Compliance Information

For Customers in the U.S.A.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: 1) this device may not cause harmful interference, and 2) this device must accept any interference received, including interference that may cause undesired operation.

Warning

Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user’s authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide responsible protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Shielded cables must be used with this unit to ensure compliance with Class A FCC limits.

The user may find the following booklet prepared by the Federal Communications Commission helpful: How to Identify and Resolve Radio-TV Interference Problems. This booklet is available from the U.S. Government Printing Office, Washington, DC 20402, Stock No. 004-00-00345-4.

This equipment is UL listed.
Support and Training

Contact Information
If you have any questions or need assistance, please contact Videojet Technologies Inc. at 1-800-843-3610 (for all customers within the United States). Outside the U.S., customers should contact their Videojet Technologies Inc. distributor or subsidiary for assistance.

Videojet Technologies Inc.
1500 Mittel Boulevard
Wood Dale, IL 60191-1073 U.S.A.
Phone: 1-800-843-3610
Fax: 1-800-582-1343
International Fax: 630-616-3629
Web: www.videojet.com

Service Program

About Total Source Commitment
Total Source® TOTAL SERVICE PLUS RELIABILITY, is the Videojet Technologies Inc. commitment to provide you - our customer - the complete service you deserve.

The Total Source Commitment
The Videojet Total Source® Service Program is an integral part of our business in providing marks, codes, and images where, when, and how often customers specify for packages, products, or printed materials. Our commitment includes:

• Applications support.
• Installation services.
• Maintenance training.
• Customer response center.
• Technical support.
• Field service.
• Extended hours phone assistance.
• Parts and supplies.
• Repair service.
Customer Training

If you wish to perform your own service and maintenance on the printer, Videojet Technologies Inc. highly recommends you complete a Customer Training Course on the printer.

*Note: The manuals are intended to be supplements to (and not replacements for) Videojet Technologies Inc. Customer Training.*

For more information on Videojet Technologies Inc. Customer Training Courses, call 1-800-843-3610 (within the United States only). Outside the U.S., customer should contact a Videojet subsidiary office or their local Videojet distributor for further information.
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Index
Introduction

In this chapter you will find:

- A brief description of the intended use of this product
- Who this manual is intended for and how it is organized
- A description of the other manuals associated with this printer

**Warning**

Read Chapter 2, “Safety” before attempting to install, operate, service, or maintain the equipment.

Equipment Description

The Videojet Universal 37pc (postal coder) printer is a non-contact, ink jet printer that prints at high production speeds onto almost any surface in any direction. This equipment is typically used for printing postal bar codes onto mail pieces.

**Printer Supplies**

Due to the large variety of inks available for use with this product, this printer can print on virtually any surface, texture, contour, or shape.

Consult your Videojet Technologies sales representative if you have any questions regarding supplies selection (inks, make-up fluids, and cleaning solutions), or product applications.

**Caution**

Only Videojet supplies are recommended for use in this printer. Non-approved supplies may damage the unit or produce inferior printer operation or printing output.
About the Service Manual

The Service Manual is intended for use by qualified service or maintenance personnel only. It contains information on installing, maintaining, troubleshooting, and servicing the printer.

Throughout this manual the Videojet Universal 37pc/UI is placed to right of the page and the Videojet Universal 37pc/UI-S is placed to the left.

Warning

Customers who intend to service and maintain the printer themselves must only have qualified personnel perform those procedures. Qualified personnel are considered to be those persons who have the proper technical training (successful completion of a training course covering this printer), have experience to work on this equipment, and are aware of the hazards to which they will be exposed. The Universal 37pc Service Manual is intended to be a supplement (and not a replacement) to training.

Related Documents

Two other documents are available (through Videojet Customer Service) for the Universal 37pc:

• Operator’s Guide (P/N 361517-01)
• Illustrated Parts Breakdown (P/N 361519-01)

Universal 37pc Operator’s Guide

Refer to the Universal 37pc Operator’ Guide (also supplied with the printer) for information on operating the printer.

Universal 37pc Illustrated Parts Breakdown

The Illustrated Parts Breakdown shows the parts of the printer and the printer accessories that are available to order from Videojet Technologies.
Language Codes

When ordering manual, be sure to add the 2-digit language code to the end of the part number. For example, the Spanish version of this manual is part number 361518-04.

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**Note:** Initial availability of the Operator’s Guide is indicated by an asterisk (*). Availability of the Service Manual is indicated by a plus sign (+). Availability of the Illustrated Parts Breakdown is indicated by the number sign (#). For more information, consult your Videojet distributor or subsidiary.
In this chapter you will find:

- Safety conventions used throughout this manual
- Important safety guidelines to follow when operating the equipment
- Important safety guidelines to follow when working with inks, make-up fluids, and cleaning solutions
- What to do in case of a medical emergency

**Warning**

Read this chapter thoroughly before attempting to install, operate, service, or maintain this product.

**Introduction**

The policy of Videojet Technologies Inc. is to manufacture non-contact printing/coding systems and ink supplies that meet high standards of performance and reliability. We enforce strict quality control techniques to eliminate the potential for defects and hazards in our products.

The intended use of this printer is to print information directly onto a product. Use of this equipment in any other fashion may lead to serious personal injury.

The safety guidelines provided in this chapter are intended to educate the operator on all safety issues so the operator can operate the printer in a safe manner.
Safety Conventions Used in the Manual

Specific safety information is listed throughout this manual in the form of Warning and Caution statements. Pay close attention to these statements as they contain important information on avoiding potential hazards to yourself or to the equipment.

Warning Statements

- are used to indicate hazards or unsafe practices which could result in personal injury or death
- have a triangular symbol with an exclamation point to the immediate left of text
- are preceded by the word “Warning”
- are always found before the step or piece of information to which they refer

For Example:

⚠️ Warning

The next step, “Cleaning the Printhead,” must be performed by service or maintenance personnel who have the proper training and experience to work on this equipment and are aware of hazards to which they are exposed.

Caution Statements

- are used to indicate hazards or unsafe practices which could result in product or property damage
- have a triangular symbol with an exclamation point to the immediate left of text
- are always preceded by the word “Caution”
- are always found before the step or piece of information to which they refer
For Example:

⚠️ **Caution**

Never turn the printer Off by switching the AC power switch to the OFF (O) position before pressing the STOP/START key and allowing the printer to complete the two-minute shutdown sequence. Failure to follow this procedure properly prevents the printer from drawing the ink in the ink return line back into the reservoir. This may cause the ink to dry in the line, resulting in problems when you turn the printer back On.

---

**Safety Guidelines for Items in the Spare Parts Kit**

Reduran® Special Hand Cleaner and Latex gloves are included as part of the printer Spare Parts Kit. The following safety precautions must be observed when using these items.

**Guidelines for using Reduran® Special**

- Reduran Special is not to be used in place of a PPE (Personal Protective Equipment), but is only to be used in cases of accidental skin contact with dried ink.
- Keep Reduran Special away from items such as clothing. It will decolorize clothing and other materials.

**Guidelines for using Latex Gloves**

- Latex gloves should not be used if the user is allergic to latex.
- Latex gloves should only be used in operations where the only concern is exposure to ink which may stain skin.
- For cases involving skin contact with VIDEOJET® fluids or organic solvents, a more durable glove such as Butyl rubber gloves are recommended. Latex gloves are not designed for use with organic solvents.
- Disposable nitrile or latex gloves may be suitable for brief contact, such as splash protection, only when the bulk of a more durable glove would interfere with maintenance operations.
- Do not re-use disposable gloves.
- Do not use disposable gloves in operations which may tear or puncture the glove.
Introduction
This section contains important safety guidelines pertaining to the operation and handling of the printer and associated equipment.

Warning
Always observe the following safety guidelines when operating and handling the printer and associated equipment.

Comply with Electrical Codes
All electrical wiring and connections must comply with applicable local codes. Consult the appropriate regulatory agency for further information.

Avoid Breathing Exhaust Vapors
During operation, the printer exhausts material through the printer exhaust tube. This material may be flammable and present a health hazard. For these reasons, do not allow the exhaust to be confined to an area that does not have proper ventilation or be located near a source of ignition. Printer exhaust fumes are generally heavier than air, so keep all sources of ignition away from low areas where fumes may travel or accumulate. If any of these circumstances apply, it may be necessary to vent the printer exhaust to outside air. Consult the appropriate regulatory agency concerning emission permitting and venting system requirements before venting printer exhaust to outside air.

Note: A Vapor Exhaust Ducting Kit is available through Videojet.
Do Not Remove Warning Labels

Do not, under any circumstances, remove or obstruct any warning, caution, or instruction labels in the printer.

Placement of the Printer

Do not place the printer in a hazardous location. Hazardous locations, as defined in the United States, are those areas that may contain hazardous materials in sufficient quantity to create an explosion. These are defined in Article 500 of the National Electrical Code ANSI/NFPA 70–1993.

Outside the United States, you must ensure compliance with all local regulations regarding equipment placement in potentially hazardous locations.

Warning

Do not place the printer in a hazardous location

Placement of Printer on the Floor

CAUTION - If the printer is to be located on the floor or table use Videojet stand (P/N 378415) for model 37PC/UI and Videojet stand (P/N 20092400) for model 37PC/UI-S. Failure to attach this stand to the printer will void the regulatory approval of this printer.

Place Printer near Outlet

To maintain regulatory approval plug printer into an easily accessible socket-outlet.

Printer Accessories

Videojet stand (P/N 378415) and Videojet stand (P/N 20092400) are the only approved stand for use with this printer. All shields of cables connected to the printer should be terminated to frame ground in an appropriate manner in order to maintain EMC compliance.
Ink Safety Guidelines

Introduction
This section contains important safety guidelines pertaining to the use and handling of printer supplies (inks, make-up fluids, and cleaning solutions).

⚠️ Warning
Always observe the following safety guidelines when using or handling inks, make-up fluids, and cleaning solutions.
For continued protection against possible fire hazard, use only Videojet supplies with a flash point no lower than -22°C (-8°F) and boiling point no lower than 56°C (133°F).

Figure 2-1. Ink, Make-up Fluid, and Cleaning Solution

No Smoking
Do not smoke when near the printer or printhead. Explosion or fire may result if the printer exhaust fumes are subjected to an ignition source.
Wear Safety Glasses

Wear safety glasses with side shields (or equivalent eye protection) when handling any ink, make-up fluid or cleaning solution. If splashed into your eyes, flush eyes with water for 15 minutes and see a physician immediately.

Avoid Skin Contact

Wear butyl rubber gloves when handling any ink, make-up fluid or cleaning solution. Avoid contact with skin and mucous membranes (nasal passage, throat). Upon contact with skin, remove any contaminated clothing and wash area with soap and water. See a physician if irritation persists.

Avoid Breathing in Vapors

Avoid prolonged exposure to vapors. If respiratory protection is needed, a cartridge organic respirator is required.

Dispose of Ink Properly

Do not pour any ink, make-up fluid, or cleaning solution into sinks, sewers, or drains. Waste disposal must comply with local regulations; contact the appropriate regulatory agency for further information.
Read the Material Safety Data Sheets (MSDS)

Read and understand the Material Safety Data Sheet (MSDS) before using any ink, make-up fluid, or cleaning solution. An MSDS exists for each type of ink, make-up fluid, and cleaning solution; the appropriate sheet or sheets are supplied with the product when shipped.

Make certain to retain all MSDSs for future reference in the event you should need to see a physician regarding an ink-related accident. Additional copies of MSDSs are available upon request and can be obtained by contacting the Videojet Customer Service Department at 800–843–3610. Outside the U.S., customers should contact a subsidiary Videojet office or their local Videojet distributor.

Electronic copies of MSDSs can be found in the support section of the Videojet web site.

Store Inks Properly

Certain inks, make-up fluids, and cleaning solutions are flammable and must be stored appropriately. Storage must comply with local regulations; contact the appropriate regulatory agency for further information. The label on the bottle or the Material Safety Data Sheet (MSDS) will indicate if a particular fluid is flammable.

Warning

The waste container or service tray used to ground the printhead must be made of metal. Use of a non-metallic waste container/service tray may result in the possibility of electrostatic discharge.

Ground the Printhead to the Service Tray

To avoid the possibility of electrostatic discharge when test printing or discharging fluid from the printhead into the service tray. Ensure all service tray and printhead fasteners are properly tightened. (refer Figure 2-2). This is necessary to avoid the possibility of electrostatic discharge that may result in fire.

Videojet highly recommends the use of the Videojet approved service tray. Use of a non-metallic container is not recommended because it cannot be grounded properly. Refer to Figure 2-2 for the recommended grounding method.
Note: The service tray is available through Videojet. Refer to the Illustrated Parts Breakdown for further information.

Figure 2-2. Grounding the Service Tray
Medical Emergencies

Introduction
This section contains important medical information should an accident occur.

⚠️ Warning
In the event of a medical emergency, contact a physician immediately.

Emergencies Involving Printer Fluids
If the incident involves an ink, make-up fluid, or cleaning solution, bring the bottle and/or Material Safety Data Sheet (MSDS) with you to the physician’s office. These items contain important information that the physician may require in order to provide treatment.

Rocky Mountain Poison Control Center
All of Videojet inks, make-up fluids, and cleaning solutions are also registered with the Rocky Mountain Poison Control Center, located in the United States. If the bottle or MSDS cannot be located, the physician can contact the Rocky Mountain Poison Control Center to obtain the information required.

Rocky Mountain Poison Control Center
(303) 623-5716

Note: Persons outside the United States requiring medical attention can have a physician contact the Rocky Mountain Poison Control Center in the United States or a poison control center or hospital in their own area.
Installation

In this chapter you will find:

- How to install the printer and prepare it for operation
- How to connect AC power and compressed air to the printer
- How to run drain, refresh and prime procedures
- How to set up and adjust the printer for operation

Introduction

Inspection

If the printer has been removed from its shipping carton for the first time, check the unit for damage. Examine the control unit, umbilical, and printhead closely. The printer is packed carefully at the manufacturing facility. If any damage is noted, damage claims should be filed with the carrier.

Chapter Content

The procedures in this chapter show you how to take a printer from the shipping carton, and install it so that the printer will print a bar code when properly interfaced to a mail sorting system. If the printer has already been installed, you can use the individual sections in this chapter as reference.

Caution

It is strongly recommended that a Videojet Technologies service engineer install the printer. This will ensure that the printer has been installed properly, and that the system parameters have been set to match your line application. Contact Videojet Technologies or your local Videojet subsidiary or distributor for further information.
Setting Up the Printer

**Tools/Supplies**

The following tools/supplies are required to complete the procedures in this section:

- small flat blade screwdriver
- Phillips screwdriver
- adjustable wrench, small
- Printer stand*
- Videojet service tray*
- air input filter kit*
- factory-supplied compressed air source, or optional portable air compressor*
- air dryer unit. (only required if using the portable air compressor or if factory compressed air is high in water content).
- high voltage gap tool* (included in configuration kit)
- flow meter* (included in configuration kit)
- appropriate-sized tubing (enough length to route from air source to air input filter kit, and quick disconnect fitting for the air hose. Five feet/1.52 m of tubing are included with the printer)
- appropriate electrical source – refer to Appendix A for electrical requirements

Items denoted by an asterisk (*) are Videojet supplies or accessories which are available from Videojet Technologies Items can be ordered by referring to the Accessories and Spare Parts chapter (Chapter 3) of the Illustrated Parts Breakdown manual.

In addition, whenever Videojet accessories or spare parts are specified as available from Videojet Technologies throughout this chapter, refer to the Accessories and Spare Parts chapter (Chapter 3) of the Illustrated Parts Breakdown manual for specific instructions for placing an order with Videojet Technologies.
Mount Printer to Stand

Caution

If the printer is to be located on the floor, use of a Videojet stand is required. Failure to attach this stand to printers placed on the floor will void the Underwriter’s Laboratories Inc. Listing of this product.

Do not position printer upside down at any time. Tilt or hold the printer upright as the printer stand is attached.

Make certain the printer is in a well-ventilated area. If it is not, use the vapor and exhaust ducting kit (P/N 370089) available from Videojet Technologies.

Determine Printer Proximity to Conveyor

Position the printer near the mail sorting system, making certain to consider the following guidelines:

• The area selected should be free of vibration.

• The umbilical is 10 feet in length. Make certain the printhead will reach its final location at the conveyor.

• Allow for some slack when routing the umbilical to the products to be printed upon. Do not kink or stretch the umbilical, or allow any portion of it to be located near sharp objects or areas of heavy traffic.

• The I/O cables must reach the mating connectors on the rear of the printer. Ensure the cabling is dressed properly and clear of moving parts.

• When selecting the location, the AC power source and compressed air source connections (unless you are using a portable air compressor) must be easily accessible.

Determine Printhead Configuration

The 37pc printer is factory fitted with a fixed or adjustable printhead. You cannot adjust fixed printheads and are available in a straight or 90 degree configuration. You must configure the adjustable printhead in a straight or 90 degree configuration.

If the 37pc being installed has an adjustable printhead then two printhead configurations are possible as shown below:
If necessary the printhead configuration may be changed by completing the following procedure;

**Warning**

PERSONAL INJURY. Only trained service or maintenance personnel must perform these installation procedures. Qualified personnel have successfully completed the training courses, have sufficient experience with this printer, and are aware of the potential hazards to which they will be exposed.
Caution

EQUIPMENT DAMAGE. Avoid stretching, pinching or damaging the tubes and wires that run through the printhead cable when performing this procedure.

90° Printhead Configuration Procedure

Do the following tasks to configure the printhead into 90° printhead:

1. Take the printhead that is in 180° configuration (see Figure 3-3).

2. Remove and retain the two hexagonal screws (item 2, Figure 3-4 on page 3) from the printhead collar (item 1) using the 3-mm screwdriver.

3. Remove and retain the two screws (item 2, Figure 3-5) that loosen the printhead collar from the umbilical (item 1) using the philips screwdriver.
Move the printhead collar (item 2, Figure 3-6) away from the printhead (item 1) slightly.

Rotate the printhead collar by 180° (see Figure 3-7 on page 3-7).

Rotate the printhead collar by 180° (see Figure 3-7 on page 3-7).
**Note:** The printhead collar can be rotated in any direction.

**Figure 3-7. Printhead Collar Rotation**

**Note:** Only rotate the collar. DO NOT rotate the printhead. Rotating the printhead in relation to the umbilical cable can twist and damage the internal wires and tubing.

6 Use the two screws to tighten the printhead collar (see Figure 3-8).

**Figure 3-8. Printhead Collar Tightening**
7 Use the two hexagonal screws to attach the printhead to the printhead collar as shown in Figure 3-9.

![Figure 3-9. 90 Degree Printhead](image)

**Connect Printer to Power Source**

The printer contains a universal power supply that operates from 90 to 264 VAC without adjustment. The printer comes equipped with a Power cord with a 120 V plug (North America).

1 If your printer requires 120 V plug (North America), plug the power cord into the appropriate electrical source. Continue to Connect Compressed Air on page 3-8

2 If your printer requires 230 V plug or International plug, complete the steps in the next section Printers Requiring Plug Replacement.

**Printers Requiring Plug Replacement**

The 120 VAC printer is equipped with a NEMA 5-15P plug. If you want to replace this plug, complete the steps below.

**Caution**

To maintain safety certification, only the plug should be replaced. The original power cord should be used unless in an EU country where the cord must be replaced. If the plug is inappropriate for the EU country follow the instructions below.

1 Cut off the attached plug from the end of the line cord.
2 Replace the plug with a compatible plug which will work with the available power outlet receptacle.

3 Follow the wiring instructions included with the purchased plug. Make certain that the green/yellow ground wire is connected to the plug's grounding pin.

4 After the new plug is attached, plug the power cord into the appropriate electronic source.

5 Continue to Connect Compressed Air.

**Connect Compressed Air**

When connecting compressed air to the printer, the use of an air line filter and regulator is mandatory. This is necessary to ensure the quality of the air supplied to the printer. An air dryer may also be needed. An air input filter kit can be purchased separately through Videojet Technologies.

If a compressed air source is not available or in the vicinity of the printer, you can use a portable air compressor to supply compressed air to the printer. An air compressor is available through Videojet Technologies.

**Air Requirements**

Before connecting compressed air to the printer, make certain the air source to be used is clean, dry, and free of contaminants, oil, and water, and the following air requirements are met:

- **Input Pressure:** 70-100 psi (4.83-6.89 bar). However, the recommended setting is between 70 and 80 psi.
- **Consumption:**
  - 0.70 SCFM (maximum)
  - 0.36 SCFM (typical)
- **Quality:** Instrument quality required (filtered to 0.03 micron and no more than 1 PPM oil content). The air quality can be achieved with commercially available twin package filters consisting of a pre-filter, followed by a sub micron coalescing type filter.
- **Pressure Dew Point:** Less than 40°F at 80 psi (4.44°C at 5.52 bar)
Procedure
Complete the following steps to connect compressed air to the printer.

1  Retrieve the coil of unconnected tubing from the ink compartment.

2  The ends of the coil are joined by a brass fitting. Disconnect one end of the coil from this fitting.
3 Feed the free end of the coil through the air tube hole in the back of the cabinet.

![Image of setting up the printer]

*Figure 3-11. Sliding the air tube into the printer*

**Note:** A small amount of alcohol applied to the outside of the tube will make it easier to slide the tube through the hole.

4 Once the end of the air tube appears on the inside of the printer cabinet, continue pulling the tube through until approximately 30 inches (76 cm) of tube are inside the cabinet.

5 Route the air tube behind the other tubes on the inside of the cabinet door as shown in Figure 3-12. Connect the end of the tube to the elbow
fitting on the bottom of the air manifold. This procedure is a good representation of both Videojet Universal 37pc printers.

6 Mount the air pressure regulator in a suitable location.

*Note:* It is not necessary to mount the regulator on the printer itself. However, the air pressure regulator that Videojet sells for use with this printer may be mounted on the printer as shown in Figure 3-13.

7 Trim the unconnected end of the input air tube to the length required to reach the air pressure regulator. If necessary, an additional length of tubing may be attached using the brass fitting that joined the ends of the tube coil.

8 Attach the printer’s input air tube to the output of the air pressure regulator and adjust the air flow to 70 psi. If using a third party air regulator, consult the instructions that came with the regulator being attached.

*Figure 3-12. Connecting the input air tube to the air manifold*
used. If using an air regulator provided by Videojet, follow the steps below:

a. Connect the compressed air source to the input of the air regulator assembly.

b. Connect the output of the air pressure regulator to the printer’s input air tube.

c. Adjust the air pressure regulator until 70 psi is shown on the gauge.

Figure 3-13. Input Air Connection to Air Pressure Regulator
Turn Printer On

1. Press the AC power switch to the ON (|) position to turn power to the printer On (refer to Figure 3-14). The light and the display screen on the keyboard will illuminate indicating that power is being supplied to the printer.

Figure 3-14. Location of AC power switch

2. Continue to “Select POSTNET/IMB or I.D. Tag/IMB Use”.

Select POSTNET/IMB or I.D. Tag/IMB Use

*Note:* The acronym IMB will be used throughout this manual to refer to the Intelligent Mail® Bar code.

A Universal 37pc in parallel mode can function as either POSTNET/IMB or I.D. Tag/IMB printer. However, the bar code type must be selected the first time the printer is powered on.

*Note:* If you are not going to operate the printer in parallel interface mode, you must still make a selection. However, which setting you select is irrelevant.

Complete these steps to set the bar code type for parallel print mode:

1. The first time a new printer is turned on, the screen shown below appears.

   ![SELECT BAR CODE TYPE FOR PARALLEL MODE](image)

2. Press the Yes/No key on the keyboard to select <YES> for one of the two options (<POSTNET/IMB> or <ID-TAG/IMB>).

3. Press the Save key to save the option selected.

   *Note:* Bar code type can only be selected upon initial setup. If the printer type select screen does not appear at initial start-up, then the printer has already been configured for a bar code type.

   To change the bar code type after installation, the control board must be manually reset. See “Changing the Bar Code Type for Parallel Mode” on page 7-61 for instructions on how to reset the control board.

4. Once the bar code type is selected and saved, the printer displays the message “INITIALIZATION COMPLETE.”

5. Press the Standby key to complete the printer selection and initialization procedure.

6. Continue to “Verify Preliminary Vacuum Setting.”
Verify Preliminary Vacuum Setting

Vacuum must be present in the system to complete the installation process. However, the final vacuum setting cannot be set until after the printer has been loaded with ink. Complete these steps to confirm there is enough vacuum to complete the installation process.

1. Press the Start/Stop key to start up the printhead. This is required to provide air to the system to adjust the vacuum. Wait until the vacuum gauge reaches its final setting (about 5 seconds). See Figure 3-16 for the location of the Vacuum gauge.

   **Note:** Check vacuum quickly. If a printer fault occurs, reset the alert and continue with the procedure.

2. If the vacuum gauge reads between 9 and 13 inches of vacuum, press the Start/Stop key to shut down the printhead, and skip the rest of this procedure, and then continue with the next procedure Checking the Pressure Tank Full Switch. If the vacuum does not read between 9 and 13 inches of vacuum, continue with step 3.

3. The vacuum adjusting needle valve is located inside the main door on the left side of the air manifold (refer to Figure 3-15). To adjust the vacuum, unlock the collar, and turn the small knob while watching the vacuum gauge. Turn the needle valve counterclockwise to increase vacuum and clockwise to decrease vacuum.

   ![Figure 3-15. Adjusting the Vacuum](image)
4 After vacuum is set to between 9 and 13 inches, lock the collar and recheck the vacuum setting.

Note: A Trap Bottle accessory may be installed when using water based inks due to the potential for foaming to occur in the ink reservoir. The Trap Bottle accessory is available from Videojet Technologies.

5 Continue to Checking the Pressure Tank Full (PTFL) Switch.
Checking the Pressure Tank Full (PTFL) Switch

Before loading the printer with fluid for the first time, check to make certain the pressure tank full (PTFL) switch is operating properly.

**Caution**

If the PTFL switch is faulty, the pressure tank will overfill when loading fluid into the printer. This may damage many internal printer components. DO NOT load fluid into the printer until you have verified that the PTFL switch works.

**Procedure**

Complete the following steps to check the pressure tank full (PTFL) switch in the printer:

**Warning**

Make certain that the air to the printer is disconnected before starting this procedure. This is a preventive measure in case you accidentally press an active key while performing this procedure.

1. Disconnect the air supply from the printer.
2. Disconnect the ink output line fitting and remove the pressure tank fitting at the bottom of the ink module (refer to Figure 3-17). The pressure tank float will fall out of the module to the bottom of the fluid pan.
3. Use a 5/16” allen wrench to loosen the door latch screw on the front right side of the printer fluid pan. Open the cabinet door to gain access to the printer's electronics section.

*Note:* The LED bank is located on the main PCB in the electronics section of the printer (refer to Figure 3-18).
Caution

Do not use a hard or abrasive object to push the float into the pressure tank as it may scratch or damage the wall causing the float to hang up or get stuck in the pressure tank.

4 Use a soft, thin object (such as a piece of plastic tubing) to push the float up into the pressure tank. Observe the PTLW LED on the LED bank to verify that the PTLW LED is lit and turns off as the float is pushed upwards.
5 Continue to push the float all the way up into the pressure tank until it stops and observe the PTFL LED on the LED bank at the same time.

6 If the PTFL LED did light up, the pressure tank full (PTFL) switch is operating properly. If the PTFL LED did not light, check the PTFL switch connection located on the solenoid bank assembly. The switch connection is #5 and is color-coded orange (refer to Figure 3-19). If the PTFL LED still does not light when pushing the float upward, replace the pressure tank full switch and check the PTFL LED again.

7 Install the pressure tank fitting and the ink output line fitting back into the ink module port (refer to Figure 3-17).

**Note:** Verify that both ferrules are still in place on the tube. Do not over tighten!
8 Continue to Ink System Service Preparation.

Figure 3-19. Checking the PTFL Switch
External Data Connections

This section describes the external data connections for the Universal 37pc printer. The six data connectors, numbered J1 through J6 are located on the rear of the printer cabinet (refer to Figure 3-20).

Output Power

The total current available at J1, J2, J3 and J6 is as follows:

- 24V DC at 225ma Max
- 12V DC at 250ma Max
- 5V DC at 150ma Max

J1, J2 and J3 — Product Detect / Encoder / Alert Light

These three ports are provided for the connection of product detectors, shaft encoders and alert lights. The design allows all three devices to be
connected to the same port or each device to be connected to a separate port.

![Pinouts for connectors J1, J2 and J3 (external view)]

### J1, J2 and J3 (DB9 Female) Pin Description

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PROD_IN</td>
<td>Product detect input. Signals the printer of a product detect when connected to GND. An open collector, drain, etc. may be used to accomplish this. The open collector should be rated for a minimum of 15 V and a maximum of 0.4 Vce (sat) @ 10 ma. The minimum pulse width when connected to GND or not connected to GND should be 65 μsec. Mechanical contact type relays should not be used. The printer may be configured to trigger on the leading edge or on the trailing edge of the pulse. See “Selecting the product detector edge trigger” on page 3-24.</td>
</tr>
<tr>
<td>2</td>
<td>ENC_IN</td>
<td>Encoder input. Signals the printer of an encoder pulse by connecting to GND and then releasing. An open collector, drain, etc. may be used to accomplish this. The open collector should be rated for a minimum of 15 V and a maximum of 0.4 Vce (sat) @ 10 ma. The internal circuitry is capable of responding to a 1 MHz clock, however, this would not be practical because of transmission line effects. The encoder pulses are divided down internally. See Chapter 9, “Serial Interface” for more information.</td>
</tr>
<tr>
<td>3</td>
<td>RED</td>
<td>Red Alert Light. This output signals an attached alert light to switch the red lamp on or off. The lamp should be on when the signal is low, off when the signal is high. Output is open collector rated at 24 VDC Max and 75ma Max.</td>
</tr>
<tr>
<td>4</td>
<td>YELLOW</td>
<td>Yellow Alert Light. This output signals an attached alert light to switch the yellow lamp on or off. The lamp should be on when the signal is low, off when the signal is high. Output is open collector rated at 24 VDC Max and 75ma Max.</td>
</tr>
<tr>
<td>5</td>
<td>GREEN</td>
<td>Green Alert Light. This output signals an attached alert light to switch the green lamp on or off. The lamp should be on when the signal is low, off when the signal is high. Output is open collector rated at 24 VDC Max and 75ma Max.</td>
</tr>
</tbody>
</table>
Selecting the product detector edge trigger
1 With the printer in the Standby mode, press the F1 key to select <SETUP/STATUS> and then the F2 key to select <SETUP>. The screen shown below should now be displayed.

![Baud Rate and Detect POS Edge](image.png)

2 Press the down arrow key once to place the cursor in the <DETECT POS EDGE> field.

3 Press the YES/NO key to select whether to trigger the printer with the positive or negative edge of the product detector signal.

**J4 — RS-232 Serial Interface**
This standard DB9 RS-232 serial interface is used to connect the printer to a host computer that will direct printing operations. See Chapter 9, “Serial Interface” for more in depth information on this interface.

![Pinouts for connector J4](image.png)

**J4 (DB9 Male) Pin Description**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-</td>
<td>No connection</td>
</tr>
<tr>
<td>2</td>
<td>Tx</td>
<td>Transmit data from the printer</td>
</tr>
</tbody>
</table>
Note: Although the printer supports all of the signals in the table above, it is possible to form a connection with only the signals on pins 2, 3 and 5 implemented on the host computer. However, if the host computer does not provide DSR and DTR signalling, it is necessary to form a loopback connection between pins 4 and 6 of the printer’s serial interface.

Setting the baud rate

The Baud Rate is the speed at which data is received and transmitted. Use the following procedure to set the Baud Rate.

1. With the printer in the Standby mode, press the F1 key to select <SETUP/STATUS> and then the F2 key to select <SETUP>. The screen below appears.

   ![BAUD RATE Screen](image)

2. View the current setting in the <BAUD RATE> field. If desired, use the left and right arrow keys to change the setting. (Settings: 1200, 2400, 4800, 9600, 19200, 38400, 57600, and 115200.)

   ![BAUD RATE Screen](image)

   Note: The baud rate must be high enough so that data is supplied to the printer faster than the printer prints the messages. Otherwise, the host-sent data will not arrive in time to be printed.

<table>
<thead>
<tr>
<th>J4 (DB9 Male) Pin Description</th>
<th>Pin</th>
<th>Signal Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Rx</td>
<td>Receive data from the computer</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>DSR</td>
<td>Data Set Ready</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>GND</td>
<td>Ground</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>DTR</td>
<td>Data Terminal Ready</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>CTS</td>
<td>Clear To Send</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>RTS</td>
<td>Request To Send</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**J5 — Parallel Interface**

Connects the printer to a host computer that will direct printing operations. See Chapter 10, “Parallel Interface” for an in depth description of this connector’s functions.

**J5 (DB15 HD Female) Pin Description**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Data 3</td>
<td>Data lines are used to transfer print data to the printer.</td>
</tr>
<tr>
<td>2</td>
<td>Data 6</td>
<td>The printer reads the data contained on Data1 – Data7 and starts the print cycle based on the data received when the data strobe line is pulsed.</td>
</tr>
<tr>
<td>3</td>
<td>Data Strobe</td>
<td>Set by DATA STROBE pulse. DATA STROBE FLAG is cleared when data is read by the printer.</td>
</tr>
<tr>
<td>4</td>
<td>Data Strobe Flag</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Ground</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Data 1</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Data 4</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Data 7</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Data Request</td>
<td>High indicates printer is ready to receive data, on the DATA lines. Low indicates that it is not.</td>
</tr>
<tr>
<td>10</td>
<td>-</td>
<td>No Connection</td>
</tr>
<tr>
<td>11</td>
<td>Data 2</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Data 5</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Data 8</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Printer Ready</td>
<td>Low when printer is ready to print data. High when a printer fault occurs.</td>
</tr>
<tr>
<td>15</td>
<td>-</td>
<td>No Connection</td>
</tr>
</tbody>
</table>
J6 — I/O

This connector contains auxiliary inputs and outputs that are not included in the primary interfaces. All inputs can be driven using an open collector, drain, etc. configuration. The open collector should be rated for a minimum of 15V and a maximum of $V_{ce\,(SAT)}$ of 0.4V @ 10ma. All outputs are open collector rated at 24 VDC Max and 10ma Max.

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SHUT_DWN</td>
<td>Remote Shutdown. The purpose of this active low input is to allow an external switch to be connected to the printer via an external cable which will allow an operator to shut down the printhead remotely. Once the operator activates this switch, the printer reacts exactly the same as it would had it received a serial port Printer Control command (see Chapter 9, “Serial Interface”) to shut the printhead down. This switch input has a 25msec debounce incorporated.</td>
</tr>
<tr>
<td>2</td>
<td>PRINT_INHIBIT</td>
<td>Print Inhibit. The purpose of this active low input is to prevent the printer from printing when a product detect occurs. While this input is held low, any product detect signals are ignored regardless of the active printer mode. This function is available only when the printer is operating in serial mode.</td>
</tr>
<tr>
<td>3</td>
<td>REV_CHR</td>
<td>Print Direction. The purpose of this active low input is to reverse the orientation of alpha characters. While this input is held low, every stroke of every alpha character will be printed in reverse. This function is available only when the printer is operating in parallel mode.</td>
</tr>
<tr>
<td>4</td>
<td>Input 4</td>
<td>(Reserved for future expansion)</td>
</tr>
</tbody>
</table>
Fluid Low Warning. This active high output will indicate when the fluid in either the ink or makeup bottle is low. After 30 minutes of a fluids low warning, an ink out fault will occur and printing stops.

Printer Not Ready. This active high output indicates whether or not the printer is ready to print (while in the Print Mode with no existing faults.).

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>FLUID_LOW</td>
<td>Fluid Low Warning. This active high output will indicate when the fluid in</td>
</tr>
<tr>
<td></td>
<td></td>
<td>either the ink or makeup bottle is low. After 30 minutes of a fluids low</td>
</tr>
<tr>
<td></td>
<td></td>
<td>warning, an ink out fault will occur and printing stops.</td>
</tr>
<tr>
<td>6</td>
<td>PRINTER_NOT_READY</td>
<td>Printer Not Ready. This active high output indicates whether or not the</td>
</tr>
<tr>
<td></td>
<td></td>
<td>printer is ready to print (while in the Print Mode with no existing faults.</td>
</tr>
<tr>
<td>7</td>
<td>Output 3</td>
<td>(Reserved for future expansion)</td>
</tr>
<tr>
<td>8</td>
<td>Output 4</td>
<td>(Reserved for future expansion)</td>
</tr>
<tr>
<td>9</td>
<td>Output 5</td>
<td>(Reserved for future expansion)</td>
</tr>
<tr>
<td>10</td>
<td>Output 6</td>
<td>(Reserved for future expansion)</td>
</tr>
<tr>
<td>11</td>
<td>Output 7</td>
<td>(Reserved for future expansion)</td>
</tr>
<tr>
<td>12</td>
<td>Output 8</td>
<td>(Reserved for future expansion)</td>
</tr>
<tr>
<td>13</td>
<td>+24 VDC</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Ground</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>+5 VDC</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Ground</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>+5 VDC</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Ground</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>+12 VDC</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Ground</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>+12 VDC</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Ground</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>+24 VDC</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Ground</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>+24 VDC</td>
<td></td>
</tr>
</tbody>
</table>
Install Printer

After the printer compressed air and AC power is connected, the printer is ready to be loaded with ink and prepared for operation.

Shown below are the steps necessary to load the printer with ink and prepare it for operation. To complete the necessary procedures, it is important to review and understand the keyboard operation section of the service manual located in Chapter 7.

Ink loading procedures should be completed in the order shown below as one continuous task, which will take approximately two hours.

1. Ink System Service Preparation
2. Prime Printer with Make-up Fluid (AUTO PRIME)
3. Drain Make-up Fluid from Printer (AUTO DRAIN)
4. Prime Printer with Ink (AUTO PRIME)
5. Complete an Auto Refresh (AUTO REFRESH)
6. Calibrate the Ink Stream
7. Conduct a Test Print
8. Set the Fluids Low Adjustment
9. Adjust the Positive Air Flow
10. Adjust the High Voltage Plate Gap
11. Adjust the Bar Height
Ink System Service Preparation

Ground the Service Tray

When working with flammable fluids (make-up or ink) there exists the possibility of fire due to static discharge that may ignite the fluids. To avoid any possibility of static discharge, the service tray used to collect fluid must be properly grounded.

Complete these steps to ground the service tray to the printer.

1. Ensure the printer is connected to an earth ground through the AC power cord.
2. Use a screwdriver to loosen the screw on the printhead, then slide the printhead out of the cover (refer to Figure 3-21 and Figure 3-22 on page 3-31).

![Figure 3-21. Removing the Printhead Cover]
3 Always use a metal grounded tray to collect flammable fluids. A metal service tray is available through Videojet Technologies. Place the service tray on a flat surface such as the floor. Then, position the printhead in the holder as shown in Figure 3-23 on page 3-32 and Figure 3-24 on page 3-32.

4 Attach the service tray grounding clip to either the printhead screw as shown or to the metal wire mesh around the base of the printhead umbilical.

5 Remove the internal cover over the ink valve.

6 Install the printhead chassis into the holder on the service tray as shown.

Figure 3-22. Removing the Printhead (Adjustable) Cover
Figure 3-23. Grounding the Service Tray

Figure 3-24. Grounding the Service Tray - Adjustable Printhead
Install Bleed Tube

A bleed tube must be attached to the ink valve bleed port when performing certain ink maintenance procedure.

Attach the bleed tube to the appropriate port, then loosen the bleed screw to allow the fluids to drip from the bleed tube directly into the stainless steel service tray. This prevents fluids from entering the nozzle, which may damage the nozzle if dust or debris is present in the empty ink system.

Tools/Supplies Required
You will need the following items (included with the printer) to attach the bleed tube to the ink valve:

- Bleed tube (provided with printer)
- 0.050 allen wrench

Procedure
Complete these steps to attach a bleed tube.

