Infoprint 3000

Theory of Operations

Third Edition (April 2000)

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Chapter 1. Overview

Infoprint 3000 printers are:

- All-points-addressable
- Continuous forms
- Host computer system attached via Parallel Channel, ESCON Channel, Token Ring TCP/IP, Ethernet TCP/IP or FDDI TCP/IP features
- nonimpact

These printers are available in two types: a simplex printer system (one printer engine and one host-system-attached control unit) and a duplex printing system (two printer engines each attached to a cross-coupled control unit, one of which is host-system-attached).

The following table summarizes printer specifications:

Table 1. Printer Specification Summary

	Paper Weight		Forms Speed		Forms Width		Forms Length Stacking	
					Min.	Max.	Min.	Max.
Model	**gm/m²**	**lbs.**	**cm/sec**	**in./sec**	**mm (in.)**	**mm (in.)**	**mm (in.)**	**mm (in.)**
Simplex 112 ppm	60-160	16-42	82.55	32.5	203 (8)	457 (18)	179 (7)	356 (14)
Duplex (112 ppm)	68-105	18-28	82.55	32.5	229 (9)	457 (18)	179 (7)	356 (14)
Prt 1 Simplex 112 ppm	60-160	16-42	82.55	32.5	203 (8)	457 (18)	179 (7)	356 (14)
Prt 2 Simplex 112 ppm	60-105	16-28	82.55	32.5	203 (8)	457 (18)	179 (7)	356 (14)

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The Infoprint 3000 printers print only on continuous forms. On the simplex system, the print line is 7 to 17 inches on forms 8 to 18 inches wide. On duplex printing systems, the print line is 8 to 17 inches on forms 9 inches to 18 inches wide.

The stacker can stack forms that are 7 to 14 inches long. The printer can print on forms longer than 14 inches, such as A3 size forms, but a postprocessor is required for longer forms. The printer uses forms in the ranges shown in Table 1 on page 7 and also can print on many special-purpose materials, such as preprinted forms and adhesive labels.

The printer can print up to 28 in long with a special feature enabled. This feature is provided free of charge on every Infoprint 3000.

Electrophotography

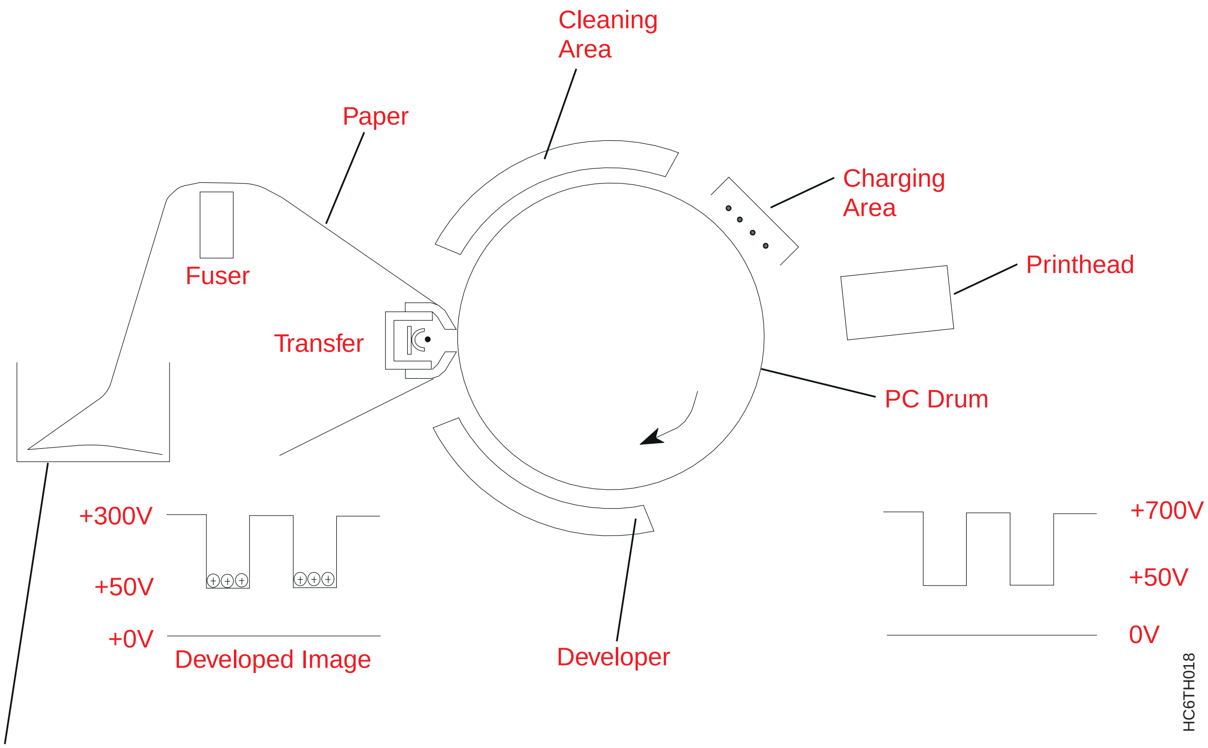


Figure 1. Principles of Electrophotographic Process

The principle of electrophotographic (EP) printing is shown in Figure 1. The electrophotographic print process requires six basic steps:

1. Charging

High-voltage is supplied to the charging area to provide an even, positive electrostatic charge on the surface of the photoconductor drum. The coating on the surface of the drum is a photoconductor (PC). The charge ranges between 500 and 950 volts, as required by the usage of the developer mix and the desired contrast.

2. Exposing

The printhead exposes the PC drum to light in the areas in which printing is desired. The printhead produces the light as pulses to form exposed areas on the PC. The length of the pulses (the time the light is on) is determined by the number of consecutive picture elements that must be printed.

At each point where the light from the print head strikes the PC surface, the electrostatic charge on the PC discharges, and a latent electrostatic image forms, such as light produces a latent image on photographic film. The voltage at each of the exposed areas in the latent image is discharged to about 50 Volts.

3. Developing

As the drum rotates, it passes the developer mechanism, which deposits toner on the areas of the PC that have been exposed to light.

Developer mix is brought into contact with the PC by a rotating magnetic roller called a mag brush. Positively charged toner is attracted to the sections of the PC that are discharged during the exposure process. The latent electrostatic image becomes visible on the PC and is called the developed image.

4. Transferring

At the transfer station, a high voltage transfers the toner to the paper.

The transfer station places a negative charge on the back of the forms. The positively charged toner transfers from the PC to the forms.

5. Fusing

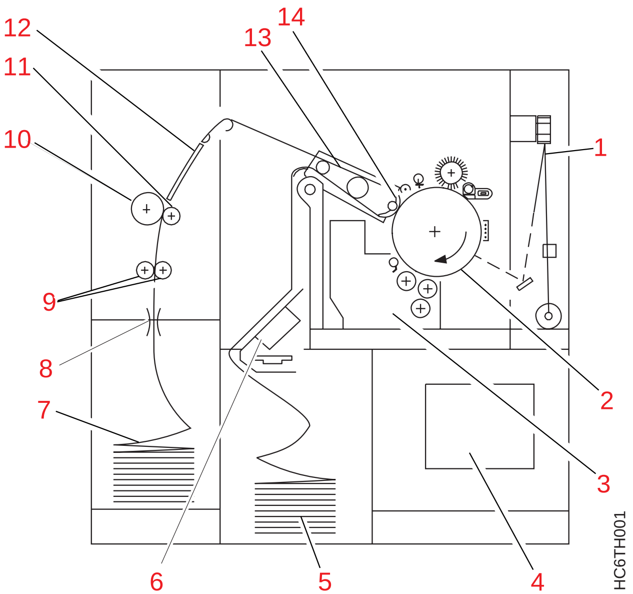
After the toner transfers to the paper, the paper goes to the fuser. The fuser preheats the paper, then applies heat and pressure to melt the toner and press it into the fibers of the paper. After the toner is fused to the paper, the paper is directed into a stacker to be stacked.

6. Cleaning

About 80% of the toner in the developed image is transferred to the paper. The rest remains on the PC drum. The drum passes under the cleaning area. The charge on the untransferred toner is neutralized by alternating current (ac) voltage. The toner is mechanically removed from the drum by a cleaner brush. An erase lamp before the cleaner station discharges the PC to a uniform condition.

Forms Drive

Table 2. Elements in the Forms Path



- **(1)** - Printhead
- **(2)** - Drum
- **(3)** - Developer
- **(4)** - Power Supply
- **(5)** - Input Forms Area
- **(6)** - Splicing Station
- **(7)** - Output Stacker Area
- **(8)** - Pendulum
- **(9)** - Scuff Rolls
- **(10)** - Hot Roll
- **(11)** - Backup Roll
- **(12)** - Preheat Platen
- **(13)** - Transfer Station
- **(14)** - Retractor

The forms are lifted and driven through the transfer station **(13)** by the tractors.

During the transfer operation, the retractor **(14)** is extended so that the forms come in contact with the toner on the PC drum **(2)**. The tension arm applies tension to the forms between the tractors and the fuser.

The forms travel over the preheat platen **(12)** and into the fuser. The hot roll **(10)** is driven and pulls the forms coming from the tractors.

During the fusing process, the backup roll **(11)** is lifted against the hot roll on the steering arms. The forms are steered by changing the pressure at either end of the backup roll through the steering arms.

The scuff rolls **(9)** feed the forms to the stacker and pull the forms when the backup roll is unloaded.

The pendulum **(8)** in the upper part of the stacker refolds the fused forms. The stacker table slowly lowers during printing to keep the top of the stack in the same place.

Page Synchronization and Customer Billing

Page synchronization in a duplex printing system is kept by printing exactly a known number of print cycles. To achieve this, many “nonprint” operations are performed by actually printing blank pages. This causes the billing meters of both machines to be incremented. Any NPRO, thread, or single-form advance operation causes the billing meters of both machines to run. This is true only while the machine is in duplex mode.

When the printer is in simplex mode, the billing meter increments only when the printer is actually printing. It does not increment during NPRO or forms-advance operations.

The form advance pushbuttons on the printer control panel do not cause billing meters to increment. If they are pressed after the duplex printing system has been threaded, page synchronization may be lost.

The operator can check page synchronization by printing verification marks on the carrier strip on both sides of the forms. The marks include a number that the operator can read. If the number printed on side 1 matches the number printed on side 2, page synchronization is correct. Printing of these verification marks can be set off or on in **Configure Printer**.

Side 1/Side 2 Verification

The verification system is designed to verify the proper alignment and synchronization of Side 1 and Side 2 of a document as it is printed on the Infoprint 3000 duplex system. The verification system will determine if the pages printed on Printer 1 and Printer 2 are out of synchronization by 4.2 mm (1/6 inch) or more for several prints. If the Side 1/Side 2 Verification fails, an error code is displayed.

The verification system consists of both hardware and microcode. Verification marks are printed on the front edge of the forms on both Side 1 and Side 2. An optical sensor on the verification sensor card, located in Printer 2, reads the marks that were printed on Printer 1. Data is sent to the MIC via the Side 1/Side 2 Verification Control Card.

The verification system is initially enabled. The CE must disable the system once before the operator can enable or disable the system. An error message is displayed whenever this function is initially disabled and at every power-on with Side 2 Verify disabled.

Side2Verify appears in the detailed status pop-up window of the printer status screen, when the Side 1/Side 2 Verification function is enabled.

The verification page numbers may be printed on the front and back of forms by setting the **Verification marks** option to **Yes**. This option is located under the **Configure\Configure Printer...** menus, and is operable even when the Side 1/Side 2 Verification hardware is not installed or is not enabled. When the Side 2 Verify is enabled, however, the verification page numbers and marks are always printed, regardless of the setting of the **Verification marks** option.

Because the location of the marks is checked, the registration in both the scan and process directions must be accurate. See “Registration” under the Printhead section of *Removals & Adjustments*.

Printing Process

The RS/6000 controller communicates with the attached host to receive the data, fonts, images, and overlays needed for printing. Internally, the controller uses memory (DRAM) and the SCSI internal disk drive to hold information in buffers. All incoming information is stored temporarily in buffers.

The RS/6000 controller reads information from the input buffer to generate raster pages of each complete page to be printed. The raster pages are stored in the output buffer until they are printed. The amount of memory allocated to the input and output buffers may be configured to achieve optimum performance (continuous running of customer jobs).

Pages with very high print coverage may need more space in the output buffer. Configuring buffer sizes for “HIGH” usage will use more of the RS/6000 memory, and could adversely affect performance of the system. Adding additional memory features to the RS/6000 controller causes buffers to increase in size, but without having to reallocate memory from other areas in the RS/6000 controller.

As pages are placed in the output buffer, the RS/6000 controller communicates to the Mechanism Interface Card (MIC) to activate the printer. The controller sends complete pages from the output buffer to the MIC to be printed. While the controller is sending pages from the output buffer, it continues to receive information from the host and build more pages for placement in the output buffer. If the output buffer runs out of pages or is not large enough, the controller communicates with the MIC to stop printing until more pages or memory become available.

To print:

- The controller is placed online to the host and is made ready.
- The host sends the information necessary to print to the RS/6000 controller.
- The information is used to construct a complete raster page to be printed, which is then placed in the output buffer.
- The controller signals the MIC to activate the printer.
- The MIC issues the ACTIVATE command to the printer to start the PC drum turning. After about 5 to 10 seconds, the printer is ready to print (if the fuser is warm).
- The controller then begins to transfer raster page data to the MIC.
- The MIC distributes the page data scan line data for each beam of the printhead, and passes the data into the Print Quality Enhancement (PQE) Card.
- To begin printing at the top of the page, the MIC issues the PAPER FEED command to the printer in synchronization with the first CVD signal to modulate the laser beam. The synchronization time is adjusted via the process and scan factory adjust settings in Configure Printer.
- As the page image that is generated by the CVD signal approaches the transfer station, the printer begins to move the form and lower the retractor to allow the form to contact the PC drum. By the time the first print position on the drum has reached the transfer position, the forms are up to speed and the transfer corona is powered to transfer the image to the forms.
- The forms continue to move without stopping as long as the controller continues to send raster pages to the MIC.
- When no more data is available for printing, the MIC drops the PAPER FEED command and stops raster page transfer to the printhead.

Chapter 2. Control Unit

Controller

The controller, or Advanced Function Common Control Unit (AFCCU), is located in the host-system-attached control unit. It is an IBM RS/6000 POWERstation computer, and is either a Type 7043 or Type 7025 Model F50.

7043 - 43P Unique Components

The 7043-43P is the standard controller for ES1 printers. The Model 43P uses a 233-MHz microprocessor chip set and has standard 128MB random access memory (RAM). A memory upgrade can add 128MB of RAM to the simplex printer.

Five PCI card slots are available on 7043:
- Slot 1 – Display card
- Slot 2 – Second host attachment card, if required
- Slot 3 – SSA adapter
- Slot 4 – First host attachment card
- Slot 5 – Not used

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7025-F50 Unique Components

The 7025-F50 is standard for ED1/ED2 duplex printing systems.

The Model F50 uses a 332-MHz microprocessor chip set and has 256MB of random access memory (RAM) as standard. A memory upgrade can add 256MB of RAM.

Nine PCI slots are available on the 7025-F50:

- Slot 1 – SSA Adapter
- Slot 2 – Not used
- Slot 3 – Display Card
- Slot 4 – Not used
- Slot 5 – Not used
- Slot 6 – First host attachment card
- Slot 7 – Not used
- Slot 8 – Second host attachment card (if required)
- Slot 9 – Not used

Components Common to All RS/6000 Models

Both controllers have a 1.44MB internal diskette drive and a 2.2GB or larger internal disk drive, and an internal CD ROM.

The internal disk drive is loaded with AIX (Version 4.2 or higher) and a compatible set of printer control microcode.

With the appropriate host attachment card, the RS/6000 controller can support Parallel channel, ESCON channel, Token-Ring, Ethernet, and FDDI attachments.

The RS/6000 includes an integrated Ethernet interface adapter that can be used for thick/thin coax or twisted pair network connections.

Extra memory is required for complex applications. Complex applications may print several combinations of fonts, images, page segments, or overlays on each page. The RS/6000 controller must have enough storage available to accommodate all the fonts and images appearing on a page.

After power on, the RS/6000 controller automatically runs self-diagnostic tests before the AIX operating system is loaded. (These tests also run when the RS/6000 controller is reset via a Restart procedure).

The first test to run is the built-in self-test (BIST) programs. These programs test the 32-bit processor and memory addressing.

Next, the power-on self-test (POST) programs load from read-only memory (ROM) and check the devices needed to accomplish an initial program load (IPL). The POST programs also check the memory, the common interrupt handler, and the direct memory access (DMA) handler.

Following the POST programs, the configuration program determines what features, cards, and devices are on the system. It also builds a configuration list that is used by the diagnostic programs to control which tests are run during system checkout.

