SERVICE MANUAL

VIDEOJET EXCEL®

170i Printer

365224-01-A

08/94

Procedures in this manual should be performed only by trained service or maintenance personnel.

recycled paper

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Marconi Data System Inc.
1500 Mittel Boulevard, Wood Dale, IL 60191-1073 U.S.A.

Marconi Data Systems Inc. Printer Compliance Information

Safety

For all customers

This equipment is UL listed in the U.S.A., CSA certified in Canada, and certified by TUV Product Service for safety in the European Union. It meets the requirements of the low voltage directive in the European Union.

Electromagnetic Compatibility

For customers in the U.S.A.

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 reasonable 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.

For customers in Canada

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Pour la clientèle du Canada

Cet appareil de la classe A respecte toutes les exigencies du Reglement sur la materiel brouilleur du Canada.

For customers in the European Union

This printer complies with all requirements of the Electromagnetic Compatibility directive of the European Union. All Marconi accessories designed to be used with this printer maintain this compliance. If non-Marconi accessories are attached to the printer, it is the sole and full responsibility of the customer to ensure that they meet the requirements of this directive. Attaching non-compliant accessories may increase the risk of injury, and cause the printer to exceed the limits of the Electromagnetic Compatibility directive.

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1

Introduction

In this chapter you will find:

- a brief description of the intended use of the product
- who this manual is intended for, how it is organized, and the writing conventions that are used to present information
- an introduction to each of the chapters in this manual
- a recommended order of steps to follow for first time or inexperienced users when getting ready to serviceoperate the printer



WARNING: Read Chapter 2, *Safety*, before attempting to operateservice the equipment.

Turn to page 1-2 for a chapter-level Table of Contents.

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Introduction

The VIDEOJET EXCEL® 170i printer is a non-contact ink jet printer designed to print small character messages onto a product. This equipment is typically used for industrial marking, coding, and overprinting.

References to the EXCEL 170i Printer

For ease of reading, the VIDEOJET EXCEL 170i printer will be referred to as the “EXCEL printer” or “printer” throughout the remainder of this manual.

Printer Supplies

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

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

Who Should Use this Manual?

Introduction

This manual is intended for use by VIDEOJET service personnel and those customers who are qualified to perform their own printer service and maintenance.



WARNING: Customers who intend to service and maintain the printer themselves must have qualified personnel only 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 Service Manual is intended to be a supplement (and not a replacement) to training.

The manual contains information on installing, setting up, maintaining, troubleshooting, and servicing the printer. Refer to the *VIDEOJET EXCEL 170i Owner's Manual* (also supplied with the printer) for information on operating the printer.

Unless otherwise noted, all procedures in this manual can be performed by the operator of the printer.



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 Service Manual is intended to be a supplement (and not a replacement) to training.

Keep this manual in a safe location where it can be easily accessed for reference.

Writing Conventions Used in this Manual

Introduction

The following ways of presenting information are commonly used throughout this manual. These writing conventions are used to set specific types of key information apart from the common text.

Note: Refer to *Chapter 2, Safety*, for examples of Warning and Caution statements.

Printer Keys and Status Lights

All keys and status lights on the keyboard are shown in bold type when referred to within the text.

For example:

Press the **ON** key to turn the printer On. The **HEAD** light will flash to indicate that the printer start-up sequence has begun.

Notes

The word **Note** is used to support a particular step or piece of information.

For example:

1. Turn the ink pressure regulator knob clockwise until the pressure gauge reads17-20 psi (1.16-1.37 bar).

Note: Set the ink pressure to approximately 17 psi (1.16 bar) if you are using an alcohol/ketone based ink or to approximately 20 psi (1.37 bar) if using a water/poly based ink.

Display Screen Text

Any word, character, or symbol which appears in the display screen is shown surrounded by the arrow symbols (<,>) when referred to within the text.

For example:

1. Press **F3** to select <VIEW PRINT>. This will display the last message that was loaded into the printer.

EXCEL 170i Owner's Manual

Introduction

The *EXCEL 170i Owner's Manual* includes all the procedures required to operate the printer. This includes installation, using the Software Summary Chart, performing system set-up, and creating and printing messages.

EXCEL 170i Service Manual

Introduction

Included with the printer is the *EXCEL 170i Printer Service Manual*. The service manual includes information about installing, setting up, maintaining, troubleshooting, and servicing the printer. Also included in the service manual are sections about theory of operation, component identification, component removal and replacement, specifications, accessories and spare parts, and an illustrated parts breakdown.

Who Should Use the Service Manual?



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 Service Manual is intended to be a supplement (and not a replacement) to training.

Keep the service manual for future reference, even if you should choose to have VIDEOJET (or one of its distributors) maintain and service your printer.

VIDEOJET Customer Training

Introduction

For customers who intend to service and maintain the printer, VIDEOJET highly recommends the completion of a Customer Training Course covering the VIDEOJET 170i printer. The Service Manual is intended to be a supplement (and not a replacement) to VIDEOJET Customer Training.

For more information on VIDEOJET Customer Training Courses, call 708-860-7300 (within the U.S.A. only). Outside the U.S.A., customers should contact a VIDEOJET subsidiary office or their local VIDEOJET distributor for further information.

Service Manual Overview

Chapter 2, Safety Data

This chapter contains important equipment and safety guidelines, as well as the safety writing conventions used throughout the manual.

Chapter 3, Equipment Description and Component Identification

This chapter shows the location and provides a brief description of each of the main components in the printhead, and the hydraulic, pneumatic, and electronic compartments of the printer.

Chapter 4, Theory of Operation

This chapter includes an overview of the fluids system, a description of how ink drops are created and controlled, and detailed functional sequences of operation for electrical, hydraulic and pneumatic functions.

Chapter 5, Software Service Mode

This chapter details each of the software functions available in the Service mode of the Software Summary Chart.

Chapter 6, Maintenance

The maintenance chapter lists all recommended scheduled maintenance procedures, ink maintenance procedures, and procedures to follow to attain the finest print quality.

Chapter 7, Troubleshooting

This chapter contains troubleshooting information for each of the printer faults and warnings, as well as additional information used to diagnose printer problems (such as LED indicators, electronic test points, and wiring diagrams).

Chapter 8, Installation

This chapter covers site preparation, and all necessary procedures to set-up the printer for operation.

Chapter 9, Illustrated Parts Breakdown

The Illustrated Parts Breakdown contains part-by-part descriptions and illustrations of each assembly in the system.

Chapter 10, Accessories and Spare Parts

This chapter contains information on all VIDEOJET accessories and spare parts available for the printer, and how to order them.

Chapter 11, Serial Interface

This chapter contains hardware descriptions, host and printer set-up, printed message set-up, ASCII character tables and hexadecimal character tables.

Chapter 12, Glossary

The Glossary provides definitions of many of the terms used in this manual.

Appendix A, Specifications

Appendix A lists printer technical specifications, physical specifications, dimensions, requirements, and print speeds.

Index

The index provides a cross reference for you to locate topics described in this manual.

*Total*Source[SM]

What is *Total*Source?

TotalSource, TOTAL SERVICE PLUS RELIABILITY, is VIDEOJET's commitment to provide to you—our customer—the complete service you deserve.

The VIDEOJET *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
- inks, make-up fluids, and supplies

If You Need Assistance

If you have any questions or need assistance, please contact MARCONI DATA SYSTEMS INC. at **800-843-3610** (for all customers within the U.S.A.). Outside the U.S.A., customers should contact their MARCONI distributor or subsidiary for assistance.

MARCONI DATA SYSTEMS INC.
1500 Mittel Boulevard
Wood Dale, IL 60191-1073 U.S.A.

Phone: 708-860-7300
Fax: 800-582-1343
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Notes:

2

Safety

In this chapter you will find:

- important safety guidelines to follow when operating the equipment
- important safety guidelines to follow when installing, operating, servicing, and maintaining 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
- safety conventions used in this manual



WARNING: Read this chapter thoroughly before attempting to operate this product.



WARNING: Read this chapter thoroughly before attempting to operate this product.

Refer to page 2 for a chapter-level Table of Contents.

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Introduction

The policy of MARCONI DATA SYSTEMS INC. is to manufacture non-contact printing/coding systems and ink supplies which 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 the EXCEL 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 in order to operate the printer in a safe manner.

The safety guidelines provided in this chapter are intended to educate the operator on all safety issues in order to install, operate, service, and maintain the printer in a safe manner.

Safety Conventions Used in this Manual

Introduction

Specific safety information is listed throughout this manual in the form of “DANGER,” “WARNING,” and “CAUTION” statements.

Danger statements are described below.

- *Warning statement . . . . . turn to page 2-5*
- *Warning statement . . . . . below*
- *Caution statement . . . . . turn to page 2-6*

Pay close attention to these statements as they contain important information on avoiding potential hazards to yourself or to the equipment.

Danger Statements

“DANGER” statements:

- are used to indicate immediate hazards which WILL result in severe personal injury or death
- appear in **bold** type,
- have a triangular symbol with an exclamation point to the immediate left
- are preceded by the word “DANGER”
- are always found before the step or piece of information to which they refer

Refer to Figure 2-1 for an example of how a Danger statement is presented in this manual.

For example:



DANGER: Turn the AC power switch Off and disconnect the power from the electrical source before removing the AC power switch.

1. Use a screwdriver to pry the AC power switch from the printer cabinet.

Figure 2-1. “Danger” Example

Warning Statements

Warning statements:

- are used to indicate hazards or unsafe practices which COULD result in severe personal injury or death
- appear in **bold** type
- have a triangular symbol with an exclamation point to the immediate left
- are preceded by the word WARNING
- are always found before the step or piece of information to which they refer

For example:



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 Service Manual is intended to be a supplement (and not a replacement) to training.

Caution Statements

Caution statements:

- are used to indicate hazards or unsafe practices which COULD result in minor personal injury or product or property damage
- appear in **bold** type
- are always preceded by the word CAUTION
- are always found before the step or piece of information to which they refer

For example:



CAUTION: For Continued Protection Against Possible Fire Hazard, Use Only VIDEOJET Fluids With a Flashpoint No Lower Than -6°C (21°F) and Boiling Point No Lower Than 56°C (133°F).

Equipment Safety Guidelines

WARNING: Always observe the following safety guidelines when operating the printer and associated equipment.

WARNING: Always observe the following safety guidelines when installing, operating, servicing, or maintaining 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 vapors through the muffler. These vapors 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 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 MARCONI. Refer to *Accessories and Spare Parts* for further information.

Do Not Remove Warning Labels



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

Placement of Printer



WARNING: Do not place the printer in an explosive atmosphere.

Ink Safety Guidelines

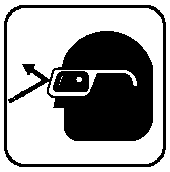
WARNING: Always observe the following safety guidelines when working with any ink, make-up fluid, or cleaning solution.

CAUTION: For Continued Protection Against Possible Fire Hazard, Use Only VIDEOJET Fluids With a Flashpoint No Lower Than -6°C (21°F) and Boiling Point No Lower Than 56°C (133°F).



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 doctor 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 doctor if irritation persists.



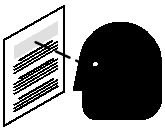
Avoid Breathing in Vapors

Avoid prolonged exposure to vapors. Consult the Material Safety Data Sheet (MSDS) for recommendations on engineering controls and personal protective equipment.



Dispose of Ink Properly

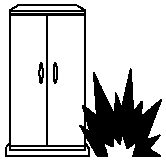
Do not pour any ink, make-up fluid, or cleaning solution into sinks, sewers, or drains. Waste disposal must comply with local regulations; contact the appropriate regulatory agency for further information.



Read the Material Data Safety Sheets (MSDS)

Read and understand the Material Safety Data Sheet (MSDS) before using any ink, make-up fluid, or cleaning solution. A 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. Additional copies of MSDSs are available upon request and can be obtained by contacting the MARCONI DATA SYSTEMS INC. Customer Service Department at 800-843-3610. Outside the U.S., customers should contact a MARCONI subsidiary office or their local MARCONI distributor.



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.

Ground the Service Tray

Ground the VIDEOJET service tray to the printer, and install the printhead into the service tray when test printing or dumping ink from the printhead. This is necessary to avoid the possibility of electrostatic discharge which may result in fire.

MARCONI highly recommends the use of the, MARCONI-approved service tray. Use of a non-metallic container presents a significant risk of fire due to static discharge. Refer to Figure 2-2 for the recommended grounding method.

Note: The service tray is available through MARCONI. Refer to *Accessories and Spare Parts* for further information.

WARNING: Ground the VIDEOJET service tray to the printer and install the printhead into the service tray. Failure to do this when using flammable ink presents a significant risk of fire due to static discharge.

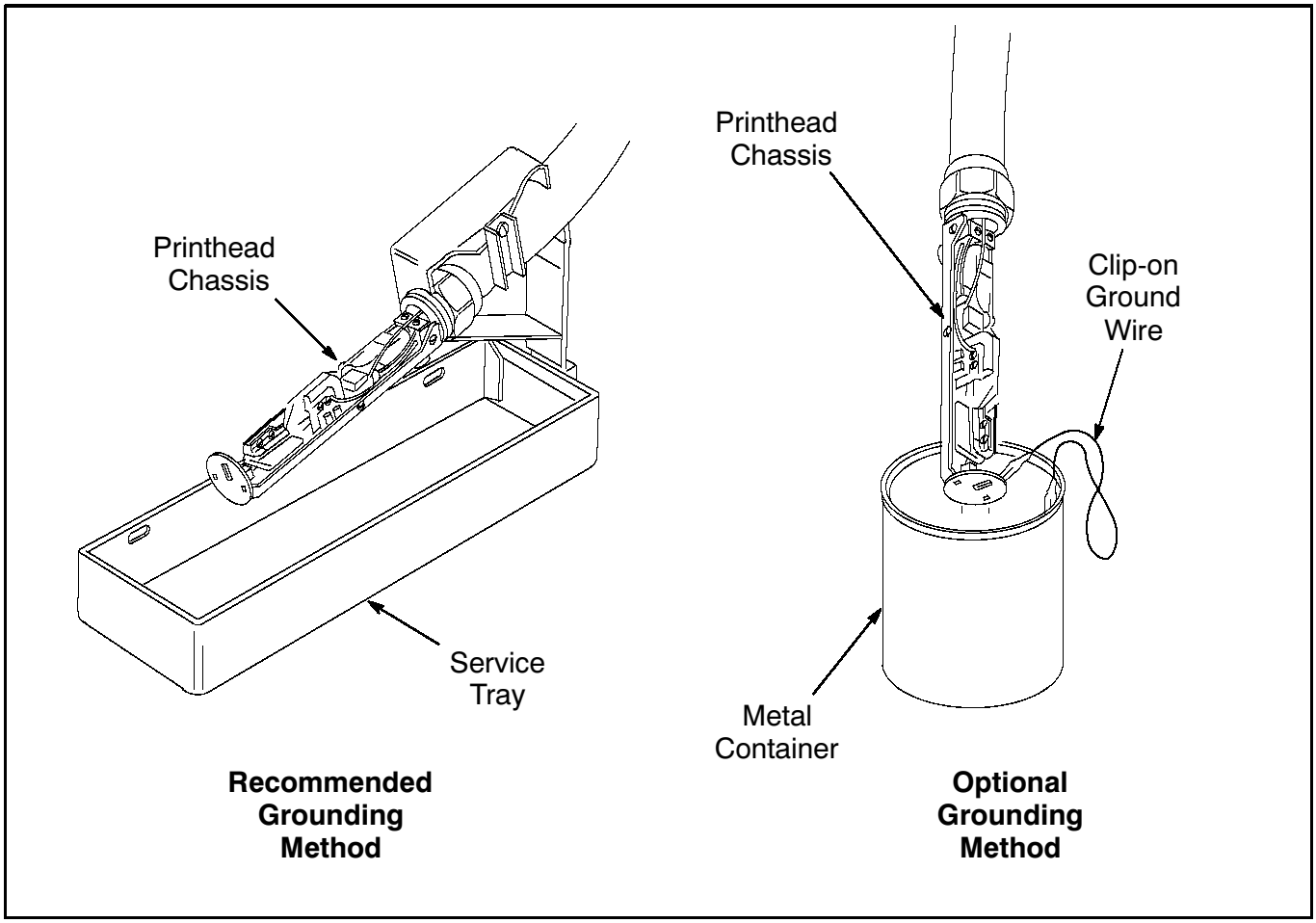


Figure 2-2. Grounding the Service Tray to the Printer

Medical Emergencies



WARNING: In the event of a medical emergency, contact a doctor 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 doctor's office. These items contain important information which the doctor may require in order to provide treatment.

Rocky Mountain Poison Control Center

All of MARCONI's inks, make-up fluids, and cleaning solutions are also registered with the Rocky Mountain Poison Control Center, located in the U.S.A. If the bottle or MSDS cannot be located, the doctor 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 U.S.A. requiring medical attention can have a doctor contact the Rocky Mountain Poison Control Center in the U.S.A. or a poison control center or hospital in their own area.

3

Equipment Description and Component Identification

In this chapter you will find:

- a brief description of the two main printer assemblies—the control unit and the printhead
- the location and a brief description of the function of the main components in the the hydraulic, pneumatic, and electronic compartments of the printer, as well as the printhead

Turn to page 3-2 for a chapter-level Table of Contents.

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Equipment Description

Introduction

The VIDEOJET EXCEL 170i printer is comprised of two basic assemblies—the control unit and the printhead—connected by an umbilical assembly (a flexible conduit containing electrical and fluid lines). Refer to Figure 3-1.

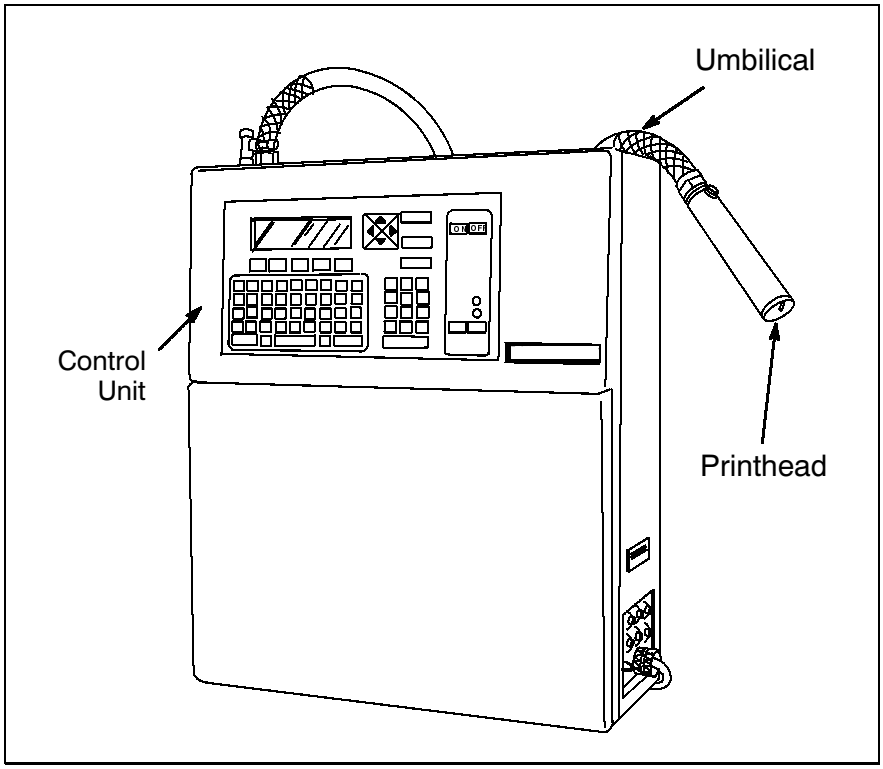


Figure 3-1. VIDEOJET EXCEL 170i Printer

The Control Unit

The control unit consists of the hydraulic, pneumatic, and electronic compartments of the printer, as well as the keyboard (refer to Figure 3-2).

Hydraulics Compartment (Fluid Pan)

The hydraulics compartment is located behind the front door of the control unit (refer to Figure 3-2). This is where ink and make-up fluid are stored, monitored, and maintained to ensure proper fluid viscosity (thickness). This is also where pressure is applied to the ink to ensure proper velocity of the ink drops at the printhead.

Note: The hydraulics compartment is also commonly referred to as the “fluid pan.”

For more information

Refer to *Hydraulic Components* on page 3-10 for information on the main components found in the hydraulics compartment.

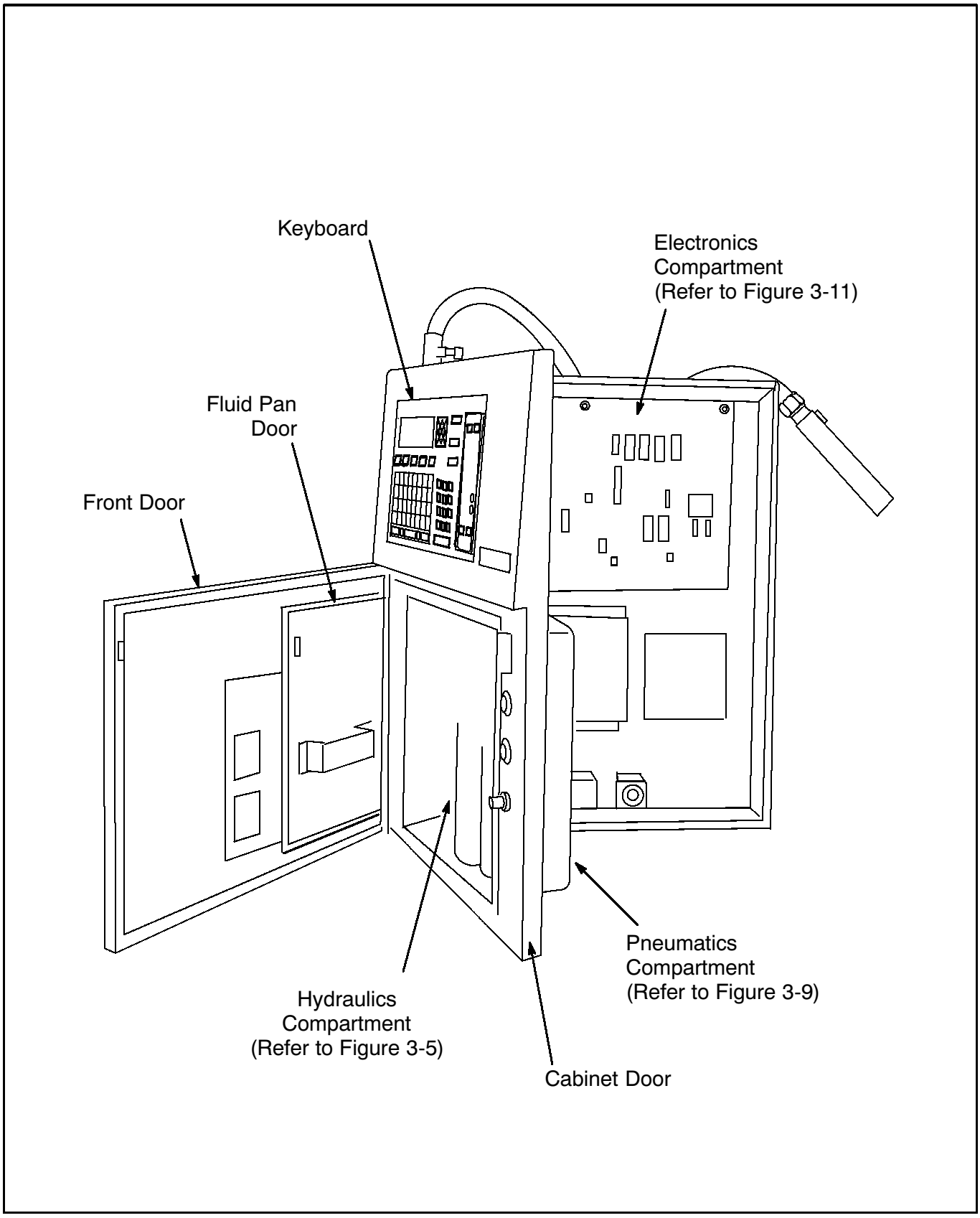


Figure 3-2. The Control Unit

Pneumatics Compartment

The pneumatics compartment is located on the back side of the cabinet door (refer to Figure 3-2). This is where incoming air pressure is regulated, controlled, and distributed.

For more information

Refer to *Pneumatic Components* on page 3-15 for information on the main components found in the pneumatics compartment.

Electronics Compartment

The electronics compartment is located against the back side of the control unit cabinet (refer to Figure 3-2). This is where all electrical and electronic signals are generated and controlled.

For more information

Refer to *Electronic Components* on page 3-19 for information on the main components found in the electronic compartment.

Keyboard

The keyboard is located on the front of the control unit (refer to Figure 3-2). The keyboard consists of control keys, an alpha keypad, a numeric keypad, and a display screen (refer to Figure 3-3). Use the keyboard to operate the printer.

For more information

Refer to the *EXCEL 170i Owner's Manual* for information on how to use the keyboard to create and print messages and perform other functions.

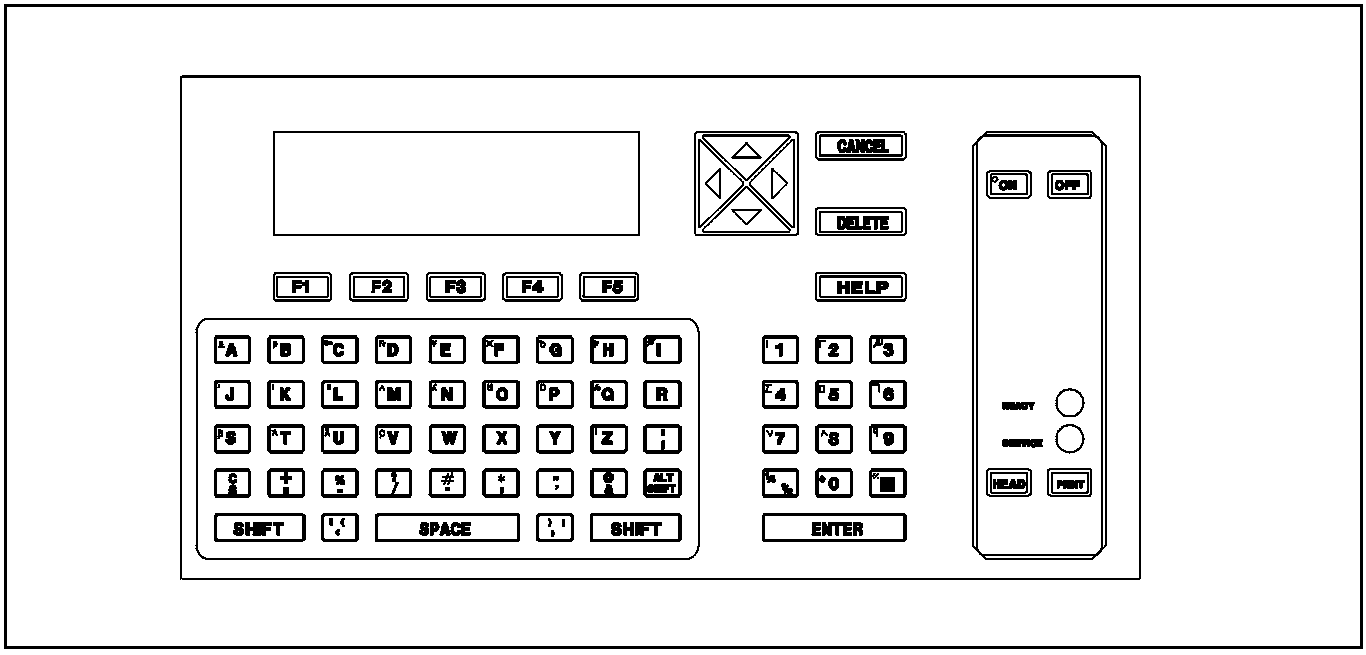


Figure 3-3. Keyboard

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.

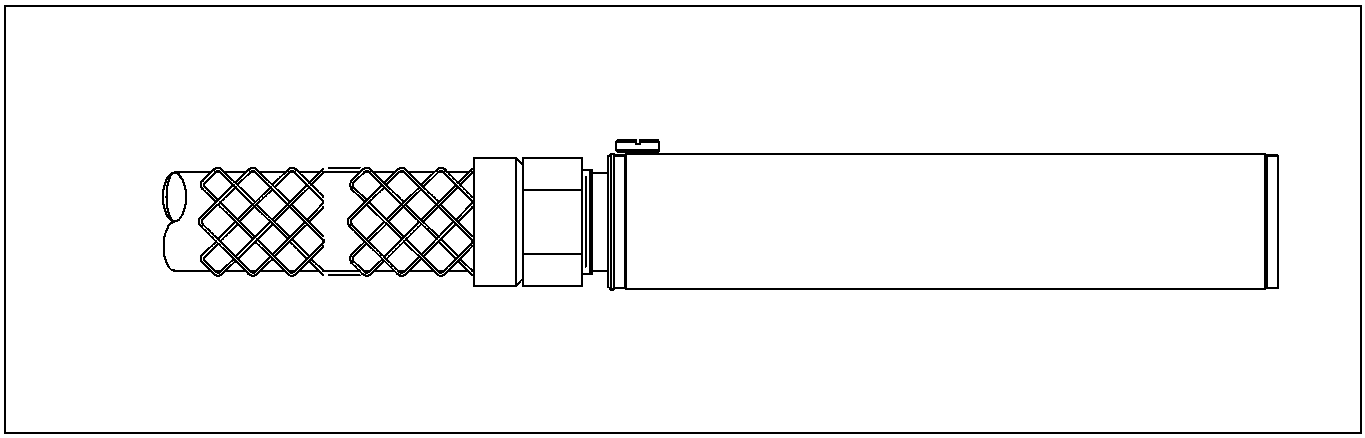


Figure 3-4. EXCEL 170i Printhead

For more information

Refer to *Printhead Components* on page 3-22 for information on the main components found in the printhead.

Refer to Chapter 4, *Theory of Operation*, for more information on how the printhead works.

Component Identification

Introduction

This section identifies the location and describes the function of the main components included in the hydraulic, pneumatic, and electronic compartments of the control unit, as well as the main components in the printhead. **Only main printer components are covered in this section.**

This section is broken down into the following subsections:

- *Hydraulic Components . . . . . turn to page 3-10*
- *Pneumatic Components . . . . . turn to page 3-15*
- *Electronic Components . . . . . turn to page 3-19*
- *Printhead Components . . . . . turn to page 3-22*

Finding the Location and Description of a Main Component

The list starting below and continuing to the next page shows each of the main printer components covered in this section. Included for each component is the following information:

- The page number where the component is located on the printer.
- The page number where you can find a brief description of the function of the component.

Note: Components below are listed alphabetically.

Component Name	Location	Description
AC Line Filter	Page 3-20	Page 3-21
Air Control Solenoid	Page 3-15	Page 3-16
Air Control Valve	Page 3-15	Page 3-16
Aux. +12V DC Power Supply	Page 3-20	Page 3-21
Cabinet Door Latch	Page 3-10	Page 3-11
Cabinet Door Lock	Page 3-10	Page 3-11
Charge Tunnel	Page 3-22	Page 3-23
Circuit Breaker	Page 3-20	Page 3-21
Display Contrast Knob	Page 3-10	Page 3-11
Dual High Voltage Power Supply	Page 3-20	Page 3-20
Ground Plate	Page 3-22	Page 3-23

Continued on next page ▶

Component Name	Location	Description
High Voltage Deflection Plate	Page 3-22	Page 3-23
Horizontal Adjustment Screw	Page 3-22	Page 3-24
Horizontal Locking Screw	Page 3-22	Page 3-23
Ink Add Solenoid	Page 3-17	Page 3-18
Ink Bottle	Page 3-10	Page 3-11
Ink Control Valve	Page 3-22	Page 3-23
Ink Low Needle Valve	Page 3-17	Page 3-19
Ink Low Switch	Page 3-15	Page 3-16
Ink Module Assembly	Page 3-14	Page 3-14
Ink Pressure Gauge	Page 3-10	Page 3-10
Ink Pressure Regulator	Page 3-12	Page 3-12
Ink Return Block	Page 3-22	Page 3-23
Ink Return Line	Page 3-22	Page 3-24
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Hydraulic Components

Refer to Figure 3-5 and Figure 3-6 for the location of the main hydraulic components, and refer to the following pages to find a brief description of the function of the components.

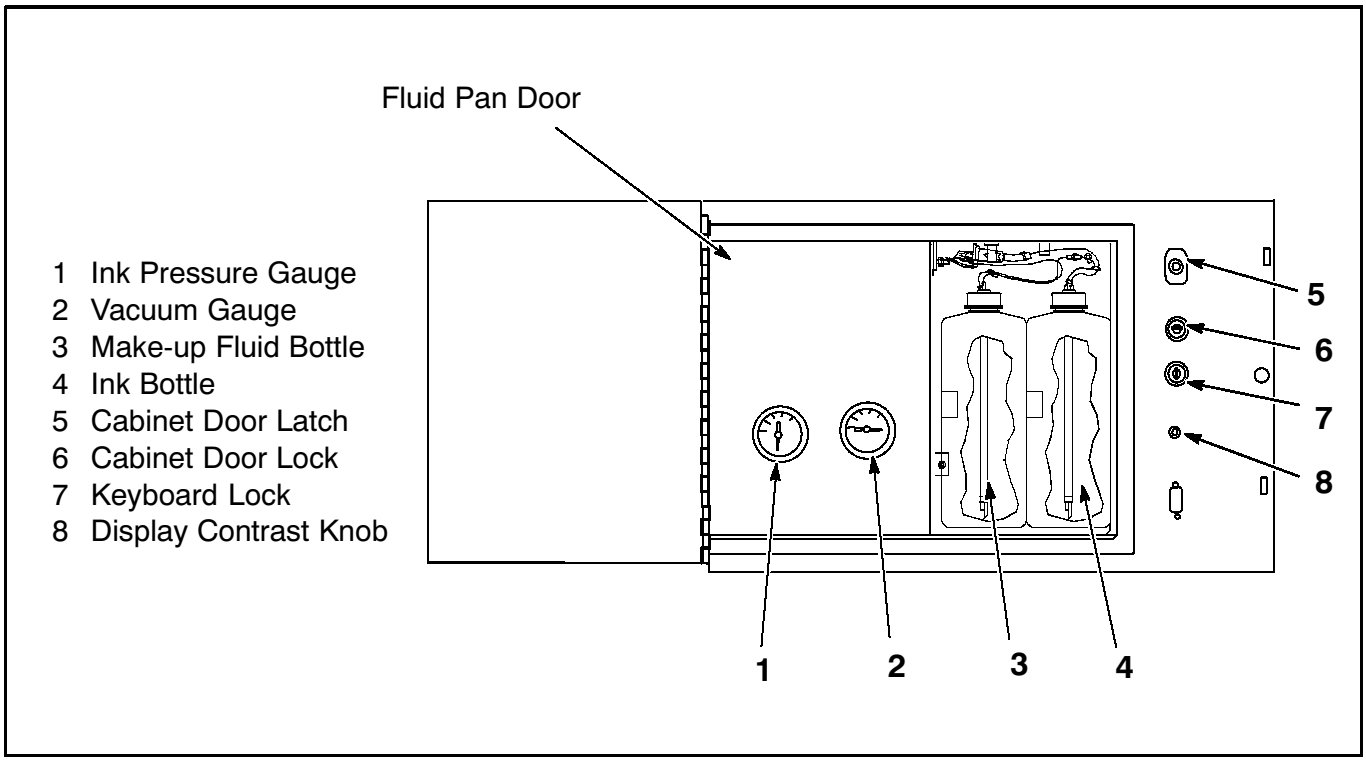


Figure 3-5. Hydraulics Compartment (with fluid pan door closed)

1 **Ink Pressure Gauge**

The ink pressure gauge indicates the amount of air pressure (in psi and bar) applied to the ink supply cylinder. This pressure is commonly referred to as “ink pressure.” The ink pressure is controlled by adjusting the ink pressure regulator (refer to page 3-12).

2 **Vacuum Gauge**

The vacuum gauge measures the current level of vacuum (in inches and cm of Hg) within the system. The vacuum level is controlled by adjusting the vacuum needle valve (Refer to page 3-18).

3 **Make-up Fluid Bottle**

The make-up fluid bottle 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.

4 **Ink Bottle**

The ink bottle contains the fresh ink, which is drawn into the ink module assembly as needed.

5 **Cabinet Door Latch**

The cabinet door latch enables you to use the hex key (supplied with the printer) to open and close the cabinet door to access the pneumatic and electronics compartments of the printer.

Note: The cabinet door lock also must be unlocked to open the cabinet door.

6 **Cabinet Door Lock**

The cabinet door lock allows you to use the key (supplied with the printer) to open and close the cabinet door to access the pneumatic and electronic compartments of the printer.

Note: In order to open the cabinet door, the cabinet door latch must also be unlocked.

7 **Keyboard Lock**

The keyboard lock allows you to use the key (supplied with the printer) to prevent unauthorized users from accessing the software. Only certain keys on the keyboard are active when the keyboard is locked. Refer to the *EXCEL 170i Owner's Manual* for further information.

8 **Display Contrast Knob**

The display contrast know allows you to adjust the contrast (brightness) of the display screen located on the keyboard.

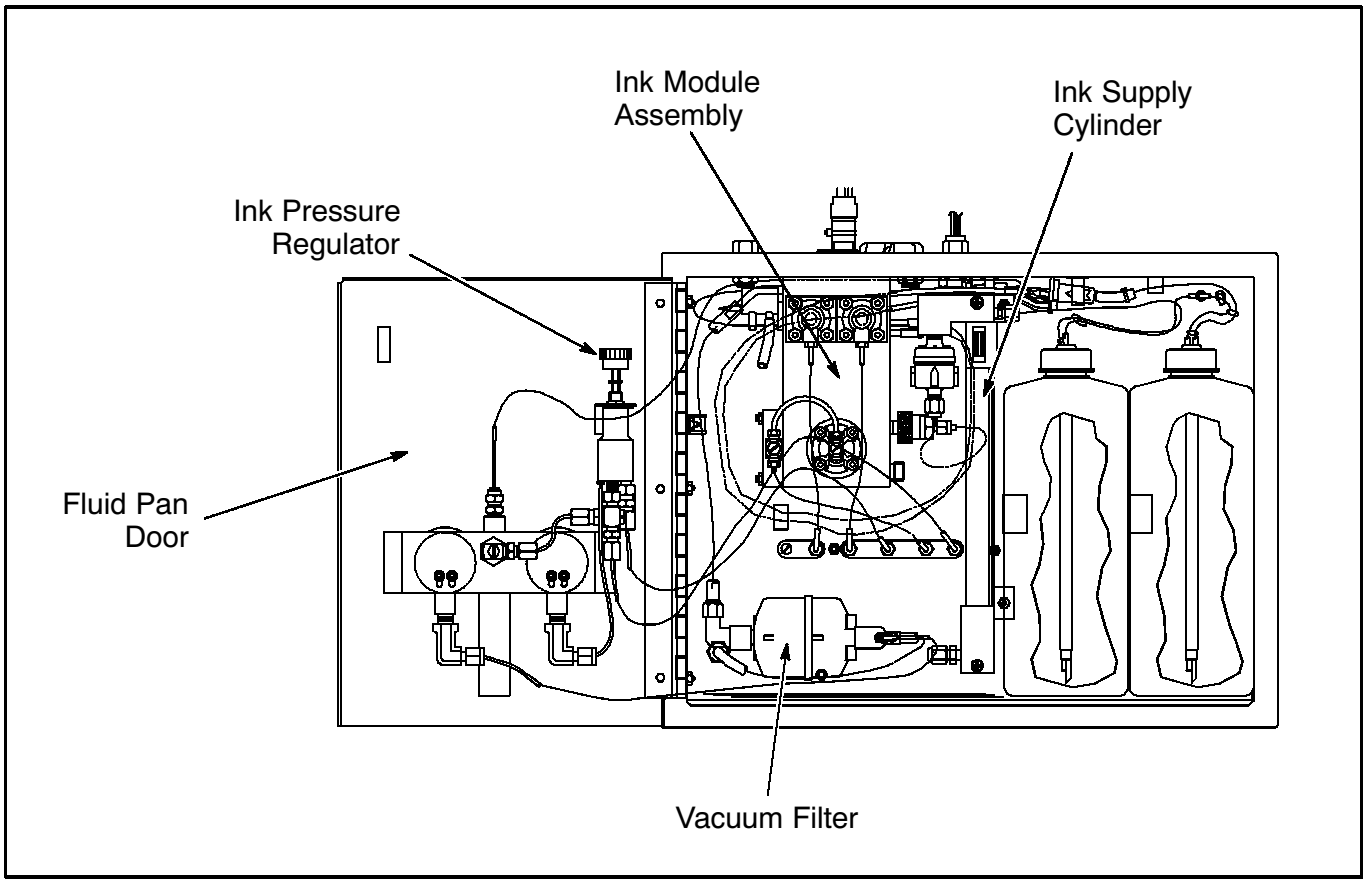


Figure 3-6. Hydraulics Compartment (Fluid Door Pan Opened)

9 **Ink Pressure Regulator**

The ink pressure regulator enables you to manually control the amount of air pressure supplied to the ink supply cylinder. This action, in turn, controls the speed of the ink drops through the printhead. Ink pressure is typically set at 40–60 psi (2.8–4.1 bar), depending on the type of ink used.

CAUTION: Do not adjust the ink pressure regulator unless you are performing the Ink Stream Calibration procedure.

10 **Vacuum Filter**

The vacuum filter limits ink particles from entering the solenoid bank and other passages inside the vacuum system.

11 **Ink Supply Cylinder**

The ink supply cylinder provides a constant supply of pressurized ink to the printhead. The ink supply cylinder contains a magnetic float and two externally mounted reed switches which are used to monitor ink viscosity and to maintain a sufficient fluid level in the cylinder.

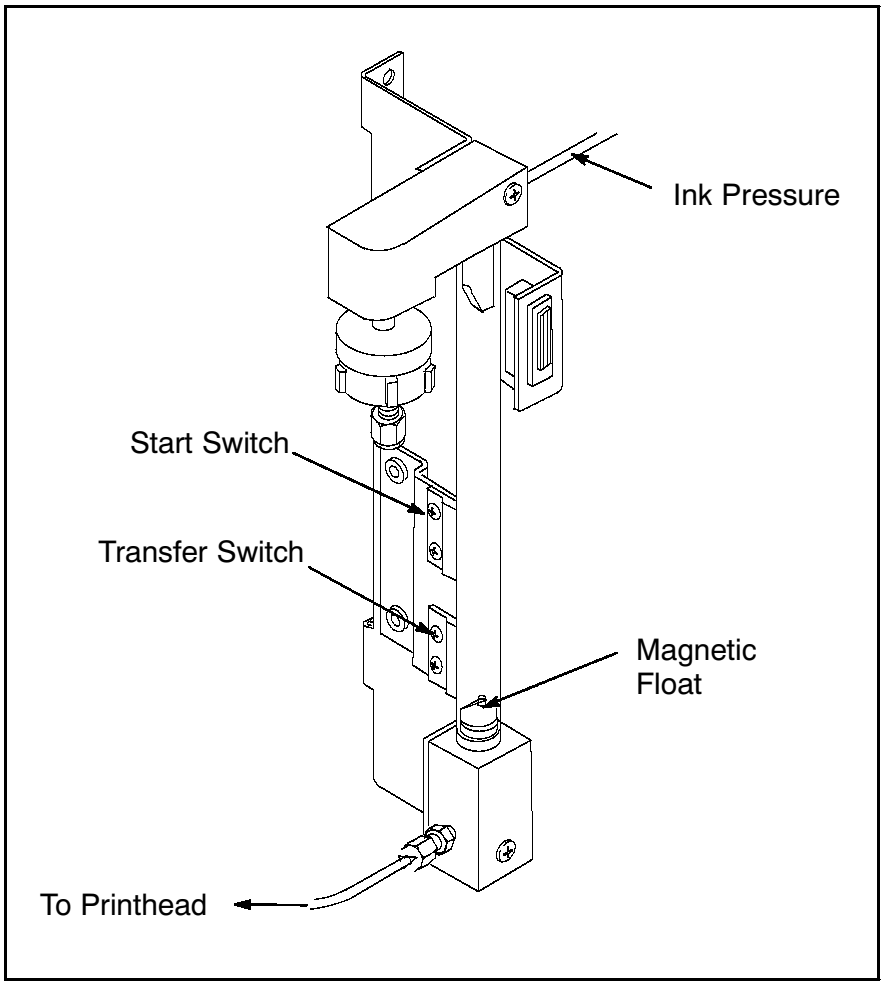


Figure 3-7. Ink Supply Cylinder

12 **Ink Module**

The ink module assembly contains all of the hydraulic components for the ink system, including the ink transfer pump, ink add valve, make-up fluid add valve, reed switch, check valve, shut-off valve, and the ink return tube (refer to Figure 3-8).

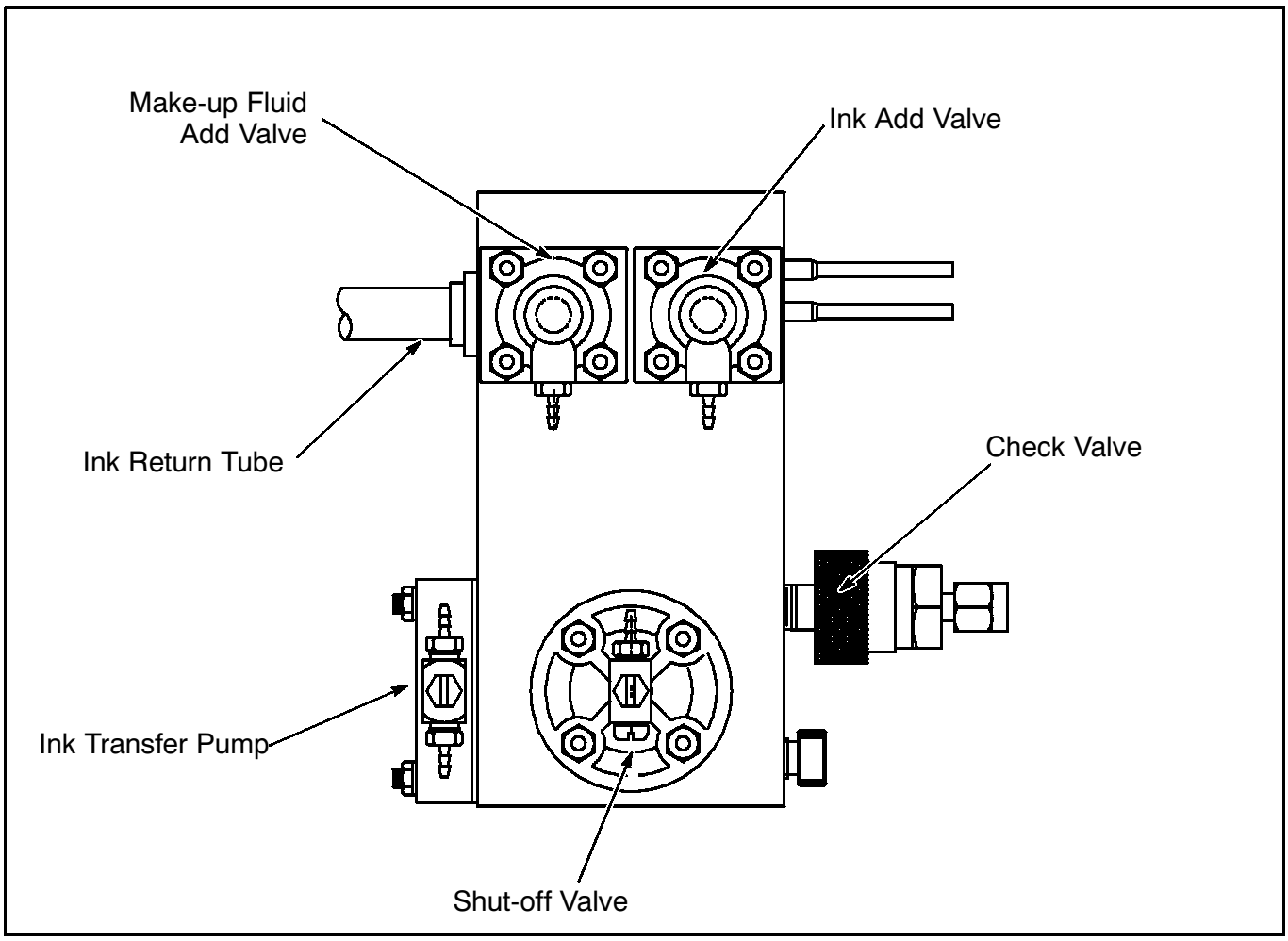
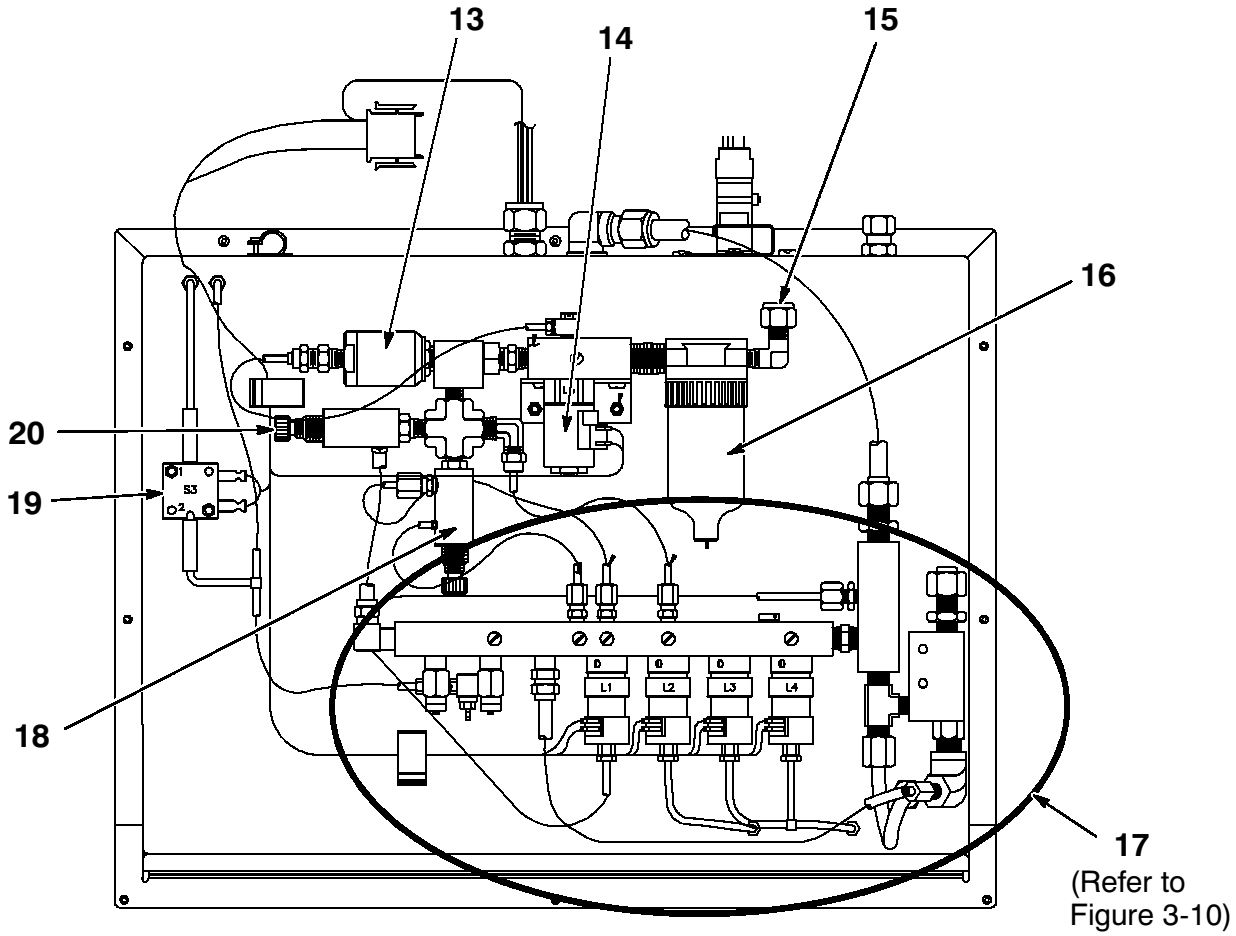


Figure 3-8. Ink Module

Pneumatic Components

Refer to Figure 3-9 for the location of the main pneumatic components, and refer to the following pages to find a brief description of the function of the components.

To access this compartment, use the keys and/or the hex key (supplied with the printer) to open the cabinet door.



13 Air Control Valve
14 Air Control Solenoid
15 Plant Air Input
16 Input Air Filter
17 Solenoid Bank
18 Transfer Pressure Regulator
19 Ink Low Switch
20 Intermediate Pressure Regulator

Figure 3-9. Pneumatics Compartment

13 **Air Control Valve**

Operated by pilot air from the air control solenoid, this valve allows air to flow to the entire system.

14 **Air Control Solenoid**

Operated by +12V DC, this solenoid allows pilot air pressure to enter the air control valve.

15 **Plant Air Input**

Regulated plant air pressure is supplied to the input air manifold assembly (consisting of the input air filter, air control valve, intermediate pressure regulator, transfer pressure regulator, and air control solenoid).

16 **Input Air Filter**

The input air filter removes contaminants present in the plant air before the air enters the air manifold assembly.

17 **Solenoid Bank**

The solenoid bank allows air and vacuum distribution to the appropriate ports and solenoids (refer to Figure 3-10).

18 **Transfer Pressure Regulator**

The transfer pressure regulator supplies air pressure to the ink transfer pump and the shut-off valve in the ink module assembly.

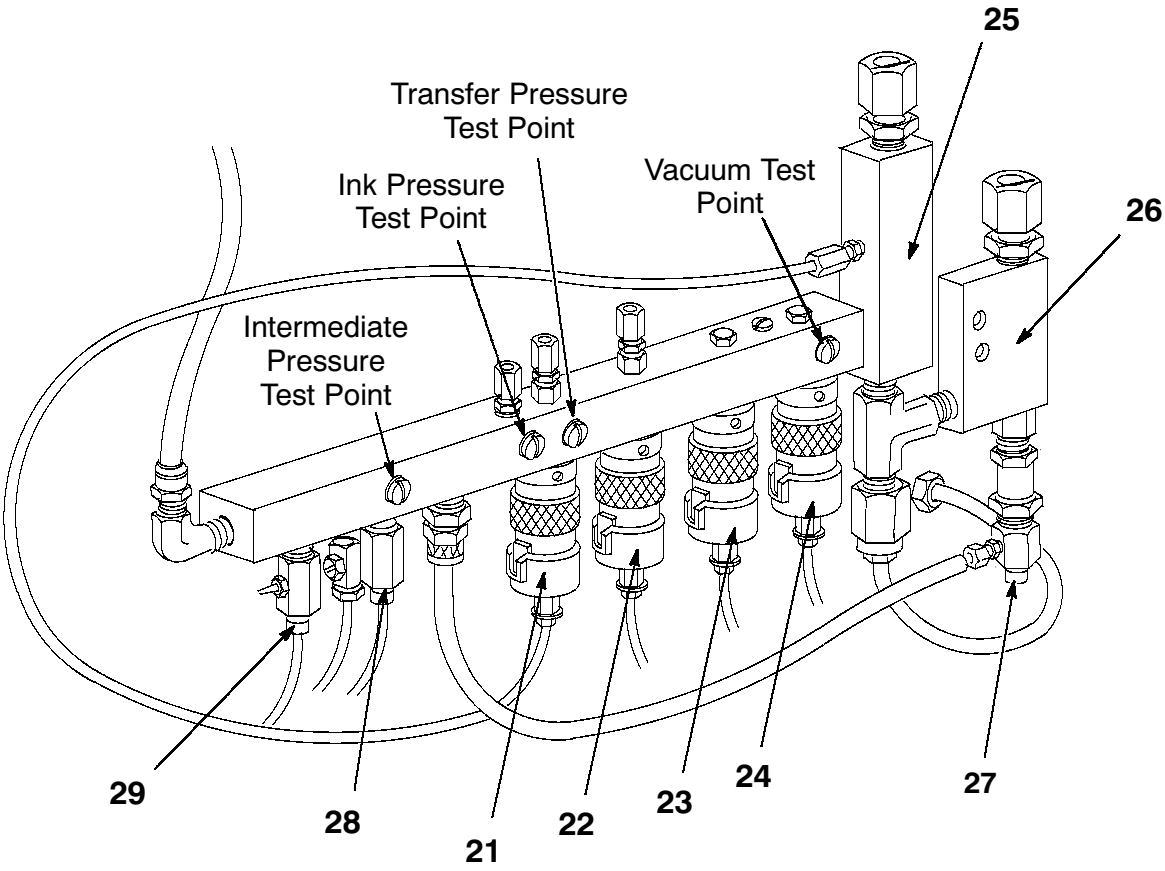
19 **Fluids Low Switch (also called Ink Low Switch)**

The fluids low switch monitors the fluid levels in the ink bottle and make-up fluid bottle through a small amount of air pressure in the bottles. The air flow to this switch is adjusted using the fluids low needle valve (refer to Figure 3-10).

20 **Intermediate Pressure Regulator**

The intermediate pressure regulator regulates air pressure to 60 psi (4.1 bar) and distributes the air to the ink low switch and the positive air and vacuum systems.

Note: The regulator is preset to 60 psi (4.1 bar) at the factory. Intermediate air pressure may be measured at a test port on the solenoid bank (refer to Figure 3-10).



21 Transfer Solenoid
22 Nozzle Solenoid
23 Ink Add Solenoid
24 Make-up Add Solenoid
25 Vacuum Check Valve
26 Vacuum Generator
27 Vacuum Needle Valve
28 Positive Air Needle Valve
29 Ink Low Needle Valve

Figure 3-10. Solenoid Bank

21 Transfer Solenoid

The transfer solenoid controls the flow of air and vacuum to the ink transfer pump located in the ink module assembly. When energized, the transfer solenoid supplies transfer (air) pressure to the ink transfer pump and the shut-off valve in order to perform an ink transfer cycle. When the solenoid is de-energized, vacuum is applied to the ink transfer pump and shut-off valve to reprime the pump for the next transfer cycle.

22 **Nozzle Solenoid**

When energized, the nozzle solenoid supplies air pressure to the ink pressure regulator. The ink pressure regulator supplies ink pressure to the ink supply cylinder. The nozzle solenoid is energized whenever the ink is On and the Head key is either flashing or on steady.

23 **Ink Add Solenoid**

When energized, the ink add solenoid allows vacuum to be applied to the ink add valve (located on the ink module assembly). This, in turn, allows fresh ink to be drawn from the ink bottle into the reservoir of the ink module assembly.

24 **Make-up Add Solenoid**

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

25 **Vacuum Check Valve**

The vacuum check valve is a safety valve designed to protect the fluid system in case of a plugged or kinked exhaust line. It prevents all components and systems under vacuum from becoming pressurized if the vacuum generator is restricted.

26 **Vacuum Generator**

The vacuum generator operates on the venturi principle to create low pressure (vacuum). Adjust vacuum with the vacuum needle valve.

27 **Vacuum Needle Valve**

The vacuum needle valve enables you to adjust the vacuum level leading into the vacuum system. Refer to the vacuum gauge to see the current vacuum setting.

28 **Positive Air Needle Valve**

The positive air needle valve enables you to adjust the positive air to the printhead. Positive air helps keep contaminants from entering the printhead. Although this valve is factory-preset, it is adjustable to 0.5-1.5 SCFH (14.16–42.47 L/hr) with the ink On. Use a flow meter to obtain an accurate setting.

Note: The exact setting depends on ambient conditions. However, too much pressure will cause misplaced ink drops and printer faults.

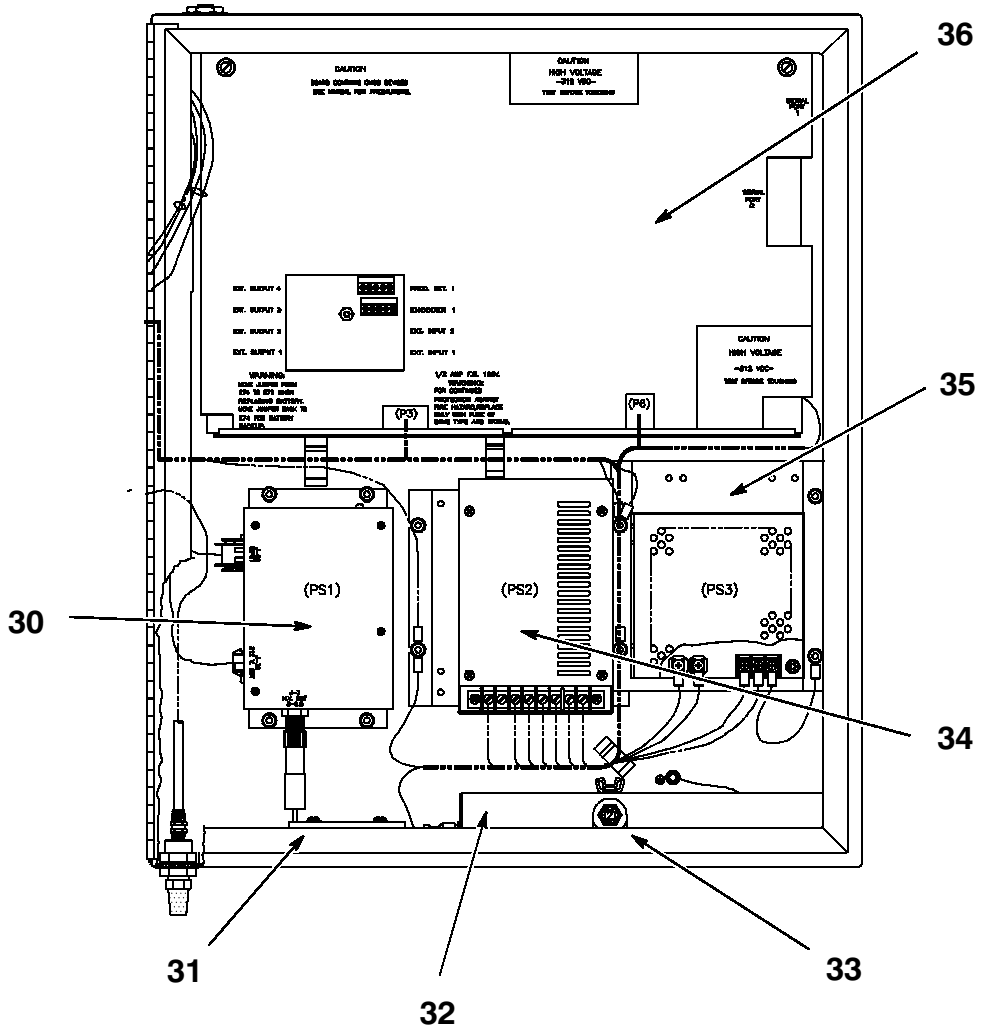
29 **Fluids Low Needle Valve (also called Ink Low Needle Valve)**

The fluids low needle valve enables you to adjust the air flow to the ink and make-up fluid bottles. This air is used to monitor the fluid level inside the bottles. This valve works in conjunction with the ink low switch.

Electronic Components

Refer to Figure 3-11 for the location of the main electronic components, and refer to the following pages to find a brief description of the function of the components.

To access this compartment, use the keys and/or the hex key (supplied with the printer) to open the cabinet door.



30 Dual High Voltage Power Supply
31 K1 Relay
32 AC Line Filter
33 Circuit Breaker
34 Low Voltage Power Supply
35 Aux. 12V Power Supply
36 Control Board

Figure 3-11. Electronics Compartment

30 Dual High Voltage Power Supply

Powered by the auxiliary +12 VDC power supply, the dual high voltage power supply provides +312 VDC to the charge amplifier and the nozzle drive circuits on the control board, and provides +3000-6000 VDC to the high voltage deflection plate in the printhead.

31 **K1 Relay**

The K1 relay is a solid state, optically operated relay enabled by the +9V DC battery and operated by the auxiliary +12V DC power supply.

32 **AC Line Filter**

The AC line filter is a low pass filter which prevents ultrasonic signals from being transmitted into the power lines.

33 **Circuit Breaker**

The circuit breaker interrupts the flow of AC current to the printer in the event of an overload. It is designed to open at two amperes.

34 **Low Voltage (Triple Output) Power Supply**

The low voltage power supply is a regulated power supply which supplies +5V, +12V, and –12V DC to the analog and logic circuits on the control board.

35 **Auxiliary +12V DC Power Supply**

The auxiliary +12 VDC power supply is an unregulated power supply which provides +12 VDC to operate the dual high voltage power supply, as well as the solenoids, lamps, product detector and shaft encoder, and the K1 relay.

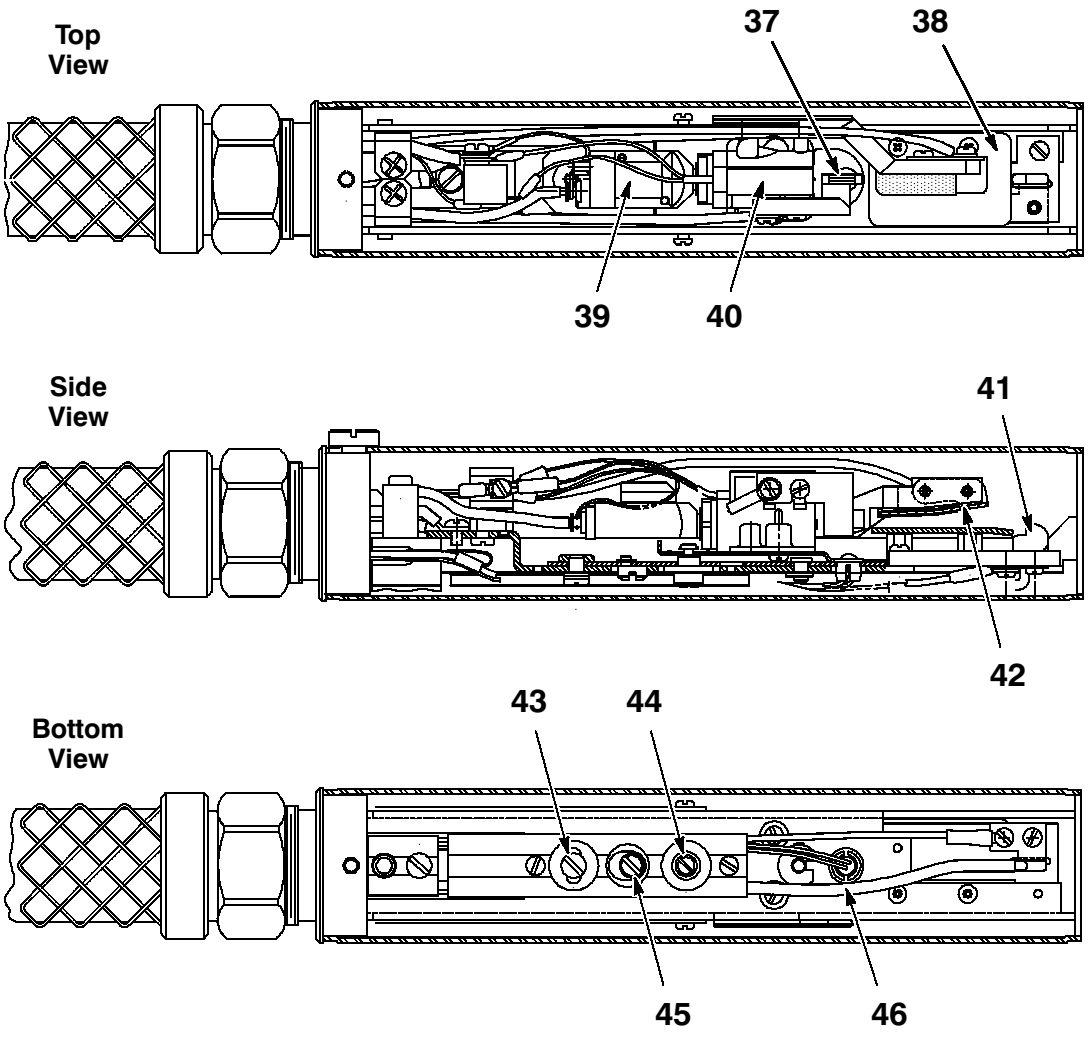
36 **Control Board**

The control board contains all logic circuitry for printer operations.

Note: The control board is also known as the printed circuit board, or PCB.

Printhead Components

Refer to Figure 3-12 for the location of the main printhead components, and refer to the following pages to find a brief description of the function of the components.



37	Charge Tunnel	42	High Voltage Deflection Plate
38	Ground Plate	43	Horizontal Locking Screw
39	Ink Control Valve	44	Vertical Adjustment Screw
40	Nozzle	45	Horizontal Adjustment Screw
41	Ink Return Block	46	Ink Return Line

Figure 3-12. Printhead Components

37 **Charge Tunnel**

The charge tunnel is an electrode that charges the ink drops as they leave the nozzle.

38 **Ground Plate**

Positioned directly opposite the high voltage deflection plate, the ground plate acts as the lower electrode (where, the high voltage deflection plate is the upper electrode). Refer to *High Voltage Deflection Plate* below for further information.

39 **Ink Control Valve**

Attached to the rear of the nozzle, the ink control valve controls the flow of pressurized ink to the nozzle. The ink control valve opens at 30 psi (2.05 bar) of ink pressure.

40 **Nozzle**

The nozzle is an assembly which houses a jeweled orifice and a piezo-electric crystal used to change the ink stream into ink droplets. The nozzle is electrically-driven by an oscillator on the control board to produce ultrasonic vibrations that break the ink stream into droplets.

41 **Ink Return Block**

The ink return block collects the ink drops that are not used for printing. Vacuum draws all unused ink droplets back into the ink module reservoir for recirculation. The ink return block also contains a sensing electrode used to detect charged ink drops to monitor the drop chargability when not printing.

42 **High Voltage Deflection Plate**

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. The high voltage deflection plate causes the negatively charged drops to be deflected over the ink return block to produce a printed code.

43 **Horizontal Locking Screw**

The horizontal locking screw enables you to adjust the nozzle horizontally. When loosened (approximately one-half turn), you can adjust the ink stream horizontally by turning the horizontal adjustment screw. When tightened, you cannot move the nozzle horizontally.

44 Vertical Adjustment Screw

The vertical adjustment screw 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.

45 Horizontal Adjustment Screw

The horizontal adjustment screw 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.

46 Ink Return Line

The ink return line is a tube leading from the ink return block, through the umbilical assembly, and to the ink module assembly in the fluid pan. The ink return line returns unprinted ink droplets to the ink module reservoir.

4

Theory of Operation

In this chapter you will find:

- an overview of the fluids system
- a description of how ink drops are created and controlled
- detailed functional sequences of operation for electrical, hydraulic and pneumatic functions

Turn to page 4-2 for a chapter-level Table of Contents.

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Introduction

Overview

This chapter describes printer theory of operation, beginning with an overview and progressing to detailed descriptions of printer functions.

Sections in this Chapter

This chapter contains the sections listed below.

- *Fluids System Overview . . . . . turn to page 4-4*
- *The Ink Stream and Ink Drops . . . . . turn to page 4-6*
- *Functional Sequences . . . . . turn to page 4-12*

Fluids System Overview

Fluids System

The term “Fluids System” refers to the major components involved in adding, recycling, and expelling (printing) fluids from the printer.

Fluids System Overview

Table 4-1 and Figure 4-1 give an overview of the fluids system.

Fluids System Overview	
Stage	**Description**
1	Ink or make-up fluid flows from the supply bottles into the reservoir in the ink module. Ink flows from the reservoir to the transfer pump.
2	Ink flows from the transfer pump, through the final ink filter, and into the ink supply cylinder.
3	Ink flows from the ink supply cylinder to the printhead.
4	Ink that is not used to print characters enters the ink return block and is pulled back to the reservoir.

Table 4-1. Fluids System Overview

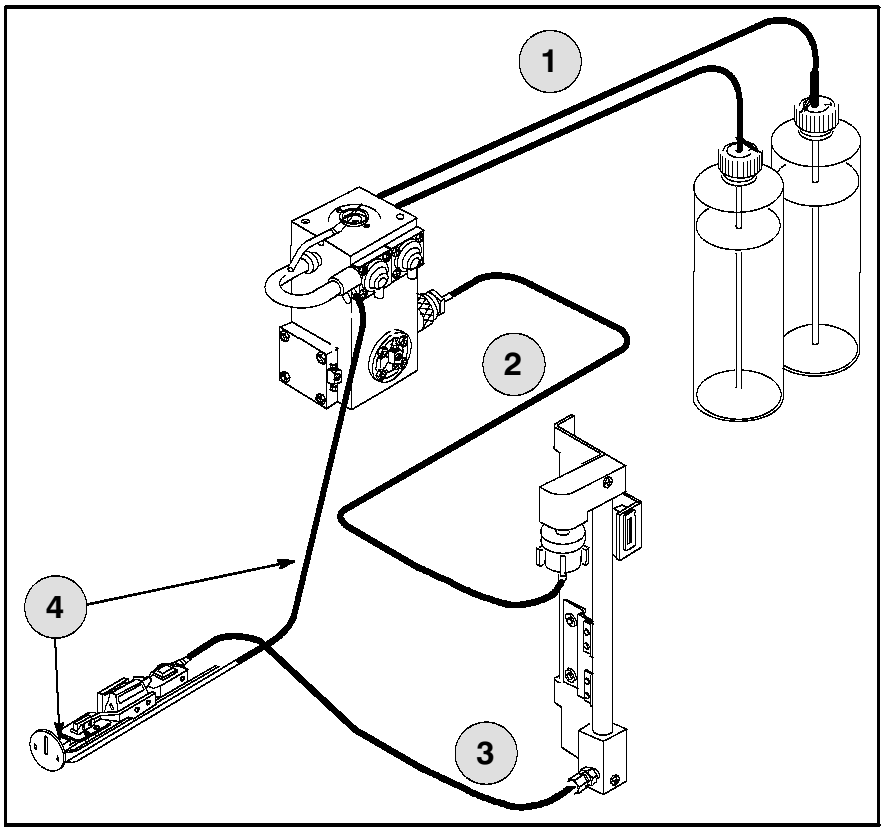


Figure 4-1. Fluids System Overview

The Ink Stream and Ink Drops

Ink Pressure

The ink pressure regulator applies pressure to the ink cylinder. Ink pressure is set to 40–60 psi (2.8–4.1 bar). Refer to Figure 4-2.

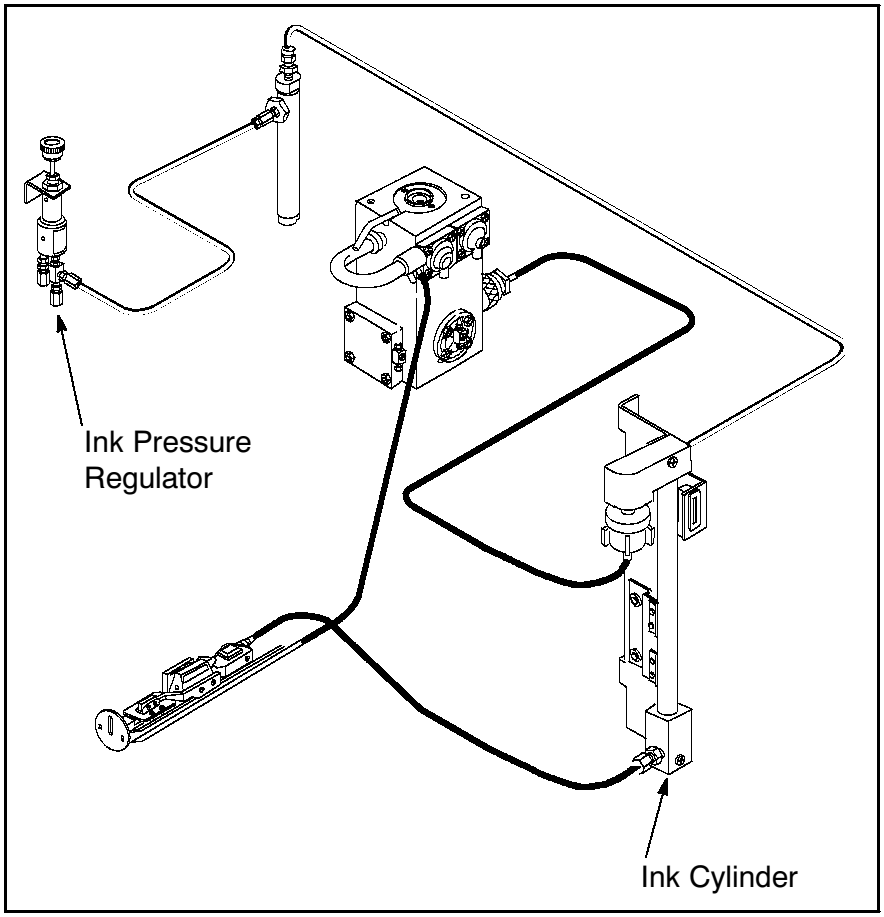


Figure 4-2. Ink Pressure Regulator and Ink Cylinder

Ink pressure forces ink from the ink cylinder to the printhead. It creates the ink stream and determines ink drop speed.

Ink pressure is adjusted during initial installation, after changing ink types, and after servicing certain printer components. Refer to Chapter 6, *Maintenance*, for information on adjusting ink pressure.

Creating Ink Drops

An oscillator crystal on the control board generates a fixed ultrasonic frequency signal: 66 kHz for the EXCEL 170i.

The fixed frequency signal energizes the piezo-electric nozzle crystal, which surrounds the nozzle ink chamber. Refer to Figure 4–3. The nozzle crystal vibration breaks the ink stream into small ink drops.

