected Parts> Waste ink absorbers, logic board
<Measures> 1. Reset the EEPROM and replace the waste ink absorbers.
2. Replace logic board.

7. Temperature Sensor Error

<Cause> Thermistor is abnormal.
<Suspected Parts> Thermistor
<Measures> Replace logic board.

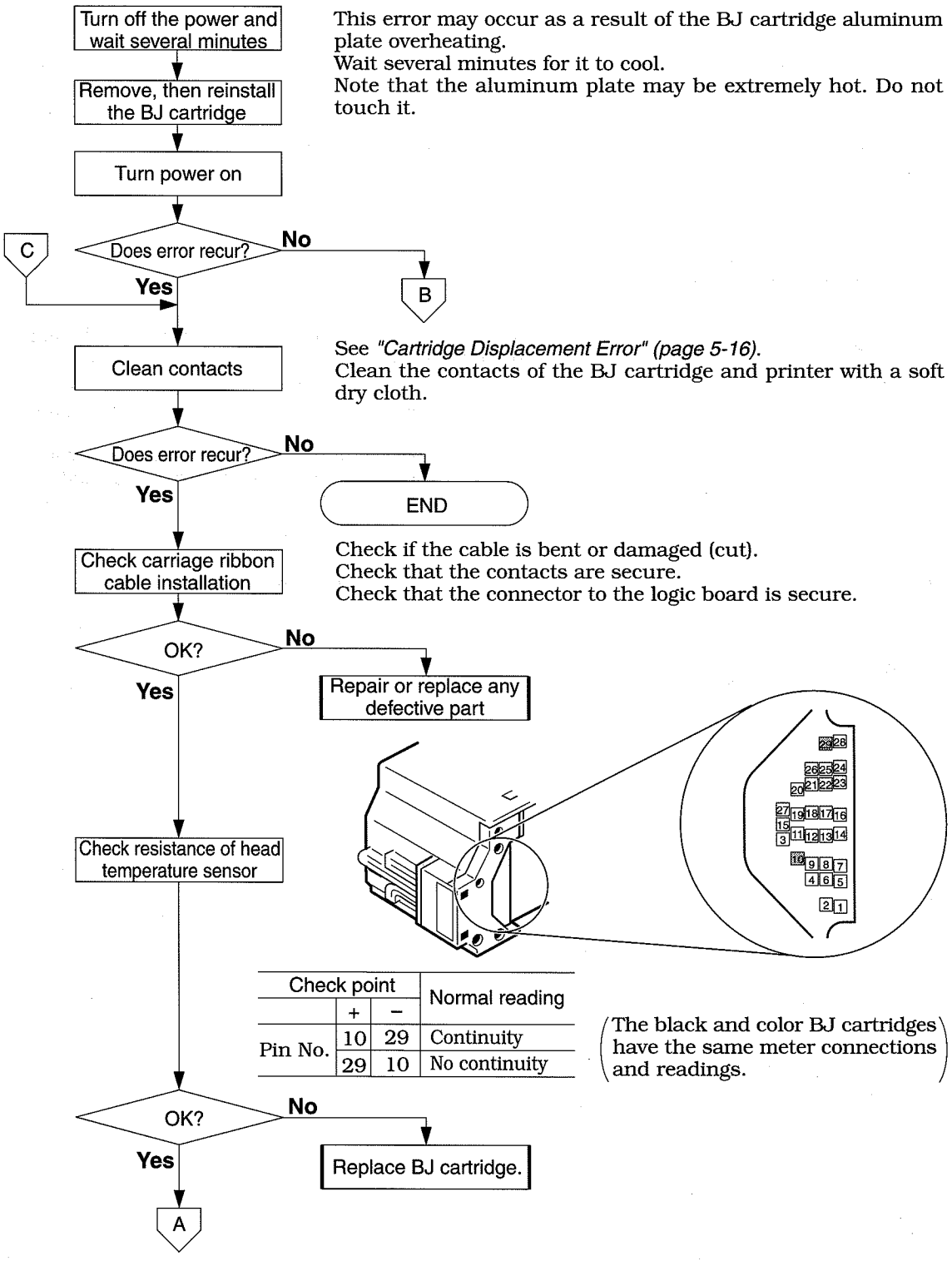
8. Printing Position Correction Error

<Cause> The printing position correction value cannot be detected.
<Suspected Parts> Carriage motor, logic board, home position sensor
<Measures> See *"Home Position Error" (page 5-17).*
* This error does not occur when installing the scanner cartridge.

9. Head Temperature Error/Head Temperature Sensor Error

<Cause> The head temperature is abnormally high.
<Suspected Parts> BJ cartridge, logic board
* This error does not occur when installing the scanner cartridge.