1. Locate the bleed port on the ink valve. Attach the bleed tube securely to the port and route the tube through the hole in the printhead face plate (refer to Figure 3-25). Make sure the tube is directed into the grounded metal service tray.

2. Connect the allen wrench to the matching set screw. During the ink maintenance procedures, you will turn the set screw to drain the fluids through the bleed port.

Figure 3-25. Attaching the Bleed Tube
3 Continue to Prime Printer with Make-up Fluid.
Prime Printer with Make-up Fluid (AUTO PRIME)

Priming the printer with make-up fluid flushes an empty ink system and prepares it for loading with ink. Complete these steps to prime the printer with make-up fluid.

1. Remove the two empty bottles in the fluid pan portion of the printer.
2. Install two bottles of the correct type of make-up fluid into the fluid pan (refer to Figure 3-27).
3. Place the AC power switch to the On (I) position.
4. Press the Service key to enter the Service mode.
5 Press the F2 key to select <INK SYSTEM>.

6 Press the F2 key to select <INK UPKEEP>.

7 Press the Down Arrow key twice to move the cursor to the <YES/NO> field next to <AUTO PRIME>.

8 Press the Yes/No key to select <YES>. The message “FOR PRIMING SYSTEM WITH NEW FLUIDS” appears on the display screen.

9 With the cursor in the <YES/NO> field next to <START PRIMING>, press the Yes/No key to start priming the printer. The message “AUTO PRIME RUNNING” appears on the display screen.

10 Wait two minutes and confirm that the ink pressure regulator is set to 5 psi (refer to Figure 3-14). If it does not read 5 psi, adjust the ink pressure regulator until the gauge reads 5 psi.

Note: It will take two or three minutes before the printer sends pressure to the ink pressure gauge once AUTO PRIME is started. The NVAL LED indicates pressure will be available to the gauge.
11 Open the bleed valve using the 0.050" allen wrench one full turn and wait until fluid drips from the bleed tube.

12 Adjust the bleed valve for a fluid flow rate of about 2 drips per second.

13 **Note:** If the fluid drip rate is not set correctly, the printer may display an ALERT and priming will stop. If this occurs, reset the alert and restart the
AUTO PRIME procedure. A “FILL TIME TOO LONG” alert indicates a too fast drip rate. An “EMPTY TIME TOO LONG” alert indicates a too slow drip rate.

14 When the message “AUTO PRIME COMPLETE” appears on the display screen, the make-up priming procedure is complete.

15 Close the bleed valve but don’t remove the allen wrench from the set screw.

16 Press the Exit key.

17 Continue to Drain Make-Up Fluid From Printer.

Drain Make-up Fluid From Printer (AUTO DRAIN)

The make-up must be completely drained from the ink system before it can be loaded with ink. Complete these steps to drain the make-up fluid from the printer.

1 Press the Down Arrow key three times to move the cursor to the <YES/NO> field next to <MORE OPTIONS>.

2 Press the Yes/No key to select <YES>.
3 Press the Yes/No key to select <YES>. The message “FOR DRAINING FLUIDS FROM THE SYSTEM” appears on the display screen.

4 With the cursor in the <YES/NO> field next to <START DRAINING>, press the Yes/No key to begin draining the printer. The message “AUTO DRAIN RUNNING” appears on the display screen.

5 Open the bleed valve using the 0.050” allen wrench one full turn.

6 When the “AUTO DRAIN COMPLETE” message appears on the display screen, the make-up draining procedure is complete.

7 Press the Exit key.

8 Close the bleed valve, but don’t remove the allen wrench from the set screw.

9 Continue to Prime Printer with Ink.
Prime Printer with Ink (AUTO PRIME)

Complete the following steps to load (prime) the printer with ink and prepare it for operation.

1. Remove the previously installed bottle of make-up fluid on the right side of the fluid pan.

2. Install a new bottle of the correct type of ink into the right side of the fluid pan as shown in Figure 3-29. (The bottle filter is marked with an ink bottle label for reference).

3. Press the Down Arrow key twice to move the cursor to the <YES/NO> field next to <AUTO PRIME>.

<table>
<thead>
<tr>
<th>SET PRESSURE</th>
<th>AUTO REFRESH</th>
<th>AUTO PRIME</th>
<th>MORE OPTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td></td>
</tr>
</tbody>
</table>

Figure 3-29. Installing the Ink Bottle
4 Press the Yes/No key to select <YES>. The message “FOR PRIMING SYSTEM WITH NEW FLUIDS.” appears on the display screen.

```
FOR PRIMING SYSTEM WITH NEW FLUIDS.

START PRIMING NO
```

5 With the cursor in the <YES/NO> field next to <START PRIMING>, press the Yes/No key to begin priming the printer. The message “AUTO PRIME RUNNING” appears on the display screen.

6 Ensure the bleed valve is still open one full turn. Wait until fluid drips from the bleed tube (about 2 to 3 minutes).

7 View the ink pressure regulator to confirm that the ink pressure regulator is still set to 5 psi (refer to Figure 3-28 on page 3-37). If it is not, adjust the ink pressure regulator to 5 psi.

8 As ink is being expelled from the bleed tube adjust the bleed valve for a fluid flow rate of about 2 drips per second.

**Note:** If the fluid drip rate is not set correctly, the printer may display an ALERT and priming will stop. If this occurs, reset the alert and restart the AUTO PRIME procedure. A “FILL TIME TOO LONG” alert indicates a too fast drip rate. An “EMPTY TIME TOO LONG” alert indicates a too slow drip rate.

9 When the message “AUTO PRIME COMPLETE” appears on the display screen, the priming with ink procedure is complete.

10 Close the bleed valve and remove the bleed tube.

11 Press the Exit key.

12 Continue to Refresh Ink System.
Refresh Ink System (AUTO REFRESH)

The Auto Refresh procedure removes all of the ink currently in the ink system, and replaces it with fresh ink from the ink bottle.

The Auto Refresh procedure takes approximately 15 minutes once it has been started. Complete these steps to refresh the ink system.

1. Remove the printhead from the printhead holder in the service tray but ensure that the grounding clip remains attached to the printhead.

2. Turn the vertical adjustment screw one turn counterclockwise to raise the ink stream over the ink return block; note its original position (refer to Figure 3-30).

3. Return the printhead to the printhead holder in the service tray.

4. Press the Down Arrow key once to move the cursor to the <YES/NO> field next to <AUTO REFRESH>.

5. Press the Yes/No key to select <YES>. The message “FOR REPLACING FLUID INSIDE THE MODULE” appears on the screen.
Warning

When the <YES> key is pressed, ink will spray from the printhead. Ensure the printhead is aimed into the service tray.

6 With the cursor in the <YES/NO> field next to <START REFRESH>, press the Yes/No key to begin the Refresh procedure. The message “AUTO REFRESH RUNNING REFER TO MANUAL” appears on the display screen.

Note: The ink refresh procedure requires an ink pressure of greater than 30 psi. If the ink pressure is set below 30 psi, ink may not spray from the nozzle.

7 Increase the ink pressure to 40 psi by adjusting the ink pressure regulator and watching the ink pressure gauge (refer to Figure 3-28 on page 3-37).

8 Ensure the ink is spraying over the ink return block. If not, adjust the ink stream vertical alignment screw counterclockwise until the ink stream completely clears the top of the ink return block. The ink must spray into the service tray for the entire refresh cycle.

9 The printer will now remove the ink currently in the ink system, and replace it with fresh ink from the ink bottle. When “AUTO REFRESH COMPLETE” appears in the display, the Auto Refresh cycle is complete.

Note: The ink will turn off four minutes prior to the completion of the ink refresh cycle.

10 Turn the vertical adjustment screw clockwise to return the vertical alignment to its original position.

11 Press the Exit key three times to return to the initial service mode screen.

12 Press the Standby key to exit the service mode.

13 Continue to Ink Stream Calibration.
Ink Stream Calibration

The ink stream calibration procedure ensures that the following conditions are met: the ink is aligned into the ink return block properly, the ink drop break-off occurs at the proper location in the charge tunnel, the ink pressure is adjusted to the correct setting, the set point time to maintain the correct ink viscosity is established, and the optimal nozzle drive setting is established.

If any of these conditions are not set properly, the printer may provide poor print quality or experience printer faults.

The ink stream calibration procedure is completed only when there is new ink in the system.

Procedure

To calibrate the ink stream, complete the following sections in the order shown:

- Align the Ink Stream
- Set the Final Vacuum Adjustment
- Center the Ink Drop Break-off
- Set the Ink Pressure
- Re-Center the Ink Drop Break-Off - If break-off has shifted significantly from the center of the charge tunnel, re-do the ink pressure setting.
- Complete the Nozzle Drive Setting

Align the Ink Stream

Complete the following steps to align the ink stream into the ink return block:

1. Aim the printhead into the service tray. If the printhead is located in the printhead holder, remove it from the printhead holder so that you can view the ink stream. However, ensure that the grounding clip remains attached to the printhead.
Press the Service key to enter the Service mode.

<table>
<thead>
<tr>
<th>37 PC/UI</th>
<th>ID#</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRINT</td>
<td>INK</td>
</tr>
<tr>
<td>HEAD</td>
<td>SYSTEM</td>
</tr>
</tbody>
</table>

2 Press the F1 key to select <PRINT HEAD>.

<table>
<thead>
<tr>
<th>INK ON</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIGH VOLTAGE ON</td>
<td>NO</td>
</tr>
<tr>
<td>TEST PRINT ON</td>
<td>NO</td>
</tr>
<tr>
<td>CHANGE SETTINGS</td>
<td>NO</td>
</tr>
</tbody>
</table>

Warning

Ink may spray out of the printhead when completing the next step - turning the Ink On.

3 With the cursor in the <INK ON> field, press the Yes/No key to select <YES> to turn the printhead On.

Note: No Signal and/or Phasing faults may occur during the ink stream calibration causing the ALERT light to flash. This is normal, ignore these alerts and continue with calibration.

4 View the ink pressure gauge to confirm that it shows a pressure setting of 40-psi (2.76 bar). If it does not, adjust the ink pressure regulator to 40-psi (2.76 bar) (refer to Figure 3-28 on page 3-37).

5 Make sure the ink stream is aligned correctly into the ink return block. If it is not, use the ink stream adjustment screws to align the ink stream in the ink return block (refer to Figure 3-31 and Figure 3-32). If the alignment is OK, continue to the next section Set Final Vacuum Adjustment. If the alignment needs adjustment, continue this procedure.

- Turn the horizontal locking screw ½ turn to loosen the adjustment screws to adjust the nozzle. Once adjustments are made, tighten the horizontal locking screw to prevent the nozzle from moving.
- Turn the horizontal adjustment screw to move the ink stream horizontally (side to side).
• Turn the vertical adjustment screw to move the ink stream vertically (up and down).

Figure 3-31. Adjustment Screws on Bottom of Printhead

6 Align the ink stream so that it enters the ink return block horizontally centered and slightly above the vertical center, as shown in Figure 3-32.

Figure 3-32. Aligning the Ink Stream into Ink Return Block

7 If the ink stream was not properly aligned in the ink return block, there may be ink spray on the printhead components. Check to see if the printhead has ink on the components. If it does, turn printer off, clean the printhead components with cleaning solution, dry with compressed air, and then turn the printer back on.

8 Continue to Set Final Vacuum Adjustment.
Set Final Vacuum Adjustment

The final vacuum adjustment must be made with the ink On. The preliminary vacuum adjustment was a rough adjustment. The final vacuum adjustment is needed to fine tune the amount of vacuum in the system, after ink is introduced into the printer.

1. With the ink On continuously for a minimum of two minutes (<INK ON> field set to <YES>), set the system vacuum adjustment to between 12 and 13 inches of vacuum as read on the vacuum gauge (refer to Figure 3-34).
   - Use the vacuum adjusting needle valve located on the left side of the air manifold (refer to Figure 3-33) to adjust the vacuum. To adjust the vacuum, unlock the collar and turn the small knob. Turn the needle valve counterclockwise to increase vacuum and clockwise to decrease vacuum.
   - View the vacuum setting at the vacuum gauge located next to the ink module (refer to Figure 3-34).

2. After vacuum is set, lock the collar. Recheck the vacuum reading after the collar has been locked.

Figure 3-33. Adjusting the Vacuum
Figure 3-34. Viewing the Vacuum Gauge

3 Continue to Center the Ink Drop Break Off.
Center the Ink Drop Break-off

Complete these steps to center the ink drop break-off in the charge tunnel:

1. With the ink stream On (ink stream spraying from the nozzle into the ink return block), press the Down Arrow key on the keyboard three times to move the cursor to the <YES/NO> field next to <CHANGE SETTINGS>.

<table>
<thead>
<tr>
<th></th>
<th>YES</th>
</tr>
</thead>
<tbody>
<tr>
<td>INK ON</td>
<td>YES</td>
</tr>
<tr>
<td>HIGH VOLTAGE ON</td>
<td>NO</td>
</tr>
<tr>
<td>TEST PRINT ON</td>
<td>NO</td>
</tr>
<tr>
<td>CHANGE SETTINGS</td>
<td>NO</td>
</tr>
</tbody>
</table>

2. Press the Yes/No key to select <YES>.

<table>
<thead>
<tr>
<th>TEST PRINT ON</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOZZLE DRIVE</td>
<td>100</td>
</tr>
</tbody>
</table>

3. Press the F1 key to select <NOZZLE DRIVE> to make the nozzle drive setting.

4. Hold the magnifier over the charge tunnel on the printhead (as shown in Figure 3-35) to view the ink stream.
Figure 3-35. Positioning Magnifier over the Charge Tunnel

**Note:** A magnifier holder used to hold the magnifier lens to the printhead is available. Refer to chapter 3, “Accessories and Spare Parts” in the Illustrated Parts Breakdown for further information.

5 Use the Arrow keys to adjust the nozzle drive setting until the ink drop break-off point is in the center of the charge tunnel as shown in Figure 3-36.

Pressing the Arrow keys will increase or decrease the current nozzle drive setting by the following increments:

- Press the Up Arrow key to increase value by 1.
- Press the Down Arrow key to decrease value by 1.
- Press the Right Arrow key to increase value by 25.
• Press the Left Arrow key to decrease value by 25.

Figure 3-36. Centering Ink Drop Break-off in Charge tunnel

6 Press the Save key to establish the new nozzle drive setting.
7 Continue to Set the Ink Pressure.
Set the Ink Pressure

Complete the following steps to set the ink pressure in the system:

*Note:* Make certain the printhead is clean and dry before performing this procedure. If it is not, the printer will not allow you to set the ink pressure.

1. With the ink On and the printhead clean, slide the printhead back into the printhead cover (refer to Figure 3-37). If this is not done, the printer may make an incorrect setting due to outside (electrical) noise. You do not need to tighten the printhead screw to secure the cover at this point.

2. Make sure the printhead is positioned at approximately the same elevation as it will be positioned during printing. This is important because printhead elevation will affect pressure and may cause an incorrect reading.

![Figure 3-37. Sliding the Printhead into the Cover](image)

3. Press the Exit key three to access the initial Service Mode screen.
4 Press the F2 key to select <INK SYSTEM>.

5 Press the F2 key to select <INK UPKEEP>.

6 With the cursor in the <SET PRESSURE> field, press the Yes/No key to select <YES>. (After a 10 second delay), the Set Pressure Bars will appear.

7 Adjust the ink pressure regulator until the right side of the bar lines up directly below the arrow as shown below.

8 Check to confirm the point of breakoff is still centered inside the charge tunnel. If the ink pressure is changed more than about 2 psi, you may need to re-center the ink drop breakoff in the charge tunnel using the Arrow Keys on the keyboard (refer to Figure 3-36). The ink pressure display must show SET, and the point of breakoff must be
centered inside the charge tunnel simultaneously before pressing the Save key.

9 Press the Save key to set the ink pressure. The following screen will appear.

![WAIT FOR THE SET POINT TO BE ESTABLISHED (APPROX 5 MINUTES)]

*Note:* If the Save key is not pressed after the SET was achieved, the printer will not establish a new set point.

10 Leave the ink On (allow the printer to run) for at least 5 minutes so that the printer can establish the correct set point. When the printer has completed the process, the following screen will appear.

![PRESSURE SET DONE]

*Note:* If you turn the ink Off before allowing it to run for approximately 5 minutes, you must repeat the procedure to set the ink pressure.

11 Press the Exit key.

12 Press the Standby key; the ink will turn OFF.

*Note:* If you turn the ink Off before allowing it to run for approximately 5 minutes, you must repeat the procedure to set the ink pressure.

13 Remove the printhead from the printhead cover.

14 Continue to Setting the Nozzle Drive.
Setting the Nozzle Drive

In this procedure, you will set the nozzle drive to obtain the correct drop breakoff pattern for printing. This adjustment will provide good print quality in typical environments under most circumstances.

If a more precise setting is required, the nozzle drive setting may be further optimized by following the procedure “Find the Optimal Nozzle Drive Setting” on page 7-56.

Complete the following steps to set the nozzle drive:

1. Press the Service key to enter the Service mode.

2. Press the F1 key to select <PRINT HEAD>.

3. With the cursor in the <YES/NO> field next to <INK ON>, press the Yes/No key to turn the ink On.

4. Press the Down Arrow key three times to move the cursor to the <YES/NO> field next to <CHANGE SETTINGS>.

5. Press the Yes/No key to select <YES>.
6  Press the F1 key to select <NOZZLE DRIVE>.

<table>
<thead>
<tr>
<th>TEST PRINT ON</th>
<th>NOZZLE DRIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOZZLE DRIVE 100</td>
<td></td>
</tr>
</tbody>
</table>

7  Use the Arrow keys to decrease the nozzle drive value to 0.

   Note: No Signal and/or Phasing faults may occur during the ink stream calibration causing the ALERT light to flash. This is normal, ignore these alerts and continue with calibration.

8  Hold the magnifier over the charge tunnel or install the magnifier lens holder on the printhead to view the ink stream (refer to Figure 3-38).

   Figure 3-38. Positioning Magnifier over the Charge Tunnel
9 Use the Arrow keys to increase the nozzle drive setting until the ink drop break-off pattern looks similar to the one shown in Figure 3-39. Pressing the Arrow keys will increase or decrease the current nozzle drive setting by the following increments.

- Press the Up Arrow key to increase value by 1.
- Press the Down Arrow key to decrease value by 1.
- Press the Right Arrow key to increase value by 25.
- Press the Left Arrow key to decrease value by 25.

**NOTE:** To achieve good print quality, the ink drop break-off does not need to be in the middle of the charge tunnel when the break-off pattern is adjusted. The important requirement is that the break-off be inside the charge tunnel, and that the satellites have merged with the main drop before leaving the charge tunnel.

A) Minimum Drive

B) Low Drive

C) Correct Drive

Acceptable Breakoff

Note: For proper breakoff pattern, refer to the specifications sheet supplied with your Videojet ink.

Figure 3-39. Correct Ink Drop Break-off Pattern

10 Press the Save key to establish the new nozzle drive setting.

11 Press the Standby key to exit the Service mode.

12 Continue to Conduct a Test Print.
Conduct a Test Print

The test print feature is used to confirm good print quality and to ensure correct ink stream alignment into the ink return block.

Test Print Guidelines

These guidelines apply to the test print procedure:

- A test print can only be generated when the ink is on. Test print will automatically turn on the high voltage but only during the 60-second test print cycle.
- The test print cycle lasts for 60 seconds. The sample of print must be taken before this time expires. At the end of 60 seconds, the printer will automatically turn both the test print and the high voltage Off.
- When adjusting nozzle drive or print height, a test print can be activated from either screen by pressing the Yes/No key.
- You can stop the test print cycle at anytime while it is active by pressing the Yes/No key to change <YES> to <NO>. Keep in mind that this will automatically turn the high voltage Off.

Test Print Message

During test print, a standard barcode is printed.

Tools/Supplies Required

You will need paper (or other substrate) to print on for this procedure.

Procedure

Complete the following steps to check the current print quality:

1. From the Standby mode, press the Service key to enter the Service mode.

   Note: If the printer is already in the <NOZZLE DRIVE> adjustment screen, press Exit and skip to step 5.
2 Press the F1 key to select <PRINT HEAD>.

   | INK ON | NO |
   | HIGH VOLTAGE ON | NO |
   | TEST PRINT ON   | NO |
   | CHANGE SETTINGS | NO |

3 Ensure that the <INK ON> field is set to <YES>. If it is not set to <YES>, press the Yes/No key to set this field to <YES>.

4 Press the Down Arrow key three times to move the cursor to the <YES/NO> field next to <CHANGE SETTINGS>.

5 Press the Yes/No key to select <YES>.

   | PRINTHEAD SETTINGS |
   | NOZZLE            | PRINT |
   | DRIVE             | HEIGHT |

6 Press the F1 key to select <NOZZLE DRIVE>.

   | TEST PRINT ON | NO |
   | NOZZLE DRIVE  | 100 |

7 With the cursor in the <TEST PRINT ON> field, press the Yes/No key to initiate the test print mode.

8 Slide a test sample past the printhead orifice to receive a sample of the current print quality. The sample paper should be moved across the front of the printhead at the correct distance of about ¼ inch.

9 Check the print quality. Also check for ink buildup on the printhead components. If no ink buildup is seen and the print quality is ok, continue with the next step. If ink is building up on the internal printhead components or if the print quality is poor, recheck the nozzle and ink stream alignment adjustments.

10 Press the Standby key to exit the Service mode.
11 You have completed the Calibrate the Ink Stream procedure. Continue to Set the Fluids Low Adjustment.

Set the Fluids Low Adjustment

Air passes through the fluids low needle valve to supply the fluids low switch and replenishment bottles. This air is used to monitor the fluid level within the bottles.

Use a screwdriver to adjust the fluids low needle valve (see Figure 3-40).

1 When adjusting the fluids low needle valve (identified as “B” for bubbler), look in the make-up replenishment bottle. The make-up fluid bottle should be nearly full. The ink bottle must be at least half full.
2 Hold the dip tube about 1/2 inch below the liquid surface (refer to Figure 3-41).

3 Adjust the needle valve for approximately one to two bubble(s) per second. This procedure adjusts the fluids alert for both replenishment bottles.

Note: Do not hold the Dip Tube more than 1/2 inch below the liquid surface, or you will not see any bubbles. This is due to a bypass “design” around the switch to reduce evaporation.

4 Continue to Adjust the Positive Air Flow.
Adjust the Positive Air Flow

Positive air supplies a slight air pressure to the printhead, which helps keep contaminants out of the printhead. Adjust the positive air setting at the positive air needle valve (refer to Figure 3-40).

Use a screwdriver and a flow meter (Videojet P/N 365230) for this adjustment. The air flow is measured at the printhead with the ink On.

*Note:* Cover must be on printhead, and ensure that ink is On for at least 2 minutes.

1. Hold the flow meter to the printhead (refer to Figure 3-42). The flow meter must be held vertical to obtain an accurate reading.
2. Adjust the positive air needle valve (identified as “P” for positive air) to 1.5–2.0 SCFH measured at the printhead.

![Flow Meter held to the Printhead](image)

3. Turn the ink and high voltage Off.
4. Continue to Adjusting the High Voltage Plate Gap.
Adjusting the High Voltage Plate Gap

Introduction

The physical distance between the high voltage deflection plate and opposing ground plate must correct. This procedure confirms the correct gap exists.

⚠️ Warning

Ink and High Voltage must be Off during this procedure.

1. Make sure the ink and high voltage are Off. Either press the Start/Stop key when in the Print or Standby mode to shut down the printhead. Or, change the <INK ON> and <HIGH VOLTAGE ON> fields to <NO> when in the Service mode.

2. Press the Standby key to place the printer into the Standby mode when the ink has been Off for at least two minutes.

3. Turn the main AC power switch to the OFF position.

4. Slide the high voltage gap tool between the high voltage plate and the ground plate. The gap tool should slide smoothly (no drag) between the components.

![Gap Gauge held to the Printhead](image)

Figure 3-43. Gap Gauge held to the Printhead
Adjust the High Voltage Gap

The physical distance between the high voltage deflection plate and opposing ground plate must be correct. This procedure confirms the correct gap exists.

1. Loosen the four screws holding the high voltage arm.
2. Place the high voltage gap tool into position.
3. Lightly press on the high voltage plate and tighten the screws.
4. Recheck the gap after tightening the screws.
5. Continue to Adjusting the Bar Height Adjustment.
Adjusting the Bar Code Height

The physical height of the bar code can be adjusted. Print height is measured in percent; the default is 50%. The print height can be set between 1 and 100%.

Adjusting the Bar Height

Complete these steps to adjust the bar code height:

1. Ensure the printer is operational and has been interfaced to a mail sorting system, and calibrated correctly.

2. Confirm the printhead is mounted at the correct distance from the printing surface. This distance must be between 3/16 inch (4.76 mm) and 5/16 inch (7.94 mm).

3. Take print samples. If the bars are too short, the high voltage setting must be increased; and conversely if the bars are too tall, the setting must be reduced.

   **Note:** If the bars are the correct height, this procedure is finished and the printer installation is complete!

4. To change the print height setting, enter the Service mode by pressing the Service key.

5. Press the F1 key to select <PRINTHEAD>.

6. Press the Down Arrow key three times to move the cursor to the <YES/NO> field next to <CHANGE SETTINGS>.

7. Press the Yes/No key to select <YES>.

8. Press the F2 key to select <PRINT HEIGHT>. The current print height value is shown in the lower right corner of the display.

9. Adjust the print height setting using the Arrow keys.

   Pressing the Arrow keys will increase or decrease the current print height setting by the following increments:

   - Press the Up Arrow key to increase value by 1.
   - Press the Down Arrow key to decrease value by 1.
   - Press the Right Arrow key to increase value by 10.
   - Press the Left Arrow key to decrease value by 10.

10. Go back to step 3 to recheck the print height.

The printer installation is now complete.
Theory of Operation

In this chapter you will find:

- A description of the ink jet printing process, including the ultrasonic, electrostatic, and pressure effects on the ink stream
- An explanation of the two factors that control the ink stream: ink pressure and nozzle drive
- A functional analysis of the printer and printhead start-up and shutdown procedures, the fresh ink add subsystem, the make-up fluid add subsystem, ink recycling (the transfer process), and the fluids low alert subsystem

Introduction

This chapter describes the ink jet printing process and how the printer applies that process.

Understanding how the printer works helps you to diagnose printer problems more easily. Read this chapter before troubleshooting the printer and refer to Chapter 8, “Troubleshooting” for further information on diagnosing printer problems.
The Ink Jet Printing Process

The ink jet printing process is based on the physical behavior of a fluid ink stream under the influence of pressure, ultrasonic vibration, and electrostatic forces.

Read the following sections in this order to better understand the ink jet printing process:

- Ultrasonic Effects on the Ink Stream
- Electrostatic Effects on the Ink Stream
- Pressure Effects on the Ink Stream

Ultrasonic Effects on the Ink Stream

The printer uses ultrasonic vibration to break a pressurized, solid ink stream into small droplets as it leaves the nozzle.

The ultrasonic vibration is produced by a ceramic crystal within the nozzle assembly (refer to Figure 4-1). The crystal is energized by an oscillating circuit on the controller PCB. The level of this signal is determined by a keyboard-selectable voltage known as “nozzle drive”. This signal causes the ink chamber within the nozzle to vibrate.

The resulting action is conducted to the ink chamber within the nozzle as a vibration. The vibration is then transduced to the pressurized ink stream, causing it to break off into tiny, uniform drops. These drops form within the field of the charge tunnel (after the ink stream leaves the nozzle orifice).

Figure 4-1. Ink Drop Break-off
Electrostatic Effects on the Ink Stream

The charge tunnel is an in-line electrode that charges the drops for printing. Just before each drop forms, a positive electrical pulse is applied to the charge tunnel at the same ultrasonic rate as the signal to the nozzle (refer to Figure 4-2). This positive pulse induces a negative charge on the drop as it is formed in the charge tunnel; it does this by pulling the negatively charged electrons through the grounded ink stream and to the surface of the drop.

![Figure 4-2. Charge Tunnel Operation](image)

Although many drops are in the charge tunnel, the positive pulse (at the tunnel) produces a negative charge only on the drop breaking off at that particular time. This allows each drop to be individually controlled.

The Amount of Charge on the Drop

The amount of charge applied to a drop depends on the intended location of that drop on the print surface. Drops located at the “top” of a character receive a greater charge than drops located at the “bottom” of a character. Voltage range is between 100-250 depending on the matrix or font.

The character generating microprocessor and the charging circuit on the controller PCB determines the amount of charge placed on every drop. Predetermined charge levels exist for all possible print characters. When a message is entered, the PCB automatically calculates the charge for each drop in the code.
The High Voltage Plate

After passing through the charge tunnel, the ink stream enters the electric field of the high voltage deflection plate, where each charged drop is deflected from its path. This deflection changes the drop’s trajectory and places the drop at a precise location on the print surface (see Figure 4-3).

![Diagram of the ink jet printing process]

Figure 4-3. Drop Deflection/Character Formation

The deflection from the ink stream results from the drop being attracted to the positive deflection field created at the deflection plate. Since unlike charges attract, the negatively charged drops are pulled towards the strong positive charge of the deflection plate.

Drops which receive a larger negative charge, due to a larger positive pulse at the charge tunnel at break-off, are deflected more than drops receiving a lesser negative charge. As explained earlier, this varying charge level precisely controls the drop pattern as the ink lands on the print surface.

Not every drop in the ink stream is used for printing a character; drops which are not used for printing are left uncharged. Uncharged ink drops are not deflected and maintain a straight trajectory into the ink return block (located at the end of the printhead). Vacuum draws unused ink back into the ink module where it is cycled through the ink system.
Pressure Effects on the Ink Stream

The only true variable in the printing process that is beyond the operator’s control is the pulsed voltage amplitude at the charge tunnel. Recall that this voltage is predetermined by the controller PCB. Changes in internal printer ink pressure, however, can also affect character formation.

Ink Pressure

Ink pressure, which is the pressure applied to the inside of the pressure tank (where ink is pushed out to the printhead), determines the speed or velocity at which the ink travels through the printhead components. This affects the spacing between drops as well as satellite formation.

**Important:** Ink pressure is controlled by the ink pressure regulator and should never be adjusted during normal operation.

To summarize the effects of changing the ink pressure, a higher ink pressure would result in smaller characters because the drops move more quickly, spending less time in the field of the deflection plate. Similarly, a decrease in ink pressure would cause a larger character printout because the slower drops are deflected further out of their path.

Flow Time

It is important to understand that the ink pressure setting also directly affects flow time. Flow time is the amount of time it takes for the pressure tank to empty. Therefore, arbitrarily changing ink pressure will upset printer operation.

**Caution**

DO NOT adjust ink pressure to change bar height. Instead, adjust the amount of high voltage applied at the printhead. See “Adjusting the Bar Height” on page 7-65 for instructions.
Controlling the Ink Stream

Two different printer adjustments control the ink stream: ink pressure and nozzle drive. These adjustments are typically made during initial installation, after changing ink types, and after servicing certain printer components.

Adjusting the Ink Pressure

As discussed on page 4-5, the ink pressure controls the ink stream velocity and, as a result, print quality. Keep in mind that the ink pressure adjustment also directly affects flow time. Once initially set, this setting must be left alone until the printer requires re-calibration.

Adjusting the Nozzle Drive

The nozzle drive adjustment compensates for variations in crystal sensitivity and ink viscosity. Changing the nozzle drive setting at the keyboard moves the position of the ink break-off drop within the charge tunnel. This adjustment is very precise and must be done in conjunction with viewing the ink stream through a magnifier lens.

An LED strobe located behind the charge tunnel viewing window allows the technician using the magnifier to view the ink stream as if it were stationary. See Chapter 7, “Service Mode” for more information on using the magnifier.

Adjusting the nozzle drive at the keyboard changes the voltage applied to the crystal in the nozzle. As the nozzle drive is advanced from the minimum value, the ink stream changes from a solid ink stream to a stream with an ink drop break-off and individual drops. The actual voltage level applied to the nozzle will vary depending on the ink type used and the crystal sensitivity.

A correct ink drop break-off should be similar to that shown in Figure 4-4. Notice in this example that the tail of the drop breaks off and forms a separate, smaller drop called a satellite. When adjusted properly, the satellite should “catch up” and merge with the parent drop within the next five additional drops. It is important to note that the break-off formation will vary depending on the ink type.
If the satellite is allowed to lag behind and merge with the following drop, erratic charge distribution occurs because the satellite carries away a portion of the parent drop charge. This causes distorted printing because both drops are improperly deflected. This condition is typically caused by a nozzle drive setting that is too high or too low. Look for a minimum of three to four complete drops prior to exiting the charge tunnel.

**Figure 4-4. Effect of Nozzle Drive Adjustment**

Note: For proper break-off pattern, refer to the specifications sheet supplied with your Videojet ink.
Functional Analysis

Understanding how the printer operates will aid in troubleshooting the system. The following sections contain a complete breakdown and analysis of both the hydraulic/pneumatic functions of the printer and the sequence of events that happen during various modes of operation. All sequences are controlled by the microprocessors on the controller printed circuit board (PCB).

Printer Start-up Sequence

When the AC power switch is switched to the ON (|) position, AC power is supplied to the printer, causing the keyboard to become active.

Printer Shutdown Sequence

When the AC power switch is changed to the OFF (O) position, AC power to the printer is disconnected. This causes the keyboard to become inactive.

Note: Never turn the AC power switch Off while the printhead is still active. Always shutdown the printhead (by pressing the Start/Stop key) and allow the printer to complete its two-minute shutdown sequence before turning the AC power Off. If you turn the AC power Off before shutting down the printhead, the ink in the ink return line will not be drawn back into the printer. This would result in dried ink forming in the ink return line and on the ink return block, thus causing problems at the next printhead start-up

Printhead Start-up Sequence

The printer is able to print a message only when the printhead is fully active (meaning that both the ink and high voltage are On). The Start/Stop key is used to begin the printhead start-up sequence and make the printhead active.

When the Start/Stop key is pressed, the controller PCB activates the air control solenoid. The air control valve provides system air (via a relief valve and input filter) to the transfer solenoid, the nozzle solenoid, and a vacuum generator.

Creating Vacuum

When air pressure is applied to the vacuum generator (which operates on the venturi principle to develop a vacuum at the side port), it creates vacuum. The operation of the vacuum generator is very similar to the operation of the carburetor in an internal combustion engine. In a
carburetor, the passage of air through the throat develops a low pressure at the side port, drawing fuel into the venturi.

In the printer, the rush of air through the venturi, or throat, of the vacuum generator causes a comparable low pressure at the side port. This port is connected to the make-up and fresh ink add solenoids and to the top of the ink module via the vacuum filter. A vacuum line (known as the ink return line) extends from the ink module to the ink return block (in the printhead) and serves to draw unused ink back into the ink module. This process is continuous during operation. Vacuum operates the fresh ink and make-up add valves (located in the ink module) and is also used in the suction stroke of the transfer pump.

**Energizing the Nozzle Solenoid**

When the nozzle solenoid is energized, two functions occur:

- The nozzle solenoid valve opens, allowing system operating air pressure to be applied to the ink pressure regulator. The ink pressure regulator sets the ink pressure to the pressure tank at a pre-specified pressure. As the ink pressure increases, the ink valve (located in the printhead) opens (the valve should open well before pressure reaches 30 psi/2.07 bar). This causes ink to flow from the pressure tank, through the ink valve and nozzle assembly into the ink return block (where the ink is returned to the ink module and reused).

- The printer software energizes the transfer solenoid when a magnetic float in the pressure tank closes a magnetic reed (PTLW) switch and immediately fills the pressure tank. This allows the system to compare the first current ink time (flow time) to the set point time, maintaining a well-balanced control of fluid viscosity within the ink module reservoir and pressure tank.

**Set Point:** The set point time is a reference point established during the ink stream calibration procedure. It refers to the time it takes the float in the pressure tank to travel from the pressure tank full (PTFL) switch (open position) to the pressure tank low (PTLW) switch (closed position), using fresh fluids in the printer. These are sense switches and they have corresponding LEDs on the Printer Circuit Board. (Refer to Figure 4-5 on page 4-10).

**Flow Time:** The flow time is the subsequent measurements taken each time the fluid in the pressure tank flows from the PTFL switch (open position) to the PTLW switch (closed position).

The software compares the flow time to the set point time to measure the ink viscosity. As a result, various actions may be taken depending upon the printer mode of operation.
Automatic Phase Control
The first 30 seconds of the printhead start-up sequence allow the ink stream to stabilize. In order for the printer to determine when each drop of ink is being formed, a test signal is applied to the charge tunnel. This test signal, known as Automatic Phase Control (APC), tests the ink stream to ensure that drop formation and drop charging remain in sync with each other. Following this group of drops, an identical group of drops receives no charge.

The APC signal consists of four such groups; each group of drops is charged at a different time, known as phases. Phase 0 starts at the same time with the nozzle drive signal. The result is that the group of drops that forms at the right time in relation to the charging signal will receive the best total charge.

This APC signal is sensed in the ink return block and monitored by a sensing circuit on the controller PCB to determine which of the four phases provides a signal where the amplitude is greater than a fixed
threshold. These “good phase” signals are sent to the microprocessor to be used to determine the best charging time during product coding.

Although the drop charge frequency is controlled by the same electronic clock as drop formation, the dynamics of the fluid ink stream may vary with temperature and other external factors, such as ink contamination.

If the circuit cannot lock onto a phase, a phasing fault occurs and the control board initiates a two-minute shutdown sequence. If the start-up procedure is completed, the phasing sequence continues for the entire time the Start/Stop key is active, except during the time a message is actually being printed (from when a product detect is received until when the printed message is complete).

Once the Start/Stop Key is Pressed:

<table>
<thead>
<tr>
<th>Step</th>
<th>Figure Ref.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The air control solenoid (AVAL) turns on (opens).&lt;br&gt;• this allows system air pressure to be applied to the vacuum generator, nozzle solenoid (NVAL), and transfer solenoid (TVAL).&lt;br&gt;• when air flows through the vacuum generator, vacuum is created and applied to the fresh ink add solenoid, make-up add solenoid, through the vacuum filter and inside the reservoir, inside the ink return line (leading from the printhead), and to the transfer solenoid (TVAL).</td>
<td>Figure 4-6</td>
</tr>
<tr>
<td>2. When the transfer solenoid valve is closed (de-energized), vacuum is applied to the transfer pump. Vacuum helps pull the diaphragm backward, causing fluid to be drawn into the pump from the reservoir. As fluid is transferred from the reservoir to the pump, the fluid level and the float in the reservoir begin to drop. When the fluid level drops to a point where the magnet on the float reaches the reservoir low switch, the reservoir low switch closes (RLOW).&lt;br&gt;This causes either the make-up add (MVAL) or the fresh ink add solenoid (IVAL) to energize, allowing system vacuum to open the corresponding adder valve. The adder valve chosen depends on the difference between the set point time and the current flow time and other fluid-related factors (Figure 4-7 shows the fresh ink adder valve energized).&lt;br&gt;Once this occurs, vacuum from the reservoir draws fluid (ink or make-up) into the reservoir from the appropriate bottle (for the example shown in Figure 4-7, it would be the fresh ink bottle). As fluid is added to the reservoir, the fluid level and float begin to rise.</td>
<td>Figure 4-7</td>
</tr>
</tbody>
</table>
3. When the fluid level rises to a point where the magnet in the float rises above the reservoir low switch, the reservoir low switch opens. This causes the fresh ink or make-up add solenoid (whichever was open) to de-energize, thus closing the adder valve and stopping the addition of fluid into the reservoir. (For the example shown in Figure 4-8, it would be the fresh ink adder valve).

4. After six seconds, the air pressure and vacuum stabilize, and the nozzle solenoid is energized (this allows air pressure to the ink pressure regulator). The ink pressure regulator allows a pre-specified amount of air pressure (referred to as “ink pressure”) into the pressure tank.

As the pressure on the fluid increases, the ink valve (located in the printhead) opens (the valve should open well before pressure reaches 30 psi/2.07 bar). This allows fluid to flow through the nozzle. The nozzle breaks the fluid stream into drops. These drops enter the ink return block and are drawn back (by vacuum) through the ink return line and into the ink module reservoir.