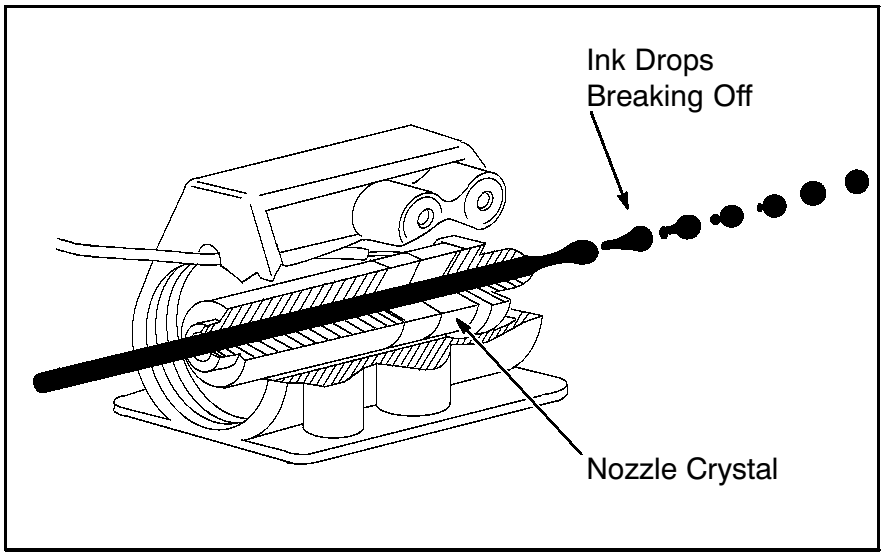


Figure 4-3. Crystal Vibration Creating Ink Drops

Nozzle Drive

Nozzle drive is the voltage of the fixed ultrasonic frequency signal sent to the crystal in the nozzle.

As the nozzle drive voltage is increased from minimum, the ink stream changes from an undulated solid stream to a stream with an ink drop breakoff and individual drops. The actual voltage level varies with ink type and crystal sensitivity.

Nozzle drive is adjusted during initial installation, after changing ink types and after servicing certain printer components. Refer to Chapter 6, *Maintenance*, for information on adjusting nozzle drive.

Ink Drop Breakoff

A correct typical ink drop breakoff should be similar to that shown in Figure 4-4. Three to four complete drops should be inside the charge tunnel.

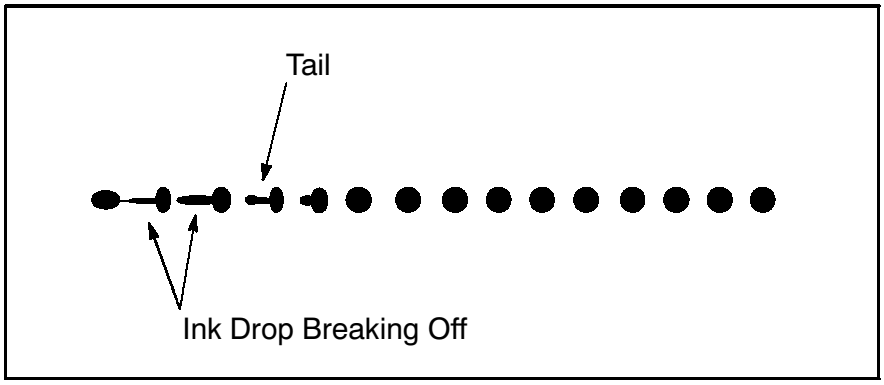


Figure 4-4. Typical Ink Drop Breakoff

Satellites

With some ink types, the tail of the drop breaks off and forms a separate smaller drop called a satellite. Refer to Figure 4-5. Actual tail and satellite formation will vary with ink type.

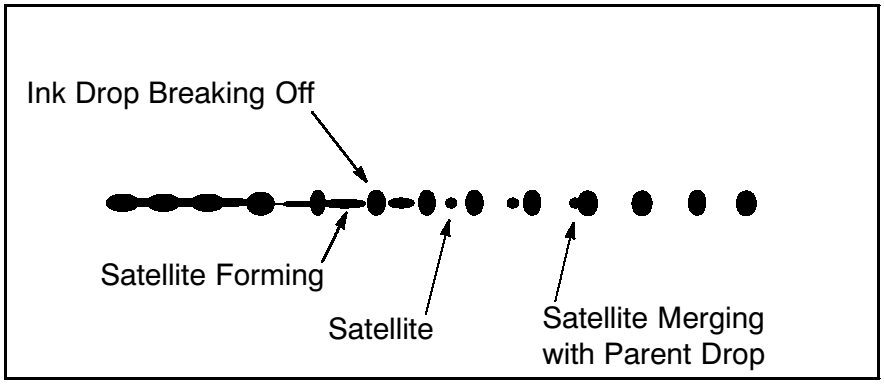


Figure 4-5. Satellite Merging with Parent Drop

If the satellite lags behind and merges with the following drop, erratic charge distribution occurs because the satellite carries away part of the parent drop charge (refer to *Charging Ink Drops*, page 4-9). This distorts printing because both drops are improperly charged.

Controlling Ink Drops

The printer uses electric charges to control or “aim” ink drops for printing.

Charging Ink Drops

Table 4-2 and Figure 4-6 describe how the printer charges ink drops.

Charging Ink Drops	
Stage	**Description**
1	The grounded ink stream exits the nozzle and enters the charge tunnel.
2	The printer sends positive electrical pulses to the charge tunnel. The pulses are synchronized with the nozzle drive signals so that a pulse arrives just as each ink drop forms.
3	The positive electrical pulses cause the ink drops to pull excess electrons from the ink stream as they break off of it. Each ink drop receives a negative charge based on the pulse that preceded it.

Table 4-2. Charging Ink Drops

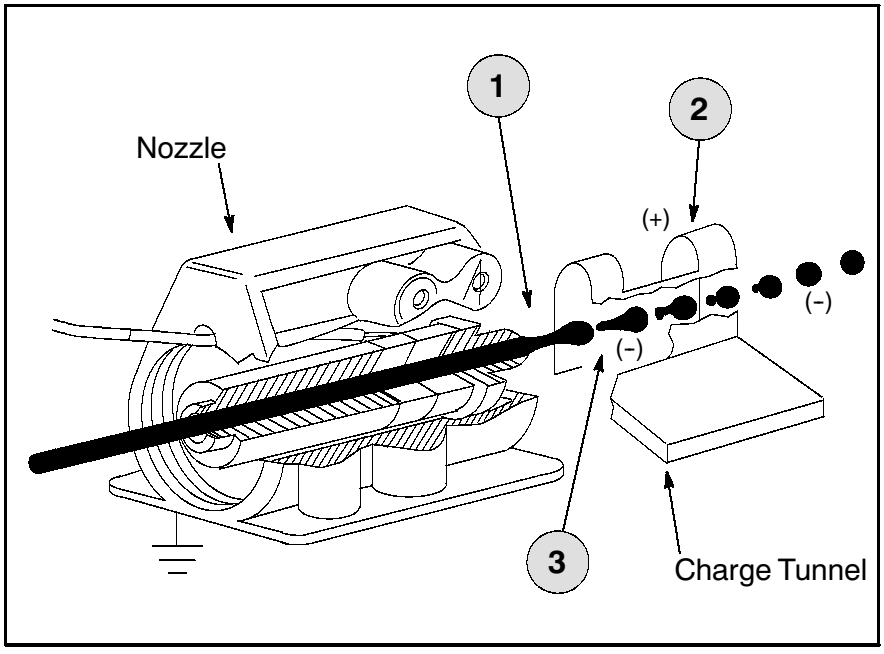


Figure 4-6. Charging Ink Drops

Ink Drop Deflection

After exiting the charge tunnel, each ink drop passes under a deflection plate. The positively charged deflection plate attracts the negatively charged ink drop, deflecting it from its original path. Refer to Figure 4-7.

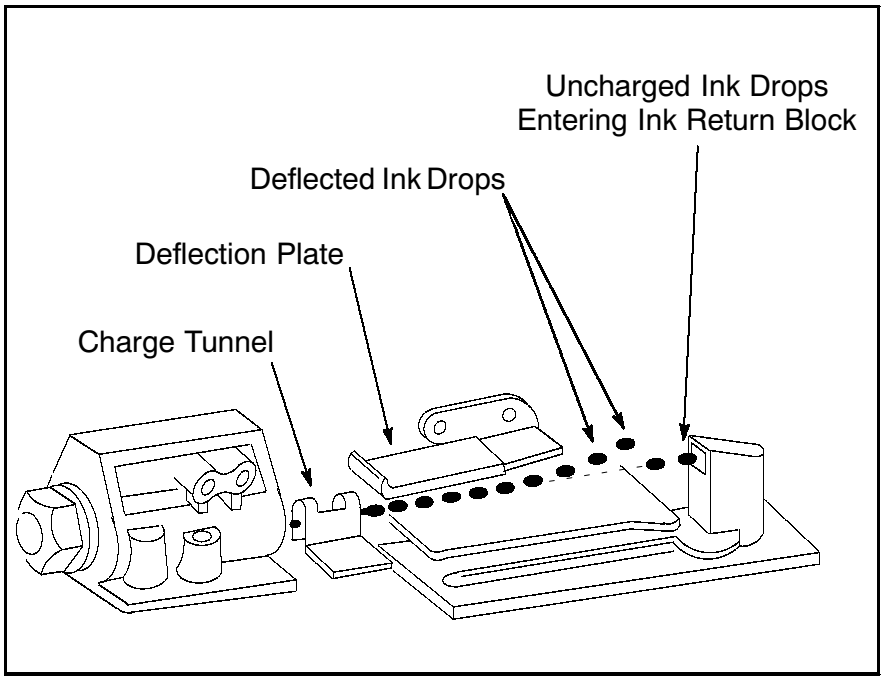


Figure 4-7. Ink Drop Deflection

The degree of deflection depends on the amount of the negative charge on the ink drop: the greater the charge, the greater the deflection.

Uncharged drops continue in a straight trajectory to the ink return block and are recycled to the ink module.

Character Fonts

Character fonts are constructed of a matrix of vertical strokes of ink drops.

For example, five vertical strokes, each up to seven drops in height, construct each character in a 5 x 7 matrix character font.

The amount of charge on an ink drop determines its location in the vertical stroke. Refer to Figure 4-8.

The printer assures horizontal alignment by automatically timing the strokes with the movement of the printing surface.

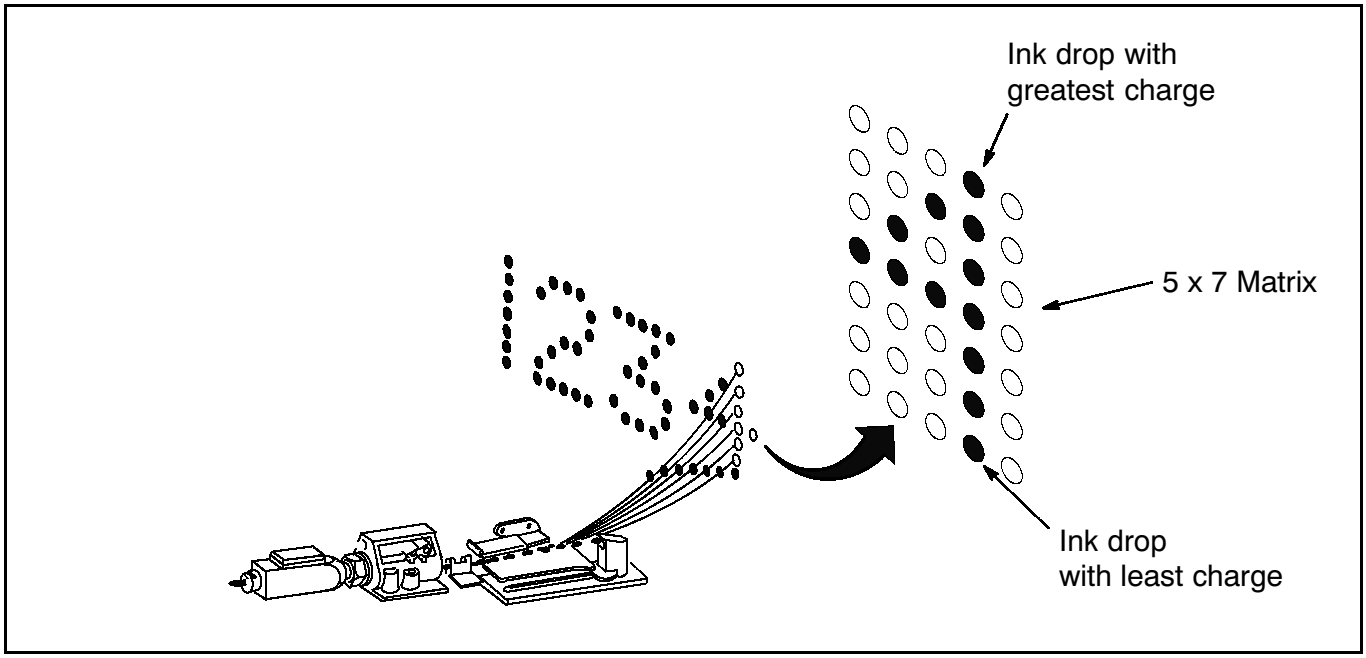


Figure 4-8. Character Font Matrix

Functional Printer Sequences

Overview

The functional sequences give detailed descriptions of events in the five major printer cycles: Power On, Start-up, Ink Transfer, Make-up Add and Fresh Ink Add. The fluids low alert sequence is also described.

Printer Power On Sequence

Table 4-3 and Figure 4-9 show the printer Power On sequence.

Printer Power On Sequence	
Stage	**Description**
1	When the AC power switch (S1) is closed: • the line side (L) of AC power TB1 connects through circuit breaker F1 and line filter Z1 to pin 1 of solid state relay K1 • neutral (N) is connected to the low voltage and auxiliary power supplies and returns to pin 2 of solid state relay K1.
2	When **ON** is pressed, the power voltage detector holds pin 4 of K1 to ground for two seconds.
3	Battery-supplied 9 VDC is applied to pin 3 of K1, energizing K1.
4	AC power flows from pin 1 to pin 2 of K1, supplying AC power to the low voltage and auxiliary power supply.
5	a. 12 V auxiliary power is now available, which: • effectively removes the 9 VDC battery from the circuit • causes the power voltage detector to maintain a closed circuit to pin 3 of K1 • applies voltage to transistor Q10 b. At the same time that 12V auxiliary is available: • the microprocessor sends an AC On signal to transistor Q10 • Transistor Q10 turns on and connects pin 4 of K1 to ground, and K1 remains energized

Table 4-3. Printer Power On Sequence

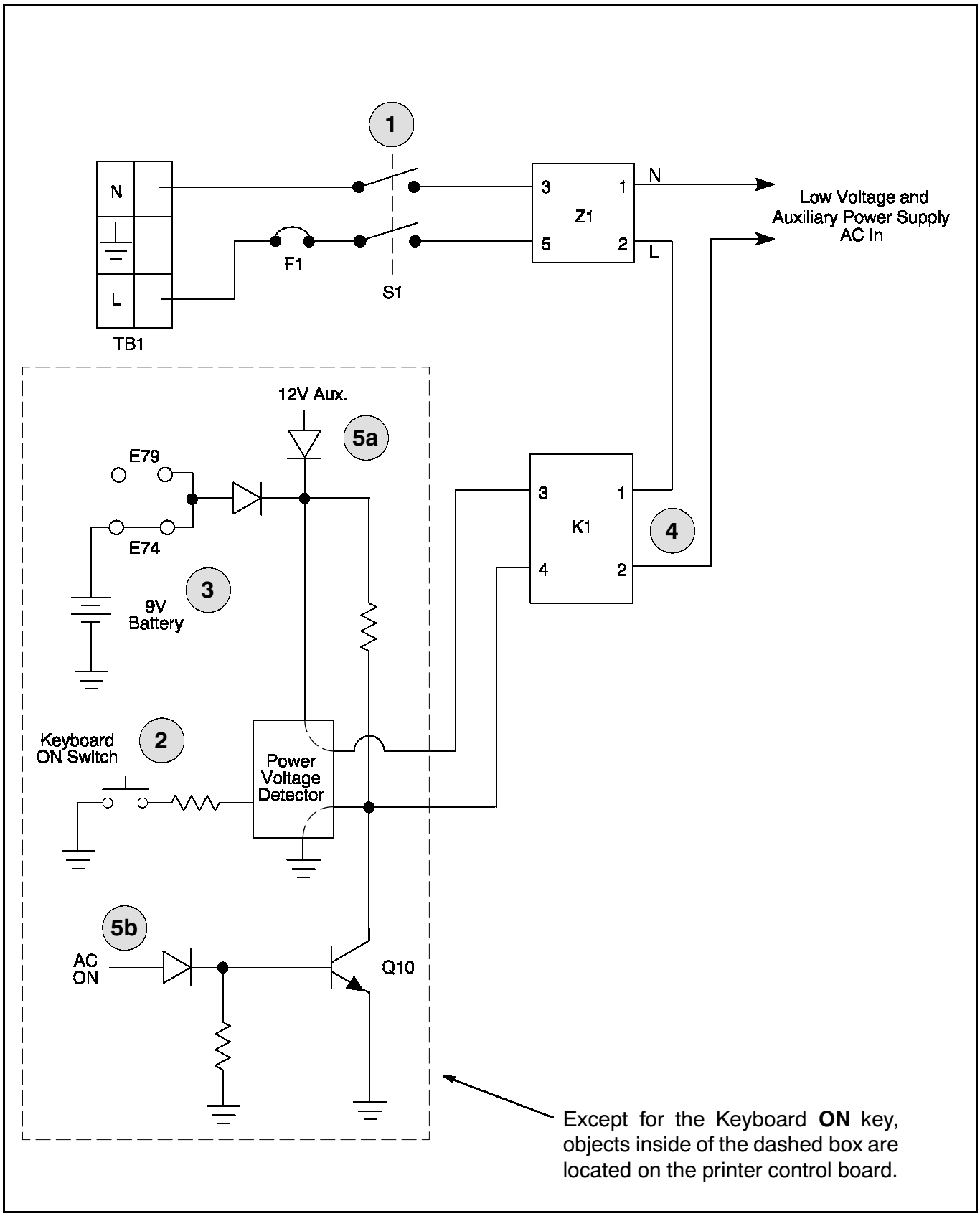


Figure 4-9. Printer Power On Circuits

Printer Start-up Sequence

The following tables and figures describe the events in the 97-second printer Start-up sequence, which begins after the **ON** key is pressed and before Print Ready status is reached.

0-1 Second After Power On	
Stage	**Description**
1	The control board energizes the air control solenoid, allowing shop air to reach the air control valve.
2	Pilot air (shop air that operates the air control valve) opens the air control valve, allowing shop air into the system.
3	The transfer pressure regulator's top port provides 15 psi (1 bar) over ink pressure to the top of the transfer solenoid. Refer to stage 20 on page 4-18.
4	The intermediate pressure regulator, which is factory set to about 60 psi (4.1 bar), applies air to the left side of the solenoid bank.
5	Shop air is applied to the nozzle solenoid. Air flow stops at this solenoid until the ink turns on.
6	The components on the left side of the solenoid bank do the following: a. The fluids (ink) low needle valve supplies air to the fluids low switch and the supply bottles. b. The positive air needle valve supplies air at the printhead, helping to keep it free of contaminants. c. The vacuum needle valve supplies air to the vacuum generator, creating vacuum for the entire system.
7	Vacuum (refer to 6c above) is applied to: a. transfer solenoid b. ink-add solenoid c. make-up add solenoid d. ink module e. vacuum filter f. ink return line
Table 4-4 continued on page 4-16	

Table 4-4. Printer Start-up

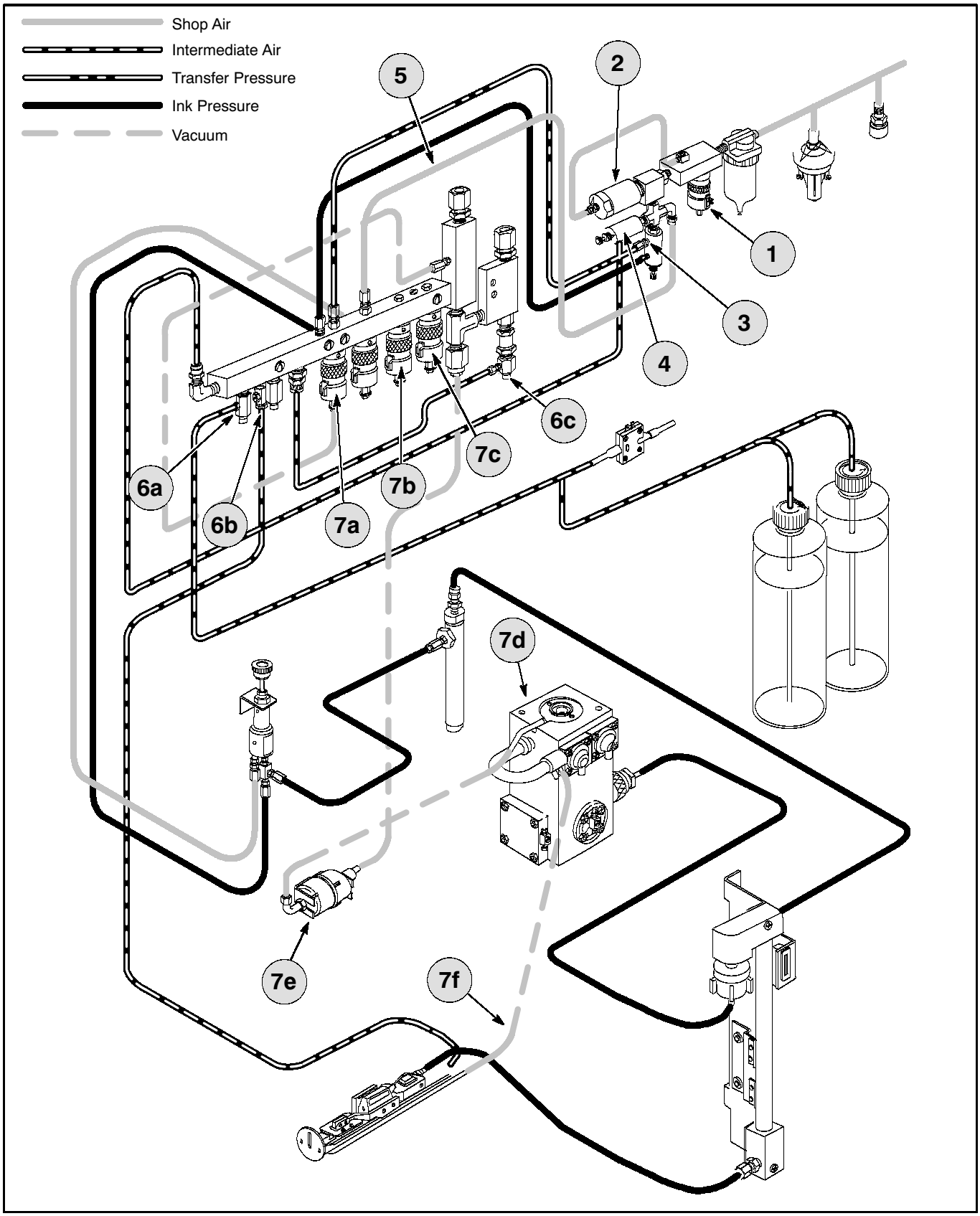


Figure 4-10. Printer Start-up, 0-1 Second

7 Seconds After Power On (continued)	
Stage	**Description**
8	The control board energizes the nozzle solenoid.
9	**HEAD** light flashes on the control panel (not shown).
10	Shop air passes through the nozzle solenoid to the bottom (input) of the ink pressure regulator. The regulator reduces shop air to about 40-60 psi (2.8-4.1 bar). This is called ink pressure.
11	The ink pressure regulator supplies ink pressure to the ink trap, the ink cylinder, and the transfer pressure regulator (through the solenoid bank).
12	The pressurized ink cylinder forces ink to the printhead.
13	Once in the printhead, the pressurized ink passes through the ink control valve. This valve needs about 30 psi (2.1 bar) to open.
14	After passing through the ink control valve, ink enters the nozzle, where it is emitted and broken into ink drops.
15	Ink drops are charged in the charge tunnel.
16	The ink passes under the high voltage plate, which is *not* energized at this point in the start-up sequence.
17	Ink then enters the ink return block, where ink drop charging is tested.
18	Vacuum in the ink return line draws all ink back to the reservoir in the ink module.
	Table 4-4 continued on page 4-18

Table 4-4, continued

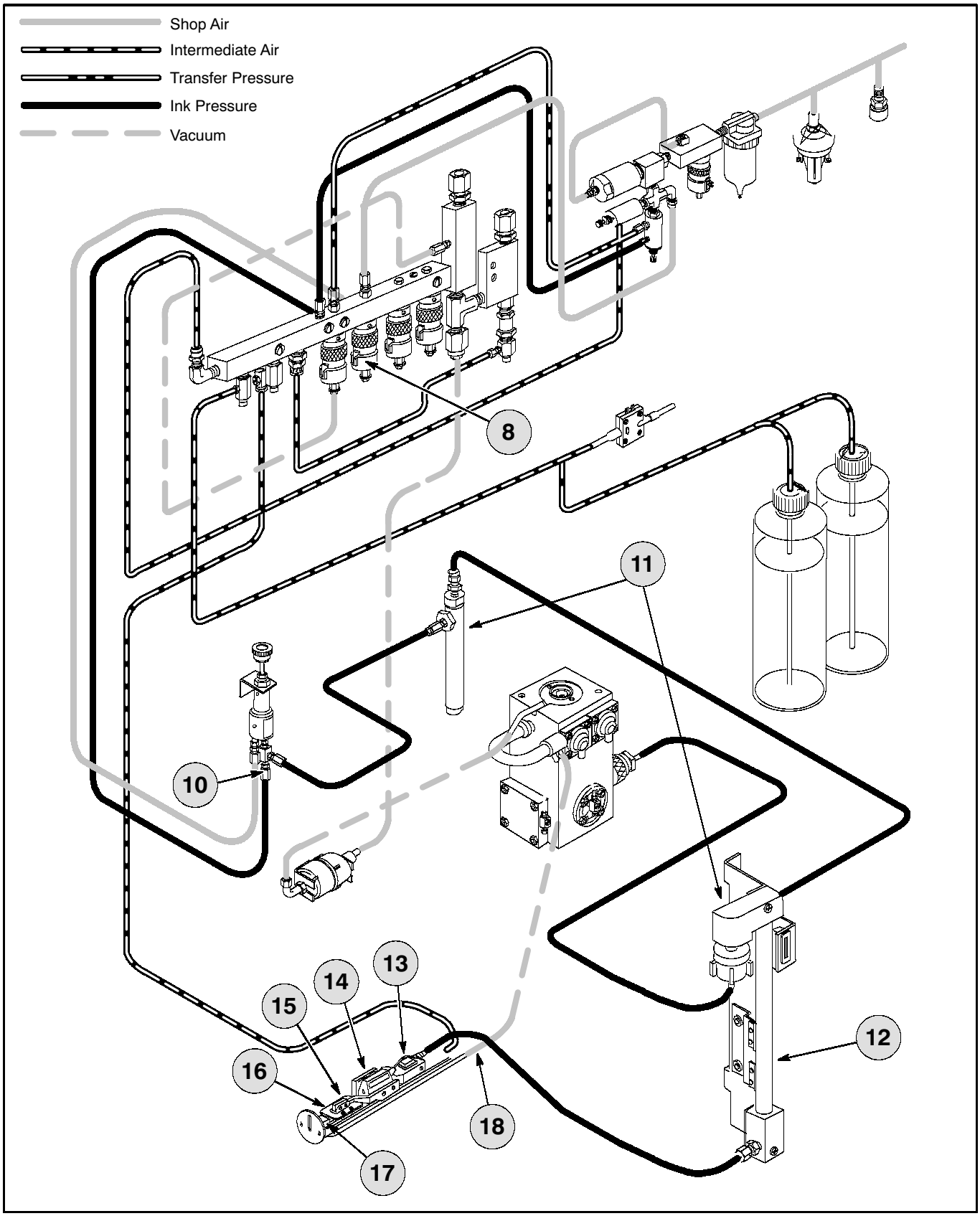


Figure 4-11. Printer Start-up, Seven Seconds After Power On (stages 8 through 18)

7 Seconds After Power On, continued	
Stage	**Description**
19	The ink pressure regulator supplies ink pressure air to the bottom port of the transfer pressure regulator.
20	The top port of the transfer pressure regulator provides air at 15 psi (1.0 bar) over ink pressure. This transfer pressure is applied to the transfer solenoid.
92-97 Seconds After Power On	
21	The control board turns on high voltage to the high voltage plate in the printhead (not shown).
22	At 97 seconds after power On, the control board monitors for all possible faults (not shown).
23	The **HEAD** lamp lights, indicating the system is ready to print (not shown).

Table 4-4, continued

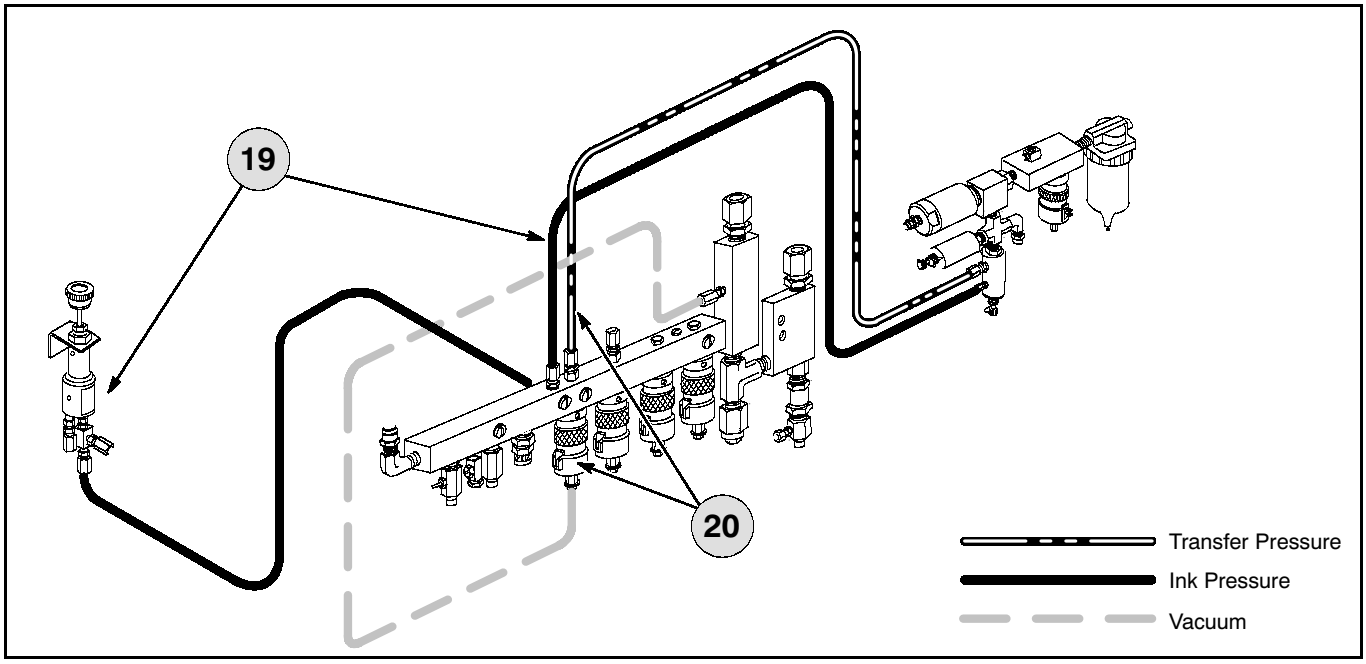


Figure 4-12. Printer Start-up, Seven Seconds After Power On (stages 19 and 20)

Printer Start-up Sequence Flowcharts

The flowcharts in Figure 4-13 through Figure 4-18 give a different perspective of the printer start-up sequence of operation. **These flowcharts show event relationships, electrical functions, and fault information not present in the tables and figures on the preceding pages.**

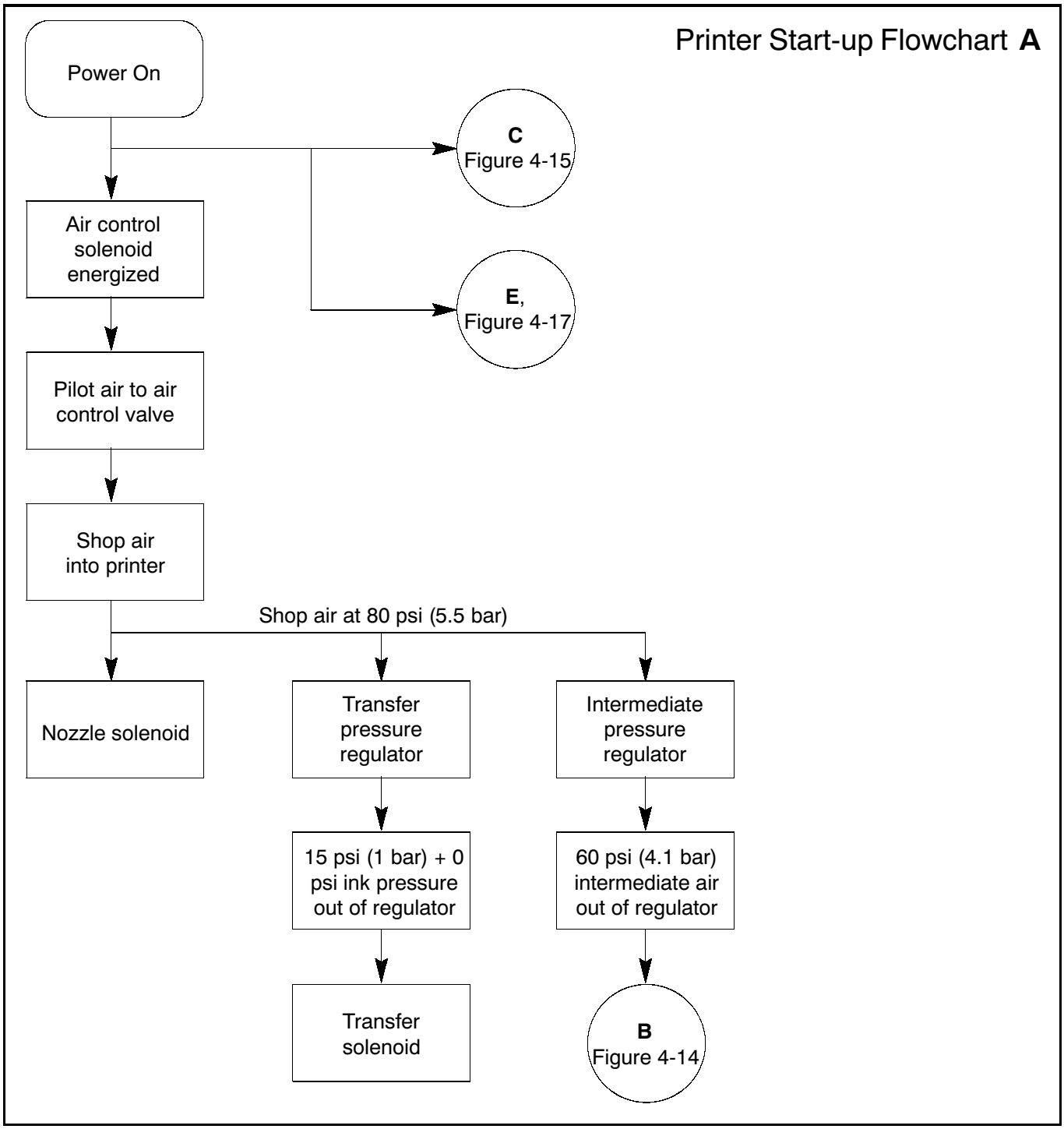


Figure 4-13. Printer Start-up Flowchart A

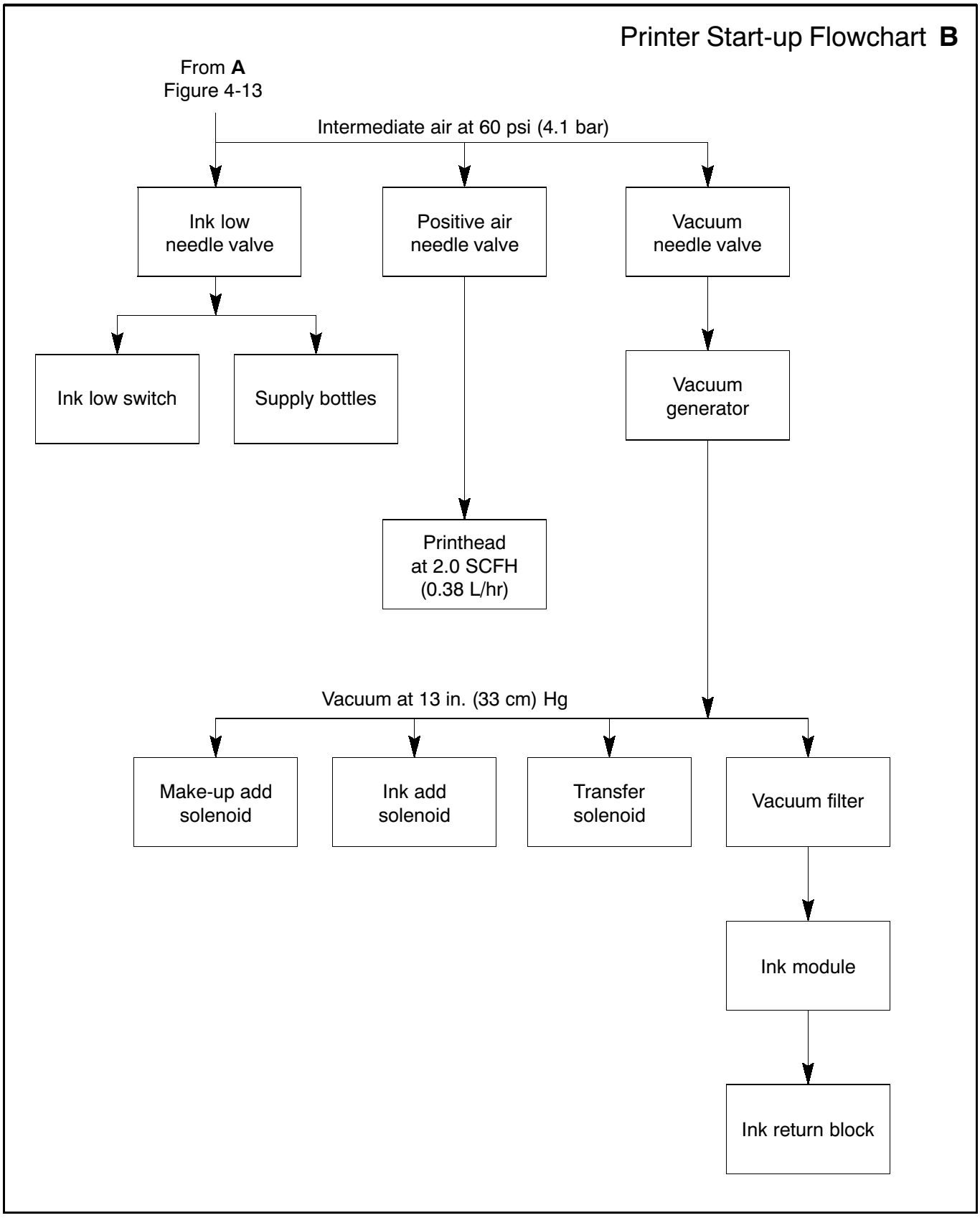


Figure 4-14. Printer Start-up Flowchart B

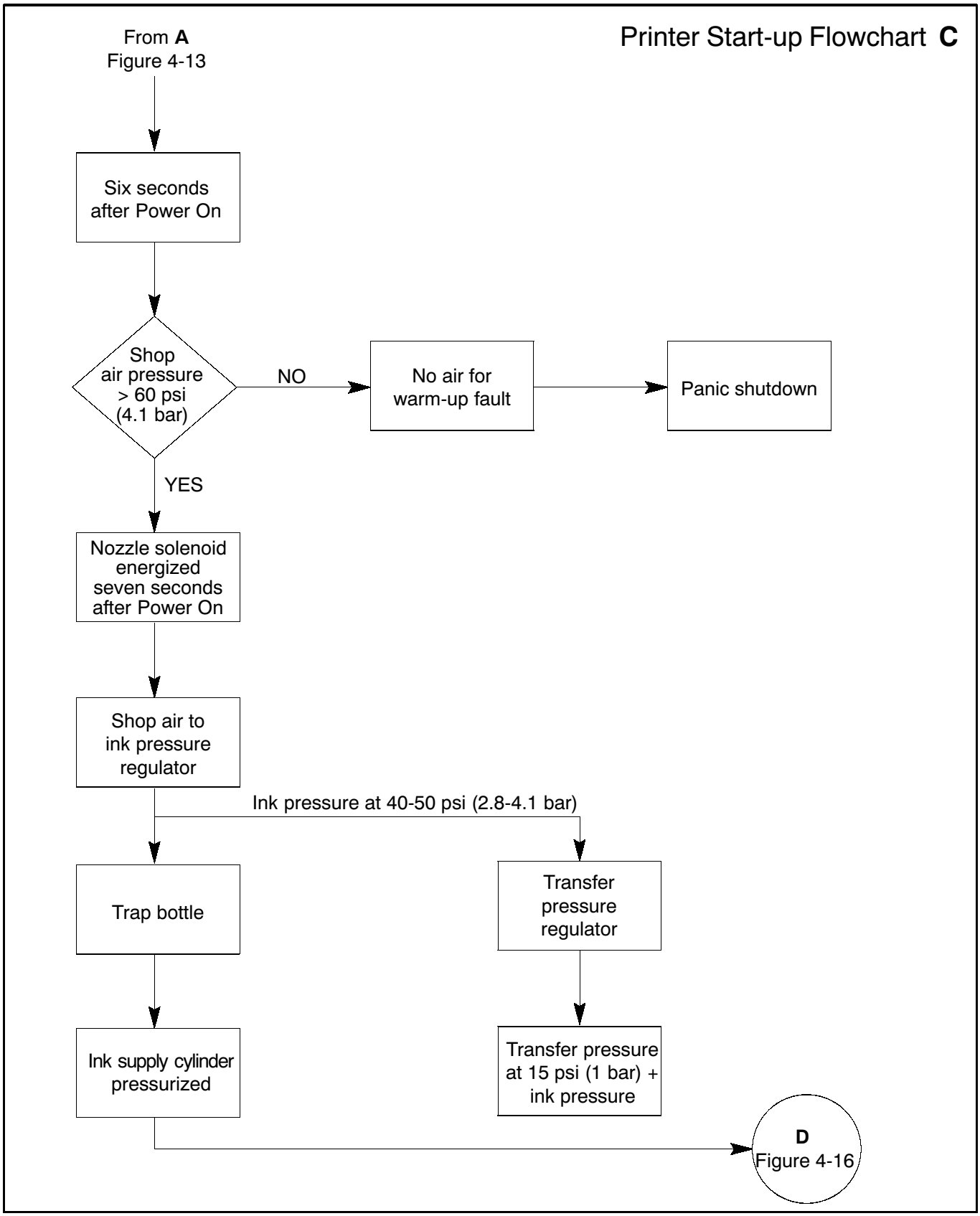


Figure 4-15. Printer Start-up Flowchart C

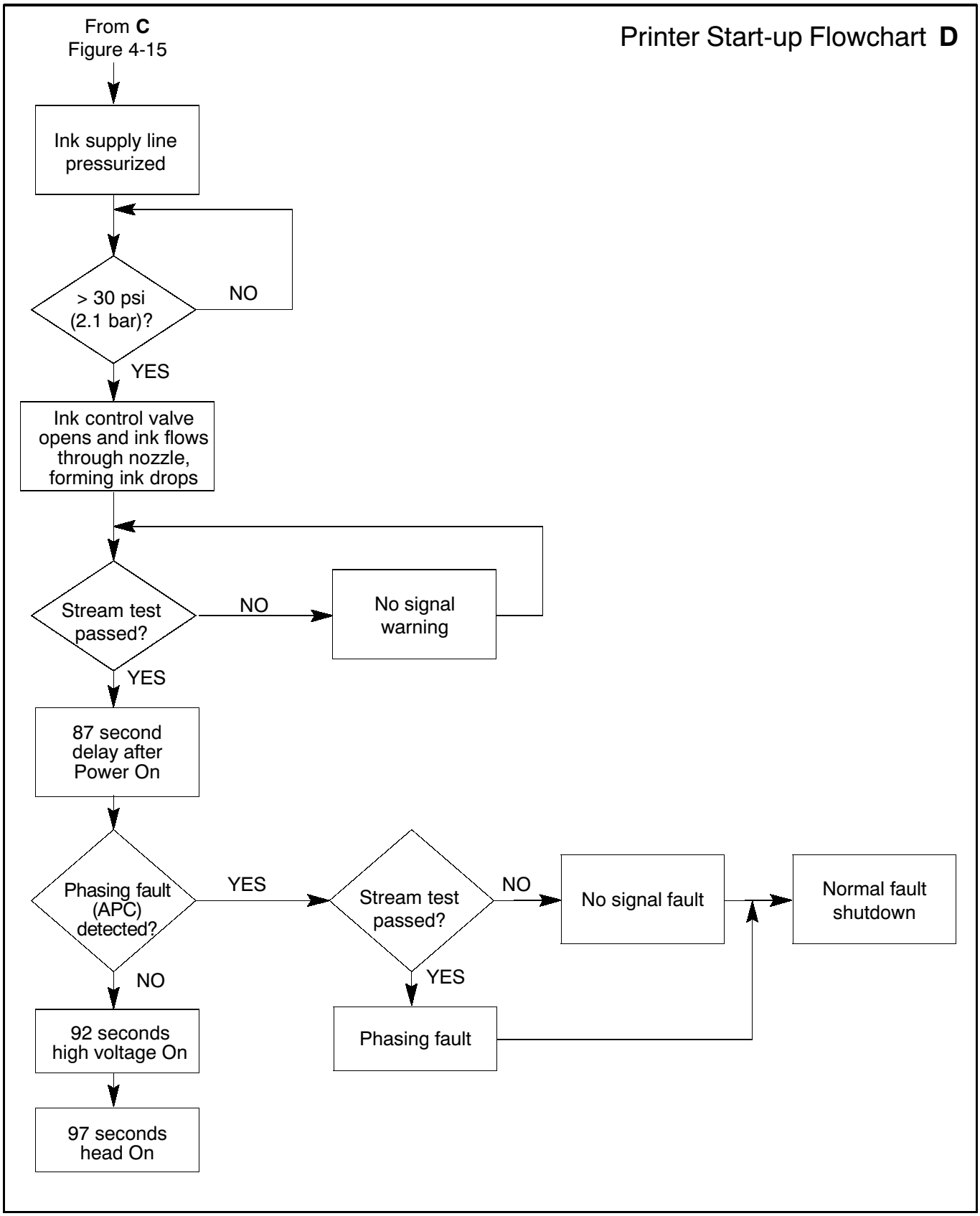


Figure 4-16. Printer Start-up Flowchart C

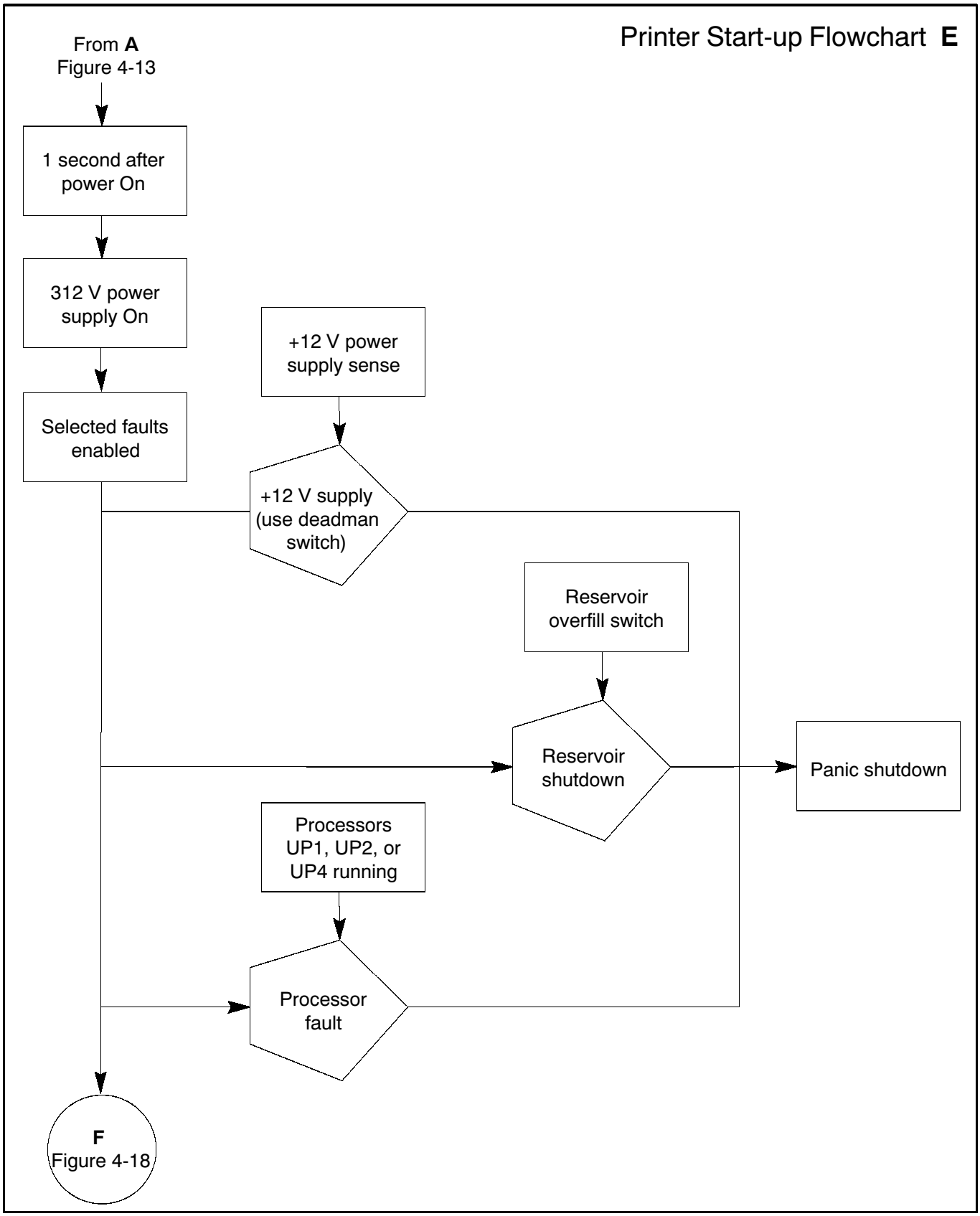


Figure 4-17. Printer Start-up Flowchart E

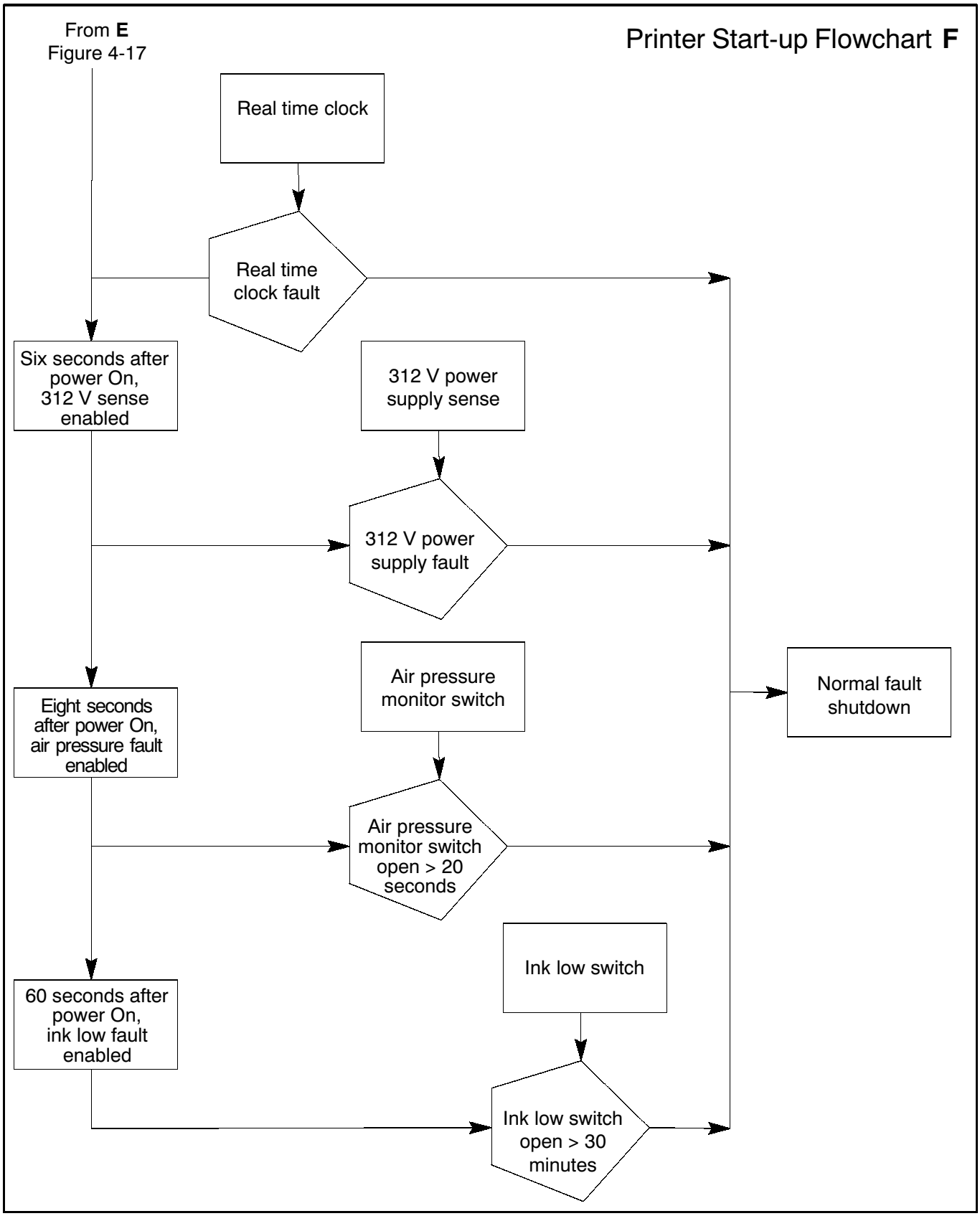


Figure 4-18. Printer Start-up Flowchart F

Printer Shutdown Sequence

When the **OFF** key is pressed, the printer starts the normal four-minute shutdown sequence. Table 4-5 shows the shutdown sequence.

Time (Sec)	Printer Action
0	• Turns Off high voltage to the printhead
2	• Nozzle solenoid de-energizes, shutting off ink to the printhead • Vacuum remains On to clear return lines
240	• Microprocessor removes AC On signal from Q10, removing the ground from the K1 relay • K1 relay de-energizes, interrupting AC power • Auxiliary 12 VDC and low voltage power supplies shut down • Air control solenoid de-energizes

Table 4-5. Printer Shutdown Sequence

Head Restart Sequence

Any procedure that turns off the air control solenoid while allowing printer electronics to remain on requires you to press the **HEAD** key to restart the printer.

Head restart is a partial start-up of the printer that takes 50 seconds. If the printer is turned off and then restarted within the four-minute shutdown sequence (while the air control solenoid is still on), the shorter 50-second head restart cycle automatically begins. This procedure brings the printer back to a ready state.

Head Restart Summary

Head restart is a partial start-up of the printer. Table 4-6 shows the sequence for the 50-second head restart:

Time (Sec)	Printer Action
0	• Displays <HEAD RESTART> • **HEAD** light flashes on the front of the printer • Tests air pressure • Activates stream test warning • Turns on 312 V supply • Enables Panic faults • Enables keyboard
7	• Nozzle solenoid energizes • Starts phasing • Activates phase test (APC)
45	• Turns high voltage to printhead on • Turns on high voltage test (five-second delay until test starts)
50	• Completes Head Restart • **HEAD** light steady (not flashing) on front of printer • Activates all faults

Table 4-6. Head Restart Sequence

Head Shutdown Sequence

If the **HEAD** key is turned off during regular operation, the printer will start a four-minute head shutdown sequence. This sequence removes the ink from the ink return line. It also eliminates unnecessary solvent evaporation that would occur if the vacuum remained on without the ink circulating.

This sequence is sometimes called the Air Control Solenoid Shutdown sequence because it results in the air control solenoid shutting Off.

Head Shutdown Sequence Summary

Table 4-7 summarizes the automatic five-minute head shutdown sequence:

Time (Sec)	Printer Action
0	• Turns off high voltage. • Turns off **HEAD** and **PRINT** lights. • Turns off **READY** light on the front of the printer. • Displays <HEAD SHUTDOWN>.
2	• Turns off ink valve. • Displays <HEAD OFF>.
302	• Turns off air control solenoid.

Table 4-7. Head Shutdown Sequence

Ink Transfer Cycle

Table 4-8 and Figure 4-19 describe the ink transfer cycle.

Ink Transfer Cycle	
Stage	**Description**
1	As pressurized ink flows to the printhead, the level in the ink supply cylinder drops. A magnetic float in the ink supply cylinder drops with the ink level.
2	When the magnetic float drops to the bottom of the cylinder, the magnet closes the externally mounted transfer request switch, signaling the control board that the ink supply cylinder is empty.
3	The control board energizes the transfer solenoid, which opens to transfer pressure.
4	The transfer solenoid applies transfer pressure to: a. the shut-off valve b. the transfer pump The shut-off valve prevents ink from entering the reservoir while the transfer pump transfers ink to the ink supply cylinder (by way of the check valve and final ink filter).
5	The magnetic float in the cylinder rises with the incoming ink until it closes the start switch.
6	When the start switch closes, the control board de-energizes the transfer solenoid. The solenoid closes to transfer pressure and opens to vacuum.
7	Vacuum is applied to the dry sides of the transfer pump and shut-off valve, allowing ink from the reservoir to refill the transfer pump.
8	As ink flows to the printhead, the magnetic float again moves downward. When it drops below the start switch, a timer circuit measures the time until the next transfer request. The time it takes to empty the ink supply cylinder is called flow time.

Table 4-8. Ink Transfer Cycle

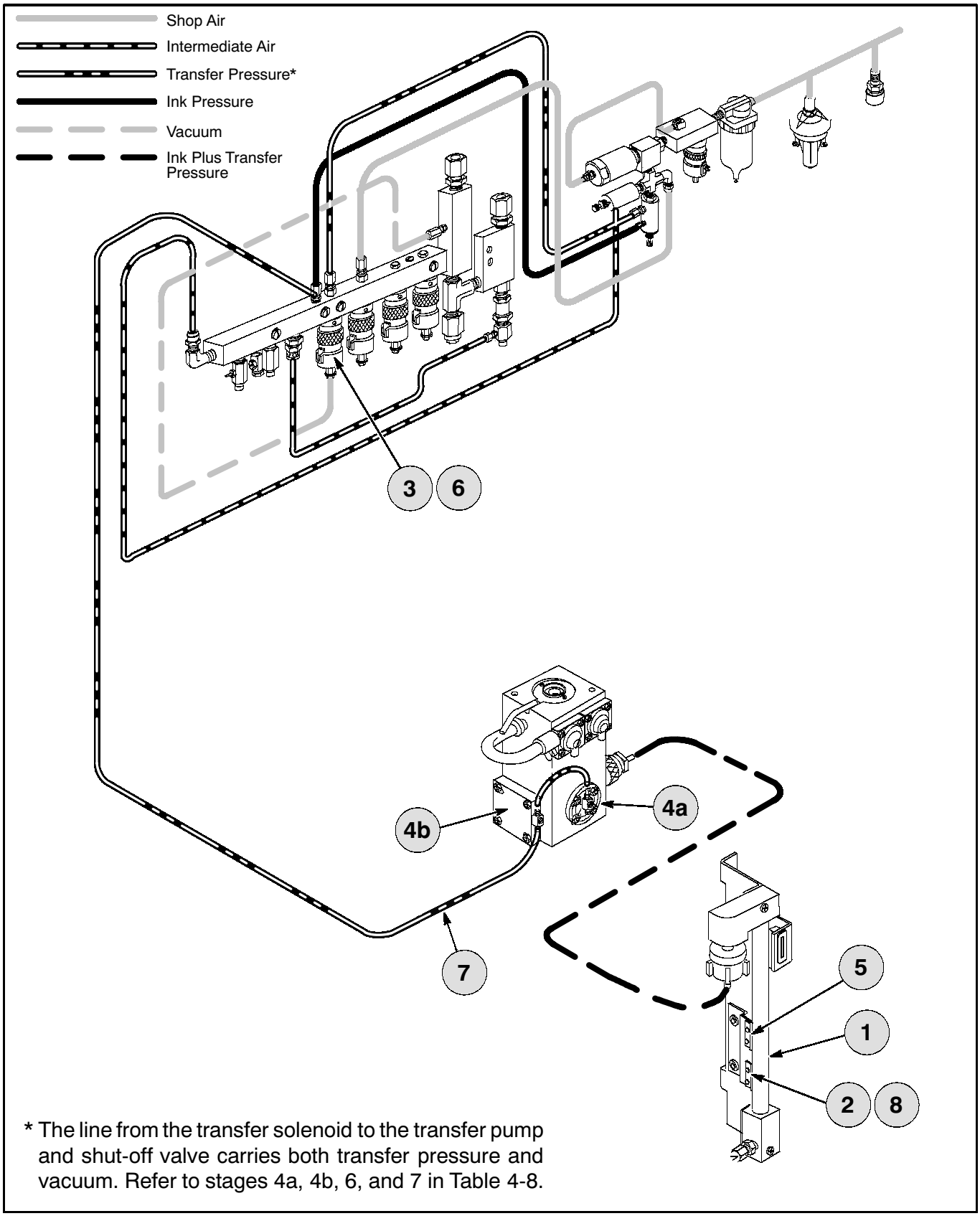


Figure 4-19. Ink Transfer Cycle

Flow Cycle and Ink Transfer Cycle

The ink transfer cycle completes about once a minute during printer run time (Ink On Time). The ink transfer cycle takes place during the flow cycle (ink recycling). Refer to Figure 4-20.

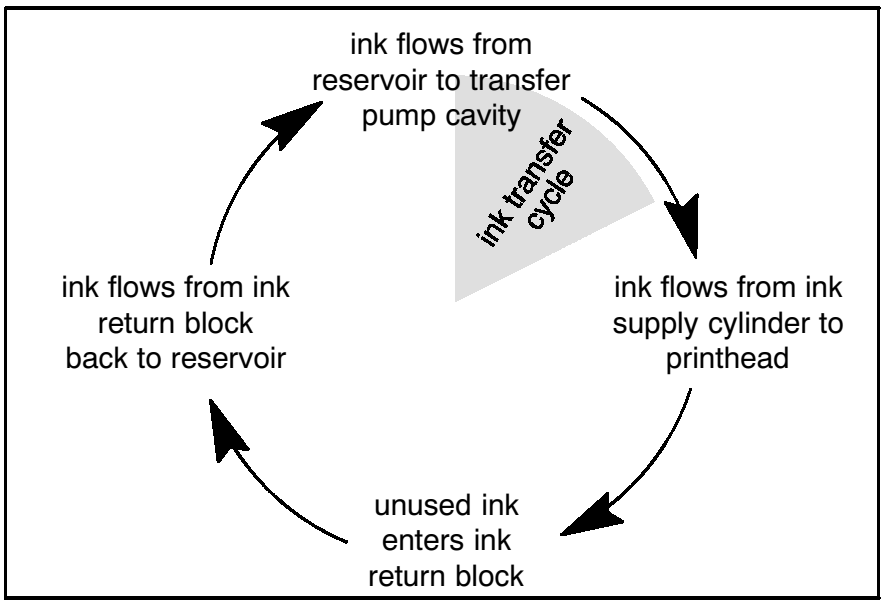


Figure 4-20. Flow Cycle and Ink Transfer Cycle

Make-up Add Sequence

The make-up add sequence adds make-up fluid to the system at the end of a transfer cycle to “make up” for evaporated solvent.

Solvent Evaporation

During printer operation, solvent/make-up evaporates from the system, increasing ink viscosity (thickness). This results in an increase in flow time (refer to stage 8 on page 4-28).

Make-up Add Time

The control board defaults to a make-up add time of 0.75 seconds at initial start-up, and then adjusts as required to control ink viscosity.

At successive start-ups, the software will use either the last recorded value or 0.2 seconds, whichever is longer.

Make-up Add Prevention

Activation of the inhibit switch (refer to Figure 4-22 on page 4-35) at any point in the flow time cycle or make-up add sequence prevents/stops the make-up add sequence.

The air and vacuum conditions set at printer start-up are in effect.

Table 4-9 and Figure 4-21 show the make-up add sequence.

Make-up Add Sequence	
Stage	**Description**
1	When the control board adds make-up at the end of the transfer cycle, it calculates make-up add time (not shown).
2	The control board energizes the make-up add solenoid for the duration of the make-up add time. This applies vacuum to and opens the make-up add valve on the ink module.
3	Vacuum pulls make-up fluid into the reservoir from the supply bottle.
Make-up Add Sequence continued on page 4-32	

Table 4-9. Make-up Add Sequence

Make-up Add Sequence, continued	
Stage	**Description**
4	The make-up add solenoid de-energizes at the end of the add time. This removes the vacuum to the make-up add valve.
5	Make-up flow to the reservoir stops when the make-up add valve closes.

Table 4-9, continued

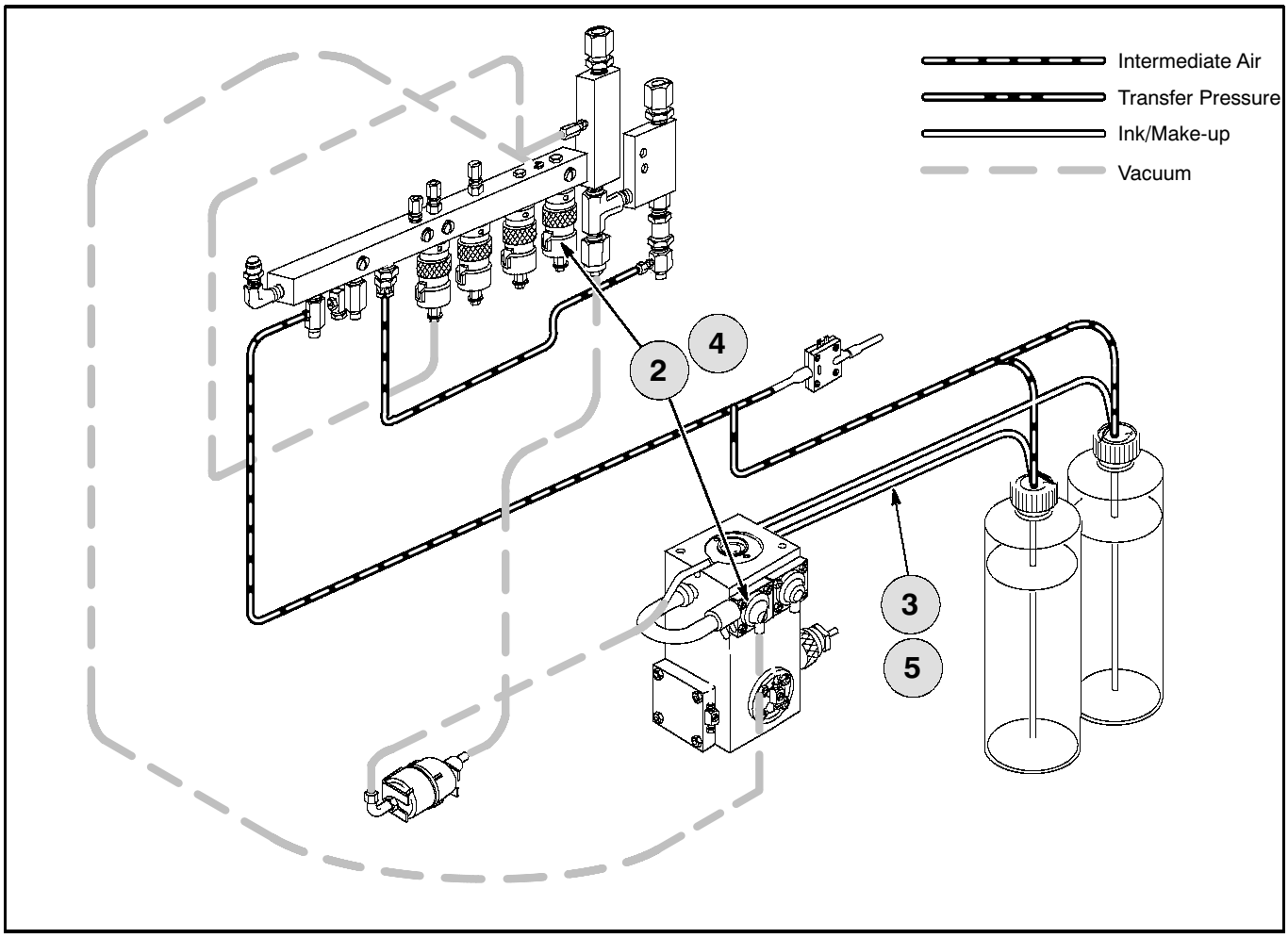


Figure 4-21. Make-up Add Sequence

Fresh Ink Add Sequence

The fresh ink add sequence adds fresh ink to the system. The following pages describe the fresh ink add sequence and the components that initiate it.

Set Point Time and Current Ink Time

Set Point Time and Current Ink Time are two values critical to the fresh ink add sequence:

- set point time is the average of the first three flow times after system calibration
- current ink time is the most recent flow time

When Fresh Ink Is Added

Fresh ink is added during normal operation only when two conditions occur at the same time:

- the magnetic float in the reservoir closes the S1 fluids request switch
- the current ink time is within 0.5 seconds of set point time

Note: If current ink time is *more than* 0.5 seconds longer than set point time, the control board adds make-up fluid instead of fresh ink.

Note: The Service Mode procedures of Auto Prime and Auto Refresh also add fresh ink instead of make-up. During all other Service procedures, however, a high flow time will initiate make-up add when the fluids request switch activates.

Fresh Ink Add Sequence	
Stage	**Description**
1	As ink is used in printing, the magnetic float in the ink reservoir drops, closing the S1 fluids request switch.
2	a. If the current ink time is within 0.5 seconds of the set point time, the control board energizes the ink add solenoid. b. If the current ink time is more than 0.5 seconds longer than the set point time, the control board energizes the make-up add solenoid. c. If the printhead is turned Off, the control board energizes the make-up add solenoid.
3	Vacuum opens either: a. the make-up add valve, or b. the ink add valve
4	Vacuum pulls fresh ink (or make-up fluid) from the supply bottle into the reservoir.
5	The magnetic float rises, opening the fluids request switch. When the switch opens, the ink add or make-up add solenoid de-energizes, closing to vacuum. This closes the valve to vacuum and stops any further addition of fluid (not shown).

Table 4-10. Fresh Ink Add Sequence

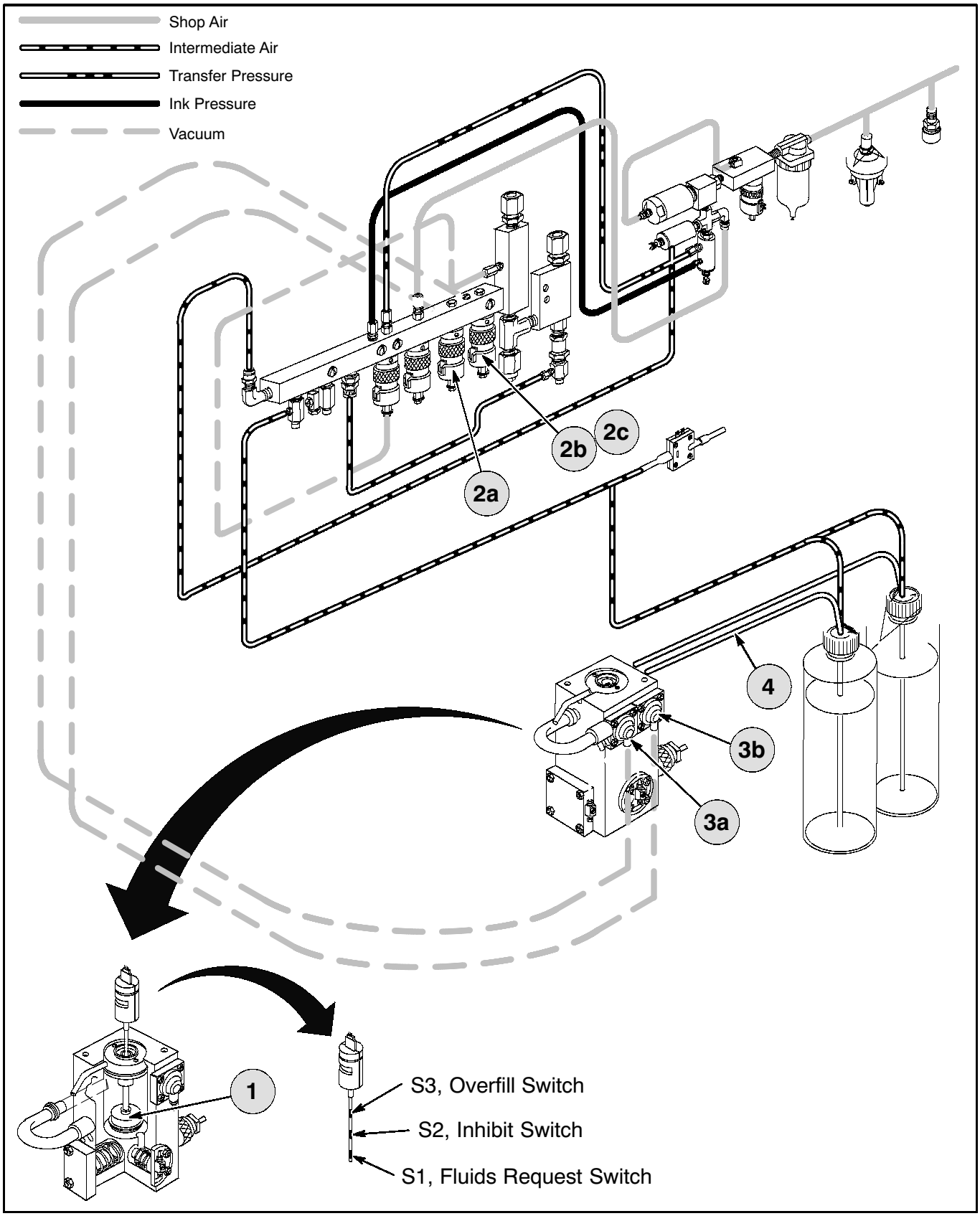


Figure 4-22. Fresh Ink Add Sequence

Fluids Low Alert Sequence

The Fluids Low Alert sequence monitors the fluid level in both the ink and make-up supply bottles. When the fluid is depleted, a Fluids Low warning alerts the operator to replace the supply bottle.

Fluids Low Switch

Fluid level is monitored by the fluids low switch, which is a differential pressure switch used to monitor back pressure imposed on the fluid in the supply bottle.

Fluids Low Alert Sequence	
Stage	**Description**
1	The fluids low needle valve applies pressure to the supply bottles and the fluids low switch. Air pressure is set to create two bubbles per second in the supply bottles.
2	As the fluid level drops in a bottle: a. the decrease in back pressure releases the fluids low switch, and the following occurs: b. a 30-minute timer actuates (not shown) c. the **SERVICE** light glows steadily and a prompt displays a Fluids Low Warning, informing the operator of the condition
3	If the bottle is not replaced within 30 minutes, the Ink Out Fault shutdown starts and the **SERVICE** light flashes.
4	If the bottle is replaced during the 30-minute warning, the **SERVICE** lamp goes out. Failure to replace the bottle within the 30-minute period will result in an Ink Out fault.

Table 4-11. Fluids Low Alert Sequence

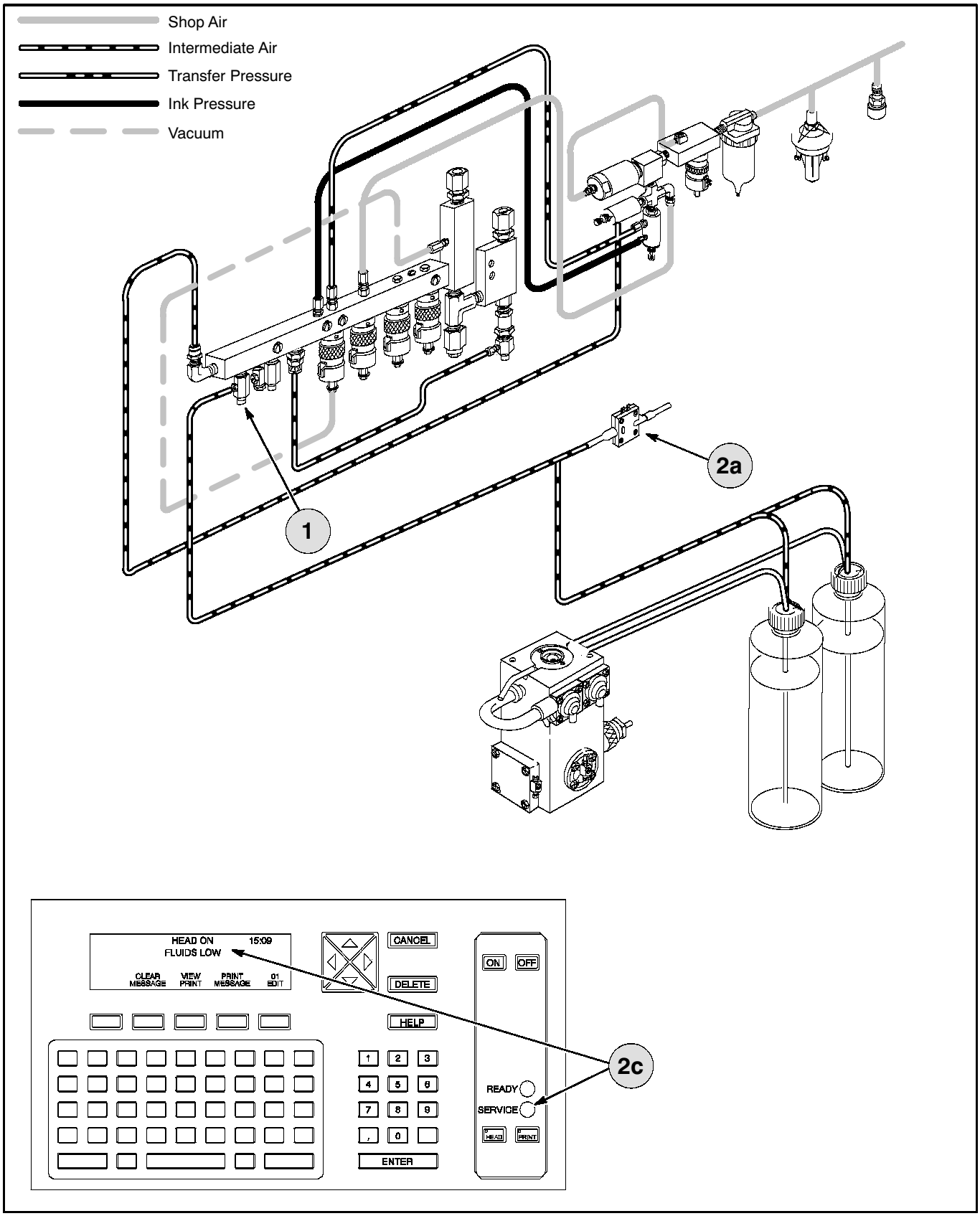


Figure 4-23. Fluids Low Alert Sequence

Notes:

5

Software Summary Chart Service Mode

In this chapter you will find:

- an explanation of how to use the Software Summary chart to perform procedures in the Service mode

Turn to page 5-2 for the chapter-level Table of Contents.

