

## C O N T E N T S

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# 1 | G E N E R A L I N F O R M A T I O N

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## 1.1. General

The Kyocera page printer combines the long life print drum, developer, and the fuser unit. Its engine has been designed to last longer than any other page printer.

It's a self-reliant, versatile machine with considerable native intelligence. Using its own microprocessor and memory, the printer tests itself and in general, looks after itself with a minimum of help. In case of internal trouble which the user's maintenance activity should be limited, the printer tells the need for attention on its display whether it is caused of mechanism (*E* codes) or controller electronics error (*F* codes). Corrective actions that should be taken against these messages are explained in *Chapter 6 Troubleshooting*.

## 1.2. Precautions on Service and Maintenance

Observe the precautions which follow before and during service and maintenance to prevent personal injury to the technician and damage to the printer.

### 1.2.1. General Precautions

Only a qualified technician should perform the service on the printer, who is familiar with fundamental safety countermeasures as dictated for electronics technicians.

### 1.2.2. Notes on Power Source

- \* Use only the power source voltage conforming to the printer's rated power voltage. Do not use other power sources.
- \* Disconnect the printer from the power source before attempting removal or replacement of an electrical component or a printed-circuit board.
- \* The printer should not be connected to a power source until the instruction is given to do so when performing tests described in this manual.
- \* In connecting the printer power, exercise an extreme care in handling the power supply or any other electric parts which may give an electric shock.
- \* Before performing maintenance or repair, power from both the power source and the associated peripheral devices (computer, sorter, etc.) should be disconnected, unless otherwise specified.
- \* To avoid possible electrical shock, extreme caution must be exercised in handling the power cord and any other electrical part.

### 1.2.3. Static

Use antistatic (discharging) tools, e.g., an antistatic wrist belt, when handling printed-circuit boards to discharge the human body.

### 1.2.4. Replacement Parts

Replace the components with only the manufacturer's recommended components. Use of non-recommended parts will void the printer's warranty.

### 1.2.5. Notes on Handling the Drum Unit

- \* Avoid impact on the drum unit.
- \* To avoid scratching the drum, keep it away from hard object.
- \* Do not touch the surface of the drum cartridge. When the drum gets dirty, wipe it with a cloth slightly soaked in isopropyl alcohol.

### 1.2.6. Toner

**Caution:** The Ecosys printer needs the special toner that contains drum cleaning substances in order that the optimum print quality and machine life are assured. We recommend using only proprietary Kyocera Microfine Ceramic Toner (TK-12).

- \* Shake the toner container well (in the horizontal direction) before use.
- \* The toner container should be stored in areas of low temperature and humidity. On how to add toner in the developer, refer to the printer's *USER MANUAL*.

### 1.2.7. Removing the Printer

Observe the following precautions in removal and transportation of the printer.

- \* When removing the printer, remove the trays and the developer unit from the printer. To remove the developer unit, see *Chapter 5 Disassembly*.
- \* Be sure to repack the printer in its original carton. The repacking procedure is printed on the carton.
- \* Do not leave the printer, toner container, and other printer components inside a vehicle if the outdoor temperature is more than 25° C or 77° F. As an unexpectedly high temperature may develop inside when a vehicle is parked for a long period of time, the drum, toner, and the supplies should be removed from the vehicle. The vehicle during transportation should be parked in the shade or with the windows open to allow minimum air circulation or the adequate air conditioning should be made.
- \* Should the printer be left in a vehicle, it may not be exposed to a temperature change of greater than 7°C or 44° F within 30 minutes.
- \* Before removing the printer to a warm place, wrap it in a blanket, etc., before crating it. Allow approximately two to three hours after having moved after uncrated. Failure to observe the above may result in moisture condensation which will affect the performance of the printer.

### 1.2.8. Storage

The printer, drum unit, toner container, and other modules should be stored keeping the following in mind:

- \* Store the printer in the original carton.
- \* Do not stack more than six cartons. Do not stand the carton upside-down or sideways.
- \* Ship the earlier carton first.
- \* Store the printer in cool, dark, and low humidity area.
- \* Avoid areas where excessive dust may develop.
- \* Avoid areas where ammonia or organic gas may develop.