<Measure>



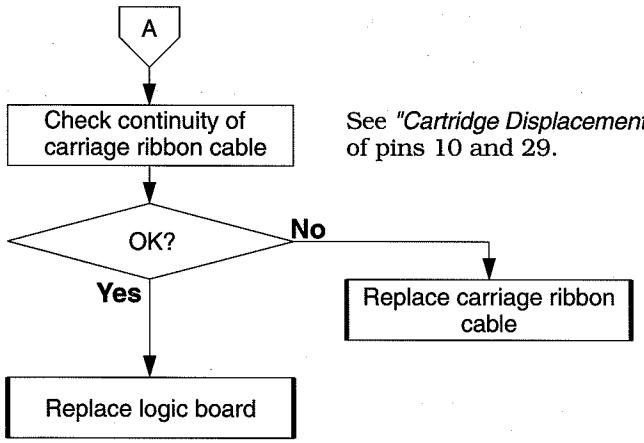
This error may occur as a result of the BJ cartridge aluminum plate overheating.
Wait several minutes for it to cool.
Note that the aluminum plate may be extremely hot. Do not touch it.

See *"Cartridge Displacement Error" (page 5-16).*
Clean the contacts of the BJ cartridge and printer with a soft dry cloth.

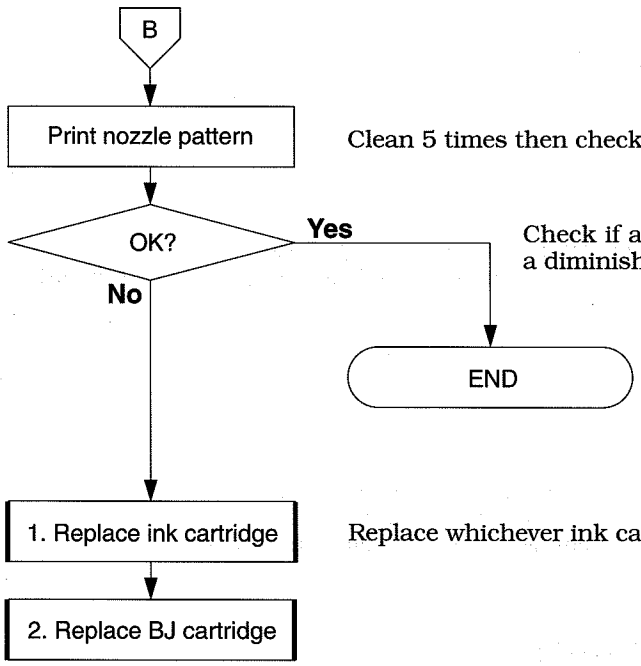
Check if the cable is bent or damaged (cut).
Check that the contacts are secure.
Check that the connector to the logic board is secure.

Check point			Normal reading
	+	−	
Pin No.	10	29	Continuity
	29	10	No continuity

(The black and color BJ cartridges have the same meter connections and readings.)



See *"Cartridge Displacement Error" (page 5-16)* and check the continuity of pins 10 and 29.



Clean 5 times then check.

Check if any nozzles are not firing or are producing a diminished dot size.

One possible cause is continuous high-duty printing.
However, if the error recurs frequently in subsequent printing, return to C and check again.

Replace whichever ink cartridge caused the problem.

10. Cleaning Error

<Cause> Cleaning is not executed properly or not being detected.
<Suspected Parts> Home position sensor, sensor arm, purge unit, carriage ribbon cable, logic board
* This error does not occur when installing the scanner cartridge.

<Measure>

Disconnect, then reconnect the power cord

Turn the power on

Home position error?

Yes

See *"Home Position Error" (page 5-17)*

No

Check operation of paper feed mechanism

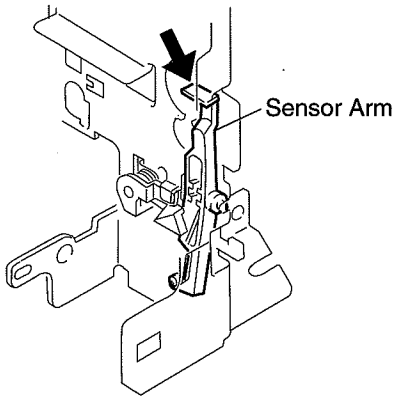
During initialization, do the paper feed motor, pick-up roller, feed roller, eject roller, etc., rotate ?
Any abnormal noises ?
Is the paper feed motor out of sync ?

OK?

No

See *"Paper Pick-up Error/ Paper Jam" (page 5-19)*

Yes



Sensor arm check

Move it by hand and see if it moves smoothly.
Also, check for any deformation or damage at the locations indicated by the arrow.

OK?

No

Replace sensor arm or repair or replace defective parts

Yes

Remove purge unit

A

b) Symptoms

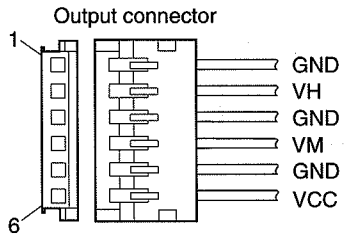
1. The Power Does Not Turn On.

<Symptom> • There is no response when the *POWER* button is pressed.
• When the power supply is turned on, the printer operates abnormally without performing an initialization sequence.

<Cause> The power supply unit or logic board is defective.

<Measure>

Check the output voltage of the power supply unit



Check point		Normal reading
Output connector Pin No.	1-2	DC24V±0.25V (VH)
	3-4	DC24V±1.2V (VM)
	5-6	DC5V±0.25V (VCC)

Disconnect the power supply unit connector from the logic board before checking.