At the same time, the controller PCB energizes the transfer solenoid applying air pressure to the diaphragm of the transfer pump. This action fills the cylinder with fluid until the Pressure Tank Full Switch (PTFL) closes.

5. As the fluid level in the pressure tank drops, the pressure tank float drops as well. Once the magnet in the pressure tank float reaches the pressure tank low (PTLW) switch again, the transfer solenoid switches (TVAL) to allow air pressure (instead of vacuum) to the transfer pump. The air pressure forces the pump diaphragm forward, causing the fluid in the transfer pump to flow from the pump, through the check valve and primary ink filter, and into the pressure tank.

**Note:** The check valve located between the transfer pump and reservoir closes. This prevents fluid from flowing back to the reservoir during the transfer process.
6. As fluid is transferred from the transfer pump to the pressure tank, the fluid level and the float in the pressure tank begin to rise.

Once the magnet on the float reaches the pressure tank full (PTFL) switch, the switch closes and the transfer solenoid is de-energized (closes). This shuts off the air pressure to the pump and reapplies vacuum to the inside of the pump. The pump refills with fluid from the reservoir, and the entire transfer process repeats itself approximately every 40-60 seconds.

Prior to the printhead ready condition, high voltage is applied to the deflection plate in the printhead (assuming that no faults have occurred). The printer can now be placed in the Print mode to print a message.

Figure 4-11
Figure 4-6. Printhead Start-up Sequence (Step 1)
Figure 4-7. Printhead Start-up Sequence (Step 2)
Figure 4-8. Printhead Start-up Sequence (Step 3)
Figure 4-9. Printhead Start-up Sequence (Step 4)
Figure 4-10. Printhead Start-up Sequence (Step 5)
Figure 4-11. Printhead Start-up Sequence (Step 6)
**Printhead Shutdown Sequence**

When the Start/Stop key is pressed to shutdown the printhead (making it inactive), the printer automatically starts the normal two-minute shutdown sequence.

The printhead shutdown sequence initially turns off high voltage to the printhead and de-energizes the nozzle solenoid (shutting off ink to the printhead). After two minutes, during which time the vacuum remains on to clear the return line, the microprocessor removes the ground circuit to the air control solenoid, stopping the flow of air into the printer.

*Note: AC power to the printer (power supplies and keyboard display) remains active unless the AC power switch is turned Off (refer to “Printer Shutdown Sequence” on page 4-8 for further information).*

**Ink Recycling (Transfer Process)**

The transfer of fluids within the system occurs within the ink module assembly. The ink module assembly contains the reservoir, transfer pump, and pressure tank, as well as the fresh ink add and make-up fluid add valves.

*Note: Refer to the illustrations on pages 4-14 through 4-19 for further clarification of the transfer process.*

The pressure tank uses a reed switch controlled by the movement of a magnetic float within the pressure tank (called the pressure tank low switch) to sense when the level of ink in the tank is low. The magnetic float inside the pressure tank falls with the drop in fluid level as ink flows out to the printhead. When the float nears the bottom of the pressure tank (indicating a low level of ink), the magnet closes the switch. This switch closure completes a ground circuit through the control board (via J10) to energize the transfer solenoid.

**The Transfer Cycle**

Energizing the transfer solenoid allows system air pressure to operate the transfer pump. When air pressure is applied to the diaphragm inside the pump, ink is transferred through the output check valve and primary ink filter and into the top end of the pressure tank to refill the tank with fluid. The input check valve prevents ink from being pumped back into the reservoir.

The transfer cycle ends when the magnetic float in the pressure tank reaches the float limit pin and closes the pressure tank full (PTFL) switch. The transfer solenoid is de-energized and switches from pressure to vacuum. This, along with spring action, draws the pump diaphragm back which opens the input check valve and allows ink from the reservoir to fill
the transfer pump for the next transfer cycle. This transfer process is repeated continually during operation.

A software feature allows the transfer pump to transfer multiple times, depending on the printer mode of operation. Normally, if a complete transfer is not achieved within 10 seconds, the software will deactivate the transfer solenoid, re-prime the pump for 10 seconds, and initialize the transfer a second time. See Chapter 8, “Troubleshooting” for further information on transfer options.

Reopening the switch as the float moves downward begins a timer circuit on the control board, which monitors how long it takes for the float to reach the pressure tank low (PTLW) switch again. The time it takes for ink to flow from the PTFL switch to the PTLW switch is referred to as the “flow time” (also known as the “Current Ink Time”). Flow time is used to control the make-up add subsystem (refer to “Make-up Fluid Add Subsystem” on page 4-21 for further information).

**Make-up Fluid Add Subsystem**

During printer operation, make-up fluid evaporates from the system. This causes the ink to thicken (increases ink viscosity), which results in an increase of flow time. Recall that flow time is the time it takes for the ink in the pressure tank to flow from the pressure tank full (PTFL) switch (open position) to the pressure tank low (PTLW) switch (closed position).

Make-up fluid add operates as follows. Make-up evaporates as ink cycles from the printhead to the ink module reservoir. Since evaporation increases ink viscosity (making the ink thicker), the controller PCB recognizes the increased viscosity by an increase in flow time.

The increase in flow time is indicated in the software under “FLOW TIME” (in the SERVICE mode). The software uses the time relationship between the set point time and the flow time to determine how long to energize the make-up add solenoid. The set point time is a calibrated reference used by the printer to control fluid viscosity. This is established during an ink stream calibration procedure.

When make-up fluid is requested, the controller PCB energizes the make-up add solenoid by completing the ground as the PTFL switch is closed. Vacuum passes through to open the make-up add valve. Then, because the ink module reservoir is under vacuum, make-up fluid is drawn into the reservoir from the make-up fluid bottle for a predetermined amount of time. This add time is calculated by the software.

Make-up fluid may be added every flow time cycle. This precisely controls ink viscosity in the reservoir by adding make-up fluid (if needed) at the end of a transfer cycle. If the reservoir full switch within the ink module reservoir is activated at anytime during the make-up add cycle, the
ground to the make-up add solenoid is removed preventing the cycle from being completed. The history of these “make-up add inhibits” can be observed in the display screen under “FLOW TIME” (in the Service mode).

At the end of the make-up add time, the make-up add solenoid is de-energized. This removes the vacuum to the make-up add valve, thus closing the valve and stopping the make-up flow into the reservoir.

**Fresh Ink Add Subsystem**

As fluid in the ink module reservoir is transferred to the pressure tank and as print drops are deflected to the product, the fluid level in the reservoir drops. When this occurs a switch is closed. If the flow time is below or equal to .25 seconds above the set point time, the printer will add fresh ink to the reservoir when fluid is requested.

The request for fresh ink occurs as follows. The reservoir in the ink module contains a magnetic float and three vertically-mounted reed switches (refer to Figure 4-12). As ink from the reservoir is cycled through the system and used in printing, the magnetic float in the reservoir drops. When the magnetic float reaches the bottom switch (the reservoir low switch), the switch closes.

![Figure 4-12. Ink Module Reservoir](image)
If the flow time is within .25 seconds of the set point time, the printer will request fresh ink (to be added into the reservoir).

When ink is requested, the controller PCB completes the ground circuit through the control board to the fresh ink add solenoid. Vacuum passes through the solenoid and opens the fresh ink adder valve. Then, because the ink module reservoir is under vacuum, fresh ink is drawn into the reservoir from the ink bottle.

As the float in the reservoir rises with the incoming fluid, the switch opens the circuit and de-energizes the fresh ink add solenoid. This closes the valve to vacuum and stops any further addition of ink into the reservoir.

**Note:** If the reservoir low switch closes and the flow time is greater than .25 seconds of the set point time or the printhead is turned off (not active), the printer will energize the make-up add solenoid instead of the fresh ink add solenoid. This replenishes the low reservoir with make-up fluid (instead of ink).

In this case, make-up is added because ink is not being depleted in printing. Rather, the low fluid level in the reservoir is caused by evaporation of make-up. Refer to “Make-up Fluid Add Subsystem” on page 4-21 for further information.

**Summary**

In summary, fresh ink is added during normal operation only when two conditions occur at the same time: 1) the magnetic float in the reservoir closes the reservoir low switch, and 2) the current flow time is below the set point time or less than .25 above the set point time (normal viscosity). Otherwise, the viscosity is too high (the flow time is greater than .25 seconds of set point time), therefore make-up fluid will be added instead of ink. The make-up fluid helps return the ink viscosity to normal (closer to the set point time).

**Two Exceptions**

Only fresh ink, never make-up fluid, will be added when a fluids request occurs during an Auto Prime and Auto Refresh (Service mode procedures). However, during all other service procedures, a high flow time will initiate make-up add when the reservoir low switch is activated.

**Fluids Low Alert Subsystem**

The fluids low subsystem monitors the fluid level in both the ink and make-up fluid bottles. When the fluid is depleted, a FLUIDS LOW warning alerts the operator to replace the replenishment bottle. Refer to Chapter 8, “Troubleshooting” for further information.

The fluid level in the fresh ink and make-up fluid bottles is monitored by the fluids low switch (a differential pressure switch used to detect back
pressure imposed by the fluid in the bottle). Fluids Low is adjusted at the fluid low needle valve where it is identified with a "B" (Bubbler).

As the fluid level in the bottle is close to being empty, the decrease in back pressure opens the fluids low switch and actuates a 30-minute timer. After approximately ten seconds, the light on the Alert key will light, and once the key is pressed, the display will show the warning, “FLUID LOW WARNING”. If the bottle is not replaced within 30 minutes of the warning, a “FLUIDS OUT FAULT” will occur (refer to Chapter 8, “Troubleshooting” for further information on the fault and warning condition).

Positive Air System

The positive air pressure is a constant air flow supplied to the printhead to keep particles and contaminants out of the printhead. Positive air is set at the positive air needle valve where it is identified with a "P" (Positive air).

Refer to Chapter 3, “Installation” for positive air adjustments.
In this chapter you will find:

- Overview of the printer and its main three subsections
- Identification of the components within the three printer sub-sections (hydraulic, pneumatic and electronic compartments)
- Identification of the components within the printhead

**Introduction**

The Videojet Universal 37pc printer consists of a cabinet and a printhead. The cabinet and the printhead are connected by an umbilical assembly (a flexible conduit containing electrical and fluid lines).

*Figure 5-1. Videojet Universal 37pc Printer*
The Control Unit

The control unit contains the keyboard and the message display (refer to Figure 5-2). Inside the cabinet are the three subsections of the printer, including:

- the hydraulic section (fluid pan)
- the pneumatic section
- the electronic section

Open the outer printer (cabinet) door to access the hydraulic section (fluid pan) of the printer. To access the pneumatic and electronic sections of the cabinet, insert the hexagonal wrench (allen key) that is provided into the door latch located in the upper-right corner of the fluid pan. Turn the wrench ¼ turn counterclockwise and then swing the inner compartment door open. The pneumatics section is located on the backside of the fluid pan. The electronics section is located on the far wall of the printer cabinet.

![Figure 5-2. Three Main Sections of the Printer](image-url)
The Printhead

The printhead is connected to the control unit by the umbilical assembly. The printhead receives pressurized ink through the umbilical, and turns the ink stream into tiny electrically-charged ink droplets which are deflected onto a substrate to form a printed code.

The printhead is available in three configurations;

- Fixed straight configuration
- Fixed 90° right angle configuration
- Adjustable configuration

*Figure 5-3. Videojet Universal 37pc Printhead*
Component Identification

Introduction
Printer components and the location of each component in the three main areas of the printer and the printhead are explained in this section.

Refer to the following sections and match the number of the component in the illustration to the same number shown in the text for a brief description of the function of the component:

- hydraulic section (refer to page 5-4)
- pneumatic section components (refer to page 5-7)
- electronic section components (refer to page 5-10)
- printhead components (refer to page 5-12)

Hydraulic Section Components
Refer to Figure 5-4 and match the number of the component in the illustration to the same number shown on the following pages to find a brief description of the function of the component.

Figure 5-4 Hydraulics (Fluid Pan) Compartment
Ink Module Assembly (1)
Houses all of the hydraulic components for the ink system, including the ink pump, ink add valve, make-up add valve, primary ink filter, reservoir, and pressure tank. The ink module assembly is connected to the air manifold (in the pneumatics compartment).

Make-up Fluid Bottle (2)
Contains the make-up fluid which is drawn into the ink module assembly as needed. Make-up fluid is used to thin the ink when the ink becomes too thick and the flow time increases.

Ink Bottle (3)
Contains the fresh ink which is drawn into the ink module reservoir as needed.

Filter Tube Assembly (4)
Consists of a bottle cap, dip tubes, and a filter. A filter tube assembly is inserted into both the ink bottle and make-up fluid bottle. The filter tube assembly acts as a pre-filter to remove contaminants from the ink and make-up fluid before it reaches the ink module assembly.

Primary Ink Filter (5)
Positioned at the bottom of the ink module assembly, this filter removes impurities (particles, contaminants, etc.) from the ink before the ink reaches the pressure tank.

Positive Air Needle Valve (6)
Adjusts positive air out of the printhead (marked with "P" for positive air). Positive air is applied to the printhead to slightly pressurize it and to keep contaminants out of the printhead. Using a flow meter, set the positive air (with the printhead cover On).

Fluids Low Needle Valve (7)
Adjusts the fluids low differential pressure (marked with a "B" for Bubbler). This pressure enables the fluids low switch to detect when a low level is reached in either the Ink or Make-up bottle.

Ink Pressure Regulator (8)
Adjusts the ink pressure applied to the pressure tank. Ink pressure is monitored by the ink pressure gauge.
Ink Pressure Gauge (9)
Measures the amount of air pressure (in psi and bar) applied to the pressure tank located inside the ink module assembly. Pressure is set by the ink pressure regulator.

Vacuum Gauge (10)
Measures the current level of vacuum (in inches and cm of Hg) within the system. The vacuum is used to pull ink and make-up back into the ink module, and pulls back unused ink from the ink return block. Vacuum should be set according to the type of ink used in the printer. Vacuum is set at the vacuum adjusting needle valve.

Vacuum Filter (11)
Prevents ink aerosols from entering the aspirator, and the vacuum passages located inside the air manifold.
Pneumatic Section Components

Refer to Figure 5-4 and match the number of the component in the illustration to the same number shown on the following pages to find a brief description of the function of the component.

**Aspirator (12)**
Located on top of the air manifold, the aspirator generates all system vacuum for the printer.

**Fresh Ink Add Solenoid (13)**
When energized, the fresh ink add solenoid allows vacuum to be applied to the ink add valve (located in the ink module assembly) which, in turn, draws fresh ink from the ink bottle into the reservoir of the ink module assembly.
Caution

Do not disconnect the solenoid while the AC power is On. Doing so will damage the PCB and it will require replacement.

Nozzle solenoid (14)
When energized, the nozzle solenoid (NVAL) supplies air pressure to the ink pressure regulator. The ink pressure regulator supplies air pressure to the ink supply cylinder located in the ink module assembly. The nozzle solenoid is energized whenever the ink is On.

Caution

Do not disconnect the solenoid while the AC power is On. Doing so will damage the PCB and it will require replacement.

Air Pressure Switch (15)
Monitors input air pressure. If the input air pressure drops too low, the air pressure switch will shut down the printer (after 20 seconds has elapsed) and an “AIR PRESSURE FAULT” will occur.

Fluids Low Switch (16)
Monitors the fluid levels in the ink bottle and make-up fluid bottle through a small amount of air pressure in the dip tubes (which is part of the filter tube assembly).

Main Air Solenoid (17)
The main air solenoid (AVAL) turns the input air pressure to the system On and Off.

Caution

Do not disconnect the solenoid while the AC power is On. Doing so will damage the PCB and it will require replacement.

Transfer Solenoid (18)
Controls the flow of air and vacuum to the ink pump located in the ink module assembly. When energized, the transfer solenoid supplies transfer (air) pressure to the ink pump in order to perform an ink transfer cycle.
When the solenoid is de-energized, vacuum is applied to the ink pump to neutralize the vacuum in the reservoir (located in the ink module assembly).

**Caution**

Do not disconnect the solenoid while the AC power is On. Doing so will damage the PCB and it will require replacement.

**Vacuum Adjusting Needle Valve (19)**

Used to adjust vacuum on the printer. Turn valve counter clockwise to increase vacuum and clockwise to decrease vacuum. View the vacuum setting at the vacuum gauge.

**Make-up Add Solenoid (20)**

When energized, the make-up add solenoid allows vacuum to be applied to the make-up add valve (located in the ink module assembly) which, in turn, draws make-up from the make-up bottle into the reservoir of the ink module assembly.

**Caution**

Do not disconnect the solenoid while the AC power is On. Doing so you will damage the PCB and it will require replacement.

**Air Manifold (21)**

Houses the input air filter, check valve, and all vacuum and air passages for the ink system. Attached to the air manifold is the aspirator, solenoids, and air pressure switch. The air manifold is connected to the ink module assembly (in the hydraulics compartment).
Electronic Section Components

Refer to Figure 5-5 and match the number of the component in the illustration to the same number shown on the following pages to find a brief description of the function of the component.

Printer Controller Board (22)

Powered by the +24 VDC power supply, the printer controller board contains all logic circuitry for printer operations such as printer start-up sequence, printhead start-up and shutdown sequence, fault detection, charge amplifier, nozzle drive amplifier, sense amplifier, interface circuitry, test points, and LED read-outs. The printer controller board also contains the high voltage (+320 V) and low voltage supplies (+5 V, +12 V, -12 V).
Lithium Battery (23)
The lithium battery is used to save the contents of the printer’s memory when the power is turned Off. The battery has a minimum life expectancy of 3 years from the time of its installation.

CAUTION - Risk of explosion if battery is replaced by an incorrect type. Dispose of used batteries according to battery manufacturers instructions. Replace with type CR2032 (P/N 218926).

+24 VDC Power Supply (24)
PCBLocated behind the AC cover, the +24 VDC power supply PCB supplies power to the printer circuit board, solenoids, and (indirectly) to the optional alert light (if used). It also applies power directly to the optional fan assembly (if used).

AC Power Switch (25)
Used to switch AC power to the printer On (I) and Off (O).

AC Cover (26)
Covers the AC components and the +24 VDC power supply PCB in the printer cabinet.

Bulkhead I/O PCB (27)
All external data connectors are located on the back side of this board. The connectors themselves extend out of the back of the printer. In addition to the parallel and serial connectors, this board has a number of ports that allow the shaft encoder, product detector, and alert light input cables to be connected.
Printhead Components

Refer to Figure 5-6, Figure 5-8 and Figure 5-7, Figure 5-9. Match the number of the component in the illustration to the same number shown on the following pages to find a brief description of the function of the component.

Figure 5-6. Printhead components — Top

Figure 5-7. Printhead components — Adjustable
Ink valve (28)
Attached to the rear of the nozzle, the ink valve controls the flow of pressurized ink to the nozzle. The ink valve opens under ink pressure.

Nozzle (29)
An assembly which contains a jeweled orifice and a piezo electric crystal used to change the ink stream into ink droplets. The nozzle is driven electrically by an oscillator on the printer circuit board to produce ultrasonic vibrations which break up the ink stream into droplets.

Charge Tunnel (30)
An electrode in which the ink droplets are formed as they leave the nozzle. As the vibrating stream passes through the charge tunnel, a break-off ink drop is formed and receives an electrical charge. Only the charged drops are used for printing.

High Voltage Deflection Plate (31)
Positioned directly opposite the ground plate, the high voltage deflection plate provides the positive high voltage (upper electrode). The ink drops pass through the electric field created between the high voltage plate and the ground plate. This field will deflect charged droplets exiting from the charge tunnel by attracting electrical charges, thus, producing a printed code. Uncharged drops will not be affected, and will enter the ink return block.

Ink Return Block (32)
Collects those ink droplets that are not used for printing. Vacuum draws all unused ink droplets back into the ink module reservoir for re-circulation. The ink return block also contains a sensing electrode used to detect charged ink drops to monitor the drop chargability when not printing.

Ground Plate (33)
Positioned directly opposite the high voltage deflection plate, the ground plate acts as the lower electrode (whereas, the high voltage deflection plate provides the upper electrode). The charged ink drops pass through and are deflected by the electric field between the upper and lower electrodes.
Figure 5-8. Printhead components – bottom

Figure 5-9. Printhead components – Adjustable

**Horizontal Locking Screw (34)**
Allows you to adjust the nozzle horizontally. When loosened (approximately 1/2 turn), you can adjust the ink stream horizontally by turning the horizontal adjustment screw. When tightened, you cannot move the nozzle horizontally.

**Horizontal Adjustment Screw (35)**
Adjusts the horizontal position of the ink stream in the ink return block. Turning this screw will adjust the ink stream to the left and right in the ink return block.

*Note:* Before you can adjust the horizontal adjustment screw, you must first loosen the horizontal locking screw.

**Vertical Adjustment Screw (36)**
Adjusts the vertical position of the ink stream in the ink return block. Turning this screw will adjust the ink stream up and down in the ink return block.

**Ink Return Line (37)**
A tube that leads from the ink return block in the printhead, through the umbilical assembly, and to the ink module assembly in the fluid pan. The ink return line is a passage through which the un-used ink droplets are recycled to the ink module reservoir.
In this chapter you will find:

- What you should do to the printer each day it is used (including how to clean the printhead)
- What items should be checked and/or replaced on the printer, and when it should be done
- How to use the ink on time reading to determine when scheduled maintenance should be performed
- The guidelines and procedure to circulate ink through the system
- The guidelines and procedure to prepare the printer for extended shutdown (storage)
- The procedure to prepare the printer for use after it has been removed from extended shutdown (storage)

**Maintenance Guidelines**

This printer is designed for continuous use. However, certain preventive maintenance procedures should be performed to ensure optimal performance:

- the fluid levels should be checked. In addition, the printhead should be cleaned periodically (refer to “Daily Inspection” on page 6-4 for further information)
- filters should be checked or replaced on a periodic basis (refer to “Scheduled Maintenance” on page 6-10 for further information)
- if you use the printer only periodically, with typically five or more days between uses, you should circulate the ink in the printer every third day for approximately one hour (refer to “Circulating Ink Through the Printer” on page 6-18 for further information)
- if you do not intend to use the printer for an extended period of time, you should follow the procedures outlined in “Preparing the Printer for Extended Shutdown” on page 6-20.
Reading the Ink On Time

The printer software tracks and records the total number of hours that the printer has been running. This 5-digit positive value is the ink on time. The ink on time is the total number of hours that the ink valve on the printhead nozzle has been open.

The ink on time can be used as a guide to determine when certain scheduled maintenance procedures should be performed (much like an odometer in an automobile is used for the same reason). Refer to “Scheduled Maintenance” on page 6-10 for further information.

The ink on time range is between 00000-59999. Once the maximum value (59999 hours) has been reached, the printer will automatically reset to 00000. The ink on time will also reset to 00000 if the software is changed on the printer circuit board. The ink on time cannot be reset by the operator.

Reading the ink on time is a service function. It is accessed in the Print and Standby modes, however, so that it can be viewed while printing.

Procedure

Ink on time can be accessed from either the Standby mode or the Print mode.

From Standby Mode...

To access the ink on time from the Standby mode:

1. Press the F1 key to select <SETUP/STATUS>.
2 Press the F1 key again to select <INK STATUS>.

<table>
<thead>
<tr>
<th>INK VISCOSITY</th>
<th>+00.06</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAKEUP ADD</td>
<td>00.30</td>
</tr>
<tr>
<td>INK ON HOURS</td>
<td>00123</td>
</tr>
<tr>
<td>INHIBIT</td>
<td>10111011</td>
</tr>
</tbody>
</table>

The ink on time is displayed after <INK ON HOURS>. (Values shown in the screen above are typical examples; your actual printer values will be displayed.)

3 Press the Exit key to return to the initial Standby mode screen.

From Print Mode...
To access the ink on time from the Print mode:

1 Press the F1 key to select <INK STATUS>.

<table>
<thead>
<tr>
<th>INK VISCOSITY</th>
<th>+00.06</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAKEUP ADD</td>
<td>00.30</td>
</tr>
<tr>
<td>INK ON HOURS</td>
<td>00123</td>
</tr>
<tr>
<td>INHIBIT</td>
<td>10111011</td>
</tr>
</tbody>
</table>

The ink on time is displayed next to <INK ON HOURS>. (Values shown in the screen above are typical examples; the actual printer values will be displayed.)

2 Press the Exit key to return to the initial Print mode screen.
Daily Inspection

Before using the printer each day, you should do the following:

- check the level of the make-up fluid and ink bottles in the printer (below).
- check the printhead. It may need to be cleaned (refer to page 6-5).

Check Fluid Levels

Complete the following steps to check the fluid levels in the bottles:

1. Either open the outer door of the printer to expose the ink and make-up fluid bottles located in the fluid pan (refer to Figure 6-1) or view the fluid levels through the exposed slots in the side of the printer.

2. Make sure there is enough fluid in the bottles to complete a shift or a product run. If there is not, replace the bottle(s) with a new full bottle of the same type of ink or make-up fluid.
Clean the Printhead

The printhead will need to be cleaned when the printhead appears to have a buildup of ink on the components which occurs over time. It should also be cleaned when print quality is less than optimal or if faults are occurring.

The schedule required for printhead cleaning will depend on your specific environment. Check the printhead before each shift until you have determined the amount of printhead cleaning required for your application. Complete the following steps to clean the printhead:

1. Use a screwdriver to loosen the screw on the printhead, then slide the printhead out of the cover (refer to Figure 6-2). At this point you may inspect the printhead components to determine whether the printhead requires cleaning. If it does not, slide the printhead back into the cover, and do not complete the rest of this procedure.

   **Tip:** If the printhead is in the printhead stand, simply loosen the screw on the printhead and slide the printhead out of the cover. This will leave the cover attached to the printhead stand so that you won't have to realign the printhead to the product when reinserting the printhead in the cover.

---

*Figure 6-2. Removing the Printhead Cover*
Caution

Make certain to ground the service tray to the printer, and install the printhead into the service tray. Failure to properly ground the service tray and printhead when using flammable ink may result in fire due to static discharge.

2 Place the service tray on a flat surface such as the floor.

3 Attach the service tray grounding clip to either the printhead screw as shown, or to the metal wire mesh around the base of the printhead umbilical as shown in Figure 6-3.

4 Install the printhead chassis into the holder on the service tray as shown.

5 While either in the Print mode or the Standby mode, press the F2 key on the keyboard to select <CLEAN HEAD>.

6 If the printer was in print mode when <CLEAN HEAD> was selected, the following screen will appear:

** WARNING **
PRINTING WILL STOP
---------------------------------------
CONTINUE ABORT

Select <CONTINUE>. Instructions that guide you through the process of cleaning the printhead will be displayed.

Note: If <ABORT> is selected, printhead shutdown will be cancelled and normal printing will continue.
7 The printer will begin the printhead shut-down procedure. As indicated on the screen, wait until the printhead has completely shut down. The vacuum gauge will read 0 when the printhead shut-down procedure is complete.

Figure 6-3. Grounding the Service Tray to the Printer

Caution

Use only a cleaning solution that is compatible with the ink type in the printer. Using an incompatible cleaning solution can damage the printer's components. Refer to the InkSource Bulletin supplied with the ink for verification of compatibility.
8 Squirt cleaning solution onto the printhead components, making certain to clean the nozzle orifice thoroughly (refer to Figure 6-4).

![Figure 6-4. Cleaning the Printhead](image)

**Caution**

Do not use shop cloths or paper towels to dry the printhead. Lint or other particles may cause printhead failure. Use only compressed air at approximately 20 psi (1.37 bar). Do not force air into the ink return block or into the orifice of the nozzle.
9 Dry the printhead using approximately 20 psi (1.37 bar) of compressed air (refer to Figure 6-5).

![Figure 6-5. Drying the Printhead with Compressed Air](image)

10 Press the F2 key again on the keyboard to finish the printhead cleaning procedure.

11 Remove the printhead from the service tray.

12 Slide the printhead back into the cover, and tighten the screw on the printhead to secure the cover.

13 Remove the grounding clip and service tray from the printer.

14 Press the Start/Stop key on the keyboard to begin the printhead start-up procedure.

15 Dispose of the cleaning solution in the service tray (or other waste container used) properly.

**Note:** Do not pour cleaning solution into sinks, sewers, or drains. Waste disposal must comply with all appropriate regulations. Consult the appropriate regulatory agency for further information.

The printer start-up procedure is now completed, and the printer is ready for operation.
Scheduled Maintenance

Introduction

Certain items in the printer should be checked or replaced on a periodic basis. Checking or replacing these items at the time interval specified will ensure optimal printer performance.

Refer to the ink on time to determine the current total number of hours that the printer has been in operation, and use this information to determine when the following printer items should be replaced (refer to “Reading the Ink On Time” on page 6-2 for further information on the ink on time).

Every 1000 Hours

- Replace the vacuum filter

Every 5000 Hours

- replace the primary ink filter
- check and/or replace the input air filter (in the ink system assembly)
- replace the filter tube assemblies

Refer to Table 6-1 for a summary of the printer items that should be maintained, and the time interval at which they should be checked and/or replaced.

<table>
<thead>
<tr>
<th>Scheduled Maintenance</th>
<th>Ink On Time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1000</td>
</tr>
<tr>
<td>Replace the vacuum filter</td>
<td>✓</td>
</tr>
<tr>
<td>Replace filter tube ass'y</td>
<td></td>
</tr>
<tr>
<td>Replace primary ink filter</td>
<td></td>
</tr>
<tr>
<td>Check input air filter</td>
<td></td>
</tr>
</tbody>
</table>

Table 6-1: Maintenance Summary Chart
1000-Hour Maintenance

After every 1000 hours of printer operation (ink on time), you should replace the vacuum filter (see below):

Replace Vacuum Filter

Complete the following steps to replace the vacuum filter:

1. If the printhead is On (square light in upper right corner on Start/Stop key is lit or flashing), press the Start/Stop key on the keyboard to turn the printhead Off.

   Wait for the printhead shut-down procedure to complete (about 2 minutes). The vacuum gauge will read 0 when the printhead shut-down procedure is complete.

2. Press the AC power switch (located on the lower right side of the printer cabinet) to the OFF (O) position to turn the AC power Off.

3. Turn the fitting located on top of the vacuum filter counterclockwise one turn, and remove the fitting from the filter (refer to Figure 6-6).

4. Pull the vacuum tube (attached to the top of the vacuum filter) off of the barbed fitting located behind the vacuum filter (refer to Figure 6-7).

   Note: Some ink may spill from the bottom of the vacuum filter once it has been removed. Have absorbent towels on hand to clean any ink spillage.

5. Remove the vacuum filter from the top of the ink module by turning the filter counterclockwise until it becomes loose.

6. Discard the old vacuum filter and attached tubing.

7. Make certain that the “O” ring is in place on the filter, then thread the new vacuum filter into the top of the ink module until it is finger tight. Do not over tighten.

8. Push the tube (supplied with the filter) onto the stem on top of the vacuum filter, and insert the opposite end of the tube onto the barbed fitting located behind the vacuum filter (refer to Figure 6-6).
9 Install the fitting removed in step #3 into the top of the new vacuum filter.

10 Press the AC power switch to the ON (|) position to turn the AC power On.

**Note:** Check to confirm that the vacuum adjustment is set correctly.

The procedure to replace the vacuum filter is completed.
5000-Hour Maintenance

After every 5000 hours of printer operation (ink on time), you should complete the following procedures:

- Replace the Filter Tube Assemblies (see below)
- Replace Primary Ink Filter (refer to page 6-15)
- Check Input Air Filter (refer to page 6-16)

Replace Filter Tube Assemblies

Complete the following steps to replace the filter tube assemblies in both the ink and make-up fluid bottles:

1. If the printhead is On (square light in upper right corner of Start/Stop key is lit or flashing), press the Start/Stop key on the keyboard to turn the printhead Off.

   Wait for the printhead shut-down procedure to complete (about 2 minutes). The vacuum gauge will read 0 when the printhead shut-down procedure is complete.

2. Press the AC power switch (located on the lower right side of the printer cabinet) to the OFF (O) position to turn the AC power Off.

3. Pull the bottle (ink or make-up) which you are replacing the filter tube assembly away from the fluid pan.

   **Note:** If you are replacing the filter tube assembly in the ink bottle, have absorbent towels on hand to clean any ink that may spill.

4. Pull the cap off of the bottle, and slide the attached filter tube assembly out of the bottle (refer to Figure 6-7). Place the bottle aside.
Figure 6-7. Replacing the Filter Tube Assembly

5 Remove the fitting from the top of the cap by turning counterclockwise one full turn.

6 Pull the line with attached rubber tube off of the top of the cap.

7 Discard the old filter tube assembly.

8 Install the fitting (removed in step #5) onto the top of the cap on the new filter tube assembly.

9 Install the line with attached rubber tube (removed in step #6) onto the top of the cap on the new filter tube assembly.

10 Insert the filter tube assembly into the bottle, and push the cap down to secure the assembly. Place the bottle into the fluid pan.

11 Repeat steps 3-10 to replace the filter tube assembly in the other bottle.

12 Press the AC power switch to the ON (|) position to turn the AC power on.

The procedure to replace the filter tube assemblies is completed.
Replace Primary Ink Filter
Complete the following steps to replace the primary ink filter:

1 If the printhead is On (square light in upper right corner of Start/Stop key is lit or flashing), press the Start/Stop key on the keyboard to turn the printhead Off.

   Wait for the printhead shut-down procedure to complete (about 2 minutes). The vacuum gauge will read 0 when the printhead shut-down procedure is complete.

2 Press the AC power switch (located on the front of the printer cabinet) to the OFF (O) position to turn the AC power Off.

3 Disconnect compressed air to the printer.

---

*Figure 6-8. Disconnecting the Vacuum Filter*
4 Place absorbent towels below the ink module to catch any ink that may spill when removing the primary ink filter.

5 Remove the fitting from the bottom of the primary ink filter by turning with a 7/16-inch wrench.

6 Unscrew the primary ink filter from the bottom of the ink module.

7 Wipe excess ink from the bottom of the ink module mounting hole with absorbent towels and cleaning solution.

8 Discard the old primary ink filter.

9 Install the new primary ink filter into the bottom of the ink module until finger tight. Do not over tighten. Hand tighten only.

10 Install the fitting into the bottom of the primary ink filter.

11 Re-connect compressed air to the printer.

12 Press the AC power switch to the ON (I) position to turn the power On.

Note: The printer will compensate for any ink that was lost during this procedure, therefore, no priming is required.

The procedure to replace the primary ink filter is completed.

Check Input Air Filter
Complete the following steps to check and/or replace the input air filter:

1 If the printhead is On (square light in upper right corner of Start/Stop key is lit or flashing), press the Start/Stop key on the keyboard to turn the printhead Off.

   Wait for the printhead shut-down procedure to complete (about 2 minutes). The vacuum gauge will read 0 when the printhead shut-down procedure is complete.

2 Press the AC power switch (located on the lower right side of the printer cabinet) to the OFF (O) position to turn the AC power Off.

   Note: Record the current input air pressure before disconnecting the air pressure to the printer or turning the air regulator down to 0 (if using the Videojet input air filter accessory).

3 Disconnect the air pressure to the printer or turn the air regulator down to 0 (if using the Videojet input air filter accessory).

4 Use a wrench to loosen the black nut at the top of the elbow fitting shown in Figure 6-9.

5 Use a dull, pointed instrument to pull the input air filter out of the bottom of the air manifold.
6 Check the input air filter for dirt and damage. Replace the input air filter if necessary. If questionable, replace the filter to ensure proper printer operation.

Figure 6-9. Accessing the Input Air Filter

7 Install the new or existing input air filter into the bottom of the air manifold.

8 Thread the elbow fitting back into the bottom of the air manifold, and tighten the nut to secure the fitting. Do not over-tighten.

9 Reconnect the air pressure to the printer or set the air regulator to the setting that was recorded before the air was disconnected.

10 Press the AC power switch to the ON (|) position to turn the AC power On.

The procedure to check the input air filter is completed.
Circulating Ink Through the Printer

If you anticipate that the printer will not be used for more than five days, the ink should be circulated in the printer every third day for approximately one hour.

If this is not done, you may experience poor printer operation, or the ink may dry, causing clogged lines and/or a build-up of dried ink in the components.

Tools/Supplies Required

No tools or supplies are required for this procedure.

Procedure

Complete the following procedure to circulate ink through the printer:

1. If the power cord was disconnected and the compressed air disconnected during the printer shut-down, re-connect the power cord and compressed air to the printer.

2. Press the AC power switch located on the lower right side of the printer cabinet to turn AC power to the printer On.

3. Press the Standby key to enter the Standby mode.

4. Press the Start/Stop key on the keyboard to turn the printhead On.

The printer will now begin the printhead start-up sequence. This procedure should take approximately 45 seconds. Once the start-up sequence is completed, the Ready light will become lit (not flashing) indicating that the printhead is now active (the square light in upper right corner of the Start/Stop key will also be lit). The ink is now circulating through the printer.

5. Allow the printer to run for approximately one hour.

*Note: The printer will not print messages because it is in the Standby mode and not the Print mode.*
6 After approximately one hour has elapsed, press the Start/Stop key to shutdown the printhead.

7 Press the AC power switch to turn the power OFF after the printer has completed the two-minute shutdown procedure.

You have completed this procedure; the printer is now ready for up to 3 days of non operation.
Preparing the Printer for Extended Shutdown

If the printer will not be used for an extended period of time, you should prepare the printer for extended shutdown (storage). The period of time that the printer can sit before you should consider preparing it for extended shutdown depends on the ink type used, the application, and when the next time the printer will be used.

Generally, if the printer is not going to be used for more than five days and you do not expect to use it again soon, you should prepare the printer for extended shutdown (storage).

If this is not done, you may experience poor print quality, or the ink may dry, causing clogged lines and/or a build-up of dried ink in the components.

Tools/Supplies Required

You will need the following items for this procedure:

• Videojet service tray
• screwdriver, flat blade
• absorbent towels
• bottle of make-up fluid
• plastic bag (or equivalent cover) to cover printhead
• rubber band
Procedure

To prepare the printer for extended shutdown (storage), complete the following procedures in the order shown. Refer to Chapter 7, “Service Mode” for the steps to perform for each procedure.

Warning

Always wear safety glasses with side shields (or equivalent eye protection) when working on the printer.

Flushing ink from the system

1. Prepare to service the printer. See “Ink System Service Preparation” on page 7-21.

2. Complete the Auto Drain procedure to remove all of the ink currently in the ink system. See “Drain Fluid From Printer (AUTO DRAIN)” on page 7-29.

3. Pull the cap from the bottle of ink in the printer, and slide the filter tube assembly out of the bottle.

4. Use an absorbent towel and make-up fluid to clean all the ink from the cap and filter tube assembly.

5. Insert the filter tube assembly into a new bottle of make-up fluid, push on the cap, and place the bottle into the fluid pan. There should now be two bottles of make-up fluid in the printer.

6. Complete the Auto Prime procedure to load make-up fluid into the ink system. See “Prime Printer with Fluid (AUTO PRIME)” on page 7-25.

7. Restart the AUTO PRIME procedure. While the Auto Prime procedure is running, spray make-up ink into the ink catcher for five seconds; wait three minutes and repeat.

8. Repeat the AUTO PRIME procedure until the Make-up fluid comes out clear.
Prepare Printer for Storage

9  Remove the printhead from the service tray.

10  Slide the printhead chassis back into the printhead cover, and tighten the screw on the printhead to secure the cover.

11  Press the AC power switch to the OFF (O) position to turn the power Off.

12  Disconnect the printer from its electrical source, or turn Off the circuit breaker (if hard-wired).

**Warning**

Turn off the air pressure or close the regulator before disconnecting the air supply to the printer. Failure to do may result in a sudden blast of air causing the air line to whip around or air to get into eyes.

13  Disconnect the incoming air supply to the printer.

14  Cover the printhead with a plastic bag (or other type of cover), and secure the bag (cover) with a rubber band (or string).