Display/Touch Screen

The Display/Touch Screen is an IBM Color Display. It operates as a normal display when it is not being used with touch-screen applications.

The display receives video signals from the display card in the controller (slot 3) via a 15-pin D-shell connector cable. The display card addresses 1024 pixels x 768 pixels.

Image size, shape, position, color, and brightness can be adjusted with front-mounted digital controls. Operator settings can be stored, or factory settings can be used.

The capacitive interactive touch screen is factory installed and fully integrated. Touch-screen signals are sent from the Display/Touch Screen to the Serial Port 2 of the controller via a 9-pin RS232 connector cable.

Mechanism Interface Card (MIC)

The mechanism interface card (MIC) is the hardware that connects the controller to the printer. The MIC is attached via a Serial Storage Architecture (SSA) interface to the controller. All commands and data for the printer must come through this interface.

The MIC provides the data and control lines required by the printer. The interface is specific to the printer, and may vary from one printer model to another. Figure 2 shows the relationship between the MIC and the rest of a simplex printer system.

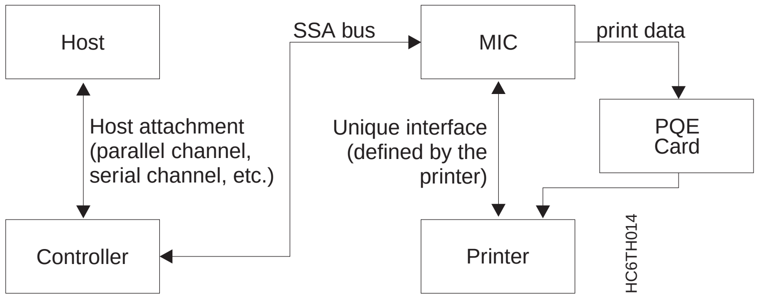

Figure 2. System Block Diagram - Simplex Printer System

More than one MIC may be on the SSA bus. If so, each MIC must have a different address to allow the controller to communicate individually with each printer.

MIC Hardware

Figure 3 shows the hardware on the mechanism interface card.

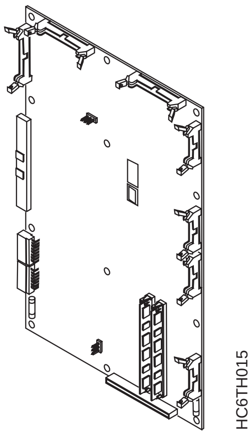

Figure 3. MIC Hardware Overview

Intel 80960 Processor

The MIC card is controlled by an Intel 80960 (i960) processor. This processor incorporates many aspects of RS/6000 technology. It is a 32-bit processor, capable of addressing up to 4GB of memory.

256KB EPROM

The MIC provides 256KB of EPROM to hold the start-up program. The actual run-time program is downloaded from the controller. The EPROM program runs power-on diagnostics on the card and download path, then waits for a command to download the run-time program into the DRAM.

The routines to handle catastrophic errors also reside in EPROM. This kind of error is so severe that data cannot be sent to the Display/Touch Screen using the SSA path, so it must be shown on the 7-segment LED display. During normal operation, the EPROM program should never be referenced.

1MB DRAM

One megabyte of dynamic RAM is provided by the MIC. This memory is used for program memory for the i960 processor.

7-Segment LED Display

A single digit 7-segment display is provided on the MIC for error and status reporting. This display is used to convey the results of diagnostic and program check errors if the communication path through the SSA to the controller has been compromised. This display is also used to show printer status and status during phase transitions and download diagnostics.

Other MIC LED Displays

Other MIC LED status indicators:

- 0 – Printing
- 2 – Normal (Ready to print)
- 3 – Engine cycling up, or out of supplies condition
- 6 – Waiting for fuser temperature
- 8 – SSA hang
- 9 – Memory test failure
- = – Waiting for RS/6000 memory download (may indicate timeout)
- L – SSA Link(s) are not online between MIC and RS/6000 controller

Start-up

The MIC is designed so that its normal operating program is downloaded from the controller. Because of this, the MIC does not power up in a “ready to run” state. Following is a description of the MIC function at power-on.

1. Whenever the i960 processor is reset (such as at first power-on), it automatically runs its built-in self test (BIST). If errors are found, the processor asserts an error pin and halts. The error pin is connected to an LED (the decimal point in the 7-segment display) on the MIC.
2. After a successful self-test, the i960 processor loads setup information from memory (EPROM) and verifies the EPROM checksum.

3. Next, the 1MB DRAM memory is tested.
4. All hardware that is needed to download programs is initialized, and a Reset_State status message is sent to the controller, which indicates that the MIC is in the reset state (with no errors).
5. The MIC waits to receive the run-time program from the controller. The controller may send programs to run more diagnostics or to run the printer.

Error Reporting

MIC errors can be grouped into hardware and software categories; each of these is subdivided into various types. The MIC has three means of reporting errors:

- The decimal point in the 7-segment display is used solely to report that the i960 processor failed its built-in self-test. (There is no microcode involvement in this test; it runs automatically at every power-on.)
- The full 7-segment LED display is used to report catastrophic errors. Multiple-digit messages are displayed by presenting each digit sequentially and blanking the display briefly between digits. When the end of a message is reached, there is an long pause, and then the message repeats. This is continued until the next power-on.
- Less severe errors are transmitted in a status message through the SSA to the controller, where they are logged and handled like other controller errors.

Host System Attachment Options

Parallel Channel Attachment

The parallel channel attachment is a customer-selected feature on an Infoprint 3000.

The printer is connected to a S/370 or S/390 host channel through the standard I/O interface via the parallel channel adapter (PCA), which is contained in the host-system-attached RS/6000 controller.

The control unit can be attached via a single-byte-wide block multiplex S/370, S/370-XA, ESA/370, or ESA/390 channel, and it can connect up to two channel interfaces. It adheres to IBM specifications S/360 and S/370 I/O Interface Channel to Control Unit OEMI, GA22-6974-10, and ESA/390 Common I/O Device Commands, SA22-7204-1.

The printer can be located at a maximum distance of 122 m (400 ft) from the channel if it is the only control unit on the interface. For each additional control unit (up to a maximum of 8 control units) the distance is reduced by 4.6 m.

The printer may also be attached to the remote end of an IBM 9034 ESCON converter or IBM 3044-II fiber optic channel extender, which can be used to extend the standard channel interface by up to 3 km.

The 9034 can also be used with the IBM 9032/9033 ESCON director to further extend the interface to a total of 6 km with one director in static connection mode (or 9 km with two directors both in static connection mode).

Another enhancement to the distance is using the extended distance feature (XDF) on the 9032 or 9033. With XDF on one director, the total distance becomes 23 km with an RPQ (with XDF on two directors, the total distance can be a maximum of 32 km with an RPQ). For more information, consult the 9034, 3044, and 9032/9033 product publications.

Also supported is the remote power control facility, which complies with the IBM specification GA22-6906, S/360 and S/370 Power-Control Interface OEMI.

The control unit also supports the remote ENABLE/DISABLE feature.

The data received for printing is in the form of the IPDS, which is described in the *Intelligent Printer Data Stream Reference*, S544-3417.

ESCON Channel Attachment

The ESCON channel attachment is a customer-selected feature on the Infoprint 3000, and it is the strategic replacement for the S/370 or S/390 parallel channel. It provides improvements in data rate, physical path length, space requirements, and overall system connectivity. ESCON channels use a fiber optic transmission media, allowing for full duplex communication.

Data is transmitted and received in a serial-by-bit fashion at a raw bit rate of 200Mb/s using a light emitting diode driver and pin-diode receiver. Eight-bit bytes are encoded into 10-bit characters resulting in a raw burst rate of 20MB/s.

The attachment is a combination of hardware and microcode; it provides the capability to attach the control unit to 370XA, ESA/370, and ESA/390 ESCON channels. It adheres to IBM specifications ESA/390 ESCON I/O Interface, SA22-7202-2, and the ESA/390 Common I/O Device Commands, SA22-7204-1.

The printer can be located at a maximum distance of 3 km from the channel.

The IBM 9032/9033 ESCON director can be used not only to provide connectivity to additional hosts, but to further extend the interface. The interface is extended to a total distance of 6 km with one director (or 9 km with two directors). Another enhancement to the distance is using the extended distance feature (XDF) on the 9032 or 9033. With XDF on one director, the total distance becomes 23 km (with XDF on two directors, the total distance becomes 43 km). For more information, consult the 9032 and 9033 product publications.

To extend the interface across common carrier fiber optic connections, the IBM 9036 ESCON remote channel extender can be used. One, two, or three 9036 extenders can be used, keeping the total distance under 43 km.

Also supported is dynamic path-finding. This allows the control unit to choose any established path within a path group to reconnect to the system that started the I/O operation. This results in improved throughput and improved availability.

Also supported is the remote power control facility, which complies with the IBM specification GA22-6906, S/360 and S/370 Power Control Interface OEMI.

The data received for printing is in the form of the IPDS, which is described in the *Intelligent Printer Data Stream Reference*, S544-3417.

Token Ring Attachment

The Token Ring attachment is a customer-selected feature on the Infoprint 3000. The attachment connects a host Token Ring through the IBM Token Ring cabling via the Token Ring high-performance adapter installed in the RS/6000 controller.

The controller can be attached to either a 16 mega bits per second (Mbps) or a 4 Mbps Token Ring local area network (LAN).

The attachment adheres to the IBM Token Ring Network OEMI. The following documents together describe the IBM Token Ring Network Other Equipment Manufacture Interface:

- IBM Cabling System Technical Interface Specification, GA27-3773
- IBM Local Area Network Technical Reference, SC30-3383
- IBM Token Ring Area Network Architecture Reference, SC30-3374 (6165877)
- Token Ring Access Method and Physical Layer Specification, IEEE Standard 802.5-1989

The printer may be located at a maximum distance of 100 meters from the 8228 multistation access unit or the 8230 controlled access unit. For more information, consult the 8228 and 8230 Product Publications.

The distance between 8228 multistation access units can be increased with either the 8220 or 8219 optical fiber repeater. For more information, consult the 8220 and 8219 product publications.

The data received for printing is in the form of the IPDS, which is described in the *Intelligent Printer Data Stream Reference*, S544-3417.

Ethernet Attachment

The Ethernet attachment is a customer-selected feature on the Infoprint 3000; it provides an interface from the RS/6000 controller Micro Channel to an Ethernet Local Area Network (LAN) through an Ethernet adapter installed in the RS/6000 controller. The adapter, whether a standard integrated adapter in the 7025 or 7043 controllers or a plug-in adapter in a PCI card slot, is IEEE 802.3 and ISO 8802/3 compatible and attaches to a 10-megabit Carrier Sense Multiple Access with Collision Detection (CSMA/CD) LAN.

The integrated Ethernet adapter in both of the controllers is composed of several functional blocks. The control module and Ethernet controller reside on the system planar, while the serial and analog portion reside on the riser card.

Ethernet adapter cards that support 10/100 Mb/sec data rates are available to install into the PCI slots in the 7025 and 7043. Installation of this Ethernet card prevents the use of the integrated Ethernet adapter.

The thick/thin adapter card provides a 15-pin DIX connector for the thick function and a BNC connector for the thin function. Both connectors are IEEE 802.3 compatible.

An Ethernet twisted pair can be connected to the thick/thin card by using an external transceiver that is plugged into the DIX connector.

The data received for printing is in the form of the IPDS, which is described in the *Intelligent Printer Data Stream Reference*, S544-3417.

Fiber Distributed Data Interface (FDDI) Attachment

The Fiber Distributed Data Interface (FDDI) is a Local Area Network (LAN) attachment that is a customer-selected feature. For more information on FDDI attachments, see the *Infoprint 3000 Advanced Function Printers Introduction and Planning Guide*, G544–5563.

The attachment connects directly to an RS/6000 processor or to an 8260 Multiprotocol Intelligent Switching Hub that is attached to an RS/6000 processor. The attachment complies with the following:

- Fiber Network Interface specification of ANSI X3T9.5 and X3T9.12
- FDDI Station Management SMT 7.3 from the ANSI X3T9 technical committee.

When using a FDDI attachment, the printer can be located a maximum distance of 2 kilometers from the 8260 Multiprotocol Intelligent Switching Hub or RS/6000 processor using 62.5/125 micron multimode fiber. For more information, refer to the 8260 publications.

The FDDI adapter cable, PN 19G4867 (20 meters in length), is included with the printer. This 62.5/125 multimode fiber cable has a Subscriber Connector (also referred to as an SC connector) on each end. There are similar cables with other part numbers that can be ordered in addition to the one that is shipped with the machine. These cables have lengths of 2, 4, 6, 10 meters, and custom lengths. They can be ordered by calling 1-800-388-7080 (U.S. only) or by using the internet: `http://www.direct.ibm.com/parts`.

Pre/Postprocessing Interfaces

Coupled Interface Signals (4710 interface only)

Table 3 describes the signals used in the pre/postprocessing coupled interface (but not the Advanced Function Postprocessing Interface). The names shown are consistent with those used on the pre/postprocessing interface test card.

Table 3. Coupled Interface Signals

Signal	Description
DEVICE READY (YES position)	Indicates that the device is powered on and ready. The display shows: `Pre/postprocessor Ready`.
DEVICE READY (NO position)	Simulates a jam or hard stop at the device. The display shows: `Pre/postprocessor Stopped`.
S SHEET ADV	Causes the printer to advance one page of forms.
NPRO	Causes the printer to fuse the forms already between the transfer station and the fuser, and feed them into the stacker. The display shows: `Pre/postprocessor NPRO`.
OPER READY	Resets the OPER STOP condition.
OPER STOP	Simulates the action of a stop key on the pre/postprocessor, a soft stop, a recoverable error, or a pause. The display shows: `Pre/postprocessor Operator Stop`.
3835 STOP (0 position)	Simulates the action of a stop key on the pre/postprocessor, a soft stop, a recoverable error, or a pause. The display shows: `Pre/postprocessor Stopped`.
3835 STOP (1 position)	Normal position.
3835 EOF (0 position)	Simulates an end-of-forms signal from the pre/postprocessor. The display shows: `End of Forms`.
3835 EOF (1 position)	Normal position.
6 PPI SYNC	Test point for ac voltage measurement.
OFFSET	Test point for dc voltage measurement.

Table 3. Coupled Interface Signals (continued)

Signal	Description
RUN CFS/BTS	Test point for dc voltage measurement.
GND	Ground point for voltage measurements.
POWER OK	Lights when the interface test card is installed and powered, and checks the voltage regulator on the isolation card.

Intelligent Interface Signals (4720 interface only)

Table 4 describes the signals used in the Advanced Function Postprocessing (Intelligent) Interface.

Table 4. Post Device Isolation Card Signals

Signal	Description
INBOUND	
READY	This signal indicates the ready state of the postprocessor. When it is activated, this signal indicates that all internal conditions for operation are met, and that the postprocessor is ready for operation.
PAUSE	This signal is activated when the postprocessor requires a limited amount of time before starting or continuing an operation. An example is a short delay or interruption that is required to allow the postprocessor to get up to speed or to get ahead. PAUSE can be activated only for conditions that are short term and self-clearing (no operator intervention is required).
STOP	This signal from the postprocessor indicates that any operation in process is to stop and new operations are not to be initiated. When READY is also deactivated, it indicates that an unusual condition exists, such as a paper jam, and operator intervention is required at the postprocessor.
PAPER ADVANCE	This signal is used to move one or more sheets of paper within the printing subsystem. Whenever this signal is activated, the printer advances one sheet of paper. Additional sheets can be advanced by activating this signal again. To execute this function, the printer must be Ready and the postprocessor must be Not Ready.
POSTPROCESSOR COMMUNICATION LINE READY	This signal is used to inform the printer that the postprocessor is ready to receive data.
OUTBOUND	
CYCLE UP	This signal provides a warning in advance of paper motion. It remains activated while paper is moving and when paper motion can resume in a short time.
SENT	This signal indicates that a sheet has been imaged by the printer. It is activated one time for each sheet and is generated whether the sheet has been printed correctly, with an error, or with a blank.

Table 4. Post Device Isolation Card Signals (continued)

Signal	Description
EJECT	This signal indicates that normal processing for this sheet is not to be done, and that the sheet needs to be ejected from the completed job output stack. EJECT is activated for sheets delivered by the printer as a result of an “Eject to Front Facing” IPDS command or a nonprocess runout (NPRO).
PAPER POSITION PULSE	This signal is generated whenever there is paper motion. The period of this signal represents a fixed distance of paper motion.
PRINTER COMMUNICATION LINE READY	This signal informs the postprocessor that the printer is ready to receive data.
RECEIVE DATA	This signal is used to receive serial data from the postprocessor.
TRANSMIT DATA	This signal is used to transmit serial data to the postprocessor.

Signal Timings

There are no fixed timings between any signals in this interface. However, all postprocessor tag responses to outbound tags must be completed within 1 second.