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Recording Ink and Make-up Fluid Data in Memory . . . 5-8
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Turning Ink On 5-11
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Turning High Voltage On 5-12
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Test Printing a Sample Message 5-13
Procedure 5-13

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Procedure 5-14

Adjusting the Nozzle Drive 5-15
Printer Calibration Procedure 5-15
Nozzle Drive Set-up Procedure 5-15

Setting a Password 5-16
Procedure 5-16

Adjusting High Voltage 5-17
Procedure 5-17

Introduction

This chapter describes how to perform service procedures. Each of the procedures in this chapter use the Service mode of the software. Refer to the Software Summary Chart in the *Owner's Manual* for a complete map of all the software. The Service mode is shown in Figure 5-2 on page 5-5.

Refer to the list below to view all the tasks covered in this chapter. Refer to the page number listed to locate the specific procedure for each task.

- *Recording Maintenance Times in Memory . . . . . turn to page 5-7*
- *Recording Ink and Make-Up Fluid Data in Printer Memory . . . . . turn to page 5-8*
- *Accessing Current Run Times . . . . . turn to page 5-9*
- *Resetting Faults . . . . . turn to page 5-10*
- *Turning Ink On . . . . . turn to page 5-11*
- *Turning High Voltage On . . . . . turn to page 5-12*
- *Test Printing a Sample Message . . . . . turn to page 5-13*
- *Setting the Ink Pressure . . . . . turn to page 5-14*
- *Adjusting the Nozzle Drive . . . . . turn to page 5-15*
- *Setting a Password . . . . . turn to page 5-16*
- *Adjusting High Voltage . . . . . turn to page 5-17*

Software Illustration Conventions

Figure 5-1 shows how to use the software illustrations provided for each procedure to move through the software.

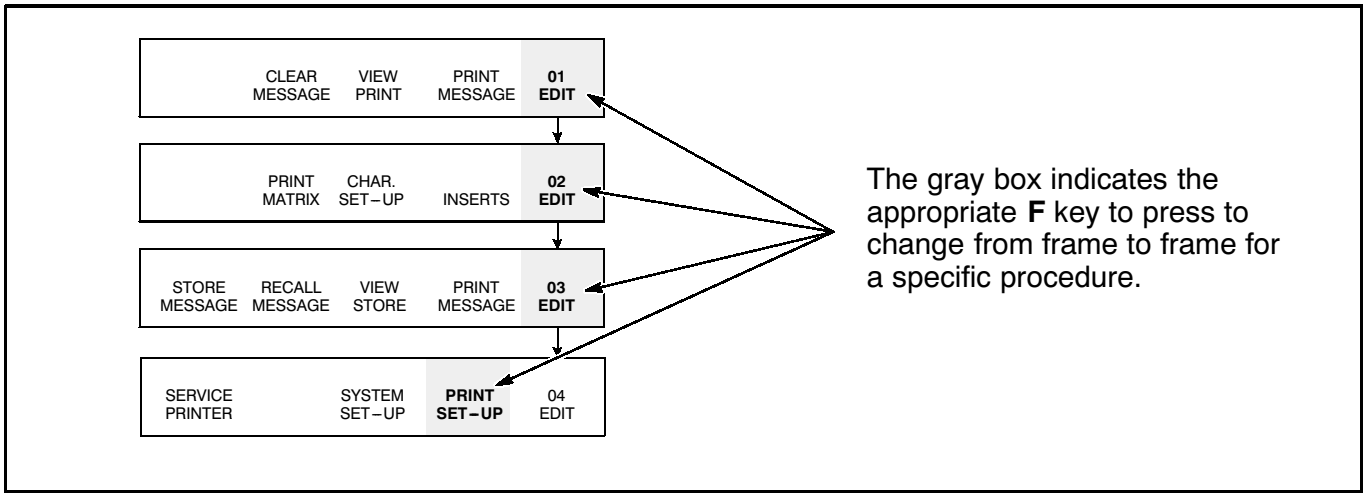


Figure 5-1. Software Illustration Example

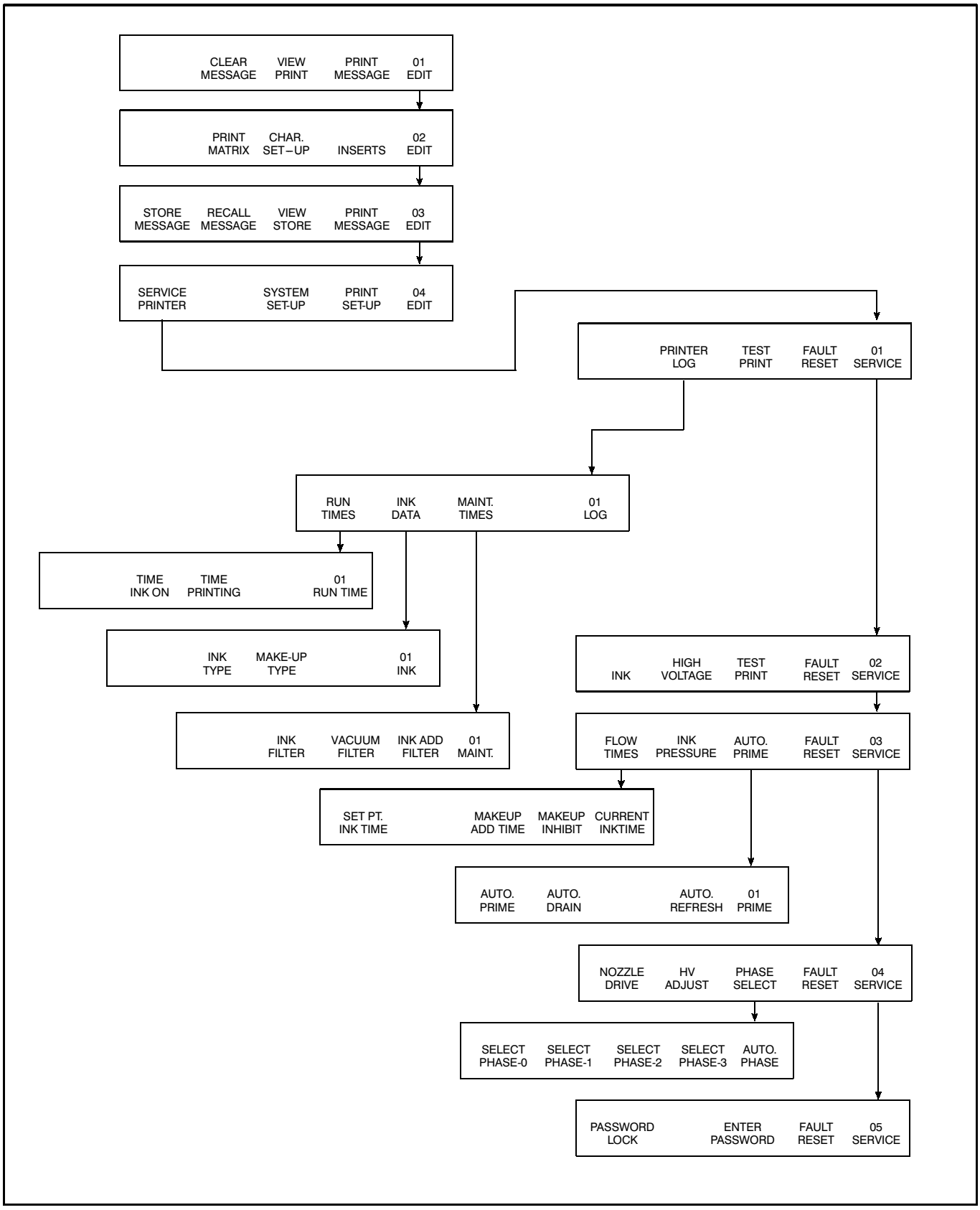


Figure 5-2. Service Mode

Recording Maintenance Information in Memory (Printer Log)

Introduction

The procedures in this section explain how to use the Printer Log feature in the software. This feature enables you to do the following:

- record maintenance times in memory
- store information such as the type of ink or make-up fluid used in the printer
- determine printer run times

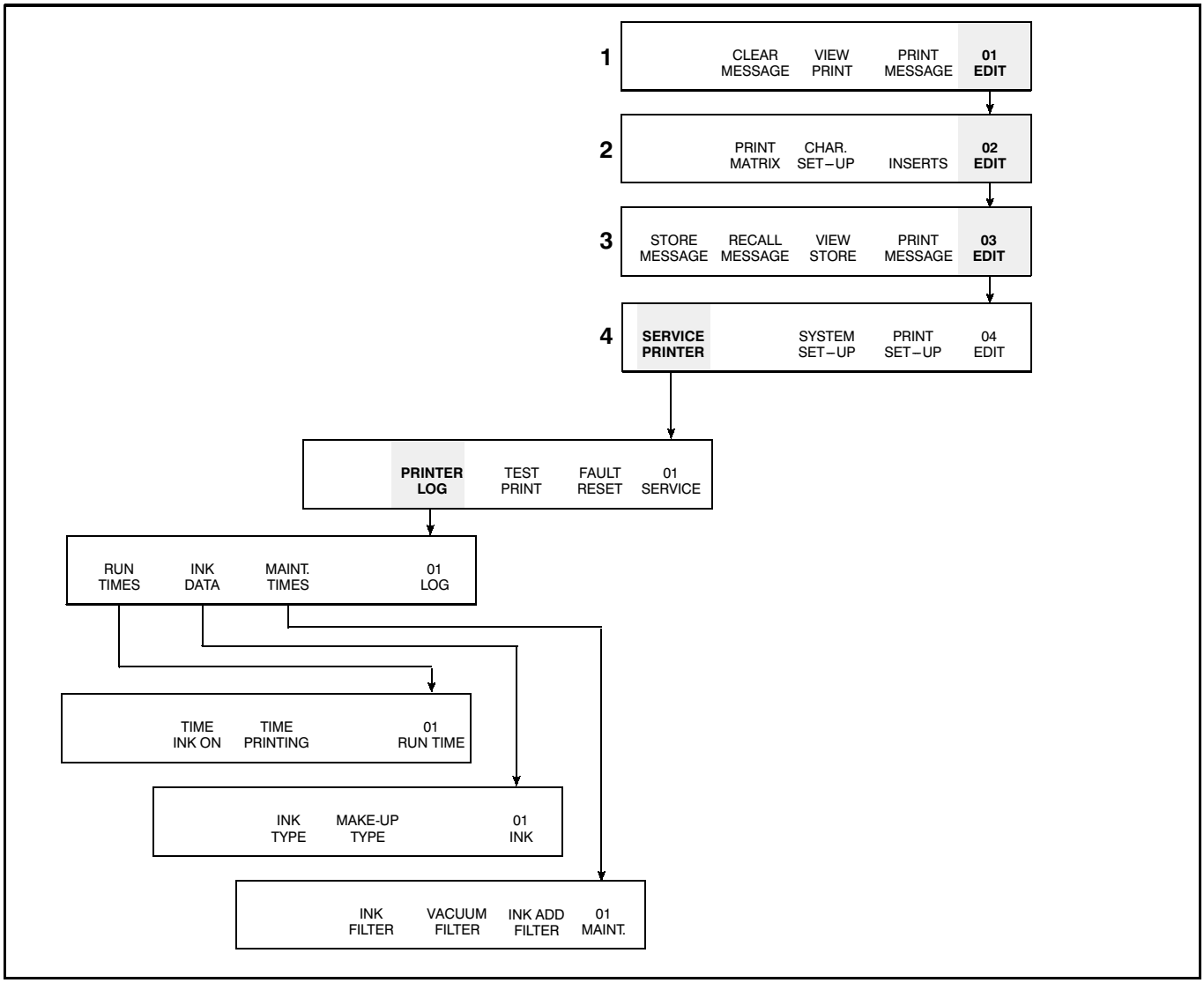


Figure 5-3. Accessing the Printer Log

Recording Maintenance Times in Memory

This procedure explains how to record the dates of filter changes in printer memory.

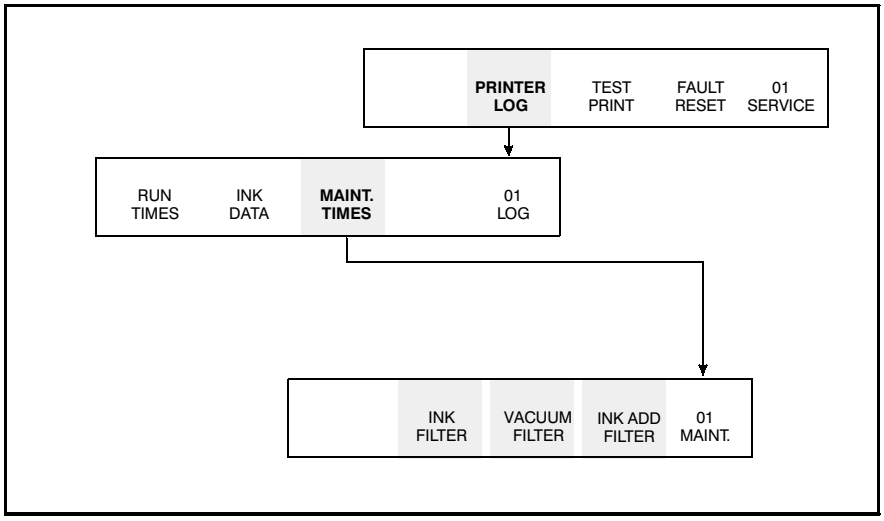


Figure 5-4. Accessing <MAINT. TIMES> in Printer Log

Procedure

1. Begin in Frame <01 SERVICE>. Refer to Figure 5-4.
2. Press **F2** to select <PRINTER LOG>. Frame <01 LOG> appears in the display screen.
3. Press **F3** to select <MAINT. TIMES>. Frame <01 MAINT.> appears in the display screen.
4. Refer to the chart below for the options available in this frame.

When you press:	This appears in the display screen:
F2 – <INK FILTER>	ENTER INK FILTER DATA – – – ▶
F3 – <VACUUM FILTER>	ENTER VACUUM FILTER DATA – – – ▶
F4 – <INK ADD FILTER>	ENTER INK ADD FILTER DATA – – – ▶

5. Enter the date of the last filter change. Up to eight digits can be entered.
6. Press the **ENTER** key. The date appears in the display screen.

Recording Ink and Make-up Fluid Data in Memory

This procedure explains how to record the type of ink and make-up fluid used in the printer in printer memory.

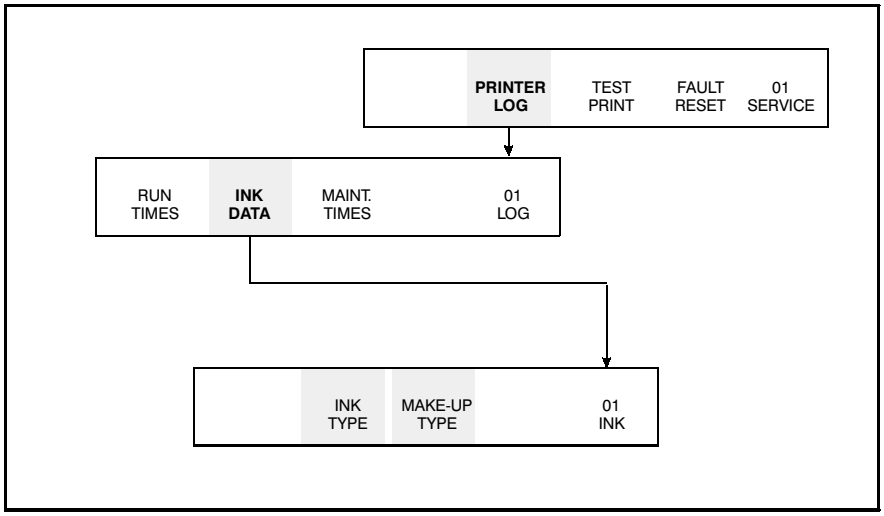


Figure 5-5. Accessing <INK DATA> in Printer Log

Procedure

1. Begin in Frame <01 SERVICE>. Refer to Figure 5-5.
2. Press **F2** to select <PRINTER LOG>. Frame <01 LOG> appears in the display screen.
3. Press **F2** to select <INK DATA>. Frame <01 INK> appears in the display screen.
4. Refer to the chart below for the options available in this frame.

When you press:	This appears in the display screen:
F2 to select <INK TYPE>	ENTER INK TYPE - - - ▶
F3 to select <MAKE-UP TYPE>	ENTER MAKE-UP TYPE - - - ▶

5. Enter the ink and make-up fluid type.
6. Press the **ENTER** key. The fluid type entered appears in the display screen.

Accessing Current Run Times

This procedure explains how to enter the <PRINTER LOG> to access the printer run times.

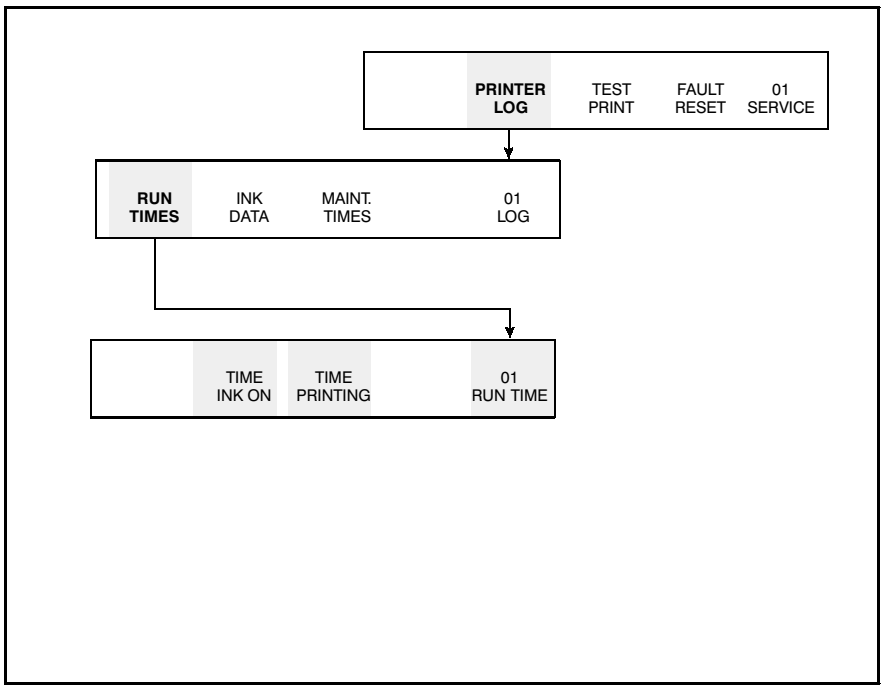


Figure 5-6. Accessing <RUN TIMES> in <PRINTER LOG>

Procedure

1. Begin in Frame <01 SERVICE>. Refer to Figure 5-6.
2. Press **F2** to select <PRINTER LOG>. Frame <01 LOG> appears in the display screen.
3. Press **F1** to select <RUN TIMES>. Frame <01 RUN TIME> appears in the display screen.
4. Refer to the chart below for the information available in this frame.

The Value Above:	Refers to:
F2 <TIME INK ON>	the number of hours that the ink has been On
F3 <TIME PRINTING>	the number of hours the **PRINT** light has been On

5. Press the **ENTER** key to return to Frame <01 LOG>.

Resetting Faults

The Reset Faults function in the software enables you to clear the fault from the display screen. The printer must be in Service mode to access this function.

Introduction

This procedure explains how to reset some printer faults.

The Fault Reset function is available in five places in the Service mode for your convenience. Each of the five instances operate identically. Refer to Figure 5-7.

Note: Refer to the Chapter 7*, Troubleshooting*, for a complete list of printer faults.

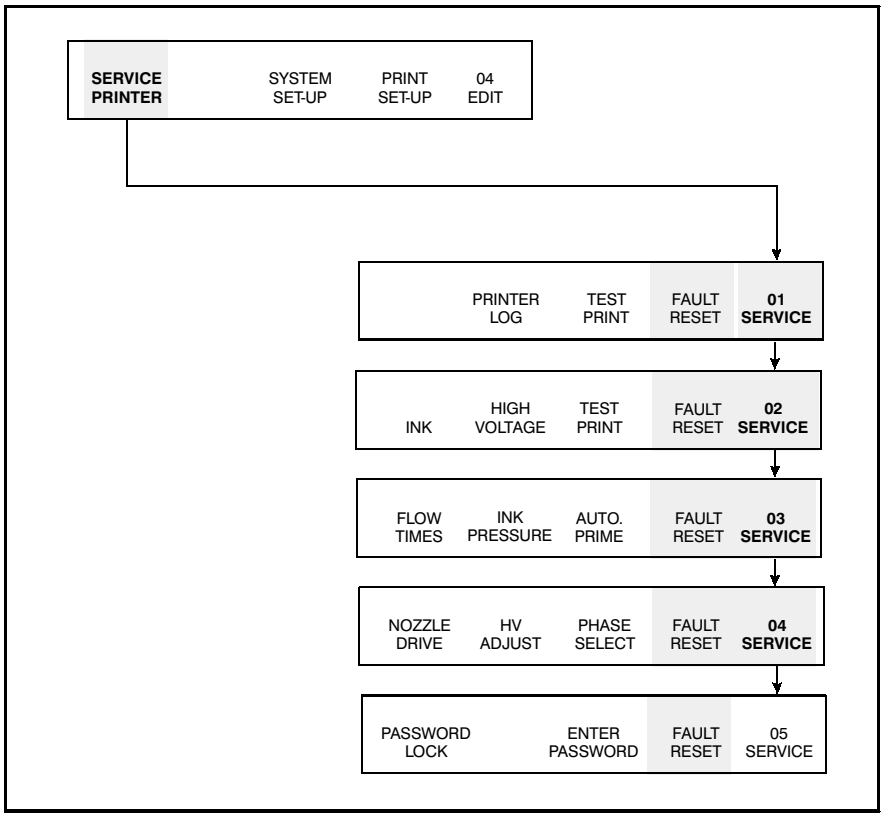


Figure 5-7. Accessing <FAULT RESET>

Procedure

This procedure describes how to reset a fault.

1. Refer to Figure 5-7 and locate Frame <01, 02, 03, 04, or 05 SERVICE>.
2. Press **F4** to reset the fault.

Turning Ink On

Introduction

This procedure explains how to turn ink On to the printhead.

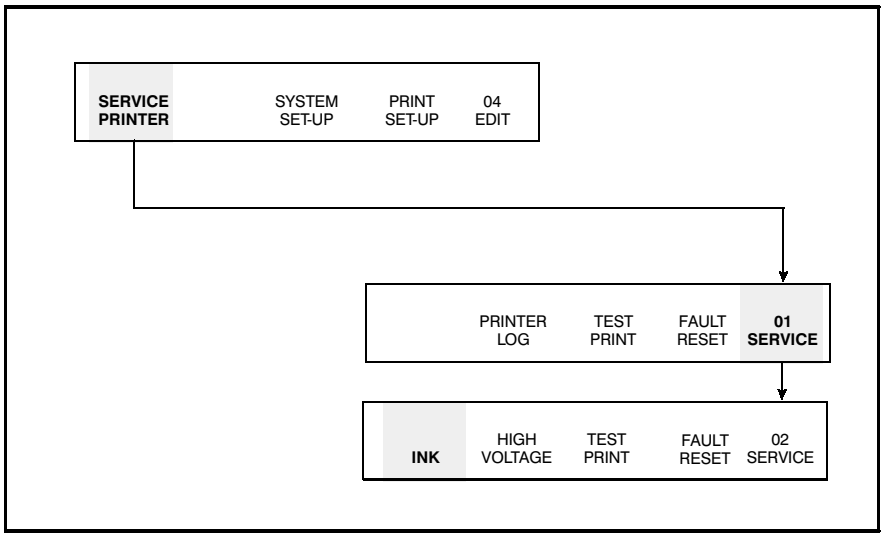


Figure 5-8. Accessing Frame <02 SERVICE>

Procedure

1. Begin in Frame <02 SERVICE>. Refer to Figure 5-8.
2. View the current setting above <INK>. (Settings: <OFF>, <ON>.) If desired, press **F1** to change the setting.

   When <INK> is set to <ON>, ink is On to the printhead.

   When <INK> is set to <OFF>, ink is Off to the printhead.

Turning High Voltage On

Introduction

This procedure explains how to turn high voltage to the printhead On. High voltage can only be turned On if the ink is On. (Refer to page 5-11 to turn the ink On.)

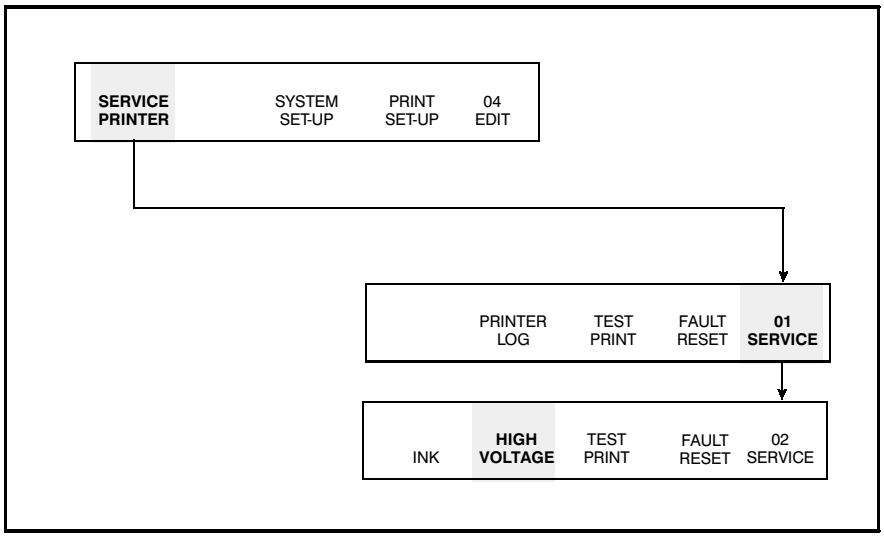


Figure 5-9. Accessing Frame <02 SERVICE>

Procedure

1. Begin in Frame <02 SERVICE>. Refer to Figure 5-9.
2. View the current setting above <HIGH VOLTAGE>. (Settings: <OFF>, <ON>.) If desired, press **F2** to change the setting.

   When <HIGH VOLTAGE> is set to <ON>, high voltage is On to the printhead.

   When <HIGH VOLTAGE> is set to <OFF>, high voltage is Off to the printhead.

Note: High voltage will not turn On unless the Ink is On.

Test Printing a Sample Message

Introduction

This procedure explains how to test print a sample message. The test print function is available in two frames: Frame <01 SERVICE> and Frame <02 SERVICE>. Each instance operates the same.

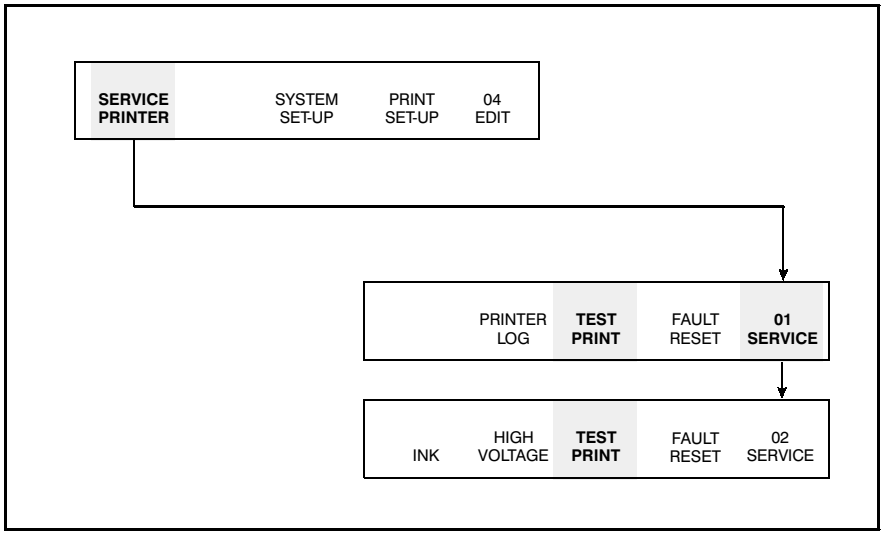


Figure 5-10. Accessing Frame <01 SERVICE>

Procedure

1. Begin in Frame <01 SERVICE> or Frame <02 SERVICE>. Refer to Figure 5-10.
2. Prepare substrate on which to test print and position the printhead for a test print.

Note: Ensure that the printhead is pointed toward the substrate prior to turning on the test print in step 3. Ink and high voltage must be turned on. When you press **F3** as explained in step 3, the printer immediately will begin to expel ink from the printhead.

Note: The internal encoder must be selected to perform test printing. Refer to Chapter 8.

3. Put the substrate in front of printhead and press **F3** to select <TEST PRINT>. The printer expels ink for about 30 seconds.

Setting the Ink Pressure

Introduction

This procedures shows you how to set the ink pressure. **This function is only used during a printer calibration procedure.** Refer to Chapter 6, *Maintenance*, for the complete printer calibration procedure.

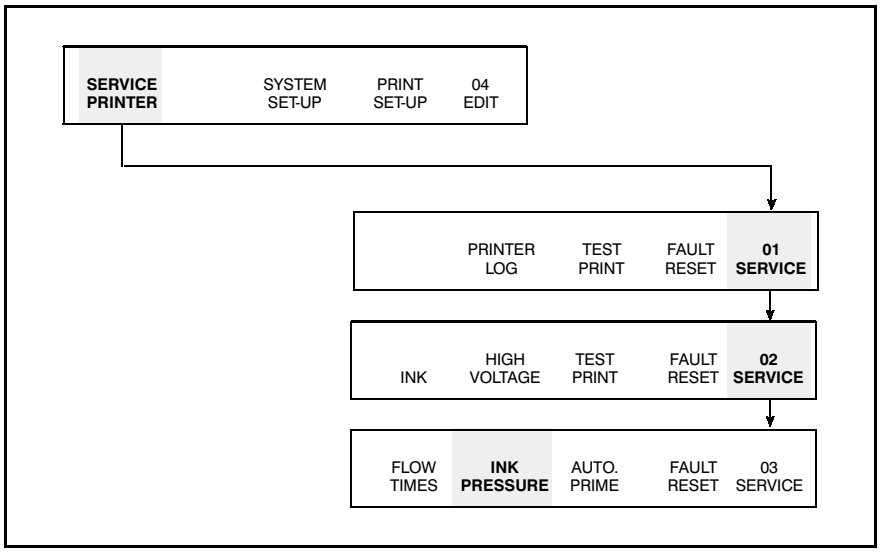


Figure 5-11. Accessing Frame <03 SERVICE>

Procedure

Perform steps 1 and 2 below during the printer calibration procedure immediately after you:

a. preset the ink pressure to 40 psi (2.8 bar) or 50 psi (3.45 bar) by adjusting the ink pressure regulator while watching the reading on the gauge door

b. adjust the nozzle drive to center the ink stream breakoff point in the charge tunnel window

1. Begin in Frame <03 SERVICE>. Refer to Figure 5-11.
2. Press **F2** to select <INK PRESSURE>. Three different words may appear on the display screen: <LOW>, <SET>, or <HIGH>. Use the table below to determine the next step to complete the procedure.

If reading is:	Do the following:
<LOW>	Turn to the ink pressure regulator to raise the ink pressure until <SET> appears. Press the **ENTER** key.
<SET>	Press the **ENTER** key.
<HIGH>	Turn the ink pressure regulator to lower ink pressure until <SET> appears. Press the **ENTER** key.

Adjusting the Nozzle Drive

Introduction

The nozzle drive function is used in two procedures: printer calibration and the nozzle drive set-up procedure.

Printer Calibration Procedure

The printer calibration procedure sets the ink pressure. To do this properly, the ink stream must be centered in the charge tunnel window using the nozzle drive adjustment.

Nozzle Drive Set-up Procedure

The nozzle drive set-up procedure defines the “print window,” or the range of nozzle drive values that yield good print quality. For this procedure, the nozzle drive value is adjusted to move the breakoff point to the position in the charge tunnel which yields the best print quality. **The breakoff point does not have to be in the exact center of the charge tunnel window, as is required in the printer calibration procedure.**

Note: The ink stream breakoff point is only centered in the charge tunnel to set the ink pressure. Thereafter, the breakoff point can move from the center of the charge tunnel. Each of these procedures are explained fully in Chapter 6, *Maintenance*.

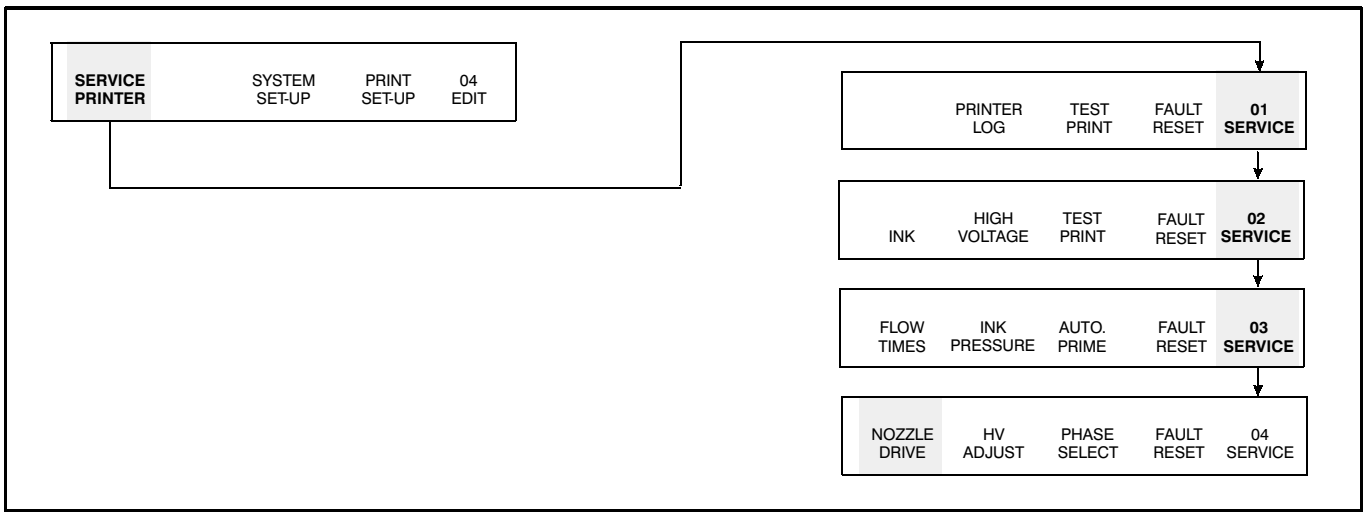


Figure 5-12. Accessing Frame <04 SERVICE>

Setting a Password

Introduction

This procedure shows you how to define a password, and how to enable (turn On) the password so that access to the Service mode is restricted.

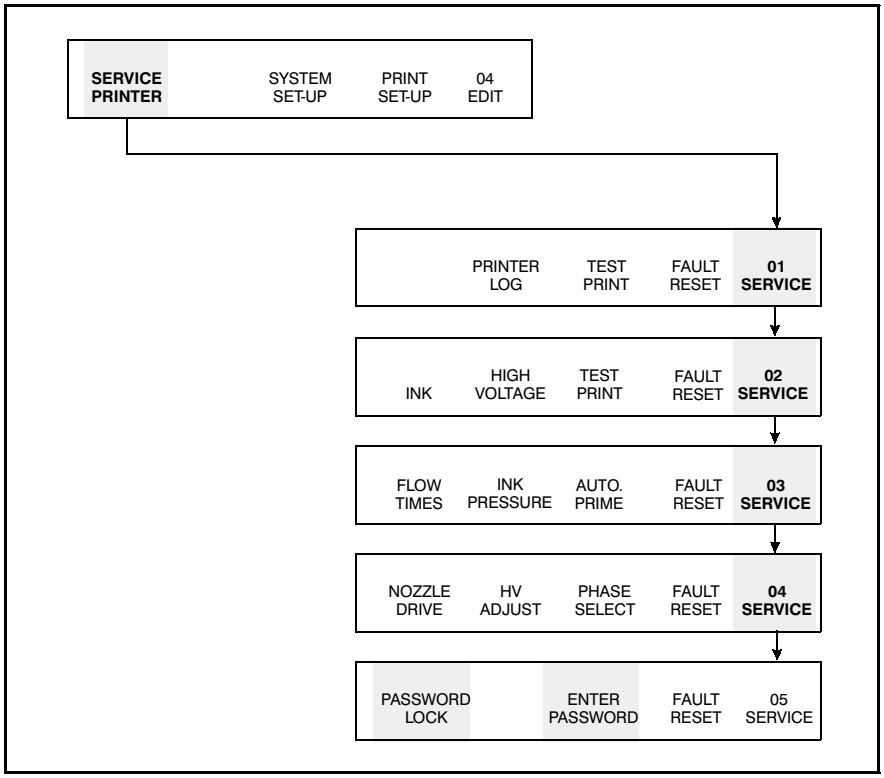


Figure 5-13. Accessing Frame <05 SERVICE>

Procedure

1. Begin in Frame <05 SERVICE>. Refer to Figure 5-13.
2. Press **F3** to select <ENTER PASSWORD>. The following appears in the display screen:

   ENTER NEW PASSWORD - - - ▶

3. Use the keyboard to enter up to eight characters for the password.
4. Press the **ENTER** key.
5. View the current setting above <PASSWORD LOCK>. (Settings: <OFF>, <ON>) If desired, press **F1** to change the setting.

   When <PASSWORD LOCK> is set to <ON>, a password is required to enter the Service mode.

   When <PASSWORD LOCK> is set to <OFF>, no password is required to enter the Service mode.

Adjusting High Voltage

Introduction

This procedure shows you how to adjust high voltage.

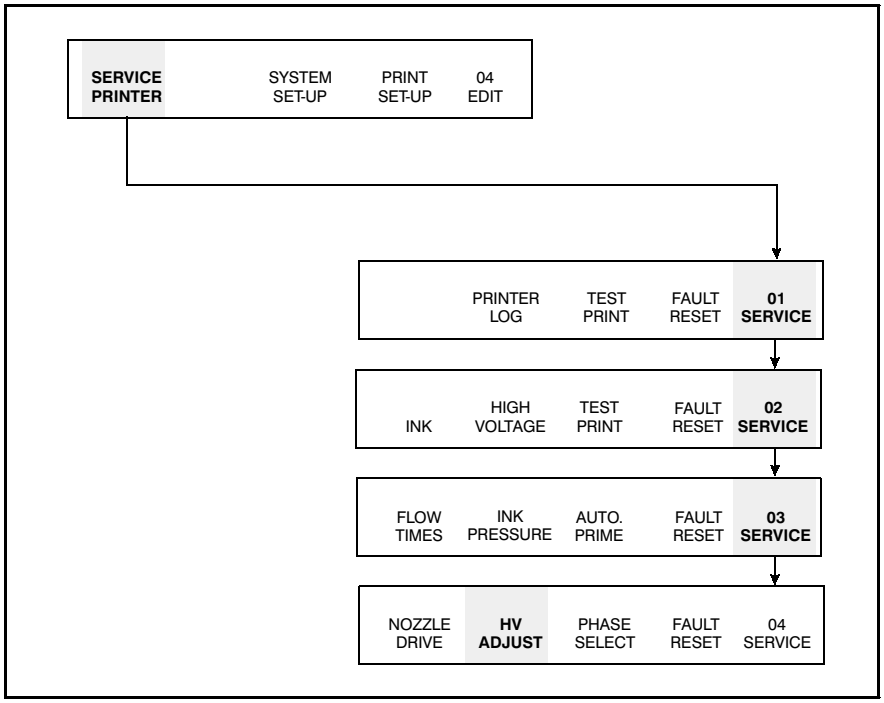


Figure 5-14. Accessing Frame <04 SERVICE>

Procedure

1. Begin in Frame <04 SERVICE>. Refer to Figure 5-14.
2. Press **F2** to select <HV ADJUST>. The following appears in the display screen.

   HEIGHT ADJUSTMENT SETTING - - - ▶

3. Use the arrow keys to raise or lower high voltage setting.

   A setting of zero represents 3,000 VDC to the printhead, and 100 represents 6,000 VDC to the printhead.

Notes:

6

Maintenance

In this chapter you will find:

- the preventive maintenance schedule
- ink maintenance procedures



CAUTION: Refer to *Ink Maintenance Precautions* on page 6-24 before performing ink maintenance procedures.

- the nozzle drive procedure required to obtain the finest print quality

Turn to page 6-2 for a chapter-level Table of Contents.

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Introduction

Scheduled (Preventive) Maintenance

This chapter contains the recommended preventive maintenance schedule. Following the recommendations provided in this schedule will help you keep your printer in peak operating condition, help you become familiar with how the printer works, and may help you more quickly identify the cause of problems when they occur.

- *Scheduled Maintenance . . . . . turn to page 6-4*

Ink Maintenance

Ink maintenance is the term given to the procedures which describe the following processes:

- Loading fluids
- Flushing fluids
- Draining fluids
- Renewing ink
- Calibrating the printer (setting ink pressure)
- Setting the nozzle drive
- Preparing the printer for storage
- Changing ink (new type of ink)

Each of these procedures are detailed in this chapter. Refer to the page number listed below.

- *Ink Maintenance Procedures . . . . . turn to page 6-24*

Print Quality (Nozzle Drive Set-up Procedure)

This section helps you locate the print window, or the range of nozzle drive values which yield good print quality. It is an expanded explanation of the nozzle drive set-up procedure shown in a flow chart in the Ink Maintenance section on page 6-37.

- *Print Quality (Nozzle Drive Set-up Procedure) . . . . . turn to page 6-39*

Scheduled Maintenance

Several regular maintenance functions must be performed on a scheduled basis to ensure optimum printer operation.

This section provides preventive maintenance schedules and procedures, in addition to information on periodic cleaning and replacement of components.

Refer to Table 6-1 below for a list of all the recommended scheduled maintenance procedures, and where to turn in this chapter to find those procedures.

Maintenance Schedule		
How Often to Perform	**Procedure**	**Turn to Page**
Daily	Clean the printhead	6-6
	Check fluid level in replenishment bottles (Change bottles, if required)	6-10
	Inspect fluid lines for leaks	6-11
	Drain input air filter	6-12
	Drain ink trap	6-13
Every 500 Hours*	Check vacuum filter	6-16
	Change ink and make-up fluid replenishment filters	6-17
Every 5,000 Hours*	Change ink filter	6-19
	* A feature in the printer software called <RUN TIMES> enables you to quickly access the number of hours the printer has been in use. Refer to *Recording Maintenance Times in Printer Memory* in Chapter 5, *Service Software*, for more information on the Printer Log Program.	
Every year (once per year)	Change control board battery	6-22

Table 6-1. Maintenance Schedule

Daily Maintenance

This section describes the procedures that should be completed every day. Carefully follow the procedures in this section to avoid diluting the ink system with excess cleaning fluids.

Daily Maintenance Schedule	
Procedure	**Turn to Page**
Clean the printhead **Summary:** Clean the printhead at the start of every shift or work period. ***Never*** clean the printhead at shutdown.	6-6
Check the fluid levels in the replenishment bottles (Change bottles, if required) **Summary:** You have approximately 30 minutes to change the ink bottle after an Ink Low warning occurs before the printer runs out of ink.	6-10
Inspect the fluid lines for leaks **Summary:** Check the ink module and other fluid components for ink leaks. If you find a leak around a fitting, use an adjustable wrench to tighten the fitting ¼-turn.	6-11
Drain the input air filter **Summary:** Oil, water, and excess particles accumulate in the input air filter. Drain each component on a daily basis.	6-12
Drain the ink trap **Summary:** Oil, water, and excess particles accumulate in the ink trap. Drain each component on a daily basis.	6-13

Table 6-2. Daily Maintenance Schedule

Cleaning the Printhead

This section describes how to clean the printhead.

When to Clean the Printhead

Clean the printhead at the start of every shift or work period.

Never clean the printhead at shutdown. By not cleaning the printhead at shutdown, a cap of ink is allowed to dry over the end of the nozzle. This ink cap keeps air from entering the nozzle and drying the ink. This helps prevent clogs in the nozzle.

Procedure

WARNING: Before starting this procedure, make certain that AC power to the printer is Off, and the AC power and compressed air supply to the printer are disconnected (unplugged). Failure to follow this warning may result in personal injury.

1. If you have not done so, press the **OFF** key to turn the printer Off. Allow the printer to complete its programmed four-minute shutdown sequence.
2. Turn the AC power switch Off. (Refer to Figure 6-1 for the location of the AC Power Switch.)

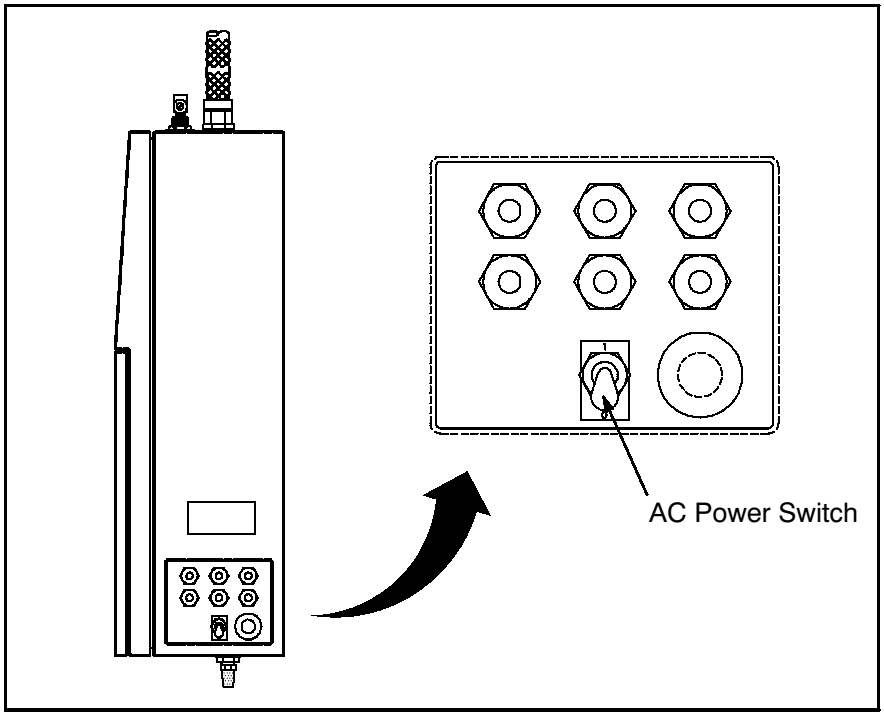


Figure 6-1. AC Power Switch

3. Locate the screw that holds the printhead cover in place. (Refer to Figure 6-2.)
4. Use a screwdriver to loosen the printhead cover holding screw, then slide the printhead out.

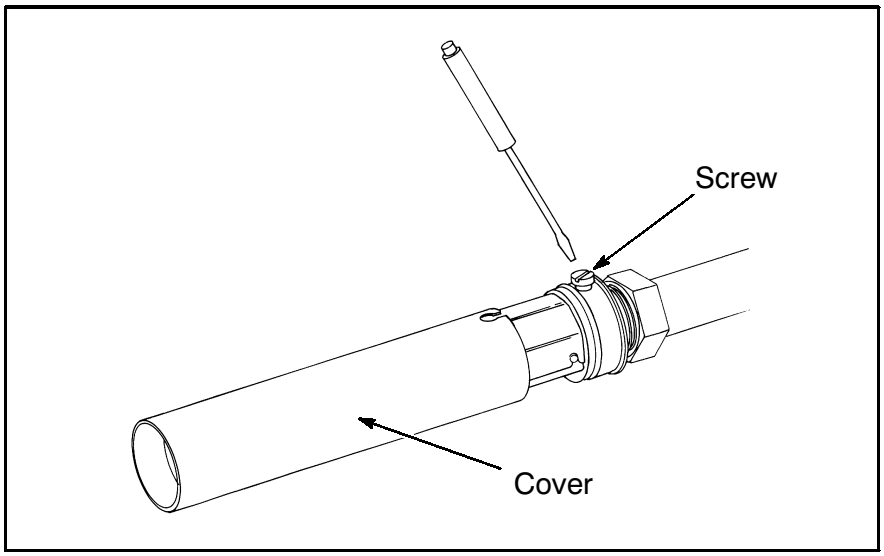


Figure 6-2. Removing the Printhead from its Cover

5. Visually inspect the printhead assembly. Look for foreign particles and ink that typically accumulate in the nozzle orifice (located on the front of the nozzle), charge tunnel, deflection plate and ink return. (Refer to Figure 6-3 for the location of each component.)

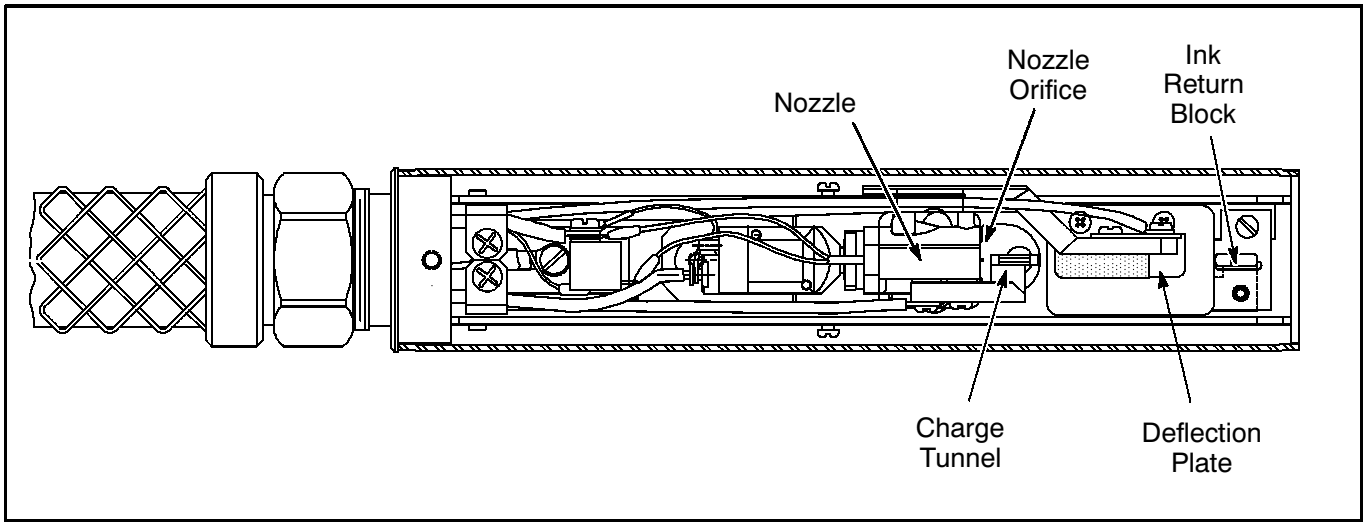


Figure 6-3. Printhead Component Identification

6. Ground the printhead. (Refer to Figure 6-4 for two grounding methods.)

WARNING: 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 cause fire due to static discharge.

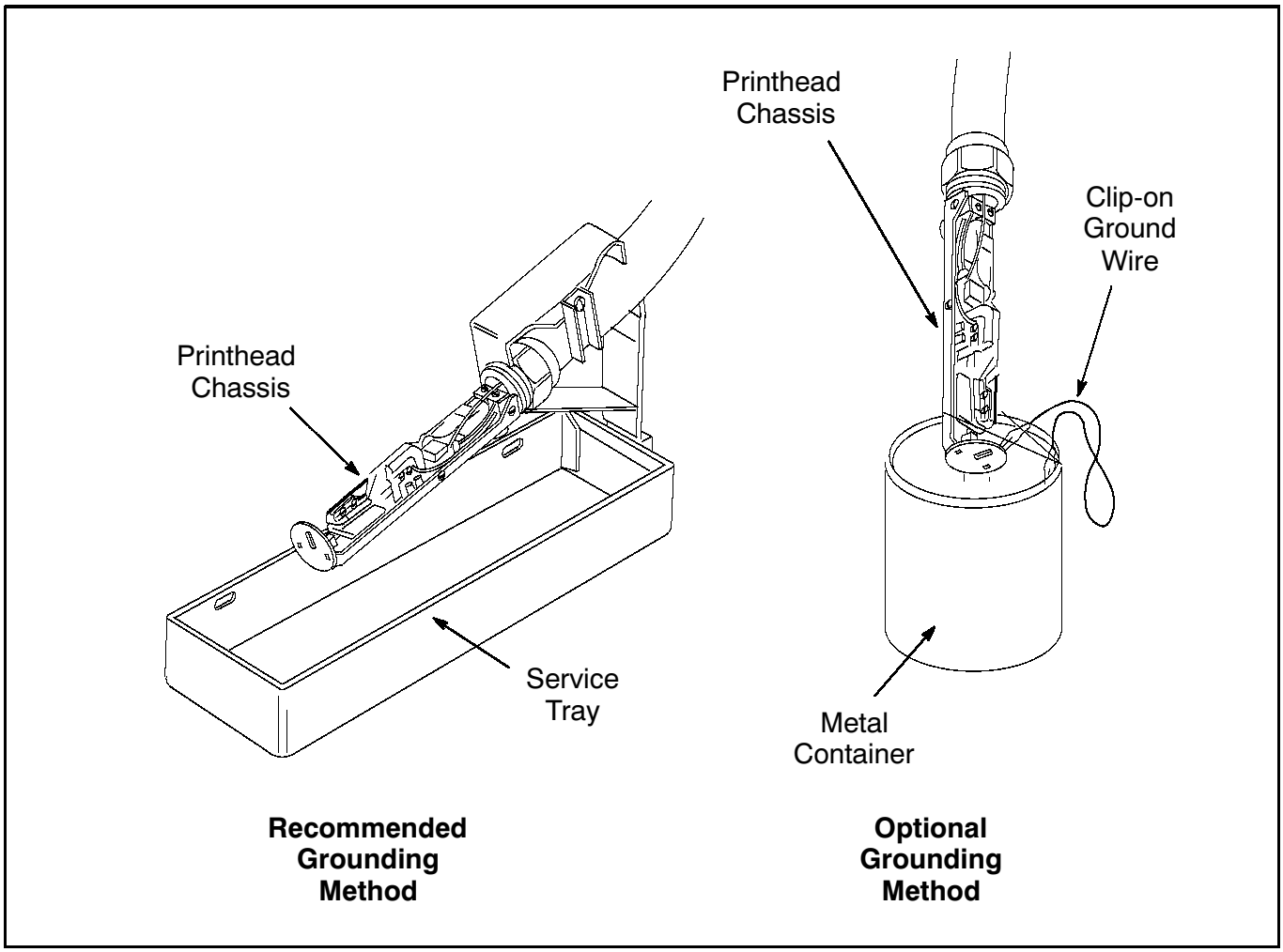


Figure 6-4. Grounding Methods

CAUTION: Be very careful when cleaning the charge tunnel. Serious misalignment or damage may occur if excessive force is used during cleaning.

7. Ensure the printhead is pointed down into the grounded service tray. Flush away contaminants using the recommended VIDEOJET cleaning solution or make-up fluid. (Refer to Figure 6-5.)

Note: Use cleaning solution sparingly. Do not flush excessive amounts of cleaning solution into the ink return block.

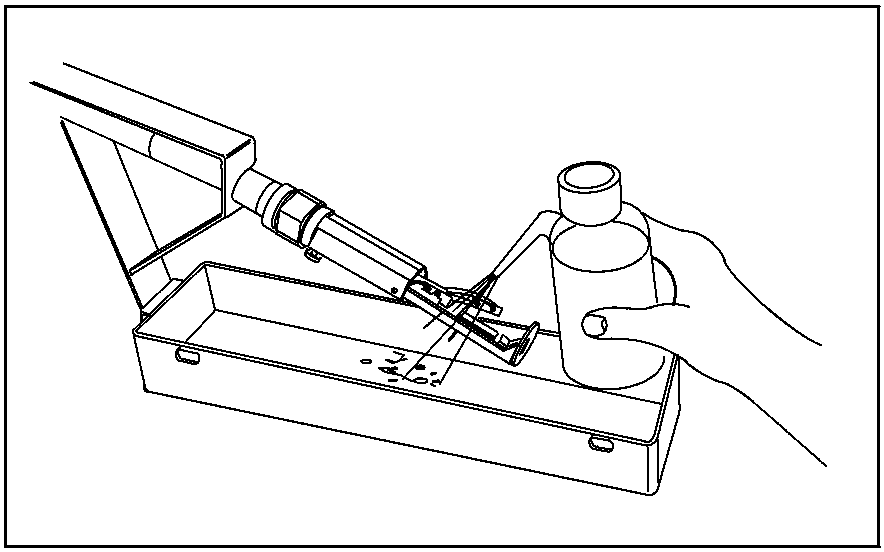


Figure 6-5. Cleaning the Printhead

8. Dry the printhead completely, using compressed air at about 20 psi (1.4 bar).

CAUTION: Do not use shop cloths or paper towels to dry the printhead or cover. Only use compressed air at about 20 psi (1.4 bar). Do not force compressed air into the ink return block.

9. Remove the printhead from the service tray.
10. Clean the printhead cover if it is dirty, then replace the printhead into the cover.
11. Dispose of the cleaning solution in the service tray (or other waste container used) properly.

CAUTION: Do not pour cleaning solution into sinks, sewers, or drains. Comply with all appropriate regulations when disposing of printer fluids. Consult the appropriate regulatory agency for further information.

Note: In some instances, you may have to carefully reclean the tip of the nozzle and dry it before use.

Check Fluid Level in Replenishment Bottles

Check the amount of fluid in the ink and make-up fluid replenishment bottles.

An Ink Low warning occurs when the level of fluid in either bottle drops below the height of the ink low sensor on the dip tubes inside the fluid bottles. This warning will appear on the printer display screen. You have approximately 30 minutes to change the ink or make-up fluid bottle after a warning occurs before the printer runs out of ink.

How to Change a Fluid Bottle

Note: The printer does not have to be Off to perform this procedure.

Note: Position shop towels inside the printer to catch any ink spilled during this procedure.

1. Identify the fluid bottle to be replaced.
2. Unscrew the cap from the new fluid bottle and discard the cap. Slice the foil and slide it back to remove, as shown in Figure 6-6 below.

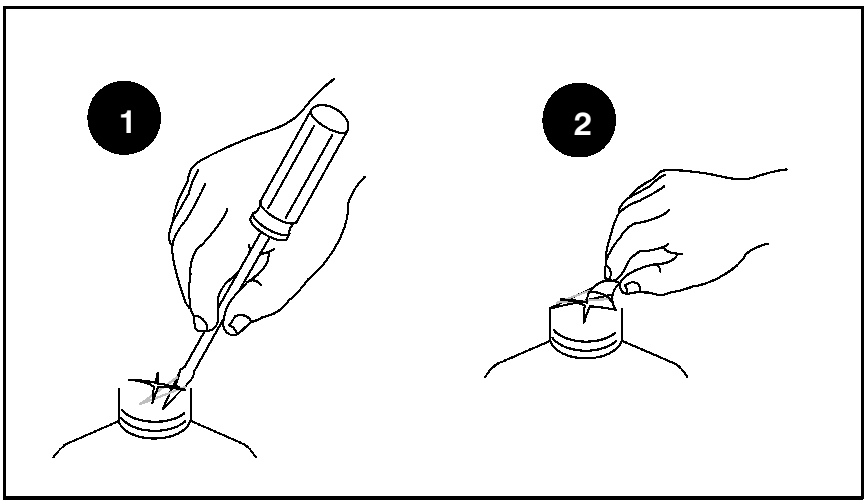


Figure 6-6. Opening a Fluid Bottle

3. Unscrew the cap on the bottle to be replaced. Carefully remove the cap and tubes from the bottle as you ease the bottle out of the cabinet.
4. Set the used bottle aside.
5. Insert the tubes into the new fluid bottle and ease the bottle into position in the fluid pan.
6. Tighten the cap.
7. Discard the fluid bottle removed from the printer following appropriate regulatory guidelines.

Inspect Fluid Lines for Leaks

Inspect the printer cabinet at the beginning of every shift. Check the ink module and other fluid components for fluid leaks. If you find a leak around a fitting, use an adjustable wrench to tighten the fitting ¼-turn.

Note: A line with a brass fitting is an air or vacuum line. A line with stainless steel fittings is an ink or make-up fluid line.

It is important to remember that leaks may cause other problems than those at the source of the leak. Refer to the diagrams in Chapter 4, *Theory of Operation*, to track the paths of fluids and air throughout the system, and ensure that potential problems are corrected immediately.

CAUTION: Do not overtighten a fitting. This will crush the fitting and the tubing.

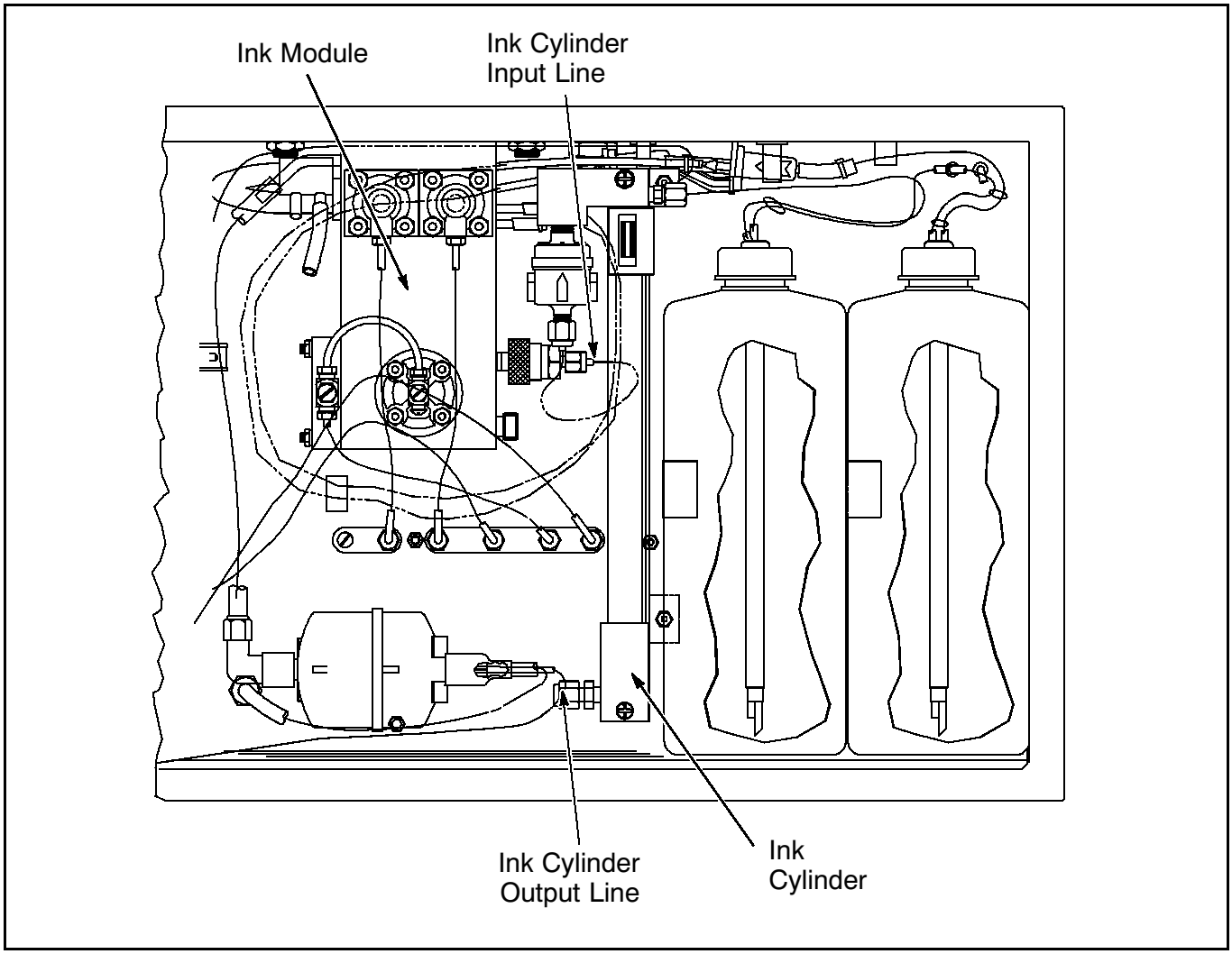


Figure 6-7. Inspect Fluid Lines for Leaks

Drain Input Air Filter and Ink Trap

This procedure describes how to drain the input air filter and ink trap. Oil, water, and excess particles accumulate in the input air filter and the ink trap. Drain each component every day before turning the printer On.

Input Air Filter Draining Procedure

1. Open the main printer door and locate the input air filter on the rear of the fluid pan. (Refer to Figure 6-8.)

WARNING: Before starting this procedure, make certain that AC power to the printer is OFF, and the AC power and compressed air supply to the printer are disconnected (unplugged). Failure to follow this warning may result in personal injury.

2. Locate the drain valve on the bottom of the input air filter.
3. Place paper towels underneath the drain valve. Press the drain valve to release the accumulated liquid and particles.
4. Replace the input air filter if required, otherwise check the quality of the shop air entering the system. Accumulation at the input air filter may be due to bad filters at the source air.

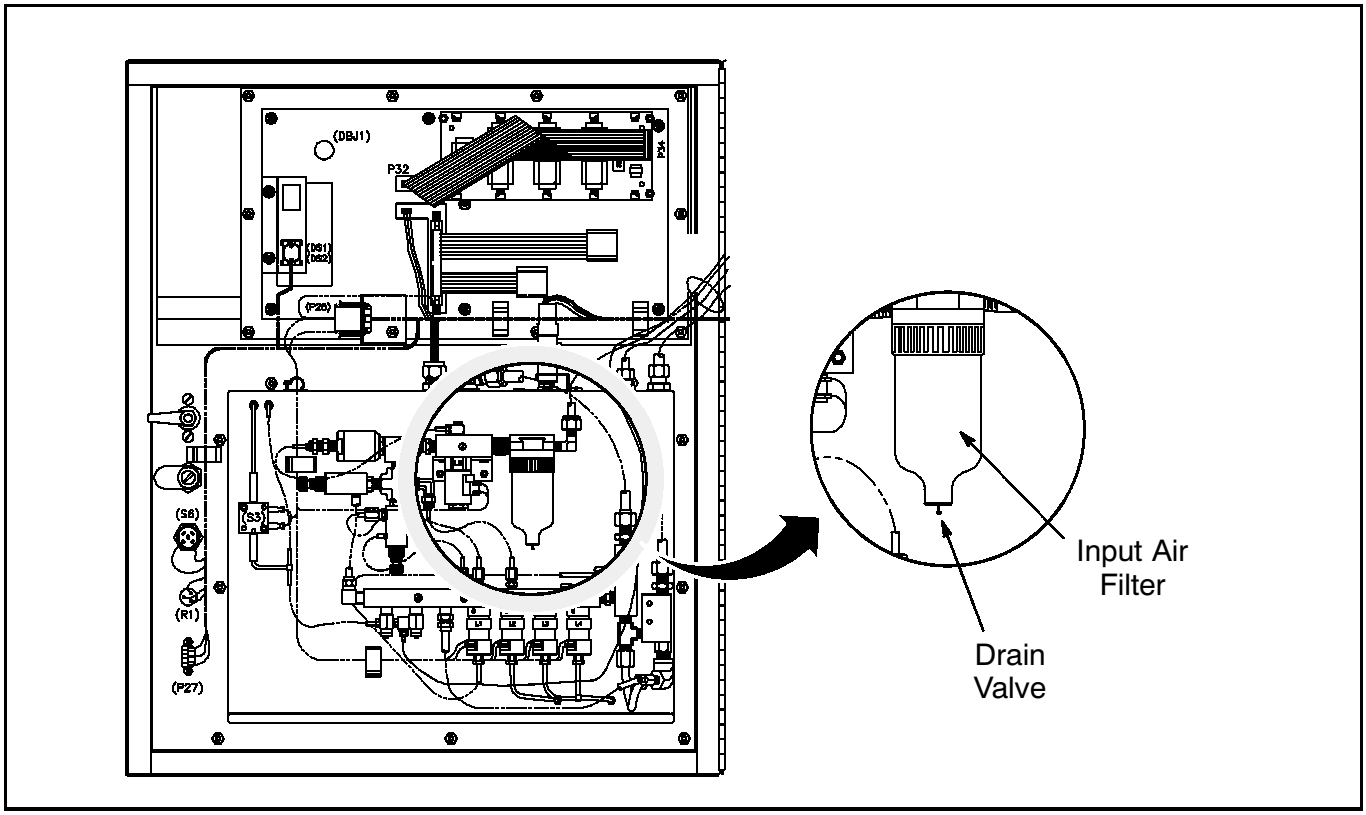


Figure 6-8. Input Air Filter

Ink Trap Procedure

1. Open the gauge door and locate the ink trap on the rear of the fluid pan. (Refer to Figure 6-9.)

WARNING: Before starting this procedure, make certain that AC power to the printer is OFF, and the AC power and compressed air supply to the printer are disconnected (unplugged). Failure to follow this warning may result in personal injury.

2. Locate the drain valve on the bottom of the ink trap.
3. Place paper towels underneath the drain valve, and press the drain valve.

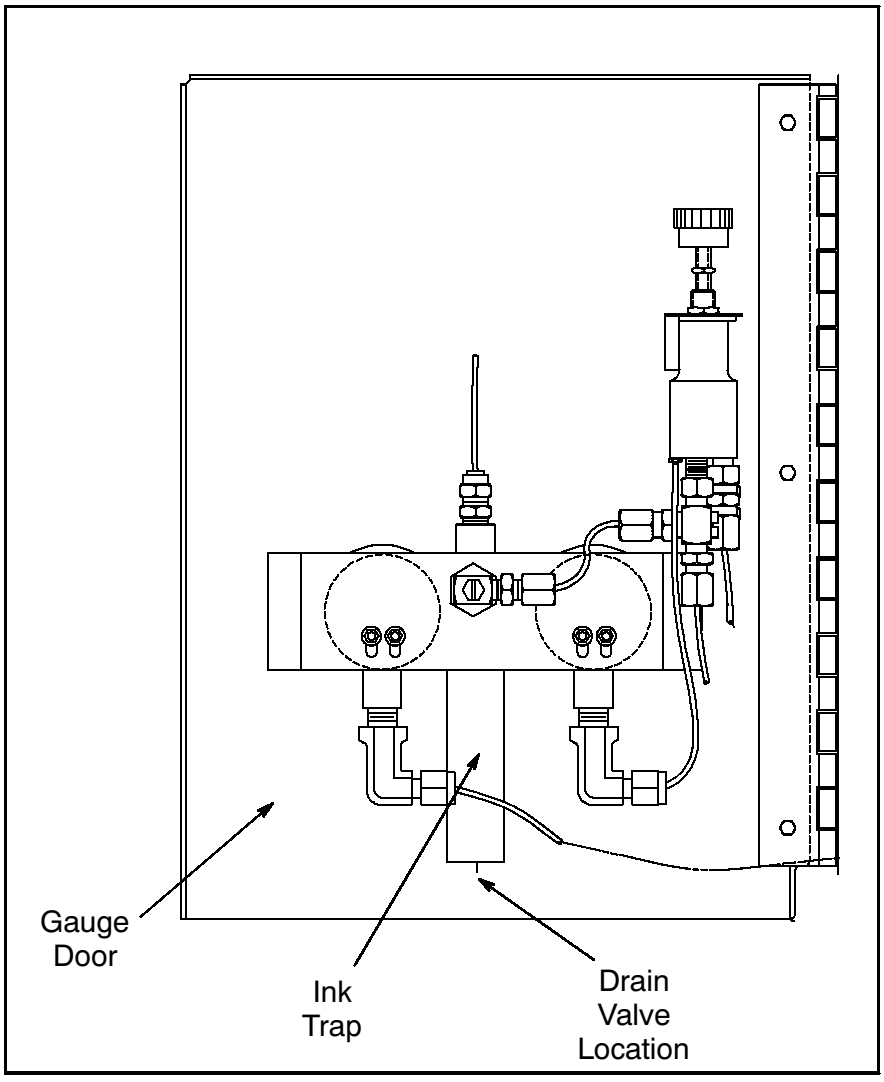


Figure 6-9. Ink Trap

500-Hour Maintenance

This section describes the procedures that should be completed every 500 hours of printer operation. Refer to Table 6-3 below for a list of the procedures in this section and the page numbers to turn to for the description of each procedure.

500-Hour Maintenance Schedule	
Procedure	**Turn to Page**
Check vacuum filter **Summary:** Inspect the vacuum filter for an accumulation of liquid every 500 hours of running time.	6-16
Change ink and make-up fluid replenishment filters **Summary:** Inspect and change the inline ink replenishment and make-up replenishment filters every 500 hours.	6-17

Table 6-3. 500-Hour Maintenance Schedule

How to Determine the Number of Hours the Printer Has Been in Operation

This procedure shows you how to access the Printer Log in the Service mode to determine the number of hours the printer has been in operation.

The printer automatically calculates two run time values: <TIME INK ON> and <TIME PRINTING>. Both values are accessed from <PRINTER LOG> in the Service mode.

- <TIME INK ON> refers to the number of hours that the ink has been On
- <TIME PRINTING> refers to the number of hours the **PRINT** light is On

Refer to the procedure below to access this section in the Service mode.

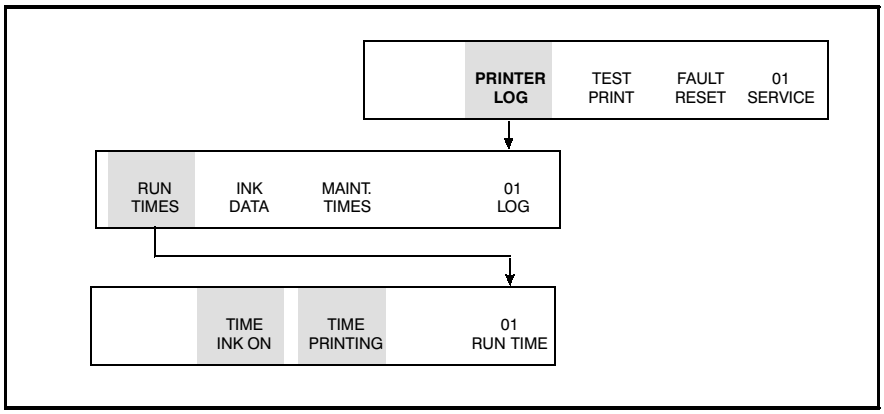


Figure 6-10. Accessing Frame <01 RUN TIME>

Procedure

Complete the following steps to access the printer log.

1. Begin in Frame <01 SERVICE>. Refer to Figure 6-10.
2. Press **F2** to select <PRINTER LOG>. Frame <01 LOG> appears in the display screen.
3. Press **F1** to select <RUN TIMES>. Frame <01 RUN TIME> appears in the display.
4. Refer to the chart below for the information available in this frame.

The Value Above:	Refers to:
F2 <TIME INK ON>	the number of hours that the ink has been On
F3 <TIME PRINTING>	the number of hours the **PRINT** light has been On

5. Press the **ENTER** key to return to Frame <01 LOG>.

Inspect Vacuum Filter

Inspect the vacuum filter every 500 hours of running time. (Refer to *How to Determine the Number of Hours the Printer Has Been in Operation* on page 6-15.) Refer to Figure 6-11 for the location of the vacuum filter.

Replace the filter if liquid is visible or if proper vacuum is difficult or impossible to maintain. Some discoloration in the filter is normal during operation. Enter the date of the filter change in the Printer log under <MAINT. TIMES>.

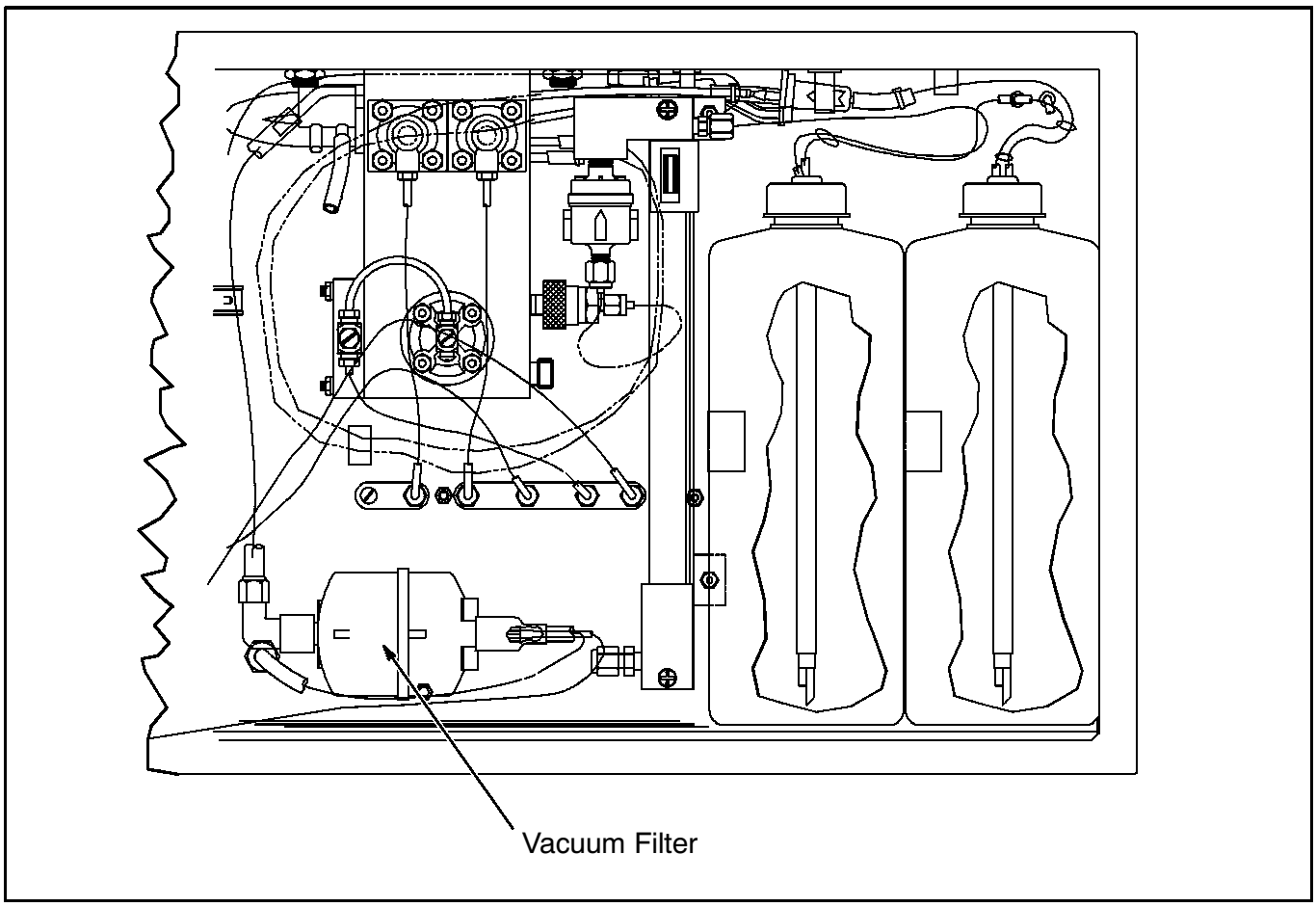


Figure 6-11. Location of Vacuum Filter

Inline Ink and Make-up Replenishment Filters

Inspect and change the inline ink replenishment and make-up replenishment filters every 500 hours. (Refer to *How to Determine the Number of Hours the Printer Has Been in Operation* on page 6-15.)