   **Note:** The plastic bag (or cover) will prevent contaminants from entering the printhead orifice.

**Warning**

Inks, make-up fluids, and cleaning solutions must be stored as flammable liquids. Storage must comply with all local regulatory requirements.

15  Cap the bottle of fluid(s) removed from the printer, and place it into storage.

The procedure to prepare the printer for extended shutdown (storage) is finished.
Preparing Printer for Use After Extended Shutdown

This procedure instructs you on how to prepare the printer for use after it has been removed from storage (extended shutdown).

Tools/Supplies Required

You will need the following items for this procedure:

- Videojet service tray
- Screwdriver, flat blade
- Squirt bottle filled with cleaning solution
- Absorbent towels
- Bottle of ink

Procedure

To prepare the printer for use after extended shutdown (storage), complete the printer installation procedure as outlined in Chapter 3, Installation.

Warning

Always wear safety glasses with side shields (or equivalent eye protection) when working on the printer.

After completing these procedures, conduct a test to ensure print quality is good.
In this chapter you will find:

- Information about the Service mode (what it is used for, the screens that appear in the display)
- How to read the current ink system times
- How to turn the ink or high voltage On and Off, independently
- How to complete ink system procedures such as Auto Drain, Auto Prime, Auto Refresh and Ink Conversion
- How to complete the ink stream calibration procedure
- How to do a test print to check current print quality

**Service Mode**

**What You Can Do in the Service Mode**

Enter the Service mode to do any of the following:

- Identify the software version installed into the printer (this is shown in the initial Service mode screen).

- Read and adjust the ink flow time values such as the set point, make-up add time, flow time, and inhibit (refer to “Ink System Times” on page 7-8).

- Turn the high voltage or ink to the printhead On and Off, independent of one another (refer to “Turn Ink or High Voltage On and Off” on page 7-16).

- Complete the Auto Drain procedure (refer to “Drain Fluid From Printer (AUTO DRAIN)” on page 7-29).

- Complete the Auto Prime with fluid procedure (refer to “Prime Printer with Fluid (AUTO PRIME)” on page 7-25).

- Complete the Auto Prime with ink procedure (refer to “Prime Printer with Ink (AUTO PRIME)” on page 7-31).
• Complete the Auto Refresh procedure (refer to “Refresh Ink System (AUTO REFRESH)” on page 7-34).
• Adjust the nozzle drive (refer to “Setting the Nozzle Drive” on page 7-51).
• Set the ink pressure (refer to “Set the Ink Pressure” on page 7-48).
• Complete a test print to check print quality (refer to “Conduct a Test Print” on page 7-55).

How To Enter the Service Mode

You can enter this mode only if the Mode keypad light located next to the word “Mode” on the keyboard is lit (refer to Figure 7-1).

![Figure 7-1. Entering the Service Mode](image)

Press the Service key to access the Service mode. The initial screen of the Service mode appears.

<table>
<thead>
<tr>
<th>37 PC/UI</th>
<th>ID#</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRINT</td>
<td>INK</td>
</tr>
<tr>
<td>HEAD</td>
<td>SYSTEM</td>
</tr>
</tbody>
</table>

The upper portion of this screen will contain the software identification information for your printer.
What Happens When Entering Service Mode

When the Service key is pressed (if the printhead is On), the printer will immediately turn Off the High Voltage. This is a safety feature which prevents high voltage from being present when you are servicing the printer. However, the printer will not turn the ink off. This means that fluids will still be running through the printhead. If you want to work on the printhead, you must turn the ink off (change the INK ON field from <YES> to <NO>), as explained in this chapter.

When going back to the Print mode, make sure the High Voltage and the Ink are turned back On before exiting the Service mode as explained in this chapter. The Start/Stop key cannot be used while in the Service mode; the Ink and High Voltage must be turned on manually. Or, once you have exited the Service Mode, you may press the Start/Stop key to turn both the ink and high voltage On.
Service Mode Screens

Figure 7-2 and Figure 7-3 show the software screens that appear while the printer is in the Service mode.
Figure 7-3. Service Mode Screens (continued)
Printer Ink-on time

The printer software tracks and records the total number of hours that the printer has been running. This 5-digit positive value is the ink-on time. The ink-on time is the total number of hours that the ink valve on the printhead nozzle has been open.

The ink-on time can be used as a guide to determine when certain scheduled maintenance procedures should be performed (much like an odometer in an automobile is used for the same reason). Refer to “Scheduled Maintenance” on page 6-10 for further information.

The ink-on time range is between 00000-59999. Once the maximum value (59999 hours) has been reached, the printer will automatically reset to 00000. The ink-on time will also reset to 00000 if the software is changed on the printer circuit board. The ink-on time cannot be reset by the operator.

Reading the ink-on time is a service function. It is accessed in the Print and Standby modes, however, so that it can be viewed while printing.

Procedure

Ink-on time can be accessed from either the Standby mode or the Print mode.

From Standby Mode...

To access the ink-on time from the Standby mode:

1. Press the F1 key to select <SETUP/STATUS>.
2 Press the F1 key again to select <INK STATUS>.

<table>
<thead>
<tr>
<th>INK VISCOSITY</th>
<th>+00.06</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAKEUP ADD</td>
<td>00.30</td>
</tr>
<tr>
<td>INK ON HOURS</td>
<td>00123</td>
</tr>
<tr>
<td>INHIBIT</td>
<td>10111011</td>
</tr>
</tbody>
</table>

The ink-on time is displayed after <INK ON HOURS>. (Values shown in the screen above are typical examples; your actual printer values will be displayed.)

3 Press the Exit key to return to the initial Standby mode screen.

**From Print Mode...**
To access the ink-on time from the Print mode:

```
PRINTING

INK STATUS  CLEAN HEAD
```

Press the F1 key to select <INK STATUS>.

<table>
<thead>
<tr>
<th>INK VISCOSITY</th>
<th>+00.06</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAKEUP ADD</td>
<td>00.30</td>
</tr>
<tr>
<td>INK ON HOURS</td>
<td>00123</td>
</tr>
<tr>
<td>INHIBIT</td>
<td>10111011</td>
</tr>
</tbody>
</table>

The ink-on time is displayed next to <INK ON HOURS>. (Values shown in the screen above are typical examples; the actual printer values will be displayed.)

4 Press the Exit key to return to the initial Print mode screen.
Ink System Times

The printer monitors the flow of the ink during each ink transfer cycle (referred to as the flow time), and compares it to the ideal flow time (the set point). This is done to make certain the ink viscosity (consistency) is kept within a specified range. If the ink in the ink module is found to be too thick, the printer will add the proper amount of make-up fluid to bring it back to the ideal viscosity. If the ink is too thin, make-up fluid is not added.

These times are available to you for reference, and are typically used to understand the current state of the ink system when troubleshooting the printer (refer to Chapter 8, “Troubleshooting” for further troubleshooting information).

The printer displays the following ink system times:

- set point
- make-up add time
- flow time
- make-up inhibit value

The Set Point

The Set Point refers to the number of seconds it took the printer to empty the pressure tank (located inside the ink module) following the pressure set procedure. The printer automatically calculates a new set point each time the ink pressure is set (this is done during the ink stream calibration procedure).

The printer acknowledges the set point as the “ideal” time that it should take for the ink supply cylinder to empty, and then compares it to the flow time (the time that it actually took the cylinder to empty after each last transfer cycle) to monitor the ink viscosity.

The Make-up Add Time

The Make-up Add Time refers to the total number of seconds that make-up fluid was added into the ink module reservoir at the end of the last transfer cycle. Make-up fluid is added when the ink viscosity becomes too thick.

Since the amount of make-up fluid added following each ink transfer cycle may differ, the make-up add time on the screen will usually change after each cycle.
The Flow Time
The Flow Time refers to the number of seconds that it took the printer to empty the pressure tank during the last ink transfer cycle only. The printer automatically calculates a new flow time after every ink transfer cycle, and then compares it to the set point for monitoring ink viscosity and determining the correct make-up add time.

If the ink (in the ink module) is found to be too thick, the printer will add the proper amount of make-up fluid to bring it back to the ideal viscosity. If the ink is too thin, make-up fluid is not added.

You cannot change the flow time value; it is displayed on the screen for reference only.

The Make-up Inhibit Value
The (make-up) value is an 8-digit string of characters which represents the history of the addition of make-up fluid into the ink module during the last eight transfer cycles.

If the reservoir in the ink module becomes full before the proper amount of make-up fluid is added, a “1” will appear in the 8-digit string for that particular transfer cycle. If the proper amount of make-up fluid is added during the transfer cycle, a “0” will appear in the 8-digit string. The leftmost digit represents the oldest of the last eight transfer cycles, while the rightmost digit represents the most recent transfer cycle.

You cannot change the inhibit value; it is displayed on the screen for reference only. If the make-up fluid request is constantly being inhibited (the module reservoir fills before the proper amount of make-up fluid is added into the ink module); this is indicated by a “1” in the inhibit value. This is a sign that there may be a faulty component in the printer, or an improper set point time was taken when the printer was initially set up.
Read the Ink System Times

You can read the set point and flow time values only while the printer is in the Service mode. To read these times, complete the following steps:

1. Press the Service key to enter the Service mode.
   
   If the printer is in the print mode, a warning screen will appear <WARNING PRINTING WILL STOP>; press F1 to continue.

2. Press the F2 key to select <INK SYSTEM>.

3. Press the F1 key to select <INK CONTROL>.

   **-set point 15.95
   **-makeup add 00.30
   **-flow time 15.89
   **-digit change +

   The Set Point, Makeup Add and Flow Time values are shown. Press the Exit key twice to return to the initial Service mode screen.
Read the Make-up Inhibit Value

Reading the Make-up Inhibit value is a service function. It is accessed in the Print and Standby modes, however, so that it can be viewed while printing.

From Standby Mode...

To access the Make-up Inhibit value from the Standby mode:

1. Press the F1 key to select <SETUP/STATUS>.

2. Press the F1 key again to select <INK STATUS>.

The Make-up Inhibit value is displayed after <INHIBIT> as an eight-digit binary number. (Values shown in the screen above are typical examples; your actual printer values will be displayed.)

3. Press the Exit key to return to the initial Standby mode screen.
From Print Mode...
To access the Make-up Inhibit value from the Print mode:

1. Press the F1 key to select <INK STATUS>.

```
INK VISCOSITY       +00.06
MAKEUP ADD          00.30
INK ON HOURS        00123
INHIBIT             1011011
```

The Make-up Inhibit value is displayed next to <INHIBIT> as an eight-digit binary number. (Values shown in the screen above are typical examples; the actual printer values will be displayed.)

2. Press the Exit key to return to the initial Print mode screen.
Change the Set Point or Make-up Add Time

A new set point or make-up add time can be manually entered into the printer as well. To do this, perform the following steps:

**Caution**

Never change the set point or make-up add time manually unless for troubleshooting purposes. This should be done only by a qualified Videojet Technologies service representative. Changing the set point or make-up add time manually may lead to poor print quality or printer faults.

1. Press the Service key to enter the Service mode.
   
   If the printer is in the print mode, a warning screen will appear <WARNING PRINTING WILL STOP>; press F1 to continue.

2. Press the F2 key to select <INK SYSTEM>.

3. Press the F1 key to select <INK CONTROL>.

4. Press the Up/Down Arrow keys to move the cursor to the <SET POINT> and/or <MAKEUP ADD> fields that you would like to change.
5 Enter a new value using the following guidelines:

- To change the value, place the cursor on the digit to be changed. Use the F1 key to decrement the highlighted digit, and use the F2 key to increment the highlighted digit.
- The value entered for the set point must be between 10.00 and 99.99 seconds. The printer will ignore all invalid entries.
- The value entered for the make-up add time must be between 00.00 and 10.00 seconds.

Tip: If at any time (after having made changes, and before pressing the Save key), you would like to go back to the original values, press the Exit key. This will change all values back to their original state, and the previous screen will appear on the display.

6 Press the Save key to confirm the change.

7 Press the Exit key two times to return to the initial Service mode screen.
Ink and High Voltage Control

You can control the ink and high voltage at the printhead, independent of each other. This is necessary for service purposes, since many operations require that the ink or high voltage (or both) be turned On while completing a particular procedure.

If the ink is On before you enter the Service mode, it will remain On after you enter the Service mode (and if it is Off, it will stay Off). However, the printer will automatically turn the high voltage Off when you enter the Service mode regardless of whether it was On or Off before you entered the mode.

You can turn the high voltage On only if the ink is already On. If you try to turn the high voltage On while the ink is Off, your attempt will be ignored.

The present state of the ink and high voltage can be found by referring to the screen shown in Figure 7-4. If the <INK ON> or <HIGH VOLTAGE ON> field reads <YES>, that particular option is On. If the field reads <NO>, the option is Off (refer to “Turn Ink or High Voltage On and Off” on page 7-16 for further information)

<table>
<thead>
<tr>
<th>INK ON</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIGH VOLTAGE ON</td>
<td>NO</td>
</tr>
<tr>
<td>TEST PRINT ON</td>
<td>NO</td>
</tr>
<tr>
<td>CHANGE SETTINGS</td>
<td>NO</td>
</tr>
</tbody>
</table>

Figure 7-4. Checking Current State of Ink and High Voltage
Turn Ink or High Voltage On and Off

You can control the ink and high voltage, independent of each other. The ink can be turned On (independently) regardless of whether the high voltage is On or Off, however you can turn the high voltage On only if the ink is already On.

To control the ink or high voltage, complete the following steps:

1 Press the Service key to enter the Service mode.

   If the printer is in the print mode, a warning screen will appear <WARNING PRINTING WILL STOP>; press F1 to continue.

2 Press the F1 key to select <PRINT HEAD>.

3 Press the Up/Down Arrow keys to move the cursor between the <INK ON> and <HIGH VOLTAGE ON> fields for the option you would like to change. Keep in mind that the ink must be On before you can turn the high voltage On.

4 Press the Yes/No key to change the <INK ON> and/or the <HIGH VOLTAGE ON> field from <NO> to <YES>.

   Once the Yes/No key is pressed, <NO> will change to <YES> and the action will occur immediately. There is no need to press the Save key.
Changing the Nozzle Drive and High Voltage Setting

In the Service mode, you can control the amount of voltage provided to the nozzle and to the high voltage deflection plate. The high voltage setting controls the height of the printed bars or characters. The nozzle drive setting controls the amount of ultrasonic signal applied to the nozzle. Nozzle drive is set as part of the printer calibration process or during troubleshooting.

Procedure

The high voltage setting can be keyboard adjusted to a value between 1 and 100 (the default setting is 50). The nozzle drive setting can be set to a value between 1 and 999 (the default setting is 100).

To adjust the High Voltage or Nozzle Drive setting, complete these steps:

1. Press the Service key to enter the Service mode.
   
   If the printer is in the print mode, a warning screen will appear <WARNING PRINTING WILL STOP>; press F1 to continue.

2. Press the F1 key to select <PRINT HEAD>.

3. Make sure that the ink is on. If not, turn it on by pressing the Yes/No key while the cursor is in the <YES/NO> field next to <INK ON>.

4. Press the Up/Down Arrow keys to move the cursor to the <YES/NO> field next to <CHANGE SETTINGS>.
5 Press the Yes/No key to select <YES>.

6 Press the F1 key to select <NOZZLE DRIVE> to change the Nozzle Drive setting. Or, press the F2 key to select <PRINT HEIGHT> to change the High Voltage setting.

7 Press the Arrow keys to change the selected value. The Up/Down Arrow keys change the number by increments of one. The Left/Right Arrow keys change the value by a greater value.

*Note:* Test print is available from either printhead setting screen by pressing the YES key.
Ink System Service

The ink system (ink module, ink lines, and printhead) are maintained by using these procedures:

- Auto Drain
- Auto Prime
- Auto Refresh
- Ink Conversion

**Caution**

Do not leave the printer unattended during any ink maintenance procedure. The fluids which are discarded during these operations are flammable.

---

**Auto Drain**

The Auto Drain procedure removes all of the fluid (ink, make-up fluid, or cleaning solution) from the ink system. This procedure is typically done when performing a system flush, preparing the printer for extended shutdown, preparing the printer for use after an extended shutdown, or when changing ink types during the system flush.

**Auto Prime**

The Auto Prime procedure loads the chosen fluid (ink, make-up fluid, or cleaning solution) into an empty ink system. Auto Prime fills the entire ink system with fluid and, at the same time, purges any air from the ink lines. This procedure is done when loading ink into the printer for the first time or after completing the Auto Drain procedure.

**Auto Refresh**

The Auto Refresh procedure removes all of the ink currently in the ink system, and replaces it with fresh ink from the ink bottle. This procedure is completed only when the printer is already loaded with fluid, and is typically done when the printer produces poor print quality or experiences printer faults.
System Flush

The System Flush procedure uses a combination of these procedures (mainly Auto Drain and Auto Prime) to remove all of the ink from the system and clean it out with make-up fluid.
Ink System Service Preparation

Ground the Service Tray

When working with flammable fluids (make-up or ink) there exists the possibility of fire due to static discharge which may ignite the fluids. To avoid any possibility of static discharge, the service tray used to collect fluid must be properly grounded.

Complete these steps to ground the service tray to the printer.

1. Ensure the printer is connected to an earth ground through the AC power cord.

2. Use a screwdriver to loosen the screw on the printhead, then slide the printhead out of the cover (refer to Figure 7-5).

   **Tip:** If the printhead is in the printhead stand, simply loosen the screw on the printhead and slide the printhead out of the cover. This will leave the cover attached to the printhead stand so that you won't have to realign the printhead to the product when reinstalling the printhead into the cover.

3. Always use a metal grounded tray to collect flammable fluids. A metal service tray is available through Videojet Technologies. Place the tray on a flat surface such as the floor. Position the printhead in the holder as shown in Figure 7-6.
4 Attach the service tray grounding clip to either the printhead screw as shown or to the metal wire mesh around the base of the printhead umbilical.

5 Remove the internal cover over the ink valve (refer to Figure 7-5).

6 Install the printhead chassis into the holder on the service tray as shown.

![Figure 7-6. Grounding the Service Tray](image)

**Installing a Bleed Tube**

A bleed tube must be attached to the ink valve bleed port when performing certain ink maintenance procedures. After the bleed tube is attached, the bleed screw is loosened allowing the fluids to drip from the bleed tube directly into the stainless steel service tray. This prevents contaminated fluids from entering the nozzle and damaging it.

**Tools/Supplies Required**

You will need the following items to attach the bleed tube to the ink valve.

- Bleed tube (provided)
- 0.050 allen wrench
Procedure
Complete these steps to attach a bleed tube.

1. Locate the ink valve bleed port on the rear of the ink valve. Attach the bleed tube securely on the port and route the bleed tube through the hole in the printhead face plate (refer to Figure 7-7 and Figure 7-8). Make sure the end of the tube is directed into a grounded metal service tray.

2. Connect the allen wrench to the bleed port set screw. During the ink maintenance procedures, you will turn the set screw to drain the fluids through the bleed port.

Figure 7-7. Attaching the Bleed Tube
Figure 7-8. Attaching the Bleed Tube - Adjustable Printhead

You have completed the Ink System Service Preparation procedure. You may now continue to the Auto Drain, Auto Prime, Refresh or System Flush Procedure.
Prime Printer with Fluid (AUTO PRIME)

Primeing the printer with fluid is used to install fluid into an empty ink system. Complete these steps to prime (load) fluid into the printer.

1. Ground the Service Tray to the printer. Refer to “Ground the Service Tray” on page 7-21.

2. Attach the bleed tube to the ink valve bleed port on the printhead. Refer to “Installing a Bleed Tube” on page 7-22.

3. Remove the ink bottle from the right side of the fluid pan.

4. Install a bottle of the correct type of fluid to be used to load into the printer into the right side of the fluid pan, in place of the ink bottle (refer to Figure 7-9).

5. Ensure that the AC power switch is in ON (I) position.

Figure 7-9. Installing the Make-up Fluid Bottles
6 Press the Service key to enter Service mode.

7 Press the F2 key to select <INK SYSTEM>.

8 Press the F2 key to select <INK UPKEEP>.

9 Press the Down Arrow key twice to move the cursor to the <YES/NO> field next to <AUTO PRIME>.

10 Press the Yes/No key to select <YES>. The message “FOR PRIMING SYSTEM WITH NEW FLUIDS” appears on the display screen.

11 With the cursor in the <YES/NO> field next to <START PRIMING>, press the Yes/No key to begin priming the printer. The message “AUTO PRIME RUNNING” appears on the display screen.
12 View the ink pressure gauge to confirm that the ink pressure regulator is set to 5 psi (.34 bar) (refer to Figure 7-10). If is not, adjust the ink pressure regulator to 5 psi (.34 bar).

**Figure 7-10. Adjusting the Ink Pressure**

**Note:** It will take two or three minutes before the printer sends pressure to the ink pressure gauge once AUTO PRIME is started. The NVAL LED indicates pressure will be available to the gauge.

13 Open the bleed valve using the 0.050” Allen wrench one full turn and wait until fluid drips from the bleed tube (about 2 to 3 minutes).

14 Adjust the bleed valve for a fluid flow rate of about 2 drips per second.
When the message “AUTO PRIME COMPLETE” appears on the display screen, the priming procedure is complete.

**Note:** If the fluid drip rate is not set correctly, the printer may display an ALERT and priming will stop. If this occurs, reset the alert and restart the AUTO PRIME procedure. A “FILL TIME TOO LONG” alert indicates a too fast drip rate. An “EMPTY TIME TOO LONG” alert indicates a too slow drip rate.

Close the bleed valve and remove the allen wrench from the set screw.

Press the Exit key three times to return to the initial Service mode screen.

The Auto Prime procedure is complete.
Drain Fluid From Printer (AUTO DRAIN)

Complete these steps to drain fluids from the printer that has been previously loaded (primed).

1. Ground the Service tray to the printer. Refer to “Ground the Service Tray” on page 7-21.

2. Attach the bleed tube to the ink valve bleed port on the printhead. Refer to “Installing a Bleed Tube” on page 7-22.

3. Ensure that the AC power switch is in ON (I) position.

4. Press the Service key to enter the Service mode.

5. Press the F2 key to select <INK SYSTEM>.

6. Press the F2 key to select <INK UPKEEP>.

7. Press the Down Arrow key three times to move the cursor to the <YES/NO> field next to <MORE OPTIONS>.
8  Press the Yes/No key to select <MORE OPTIONS>.

9  Press the Yes/No key to select <YES>. The message “FOR DRAINING FLUIDS FROM THE SYSTEM” appears on the display screen.

10 With the cursor in the <YES/NO> field next to <START DRAINING>, press the Yes/No key to begin draining the printer. The message “AUTO DRAIN RUNNING” appears on the display screen.

11 View the ink pressure gauge (see Figure 7-10 on page 7-27) to ensure the ink pressure is set to 5 psi (.34 bar). If it is not, adjust the ink pressure regulator to 5 psi (.34 bar).

12 Open the bleed valve using the 0.050” Allen wrench one full turn and wait until fluid drips from the bleed tube.

13 When the “AUTO DRAIN COMPLETE” message appears on the display screen, the fluid draining procedure is complete.

14 Close the bleed valve and remove the allen wrench from the set screw.

15 Press the Exit key three times to return to the initial Service mode screen.

The Auto Drain procedure is complete.
Prime Printer with Ink (AUTO PRIME)

Complete the following steps to (load) an empty (drained) ink system with ink.

1. Ground the Service tray to the printer. Refer to “Ground the Service Tray” on page 7-21.

2. Attach the bleed tube to the ink valve bleed port on the printhead. Refer to “Installing a Bleed Tube” on page 7-22.

3. Make sure there is a new bottle of the correct type of ink in the right side of the fluid pan (refer to Figure 7-11). Confirm ink is within the marked expiration date. (The bottle filter is marked with an ink bottle label for reference).

4. Ensure that the AC power switch is in ON (I) position.

*Figure 7-11. Installing the Ink Bottle*
5 Press the Service key to enter the Service mode.

6 Press the F2 key to select <INK SYSTEM>.

7 Press the F2 key to select <INK UPKEEP>.

8 Press the Down Arrow key twice to move the cursor to the <YES/NO> field next to <AUTO PRIME>.

9 Press the Yes/No key to select <YES>. The message “FOR PRIMING SYSTEM WITH NEW FLUIDS.” appears on the display screen.

10 With the cursor in the <YES/NO> field next to <START PRIMING>, press the Yes/No key to begin priming the printer. The message “AUTO PRIME RUNNING” appears on the display screen.
Note: It will take two or three minutes before the printer sends pressure to the ink pressure gauge once AUTO PRIME is started. The NVAL LED indicates pressure will be available to the gauge.

11 View the ink pressure gauge to confirm that the ink pressure is set to 5 psi (.34 bar) (refer to Figure 7-10 on page 7-27). If it is not, adjust the ink pressure regulator to 5 psi (.34 bar).

12 Open the bleed valve using the 0.050” Allen wrench one full turn. Wait until fluid drips from the bleed tube (about 2 to 3 minutes). Adjust the bleed valve for a fluid flow rate of about 2 drips per second.

Note: If the fluid drip rate is not set correctly, the printer may display an ALERT and priming will stop. If this occurs, reset the alert and restart the AUTO PRIME procedure. A “FILL TIME TOO LONG” alert indicates a too fast drip rate. An “EMPTY TIME TOO LONG” alert indicates a too slow drip rate.

13 When the message “AUTO PRIME COMPLETE” appears on the display screen, the priming procedure is complete.

14 Close the bleed valve, and remove the allen wrench from the set screw.

15 Press the Exit key three times to return to the initial Service mode screen.

The Prime the Printer with Ink procedure is complete.
Refresh Ink System (AUTO REFRESH)

The Auto Refresh procedure removes all of the ink currently in the ink system, and replaces it with fresh ink from the ink bottle.

The Auto Refresh procedure takes approximately 15 minutes once it has been started. Complete these steps to refresh the ink system.

1 Ground the Service tray to the printer. Refer to “Ground the Service Tray” on page 7-21.

2 Remove the printhead from the printhead holder but make sure the grounding clip stays attached to the printhead.

3 Turn the vertical adjustment screw counterclockwise to raise the ink stream over the ink return block (refer to Figure 7-12).

4 Ensure a known good bottle of ink is in the printer. If the condition of the ink in the fresh ink bottle is unknown or the bottle is less than half full, install a new bottle of ink.

5 Ensure that the AC power switch is in ON (I) position.
6 Press the Service key to enter the Service mode.

7 Press the F2 key to select <INK SYSTEM>.

8 Press the F2 key to select <INK UPKEEP>.

9 Press the Up Arrow key once to move the cursor to the <YES/NO> field next to <AUTO REFRESH>.

10 Press the Yes/No key to select <YES>. The message “FOR REPLACING FLUID INSIDE THE MODULE” appears on the screen.

11 When the <YES> key is pressed in step 11, ink will spray from the printhead. Ensure the printhead is aimed into the service tray.

12 With the cursor in the <YES/NO> field next to <START REFRESH>, press the Yes/No key to begin the Refresh procedure. The message
“AUTO REFRESH RUNNING REFER TO MANUAL” appears on the display screen.

13 The ink refresh procedure requires an ink pressure of greater than 30 psi (2.07 bar). Check the ink pressure regulator to ensure that it is set to at least 30 psi (2.07 bar). If the ink pressure is set below 30 psi (2.07 bar), ink may not spray from nozzle.

Note: Typical operating pressure is approximately 40 psi (2.76 bar).

14 Ensure the ink is spraying over the ink return block. If not, adjust the ink stream vertical adjustment screw counterclockwise until the ink stream completely clears the ink return block. The ink must spray into the service tray for the entire refresh cycle.

Note: Ink flow will stop about four minutes prior to the end of the ink refresh cycle.

15 The printer will now begin to remove the ink currently in the ink system, and replace it with fresh ink from the ink bottle. When “AUTO REFRESH COMPLETE” appears in the display, the Auto Refresh procedure is complete.

16 Turn the vertical adjustment screw clockwise to lower the ink stream back so that the fluids stream enters the ink return block.

Note: A printer calibration and ink stream alignment procedure may be necessary after completion of the ink refresh procedure.

17 Press the Exit key three times to return to the initial Service mode screen.

The Auto-Refresh Procedure is complete.
Ink Conversion

The ink conversion procedure is used to change to a different ink within the same ink family (ketone, water, poly, etc.).

The ink conversion procedure uses a combination of the Auto Drain and Auto Prime procedures to remove all of the ink from the system, and then clean it out with make-up fluid. It then reloads the system with fresh ink.

Note: When flushing the system in preparation for a different ink type, flush the system with the make-up that had been in use, followed with flushing with the make-up to be used with the new ink that will be loaded into the printer after flushing.

Procedure

Complete these steps/procedures to convert to a new ink:

1. Prepare to service the printer. See “Ink System Service Preparation” on page 7-21.

2. Complete the Auto Drain procedure to remove all of the ink currently in the ink system. See “Drain Fluid From Printer (AUTO DRAIN)” on page 7-29.

3. Pull the cap from the bottle of ink in the printer, and slide the filter tube assembly out of the bottle.

Caution

Use only a make-up fluid which is compatible with the type of ink used in the printer. Using a make-up fluid which is not compatible with the ink can cause damage to the printer.

4. Use an absorbent towel and make-up fluid to clean all the ink from the cap and filter tube assembly.

5. Insert the filter tube assembly into a new bottle of make-up fluid, push on the cap, and place the bottle into the fluid pan. There should now be two bottles of make-up fluid in the printer.

6. Complete the Auto Prime procedure to load make-up fluid into the ink system. See “Prime Printer with Ink (AUTO PRIME)” on page 7-31.

7. Complete Auto Refresh procedure with Make-up ink. See “Refresh Ink System (AUTO REFRESH)” on page 7-34. While the Auto Refresh procedure is running, spray make-up ink into the ink catcher for five seconds; wait three minutes and repeat.
8 Repeat the AUTO REFRESH procedure until the Make-up fluid comes out clear.

9 Remove and replace both bottles of make-up in the printer with bottles of the new type of make-up fluid. Complete another AUTO REFRESH procedure.

10 Complete the Auto Drain procedure to remove all of the make-up fluid from the ink system. See “Drain Fluid From Printer (AUTO DRAIN)” on page 7-29.

11 Pull the cap from the bottle of make-up fluid on the right side of the fluid pan, and remove the filter tube assembly from the bottle.

12 Replace the ink and bottle filters.

13 Insert the new filter tube assembly into a new bottle of the new type of fresh ink, push on the cap, and place the bottle into the fluid pan. There should now be one bottle of the correct type of ink on the right, and one bottle of the corresponding make-up fluid on the left side of the fluid pan.

14 Complete the Auto Prime procedure to load fresh ink into the ink system. See “Prime Printer with Ink (AUTO PRIME)” on page 7-31.

15 Complete the Auto Refresh procedure to ensure the ink module has been loaded with ink properly. See “Refresh Ink System (AUTO REFRESH)” on page 7-34.

16 Complete the Ink Stream Calibration procedure. See “Ink Stream Calibration” on page 7-39 in this chapter for instructions.

The Ink Conversion procedure is complete.
**Ink Stream Calibration**

The ink stream calibration procedure ensures that the ink is aligned into the ink return block properly, the ink drop break-off (nozzle drive) is set correctly, the ink pressure is adjusted to the correct setting, the set point time to maintain the correct ink viscosity is established, and the optimal nozzle drive setting is established.

If any of these adjustments are not set properly, the printer may provide poor print quality or experience printer faults.

The ink stream calibration procedure is completed only when the ink in the printer is assumed to be in good condition. To ensure the ink is in good condition, make sure this procedure always follows the Auto Refresh procedure using a new bottle of ink.

The ink stream calibration procedure is also used as a troubleshooting tool to correct poor print quality or to eliminate certain printer faults.

To calibrate the ink stream, complete the following sections in the order shown:

- Align the Ink Stream
- Set the Final Vacuum Adjustment
- Center the Ink Drop Break-off
- Set the Ink Pressure
- Re-Center the Ink Drop Break-Off - If break-off has shifted significantly from the center of the charge tunnel, re-set the ink pressure.
- Complete the Nozzle Drive Setting
Align the Ink Stream

Complete the following steps to align the ink stream into the ink return block:

1. Ground the Service tray to the printer. Refer to “Ground the Service Tray” on page 7-21.

2. Aim the printhead into the service tray. If the printhead is loaded in the printhead holder, remove it from the printhead holder so that you can view the ink stream. (Make sure the grounding clip stays attached to the printhead).

3. Ensure that the AC power switch is in ON (I) position.

4. Press the Service key to enter the Service mode.

   If the printer is in the print mode, a warning screen will appear <WARNING PRINTING WILL STOP>; press F1 to continue.

5. Press the F1 key to select <PRINT HEAD>.

   Warning

   Ink may spray out of the printhead when completing the next step - turning the Ink On.

6. With the cursor in the <YES/NO> field next to <INK ON>, press the Yes/No key to select <YES> to turn the ink ON.

   Note: No Signal and/or Phasing faults may occur during the ink stream calibration causing the ALERT light to flash. This is normal; ignore these alerts and continue with calibration.
7. View the ink pressure gauge. If it does not show a pressure setting of 39 to 42 psi (2.69 to 2.90 bar), adjust the ink pressure regulator to 39 to 42 psi (2.69 to 2.90 bar).

8. Make sure the ink stream is aligned correctly in the ink return block. If it is not, use the ink stream adjustment screws to align the ink stream in the ink return block (refer to Figure 7-16).

- Turn the horizontal locking screw ½ turn to loosen the adjustment screws to adjust the nozzle. Once adjustments are made, tighten the horizontal locking screw to prevent the nozzle from moving.
- Turn the horizontal adjustment screw to move the ink stream horizontally (side to side).
- Turn the vertical adjustment screw to move the ink stream vertically (up and down).

---

**Figure 7-14. Adjustment Screws on Bottom of Printhead**

**Figure 7-15. Adjustment Screws on Bottom of Adjustable Printhead**
9  Align the ink stream so that it enters the ink return block slightly above the center, as shown in Figure 7-16.

![Figure 7-16. Aligning the Ink Stream into Ink Return Block](image)

10  If the ink stream was not properly aligned in the ink return block, there will be ink spray on the printhead components. Check to see if the printhead has ink on the components. If there is, turn the ink Off (change the <INK ON> field to <NO>). Clean the printhead components with cleaning solution, dry with compressed air, and then turn the Ink back On.

11  Continue to Check and Adjust Vacuum.
Check and Adjust Vacuum

The calibration procedure may not work properly if the vacuum is set incorrectly. Complete this procedure to correctly adjust the amount of vacuum in the system.

1. With the Ink On continuously for a minimum of two minutes (<INK ON> field set to <YES>), set the system vacuum adjustment to between 12 and 13 inches of vacuum.

2. Use the vacuum adjusting needle valve located on the left side of the air manifold (refer to Figure 7-17) to adjust the vacuum. To adjust the vacuum, unlock the collar and turn the small knob. Turn the needle valve counterclockwise to increase vacuum and clockwise to decrease vacuum.

3. View the vacuum setting at the vacuum gauge located next to the ink module (refer to Figure 7-18 on next page).

4. After the vacuum is set, lock the collar. Recheck the vacuum reading after the collar has been locked.

Figure 7-17. Adjusting the Vacuum
5 Continue to Center the Ink Drop Break-Off.
Center the Ink Drop Break-Off

Complete these steps to center the ink drop break-off in the charge tunnel:

1. With the ink stream On (ink stream spraying from the nozzle into the catcher), press the Down Arrow key three times to move the cursor to the <YES/NO> field next to <CHANGE SETTINGS>.

<table>
<thead>
<tr>
<th>INK ON</th>
<th>YES</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIGH VOLTAGE ON</td>
<td>NO</td>
</tr>
<tr>
<td>TEST PRINT ON</td>
<td>NO</td>
</tr>
<tr>
<td>CHANGE SETTINGS</td>
<td>NO</td>
</tr>
</tbody>
</table>

2. Press the Yes/No key to select <YES>.

<table>
<thead>
<tr>
<th>TEST PRINT ON</th>
<th>NO</th>
</tr>
</thead>
</table>

| NOZZLE DRIVE | 100 |

3. Press the F1 key to select <NOZZLE DRIVE> to make the nozzle drive setting.

4. Hold the magnifier over the charge tunnel on the printhead (as shown in Figure 7-19) to view the ink stream.

**Note:** A magnifier holder used to hold the magnifier lens to the printhead is available. Refer to the Accessories and Spare Parts chapter (Chapter 3) of the Illustrated Parts Breakdown manual for further information.
Figure 7-19. Positioning Magnifier over the Charge Tunnel

Figure 7-20. Magnifier over the Charge Tunnel - Adjustable Printhead
5 Use the Arrow keys to adjust the nozzle drive setting until the ink drop break-off is in the center of the charge tunnel as shown in Figure 7-21.

Pressing the Arrow keys will increase or decrease the current nozzle drive setting by the following increments:

- Press the Up Arrow key to increase the value by 1.
- Press the Down Arrow key to decrease the value by 1.
- Press the Right Arrow key to increase the value by 25.
- Press the Left Arrow key to decrease the value by 25.

![Figure 7-21. Centering Ink Drop Break-off in Charge tunnel](image)

6 Press the Save key to establish the new nozzle drive setting.

7 Continue to Set the Ink Pressure.
Set the Ink Pressure

Complete the following steps to set the ink pressure in the system:

Note: Make certain the printhead is clean and dry before performing this procedure. If it is not, the printer will not allow you to set the ink pressure.

1. Slide the cover onto the printhead once more (refer to Figure 7-22). If this is not done, the printer may make an incorrect setting due to outside (electrical) noise. You do not need to tighten the printhead screw to secure the cover at this point.

2. Make sure the printhead is positioned at approximately the same elevation as it is positioned during printing. This is important because printhead elevation will affect pressure and may cause an incorrect reading.

Figure 7-22. Sliding the cover onto the printhead

3. Press the Exit key to access the initial Service Mode screen.

<table>
<thead>
<tr>
<th>37 PC/UI</th>
<th>ID#</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRINT</td>
<td>INK</td>
</tr>
<tr>
<td>HEAD</td>
<td>SYSTEM</td>
</tr>
</tbody>
</table>
4 Press the F2 key to select <INK SYSTEM>.

5 Press the F2 key to select <INK UPKEEP>.

6 With the cursor in the <SET PRESSURE> field, press the Yes/No key to select <YES>. (After a 10 second delay), the Set Pressure Bars will appear.

Note: If the Save key is not pressed after it has been changed, the printer will not establish a new set point.

7 Adjust the ink pressure regulator until the right side of the bar lines up directly below the arrow as shown below.

8 Check to confirm the point of break-off is still centered inside the charge tunnel. If the ink pressure is changed more than about 2 psi (.14 bar), you may need to re-center the ink drop break-off in the
charge tunnel using the Arrow keys on the keyboard (refer to Figure 7-21). The ink pressure display must show SET and the point of break-off must be centered inside the charge tunnel simultaneously before pressing the Save key.

9  Press the Save key to set the ink pressure. The following screen will appear.

**WAIT FOR THE SET POINT TO BE ESTABLISHED**

(APPROX 5 MINUTES)

*Note: If the Save key is not pressed after the SET was achieved, the printer will not establish a new set point.*

10 Leave the ink On (allow the printer to run) for at least 5 minutes so that the printer can establish the correct set point. When the printer has completed the process, the following screen will appear.

**PRESSURE SET DONE**

-----------------------------------

**SET POINT ESTABLISHED**

11 Press the Exit key.

12 Press the Standby key; the ink will turn OFF.

*Note: If you turn the ink Off before allowing it to run for approximately 5 minutes, you must repeat the procedure to set the ink pressure.*

13 Remove the printhead from the printhead cover.

14 Continue to Setting the Nozzle Drive.
Setting the Nozzle Drive

In this procedure, you will set the nozzle drive to obtain the correct drop break-off pattern. This adjustment will provide good print quality in typical environments under most circumstances.

If a more precise setting is required, the nozzle drive setting may be further optimized by following the procedure “Find the Optimal Nozzle Drive Setting” on page 7-56.