Power Input/Power Return

The postprocessor must supply power for the interface logic. Because of the potential distances involved, +5 volts cannot be transmitted within tolerance to the interface logic by the postprocessor. Therefore, a voltage regulator on the interface logic board is used to supply power for the interface logic. The postprocessor must supply power for the voltage regulator.

The voltage, as measured at the input to the interface logic board, must be equal to or less than +28 volts and greater than +9.5 volts. There is a POWER INPUT (HIGH) that handles voltages between +28 and +18 volts and a POWER INPUT (LOW) that handles inputs between +18 and +9.5 volts, and a POWER RETURN for each input. The postprocessor may use either POWER INPUT (HIGH) or POWER INPUT (LOW), but not both.

Transmission Protocol

The transmission of information is accomplished using two serial lines: TRANSMIT DATA and RECEIVE DATA.

The basic component of transfer is a byte, with 6 or more bytes composing a frame. Outbound frames are referred to as commands, and inbound frames are called requests.

Power

Electrical voltages in the control unit are controlled by two units:

- AC control box
- Low-voltage dc power supply

AC Control Box

This unit controls power sequencing to the control unit and its attached printer. The ac circuits in the control unit are protected by the main power disconnect switch in the printer.

Low-Voltage DC Power Supply

This unit provides the following dc voltages:

Voltage	Regulation Under Load
+12	+11.7 to +12.5
−12	−12.7 to −11.5
+5	+4.9 to +5.2
−5	−5.3 to −5.0

If the load is removed, the voltage may be slightly higher.

An internal failure or a short circuit in any dc voltage circuit electronically switches off all the dc circuits. Therefore, fuses are not needed in dc circuits.

Unit Emergency Switch

The unit emergency switch has two settings: Power Off and Power Enable.

In the Power Off position, all voltage is removed from the control unit and the printer, except voltages to the ac control box.

In the Power Enable position, secondary voltage is supplied to the power-on switch. However, power is not distributed to the printer until the **Power On** switch is pressed or by the remote power sequencing if in Remote.

Power On Switch

Both the control unit and its attached printer have a Power On switch. Each switch is active only if its associated Local/Remote Switch is set to Local, the Unit Emergency Switch is in the Power Enable position, and the printer circuit breakers (see "Power Switches" on page 97) are ON. With the Control Unit Local/Remote switch set to Local and the associated Printer Local/Remote switch set to Remote, pressing the Control Unit Power On switch supplies line voltages to the transformer and begins the initialization process (see Chapter 3. Initialization and Sequencing).

In duplex printing systems, with the Control Unit Local/Remote switch of Printer 2 set to Local, the Control Unit Local/Remote switch of Printer 1 set to Remote, and both Printer Local/Remote switches set to Remote, pressing the Control Unit Power On switch of Printer 2, powers on the entire printing system.

Power Off Switch

Both the control unit and its attached printer have a **Power Off If In Local** switch. Each switch is active only if its associated Local/Remote Switch is set to Local.

With the Control Unit Local/Remote switch set to Local and the associated Printer Local/Remote switch set to Remote, pressing the Control Unit **Power Off If In Local** switch removes all dc voltages from the printer (except 24 V dc to the Printer Power On switch) and removes ac voltages from the transformer. All power is removed from the printer except the 3-phase input power to the primary connectors, line noise filter, and circuit breakers in the printer ac control box.

Operator Alert Assembly

The operator alert assembly, located on top of the control unit, alerts the operator when an intervention has occurred. It does this with a light (flashing or always on) and an alarm with adjustable volume. If the customer prefers that printer-attention-alerts be relayed to a remote operator's terminal, contacts are provided to connect to an external device.

Note: The customer is responsible for supplying power to run any external device used.

Chapter 3. Initialization and Sequencing

In the course of transferring information to paper, there are numerous steps. Some of the actions are determined by the control unit and some by the printer.

Printer – Control Unit Interaction

Printer Functions

- Manage all temperatures, processes, speeds, supplies levels, and errors
- Report readiness, heating (waiting), error status, and memory contents.

Printer States

The printer can be put into any of the following states by the control unit:

- PRINT – Ready or actively printing
- COOL – Heating the hot roll or preheat platens
- WAIT – Intervention condition present
- DORMANT – Inactive between print jobs

  The drum is stopped and the fuser is hot.
- FUSER OFF – Inactive during long periods between print jobs

  The drum is stopped and the fuser is cool.

Control Unit Functions

- Build page images from the channel data and serialize them for the printhead
- Read, display, and log errors from itself or the printer
- Control the state of the printer (but not the status of any individual motor, switch, or lamp).

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Control Unit Commands

The control unit issues the following commands to the printer:

- ACTIVATE – Prepare for printing
- DORMANT – Go to the DORMANT state
- PAPER FEED – Move the forms with full process on
- NPRO – Move the forms without printing them
- CHECK RESET – Clear any error or intervention
- REQUEST – Send status or memory contents
- FUSER OFF – Go to the FUSER OFF state.

Initialization

Initialization occurs when power is turned on to the printer. Initialization prepares the printer to receive data from the host and print it on forms. Initialization occurs in two stages: **power sequencing** and **printer sequencing.**

Power Sequencing

Before power is applied to the system, the printer switches should be in the following positions:

Table 5. Switch Positions For The Simplex Printer

Switch Name	Set To
CB451, CB452, CB453	ON
Control unit CP1	ON
Unit Emergency	1
CU Local/Remote	Local
Printer Local/Remote	Remote
CU Service Disconnect	Normal
Printer Service Disconnect	Normal
RS/6000 controller power switch	ON
Display/Touch Screen power switch	ON

Table 6. Switch Positions for a Duplex System

Switch Name	**Printer**	**Set To**
CB451, CB452, CB453	1	ON
Control unit CP1	1	ON
Unit Emergency	1	1
CU Local/Remote	1	Remote
Printer Local/Remote	1	Remote
CU Service Disconnect	1	Normal
Printer Service Disconnect	1	Normal
CB451, CB452, CB453	2	ON
Control unit CP2	2	ON
Unit Emergency	2	1
CU Local/Remote	2	Local
Printer Local/Remote	2	Remote
CU Service Disconnect	2	Normal
Printer Service Disconnect	2	Normal
RS/6000 controller power switch	1	ON
Display/Touch Screen power switch	1	ON

See Figure 4.

When the printer power-on switch is pressed, the following occurs:

1. AC voltage comes into the printer primary connectors, line noise filter, and CB451. When CB451, CB452, and CB453 are ON, voltage is supplied to the dc power supply in the printer.

2. The dc power supply generates all dc voltages in the printer. And lights the AC IN LED and POWER LED. This indicates that ac voltage is being supplied to the printer.
3. With CB451 and CB452 ON, ac voltage is always present in the control unit. This voltage goes to the ac control box where 24 V dc is generated for use in power sequencing. The 24 V dc goes to the power-on switch located on the control unit power panel.

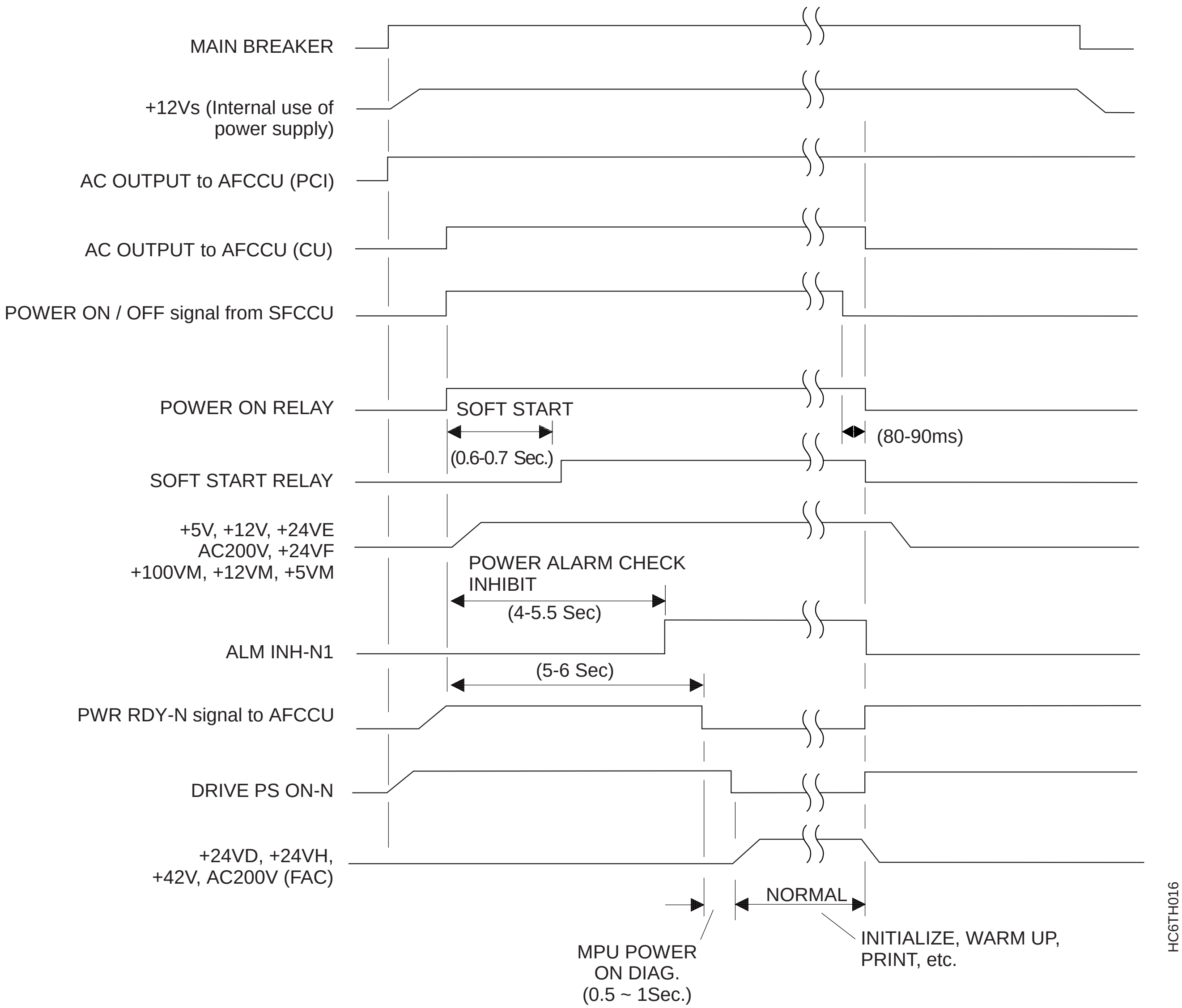


Figure 4. Printer Power Sequencing Timing Chart

Infoprint 3000 Control Unit

The RS/6000 controller for the Infoprint 3000 Printers is located in the control unit. The RS/6000 controller for the duplex systems is located in the Printer 2 control unit. When the control unit power-on switch is pressed, the following occurs:

1. In the control unit, relays K1 and K2 in the ac control box pick.

   Relay K2 contacts provide ac power to the RS/6000 controller and the Display/Touch Screen at connectors PJA05 and PJA06.

   Relay K1-1 contact holds K1 and K2 and also starts a time-delay sequence.
2. After the delay, relays K21, K22, and K3 in the ac control box pick.
3. Relay K3-2 contact supplies 24 V dc to the dc power supply in the printer through PJA07-1 to start the printer power-on sequence. Go to Printer Power-On Sequence for details about the printer power-on sequence.
4. After a second delay, K23 picks. The ac control box supplies 24 V dc to the printer tailgate through PJA09.

Infoprint 3000 Printer 1 Control Unit (PUM)

A cable from the Printer 2 control unit tailgate is connected to the Printer 1 control unit remote host connection.

1. The power pick and power hold lines from the remote host connection pick and hold relays K1 and K2 in the Printer 1 ac control box.

   Relay K1-1 contact holds K1 and K2, and also starts a time-delay sequence.
2. After the delay, relays K21, K22, and K3 in the ac control box pick.
3. Relay K3-2 contact supplies 24 V dc to Printer 1 through PJA07-1 to start the Printer 1 power-on sequence. Go to Printer Power-On Sequence for details about the printer power-on sequence.

Printer Power-On Sequence

When 24 V dc is supplied to a printer power-on line (PJ205-1), the following sequence occurs:

Note: The unit emergency switch in its normal position connects PJ205-6 and PJ205-8.

1. In the printer, the dc power supply creates the following time-delayed outputs:
   - PWR ON
   - SOFT START
   - DRIVE PS ON
   - DC & AC voltages
2. The dc power supply first turns on the following systems:
   - +5 V
   - +12 V
   - +24 VE
   - 200 V ac
   - +24 VF
   - +100 VM
   - +12 VM
   - +5 VM
3. The soft start relay engages after 0.7 second to bypass the soft start resistors.
4. The dc power supply turns the DRIVE PS ON signal after approximately 7 seconds.
5. The remaining voltages turn on after a 1 second diagnostic, including:
   - +24 VD
   - +24 VH
   - +40 VD
   - 200 V ac (FAC)

The power-on sequence is complete.

Printer Sequencing

After the power-on sequence, the printer begins its initialization. The steps in the initialization are:

- When the printer is powered on, it begins in the cool status.
- When the printer is powered on or the reset switch on the CPxxx Card is operated, the microprogram executes processing from address 0. In the initial stage, a test program executes for about 6 seconds to diagnose the logical circuits in the printer. After execution of the test program, execution of the main program begins.
- The resolution switching lens cycles and moves to its correct resolution position.
- The mirror motor is driven to the specified speed of 11 520 RPM for 480 DPI, and 14 400 RPM for 600 DPI.
- Power is applied to the preheat platens and the hot roll lamps.
- These mechanisms cycle and move to their home positions:
  - Cleaning station housing and brush
  - Retractor
  - Backup roll open/close mechanism
  - Paper feed motor
  - Pendulum
  - Scuff rolls.
- The photoconductor drum begins to rotate; 3 seconds later the coronas, erase lamps, and magnet roll motor are turned on; and the developer run operation is performed. Meanwhile, the cleaner housing swings right and left, and the cleaning brush turns clockwise and counterclockwise to automatically clean the inside of the cleaner housing.
- The rotation of the photoconductor drum continues for approximately 2 minutes. After about 10 minutes (maximum 15 minutes), the preheat platens and hot roll reach their specified temperatures. At that time, the status of the printer changes from cool to dormant.

Printer Sequencing Power Problems

The printer may power up normally. However, during the sequencing stage, voltages are applied to the various components in the printer system (drum motor, cleaner housing, backup roll, and other functional areas). If there is a short circuit in one of these areas, a circuit breaker trips. These problems are the most difficult to diagnose.

To help isolate these failures, it is important to understand the timing relationship between the various printer components; that is, to know what device was sequencing when the circuit breaker tripped.

See Figure 5.

This timing chart shows the sequencing of the printer components. For example, if a circuit breaker tripped 3 seconds after the cyclone blower started, the problem might be a short circuit in either the cleaner housing motor or the cleaner brush, because the cleaner housing motor and the cleaner brush *both* come on approximately 3 seconds after the cyclone blower starts.