Ensure that the replacement filters are positioned exactly the same as the old filters (refer to Figure 6-12). Enter the date of the filter change in the Printer Log under <MAINT. TIMES>.

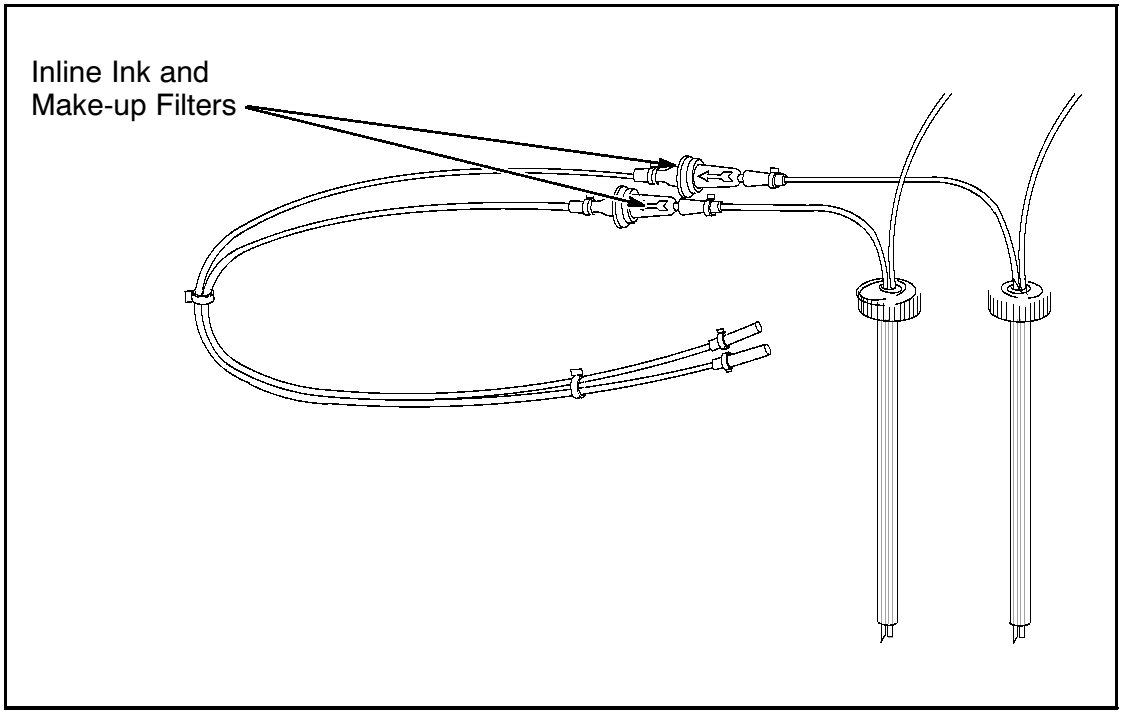


Figure 6-12. Inline Ink and Make-up Replenishment Filters

5,000-Hour Maintenance

This section describes the procedure that should be completed every 5,000 hours of printer operation. Refer to Table 6-4 below for the procedure in this section, and the page number to turn to for the description of that procedure.

5,000-Hour* Maintenance Schedule	
Procedure	**Turn to Page**
Change ink filter	6-19

Table 6-4. 5,000-Hour Maintenance Schedule

Note: * Refer to *How to Determine the Number of Hours the Printer Has Been in Operation* on page 6-15.

Change Ink Filter

This procedures describes how to change the final ink filter (refer to Figure 6-13). A system prime will be required following installation.

Final Ink Filter Replacement Procedure

1. Spread paper towels or absorbent rags on the bottom of the fluid pan to catch any ink that may spill during this procedure.

WARNING: Before starting this procedure, make certain that AC power to the printer is OFF, and the AC power and compressed air supply to the printer are disconnected (unplugged). Failure to follow this warning may result in personal injury.

2. Remove the ink cylinder input line from the bottom of the existing ink filter.
3. Turn the existing ink filter counterclockwise to remove it from the bottom of the ink cylinder top cap.

CAUTION: Do not use Teflon tape on the ink filter. Use caution when threading the filter into the top cap and ink cylinder input line to avoid cross-threading the filter.

4. Mount the new filter to the top cap of the ink cylinder. Carefully hand-tighten the filter into the top cap by turning it clockwise.
5. Connect the ink cylinder input line to the input end of the new filter.
6. Holding the filter in your hand, carefully tighten the nut with your fingers. Then use a 7/16" wrench to tighten the nut an additional half turn. If the filter leaks during operation, it may be tightened another half turn. Do not exceed a total of one full turn, or you may strip the threads on the filter.
7. Prime the system with new ink. Refer to page 6-27 for the proper procedure.

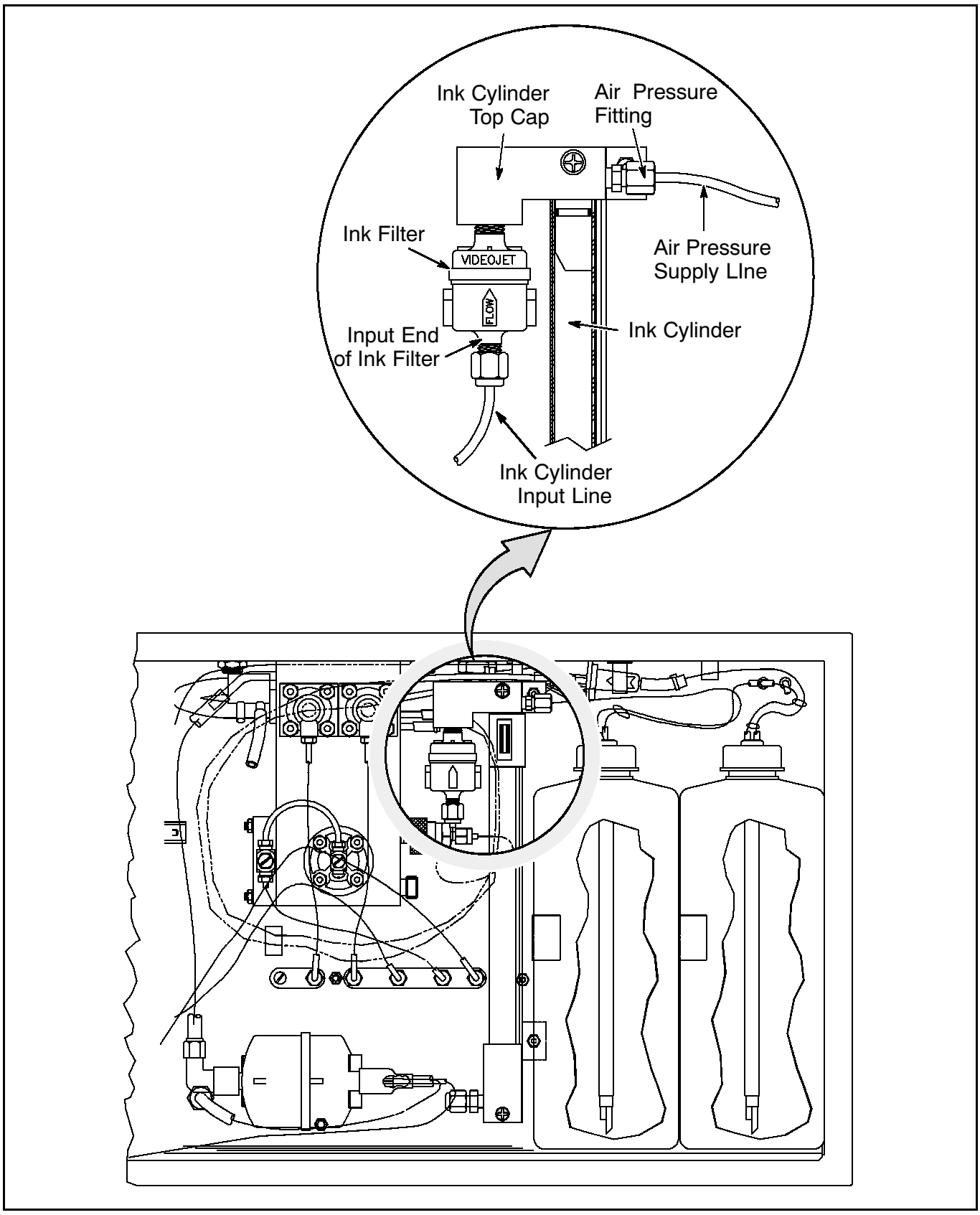


Figure 6-13. Change the Ink Filter

Yearly Maintenance

This section describes the procedure that should be completed once a year.

Yearly Maintenance Schedule	
Procedure	**Turn to Page**
Change control board battery	below

Table 6-5. Yearly Maintenance Schedule

Changing the Control Board Memory Battery

This section describes how to change the battery on the control board.

Important: The battery enables the control board to keep all stored printer values, messages and set-up information in memory. If the printer is turned Off and you remove the battery, all the values entered in memory will be lost. If you leave the printer On when you change the battery, none of the data will be lost.



CAUTION: You must be electrostatically connected to the printer chassis using a grounding strap. This prevents erasure of the program by static discharge.

Procedure

1. Attach a wrist grounding strap to your wrist.
2. Locate the braided wire strain relief in the upper left corner of the cabinet where the umbilical cable enters the cabinet.
3. Attach the loose end of the grounding strap to the braided wire.
4. With the printer On (refer to **Important:** above), move the jumper on the pins at E74 to the pins at E79. Refer to Figure 6-14.
5. Remove the old battery and discard it.
6. Place the new battery in position on the control board.
7. Position the jumper moved in step 4 back to E74.

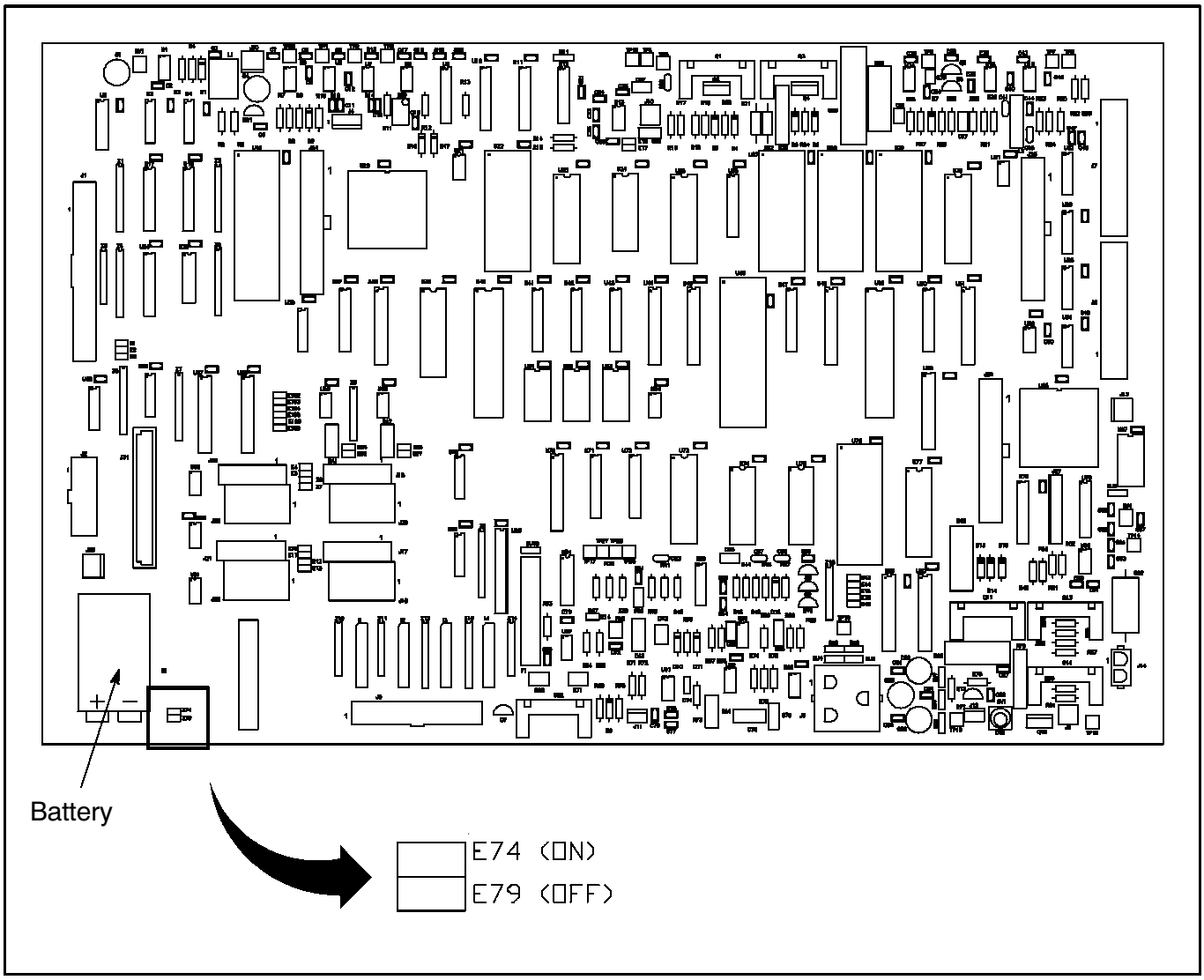


Figure 6-14. Control Board – Location of Battery and Jumpers E74 and E79

Ink Maintenance Procedures

Introduction

This section describes all the procedures necessary to load fluids into the printer, maintain the fluids in the printer, and drain fluids from the printer.

All the procedures required to handle printer fluids have been broken down into their simplest forms. Flow charts are used to illustrate each of the procedures. The flow charts are easier to follow if you are familiar with the equipment. It is recommended that you be familiar with how to use the software, and can follow the Software Summary Chart in order to perform these procedures.

Ink Maintenance Procedure Safety Precautions

The following safety procedures are recommended for all procedures in this section.



CAUTION: Ground the printhead to a metal service tray. Refer to Chapter 2, *Safety*, in this manual for the recommended printhead grounding methods.



CAUTION: Wear safety glasses with side shields when working with fluids.



CAUTION: Ensure that the work area is well-ventilated.



CAUTION: Pour all unused fluids into a grounded, metal container.



CAUTION: Properly dispose of all unused fluids in approved containers and in an approved manner.

General EXCEL Printer Fluid Maintenance

If you need to do any of these:

- flush the system
- install a new printer
- remove contaminated ink
- store the printer

Perform the procedures in the order shown in Figure 6-15 on page 6-26.

Figure 6-15 is a complete flow chart which covers the conditions under which you perform the maintenance procedures.

Ink Maintenance Flow Charts

Notice that some procedures are repeated for different fluid types: **PROCEDURE 1** for Loading Ink and for Loading Make-up Fluid, for example.

Refer to Figure 6-15 for the procedure to complete in each situation, and the page number to turn to for that particular procedure. Refer to Table 6-6 for a list of each of the procedures found in Figure 6-15, and where to turn in this chapter to find that procedure.

Procedure Name	Procedure Number	Page Number of Flow Chart
Loading Fluids	1	6-27
Flushing Fluids	2	6-28
Draining Fluids	3	6-30
Renewing Ink	4	6-32
Calibrating the Printer	5	6-34
Storing the Printer	6	6-36
Setting the Nozzle Drive	7	6-37
Changing the Ink Type	8	6-38

Table 6-6. Ink Maintenance Flow Charts

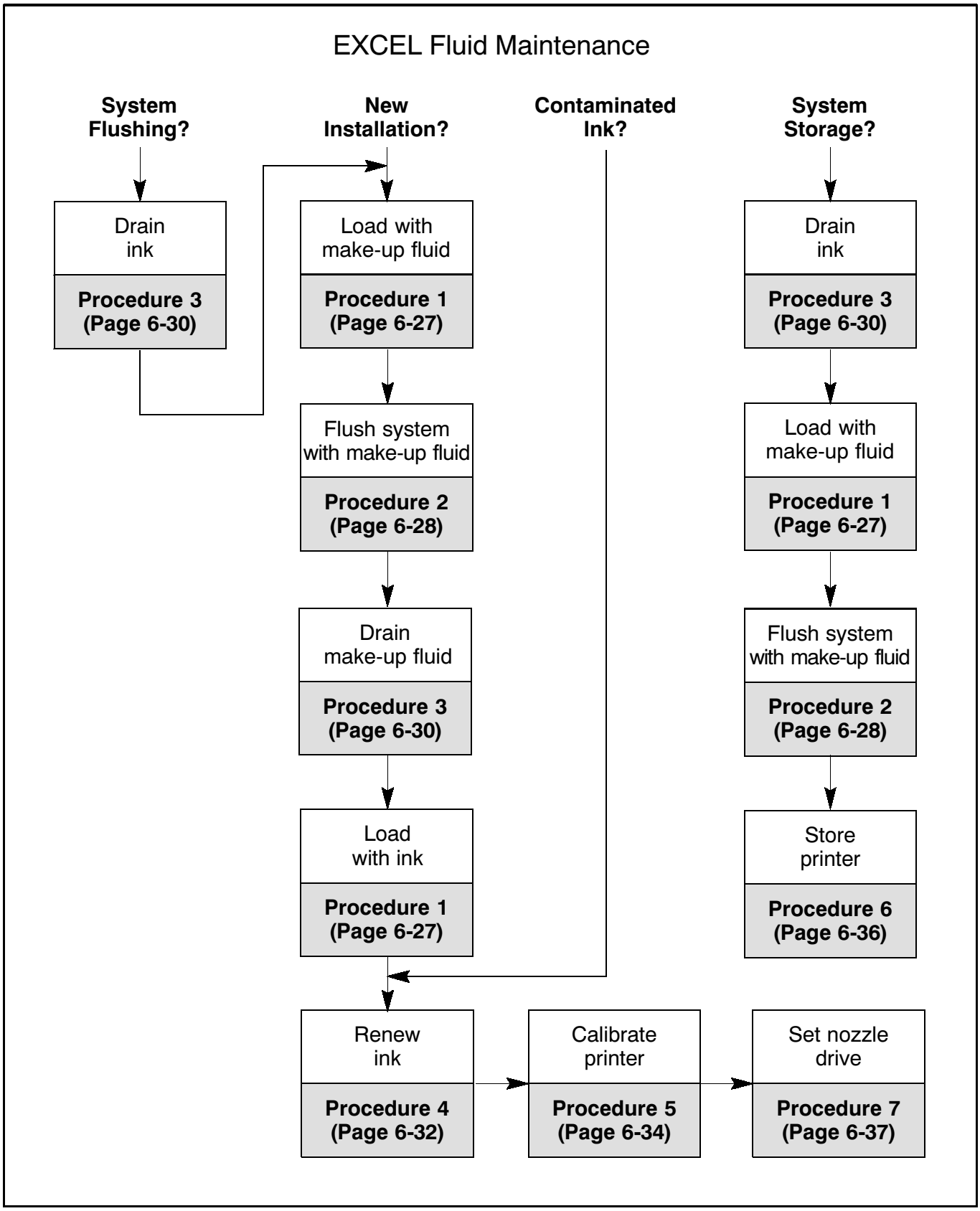


Figure 6-15. Fluid Maintenance

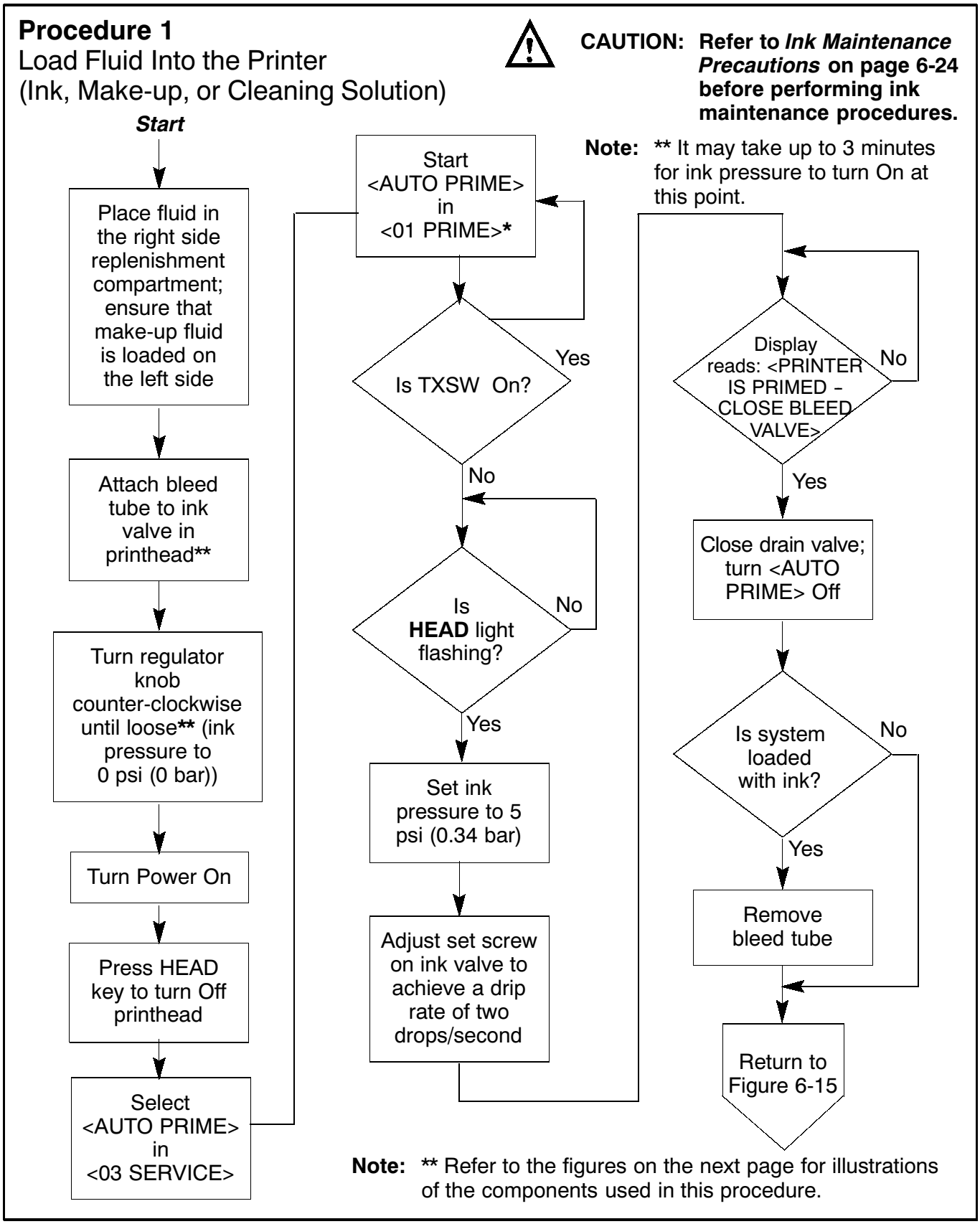


Figure 6-16. Loading Fluid into the Printer (Procedure 1)

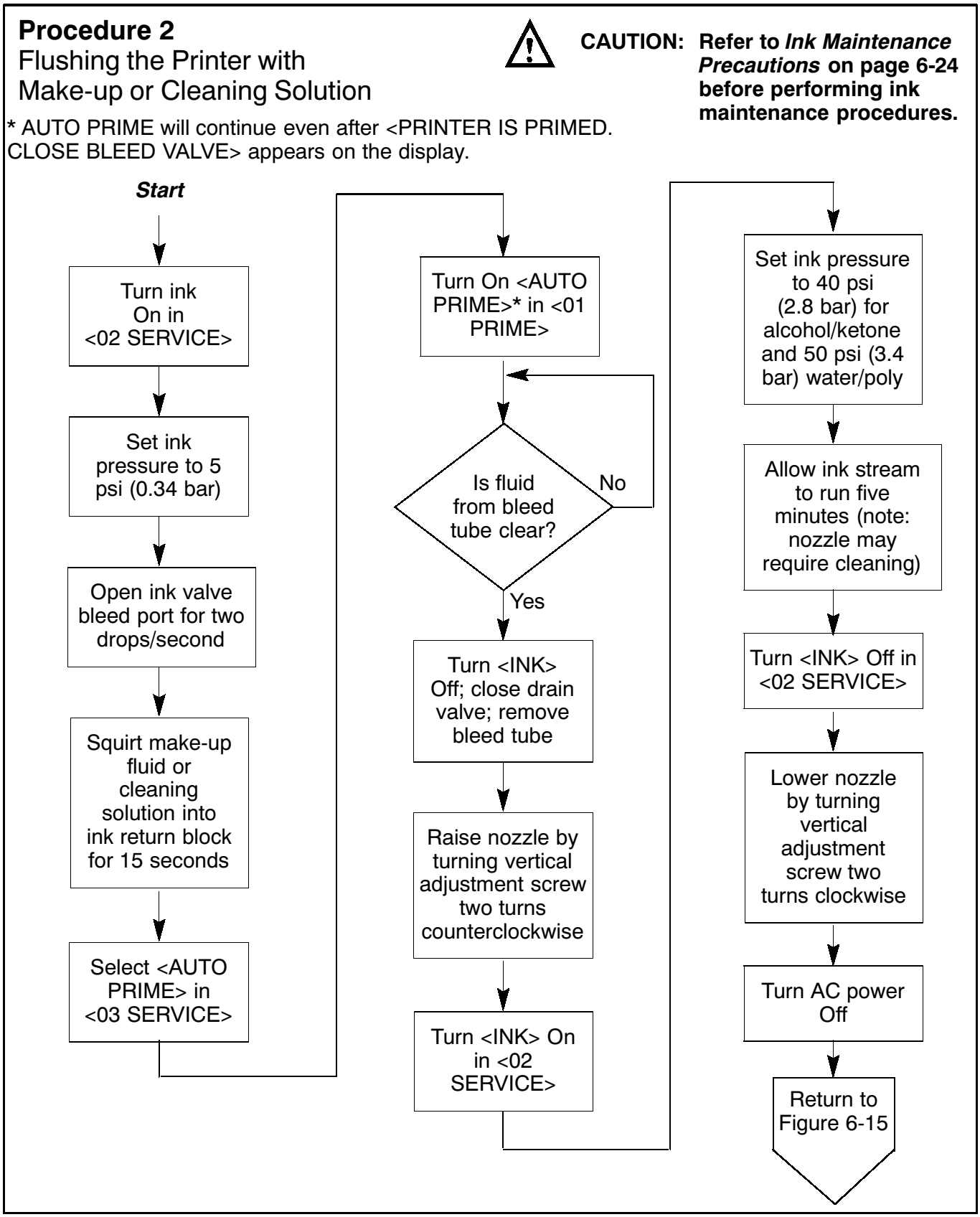


Figure 6-17. Flushing the Printer With Make-up Fluid or Cleaning Solution (Procedure 2)

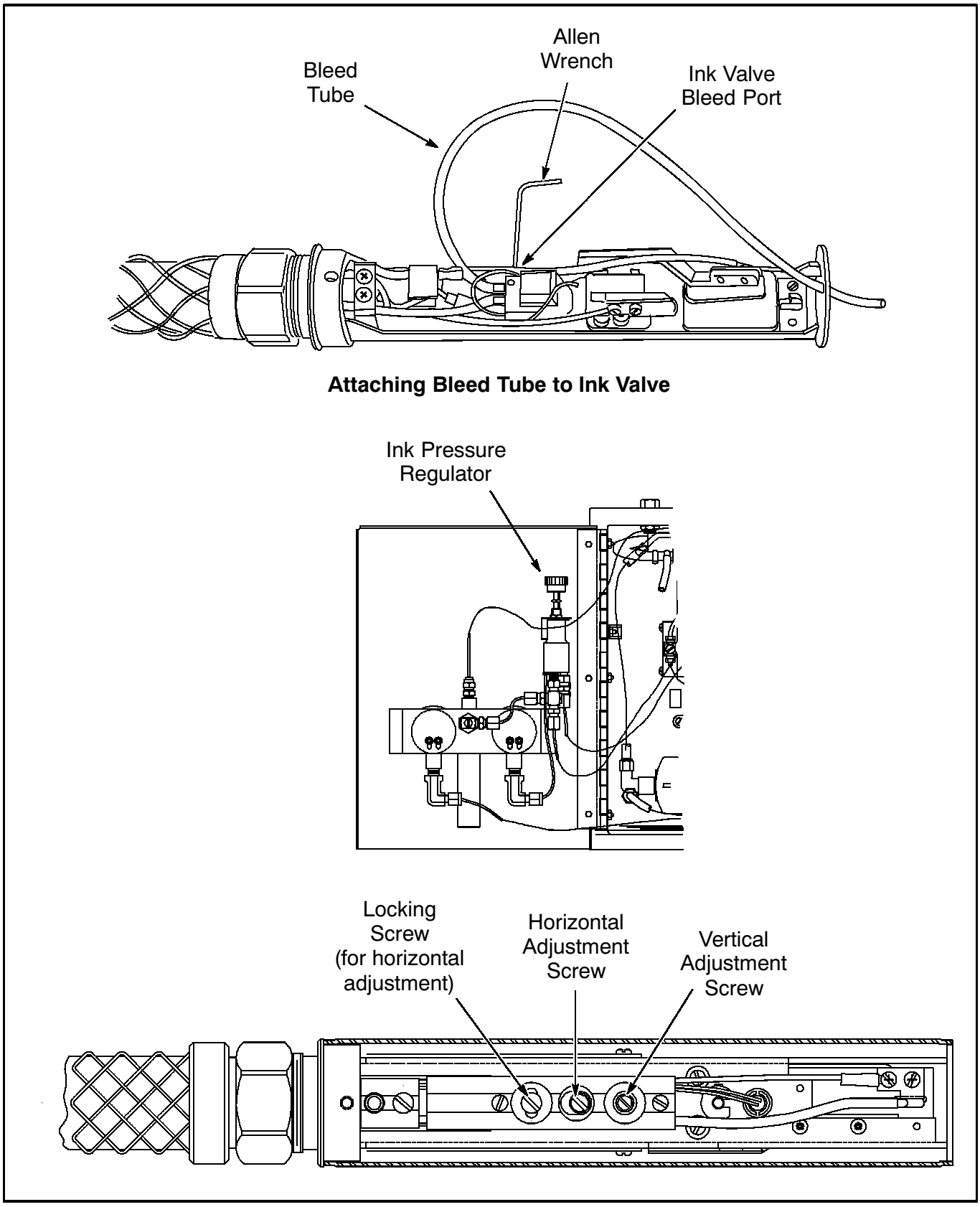


Figure 6-18. Component Identification for Flushing Procedure

Procedure 3
Draining Fluid from the Printer

CAUTION: Refer to *Ink Maintenance Precautions* on page 6-24 before performing ink maintenance procedures.

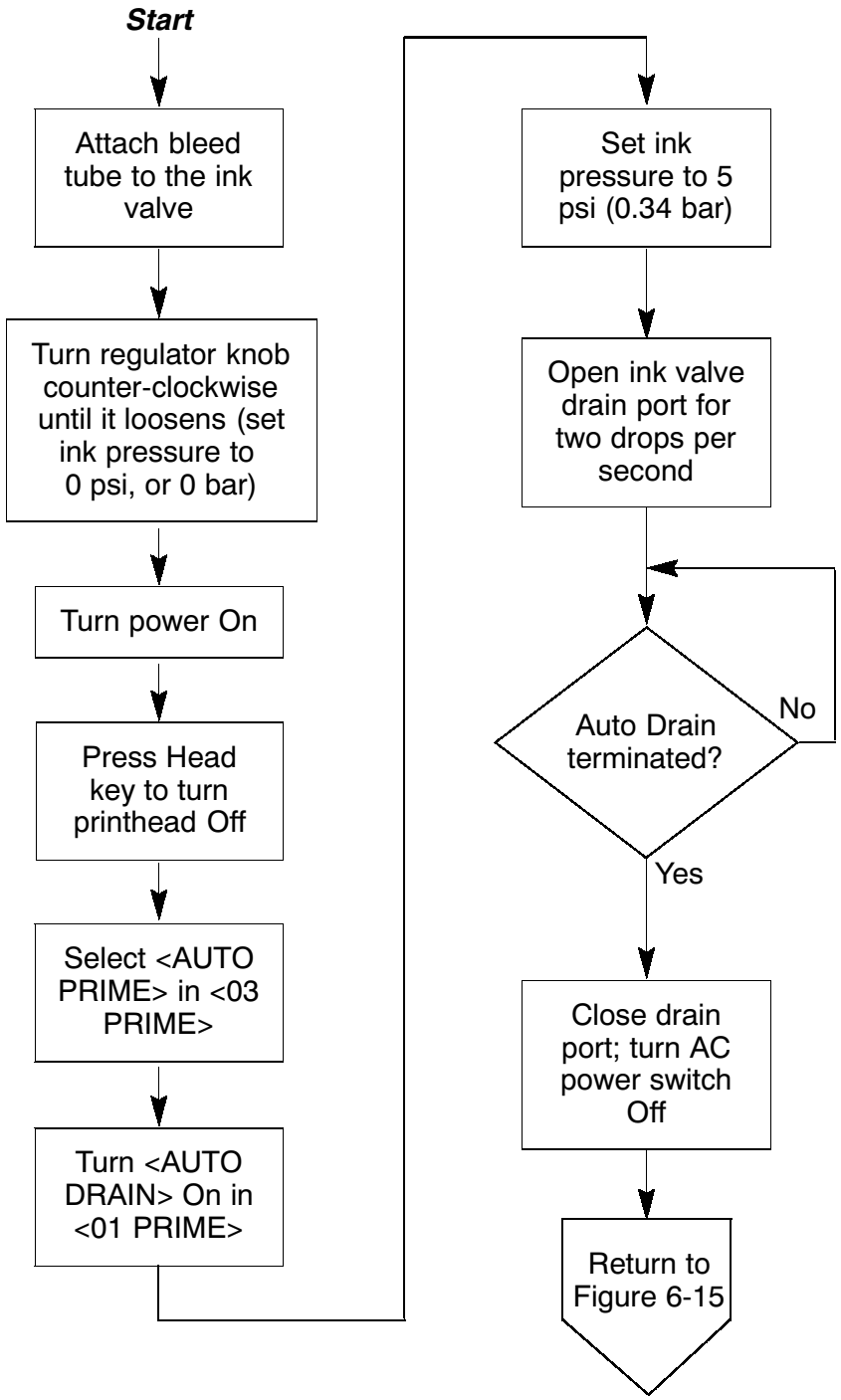
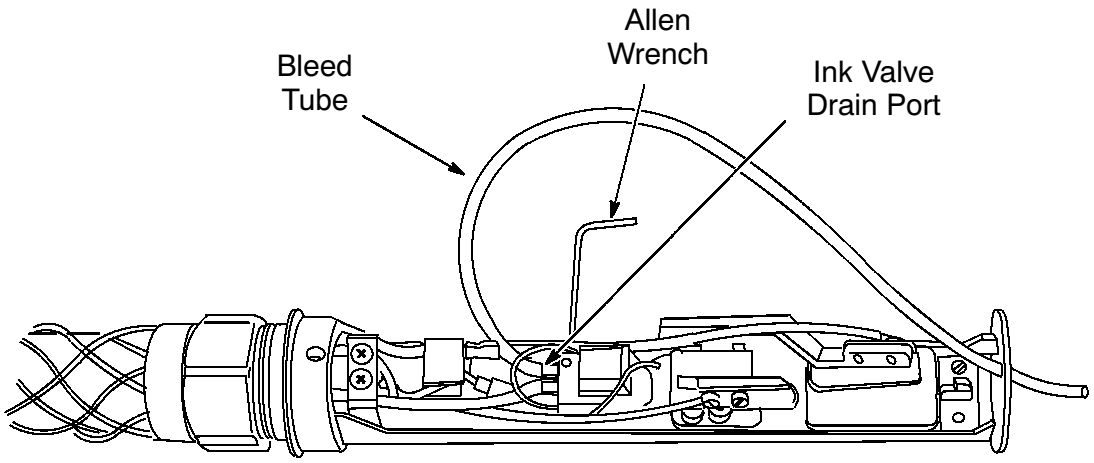


Figure 6-19. Draining Fluid from the Printer (Procedure 3)



Attaching Bleed Tube to Ink Valve

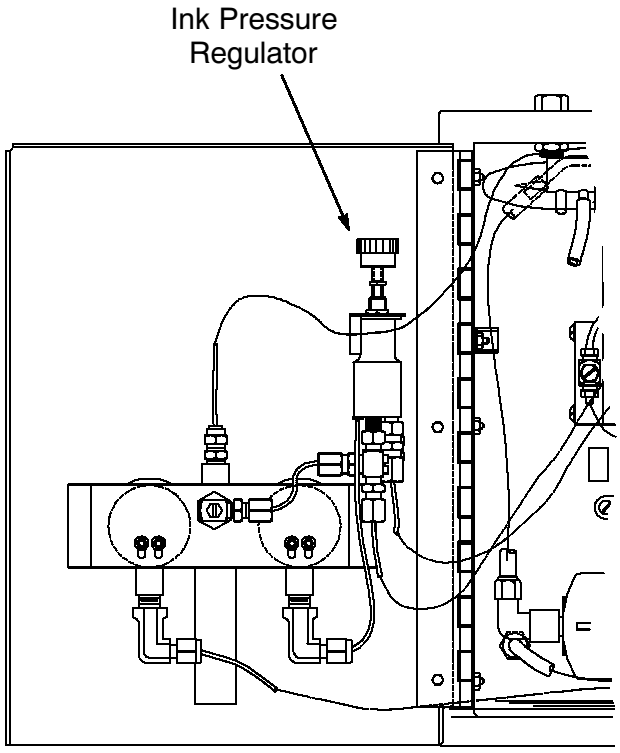


Figure 6-20. Component Identification for Fluid Drain Procedure

Procedure 4
Ink Renewal

CAUTION: Refer to *Ink Maintenance Precautions* on page 6-24 before performing ink maintenance procedures.

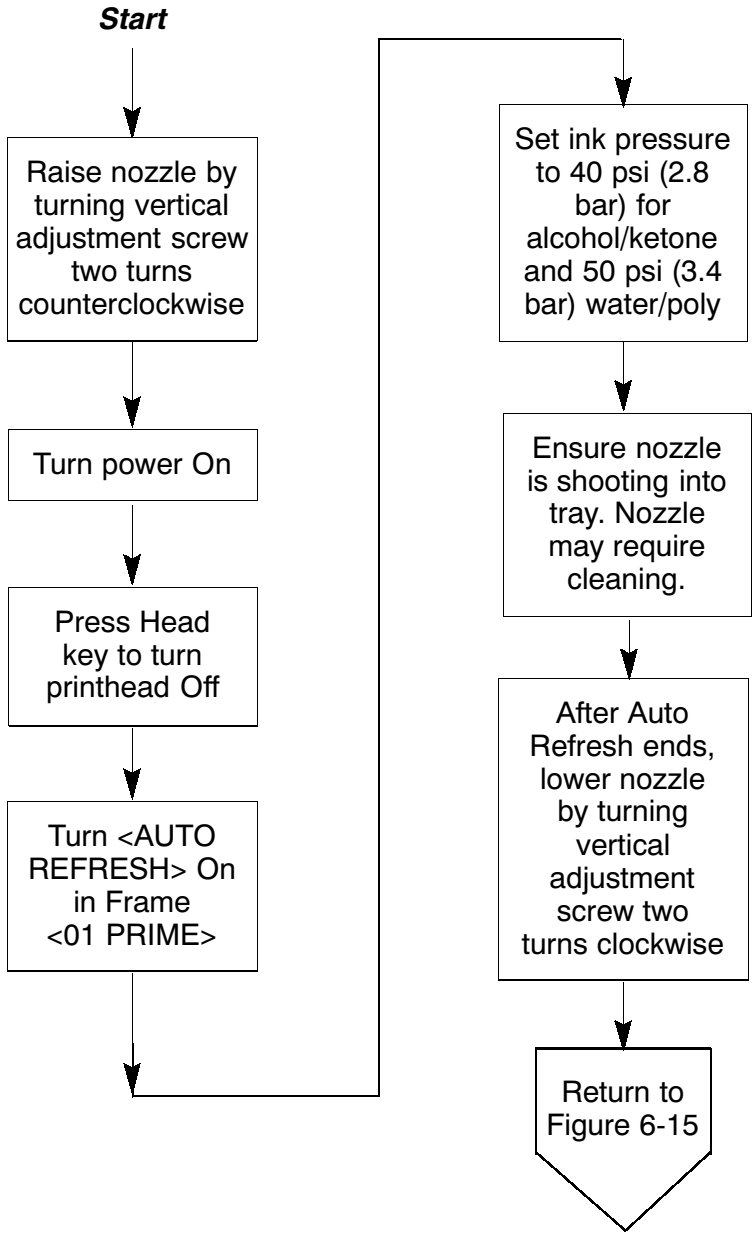
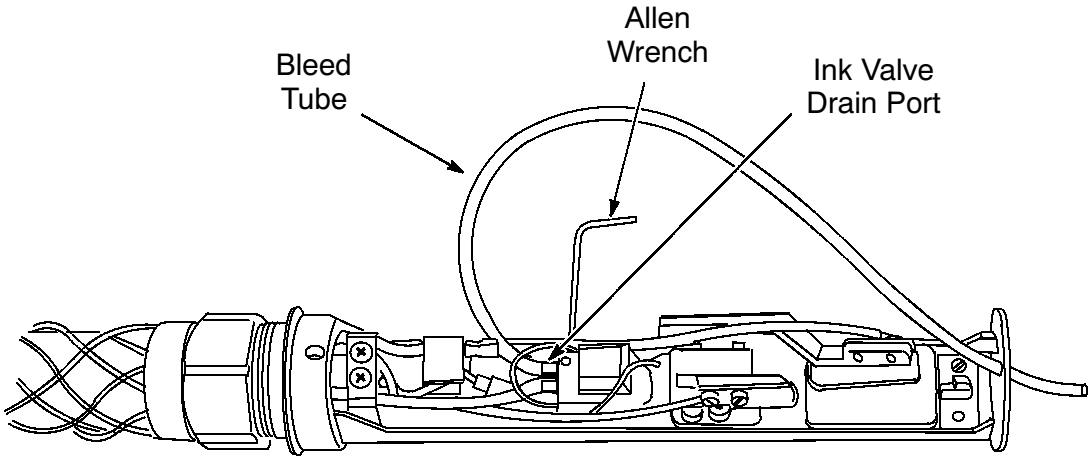


Figure 6-21. Ink Renewal (Procedure 4)



Attaching Bleed Tube to Ink Valve

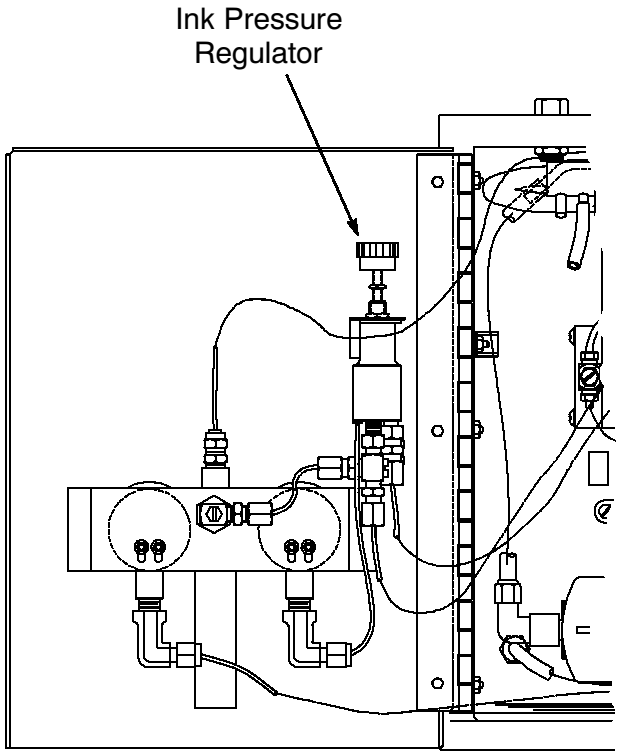


Figure 6-22. Component Identification for Ink Renewal Procedure

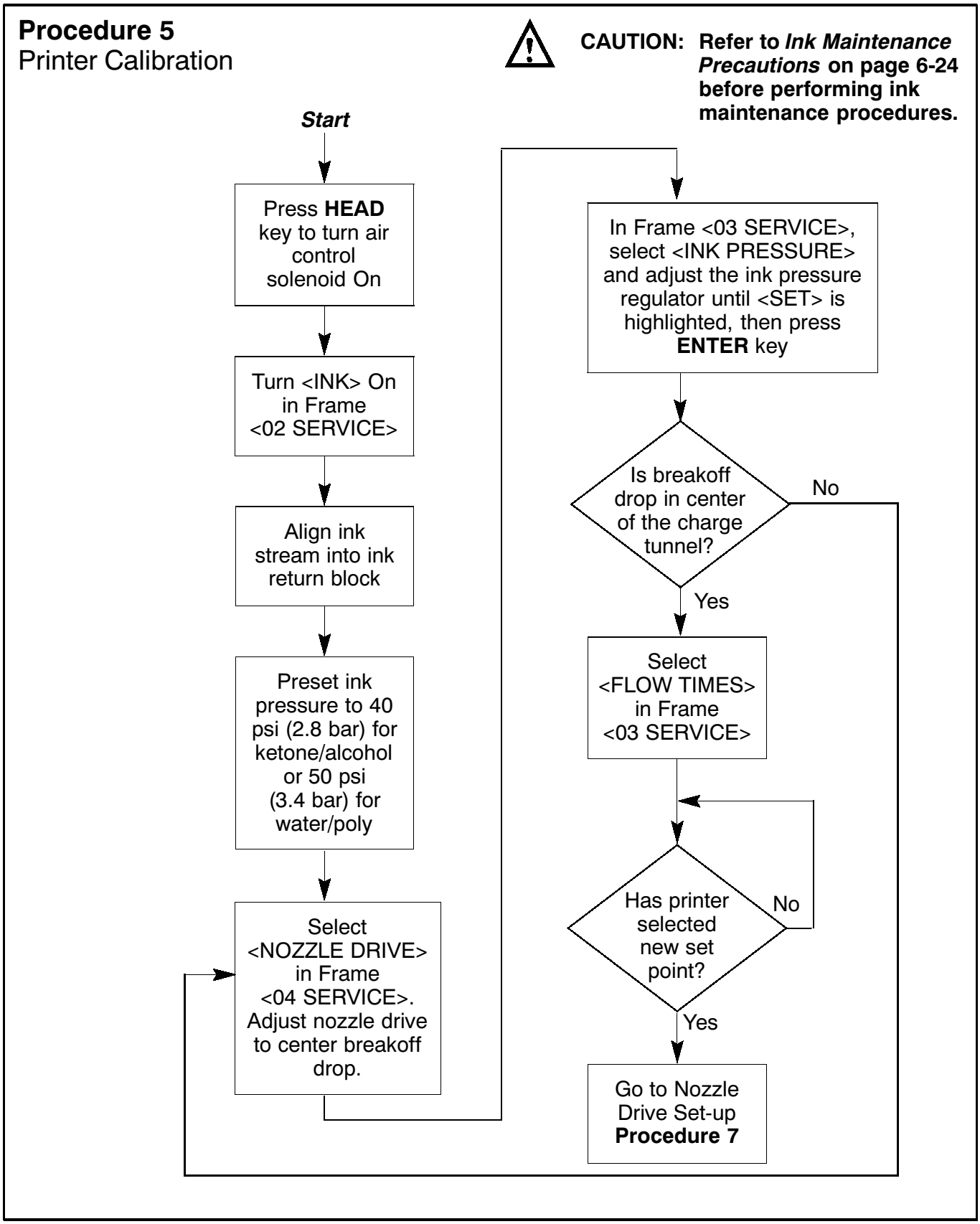


Figure 6-23. Printer Calibration (Procedure 5)

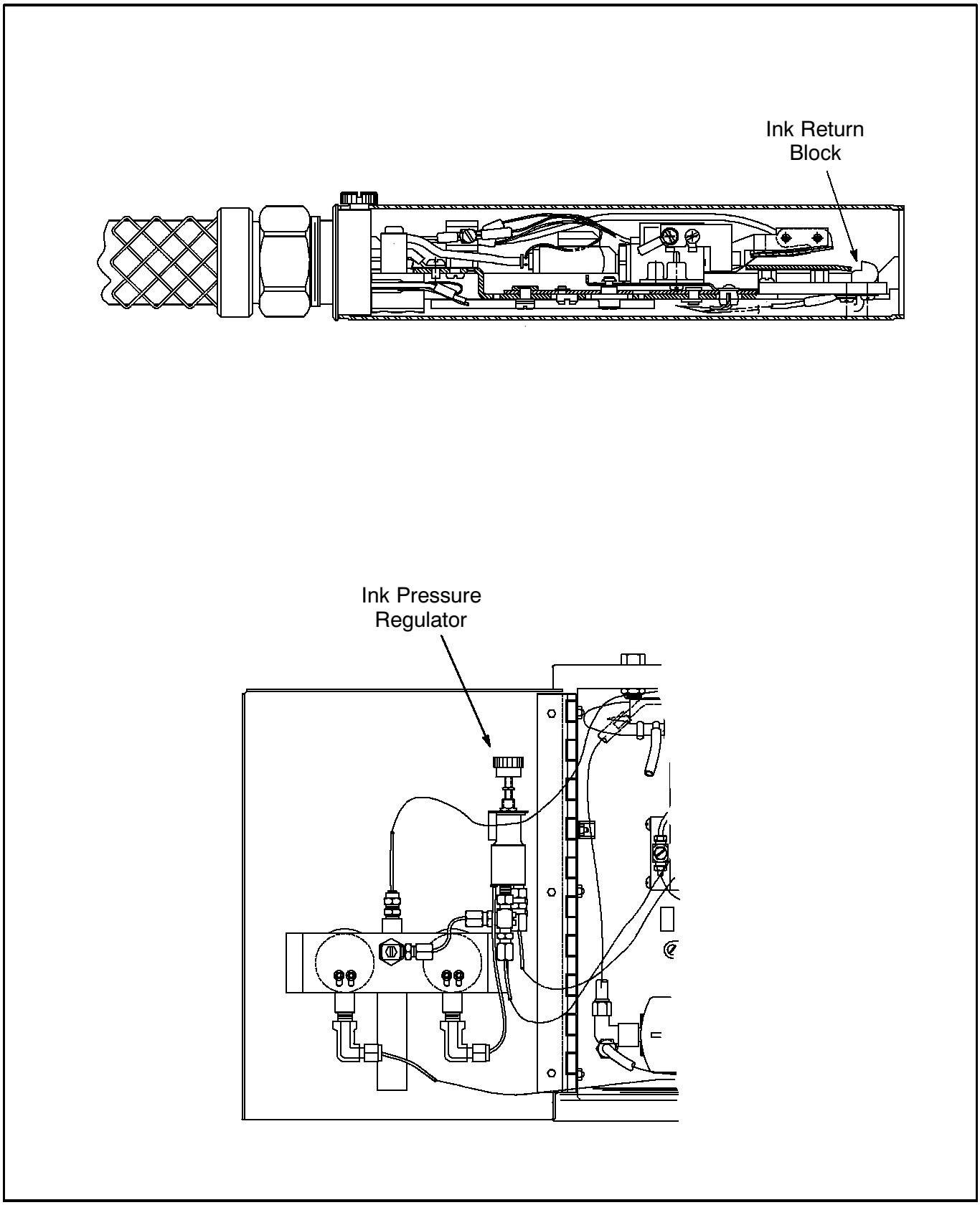


Figure 6-24. Component Identification for Printer Calibration Procedure

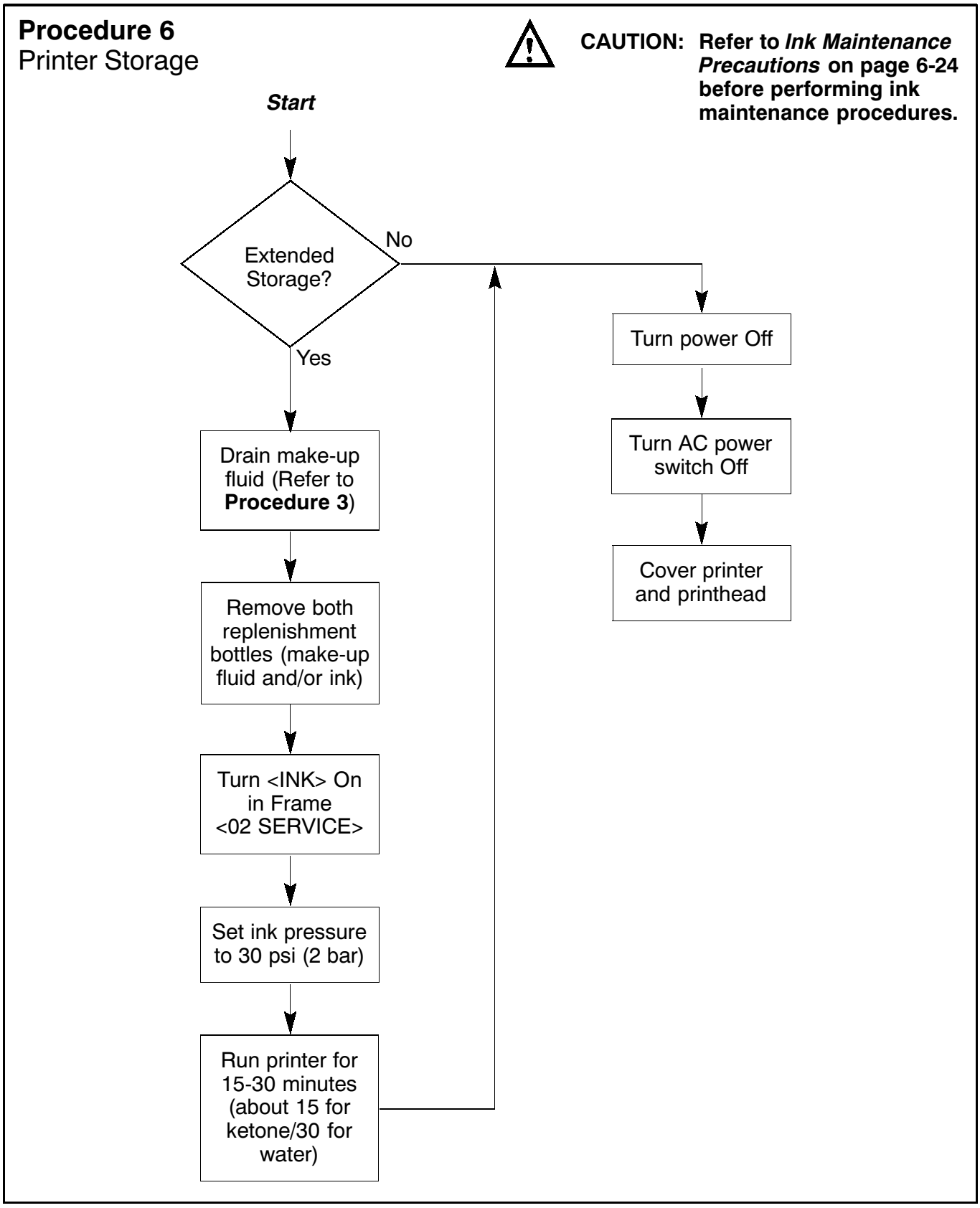
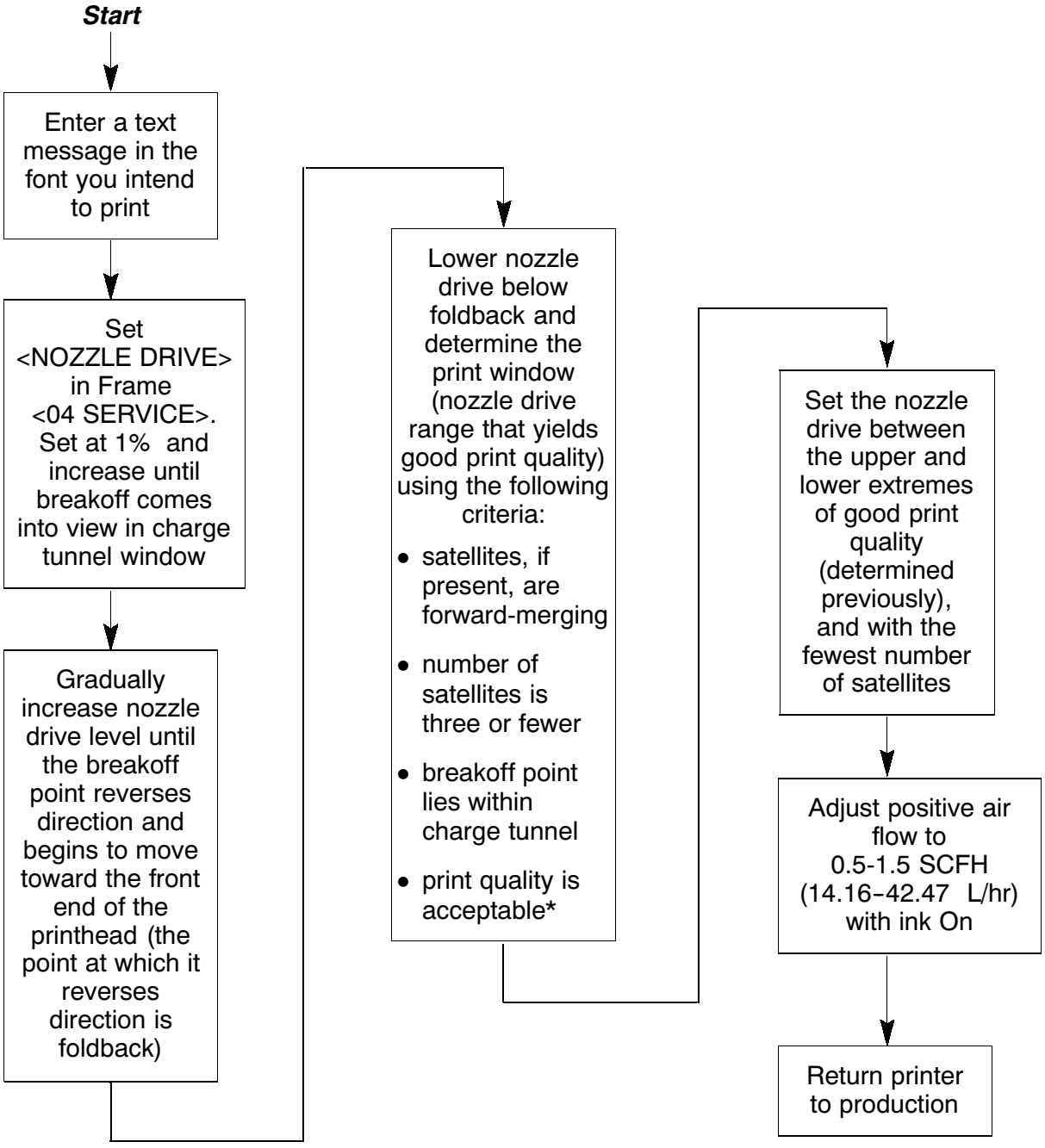


Figure 6-25. Printer Storage (Procedure 6)

Procedure 7
Nozzle Drive Set-up

CAUTION: Refer to *Ink Maintenance Precautions* on page 6-24 before performing ink maintenance procedures.



*Refer to page 6-39, Print Quality (Nozzle Drive Set-up Procedure) for a more detailed explanation.

Figure 6-26. Nozzle Drive Set-up (Procedure 7)

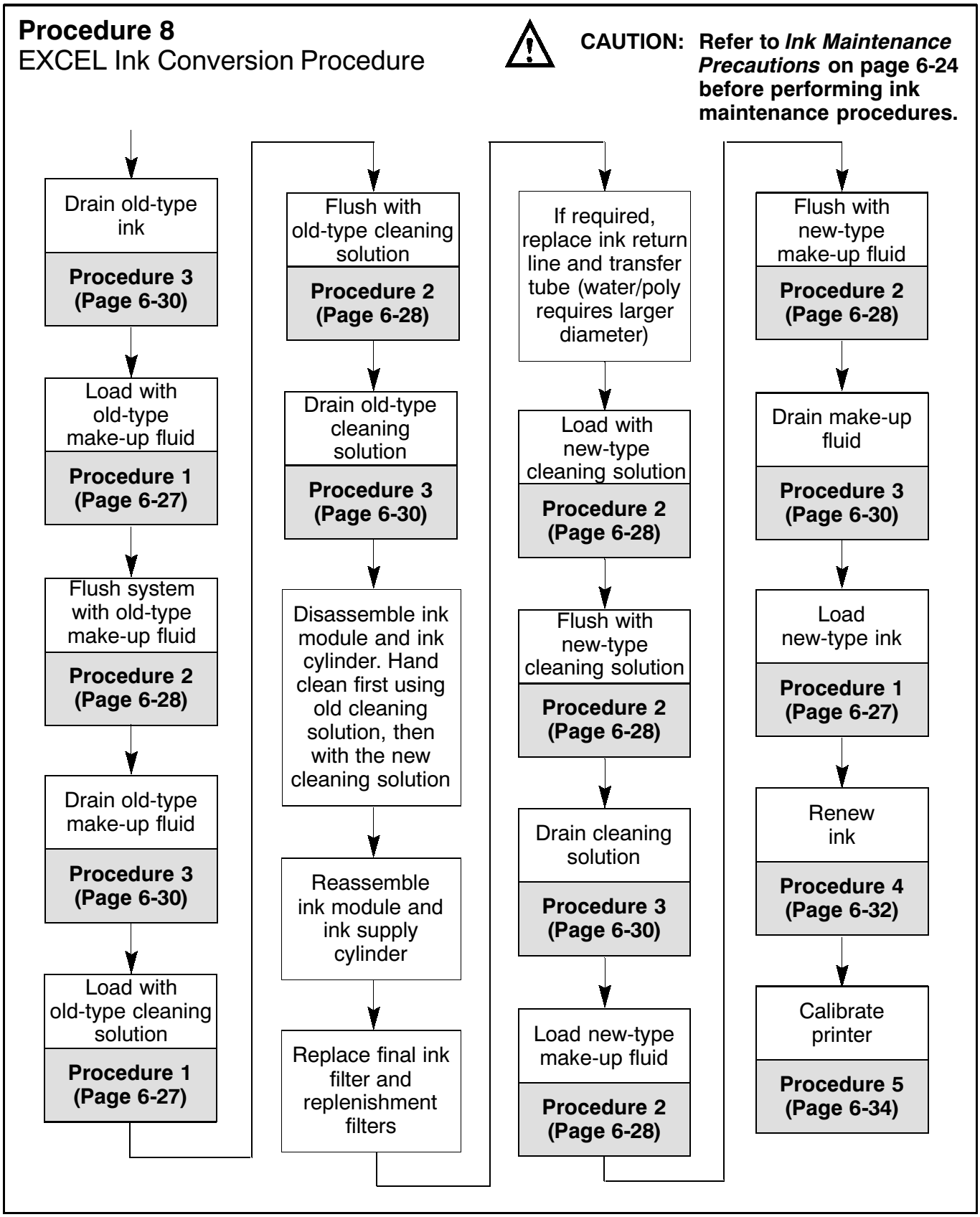


Figure 6-27. EXCEL Ink Conversion Procedure

Print Quality (Nozzle Drive Set-up Procedure)

Introduction

The purpose of the nozzle drive set-up procedure is to locate the "print window," or the nozzle drive range that yields good print quality, and set the nozzle drive inside the print window. Complete the nozzle drive set-up procedure immediately after you complete the ink stream calibration procedure and set the ink pressure.

The print window for one particular printhead may vary from another printhead due to differences in inks and variations in nozzles. **This procedure will work for all ink types and all EXCEL nozzles.**

Definition: Foldback

The nozzle drive set-up procedure requires that you find the "foldback" nozzle drive level. Foldback is the point at which the breakoff point just begins to move toward the front end of the printhead as you increase the nozzle drive level. **The print window always is below foldback.** This concept is explained in depth in the procedure.

Note: The following procedure may have to be repeated if the ambient temperature changes substantially.

Procedure

1. Perform the printer calibration procedure (refer to page 6-34) to set the ink pressure.
2. Enter a text message using the font you intend to print.
3. Find the foldback nozzle drive level using the following procedure.
   a. Set the nozzle drive level at one percent and increase the nozzle drive level until the breakoff point is just inside the charge tunnel window. Observe the position of the breakoff point inside the charge tunnel window with a loupe or magnifying glass. (Refer to Figure 6-28 for an example of what the ink stream may look like inside the charge tunnel.)

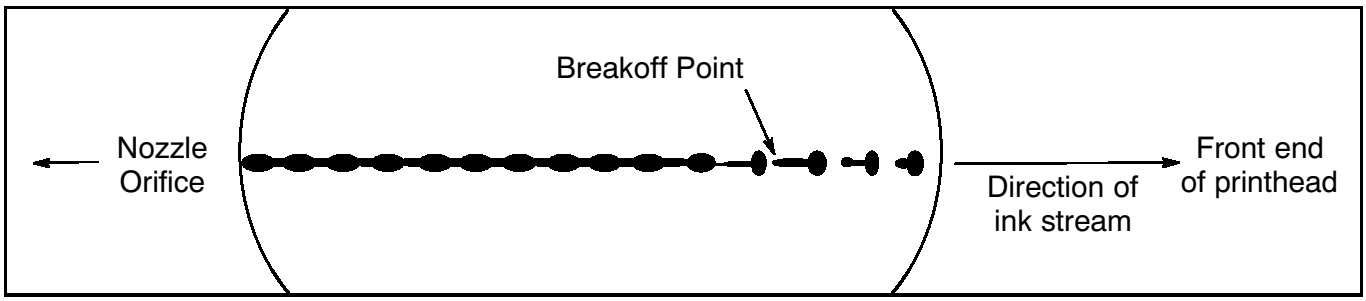


Figure 6-28. Locating the Breakoff Point

b. Gradually increase the nozzle drive level. The position of the breakoff point should be moving toward the nozzle orifice (away from the front end of the printhead) as you increase the nozzle drive level. (Refer to Figure 6-29.)

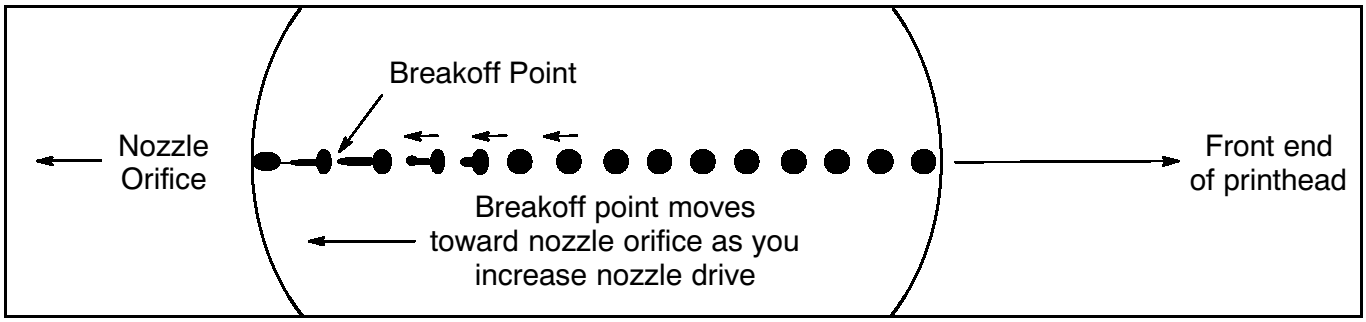


Figure 6-29. Breakoff Point Initially Moves Toward Nozzle

c. Continue increasing the nozzle drive level until the position of the breakoff point reverses direction and just begins to move toward the front end of the printhead. The nozzle drive level at which the stream reverses direction is the foldback level.

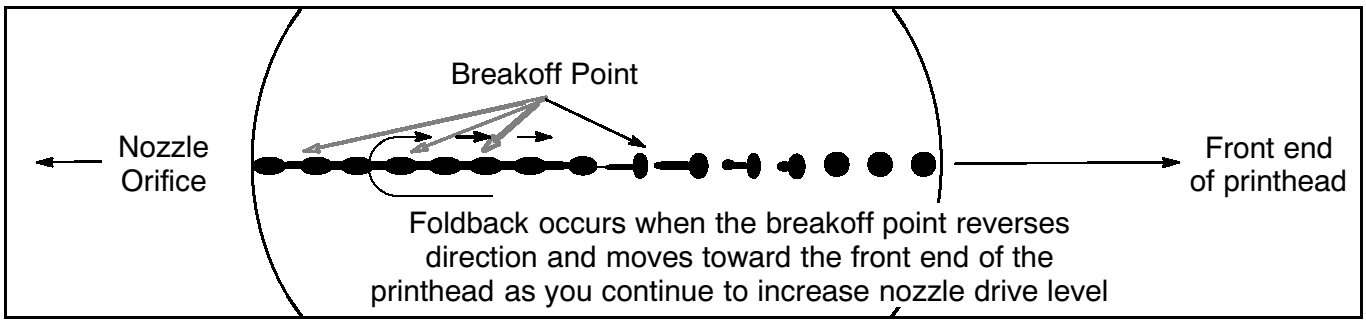


Figure 6-30. Foldback Occurs When Breakoff Point Reverses Direction

Note: The breakoff point may disappear from view in the charge tunnel window while you increase the nozzle drive level. If this occurs, observe the ink stream until the breakoff point comes back into view. **The final nozzle drive setting must be below the foldback level.**

4. Locate the print window, or the nozzle drive range that yields good print quality, using the following procedure.
   a. Gradually decrease the nozzle drive level below the foldback level you located in step 3 to determine the continuous nozzle drive range of values (or print window) that satisfies *all* of the following conditions:

• The print quality must be acceptable. (Perform several test prints with the font you intend to print when the above conditions are met to determine the print window, or the range of nozzle drive values that yield good print quality.)
• The breakoff point must lie inside the charge tunnel. However, the breakoff point does not have to be centered.
• Satellite drops, if present, must be forward merging in the drop stream, joining at the rear of the preceding drop. (Refer to Figure 6-31 for an illustration of forward-merging satellites.)
• The number of forward merging satellites must be small (typically three or fewer).

Note: The print window, useful for reliable printing, will always be located below the foldback level.

5. Set the nozzle drive midway between the upper and lower bounds of good print quality determined in step 4. (Refer to Figure 6-32.) Check that the number of forward merging satellites, if present, near the breakoff point is three or fewer.

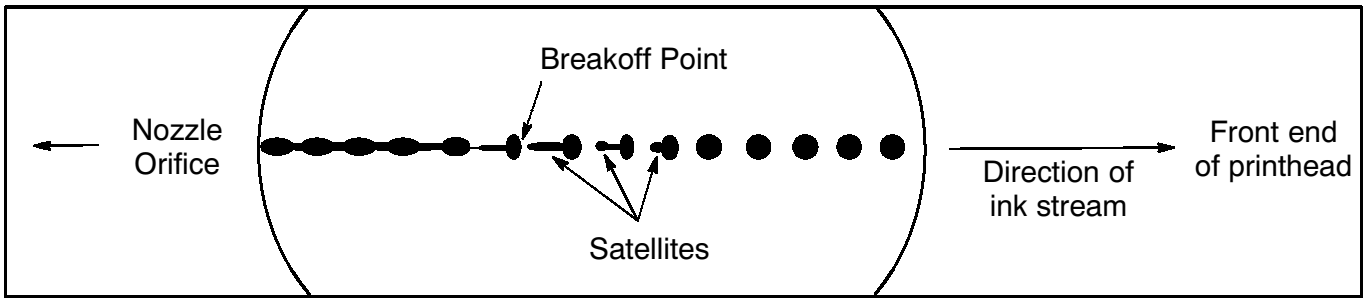


Figure 6-31. Satellite Identification

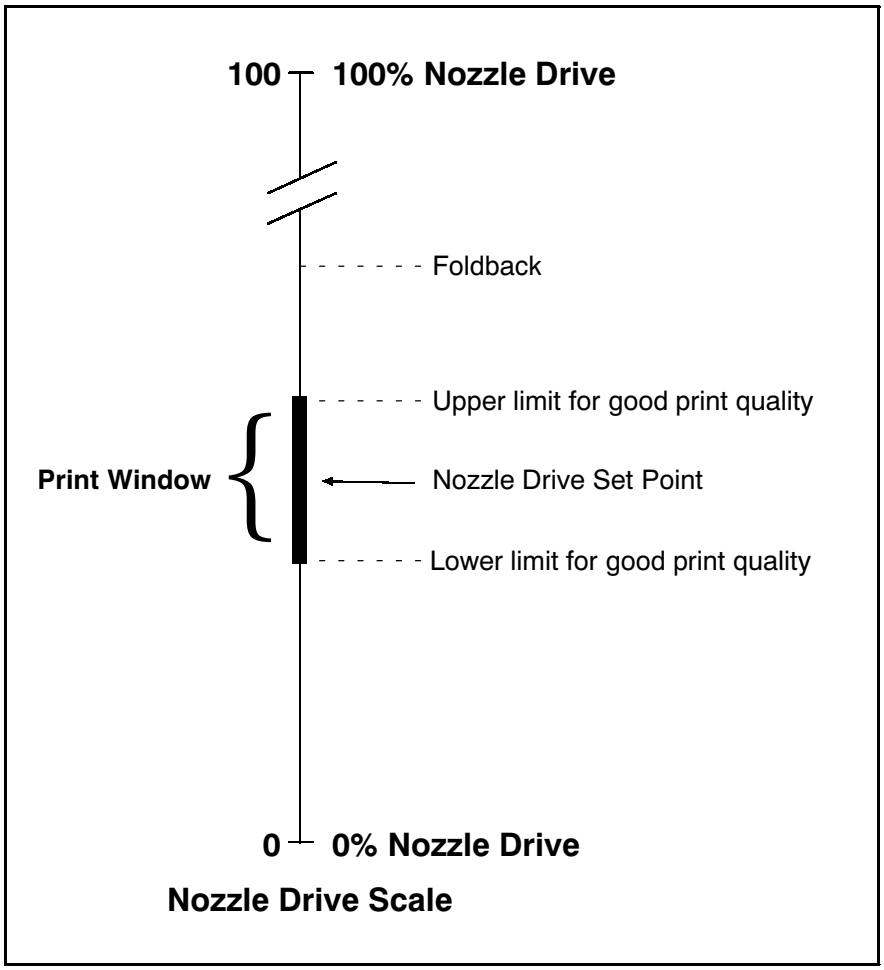


Figure 6-32. Setting the Nozzle Drive

Nozzle Drive Setting Guidelines

Never set the nozzle drive higher than the foldback level.

This entire procedure must be repeated if a new nozzle or ink type is introduced into the system, or if the ambient temperature changes substantially.

7

Troubleshooting

In this chapter you will find:

- information about printer faults and warnings in general (such as what they are, what happens to the printer when they occur, and what you should do when one has occurred)
- specific information for each fault and warning (such as when the fault or warning is enabled, the condition that has occurred, and the possible causes and solutions for each printer fault or warning)
- how to use the LEDs, electronic test points, wiring diagrams, and the **HELP** key to troubleshoot printer problems

Turn to page 7-2 for a chapter-level Table of Contents.

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Introduction

Chapter Overview

This chapter helps you identify, analyze, diagnose, and correct 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 gone wrong)
- the possible causes, and the corresponding solutions

Also included in this chapter is information on using the LEDs, the **HELP** key, the electronic test points, and a wiring diagram (showing pin-to-pin connections) to help diagnose printer problems.

Warnings

What is a Warning?

A warning alerts you to a potential problem (fault) before that problem occurs. It allows you a predetermined period of time to correct the warning condition before it turns into a printer fault.

The printer provides you with three warnings:

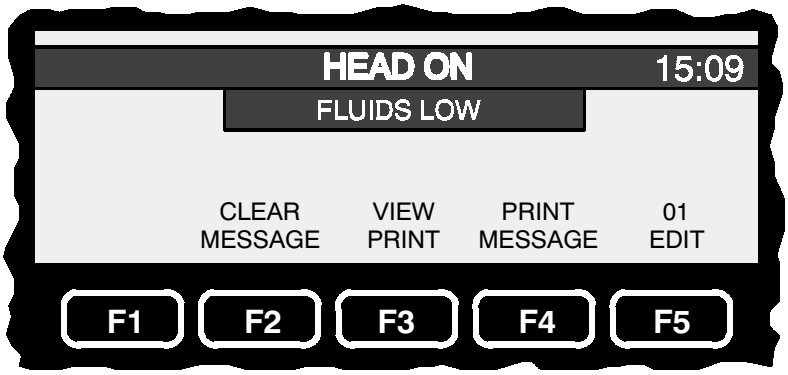
- Fluids Low Warning (refer to page 7-6)
- No Signal Warning (refer to page 7-8)
- Not Phasing Warning (refer to page 7-7)

What Happens When a Warning Occurs?