OK? — No → A

Yes → Replace logic board

Is operation normal? — Yes → Replace logic board

Check if the test print is normal.

No → Check printer's electrical parts

There may be some type of trouble, such as a motor overload in the electrical section. Check all the printer's electrical parts other than the power supply unit and logic board.

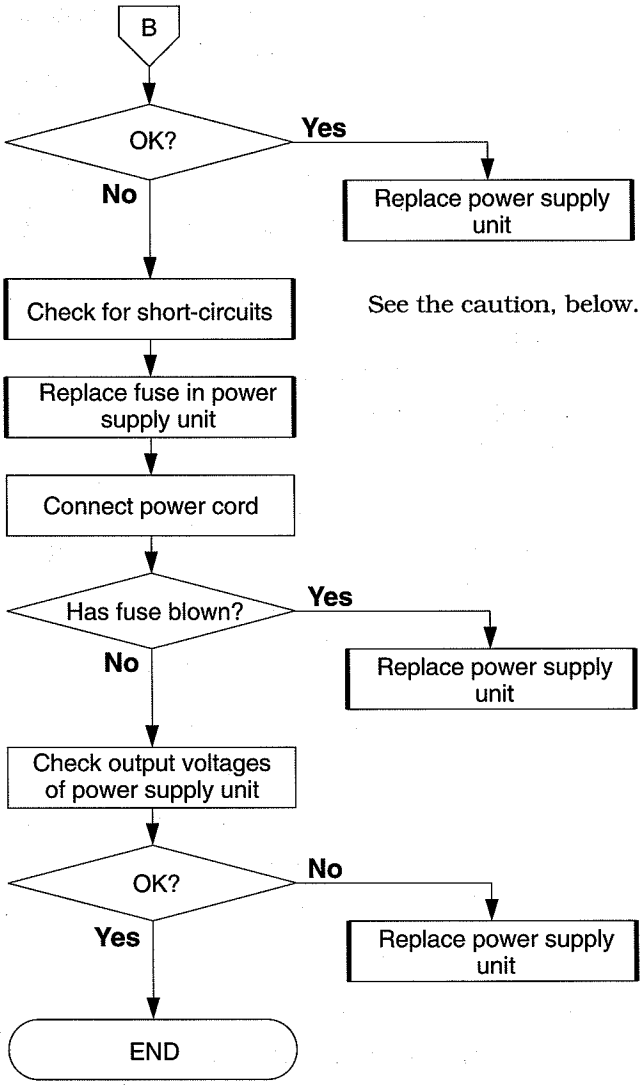
A

Symptom? — One or more wrong voltage outputs → Replace power supply unit

Absolutely no voltage output → Check power supply unit fuse

Check if the fuse has blown.

B



CAUTION

The fuse in the power supply unit blows when an abnormal AC voltage is input or there is a short-circuit on the primary side of the power supply unit, or other reason.
If the fuse has blown, be sure to check the primary side of the power supply unit and all the other electrical components for short-circuits.

4. Defective Printing <2>: White Stripes Appear

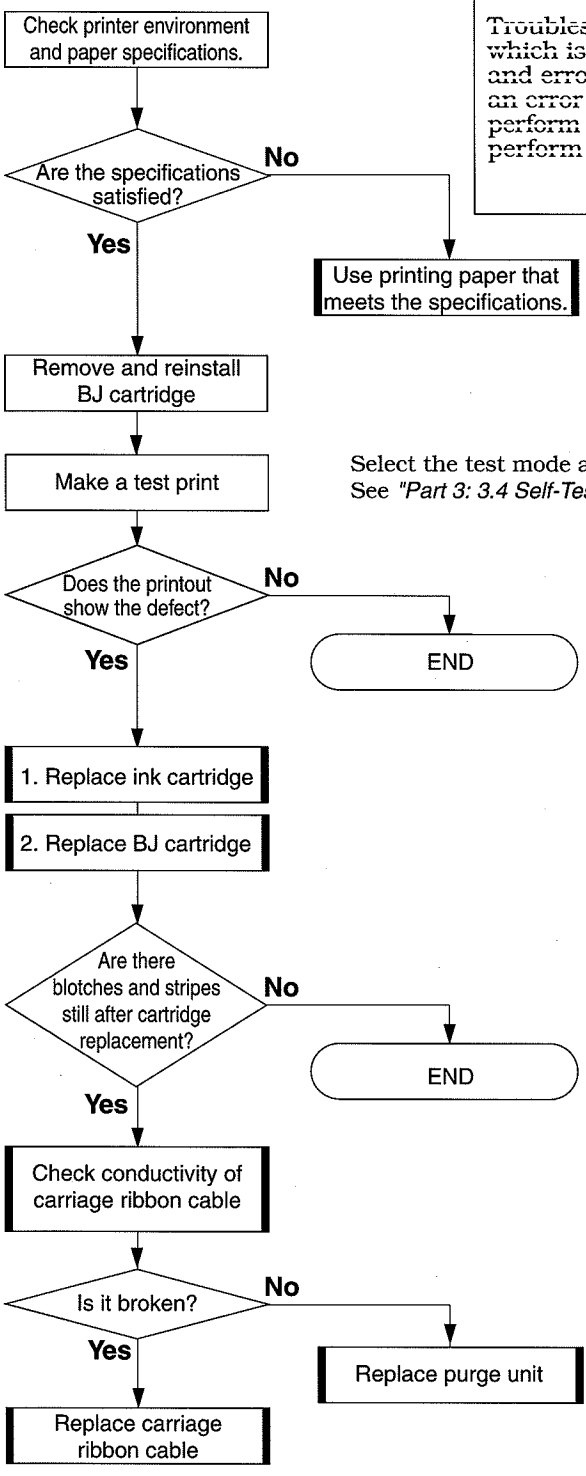
<Symptom>
- There is blotching.
- There are white stripes.
- The specified dots are not printed.