## 1.3. Paper

The page printer is designed to print on high-quality copier bond paper (the kind used in ordinary dry copier machines), but it can accept a variety of other types of paper as well within the limits specified below.

Note: Kyocera assume no liability for problems that occur when paper not satisfying these requirements is used with the printer.

Selection of the right paper is important. The wrong paper can result in jams, misfeeds, curl, poor print quality, and paper waste, and in extreme cases can damage the printer. The guidelines given below will increase the productivity of your office by ensuring efficient, trouble-free printing and reducing wear on the printer.

### 1.3.1. Paper Availability

Most types of paper are compatible with a variety of machines. Paper intended for xerographic copiers and small offset duplicators can also be used with the printer.

There are three general grades of paper: economy , standard , and premium . The most significant difference between grades is the ease with which they pass through the printer. This is affected by the smoothness, size, and moisture content of the paper, and the way in which the paper is cut. The higher the grade of paper you use, the less risk there will be of paper jam and other problems, and the higher the level of quality your printed output will reflect.

Differences between paper from different suppliers can also affect the printer's performance. A high-quality printer cannot produce high-quality results when the wrong paper is used. Low-priced paper is not economical in the long run if it causes printing problems.

Paper in each grade is available in a range of basis weights (defined later). The traditional standard weights are 16, 20, and 24 pounds.

The following table summarizes the basic paper specifications. Details are given on the following pages.

Table 1.1. Paper availability

Item	Specification
Weight	60 to 90 g/m <sup>2</sup> (16 to 24 lbs/ream)
Thickness	0.086 to 0.110 mm (3.4 to 4.3 mils)
Dimensional accuracy	± 0.7 mm (± 0.0276 inches)
Squareness of corners	90 ± 0.2°
Moisture content	4 to 6%
Direction of grain	Long grain
Pulp content	80% or more

### 1.3.2. Selecting the Right Paper

Printing with the page printer is a process involving LED light, electrostatic discharge, toner, and heat. In addition, as the paper passes through the printer it undergoes considerable sliding, bending, and twisting motions. A high-quality printing paper matching the printer's requirements with-stands all these stresses, enabling the printer to turn out clean, crisp printed copy consistently.

Remember that all paper is *not* the same. Some of the factors to consider when selecting paper for the printer are as follows:

#### Condition of the paper

Avoid using paper that is bent at the edges, curled, dirty, torn, or contaminated with lint, clay, or paper shreds.

Use of paper in these conditions can lead to illegible printing, misfeeding, and paper jams, and can shorten the life of the printer. In particular, avoid using paper with a surface coating or other surface treatment. The paper should have as smooth and even a surface as possible.

#### Composition

Do not use paper that has been coated or surface-treated and contains plastic or carbon. The heat of fusing can cause such paper to give off harmful fumes.

Bond paper should contain at least 80% pulp. Not more than 20% of the total paper content should consist of cotton or other fibers.



## Paper size

The printer accepts the paper sizes listed below for automatic feed. The dimensional tolerances are  $\pm 0.7$  mm ( $\pm 0.0276$  inches) for the length and width. The angle at the corners must be  $90 \pm 0.2^\circ$ .

Table 1.2. Paper size

Size	Cassette
Letter	8.5 × 11 inches
Legal	8.5 × 14 inches (The optional paper cassette must be used.)
JIS A4	21 × 29.7 cm
JIS B5	18.2 × 25.7 cm
JIS A5	14.8 × 21 cm

Other sizes of paper can be fed manually. The minimum size of manually fed paper is 8 × 14.8 cm (3.1 × 5.8 inches), fed lengthwise. The maximum size is 21.6 × 35.6 cm (8.5 × 14 inches).

The printer recognizes paper sizes as commanded by the front panel MODESELECT, but regards all manually fed paper as having the Legal size.

## Smoothness

The paper should have a smooth, uncoated surface.