When a warning condition occurs, the following happens:

- The **SERVICE** light on the keyboard turns On (does not flash).
- A screen similar to the one shown below will appear in the display indicating which warning has occurred. The name of the warning will flash in the display screen.

  Note: The screen shown below indicates that a Fluids Low Warning has occurred.



- If the Fluids Low Warning has occurred and the alert light has been installed, the alert light will flash one minute after the warning has occurred.
- **Note:** The printer will continue to print when a warning condition has occurred. However, if the warning is not corrected and it turns into a fault, printing will stop and the printer will automatically begin the four-minute shutdown sequence.

What Do You Do When a Warning Occurs?

Since the purpose of a warning is to alert you to a potential problem (fault) before it occurs, a warning allows you a predetermined period of time to correct the warning condition before it turns into a printer fault. The time that the printer allows depends on the warning that has occurred.

When a warning occurs, refer to the “Cause/Solution” table for that particular warning and try the solutions provided to correct the condition. Once the condition is corrected, the printer will automatically clear the warning condition.

Common Conditions and Cures for Warnings

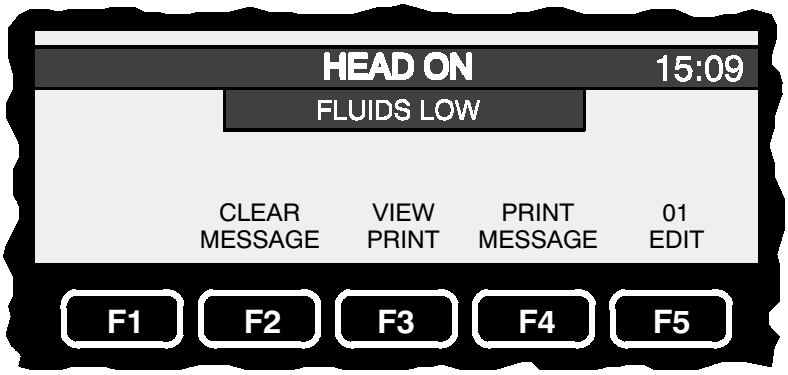
The following pages cover all of the printer warnings. For each warning, the following information is provided.

- How long you have to correct the warning condition until it turns into a fault, and which fault will occur if it is not corrected.
- **Time Enabled**: tells you when the warning condition can occur in the printer.
- **Condition**: tells you what has happened to the printer in order for the warning to occur.
- **Cause**/**Solution**: tells you what may have caused the warning condition (in the order which they are most likely to occur) and what you should do to correct the possible cause.

Use this information as reference to correct the warning condition and return the printer to its normal operating mode.

Fluids Low Warning

Once the Fluids Low Warning has occurred, you have 30 minutes to replenish the fluid level in the low ink and/or make-up fluid bottle. If this is not done, an Ink Out Fault will occur (refer to page 7-17 for further information).



Time Enabled: Warning is enabled 60 seconds after the air control solenoid turns On.

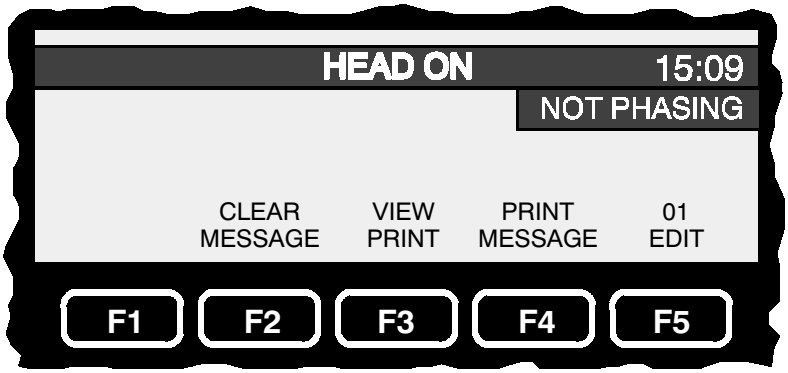
Condition: The signal from the ink low switch is Off, and has remained Off for no more than 30 minutes. (Once the signal has remained Off for 30 minutes, an Ink Out Fault will occur.)

Cause*	Solution
1. The fluid level in the ink or make-up fluid bottle may be low.	Check the fluid levels in both bottles. If the fluid level is low, replace the appropriate bottle(s) with a full bottle.
2. The sense air pressure in the bottles is not set properly.	With the bottle cap On, position the end of the dip tube one inch (25 mm) below the fluid level in the bottle, then adjust the fluids low needle valve until two bubbles per second is obtained.
3. The line leading to the ink or make-up fluid bottle has become disconnected from the bottle or is not positioned inside the bottle properly.	Check the condition of the line leading to both bottles. Make certain the line is leading into the bottle and the end of the line is below the fluid level.
4. The ink low switch may be defective.	Replace the ink low switch.

* The possible causes for this warning are listed in the order in which they are most likely to occur.

Not Phasing Warning

When the Not Phasing Warning occurs, you have five minutes to correct the condition. If this is not done, a No Phase Time Fault will occur (refer to page 7-15 for further information).



Time Enabled: Warning is enabled while the printer is printing.

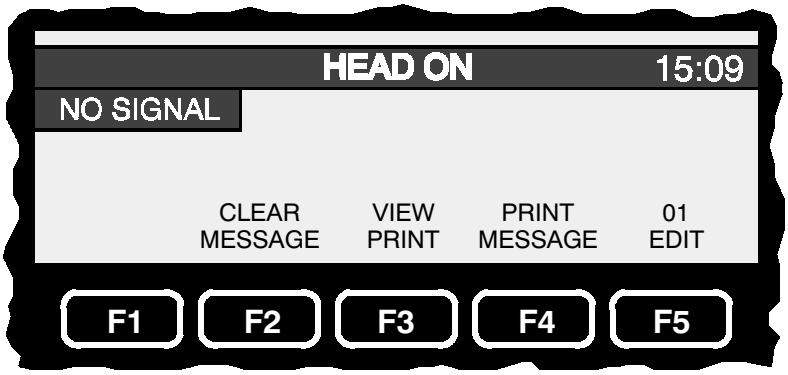
Condition: There is not enough time from the end of one message to the next product detect signal. (There must be a minimum of seven milliseconds between messages.)

Cause*	Solution
1. The product detector is “double triggering” (sending two signals at once).	Try these solutions (in the order shown) until the condition is corrected: •Clean the detector eye. •Adjust the product detector sensitivity. •Check and/or reposition the product detector. •Replace the product detector.
2. The products on the conveyor are crowded too close together.	Review the application to see if there is a better method of product detection.

* The possible causes for this warning are listed in the order in which they are most likely to occur.

No Signal Warning

The No Signal Warning is different than the other two warnings in that it is used as reference during printer warm-up. The printer does not allow you a predetermined period of time to correct the condition.



Time Enabled: Warning is enabled during the ink stream test portion of the printhead warm-up or restart sequence.

Condition: One of the following conditions has occurred: 1) no ink stream, 2) no ink drops, 3) the steam test signal is not being applied to the ink stream by the charge tunnel, or 4) the sensor in the ink stream is not picking up the charges from the drops.

Cause*	Solution
1. There is no ink stream.	Try these solutions (in the order shown) until the condition is corrected: •Check the nozzle for clogging. •Check the final ink filter for clogging. •Check to see if the output of the ink supply cylinder is restricted. •Verify that ink pressure is applied to the ink supply cylinder.
2. There are no ink drops.	Try these solutions (in the order shown) until the condition is corrected: •Check and adjust the nozzle drive. •Verify the nozzle drive output from the control board at test point 5 (TP5). •Check for broken wires leading from the control board to the nozzle. •Replace the nozzle. •Replace the control board.

* The possible causes for this warning are listed in the order in which they are most likely to occur.

Table continued on next page ▶

Cause*	Solution
3. A signal is not being applied to the charge tunnel (3.5–4.5 VDC not present).	Try these solutions (in the order shown) until the condition is corrected: •Check for open 10K resistor leading to the charge tunnel. •Check for output at TP15. •Check for broken wires leading from the charge tunnel to the control board. •Replace the control board.
4. The sensor in the ink stream is not picking up the charges from the drops.	Try these solutions (in the order shown) until the condition is corrected: •Check the connection to the ink return block. •Replace the ink return block. •Check the continuity from the ink return block to the control board. Replace the control board, if necessary.

* The possible causes for this warning are listed in the order in which they are most likely to occur.

Faults

What is a Fault?

A fault is defined as any printer condition that interrupts normal printer operation. Faults have a variety of possible causes, including ink that is out of tolerance or failure of one of the main printer components.

The printer continually monitors all systems for faults. There are two different types of faults: 1) normal faults, and 2) panic faults.

Normal Faults

Normal faults are malfunctions that will not cause permanent damage if allowed to continue. Therefore, when a normal fault occurs, the printer initiates the four-minute shutdown sequence.

The printer provides you with the following normal faults:

- Real Time Clock Fault (refer to page 7-14)
- No Phase Time Fault (refer to page 7-15)
- Air Pressure Fault (refer to page 7-16)
- Ink Out Fault (refer to page 7-17)
- 312 Volt Power Supply Fault (refer to page 7-18)
- High Voltage Fault (refer to page 7-19)
- Phasing Fault (refer to page 7-20)
- Transfer Request Too Long Fault (refer to page 7-21)
- No Signal Fault (refer to page 7-22)
- Fill Time Too Long Fault (refer to page 7-24)
- Empty Time Too Long Fault (refer to page 7-25)
- Flow Time Too Long Fault (refer to page 7-26)
- Flow Time Too Short Fault (refer to page 7-27)

Panic Faults

Panic faults are malfunctions that may cause permanent damage if allowed to continue. When a panic fault occurs, the printer shuts down immediately, but the display remains On, indicating the fault.

The printer provides you with the following panic faults:

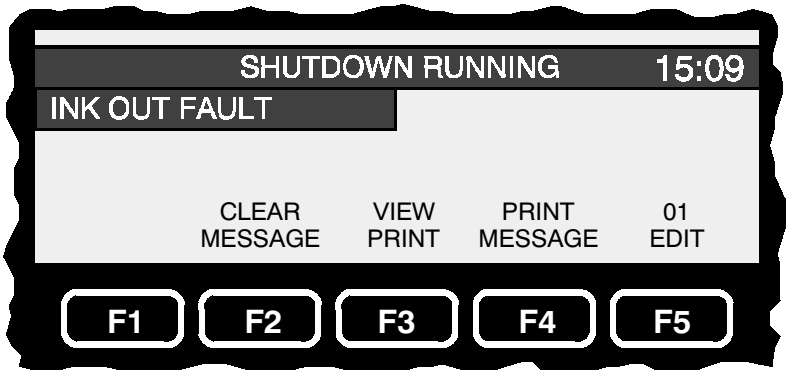
- No Air for Warm-up Fault (refer to page 7-28)
- Fluids Request Too Long Fault (refer to page 7-29)
- Reservoir Overfill Fault (refer to page 7-30)
- Processor #1 Fault (refer to page 7-31)
- Processor #2 Fault (refer to page 7-31)
- Processor #4 Fault (refer to page 7-31)
- +12 Volt Supply - Use Deadman Switch Fault (refer to page 7-32)

What Happens When a Fault Occurs?

When a fault occurs, the following happens:

- If the printer was printing, the printing will stop.
- The **SERVICE** light on the keyboard flashes.
- A screen similar to the one shown below will appear in the display indicating which fault has occurred. The name of the fault will flash in the display screen.

  Note: The screen shown below indicates that an Ink Out Fault has occurred.



- If a normal fault occurs, the four-minute shutdown begins. Once the shutdown sequence is complete, the words <SHUTDOWN IDLE> will appear at the top of the display.

  If a panic fault occurs, the printer will shutdown immediately, and the words <SHUTDOWN COMPLETE> will appear at the top of the display.

What Do You Do When a Fault Occurs?

When a fault occurs, refer to the “Cause/Solution” table for that particular fault and try the solutions provided to correct the problem.

Once you have tried one of the solutions to correct the problem, you must reset the fault condition in order for the printer to return to normal operating mode. Refer to *Resetting A Fault* on page 7-12 for further information.

Resetting A Fault

There are two ways to reset a fault after you have tried to solve the problem:

- If the message <SHUTDOWN RUNNING> appears in the display, press the **OFF** key, then press the **CANCEL** key.
- If the printer is in the Service mode, press the **F4** key while in frame 01 SERVICE, 02 SERVICE, 03 SERVICE, 04 SERVICE, or 05 SERVICE (refer to Figure 7-1).

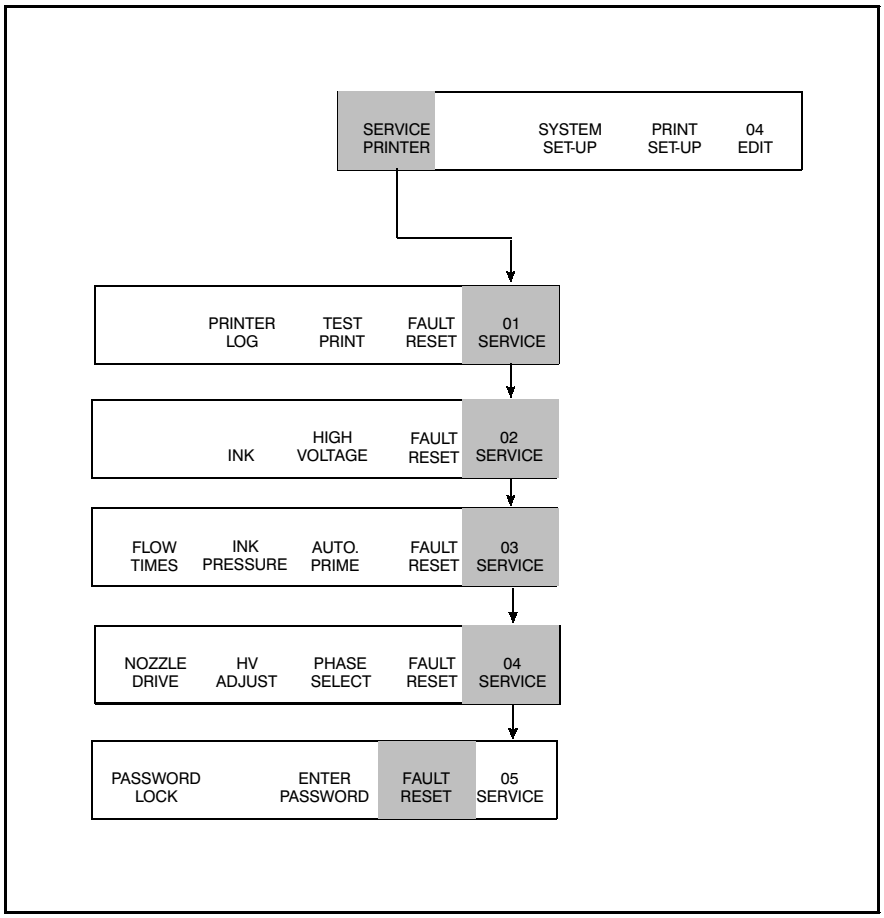


Figure 7-1. Selecting the <FAULT RESET> Option

The fault will disappear from the display and the printer will operate normally if the solution attempted corrects the problem. If it did not correct the problem, the original fault (or a different fault) will reappear.

If this happens, try another solution to clear the fault condition, then repeat the procedure to reset the fault. Once the appropriate solution has been performed, the fault will disappear from the display and the printer will operate normally.

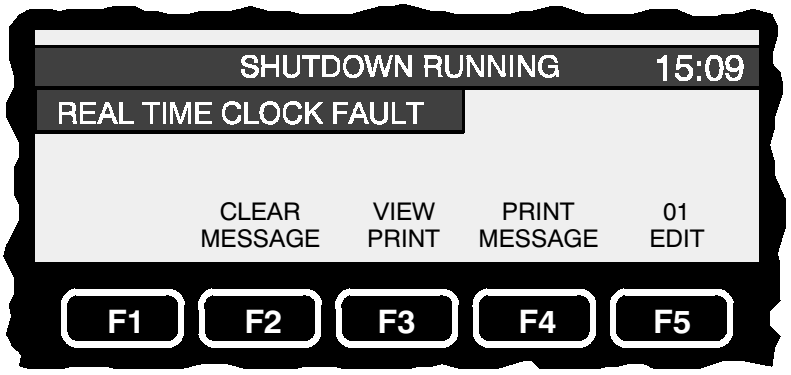
Common Conditions and Cures for Faults

The following pages cover all of the printer faults. For each fault, the following information is provided.

- **Time Enabled**: tells you when the fault can occur to the printer.
- **Condition**: tells you what has happened to the printer in order for the fault to occur.
- **Causes**/**Solutions**: tells you what may have caused the fault (in the order in which they are most likely to occur) and what you should do to correct the fault.

Use this information as reference to correct the fault and return the printer to its normal operating mode.

Real Time Clock Fault



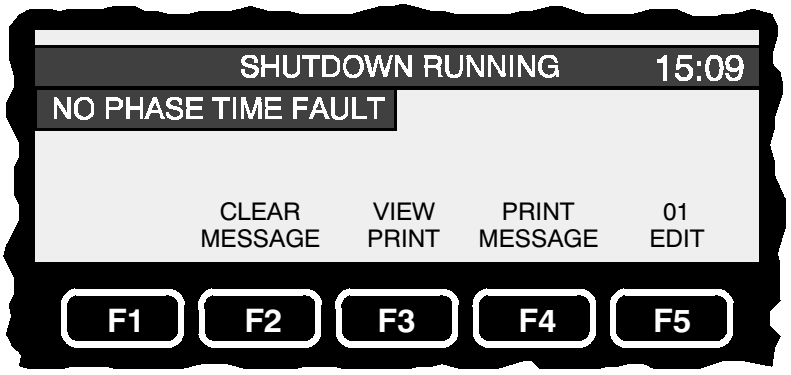
Time Enabled: Fault is enabled one second after the system is turned On.

Condition: The real time clock is not sending a status signal to the control board to indicate it is working.

Cause*	Solution
1. The battery on the control board is low.	Replace the battery.
2. The control board is defective.	Replace the control board.

***** The possible causes for this fault are listed in the order in which they are most likely to occur.

No Phase Time Fault



Time Enabled: Fault is enabled while the printer is printing.

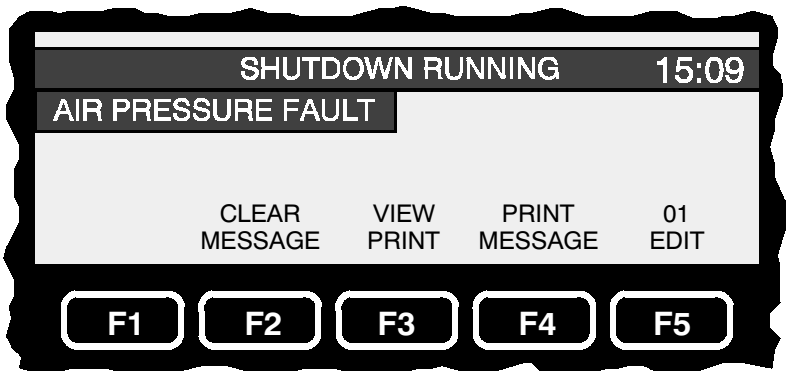
Condition: There is not enough time from the end of one message to the request to print. (There must be a minimum of seven milliseconds between messages.)

The fault condition indicates that the Not Phasing Warning has been On for the past five minutes. (Refer to page 7-7 for further information.)

Cause*	Solution
1. The product detector is “double triggering” (sending two signals at once).	Try these solutions (in the order shown) until the condition is corrected: •Clean the detector eye. •Adjust the product detector sensitivity. •Adjust the product detector placement. •Replace the product detector.
2. The products on the conveyor are crowded too close together.	Review the application to see if there is a better method of product detection.

* The possible causes for this fault are listed in the order in which they are most likely to occur.

Air Pressure Fault



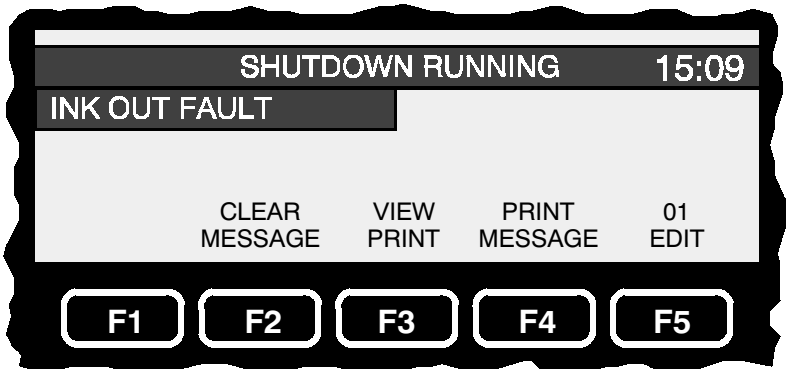
Time Enabled: Fault is enabled five seconds after the main air solenoid is turned On.

Condition: The air pressure has dropped below approximately 60 psi (4.1 bar) for more than 20 seconds.

Cause*	Solution
1. The air supply to the printer has been stopped.	Check to make certain the air pressure supply is connected to the printer, and the air pressure is turned On.
2. The air supply to the printer has fallen below approximately 60 psi (4.1 bar).	Increase the incoming air pressure to at least the minimum required for the type of ink that is installed into the printer.
3. The air pressure monitor switch is defective.	Try these solutions (in the order shown) until the condition is corrected: •Use an ohmmeter to check the operation of the air pressure monitor switch. The switch is normally open, and held closed by air pressure. •Replace the air pressure monitor switch.
4. The wiring between the air pressure monitor switch and the control board is broken or loose.	Try these solutions (in the order shown) until the condition is corrected: •Check the continuity of the wiring. •Replace the control board.

* The possible causes for this fault are listed in the order in which they are most likely to occur.

Ink Out Fault



Time Enabled: Fault is enabled in one of two ways:

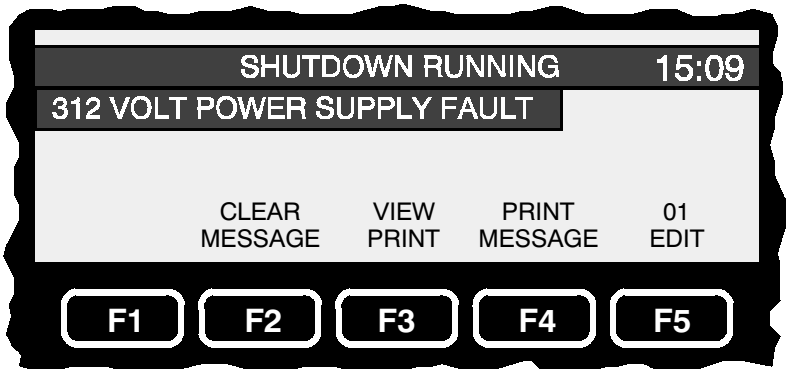
- When the printer is started with an empty make-up fluid or ink bottle, the fault is sensed immediately after the main air solenoid is turned On.
- If the Fluids Low Warning has been active for more than 30 minutes.

Condition: The ink low switch has been Off for more than 30 minutes or an attempt was made to start the printer with an empty bottle.

Cause*	Solution
1. The fluid level in the ink or make-up fluid bottle may be low.	Check the fluid levels in both bottles. If the fluid level is low, replace the appropriate bottle(s) with a full bottle.
2. The sense air pressure in the bottles is not set properly.	Position the end of the dip tube one inch (25 mm) below the fluid level in the bottle, then adjust the fluids low needle valve until two bubbles per second is reached.
3. The line leading to the ink or make-up fluid bottle has become disconnected from the bottle or is not positioned inside the bottle properly.	Check the condition of the line leading to both bottles. Make certain the line is leading into the bottle and the end of the line is below the fluid level.
4. The ink low switch is defective.	Replace the ink low switch.

* The possible causes for this fault are listed in the order in which they are most likely to occur.

312 Volt Power Supply Fault



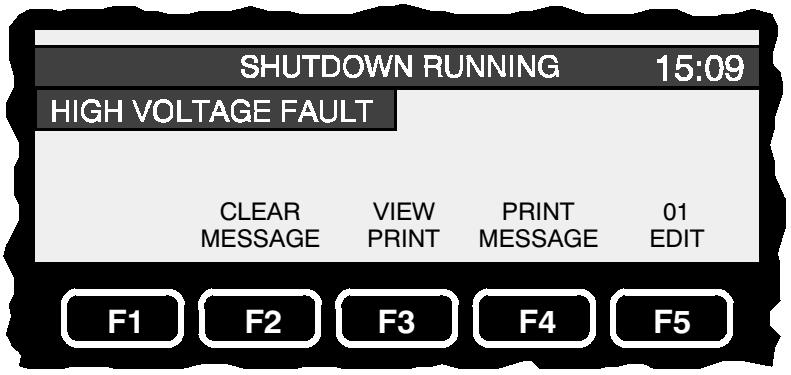
Time Enabled: Fault is enabled after the dual high voltage power supply is turned On.

Condition: The control board does not sense the output of the dual high voltage power supply.

Cause*	Solution
1. The dual high voltage power supply is defective.	Replace the dual high voltage power supply.
2. The input voltage from the +12 VAC auxiliary power supply is defective.	Replace the +12 VAC auxiliary power supply.
3. The power supply connections leading from the dual high voltage power supply to the control board are broken or loose.	Try these solutions (in the order shown) until the condition is corrected: •Tighten any loose connections. •Check for broken wiring. Repair if necessary.
4. Defective circuitry on the control board has shorted the 312 V output.	Replace the control board.

* The possible causes for this fault are listed in the order in which they are most likely to occur.

High Voltage Fault



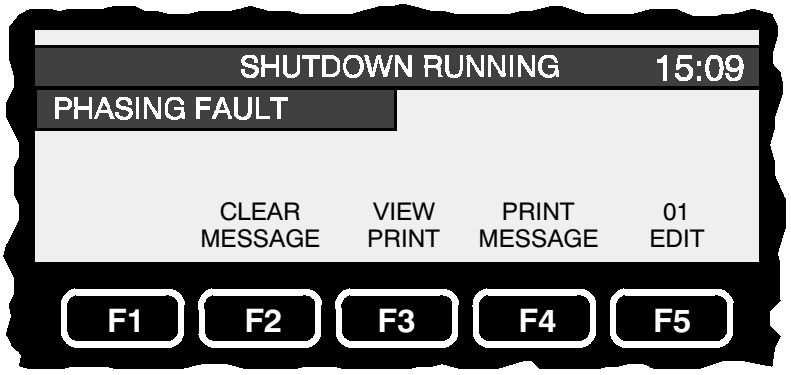
Time Enabled: Fault is enabled after the dual high voltage power supply is turned On.

Condition: The control board does not sense the output of the dual high voltage power supply.

Cause*	Solution
1. A short has occurred in the printhead due to excessive build up of fluids on the printhead components.	Clean the printhead and dry it **thoroughly**.
2. The dual high voltage power supply is defective.	Replace the dual high voltage power supply.
3. The lead going from the HV deflection plate to the dual high voltage power supply has shorted.	Replace the cable and duct assembly (umbilical).
4. The program voltage from the control board to the HV supply has failed.	Replace the control board.

* The possible causes for this fault are listed in the order in which they are most likely to occur.

Phasing Fault



Time Enabled: Fault is enabled 87 seconds after the printer is turned On or 35 seconds after the printhead has been restarted.

Condition: The printer has passed the ink stream test, but failed to find one good phase (out of four).

Cause*	Solution
1. Ink has accumulated on the ink return block.	Clean the printhead, and dry it **thoroughly**.
2. The ink is contaminated.	Perform the Ink Renewal procedure, followed by the Printer Calibration procedure. (Refer to Chapter 6, *Maintenance*.)
3. The printer is out of adjustment.	Perform the Ink Renewal procedure, followed by the Printer Calibration procedure. (Refer to Chapter 6, *Maintenance*.)
4. The sensing circuit, ink return block, wires or control board is defective.	Try these solutions (in the order shown) until the condition is corrected: •Make certain connectors are plugged in. •Check ground connections on sensing circuits. •Check for continuity in sense wiring between printhead connection and control board. •Replace the control board.

***** The possible causes for this fault are listed in the order in which they are most likely to occur.

Transfer Request Too Long Fault



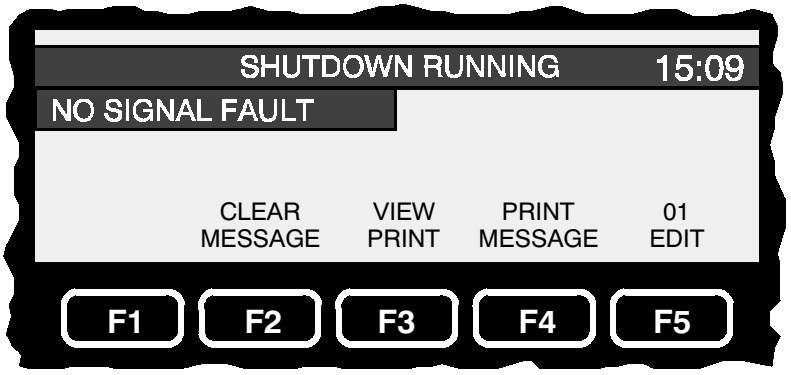
Time Enabled: Fault is checked while the ink is flowing (the nozzle solenoid is On).

Condition: The transfer request switch on the ink supply cylinder has been closed for more than 10 seconds.

Cause*	Solution
1. Loss of transfer pressure in the system.	Measure the transfer pressure and vacuum at the solenoid bank. If both are OK, try these solutions (in the order shown) until the condition is corrected: •Inspect the check valve from the output of the ink module. •Check the shut-off valve in the ink module. •Check the transfer pump in the ink module. •Check operation of the transfer solenoid.
2. The transfer request switch on the ink cylinder is defective.	Test the switch with a magnet and ohmmeter to see if the contact is closed.
3. The output line leading from the transfer solenoid to the transfer pump/shut-off valve is leaking air.	Replace the output line.
4. The magnetic float in the ink supply cylinder has sunk or is stuck.	Take the ink supply cylinder apart and free the magnetic float.
5. The check valve is defective.	Replace the check valve.
6. The final ink filter is obstructed.	Replace the final filter.

* The possible causes for this fault are listed in the order in which they are most likely to occur.

No Signal Fault



Time Enabled: Fault is enabled seven seconds after the printer is turned On and after two failed phasing checks have already occurred.

Condition: The control board is unable to sense the presence of any charged drops in the printhead.

The fault condition indicates that the No Signal Warning has occurred. (Refer to page 7-8 for further information.)

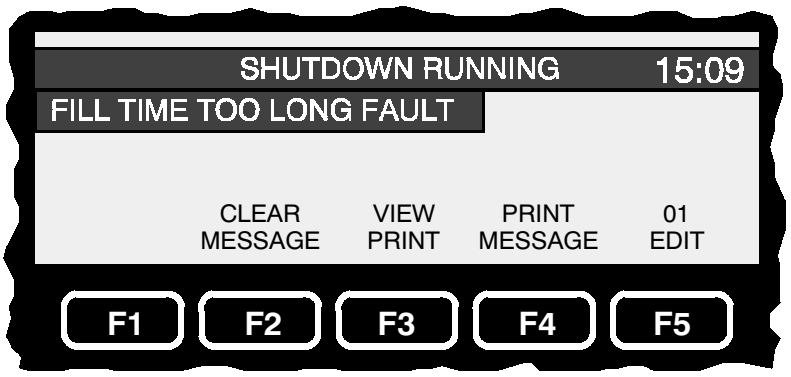
Cause*	Solution
1. There is no ink stream.	Try these solutions (in the order shown) until the condition is corrected: •Check the ink control valve for clogging. •Check the nozzle for clogging. •Check the final ink filter for clogging. •Check if the output of the ink supply cylinder is restricted. •Check the output of the ink pressure regulator. •Check the input of the ink pressure regulator.
2. There are no ink drops.	Try these solutions (in the order shown) until the condition is corrected: •Check and adjust the nozzle drive. •Replace the nozzle. •Check for broken wires leading from the control board to the nozzle. •Replace the control board.

Continued on next page ▶

3. A signal is not being applied to the charge tunnel (i.e. 3.5–4.5 VDC is not present).	Try these solutions (in the order shown) until the condition is corrected: •Check for open 10K resistor located between the charge tunnel and the connector on the control board. •Check for output at TP15. •Check for broken wires leading from the charge tunnel to the control board. •Replace the control board.
4. There is no sense signal at the ink return block. **Note:** This is the electrical charge on the drops as they accumulate in the ink return block. These charges are picked up by the electrodes in the ink return block and result in a current on the wires connected to the input of the phasing select circuit on the control board.	Try these solutions (in the order shown) until the condition is corrected: •Clean and dry the printhead. •Check for signal at TP27 or TP28. •Check for output at TP15. •Check for grounded or open sense wires. •Replace the control board.

***** The possible causes for this fault are listed in the order in which they are most likely to occur.

Fill Time Too Long Fault



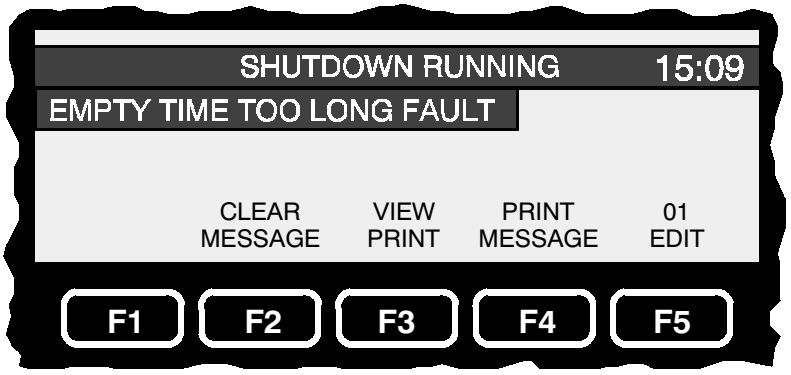
Time Enabled: Fault is checked while the ink is flowing (the nozzle solenoid is On).

Condition: The transfer request switch has opened, but more than 20 seconds has elapsed and the start switch has not closed.

Cause*	Solution
1. The transfer pressure is too low.	Verify that transfer pressure is approximately 15 psi (1.03 bar) above the current ink pressure.
2. The vacuum is too low for the type of ink used.	Verify that the vacuum setting is correct for the type of ink being used.
3. The input air pressure is too low for the type of ink used.	Verify that the input air pressure is at least 15 psi (1.03 bar) above the current ink pressure.
4. The transfer pump is defective.	Check the shut-off valve diaphragm and the transfer pump diaphragm for separation and damage.
5. The check valve is defective.	Replace the check valve.
6. The transfer pump is defective.	Replace the final ink filter.

* The possible causes for this fault are listed in the order in which they are most likely to occur.

Empty Time Too Long Fault



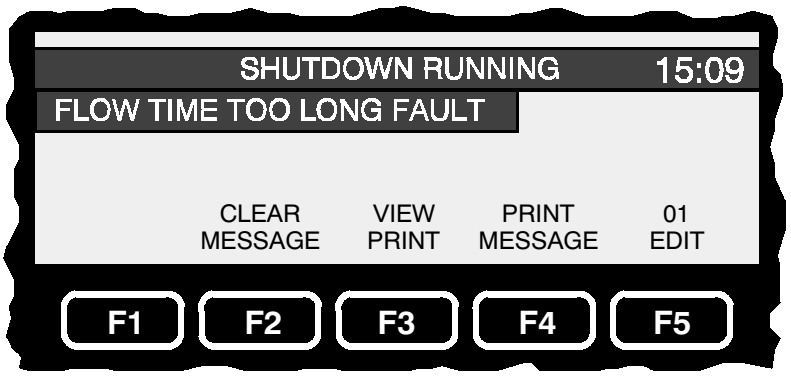
Time Enabled: Fault is checked while the ink is flowing (the nozzle solenoid is On).

Condition: The current ink time is greater than 125 percent of the set point time.

Cause*	Solution
1. The nozzle in the printhead is partially clogged.	Back flush the nozzle. Replace the nozzle, if necessary.
2. The lines and/or fittings located between the ink supply cylinder and the printhead are clogged, kinked, or restricted.	Check the lines and/or fittings for clogging, kinking, or restrictions.
3. The ink pressure is too low.	Perform the Ink Renewal procedure, followed by the Printer Calibration procedure. (Refer to Chapter 6, *Maintenance*.)
4. The check valve is defective.	Replace the check valve.

* The possible causes for this fault are listed in the order in which they are most likely to occur.

Flow Time Too Long Fault



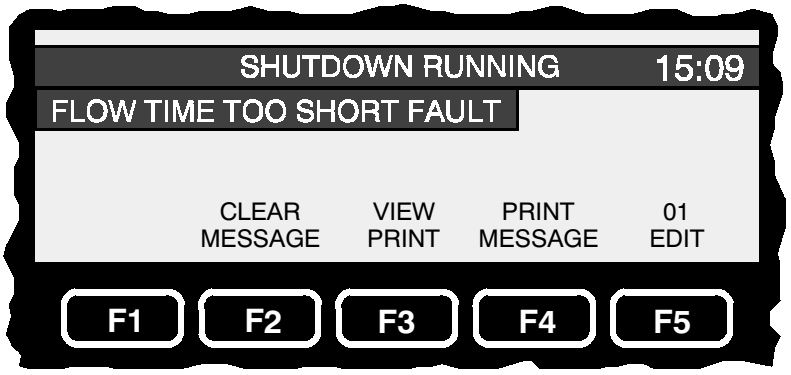
Time Enabled: Fault is checked while the ink is flowing (the nozzle solenoid is On).

Condition: The current ink time is greater than 115 percent of the set point time.

Cause*	Solution
1. Make-up fluid is not being added to the ink module.	The in-line filter is clogged, the make-up add valve is clogged, or there are problems with the make-up add settings or make-up add solenoid.
2. The nozzle is partially clogged.	Check the nozzle for clogs by flushing the nozzle with make-up fluid.
3. The system is out of calibration.	Perform the Ink Renewal procedure, followed by the Printer Calibration procedure. (Refer to Chapter 6, *Maintenance*.)
4. The ink control valve is tightened too tightly to the nozzle.	Check the tightness of the ink control valve to the nozzle, and adjust as needed.
5. The float in the ink supply cylinder is sticking (not stuck).	Verify that the printer is perpendicular to the floor (it is not tilted one way or the other).

***** The possible causes for this fault are listed in the order in which they are most likely to occur.

Flow Time Too Short Fault



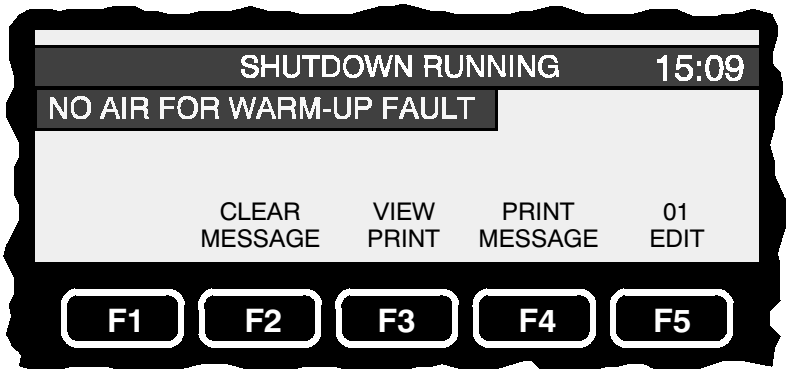
Time Enabled: Fault is checked while the ink is flowing (the nozzle solenoid is On).

Condition: The current ink time is less than 85 percent of the set point time.

Cause*	Solution
1. There is a leak between the output of the ink supply cylinder and the nozzle.	Check for hydraulic leaks (ink dripping) between the output of the ink supply cylinder and the nozzle.
2. The ink is diluted.	Try these solutions (in the order shown) until the condition is corrected: •Check the make-up add valve in the ink module for leaking. •Check the make-up add solenoid for leakage. •Perform the Ink Renewal procedure, followed by the Printer Calibration procedure. (Refer to Chapter 6, *Maintenance*.)

* The possible causes for this fault are listed in the order in which they are most likely to occur.

No Air for Warm-up Fault



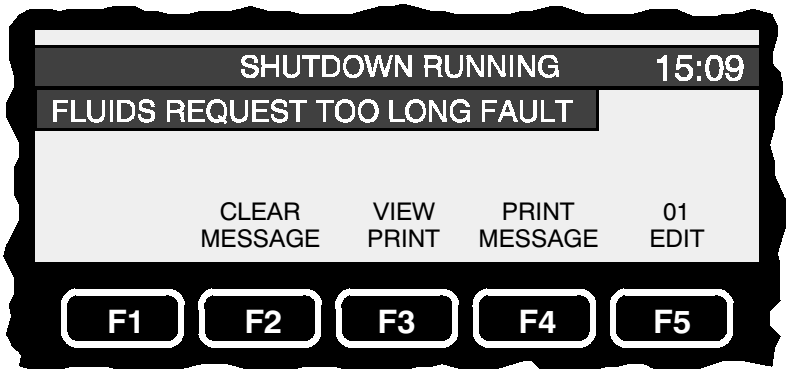
Time Enabled: Fault is checked for six seconds after the printer is turned On.

Condition: The air pressure monitor switch is open.

Cause*	Solution
1. There is no air input to the printer.	Check the input air pressure to make certain it is connected and turned On.
2. The input air pressure has fallen below approximately 60 psi (4.1 bar), depending on the type of ink used.	Increase the air pressure to the appropriate air pressure required for that type of ink.
3. The air pressure monitor switch is defective.	Replace the air pressure monitor switch.
4. The wires leading from the air pressure monitor switch to the control board are broken or loose.	Try these solutions (in the order shown) until the condition is corrected: •Tighten any loose connections. •Check for broken wiring. Repair if necessary.

***** The possible causes for this fault are listed in the order in which they are most likely to occur.

Fluids Request Too Long Fault



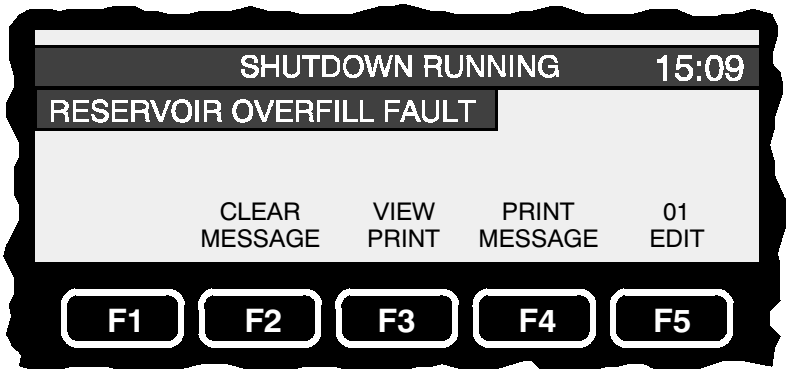
Time Enabled: Fault is checked every time fresh ink is requested.

Condition: The fresh ink request lasted longer than 20 seconds.

Cause*	Solution
1. The system vacuum is low or not present.	Verify system vacuum at the vacuum gauge.
2. The fresh ink line and/or replenishment filter is constricted or clogged.	Inspect the fluid lines and replenishment filters for clogs.
3. The float in the ink module has sunk or is not moving freely.	Remove the cap and stem assembly and inspect the float.
4. The reed switches on the cap and stem assembly are defective.	Replace the cap and stem assembly.
5. The vacuum filter is clogged.	Replace the vacuum filter.
6. The ink add valve is defective.	Repair or replace the ink add valve.
7. The ink add solenoid is defective.	Replace the ink add solenoid.

***** The possible causes for this fault are listed in the order in which they are most likely to occur.

Reservoir Overfill Fault



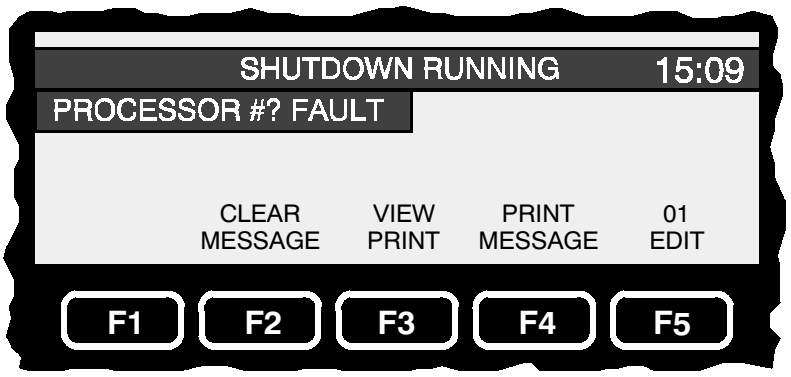
Time Enabled: Fault is checked one second after the printer is turned On.

Condition: The magnetic float in the ink module is at the top of its travel, and has caused the overfill switch to close.

Cause*	Solution
1. Either (or both) the ink add valve or make-up add valve is leaking.	Inspect and clean add valves. Replace diaphragms and/or piston valves, if required.
2. The reed switches on the cap and stem assembly are defective.	Replace the cap and stem assembly.
3. The ink add or make-up add solenoid is stuck open.	Replace the solenoid.

***** The possible causes for this fault are listed in the order in which they are most likely to occur.

Processor #1 Fault
Processor #2 Fault
Processor #4 Fault



Time Enabled: Fault is enabled one second after the printer is turned On.

Condition: The CPU watchdog has failed.

Cause*	Solution
1. The control board is defective.	Complete the following steps: 1) Press the **OFF** key to turn power Off, 2) Remove the battery jumper on the control board, 3) Wait approximately 15 seconds, 4) Replace the battery jumper, 5) Press the **On** key to turn power back On. If the fault is corrected, perform a Printer Calibration procedure. (Refer to Chapter 6, *Maintenance*.) If the fault is still present, replace the control board. **Note:** In either case, all saved data, including stored messages, set-up and print parameters, and set point time will be lost.
2. There is no +5 VDC on the control board.	Check the +5 VDC power supply. The voltage should not be less than 4.95. If it is, replace the low voltage power supply.

***** The possible causes for this fault are listed in the order in which they are most likely to occur.

+12 Volt Supply - Use Deadman Switch Fault

When the +12 Volt Supply - Use Deadman Switch Fault occurs the power on the printer is removed immediately. Therefore, nothing will appear in the display screen (as shown below).



Press and hold the **ON** key until something appears in the display. The display will show that a +12 Volt Supply - Use Deadman Switch Fault has occurred.

Time Enabled: Fault is enabled one second after the printer is turned On.

Condition: The +12 V auxiliary power supply has failed.

Cause*	Solution
1. The +12 V auxiliary power supply is defective.	Replace the +12 V auxiliary power supply.
2. The wires leading from the +12 V auxiliary power supply to the control board are broken or loose.	Try these solutions (in the order shown) until the condition is corrected: •Tighten any loose connections. •Check for broken wiring. Repair if necessary.
3. A circuit has shorted, causing power supply shutdown.	Remove the power supply loads one by one to locate the short.

***** The possible causes for this fault are listed in the order in which they are most likely to occur.

LED Printer Status Indicators

Introduction

Many light emitting diode (LED) indicators are present on the control board. Refer to Figure 7-2. The control board is located inside the electronics cabinet of the printer. The LEDs can be useful in determining the exact cause of a printer fault.

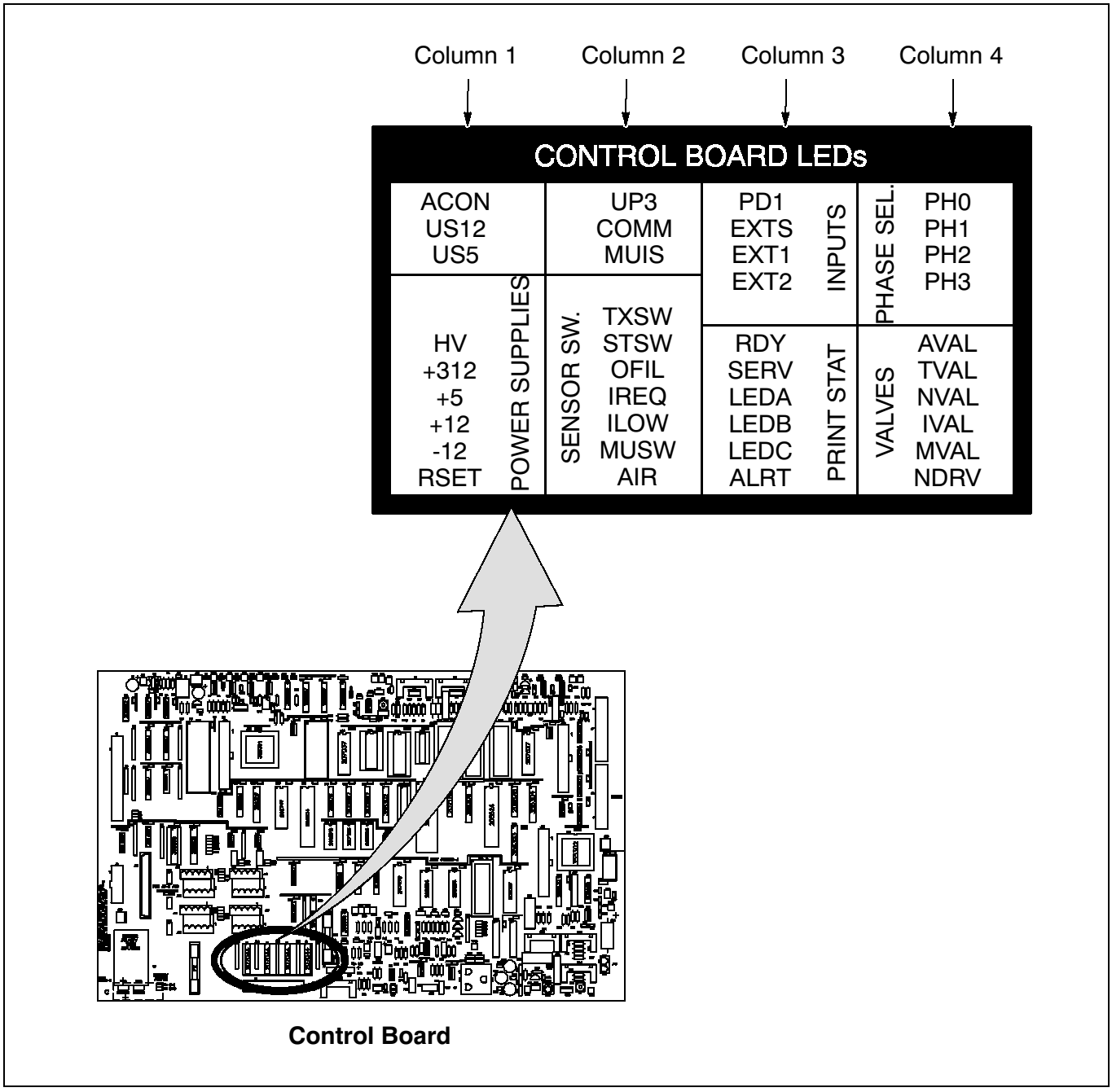


Figure 7-2. LED Panel on the Control Board

Using the LEDs for Troubleshooting

In order for the LEDs to be useful when troubleshooting problems, you need to be familiar with the operational sequences for the printer (such as printer power-up, printer start-up, printer shutdown, printhead restart, printhead shutdown, ink transfer, or recycling, make-up add, and fresh ink add). Refer to Chapter 5, *Theory of Operation*, for further information on operational sequences.

The LEDs indicate the status of the printer when the problem occurred. It shows which valves, switches, power supplies, etc. were active or inactive.

LED Descriptions

The LEDs are arranged into four vertical groups (refer to Figure 7-2):

- Column 1 Power Supplies
- Column 2 Sensor Switches
- Column 3 Printer Status and Inputs
- Column 4 Valves and Phase Select

The following pages provide a brief description of what each LED monitors and what it means when the LED is lit or not lit (and, in some cases, flashing).

ACON

AC Power On

Follows the ACON signal from the UP3 processor. Indicates whether or not AC power is currently being applied to the printer.

LED On: Indicates that UP3 processor is holding the solid state relay On (which applies AC power to the low voltage power supplies).

LED Off: Indicates that the UP3 processor has failed. (In this case, all other LEDs also will be Off.)

US12

User +12 V

Indicates whether or not the +12 volts from the +12 VDC auxiliary power supply are On and being applied to pin 1 of connectors J15, J17, J18, J20, J21, J22, J28, and J29 (found on the control board).

LED On: Indicates that the +12 VDC from the +12 V auxiliary power supply are On.

LED Off: Indicates that the +12 VDC from the +12 V auxiliary power supply are Off.

US5

User +5 Volts

Indicates whether or not the +5 volts from the low voltage regulator (which is powered by the +12 VDC auxiliary power supply) are On and being applied to pin 2 of connectors J15, J17, J18, J20, J21, J22, J28, and J29 (found on the control board).

LED On: Indicates that+5 VDC from the low voltage regulator are On.

LED Off: Indicates that+5 VDC from the low voltage regulator are Off.

HV

High Voltage

Indicates whether or not high voltage is being applied to the high voltage deflection plate in the printhead.

LED On: Indicates that high voltage is being applied to the high voltage deflection plate.

LED Off: Indicates that high voltage is not being applied to the high voltage deflection plate.

+312

+312 V

Indicates whether or not +312 volts are available (from the high voltage power supply) for charging and nozzle drive circuitry.

LED On: Indicates that +312 VDC are available for charging and nozzle drive circuitry.

LED Off: Indicates that +312 VDC are not available for charging and nozzle drive circuitry.

+5

+5 V

Indicates whether or not +5 volts (from the low voltage power supply) are being applied to the control board.

LED On: Indicates that +5 VDC are being applied to the control board.

LED Off: Indicates that +5 VDC are not being applied to the control board.

+12

+12 V

Indicates whether or not +12 volts (from the low voltage power supply) are being applied to the control board.

LED On: Indicates that +12 VDC are being applied to the control board.

LED Off: Indicates that +12 VDC are not being applied to the control board.

-12

-12 V

Indicates whether or not -12 volts (from the low voltage power supply) are being applied to the control board.

LED On: Indicates that -12 VDC are being applied to the control board.

LED Off: Indicates that -12 VDC are not being applied to the control board.

RSET

Reset

Indicates whether or not the printer is resetting the microprocessors. This occurs only when powering up the printer.

LED On: Indicates that the printer is resetting the microprocessors. The LED lights only momentarily.

LED Off: Indicates that the printer is not resetting the microprocessor. This is the normal state.

μPC

Microprocessor 3

Indicates whether or not the watchdog timer for microprocessor 3 is running.

LED On: Indicates that the watchdog timer for microprocessor 3 is running.

LED Off: Indicates that the watchdog timer for microprocessor 3 is not running.

COMM

Serial Interface Communications Status

Indicates whether or not the printer is receiving data from the RS-232 serial interface communications.

LED On: Indicates that the printer is presently receiving data from RS-232.

LED Off: Indicates that the printer is not presently receiving data from RS-232.

MUIS

Make-up Inhibit Status

Indicates whether or not a make-up inhibit has occurred within the last eight transfer cycles.

LED On: Indicates that a make-up inhibit has occurred within the last eight transfer cycles.

LED Off: Indicates that a make-up inhibit has not occurred within the last eight transfer cycles.

TXSW

Transfer Request Switch

The transfer request switch is the lower switch on the ink supply cylinder. When triggered by the float inside the cylinder, it energizes the transfer solenoid and signals the microprocessor to stop measuring flow time.

LED On: Indicates that the fluid level in the ink supply cylinder is low, fluids are being requested, and the printer has stopped measuring the flow time.

LED Off: Indicates that the fluid level in the ink supply cylinder is not low and fluids are not being requested.

STSW

Start Switch

The start switch is the upper switch on the ink supply cylinder. When triggered by the float inside the cylinder, it de-energizes the transfer solenoid and signals the microprocessor to start measuring flow time.

LED On: Indicates that the fluid level in the ink supply cylinder is full, and the printer has reset the flow time to zero. (**Note:** The printer begins to measure flow time once the LED goes Off.)

LED Off: Indicates that the fluid level in the ink supply cylinder is not full.

OFIL

Reservoir Overfill Switch

The reservoir overfill switch is the top switch on the cap and stem assembly (located inside the ink module reservoir). It monitors the fluid level inside the reservoir to make certain the reservoir does not overfill with fluids.

LED On: Indicates that an overfill condition has occurred in the ink module reservoir.

LED Off: Indicates that there is not an overfill condition in the ink module reservoir.

IREQ

Ink Request Switch

The ink request switch is the bottom switch on the cap and stem assembly (located inside the ink module reservoir). It monitors the fluid level inside the reservoir and signals the control board to add fluid when the reservoir level is low.

LED On: Indicates that the fluids level in the reservoir is low, and the printer is presently adding either fresh ink or make-up fluid into the reservoir (depending on the latest flow time reading).

LED Off: Indicates that the reservoir is not low and neither fresh ink or make-up fluid are being added into the reservoir.

ILOW

Ink Low Monitor Switch

The ink low monitor switch monitors back pressure in the fresh ink and make-up fluid bottles to check for low conditions.

LED On: Indicates that the fluid level in either (or both) the ink and make-up bottles is low.

LED Off: Indicates that the fluid level in the ink and make-up bottles is not low.

MUSW

Make-up Inhibit Request Switch

The make-up inhibit request switch is the middle switch on the cap and stem assembly (located inside the ink module reservoir). It prevents fresh ink or make-up fluid from being added to the ink module and overfilling the reservoir.

LED On: Indicates that the fluid level in the reservoir is full and fluid is not being added.

LED Off: Indicates that the fluid level in the reservoir is neither low or full (but somewhere in between).

AIR

Air Pressure Monitor Switch

The air pressure monitor switch monitors the input air pressure to the printer.

LED On: Indicates that the input air pressure is above 60 psi (4.1 bar).

LED Off: Indicates that the input air pressure is below 60 psi (4.1 bar).

PD1

Product Detector Status

This LED indicates the status of the product detector. It shows the state of the product detect signal (whether it is On or Off).

LED On: Indicates that the printer is currently receiving a product detect signal (or vice versa, depending on the type and set-up of the product detector).

LED Off: Indicates that the printer is not currently receiving a product detect signal (or vice versa, depending on the type and set-up of the product detector).

EXTS

External Stroke Status

This LED indicates when the printer is receiving pulses from the shaft encoder (if installed).

LED On: Indicates that the printer is receiving pulses from the shaft encoder. **Note:** The LED flashes each time it receives a pulse. However, since the time between pulses is so short, the LED appears as if it is lit (solid).

LED Off: Indicates that the printer is not receiving pulses from the shaft encoder.

EXT1

External Input 1

This LED indicates the presence of an external input signal for a transverse printhead.

LED On: Indicates that the external input signal is present.

LED Off: Indicates that the external input signal is not present.

EXT2

Not Used

RDY

Printer Ready Status

This LED indicates the current status of the printer. Shows you whether or not the printer is ready to print a message (whenever it receives a product detect signal).

LED On: Indicates that the light on both the **HEAD** key and the **PRINT** key are lit. Therefore, the printer is ready to print a message. The **READY** light on the keyboard also will be On.

LED Off: Indicates that the light on both the **HEAD** key and the **PRINT** key are not lit. Therefore, the printer is not ready to print a message. The **READY** light on the keyboard will also be Off.

SERV

Service Request Status

This LED indicates the current status of the printer. Shows you whether or not the printer is in the normal operating mode.

LED On: Indicates that a fault condition has occurred and the printer is presently shutting down or has already shutdown. The **SERVICE** light on the keyboard will also be On.

LED Off: Indicates that the printer is operating normally. The **SERVICE** light on the keyboard will also be Off.

LEDA

Printhead Status

This LED indicates the current status of the printhead. Shows you whether or not the printhead is active (meaning both the ink and high voltage are On).

LED On: Indicates that both the ink and high voltage are On. The light on the **HEAD** key will also be On.

LED Off: Indicates that both the ink and high voltage are Off. The light on the **HEAD** key will also be Off.

Note: If the LED is flashing, this indicates that the ink is On and the high voltage printhead is Off. The light on the **HEAD** key will also flash.

LEDB

Print On Status

This LED indicates the current status of printing. Shows you whether or not data from the print buffer can be sent to the printhead for printing.

LED On: Indicates that the printhead is accepting data from the print buffer for printing. The light on the **PRINT** key will also be On.

LED Off: Indicates that the printhead is not accepting data from the print buffer for printing. The light on the **PRINT** key will also be Off.

LEDC

Not Used

ALRT

Alert Light Status

This LED indicates the current status of the alert light. Shows you whether or not a fault or warning has occurred in the printer.

LED On: Indicates that a fault or warning has occurred in the printer.

LED Off: Indicates that a fault or warning has not occurred in the printer.

PH0

Phase 0

This LED indicates whether or not Phase 0 is the phase that the printer is going to use for printing.

LED On: Indicates that Phase 0 is the phase that the printer is going to use for printing.

LED Off: Indicates that Phase 0 is not the phase that the printer is going to use for printing. Instead, it will use Phase 1, Phase 2, or Phase 3.

PH1

Phase 1

This LED indicates whether or not Phase 1 is the phase that the printer is going to use for printing.

LED On: Indicates that Phase 1 is the phase that the printer is going to use for printing.

LED Off: Indicates that Phase 1 is not the phase that the printer is going to use for printing. Instead, it will use Phase 0, Phase 2, or Phase 3.

PH2

Phase 2

This LED indicates whether or not Phase 2 is the phase that the printer is going to use for printing.

LED On: Indicates that Phase 2 is the phase that the printer is going to use for printing.

LED Off: Indicates that Phase 2 is not the phase that the printer is going to use for printing. Instead, it will use Phase 0, Phase 1, or Phase 3.

PH3

Phase 3

This LED indicates whether or not Phase 3 is the phase that the printer is going to use for printing.

LED On: Indicates that Phase 3 is the phase that the printer is going to use for printing.

LED Off: Indicates that Phase 3 is not the phase that the printer is going to use for printing. Instead, it will use Phase 0, Phase 1, or Phase 2.

AVAL

Air Control Solenoid

This LED indicates whether or not the air control solenoid is energized.

LED On: Indicates that the air control solenoid is energized, and allowing air into the system.

LED Off: Indicates that the air control solenoid is not energized, and air is not being allowed into the system.

TVAL

Transfer Solenoid

This LED indicates whether or not the transfer solenoid is energized.

LED On: Indicates that the transfer solenoid is energized, causing fluid to be transferred from the transfer pump to the ink supply cylinder.

LED Off: Indicates that the transfer solenoid is not energized, and fluid is not being transferred from the transfer pump to the ink supply cylinder.

NVAL

Nozzle Solenoid

This LED indicates whether or not the nozzle solenoid is energized.

LED On: Indicates that the nozzle solenoid is energized, causing air pressure to enter the ink supply cylinder and force ink to the nozzle.

LED Off: Indicates that the nozzle solenoid is not energized, and ink is not being forced to the nozzle.

IVAL

Ink Add Solenoid

This LED indicates whether or not the ink add solenoid is energized.

LED On: Indicates that the ink add solenoid is energized, causing ink from the ink bottle to be transferred into the ink module reservoir.

LED Off: Indicates that the ink add solenoid is not energized, and ink from the ink bottle is not being transferred into the ink module reservoir.

MVAL

Make-up Add Solenoid

This LED indicates whether or not the make-up add solenoid is energized.

LED On: Indicates that the make-up add solenoid is energized, causing make-up fluid from the make-up fluid bottle to be transferred into the ink module reservoir.

LED Off: Indicates that the make-up add solenoid is not energized, and make-up fluid from the make-up fluid bottle is not being transferred into the ink module reservoir.

NDRV

Nozzle Drive Status

This LED indicates the current status of the nozzle drive output. Shows you whether or not the nozzle drive is on, off, or has shorted.

LED On: Indicates that the nozzle drive output is present.

LED Off: Indicates that the nozzle drive output is not present.

LED Bright: Indicates that the nozzle drive circuitry may have shorted. (**Note:** The LED is brighter than all other LEDs.)

Electronic Test Points

Introduction

It may be necessary to analyze the control board to find the cause of printer faults and other conditions. The test points on the control board 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 control board, when checking the continuity and resistance of a suspected wire, or the functionality of a suspected circuit or component.

Refer to Figure 7-3 for the location of the test points on the control board, and refer to Table 7-1 on the next page to find the signal definition for each test point.

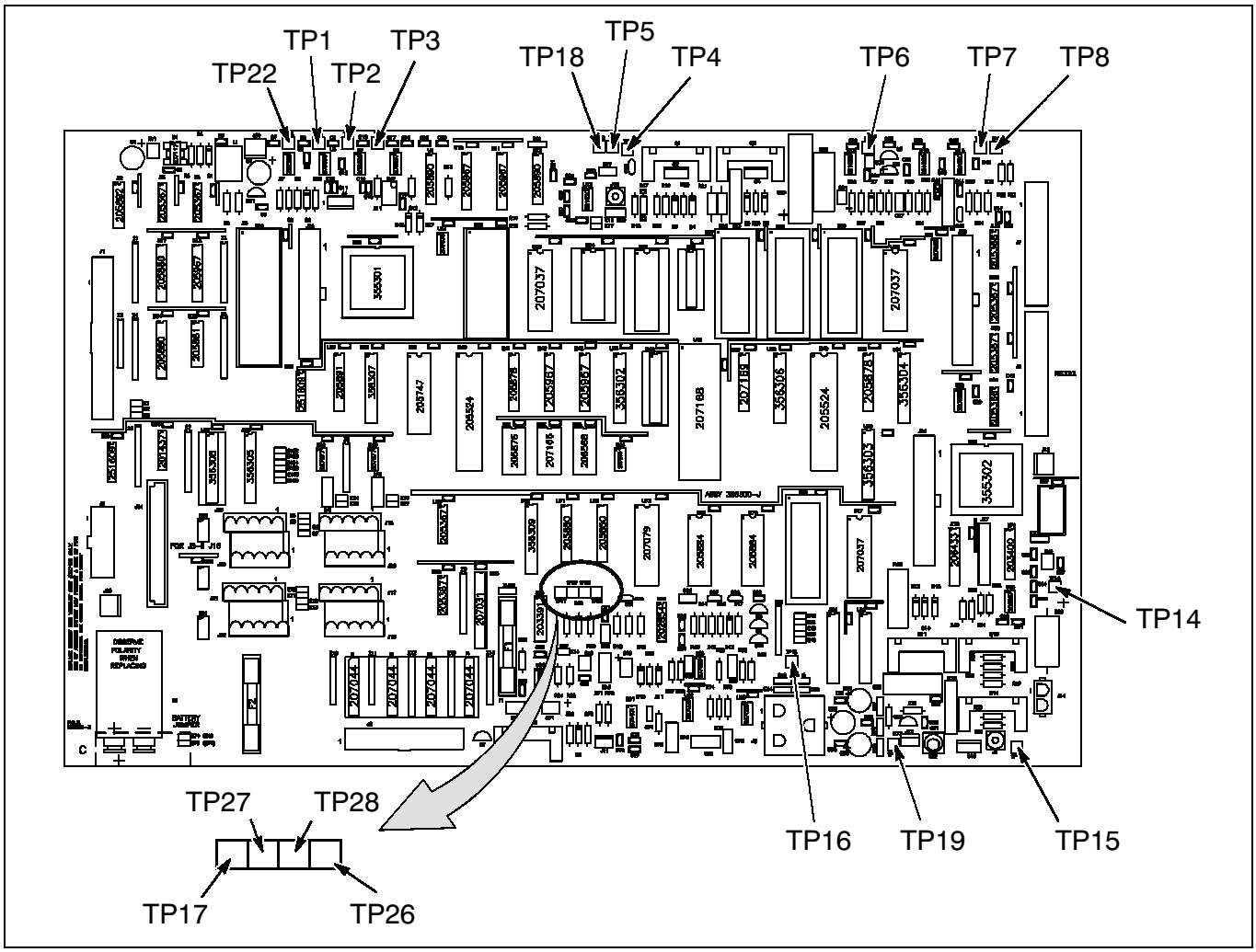


Figure 7-3. Test Point Locations on Control Board

Test Point	Signal Definition
TP1	High Voltage Monitor
TP2	High Voltage Programming Voltage
TP3	Programming Voltage Set-up
TP4	Nozzle Drive Scale Amp
TP5	Nozzle Drive
TP6	Nozzle Drive AGC Output
TP7	Nozzle Drive Sine Out
TP8	Nozzle Drive Amp Input
TP14	Charge Amp Input
TP15	Charge Amp
TP16	Ground
TP17	Ground
TP18	Ground
TP19	Ground
TP22	High Voltage Sense Amp
TP26	Sense Amp AV1
TP27	Sense Signal
TP28	Sense Amp AV4

Table 7-1. Test Point Signal Definitions

No Signal Faults

Introduction

A No Signal Fault occurs when a charge signal is not sensed in the ink return block during a stream test. The printer does not sense that a charged ink stream is entering the ink return block. The printer performs a stream test at start-up, after sensing a Phasing Fault and when ink pressure is set.

Many causes of the No Signal Fault are listed earlier in this chapter. Certain conditions require electronic testing to isolate a broken wire or a faulty printer component or control board.

Troubleshooting Guidelines

Follow these guidelines to troubleshoot a No Signal Fault:

- Make sure the printhead is clean and dry.
- Turn the ink On and turn the high voltage Off when performing most tests. Some tests will require the ink to be turned Off as well.
- With ink turned On and high voltage turned Off, check for phase indicator LEDs flickering while adjusting the nozzle drive.
- Test in this order:
    1. nozzle system
    2. charge system
    3. return system
- Check for an ink stream at the nozzle.
- Check for vacuum at the ink return block.
- Check the power supply LEDs.

If No Ink Stream or Vacuum

If there is no ink stream or vacuum, the problem is not likely to be at the printhead. Instead, look for a pneumatic or hydraulic problem.

Check for Obvious Causes

Before performing any detailed electrical checks, look for the obvious causes of a No Signal Fault.

- Check the alignment of the ink stream, and make sure the ink stream enters the ink return block properly.
- Check the vacuum setting, and make any necessary adjustments.
- If the No Signal Fault is still present, run all electrical circuitry checks that require the printer to be On while in the Service mode. Be sure the high voltage is turned Off.



CAUTION: Do not measure high voltage at the high voltage plate with a regular voltage meter. Use a special high voltage probe to measure 3,000 to 6,000 VDC.

Nozzle Drive Circuitry Checks

A possible problem with the nozzle or nozzle drive wire is indicated by a No Signal Fault. If this is the case, use these guidelines to correct the problem:

Check Printhead Components

If a nozzle problem is suspected, use the magnifier to check for ink drops within the charge tunnel. If an ink stream is present, but you cannot see ink drops, adjust the nozzle drive setting. If the solid ink stream does not break into drops when the nozzle drive is adjusted, check the nozzle wire terminal connections at the printhead. Clean or tighten if needed.

Perform AC Voltage Test

If the connections appear to be good, use an oscilloscope or multi-meter to check the peak-to-peak AC drive voltage at the printhead. If you use an oscilloscope, the voltage should read approximately 30 volts peak-to-peak with a typical drive voltage of 10.

Check Wires

If this test fails, move the nozzle drive wire at the printhead. If the scope responds with a voltage reading, the problem is a dirty or faulty connection, or a faulty nozzle. Clean or repair as needed. If you get a voltage reading at the printhead, but still do not see drops within the charge tunnel, the nozzle is faulty and must be replaced.

If the voltage test fails, check the continuity of the nozzle drive wire with a multi-meter. The meter should read approximately 0 ohms. Any other reading indicates a break in the nozzle drive wire. If the nozzle drive circuit fails the continuity check, repair or replace the umbilical.

Check Control Board

If the wire is not broken, the problem may be a faulty control board. Verify a control board nozzle drive output failure at test point 5.

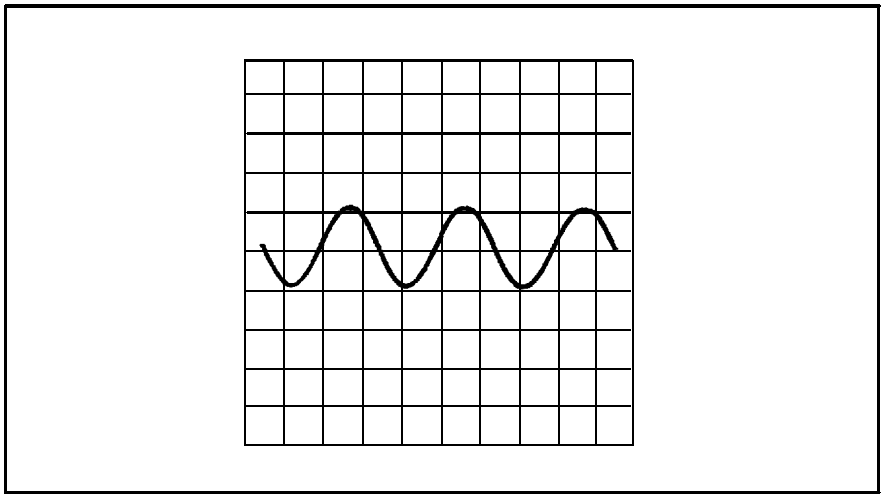


Figure 7-4. Test Point 5 – Nozzle Drive

Figure 7-4 represents the nozzle drive taken at test point 5. Use this test point to check for possible nozzle or control board failure. Severe distortions in wave form could indicate a problem. The cycle period is 15 microseconds at 5 microseconds per division. Use test point 16 or a power supply as ground.

The voltage varies from approximately 0 to 150 VAC, peak-to-peak. It is controlled with the nozzle drive adjustment in the software program. Control is obtained by setting a specific percentage (0–100%) of the available voltage. Each percentage represents an increase or decrease of about one and one-half volts peak-to-peak. The AC voltage should read about 30 volts peak-to-peak with a typical nozzle drive setting of 10.

Charge Tunnel Circuitry Checks

A No Signal Fault can also indicate a charge tunnel problem. Use a multi-meter and oscilloscope to check the charge tunnel circuit.

Check Printhead Components

If you suspect a charge circuit problem, first use the magnifying glass to check for the presence of ink drops within the tunnel. If you see an ink stream, but do not see drops, follow the previous procedure for testing the nozzle circuit. However, if the drop breakoff is correct and the system shows a No Signal Fault, check the charge tunnel.

Examine Charge Wire Connection

First, examine the charge wire connection in the printhead. Clean or tighten if needed. If the connection is good, use a meter to check the charge voltage at the charge tunnel. There should be a reading of about 10 VDC peak-to-peak with an oscilloscope, or 3.5 VRMS with a multi-meter. If the test fails, first move the charge tunnel wire at the printhead. If the meter responds with a voltage reading, the problem is a dirty or faulty connection. Clean or repair as needed. If the voltage reading is still incorrect, use a multi-meter to check for a broken wire or resistor.

Check Continuity

Check the continuity of the charge tunnel wire from the control board to the printhead. The charge tunnel wire should read about 10,000 ohms. Remember that a 10K resistor is located in the wire at the printhead. If the charge circuit fails the continuity check, repair or replace the umbilical.

Test Point 15

If continuity is good, but voltage is not read at the charge tunnel, check the charge voltage at test point 15 on the control board.

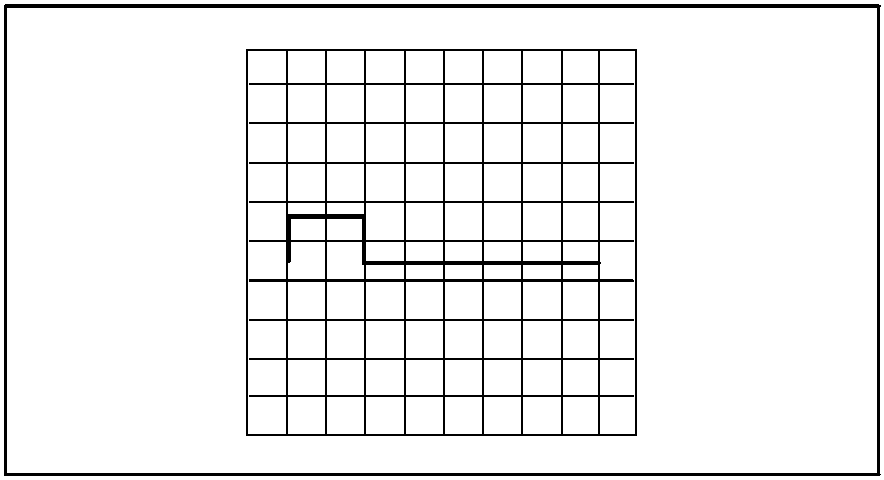


Figure 7-5. Test Point 15 – Stream Test

Stream Test

The printer performs a stream test during an Automatic Phase Control (APC) Sequence. (The stream test is shown in Figure 7-5.) The stream test is also performed at start-up, before a fault and when the ink pressure is set. The control board uses the stream test in order to lock onto the proper charging “window” within the charge tunnel. The test also checks for the presence and speed of the ink stream as it goes from the charge tunnel into the ink return block. This control is completely automatic.

Signal

The signal in the figure is test point 15, which represents the charge amplifier signal from the control board to the charge tunnel. It represents the charge placed on 28 drops in the charge tunnel. A single continuous 10 VDC charge is applied for 420 microseconds. The picture represents 0.5 microseconds per division.

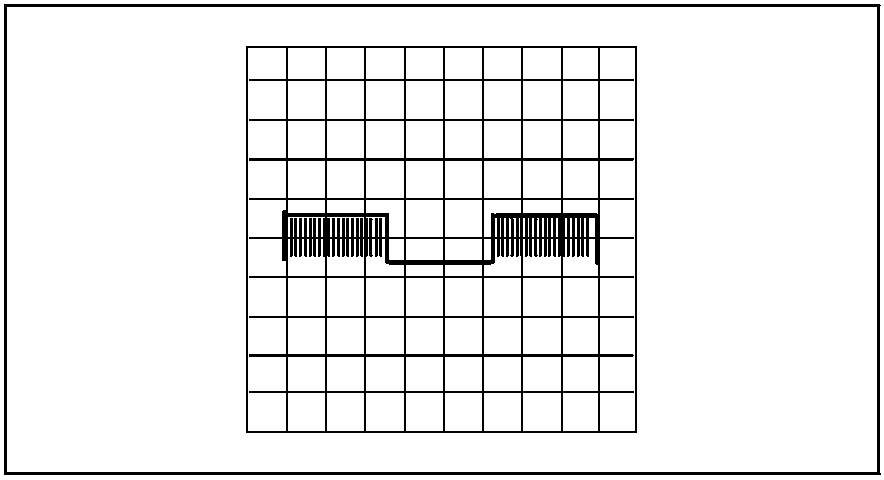


Figure 7-6. Test Point 15 – Phasing Test

Phasing Test

The Phasing Test, which is part of the APC sequence, is shown in Figure 7-7. The phase test checks for the presence of charge on specific drops of ink. The phasing test looks for the best charge on drops that are in one of four testing periods (phases). The test is run any time the nozzle solenoid is On, except when the printer runs a stream test or prints.