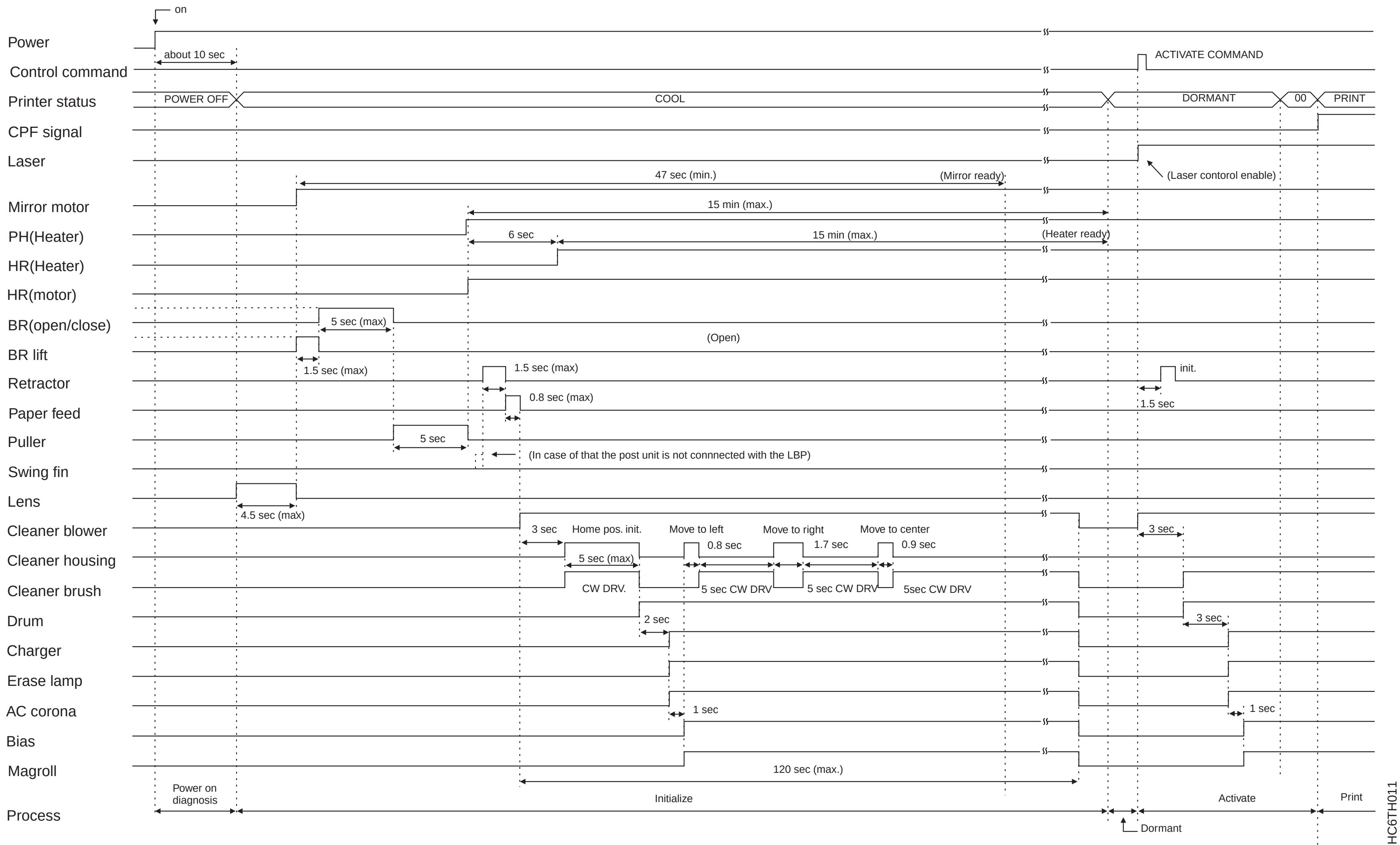


Figure 5. Printer Power-On Sequencing Timing Chart

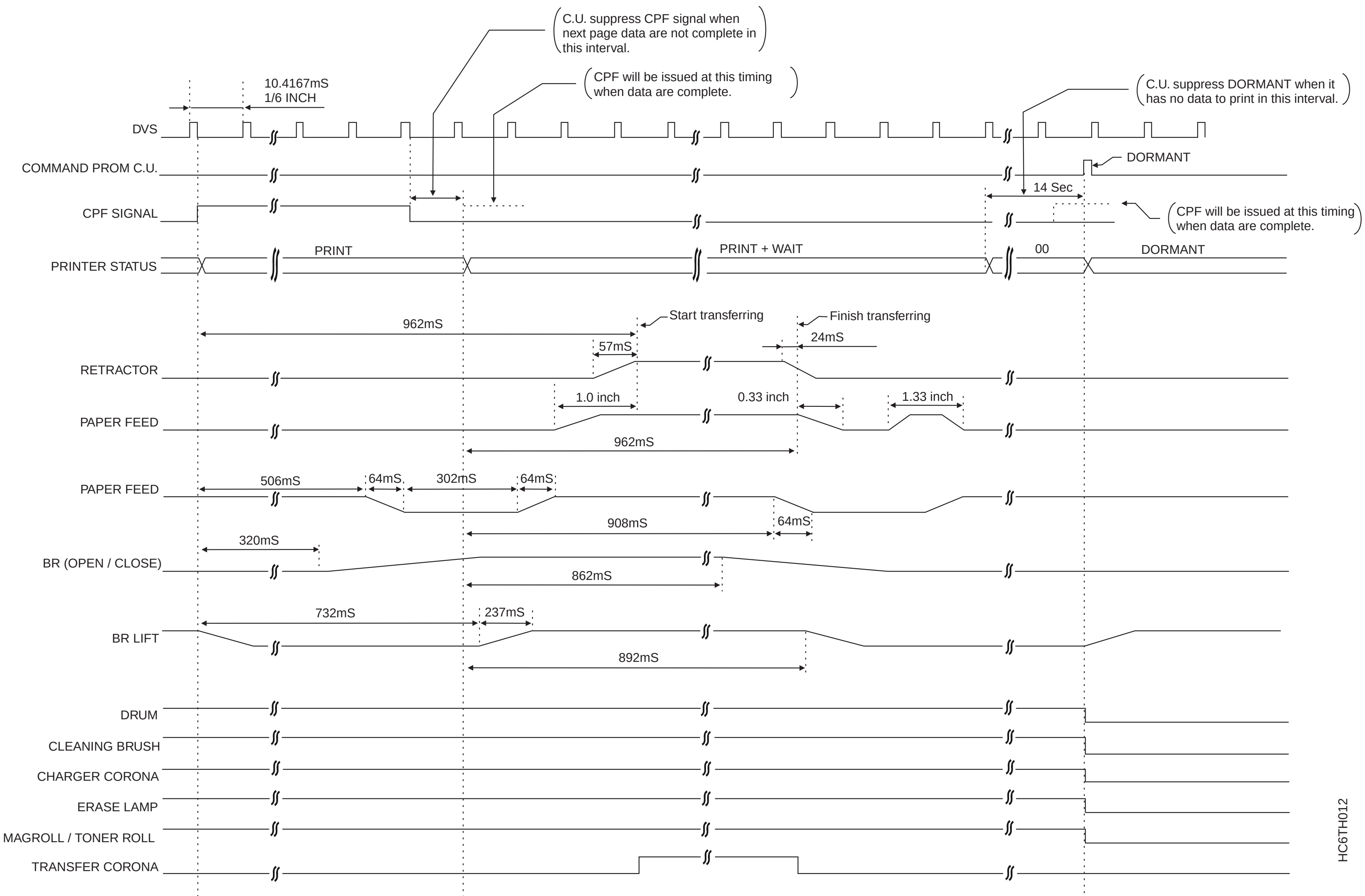


Figure 6. Printing Process Timing Chart

RS/6000 Controller Sequencing

Following any system power-on sequence or a Restart procedure, the RS/6000 controller runs internal diagnostics. When successfully completed, an initial microcode load (IML) from the disk is performed and additional diagnostics are run.

Until the fuser reaches the temperature required to operate the printer, the Display/Touch Screen shows **Warming Up**. If no error is sensed by the diagnostics, the Display/Touch Screen shows **Not Ready** if attachments are enabled or if there are no attachments. Printing is started when the **Ready** button is pressed. If attachments are not enabled, the display shows that the attachment(s) is disabled and printing cannot be started.

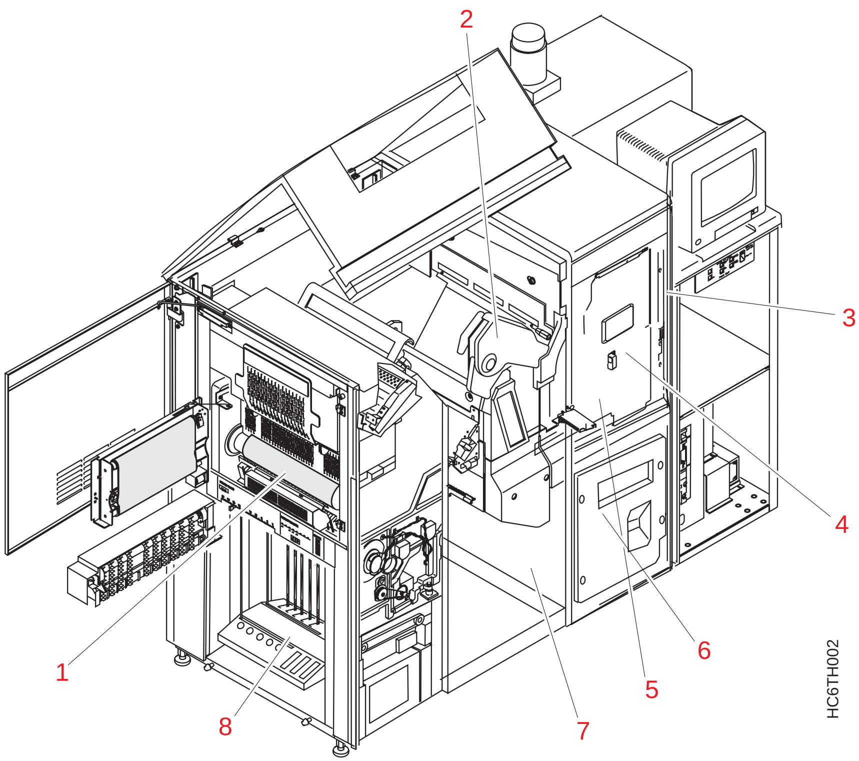
If the **Auto Start** configuration item is set to “Yes”, all current attachment interface status (enabled/disabled) is saved during a **Shutdown** procedure and automatically restored at the next power on of the system. Simplex and dual-simplex printers are also automatically made Ready at the completion of the power on sequence, unless there is an error. The Thread/Align forms procedure must be performed on duplex printers before the system can be made ready.

Chapter 4. Subsystems

Subsystems are the units of the printer that do some major part of the operations of the printer, such as moving paper, transferring the latent image, developing the latent image, and fusing the image to the paper.

Table 7 shows the front view of a Infoprint 3000 with subsystems labeled. See Chapter 2. Control Unit for subsystems of the control unit. Table 8 shows the rear view of the printer with subsystems labeled.

Table 7. Front View of an Infoprint 3000



- **(1)** – Fuser station
- **(2)** – Transfer station
- **(3)** – Printhead
- **(4)** – Photoconductor drum
- **(5)** – Developer
- **(6)** – Power supplies, ac and dc
- **(7)** – Input station
- **(8)** – Stacker

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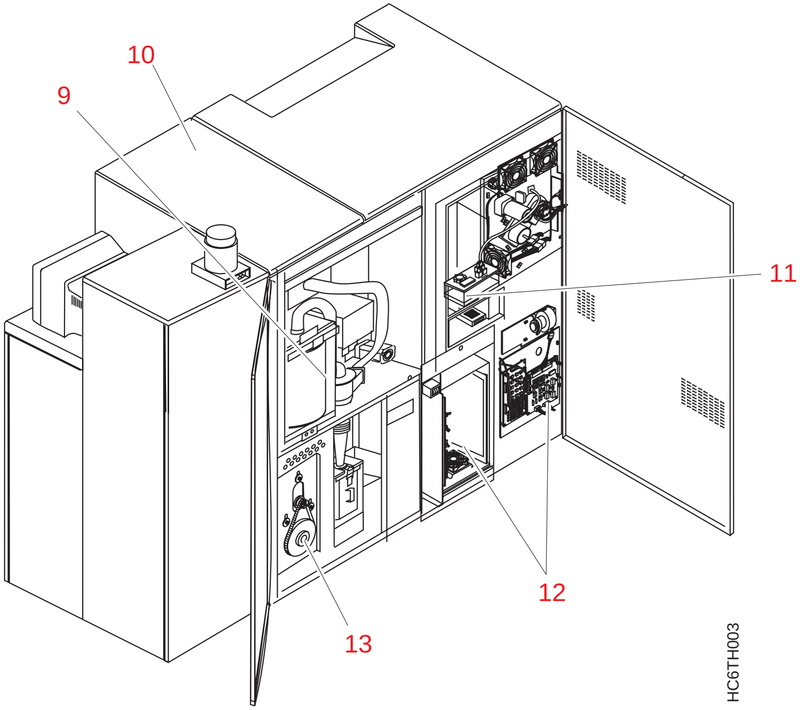
Table 8. Rear View of Infoprint 3000



- **(9)** – Cleaner system
- **(10)** – High-voltage power supply
- **(11)** – Fuser oil tank
- **(12)** – Electronics
- **(13)** – Vacuum system

Printhead

Table 9. Printhead

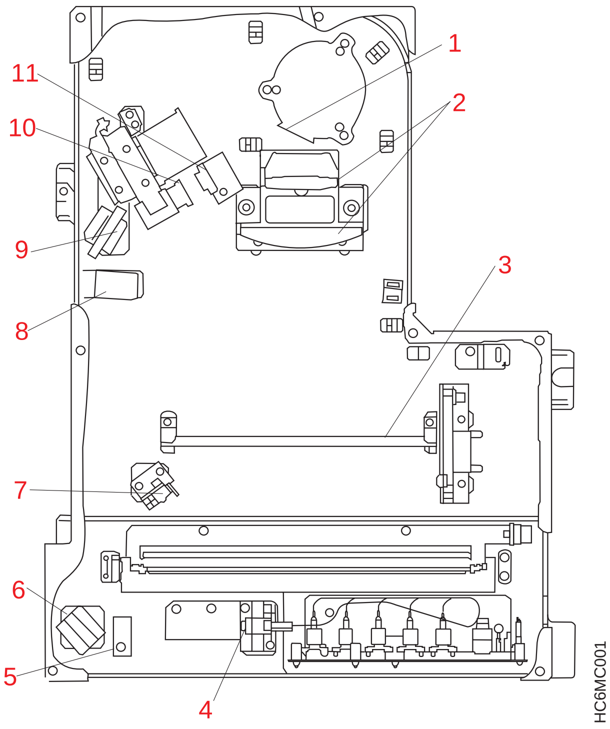
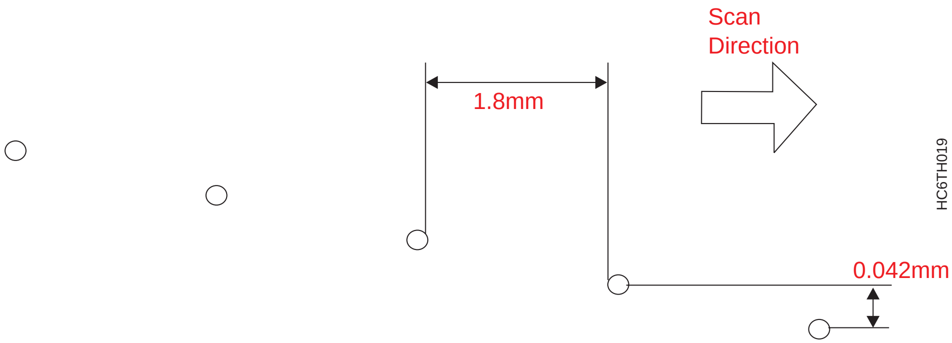


Table 9 shows the printhead components. Table 11 shows how the beam is generated and passes through the various elements of the printhead.

The printhead can print at either 480 DPI or 600 DPI resolution.

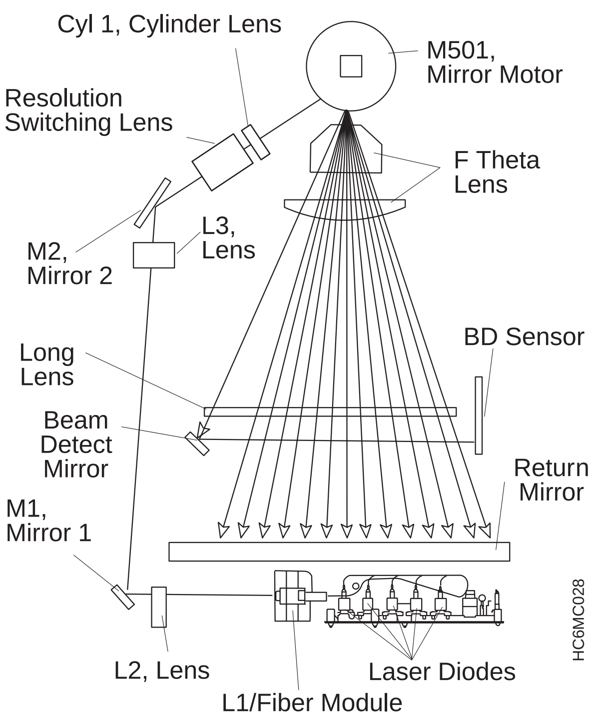
The printhead creates five separate beams of light that discharge the charged PC drum to write the latent image. To generate the beams and write a series of dots on the drum, the printhead uses five laser diodes, mirrors, lenses, and a beam-detect card. A multifaceted rotating mirror scans the beam along the axis of the rotating drum.

Table 10. Printhead Beam Pattern



At the drum, the laser beams are in a line inclined at a small angle. The 600 DPI beam spacing is shown in Table 10. All five beams scan together. Each beam prints one of the five rows of PELS. The beams scan from the front of the printer to the rear.

Table 11. Elements in the Printhead Path



You can compare the drawings in Table 11 and Table 9 to orient yourself with regard to the position of the elements in the beam path. Refer to Table 11 as you read the descriptions that follow. In describing the condition of the laser beam, these terms are used:

- *Focus*

  The rays of the beam are converging toward a point; that is, the diameter of the beam is becoming smaller.
- *Diverging* or *expanding*

  The rays of the beam are spreading; that is, the diameter of the beam is becoming larger.
- *Parallel*

  The rays of the beam are neither diverging or converging; that is, the diameter of the beam is not changing.