Paper with a rough or sandy surface can cause voids in the printed output. Paper that is too smooth, however, can cause multiple feeding and fogging problems. (Fogging is a gray background effect.)

## Basis weight

Basis weight is the weight of a standard quantity of paper. In the traditional system the standard quantity is a ream consisting of 500 sheets measuring 17 × 22 inches each. In the metric system the standard quantity is 1 square meter.

Paper that is too light or too heavy can cause misfeeding, jams, multiple feeds, print defects, poor toner fusing, blurring, and other print quality problems. The proper weight is: 60 to 90 g/m<sup>2</sup> (16 to 24 lbs/ream).

## Thickness (Caliper)

Thick paper is referred to as high-caliper paper and thin paper as low-caliper paper. The paper used with the printer should be neither extremely thick nor ex-

tremely thin. If you are having problems with paper jams, multiple feeds, and faint printing, the paper may be too thin. If you are having problems with paper jams and blurred printing the paper may be too thick. The proper thickness is: 0.086 to 0.110 mm (3.4 to 4.3 mils).

### Moisture content

Moisture content is defined as the percent ratio of moisture to the dry mass of the paper. Moisture can affect the paper's appearance, feedability, curl, electrostatic properties, and toner fusing characteristics.

The moisture content of the paper varies with the relative humidity in the room. When the relative humidity is high and the paper absorbs moisture, the paper edges expand, becoming wavy in appearance. When the relative humidity is low and the paper loses moisture, the edges shrink and tighten, and print contrast may suffer.

Wavy or tight edges can cause misfeeding and alignment anomalies. The moisture content of the paper should be: 4% to 6%.

To ensure the proper moisture content it is important to store the paper in a controlled environment. Some tips on moisture control are:

- \* Store paper in a cool, dry location.
- \* Keep the paper in its wrapping as long as possible. Rewrap paper that is not in use.
- \* Store paper in its original carton. Place a pallet etc. under the carton to separate it from the floor.
- \* After removing paper from storage, let it stand in the same room as the printer for 48 hours before use.
- \* Avoid leaving paper where it is exposed to heat, sunlight, or damp.

### Paper grain

When paper is manufactured, it is cut into sheets with the grain running parallel to the length (long grain) or parallel to the width (short grain). Short grain paper can cause feeding problems in the printer. All paper used in the printer should be long grain. Direction of grain should be long.

### Other paper properties

*Porosity:* Refers to the density of the paper structure; that is, to how openly or compactly the fibers are bonded.

*Stiffness:* Limp paper can buckle inside the printer, while paper that is too stiff may bind. Either way the result is a paper jam.

*Curl:* Most paper has a natural tendency to curl in one direction. The paper should be loaded so that the natural curl is downward, to counteract the upward curl imparted by the printer. Printed sheets will then come out flat. Most paper

also has a top and bottom surface. Loading instructions are usually given on the paper package.

*Electrostatic properties:* During the printing process the paper is electrostatically charged to attract the toner. The paper must be able to release this charge so that printed sheets do not cling together in the output tray.

*Whiteness:* The contrast of the printed page depends on the whiteness of the paper. Whiter paper provides a sharper, brighter appearance.

*Quality control:* Uneven sheet size, corners that are not square, ragged edges, welded (uncut) sheets, and crushed edges and corners can cause the printer to malfunction in various ways. A quality paper supplier should take considerable care to ensure that these problems do not occur.

*Packaging:* Paper should be packed in a sturdy carton to protect it from damage during transport. Quality paper obtained from a reputable supplier is usually properly packaged.

### 1.3.3. Special Paper

The following types of special paper can be used:

- \* Recycled paper
- \* Overhead projection (OHP) film
- \* Adhesive-backed label paper
- \* Envelopes
- \* Colored paper
- \* Preprinted paper

Use paper that is sold specifically for use with copiers or page printers (heat-fusing type). OHP film, label paper, and envelopes should not be placed in the cassette; they must be fed manually<sup>1</sup> and stacked face up.

<sup>1</sup> The option envelope feeder EF-1/UF-1 allows the printer to automatic feed envelopes.