<Cause>
- The BJ cartridge or cartridge contacts are defective.
- The carriage ribbon cable is defective.
- The purge unit or paper feed mechanism (missing gear tooth) is defective.

<Measure>

White Line Sample

Troubleshooting consists of error condition diagnosis, which is required if the cause of an error is unknown, and error recovery, which is performed if the cause of an error is known. If the cause of an error is unknown, perform the error condition diagnosis, and if it is known, perform error recovery.



Select the test mode as required for checking the fault.
See *"Part 3: 3.4 Self-Test Printout" (page 3-21)* for details.

5. Defective Printing <3>: Other Print Problem

Symptom	Check Item	Measures
Paper contamination	Ink mist on the platen.	Use a soft cloth moistened with water to clean.
	Ink has dried around the head's nozzles. (No paper contamination during paper feeding and discharging.)	Cleaning a few times. If problem persists, replace the BJ cartridge.
	Ink has dried (or paper bits have stuck) around the purge unit's head wiper or head capping area.	Replace purge unit.
	Ink has adhered to the paper transport system. (The paper is already contaminated by the time it reaches the platen.)	Disassemble the paper transport system and use a soft cloth moistened with water to clean.
Spur tracks appear	Ink has adhered to the spurs.	Use a soft toothbrush to clean the spurs.
	The spurs have deformed.	Replace the spurs.
Vertically-oriented printed lines are misaligned.	The BJ cartridge is installed incorrectly.	Reinstall the BJ cartridge correctly.
	The paper thickness lever is not set properly.	Set the lever at the specified position.
	The problem occurs when the user's BJ cartridge (causing the problem) is installed in a normally-operating printer.	Replace the BJ cartridge.
	The head gap has not been set correctly.*	Adjust the head gap. (See *"5. Adjustments" (page 5-7.)*)
Corrugated printing	The carriage guide frame is deformed.	Replace the carriage guide frame.
	Frictional wear between the carriage base and carriage shaft.	Replace the carriage unit.
The printout is either light or dark.	Check the printing mode.	Set the desired printing mode.
	The BJ cartridge is defective.	Replace the BJ cartridge.

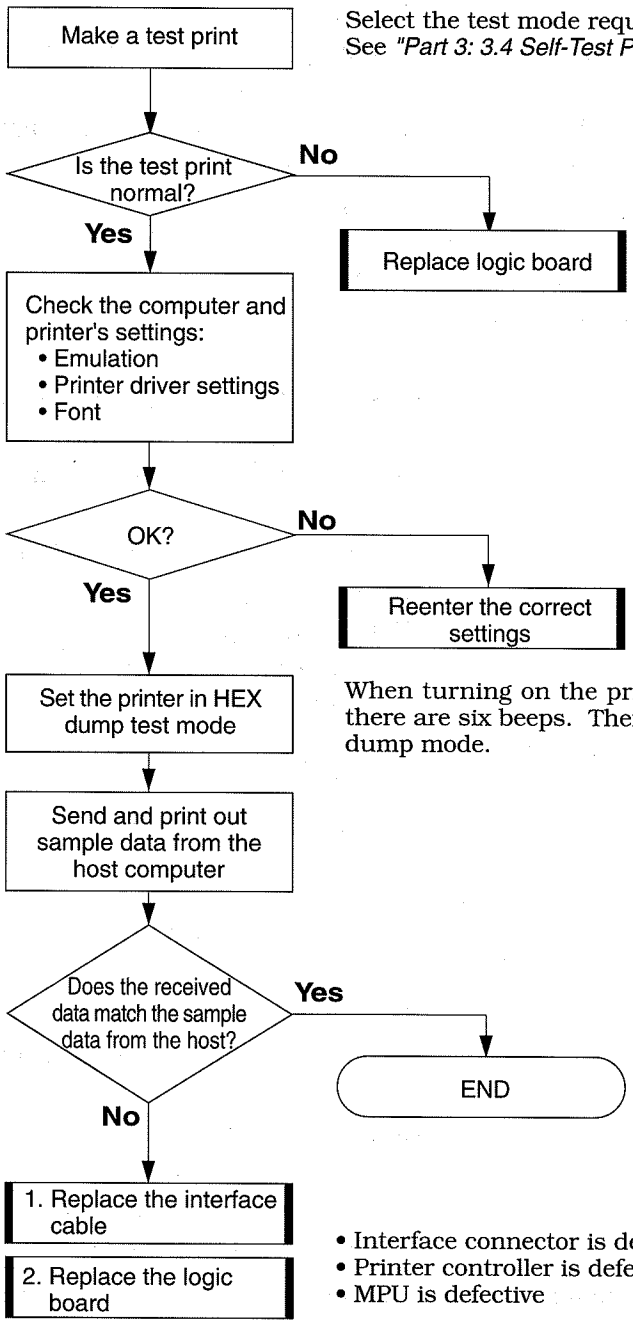
* Checking this is difficult. Readjust the head gap and then check whether it fixes the problem.