Laser

There are five separate laser diodes in the printhead. Each laser diode provides a beam of visible red light. The beam is produced at a power of 10 mW and a wavelength of 635 nm. Each laser diode is mounted precisely into an assembly that has an optical fiber cable attached. A lens couples the light from the laser into the fiber. Only a portion of the original light produced enters the fiber. The LD272 card controls the output power of each laser. Five potentiometers are located on the LD272 card that allow the output power to be adjusted.

The laser turns on just before printing begins so that the scanning beam reaches the BD sensor and produces BD signals.

Each laser can be turned on and off individually in diagnostic mode. All five beams can also be turned on together.

Printhead Cover Switch

The operating power of the laser can damage the eyes. The printhead cover switch is actuated by the printhead cover. When the switch is open (printhead cover is off), the laser beams operate at a reduced power that is at a safe level. This allows maintenance to be safely performed when the laser diodes are turned on.

Fiber Module/Lens L1 Assembly

The five fiber cables are combined at the fiber module assembly. Lens L1, within the assembly, focuses the beams.

Lens L2

As the beams leave the fiber module/Lens L1 assembly, they enter Lens L2. Lens L2 focuses the beams near Mirror M1.

Mirror M1

As the beams leave Lens L2, they strike mirror M1. Mirror M1 reflects the beams and directs them to the Lens L3.

Lens L3

The beams that leave Mirror M1 are diverging from their focused condition. Lens L3 modifies the shape of the beams before they strike Mirror M2. The beams that leave lens L3 are circular and parallel.

Mirror M2

Mirror M2 reflects the beams and directs them to the resolution switching lens and the Cylinder 1 lens.

Resolution Switching Lens

The resolution switching lens allows the printhead to print at 480 DPI by changing the size of the beam and spacing when the lens is placed in the beam path. When the resolution switching lens is *not* in the beam path, the printhead prints at 600 DPI.

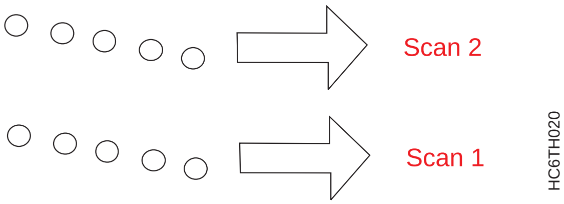
The two-piece lens is mounted on an arm that is lifted by a cam driven by a dc motor. The position of the lens is determined by the resolution value set in Printer Configuration. It can also be activated in diagnostic mode.

Cylinder 1 Lens

The Cylinder 1 lens focuses the beams onto the facet of the rotating scanning mirror. The Cylinder 1 lens focuses the beams only in the vertical direction. The result is that the beams that strike the rotating mirror (scanning mirror) appear like a line rather than a circular spot.

Scanning Mirror

For the beams to write on all printable positions of the PC drum, they must move across the drum and down the page area of the drum. The scanning mirror creates scan lines by moving the beams across the PC drum. Because the PC drum is also turning, each group of five beams is placed directly below the previous group of five beams on the page area of the PC drum.



Each facet of the scan mirror creates five scan lines on the PC drum as it scans across, because there are five beams on each facet.

The scanning mirror is an 8-faceted mirror that is mounted on a high-quality air bearing. The mirror turns at 14 400 revolutions per minute for 600 DPI and at 11 520 revolutions per minute for 480 DPI.

The mirror is driven by a three-phase synchronous motor. The motor is controlled by the DV101 card. The high quality of the air bearing allows the mirror to spin for minutes after the motor has been turned off. The rotational speed of the mirror is checked internally by an LED light source and phototransistor receiver. The mirror rotates counterclockwise when viewed from the right side of the printer.

As the mirror rotates, the beams strike the facet at a different angle, causing the beams to be reflected toward a different point on the F-Theta lens.

F-Theta Lens

The design of the F-Theta lens produces a beam of constant velocity and spot size with its curved surface. It also provides the correct magnification of the image.

Long Lens

The beams pass through the long lens and are focused onto the return mirror.

Return Mirror

When the beams strike the return mirror, they are reflected down toward the PC drum, writing the latent image. The return mirror can be adjusted to control where the scanning group of beams strikes the drum.

Beam-Detect Mirror

At the start of each scan, the beam-detect mirror receives the beams from the long lens and reflects them to the beam-detect card.

Beam-Detect Card

The beam-detect card creates short electrical pulses when the laser beams are scanned across it. The pulses are used by the MIC card to determine when to turn on each laser for each scan of the laser beams across the drum.

The electronics in the printer allow you to change the start-of-scan position. This is done by changing the delay time between when the beam-detect pulse is sensed and when printing begins.

The beam-detect card requires that the beams be correctly aligned on its sensor and that the beams have enough power. Because this is the only sensor beyond the laser diodes, it detects most of the problems in the printhead.

Fan

A dc fan provides air to the printhead. The fan is mounted at the rear of the printer; an attached air hose provides air to a cooling duct that is attached to the printhead cover. The cooling duct provides cooling to the laser diodes and the LD272 card. The laser diodes can be damaged if they are not cooled properly. Therefore, the cooling duct must be removed from the cover and placed so that the air is blown on the laser diodes whenever the laser diodes are turned on with the printhead cover removed.

Printhead Specifications

Table 12. Printhead Specifications

Item	Value
Operating laser power	10 mW
Wavelength	635 nm
Laser technology	InGaAsP Laser Diode
Beam diameter at PC drum	0.060 x 0.080 mm
Power loss through optics	25%
Beam power at PC drum	1.28 mW per beam
Interlock circuit	PC drum cover and Printhead cover
Mirror facets	8
Mirror speed	14 400 RPM for 600 DPI, 11 520 RPM for 480 DPI
Scan time	651.04 µsec – 480 DPI 520.83 µsec – 600 DPI

Photoconductor Drum and Charging Mechanism

Table 13. PC Drum Subsystem

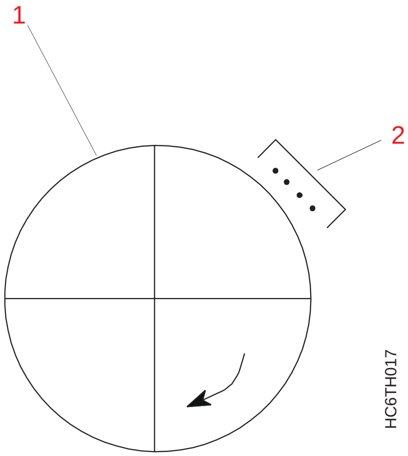


Table 13 shows a cross-sectional view of the photoconductor (PC) drum and the charging mechanism. The charging mechanism consists of coronas and an erase lamp.

The PC drum **(1)** is driven in the direction indicated by the arrow. The drum rotates at 40.39 cm (15.9 in.) per second. Assume that the point of interest on the drum has just passed the cleaning mechanism. It now will pass under the charge corona.

Drum Drive

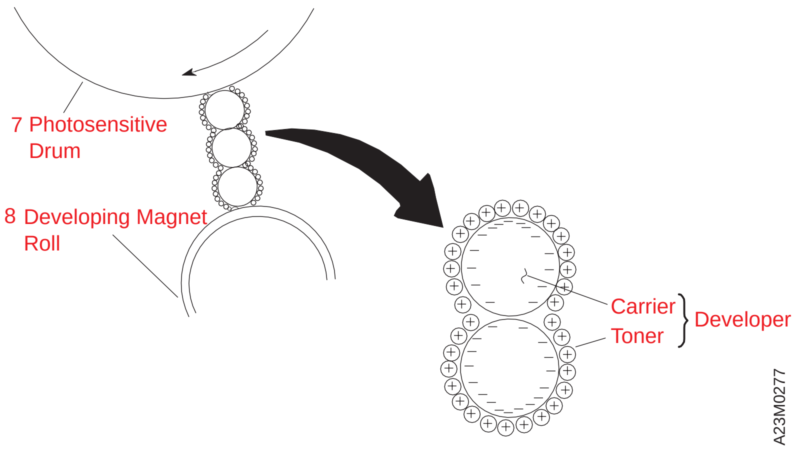
The drum is driven by a dc servo motor through a toothed belt. Drum rotation is sensed by a sensor that detects rotation of the drum drive pulley.

Charge Corona

The charge corona **(2)** charges the PC drum surface to approximately +500 to +950 V dc. The actual voltage depends on the position of the contrast setting and the life of the developer mix.

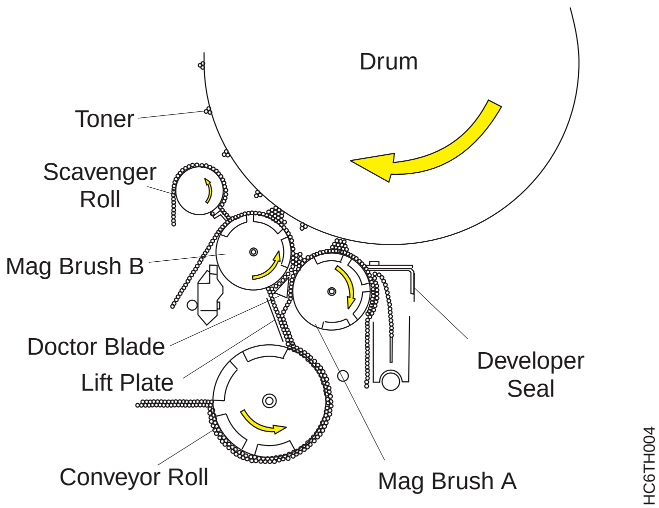
Developer

Table 14. Toner Transfer to the PC Drum



The developer brings developer mix into contact with the charged PC drum. When the developer mix is in contact with the PC drum, the toner can be transferred to the latent image on the drum.

Table 15. Developer Operation



The developer components are shown in Table 15. For discussion, the developer can be divided into two general areas: the toner flow area and the mix flow area. The upper left portion of the developer is the toner flow area; the rest of the developer is the mix flow area.

Mix

The developer mix consists of plastic toner and iron beads. The beads become negatively charged and the toner becomes positively charged. Because of this opposite charging, the toner and beads are strongly attracted to each other. This coupling force must be overcome for the toner to leave the developer and become attached to the PC drum. Some of the most common print-quality problems (light print, background, non-uniform prints, or end-of-life of the mix) can be caused by a toner charging problem.

The charge is developed through the friction of the toner on the beads and is affected by humidity, the amount of printing for which the carrier beads are used, and the amount of toner in the developer.

New beads have rough surfaces, and so new mix causes the toner to have a high charge. High charge causes the toner to adhere strongly to the beads and results in light print. Eventually, toner becomes packed in the rough surfaces of the beads, reducing the ability of the beads to charge the toner. The end-of-life of the mix occurs when low toner charge results in poor solid area fill, then background and dark print.

The addition of extra toner to the mix also results in low toner charge. This is because there are more toner particles for each carrier bead, and so the toner spends less time in contact with the beads. Increasing the amount of toner in the mix can result in darker prints by reducing the binding force to the carrier beads. However, this lower-charged toner can result in background and wider stroke width.

Table 16. Mix Specification Summary

Item	**Value**
Carrier bead diameter	70 to 140 µm; 100 µm avg
Toner particle diameter	11.5 to 12.5 µm

Mix Flow

Developer

A shear force is required to remove the toner from the carrier beads. The toner is rubbed from the beads when the PC drum drags through a pile of mix. One purpose of the developer is to provide a pile of the correct size, and constantly supply it with charged toner.

Table 14 shows one of the many stacks of carrier beads and toner that pile up on the mag brushes. As the PC drum rotates, the toner is wiped from the carrier beads and attaches itself to the discharged areas of the drum.

Conveyor Roll

The conveyor roll (Table 15) lifts fresh mix from the bottom of the developer and passes it over the lift plate to the mag brushes. The roll consists of a sleeve rotating around fixed magnets. The magnets attract the beads, and the sleeve carries the mix to the lift plate.

Mag Brushes

The mag brushes **A & B** are similar to the conveyor roll, because their function is to receive the mix from the roll and lift it to the PC drum.

The mag brushes get their name from the appearance of the mix in the area of contact with the PC drum. The magnetic field causes the beads to form chains that look like the bristles of a brush. The position of the magnets within the mag brushes is critical because the magnets affect the transfer and the shape of the bead chains that contact the drum.

Doctor Blade

The doctor blade smooths and levels the mix on the mag brushes before it reaches the PC drum. The gap setting between it and the mag brushes is critical because it controls the amount of mix that reaches the drum. Too little mix can result in light print, and too much mix piles up because it cannot flow between the drum and the mag brushes. Between these extremes, other print quality problems can result from a poorly set gap.

Developer Seal

The developer seal is located on the right side of the developer. Its purpose is to contain the mix coming off the mag brushes and prevent it from contaminating the PC drum cavity.

Developer Bias
The developer bias is applied to the mag brushes to aid in development of the black fill areas by repelling the toner toward the drum. The positively charged toner particles that are sheared off the beads are attracted to the more negative discharged areas. The developer bias is also applied to the doctor blade to keep toner from building up on this surface.

Scavenger Roll
Because the carrier beads are negatively charged, they are attracted to the positively charged PC drum. Occasionally, a bead is carried out by the drum. This bead will leave a large void on the print if it reaches the transfer point.

To prevent this problem, a strong magnetic roller called a scavenger roll is provided. The scavenger roll uses magnetic force to pull the iron beads from the surface of the PC drum. A motor constantly turns the scavenger roll to wipe the beads onto a plastic wiper.

Toner Control System and Toner Flow
The amount of toner mixed with the carrier beads has a strong effect on print quality. For this reason, the toner is loaded and stored in a separate chamber and is fed slowly into the mixing area when needed.

Toner Loading
Toner is loaded into the printer by inserting a toner cartridge above the toner hopper area of the developer.

When the toner low sensor detects the absence of toner in the toner hopper, the printer continues printing for an additional 1000 feet of forms, then printing stops and an `Add Toner` message is displayed on the Display/Touch Screen. Printing cannot resume until toner is added to the toner hopper.

Toner Feed
When the concentration of toner in the developer mix becomes too low, the toner feed motor turns to feed toner to the developer.

As the toner-feed shaft turns, notches in the shaft pick up measured amounts of toner and transfer it to the developer mix. The plate above the toner-feed shaft ensures that the toner does not pack into and remain in the notches.

Toner Concentration Control

Note: The toner control sensor is located under the mixing paddle.

An electrical coil in the toner control sensor acts as an inductor in the sensing circuit. The amount of iron in the developer mix that flows past the sensor affects the inductance. When more toner is fed into the developer, there is proportionately less iron in the developer mix as a result. Toner feeds are controlled in this manner. The mixing paddle above the toner control sensor allows a measured flow of mix through it.

The toner concentration (TC) is controlled by the CPxxx Card. The level of TC is automatically adjusted at programmed intervals of developer mix life to keep background low.

Toner-Empty Sensor

The level of toner in the developer is sensed by a vibrating crystal in the toner-empty sensor. When the toner level falls below the crystal, the crystal vibrations are no longer damped, and the increased voltage across the crystal is sensed by the PC561 Card.

Without the Enhanced Toner Loading Feature Installed: When the toner low sensor detects the absence of toner in the toner hopper, the printer continues printing for an additional 1000 feet of forms, then printing will stop and an `Add Toner` window is displayed on the Display/Touch Screen. Printing cannot resume until toner has been added to the toner hopper.

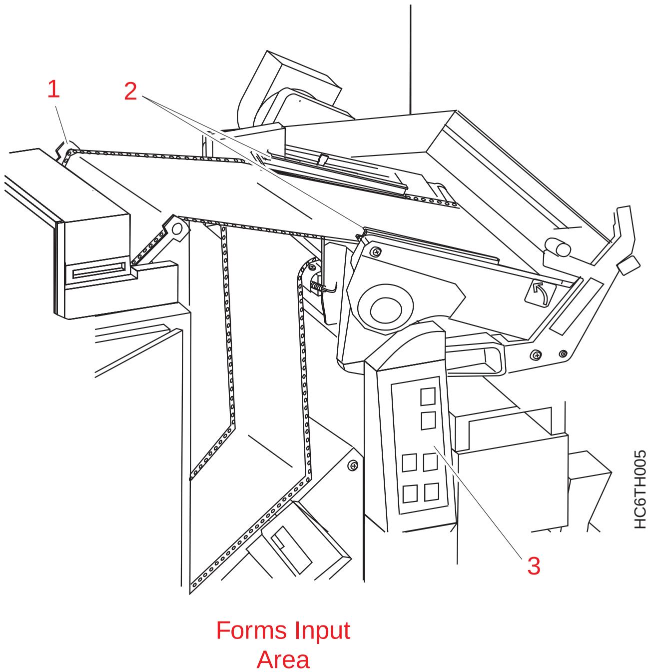
With the Enhanced Toner Loading Feature Installed: When the toner low sensor detects the absence of toner in the toner hopper, a `Toner Supply Low` window is displayed on the Display/Touch Screen while printing continues. The operator has until an additional 800 feet of forms are processed to add toner while printing continues. Once the 800 feet of forms has been processed without adding toner, printing will stop and an `Add Toner` window is displayed on the Display/Touch Screen. Printing cannot resume until toner has been added to the toner hopper.