Complete the following steps to set the nozzle drive:

1. Press the Service key to enter the Service mode.

2. Press the F1 key to select <PRINT HEAD>.

3. With the cursor in the <YES/NO> field next to <INK ON>, press the Yes/No key to turn the ink On.

4. Press the Down Arrow key three times to move the cursor to the <YES/NO> field next to <CHANGE SETTINGS>.

5. Press the Yes/No key to select <YES>.

6. Press the F1 key to select <NOZZLE DRIVE>.

7. Use the Left Arrow key and the Down Arrow key to decrease the nozzle drive value to 10.
8 Hold the magnifier over the charge tunnel or install the magnifier lens holder on the printhead to view the ink stream (refer to Figure 7-23 and Figure 7-24 on page 7-53).

Figure 7-23. Positioning Magnifier over the Charge Tunnel
Use the Arrow keys to adjust the nozzle drive setting until the ink drop break-off pattern looks similar to the one shown in Figure 7-25. Pressing the Arrow keys will increase or decrease the current nozzle drive setting by the following increments.

- Press the Up Arrow key to increase the value by 1.
- Press the Down Arrow key to decrease the value by 1.
- Press the Right Arrow key to increase the value by 25.
- Press the Left Arrow key to decrease the value by 25.

**Note:** To achieve good print quality, the ink drop break-off does not need to be in the middle of the charge tunnel when the break-off pattern is adjusted. The important requirements are that the break-off be inside the charge tunnel, and that the satellites have merged with the main drop before leaving the charge tunnel.
10 Press the Save key to establish the new nozzle drive setting.
11 Press the Standby key exit the Service mode.
12 Continue to Conduct a Test Print.

Note: For proper break-off pattern, refer to the specifications sheet supplied with your Videojet ink.

Figure 7-25. Correct Ink Drop Break-off Pattern
Conduct a Test Print

The test print feature is used to confirm good print quality and to ensure correct ink stream alignment into the ink return block.

Test Print Guidelines

These guidelines apply to the test print procedure:

- A test print can only be generated when both the ink and high voltage are On.
- The test print cycle lasts for 60 seconds, at which case a print sample can be generated until the time (60 seconds) has expired. At the end of 60 seconds, the printer will automatically turn both the test print and the high voltage Off.
- You can select and adjust the nozzle drive while test print is active.
- You can stop the test print cycle at anytime while it is active by pressing the Yes/No key to change <YES> to <NO>. Keep in mind that this will automatically turn the high voltage Off.

Test Print Message

During test print, a standard barcode is printed.

Tools/Supplies Required

You will need paper (or other substrate) to print on for this procedure.

Procedure

Complete the following steps to check the current print quality:

1. Press the Service key to enter the Service mode.

If the printer is in the print mode, a warning screen will appear <WARNING PRINTING WILL STOP>; press F1 to continue.
2 Press the F1 key to select <PRINT HEAD>.

<table>
<thead>
<tr>
<th>Field</th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>INK ON</td>
<td>NO</td>
</tr>
<tr>
<td>HIGH VOLTAGE ON</td>
<td>NO</td>
</tr>
<tr>
<td>TEST PRINT ON</td>
<td>NO</td>
</tr>
<tr>
<td>CHANGE SETTINGS</td>
<td>NO</td>
</tr>
</tbody>
</table>

3 Ensure that the <INK ON> field is set to <YES>. If it is not set to <YES>, press the Yes/No key to set this field to <YES>.

4 Press the Down Arrow key twice to move the cursor to the <YES/NO> field next to <TEST PRINT>.

5 Press the Yes/No key to initiate the Test Print mode.

6 Slide a test sample past the printhead orifice to receive a sample of the current print quality. The sample paper should be moved across the front of the printhead at the correct distance of about ¼ inch.

7 Check the print quality. Also check for ink buildup on the printhead components. If no ink buildup is seen and the print quality is ok, continue with the next step. If ink is building up on the internal printhead components or if the print quality is poor, recheck the nozzle and ink stream alignment procedures.

8 If print quality was less than optimal, you will need to complete the next section “Find the Optimal Nozzle Drive Setting” on page 7-56. If print quality is adequate, then the entire Ink Stream Calibration procedure is complete.

Find the Optimal Nozzle Drive Setting

In this procedure, you will find the upper and lower nozzle drive limits so you can set the nozzle drive at the midpoint of the two values. This is done to maintain print quality in case changes in ambient temperature or ink composition occur.

To do this procedure requires taking a test print. Read the introduction and guidelines for taking a test print in the “Conduct a Test Print” on page 7-55 for more information on conducting a test print.

Complete the following steps to determine the optimal nozzle drive setting:
1. Press the Service key to enter the Service mode.

2. Press the F1 key to select <PRINT HEAD>.

3. Ensure that the <INK ON> field is set to <YES>. If it is not set to <YES>, press the Yes/No key to set this field to <YES>.

4. Ensure that the <HIGH VOLTAGE ON> field is set to <NO>. If it is not set to <NO>, press the Yes/No key to set this field to <NO>.

5. Press the Down Arrow key three times to move the cursor to the <YES/NO> field next to <CHANGE SETTINGS>.

6. Press the Yes/No key to select <YES>.

7. Press the F1 key to select <NOZZLE DRIVE>.

8. Use the Left Arrow key and the Down Arrow key to decrease the nozzle drive value to 10.
9 Hold the magnifier over the charge tunnel or install the magnifier lens holder on the printhead to view the ink stream (refer to Figure 7-23 on page 7-52 and Figure 7-24 on page 7-53).

10 Use the Arrow keys to adjust the nozzle drive setting until the ink drop break-off pattern looks similar to the one shown in Figure 7-26.

Pressing the Arrow keys will increase or decrease the current nozzle drive setting by the following increments:

- Press the Up Arrow key to increase the value by 1.
- Press the Down Arrow key to decrease the value by 1.
- Press the Right Arrow key to increase the value by 25.
- Press the Left Arrow key to decrease the value by 25.

**Note:** To achieve good print quality, the ink drop break-off does not need to be in the middle of the charge tunnel when the break-off pattern is adjusted. The important requirements are that the break-off be inside the charge tunnel, and that the satellites have merged with the main drop before leaving the charge tunnel.

![Figure 7-26. Correct Ink Drop Break-off Pattern](image)

**Note:** For proper break-off pattern, refer to the specifications sheet supplied with your Videojet ink.

<table>
<thead>
<tr>
<th>TEST PRINT ON</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOZZLE DRIVE</td>
<td>100</td>
</tr>
</tbody>
</table>

**Note:** Have a substrate ready to print on before you start a test print.
11 With the cursor in the <YES/NO> field next to <TEST PRINT ON>, press the Yes/No key to initiate a test print.

12 Slide a substrate past the printhead orifice to receive a sample of the current print quality. Make sure the Printhead to Product Distance is set correctly.

13 Press the Down Arrow key once to move the cursor to the <YES/NO> field next to <CHANGE SETTINGS >.

14 Press the Yes/No key to select <YES>.

15 Did the print sample have good print quality?
   • If YES, record the current nozzle drive setting displayed on the screen, then go to step #18. (The value recorded is referred to as the “original” nozzle drive setting.)
   • If NO, continue to the next step.

16 Use the arrow keys to increase or decrease the nozzle drive setting by an increment of 5 (or by whatever increment you feel is necessary), and slide another substrate past the printhead to check the current print quality.
   • Press the Up Arrow key to increase the value by 1.
   • Press the Down Arrow key to decrease the value by 1.
   • Press the Left Arrow key to decrease the value by 25.
   • Press the Right Arrow key to increase the value by 25.

17 Was the print quality of the sample good?
   • If YES, record the current nozzle drive setting, then continue to the next step. (This value is referred to as the “original” nozzle drive setting.)
• If NO, repeat step #16. Then, perform another test print. Do this until the print quality is good, then continue to the next step. (This value is referred to as the “original” nozzle drive setting.)

18 Decrease the nozzle drive setting by an increment of 5 (or by whatever increment you feel is necessary), and slide another substrate past the printhead to check the current print quality.

19 Was the print quality of the sample poor?

• If YES, record the current nozzle drive setting, use the arrow keys to return the nozzle drive setting back to the original value, then continue to the next step. (The value recorded is referred to as the “lower” nozzle drive setting.)

• If NO, repeat step #18.

20 Increase the nozzle drive setting by an increment of 1 (or by whatever increment you feel is necessary), and slide another substrate past the printhead to check the current print quality.

21 Was the print quality of the sample poor?

• If YES, record the current nozzle drive setting, then continue to the next step. (This value is referred to as the “upper” nozzle drive setting.)

• If NO, repeat step #20.

22 Add the lower setting to the upper setting, and divide the total by 2. This will provide you with the midpoint (the optimal nozzle drive setting).

For example:

a. 165 (upper setting) + 95 (lower setting) = 260 (total)

b. 260 (total) / 2 = 130 (midpoint)

23 Set the nozzle drive value to the midpoint (optimal nozzle drive setting).

24 Press the Save key to set the new nozzle drive value.

25 Reinstall the printhead into the printhead cover. Tighten the printhead screw to secure the cover.

The entire ink stream calibration procedure is now completed.
Changing the Bar Code Type for Parallel Mode

The bar code type for parallel mode is normally selected during initial power up. The selection of POSTNET/IMB or ID-TAG/IMB is then retained in memory for the life of the printer. In the event that the bar code type must be changed, the control board will need to be re-initialized. Before re-initializing the board, the following should be considered.

- the ink type must be changed to complement the printer type.
- all printer settings will be lost and replaced with default settings.
- the printer’s real time clock will be reset.
- ink on time will be reset to zero.

Re-initializing the control board must be followed by an ink refresh and printer calibration procedure.

Procedure

1. If the ink is on, press the Start/Stop key to turn off the printhead.
2. Wait until the printer completes the printhead shut-down procedure and the vacuum gauge reads 0 (about 2 minutes).
3. Turn off the main AC power switch.
4. Use a jumper cable to connect TP7 on the main circuit board to one of the ground test points (such as TP51, TP52, TP53 or TP54). See Figure 7-27 for test point locations.
5. Turn on the main AC power switch.
6. Wait until the printer’s display reads:

   SELECT BAR CODE TYPE FOR PARALLEL MODE
   POSTNET/IMB   NO
   ID-TAG/IMB    YES

7. Press the Yes/No key to select <YES> for one of the two barcode options (<POSTNET/IMB> or <ID-TAG/IMB>).
8. Press the Save key to save the option selected.
9 Wait until the display reads:

**INITIALIZATION COMPLETE**

**POWER DOWN**

**REMOVE TP7 JUMPER**

10 Turn off the main AC power switch.

11 Remove the jumper cable.

12 Turn on the main AC power switch. The printer will now be configured to print the selected barcode.

The procedure to change the bar code type is complete.
Adjusting the High Voltage Plate Gap

The physical distance between the high voltage deflection plate and the opposing ground plate must be correct. This procedure confirms that the correct gap exists.

**Warning**

Ink and High Voltage must be Off during this procedure.

1. Make sure the ink and high voltage are Off. Either press the Start/Stop key when in the Print or Standby modes to shut down the printhead. Or, change the <INK ON> and <HIGH VOLTAGE ON> fields to <NO> when in the Service mode.

2. Press the Standby key to place the printer into the Standby mode when the ink has been Off for at least two minutes.

3. Turn the main A.C. power switch to the OFF position.

4. Slide the high voltage gap tool between the high voltage plate and the ground plate. The gap tool should slide smoothly (no drag) between the components.

*Figure 7-28. Gap Gauge held to the Printhead*
Adjust the High Voltage Gap

The physical distance between the high voltage deflection plate and opposing ground plate must be correct. This procedure confirms the correct gap exists.

1. Loosen the four screws holding the high voltage arm.
2. Place the high voltage gap tool into position.
3. Lightly press on the high voltage plate and tighten the screws.
4. Recheck the gap after tightening the screws.

The procedure to Adjust the High Voltage Gap is complete.
Adjusting the Bar Height

The physical height of the bar code can be adjusted. Print height is measured in percent; the default is 50%. The print height can be set between 1 and 100%.

Procedure

Complete these steps to adjust the bar code height:

1. Ensure the printer is operational and has been interfaced to a mail sorting system, and calibrated correctly.

2. Confirm the printhead is mounted at the correct distance from the printing surface. The printing surface to printhead gap must be ¼” (6 mm).

3. Take print samples. If the bars are too short, the high voltage setting must be increased; and conversely if the bars are too tall, the setting must be reduced. *If the bars are the correct height, this procedure is finished.

4. To change the print height setting, enter the Service mode by pressing the Service key.

5. Press the F1 key to select <PRINTHEAD>.

6. Press the Down Arrow key three times to move the cursor to the <YES/NO> field next to <CHANGE SETTINGS>.

7. Press the Yes/No key to select <YES>.

8. Press the F2 key to select <PRINT HEIGHT>. The current print height value is shown in the lower right corner of the display.

9. Adjust the print height setting using the Arrow keys.

   Pressing the Arrow keys will increase or decrease the current print height setting by the following increments:

   - Press the Up Arrow key to increase the value by 1.
   - Press the Down Arrow key to decrease the value by 1.
   - Press the Right Arrow key to increase the value by 10.
   - Press the Left Arrow key to decrease the value by 10.

10. Go back to step 3 to recheck the print height.

The procedure to adjust the bar height is complete.
Troubleshooting

In this chapter you will find:

• How to recognize printer faults and warnings
• A description of the printer faults and warnings, what they mean, and how to correct the condition
• How to clear printer faults after attempting to correct the condition
• What the LEDs on the main PCB indicate when lit
• A description of the electronic test points on the main PCB for troubleshooting printer problems

Introduction

Chapter Overview

This chapter is dedicated to identifying, analyzing, diagnosing, and correcting printer problems.

Each printer fault and warning is addressed individually in this chapter. For each fault and warning, the following information is provided:

• the time the fault or warning is enabled
• the condition (what has occurred)
• the possible causes, and the corresponding solutions

Also included in this chapter is information on using the LEDs and the electronic test points on the main PCB to help diagnose the problem, and a wiring diagram showing the pin-to-pin wiring connections.
Fault Diagnosis

Recognizing Faults and Warnings

The printer continually monitors the ink composition and all internal systems for potential problems. If a problem is found or a condition is present which may lead to a problem, the printer will activate the light on the Alert key (refer to Figure 8-1).

Figure 8-1. Alert Key

Alert Key Flashs

If the light on the Alert key begins to flash, this indicates that a fault has occurred. A fault is a problem which is presently found in the printer. There are two types of faults: normal faults and panic faults. The majority of printer faults are normal faults, and are the less serious of the two types.

Normal Faults

Once a normal fault occurs, the printer will begin the two-minute printhead shutdown sequence (if the printhead was active). All normal faults are resettable (refer to “Clearing Faults and Returning Printer to Service” on page 8-28 for further information).

Panic Faults

Once a panic fault occurs, the main air valve is turned off immediately. In other words, the printer shuts down everything right away. Panic faults are not resettable. Therefore, to clear a panic fault, you must first perform
the action necessary to solve the condition, then you must turn the AC power off and then back on to clear the fault.

**Alert Key Lights**

If the light on the Alert key is lit (not flashes), this indicates that a warning has occurred. A warning is a condition which is presently found in the printer that may lead to a problem (a fault) if it is not corrected. The printer will continue to operate for a limited amount of time once a warning is detected. If the warning is not corrected within the specified time, the corresponding fault will occur.

If the Alert Light option is installed onto the printer, the light will flash whenever a fault or warning has occurred (refer to “Fluids Low Warning” on page 8-7 for the exception).

**What to do when the Alert Key Lights or Flashes**

Whenever the light on the Alert key is lit or flashing, press the Alert key. Once this is done, the description of the fault or warning will appear in the display.

Refer to the next section (“Correcting a Fault” on page 8-6) for a description of the fault, and a list of the possible causes and solutions. For example, you would refer to page 8-21 for further information on the Air Pressure Fault.

![Figure 8-2. Identifying the Fault](image-url)
Types of Printer Faults

There are 19 faults and warnings that the printer may experience. These faults and warnings are explained separately in this chapter. Listed under each fault and warning is the time that the fault or warning is enabled, the condition that is present, the possible causes for the condition, and the solutions for correcting the condition. The faults are listed below:

1. Fluids Low Warning (Refer to Page 8-7)
2. Phasing Fault (Refer to Page 8-8)
3. No Signal Fault (Refer to Page 8-9)
4. Flow Time Too Long Fault (Refer to Page 8-10)
5. Flow Time Too Short Fault (Refer to Page 8-11)
6. Fluids Out Fault (Refer to Page 8-12)
7. HV Supply Fault (Refer to Page 8-13)
8. High Voltage Fault (Refer to Page 8-14)
9. +320 Volt Fault (Refer to Page 8-15)
10. Empty Time Too Long Fault (Refer to Page 8-16)
11. Reservoir Low Request Too Long Fault (Refer to Page 8-17)
12. Fill Time Too Long Fault (Refer to Page 8-18)
13. Transfer Request Too Long Fault (Refer to Page 8-20)
14. Air Pressure Fault (Refer to Page 8-21)
15. Ink Cylinder Switch Fault (Refer to Page 8-22)
16. Reservoir Switch Fault (Refer to Page 8-23)
17. Reservoir Overfill Fault (Refer to Page 8-24)
18. System Processor Fault (Refer to Page 8-25)
19. RAM Failure Fault (Refer to Page 8-26)
20. Serial Processor Failure Fault (Refer to Page 8-27)

Note: When in serial communication mode, certain data synchronization faults can occur that may cause the printer to stop printing. These faults are not shown on the printer’s display. See “Communication Faults” on page 9-50 for more information.
When Two Faults Occur at the Same Time

If two or more faults have occurred at the same time, the printer will identify one fault first. This fault is called the predominant fault and is generally the more serious of the two faults. For example, if an Air Pressure Fault and a No Signal Fault occur at the same time, the Air Pressure Fault (the predominant fault) will appear in the display once the Alert key is pressed. After the predominant fault has been corrected, the printer will then display the subsequent fault (if it still exists).

The following is a list of the printer faults by order of predominance (fault #1 being the most predominant fault).

1. Serial Processor Failure Fault (panic fault)
2. RAM Failure Fault (panic fault)
3. System Processor Failure Fault (panic fault)
4. Reservoir Overfill Fault (panic fault)
5. Reservoir Switch Fault (panic fault)
6. Ink Cylinder Switch Fault (panic fault)
7. Air Pressure Fault
8. Transfer Request Too Long Fault
9. Fill Time Too Long Fault
10. Reservoir Low Request Too Long Fault
11. Empty Time Too Long Fault
12. +320 Volt Fault
13. HV Supply Fault
14. Fluids Out Fault
15. Flow Time Too Short Fault
16. Flow Time Too Long Fault
17. High Voltage Fault
18. No Signal Fault
19. Phasing Fault
20. Fluids Low Warning
Correcting a Fault

For each fault covered in the following pages, there is a heading called, “Causes/Solutions”. This section lists the possible causes for the fault or warning, as well as the corresponding solution for correcting that cause. The possible causes are listed in the order most likely to occur, therefore, you should attempt the solutions in the order presented.

The easiest, most likely cause and solution to correct the problem are listed first, followed by the next most likely cause and solution, and so on. The causes/solutions are organized this way to prevent you from trying a more difficult or costly solution before a more simple or less costly one.
Fluids Low Warning

Once a fluids low warning occurs, the light on the Alert key will light (not flash).

Once the Alert key is pressed, the display will read:

![RESET ALERT NO FLUIDS LOW WARNING]

Time Enabled
Warning is enabled 15 seconds after the air valve turns On (the AVAL LED lights).

Condition
The signal from the fluid low switch is off, and has remained off for no more than 30 minutes. (Once the signal has remained off for 30 minutes, a fluids out fault will occur after a 10-second delay.)

Causes/Solutions
1. The fluid level in the ink or make-up bottle may be low. If so, replace the appropriate bottle(s) with a full bottle.
2. The line leading to the filter tube assembly is kinked or has become disconnected from the bottle cap. Check the condition of the line on both filter tube assemblies.
3. The fluids low needle valve may be misadjusted. Readjust.
4. The fluids low switch may be defective. Replace the fluids low switch.
5. The fluids low restrictor may be clogged. Replace. (This restrictor is located on the tubing coming from the needle valve assembly).
6. The filter tube assembly may be leaking. Replace.

If the solution attempted corrected the condition, this screen will disappear after a 10-second delay has elapsed. There is no need to clear the warning and return the printer to service, therefore, the <RESET ALERT> field is inactive.
Phasing Fault

Once a phasing fault occurs, the light on the Alert key will flash, and the Alert Light option will flash (if installed). Once the Alert key is pressed, the display will read:

![PHASING FAULT
RESET ALERT NO]

Time Enabled
Fault is enabled 39 seconds after the Start/Stop key is pressed (to begin printhead start-up).

Condition
The printer has passed the stream (no signal) test, but failed the phasing test.

Causes/Solutions
1. The printhead is dirty or the ink return block and/or sensing wires are wet. Clean the printhead (refer to chapter 6).
2. The ink stream may be improperly aligned in the ink return block, causing build up on the return block. Ensure ink is properly aligned in the ink return block, and/or clean the printhead.
3. Improper break off or satellite formation. View the ink stream for proper break off. If incorrect, adjust the break-off. Check for print quality and then adjust break-off again if necessary.

Note: If step 2 and 3 do not correct the problem, perform a Refresh and an Ink Calibration.
4. Sensing circuit, ink return block, or wires may be defective. Check the sensing circuit for loose connections, check the ink return block for leaks, and check for disconnected wires.
5. The cable carrying the nozzle drive signal may be defective or the connector is loose.
6. The charge amp cable leading to the charge tunnel may be defective or the 10K-ohm resistor inside the shrink tubing may be broken.
7. The main PCB may be defective. Replace the main PCB.
8. The printhead is exposed to too much vibration.
After a solution has been attempted, you must clear the fault and return the printer to service (refer to “Clearing Faults and Returning Printer to Service” on page 8-28).

No Signal Fault

When a no signal fault occurs, the light on the Alert key will flash, and the Alert Light option will flash (if installed). Once the Alert key is pressed, the display will read:

<table>
<thead>
<tr>
<th>NO SIGNAL FAULT</th>
</tr>
</thead>
<tbody>
<tr>
<td>RESET ALERT</td>
</tr>
<tr>
<td>NO</td>
</tr>
</tbody>
</table>

Time Enabled
Fault is enabled 39 seconds after the Start/Stop key is pressed (to begin printhead start-up).

Condition
The printer has not passed the stream (no signal) test.

Causes/Solutions
1  The printhead is dirty or the ink return block and/or sensing wires are wet. Clean the printhead (refer to Chapter 6).

2  The ink stream may be improperly aligned in the ink return block, causing build up on the ink return block. Ensure ink is properly aligned in the ink return block, and then clean the printhead.

3  Improper break off or satellite formation. View the ink stream for proper break off. If incorrect, adjust the break-off. Check for print quality and then adjust break-off again if necessary.

   Note: If step 2 and 3 do not correct the problem, perform a Refresh and an Ink Calibration.

4  Sensing circuit, ink return block, or wires may be defective. Check the sensing circuit for loose connections, check the ink return block for leaks, and check for disconnected wires.

5  Ink is drooling out of the return block. Check the vacuum level, or check for a clogged return line. Also check for loose vacuum fitting causing a vacuum leak.
6 Vacuum setting is too low, or improper return line is used. Adjust vacuum or install the correct return line for the type of printer and configuration.

7 The cable carrying the nozzle drive signal may be defective or the connector is loose.

8 The main PCB may be defective. Replace the main PCB.

After a solution has been attempted, you must clear the fault and return the printer to service (refer to “Clearing Faults and Returning Printer to Service” on page 8-28).

**Flow Time Too Long Fault**

When a flow time too long fault occurs, the light on the Alert key will flash, and the Alert Light option will flash (if installed). Once the Alert key is pressed, the display will read:

FLOW TIME TOO LONG

RESET ALERT   NO

**Time Enabled**

Fault is enabled while the nozzle valve is On (the NVAL LED lights), except when the printer is in Auto Drain, Auto Prime, or Auto Refresh.

**Condition**

The current flow time is equal to 116% or more of the set point time.

**Causes/Solutions**

1 The ink pressure or set point is not within specification. Check the ink pressure gauge to make certain the ink pressure is between 36-44 psi. If not perform an ink stream pressure set and calibration procedure.

2 Make-up fluid is not being added to the system. Check the fluid level in the make-up fluid bottle, and check the fluid line leading from the make-up fluid bottle into the ink module assembly. If the fluid level in the make-up fluid bottle is low, replace it with a full bottle. Check to make certain the fluid line is not kinked, clogged, or disconnected.
3 The make-up add solenoid or the make-up add valve may be defective. Replace the make-up add solenoid or the make-up add valve.

After a solution has been attempted, you must clear the fault and return the printer to service (refer to “Clearing Faults and Returning Printer to Service” on page 8-28).

Flow Time Too Short Fault
When a flow time too short fault occurs, the light on the Alert key will flash, and the Alert Light option will flash (if installed). Once the Alert key is pressed, the display will read:

FLOW TIME TOO SHORT
RESET ALERT NO

Time Enabled
Fault is enabled while the nozzle valve is On (the NVAL LED lights), except when the printer is in Auto Drain, Auto Prime, or Auto Refresh.

Condition
The current flow time is equal to 84% or less of the set point time.

Causes/Solutions
1 The ink pressure or set point is not within specification. Check the ink pressure gauge to make certain the ink pressure is between 36 to 44 psi. If not perform an ink stream pressure set and calibration procedure.
2 The PTLW and PTFL switches in the ink supply cylinder (pressure tank) may be defective. Replace the PTLW and PTFL switches.

After a solution has been attempted, you must clear the fault and return the printer to service (refer to “Clearing Faults and Returning Printer to Service” on page 8-28).
Fluids Out Fault

When a fluids out fault occurs, the light on the Alert key will flash, and the Alert Light option will flash (if installed). Once the Alert key is pressed, the display will read:

```
FLUIDS OUT FAULT
RESET ALERT       NO
```

Time Enabled
Fault is enabled 15 seconds after the air valve turns On (the AVAL LED lights).

Condition
The signal from the fluid low switch is off for more than 30 minutes or an attempt was made to start the printhead with no fluid in the ink or make-up fluid bottle.

Causes/Solutions
1. The fluid level in the ink or make-up bottle may be low or out. If so, replace the appropriate bottle(s) with a full bottle.
2. The line leading to the filter tube assembly is kinked or has become disconnected from the bottle cap. Check the condition of the line on both filter tube assemblies.
3. The fluids low needle valve may be misadjusted. Check the fluids low needle valve and readjust if necessary.
4. The fluids low switch may be defective. Replace the fluids low switch.
5. The fluids low restrictor may be clogged. Replace. (The fluids low restrictor is located on the tubing coming from the needle valve assembly).

After a solution has been attempted, you must clear the fault and return the printer to service (refer to “Clearing Faults and Returning Printer to Service” on page 8-28).
HV Supply Fault

When a HV supply fault occurs, the light on the Alert key will flash, and the Alert Light option will flash (if installed). Once the Alert key is pressed, the display will read:

<table>
<thead>
<tr>
<th>HV SUPPLY FAULT</th>
</tr>
</thead>
<tbody>
<tr>
<td>RESET ALERT</td>
</tr>
<tr>
<td>NO</td>
</tr>
</tbody>
</table>

Time Enabled
Fault is enabled two seconds after the AC power is turned On (the AC power switch is turned On).

Condition
The high voltage power supply (located on the main PCB) detects that the output of the supply is less than 90% of the programmed output setting when On.

Causes/Solutions
1. Reset the fault (refer to Clearing Faults and Returning Printer to Service on page 8-34).
2. The high voltage power supply may be defective. Replace the main PCB.

After a solution has been attempted, you must clear the fault and return the printer to service (refer to “Clearing Faults and Returning Printer to Service” on page 8-28).
High Voltage Fault

When a high voltage fault occurs, the light on the Alert key will flash, and the Alert Light option will flash (if installed). Once the Alert key is pressed, the display will read:

<table>
<thead>
<tr>
<th>HIGH VOLTAGE FAULT</th>
</tr>
</thead>
<tbody>
<tr>
<td>RESET ALERT</td>
</tr>
<tr>
<td>NO</td>
</tr>
</tbody>
</table>

**Time Enabled**
Fault is enabled two seconds after the high voltage is turned On.

**Condition**
A high voltage arc is detected at the printhead.

**Causes/Solutions**

1. Reset the fault (refer to “Clearing Faults and Returning Printer to Service” on page 8-28).

2. Clean the printhead and dry thoroughly (refer to chapter 6).

   *Note: If the printhead becomes dirty quickly, perform an ink refresh and printer calibration procedure.*

3. Disconnect the high voltage cable at the PCB. Did the high voltage fault stop?
   - If NO, the main PCB is defective. Replace the main PCB.
   - If YES, the printhead umbilical is defective. Replace the printhead umbilical.

After a solution has been attempted, you must clear the fault and return the printer to service (refer to “Clearing Faults and Returning Printer to Service” on page 8-28).
**+320 Volt Fault**

When a +320 volt fault occurs, the light on the Alert key will flash, and the Alert Light option will flash (if installed). Once the Alert key is pressed, the display will read:

![320 Volt Fault Diagram]

**Time Enabled**

Fault is enabled 2 seconds after the AC power is turned On (the AC power switch is turned On).

**Condition**

The +320 V power supply (located on the main PCB) detects that the output of the supply is less than 285 volts when On.

**Causes/Solutions**

1. Reset the fault (refer to “Clearing Faults and Returning Printer to Service” on page 8-28).

2. The +320 volt power supply may be defective. Replace the main PCB.

After a solution has been attempted, reset the fault, turn the ink On manually, and wait 5 seconds to refer to if the fault clears. If the fault does not clear, try the next possible solution and repeat this procedure.
Empty Time Too Long Fault

When an empty time too long fault occurs, the light on the Alert key will flash, and the Alert Light option will flash (if installed). Once the Alert key is pressed, the display will read:

```
EMPTY TIME TOO LONG
RESET ALERT           NO
```

Time Enabled

Fault is enabled while the nozzle solenoid valve is On (the NVAL LED lights), except when the printer is in Auto Drain.

Condition

The current flow time has exceeded 125% of the set point time.

Causes/Solutions

1. The system may be out of calibration. Perform the ink refresh procedure followed by an ink stream calibration (refer to chapter 7).
2. The PTLW switch in the pressure tank may be defective. Replace the PTLW switch.
3. The screen in the nozzle or the nozzle orifice may be clogged. Flush the nozzle with cleaning solution. If this doesn't clear the problem, replace the nozzle.

After a solution has been attempted, you must clear the fault and return the printer to service (refer to “Clearing Faults and Returning Printer to Service” on page 8-28).
Reservoir Low Request Too Long Fault

When a reservoir low request too long fault occurs, the light on the Alert key will flash, and the Alert Light option will flash (if installed). Once the Alert key is pressed, the display will read:

<table>
<thead>
<tr>
<th>RES LOW REQ TOO LONG</th>
</tr>
</thead>
<tbody>
<tr>
<td>RESET ALERT</td>
</tr>
<tr>
<td>NO</td>
</tr>
</tbody>
</table>

**Time Enabled**
Fault is enabled while the air valve is On (the AVAL LED lights). The fault occurs 20 seconds after the RLOW LED lights (if requesting ink) or 30 seconds after the RLOW LED lights (if requesting make-up fluid). This fault is not active during Auto Refresh or Auto Drain.

**Condition**
The fluid level in the reservoir is low.

**Causes/Solutions**

1. The ink or make-up bottle is empty. Replace the ink or make-up bottle.

   *Note: The Fluids Low switch is not adequately detecting the level of fluids in the bottle. Check the Fluids Low Switch for proper operation. (Refer to “Fluids Out Fault” on page 8-12).*

2. The vacuum is too low. Verify proper vacuum system operation.

3. The reservoir in the ink module is not getting fluid. Check all lines to make certain they are not kinked, clogged, or disconnected.

4. The fresh ink add or make-up add solenoid may be defective. Replace the fresh ink add or make-up add solenoid.

5. The cap and stem assembly may be defective. Replace the cap and stem assembly.

After a solution has been attempted, you must clear the fault and return the printer to service (refer to “Clearing Faults and Returning Printer to Service” on page 8-28).
Fill Time Too Long Fault

When a fill time too long fault occurs, the light on the Alert key will flash, and the Alert Light option will flash (if installed). Once the Alert key is pressed, the display will read:

```
FILL TIME TOO LONG
RESET ALERT NO
```

Time Enabled
Fault is enabled while the nozzle valve is On (the NVAL LED lights), except when the printer is in Auto Drain, Auto Prime, and Auto Refresh.

Condition
The software was unable to detect proper filling of the pressure tank.

Causes/Solutions
1. The air supply to the printer has fallen below approximately 70 psi (4.83 bar). Increase the input air pressure to a minimum of 72-75 psi (4.97-5.17 bar).
2. The ink may be thick. Perform an ink refresh and calibration.
3. The primary ink filter may be clogged. Replace the primary ink filter (refer to “Replace Primary Ink Filter” on page 6-15).
4. The transfer line (tube leading from the primary ink filter to the ink module) may be clogged. Disconnect the line at both ends, and blow air through the tube to remove anything that may be clogging the line.
5. The transfer solenoid may be defective. Replace the transfer solenoid.
6. The PTFL switch in the pressure tank may be defective. Replace the PTFL switch.
7. The inlet or outlet check valves on the ink module are stuck open. Check the inlet and outlet check valves for foreign particles holding the valve open, or a valve that is not seated properly. The inlet check valve is the most likely cause.
8. The cap and stem assembly is defective. Replace.
9. The ink module may be defective. Replace the ink module.
After a solution has been attempted, you must clear the fault and return the printer to service (refer to “Clearing Faults and Returning Printer to Service” on page 8-28).
Transfer Request Too Long Fault

When a transfer request too long fault occurs, the light on the Alert key will flash, and the Alert Light option will flash (if installed). Once the Alert key is pressed, the display will read:

```
TRANS REQ TOO LONG
RESET ALERT       NO
```

Time Enabled
Fault is enabled three minutes after the nozzle valve is On (the NVAL LED lights), except when the printer is in Auto Drain.

Condition
The pressure tank low switch remains closed (the PTLW LED lights) for more than 15 seconds while the nozzle valve is On (the NVAL LED lights).

Causes/Solutions
1. The air supply to the printer has fallen below approximately 70 psi (4.83 bar). Increase the input air pressure to a minimum of 72-75 psi (4.97-5.17 bar).
2. The primary ink filter may be clogged. Replace the primary ink filter (refer to “Replace Primary Ink Filter” on page 6-15).
3. The transfer line (tube leading from the primary ink filter to the ink module) may be clogged. Disconnect the line at both ends, and blow air through the tube to remove anything that may be clogging the line.
4. The transfer solenoid may be defective. Replace the transfer solenoid.
5. The inlet or outlet check valves on the ink module are stuck open. Check the inlet and outlet check valves for foreign particles holding the valve open, or a valve that is not seated properly. The outlet check valve is the most likely cause.
6. The ink module may be defective. Replace the ink module.

After a solution has been attempted, you must clear the fault and return the printer to service (refer to “Clearing Faults and Returning Printer to Service” on page 8-28).
Air Pressure Fault

When an air pressure fault occurs, the light on the Alert key will flash, and the Alert Light option will flash (if installed). Once the Alert key is pressed, the display will read:

**AIR PRESSURE FAULT**

RESET ALERT    NO

Time Enabled
Fault is enabled when the air valve is turned On (the AVAL LED lights).

Condition
The air pressure switch has remained open for 20 seconds. The air pressure switch opens only when the input air pressure has dropped below 60 psi (4.14 bar).

Causes/Solutions
1. Increase the input air pressure to a minimum of 72-75 psi (4.97-5.17 bar). Input air psi should be 20 psi (1.38 bar) above ink pressure or no less than 70 psi (4.83 bar).
2. The air pressure switch may be defective. Replace the air pressure switch.

After a solution has been attempted, you must clear the fault and return the printer to service (refer to “Clearing Faults and Returning Printer to Service” on page 8-28).
Ink Cylinder Switch Fault

When an ink cylinder switch fault occurs, the light on the Alert key will flash, the air valve will shut off immediately, and the Alert Light option will flash (if installed).

Once the Alert key is pressed, the display will read:

<table>
<thead>
<tr>
<th>INK CYL SWITCH FAULT</th>
</tr>
</thead>
<tbody>
<tr>
<td>RESET ALERT</td>
</tr>
<tr>
<td>NO</td>
</tr>
</tbody>
</table>

Time Enabled
Fault is enabled one second after the system is powered up (the AC switch is turned On).

Condition
The full (pressure tank full) switch and empty (pressure tank low) switch in the ink supply cylinder (pressure tank) are On at the same time.

Causes/Solutions
1. The PTFL switch in the ink supply cylinder (pressure tank) may be defective. Replace the PTFL switch.
2. The PTLW switch in the ink supply cylinder (pressure tank) may be defective. Replace the PTLW switch.

This fault is not resettable. After the problem has been corrected (by performing one of the solutions listed above), turn the AC power off and back on (using the AC power switch). If the problem was corrected, the fault will disappear. If not, try another solution and repeat this procedure.
Reservoir Switch Fault

When a reservoir switch fault occurs, the light on the Alert key will flash, the air valve will shut off immediately, and the Alert Light option will flash (if installed).

Once the Alert key is pressed, the display will read:

<table>
<thead>
<tr>
<th>RES SWITCH FAULT</th>
</tr>
</thead>
<tbody>
<tr>
<td>RESET ALERT</td>
</tr>
<tr>
<td>NO</td>
</tr>
</tbody>
</table>

Time Enabled
Fault is enabled one second after the system is powered up (the AC switch is turned On).

Condition
Two out of three reservoir switches are on at the same time: reservoir low, reservoir full, and reservoir overfill.

Cause/Solution
The cap and stem assembly may be defective. Replace the cap and stem assembly.

This fault is not resettable. After the problem has been corrected (by performing one of the solutions listed above), turn the AC power off and back on (using the AC power switch). If the problem was corrected, the fault will disappear. If not, try another solution and repeat this procedure.
Reservoir Overfill Fault

When a reservoir overfill fault occurs, the light on the Alert key will flash, the air valve will shut off immediately, and the Alert Light option will flash (if installed).

Once the Alert key is pressed, the display will read:

![Reservoir Overfill](image)

**Time Enabled**
Fault is enabled one second after the system is powered up (the AC switch is turned On).

**Condition**
The float on the cap and stem assembly is at the top of its travel causing the reservoir overfill switch to close (and the OFIL LED lights).

**Causes/Solutions**

1. The fresh ink add or make-up add solenoids may be defective. Replace either or both solenoids.
2. The cap and stem assembly may be defective. Replace the cap and stem assembly.
3. The ink or make-up add valves in the ink module may be leaking. Replace or rebuild the ink module assembly.

*Note: Reservoir overfill is not a resettable fault. Some fluid must be removed from the ink reservoir or the fault will reappear immediately on startup. To remove fluid from the ink reservoir, remove the vacuum filter and use a syringe with tubing attached to reach into the reservoir and pull 10cc of fluid into the syringe.*

After the problem has been corrected, turn the AC power off and back on (using the AC power switch). If the problem was corrected, the fault will disappear. If not, try another solution and repeat this procedure.
System Processor Fault

When a system processor fault occurs, the Mode LED on the keypad and the light on the Alert key will flash, the air valve will shut off immediately, and the following screen will appear in the display:

![SYSTEM PROC FAILURE
POWER DOWN](image)

Time Enabled
Fault is enabled one second after the system is powered up (the AC switch is turned On).

Condition
The master watchdog check has failed.

Cause/Solution
1. The master watchdog check has failed. Turn AC power switch Off, and then back On.
2. The (main) printer circuit board (PCB) has failed. Replace the PCB.