6. Defective Interface

<Symptom>
- Nothing is printed.
- An unspecified font is printed.
- An unspecified color is printed.

<Cause>
- The printer driver setting is defective.
- The interface cable is defective.
- The printer's logic board is defective.

<Measure>



Select the test mode required for checking the fault.
See *"Part 3: 3.4 Self-Test Printout" (page 3-21)* for details.

When turning on the printer, hold down the *POWER* button until there are six beeps. Then release the *POWER* button to select HEX dump mode.

- Interface connector is defective
- Printer controller is defective
- MPU is defective

8. Scanner Cartridge: Installation Problems

Symptom	Check Item	Measures
• No head error message	• Scanner cartridge is installed incorrectly.	• Press the cartridge button, move the carriage to the cartridge replacement position and reinstall the cartridge correctly. • Restart using the power button.
• Head mismatch error message	• Scanner cartridge is installed incorrectly.	• Press the cartridge button, move the carriage to the cartridge replacement position and reinstall the cartridge correctly. • Restart using the power button.
	• Driver not set to scanner mode.	• Activate the scanner driver in the host computer. Switch setting to scanner mode.
• Paper feed error message	• Scanning document is jammed.	• Press the RESUME button to erase the error message.
	• Check scanning document size. • Check scanning document thickness.	• Place the document between the scanning folder and rescan.
• Paper delivery error message	• Scanning document is jammed. • Check scanning document length.	• Remove jammed document. • Make sure the scanning document fits within the scanning folder.
• Scanner cartridge error	• Check white calibration sheet. • Check scanner driver setting. • Visually check scanner operation.	• Re-scan while calibration sheet. • Re-input scanner driver setting. • Replace scanner cartridge.
	• Check connection and conductivity of the carriage ribbon cable.	• Replace carriage ribbon cable.
	• Check computer and printer.	• Repair faulty parts.

In BJC-4650 only the color scanner cartridge IS-22 may be used.

7. LOCATION & SIGNAL ASSIGNMENT

7.1 Logic Board

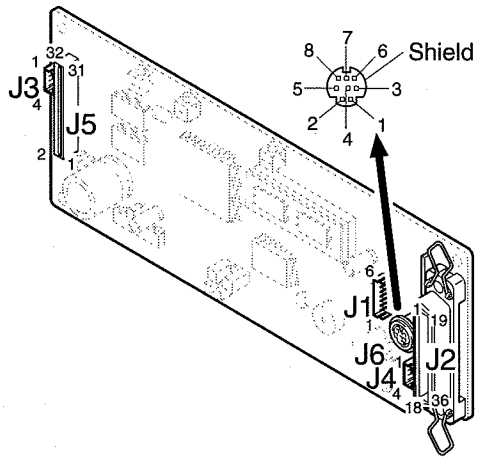


Figure 5-9 Logic Board

J1 (DC power connector)

Pin No.	Signal name	IN/OUT	Function
1	VH-G	...	VH GND
2	VH	IN	Head driver voltage (+24V ±0.25V)
3	VM-G	...	VM GND
4	VM	IN	Motor driver voltage (+24V ±1.2V)
5	S-GND	...	VCC GND
6	VCC	IN	IC and LSI drive voltage (+5V ±0.25V)

J2 (Parallel interface connector)

Pin No.	Signal name	IN/OUT	Function
1	$\overline{\text{STROBE}}$	IN	See *"Part 2: 2.3.1 Parallel Interface" (page 2-14).*
2	DATA1	IN	
≀	≀	≀	
9	DATA8	IN	
10	$\overline{\text{ACKNLG}}$	OUT	
11	BUSY	OUT	
12	P.E.	OUT	
13	SELECT	OUT	
14	$\overline{\text{AUTO FEED XT}}$	IN	
15	N.C.	...	
16	S-GND	...	
17	F-GND	...	
18	+5V	...	
19	$\overline{\text{STROBE}}$-RET	...	
20	DATA1-RET	...	
≀	≀		
27	DATA8-RET		
28	ACKNLG-RET	...	
29	BUSY-RET	...	
30	$\overline{\text{INIT}}$	...	
31	$\overline{\text{INIT}}$	IN	
32	$\overline{\text{FAULT}}$	OUT	
33	S-GND	...	
34	N.C	...	
35	+5V	...	
36	$\overline{\text{SELECT IN}}$	IN	

J3 (Carriage motor connector)