The `Add Toner` message is posted when the crystal remains undamped for 1000 feet of forms processed.

Input Area and Transfer Station

The input area and transfer station provide a place for the forms to enter the printer and make contact with the PC drum to transfer the developed image from the drum to the form. Table 17 shows the path the paper takes through the input area and transfer station.

Table 17. Paper Path through the Input Area & Transfer Station



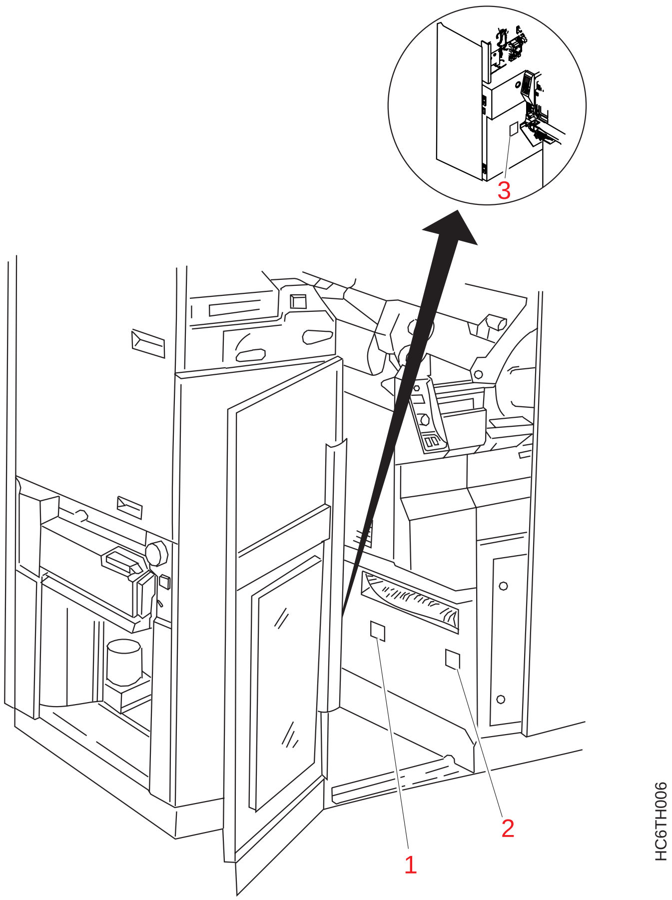
- **(1)** – Tension Arm
- **(2)** – Tractors
- **(3)** – Printer Control Panel

Input Area

The input area provides a path for the forms from the stack of new forms to the transfer station as shown in Table 17. Elements in the input area are the end-of-forms sensors and the splicing station.

End-of-Forms Sensors

Table 18. Input Area

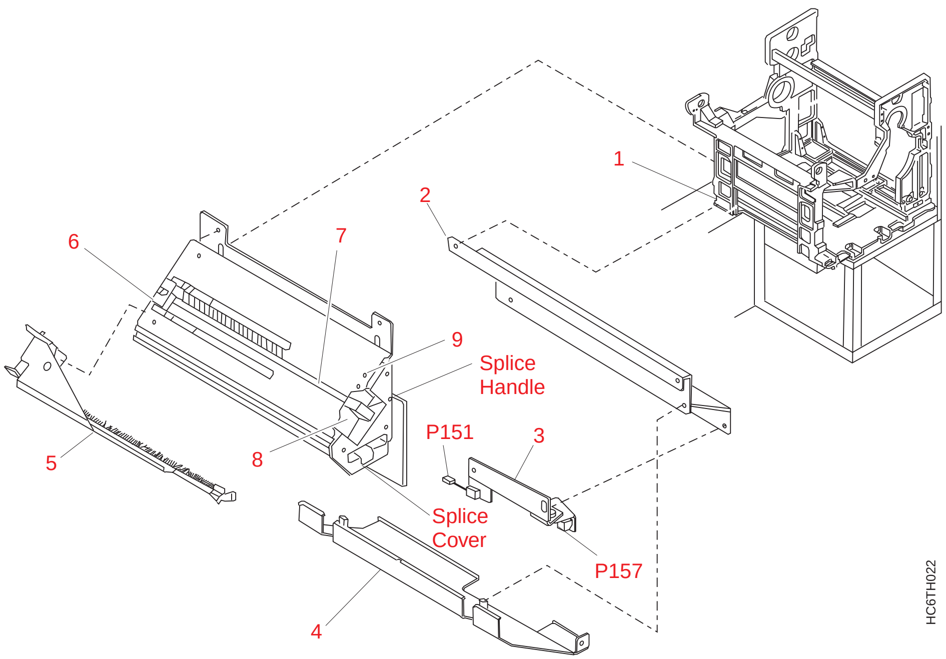


The last sheet in a box of forms is called the end of forms. It must be sensed early enough to stop the forms motion before the last form passes the splicing station.

The input area contains a sensor to detect the end of forms. The sensor consists of a visible red LED light source and a phototransistor receiver. The end-of-forms LED **(2)** lights the end-of-forms phototransistor **(1)**, after reflecting off a mirror **(3)**.

Splicing Station

Table 19. Splicing Station

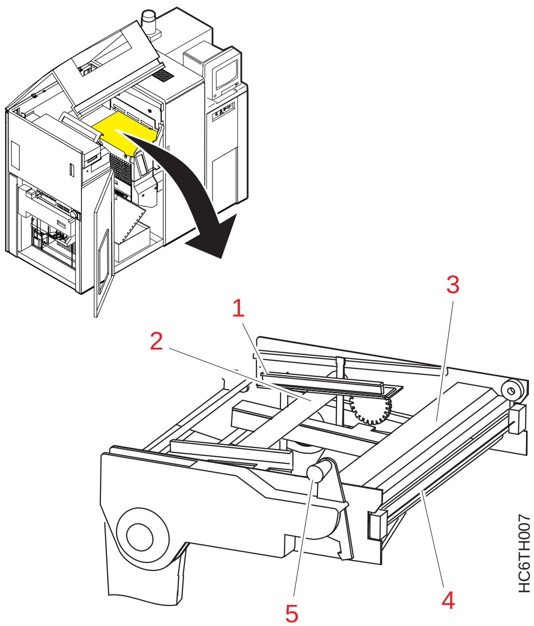


The splicing station provides a work surface to hold and align the forms while splicing tape is applied. An operator-controlled valve **(6)** applies vacuum to the tape slot **(7)** to hold the splicing tape in place. A sensor **(8)** detects the position of this valve to prevent vacuum loss at the vacuum plate in the fuser. Fixed pins **(9)** and movable pins **(6)** hold the forms while the splicing tape is applied.

As the forms enter the splicing table, they pass between two chad brushes **(5)**. The chad brushes remove loose material from the forms and remove any static charge that may build up on the forms.

Transfer Station

Table 20. Transfer Station



The transfer station transfers the toner from the drum to the forms and moves the forms from the input area to the fuser. Its major components include the tractors, retractor, transfer corona, jam sensor, premeasure shaft, and forms width sensor.

Tractors

As the forms leave the splicing table, they enter the tractors (Table 17). A single servo motor drives the tractor drive shaft through a toothed belt. The drive shaft drives two tractors, one in the front and one in the rear of the printer. The front tractors are fixed, and the rear tractors are adjusted to the correct forms width by the operator.

Magnets, attached to the rear tractor, pass over the Hall-effect sensors on the forms width sensor board (PW111) to register the forms width setting.

The rear tractor, when moved, pulls out a special tape to shield the transfer corona from the toner on the drum in the area where no forms are present.

The tractor motor is a dc servo motor that is used during normal printing, during nonprocess runout (when the forms feed buttons are pressed). The servo motor allows the printer to count driving pulses to the motor to determine how far forms are being fed. Whenever forms feeding stops, the tractor motor reverses and positions the perforation ½ in. below the transfer point.

This operation allows for the time required to accelerate the forms to the speed of the drum before transfer begins. This reversing operation is called *backhitching,* and it is particularly noticeable when an extremely complex print job causes the forms path to stop often to allow the control unit to process the next page.

An encoder at the rear of the tractor motor gives a pulse every 0.167 in.. This is the basic clock unit between the printer and the control unit.

Retractor

The retractor **(3)** in Table 20 moves the forms away from the drum at times when the forms and the drum are moving at different speeds. This occurs during nonprocess runout, forms acceleration, backhitching, and when the forms path is stopped but the drum continues to cycle during warm-up and between print jobs. Because of the difference in speeds, contact between the forms and the drum at these times would cause smearing from developed images and low-level background on the drum.

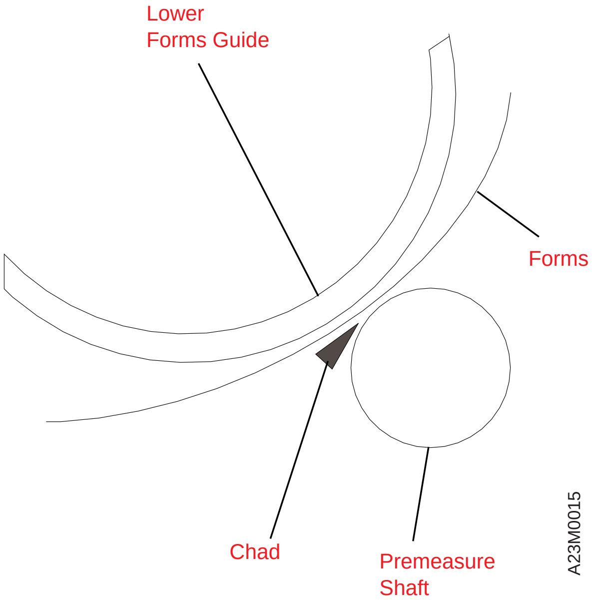
The retractor is a curved plate with a slot in the center, the same width as the transfer station. It is moved by a crank mechanism that is driven by a dc servo motor directly through a coupling. The motor turns in only one direction.

Path Modifier

The path modifier is a plate that moves with the retractors to keep tension on the forms as they are pulled back from the drum.

Lower Forms Guide and Premeasure Shaft

Table 21. Chad Jam at the Premeasure Shaft



The lower forms guide works with the premeasure shaft to prevent damage to the PC drum. Should a chad pile or other foreign substance be traveling with the form, it becomes wedged in the gap between the lower forms guide and the premeasure shaft as shown in Table 21. The gap is slightly smaller than the gap between the retractor and the PC drum.

This wedging of the form at the premeasure shaft causes the form to break and stop the printer, but also it prevents the chad pile or other foreign material from scratching the PC drum.

The premeasure shaft is mounted to the frame of the printer just below the area in which the PC drum is exposed to the transfer station. The lower forms guide is mounted to the transfer station.

When the transfer station is opened for manual forms loading, the lower forms guide is moved away from the premeasure shaft to provide clearance for inserting the forms.

Transfer Corona

The transfer corona is the only corona with a negative voltage. Its purpose is to attract the positively charged toner from the drum to the forms.

The transfer point is 18.9 in. along the PC drum surface from the laser beam scan line.

Normally, about 80% of the toner on the PC drum is transferred to the forms. This number is called the *transfer efficiency*. It is affected by:

- Contrast setting (thickness of toner on the PC drum)
- Forms tension at the PC drum surface
- Life of the developer mix
- PC drum surface voltage
- Retractor to PC drum gap
- Toner charge
- Transfer corona voltage

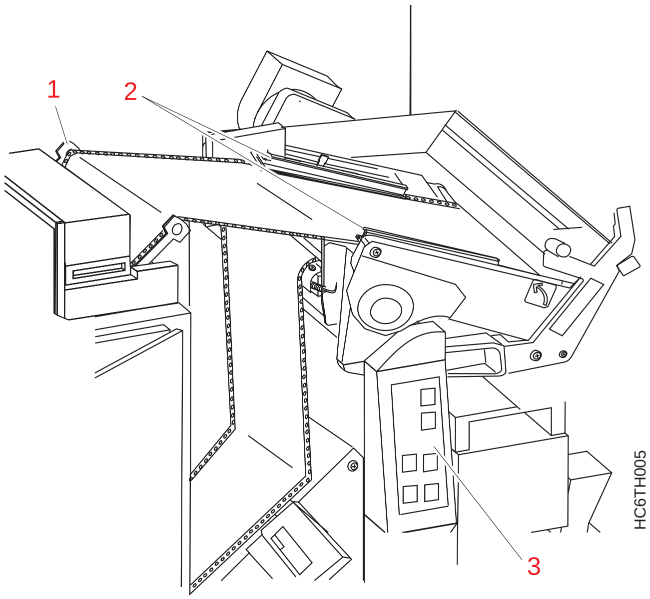
Jam Sensors

There is one forms jam sensor on the transfer station. It consists of a lamp and receiver in the same unit. These elements are aligned so that the light from the lamp reflects off the forms and onto the receiver. You cannot see this light because it is infrared.

The upper jam sensor is located under the pin feed holes at the front edge of the forms. The logic checks for light and darkness as the holes pass over the sensor. When the logic detects constant light or darkness, a jam condition is reported.

Tension Arm

Table 22. Tension Arm



The tension arm **(1)** senses the tension in the forms as they pass between the transfer station and the fuser. Spring force is used to hold the tension arm against the forms.

Three encoders sense the position of a slotted disk mounted to the tension arm shaft. These encoders detect the normal run position of the tension arm in addition to overtravel in the up and down positions. The printer electronics can determine from the position of the tension arm whether the forms are too tight or too loose.

Drum Cleaning Mechanism

The transfer station transfers about 80% of the toner that is deposited by the developer to the forms. The rest must be removed to prevent shadow printing. The drum cleaning mechanism removes this excess toner and disposes of it.

The drum cleaning mechanism has two areas: the drum cleaning area and the vacuum area. The drum cleaning area is located above and to the left of the PC drum. The vacuum area is located at the back of the printer as shown in Table 8 **(13)**.

Drum Cleaning Area

The drum cleaning area discharges the toner and the drum, and sweeps away the toner. The drum cleaning area consists of the preclean corona, the primary erase lamp, and the cleaner brush and housing. Figure 7 shows the drum cleaning area.

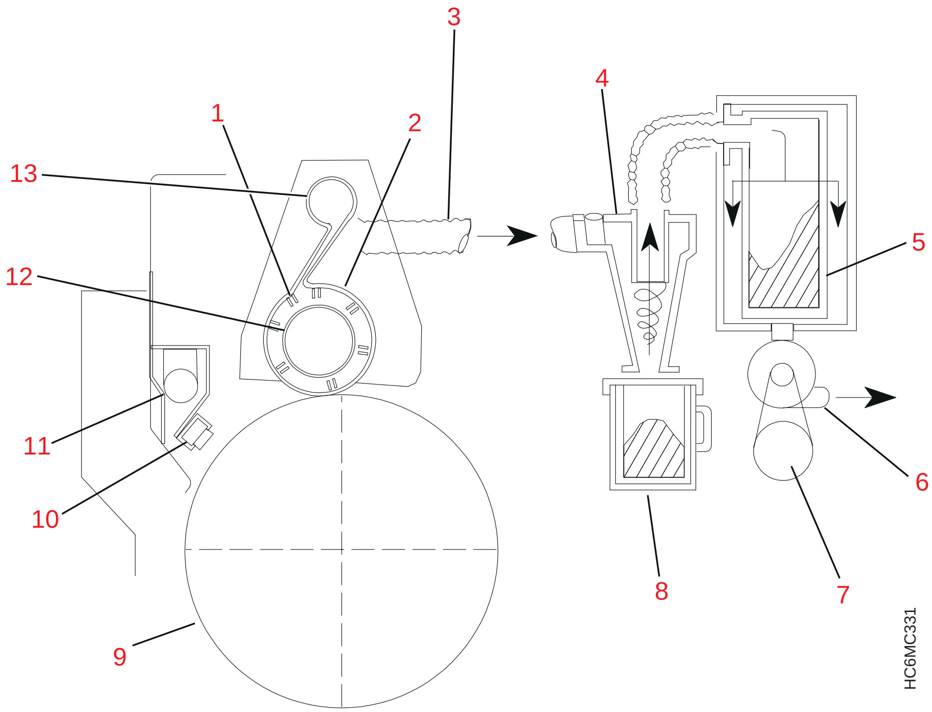


Figure 7. Drum Cleaning Area

Preclean Corona

The preclean corona **(10)** neutralizes any charge that remains on the toner that was not transferred to the paper. An ac voltage (4 kV) applied to the corona that neutralizes the toner charge and the PC drum.