This fault is not resettable. After the problem has been corrected (by performing one of the solutions listed above), turn the AC power off and back on (using the AC power switch). If the problem was corrected, the fault will disappear. If not, try another solution and repeat this procedure.
**RAM Failure Fault**

When a RAM failure fault occurs, the light on the Alert key will flash, the air valve will shut off immediately, and the following screen will appear in the display:

![RAM FAILURE POWER DOWN]

**Time Enabled**
Fault is enabled one second after the system is powered up (the AC switch is turned On).

**Condition**
Upon the virgin start-up, the processor could not initialize the RAM.

**Causes/Solutions**
1. Processor did not initialize RAM. Turn AC power switch Off, and then back On.
2. The lithium battery on the main PCB has failed. Replace the battery and then re-calibrate the printer (all configuration data will be lost when replacing the battery).

**Caution**
Replace the lithium battery only with the same type of battery.

3. The RAM on the (main) printer circuit board (PCB) has failed. Replace the main PCB.

This fault is not resettable. After the problem has been corrected (by performing one of the solutions listed above), turn the AC power off and back on (using the AC power switch). If the problem was corrected, the fault will disappear. If not, try another solution and repeat this procedure.
Serial Processor Failure Fault

When a Serial Processor Failure fault occurs, the light on the Alert key will flash and the air valve will shut off immediately. The following screen will be displayed:

<table>
<thead>
<tr>
<th>SERIAL PROC FAILURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>RESET ALERT</td>
</tr>
<tr>
<td>NO</td>
</tr>
</tbody>
</table>

Time Enabled
Fault is enabled a few seconds after the system is powered up (the AC switch is turned on).

Condition
The serial processor does not respond.

Causes/Solutions
The serial processor on the main PCB has failed to respond to commands sent from the message processor. Replace the main PCB.
Clearing Faults and Returning Printer to Service

After you have performed the necessary action(s) to correct a printer fault, the fault must be cleared. The procedure to clear the fault differs depending on whether the fault was a normal or panic fault. Both procedures are included in this section; follow only the procedure for the type of fault which is present.

Most printer faults are normal faults. Only the following are panic faults:

- Serial Processor Failure Fault
- RAM Failure Fault
- System Processor Failure Fault
- Reservoir Overfill Fault
- Reservoir Switch Fault
- Ink Cylinder Switch Fault

Note: Printer warnings are automatically reset by the printer. This occurs approximately 10 seconds after the warning condition is corrected.

Procedure for Normal Faults
To clear a normal fault and return the printer to service, complete the following steps:

1. Complete one of the recommended actions for clearing that fault.
2. Press the Yes/No key to change <RESET ALERT> from <NO> to <YES>.
3. Press the Exit key.
4. Press the Start/Stop key to restart the printhead.

Procedure for Panic Faults
To clear a panic fault and return the printer to service, complete the following steps:

1. Complete one of the recommended actions for clearing that fault.
2. Press the AC power switch to the OFF (O) position to turn the printer Off, and press it again to turn it back On (refer to Figure 8-3).
3. Turning the printer off and then on again will clear the fault message from the screen. If the fault message remains on the screen after the
printer is turned back on, it will be necessary to try additional solution(s) to correct the fault.

Figure 8-3. AC Power Switch Location
LED Printer Status Indicators

A number of light emitting diode (LED) indicators are present on the main printed circuit board (PCB). The main PCB is located inside the electronics section of the printer (see Figure 8-4).

Understanding what happens inside the printer aids in troubleshooting. These LEDs are useful in determining the exact cause of a printer fault. Whenever an LED is lit, it means that particular printer operation or function is active or has occurred (see Table 8-1 on page 8-31 for further information).

This section describes the functional cycle and LED sequence for each of the main printer functions. This information is provided for each of the following:

- Printer Start-up Sequence
- Printer Shutdown Sequence
- Printhead Start-up Sequence
- Printhead Shutdown Sequence
- Ink Transfer Sequence
• Fluid Replenishment Sequence

<table>
<thead>
<tr>
<th>LED</th>
<th>Description</th>
<th>What does it mean when LED is lit?</th>
</tr>
</thead>
<tbody>
<tr>
<td>MUIS</td>
<td>Make-up Inhibit</td>
<td>The ink level in the reservoir is or was full at least once during the eight most recent ink transfer cycles.</td>
</tr>
<tr>
<td></td>
<td>Status</td>
<td></td>
</tr>
<tr>
<td>PTLW</td>
<td>Pressure Tank Low</td>
<td>The ink level in the pressure tank is low and the pressure tank is now beginning to refill.</td>
</tr>
<tr>
<td>PTFL</td>
<td>Pressure Tank Full</td>
<td>The ink level in the pressure tank has reached its full capacity and the pressure tank is now beginning to empty.</td>
</tr>
<tr>
<td>OFIL</td>
<td>Reservoir Overfill</td>
<td>The fluid level in the ink module reservoir has exceeded its capacity. This will result in a printer fault.</td>
</tr>
<tr>
<td>RLOW</td>
<td>Reservoir Low</td>
<td>Ink or make-up fluid is being requested (depending on the present flow time), and the ink or make-up add valve is On.</td>
</tr>
<tr>
<td>RFUL</td>
<td>Reservoir Full</td>
<td>The ink module reservoir is presently at the inhibit level, and no additional fluid is allowed.</td>
</tr>
<tr>
<td>AIR</td>
<td>Air Switch</td>
<td>Air pressure switch is Off (switch contacts are open). This indicates that the input air pressure has dropped below approximately 70-72 psi (4.83-4.97 bar).</td>
</tr>
<tr>
<td>ILOW</td>
<td>Fluids Low</td>
<td>The fluid level in either the ink bottle or the make-up bottle is low.</td>
</tr>
<tr>
<td>SW1</td>
<td>(not currently used)</td>
<td>Reserved for future expansion.</td>
</tr>
<tr>
<td>SW2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>+24V</td>
<td>+24 V Supply</td>
<td>The +24 volt supply is on.</td>
</tr>
<tr>
<td>US12</td>
<td>User 12 V Supply</td>
<td>The user supply is on.</td>
</tr>
<tr>
<td>AVAL</td>
<td>Main Air Valve</td>
<td>The main air solenoid valve is On, and the pneumatics and hydraulics comprising the ink module are energized and active.</td>
</tr>
<tr>
<td>TVAL</td>
<td>Transfer Valve</td>
<td>The transfer solenoid valve is On, and the ink is being transferred from the ink pump into the ink supply cylinder (pressure tank).</td>
</tr>
<tr>
<td>NVAL</td>
<td>Nozzle Valve</td>
<td>The nozzle solenoid valve is On, and the ink is flowing out from the nozzle (in the printhead).</td>
</tr>
<tr>
<td>IVAL</td>
<td>Fresh Ink Add Valve</td>
<td>The fresh ink add solenoid valve is On, and the ink is being drawn from the ink bottle into the ink module reservoir.</td>
</tr>
<tr>
<td>MVAL</td>
<td>Make-up Add Valve</td>
<td>The make-up add solenoid valve is On, and the make-up fluid is being drawn from the make-up fluid bottle into the ink module reservoir.</td>
</tr>
</tbody>
</table>

Table 8-1: LED Description and Function
### LED Description and Function

<table>
<thead>
<tr>
<th>LED</th>
<th>Description</th>
<th>What does it mean when LED is lit?</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAL1</td>
<td>(not currently used)</td>
<td>Reserved for future expansion</td>
</tr>
<tr>
<td>VAL2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VAL3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>POR</td>
<td>Power On</td>
<td>The printer has just been switched on or reset. This LED stays lit during the first part of the initialization process and switches off as soon as the message processor has been released.</td>
</tr>
<tr>
<td>RES</td>
<td>Reset</td>
<td>This LED is similar to POR except that it stays on longer, indicating the second stage of the printer initialization process. Switches off when ALL processors have been released.</td>
</tr>
<tr>
<td>HV</td>
<td>High Voltage Status</td>
<td>The high voltage is On.</td>
</tr>
<tr>
<td>+320V</td>
<td>+320 V Supply Status</td>
<td>+320 V supply is On.</td>
</tr>
<tr>
<td>PD</td>
<td>Product Detect</td>
<td>When the printer is in serial mode, this LED reflects state of the external product detect input. This LED is not used in parallel mode.</td>
</tr>
<tr>
<td>TXD</td>
<td>Transmit Data</td>
<td>The printer is transmitting data to the host. (serial mode only)</td>
</tr>
<tr>
<td>RXD</td>
<td>Receive Data</td>
<td>The printer is receiving data from the host. (serial mode only)</td>
</tr>
<tr>
<td>DSTB</td>
<td>Data Strobe Flag</td>
<td>Parallel mode DATA STROBE FLAG is set</td>
</tr>
<tr>
<td>DREQ</td>
<td>Data Request</td>
<td>The printer is not ready to receive data (parallel mode only)</td>
</tr>
<tr>
<td>PRDY</td>
<td>Printer Ready</td>
<td>The printer is ready to print (parallel mode only)</td>
</tr>
</tbody>
</table>

*Table 8-1: LED Description and Function*
Printer Start-up Sequence

The printer start-up sequence begins once AC power is applied to the printer. To apply AC power to the printer, press the AC power switch to the ON (|) position.

<table>
<thead>
<tr>
<th>Time (seconds)</th>
<th>Printer Action</th>
<th>Main PCB LEDs Affected</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>The following LEDs on the keyboard light:</td>
<td>POR lights&lt;br&gt;RES lights&lt;br&gt;US12 lights&lt;br&gt;+24V lights&lt;br&gt;AIR lights (if air is applied to printer)</td>
</tr>
<tr>
<td></td>
<td>• the Power light&lt;br&gt; • the arrow key light&lt;br&gt; • the Standby key light&lt;br&gt; • the “MODE” LED light&lt;br&gt; • the circular light on the Start/Stop key</td>
<td>POR lights&lt;br&gt;RES lights&lt;br&gt;US12 lights&lt;br&gt;+24V lights&lt;br&gt;AIR lights (if air is applied to printer)</td>
</tr>
<tr>
<td>1-6</td>
<td>The display screen on the keyboard lights</td>
<td>POR extinguishes&lt;br&gt;RES extinguishes</td>
</tr>
</tbody>
</table>

Table 8-2: Printer Start-up Sequence

Printer Shutdown Sequence

Printer shut-down is when AC power is no longer applied to the printer. To remove AC power from the printer, press the AC power switch to the OFF (O) position. This procedure should only be performed after the printhead has been shut down and the time it takes for the printhead shutdown procedure to complete (2 minutes) has occurred.

Do not turn the AC power off before completing the printhead shut-down procedure or the ink in the ink return line will not be drawn back into the printer resulting in dried ink forming in the ink return line and on the ink return block. This will cause problems at the next printhead start-up.

<table>
<thead>
<tr>
<th>Time (seconds)</th>
<th>Printer Action</th>
<th>Main PCB LEDs Affected</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-1</td>
<td>• all lights on the keyboard that were lit will turn off&lt;br&gt; • the display screen on the keyboard turns off</td>
<td>All LEDs will turn off</td>
</tr>
</tbody>
</table>

Table 8-3: Printer Shutdown Sequence
## Printhead Start-up Sequence

The printhead start-up sequence begins once the Start\Stop key is pressed while the square light on the key is off. The times listed below are the number of seconds in which the corresponding printer action occurs after the Start\Stop key is pressed to begin the printhead start-up sequence.

<table>
<thead>
<tr>
<th>Time (seconds)</th>
<th>Printer Action</th>
<th>Main PCB LEDs Affected</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>if the air valve was Off, it will turn On</td>
<td>AVAL lights</td>
</tr>
<tr>
<td>1</td>
<td>the Ready light and the square light on the Start/Stop key will begin to flash</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>the ink valve turns On. (The ink valve turns on after the reservoir low switch opens and the pressure tank full switch is closed)</td>
<td>NVAL lights, PTFL lights (RLOW and IVAL may come on) +320 lights</td>
</tr>
<tr>
<td></td>
<td>if the PTFL LED on the LED bank is not lit, an ink transfer cycle will occur to fill the ink supply cylinder (pressure tank)</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Note: After the transfer is completed, the RLOW LED may light if the level in the reservoir is low.</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>+320 voltage turns On</td>
<td></td>
</tr>
<tr>
<td></td>
<td>phasing begins (starts charging ink drops)</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>checks fluid levels in the bottles</td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>high voltage turns On</td>
<td>HV lights</td>
</tr>
<tr>
<td>39</td>
<td>the Ready light and the square light on the Start/Stop key light (not flash)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>phase fault checking begins (starts monitoring for faults)</td>
<td></td>
</tr>
</tbody>
</table>

*Table 8-4: Printhead Start-up Sequence*
Printhead Shutdown Sequence

The printhead shutdown sequence begins once the Start\Stop key is pressed while the square light on the key is lit or flashing.

The sequence differs depending on whether the light was lit or flashing when the Start\Stop key was pressed. The times listed in both sequences are the number of seconds in which the corresponding printer action occurs after the Start\Stop key is pressed to begin the printhead shutdown sequence.

![Diagram of printhead shutdown sequence]

Sequence A (refer to page 8-36).

Sequence B (refer to page 8-37).

Figure 8-5. Printhead Shutdown Sequence
Sequence A
The square light on the Start/Stop key was flashing when the key is pressed.

<table>
<thead>
<tr>
<th>Time (seconds)</th>
<th>Printer Action</th>
<th>Main PCB LEDs Affected</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>the nozzle valve turns Off</td>
<td>NVAL turns off</td>
</tr>
<tr>
<td></td>
<td>+320 voltage turns Off</td>
<td>+320 turns off</td>
</tr>
<tr>
<td></td>
<td>if the transfer valve is On (the TVAL LED is lit), it will turn Off</td>
<td>TVAL turns off (if it was On)</td>
</tr>
<tr>
<td></td>
<td>if the printer is replenishing ink or make-up fluid in the ink module reservoir (the MVAL or IVAL LED is lit), the ink add valve or make-up add valve will remain On until the cycle is completed</td>
<td>MVAL or IVAL will stay On (if it was On)</td>
</tr>
<tr>
<td></td>
<td>phasing stops (ink drops are no longer charged)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>the square light on the Start/Stop key turns Off</td>
<td></td>
</tr>
<tr>
<td>120</td>
<td>the air valve turns Off</td>
<td>AVAL turns off</td>
</tr>
</tbody>
</table>

*Table 8-5: Printhead Shutdown Sequence (for Sequence A)*
Sequence B
The square light on the Start/Stop key was lit (but not flashing) when the key is pressed.

<table>
<thead>
<tr>
<th>Time (seconds)</th>
<th>Printer Action</th>
<th>Main PCB LEDs Affected</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>high voltage turns Off</td>
<td>HV turns off</td>
</tr>
<tr>
<td>1</td>
<td>the Ready light turns off, and the square light on the Start/Stop key begins to flash</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>the nozzle valve turns Off</td>
<td>NVAL turns off</td>
</tr>
<tr>
<td></td>
<td>+320 voltage turns Off</td>
<td>+320 turns off</td>
</tr>
<tr>
<td></td>
<td>if the transfer valve is On (the TVAL LED is lit), it will turn Off</td>
<td>TVAL turns off (if it was On)</td>
</tr>
<tr>
<td></td>
<td>if the printer is replenishing ink or make-up fluid in the ink module reservoir (the MVAL or IVAL LED is lit), the ink add valve or make-up add valve will remain On until the cycle is completed</td>
<td>MVAL or IVAL will stay On (if it was On)</td>
</tr>
<tr>
<td></td>
<td>phasing stops (ink drops are no longer charged)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>the square light on the Start/Stop key turns Off</td>
<td></td>
</tr>
<tr>
<td>120</td>
<td>the air valve turns Off</td>
<td>AVAL turns off</td>
</tr>
</tbody>
</table>

Table 8-6: Printhead Shutdown Sequence (for Sequence B)
Ink Transfer Sequence

The ink transfer sequence begins once the fluid level in the pressure tank reaches and activates the pressure tank low (PTLW) switch.

It may take between 1-5 transfer cycles for the pressure tank to fill completely, except if performing an Auto Prime. During Auto Prime, it can take anywhere between 1-10 cycles to fill the tank. A transfer cycle is defined as the time between when the transfer valve turns On (TVAL LED lights) to when it turns Off (TVAL LED turns off).

Figure 8-6. Ink Transfer Sequence

* 5 seconds if in Auto Prime
**Fluid Replenishment Sequence**

The fluid replenishment sequence begins once the fluid level in the ink module reservoir reaches and activates the reservoir low switch. The printer will add fresh ink or make-up fluid into the reservoir (depending on the flow time).

![Diagram of Fluid Replenishment Sequence](image)

*Figure 8-7. Fluid Replenishment Sequence*
Electronic Test Points

Introduction

Occasionally it is necessary to analyze the main printed circuit board (PCB) to find the cause of printer faults and other conditions. The test points on the main PCB are used to help localize or isolate a problem.

Electrical circuit checks may be necessary when wiring breaks or printhead failure is suspected. Use a digital voltmeter (DVM) or an oscilloscope (when appropriate) to check voltage signal levels at the printhead and main PCB, when checking the continuity and resistance of a suspected wire or the functionality of a suspected circuit or component.

Refer to Table 8-7 on the next page to find the signal definition for each test point, and refer to Figure 8-8 for the location of the test points on the main PCB.

![Figure 8-8. Test Point Locations on PCB](image-url)

---

8-40  Electronic Test Points
<table>
<thead>
<tr>
<th>Test Point</th>
<th>Signal Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>TP1</td>
<td>+12 V Auxiliary Supply (refer to page 8-42)</td>
</tr>
<tr>
<td>TP4</td>
<td>+5 V Logic Supply (refer to page 8-42)</td>
</tr>
<tr>
<td>TP5</td>
<td>+24 VDC Input (refer to page 8-42)</td>
</tr>
<tr>
<td>TP7</td>
<td>Re-initialize Printer</td>
</tr>
<tr>
<td>TP8</td>
<td>High Voltage Monitor (refer to page 8-43)</td>
</tr>
<tr>
<td>TP12</td>
<td>High Voltage “ON” Signal (refer to page 8-44)</td>
</tr>
<tr>
<td>TP16</td>
<td>High Voltage Programming Voltage (refer to page 8-44)</td>
</tr>
<tr>
<td>TP19</td>
<td>+320 V Supply (refer to page 8-45)</td>
</tr>
<tr>
<td>TP21</td>
<td>Ground</td>
</tr>
<tr>
<td>TP27</td>
<td>Charge Amp Output (refer to page 8-46)</td>
</tr>
<tr>
<td>TP29</td>
<td>Nozzle Drive Ground</td>
</tr>
<tr>
<td>TP31</td>
<td>Nozzle Drive Output (refer to page 8-48)</td>
</tr>
<tr>
<td>TP44</td>
<td>Phase Signal (refer to page 8-49)</td>
</tr>
<tr>
<td>TP46</td>
<td>Phase Comparator (refer to page 8-50)</td>
</tr>
<tr>
<td>TP51</td>
<td>Ground</td>
</tr>
<tr>
<td>TP52</td>
<td>Ground</td>
</tr>
<tr>
<td>TP53</td>
<td>Ground</td>
</tr>
<tr>
<td>TP54</td>
<td>Ground</td>
</tr>
<tr>
<td>TP58</td>
<td>Encoder Input (refer to page 8-53)</td>
</tr>
<tr>
<td>TP59</td>
<td>Product Detector Input</td>
</tr>
</tbody>
</table>

Table 8-7: Test Point Signal Definitions

Note: The remaining test points are used for manufacturing testing only and, therefore, are not listed. These test points are of no use in troubleshooting or analyzing the printer.
Test Point 1
+12 V Auxiliary Supply

Description
Indicates the +12 VDC auxiliary power supply output.

Testing
Using a digital voltmeter (DVM), connect the ground probe to TP51, 52, 53 or 54 and the other probe to TP1. You should get a reading between 11.00 - 13.00 volts.

Test Point 4
+5 V Logic Supply

Description
Indicates the +5 VDC power supply output.

Testing
Using a digital voltmeter (DVM), connect the ground probe to TP51, 52, 53 or 54 and the other probe to TP4. You should get a reading between 4.75 - 5.25 volts.

Test Point 5
+24 VDC Input

Description
Indicates the voltage input to the main PCB from the +24 V power supply.

Testing
Using a digital voltmeter (DVM), connect the ground probe to TP51, 52, 53 or 54 and the other probe to TP5. You should get a reading of 24 VDC ± 1.48 volts.

Note: However, you could get a reading as low as 21 VDC or as high as 27 VDC, and the printer will function normally.
Test Point 7
Re-initialize printer

Description
This test point is used to reset the printer to its factory default settings and initialize the run time clock to 0.

Use
See “Changing the Bar Code Type for Parallel Mode” on page 7-61 for instructions on using this test point.

Test Point 8
High Voltage Monitor

Description
Indicates the output level of the high voltage power supply. This voltage is a positive reading. (For example: if TP16 shows the voltage to be +4.5 volts, TP8 should also read this voltage value.) This value is 1/1000 of the actual voltage at the printhead. (For example +4.5 volts at TP35 equates to +4500 volts at the printhead.

Testing
Using a digital voltmeter (DVM), connect the ground probe to TP51, 52, 53 or 54 and the other probe to TP8. (Use the 20 V scale.) You should get a reading of approximately 3 to 6 volts.

Note: The high voltage must be On to obtain a reading.
Test Point 12
High Voltage “ON” Signal

Description
This signal is the microprocessor control line to the high voltage supply. The microprocessor can turn the high voltage supply ON or OFF via this line.

Testing
Using a digital voltmeter (DVM), connect the ground probe to TP51, 52, 53 or 54 and the other probe to TP12. (Use the 20 V scale.) A reading of 0.7 volts or lower indicates a high voltage “OFF” condition. A reading of 2.5V or greater indicates a high voltage “ON” condition.

Test Point 16
High Voltage Programming Voltage

Description
Factory set level that programs the high voltage circuit. This level will determine the intended output level of the high voltage deflection power supply. This voltage is present at all times if J22 is in the Trim position; otherwise it is present if the HV supply is On.

Testing
Using a digital voltmeter (DVM), connect the ground probe to TP51, 52, 53 or 54 and the signal probe to TP16. (Use the 20 V scale.) You should get a reading of approximately 3 to 6 volts.
**Test Point 19**

+320 V Supply

**Description**
Indicates the +320 VDC power supply output.

**Testing**

⚠️ **Caution**
Use caution when measuring this voltage and connecting or disconnecting the test leads.

Using a digital voltmeter (DVM), connect the ground probe to TP21 and the other probe to TP19. You should get a reading of +320 volts ± 1 volt.
Test Point 27
Charge Amp Output

Description
Measures the test video.

Testing
Using an oscilloscope, connect the ground probe to TP21 and the other probe to TP27. The output that appears in the oscilloscope screen will depend on the status of the printer at that time (refer to Figure 8-9, Figure 8-10 and Figure 8-11).

Test Video at Charge Amp Output
Individual drop charge represented during non-printing (unit is phasing). The amplitude is 10 volts (refer to Figure 8-9).

![Figure 8-9. Test Point 27 Signal](image)
**Test Video at Charge Tunnel Output**

Represents Automatic Phase Control (APC) phasing “bursts” of drops charged at 10 volts, followed by drops charged at 0 volts.

![Diagram of Test Video at Charge Tunnel Output]

*Figure 8-10. Test Point 27 Signal*

**Test Video at Charge Tunnel Output**

During test print or while printing a message, actual drop charge voltages for character generation can be measured. APC phase “bursts” are provided between each printed message (refer to Figure 8-11).

![Diagram with characters DE]

*Figure 8-11. Test Point 27 Signal*

**Note:** The characters shown in this grid are the result of printing the characters “DE.” The actual characters that appear should match those in your message.
Test Point 31
Nozzle Drive Output

Description
Indicates the voltage level from the main PCB to the crystal. (The crystal drives the nozzle and controls the ink drop break-off). The voltage applied to the crystal should be between 0 and 80 VAC Peak to Peak (P-P).

Testing
Using an oscilloscope, connect the ground probe to TP29 and the other probe to TP31. You should see a wave form similar to that shown in Figure 8-12. The sine wave should be clear and free from circuit noise and interference.

Figure 8-12. Test Point 31 Signal
Test Point 44
Phase Signal

**Description**
Provides an analog representation of the four phases. The phase control circuit on the PCB measures each of the phases to determine the best charging time for product coding.

Nominal amplitude is approximately 1.5 volts peak-to-peak (VPP). A value greater than 0.5 VPP is translated as a good phase to the microprocessor (as shown at TP46).

**Testing**
Using an oscilloscope, connect the ground probe to TP51, 52, 53 or 54 and the other probe to TP44. You should see a waveform similar to that shown in Figure 8-13.

![Figure 8-13. Test Point 44 Signal](image-url)
Test Point 46

Phase Comparator

**Description**
Comparator output which provides a specific signal to the microprocessor to determine which phase signal is selected.

**Testing**
Using an oscilloscope, connect the ground probe to TP51, 52, 53 or 54 and the other probe to TP46. You should see a square wave similar to that shown in Figure 8-14.

![Figure 8-14. Test Point 46 Signal](image)

As the amplitude of a charged group of drops reaches 0.5 VDC, the state of the comparator switches resulting in an inverted signal which represents the good phase. This can be done using a dual trace oscilloscope (refer to Figure 8-15).

![Figure 8-15. Comparing TP44 and TP46](image)
**Test Point 58**

Encoder Input

**Description**
Verifies the encoder input signal to the main PCB.

**Testing**
Using an oscilloscope, connect the ground probe to TP51, 52, 53 or 54, and the other probe to TP58. You should see a square wave similar to that shown in Figure 8-16.

![Figure 8-16. Test Point 58 Signal](image)
**Test Point 59**

Product Detector Input

**Description**

Allows monitoring of the product detect signal to the main PCB.

**Testing**

Using an oscilloscope, connect the ground probe to TP51, 52, 53 or 54, and the other probe to TP59.
Wiring Diagrams

Use the wiring diagrams in this section to trace a particular wire from its starting point to its final destination. This information is helpful for:

- identifying the signal inputs and outputs throughout the printer
- replacing individual wires
- general diagnostics

<table>
<thead>
<tr>
<th>Description</th>
<th>Page #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Printhead Connections</td>
<td>8-54</td>
</tr>
<tr>
<td>Power Connections</td>
<td>8-55</td>
</tr>
<tr>
<td>Ink Module/Air Manifold Connections</td>
<td>8-56</td>
</tr>
<tr>
<td>Ribbon Cables</td>
<td>8-57</td>
</tr>
</tbody>
</table>
### Printhead Connections

#### Figure 8-17. Printhead Connections

<table>
<thead>
<tr>
<th>Cable Termination</th>
<th>PCB Connection</th>
<th>Printhead Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>P10/P17</td>
<td>J17</td>
<td>Nozzle Drive Signal</td>
</tr>
<tr>
<td>P3/P10</td>
<td>J10</td>
<td>High Voltage</td>
</tr>
<tr>
<td>P20-1 (Black)</td>
<td>J20-1</td>
<td>Shield</td>
</tr>
<tr>
<td>P20-2 (White)</td>
<td>J20-2</td>
<td>Sensor Signal</td>
</tr>
<tr>
<td>P20-3</td>
<td>J20-3</td>
<td>Sensor Ground</td>
</tr>
<tr>
<td>P19-1 (Red)</td>
<td>J19-1</td>
<td>LED (Anode)</td>
</tr>
<tr>
<td>P19-2 (Black)</td>
<td>J19-2</td>
<td>LED (Cathode)</td>
</tr>
<tr>
<td>P9/P15</td>
<td>J15</td>
<td>Charge Tunnel</td>
</tr>
</tbody>
</table>
Power Connections

Note: Although the fan connector is present, the fan option is not currently available for the Universal 37pc.

<table>
<thead>
<tr>
<th>Power Supply Conn</th>
<th>Device Connection</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PS1-1</td>
<td>P2-1</td>
<td>Main PCB (24vdc)</td>
</tr>
<tr>
<td>PS1-2</td>
<td>FAN-1</td>
<td>Fan (24vdc) (optional)</td>
</tr>
<tr>
<td>PS1-3</td>
<td>P2-3</td>
<td>Main PCB (GND)</td>
</tr>
<tr>
<td>PS1-4</td>
<td>FAN-2</td>
<td>Fan (GND) (optional)</td>
</tr>
</tbody>
</table>
### Ink Module/Air Manifold Connections

<table>
<thead>
<tr>
<th>Main PCB Connection</th>
<th>Device Connection</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P8-3</td>
<td>L2-2</td>
<td>Nozzle Ink Solenoid</td>
</tr>
<tr>
<td>P8-4</td>
<td>L2-1</td>
<td>Nozzle Ink Solenoid</td>
</tr>
<tr>
<td>P8-5</td>
<td>L5-2</td>
<td>Air Solenoid</td>
</tr>
<tr>
<td>P8-6</td>
<td>L5-1</td>
<td>Air Solenoid</td>
</tr>
<tr>
<td>P8-7</td>
<td>L4-2</td>
<td>Make-up Solenoid</td>
</tr>
<tr>
<td>P8-8</td>
<td>L4-1</td>
<td>Make-up Solenoid</td>
</tr>
<tr>
<td>P8-9</td>
<td>L3-2</td>
<td>Fresh Ink Solenoid</td>
</tr>
<tr>
<td>P8-10</td>
<td>L3-1</td>
<td>Fresh Ink Solenoid</td>
</tr>
<tr>
<td>P8-11</td>
<td>L1-2</td>
<td>Transfer Solenoid</td>
</tr>
<tr>
<td>P8-12</td>
<td>L1-1</td>
<td>Transfer Solenoid</td>
</tr>
<tr>
<td>P8-13</td>
<td>MARS-2</td>
<td>MARS (Alert) Light</td>
</tr>
<tr>
<td>P8-14</td>
<td>MARS-1</td>
<td>MARS (Alert) Light</td>
</tr>
</tbody>
</table>

Figure 8-19. Ink Module/Air Manifold Connections
Ribbon Cables

There are two ribbon cables in the Universal 37pc. They include:

- The Bulkhead Board Ribbon Cable (P/N 378432) runs from J23 on the bulkhead circuit board to J23 in the printer controller PCB.
- The Keyboard/Display Cable Assembly (P/N 378418) runs from J7 on printer controller PCB to both the keyboard connector and the display connector on the keyboard and display assembly.

<table>
<thead>
<tr>
<th>Main PCB Connection</th>
<th>Device Connection</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P8-15</td>
<td>JS5-1</td>
<td>Pressure Tank Low Switch</td>
</tr>
<tr>
<td>P8-16</td>
<td>JS5-2</td>
<td>Pressure Tank Low Switch</td>
</tr>
<tr>
<td>P8-17</td>
<td>JS4-1</td>
<td>Pressure Tank Full Switch</td>
</tr>
<tr>
<td>P8-18</td>
<td>JS4-2</td>
<td>Pressure Tank Full Switch</td>
</tr>
<tr>
<td>P8-19</td>
<td>RESV-3</td>
<td>Reservoir Overfill Switch</td>
</tr>
<tr>
<td>P8-20</td>
<td>RESV-2</td>
<td>Reservoir Full (Inhibit) Switch</td>
</tr>
<tr>
<td>P8-21</td>
<td>RESV-1</td>
<td>Reservoir Low Switch</td>
</tr>
<tr>
<td>P8-22</td>
<td>RESV-4</td>
<td>Reservoir Switch Common</td>
</tr>
<tr>
<td>P8-23</td>
<td>S3-1</td>
<td>Fluids Low Switch</td>
</tr>
<tr>
<td>P8-24</td>
<td>S3-2</td>
<td>Fluids Low Switch</td>
</tr>
<tr>
<td>P8-25</td>
<td>S2-NO</td>
<td>Air Pressure Switch</td>
</tr>
<tr>
<td>P8-26</td>
<td>S2-C</td>
<td>Air Pressure Switch</td>
</tr>
</tbody>
</table>
Serial Interface

In this chapter you will find:

• A definition of serial interface
• Serial communications protocol
• A list of commands and responses sent from the host to the printer and from the printer to the host.
• Information on zero-length messages
• Information on control signal timing issues
• A list of barcode character definitions

Introduction

Purpose

This document serves as a guideline for communicating serially with the Universal 37pc postal coder.

Description

The 37 series postal coder is a Videojet inkjet printer whose software is specifically designed to print barcode symbols onto moving mail pieces. This printer will be part of a mail processing system, where pieces of mail are moved along a transport. Several signals from the transport (i.e. Encoder signal and Product Detect signal) will inform the printer how fast the transport is running and when to begin a barcode print cycle.

The role of the printer is to print barcode information onto the mail piece starting at a specific location on the letter. Refer to Figure 9-1 on page 9-3 for a pictorial description of the entire system.
Notes

The appearance of an "h" after a value (i.e. d4h) denotes a Hexadecimal value.

Some command/response headings may contain additional information in parenthesis. For example:

Clear Buffer (Reset Printer)

Definitions

Host
The heart (master) of the mail processing system. The system contains an RS232C compatible serial interface. The central processing unit decides which frames (see definition of Frame below) are sent over the serial interface to the printer. The central processing unit also decides when these frames are sent to the printer (under this architecture, the host always initiates communication with the printer).

Printer
The Videojet Ink Jet printing system (slave) containing a serial interface used to communicate with the host.

Frame
A serial interface command (a series of contiguous bytes) sent either by the host or by the printer. The first byte of a frame is typically the Function Code and the last byte of a frame is typically the checksum value.

Message
The data that is sent to the printer, converted into barcode or text characters, and eventually printed. A Postal Code would be one example of a message.

ACK
General Acknowledgement (06h). The response to an ENQ command when the printer is in the print mode, and no errors have been detected.

NAK
General Negative Acknowledgement (15h). The response to an ENQ command when the printer is not in the print mode, or a fault has been detected.
GSR
General Status Response (All bits = 0 means everything is OK. For a definition of the bits, refer to the description of the GSR response).

Figure 9-1. System Diagram
Definition of the Serial Interface

Cable Specifications
A cable must be used as the serial link between the printer and the host. See “J4 — RS-232 Serial Interface” on page 3-24 for detailed information on the cable connector.

Electrical Features
The serial interface baud rates available are 1200, 2400, 4800, 9600, 19200, 38400, 57600 and 115200. The serial data is sent in 8-bit format, no parity, 1 start bit, and 1 stop bit.
The baud rate of the printer is set via the keyboard.

Switching the Printer to Serial Mode
You can select either parallel or serial mode simply by attaching the appropriate cable before the printer is switched on. If both types of cables are attached, the printer will default to serial mode.

Serial Mode is designed to allow the host computer to be dynamically connected and disconnected while the printer running. This impacts mode switching in two distinct ways:

• Attaching a serial cable while the printer is in parallel mode will cause the printer to switch to serial mode immediately, even if the printer is already on.

• Once serial mode is selected, the printer will remain in serial mode until it is restarted, even if the serial cable is disconnected and a parallel cable is connected.

When serial mode is selected, the letters “SI” (Serial Interface) appear in the upper-right corner of the main standby screen and the main print screen as shown below:
Serial Communications Protocol

General

The host will act as the master whenever a conversation is to take place across the serial interface. A generic Frame Structure (see definition below) will be used for all communication (i.e. whenever the host sends something to the printer).

If the Print Continuous bar code parameter is off, the architecture of this printer is such that each Product Detect requires a new message before any printing can occur. Once printed, the message is cleared from the Print Buffer and a new message must be sent (via the External Serial Interface) before the next Product Detect occurs. See the Timing Diagrams at end of this document for clarification. If the Print Continuous parameter is on, the last message sent to the printer will be printed once after every Product Detect.

The host begins the conversation by transmitting a single-byte ENQ command. The host then waits for the single-byte ACK/NAK response from the printer. If the printer responds with an ACK, the host may transmit the frame to the printer. If the printer responds with a NAK, the printer is informing the host that it is incapable of printing.

When the printer transmits a NAK to the host, it is informing the host that it is not capable of printing, and the host should not transmit any print setup or print messages to the printer. Upon receiving a NAK, the host should transmit a GSR Request and subsequently a Fault Enquiry message (if necessary) to the printer to determine the reason the printer cannot print. The host should then take appropriate action to allow the printer to print.

Frame Structure

Each frame consists of a Header section, a Body, and finally a Checksum unless otherwise noted. The Header section is composed of a Function Code byte, a Frame Length byte, and a Frame Type byte. The Body of the frame contains (in many, but not all cases) barcode and/or text data to be printed.
**Function Code**
A byte value that categorizes the content of the frame. For example, a function code of d4h is typically associated with a frame that contains either barcode parameter information or barcode data (a MESSAGE).

**Frame Length**
A byte value that is equal to the length of the frame (in bytes) minus 3. Three (3) is subtracted because the Function Code, Frame Length, and Checksum are not included in the calculation of the frame length.

**Frame Type**
A one byte value defining the type of frame being transmitted. Refer to the sections entitled List of Commands Host Sends to Printer and List of Responses Printer Sends to Host for more specific information about Frame Types.

**Frame Data**
Zero to fifty (50) bytes containing data for the given Function Type/Frame Type command. Insert codes used in the text data portion of a message will be expanded to the number of bytes required for the specific insert. Refer to the sections List of Commands Host Sends to Printer and List of Responses Printer Sends to Host for more specific information about Frame Data.

**Note:** If in the frame data, there is a field requiring multiple bytes (for example Print Delay in the Barcode Parameters Frame), then the first byte will be the most significant byte of data, and the last byte will be the least significant byte of data.
Checksum
The checksum is an unsigned byte value (modulo 8) that is calculated according to the following algorithm:

\[ \Sigma I + \text{checksum} = 255 \]

Therefore, the checksum value the printer sends back to the host will be calculated as follows:

\[ 255 - \Sigma I \]

where \( \Sigma I \) equals the sum of all the bytes in the entire frame (calculated as an unsigned 8-bit quantity, where any and all overflow is ignored).

Example:

If the frame contains the following bytes \((3, 6, 9, 12, 15)\), then the unsigned summation of these bytes is 45, and the checksum value sent to the host is

\[ 255 - 45 = 210. \]
## List of Commands Host Sends to Printer

### General

Using a Function Code of d4h, the host can send the following Frame Types to the printer. The Function Code of d4h and the hex code for the Frame Type are shown to the left of each description.

<table>
<thead>
<tr>
<th>d4h,XXh</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>00h</td>
<td>Clear Buffer (Reset Printer)</td>
</tr>
<tr>
<td>01h</td>
<td>Bar code parameters info</td>
</tr>
<tr>
<td>02h</td>
<td>5mm Bar/No Bar code</td>
</tr>
<tr>
<td>03h</td>
<td>5mm Bar/No Bar code (same as 02h)</td>
</tr>
<tr>
<td>04h</td>
<td>5mm Bar/No Bar code + Text</td>
</tr>
<tr>
<td>05h</td>
<td>5mm Bar/No Bar code (same as 02h)</td>
</tr>
<tr>
<td>06h</td>
<td>Royal Mail 4 State Bar code</td>
</tr>
<tr>
<td>07h</td>
<td>4mm Bar/No Bar + Text</td>
</tr>
<tr>
<td>08h</td>
<td>4mm Bar/No Bar code</td>
</tr>
<tr>
<td>09h</td>
<td>Royal Mail 4 State Bar code (same as 06h)</td>
</tr>
<tr>
<td>0ah</td>
<td>4 State Bar pattern</td>
</tr>
<tr>
<td>0bh</td>
<td>4 State Bar pattern (same as 0ah)</td>
</tr>
<tr>
<td>0ch</td>
<td>Text + 4 State Bar pattern, 5mm height</td>
</tr>
<tr>
<td>0dh</td>
<td>4mm Bar/No Bar + space insert</td>
</tr>
<tr>
<td>0eh</td>
<td>4 State Bar pattern + Text, 5mm height</td>
</tr>
<tr>
<td>0fh</td>
<td>Text + POSTNET bar pattern</td>
</tr>
<tr>
<td>10h</td>
<td>Text + POSTNET bar pattern (same as 0fh)</td>
</tr>
<tr>
<td>11h</td>
<td>POSTNET bar pattern + Text</td>
</tr>
<tr>
<td>12h</td>
<td>POSTNET bar pattern + Text (same as 11h)</td>
</tr>
<tr>
<td>13h</td>
<td>4 State 3 Bar pattern + Text</td>
</tr>
<tr>
<td>14h</td>
<td>4 State 3 Bar pattern +Text (same as 13h)</td>
</tr>
<tr>
<td>15h</td>
<td>Text + 4 State 3 Bar pattern</td>
</tr>
<tr>
<td>16h</td>
<td>Text + 4 State 3 Bar pattern (same as 15h)</td>
</tr>
<tr>
<td>17h</td>
<td>Text (external encoder only)</td>
</tr>
<tr>
<td>18h</td>
<td>Intelligent Mail® Barcode (IMB) Pattern</td>
</tr>
<tr>
<td>19h</td>
<td>Intelligent Mail® Barcode (IMB) Pattern (same as 18h)</td>
</tr>
</tbody>
</table>
Redundant versions of Frames are included for flexibility. This allows the host to set up different print parameters for the same message types.