Pin No.	Signal name	IN/OUT	Function
1	CRA	OUT	Carriage motor phase A
2	$\overline{\text{CRA}}$	OUT	Carriage motor phase $\overline{\text{A}}$
3	$\overline{\text{CRB}}$	OUT	Carriage motor phase $\overline{\text{B}}$
4	CRB	OUT	Carriage motor phase B

J4 (Paper feed motor connector)

Pin No.	Signal name	IN/OUT	Function
1	LFA	OUT	Paper feed motor phase A
2	LFB	OUT	Paper feed motor phase B
3	$\overline{\text{LFB}}$	OUT	Paper feed motor phase $\overline{\text{B}}$
4	$\overline{\text{LFA}}$	OUT	Paper feed motor phase $\overline{\text{A}}$

J5 (Ribbon cable connector)

Pin No.	Signal name	IN/OUT	Function
1	VH-G	...	GND for head driver voltage VH
2	VH-G	...	GND for head driver voltage VH
3	HT0	IN	Temperature control heater drive signal
4	HT1	IN	Temperature control heater drive signal
5	VH	OUT	Head drive voltage
6	VH	OUT	Head drive voltage
7	W-HT	OUT	Sub heater drive signal
8	INKS1	...	Not used
9	TOP	IN	Rank resistance detection signal
10	DIODEA	OUT	Head temperature sensor (diode) anode
11	ID0	IN	BJ cartridge (black or color) detection signal
12	ID1	IN	BJ cartridge (black or color) detection signal
13	INKS2	...	BJ cartridge (black or color) detection signal
14	HVss	...	Head's logic drive voltage HVdd GND
15	HENB0 (Y)	OUT	Heat enable (Y)
16	Even ENB	OUT	Even nozzle heat enable
17	HENB1 (M)	OUT	Heat enable (M)
18	HENB3 (B)	OUT	Heat enable (Black)
19	Odd ENB	OUT	Odd nozzle heat enable
20	BENB1	OUT	Block enable decoder's output generation signal
21	BENB2	OUT	Block enable decoder's output generation signal
22	BENB3	OUT	Block enable decoder's output generation signal
23	HVdd	OUT	IC drive voltage (+5V)
24	HCLK	OUT	Print data transfer signal
25	HLATCH	OUT	Shift resistor print data latch timing signal
26	HRES	OUT	Latch reset signal
27	HENB2 (C)	OUT	Heat enable (C)
28	HDATA	OUT	Print data
29	DIODEK	IN	Head temperature sensor (diode) cathode
30	HPO	IN	Home position sense High(sense)/Low
31	HPG	...	Ground
32	HPA	OUT	Photo LED drive

J6 (Serial interface connector)

Pin No.	Signal name	IN/OUT	Function
1	DTR	OUT	Data terminal Ready
2	...	...	Not used
3	TXD–	OUT	Transmit data
4	S-GND	...	GND
5	RXD–	IN	Receive data
6	TXD+	OUT	Transmit data
7	...	...	Not used
8	RXD+	IN	Receive data
Shield	PG	...	Interface cable shield ground

8. CIRCUIT DIAGRAMS

8.1 Parts Layout

8.1.1 Logic board

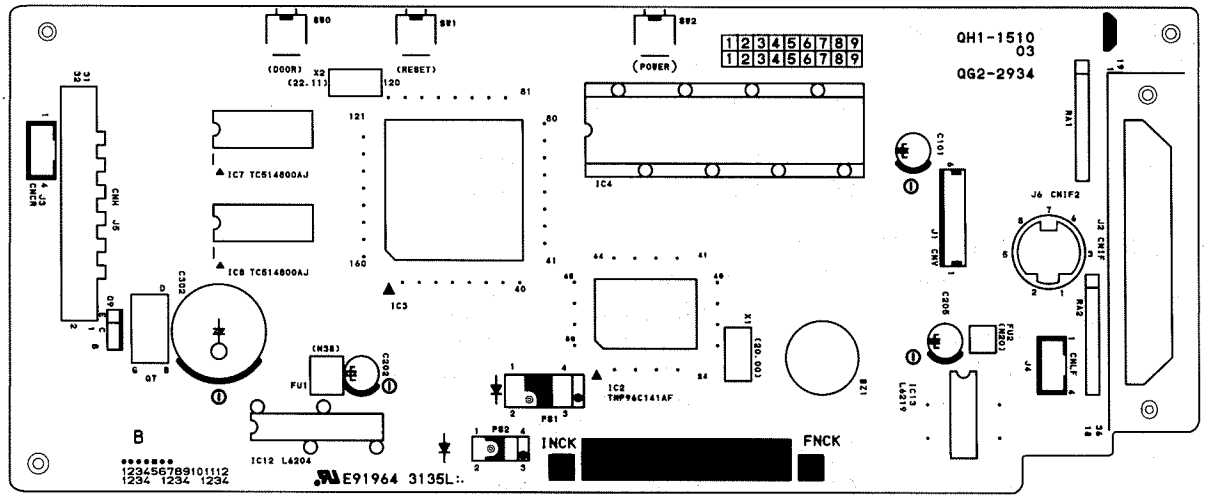


Figure 5-10 Logic Board (Top View)