Since the composition and quality of special paper vary considerably, special paper is more likely than white bond paper to give trouble during printing. No liability will be assumed if moisture etc. given off in printing on special paper causes harm to the machine or operator.

**Note:** Before purchasing any type of special paper, test a sample on the printer and check that printing quality is satisfactory.

Specifications for each type of special paper are given below.

#### Recycled paper

Select recycled paper that meets the same specifications as the white bond paper except whiteness.

#### Overhead Projection (OHP) Film

OHP film must be able to withstand the heat of fusing during the printing process. It should satisfy the conditions provided below.

Table 1.3. Overhead projection film specifications

Item	Specification
Tolerance of heat	Must tolerate at least 190° C (374° F)
Thickness	0.100 to 0.110 mm (3.9 to 4.3 mils)
Dimensional accuracy	±0.7 mm (±0.0276 in)
Squareness of corners	90 ±0.2°

To avoid trouble, OHP film must be delivered face-down.

If OHP film jams frequently, pull the top of the sheet very gently as it leaves the printer.

#### Adhesive-Backed Labels

The basic rule for printing on adhesive labels is that the adhesive must never come into contact with any part of the printer. Adhesive paper sticking to the drum or rollers will damage the printer.

Label paper must be manually fed.

Label paper has a structure consisting of three layers, as shown in Figure 1.1. below. The top sheet is printed on. The adhesive layer consists of pressure-sensitive adhesives. The carrier sheet (also called the linear or backing sheet) holds the labels until use. Due to the complexity of its composition, adhesive-backed label paper is particularly likely to give trouble in printing.

Adhesive label paper must be entirely covered by its top sheet, with no spaces between the individual labels. Labels with spaces in between are apt to peel off, causing serious jam problems. See Figure 1.2. below.

Figure 1.1. Adhesive-backed Label

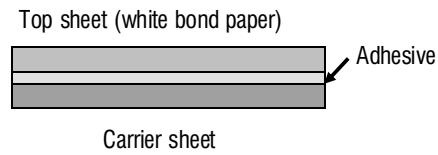
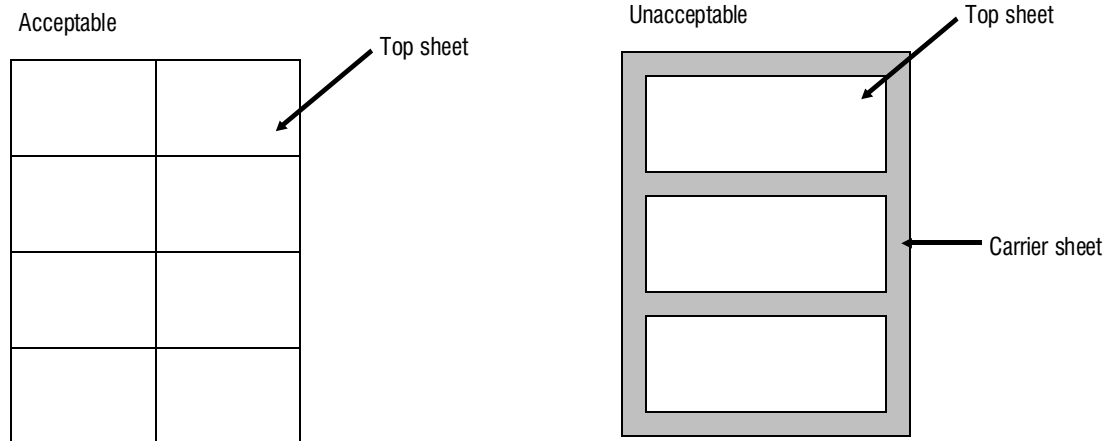


Figure 1.2. Label Arrangement



Some label paper is manufactured with an extra margin of top sheet around the edge. Do not remove the extra top sheet from the carrier sheet until after printing is finished.

The table below lists the specifications for adhesive label paper.