Other commands the host can send to the printer are listed below. These commands use a variety of different Function Codes. They are discussed in the following sections. The hex value for the Function Code (for each command) is shown to the left of each description below.

<table>
<thead>
<tr>
<th>Hex Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>05h</td>
<td>ENQ (host is requesting a conversation with printer)</td>
</tr>
<tr>
<td>d9h</td>
<td>Version Enquiry</td>
</tr>
<tr>
<td>dah</td>
<td>Fault Enquiry</td>
</tr>
<tr>
<td>c6h</td>
<td>Printer Control (Print ON/OFF)</td>
</tr>
<tr>
<td>c9h</td>
<td>Set Date and Time</td>
</tr>
</tbody>
</table>

The Self Test Messages listed below will print on the next Product Detect. Note that during processing of the Self Test Messages, Communication Synchronization Faults are disabled.

<table>
<thead>
<tr>
<th>Hex Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>98h,01h</td>
<td>Self Test Message #1 (Bar no Bar code, 4mm height)</td>
</tr>
<tr>
<td>98h,02h</td>
<td>Self Test Message #2 (Bar no Bar code + text, 4mm height)</td>
</tr>
<tr>
<td>98h,03h</td>
<td>Self Test Message #3 (4 State Bar code, 5mm height)</td>
</tr>
<tr>
<td>98h,04h</td>
<td>Self Test Message #4 (Bar no Bar, 5mm height)</td>
</tr>
</tbody>
</table>

### Enquire Command (ENQ) – 05h

The structure for this frame is shown below:

```
ENQ (05h)
```

A valid response from the printer would be: ACK or NAK (Refer to List of Responses Printer Sends to Host section.)
Clear Buffer (Reset Printer) – d4h,00h

The structure for this frame is shown below:

<table>
<thead>
<tr>
<th>Function Code (d4h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frame Length (01h)</td>
</tr>
<tr>
<td>Frame Type (00h)</td>
</tr>
<tr>
<td>Checksum (2Ah)</td>
</tr>
</tbody>
</table>

This command will reset the print buffer and message buffer. Also, any Communication/Synchronization fault, Encoder fault, or Checksum error will be cleared.

The only valid response from the printer is a GSR response.

Note: After requesting a “Clear Buffer”, all communication from the host should be suspended until the GSR byte is received.

Barcode Parameters Information – d4h,01h

The structure for this frame is shown below. The first byte of the frame data will be the barcode Frame Type. The printer will store the barcode parameters for each barcode Frame Type. Prior to printing a barcode message, the host must have previously sent the barcode parameters for the barcode message type being printed. Failure to do so may cause the printer to incorrectly print the barcode message. Barcode parameter information is not cleared by the Clear Buffer message or when power is turned off. This information will remain in the printer until the host changes the parameters, new software is installed, or the printer is re-initialized by grounding TP7 on the main controller board when the unit is turned on (see “Electronic Test Points” on page 8-40 for more information on TP7).

The host should send zeros for parameter information that is not used.

<table>
<thead>
<tr>
<th>Function Code (d4h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frame Length (12h)</td>
</tr>
<tr>
<td>Frame Type (01h)</td>
</tr>
<tr>
<td>Barcode Type (1 byte)</td>
</tr>
<tr>
<td>Direction (1 byte)</td>
</tr>
<tr>
<td>Reserved (1 byte)</td>
</tr>
<tr>
<td>Encoder Division (2 bytes)</td>
</tr>
<tr>
<td>Print Delay (2 bytes)</td>
</tr>
</tbody>
</table>
The only valid response from the printer is a GSR response.

**Function Code**
A byte value that categorizes the content of the frame. A function code of d4h is associated with a frame that contains barcode parameters or barcode data.

**Frame Length**
A one byte value that is equal to the length of the frame (in bytes) minus 3. Three (3) is subtracted because the Function Code, Frame Length, and Checksum bytes are not included in the calculation.

**Frame Type**
This section of the frame contains the Frame Type (01h).

**Barcode Type (Parameter Information)**
Specifies which barcode Frame Type the parameters are for. Valid barcode message types are 02h – 17h.

**Direction**
The bit positions of the byte are defined as follows:

<table>
<thead>
<tr>
<th>Bit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>not used</td>
</tr>
<tr>
<td>1</td>
<td>Print Delay units</td>
</tr>
<tr>
<td></td>
<td>(0 = millimeters, 1= # of divided encoder pulses)</td>
</tr>
<tr>
<td>2</td>
<td>not used</td>
</tr>
<tr>
<td>3</td>
<td>Print Continuous (0=off, 1=on)</td>
</tr>
<tr>
<td>4</td>
<td>Encoder Source (Bar code only) (0=internal, 1=external)</td>
</tr>
<tr>
<td>5</td>
<td>Invert Message (0=off, 1=on) (Bar code only)</td>
</tr>
<tr>
<td>6</td>
<td>Reverse Character (0=off, 1=on)</td>
</tr>
</tbody>
</table>
Bit 7  Reverse Message (0=off, 1=on)

**Encoder Division**
A two byte quantity that is only used when Bit 4 of the direction byte is one (1). Contains the barcode resolution (gap between bars). Limit values from 1 to 4095.

**Print Delay**
A two byte quantity that indicates the position of the 1st printed stroke in relation to the product detect signal. The position may be provided (by the host) in either millimeters or in the number of divided encoder pulses. Bit 1 of the Direction byte indicates whether the Print Delay is in millimeters or encoder pulses. This number may range from 1 to 9999.

**Line Speed (Item Speed)**
A two byte quantity used when Internal Encoder is selected for bar code printing (see “Direction” on page 9-11). When an External Encoder is selected for bar code printing, this value is used to determine the pitch of the Text portion (if any) of the message unless otherwise specified. It represents the speed at which the mail pieces travel (in millimeters/sec). Valid line speeds are from 1 to 4000 mm/s.

**Number of Encoder Pulses**
The number of Encoder pulses in a given distance. The distance is given in millimeters in the next byte.

**Distance (in millimeters)**
The amount of space required for the number of encoder pulses defined by the preceding byte.
5mm Bar/No Bar Barcode – (d4h,02h, d4h,03h & d4h,05h)

The structure for this frame is shown below:

<table>
<thead>
<tr>
<th>Function Code (d4h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frame Length</td>
</tr>
<tr>
<td>Frame Type</td>
</tr>
<tr>
<td>Barcode data to be printed</td>
</tr>
<tr>
<td>Checksum</td>
</tr>
</tbody>
</table>

**Frame Type**

This sector of the Frame contains the Frame Type (02h, 03h or 05h).

**Barcode Data**

This section of the Frame contains the Bar code Data to be Printed. This section of the Frame may contain from 0 to 50 bytes to represent the bar code patterns.

Format: the following is a description of the data format for a Bar/No Bar print message. This description applies only to the data to be printed. All Bar/No Bar print commands will use this format for printing bar code patterns unless otherwise specified.

In the case where there are one (1) or more bytes of Frame Data, each byte will contain a pattern of bars to print. A one (1) in a bit position will signify a bar position. A zero (0) in a bit position will signify a no bar position. Only the least significant six bit positions will be used to generate a bar pattern. The most significant two bit positions will always be ignored. In normal orientation, (i.e. not reverse character), the order of printing will be least significant bit of a byte, printed first. Six bar positions will always be printed for all Bar / No Bar type bar code messages.

In the case where there are NO BYTES of Frame Data, the net result is the same as the first case where all of the Frame Data consists of ZEROes (0's).

The only valid response from the printer is a GSR.
5mm Bar/No Bar code + Text – (d4h,04h)

The structure of this frame is shown below:

<table>
<thead>
<tr>
<th>Function Code (d4h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frame Length</td>
</tr>
<tr>
<td>Frame Type</td>
</tr>
<tr>
<td>Barcode Length</td>
</tr>
<tr>
<td>Barcode data to be printed</td>
</tr>
<tr>
<td>Number of Strokes (encoder) between Bar code &amp; Text</td>
</tr>
<tr>
<td>Text Data to be Printed</td>
</tr>
<tr>
<td>Checksum</td>
</tr>
</tbody>
</table>

**Frame Type**
This section of the Frame contains the Frame Type (04h).

**Bar code Length**
A one byte quantity that is used to determine the number of bar coded bytes being sent in the frame. This byte may range from 0 to 50. Zero (0) represents no bar code data to be printed.

**Barcode Data**
This section of the Frame contains the Bar code Data to be Printed. See “Barcode Data” on page 9-13 for the data format.

**Number of Strokes Between Bar Code and Text**
A two byte quantity of the number of Bars (strokes) to delay before printing text after printing the bar code field. This number may range from 0 to 9999.

**Text Data to be Printed**
This section of the frame contains the frame contains the ASCII text characters or insert codes. Text will be printed at 8.3 characters per 25 millimeters.

The only valid response from the printer is a GSR.
Royal Mail 4 State Bar code – (d4h, 06h & d4h, 09h)

The structure for this frame is shown below:

<table>
<thead>
<tr>
<th>Function Code (d4h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frame Length</td>
</tr>
<tr>
<td>Frame Type (06h or 09h)</td>
</tr>
<tr>
<td>Barcode data to be printed</td>
</tr>
<tr>
<td>Checksum</td>
</tr>
</tbody>
</table>

**Frame Type**

This section of the Frame contains the Frame Type (06h or 09h).

**Barcode Data**

This section of the Frame contains the Bar code Data to be Printed. This section may contain from 0 to 50 bytes of ASCII characters to be translated by the printer into bar patterns. See “Character Definitions” on page 9-53.

The only valid response from the printer is a GSR.
4mm Bar/No Bar code + Text – (d4h,07h)

The structure for this frame is shown below.

<table>
<thead>
<tr>
<th>Function Code (d4h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frame Length</td>
</tr>
<tr>
<td>Frame Type (07h)</td>
</tr>
<tr>
<td>Barcode Length</td>
</tr>
<tr>
<td>Barcode Data to be Printed</td>
</tr>
<tr>
<td>Number of Strokes (encoder) between Barcode &amp; Text</td>
</tr>
<tr>
<td>Text Data to be Printed</td>
</tr>
<tr>
<td>Checksum</td>
</tr>
</tbody>
</table>

**Frame Type**

This section of the Frame contains the Frame Type (07h).

**Barcode Length**

A one byte quantity that is used to determine the number of bar coded bytes being sent in the frame. This byte may range from 0 to 50. Zero (0) represents no bar code data to be printed.

**Barcode Data**

This section of the Frame contains the Bar code Data to be Printed. See “Barcode Data” on page 9-13 for the data format.

**Number of Strokes Between Bar Code and Text**

A two byte quantity of the number of Bars (strokes) to delay before printing text after printing the bar code field. This number may range from 0 to 9999.

**Text Data to be Printed**

This section of the frame contains the ASCII text characters or insert codes. Text will be printed at 8.3 characters per 25 millimeters.

The only valid response from the printer is a GSR.
4mm Bar/No Bar code – (d4h,08h)

The structure for this frame is shown below.

<table>
<thead>
<tr>
<th>Function code (d4h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frame Length</td>
</tr>
<tr>
<td>Frame Type (08h)</td>
</tr>
<tr>
<td>Bar code Data to be Printed</td>
</tr>
<tr>
<td>Checksum</td>
</tr>
</tbody>
</table>

**Frame Type**

This section of the Frame contains the Frame Type (08h).

**Bar code Data**

This section of the Frame contains the Bar code Data to be Printed. This section of the Frame may contain from 0 to 50 bytes to represent the bar code patterns. See “Barcode Data” on page 9-13 for the data format.

The only valid response from the printer is a GSR.
4 State Bar code – (d4h,0ah & d4h,0bh)

The structure for this frame is shown below.

<table>
<thead>
<tr>
<th>Function Code (d4h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frame Length</td>
</tr>
<tr>
<td>Frame Type</td>
</tr>
<tr>
<td>Bar code Length</td>
</tr>
<tr>
<td>Bar code Data to be Printed</td>
</tr>
<tr>
<td>Checksum</td>
</tr>
</tbody>
</table>

**Frame Type**
This section of the Frame contains the Frame Type (0ah or 0bh).

**Bar code Length**
A one byte quantity that is used to determine the number of bars to be printed. This byte may range from 0 to 255. Zero (0) represents no bar code data to be printed.

**Bar code Data**
0 to 50 bytes of 4-State Bar patterns. Each byte of data, except the last, will contain four bars (two bits per bar). The last byte can contain one to four bars. This was done to allow printing of 4-State codes whose length is not a multiple of four. The following is a definition of the 2-bit encoded patterns that are used to print the different bar types.

- 0 0  Track Bar
- 0 1  Descender Bar
- 1 0  Ascender Bar
- 1 1  Full Bar

The bars, when normal orientation is selected, will be printed in the following manner: The least significant two bits will be used to print the first bar. Bars will be printed in a right to left order within the byte of data.

The only valid response from the printer is a GSR.
Text + 4 State Bar pattern – (d4h,0ch)

The structure for this frame is shown below.

<table>
<thead>
<tr>
<th>Function Code (d4h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frame Length</td>
</tr>
<tr>
<td>Frame Type (0ch)</td>
</tr>
<tr>
<td>Bar code Length</td>
</tr>
<tr>
<td>Text Data to be Printed</td>
</tr>
<tr>
<td>Number of Strokes (encoder) between Bar code &amp; Text</td>
</tr>
<tr>
<td>Bar code Data to be Printed</td>
</tr>
<tr>
<td>Checksum</td>
</tr>
</tbody>
</table>

**Frame Type**
This section of the Frame contains the Frame Type (0ch).

**Bar code Length**
A one byte quantity that is used to determine the number of bars to be printed. This byte may range from 0 to 255. Zero (0) represents no bar code data to be printed.

**Text Data to be Printed**
This section of the frame contains the ASCII text characters or insert codes. Text will be printed at 8.3 characters per 25 millimeters.

**Number of Strokes Between Bar Code and Text**
A two byte quantity of the number of Bars (strokes) to delay before printing the bar code field after printing the text. This number may range from 0 to 9999.

**Bar code Data**
This section of the frame contains 4-State Bar patterns. Each byte of data, except the last, will contain four bars (two bits per bar). The last byte can contain one to four bars. This was done to allow printing of 4-State codes whose length is not a multiple of four.
The following is a definition of the 2-bit encoded patterns that are used to print the different bar types.

0 0  Track Bar
0 1  Descender Bar
1 0  Ascender Bar
1 1  Full Bar

The bars, when normal orientation is selected, will be printed in the following manner: The least significant two bits will be used to print the first bar. Bars will be printed in a right to left order within the byte of data.

The only valid response from the printer is a GSR.
4mm Bar/No bar + space insert – (d4h,0dh)

The structure for this frame is shown below.

<table>
<thead>
<tr>
<th>Function Code (d4h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frame Length</td>
</tr>
<tr>
<td>Frame Type (0dh)</td>
</tr>
<tr>
<td>First Bar code Length</td>
</tr>
<tr>
<td>First Bar code Data to be Printed</td>
</tr>
<tr>
<td>Number of Strokes (encoder) between first and second barcodes</td>
</tr>
<tr>
<td>Second Bar code Data to be Printed</td>
</tr>
<tr>
<td>Checksum</td>
</tr>
</tbody>
</table>

**Frame Type**

This section of the Frame contains the Frame Type (0dh).

**First Barcode Length**

A one byte quantity that is used to determine the number of bar code character bytes being sent in the frame. This byte may range from 0 to 50. Zero (0) represents no bar code data to be printed.

**Barcode Data**

This section of the Frame contains the Bar code Data to be Printed. These sections of the Frame may contain a total of 50 bytes, representing the postal barcode patterns.

In the case where there are one (1) or more bytes of Frame Data, each byte will contain a pattern of bars to print. A one (1) in a bit position will signify a bar position. A zero (0) in a bit position will signify a no bar position. All 8 bit positions will be used to generate a bar pattern. In normal orientation, (i.e. not reverse character), the bar associated with the least significant bit of a byte will be printed first.

**Number of Strokes Between First and Second Barcodes**

A two byte quantity of the number of Bars (strokes) to delay before printing the second bar code field. This number may range from 0 to 9999.

The only valid response from the printer is a GSR.
4 State Bar pattern + Text – (d4h,0eh)

The structure for this frame is shown below.

<table>
<thead>
<tr>
<th>Frame Type (0eh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barcode Length</td>
</tr>
<tr>
<td>Barcode Data to be Printed</td>
</tr>
<tr>
<td>Number of Strokes (encoder) between Barcode &amp; Text</td>
</tr>
<tr>
<td>Text Data to be Printed</td>
</tr>
<tr>
<td>Checksum</td>
</tr>
</tbody>
</table>

**Frame Type**

This section of the Frame contains the Frame Type (0eh).

**Barcode Length**

A one byte quantity that is used to determine the number of bars to be printed. This byte may range from 0 to 255. Zero (0) represents no bar code data to be printed.

**Barcode Data**

This section of the frame contains 4-State Bar patterns. Each byte of data, except the last, will contain four bars (two bits per bar). The last byte can contain one to four bars. This was done to allow printing of 4-State codes whose length is not a multiple of four. The following is a definition of the 2-bit encoded patterns that are used to print the different bar types.

- 0 0 Track Bar
- 0 1 Descender Bar
- 1 0 Ascender Bar
- 1 1 Full Bar

The bars, when normal orientation is selected, will be printed in the following manner: The least significant two bits will be used to print the first bar. Bars will be printed in a right to left order within each byte of data.
Number of Strokes Between Bar Code and Text
A two byte quantity of the number of Bars (strokes) to delay before printing the bar code field after printing the text. This number may range from 0 to 9999.

Text Data to be Printed
This section of the frame contains the ASCII text characters or insert codes. Text will be printed at 8.3 characters per 25 millimeters.

The only valid response from the printer is a GSR.
Text + POSTNET bar pattern – (d4h,0fh & d4h,10h)

The structure for this frame is shown below.

<table>
<thead>
<tr>
<th>Function Code (d4h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frame Length</td>
</tr>
<tr>
<td>Frame Type</td>
</tr>
<tr>
<td>Bar code Length</td>
</tr>
<tr>
<td>Text Data to be Printed</td>
</tr>
<tr>
<td>Number of Strokes (encoder) between Bar code &amp; Text</td>
</tr>
<tr>
<td>Bar code Data to be Printed</td>
</tr>
<tr>
<td>Checksum</td>
</tr>
</tbody>
</table>

Frame Type
This section of the Frame contains the Frame Type (0fh or 10h).

Bar code Length
A one byte quantity that is used to determine the number of bars to be printed. This byte may range from 0 to 255. Zero (0) represents no bar code data to be printed.

Text Data to be Printed
The section of the frame contains the ASCII text characters or insert codes. Text will be printed at 8.3 characters per 25 millimeters.

Number of Strokes Between Bar Code and Text
A two byte quantity of the number of Bars (strokes) to delay before printing the bar code field after printing the text. This number may range from 0 to 9999.

Bar Code Data
This section contains POSTNET bar patterns. Each bit in a data byte will represent a bar. A 1 in a bit position will represent a full bar and a 0 in a bit position will represent a half bar. The last byte can contain 1 to 8 bars which will be determined by the value entered in the frame for the bar code length. Bars will be printed right to left within each data byte.

The only valid response from the printer is a GSR.
POSTNET bar pattern + Text – (d4h,11h & d4h,12h)

The structure for this frame is shown below.

<table>
<thead>
<tr>
<th>Function Code (d4h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frame Length</td>
</tr>
<tr>
<td>Frame Type</td>
</tr>
<tr>
<td>Bar code Length</td>
</tr>
<tr>
<td>Bar code Data to be Printed</td>
</tr>
<tr>
<td>Number of Strokes (encoder) between Bar code &amp; Text</td>
</tr>
<tr>
<td>Text Data to be Printed</td>
</tr>
<tr>
<td>Checksum</td>
</tr>
</tbody>
</table>

Frame Type
This section of the Frame contains the Frame Type (11h or 12h).

Bar code Length
A one byte quantity that is used to determine the number of bars to be printed. This byte may range from 0 to 255. Zero (0) represents no bar code data to be printed.

Bar code Data
This section of the frame contains POSTNET bar patterns. Each bit in a data byte will represent a bar. A 1 in a bit position will represent a full bar and a 0 in a bit position will represent a half bar. The last byte can contain 1 to 8 bars which will be determined by the value entered in the frame for the bar code length. Bars will be printed right to left within each data byte.

Number of Strokes Between Bar Code and Text
A two byte quantity of the number of Bars (strokes) to delay before printing the bar code field after printing the text. This number may range from 0 to 9999.

Text Data to be Printed
This section of the frame contains the ASCII text characters or insert codes. Text will be printed at 8.3 characters per 25 millimeters.

The only valid response from the printer is a GSR.
4 State 3 Bar pattern + Text – (d4h, 13h & d4h, 14h)

The structure for this frame is shown below.

<table>
<thead>
<tr>
<th>Function Code (d4h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frame Length</td>
</tr>
<tr>
<td>Frame Type</td>
</tr>
<tr>
<td>Barcode Length</td>
</tr>
<tr>
<td>Barcode Data to be</td>
</tr>
<tr>
<td>Printed</td>
</tr>
<tr>
<td>Number of Strokes</td>
</tr>
<tr>
<td>(encoder) between</td>
</tr>
<tr>
<td>Bar code &amp; Text</td>
</tr>
<tr>
<td>Text Data to be</td>
</tr>
<tr>
<td>Printed</td>
</tr>
<tr>
<td>Checksum</td>
</tr>
</tbody>
</table>

**Frame Type**
This section of the Frame contains the Frame Type (13h or 14h).

**Barcode Length**
A one byte quantity that is used to determine the number of bars to be printed. This byte may range from 0 to 255. Zero (0) represents no bar code data to be printed.

**Barcode Data**
This section of the frame contains 4-State 3 Bar patterns. Each byte of data, except the last, will contain four bars (two bits per bar). The last byte can contain one to four bars. This was done to allow printing of 4-State codes whose length is not a multiple of four. The following is a definition of the 2-bit encoded patterns that are used to print the different bar types.

- 0 0  Track Bar
- 0 1  Descender Bar
- 1 0  Ascender Bar
- 1 1  Full Bar

The bars, when normal orientation is selected, will be printed in the following manner: The least significant two bits will be used to print the first bar. Bars will be printed in a right to left order within each byte of data.
**Number of Strokes Between Barcode and Text**
A two byte quantity of the number of Bars (strokes) to delay before printing the bar code field after printing the text. This number may range from 0 to 9999.

**Text Data to be Printed**
This section of the frame contains the ASCII text characters or insert codes. Text will be printed at 8.3 characters per 25 millimeters.

The only valid response from the printer is a GSR.
Text + 4 State 3 Bar pattern – (d4h,15h; d4h,16h)

The structure for this frame is shown below.

<table>
<thead>
<tr>
<th>Function Code (d4h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frame Length</td>
</tr>
<tr>
<td>Frame Type</td>
</tr>
<tr>
<td>Bar code Length</td>
</tr>
<tr>
<td>Text Data to be Printed</td>
</tr>
<tr>
<td>Number of Strokes (encoder) between Bar code &amp; Text</td>
</tr>
<tr>
<td>Bar code Data to be Printed</td>
</tr>
<tr>
<td>Checksum</td>
</tr>
</tbody>
</table>

**Frame Type**
This section of the Frame contains the Frame Type (15h or 16h).

**Bar code Length**
A one byte quantity that is used to determine the number of bars to be printed. This byte may range from 0 to 255. Zero (0) represents no bar code data to be printed.

**Text Data to be Printed**
This section of the frame contains the ASCII text characters or insert codes. Text will be printed at 8.3 characters per 25 millimeters.

**Number of Strokes Between Bar Code and Text**
A two byte quantity of the number of Bars (strokes) to delay before printing the bar code field after printing the text. This number may range from 0 to 9999.
Bar code Data
This section of the frame contains 4-State 3 Bar patterns. Each byte of data, except the last, will contain four bars (two bits per bar). The last byte can contain one to four bars. This was done to allow printing of 4-State codes whose length is not a multiple of four. The following is a definition of the 2-bit encoded patterns that are used to print the different bar types.

0 0  Track Bar
0 1  Descender Bar
1 0  Ascender Bar
1 1  Full Bar

The bars, when normal orientation is selected, will be printed in the following manner: The least significant two bits will be used to print the first bar. Bars will be printed in a right to left order within each byte of data.

The only valid response from the printer is a GSR.
Text (external encoder) – (d4h,17h)
The structure for this frame is shown below.

<table>
<thead>
<tr>
<th>Function Code (d4h)</th>
<th>Frame Length</th>
<th>Frame Type (17h)</th>
<th>Text Data to be Printed</th>
<th>Checksum</th>
</tr>
</thead>
</table>

**Frame Type**
This section of the Frame contains the Frame Type (17h).

**Text Data to be Printed**
This section of the frame contains the ASCII text characters or insert codes. Text will be printed using an external encoder only.
The only valid response from the printer is a GSR.
Intelligent Mail® Barcode (IMB) Pattern - (d4h,18h & d4h,19h)

The structure for this frame is shown below.

<table>
<thead>
<tr>
<th>Function Code (d4h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frame Length</td>
</tr>
<tr>
<td>Frame Type</td>
</tr>
<tr>
<td>Bar code Length</td>
</tr>
<tr>
<td>Bar code Data to be Printed</td>
</tr>
<tr>
<td>Checksum</td>
</tr>
</tbody>
</table>

Frame Type

This section of the Frame contains the Frame Type (18h or 19h).

Bar code Length

A one byte quantity that is used to determine the number of bars to be printed. This byte may range from 0 to 255. Zero (0) represents no bar code data to be printed.

Bar code Data

0 to 50 bytes of IMB patterns. Each byte of data, except the last, will contain four bars (two bits per bar). The last byte can contain one to four bars. This was done to allow printing of IMB patterns whose length is not a multiple of four. The following is a definition of the 2-bit encoded patterns that are used to print the different bar types.

- 0 0  Track Bar
- 0 1  Descender Bar
- 1 0  Ascender Bar
- 1 1  Full Bar

The bars, when normal orientation is selected, will be printed in the following manner: The least significant two bits will be used to print the first bar. Bars will be printed in a right to left order within the byte of data. The only valid response from the printer is a GSR.
Text + Intelligent Mail® Barcode (IMB) Pattern - (d4h,1ah & d4h,1bh)

The structure for this frame is shown below.

<table>
<thead>
<tr>
<th>Function Code (d4h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frame Length</td>
</tr>
<tr>
<td>Frame Type</td>
</tr>
<tr>
<td>Bar code Length</td>
</tr>
<tr>
<td>Text Data to be Printed</td>
</tr>
<tr>
<td>Number of Strokes (encoder) between Bar code &amp; Text</td>
</tr>
<tr>
<td>Bar code Data to be Printed</td>
</tr>
<tr>
<td>Checksum</td>
</tr>
</tbody>
</table>

Frame Type
This section of the Frame contains the Frame Type (1ah or 1bh).

Bar code Length
A one byte quantity that is used to determine the number of bars to be printed. This byte may range from 0 to 255. Zero (0) represents no bar code data to be printed.

Text Data to be Printed
This section of the frame contains the ASCII text characters or insert codes. Text will be printed at 8.3 characters per 25 millimeters.

Number of Strokes Between Bar Code and Text
A two byte quantity of the number of Bars (strokes) to delay before printing the bar code field after printing the text. This number may range from 0 to 9999.

Bar code Data
This section of the frame contains IMB patterns. Each byte of data, except the last, will contain four bars (two bits per bar). The last byte can contain one to four bars. This was done to allow printing of IMB patterns whose length is not a multiple of four.
The following is a definition of the 2-bit encoded patterns that are used to print the different bar types.

0 0  Track Bar
0 1  Descender Bar
1 0  Ascender Bar
1 1  Full Bar

The bars, when normal orientation is selected, will be printed in the following manner: The least significant two bits will be used to print the first bar. Bars will be printed in a right to left order within the byte of data.

The only valid response from the printer is a GSR.

**Intelligent Mail® Barcode (IMB) Pattern + Text - (d4h,1ch & d4h,1dh)**

The structure for this frame is shown below.

<table>
<thead>
<tr>
<th>Function Code (d4h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frame Length</td>
</tr>
<tr>
<td>Frame Type</td>
</tr>
<tr>
<td>Barcode Length</td>
</tr>
<tr>
<td>Barcode Data to be Printed</td>
</tr>
<tr>
<td>Number of Strokes (encoder) between Barcode &amp; Text</td>
</tr>
<tr>
<td>Text Data to be Printed</td>
</tr>
<tr>
<td>Checksum</td>
</tr>
</tbody>
</table>

**Frame Type**

This section of the Frame contains the Frame Type (1ch or 1dh).

**Barcode Length**

A one byte quantity that is used to determine the number of bars to be printed. This byte may range from 0 to 255. Zero (0) represents no barcode data to be printed.

**Barcode Data**

This section of the frame contains IMB patterns. Each byte of data, except the last, will contain four bars (two bits per bar). The last byte can contain one to four bars. This was done to allow printing of IMB patterns whose
length is not a multiple of four. The following is a definition of the 2-bit encoded patterns that are used to print the different bar types.

- 0 0  Track Bar
- 0 1  Descender Bar
- 1 0  Ascender Bar
- 1 1  Full Bar

The bars, when normal orientation is selected, will be printed in the following manner: The least significant two bits will be used to print the first bar. Bars will be printed in a right to left order within each byte of data.

**Number of Strokes Between Bar Code and Text**
A two byte quantity of the number of Bars (strokes) to delay before printing the bar code field after printing the text. This number may range from 0 to 9999.

**Text Data to be Printed**
This section of the frame contains the ASCII text characters or insert codes. Text will be printed at 8.3 characters per 25 millimeters.

The only valid response from the printer is a GSR.

**Version Enquiry – (d9h)**
The structure for this frame is shown below:

<table>
<thead>
<tr>
<th>Function Code (d9h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frame Length (01h)</td>
</tr>
<tr>
<td>Frame Type (00h)</td>
</tr>
<tr>
<td>Checksum (25h)</td>
</tr>
</tbody>
</table>

The only valid response from the printer is the Version Enquiry Response.
Fault Enquiry – (dah)
The structure for this frame is shown below:

<table>
<thead>
<tr>
<th>Function Code (dah)</th>
<th>Frame Length (01h)</th>
<th>Frame Type (00h)</th>
<th>Checksum (24h)</th>
</tr>
</thead>
</table>

The only valid response from the printer is the Fault Enquiry Response.

Printer Control (Print ON/OFF) – c6h

The structure for this frame is shown below:

<table>
<thead>
<tr>
<th>Function Code (c6h)</th>
<th>Frame Length (01h)</th>
<th>Frame Type (xxh)</th>
<th>Checksum</th>
</tr>
</thead>
</table>

Frame Type
In this case, the Frame Type is actually a Control Byte. This control byte will have the following characteristics:

00h  Stop Print
0dh  Start Print
08h  Printer Shutdown, Standby mode after printer shutdown
69h  GSR request

The only valid response from the printer is a GSR response. For the three (3) cases shown above for this Printer Control command, the GSR response should be ignored by the host.

The ability to do a non-destructive GSR request exists. By sending the above command with a Frame Type of 69h and a Checksum of CFh, one can force a GSR status response to be sent by the printer. This is useful for obtaining information such as an Encoder Fault or Printer System Fault.
Set Date and Time – c9h

The structure for this frame is shown below.

<table>
<thead>
<tr>
<th>Function Code (c9h)</th>
<th>Frame Length (06h)</th>
<th>Frame Type (00h)</th>
<th>Minute (00h - 59h)</th>
<th>Hour (00h - 23h)</th>
<th>Date (01h - 31h)</th>
<th>Month (01h – 12h)</th>
<th>Year (00h – 99h)</th>
<th>Checksum</th>
</tr>
</thead>
</table>

Frame Data

This data contained in this frame type is used to set the real time clock in the printer. The Minute, Hour, Date, Month, and Year frame data are each one byte BCD encoded values.

The only valid response from the printer is a GSR. The response to this command should only be used to verify that the data has been received by the printer without any errors in coding or transmission.
Self-Test Messages

The intent of the Self-Test message is to provide a way of testing the printer with a simple configuration: a conveyor belt, an encoded signal, a product detect signal, and a console (or protocol analyzer). The Self-Test message will cause the printer to print a fixed message with predefined print parameters. The fixed message and print parameters will be resident (hard coded) in the printer. Print parameters will be defined as if they were received from a barcode parameters information message. The parameter values are shown below. The test message will be printed when the next product detect signal is received by the printer.

Print Parameters for Test Messages:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direction</td>
<td>012h</td>
</tr>
<tr>
<td>Reserved (not used)</td>
<td>000h</td>
</tr>
<tr>
<td>Encoder Division</td>
<td>000h,001h</td>
</tr>
<tr>
<td>Print Delay</td>
<td>000h,017h</td>
</tr>
<tr>
<td>Reserved (not used)</td>
<td>000h,000h</td>
</tr>
<tr>
<td>Reserved (not used)</td>
<td>000h,000h</td>
</tr>
<tr>
<td>Line Speed</td>
<td>005h,0dch</td>
</tr>
<tr>
<td>Reserved (not used)</td>
<td>000h,000h</td>
</tr>
<tr>
<td># Encoder Pulses</td>
<td>00fh</td>
</tr>
<tr>
<td>Distance (mm)</td>
<td>019h</td>
</tr>
</tbody>
</table>
Self-Test Message #1 – 98h,01h (4mm Bar/No bar code)

The structure for this frame is shown below:

<table>
<thead>
<tr>
<th>Function Code (98h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frame Length (01h)</td>
</tr>
<tr>
<td>Frame Type (01h)</td>
</tr>
<tr>
<td>Checksum (65h)</td>
</tr>
</tbody>
</table>

**Message Data**

“6543210” (4mm Bar/No Barcode characters)

**Printed Pattern**

“•” represents a “space” stroke

![Print Pattern](image)

The only valid response from the printer is a GSR.

Self Test Message #2 – 98h,02h (4mm Bar/No bar code + Text)

The structure for this frame is shown below:

<table>
<thead>
<tr>
<th>Function Code (98h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frame Length (01h)</td>
</tr>
<tr>
<td>Frame Type (02h)</td>
</tr>
<tr>
<td>Checksum (65h)</td>
</tr>
</tbody>
</table>

**Message Data**

Bar pattern (4mm bar/no bar code characters) + 5 “space” strokes +10VLK (Assumes mail piece is moving from right to left).

**Printed Pattern**

“•” represents a “space” stroke

![Print Pattern](image)

The only valid response from the printer is a GSR.
Self-Test Message #3 – 98h,03h (4 State Barcode)
The structure for this frame is shown below:

<table>
<thead>
<tr>
<th>Function Code (98h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frame Length (01h)</td>
</tr>
<tr>
<td>Frame Type (03h)</td>
</tr>
<tr>
<td>Checksum (65h)</td>
</tr>
</tbody>
</table>

Message Data
5mm 4 State bar code characters (Assumes mail piece is moving from right to left).

Printed Pattern
“•” represents a “space” stroke

The only valid response from the printer is a GSR.

Self Test Message #4 – 98h,04h (5mm Bar/No bar code)
The structure for this frame is shown below:

<table>
<thead>
<tr>
<th>Function Code (98h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frame Length (01h)</td>
</tr>
<tr>
<td>Frame Type (03h)</td>
</tr>
<tr>
<td>Checksum (65h)</td>
</tr>
</tbody>
</table>

Message Data
5mm bar/no bar code characters (Assumes mail piece is moving from right to left).

Printed Pattern: “•” represents a “space” stroke

The only valid response from the printer is a GSR
List of Responses Printer Sends to Host

All possible host responses are listed below. Detailed descriptions of these responses follow this list.

- General Acknowledgement (ACK)
- General Negative Acknowledgement (NAK)
- General Status Response (GSR)
- Version Enquiry Response
- Fault Enquiry Response

Responses to the Enquire Command

06h - ACK
The Acknowledge response. A handshaking type of response that tells the host that the printer is ready to talk and is able to print. This response is only given for the ENQ command. The structure for this response is shown below.

NAK (15h)

15h - NAK
The Negative Acknowledge response. A handshaking type of response that tells the host that the printer is not ready to print for some reason. It is a generic indicator that some kind of error condition exists as indicated in the GSR byte. This response is only given for the ENQ command. The structure for this response is shown below.

General Status Response - GSR
The structure for this response is shown below. This status response will be issued after each command is received from the host. When all bits are zero (0), this means there were no errors; everything is OK. Bit 3 is used to indicate a fluids low warning. If errors do occur, the appropriate bit(s) will be sent.
GSR data bits

<table>
<thead>
<tr>
<th>7</th>
<th>6</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
<th>0</th>
</tr>
</thead>
</table>

Bit 0 - Communications/Synchronization Fault
Bit 1 - Encoder Fault
Bit 2 - Not used
Bit 3 - Fluids Low (Consumable Low)
Bit 4 - Not used
Bit 5 - Checksum Error
Bit 6 - Printer System Fault
Bit 7 - Print Not Ready

This type of response is given for all commands that come from the host, unless otherwise noted.

Communications/Synchronization Fault
Zero under normal operation. Set to a one by the printer when a communications or print synchronization fault is detected. To determine the type of fault, the host must transmit a Fault Enquiry message to the printer. Further descriptions of the Communications/Synchronization fault types are found under the section labeled Fault Enquiry Response. This bit will be reset to zero when the printer receives the next message from the host.

Encoder Fault
Zero under normal operation. Set to a one by the printer when an Encoder fault is detected. An encoder fault occurs when the encoder signal is received by the printer at a rate of less than two (2) Hertz, while printing. This fault most likely occurs because the encoder cable has become disconnected from the printer, or the mail pieces have stopped moving for some reason. Printing is defined as the time interval from when the product detect is received by the printer until the last bar (character) in the message is printed. Upon detection of this fault, the printer will abort printing, clear the buffer, and set the encoder fault bit in the GSR. This bit will be reset to zero when the printer receives the next message from the host.

Fluids Low Warning
Zero under normal operation. Set to a one by the printer when either the ink or makeup bottle is low in fluid. This bit may only be cleared by replenishing the fluid in the ink or makeup bottle. If the bottle is not
refilled within thirty minutes, the printer will generate a Fluids Out fault and execute a fault shutdown.

**Checksum Error**
Zero under normal operation. Set to a one by the printer when a checksum error is detected in a message received from the host. The message with an error will be discarded. This bit will be reset to zero when the printer receives a Clear Buffer message from the host.

**Printer System Fault**
Zero under normal operation. Set to a one by the printer when a printer fault is detected. To determine the type of fault, the host must transmit a Fault Enquiry message to the printer. This bit may only be reset to zero at the printer.

**Print Not Ready**
Zero under normal operation. Set to a one when the printer is not capable of printing. This may be due to a printer fault, the printhead not being turned on, or the printer not being in the Print mode.