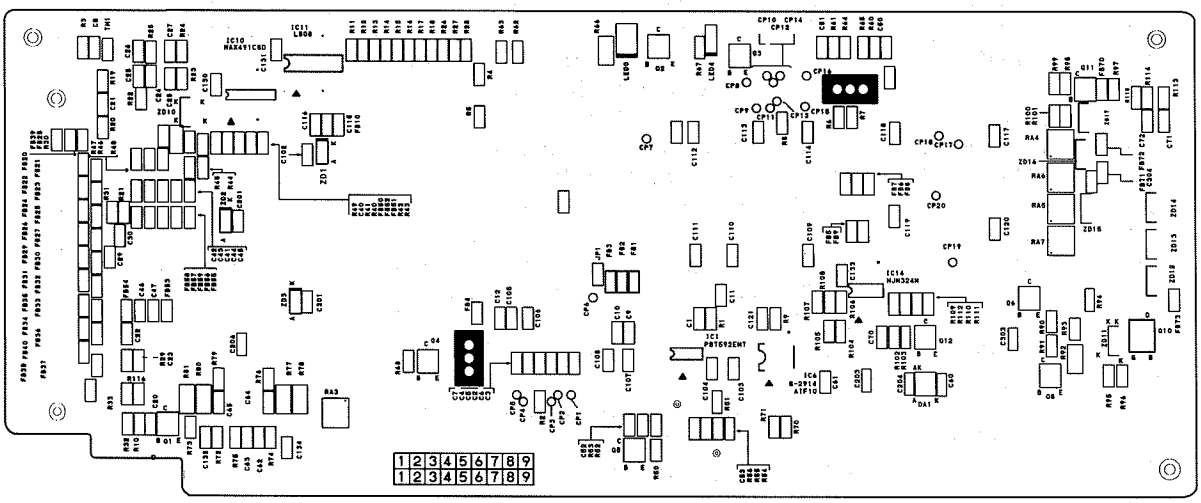
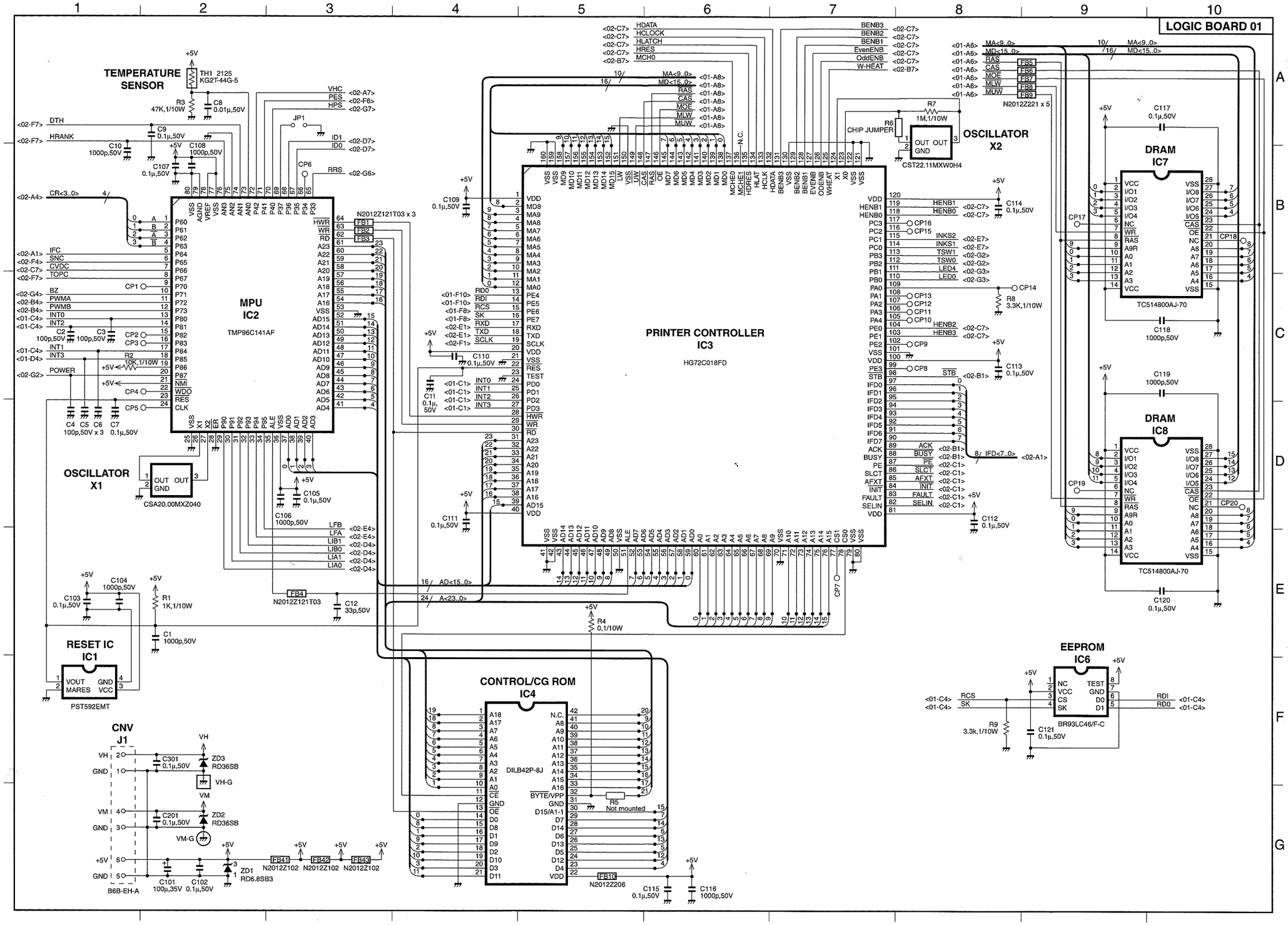
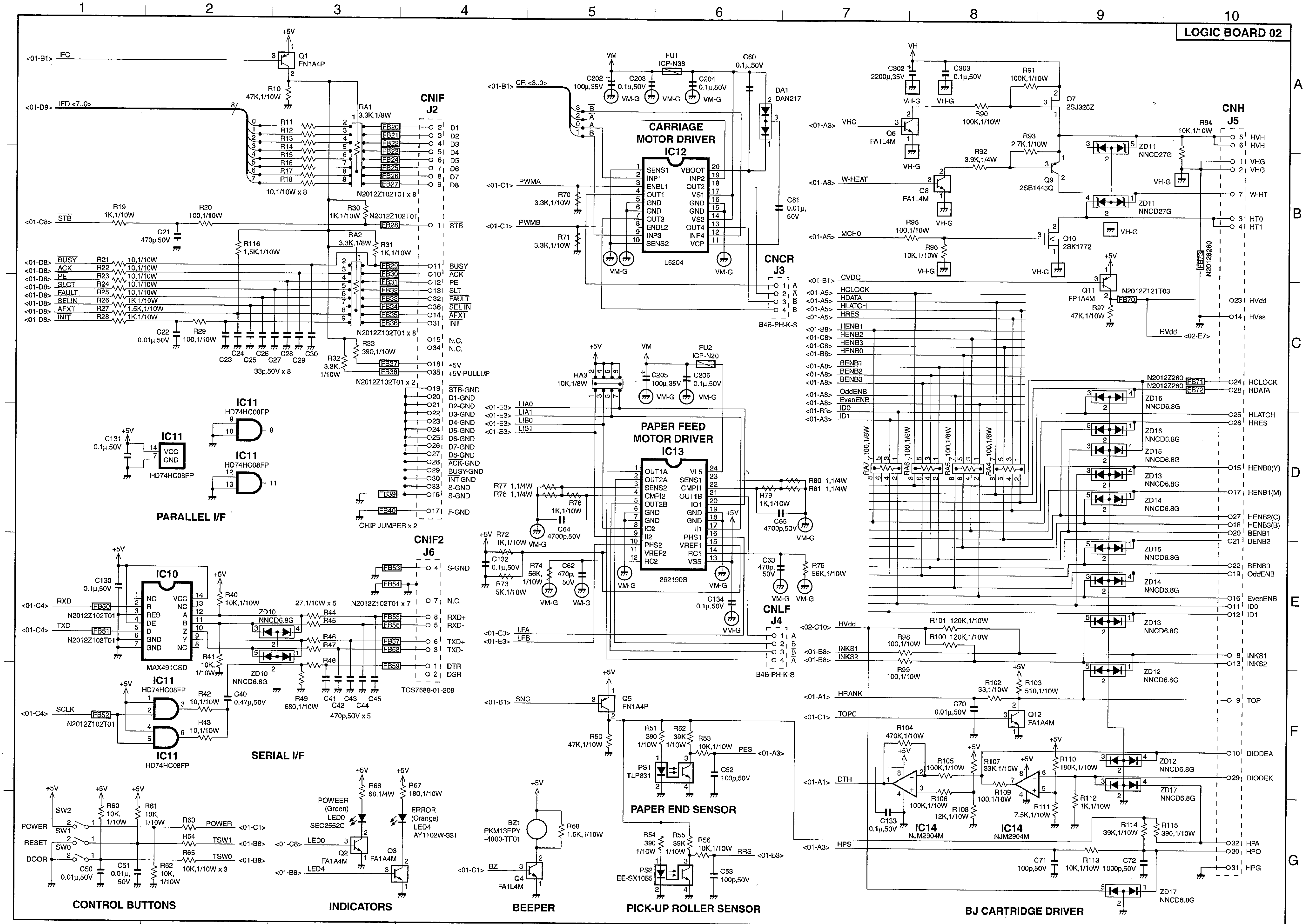


Figure 5-11 Logic Board (Bottom View)

8.2 Circuit Diagrams




LOGIC BOARD 02
CARRIAGE MOTOR DRIVER
IC12
PAPER FEED MOTOR DRIVER
IC13
PARALLEL I/F
SERIAL I/F
CONTROL BUTTONS
INDICATORS
BEEPER
PAPER END SENSOR
PICK-UP ROLLER SENSOR
BJ CARTRIDGE DRIVER
CNIF J2
CNIF2 J6
CNCR J3
CNLF J4
CNH J5

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