Erase Lamp

The erase lamp unit **(11)** consists of a fluorescent lamp and a photosensor. The erase lamp lights the PC drum through the filter to discharge the remaining charge on the surface of the drum. The photosensor detects any failure of the lamp to remain lighted.

Cleaner Brush and Housing

The cleaner brush **(1)**, driven by an induction motor, sweeps the neutralized toner into the cleaner brush housing **(12)**. The flicker bar knocks the toner off the brush bristles so the toner can travel up the opening in the housing to the vacuum chamber **(14)**. Vacuum from the vacuum area draws the toner away from the cleaner brush housing.

Some of the toner that is removed from the drum tends to collect on the sides of the cleaner brush housing. If it is not removed, this toner can drop onto the drum and cause poor print quality.

During initialization of the printer, the cleaner housing motor rotates the cam that moves the cleaner housing mounting and causes the cleaner brush to come in contact with each side of the cleaner housing.

The cleaner housing motor is a stepper motor that makes a partial revolution in each direction. A reed switch detects the direction in which the motor has rotated and when the motor is at its home position.

At the time that the right side of the cleaner housing is in contact with the cleaner brush, the cleaner brush motor reverses so that any toner on that side of the cleaner brush housing is driven toward the opening that leads to the vacuum chamber.

Cleaning System Vacuum

A strong vacuum is applied to the cleaner housing to remove toner that has been loosened by the cleaner brush. The toner exits through an air chamber at the top of the cleaner housing. This system also applies vacuum to the transfer corona to remove any toner that is attracted past the forms.

The vacuum system was designed to:

- Eliminate any chance of toner entering the blower motor
- Eliminate the need for frequent, costly filter changes.

To prevent toner from entering the motor, the blower **(6)** (Figure 7) is separated from the motor **(7)** and driven through a belt. A rotation sensor checks that the blower pulley is turning and that the belt has not broken.

A two-stage air filtration system is used. First, a cyclone separator **(4)** is used to remove about 90% of the toner from the air without any filter element. As the air enters the cyclone separator, the air is forced tospin around inside the separator.

The spinning of the air causes the larger, heavier particles of toner to migrate to the outside of the cyclone. The toner particles that migrate to the outside area drop to the toner collector **(8)** at the bottom of the cyclone.

The migration of the toner particles separates the toner from the air stream, which continues out of the cyclone through the hose on top. Second, a fine filter **(5)** uses a paper element to filter the remaining toner from the air before it reaches the blower.

The toner that has been removed by the cyclone falls into the toner collector **(8)**, which contains a bag that the customer replaces when prompted. The `Change Toner Collector` message occurs when all of the following conditions exist:
1. End of forms or every 2000 feet
2. Out of toner
3. A third consecutive out-of-toner condition has been detected.

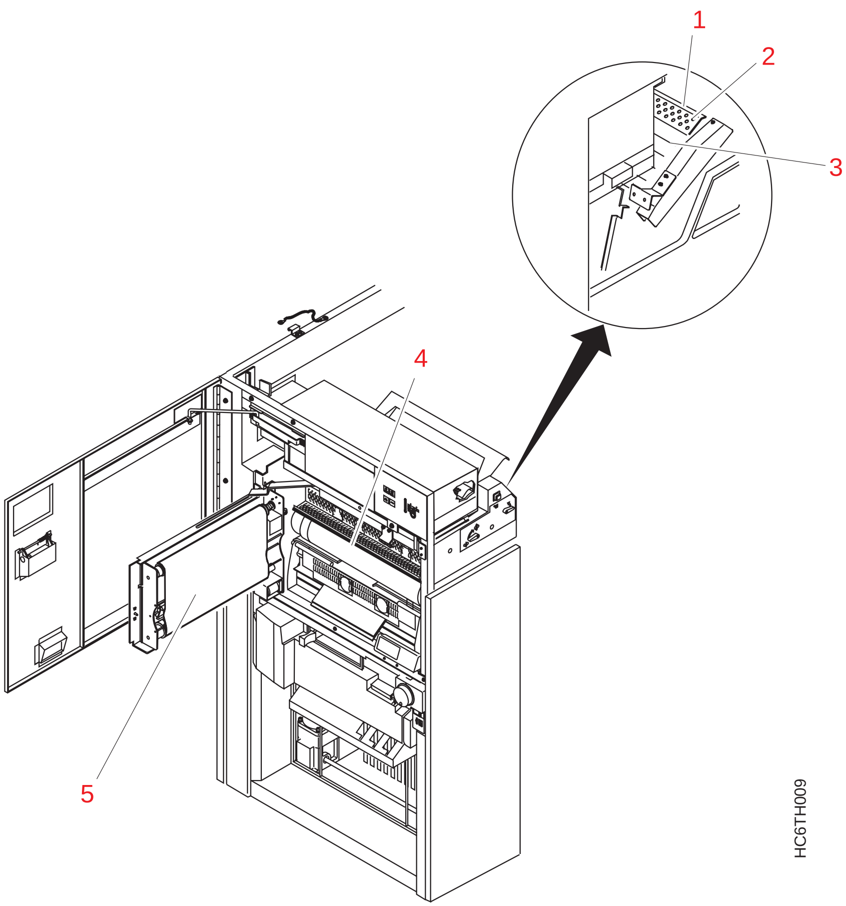
The toner collector must be in place and correctly seated for the cyclone to work correctly. The toner collector also must not be full; a full toner collector prevents the cyclone from working correctly.

A vacuum sensor checks the pressure drop across the fine filter. The pressure drop increases as the filter fills with toner. When the pressure difference becomes too great, the `Replace Fine Filter` message is displayed when an end-of-forms condition occurs.

There is no adjustment for this vacuum system. The amount of toner removed by the cyclone (and the fine filter life) varies slightly with altitude and line frequency (50 or 60 Hz).

Fuser

Table 23. Fuser Area



When the image is transferred from the PC drum to the forms, the toner remains as a powder that is not permanently fixed to the forms. The fuser applies heat and pressure to the forms to melt and bond the toner to the forms. The fuser station also moves the forms that leave the transfer station to the entrance of the stacker.

Some elements of the fuser are concerned mainly with forms movement and others are concerned mainly with toner bonding. The elements that are concerned with forms movement are:

- Scuff rolls
- Skew detection and steering mechanism.

The elements that are concerned with toner bonding are:

- Backup roll
- **(4)** – Hot roll
- **(5)** – Oiler belt
- **(3)** – Preheat Platen

Preheat Platen & Preheat Control

To improve fusing, the forms are first heated from the back by the preheat platen **(3)**.

The preheat platen heating elements are powered directly by the line voltage.

The temperature is maintained by turning the power off and on. To eliminate problems with mechanical relays, solid state relays are used.

The platen temperature is sensed through three thermistors. An over-temperature sensor drops power if there is a failure in the temperature control system that causes an over-temperature condition.

The preheat platen can operate between 45°C and 100°C. This temperature can be set by the CE or customer using the Display/Touch Screen.

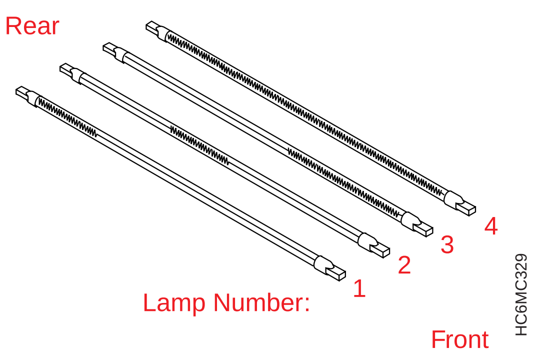
Hot Roll

The hot roll **(4)** (Table 23), in conjunction with the backup roll, completes fusing the toner to the forms by a combination of heat and pressure. The heat from the hot roll melts the toner and the pressure applied by the backup roll forces the melted toner into the fibers of the form.

The hot roll is driven by a stepper motor through a set of gears. The motor has a tendency to run hot because of the heater lamps and a high load. For this reason, a blower is attached to the motor to provide cooling air.

Heat Source

Table 24. Heat Lamps



Radiant heat is applied to the rotating hot roll by four stationary heat lamps. The positions of the heating elements inside the lamps allow (Table 24) heating of the hot roll only in the area contacted by the forms. The logic determines which fuser lamps are turned on based on the width of the forms. The width of the forms is known to the logic from the position of the rear tractor. For example, only two of the lamps are driven when the forms are very narrow. A different group of lamps is turned on for Printer 2, because the forms have already been heated by the fuser in Printer 1.

Temperature Control

The hot roll temperature is sensed through two thermal ferrite chips mounted at the surface of the hot roll. The chips sharply change their magnetic properties at a certain temperature. A stationary sensor near the front of the printer detects the chips when the hot roll is below the operating temperature. When the hot roll reaches or exceeds the operating temperature, the sensor can no longer detect the chips and stops driving the heat lamps.

Note: There are two different types of hot rolls currently in use. The two hot rolls have different operating temperature ranges.

One chip changes its properties at approximately 180°C, which is the normal operating temperature. Newer hot rolls have a normal operating temperature of 190°C.

The other chip changes its properties at approximately 220°C, which is the over-temperature condition. With a newer hot roll installed the over-temperature condition occurs at approximately 240°C.

The temperature is maintained by turning the power to the lamps off and on. To eliminate problems with mechanical relays, solid state relays are used. The over-temperature chip drops the relays if there is a failure in the temperature control system that causes an over-temperature condition.

Temperature Control With Thermistors

In addition to using a thermal ferrite chip on the hot roll, thermistor control of the hot roll temperature is used. This allows tighter temperature tolerances on the hot roll.

Backup Roll

The backup roll applies pressure to the forms while the hot roll is applying heat to complete the fusing process. The backup roll also provides steering to the forms to correct for skew in feeding.

As shown in Figure 8, the backup roll is mounted in a yoke assembly that can be pivoted away from the hot roll when the forms motion stops. The yoke is lifted by cams driven by an ac motor.

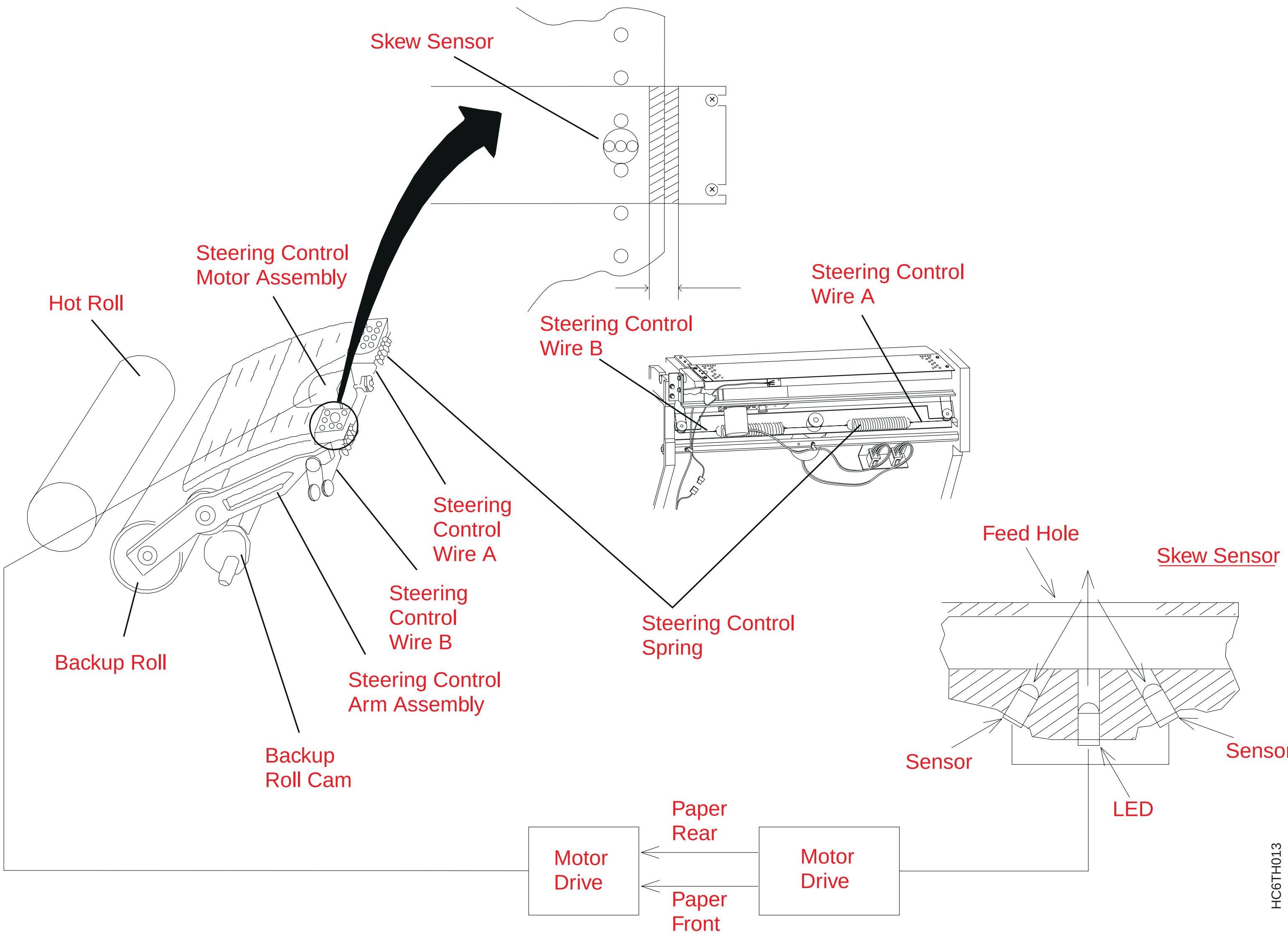


Figure 8. Backup Roll Mechanism

The loaded or unloaded position of the backup roll is detected by a slotted encoder disk sensor at the front of the cam shaft. The pressure of the backup roll against the hot roll is varied by the springs in the steering system.

Backup Roll Lift Motor

When printing, the backup roll keeps the forms in contact with the hot roll to fuse the toner. When stopped, the backup roll lets the forms drop away from the hot roll to avoid damaging the paper.

Bloom, or double fusing, results from the backup roll bringing previously fused forms into contact with the hot roll when the forms begin to move. Bloom appears as a band of darkened, or bolder printing. On images, this band will also appear glossy.

Normally, a short length of the forms gets fused a second time when the forms begin to move to ensure that no region is left unfused. When the forms begins to move, the backup roll loads, bringing the forms in contact with the hot roll. Bloom is the result of two factors:

1. Double fusing
2. The loading dynamics of the backup roll against the hot roll

The purpose of the backup roll lift motor hardware is to reduce bloom by controlling more precisely the loading of the backup roll to the hot roll. This is done by adding a backup roll lift motor for controlling the backup roll separately from the preheat platen. With a smaller mass being moved, the precision and timing of the backup roll to hot roll loading can be optimized to reduce bloom.

Skew Detection and Steering

A worn backup roll, lack of parallelism between the tractors and the hot roll, and other causes can prevent the forms from feeding straight into the fuser. The error caused by feeding the forms at an angle is called *skew*.

As shown in Figure 8, forms tracking is detected by skew sensors that are mounted at the entrance to the fuser. The sensors are aligned under the pin feed holes at the front edge of the forms. When a hole passes between the sensors, the sensors see the edges at the same time. If the hole passes closer to one sensor than to the other, the edges are seen at different times. The signal from the skew sensor feeds position-determining circuits that control the motor driver. The motor driver drives the skew control motor to turn in one direction or the other.

Skew is counteracted by varying the pressure along the backup roll against the hot roll to steer the forms. The backup roll is mounted in a yoke assembly. The arms of the yoke act as a lever, with the backup roll load cam as the fulcrum. A cable is attached to the arms of the yoke, and it can be pulled in either direction by a pulley that is driven by the skew control stepper motor. The tension in the cable applies the load to the backup roll. The additional pressure changes the nip “footprint” to correct the skew.

The skew sensor and position-determining circuits work on the difference in time between the signals from the two sensors in the skew sensor. As shown in Figure 9, the LED lights the tractor holes in the forms as the forms feed over the skew sensor.