Table 1.4. Adhesive-label specifications

Item	Specification
Weight of top sheet	44 to 74 g/m <sup>2</sup> (12 to 20 lbs/ream)
Composite weight	104 to 151 g/m <sup>2</sup> (28 to 40 lbs/ream)
Thickness of top sheet	0.086 to 0.107 mm (3.9 to 4.2 mils)
Composite thickness	0.115 to 0.145 mm (4.5 to 5.7 mils)
Moisture content	4% to 6% (composite)

## Envelopes

The printer can print on envelopes using paper with a basis weight of 60 to 79 g/m<sup>2</sup> (16 to 21 lbs/ream). Envelopes must be manually fed.

An envelope is a more complex object than a single sheet of paper. For this reason, it may not be possible to obtain consistent printing quality over the entire envelope surface.

Many envelopes have a diagonal grain orientation. (See Paper Grain above.) This orientation is more likely to wrinkle and crease on its way through the printer. Before purchasing envelopes for use with the printer, test a sample to verify the envelope's suitability.

Do not use envelopes having an encapsulated liquid adhesive.

Avoid long printing runs consisting of envelopes only. Extensive envelope printing can cause premature printer wear.

To avoid jam due to curled envelopes, do not leave more than approximately 10 printed envelopes stacked in the face-up paper tray during multiple printing the envelopes.

## Colored Paper

Colored paper should satisfy the same conditions as white bond paper. In addition, the pigments used in the paper must be able to withstand the heat of fusing during the printing process (up to 190° C or 374° F).

## Preprinted Paper

Preprinted paper should have a bond paper base. The preprinted ink must be able to withstand the heat of fusing during the printing process, and must not be affected by silicone oil.

Do not use paper with any kind of surface treatment, such as the type of paper commonly used for calendars.

## 1.4. Maintenance Schedule

The Ecosys printer does not normally require periodic replacement of the drum, developer, fuser, etc. Only maintenance needed on schedule is to add toner when the toner supply in the developer dwindles.

### 1.4.1. Supplying Toner

When the printer begins to run low on toner, the message display displays *Warning Low Toner TK-12*. At the earliest convenient opportunity after this message is shown, the toner supply in the developer unit must be replenished by installing a new toner kit TK-12.

The Ecosys printer requires drum cleaning toner in order to guarantee optimum machine performance and print quality. We recommend using only proprietary Kyocera Microfine Ceramic Toner (TK-12).

To supply toner in the developer, refer to the printer's *User Manual*.

#### Toner supply interval

Approximate toner supply interval is every 10,000 pages (depending on the amount of printing per page: Approximately 5%).

#### On the toner kit

Kyocera Toner Kit TK-12 contains a toner container, a cap (to seal the old toner container), and an instruction sheet (5 languages).

## 1.5. Jigs and Tools

The following tables summarize jigs and tools available for Ecosys printers. See the regional Kyocera office for availability.

### Table 1.5. Jigs and Tools

[illegible]



[illegible]

## 1.6. Product information

### 1.6.1. General

The Kyocera page printer is primarily designed for minimum requirement of replenishment or consumables. The only maintenance needed is to periodically replenish the toner supply. This ensures reduction of the down time which may require unexpected repair.

The printer is a self-reliant, versatile machine with considerable native intelligence. Using its own microprocessor and memory, the printer tests itself and in general, looks after itself with a minimum of help.

In case of internal trouble which the user's maintenance activity should be limited, the printer tells the need for attention on its display whether it is caused of mechanism or controller electronics error (Chapter 6).

### 1.6.2. Printer Features

This Kyocera page printer features one of the newest and best computer printing technologies. Printing can be found faster, quieter, and much more versatile, and the near-typeset quality and excellent graphics will be really appreciated by a wide range of users.

The Kyocera printer also has many extremely desirable features. (For technical specifications, refer to section 1.5.3. which follows.) These include:

*High speed:* A4-size pages typically print at the rate of 10 (Series 1550) or 18 pages per minute (Series 3400). (Actual time required varies according to page complexity.)

*Large paper capacity:* The printer accommodates the paper feed cassette with a capacity of 250 sheets of 75g/m<sup>2</sup>. It also provides a face-down output tray and a face-down output tray.