**Version Enquiry Response**
The response the printer will send the host is shown below:

<table>
<thead>
<tr>
<th>Function Code (d1h)</th>
<th>Frame Length (06h)</th>
<th>Frame Type (00h)</th>
<th>Version Data (5 bytes)</th>
<th>Checksum</th>
</tr>
</thead>
</table>

**Version Data**
The Version data consists of five ASCII bytes of data which indicate the current software version installed in the printer.
Fault Enquiry Response

The response the printer will send the host is shown below:

<table>
<thead>
<tr>
<th>Function Code (d2h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frame Length (02h)</td>
</tr>
<tr>
<td>Frame Type (00h)</td>
</tr>
<tr>
<td>Fault Code for Most Recent Fault</td>
</tr>
<tr>
<td>Checksum</td>
</tr>
</tbody>
</table>

Fault Code

The Fault Code is a one byte hexadecimal value that indicates the most recent fault in the printer. The codes are listed below.

<table>
<thead>
<tr>
<th>Printer Faults</th>
<th>Communication/Synchronization Faults</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code</td>
<td>Fault Type</td>
</tr>
<tr>
<td>00</td>
<td>No Fault</td>
</tr>
<tr>
<td>01</td>
<td>Phasing Fault</td>
</tr>
<tr>
<td>02</td>
<td>No Signal Fault</td>
</tr>
<tr>
<td>03</td>
<td>High Voltage Fault</td>
</tr>
<tr>
<td>04</td>
<td>Flow Time Too Long Fault</td>
</tr>
<tr>
<td>05</td>
<td>Flow Time Too Short Fault</td>
</tr>
<tr>
<td>06</td>
<td>Fluids Out Fault</td>
</tr>
<tr>
<td>07</td>
<td>High Voltage Supply Fault</td>
</tr>
<tr>
<td>08</td>
<td>320 Volt Fault</td>
</tr>
<tr>
<td>09</td>
<td>Empty Time Too Long Fault</td>
</tr>
<tr>
<td>0a</td>
<td>Reservoir Low Request Too Long Fault</td>
</tr>
<tr>
<td>0b</td>
<td>Fill Time Too Long Fault</td>
</tr>
<tr>
<td>0c</td>
<td>Transfer Request Too Long Fault</td>
</tr>
<tr>
<td>0d</td>
<td>Air Pressure Fault</td>
</tr>
</tbody>
</table>
### Printer Faults

<table>
<thead>
<tr>
<th>Code</th>
<th>Fault Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>0e</td>
<td>Reservoir Overfill Fault</td>
</tr>
<tr>
<td>0f</td>
<td>Ink Cylinder Switch Fault</td>
</tr>
<tr>
<td>10</td>
<td>Reservoir Switch Fault</td>
</tr>
<tr>
<td>11</td>
<td>System Processor Failure</td>
</tr>
<tr>
<td>12</td>
<td>RAM Failure</td>
</tr>
<tr>
<td>13</td>
<td>Serial Processor Failure</td>
</tr>
</tbody>
</table>

### Communication/Synchronization Faults

<table>
<thead>
<tr>
<th>Code</th>
<th>Fault Type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note:** Faults with hex codes less than 80 are resettable by the printer only. Faults with hex codes greater than or equal to 80 are reset when the printer receives the next message from the host.

---

## Zero-Length Messages

One of the features of the printer is its ability to skip cards by sending the printer null barcode data. The printer will essentially print nothing when it sees this null data. With this capability, the operator can skip entire cards by inserting null data in the barcode field. The operator has the option of including binary zeros (0s) in the barcode data field of the message, or he can simply leave the barcode data field empty (null).

Below are some examples of zero-length messages. Notice the variations that are possible.

### Example 1: no Frame Data at all

**Message Sent to Printer**

<table>
<thead>
<tr>
<th>Function Code</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>D4h</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Frame Length</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>01h</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Frame Type</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>02h</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Checksum</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>28h</td>
<td></td>
</tr>
</tbody>
</table>
Example 2: one byte of Null Frame Data
Message Sent to Printer

----------------------------
Function Code = D4h
Frame Length = 02h
Frame Type = 02h
Frame Data = 00h
Checksum = 27h

Example 3: three (3) bytes of Frame Data
Message Sent to Printer

----------------------------
Function Code = D4h
Frame Length = 04h
Frame Type = 02h
Frame Data = 00h
          = 00h
          = 00h
Checksum = 25h

Example 4: no bar code data & no alpha data
Message Sent to Printer

----------------------------
Function Code = D4h
Frame Length = 04h
Frame Type = 04h
Bar Code Len = 00h
No. of Bar = 00h,02h
positions between
bar codes & text
Checksum = 21h
Example 5: bar code data, but no alpha data

Message Sent to Printer

----------------------------------------------
Function Code = D4h
Frame Length = 06h
Frame Type = 04h
Bar Code Len = 02h
bar code data = 00h,00h
No. of Bar = 00h,04h
positions between bar codes & text
Checksum = 1Bh

Example 6: no bar code data, but alpha data

Message Sent to Printer

----------------------------------------------
Function Code = D4h
Frame Length = 06h
Frame Type = 04h
Bar Code Len = 00h
No. of Bar = 00h,04h
positions between bar codes & text
Text Data = 41h,42h (any ascii code)
Checksum = 9Ah
Example 7: no bar code data, no alpha data
Message Sent to Printer

----------------------------
Function Code = D4h
Frame Length = 04h
Frame Type = 0ch
Bar Code Len = 00h
No. of Bar = 00h,01h
  positions between
  bar codes & text
Checksum = 1Ah

Example 8: bar code data, but no alpha data
Message Sent to Printer

----------------------------
Function Code = D4h
Frame Length = 05h
Frame Type = 0ch
Bar Code Len = 01h
No. of Bar = 00h,01h
  positions between
  bar codes & text
Bar code data = 00h
Checksum = 18h
Example 9: no bar code data, but alpha data

Message Sent to Printer

----------------------------------------
Function Code = D4h
Frame Length = 05h
Frame Type = 0ch
Bar Code Len = 00h
Text data = 41h (any ascii code)
No. of Bar positions between bar codes & text = 00h, 01h
Checksum = d8h
Control Signal Timing Issues

Normal Serial Interface Conversation

The diagram below shows a typical (normal) conversation between the host and printer. The “Function Code d4h” shown below is only one example of the many different types of commands (command prefixes) that will follow this communications protocol. The Status Response shown in the diagram refers to the GSR response.

Note that multiple sequences of ENQ followed by an ACK/NAK response will be supported. This means that any number of ENQ--ACK/NAK sequences may occur before the printer begins to process a command starting with the Function Code. Note the required 1 millisecond maximum time between the end of the host’s ENQ and the beginning of the printer’s ACK response.

Once the Barcode Parameters have been sent for a Barcode Type, they do not need to be sent again until any of the parameters are to be changed. The Print Barcode Data (0d4h,02h) shown below is only one of many different barcode commands that can occur here.
Communication Faults

If any one of the communications faults below occurs, bit 0 of the GSR will be set, the GSR response will then be sent to the host.

Communication/Synchronization Fault Type #1

The timing diagram below shows the fault when two (2) barcode messages are received by the printer before a product detect signal occurs. The message that generated the error will be discarded.

Communication/Synchronization Fault Type #2

The timing diagram below shows the fault where one (1) product detect occurs before data is ready to print. The message that was being received will be discarded.
Communication/Synchronization Fault Type #3
The timing diagram below shows the fault where a second product detect occurs before printing has been completed. The printer will abort printing and clear the print buffer. The next message in the buffer will be printed on the next product detect.

Illegal Frame Length
A Frame Length of zero was detected in a message from the host. The message is discarded and an error is reported to the host. This error condition is reset when the next message is sent to the printer.

Illegal Function Code
An unknown Function Code was detected in a message from the host. The message is discarded and an error is reported to the host. This error condition is reset when the next message is sent to the printer.

Illegal Frame Type
An unknown Frame Type was detected in a message from the host with a Function Code of d4h. The message is discarded and an error is reported to the host. This error condition is reset when the next message is sent to the printer.

Invalid Bar Code Type
An invalid bar code message type was specified in the Bar Code Parameters frame received by the printer. This error condition is reset when the next message is sent to the printer.
**Encoder Timing Issues**

Below is a timing diagram that shows how the printer executes a print delay and synchronization to the divided encoder signal when using an external divide encoder. For this example, a print delay of 3 divided pulses and an external divide rate of 2 will be used.

*Note:* The first print stroke occurs after the print delay count, plus the number of pulses in the divided code.

**Signal Definitions**

- **Encoder Signal**: Signal provided to the printer by external hardware.
- **Divided Encoder Signal**: Signal generated from the encoder signal. The encoder signal is used as a clock signal to a counter. The counter generates a divided encoder signal every \(n\) clock pulses. The number of clock pulses (divide rate) is user programmable and is sent as part of the Barcode Parameter information.
## Character Definitions

Below is a table showing the hexadecimal values for the various ASCII encoded characters and barcodes used with the printer.

<table>
<thead>
<tr>
<th>Hex</th>
<th>ASCII</th>
<th>4 State Royal Mail</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>Space</td>
<td>not used</td>
</tr>
<tr>
<td>21</td>
<td>!</td>
<td>not used</td>
</tr>
<tr>
<td>22</td>
<td>&quot;</td>
<td>not used</td>
</tr>
<tr>
<td>23</td>
<td>#</td>
<td>not used</td>
</tr>
<tr>
<td>24</td>
<td>$</td>
<td>not used</td>
</tr>
<tr>
<td>25</td>
<td>%</td>
<td>not used</td>
</tr>
<tr>
<td>26</td>
<td>&amp;</td>
<td>not used</td>
</tr>
<tr>
<td>27</td>
<td>'</td>
<td>not used</td>
</tr>
<tr>
<td>28</td>
<td>(</td>
<td>not used</td>
</tr>
<tr>
<td>29</td>
<td>)</td>
<td>not used</td>
</tr>
<tr>
<td>2A</td>
<td>*</td>
<td>not used</td>
</tr>
<tr>
<td>2B</td>
<td>+</td>
<td>not used</td>
</tr>
<tr>
<td>2C</td>
<td>,</td>
<td>not used</td>
</tr>
<tr>
<td>2D</td>
<td>-</td>
<td>not used</td>
</tr>
<tr>
<td>2E</td>
<td>.</td>
<td>not used</td>
</tr>
<tr>
<td>2F</td>
<td>/</td>
<td>not used</td>
</tr>
<tr>
<td>30</td>
<td>0</td>
<td>• •</td>
</tr>
<tr>
<td>31</td>
<td>1</td>
<td>•</td>
</tr>
<tr>
<td>32</td>
<td>2</td>
<td>•</td>
</tr>
<tr>
<td>33</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>4</td>
<td>l</td>
</tr>
<tr>
<td>35</td>
<td>5</td>
<td>l l l</td>
</tr>
<tr>
<td>36</td>
<td>6</td>
<td>•</td>
</tr>
<tr>
<td>37</td>
<td>7</td>
<td>•</td>
</tr>
<tr>
<td>38</td>
<td>8</td>
<td>•</td>
</tr>
<tr>
<td>39</td>
<td>9</td>
<td>l</td>
</tr>
<tr>
<td>Hex</td>
<td>ASCII</td>
<td>4 State Royal Mail</td>
</tr>
<tr>
<td>-----</td>
<td>-------</td>
<td>-------------------</td>
</tr>
<tr>
<td>3A</td>
<td>:</td>
<td>not used</td>
</tr>
<tr>
<td>3B</td>
<td>;</td>
<td>not used</td>
</tr>
<tr>
<td>3C</td>
<td>&lt;</td>
<td>not used</td>
</tr>
<tr>
<td>3D</td>
<td>=</td>
<td>not used</td>
</tr>
<tr>
<td>3E</td>
<td>&gt;</td>
<td>not used</td>
</tr>
<tr>
<td>3F</td>
<td>?</td>
<td>not used</td>
</tr>
<tr>
<td>40</td>
<td>@</td>
<td>not used</td>
</tr>
<tr>
<td>41</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>D</td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>E</td>
<td></td>
</tr>
<tr>
<td>46</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td>47</td>
<td>G</td>
<td></td>
</tr>
<tr>
<td>48</td>
<td>H</td>
<td></td>
</tr>
<tr>
<td>49</td>
<td>I</td>
<td></td>
</tr>
<tr>
<td>4A</td>
<td>J</td>
<td></td>
</tr>
<tr>
<td>4B</td>
<td>K</td>
<td></td>
</tr>
<tr>
<td>4C</td>
<td>L</td>
<td></td>
</tr>
<tr>
<td>4D</td>
<td>M</td>
<td></td>
</tr>
<tr>
<td>4E</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>4F</td>
<td>O</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Hex</td>
<td>ASCII</td>
<td>4 State Royal Mail</td>
</tr>
<tr>
<td>-----</td>
<td>-------</td>
<td>--------------------</td>
</tr>
<tr>
<td>51</td>
<td>Q</td>
<td>___</td>
</tr>
<tr>
<td>52</td>
<td>R</td>
<td>___</td>
</tr>
<tr>
<td>53</td>
<td>S</td>
<td>___</td>
</tr>
<tr>
<td>54</td>
<td>T</td>
<td>___</td>
</tr>
<tr>
<td>55</td>
<td>U</td>
<td>___</td>
</tr>
<tr>
<td>56</td>
<td>V</td>
<td>___</td>
</tr>
<tr>
<td>57</td>
<td>W</td>
<td>___</td>
</tr>
<tr>
<td>58</td>
<td>X</td>
<td>___</td>
</tr>
<tr>
<td>59</td>
<td>Y</td>
<td>___</td>
</tr>
<tr>
<td>5A</td>
<td>Z</td>
<td>___</td>
</tr>
<tr>
<td>5B</td>
<td>[</td>
<td>not used</td>
</tr>
<tr>
<td>5C</td>
<td>\</td>
<td>not used</td>
</tr>
<tr>
<td>5D</td>
<td>]</td>
<td>not used</td>
</tr>
<tr>
<td>5E</td>
<td>^</td>
<td>not used</td>
</tr>
<tr>
<td>5F</td>
<td></td>
<td>not used</td>
</tr>
<tr>
<td>60</td>
<td>Leading Frame Bar</td>
<td></td>
</tr>
<tr>
<td>61</td>
<td>Trailing Frame Bar</td>
<td></td>
</tr>
</tbody>
</table>

* Denotes a non-printed stroke
Insert Codes

The following codes, when contained in the text portion of a message, will be replaced with the corresponding characters when the message is printed.

<table>
<thead>
<tr>
<th>Hex Code</th>
<th>Insert Description</th>
<th>Printed Format</th>
</tr>
</thead>
<tbody>
<tr>
<td>08</td>
<td>Time</td>
<td>HH:MM</td>
</tr>
<tr>
<td>10</td>
<td>Numeric Month</td>
<td>MM</td>
</tr>
<tr>
<td>12</td>
<td>Date</td>
<td>DD</td>
</tr>
<tr>
<td>14</td>
<td>2 Digit Year</td>
<td>YY</td>
</tr>
</tbody>
</table>
Parallel Interface

In this chapter you will find:

- Theory of operation
- Wiring information
- Signal definitions

Introduction

This chapter describes the function of the parallel interface. The printer can print a POSTNET bar code, an I.D. Tag bar code, Intelligent Mail® Bar code (IMB) and alphanumeric characters.

*Note:* The acronym IMB will be used throughout this manual to refer to the Intelligent Mail® Bar code

Switching the Printer to Parallel Mode

You can select either parallel or serial mode simply by attaching the appropriate cable before the printer is switched on. However, if both types of cables are attached, the printer will default to serial mode.

When parallel mode is selected, the letters “PI” (Parallel Interface) appear in the upper-right corner of the main standby screen and the main print screen as shown below:

<table>
<thead>
<tr>
<th>STANDBY</th>
<th>PI</th>
</tr>
</thead>
<tbody>
<tr>
<td>SETUP/</td>
<td>CLEAN</td>
</tr>
<tr>
<td>STATUS</td>
<td>HEAD</td>
</tr>
</tbody>
</table>
Procedure

Follow these steps to switch from serial mode to parallel mode:

1. Shut down the printhead.
2. Switch off the printer.
3. Disconnect the serial cable and attach the parallel cable.
4. Switch on the printer.

Theory of Operation

The parallel interface provides external control of the printer with hand
shaking signals and data lines. The printer will print only when a print
command is applied through the parallel interface. In this configuration
the printer is classified as a slave printer.

Parallel Interface

The main circuit board contains three individual jumper plugs which
determine the polarity (active high or active low) of the Data Request,
Data Strobe, and the Data Strobe Flag signals. The operational description
of the parallel interface in this document assumes that these jumpers are
all in the active high position.

The parallel interface port signal definitions are as follows:

Printer Ready (37pc to host)
This signal is LOW when printer is in the Print Mode. It will be HIGH all
other times.

Data Request (37pc to host)
This signal will go HIGH when the printer is ready to receive data from
the host.

Note: The printer must be in print mode to be able to receive data. This signal will
be LOW when not in the print mode or while printing. This signal will go LOW
after reading in data to be printed. It will remain LOW until the printer is done
 printing.

Data Strobe Flag (37pc to host)
This signal will go HIGH when the printer hardware detects the Data
Strobe signal from the host. This signal will go LOW after the printer has
read in the data.
Data Strobe (host to 37pc)
A (minimum 5 microseconds) pulse from the host to the Universal 37pc indicating that there is data to be read. This signal will cause an interrupt to the character generator micro-processor. The Universal 37pc will start printing upon reception of this signal.

Data1-Data8. (host to 37pc)
Eight bits of data to inform the printer what to print. The host will output the data onto the parallel interface and hold the data until it has been read. The host will indicate there is data to be read by pulsing the Data Strobe line.

Note: The Data8 line is not used by the USPS but it is incorporated into the interface for possible future needs.

Protocols
The parallel interface communications will only be monitored in the Print Mode. At all other times, the parallel interface will be ignored.

Upon entering the Print Mode, the Universal 37pc will:
1. Clear the Data Strobe Flag by reading and discarding any data on the data bus of the Parallel Interface.
2. Set the Print Ready signal to a LOW state indicating the Universal 37pc is ready to print.
3. Set the Data Request Signal to a HIGH state indicating the Universal 37pc is ready to receive data via the parallel interface.

Upon exiting the Print Mode, the Universal 37pc will:
1. Set the Data Request Signal to a LOW state indicating the Universal 37pc is not ready to receive data via the parallel interface.
2. Set the Print Ready signal to a HIGH state indicating the Universal 37pc is not ready to print.
3. Clear the Data Strobe Flag by reading and discarding any data on the data bus of the Parallel Interface.

While in the Print Mode, communications will be handled in the following manner:
1. The Host will verify the Universal 37pc is in the Print mode by checking that the Print Ready signal is LOW. The Host should only send data to the Universal 37pc when Print Ready is LOW.
2. The Host will verify the Universal 37pc is ready to receive data by checking that the Data Request signal is HIGH. The Host should only
send data to the Universal 37pc when Data Request is HIGH. Data sent while Data Request Low may not be received and printed correctly.

3 The Host will output and hold the data on the parallel interface data lines.

4 The Host will allow one (1) microsecond for the data to settle.

5 The Host will pulse the Data Strobe line of the parallel interface. The pulse must be at least five (5) microseconds long.

6 The Universal 37pc hardware will set the Data Strobe Flag HIGH upon detection of the Data Strobe. The Data Strobe flag going high will cause an interrupt to the 37PC/PI printer.

7 The Universal 37pc will set the Data Request signal LOW indicating it is busy processing the data.

8 The Universal 37pc will read and store the parallel interface data lines. The reading of the data lines will cause the Universal 37pc hardware to set the Data Strobe Flag LOW indicating the data has been read.

9 The Host can now remove the data from the parallel interface data lines.

10 The Universal 37pc will print a stroke.

11 Upon completion of printing a stroke (bar) or character (text), the Universal 37pc will set the Data Request signal HIGH indicating the Universal 37pc is ready to receive new data from the Host.
Communications Timing Diagram

Figure 10-1. Communications Timing Diagram

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Typ</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Printer Ready Low to Data Request High</td>
<td>1.3</td>
<td>μsec</td>
</tr>
<tr>
<td>B</td>
<td>Data Request Low (busy printing a bar stroke)</td>
<td>187</td>
<td>μsec</td>
</tr>
<tr>
<td>B</td>
<td>Data Request Low (busy printing a character)</td>
<td>672</td>
<td>μsec</td>
</tr>
<tr>
<td>C</td>
<td>Data Strobe High to Data Request Low</td>
<td>18</td>
<td>μsec</td>
</tr>
<tr>
<td>D</td>
<td>Data Strobe</td>
<td>&gt;5</td>
<td>μsec</td>
</tr>
<tr>
<td>E</td>
<td>Data Strobe High to Data Strobe Flag High</td>
<td>12</td>
<td>μsec</td>
</tr>
<tr>
<td>F</td>
<td>Data Strobe Flag High to Data Strobe Flag Low</td>
<td>7</td>
<td>μsec</td>
</tr>
</tbody>
</table>

Table 10-1: Communications Timing
Wiring Information

Host Connection

The printer is connected to the host computer through one 15-pin connector cable.

<table>
<thead>
<tr>
<th>Printer Interface Connector 15 pin</th>
<th>Signal Name</th>
<th>Signal Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DATA 3</td>
<td>Input</td>
</tr>
<tr>
<td>2</td>
<td>DATA 6</td>
<td>Input</td>
</tr>
<tr>
<td>3</td>
<td>DATA STROBE</td>
<td>Input</td>
</tr>
<tr>
<td>4</td>
<td>DATA STROBE FLAG</td>
<td>Output</td>
</tr>
<tr>
<td>5</td>
<td>SIGNAL GROUND</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>DATA 1</td>
<td>Input</td>
</tr>
<tr>
<td>7</td>
<td>DATA 4</td>
<td>Input</td>
</tr>
<tr>
<td>8</td>
<td>DATA 7</td>
<td>Input</td>
</tr>
<tr>
<td>9</td>
<td>DATA REQUEST</td>
<td>Output</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>DATA 2</td>
<td>Input</td>
</tr>
<tr>
<td>12</td>
<td>DATA 5</td>
<td>Input</td>
</tr>
<tr>
<td>13</td>
<td>DATA 8</td>
<td>Input</td>
</tr>
<tr>
<td>14</td>
<td>PRINTER READY</td>
<td>Output</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 10-2: Host connection
Signal Definitions

Table 10-3 defines each signal present on the parallel interface board connectors.

<table>
<thead>
<tr>
<th>Signal Name</th>
<th>I/O</th>
<th>Signal Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRINTER-READY</td>
<td>Out</td>
<td>Goes low when printer is ready to print data. Goes high when a printer fault occurs.</td>
</tr>
<tr>
<td>DATA REQUEST</td>
<td>Out</td>
<td>High indicates printer is ready to receive data, on the DATA lines. When the printer has read data, DATA REQUEST goes low. After printing DATA REQUEST, printer will return to a high state.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Note:</strong> When printer is in Test Print, DATA REQUEST will be low.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Note:</strong> This signal is provided as an option for the user. We recommend that it be used for applications where the printer approaches maximum speed.</td>
</tr>
<tr>
<td>DATA 1, DATA 2, DATA 3, DATA 4, DATA 5, DATA 6, DATA 7</td>
<td>In</td>
<td><strong>Note:</strong> Data must be valid before leading edge of DATA STROBE and be held until DATA REQUEST goes low. Hold DATA lines low during idle or non-printing time periods for better noise immunity.</td>
</tr>
<tr>
<td>DATA STROBE</td>
<td>In</td>
<td>The printer reads the data contained on Data1 – Data7 and starts the print cycle based on the data received when the data strobe line is pulsed.</td>
</tr>
<tr>
<td>DATA STROBE FLAG</td>
<td>Out</td>
<td>Set by DATA STROBE pulse. DATA STROBE FLAG is cleared when data is read by the printer.</td>
</tr>
</tbody>
</table>

*Table 10-3: Signal definition*
Parallel Interface Indicator LEDs

The main circuit board contains three LEDs to assist in determining proper interface operation. Table 10-4 lists each LED and defines the associated on/off condition. Refer to Figure 10-2 on page 10-10 for location of the LEDs.

<table>
<thead>
<tr>
<th>LED Name / Mnemonic</th>
<th>Condition</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>DATA REQUEST/ DREQ</td>
<td>ON</td>
<td>Printer not ready to receive data</td>
</tr>
<tr>
<td></td>
<td>OFF</td>
<td>Printer requesting data</td>
</tr>
<tr>
<td>PRINTER READY/ PRDY</td>
<td>ON</td>
<td>Printer is ready to print</td>
</tr>
<tr>
<td></td>
<td>OFF</td>
<td>Printer not ready to print</td>
</tr>
<tr>
<td>DATA STROBE FLAG/ DSTB</td>
<td>ON</td>
<td>DATA STROBE FLAG set</td>
</tr>
<tr>
<td></td>
<td>OFF</td>
<td>DATA STROBE FLAG cleared</td>
</tr>
</tbody>
</table>

Table 10-4: Parallel interface LEDs

Jumpers

The main circuit board jumpers allow the polarity of certain signals to be changed. Table 10-5 lists the jumpers and the default positions for each jumper. Refer to Figure 10-2 for locations of jumpers.

<table>
<thead>
<tr>
<th>Jumper</th>
<th>Name</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>J4</td>
<td>Data Strobe Flag</td>
<td>Active High</td>
</tr>
<tr>
<td>J5</td>
<td>Data Strobe</td>
<td>Active High</td>
</tr>
<tr>
<td>J6</td>
<td>Data Request</td>
<td>Active High</td>
</tr>
</tbody>
</table>

Table 10-5: Jumper Connections

Note: An “H” silk-screened onto the circuit next to each of these jumpers indicates which jumper position is active high.
Figure 10-2. Parallel Interface Jumper and LED Locations
United States Postal Service Interface Information

An interface adapter board assembly P/N 374848 is required to convert the printer’s 15 pin I/O port to the 40 pin ribbon cable used with USPS applications. One interface adapter board is shipped with each new printer. The interface adapter assembly plugs directly into the printer’s I/O port and adapts the printer to accept the proprietary 40 pin USPS interface cable.

<table>
<thead>
<tr>
<th>Printer Interface Connector 15 pin db.</th>
<th>Signal Name</th>
<th>Signal Type</th>
<th>Output from 40 pin Interface Adapter</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DATA 3</td>
<td>Input</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>DATA 6</td>
<td>Input</td>
<td>29</td>
</tr>
<tr>
<td>3</td>
<td>DATA STROBE FLAG</td>
<td>Output</td>
<td>N.C.</td>
</tr>
<tr>
<td>4</td>
<td>SIGNAL GROUND</td>
<td></td>
<td>2, 4, 6, 8, 10, 14, 16, 20, 23, 26, 30, 33</td>
</tr>
<tr>
<td>5</td>
<td>DATA 1</td>
<td>Input</td>
<td>38</td>
</tr>
<tr>
<td>6</td>
<td>DATA 4</td>
<td>Input</td>
<td>24</td>
</tr>
<tr>
<td>7</td>
<td>DATA 7</td>
<td>Input</td>
<td>27</td>
</tr>
<tr>
<td>8</td>
<td>DATA REQUEST</td>
<td>Output</td>
<td>9</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>DATA 2</td>
<td>Input</td>
<td>32</td>
</tr>
<tr>
<td>12</td>
<td>DATA 5</td>
<td>Input</td>
<td>31</td>
</tr>
<tr>
<td>13</td>
<td>DATA 8</td>
<td>N.C.</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>PRINTER READY</td>
<td>Output</td>
<td>3</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 10-6: Postal Service Interface Information

Setting Alpha Character Print Direction

Printing alpha characters requires consideration of the direction that the mail piece passes the printhead. If the print direction is not set correctly, each alpha character will be printed in reverse, as if viewed in a mirror. The Universal 37pc printer is factory set to print alpha characters in the reverse direction which supports printing on mail pieces traveling in a stamp leading orientation.
To set the print direction to support a stamp trailing format, hold pin 3 of the external I/O connector (J6) low. See “J6 — I/O” on page 3-27 for more information on the J6 connector.

**Character Chart**

Standard POSTNET, Bar-No Bar (I.D. Tag), and 4 State (IMB) barcode symbols along with 64 alphanumeric characters are available. The chart indicates what character is printed for a particular hexadecimal code.

<table>
<thead>
<tr>
<th>BAR-NO-BAR (I.D. Tag) Characters</th>
<th>02 or 7E</th>
<th>No Bar</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>03 or 7F</td>
<td>Full Bar</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>POSTNET Characters</th>
<th>02 or 7E</th>
<th>Half Bar</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>03 or 7F</td>
<td>Full Bar</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4-STATE (IMB) Characters</th>
<th>10</th>
<th>Track Bar</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>11</td>
<td>Descender Bar</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>Ascender Bar</td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>Full Bar</td>
</tr>
</tbody>
</table>

*Table 10-7: Character Chart*

<table>
<thead>
<tr>
<th>Alphanumeric Characters</th>
<th>Hex</th>
<th>Character Printed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>20</td>
<td>(space)</td>
</tr>
<tr>
<td></td>
<td>21</td>
<td>!</td>
</tr>
<tr>
<td></td>
<td>22</td>
<td>“</td>
</tr>
<tr>
<td></td>
<td>23</td>
<td>#</td>
</tr>
<tr>
<td></td>
<td>24</td>
<td>$</td>
</tr>
<tr>
<td></td>
<td>25</td>
<td>%</td>
</tr>
<tr>
<td></td>
<td>26</td>
<td>&amp;</td>
</tr>
<tr>
<td></td>
<td>27</td>
<td>'</td>
</tr>
<tr>
<td></td>
<td>28</td>
<td>(</td>
</tr>
<tr>
<td></td>
<td>29</td>
<td>)</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>=</td>
</tr>
<tr>
<td></td>
<td>31</td>
<td>?</td>
</tr>
<tr>
<td></td>
<td>32</td>
<td>_</td>
</tr>
<tr>
<td></td>
<td>33</td>
<td>`</td>
</tr>
<tr>
<td></td>
<td>34</td>
<td>'</td>
</tr>
<tr>
<td></td>
<td>35</td>
<td>'</td>
</tr>
<tr>
<td></td>
<td>36</td>
<td>'</td>
</tr>
<tr>
<td></td>
<td>37</td>
<td>'</td>
</tr>
<tr>
<td></td>
<td>38</td>
<td>'</td>
</tr>
<tr>
<td></td>
<td>39</td>
<td>'</td>
</tr>
<tr>
<td></td>
<td>40</td>
<td>'</td>
</tr>
<tr>
<td></td>
<td>41</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>42</td>
<td>B</td>
</tr>
<tr>
<td></td>
<td>43</td>
<td>C</td>
</tr>
<tr>
<td></td>
<td>44</td>
<td>D</td>
</tr>
<tr>
<td></td>
<td>45</td>
<td>E</td>
</tr>
<tr>
<td></td>
<td>46</td>
<td>F</td>
</tr>
<tr>
<td></td>
<td>47</td>
<td>G</td>
</tr>
<tr>
<td></td>
<td>48</td>
<td>H</td>
</tr>
</tbody>
</table>

*Table 10-8: Alphanumeric Character Chart*
### Alphanumeric Characters

<table>
<thead>
<tr>
<th>ASCII</th>
<th>Character</th>
<th>Arabic</th>
<th>Greek</th>
</tr>
</thead>
<tbody>
<tr>
<td>28</td>
<td>(</td>
<td>49</td>
<td>I</td>
</tr>
<tr>
<td>29</td>
<td>)</td>
<td>4A</td>
<td>J</td>
</tr>
<tr>
<td>2A</td>
<td>*</td>
<td>4B</td>
<td>K</td>
</tr>
<tr>
<td>2B</td>
<td>+</td>
<td>4C</td>
<td>L</td>
</tr>
<tr>
<td>2C</td>
<td>,</td>
<td>4D</td>
<td>M</td>
</tr>
<tr>
<td>2D</td>
<td>-</td>
<td>4E</td>
<td>N</td>
</tr>
<tr>
<td>2E</td>
<td>.</td>
<td>4F</td>
<td>O</td>
</tr>
<tr>
<td>2F</td>
<td>/</td>
<td>50</td>
<td>P</td>
</tr>
<tr>
<td>30</td>
<td>0</td>
<td>51</td>
<td>Q</td>
</tr>
<tr>
<td>31</td>
<td>1</td>
<td>52</td>
<td>R</td>
</tr>
<tr>
<td>32</td>
<td>2</td>
<td>53</td>
<td>S</td>
</tr>
<tr>
<td>33</td>
<td>3</td>
<td>54</td>
<td>T</td>
</tr>
<tr>
<td>34</td>
<td>4</td>
<td>55</td>
<td>U</td>
</tr>
<tr>
<td>35</td>
<td>5</td>
<td>56</td>
<td>V</td>
</tr>
<tr>
<td>36</td>
<td>6</td>
<td>57</td>
<td>W</td>
</tr>
<tr>
<td>37</td>
<td>7</td>
<td>58</td>
<td>X</td>
</tr>
<tr>
<td>38</td>
<td>8</td>
<td>59</td>
<td>Y</td>
</tr>
<tr>
<td>39</td>
<td>9</td>
<td>5A</td>
<td>Z</td>
</tr>
<tr>
<td>3A</td>
<td>:</td>
<td>5B</td>
<td>[</td>
</tr>
<tr>
<td>3B</td>
<td>;</td>
<td>5C</td>
<td>\</td>
</tr>
<tr>
<td>3C</td>
<td>&lt;</td>
<td>5D</td>
<td>]</td>
</tr>
<tr>
<td>3D</td>
<td>=</td>
<td>5E</td>
<td>^</td>
</tr>
<tr>
<td>3E</td>
<td>&gt;</td>
<td>5F</td>
<td>■ (box mark)</td>
</tr>
<tr>
<td>3F</td>
<td>?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>@</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Table 10-8: Alphanumeric Character Chart (Continued)*
In this Appendix you will find:

- physical specifications for the equipment (including materials, dimensions, and weights)
- technical specifications for the equipment (including environmental, electrical, and air requirements; and, specifications for the keyboard, display, and character set)
- printing specifications pertaining to the printer’s output. Included in this section are specifications covering the print matrices, print resolution and spot size, maximum print rate, maximum line speed, nominal character height, and nominal character pitch

### Physical Specifications

<table>
<thead>
<tr>
<th></th>
<th>Model 37pc/UI</th>
<th>Model 37pc/UI-S</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control Unit</td>
<td>Steel (refer to Figure A-1 for dimensions). Requires mounting stand.</td>
<td>Steel (refer to Figure A-2 for dimensions). Requires mounting stand.</td>
</tr>
<tr>
<td>Printhead</td>
<td>Stainless steel cover and chassis (refer to A-3 for dimensions). Nozzle type: 70 micron, universal.</td>
<td>Stainless steel cover and chassis (refer to A-3 for dimensions). Nozzle type: 70 micron, universal.</td>
</tr>
<tr>
<td>Umbilical</td>
<td>Vinyl-coated, armored conduit</td>
<td>Vinyl-coated, armored conduit</td>
</tr>
<tr>
<td></td>
<td>Dimensions: 10 ft. (3.66 m) in length, .7 in. (17.7 mm) in diameter. Bend radius: 6 in. (152.4 mm), minimum.</td>
<td>Dimensions: 10 ft. (3.66 m) in length, .7 in. (17.7 mm) in diameter. Bend radius: 6 in. (152.4 mm), minimum.</td>
</tr>
<tr>
<td>Weights</td>
<td>approx. 47.5 lbs. (21.5 kg), unpacked, and dry.</td>
<td>approx. 75 lbs. (33.75 kg), unpacked, and dry.</td>
</tr>
<tr>
<td></td>
<td>approx. 52.5 lbs. (23.8 kg), unpacked and loaded with fluid.</td>
<td>approx. 80 lbs. (36.36 kg), unpacked and loaded with fluid.</td>
</tr>
</tbody>
</table>
Figure A-1. Printer Dimensions for Model 37PC/UII
Figure A-2. Printer Dimensions for Model 37PC/UI-S

- 21.5 inches (56.6 cm)
- 11.55 inches (29.3 cm)
- 16.75 inches (42.5 cm)
- 11.05 inches (28.1 cm)
Figure A-3. Printhead Dimensions
Environmental Requirements

Note: The typical temperature and humidity ranges specified below are subject to the type of ink used. Refer to the InkSource® Bulletin (supplied with the ink) for additional information.

| Temperature | Operating, 40°F to 110°F (4.4°C to 43°C).  
Storage, -40°F to +140°F (-40°C to +60°C). |
|-------------|---------------------------------------------|
| Humidity    | Operating, 10% to 90% RH without condensation.  
Storage, 5% to 95% RH without condensation. |
Electrical Requirements

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>90 to 260 VAC.</td>
</tr>
<tr>
<td>Frequency</td>
<td>50/60 Hz, universal.</td>
</tr>
<tr>
<td>Power Consumption</td>
<td>30 watts, maximum.</td>
</tr>
</tbody>
</table>

Air Requirements

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Pressure</td>
<td>75 psi (5.17 bar), minimum.</td>
</tr>
<tr>
<td></td>
<td>100 psi (6.87 bar), maximum.</td>
</tr>
<tr>
<td>Consumption</td>
<td>0.7 SCFM (1698.9 l/hr.), maximum at 70 psi.</td>
</tr>
<tr>
<td>Quality</td>
<td>Instrument quality (filtered to .03 micron, no more than 1 PPM oil content, and 99% water-free).</td>
</tr>
<tr>
<td>Pressure Dew Point</td>
<td>Less than 40°F at 70 psi (4.4°C at 4.80 bar).</td>
</tr>
</tbody>
</table>
## User Interface

<table>
<thead>
<tr>
<th>Display</th>
<th>20 character, 4-line LCD.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Keyboard</td>
<td>Moisture and ketone resistant, membrane-type. Contains 9 control keys, 3 mode keys, 2 function keys and a Help key.</td>
</tr>
</tbody>
</table>

Figure A-4. Keyboard

## Printing Specifications

The following specifications cover the printed output of the printer. Refer to the documentation included with the ink supplies (ink, make-up fluid, and cleaning solution) for general information and specifications regarding those items.
Print Matrices

Available are operator-selectable print matrix options.

<table>
<thead>
<tr>
<th>Parallel Mode</th>
<th>Serial Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>POSTNET</td>
<td>POSTNET</td>
</tr>
<tr>
<td>Bar/No Bar (4mm) (I.D.Tag)</td>
<td>Bar/No Bar (4mm)</td>
</tr>
<tr>
<td>4-State (IMB)</td>
<td>Bar/No Bar (5mm)</td>
</tr>
<tr>
<td>5x5 Alpha-numeric characters</td>
<td>4 State</td>
</tr>
<tr>
<td></td>
<td>4 State (IMB)</td>
</tr>
<tr>
<td></td>
<td>4 State/3 Bar</td>
</tr>
<tr>
<td></td>
<td>5 x 5 Alpha-numeric Characters</td>
</tr>
</tbody>
</table>

Maximum Print Rate

Serial Mode

Maximum of 4009 bars/second for all bar types. The 5x5 alphanumeric font will maintain spacing of 8.3 characters per inch up to a maximum line speed of 188 inches/sec (4775mm/sec) when using the internal encoder. The 5x5 alpha-numeric font will be capable of printing 1560 characters/second when using an external encoder.

Parallel Mode

Depends on bar code type:

<table>
<thead>
<tr>
<th>POSTNET</th>
<th>Bar-No Bar (I.D.Tag) / 4-State (IMB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4327 Bars/Sec</td>
<td>4020 Bars/Sec</td>
</tr>
<tr>
<td>Alpha-Numeric 1479 Chars./Sec.</td>
<td>5 x 5 Single Line Alpha-Numeric</td>
</tr>
<tr>
<td></td>
<td>(1479 Chars./Sec.)</td>
</tr>
</tbody>
</table>

Maximum Line Speed

Up to 188 inches/second, depending on mode (parallel/serial) and print density:

Nominal Character Height

<table>
<thead>
<tr>
<th>5 x 5 Alpha-Numeric Characters</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.115 inches (2.9 mm)</td>
</tr>
</tbody>
</table>
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