The illustration represents 28 drops being charged at the charge tunnel. Each drop in the group of 28 receives a 10 VDC charge. The illustration represents 0.5 microseconds per division.

Using Test Point 15

Use test point 15 to check for a faulty control board. Also check for loose connections or broken wiring before changing a control board. A “double check” for this test point is to first take a reading at test point 15, then move the probe to the charge tunnel (use the printhead chassis for a ground) and repeat the measurement. A correct reading at the control board and an incorrect reading at the charge tunnel indicates faulty wiring or a bad connection. However, if voltage is not obtainable at test point 15, replace the control board.

Sense Signal Circuitry Checks

A no signal fault may also be caused by a faulty sense signal circuit. The sense signal is the voltage reading that is sent back to the control board during the APC sequence. If the printer is faulting on No Signal, first follow the previous procedures to test the nozzle drive and charge circuits. If these are good, check the sense circuit.

Check Ink Stream

First, ensure that the ink stream enters the ink return block properly. Also be sure that the vacuum is correct. Make any necessary adjustments. If the fault persists, examine the ink return block. Make sure that connectors are clean and snug. If the connections are good, perform the following test to isolate the problem to the ink return block, wire, or control board.

Check Continuity

Check the continuity of both the white and black wires at the ink return block. Replace the umbilical if you do not obtain a reading of 0 ohms.

Check for Shorts

You can also check for a short across the ink return block to the ground and signal leads. The meter should read an infinite amount of resistance. If the reading is low, use a screwdriver to carefully disconnect the black lead wire from the ink return block and retest for shorts at the ink return block. If the tests are good, check the control board.

Test Point 27

The sense signal (as it appears before being sent through a digital converter) is shown in Figure 7-8. This is the signal that the control board uses to analyze drop charge.

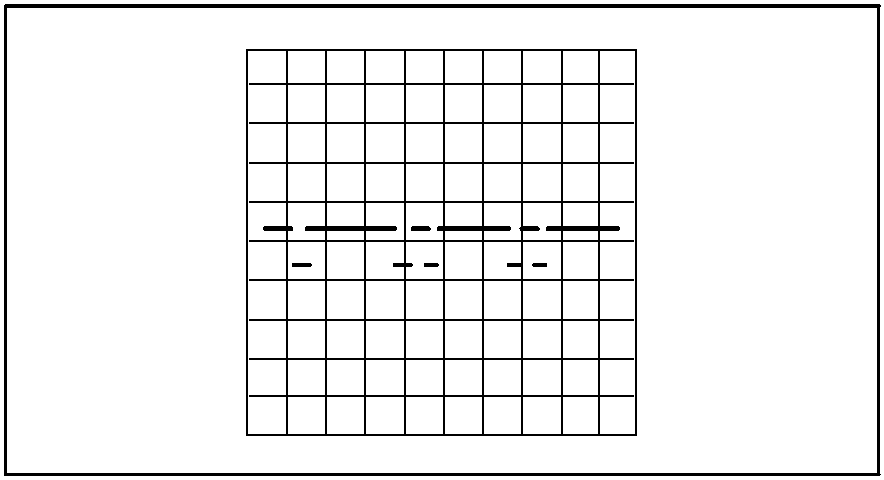


Figure 7-7. Test Point 27

The control board processes the signal from the return block and determines the phase upon which to lock. This procedure is automatic.

Use this test point to check for a faulty ink return block or control board. Do not overlook broken wiring and improper grounds in the printhead when troubleshooting. If the test fails, replace the control board.

Test Point 28

The signal test at test point 28 is shown in Figure 7-7. This signal inputs from the ink return block in the printhead. It represents the phases, or groups of drops, that were charged at the charge tunnel. Each wave equals one phase.

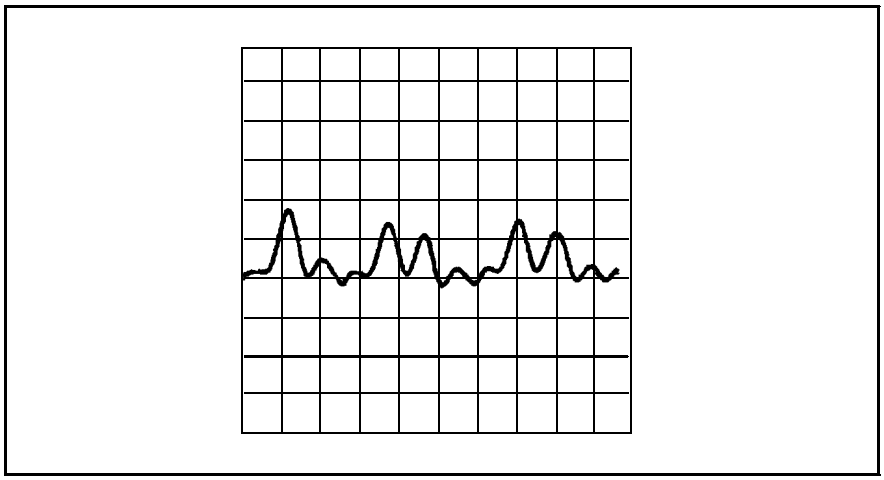


Figure 7-8. Test Point 28

Wiring Diagrams

Introduction

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

For More Information

Refer to the following tables for the page numbers to find specific wiring diagrams.

Description	Page Number
Wires Leading from Printhead	7-55

Table 7-2. Printhead Connections

Description	Page Number
Wires Leading from High Voltage Power Supply	7-57
Wires Leading from Low Voltage Power Supply	7-57
Wires Leading from Solid State Relay	7-57
Wires Leading from +12V Auxiliary Power Supply	7-58
Wires Leading from Line Filter	7-58
Wires Leading from Circuit Breaker	7-58
Wires Leading from Line Cord	7-58
Wires Leading from Power Switch	7-58

Table 7-3. Power Connections

Continued on next page ▶

Description	Page Number
Wires Leading from Keylock Switch	7-59
Wires Leading from Contrast Adjustment	7-60
Wires Leading from Remote Service Port	7-60
Wires Leading from Cap and Stem Assembly	7-60
Wires Leading from Fluids Low Switch	7-60
Wires Leading from Main Air Solenoid	7-60
Wires Leading from Transfer Solenoid	7-61
Wires Leading from Nozzle Solenoid	7-61
Wires Leading from Ink Solenoid	7-61
Wires Leading from Make-up Solenoid	7-61
Wires Leading from Start Switch	7-61
Wires Leading from Transfer Switch	7-61

Table 7-4. Hydraulic Connections

Description	Page Number
Wires Leading from Control Board	7-62

Table 7-5. Control Board Connections

Printhead Connections

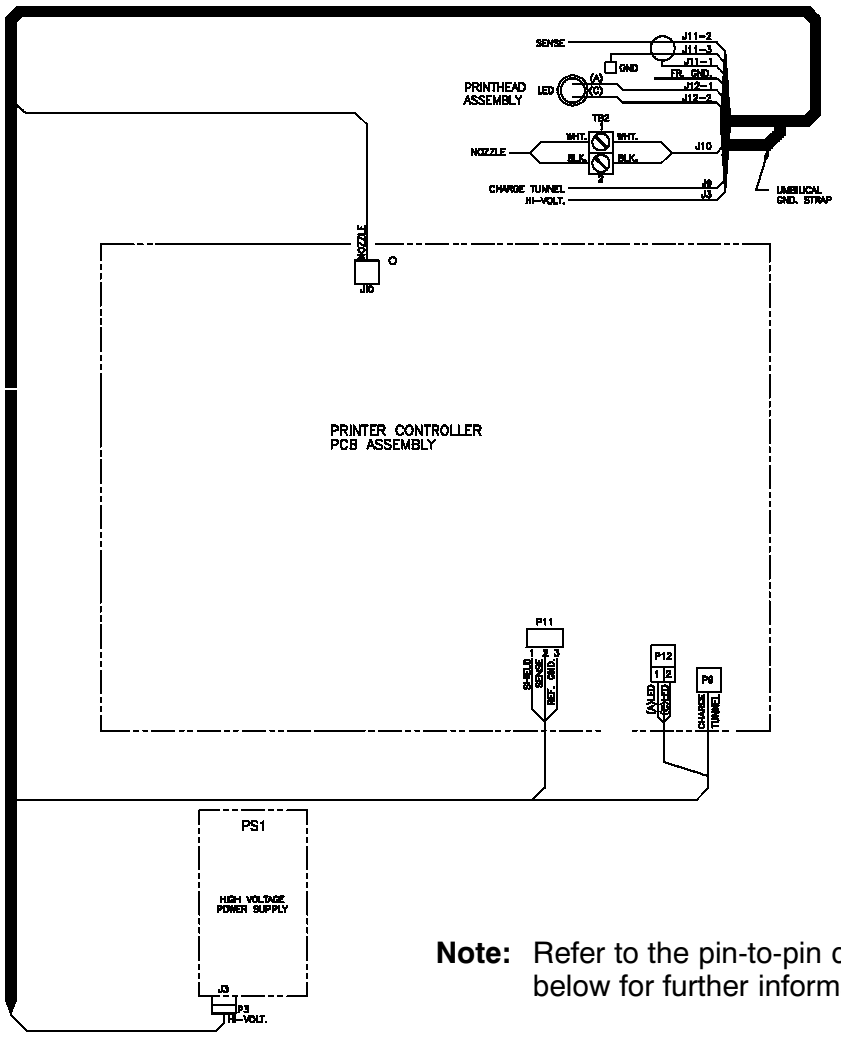
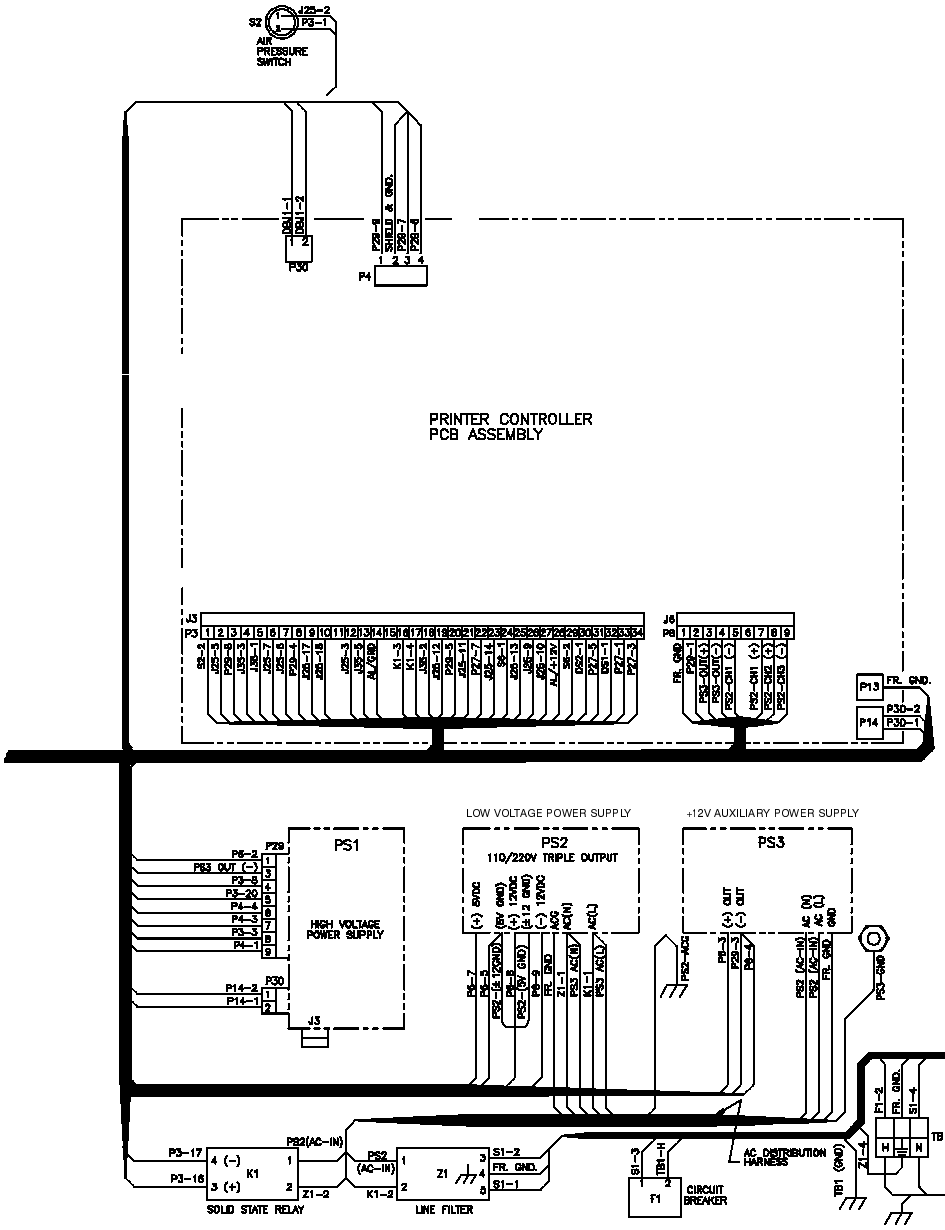


Figure 7-9. Printhead Connections

Wires Leading from Printhead . . .				*Refer to Figure 7-9*
Connection	**Location**	**To/From**	**Connection**	**Location**
HIGH VOLTAGE	Printhead	⬌	J3	High Voltage P.S.
CHARGE TUNNEL	Printhead	⬌	J9	Control Board
NOZZLE	Printhead	⬌	J10	Control Board
SHIELD	Printhead	⬌	J11-1	Control Board
SENSE	Printhead	⬌	J11-2	Control Board
REF. GROUND	Printhead	⬌	J11-3	Control Board
LED (A)	Printhead	⬌	J12-1	Control Board
LED (C)	Printhead	⬌	J12-2	Control Board

Power Connections



Note: Refer to the pin-to-pin connections on the following pages for further information.

Figure 7-10. Power Connections

Wires Leading from High Voltage Power Supply . . . *Refer to Figure 7-10*

Connection	Location	To/From	Connection	Location
P3	High Voltage P.S.	⇔	HIGH VOLTAGE	Printhead
P29-1	High Voltage P.S.	⇔	P6-2	Control Board
P29-3	High Voltage P.S.	⇔	PS3 OUT (-)	+12V Aux. P.S.
P29-4	High Voltage P.S.	⇔	P3-8	Control Board
P29-5	High Voltage P.S.	⇔	P3-20	Control Board
P29-6	High Voltage P.S.	⇔	P4-4	Control Board
P29-7	High Voltage P.S.	⇔	P4-3	Control Board
P29-8	High Voltage P.S.	⇔	P3-3	Control Board
P29-9	High Voltage P.S.	⇔	P4-1	Control Board
P30-1	High Voltage P.S.	⇔	P14-2	Control Board
P30-2	High Voltage P.S.	⇔	P14-1	Control Board

Wires Leading from Low Voltage Power Supply . . . *Refer to Figure 7-10*

Connection	Location	To/From	Connection	Location
PS2-CH1 (+)	Low Voltage P.S.	⇔	P6-7	Control Board
PS2-CH1 (-)	Low Voltage P.S.	⇔ ⇔	P6-5 PS2-CH2 (0)	Control Board Low Voltage P.S.
PS2-CH2 (+)	Low Voltage P.S.	⇔	P6-8	Control Board
PS2-CH2 (0)	Low Voltage P.S.	⇔	PS2-CH1 (-)	Low Voltage P.S.
PS2-CH3 (-)	Low Voltage P.S.	⇔	P6-9	Control Board
PS2-ACG	Low Voltage P.S.	⇔	Ground	Cabinet
PS2 (AC-IN)	Low Voltage P.S.	⇔	Z1-1 PS3 AC (N) K1-1 PS3 AC (L)	Line Filter +12V Aux. P.S. Solid State Relay +12V Aux. P.S.
PS2 (SELECT)	Low Voltage P.S.	⇔	PS2 (SELECT)	Low Voltage P.S.

Wires Leading from Solid State Relay . . . *Refer to Figure 7-10*

Connection	Location	To/From	Connection	Location
K1-1	Solid State Relay	⇔	PS2 (AC-IN)	Low Voltage P.S.
K1-2	Solid State Relay	⇔	Z1-2	Line Filter
K1-3	Solid State Relay	⇔	P3-16	Control Board
K1-4	Solid State Relay	⇔	P3-17	Control Board

Wires Leading from +12V Auxiliary Power Supply . . . *Refer to Figure 7-10*

Connection	Location	To/From	Connection	Location
PS3-OUT (+)	+12V Aux. P.S.	⬍	P6-3	Control Board
PS3-OUT (-)	+12V Aux. P.S.	⬍	P29-3 P6-4	High Voltage P.S. Control Board
PS3 AC (N)	+12V Aux. P.S.	⬍	PS2 (AC-IN)	Low Voltage P.S.
PS3 AC (L)	+12V Aux. P.S.	⬍	PS2 (AC-IN)	Low Voltage P.S.
PS3-GND	+12V Aux. P.S.	⬍	Ground	Cabinet

Wires Leading from Line Filter . . . *Refer to Figure 7-10*

Connection	Location	To/From	Connection	Location
Z1-1	Line Filter	⬍	PS2 (AC-IN)	Low Voltage P.S.
Z1-2	Line Filter	⬍	K1-2	Solid State Relay
Z1-3	Line Filter	⬍	S1-2	Power Switch
Z1-4	Line Filter	⬍	Ground	Cabinet
Z1-5	Line Filter	⬍	S1-1	Power Switch

Wires Leading from Circuit Breaker . . . *Refer to Figure 7-10*

Connection	Location	To/From	Connection	Location
F1-1	Circuit Breaker	⬍	S1-3	Power Switch
F1-2	Circuit Breaker	⬍	TB1-H	Line Cord

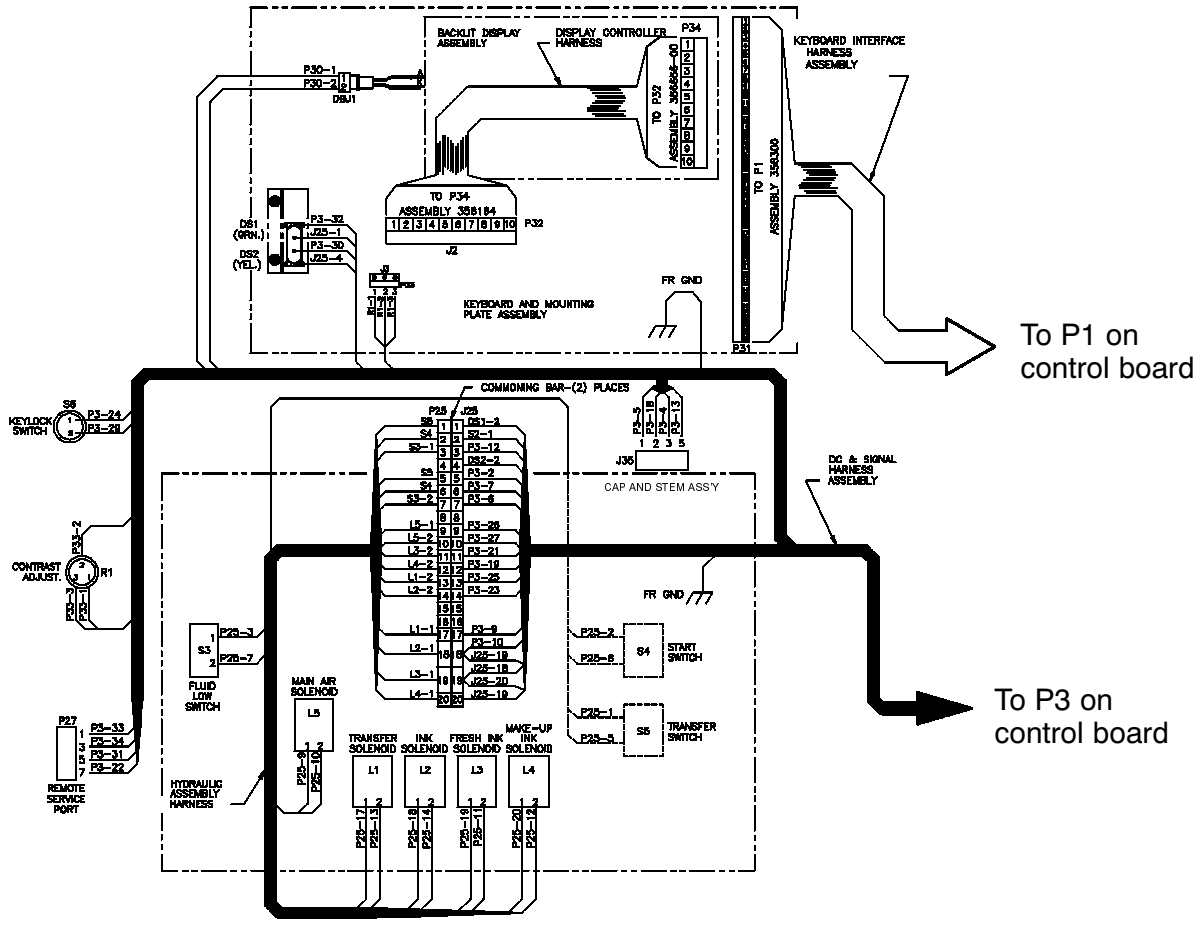
Wires Leading from Line Cord . . . *Refer to Figure 7-10*

Connection	Location	To/From	Connection	Location
TB1-H	Line Cord	⬍	F1-2	Circuit Breaker
TB1-GND	Line Cord	⬍	Ground	Cabinet
TB1-N	Line Cord	⬍	S1-4	Power Switch

Wires Leading from Power Switch . . . *Refer to Figure 7-10*

Connection	Location	To/From	Connection	Location
S1-1	Power Switch	⬍	Z1-5	Line Filter
S1-2	Power Switch	⬍	Z1-3	Line Filter
S1-3	Power Switch	⬍	F1-1	Circuit Breaker
S1-4	Power Switch	⬍	TB1-N	Line Cord

Hydraulic Connections



Note: Refer to the pin-to-pin connections on the following pages for further information.

Figure 7-11. Hydraulic Connections

Wires Leading from Keylock Switch . . .				***Refer to Figure 7-11***
Connection	**Location**	**To/From**	**Connection**	**Location**
S6-1	Keylock Switch	⬍	P3-24	Control Board
S6-2	Keylock Switch	⬍	P3-29	Control Board

Wires Leading from Contrast Adjustment . . . *Refer to Figure 7-11*

Connection	Location	To/From	Connection	Location
R1-1	Contrast Adjustment	⧫ ⧫	P33-1	Keyboard & Mtg. Plate
R1-2	Contrast Adjustment	⧫ ⧫	P33-2	Keyboard & Mtg. Plate
R1-3	Contrast Adjustment	⧫ ⧫	P33-3	Keyboard & Mtg. Plate

Wires Leading from Remote Service Port . . . *Refer to Figure 7-11*

Connection	Location	To/From	Connection	Location
P27-1	Remote Service Port	⧫ ⧫	P3-33	Control Board
P27-3	Remote Service Port	⧫ ⧫	P3-34	Control Board
P27-5	Remote Service Port	⧫ ⧫	P3-31	Control Board
P27-7	Remote Service Port	⧫ ⧫	P3-22	Control Board

Wires Leading from Cap and Stem Assembly . . . *Refer to Figure 7-11*

Connection	Location	To/From	Connection	Location
J35-1	Cap and Stem Assembly	⧫ ⧫	P3-5	Control Board
J35-2	Cap and Stem Assembly	⧫ ⧫	P3-18	Control Board
J35-3	Cap and Stem Assembly	⧫ ⧫	P3-4	Control Board
J35-5	Cap and Stem Assembly	⧫ ⧫	P3-13	Control Board

Wires Leading from Fluids Low Switch . . . *Refer to Figure 7-11*

Connection	Location	Commoning Bar	Connection	Location
S3-1	Fluids Low Switch	⧫ P25-3/J25-3 ⧫	P3-12	Control Board
S3-2	Fluids Low Switch	⧫ P25-7/J25-7 ⧫	P3-6	Control Board

Wires Leading from Main Air Solenoid . . . *Refer to Figure 7-11*

Connection	Location	Commoning Bar	Connection	Location
L5-1	Main Air Solenoid	⧫ P25-9/J25-9 ⧫	P3-26	Control Board
L5-2	Main Air Solenoid	⧫ P25-10/J25-10 ⧫	P3-27	Control Board

Continued on next page ▶

Wires Leading from Transfer Solenoid . . . *Refer to Figure 7-11*

Connection	Location	Commoning Bar	Connection	Location
L1-1	Transfer Solenoid	P25-17/J25-17	P3-9	Control Board
L1-2	Transfer Solenoid	P25-13/J25-13	P3-25	Control Board

Wires Leading from Nozzle Solenoid . . . *Refer to Figure 7-11*

Connection	Location	Commoning Bar	Connection	Location
L2-1	Nozzle Solenoid	P25-18/J25-18	P3-10 J25-19	Control Board Commoning Bar
L2-2	Nozzle Solenoid	P25-14/J25-14	P3-23	Control Board

Wires Leading from Ink Solenoid . . . *Refer to Figure 7-11*

Connection	Location	Commoning Bar	Connection	Location
L3-1	Ink Solenoid	P25-19/J25-19	J25-18 J25-20	Commoning Bar Commoning Bar
L3-2	Ink Solenoid	P25-11/J25-11	P3-21	Control Board

Wires Leading from Make-up Solenoid . . . *Refer to Figure 7-11*

Connection	Location	Commoning Bar	Connection	Location
L4-1	Make-up Solenoid	P25-20/J25-20	J25-19	Commoning Bar
L4-2	Make-up Solenoid	P25-12/J25-12	P3-19	Control Board

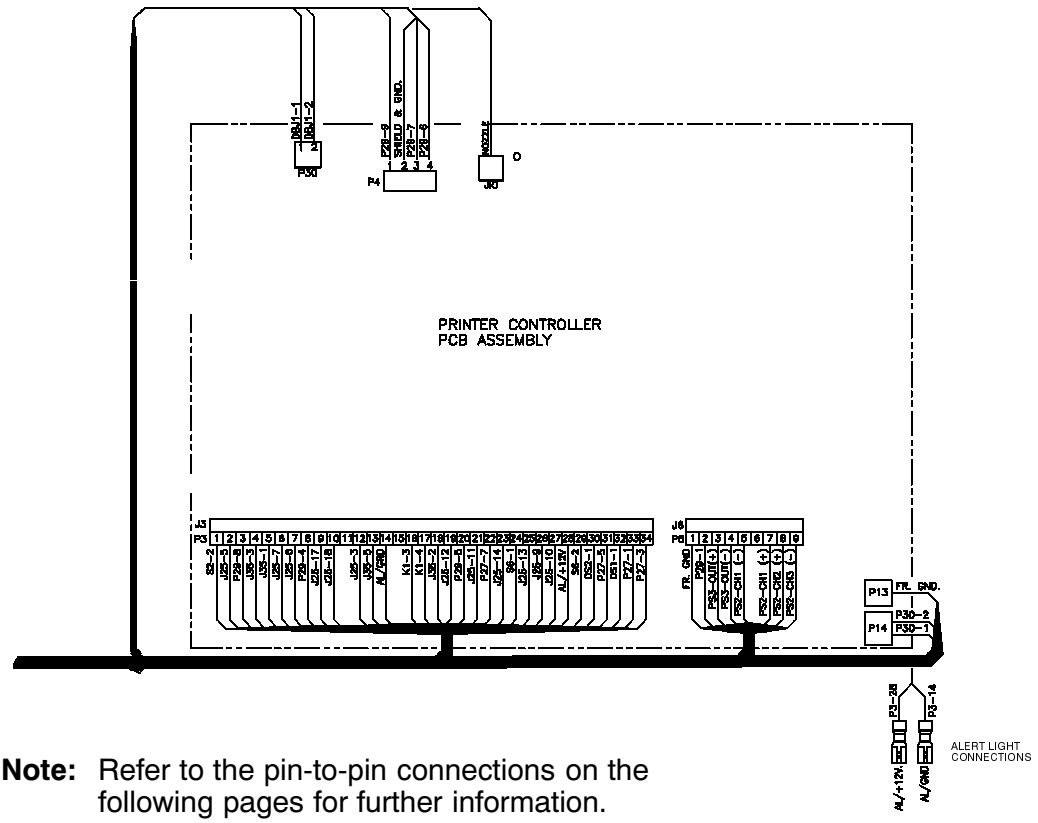
Wire Leading from Start Switch . . . *Refer to Figure 7-11*

Connection	Location	Commoning Bar	Connection	Location
S4	Start Switch	P25-2/J25-2 P25-6/J25-6	S2-1 P3-7	Air Pressure Switch Control Board

Wire Leading from Transfer Switch . . . *Refer to Figure 7-11*

Connection	Location	Commoning Bar	Connection	Location
S5	Transfer Switch	P25-1/J25-1 P25-5/J25-5	DS1-2 P3-2	Ready Light Control Board

Control Board Connections



Note: Refer to the pin-to-pin connections on the following pages for further information.

Figure 7-12. Control Board Connections

Wires Leading from Control Board . . . ***Refer to Figure 7-12***

Connection	Location	To/From	Connection	Location
J10	Control Board	⬌	NOZZLE	Printhead
P1	Control Board	⬌	P31	Keyboard & Mtg. Plate
P3-1	Control Board	⬌	S2-2	Air Pressure Switch
P3-2	Control Board	⬌	S5	Transfer Switch
P3-3	Control Board	⬌	P29-8	High Voltage P.S.
P3-4	Control Board	⬌	J35-3	Cap and Stem Ass'y
P3-5	Control Board	⬌	J35-1	Cap and Stem Ass'y
P3-6	Control Board	⬌	S3-2	Fluid Low Switch
P3-7	Control Board	⬌	S4	Start Switch

Continued on next page ▶

Wires Leading from Control Board . . . *Refer to Figure 7-12*

Connection	Location	To/From	Connection	Location
P3-8	Control Board	⧫⧫	P29-4	High Voltage P.S.
P3-9	Control Board	⧫⧫	L1-1	Transfer Solenoid
P3-10	Control Board	⧫⧫	L2-1	Nozzle Solenoid
P3-12	Control Board	⧫⧫	S3-1	Fluid Low Switch
P3-13	Control Board	⧫⧫	J35-5	Cap and Stem Ass'y
P3-14	Control Board	⧫⧫	AL/GND	Alert Light
P3-16	Control Board	⧫⧫	K1-3	Solid State Relay
P3-17	Control Board	⧫⧫	K1-4	Solid State Relay
P3-18	Control Board	⧫⧫	J35-2	Cap and Stem Ass'y
P3-19	Control Board	⧫⧫	L4-2	Make-up Solenoid
P3-20	Control Board	⧫⧫	P29-5	High Voltage P.S.
P3-21	Control Board	⧫⧫	L3-2	Fresh Ink Solenoid
P3-22	Control Board	⧫⧫	P27-7	Remote Service Port
P3-23	Control Board	⧫⧫	L2-2	Nozzle Solenoid
P3-24	Control Board	⧫⧫	S6-1	Keylock Switch
P3-25	Control Board	⧫⧫	L1-2	Transfer Solenoid
P3-26	Control Board	⧫⧫	L5-1	Main Air Solenoid
P3-27	Control Board	⧫⧫	L5-2	Main Air Solenoid
P3-28	Control Board	⧫⧫	AL/+12V	Alert Light
P3-29	Control Board	⧫⧫	S6-2	Keylock Switch
P3-30	Control Board	⧫⧫	DS2-1	Service Light
P3-31	Control Board	⧫⧫	P27-5	Remote Service Port
P3-32	Control Board	⧫⧫	DS1-1	Ready Light
P3-33	Control Board	⧫⧫	P27-1	Remote Service Port
P3-34	Control Board	⧫⧫	P27-3	Remote Service Port
P4-1	Control Board	⧫⧫	P29-9	High Voltage P.S.
P4-2	Control Board	⧫⧫	SHIELD & GND	Cabinet
P4-3	Control Board	⧫⧫	P29-7	High Voltage P.S.
P4-4	Control Board	⧫⧫	P29-6	High Voltage P.S.
P6-1	Control Board	⧫⧫	GND	Cabinet
P6-2	Control Board	⧫⧫	P29-1	High Voltage P.S.
P6-3	Control Board	⧫⧫	PS3-OUT (+)	+12V Aux. .P.S.

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Wires Leading from Control Board . . . *Refer to Figure 7-12*

Connection	Location	To/From	Connection	Location
P6-4	Control Board	⬍	PS3-OUT (-)	+12V Aux. .P.S.
P6-5	Control Board	⬍	PS2-CH1 (-)	Low Voltage .P.S.
P6-7	Control Board	⬍	PS2-CH1 (+)	Low Voltage .P.S.
P6-8	Control Board	⬍	PS2-CH2 (+)	Low Voltage .P.S.
P6-9	Control Board	⬍	PS2-CH3 (-)	Low Voltage .P.S.
P9	Control Board	⬍	CHARGE TUNNEL	Printhead
P11-1	Control Board	⬍	SHIELD	Printhead
P11-2	Control Board	⬍	SENSE	Printhead
P11-3	Control Board	⬍	GND	Printhead
P12-1	Control Board	⬍	A (LED)	Printhead
P12-2	Control Board	⬍	C (LED)	Printhead
P13	Control Board	⬍	GND	Cabinet
P14	Control Board	⬍	P30-1 P30-2	Control Board Control Board
P23	Control Board	⬍	GND	Cabinet
P30-1	Control Board	⬍	DBJ1-1	Backlit Display
P30-2	Control Board	⬍	DBJ1-2	Backlit Display

The HELP Key

Introduction

This section describes how to access and use fault information provided by the printer. When pressed, the **HELP** key provides information on printer switch settings and component operations at the time of a fault. The **HELP** key provides information for the current fault only.

Note: Pressing the **SHIFT** and **HELP** keys at the same time returns information from the previous fault condition to the display. If the printer was turned Off since the last fault occurred, pressing these keys will show information from the last fault that occurred before power was shut Off. If you press the **HELP** key without pressing the **SHIFT** key, the message <NO INFORMATION AVAILABLE> will appear in the display.

Information obtained from the **HELP** key is displayed in hexidecimal form. Use the tables in this section to interpret the hex code. When read correctly, the **HELP** feature can be an effective troubleshooting aid. It is even more helpful to use the **HELP** key along with the LEDs (refer to page 7-33) to troubleshoot printer problems.

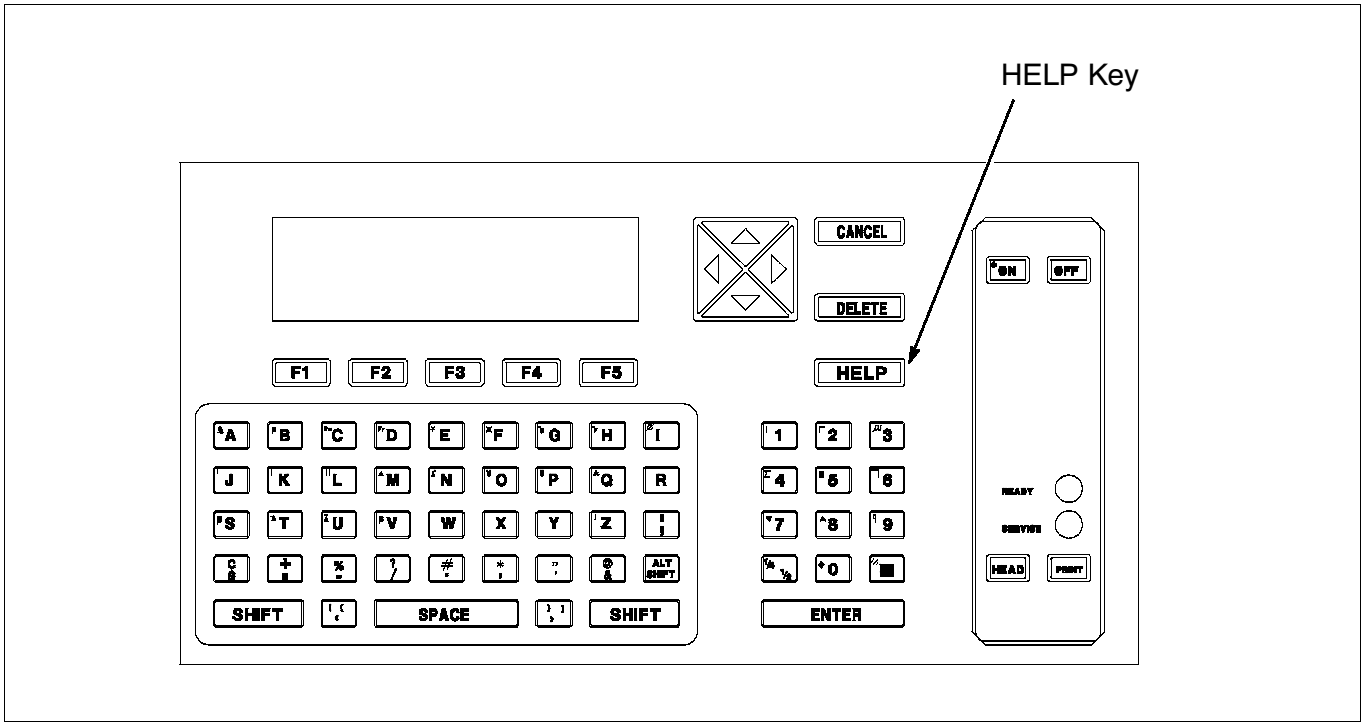


Figure 7-13. Keyboard

HELP Key Description

The **HELP** key provides information about printer operation at the time of a fault. Use the “S1-S4 Chart” and the “HELP Chart” on the following pages to interpret the information shown on the printer display.

Pressing the **HELP** key displays the following:

Example:

FAULT=08 T=15:04 S1=00 S2=1E S3=00 S4=00

1. **FAULT CODE:** A two-digit code confirms the fault name shown on the display. Use Table 7-6 to identify the fault code.
2. **TIME FAULT OCCURRED:** Displayed as “T” followed by a time, this indicates the exact time of fault occurrence and printer shutdown.
3. **SWITCH POSITIONS:** The display shows “S1” followed by a two-digit code. Use Table 7-7 and Table 7-8 to interpret the code. The switch code indicates which reed switches were On and Off at the time of the fault. This column helps identify a switch malfunction as the cause of a fault.
4. **COMPONENT POSITIONS:** The display shows “S2” followed by a two-digit hex code. Use Table 7-7 and Table 7-8 to interpret the code. The component code indicates the status of the solenoids at the time of the fault. Status of the AC Relay and +312 Volt supply are also listed.
5. **PRINTER STATUS:** The codes displayed after “S3” and “S4” are related to other printer factors and conditions. Use Table 7-7 and Table 7-8 to interpret the code.

Fault Code	Fault Description ("No" Faults are Resettable)
01	No Air for Warm-up
02	Fluid Levels Too Low
03	+12 Supply Fault - Use Deadman Switch
04	Reservoir Overfill
05	Air Pressure Fault
06	Ink Out Fault
07	+312 Volt Power Supply Fault
08	High Voltage Fault
0a	Real Time Clock Fault
0b	No Phase Time Fault
0c	Phasing Fault
0d	No Signal Fault
0e	Fluids Request Too Long Fault
0f	Transfer Request Too Long Fault
10	Fill Time Too Long Fault
11	Empty Time Too Long Fault
12	Flow Time Too Short Fault
13	Flow Time Too Long Fault
14	Processor #2 Fault
15	Processor #4 Fault

Table 7-6. Fault Codes

Correcting a Fault Using the HELP Key

The following text describes what happens within the printer when a fault occurs. It then continues with your instructions for identifying a fault and troubleshooting it by using the **HELP** key.

When a Fault Occurs

When a fault occurs, the printer does the following:

1. The system automatically performs a self-check and gathers information about component and printer status.
2. The **SERVICE** light flashes. A fault identification message appears in the display immediately.
3. The printer classifies the fault as Normal or Panic. Remember that a Panic fault causes an immediate and complete printer shutdown. A normal fault starts the four-minute shutdown sequence.
4. The display indicates either <SHUTDOWN COMPLETE> (following a Panic fault) or reads <SHUTDOWN IDLE> (following a Normal fault).

To Troubleshoot a Fault

To troubleshoot a fault, do the following:

1. Check the printer for obvious causes of the fault.
2. Identify if the fault is Normal or Panic (this is shown in the display; refer to step #4 above).
3. If necessary, clean and dry the printhead.
4. In many cases, restarting the printer will clear a Normal fault. If it is a Normal fault, restart the printer. The system should at least begin its start-up sequence before faulting again.
5. If the system shuts down on a Panic fault, check the Cause/Solution chart (for that fault), LEDs, and **HELP** key to correct the fault before restarting the printer.
6. If the system faults after being restarted, refer to the Faults Cause/Solution chart beginning on page 7-13. The LEDs are also useful in troubleshooting. The following paragraphs describe how to use the **HELP** key to correct a printer fault.

The S1-S4 Chart

The S1-S4 Chart helps you to determine the condition of the printer at fault shutdown. (Refer to Table 7-8.) It is used to help interpret the “HELP” hexidecimal code for troubleshooting. A copy of the S1-S4 Chart may be used to copy down the necessary information from the **HELP** key. The chart is divided into four areas:

- A line to write down the fault name which appears on the display before pressing the **HELP** key.
- A line for the fault code.
- A line for the time of the fault.
- Four “S” charts: one labeled “Sense Switch Status,” one labeled “Component Status” and two “Printer Status” charts.

The “S” Charts are divided into three rows. The “Character Digits” row is where the two-digit S1 status is written. The “ON/OFF” row is where the ON/OFF status obtained from Table 7-7 is inserted. The “Component” row lists the specific components that are related to the ON/OFF status row.

The S1-S4 chart indicates the printer status at shutdown. The information is the same as that provided by the LEDs on the control board.

"S" Reference Chart

The "S" Reference chart has two columns labeled "Character" and "ON/OFF" pattern. (Refer to Table 7-7.) Information from this chart aids you in troubleshooting. Use it to translate the two-digit fault code into a four-digit On/Off code which corresponds to the "S" Chart. Each single digit of the two-digit fault code on the "Character Digits" row appears in the left column. The four-digit "0/1" number in the right column appears in the ON/OFF row.

Character	On/Off Pattern 1=On 0=Off
0	0000
1	0001
2	0010
3	0011
4	0100
5	0101
6	0110
7	0111
8	1000
9	1001
A	1010
B	1011
C	1100
D	1101
E	1110
F	1111

Table 7-7. "S" Reference Chart

FAULT NAME: _____ **TIME FAULT OCCURRED:** _____

FAULT CODE: _____

S1 SENSE SWITCH STATUS								
CHARACTER DIGITS								
ON/OFF								
COMPONENT	TRANSFER SWITCH	START SWITCH	INK CHAMBER OVERFILL	FRESH INK REQUEST	INK LOW SWITCH 1 = GOOD	AIR PRESSURE 1 = GOOD	MAKE-UP INHIBIT	NO SIGNAL/ PHASING 1 = BAD
S2 COMPONENT STATUS								
CHARACTER DIGITS								
ON/OFF								
COMPONENT	TRANSFER SOLENOID	FRESH INK SOLENOID	MAKE-UP INK SOLENOID	AIR CONTROL SOLENOID	NOZZLE SOLENOID	K1 RELAY	300 VDC POWER	UNUSED
S3 PRINTER STATUS								
CHARACTER DIGITS								
ON/OFF								
COMPONENT	UNUSED	PRINTER IN FAULT	UNUSED	IN SYSTEM SET-UP MODE	IN SERVICE MODE	UNUSED	HEAD READY	HIGH VOLTAGE
S4 PRINTER STATUS								
CHARACTER DIGITS								
ON/OFF								
COMPONENT	STREAM TEST - NO SIGNAL 1 = BAD	LOW FLUIDS WARNING	NO TIME TO PHASE	PASS-WORD	UNUSED	UNUSED	IN AUTO PRIME	TEST PRINT

Table 7-8. S1-S4 Chart

Using the HELP Key

The following paragraphs describe how to use the **HELP** key to troubleshoot the printer. Refer to Table 7-10 for a sample.

1. Write down the fault name. Press the **HELP** key.
2. The printer displays a row of numeric and hexidecimal codes. Refer to Table 7-7.) The **HELP** key information includes a two-digit fault code, the time the fault occurred and major switch, component and system status information. Write this information on a copy of the S1-S4 chart (refer to Table 7-8). Table 7-10 is an example of how the chart is completed. Copy the numbers from the display in the lines marked "CHARACTER DIGITS."
3. Look up the two-digit fault code from the display in the fault code table. (Refer to Table 7-6.) Ensure the fault code and the fault name from the display are the same. Write the information on the S1-S4 chart.
4. Find the four-digit ON/OFF pattern by using Table 7-9. Write the ON or OFF status in the second row of the S1-S4 chart (labeled ON or OFF). A "1" above the component name means the component was ON or active when the fault occurred. A "0" above the component means the component was OFF or de-activated at the time of the fault.

The following codes vary from the normal "0" or "1" setting: Ink Low Switch (1 = GOOD), Air Pressure (1 = GOOD), No Signal/Phasing (1 = BAD) and Stream Test (1 = BAD).

5. Compare the information obtained from the printer with that found in the Cause/Solution Charts and the "HELP Chart."

Using the HELP Key — Fault Example

The following example lists the previous steps as applied to a specific fault. The fault was induced by shutting Off input air while the printer was operating. This caused an Air Pressure Fault. (Refer to Figure 7-14.)

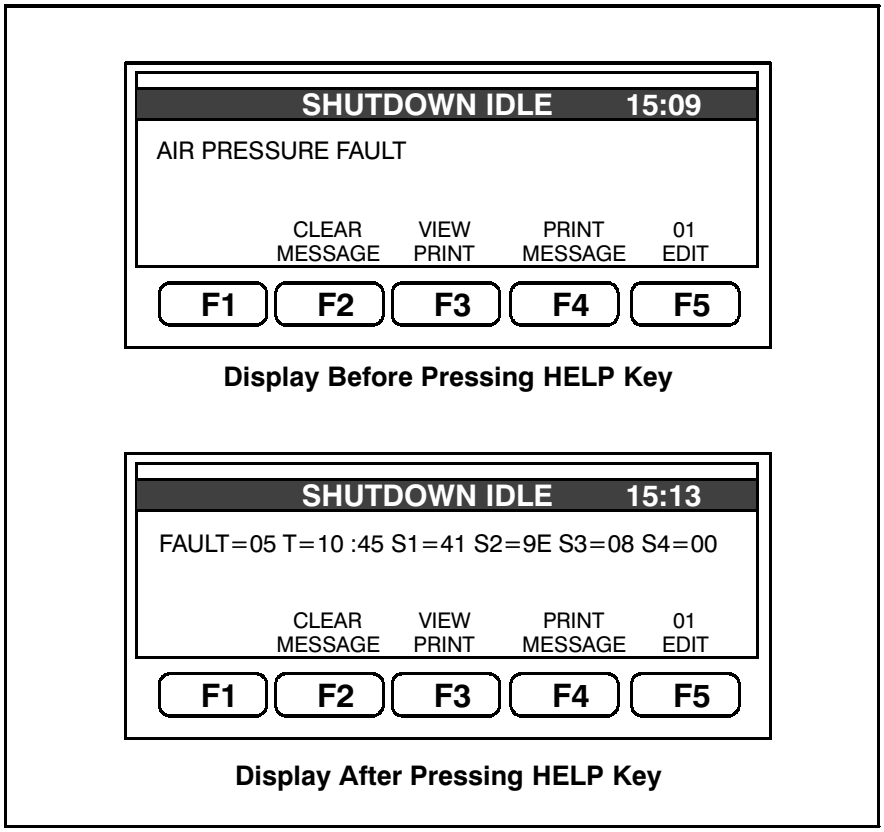


Figure 7-14. Using the HELP Key

Note: All code numbers are included for demonstration purposes only. Actual fault numbers may vary.

1. If the printer has already shutdown, restart it. The fault will reoccur if the problem still exists.
2. Write the fault name on a copy of the S1-S4 Chart. The display reads AIR PRESSURE FAULT.
3. Press the **HELP** key. Write the fault code (05), the time of the fault (10:45) and the information following S1 through S4 (S1:41, S2:9E, S3:08, S4:00) on the chart.
4. Find the four-digit ON/OFF pattern (refer to Table 7-6) and write it in the ON/OFF row. The “0” or “1” status is just above the “COMPONENT” row. (S1:0100,0001 — S2:1001,1110 — S3:0100,1000 — S4:0000,0000).

Fault Example (S1 - S4 Explanation)

The numbers “S1–41” under S1 Switch Status translate into the following:

4	1
Transfer Switch OFF	Ink Low Switch BAD
Start Switch ON	Air Pressure BAD
Overfill Switch OFF	Make-up Inhibit OFF
Fluids Request OFF	Phasing BAD

The “S2 - 9E” under S2 Component Status (second line down) translates into the following:

9	E
Transfer Solenoid ON	Nozzle Solenoid ON
Ink Add Solenoid OFF	K1 Relay ON
Make-up Add Sol. OFF	300 V Power Supply ON
Air Control Solenoid ON	Unused

The “S3 - 08” under the first row of Printer Status (third line down) translates into the following:

0	8
Printer in Fault	In SERVICE mode
	Head NOT Ready
NOT in SYSTEM mode	High Voltage OFF

The “S4 - 00” under the second Printer Status Row (fourth line down) translates into the following:

0	**0**
Stream Test GOOD	
NO Fluids Low Warning	
Phase Test Functioning Normal	NOT in Auto Prime
Password OFF	NOT in Test Print

FAULT NAME: AIR PRESSURE FAULT **TIME FAULT OCCURRED:** 10:45

FAULT CODE: 05

S1 SENSE SWITCH STATUS								
CHARACTER DIGITS	4				1			
ON/OFF	0	1	0	0	0	0	0	1
COMPONENT	TRANSFER SWITCH	START SWITCH	INK CHAMBER OVERFILL	FRESH INK REQUEST	INK LOW SWITCH 1 = GOOD	AIR PRESSURE 1 = GOOD	MAKE-UP INHIBIT	NO SIGNAL/ PHASING 1 = BAD
S2 COMPONENT STATUS								
CHARACTER DIGITS	9				E			
ON/OFF	1	0	0	1	1	1	1	0
COMPONENT	TRANSFER SOLENOID	FRESH INK SOLENOID	MAKE-UP INK SOLENOID	AIR CONTROL SOLENOID	NOZZLE SOLENOID	K1 RELAY	300 VDC POWER	UNUSED
S3 PRINTER STATUS								
CHARACTER DIGITS	0				8			
ON/OFF	0	0	0	0	1	0	0	0
COMPONENT	UNUSED	PRINTER IN FAULT	UNUSED	IN SYSTEM SET-UP MODE	IN SERVICE MODE	UNUSED	HEAD READY	HIGH VOLTAGE
S4 PRINTER STATUS								
CHARACTER DIGITS	0				0			
ON/OFF	0	0	0	0	0	0	0	0
COMPONENT	STREAM TEST - NO SIGNAL 1 = BAD	LOW FLUIDS WARNING	NO TIME TO PHASE	PASS-WORD	UNUSED	UNUSED	IN AUTO PRIME	TEST PRINT

Table 7-10. Fault Example, S1-S4

Troubleshooting Notes:

8

Installation

In this chapter you will find:

- site preparation requirements
- procedures for unpacking and assembly
- encoder and product detect set-up procedures

Turn to page 8-2 for a chapter-level Table of Contents.

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Introduction

This chapter guides you through the recommended procedures to install the printer.

Proceed through the sections in this chapter in the order shown below:

- *Site Preparation . . . . . turn to page 8-4*
- *Install the Printer Stand . . . . . turn to page 8-6*
- *Unpack and Inspect the Printer . . . . . turn to page 8-7*
- *Assemble the Printhead Stand . . . . . turn to page 8-13*
- *Control Board Connections . . . . . turn to page 8-14*
- *Set up the Printer . . . . . turn to page 8-29*

Site Preparation

Determine Printer Location

Position the printer near the conveyor. Consider the following guidelines:

- The area selected should be free of vibration.
- Make certain the printhead will reach the 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.
- Once the final location of the printer has been determined, the printer stand should be firmly attached to the floor (or wall) to prevent vibration during operation. (This is not necessary if the printer is attached to a mobile floor stand.)

Note: Do not secure the printer stand to the floor or wall until you are certain that the printhead will easily reach its position at the conveyor.

- When selecting the location, keep in mind that the AC power source and compressed air source connections (unless you are using a portable air compressor) must be accessible.
- Allow enough room to open the cabinet and access the printer for routine maintenance and servicing.
- Allow room to service the printhead. During many routine service procedures, the printhead is removed from its holder and placed in a service tray.

Electrical Requirements	The EXCEL printer is available as either 120 VAC or 240 VAC.
Voltage/Frequency:	The EXCEL printer operates at 90-132 VAC/50-60 Hz or 180–260 VAC/50-60 Hz, selectable by jumpers located on the power supplies.
Power Consumption:	75 Watts maximum, 60 Watts typical
Compressed Air Requirements	The air source must provide clean, dry air, free of contaminants, oil, and water, to meet the following requirements:
Air Pressure:	Minimum 70 psi (4.8 bar); maximum 100 psi (6.9 bar); recommended 80 psi (5.5 bar)
Air Consumption:	2 SCFM (3398 L/hr) maximum, 1.5 SCFM (2548.5 L/hr) typical at 80 psi (5.5 bar)
Air 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 prefilter, followed by a submicron coalescing-type filter.
Air Pressure Dew Point	Less than 40°F (4°C) at 80 psi (5.5 bar)

Install the Printer Stand

Unpack the Printer Stand

Remove the printer stand from its carton and inspect the unit for possible shipping damage.

Assemble the Printer Stand

Follow the instructions included with your printer stand or wall mount kit.

Unpack and Inspect the Printer

The procedures in this section explain how to unpack and inspect the printer.

Remove the Printer from its Carton

Remove the printer from its carton and visually inspect it for damage. Examine the control unit, umbilical, and printhead closely (refer to Figure 8-1). The printer is packed carefully at the MARCONI manufacturing facility. If any damage is noted, file damage claims with the carrier.

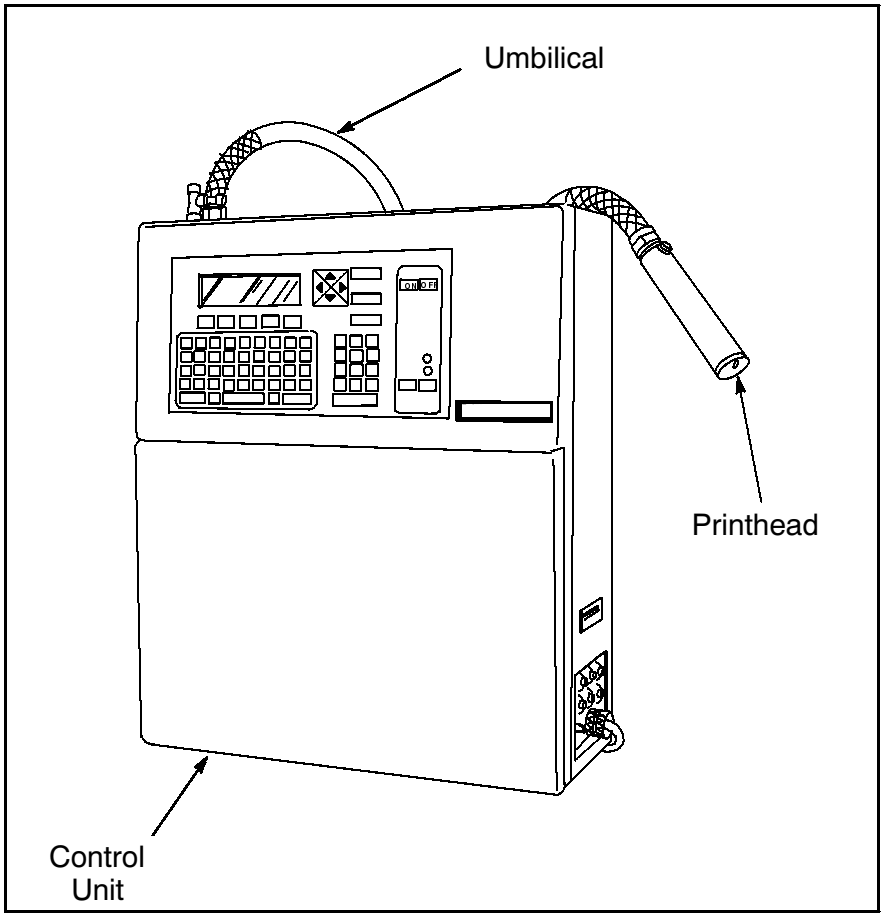


Figure 8-1. Videojet EXCEL Printer

Mount the Printer onto the Printer Stand

The VIDEOJET EXCEL printer is not a free-standing unit. Therefore, it must be secured to a printer stand for stability and practicality. The printer stand is available through MARCONI DATA SYSTEMS INC.. Within the U.S.A., contact MARCONIat **800-843-3610**. Outside the U.S.A., customers should contact their MARCONI distributor or subsidiary for assistance.

CAUTION: The EXCEL printer must be securely mounted to a floor printer stand or a wall-mount printer stand. Proper mounting includes the use of four 5/16-inch bolts. At least one-half of the threads on each bolt must be engaged.

Mount the printer to any of the printer stands or wall brackets by following the instructions supplied with the mounting device.

Install the Muffler

The muffler is found in the bag of supplemental parts included with the packed printer. The parts are listed in Table 1-1.

Quantity	Description	Part Number
1	Muffler	206041
1	Hex key $5/16$" (8 mm)	186975
1	Hex key (.050") (1.3 mm)	186514
1	Bleed tube	356539
1	Transfer tube (large diameter)	356089
1	Magnifier Loupe	355269
1	High Voltage Plate Gap Gauge	186976
2	Keyboard lock keys	—
2	Door lock keys	—

Table 1-1. Supplemental Parts

Install the muffler as shown in Figure 8-2.

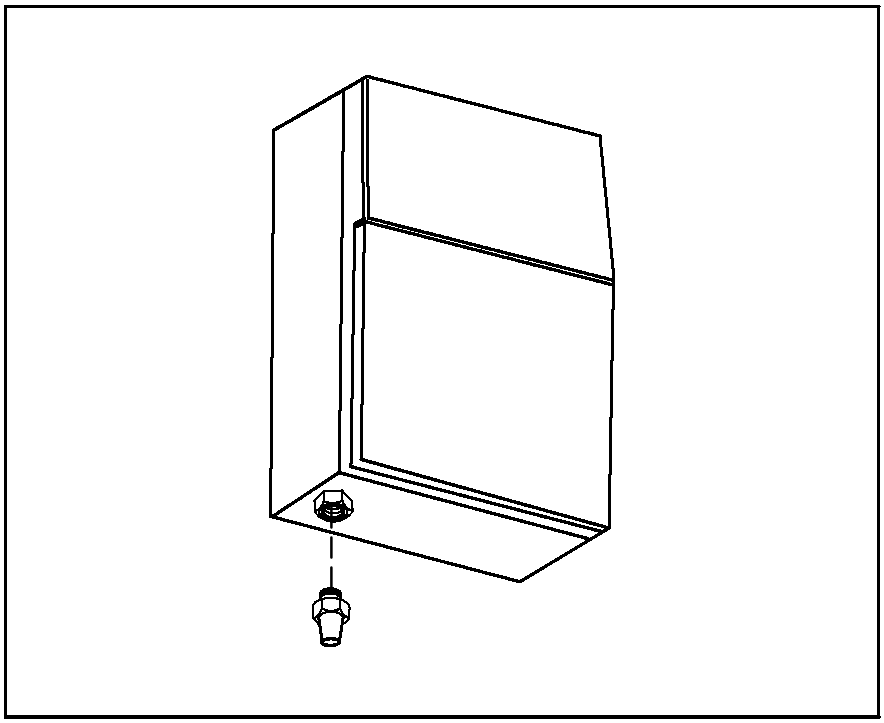


Figure 8-2. Install the Muffler

Connect Electrical Power

The printer is available in two power configurations:

- 120 VAC printers are shipped with the power cord already installed. Additional modifications should not be required for AC connection.
- 240 VAC printers are shipped without a power cord. However, the appropriate hardware required to hardwire the AC connection is supplied with the printer.

Follow these instructions for 120 VAC and 240 VAC units:

Instructions for Connecting 120 VAC Units

Complete the following steps to connect AC power to a 120 VAC printer:

Note: In cases where the power line cord supplied with the 120 VAC printer is incorrect for the outlet, follow the instructions for connecting 240 VAC units (with the exception of the power line cord used).

1. Plug the power cord plug into the appropriate electrical source.

Note: The electrical source used must have voltage between 90 and 132 VAC.

2. Push the AC power switch up to turn the printer ON (I). (Refer to Figure 8-3.)
3. Push the AC power switch down to turn the printer OFF (O).

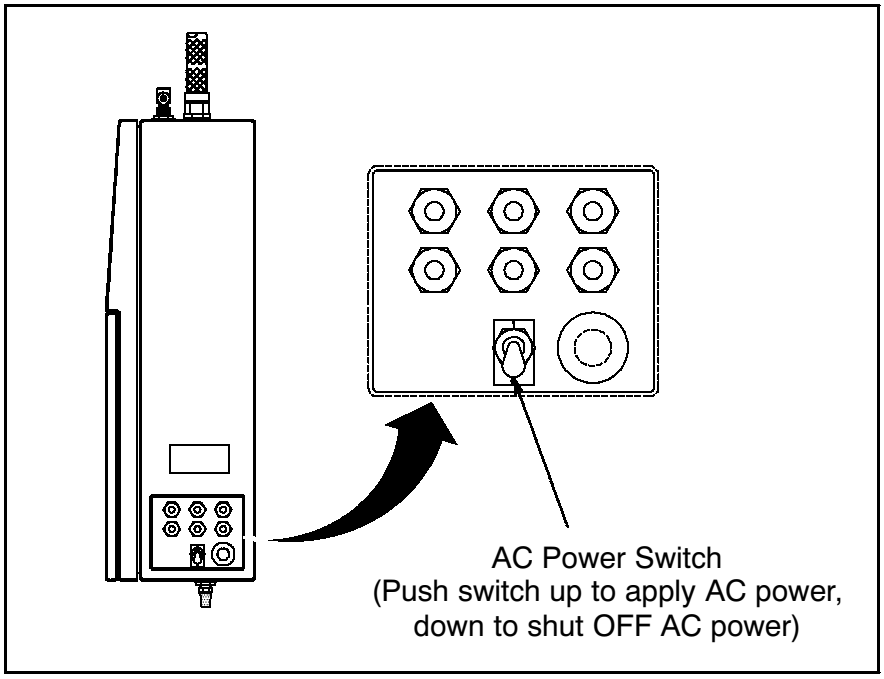


Figure 8-3. EXCEL Printer Power Switch

Connect Compressed Air

Connect the EXCEL printer to a source of clean, oil free, filtered, dry air at 80 to 100 psi (5.5–6.9 bar). Refer to Chapter 10, *Accessories and Spare Parts*, for a description of the recommended air filter.

Follow the instructions included with your air filter assembly. Keep in mind the following air quality and operating pressure guidelines for maximum performance:

- Air should not contain solid particulates larger than one micron.
- Do not exceed 100 psi (6.9 bar) pressure. A pressure relief valve will automatically expel the air supply if it exceeds 100 psi.

Connect the Transfer Solenoid Tubing

Locate the transfer solenoid tubing. Refer to Figure 8-4.

The line is unattached for shipping and marked with a yellow tag. Attach the transfer solenoid tubing, and tighten the fitting with an open-end wrench. Do not tighten the brass fitting too tightly—it may break. (Refer to Figure 8-4.)

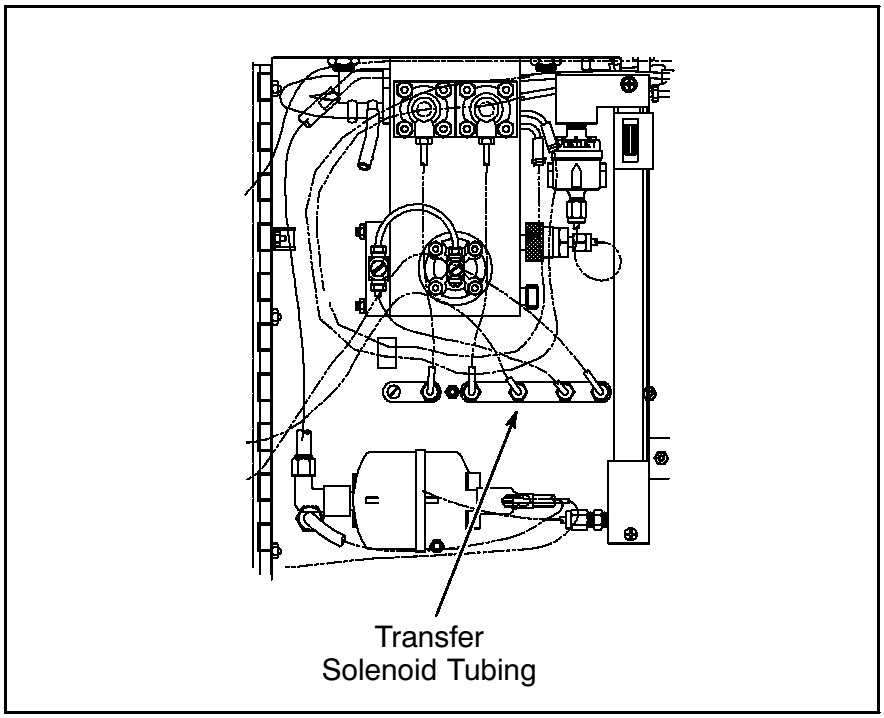


Figure 8-4. Connect the Transfer Solenoid Tubing

Connect the Vacuum Tubing

The vacuum line is shipped disconnected from the elbow fitting on the vacuum filter. (Refer to Figure 8-5.) Follow these steps to install the vacuum tubing:

1. Connect the vacuum tubing at the left side of the vacuum filter. Hand-tighten the plastic fitting. Securely tighten the plastic fitting or a vacuum leak will occur.
2. Connect the vacuum tubing at the ink module. Hand-tighten the plastic fitting. Securely tighten the plastic fitting or a vacuum leak will occur.

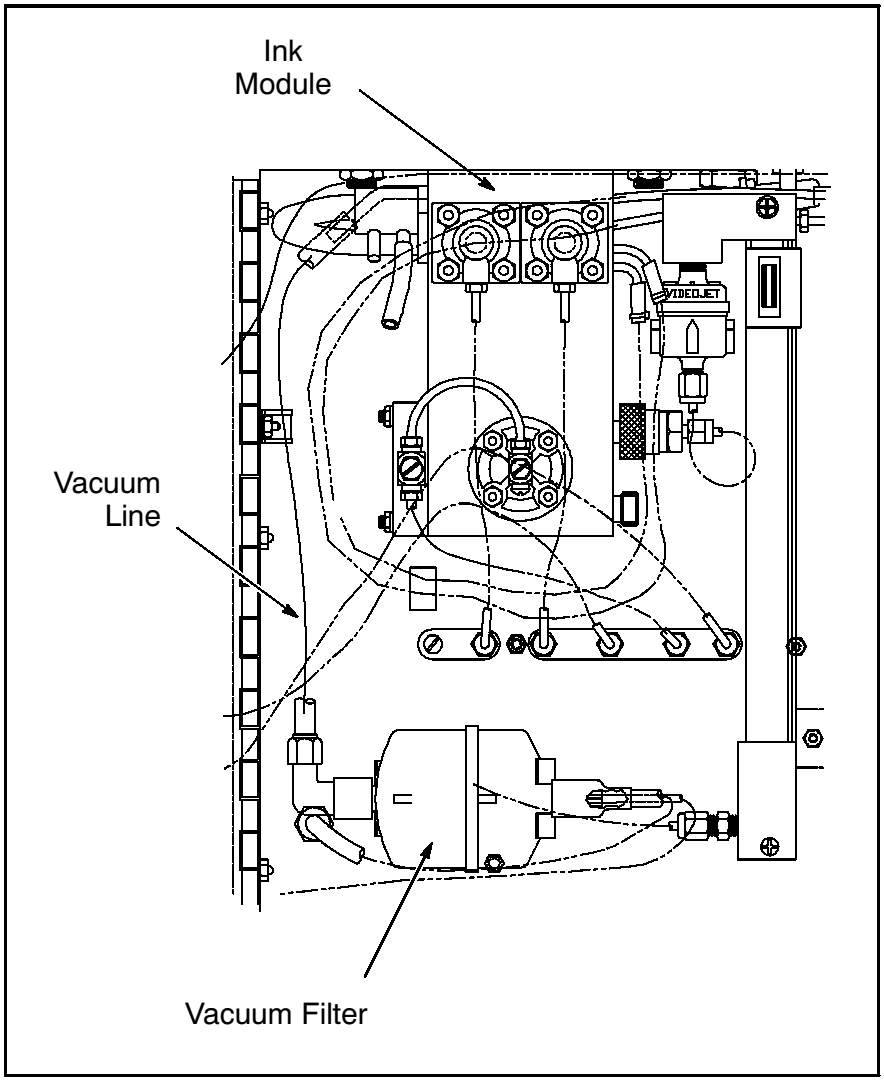


Figure 8-5. Connect the Vacuum Tubing

Place the Printer and Stand into Position

Place the printer and stand at the location where it will be used. Allow enough room in the front of the printer to access to the cabinet for servicing. Also, make certain that the location allows enough room for the printhead to reach its mounting location.

Assemble the Printhead Stand

Unpack and Assemble the Printhead Stand

Refer to Chapter 10, *Accessories and Spare Parts*, for a description of the printhead stand. Follow the installation instructions included with the printhead stand.

Bolt the Printhead Stand to the Floor

Once you have determined the final location of the printhead stand, bolt the stand to the floor. Refer to the installation instructions included with the printhead stand.

Control Board Connections

Connect the Battery

Open the printer cabinet to access the control board. Follow the steps below to connect the printer's memory battery.

1. Remove the protective shield covering from the control board by loosening the two thumb screws. (Refer to Figure 8-6.)

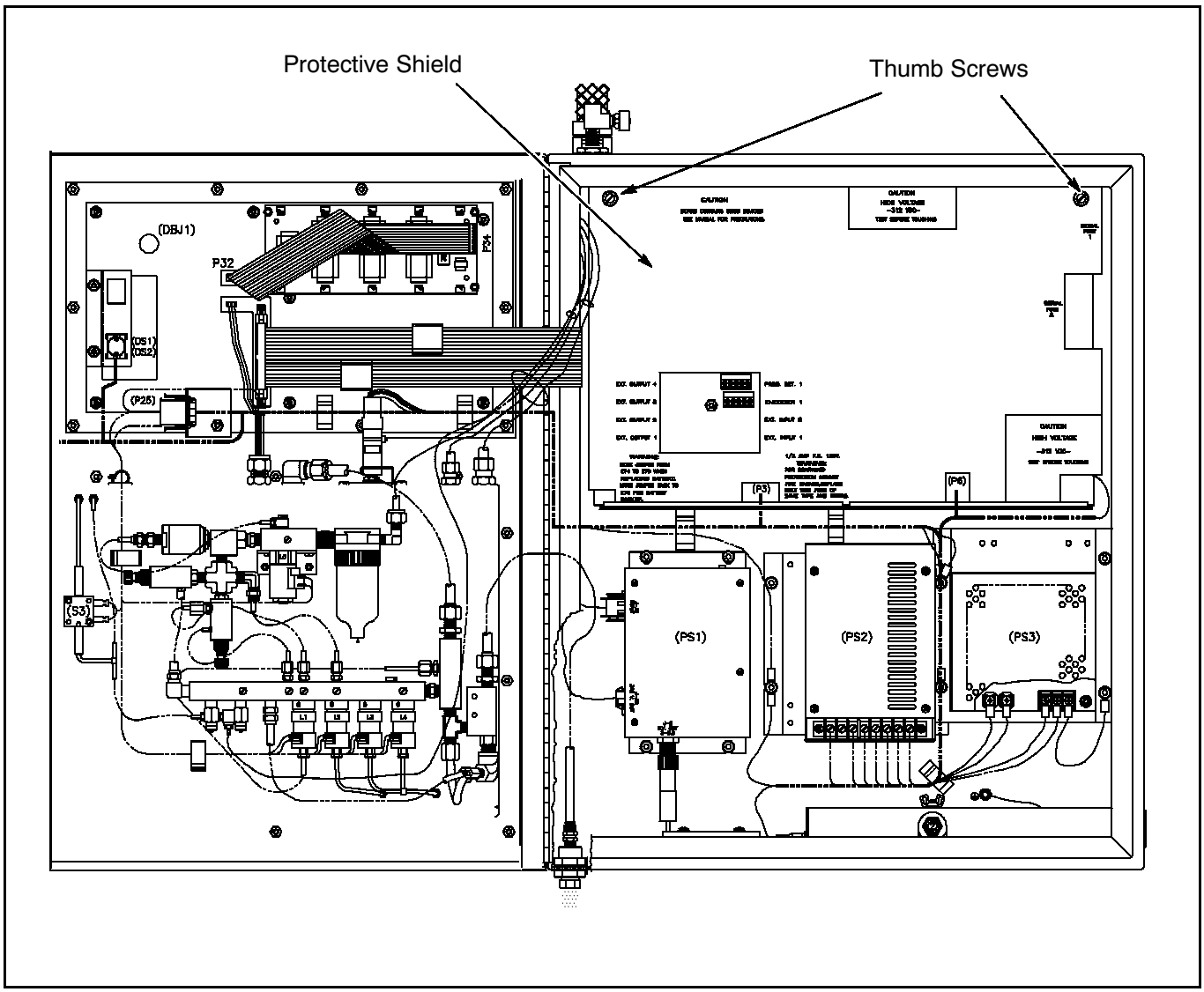


Figure 8-6. Printer Electronics Compartment

2. Locate the battery on the control board. (Refer to Figure 8-7.) Connect the battery by switching jumper positions on the control board. Remove the jumper on the pins at E79 and move it to the pins at E74.

Note: The printer will not turn on until the jumper is placed onto E74.

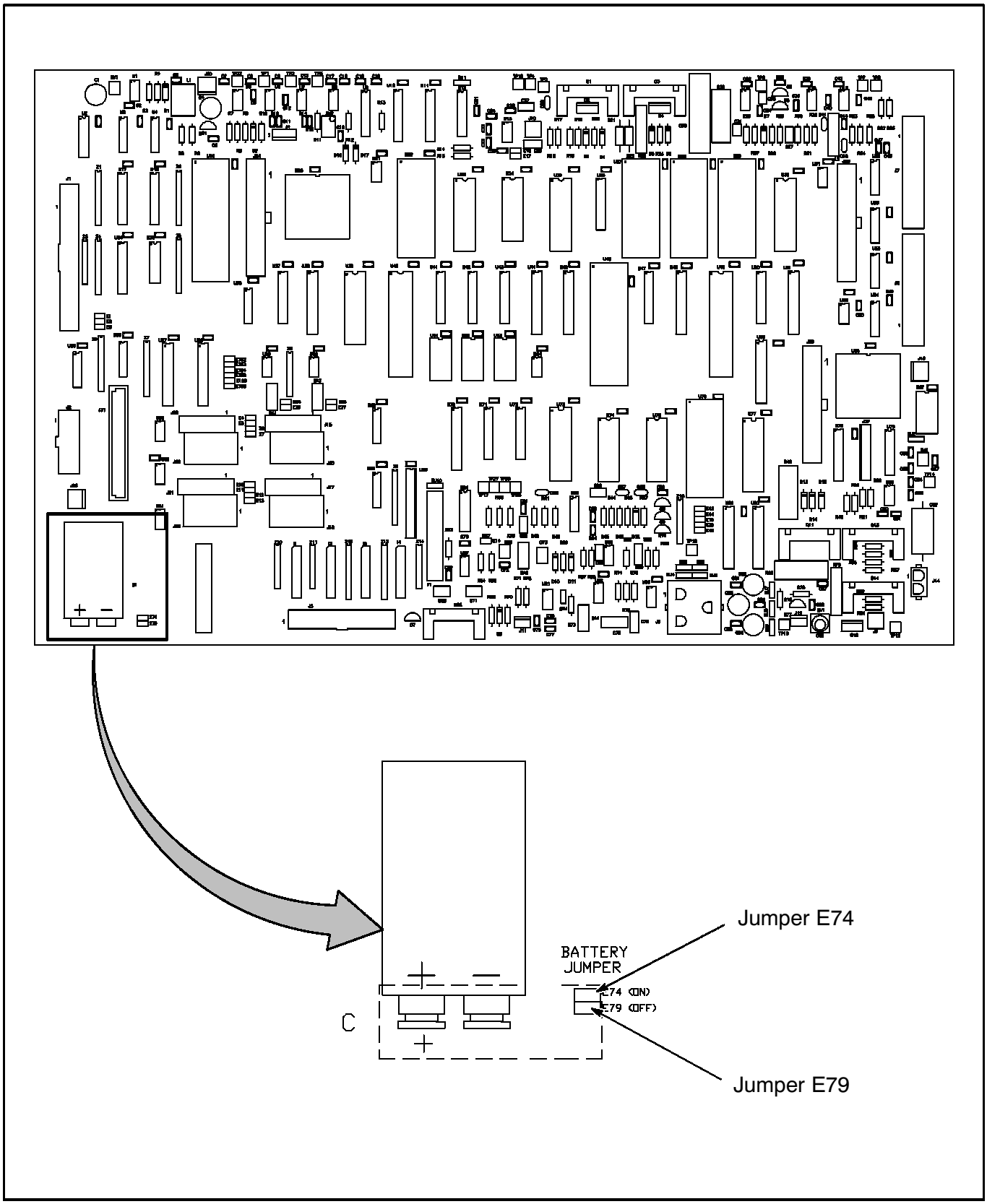


Figure 8-7. Location of Battery and Battery Jumpers on the Control Board

Set the Jumpers in the Proper Positions

Table 1-2 shows important jumper locations on the control board. A jumper is a small plastic-covered clip that electrically connects two pins on the control board. Jumpers not listed in the table are for internal use and should not be altered.