*Wide print media variety:* In addition to standard paper, the printer prints on special media of a wide range of types and sizes, including envelopes, labels, and OHP film.

*Superb print quality:* The printer's combination of the Kyocera's state-of-the-art technologies, such as the amorphous silicon drum and micro fine ceramics toner, dynamically driven micro LED printing head, multiple component developing system, and KIR (Kyocera Image Refinement), provides sharpness and consistency that is unmatched by other printer maker.

#### Software features

*Bitmapped and scalable typefaces:* In addition to its 79 internal bitmap fonts, the printer provides 13 fully-scalable resident typefaces. The scalable typefaces can

be used at any size desired to 999.75 points, in 0.25-point increments.

*A new printer control language:* PRESCRIBE II features including advanced graphics capabilities that allow you to print any conceivable outline shape or solid form. Also provided are a variety of special effects, such as patterned fills, gray-scale shading, a user-accessible print image model, and multiple page orientations and print directions within the same page.

*Automatic rotation of fonts and graphics:* Images and scalable fonts are automatically rotated to match the page orientation.

*A wide variety of internal symbol sets:* The printer supports most of the Hewlett-Packard LaserJet III compatible symbol sets for both bitmap and scalable fonts.

*Display of printer messages in any of seven languages:* The message display tells various information in any of English, French, and German.

*Two IC card slots for option fonts, macros, fonts, etc.:* Data in the IC cards can be selectively reread from the printer's control panel.

*Large memory:* 1MB of base memory, expandable with optional SIMMs to a maximum capacity of 5 megabytes.

*Multiple interface:* Standard serial, Centronics, and an option interface for simultaneous use of the printer by different computers.

*Simple network management protocol (SNMP) compliance* [Plus version only]: Offers network managers complete open system network management.

### Maintenance features

*Compact design:* Thanks to the inboard paper feed cassette, the printer's compact design requires less space to occupy.

*Ultra long life modules:* The main modules for developing image and printing, such as the drum, developer, and the fuser, are specifically designed to ensure extraordinarily long life and no periodic replacement. The drum is made of amorphous silicon which is environmentally transparent and never wears out even after several hundred thousand pages of printing are made. The only maintenance regularly needed is to replenish the toner supply in the developer every approximately 10,000 pages and cleaning some parts inside the printer.

*Safe and clean waste:* The toner supply container and the waste toner bottle are made of a burnable material which generates no harmful gas when burning.

### Options

- \* Paper cassette PC-7: Available in either A5, B5, A4, letter, or letter/legal size.
- \* Paper feeders PF-5/PF-7
- \* Universal feeders EF-1/UF-1
- \* Sorter SO-6
- \* 2000-sheet bulk stacker HS-3

- \* Duplexer DU-1
- \* Face-down path adaptor PA-4 (for DU-1)
- \* KPDL upgrade kit PK-2: Upgrades the printer for compatibility to the Post-Script® command language; includes ROMs and fonts.
- \* PCL font ROM FR-1
- \* AppleTalk® interface board IB-3
- \* Network printer interface board IB-4 (Ethernet 802.3 or II compatible, BNC or UTP cabling)
- \* Network printer interface board IB-5 (Ethernet 802.3 or II compatible, AUI cabling)
- \* Network printer interface board IB-6 (Token Ring compatible, Type-1 cabling)
- \* SCSI interface board IB-7
- \* High-speed parallel interface board IB-8
- \* RS-232C interface board IB-9

**Related documentation**

- \* Ecosys FS-1550/1600/3400/3600 series combined User's Manual
- \* PRESCRIBE II Programming Manual