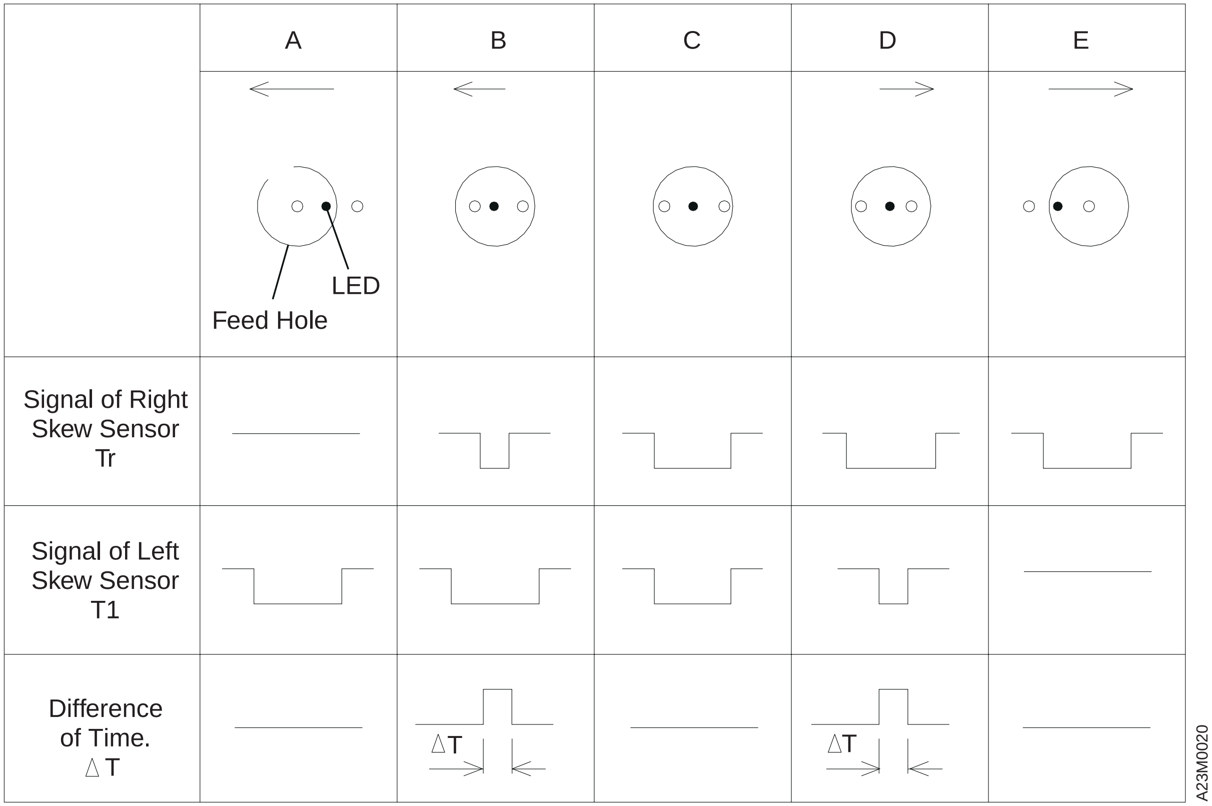


Figure 9. Skew Sensor Operation

If the forms are straight, the center of the hole passes over the skew sensor and both sensors detect the hole at the same time. If the forms are skewed, one sensor detects the hole before the other sensor does and detects the trailing edge of the hole after the other sensor does. The position-determining circuit then signals the motor driver to apply more pressure to the side of the backup roll that has the shorter signal.

Fuser Wrap Detection

Occasionally, a form may adhere to the backup roll and begin to wrap around it. If the form were to completely wrap the backup roll, it could not be cleared by the operator. On the Infoprint 3000, the fuser-wrap sensor is a microswitch that is located under the backup roll. A wrapping form will activate the switch and stop the printer. The backup roll drops away from the hot roll, preventing a wrap.

Scuff Rolls

The purpose of the scuff rolls is to push the forms down through the pendulum, especially when the backup roll is unloaded and the hot roll cannot pull the forms. A set of spring-loaded pressure rollers load the forms against the scuff rolls.

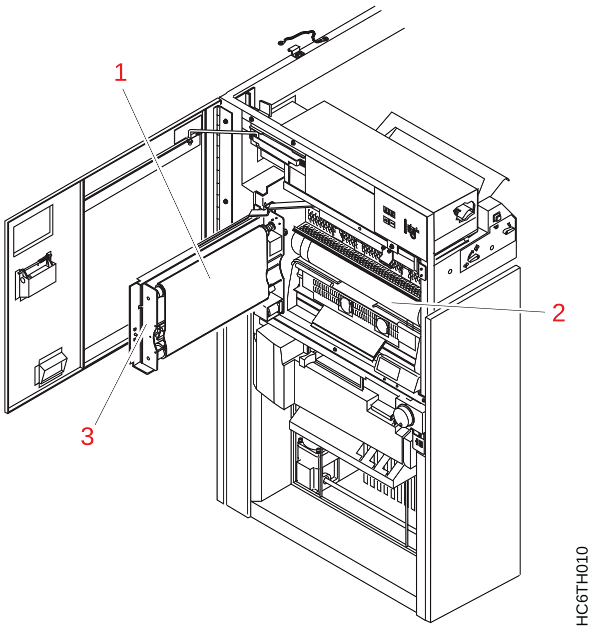
A scuff roll will slip between its inner and outer races when its torque limit is exceeded. This means that the scuff rolls can be driven even when the forms are not moving, to apply tension to the forms without scrubbing against the forms.

Oiling System

The heat and pressure of fusing cause the toner and forms to tend to stick to the hot roll. An oiling system coats the hot roll with fuser oil, allowing the toner and forms to separate from the hot roll. An oiler belt **(1)** (in Table 25) supplies oil to areas of the hot roll surface. The elements of the oiling system are:

- Oiler belt
- Oiler belt drive
- Oil pumps.

Table 25. Oiler Belt Mechanism



Oiler Belt

The oiler belt **(1)** is a felt belt attached to two spools and mounted on the oiler belt gate **(3)**. One of the spools is a supply spool, and the other is a take-up spool. When the oiler belt gate is closed, the belt touches the hot roll **(2)**.

Oil pumps and an oil tank **(11)** (Table 8) supply fuser oil to the back of the oiler belt through flexible tubing. The amount of oil supplied by each tube varies according to the paper width and the position of the forms select switch.

Oil Pumps

The amount of oil pumped onto the belt is controlled by driving certain pumps based on the forms width. In addition, oil is pumped every 20 minutes of standby time by turning on pump 2. The oil rate can be increased or decreased by altering printer memory. For details about altering printer memory, see “Read from or Write to Memory (Position 2)“ in *Diagnostics*.

A float switch in the oil tank senses when the fuser oil tank is empty, and the condition appears on the Display/Touch Screen at the time of end-of-forms and power-on reset.

Heavier weight forms require more oil. This is accomplished by increasing the oil pumping rate, selected by the operator through the forms select switch on the stacker control panel (LP041). Positions A and B on the forms select switch are used to set the correct oiling rate for the weight of the forms being used.

Oiler Belt Drive

Because toner gradually builds up on the oiler belt, it must be advanced periodically to apply a clean surface to the hot roll. The oiler belt is driven by a stepper motor that steps once after a certain number of feet of forms are printed. A chain drive is used because of the high temperature and the oily environment.

The oiler belt rate can be increased or decreased by altering printer memory. For details about altering printer memory, “Read from or Write to Memory (Position 2)” in *Diagnostics*.

The end of the oiler belt is sensed when a notch in the belt frees a lever and trips the oiler belt end switch.

Oiler Belt Gate Switch

An interlock switch is provided on the oiler gate so that the operator is not exposed to rotating parts if the gate is opened during printing.

Oil Pump Control

The printer microcode activates the oil pumps at different rates based on the paper width. Each oil pump is cycled as defined in Table 26. The X in this table is the hexadecimal value in printer memory location FF20. Memory values can be between X'0B' (11) and X'FF' (255); the normal value for X in FF20 is X'64' (100). The oiling rate can be increased by decreasing the values in memory location FF20.

Example

For 9.0-in.-wide paper (60 to 82.5 m/g², 16 - 22 lb),

Pump 1 cycles every 3 × X'64' ÷ 16 = 3 × 100 ÷ 16 = 18.75 seconds between oil feeds.

PPM	Inches/second
112	16

Table 26. Oil Pump Rates

Paper Width (inches)	Pump 1		Pump 2		Pump 3	
	Switch		Switch		Switch	
	16–22 lb	> 22 lb plastic	16–22 lb	> 22 lb plastic	16–22 lb	> 22 lb plastic
8.0	4X	3.33X	0	0	0	0
8.5	4X	3.33X	0	0	0	0
9.0	3X	2.5X	0	0	0	0
9.5	3X	2.5X	0	0	0	0
10.0	3X	2.5X	7X	5.83X	0	0
10.5	3X	2.5X	6X	5X	0	0
11.0	3X	2.5X	5X	4.17X	0	0
11.5	3X	2.5X	4X	3.33X	0	0
12.0	3X	2.5X	3X	2.5X	0	0
12.5	3X	2.5X	2X	1.67X	0	0
13.0	3X	2.5X	2X	1.67X	0	0
13.5	3X	2.5X	2X	1.67X	0	0
14.0	3X	2.5X	2X	1.67X	14X	11.67X
14.5	3X	2.5X	2X	1.67X	14X	11.67X
15.0	3X	2.5X	2X	1.67X	12X	10X
15.5	3X	2.5X	2X	1.67X	10X	8.33X
16.0	3X	2.5X	2X	1.67X	9X	7.5X
16.5	3X	2.5X	2X	1.67X	7X	5.83X
17.0	3X	2.5X	2X	1.67X	6X	5X
17.5	3X	2.5X	2X	1.67X	5X	4.17X

Table 26. Oil Pump Rates (continued)

Paper Width (inches)	Pump 1		Pump 2		Pump 3	
	Switch		Switch		Switch	
	16–22 lb	> 22 lb plastic	16–22 lb	> 22 lb plastic	16–22 lb	> 22 lb plastic
18.0	3X	2.5X	2X	1.67X	5X	4.17X

Upper Stacker

Pendulum

The purpose of the pendulum is to force the forms to fold on the perforations in the same manner as they were in the box. This is necessary for reliable stacking because the heat and pressure of the fuser tend to iron out the perforations. The pendulum also assists in stacking lightweight forms or those with strong perforations.

The printer cannot detect the folding direction of the perforation (sometimes called the forms direction). Therefore, the operator must inform the printer by pressing a key on the printer control panel when prompted to do so.

The arc of the pendulum changes with the form length, which is sensed through the Hall-effect sensors in the stacker. The pendulum is precisely controlled by an encoder at the rear of the pendulum motor. A hall sensor detects when the pendulum has moved past the vertical (home) position.

Finger Belts

The heat and pressure of the fuser stiffens the perforations, which could result in a “dishing” stack; that is, the edges are higher than the middle, which leads to curling and stacker jams. To prevent this, a rack of finger belts on the front and rear of the stacker constantly rub against the folds to press down the stack.

Each set of stacker belts has its own stepper motor. These belts stop rotating when the stacker gate is opened.

Stacker Gate

The stacker gate swings out to allow forms to be removed from the printer. An interlock switch prevents the printer from running with the gate open.

Height-Detect Sensors

The top of the stack must be maintained at a certain position for correct operation of the pendulum and the finger belts. The stacker height-detect sensors cause the logic to lower the table when the top of the stack is sensed.

The height-detect sensors consist of two pairs of an LED light source and a photosensor. One pair is positioned over the right-side folds, and the other over the left-side folds. The logic lowers the table 6 to 7 mm when the light from the rear height-detect sensor and either the front height-detect sensor or the stacker jam sensor is blocked for 4 seconds.

Stacker Jam Sensor

The purpose of the stacker jam sensor is to detect loose misfolds at the top of the stack. The most common cause of this problem is that the operator did not correctly set the pendulum starting direction or the perforation on the scale.

The stacker jam sensor consists of an LED light source and a photosensor. The logic monitors the sensor for light and darkness as the pendulum causes the forms to block and unblock the light. Constant detection of either light or darkness during the time it takes to print 6 pages will cause a stacker jam message to be displayed.

Upper-Limit Sensor

An upper-limit sensor is used to stop the rising of the table when there are no forms in the stacker.

Lower Stacker

Table-Lift Mechanism

The stacker table is raised through toothed belts and a worm gear driven by an ac motor. The table is held in position by the design of the worm gear and by a brake on the motor, which activates when the motor is powered off.

Lower-Limit Sensor

A lower-limit sensor is used by the logic to determine when the table has reached the bottom of its travel.

The stacker is determined to be full when this sensor detects the table and the height-detect sensors are blocked.

Stacker Length Knob

The stacker can be adjusted for various form lengths by moving the front and rear finger belts together or apart as necessary. Turning the knob drives a screwshaft that moves the finger belts.

Stacker Length Sensing

The printer logic must know the length of the forms to control the pendulum travel.

Two sensors are used to sense the stacker position. The FL061 Card can sense the length to the nearest ½ in. from the positions of magnets that travel over the card in a straight line. The stacker length rotary card (FL031) determines the correct fraction of an inch by sensing the rotational position of the lead screw that changes the stacker length.

Stacker Safety Bail

A safety bail and two position switches are mounted below the stacker gate. The safety switches automatically lower the stacker table when the bail is raised. The switches are for the safety of the operator and the printer in case the table is raised and a person or obstacle is between the table and the closed stacker gate.

Air System

An Infoprint 3000 has an air system for providing the following:

- Vacuum for cleaning the PC drum and transfer corona
- Vacuum for holding the tape at the splicing station.

Electronics

Logic Cards

Several logic cards are located throughout the printer. A brief description of all the cards is listed in Table 27. The data connections between the cards can be seen in *Wiring Diagram* - WD46.

Table 27. Logic Cards

Card Number	Card Name	Function
BD171	Beam Detect	Receives beam detect signals and passes information to the LD272 card.
CP261/CP471	Printer Control	Controls printer operations. Contains hot roll, preheat thermal, and toner concentration sensor control. Communicates with the MIC.
DV061	Stepper Motor Driver	Primary dc power distribution. Provides power to high current dc motors and all other cards.
DV071	Fuser/Stacker Driver	Driver card for the following motors: skew, puller, backup roll lift and pendulum. Controls stacker and fuser sensors as well as fuser lamps.
DV081	Fuser/Stacker Driver	Driver card for the following motors: stacker, and backup roll.
DV101	AC Motor Driver	Driver card for the following motors: mirror, resolution switching lens, air system and developer.
FL031	Forms Length Fraction Select	Measures stacker forms length (in fractions of an inch).

Table 27. Logic Cards (continued)

Card Number	Card Name	Function
FL061	Forms Length Select	Measures stacker forms length (in inches).
FU041	Fuser Control	Intermediary card between CPxxx and the DV071 and DV081 cards. Monitors stacker height and safety sensors.
IF491	Printer Interface	Signal interface between the control unit and print engine.
LD272	Laser Driver	Contains laser diodes. Monitors mirror rotations, lens position and beam detect.
LP041	Stacker Control Panel	
MP021	Maintenance Panel	
PC561	Paper Path/EP Process Control	Monitors developer, drum, transfer station, and EOF sensors.
PR011	EP Process	Controls the HVPS and monitors drum area sensors.
PW111	Forms Width Sensor	
SW761	Printer Control Panel	

Transformer

The transformer transforms line voltages of 200, 208, 220, 230, or 240 V ac, 50 or 60 Hz, into 100, 120, and 220 V ac.

The phase input must be connected to the correct point for that particular line voltage in the jumper plugs on the side of the ac control box:

Line Voltage	Connector
240 V ac	JA02
220/230 V ac	JA03
200/208 V ac	JA04

Also see the *Wiring Diagrams* for the connections for the available line voltages.

Power Switches

- CIRCUIT BREAKER CB451 (printer main power): This circuit breaker is normally kept in the ON position and supplies ac voltage to the entire system.
- CIRCUIT BREAKER CB452: This circuit breaker is normally kept in the ON position and supplies power to the control unit ac control box, printer dc units 1 and 2, and the transformer. The transformer supplies power to ac motors and fans in the printer.
- CIRCUIT BREAKER CB453: This circuit breaker is normally kept ON and supplies power to the power sequencing circuitry.

LEDs on the DC Power Supply

Table 28. DC Power Supply LEDs

LED Name	Color	Indication when Lit
AC IN	Green	Presence of ac voltage to the power supply
POWER	Green	Presence of dc voltage out of the power supply
+5V ALARM	Red	Loss of +5 volts out of the power supply
±12V ALARM	Red	Loss of ±12 volts out of the power supply
+24VE ALARM	Red	Loss of +24 VE out of the power supply
+24VF ALARM	Red	Loss of +24 VF out of the power supply
+24VH ALARM	Red	Loss of +24 VH out of the power supply
TRNS TH	Red	The ac power supply transformers have overheated.
SOFT TH	Red	The ac control box soft-start resistors have overheated.
MIRROR	Red	Loss of +5 VM, +12 VM, or +100 VM out of the power supply
DRIVE	Red	Loss of +40 VD, or +24 VD out of the power supply
FAN	Red	The power supply cooling fans have stopped turning.

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