Location	Installed	Description
Battery Replacement (Refer to Figure 8-7)		
E74 E79	No Yes	Battery May Be Removed
E74 E79	Yes No	Reconnects Memory to Battery
Product Detect Selection — Input Active Low (Refer to Figure 8-9)		
E108 E109	Yes No	Negative Edge Triggering
E108 E109	No Yes	Positive Edge Triggering
Stroke Rate Selection Internal/External Encoding (Refer to Figure 8-11)		
E39 E40 E43 E44	Yes No No Yes	Access for Internal Stroke Rate and Auto Encoder
E39 E40 E43 E44	Yes No Yes No	Access for Electrically Divided Down External Encoder
E39 E40 E43 E44	No Yes No Yes	Access for Directly Connected External Encoder

Table 1-2. Jumper Functions

Connect RS-232

The EXCEL RS-232 standard serial interface is designed to establish a communications link to a wide variety of external communication devices and host computers.

With the appropriate interface configuration, the printer can receive message data from nearly any source compatible with the RS-232 specifications. Refer to Chapter 11, *Serial Interface*, for detailed information about the RS-232 interface.

Connect the Product Detector

Follow these steps to connect the product detector:

CAUTION: The printer must be Off when installing the product detector.

1. Route the detector wires through one of the six side ports on the printer. (Follow the instructions provided with your VIDEOJET product detector.)
2. Remove the product detector connector from J15 on the control board. Refer to Figure 8-9 for the location of this connector.
3. Attach the wires from the detector to the board connector. Pin identification for detector hook-up is shown in Figure 8-8.
4. Do not plug in the connector at this time.

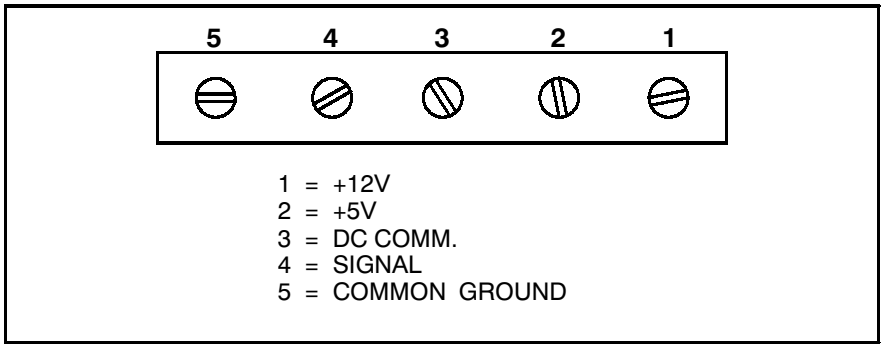


Figure 8-8. Pin Identification for Product Detector Connector

5. Select jumper E108 or E109 to trigger off of either the leading edge or the trailing edge of the product. (For more information about choosing leading edge and trailing edge product detection, refer to page 8-19.)

Note: The printer only prints when LED labeled PD1 goes from OFF to ON. If PD1 goes on as the product enters the eye, this is the leading edge. If PD1 is OFF and goes ON as the product leaves the eye, this is the trailing edge. This is the configuration required for the Auto Encode feature. (Refer to Figure 8-9.) For more information, refer to Chapter 7, *Troubleshooting.*

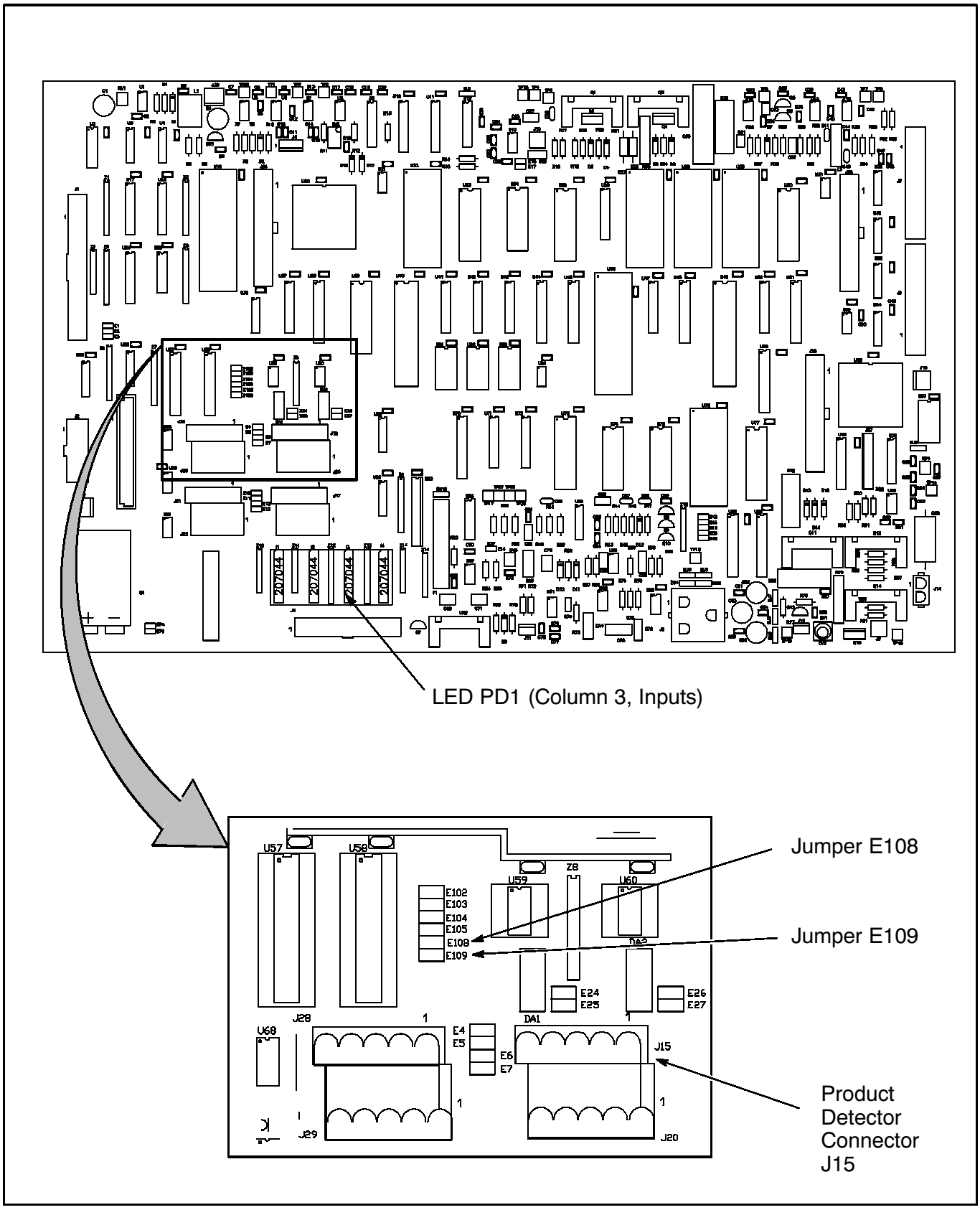
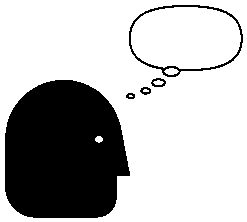


Figure 8-9. Product Detector Connector and Jumper Locations



Setting Product Detector Jumpers

Jumpers are set on the control board in order to determine whether the printer triggers from the leading or trailing edge of the product detector input signal. The type of signal received from the product detector depends on the method used for detection: retroflective vs. proximity, or beam break vs. beam make. (The installation instructions provided with your VIDEOJET product detector will indicate which type you are using.)

Internal and external encoding generally use the leading edge of the signal. Auto encoding must use the trailing edge of the detector signal. (Refer to page 8-21 for more information about the types of encoding.)

The detector signal LED PD1 on the control board indicates the status of the detector signal. (Refer to Figure 8-9 for the location of the detector signal LED PD1.) Printing is triggered (the printer starts printing a message) when the LED goes from Off to On.

Refer to Figure 8-10 for the various combinations of jumper settings and the status of the product detector LED for each situation. Choose the jumper settings (E108 and E109) which are appropriate for your application.

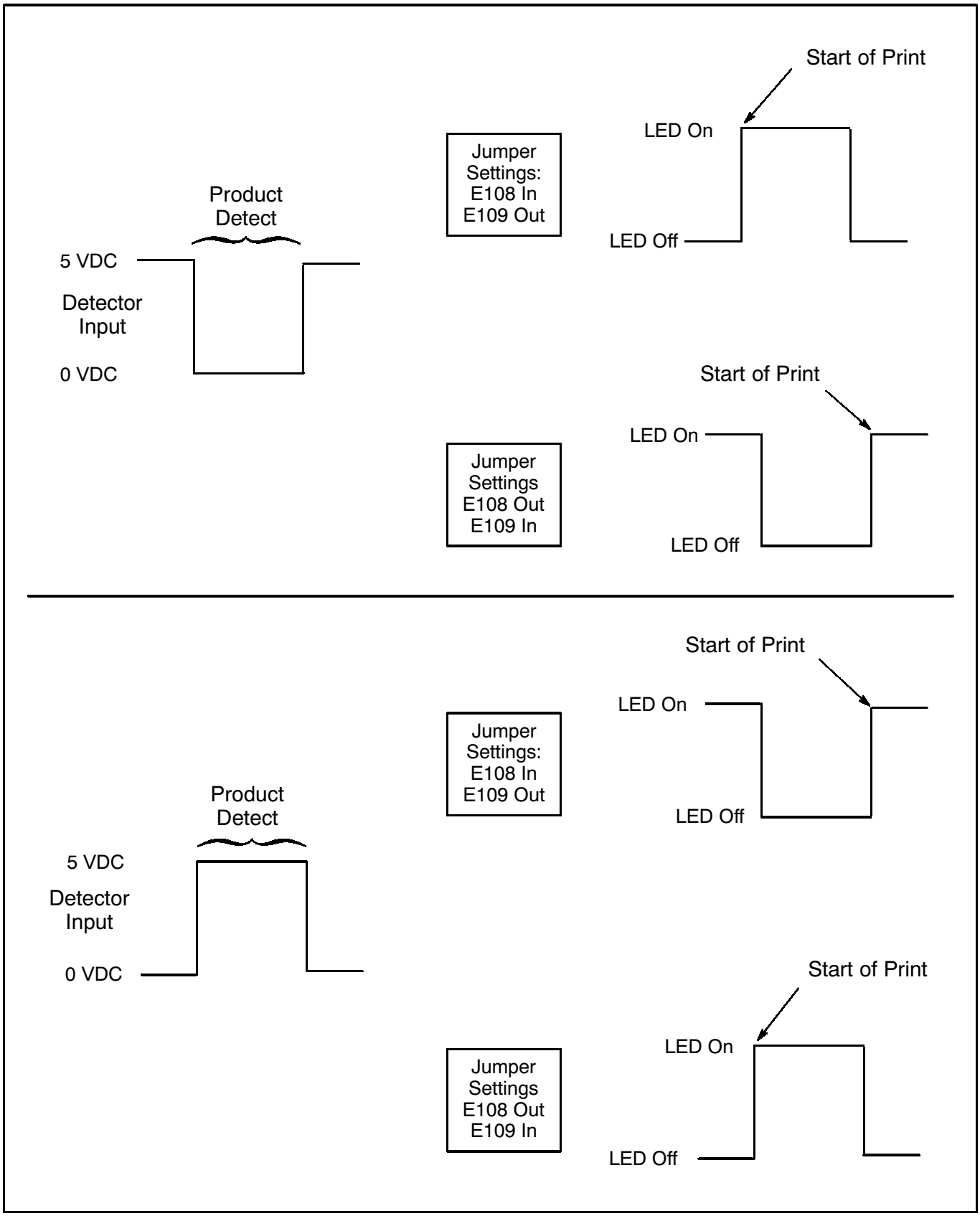


Figure 8-10. Product Detector Signals and Jumper Settings

Connect the Encoder

A shaft encoder is used when the speed of the conveyor varies. Shaft encoders may either be direct coupled or divided-down:

- A direct encoder maintains a 1:1 ratio between encoder pulses and print strokes.
- A divided-down encoder is used when the conveyor requires fewer pulses than the actual output of the shaft encoder.

INTERNAL (INT) is used when product speed is constant. An internal clock sets the stroke-rate to a constant pace. (Refer to Table 1-3.)

Refer to page 8-24, *When to Use Internal Encoding*, for more information about internal encoding.

EXTERNAL (EXT) is used when product conveyor speed is not constant. A shaft encoder must be used with this selection. The shaft encoder monitors changes in conveyor speed and varies the stroke rate accordingly. (Refer to Table 1-2.)

Refer to page 8-25, *When to Use External Encoding*, for more information about external encoding.

AUTO is used when the product speed varies from that of the conveyor (product slippage). With this selection, the signal from the product detector is used to determine product speed. (Refer to Table 1-2.)

Refer to page 8-27, *When to Use Auto Encoding*, for more information about auto encoding.

Procedure

Follow these steps to install the encoder wires in the printer:



CAUTION: The printer must be Off when installing the encoder.

1. Determine the type of encoding required for the application and set jumpers E39, E40, E43 and E44 accordingly. Refer to Table 1-3.
2. Remove the green encoder connector from J20 on the control board. Refer to Figure 8-11 on page 8-23 for the location of this connector.
3. Route the encoder wires through one of the six side ports on the printer.
4. Attach the wires from the product detector to the green connector. (Follow the instructions provided with your VIDEOJET encoder.)
5. Do not plug in the connector at this time.

Stroke Rate Selection Internal/External Encoding		
Location	**Installed**	**Description**
E39 E40 E43 E44	Yes No No Yes	Access for Internal Stroke Rate and Auto Encoder
E39 E40 E43 E44	Yes No Yes No	Access for Electrically Divided Down External Encoder
E39 E40 E43 E44	No Yes No Yes	Access for Directly Connected External Encoder

Table 1-3. Encoder Jumper Functions

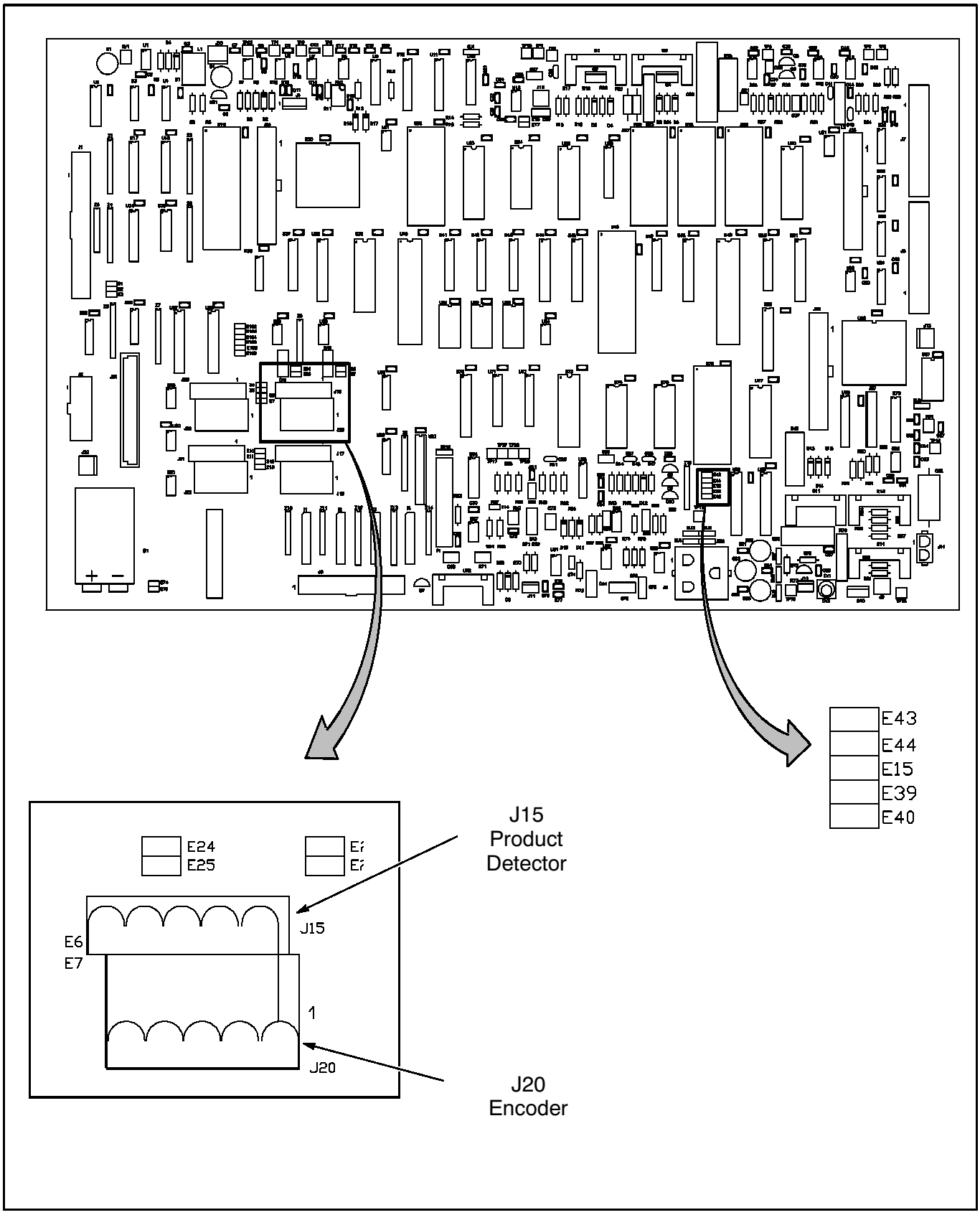
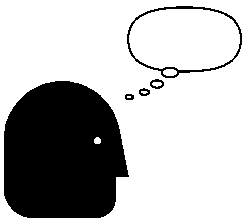


Figure 8-11. Location of Encoder Connector and Jumpers



When to Use Internal Encoding

Internal Encoding is used when the product speed is constant. The internal clock of the printer is set to the speed of the product in feet per minute (ft./min.).

Note: Internal encoding is also used when test printing a sample message. For more information on test printing a sample message, refer to Chapter 5, page NO TAG.

It is therefore necessary to determine the product speed. Below are four methods which can be used to determine the product speed.

Method 1:

Use a hand-held tachometer that is calibrated to measure linear surface speed in ft./min. or measure the revolutions per minute (RPM) of the belt's pulley. Convert RPM to surface speed by using the following formula:

$$\text{Surface speed (ft./min.)} = \frac{\pi d(\text{RPM})}{12}$$

where $\pi = 3.14$
where d = pulley diameter in inches

Method 2:

Establish a reference mark on the conveyor belt and measure how many inches (one inch equals 25.4 mm) this mark moves in 5 seconds. This number is equal to the conveyor speed in ft./min.

Method 3:

If you know the number of products produced per minute on the line, the size of the product, and the gap between each product, you can calculate the product speed.

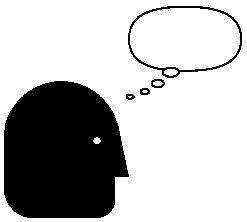
For example:

- 1,200 products/min. are produced on the line,
- each product is 2.5 inches wide, and
- there is a one-inch gap between each product

$$\text{Conveyor speed (ft./min.)} = \frac{\text{(products/min) (size + gap)}}{12}$$

Method 4:

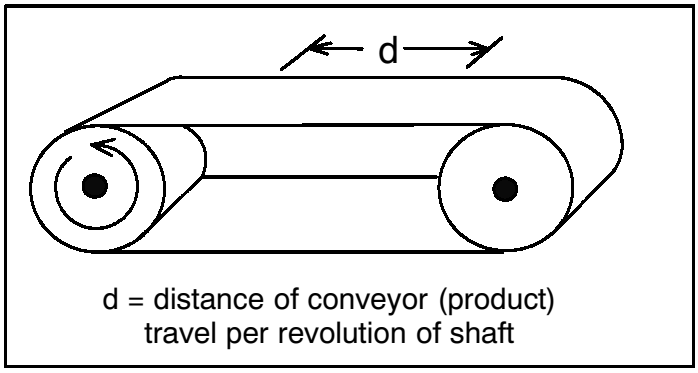
It is also possible to use the printer's product counter to determine the number of products per minute, and then calculate the line speed as shown in Method 3.



When to Use External Encoding

External Encoding is used when the speed of the product and conveyor changes. In this case, a shaft encoder is required.

The shaft encoder is coupled to the conveyor at a point where the selected conveyor shaft and the conveyor are turning together. The shaft encoder will provide either one pulse or many pulses (which are mathematically divided) for each vertical stroke of the message.



d = distance of conveyor (product) travel per revolution of shaft

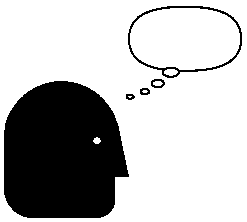
Required shaft encoder:
Pulses per Revolution (PPR) = d x strokes/in.
Where strokes/in. = strokes/character x characters/in.

Example 1

Given information:
d = 23 in.
5 x 7 matrix
10 characters/in.
6 strokes/character

23 in./revolution x 60 strokes/in. = 1380 PPR

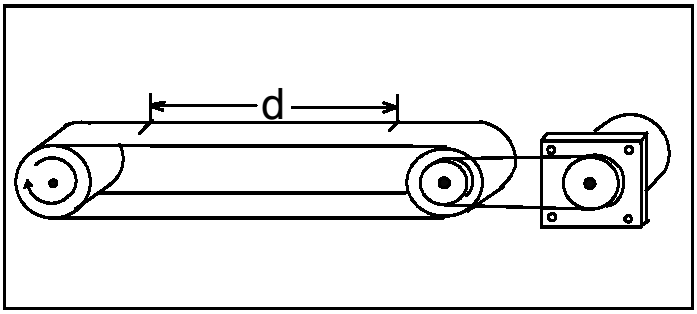
Continued on next page ▶



When to Use External Encoding (continued)

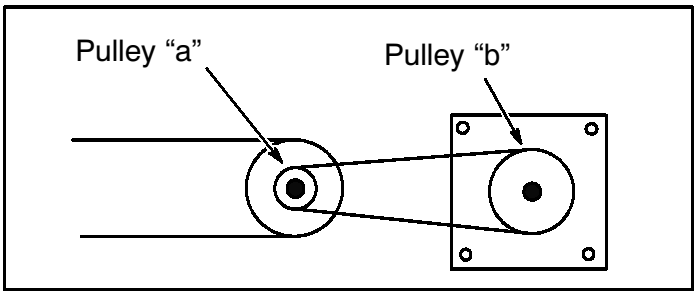
Example 2

If the standard 1800 PPR shaft encoder is to be used as shown in Example 1, it will be necessary to provide some type of gearing to supply the required 60 pulses/in. as the diagram below shows.



To determine the required gearing the following method is used:

$$\frac{\text{1800 PPR}}{\text{1380 PPR}} = 1.3 \quad \text{or 1.3:1 gear ratio}$$



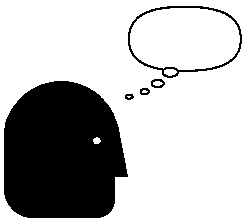
If the diameter of “a” = 2.0 in., then the diameter of “b” is 2.6 in. (2.0 in. x 1.3 = 2.6 in.). For one rotation of “a,” 1380 pulses are produced from the 1800 PPR shaft encoder.

If that same 1800 PPR shaft encoder is connected directly to the shaft on the conveyor, the calculation would be as follows:

$$\frac{\text{1800 pulses/revolution}}{\text{23 in./revolution}} = 78 \text{ pulses/in.}$$

$$\frac{\text{78 pulses/in.}}{\text{6 strokes/character}} = 13 \text{ characters/in.}$$

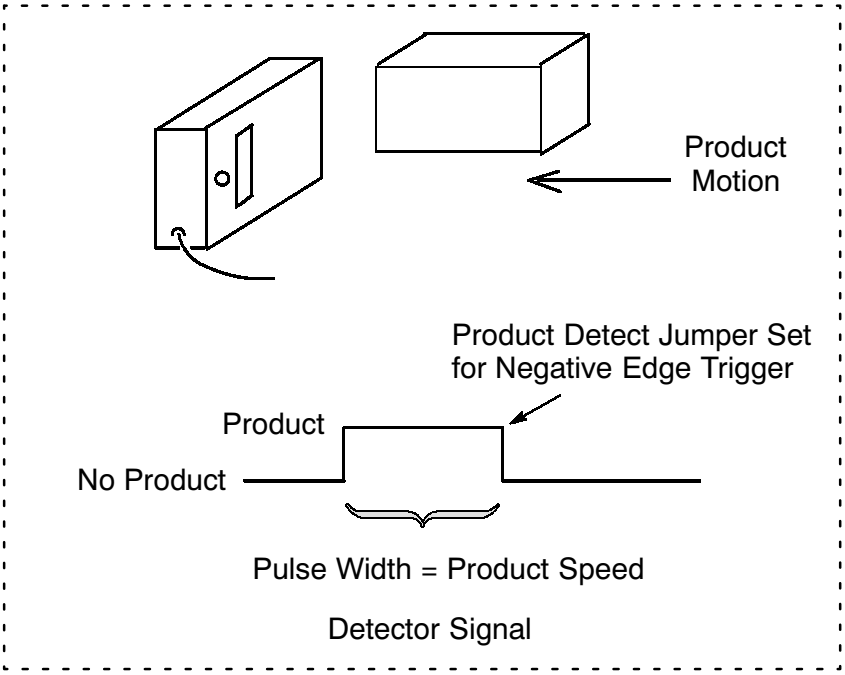
Since the standard calls for 10 characters/in., the message would be compressed on the product.



When to Use Auto Encoding

Auto Encoding is used when the speed of the product is changing due to slipping on the conveyor or when the product is allowed to fall through guides from one level to another.

When set for Auto Encoder, the printer will determine the speed of each individual product, and then code the product at that speed. The printer needs a product detector installed, and the correct jumper settings on the control board to work with auto encoding. In addition, the length of the detect area (the amount which the detector senses) is entered into the printer.



$$\frac{\text{50 in./sec. x 60 sec./min.}}{\text{12 in./ft.}} = \text{250 ft./min.}$$

or

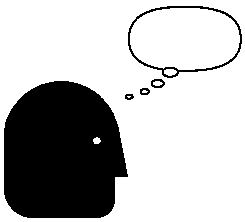
$$\frac{\text{1270 mm/sec. x 60 sec./min.}}{\text{1000 mm/m}} = \text{76.2 m/min.}$$

Example 1

Given information:
Detect area = 5 in. (127 mm)
Pulse width of this product = 0.1 sec.

Then: Product speed = 5 in./0.1 sec. = 50 in./sec.
(127.0 mm/0.1 sec. = 1270.0 mm/sec.)

Continued on next page ▶



When to Use Auto Encoding (continued)

Installation Guidelines:

- Set the product detect jumper such that the product detect LED is On with no product in front of the detector (negative edge trigger).
- Product size must be between 0.1” (2.54 mm) and 13” (330.2 mm)
- Minimum product speed is 5 ft./min. (1.524 m/min.)
- Printhead to detector distance should be greater than the product size if printing must occur on the leading edge of the product
- In order to precisely measure the speed of each product, the product detector must have a narrow beam
- When setting the print delay, the total delay is equal to the distance between the printhead and detector minus the product size. Also, the distance code is from the product’s leading edge times strokes per inch.

Set Up the Printer

Final Installation Topics

Your EXCEL printer is now ready for its final installation set-up. The final set up includes choosing the proper ink return line, loading ink, and making air and vacuum adjustments. The final installation topics are discussed on the following pages:

- *tools and supplies needed . . . . . below*
- *selecting the correct ink return line . . . . . below*
- *flushing the system and loading ink . . . turn to page 8-30*
- *setting the fluids low adjustment . . . . . turn to page 8-31*
- *adjusting the positive air flow . . . . . turn to page 8-33*
- *adjusting the vacuum . . . . . turn to page 8-35*
- *making the final encoder settings . . . . . turn to page 8-37*

Tools and Supplies Needed

Note: Parts denoted by an asterisk (*) are included in the final printer assembly. Refer to Chapter 10, *Accessories and Spare Parts*, for information about printer accessories and the VIDEOJET Spare Parts Kits.

The following are essential for proper printer set-up:

- VIDEOJET ink
- VIDEOJET make-up fluid
- VIDEOJET cleaning solution
- Flow Meter (P/N 356230)
- *Bleed Tube (P/N 356539)
- *Hex Key (P/N 186514)
- Wash Pan (Service Tray) (P/N 355495)
- Printhead Holder & Thumb Screw (P/N 355497)
- Graduated Cylinder (25 ml) (P/N 205416)
- *Magnifier Glass (P/N 355269)
- Magnifier Glass Holder (P/N 355257)
- Selection of hand tools

Select the Proper Ink Return Line

Printheads are shipped with the smaller ink return line attached. Some ink types, however, require the use of the larger return line. Table 1-4 on page 8-35 indicates which return line is required for use with each ink type.

Note: MARCONI recommends configuring the printhead in the standard position (high voltage plate facing the ceiling). In circumstances where an inverted printhead orientation is required (high voltage plate facing the floor), use the large ink return line and set the vacuum levels as shown in Table 1-4 on page 8-35.

Flush the System and Load the Ink

Note: Instructions for flushing the system with make-up fluid and loading it with ink, as well as the following calibration procedure, are found in Chapter 6, *Maintenance*.



WARNING: 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 cause fire due to static discharge.



CAUTION: Ensure that the work area is well-ventilated.



CAUTION: The printer must be flushed with make-up fluid before ink is loaded into the system for the first time. The system must also be flushed with make-up when it is brought back on-line from storage.

Follow the System Flush procedure (Chapter 6, *Maintenance*) to flush the system with make–up fluid and load the system with ink. Be sure to include these steps:

1. Prepare the printer
2. Load the make-up fluid
3. Drain the make-up fluid
4. Load the ink
5. Ink Stream Calibration
6. Ink Stream Breakoff Adjustment
7. Final Ink Stream Height Adjustment

Set the Fluids Low Adjustment

Air passes through the fluids low needle valve on the solenoid bank 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 needle valve. (Refer to Figure 8-12.)

1. When adjusting the needle valve, look in the make-up replenishment bottle (make-up fluid bottle should be nearly full).
2. Hold the dip tubes 25.4 mm (1 inch) below liquid surface. (Refer to Figure 8-13.)
3. Adjust the needle valve for approximately two bubbles per second.

CAUTION: Do not open the bleed valve by more than 1/8 turn. Excessive air pressure will damage the switch.

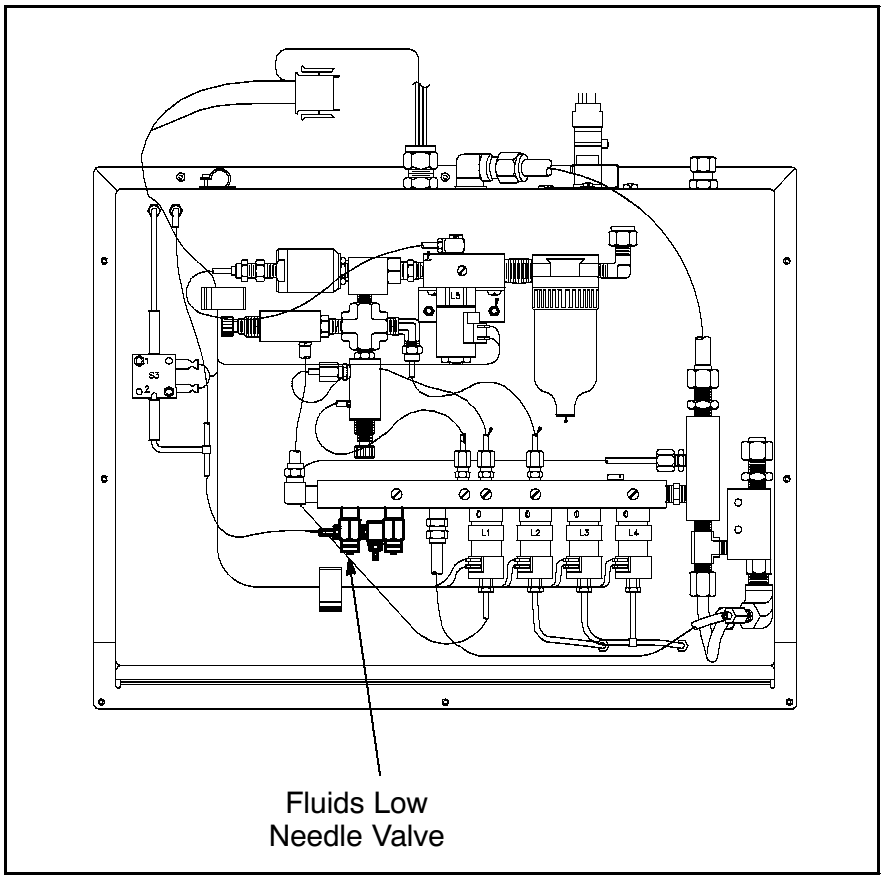


Figure 8-12. Adjusting the Fluids Low Needle Valve

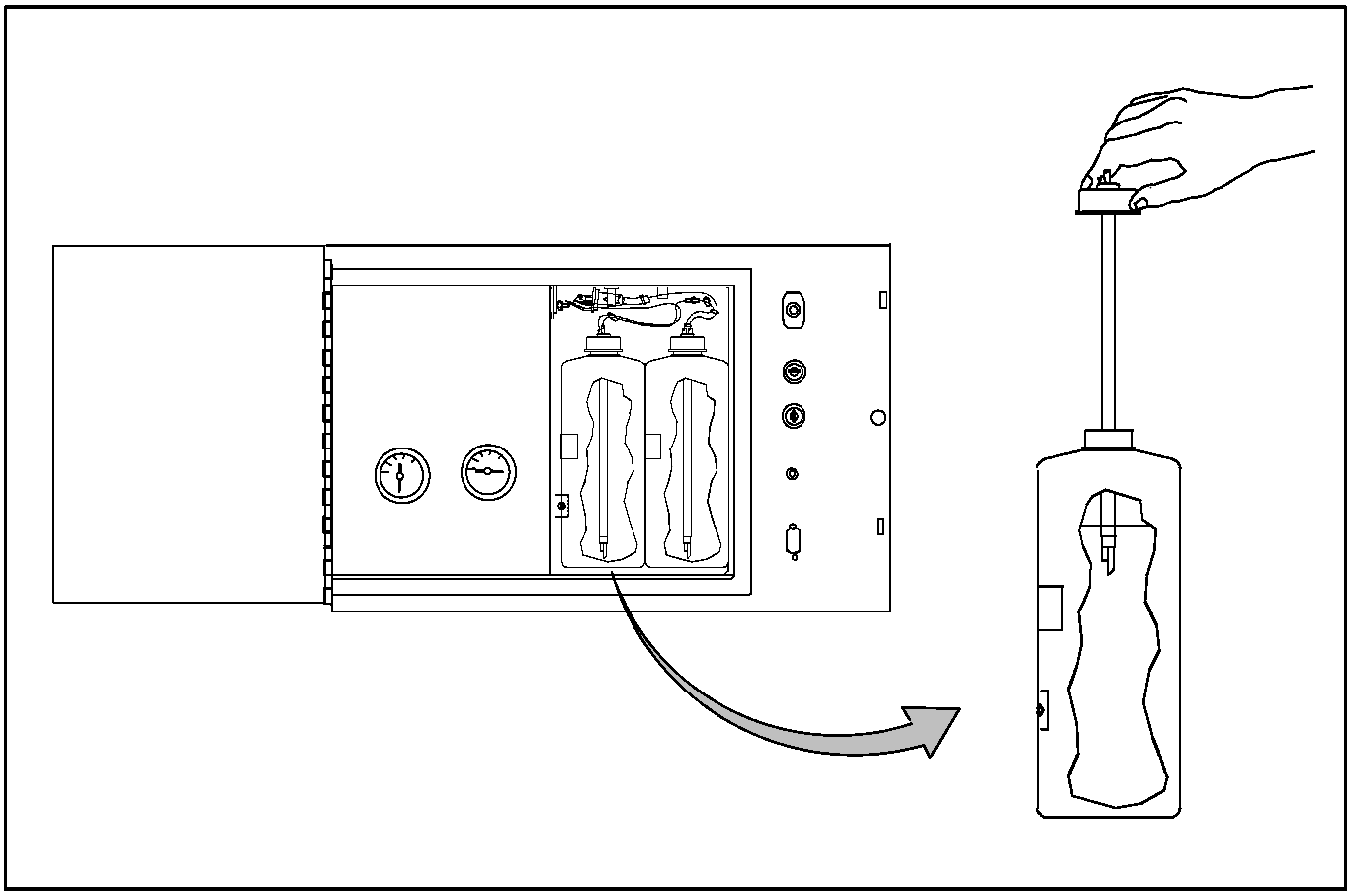


Figure 8-13. Setting the Fluids Low Adjustment

Adjust the Positive Air Flow

Positive air helps keep contaminants out of the printhead. Adjust the setting at the positive air needle valve, located on the solenoid bank. (Refer to Figure 8-14.)

Use a screwdriver and a flow meter (VIDEOJET Part Number 356230) for this adjustment. The air flow is measured at the printhead with the ink On.

1. Attach the flow meter to the printhead. (Refer to Figure 8-15.)
2. Adjust the needle valve to 1 $\pm$ 0.5 SCFH measured at the printhead.

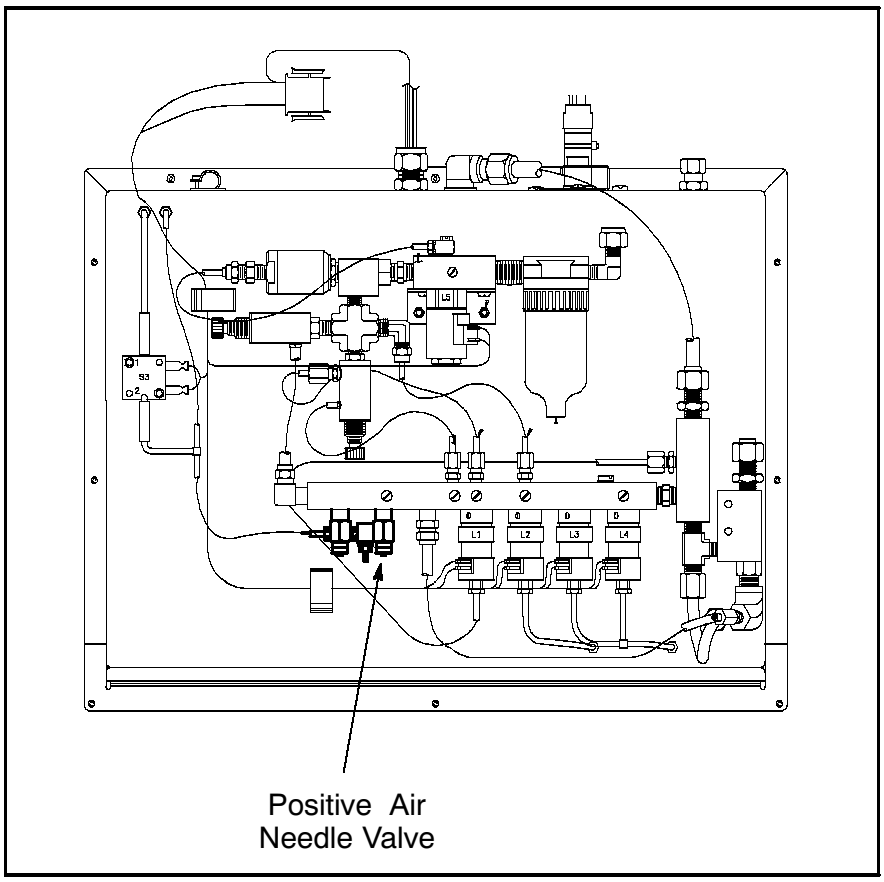


Figure 8-14. Adjusting the Positive Air Needle Valve

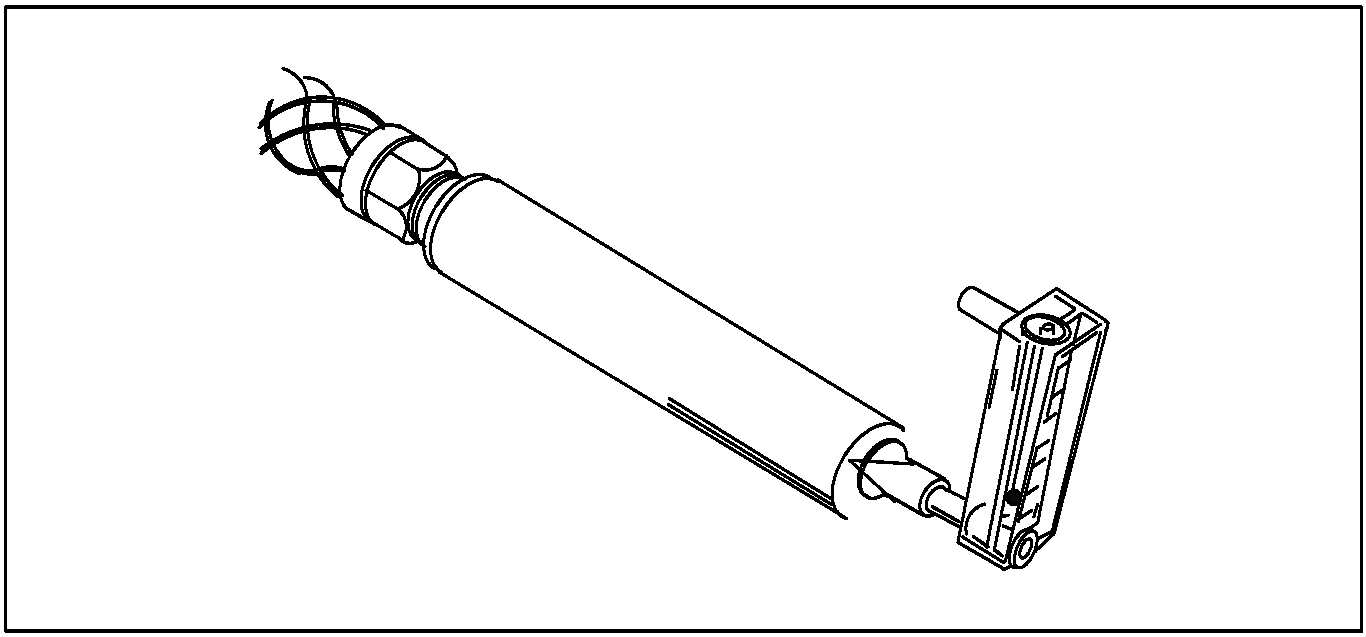


Figure 8-15. Air Flow Meter Attached to the Printhead

Adjust the Vacuum

The printer uses vacuum to pull ink from the ink return in the printhead back to the ink module, to operate the ink and make-up add valves, to draw ink from the replenishment bottles into the module and to operate the transfer pump and shut-off valve in the module.

Adjust the vacuum while ink circulates through the system.

1. Adjust the vacuum to the setting in Table 1-4 which corresponds with your ink type and printer conditions.
2. Use a screwdriver to adjust vacuum at the needle valve on the vacuum generator. (Refer to Figure 8-16.)
3. Check the vacuum gauge on the fluid pan door while adjusting vacuum. (Refer to Figure 8-17.)

	Standard Printhead Configuration				Inverted Printhead Orientation			
	Vacuum in-Hg (cm Hg)		Ink Return Line		Vacuum in-Hg (cm Hg)		Ink Return Line	
Ink Type	Below 65°F (18°C)	65°F (18°C) and above	Small	Large	Below 65°F (18°C)	65°F (18°C) and above	Small	Large
16-1200	13 (33)	13 (33)		X	13 (33)	13 (33)		X
16-5000	13 (33)	10 (26)		X	13 (33)	13 (33)		X
16-5600	13 (33)	10 (26)	X		13 (33)	13 (33)		X
16-5700	13 (33)	10 (26)	X		13 (33)	13 (33)		X
16-7900	13 (33)	10 (26)	X		13 (33)	13 (33)		X
16-8000	13 (33)	10 (26)	X		13 (33)	13 (33)		X
16-8100	13 (33)	10 (26)	X		13 (33)	13 (33)		X
16-8200	13 (33)	10 (26)	X		13 (33)	13 (33)		X
16-8700	13 (33)	10 (26)		X	13 (33)	13 (33)		X
16-8720	13 (33)	10 (26)		X	13 (33)	13 (33)		X

Table 1-4. Vacuum Settings for Representative Inks Used in EXCEL 170i Printers

Note: Table 1-4 represents the most commonly used MARCONI inks. It does not include data for all MARCONI-produced inks.

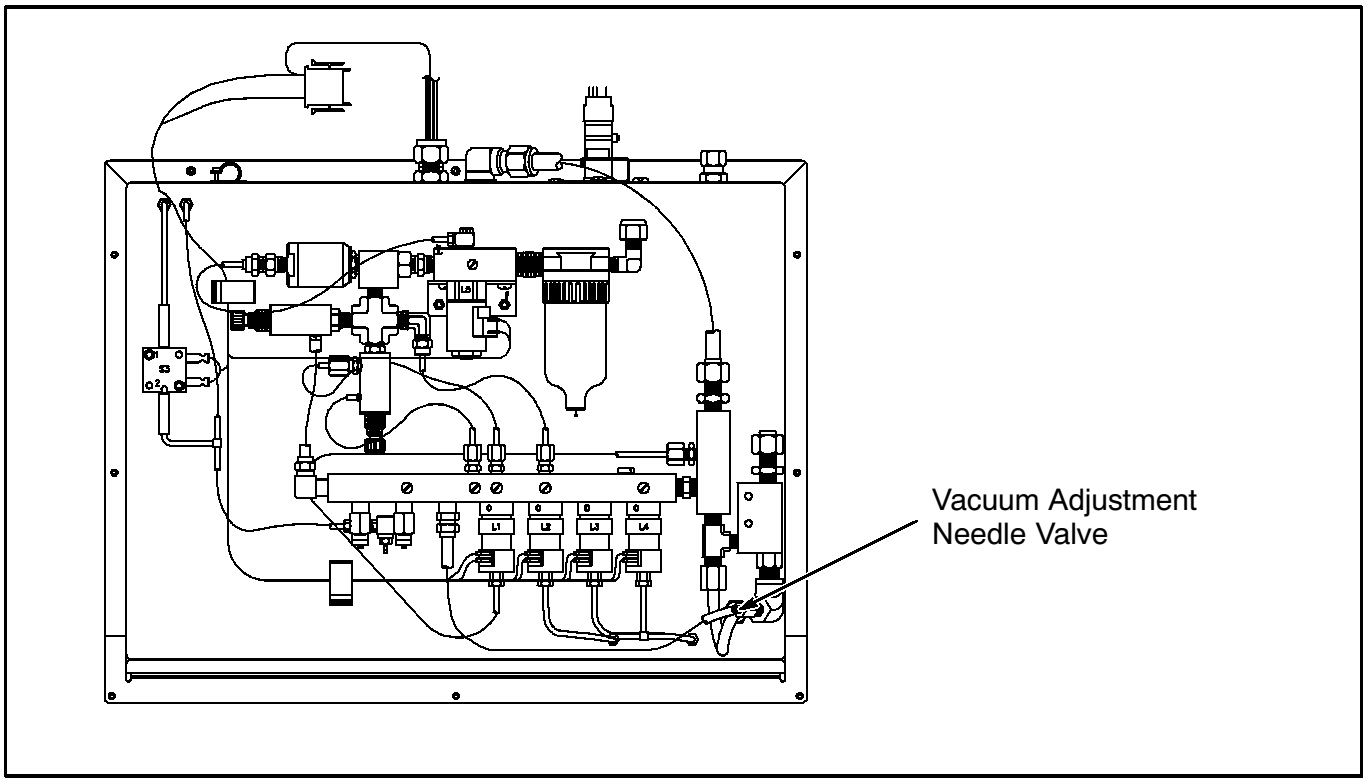


Figure 8-16. Adjust the Vacuum

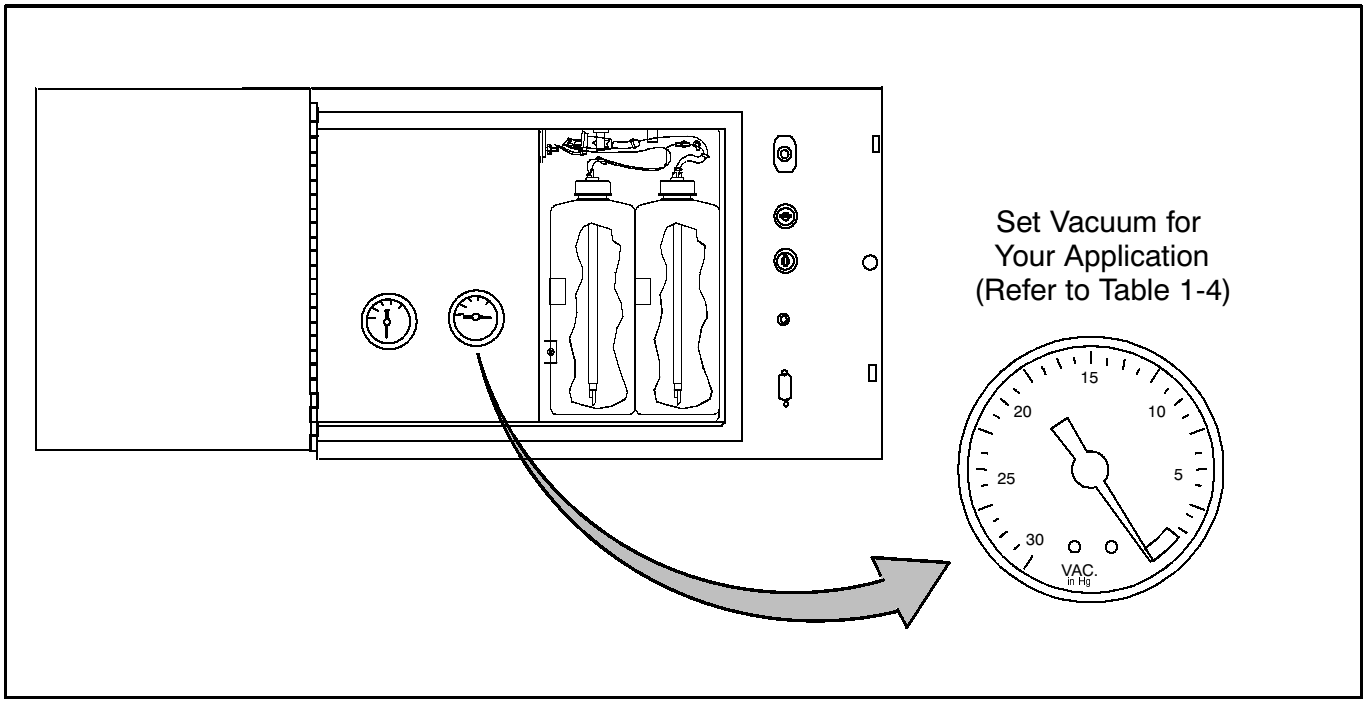


Figure 8-17. EXCEL 170i Printer Vacuum Gauge

Make the Final Encoder Settings

Follow these steps to make the final encoder connections:

1. After the jumpers are set, replace the protective control board cover.

Note: The control board protective cover has a cut-out so that connectors can be installed with the cover in place.

2. Plug in the encoder connector to J20 on the control board. (Refer to Figure 8-11 on page 8-23.)
3. Plug in the product detector connector to J15 on the control board. (Refer to Figure 8-11 on page 8-23.)
4. Ensure that the product detector and shaft encoder connectors are snugly attached.

Set the encoder at the keyboard in the Print Set-up mode. Use the following guidelines for your application:

1. Begin in Frame <04 PRINT>. Refer to Figure 8-18.
2. View the current setting above <SELECT ENCODER>. Press **F1** to change the setting. (Settings: INT., AUTO., and EXT.)

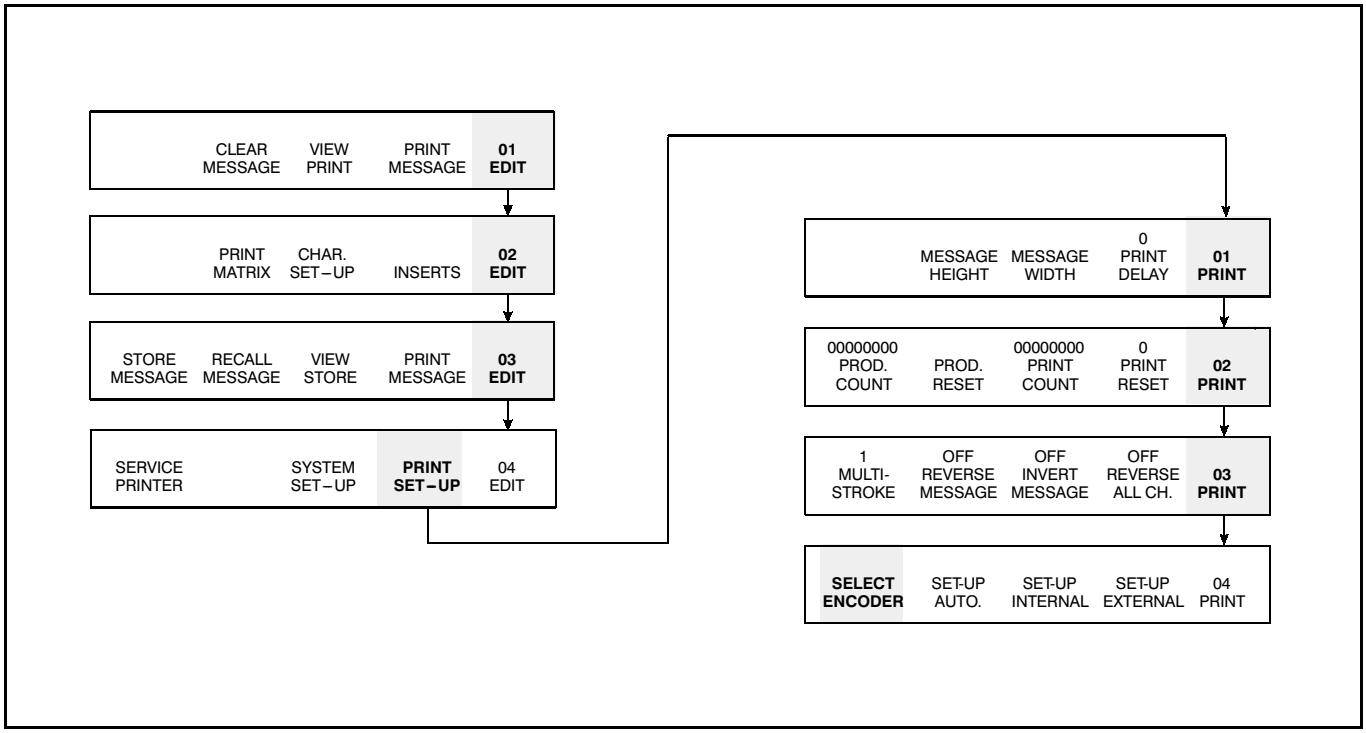


Figure 8-18. Accessing Frame <04 PRINT>

Set the Printer's Speed Compensation

Speed compensation is determined by the type of encoding which will be used in your application. There are three encoding settings available: Internal, External, and Auto. Refer to Table 1-5 below to select the appropriate setting for your application.

If the Product Speed:	Then the Encoder Type Should Be Set to:
is constant	<INT> Internal
varies	<EXT> External
differs from that of the conveyor due to product slippage	<AUTO> Automatic

Table 1-5. Selecting the Appropriate Encoding Type

Note: External encoding is the only setting that is used with an encoder.

Procedure

Follow these steps to set the printer's speed compensation:

1. Begin in Frame <04 PRINT>.
2. Refer to Table 1-6 below to complete the next step.
   - Go to Frame <01 AUTO.-E> to set the Auto Encoder.
   - Go to Frame <01 INT.-E> to set the Internal Encoder.
   - Go to Frame <01 EXT.-E> to set the External Encoder.

   (Refer to Figure 8-19 for a view of these Frames in the Software Summary Chart.)

If <SELECT ENCODER> is set to:	Then Select:	Use the Numeric Keypad to Enter the Following Values:
<INT>	<SET-UP INTERNAL> press (**F3**)	ENTER FEET/MINUTE (5-999) - - - ▶
<AUTO>	<SET-UP AUTO> press (**F2**)	ENTER IN TENTHS OF INCHES (1-130) - ▶
<EXT>	<SET-UP EXTERNAL> press (**F4**)	ENCODER REDUCTION (2-9999) - - - ▶

Table 1-6. Setting the Appropriate Encoder Values

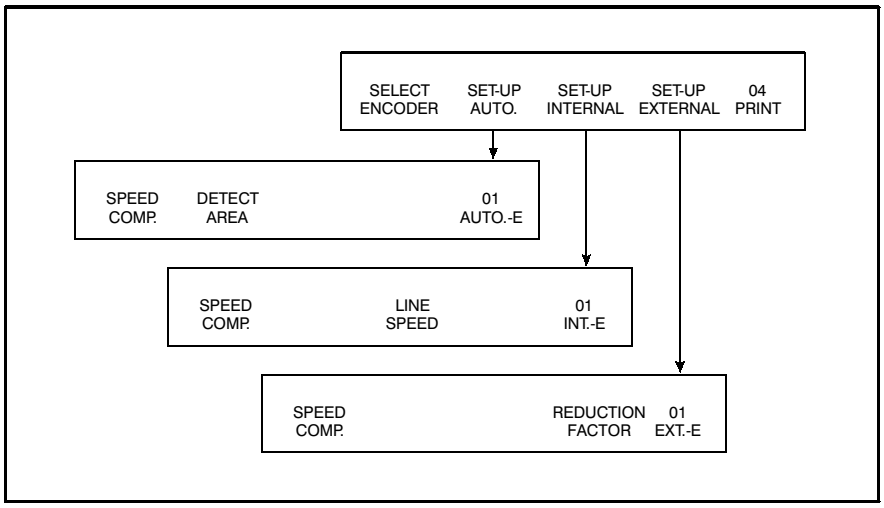
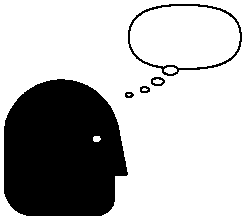


Figure 8-19. Accessing Encoder Frames

Note: The next step is optional. If you do not want Speed Compensation On, continue to step 4. Follow these instructions to turn Speed Compensation On.

3. View the current setting above <SPEED COMP.>. If desired, press **F1** to change the setting. (Settings: ON, OFF)
4. Press the **ENTER** key. Frame <04 PRINT> appears in the display screen.

Note: Refer to the Speed Compensation Summary below for more information.



Speed Compensation

Speed Compensation enables the printer to print a message in the same position on a product as the product speed changes. The printer does this by computing a variable stroke delay for each product. As the product speed is reduced, the variable stroke delay increases. This feature is designed for a print distance of $1\frac{1}{32}$ or 0.1875 inch (4.76 mm).

Note: When speed compensation is ON, the print delay is increased by 60 strokes. Therefore, 60 strokes must be subtracted from the existing delay in order for the printed code to remain in the same position on the product.

Notes:

9

Illustrated Parts Breakdown

For a copy of the Illustrated Parts Breakdown, order P/N:

- 365808-01 – USA version, 8½ x 11 format, or
- 365808-21 – UK version, A4 format.

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10

Accessories and Spare Parts

In this chapter you will find:

- accessories that are available for use with the EXCEL 170i printer
- items included in the EXCEL 170i Spare Parts Kit.
- information on how to order accessories, parts, and supplies

Turn to page 10-2 for a chapter-level Table of Contents.

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Programmable Counter 10-9
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Spare Parts and the Spare Parts Kit 10-12
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Introduction

Overview

MARCONI DATA SYSTEMS INC. offers many accessories, parts, and supplies (inks, make-up fluids, and cleaning solutions) for use with the EXCEL 170i printer. This chapter lists the accessories available for the 170i printer, and the contents of the 170i Spare Parts Kit.

- *Accessories . . . . . turn to page 10-4*
- *Spare Parts and the Spare Parts Kit . . turn to page 10-12*

Ordering Accessories, Parts, and Supplies

This section contains instructions for customers to follow to place orders with VIDEOJET.

For Customers in the U.S.A.

To obtain MARCONI accessories, parts, and supplies (ink, make-up fluid, and cleaning solution), contact the MARCONI Customer Service Department at 1-800-843-3610.

Be prepared to have the following information available for the MARCONI Customer Service representative:

- your customer number
- your name and telephone number
- your purchase order (P.O.) number
- the preferred method of delivery
- part number and quantity of all accessories, parts, or supplies required

For Customers Outside the U.S.A.

Contact the MARCONIsubsidiary or distributor in your area to obtain MARCONI accessories, parts, and supplies.

Accessories

This section contains the part numbers of MARCONI accessories, and several illustrations.

- *Printhead Stands . . . . . turn to page 10-5*
- *Product Detectors . . . . . turn to page 10-6*
- *Shaft Encoder (with cable) . . . . . turn to page 10-7*
- *Air Accessories . . . . . turn to page 10-8*
- *Programmable Counter . . . . . turn to page 10-9*
- *External Five-gallon Make-up Fluid Supply . . . . . turn to page 10-10*
- *Manual Transport . . . . . turn to page 10-11*

Printhead Stands

Description	Part Number
Printhead Stand, Single Head	800013
Printhead Stand, Dual Head	800014
Printhead Stand Assembly	343840
Extra Arm Assembly (For P/N 343840)	343879

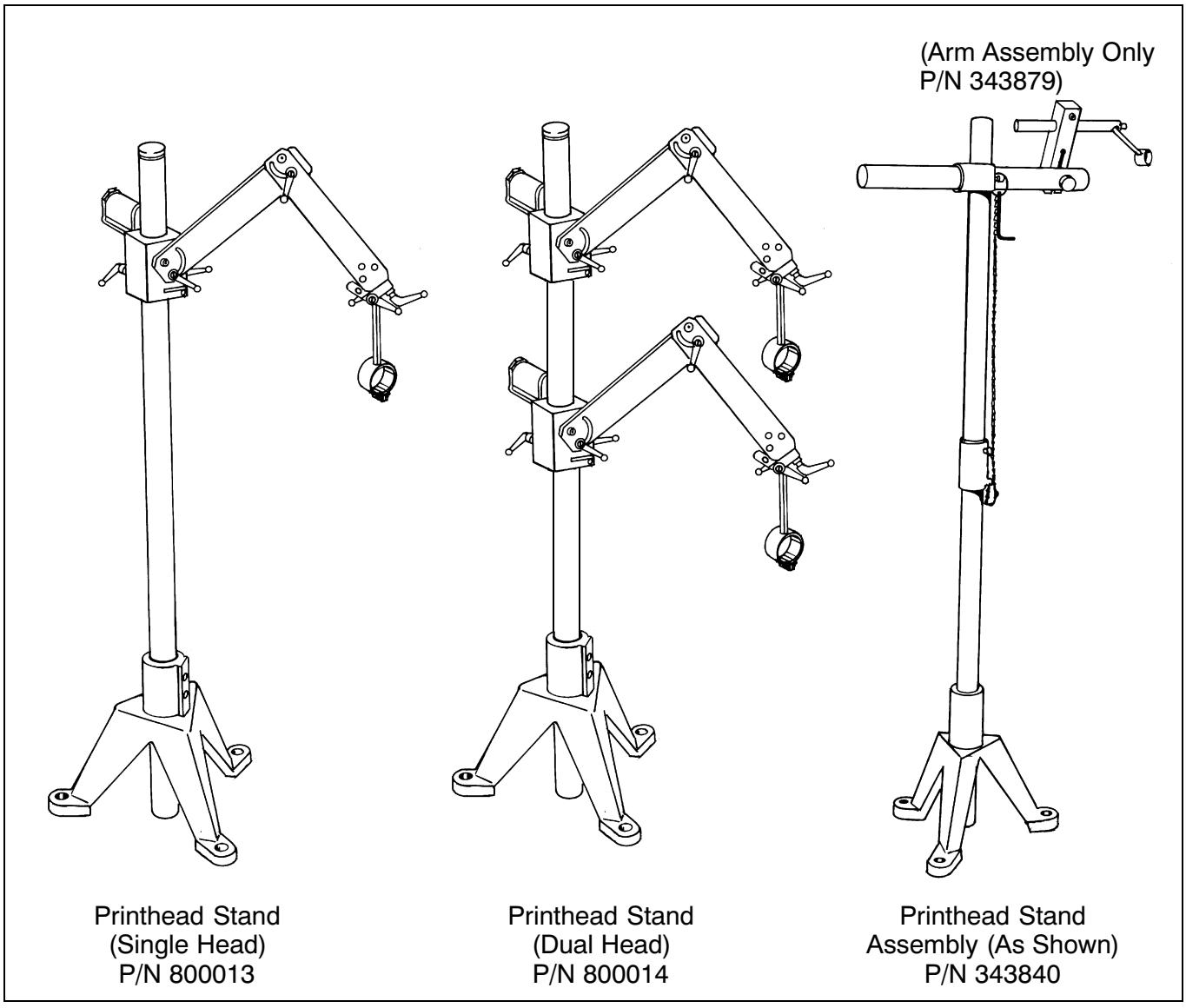
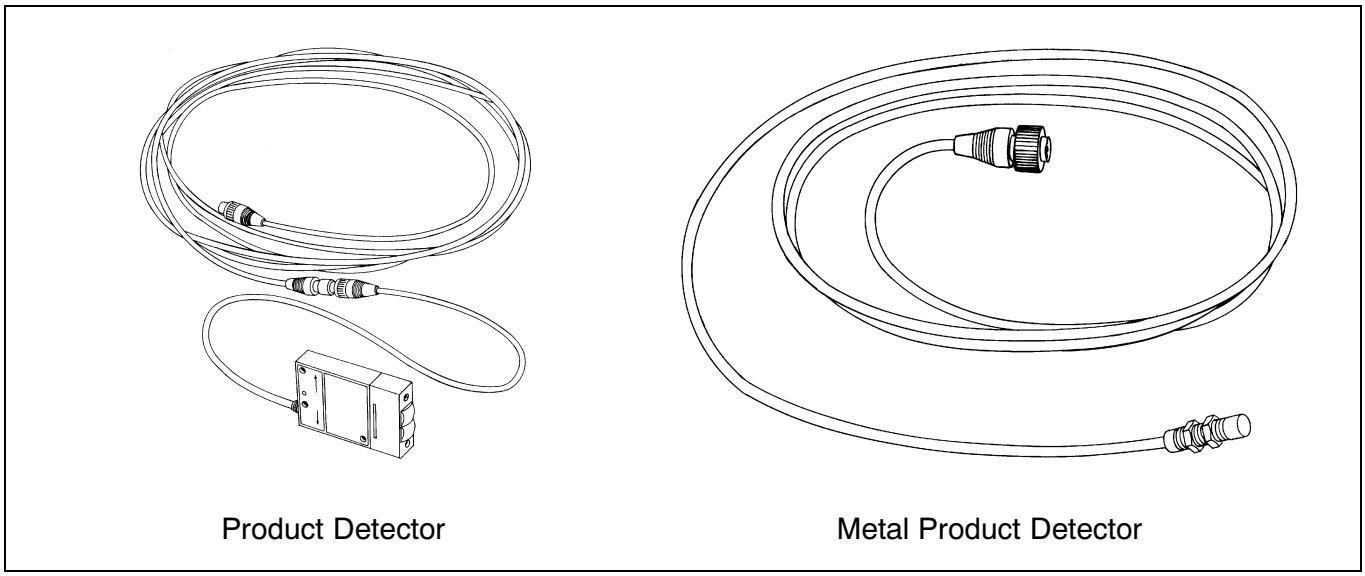


Figure10-1. Printhead Stands

Product Detectors

Product Detector Type	Part Number
Metal	343885
Proximity	356105-01
Retro-reflective	356105-02
Fiber Optic, 0.125” (3.17 mm)	356105-03
Fiber Optic, 0.046” (1.17 mm)	356105-04
Fiber Optic, 0.125” (3.17 mm), through-beam	356105-05



Product Detector

Metal Product Detector

Figure10-2. Product Detectors

Shaft Encoder (with Cable)

Description	Part Number
Shaft Encoder (1800 PPR)	355456
Shaft Encoder (1800 PPR) environmentally-sealed	356548

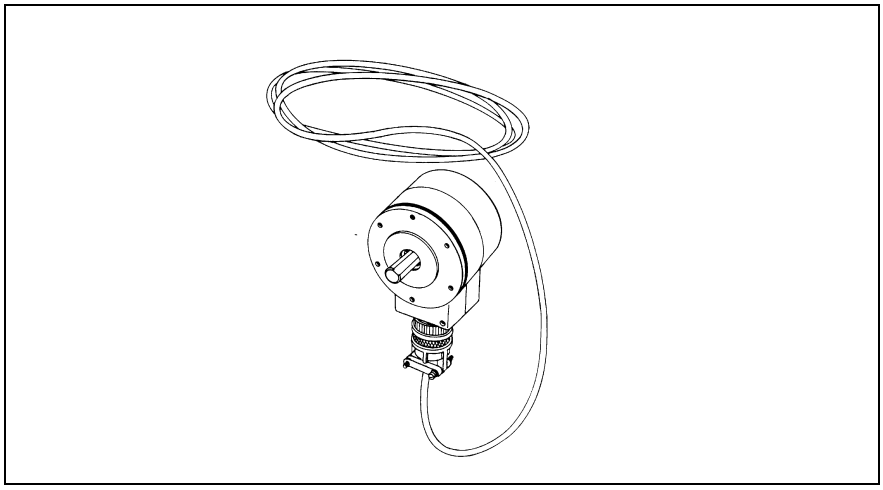


Figure10-3. Shaft Encoder

Air Accessories

Description	Part Number
Air Pressure Booster	356805
Maintenance Kit for Air Booster	356830
Compressed Air Filtration System	355458

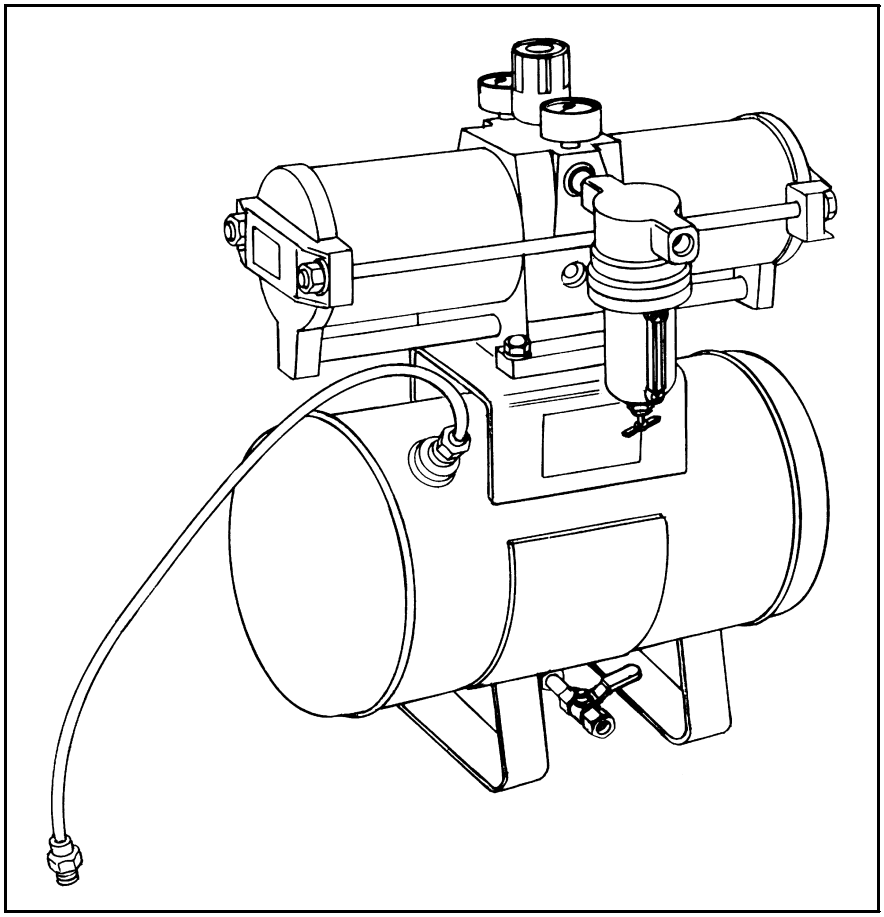


Figure10-4. Air Pressure Booster

Programmable Counter

Description	Part Number
Programmable Counter	356844
Enclosure for Counter	207539

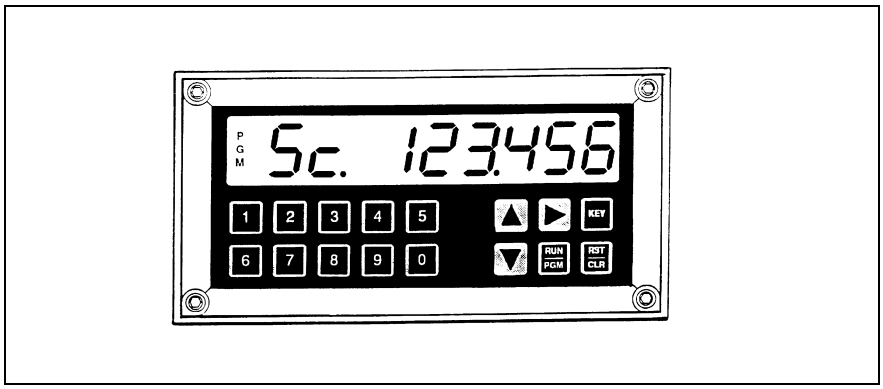


Figure10-5. Programmable Counter

External Five-gallon Make-up Fluid Supply

Description	Part Number
External Five-gallon Make-up Fluid Supply	353250

Manual Transport

Description	Part Number
Manual Transport	368090

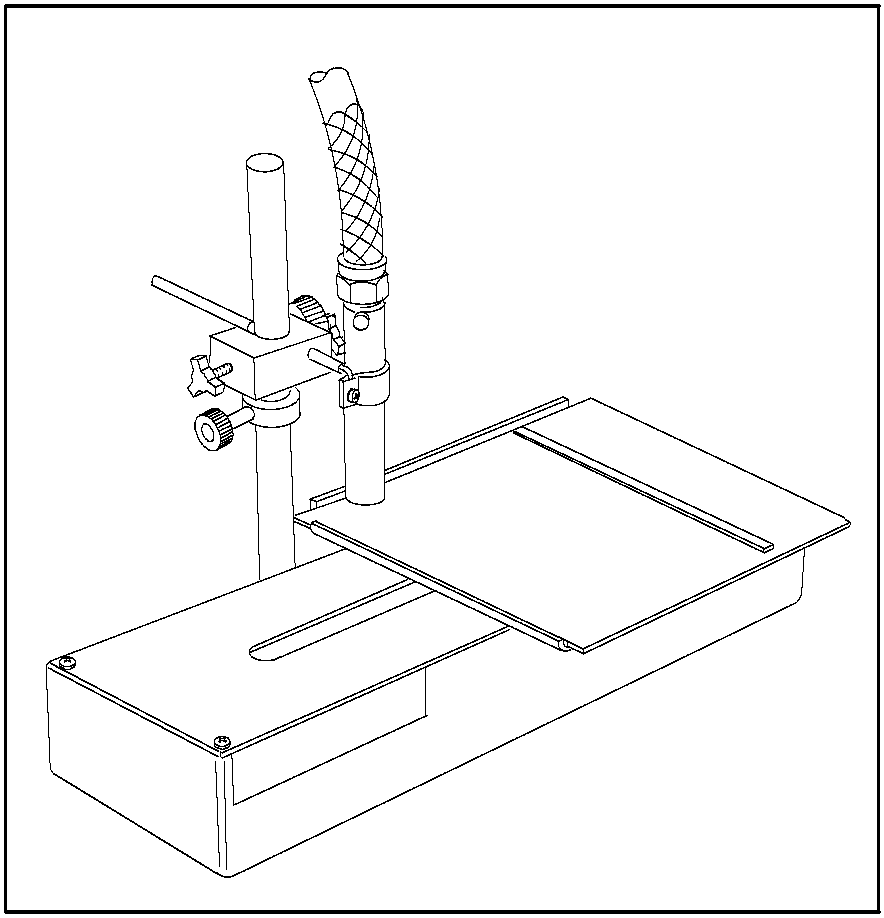


Figure10-6. Manual Transport

Spare Parts and the Spare Parts Kit

Spare Parts Kit (P/N 356740)

A spare parts kit consisting of normal maintenance items for the EXCEL 170i printer is available through MARCONI.

Each item included in the Spare Parts Kit is also available separately. Individual items can be ordered by referring to the corresponding part number shown below.