## 1.6.3. Printer Specifications

	Item	Description	
		FS-1550 series	FS-3400 series
Engine	Printing method	Electrophotography, LED direct scan	
	Printing speed (A4 or letter-size paper, when printing multiple copies of the same page)	10 pages/minute	18 pages/minute
	Resolution	300 dots/inch (vertical and horizontal) with KIR (Kyocera Image Refinement)	
	First print (A4 or letter size), depends on input data	Approx. 20 seconds	Approx. 17 seconds
	Warm-up time (at 20° C)	120 seconds or less	150 seconds or less
	Duty cycle	25,000 pages/month	50,000 pages/month
	Developer	Multi-component dry developer	
	Main charger	Scorotron charger	
	Transferring	Charger roller	
	Separation	Curvature separation	
	Drum cleaning	Blade cleaner	
	Drum discharging	Illumination by eraser LED array	
	Fuser	Heat roller and pressure roller	
	Paper	Plain paper. See section 1.3.	
	Paper feed tray	A4 or letter size. Holds up to 250 sheets of weight 75g/cm <sup>2</sup> , thickness 0.1 mm.	
	Capacity of output trays	Face-down tray: 250 sheets; Face-up tray: 250 sheets	
Miscellaneous	Ambient conditions	Temperature: 10 to 32.5° C (50 to 90.5°F) Humidity: 20 to 80 % RH Optimum conditions: 20° C and 65 % RH Altitude: 2000 m Illumination: Max. 1500 lux	
	Power requirements (Max. allowable voltage fluctuation: ±10%; Max. allowable frequency fluctuation: ±2%)	120V, 60Hz, max. 5 A (US/Canada) 220-240V, 50/60Hz, max. 2.5 A (Europe)	120V, 60Hz, max. 8 A (US/Canada) 220-240V, 50/60Hz, max. 4 A (Europe)
	Power consumption	Max. 550 W 15 W during sleeping	Max. 960 W 19 W during sleeping
	Noise (Measured 1 m from the outside of the printer)	Max. 50 dB (A) when printing (excl. peak values) Max 37 dB (A) when idling/sleeping (excl. peak values)	Max. 53 dB (A) when printing (excl. peak values) Max 39 dB (A) when idling/sleeping (excl. peak values)
	Dimensions	220 mm (8.7") high 345 mm (13.6") wide 350 mm (13.8") deep (Excl. protrusions)	
	Weight	11 kg (24 lbs.)	

	Item	Description	
		FS-1550 series	FS-3400 series
Controller	Controller	MC68EC020 (16.5 MHz) + Engine: $\mu$ PD78002	
	System ROM size	1 MB (4Mbit by 2)* <sup>1</sup>	
	Font ROM size	2 MB (16 Mbit by 1); 16-bit bus; 13 outline fonts+79 bitmap fonts* <sup>2</sup>	
	Option fonts	2 IC sockets First: 2MB (16 Mbit by 1), 16-bit bus; for FR-1 or PK-4* <sup>3</sup> Second: 4Mbit by 1 for customizing EPROM (The device type should be same as the system ROM.)	
	Main RAM	1 MB (4Mb by 2) expandable up to 5MB	
	Option RAM	One slot for PC SIMM: 1, 2, or 4 MB.	One slot for PC SIMM: 1, 2, 4, or 8 MB.
	SRAM	64 kbits	
	IC card	One slot (JEIDA 4.0/PCMCIA 1.0 compatible)	
	Host interface	Standard Centronics interface and an option interface	High-speed Centronics interface and an option interface
	Front control panel config.	One LCD: 16 char. by 2 rows, 12 keys, 13 LED's, trilingual message (English, German, French)	
	Native page description language	Prescribe II	
	Standard emulation modes	Line printer, IBM Proprinter X-24E, Diable 630, Epson LQ-850, HP LaserJet III	
	Optional emulation	KPDL (PostScript)	
	Gate arrays	16 by 16 rotation, ALU, pattern generator, print model, KIR, EcoPrint (included within the controller GA), reverse sweeping-out, high-speed Centronics interface control (only for the FS-3400/A)	

\*<sup>1</sup> Mask-ROM (compatible with EPROM in consideration of firmware modification)

\*<sup>2</sup> Compatible with the mask-ROM for FS-400, FS-850, and FS-1500.

\*<sup>3</sup> FR-1 includes 46 outline and 8 bitmap PCL fonts. PK-4 includes 47 outline PostScript compatible fonts.