Contents

The EXCEL170i Spare Parts Kit consists of the following items:

Description	Part No.	Qty.
Regulator Assembly	SP355134	1
Nozzle, 66 micron	SP363006	1
Filter, 3 micron	204667	1
Filter/Tube Assembly	SP355390	2
Holder, Magnifier Assembly	355257	1
Bracket, Printhead Holder	355262	1
“O”-Ring, .042” I.D. (0.11 cm)	SP206582	1
Diaphragm With “O”-Ring	SP207016	1
Ink Filter	SP371130-01	1
Diaphragm, Shutoff Valve	SP355610	1
Pump Spring	SP205978	1
Bleed Tube	356539	1
Diaphragm, Make-up	SP355611	1
Transfer Tube Assembly	356086	1
Pump Spring, Ink Add	SP355088	1
Wash Bottle	202047	1
Thumb Screw Assembly	355258	1
Transfer Tube Assembly	356089	1
Output Pressure Tube Assembly	356093	1
Shut-off Valve Piston	355961	1
Inventory Sheet	356742	1
Spring, Adder Valve	SP355342	1
Key, Allen	186514	1

Continued on next page ▶

Description	Part No.	Qty.
Pressure Switch	204446	1
Relay, Solid State	205295	1
Lamp, Incandescent 14V	205604	2
Valve, Solenoid	SP206429	1
Service Tray Assembly	355267	1
Gap Gauge, High Voltage Plate	186976	1
Fitting, Tube	203473	2
Fitting, Tube, 1/16" (0.16 cm) I.D.	207110	1

Supplies

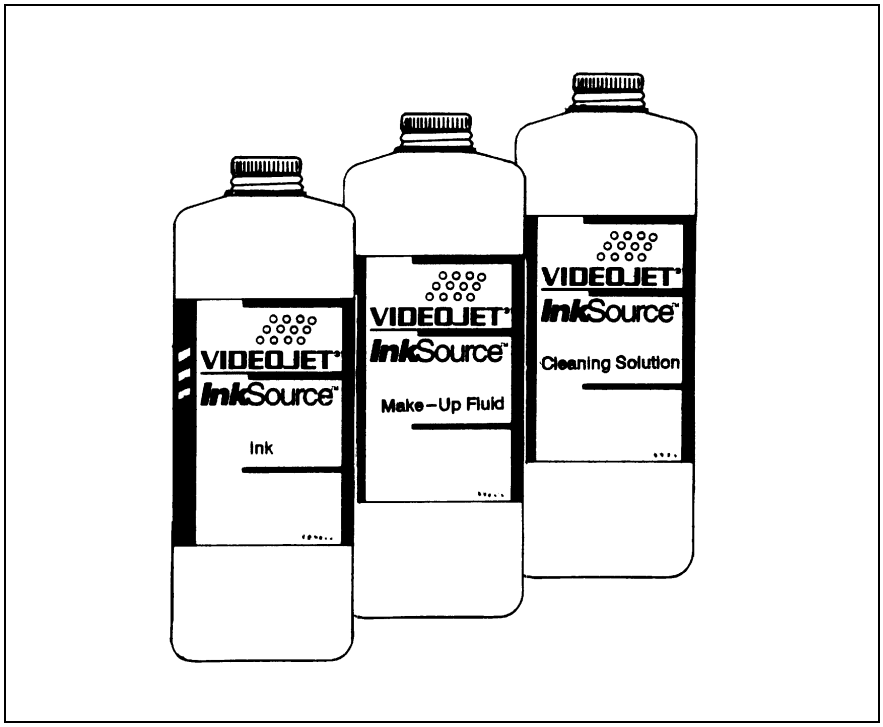


Figure10-7. Ink, Make-up Fluid, and Cleaning Solution

A variety of MARCONI inks, make-up fluids, and cleaning solutions suitable for your particular application are available through MARCONI.

Refer to *Ordering Accessories, Parts, and Supplies* on page 10-3 for information on obtaining MARCONI supplies.

11

Serial Interface

In this chapter you will find:

- hardware description
- Host and printer set-up
- printed message set-up
- communication description
- hex (hexadecimal) character tables

Turn to page 11-2 for a chapter-level Table of Contents.

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Introduction

Overview

The printer is equipped with an RS-232 Serial Interface to allow for control by an external computer. This chapter shows you how to set up an EXCEL printer to communicate with another computer, and lists all the commands you can send to the printer.

Sections in this Chapter

This chapter contains the sections listed below.

- *Theory of Operation . . . . . turn to page 11-4*
- *Host Set-up . . . . . turn to page 11-5*
- *EXCEL Printer Set-up . . . . . turn to page 11-6*
- *Cable Set-up . . . . . turn to page 11-13*
- *Printed Message Set-up . . . . . turn to page 11-20*
- *Communication Description . . . . . turn to page 11-30*
- *Sample Communication Program . . . . turn to page 11-36*
- *Character Sets . . . . . turn to page 11-37*

Theory of Operation

The EXCEL printer is configured as a “DTE” (Data Terminal Equipment) device as described in the RS-232 Interface Standard. The CCITT V.24 Interface Standard is equivalent to the RS-232C. Therefore, the descriptions of the EIA standards with respect to CCITT V.24 would also apply. (Refer to Figure 11-1.)

The Serial Interface allows external messages to be downloaded into the printer. The data may be inserted into an existing message created at the printer’s keyboard, or the entire message may originate at the computer, referred to as the “host.”

The host computer does not control the printer application. The host computer is functionally a remote memory for messages. The regular printer configuration allows 32 messages to be stored in memory. The RS-232 Interface increases this storage area to the storage limitations of the host computer. It also allows a new signal message to be inserted for each product detect signal.

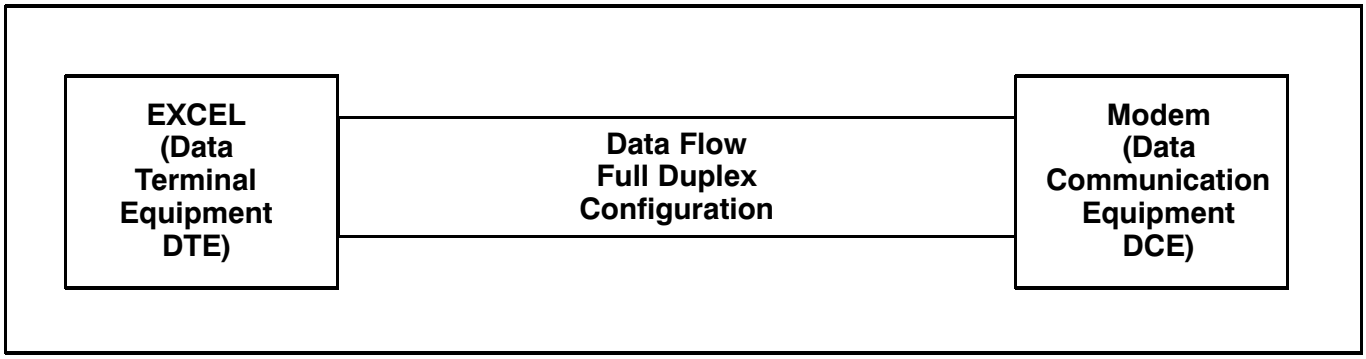


Figure 11-1. Basic RS-232 Interface

Basic Serial Interface Operation

The basic operation of the interface is as follows:

1. A message is created in the Edit mode of the printer and/or at the host computer.
2. The Remote mode setting in the printer software is used to insert data into the printer message, or to download the entire message from the host computer.
3. Each new product detect from the host will trigger a message change in the printer. If the host does not send additional messages to the printer, the printer will continue printing the last message received.

Host Set-up

This section describes the set-up parameters of the host computer.

Communication Parameters

Consult your host computer operation manual for instruction on the set-up of the following:

Word length	8 bits
Parity	None
Duplex	Full
Baud rate	150-19,200
Start bit	1
Stop bits	1 or 2

RS-232 Parameters

Determine whether the host is a DCE (Data Communication Equipment) or a DTE (Data Terminal Equipment). Evaluate the degree of conformity of the host to the 25-pin RS-232 standard.

The actual message from the host may be created and sent by commercial software or by specific on-site programming. Cabling, communication parameters, hexadecimal codes, and character information are discussed in the following sections.

EXCEL Printer Set-up

This section describes the set-up procedures to prepare the EXCEL printer for communication with the host computer.

The printer must be programmed to receive messages from the host. The following parameters are set in the EXCEL system software:

- *Baud Rate . . . . . turn to page 11-7*
- *Remote Mode . . . . . turn to page 11-8*
- *INSERT Buffer Size . . . . . turn to page 11-10*
- *Print Matrix Selection . . . . . turn to page 11-12*

The following sections show how to set each parameter.

Baud Rate

The Baud Rate is the speed at which data is received and transmitted. This is set in Frame <02 System>. Use the following procedure to set the Baud Rate.

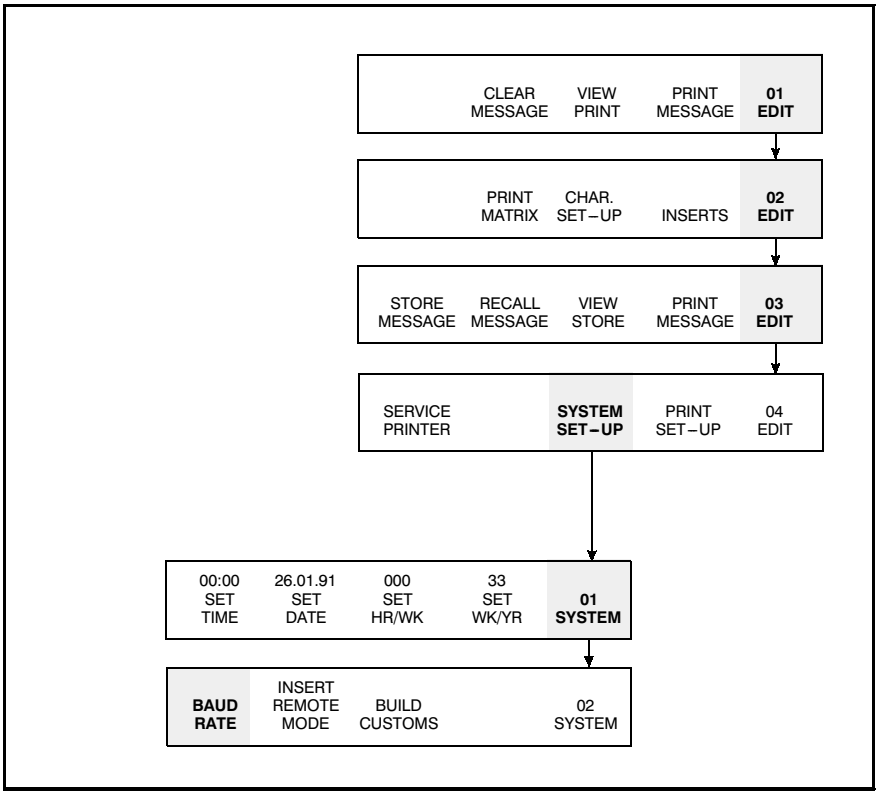


Figure 11-2. Accessing Frame <02 SYSTEM>

Procedure

1. Begin in Frame <02 SYSTEM>. Refer to Figure 11-2.
2. View the current setting above <BAUD RATE>. If desired, press **F1** to change the setting. (Settings: 300, 1200, 2400, 4800, 9600, and 19200.)

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, and the printer will continue to print the last message in the print buffer.

Remote Mode

There are two settings for the Remote Mode: <MESSAGE> and <INSERT>.

Note: Matrix selection must precede Remote Mode setting. Refer to *Select Matrix* on page 11-12.

Message

Message is used when the entire printed message is inserted remotely. When this mode is selected, data from the host is placed into a print buffer and printed at the next product detect received by the printer.

Note: Do not confuse Remote Mode <INSERT> with Insert Mode.

Insert

INSERT is used when data sent to the printer is inserted into a message that has been previously constructed on the printer keyboard.

If INSERT is selected, additional set-up parameters must be selected in the PRINT SET-UP mode. The size of the INSERT message must also be selected at the keyboard. The maximum INSERT buffer size is 31 printed characters in the 16 x 24 matrix. (Refer to *INSERT Buffer Size* on page 11-10.) The INSERT message can be placed at any one point within the fixed message, providing there is sufficient room for the insert.

When INSERT is selected, the format or matrix of the message is constructed at the printer keyboard and cannot be controlled by the external host.

REMOTE MODE (02 SYSTEM): This mode alternates between MESSAGE and INSERT.

If <REMOTE MODE> Is Set to:	Then:
<MESSAGE>	External data transmissions take the place of any messages that are on the display screen.
<INSERT>	External data transmissions are printed alongside messages that are created through the keyboard.

Table 11-1. REMOTE MODE Settings

With the remote mode set to <INSERT>, use the arrow keys to put the cursor in front of, or behind, the other messages.

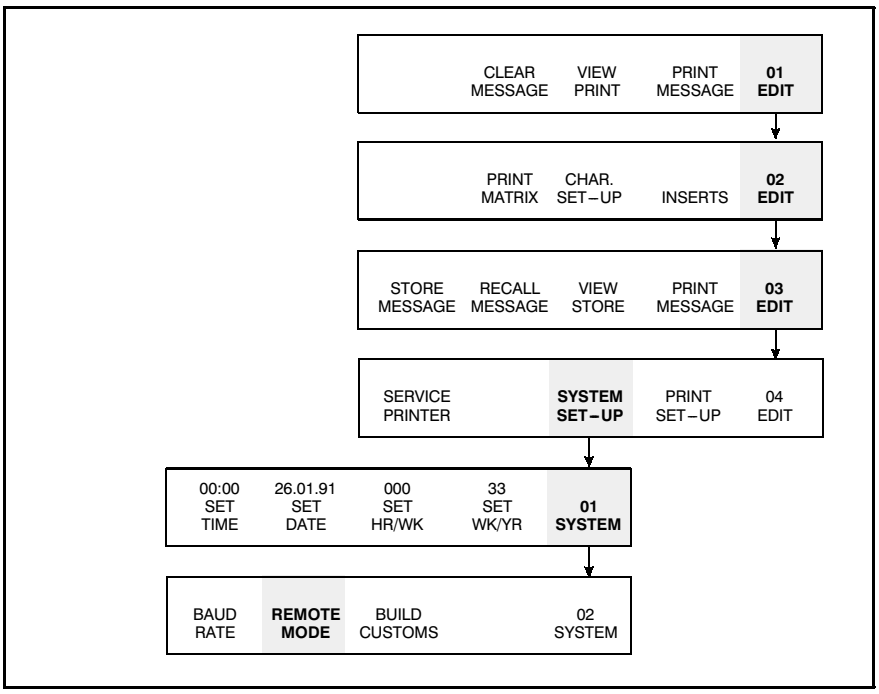


Figure 11-3. Accessing Frame <02 SYSTEM>

Procedure

This procedure shows you how to set the remote mode for external data transmission.

1. Begin in Frame <02 SYSTEM>. Refer to Figure 11-3.
2. View the current setting above <REMOTE MODE>. If desired, press **F2** to change the setting. (Settings: MESSAGE and INSERT.)

Note: If INSERT is selected, then INSERT buffer size must be set. Refer to *INSERT Buffer Size* on page 11-10.

3. Press the **ENTER** key to save the setting.

INSERT Buffer Size

The INSERT buffer size is the input storage capacity of the INSERT buffer, which receives Remote Mode INSERT data from the host. INSERT buffer size is set when INSERT is selected in the Remote mode.

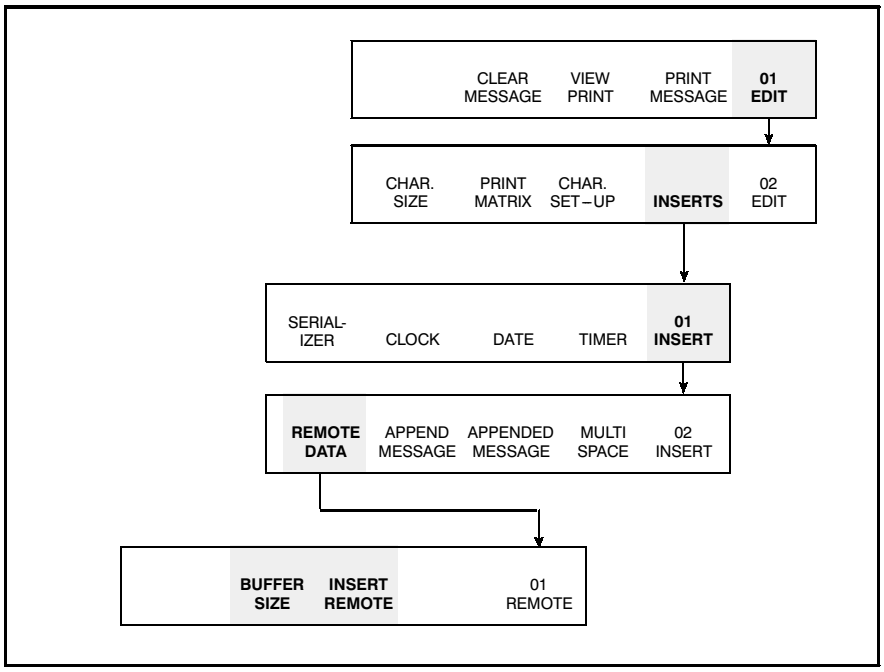


Figure 11-4. Accessing Frame <01 REMOTE>

Procedure

1. Begin in Frame <01 REMOTE>. Refer to Figure 11-4.
2. Use the arrow keys to move the cursor to the location in the message where you want the insert to appear.
3. Press **F2** to select <BUFFER SIZE>. The following appears in the display screen:

   ENTER BUFFER SIZE (1-32) – – – ▶

4. Use the numeric keyboard to enter the buffer size. The entry must be between 1-32.

   The INSERT buffer size is the maximum number of characters that appear in the longest line of the Remote Mode INSERT data, plus one character for the carriage return (indicating the end of the message).

For example:

The longest line is 25 characters. You must enter 26 as the INSERT buffer size (since you need to consider the carriage return as one character).

Note: If the data sent from the host is formatted without a carriage return (hex code 00D), then the INSERT buffer size must be set to the exact number of characters required for the insert.

5. Press the **ENTER** key. Frame <01 REMOTE> reappears in the display screen.

6. Press **F3** to select <INSERT REMOTE>. The insert will appear in the message as “insert remote symbols.” Refer to Figure 11-5.

A remote insert remote symbol will appear for each character entered in <BUFFER SIZE>. If the <BUFFER SIZE> option is set to 8, eight insert remote symbols will appear in the message where the remote information will be printed. Refer to Figure 11-5.

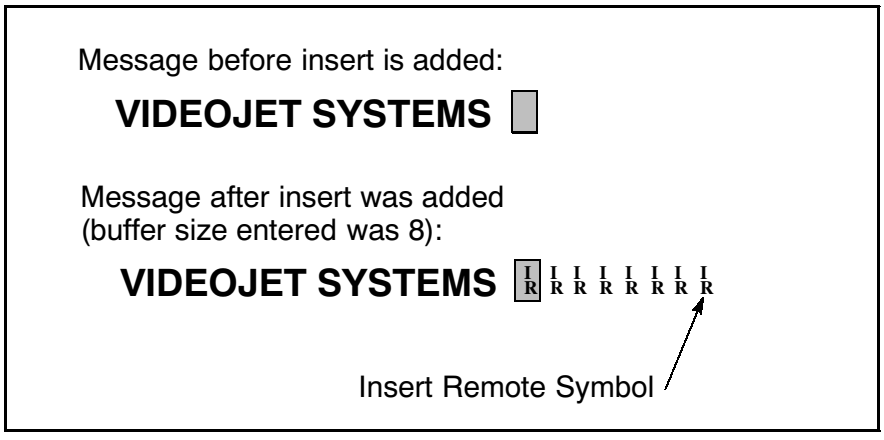


Figure 11-5. Message with a Remote Insert

Print Matrix Selection

Select your print matrix in Frame <02 EDIT> after selecting Remote Mode <INSERT>.

Note: Print matrix selection requires you to first select Remote Mode <INSERT>, regardless of whether the message(s) will be sent in Remote Mode <MESSAGE> or Remote Mode <INSERT>. Refer to *Remote Mode* on page 11-8 to select Remote Mode <INSERT>.

The following are set up through the EDIT mode of the printer software: Print matrix selection, INSERT mode, and SYSTEM SET-UP mode.

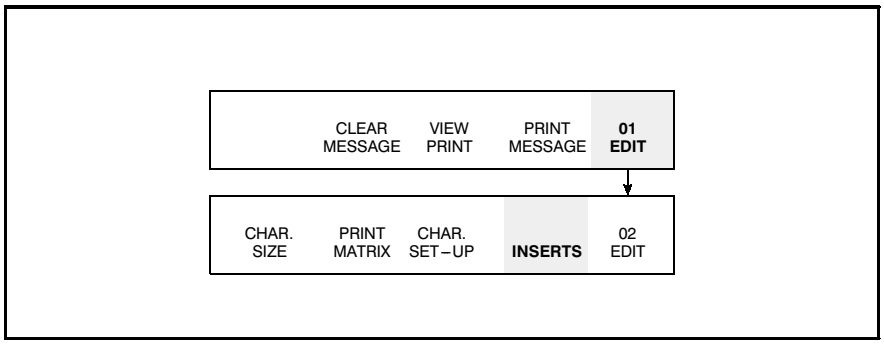


Figure 11-6. Print Matrix Selection

1. Select Remote Mode <INSERT>. Refer to *Remote Mode* on page11-8.
2. Select Frame <02 EDIT>. Refer to Figure 11-6.
3. Press **F2** repeatedly to view all of the print matrix selections.

Note: **F2** will not respond unless the display screen is cleared of all messages.

4. Stop pressing **F2** when the desired print matrix appears in the display above the **F2** key.
5. Press **F5** until Frame <01 EDIT> appears.
6. Press **F4** <PRINT MESSAGE>. This loads the print matrix into the print buffer.
7. Now that the print matrix is selected, select Remote Mode <INSERT> or <MESSAGE> as required for the message(s) using the selected print matrix. Refer to *Remote Mode* on page 11-8.

Cable Set-up

This section contains basic installation procedures, the RS-232 designation of required pins, and sample cable configurations.

Refer to the page number listed to locate the information found in this section.

- *Installation . . . . . below*
- *RS-232 Designations . . . . . turn to page 11-14*
- *Cable Configurations . . . . . turn to page 11-16*

Installation

Connect the host to the controlling data lines with a D-type female 25-pin connector. Use J8, located on the right -hand side of the control board, as the serial interface connection. (Refer to Figure 11-7.) The printer voltage tolerances conform to the Input/Output voltages specified in the RS-232 standard.

Connect the RS-232 data source (host) to the mating connector through the side port of the printer cabinet. Disconnect the cable from the connector, pass the cable through the port, and then reconnect the wires. Mark the wires properly for re-insertion.

RS-232 Designations

The RS-232 specification calls for 25 conductors. However, applications with the host require less than the full 25 pins, so it may be more efficient to maintain only the required pins. This decreases signals that may interfere with communication.

The complete RS-232 specifications for pins used by the EXCEL 170i are listed in Table 11-2.

RS-232 EIA Modem Terminal Interface Connections (for Pins Used by EXCEL 170i)						
Pin	**Name**	**From**	**To**	**Function**	**Circuit**	
					CCITT V.24	**EIA RS-232**
1	FG			FRAME GROUND	101	(AA)
2	TD	DTE	DCE	TRANSMITTED DATA	103	(BA)
3	RD	DCE	DTE	RECEIVED DATA	104	(BB)
4	RTS	DTE	DCE	REQUEST TO SEND	105	(CA)
5	CTS	DCE	DTE	CLEAR TO SEND	106	(CB)
6	DSR	DCE	DTE	DATA SET READY	107	(CC)
7	SG			SIGNAL GROUND	102	(AB)
8	DCD	DCE	DTE	DATA CARRIER DETECT	109	(CF)
20	DTR	DTE	DCE	DATA TERMINAL READY	108.2	(CD)

Table 11-2. RS-232 Serial Interface Standard (only pins used by EXCEL 170i)

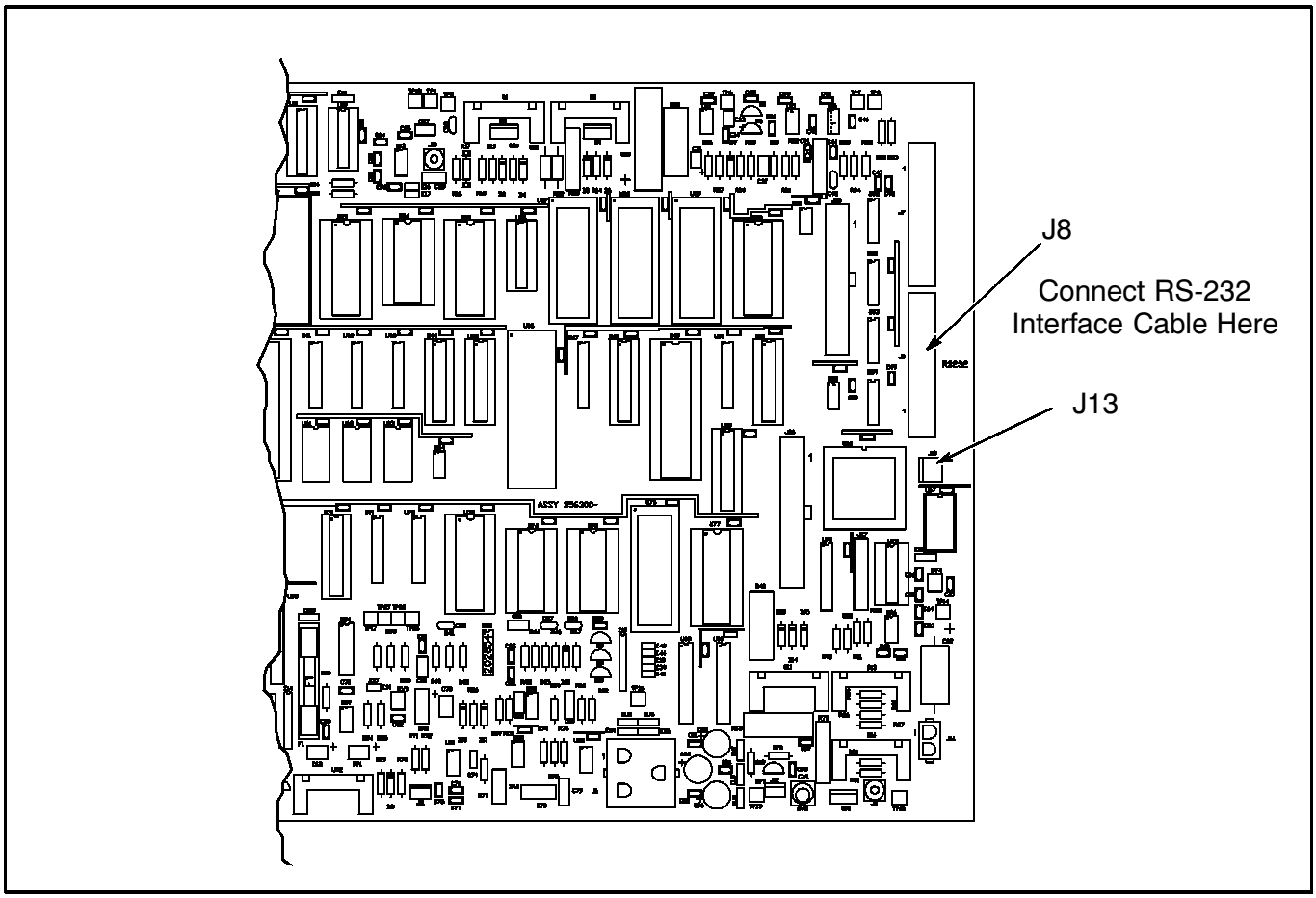


Figure 11-7. RS-232 Data Port and Jumper Locations

CAUTION: The cable descriptions for the host are as listed in the RS-232 specifications. Do not assume that all RS-232 devices can be cabled to the EXCEL "as is." Certain host devices may not be able to provide or receive the control signals described.

Special cables may be required for certain applications. If the host does not provide the signals, then steps must be taken to either insert or remove the jumpers for the required signals and accomplish either cross-over cable or software handshaking.

The "standard" interface cables (straight, null, reverse, cross-over and software only) are defined in the following sections. These signals cannot be disabled on the printer.

Cable Configurations

This section describes the standard interface connections required by the printer. Included are several cable configurations which have been used successfully to communicate between various hosts and the printer.

While these configurations cover many applications, they should not be viewed as correct for every hardware and software environment. Rather, they are illustrated here strictly for informational purposes. Each situation must be studied for possible application of these cable configurations for any particular environment.

The RS-232 standard specifies a maximum cable length of 50 feet (15.25 m) between the printer and the host. This length is due to the effects of inductance and capacitance on transmitted voltages over longer distances. The effect of inductance and capacitance is reduced at a lower baud rate. If a distance of greater than 50 feet must be used, a voltage amplifier (short haul modem) is recommended.

Shielded Cable Precaution

Pin 1 of the RS-232 specification is described as protective ground. A shielded connection is connected to pin 1. The shield is connected on only one side of the communication cable.

Note: Do not connect the shield to Pin 1 of both communicating devices. “Ground Loop Interference” pick-up may result.

Since the Printer Interface pin 1 is connected to Earth Ground, connect the shield to this port. If the host device or source already has Earth Ground tied to pin 1, disable EXCEL pin 1 by removing connector J13, located on the right-hand side of the control board. (Refer to Figure 11-7 on page 11-15.)

RS-232 Straight Cable

A straight cable may be used when the printer interface is connected to a modem. Since the printer interface is a DTE (Data Terminal Equipment) device and the modem is a DCE (Data Communication Equipment) device, the communication signal can run straight through. (Refer to Figure 11-8.)

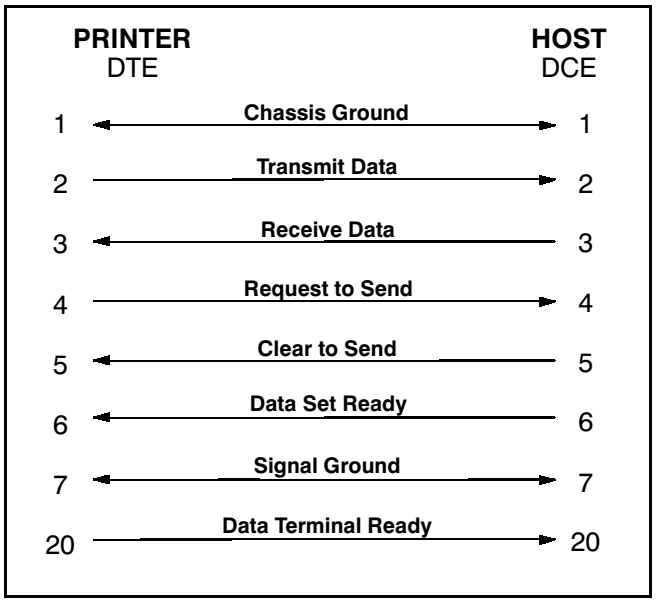


Figure 11-8. Straight Cable Interface

Cross-over, Null, Reverse Cable

This cable may be used when the printer interface, a DTE device, is connected to a DTE host. Since both communicating devices are of the same type, a cross-over cable must be used. This allows both devices to transmit and use the proper signals. If cross-over is not accomplished, both devices will transmit and receive on the same lines and cancel out both functions.

Notice that pin 8 of the host is connected to pin 20 on the printer interface side of the communication channel. (Refer to Figure 11-9.) The effect of this connection is to keep pin 8 (Carrier Detect) of the host TRUE at all times.

Certain software communication packages running on a host sometimes require a carrier detect signal as a flag to indicate that a communication device is connected to the host's port. If the signal is not there, the host cannot talk to the RS-232 port. The jumpered pins 20 and 8 effectively supply this signal to the host.

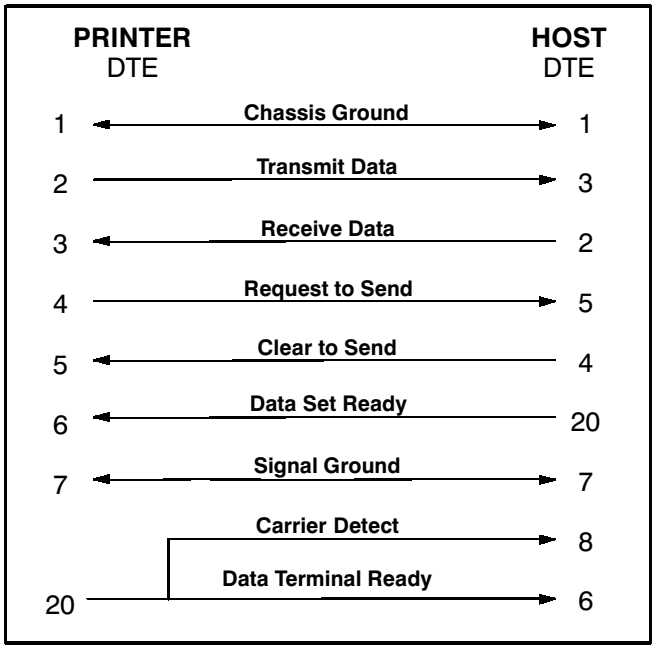


Figure 11-9. Cross-over, Null, Reverse Cable

Reverse Software Handshaking

This type of cable is used when a host cannot provide any form of hardware handshaking. This cabling forces all hardware handshaking to the TRUE. With the hardware handshaking jumpered out, only software handshaking (refer to *Data Flow Control* on page 11-32) is active in this cable arrangement. (Refer to Figure 11-10.)

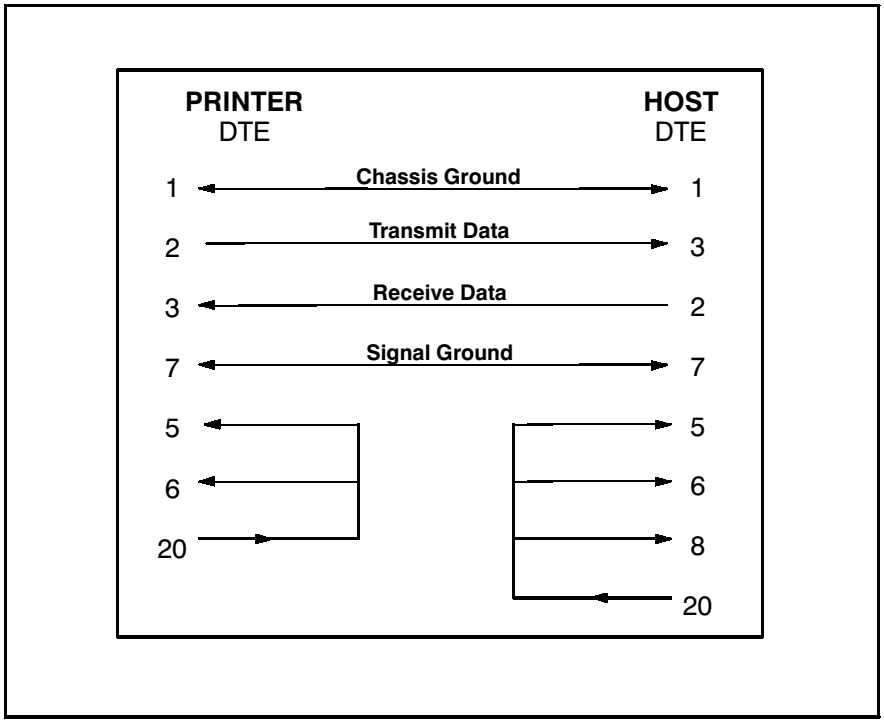


Figure 11-10. Software Handshaking Cable

Note: Since the hardware handshaking of the printer interface cannot be defeated, ignoring these signal requirements will prevent the printer interface from receiving or transmitting data.

Printed Message Set-up

Refer to the page number listed to locate the information found in this section.

- *General Information . . . . . below*
- *Character Set . . . . . turn to page 11-21*
- *Delimiting Messages . . . . . turn to page 11-21*
- *RS-232 Command Set . . . . . turn to page 11-22*
- *Single Line Mode . . . . . turn to page 11-25*
- *Twin Line Mode . . . . . turn to page 11-25*
- *Selecting Twin/Single Line in 10 x 16 Print Matrix . . . . . turn to page 11-27*
- *Selecting Font in 16 x 24 Print Matrix . . . turn to page 11-28*
- *Message Mode . . . . . turn to page 11-29*
- *Insert Mode . . . . . turn to page 11-29*
- *Append Message . . . . . turn to page 11-29*

General Information

This section describes the set-up of messages from the host.

1. Select MESSAGE or INSERT in Frame <02 System>.
2. If INSERT is selected:
   a. the INSERT buffer size must be established in the Insert mode, Frame <01 REMOTE> (refer to page 11-10 for the procedure).
   b. the desired matrix must be selected from the Edit mode prior to inserting remote data.
   c. <PRINT MESSAGE> must be pressed in Frame <01 EDIT> or Frame <03 EDIT> to activate these selections.

Character Set

The printer comes with a built-in set of characters. The character sets vary slightly, depending on the font selected. These include:

- blank space
- letters of the alphabet
- numerals 0-9
- standard punctuation marks
- standard graphics characters which appear on most typewriters (such as +, =, <, >, @, &, etc.)
- an extended graphics characters set. This includes a variety of characters, especially useful for international applications such as international currency symbols; letters with umlauts, accents, and angstroms; Arabic numbers; and other commonly used symbols
- custom characters

Delimiting Messages

Messages sent to the printer should be delimited with a carriage return (CR) (code 0D). If a host sends a line feed (LF) character (code 0A), it is ignored. If a carriage return character is not present, the printer will truncate messages at the appropriate message size limit and begin loading a new message if the communications buffer still contains data.

RS-232 Command Set

Refer to Table 11-3 for the command set for EXCEL 170i Printers.

Command Description	Command (hex code)	Page Number
System Query		
Print Status Inquiry	1B,13	11-34
System Control		
Reinitialize RS-232	1B,18,21,00	11-33
Clear Communications and Print Buffers	1B,18,21,01	11-34
Data Fonts		
Select 10 x 16 Single Line	1B,81	11-25
Select 16 x 24 Single Line	1B,B8	11-28
Select 10 x 16 Twin Line	1B,80	11-27
Select 5 x 7 Triple Line	1B,B9	11-28
Select 5 x 7/10 x 16 Twin Line	1B,BA	11-28
Select 10 x 16/5 x 7 Twin Line	1B,BB	11-28
Data Graphic		
Include ROM Graphic #1-#8	1B,92-99	11-23
Data Custom		
Include Custom Character #0	1B,BC	11-23
Include Custom Character #1-#2	1B,90-91	11-23
Include Custom Character #3-#9	1B,BD-C3	11-23
Data Bar Codes		
2 of 5I, Start	1B,8C	11-24
2 of 5I, Stop	1B,8D	11-24
Code 39, Start	1B,8E	11-24
Code 39, Stop	1B,8F	11-24

Table 11-3. RS-232 Command Set (EXCEL 170i Printers)

Inserting Custom Characters into Message

The following commands allow custom characters to be inserted anywhere into a message. Up to 10 custom characters can be saved; they are numbered 0 through 9.

The custom character must be built and saved from the printer keyboard. The commands are valid in all print matrices.

To select the first custom character, place the hex code (1B, BC) into the message data where you wish the character to appear.

Hex Codes	Command
1B, BC	Custom Character 0
1B, 90	Custom Character 1
1B, 91	Custom Character 2
1B, BD	Custom Character 3
1B, BE	Custom Character 4
1B, BF	Custom Character 5
1B, C0	Custom Character 6
1B, C1	Custom Character 7
1B, C2	Custom Character 8
1B, C3	Custom Character 9

Insert Graphics Character into Message

The following commands allow the ROM graphic characters purchased from VIDEOJET to be inserted into the message. The commands are valid in the 10 x 16 and 16 x 24 print matrices only, while in single-line character mode. Insert the code for the desired graphics character at the appropriate point in the message.

Hex Codes	Command
1B, 92	Graphic Character 1
1B, 93	Graphic Character 2
1B, 94	Graphic Character 3
1B, 95	Graphic Character 4
1B, 96	Graphic Character 5
1B, 97	Graphic Character 6
1B, 98	Graphic Character 7
1B, 99	Graphic Character 8

Insert Code 39 Bar Code into Message

The following commands allow the host to switch in and out of Code 39 Bar code font. The commands are valid in the 10 x 16 and 16 x 24 print matrices only. **The host should select the single line font before issuing the start command.**

The command to print bar codes is sent directly before the characters that are to be printed as a bar code.

After sending the Bar Code font On instruction (Start: 1B, 8E), send the alpha or numeric characters that are to be printed as a bar code. These characters will automatically be translated into their bar code equivalents.

Then, send the Bar Code Off instruction (Stop: 1B, 8F) to return to printing normal characters.

Hex Codes	Command
1B, 8E	Code 39 Start Command
1B, 8F	Code 39 Stop Command

Insert Interleaved 2 of 5 Bar Code into Message

The following commands allow the host to switch in and out of Interleaved 2 of 5 Bar code font. The commands are valid in the 10 x 16 and 16 x 24 print matrices only. **The host should select the single line font before issuing the start command.**

The instruction to print bar codes is sent like a message parameter, directly before the characters that are to be printed as a bar code.

After sending the Bar Code font On instruction (Start: 1B, 8C), send the numeric characters (an even number of numeric characters only) that are to be printed as a bar code. These characters will automatically be translated into their bar code equivalents.

Then, send the Bar Code Off instruction (Stop: 1B, 8D) to return to printing normal characters.

Hex Codes	Command
1B, 8C	Interleaved 2 of 5 Start Command
1B, 8D	Interleaved 2 of 5 Stop Command

Single Line Mode

Messages with invalid data or control characters will be printed by the printer as a “?”. The printer will attempt to maintain communication at all times. If the communication from the host becomes garbled, the printer will send a communication error message to the host (refer to *Communication Error Message* on page 11-33) but remain online at all times. If the printer is in a print function mode, the messages being printed could reflect the garbled data coming in at the RS-232 port.

Access single line mode by selecting a single line matrix (7 x 9, 5 x 5) or by using hex codes when in the10 x 16 or 16 x 24 mode.

Hex Codes	Command
1B, 81	Select 10 x 16 single line mode
1B, B8	Select 16 x 24 single line mode

Twin Line Mode

In the following tables, the “^” character represents a space (hex code 020). The symbol “CR” represents the carriage return (hex code 00D).

If TWIN LINE has been selected at the printer keyboard, the RS-232 driver does not translate the incoming data. Since the twin line message is printed with one printhead, both lines of print must come into the port as a single message with a “cr” at the end of the message. The upper or lower lines of a twin line message must be padded with spaces when the messages are not of equal length.

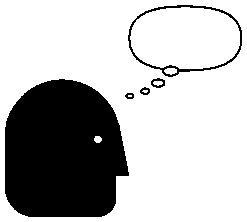
Access twin line mode through keyboard selection, or by using hex codes for the 10 x 16 font only.

Hex Codes	Command
1B, 80	Select 5 x 7 twin line mode

Note: If the printer has been set to run in TWIN LINE, messages in a single line format will be accepted, but will print in an incorrect sequence.

If the printer is set to SINGLE LINE, twin line messages will be accepted, but will print in an incorrect sequence.

Several examples of twin line messages are shown below:



Twin Line Message Examples

Message #1

The following twin line message:

THE
END

should come into the communication port as TEHNED<CR>

Message #2

The following twin line message:

APPLE
TURNOVER

would translate to ATPUPRLNEO^V^E^R^<CR>

Message #3

The following twin line message:

COMPUTER
FORMS

would translate to CFOOMRPMUST^E^R^<CR>

An even number of characters must be sent in each twin line message. If an odd number of characters is sent, the printer driver will insert an ASCII “?” to fill in the missing character.

For example:

Correct	**Incorrect**
TEHNED cr	TEHNE cr
THE	THE
END	EN?

Selecting Twin/Single Line in 10 x 16 Print Matrix

The following commands switch the current message being loaded into twin line mode or single line mode.

In twin line mode, the characters must be sent in the following order: top line character followed by bottom line character. The twin line selection is only valid for the current message.

If an odd number of characters is transmitted in the twin line mode, the printer will respond with a question mark character. The single line mode is the default. The commands are valid only in the 10 x 16 print matrix.

Hex Codes	Command
1B, 80	Select 5 x 7 twin line mode
1B, 81	Select 10 x 16 single line mode

Selecting Font in 16 x 24 Print Matrix

The following commands switch the current message being loaded among the four fonts available in the 16 x 24 print matrix. The four fonts are:

- 16 x 24 single line
- 5 x 7 triple line
- 5 x 7/10 x 16 twin line
- 10 x 16/5 x 7 twin line

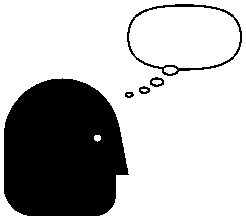
In 5 x 7 triple line mode, the characters must be sent in the following order: top line character, followed by middle line character, then the bottom line character.

In 5 x 7/10 x 16 twin line mode, the characters must be sent in the following order: top two 5 x 7 characters, followed by 10 x 16 character. Refer to the example on the following page.

In 10 x 16/5 x 7 twin line mode, the characters must be sent in the following order: 10 x 16 character, followed by the bottom two 5 x 7 characters. Refer to the example on the following page.

Each message defaults to single line mode. You must specify other font mode information before each message. The other font mode selections are only valid for the current message. If an incorrect number of characters is transmitted in the twin line modes or the triple line mode, the printer will pad the message with question mark character(s).

Hex Codes	Command
1B, B8	Select 16 x 24 single line mode
1B, B9	Select 5 x 7 triple line mode
1B, BA	Select 5 x 7/10 x 16 twin line mode
1B, BB	Select 10 x 16/5 x 7 twin line mode



Twin Line Examples

5 x 7/10 x 16 twin line mode (in 16 x 24 matrix):

USE
BY

should come into the communication port as USBE^Y cr.

10 x 16/5 x 7 twin line mode (in 16 x 24 matrix):

VIDEOJET
SYSTEMS

should come into the communication port as VSYISTDEMES^O^^J^^E^^T^^.

Message Mode

Delimit each message sent to the printer with a carriage return character. Refer to *Delimiting Messages* on page 11-21.

Insert Mode

If set to <INSERT>, the printer expects an exact number of characters. For instance, when an INSERT buffer size of 5 is selected, the driver will collect five characters for printing and consider this a complete message. It does not expect a carriage return. Inserting a carriage return at the end of this message causes the next message to be blank because the printer driver sees the carriage return character when an exact number of characters can be sent.

Not all systems are able to send an exact number of characters. This has been provided for in the following manner: when you need to send <INSERT> messages of varying sizes, define the size of the INSERT buffer to one character larger than your largest INSERT message. This lets you send each message with a carriage return at the end of the string. The driver recognizes the carriage return as the end of that particular message. The largest allowable INSERT message is 31 characters, allowing the carriage return character to be the 32nd character.

Append Message

Activate the Append Message function in Frame <02 INSERT>. An appended message cannot be loaded when the printer is in the MESSAGE mode. Refer to Chapter 6, *Keyboard Operation*, in the *EXCEL Owner's Manual* for additional information on the Append Message function.

Communication Description

Refer to the page number listed to locate the information found in this section.

- *Communication Hardware . . . . . below*
- *False Start Bit Detection . . . . . below*
- *Buffers . . . . . turn to page 11-31*
- *Data Flow Control . . . . . turn to page 11-32*
- *Reinitializing Interface and Buffers . . . turn to page 11-33*
- *Print Status Inquiry . . . . . turn to page 11-34*
- *Additional Information . . . . . turn to page 11-34*

Communication Hardware

The interface USART (Universal Serial Asynchronous Receiver/Transmitter) is a type 82510.

The EXCEL connector is a D type 25-pin male connector.

The printer is a Full Duplex communication device: it can transmit and receive data at the same time.

False Start Bit Detection

The USART provides false start bit detection by analyzing the first communication bit (start bit) sent to it.

The USART divides the start bit into 16 clock cycles. If at the eighth clock tick the start bit is no longer TRUE, then the USART assumes a false start and looks for the next start bit.

As a result of false start bit detection, the transmission of characters to the printer at a bps rate other than what has been selected could result in the following conditions:

- The USART will not accept any characters and it will appear as if characters are not being transmitted to the printer. This is especially noticeable at higher baud rates.
- Received characters will be false, causing improper characters in the print message.

Buffers

The communications (external) buffer is the storage location for data received from the host. It supplies data to the print (internal) buffer. (Refer to Figure 11-11.)

At each product detect, the print buffer requests data from the communications buffer. If the communications buffer cannot supply new data, the printer prints whatever is in the print buffer.

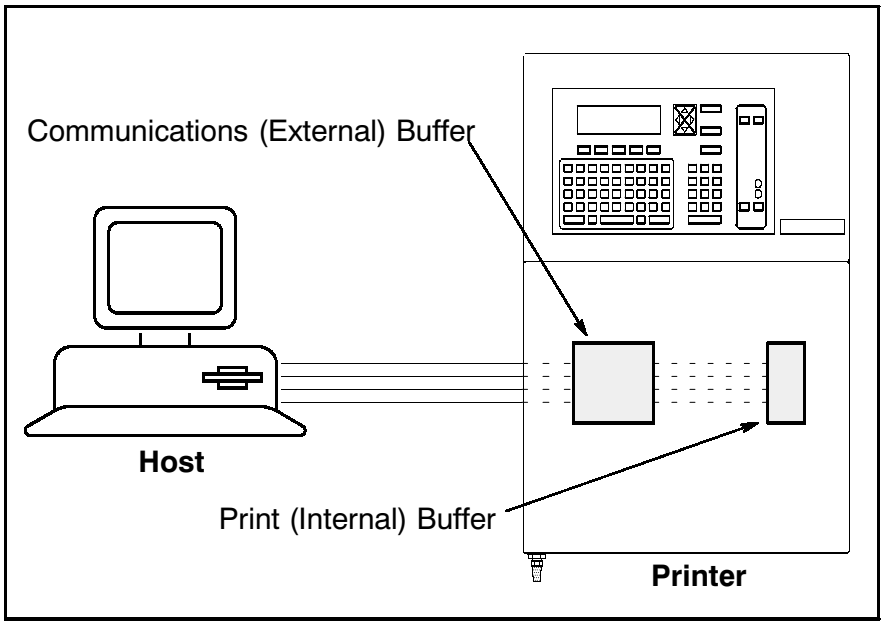


Figure 11-11. Communications Buffer and Print Buffer

Communications Buffer Specifications

Note: Buffer specifications may change with printer software versions.

Buffer Size	3,880 characters
Buffer Full	3,242 characters
Buffer Overfill	3,580 characters
Overflow Buffer	338 characters
Buffer Full Cleared	1,000 characters
Buffer Overfill Cleared	1,000 characters

Data Flow Control

The printer sends both software handshaking and hardware handshaking signals to the host. The host determines which signals it will use for data flow control.

Software Handshaking

Software handshaking is uni-directional: the printer sends X-OFF and X-ON signals to the host. The printer will not respond to software handshaking characters sent from the host.

- X-OFF (hex code 13) is sent to the host when a Buffer Full or Buffer Overfill condition exists. This instructs the host to stop transmission.
- X-ON (hex code 11) is sent to the host when a Buffer Full Cleared condition exists. This instructs the host to resume transmission.

X-ON and X-OFF are transmitted on pin 2 as control data.

Note: There are a variety of situations where the printer sends an X-ON character to the host. It is possible for the printer to send multiple X-ON characters to the host.

When the printer sends X-OFF to the host, time can elapse before the host responds. Any data sent by the host during this time is held in the printer communications buffer's overflow buffer and is not lost.

Hardware Handshaking

Hardware handshaking is bi-directional: the printer and the host send signals to each other.

- When a Buffer Full or Buffer Overfill condition exists, the printer makes pin 4 (RTS) NOT TRUE to instruct the host not to transmit data. If the host ignores this instruction, the printer continues to receive data, which could be lost.
- When a Buffer Full Cleared or Buffer Overfill Cleared condition exists, the printer makes pin 4 (RTS) TRUE to instruct the host to transmit data.

Overflow Buffer Full Message (07, 03)

This message is the printer's last attempt to warn the host that the host has ignored all software handshaking and hardware handshaking instructions to stop data transmission. At this point, the printer is losing data as it is sent from the host.

Printer/Host Online Handshaking

When the printer is On, it makes pin 20 (DTR) TRUE. This indicates to the host that the printer is online.

The printer expects the host to make pin 6 (DSR) TRUE. If it is not, the printer will be incapable of receiving data from the host.

Communication Error Message (07, 02)

The printer sends this message to signal the host that it has detected a transmission error in the sending of data from the host to the printer.

However, if severe communication problems occur, the host will probably not recognize the communication error message from the printer.

The printer should continue to receive data whether or not a clean transmission is received.

Reinitializing Interface and Buffers

The commands that reinitialize the serial interface and the communication and print buffers are sent by the host to the printer.

Any reinitialization command from host to printer should be a single-command transmission. If the command is immediately followed by additional characters—including carriage return or line feed characters—the first printed message will likely contain improper characters.

In the correct procedure, the host sends a single reinitialization command, withholding additional characters to the printer until the printer issues an appropriate response to the host.

Reinitialize RS-232 Serial Interface Command

The Reinitialize RS-232 Serial Interface command is hex code (1B, 18, 21, 00). This command reinitializes all buffers (except the print buffer) and communication lines of the printer. The printer continues to print the last message until new messages are received.

The printer responds with hex code (11, 07, 01, 07, 08).

The printer buffer clears and the printer is now ready to receive a character transmission from the host.

Note: The printer initializes its data buffers and pointers at Start-up.

Clear External and Internal Buffers Command

This command sequence will reinitialize the internal RS-232 flags and buffers. It also clears the printer's print buffer. No message will be printed until a new command is sent. The command sequence is hex code (1B, 18, 21, 01).

The printer will respond with hex code (07, 08, 07, 07).

Print Status Inquiry

The host can inquire about print status. The host sends hex code (1B, 13) to inquire if the **PRINT** key is enabled.

Printer Responses to Host's Print Status Inquiry	
Printer Response (Hex Code)	**Reason**
07, 05	**PRINT** key is Off
07, 06	**PRINT** key is On

Additional Information

The following additional information on the serial interface may prove helpful if troubleshooting is required.

Message Received Regardless of Print Status

The Printer RS-232 communications buffer is always active. The buffer remains active even when the printer is in a non-printing mode, and it continues to receive characters until a Buffer Full condition occurs.

Message Repeat Desired

If a message is sent to the printer and no additional messages are sent, the printer continues to print the same message at each product detect until additional messages are received.

Message Repeat Not Desired

If the printer begins to repeat messages, and this is not the desired result, it is possible that the data is arriving too slowly. If the printer does not receive a new message by the time of the next product detect, the previously transmitted message will print again. Ensure the baud rate is high enough to complement the frequency of your product detect signal.

Message Storage

If all messages from a current run are not used, the messages are maintained and printed first when the next run begins. However, the messages will be lost if the printer is shut down between runs or a command to clear the buffers is received.

False Characters

If a bad host-to-printer transmission occurs, or if the host sends invalid printer characters, the printer may substitute the ASCII “?” character for characters which it does not recognize. This is a warning to the system operator that a problem exists and corrective action is necessary.

Sample Communication Program

QBASIC Sample

The following QBASIC program demonstrates host programming. Remarks lines are bolded for ease of reading. Hex codes are used, but decimal could be used instead [for example, CHR$(27) instead of CHR$(&H1B) for the ESC character]. This program does not read or interpret responses from the printer.

Note: MARCONIdoes not support programming. The sample program is intended only as a guide.

For best results, use a software handshaking cable configuration. Refer to *Reverse Software Handshaking* on page 11-19.

Note: Use the printer keyboard to print a message in the 10 x 16 matrix before switching to Remote Mode <MESSAGE> to run the sample program.

```
CLS
OPEN “COM1:9600,N,8,1: FOR OUTPUT AS #1
PRINT
REM THE FOLLOWING LINE SENDS THE REINITIALIZE RS-232 SERIAL INTERFACE COMMAND
PRINT #1, CHR$(&H1B) + CHR$(&H18) + CHR$(&H21) + CHR#(&H00);
PRINT “RS-232 interface reinitialization sent to printer.”
PRINT “”
FOR T = 1 TO 1000: NEXT T
REM THE FOLLOWING LINE SENDS THE CLEAR EXTERNAL AND INTERNAL BUFFERS COMMAND
PRINT #1, CHR#(&H1B) + CHR$(&H18) + CHR$(&H21) + CHR$(&H01);
PRINT “Printer external and internal buffers cleared.”
PRINT “”
FOR T = 1 TO 1000: NEXT T
REM THE FOLLOWING LINE SENDS A TEXT STRING IN 10 X 16 SINGLE LINE MATRIX
PRINT #1, CHR$(&H1B) + CHR$(&H81) + “170i Printer ”;
REM THE FOLLOWING LINE SENDS THE TEXT STRING “Videojet Systems ” IN 10 X 16 TWIN LINE MATRIX
PRINT #1, CHR$(&H1B) + CHR$(&H80) + “VSiydsetoejmest ”;
REM THE FOLLOWING LINE PUTS THE PRINTER INTO SINGLE LINE MODE FOR THE CODE 39 BAR CODE (BELOW)
PRINT #1, CHR$(&H1B) + CHR$(&H81);
REM THE FOLLOWING LINE SENDS A TEXT STRING IN CODE 39 (BAR CODE)
PRINT #1, CHR$(&H1B) + CHR$(&H8E) + “Videojet Systems” + CHR$(&H1B) + CHR$(&H8F);
REM THE FOLLOWING LINE SENDS CUSTOM CHARACTER #1 FOLLOWED BY
REM A TEXT STRING IN 10 X 16 SINGLE LINE MATRIX
PRINT #1, CHR$(&H1B) + CHR$(&H81) + CHR$(&H1B) + CHR$(&HBC) + “ Test Message” + CHR$(&H0D)
PRINT “”
PRINT “Message sent. Please make a print sample.”
CLOSE #1
END
```

Character Sets

United States Printed Characters		
DEC	**HEX**	**Character Printed**
000	00	Space
001	01	?
002	02	?
003	03	?
004	04	?
005	05	?
006	06	?
007	07	?
008	08	?
009	09	?
010	0A	This character ignored
011	0B	?
012	0C	?
013	0D	This signals end of message
014	0E	?
015	0F	?
016	10	?
017	11	?
018	12	?
019	13	?
020	14	?
021	15	?
022	16	?
023	17	?
024	18	?
025	19	?
026	1A	?
027	1B	?
028	1C	?
029	1D	?

DEC	HEX	Character Printed
030	1E	?
031	1F	?
032	20	Space
033	21	!
034	22	”
035	23	#
036	24	$
037	25	%
038	26	&
039	27	’
040	28	(
041	29	)
042	2A	*
043	2B	+
044	2C	,
045	2D	-
046	2E	.
047	2F	/
048	30	0
049	31	1
050	32	2
051	33	3
052	34	4
053	35	5
054	36	6
055	37	7
056	38	8
057	39	9
058	3A	:
059	3B	;
060	3C	<
061	3D	=
062	3E	>
063	3F	?
064	40	@
065	41	A

DEC	HEX	Character Printed
066	42	B
067	43	C
068	44	D
069	45	E
070	46	F
071	47	G
072	48	H
073	49	I
074	4A	J
075	4B	K
076	4C	L
077	4D	M
078	4E	N
079	4F	O
080	50	P
081	51	Q
082	52	R
083	53	S
084	54	T
085	55	U
086	56	V
087	57	W
088	58	X
089	59	Y
090	5A	Z
091	5B	[
092	5C	\
093	5D	]
094	5E	^
095	5F	■
096	60	‘
097	61	a
098	62	b
099	63	c
100	64	d
101	65	e

DEC	HEX	Character Printed
102	66	f
103	67	g
104	68	h
105	69	i
106	6A	j
107	6B	k
108	6C	l
109	6D	m
110	6E	n
111	6F	o
112	70	p
113	71	q
114	72	r
115	73	s
116	74	t
117	75	u
118	76	v
119	77	w
120	78	x
121	79	y
122	7A	z
123	7B	′
124	7C	|
125	7D	|
126	7E	~
127	7F	▩
128	80	?
129	81	?
130	82	?
131	83	?
132	84	?
133	85	?
134	86	?
135	87	?
136	88	?
137	89	?

DEC	HEX	Character Printed
138	8A	?
139	8B	?
140	8C	?
141	8D	?
142	8E	?
143	8F	?
144	90	?
145	91	?
146	92	?
147	93	?
148	94	?
149	95	?
150	96	?
151	97	?
152	98	?
153	99	?
154	9A	?
155	9B	?
156	9C	?
157	9D	?
158	9E	?
159	9F	?
160	A0	¤
161	A1	¢
162	A2	£
163	A3	p
164	A4	D_m
165	A5	F_r
166	A6	¥
167	A7	°C
168	A8	°F
169	A9	Ñ
170	AA	À
171	AB	Â
172	AC	Ä
173	AD	Æ

DEC	HEX	Character Printed
174	AE	É
175	AF	Ö
176	B0	•
177	B1	\
178	B2	٢
179	B3	٣
180	B4	٤
181	B5	٥
182	B6	٦
183	B7	V
184	B8	Λ
185	B9	٩
186	BA	Ü
187	BB	β
188	BC	∅
189	BD	Ç
190	BE	¼
191	BF	½
192	C0	‘
193	C1	a
194	C2	b
195	C3	c
196	C4	d
197	C5	e
198	C6	f
199	C7	g
200	C8	h
201	C9	i
202	CA	j
203	CB	k
204	CC	l
205	CD	m
206	CE	n
207	CF	o
208	D0	p
209	D1	q

DEC	HEX	Character Printed
210	D2	r
211	D3	s
212	D4	t
213	D5	u
214	D6	v
215	D7	w
216	D8	x
217	D9	y
218	DA	z
219	DB	ı
220	DC	⎜
221	DD	⎜
222	DE	~
223	DF	
224	E0	?
225	E1	?
226	E2	?
227	E3	?
228	E4	?
229	E5	?
230	E6	?
231	E7	?
232	E8	?
233	E9	?
234	EA	?
235	EB	?
236	EC	?
237	ED	?
238	EE	?
239	EF	?
240	F0	?
241	F1	?
242	F2	?
243	F3	?
244	F4	?
245	F5	?

DEC	HEX	Character Printed
246	F6	?
247	F7	?
248	F8	?
249	F9	?
250	FA	?
251	FB	?
252	FC	?
253	FD	?
254	FE	?
255	FF	?

12

Glossary

In this chapter you will find:

- definitions of common terms used in this manual

The following terms are used throughout this manual.

Add Valve

The ink module contains two add valves; one for make-up fluid and one for fresh ink. The valve diaphragms open by vacuum from a solenoid. The valves are used to add replenishment fluid (ink or make-up fluid) to the module.

Air Control Solenoid

This solenoid allows input air into the system. The solenoid remains on for four minutes after the **OFF** key is pressed. The solenoid shuts off immediately when a panic fault occurs. The solenoid automatically turns off five minutes after the **HEAD** key is turned off.

Auto Drain

This function drains fluid from the system during a system flush. Auto Drain shuts off automatically. Use Auto Drain with the bleed tube.

Auto Prime

Auto prime pulls fluid into the ink module during a system flush, and must be shut off by the operator at the keyboard.

Auto Refresh

Auto refresh pulls fluid into the ink module during an ink renewal and system flush. Auto refresh runs for 30 minutes and shuts off automatically.

Automatic Message Reverse

This is a hardware signal which automatically reverses characters and message.

Automatic Phase Control (APC)

This automatic function of the control board tests the ink stream to ensure that drop charging and drop formation occur in synchronization with each other. APC is performed continuously between messages and when the ink is circulating, but the printer is not printing.

Bar

Bar is a measurement of air pressure. 0.0689476 bar equals 1 pound per square inch (psi).

Baud Rate

The baud rate is the speed at which serial communications occurs between the host computer and the printer.

Bleed Tube

The bleed tube is a length of tubing used during a system flush to drain fluid from the system.

Bleed Valve

This component is located on the ink control valve. The bleed valve is used with the bleed tube to bleed ink and air from the system during a system flush.

Breakoff Drop

The breakoff drop is the last drop which is still connected to the ink stream within the charge tunnel.

Charge Tunnel

Located in the printhead, the charge tunnel is an in-line electrode that places a negative charge on ink drops used for printing.

Cleaning Solution

A fluid made by Videojet Systems International, Inc. to be used for cleaning the printhead. DO NOT USE CLEANING SOLUTION IN PLACE OF MAKE-UP FLUID.

Control Board

The control board is the printed circuit board that controls all printer operations.

Control Keys

Control keys are keyboard keys which allow access to printer functions. Refer to Chapter 3, *Using the Keyboard*, in the *EXCEL Owner's Manual* for a definition of each control key.

Deflection Plate

Refer to *High Voltage Deflection Plate*.

Dot Matrix

Refer to *Matrix*.

Electronics Compartment

This section of the printer contains the control board, power supplies and electrical components.

Encoding

An encoder determines the speed at which to print each stroke of the print matrix. There are three types: internal, external, and auto. Internal encoding is used when product speed does not change; an internal clock sets the stroke rate to a constant pace. External encoding is used when product speed varies. A shaft encoder informs the control board of changes in conveyor speed, and the control board adjusts the stroke rate accordingly. Auto encoding is used when the product varies from the speed of the conveyor (product slippage). Auto encoding uses the signal from the product detector to determine the product speed.

Fault

A fault is an online signal to an operator of a printer malfunction. Faults are categorized as normal and panic. The printer shuts down when a fault occurs.

Final Ink Filter

Refer to *Ink Filter*.

Flow Time

Flow Time is the period of time that it takes for the magnetic float within the ink supply cylinder to travel from the start switch to the transfer request switch.

Fluid Pan

The fluid pan contains all hydraulic components. It is located behind the magnetically-latched door on the front of the printer. All pneumatic components are attached to the back of the fluid pan.

Fluids Low

<FLUIDS LOW> is a printer condition that indicates a low fluid level in the fresh ink or make-up replenishment bottle. This 30-minute warning condition precedes a Ink Out Fault.

Fluids Low Needle Valve

The fluids low needle valve is located on the solenoid bank. It controls the flow rate of air into the replenishment bottles that monitors fluid level. Adjust with a screwdriver to about two bubbles per second in the bottles.

Fluids Low Switch (also called Ink Low Switch)

This switch monitors the fluid levels in the ink bottle and make-up fluid bottle through a small amount of air pressure in the bottles. The air flow to this switch is adjusted using the fluids low needle valve (also called ink low needle valve)

Fluids Request Switch

The Fluids Request Switch is a reed switch located within the float stem of the ink module. The fluids request switch closes when the fluid level within the module drops. The switch triggers the addition of either fresh ink or make-up fluid.

Flush

System Flush is a maintenance procedure that is used to purge the system of ink. A flush may be used when preparing the printer for storage, changing ink types, or purging the system of contaminated ink.

Font

Ink drops are arranged in vertical and horizontal patterns within a specific print matrix. Refer to the Keyboard Operation chapter in the Owner's Manual for samples of each font.

HELP Key

When pressed, the **HELP** key provides information about printer reed switch settings and component operations at the time of a fault.

High Voltage

The printer uses a programmable high voltage level to deflect charged ink drops for printing. The voltage originates at the control board and is sent to the high voltage power supply. There it is amplified 1,000 times to a level of 3,000–6,000 VDC and sent to the high voltage deflection plate in the printhead.

High Voltage Deflection Plate

The high voltage deflection plate is located on the printhead. It receives 3,000–6,000 VDC, which is used to deflect charged ink drops for printing.

Inhibit Switch

A reed switch located within the float assembly of the ink module. The inhibit switch closes when too much make-up fluid or ink is drawn into the module.

Ink

Ink is a colored fluid containing dye and solvent that is used for printing. Ink comes in three bases: water, ketone and alcohol. A fourth VIDEOJET ink category is poly-type.

Ink Add Valve

Refer to *Add Valve*.

Ink Control Valve

Located in the printhead, the ink control valve allows ink to enter the nozzle. About 30 psi (2.1 bar) is required to open this valve.

Ink Control Valve Bleed Port

Refer to *Bleed Valve*.

Ink Filter

This filter is located near the ink supply cylinder. Ink passes through the filter as it flows to the printhead.

Ink Low

Refer to *Fluids Low*.

Ink Low Switch

Refer to *Fluids Low Switch*.

Ink Module

Contains all of the hydraulic components for the ink system, including the ink transfer pump, ink add valve, make-up fluid add valve, fluid level monitor switch, check valve, shut-off valve, and the end of the ink return tube.

Ink Pressure

The ink pressure regulator supplies 40-60 psi (2.8-4.1 bar) of air to the ink supply cylinder. This ink pressure pushes the ink out of the cylinder and to the printhead.

Ink Pressure Regulator

The ink pressure regulator enables you to manually control the amount of air pressure supplied to the ink supply cylinder during a printer calibration. This, in turn, controls the speed of the ink stream to the printhead. Ink pressure is typically set between 40-60 psi (2.8-4.1 bar), depending on the type of ink used.

Ink Renewal

Ink renewal is a maintenance procedure that drains contaminated ink from the printer and replaces it with fresh ink.

Ink Return Block

The ink return block collects those ink droplets that are not used for printing. The return block is attached to the ink return line, which pulls the unused ink back to the ink module. The ink return block also contains a sensing electrode used to detect charged ink drops to monitor the drop chargability when not printing.

Ink Return Line

This tubing is attached to the ink return block and the ink module. Vacuum in the tube pulls unused ink back to the module for recycling.

Ink Stream

The ink stream emits from the nozzle in the printhead. It consists of tiny drops that are either charged and used to form characters, or drawn into the ink return and recycled.

Ink Supply Cylinder (also called Ink Cylinder)

Pressurizes the ink inside the cylinder and pushes it to the printhead (and out through the nozzle). The ink supply cylinder contains a magnetic float and two externally mounted reed switches which are used to monitor ink viscosity and to control the amount of ink entering the cylinder.

Ink Trap

The ink trap is located behind the gauge door, on the line between the ink pressure regulator and the ink supply cylinder. It traps ink in the line.

Input Air

Also refer to *Plant Air*.

Regulated plant air pressure is supplied to the input air manifold assembly (consisting of the input air filter, air control valve, intermediate pressure regulator, transfer pressure regulator, and air control solenoid). The air to the printer should be regulated between 70 and 100 psi (4.8 and 6.9 bar). About 80 psi (5.5 bar) is recommended for best printer operation.

Input Air Filter

This 3-micron filter traps any oil, water or dirt that is not captured by in-line air filters on the plant air line.

Intermediate Air Pressure

This pressure originates at the intermediate pressure regulator and is factory set to 60 psi (4.1 bar). Intermediate pressure supplies the ink low system, the positive air system and the vacuum system.

Intermediate Pressure Regulator

Regulates air pressure to 60 psi (4.1 bar) and distributes the air to the ink low switch and the positive air and vacuum systems.

Note: The regulator is preset to 60 psi (4.1 bar) at the factory. Intermediate air pressure may be checked at a test port on the solenoid bank.

Jumper

A jumper is a small clip with a plastic cover that connects pins electrically on the control board.

LED

A number of Light Emitting Diodes (LEDs) are located on the control board. The LEDs indicate printer operation and are used when troubleshooting. The main LED cluster is shown in Chapter 7, *Troubleshooting*.

Magnifier

A 10x power magnifying glass is supplied with the printer. Use the magnifier to look at ink drops in the charge tunnel when setting the nozzle drive to attain the finest print quality.

Make-up Add Time

Make-up add time is the time period required to add make-up fluid to the ink module. This time is automatically calculated by the control board during operation.

Make-up Add Valve

Refer to *Add Valve*.

Make-up Fluid

Make-up fluid is used to thin the ink when the ink becomes too thick and the flow time increases.

Make-up Inhibit

Make-up add is automatically inhibited by the control board if the fluid level within the module is at the inhibit switch.

Matrix

Ink drops are arranged in vertical and horizontal patterns within a specific print matrix.

No Signal Fault

No Signal faults are detected by the printer during operation. A No Signal fault indicates that ink drops either are not receiving a charge at the printhead, that the charge is not measured properly, or that ink drops are not being formed at the printhead.

Normal Fault

A Normal fault is a printer malfunction that will not cause permanent damage if allowed to continue. These faults initiate the standard four-minute shutdown.

Nozzle

An ultrasonic device which transduces an electrical nozzle drive signal into mechanical motion to break the ink stream into drops. The nozzle is located in the printhead.

Nozzle Drive

The nozzle drive is a 66 kHz (AC voltage) signal. The nozzle drive causes a vibration within the nozzle which breaks the ink stream into drops.

Overfill Switch

This is a reed switch that is located within the float assembly in the ink module. The switch is used to prevent accidental overfill of the module.

Panic Fault

A Panic fault causes an immediate and complete printer shutdown. The Panic fault cannot be reset until the printer is turned Off and the cause is corrected.

Phasing Fault

A phasing fault indicates an improper charge on the ink drops.

Plant Air Input

Regulated plant air pressure is supplied to the input air manifold assembly (consisting of the input air filter, air control valve, intermediate pressure regulator, transfer pressure regulator, and air control solenoid). The air to the printer should be regulated between 70 and 100 psi (4.8 and 6.9 bar). About 80 psi (5.5 bar) is recommended for best printer operation.

Positive Air

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 to between 0.5 and 1.5 SCFH (14-42.47 L/hr).

Positive Air Needle Valve

This needle valve is located on the solenoid bank. The needle valve supplies positive air to the printhead to help keep out contaminants.

Pressure Tank

Refer to *Ink Supply Cylinder*.

Printer Calibration

Printer Calibration is a maintenance procedure in which the ink pressure is set and a new set point time is automatically calculated. Perform this procedure only after an ink renewal or system flush.

Printhead

The printhead contains the components used to turn a pressurized ink stream into minute drops which will be deflected and appear on a product as a printed code. It is connected to the control unit by a 20-foot (6 meter) armored umbilical cable.

Product Detector

A product detector is used to send a signal to the printer when a product is in front of the printhead.

PSI

Unit of air measurement indicating pounds per square inch. One psi is equal to 0.0689476 bar.

Replenishment Bottles

The fluid pan contains one bottle of fresh ink and one bottle of make-up fluid. These fluids are used to replenish what has been lost due to printing and evaporation.

Replenishment Filters

These filters are located on the fresh ink and make-up fluid replenishment lines between the replenishment bottles and the ink module. Replace every 500 hours.

Reservoir

The reservoir is located in the top portion of the ink module. It collects returned ink from the printhead. The reservoir is also used in make-up and ink add sequences. It contains a float assembly and reed switch assembly.

RS-232

Refer to *Serial Interface*.

Satellite

A satellite is a small portion of an ink drop that is created when a drop breaks off from the ink stream.

SCFH

This is an air flow measurement indicating Standard Cubic Feet Per Hour. One SCFH equals 28.3165 liters per hour.

SCFM

An air flow measurement indicating Standard Cubic Feet per Minute.

Sense Signal

During the Automatic Phase Control sequence, the voltage level of the charged ink is collected at the ink return. This signal is sent back to the control board as the sense signal.

Serial Interface

Serial interface is a connection between the printer and a host computer that uses RS-232 protocol to send messages to the printer.

Set Point Time

This is a standard measurement used by the printer to control viscosity. Set point time is automatically calculated by the control board during a printer calibration.

Shaft Encoder

A rotary external shaft encoder is used to provide precise monitoring of product motion for generation and positioning of the printed message.

Shut-off Valve

This valve is the inlet valve between the reservoir and the transfer pump in the ink module. The valve is closed when the transfer solenoid activates.

Solenoid

A solenoid is an electrically operated valve. The printer uses five +12 VDC solenoids in the pneumatic (air) control system.

Start Switch

The start switch is located on the outside of the ink cylinder. It is a magnetically-operated reed switch that monitors fluid level within the cylinder. A magnetic float within the cylinder activates the switch, which is used in measuring flow time.

Stroke Rate

Stroke rate is the amount of print strokes and non-print strokes (spaces) per inch. This number is used by the control board to determine message size.

Supply Bottles

Refer to *Replenishment Bottles*.

Test Print

<TEST PRINT> is a keyboard function that allows the operator to print a sample message while aligning the ink stream.

Transfer

A transfer is the movement of ink from the transfer pump to the ink supply cylinder using air pressure from the transfer solenoid.

Transfer Pressure

Transfer pressure is supplied by the transfer pressure regulator. Set to about 15 psi (1.0 bar) above ink pressure, transfer pressure feeds the transfer solenoid. This air is used in a transfer.

Transfer Pressure Regulator

The transfer pressure regulator supplies air pressure to the ink transfer pump and the shut-off valve in the ink module assembly.

Note: The regulator is factory preset to 15 psi (1 bar) with the ink turned Off. The transfer pressure is 15 psi .(1 bar) over the ink pressure with the ink turned On.

Transfer Pump

The transfer pump is located in the bottom portion of the ink module. It transfers ink from the module to the ink supply cylinder. The pump is operated by transfer pressure from the transfer solenoid.

Transfer Request Switch

The transfer request switch is located on the outside of the ink cylinder. It is a magnetically-operated reed switch that monitors fluid level within the cylinder. A magnetic float within the cylinder activates the switch, which is used to request a transfer.

Vacuum Filter

The vacuum filter prevents ink aerosols from entering the solenoid bank and other passages inside the vacuum system.

Viscosity

Viscosity is the thickness of the ink. The control board monitors ink viscosity with the flow time measurement.

Warning

The control board issues a Warning to alert the operator that a fault could occur if a printer problem is not corrected. All warnings are a time delay until a fault shutdown begins.

A

Appendix A
Specifications

In this appendix you will find:

- technical specifications
- printing specifications
- printer dimensions

Turn to page A- 2 for a chapter-level Table of Contents.

Appendix A Contents

Introduction A-3
Technical Specifications A-3
Printing Specifications A-3
Printer Dimensions A-3
Technical Specifications A-4
Printing Specifications A-6
Printer Dimensions A-7

Introduction

This appendix details the specifications for the printer.

Technical Specifications

• *Technical specifications . . . . . turn to page A- 4*

The technical specifications in this chapter include:

- Physical dimensions
  (also refer to *Printer Dimensions* on page A- 7)
- Temperature ranges
- Electrical requirements
- Nozzle specifications
- Air requirements
- Character set
- Stored messages
- Fonts
- Keyboard
- Display
- External Stroke Rate Input
- Character Height
- Custom Characters/Logo/Graphics
- Data Interface

Printing Specifications

• *Printing specifications . . . . . turn to page A- 6*

The printing specifications in this chapter include:

- Font matrix name
- Software speed
- Characters per second
- Nominal character pitch
- Maximum speed
- Nominal character height range

Printer Dimensions

• *Printer dimensions . . . . . turn to page A- 7*

Technical Specifications

Technical specifications for the printer are listed in Table A-1.

Physical Specifications	
Control Unit	Stainless steel unit requires mounting stand or wall brackets. Height: 24 inches (610 mm) Width: 20 inches (508 mm) Depth: 8 inches (203 mm) (also refer to *Printer Dimensions* on page A- 7)
Printhead	Stainless steel 1.375-inch x 7-inch (35 mm x 178 mm) long printhead; omni-directional and independently programmable. Durable construction allows for easy replacement and realignment. Front and rear hub on printhead chassis.
Umbilical	One 12- or 20-foot (3.7 m or 6.1 m) vinyl-coated armored conduit; 1 inch (25.4 mm) in diameter. Two ink return lines to accommodate both water/poly (0.066-inch [1.7 mm] inside diameter) and/or ketone/alcohol (0.053-inch [1.3 mm] inside diameter) inks.
Shipping Weight	100 lbs. (45.4 kg) packed; 82 lbs. (37 kg) unpacked dry; 86 lbs. (39 kg) with fluid.
Mounting	Eight threaded inserts allow for wall mounting, or mounting to a table. Refer to Figure A-1. For information on the VIDEOJET printer stand refer to Chapter 11, *Accessories and Spare Parts*.
Temperature Range	
Temperature	Operating: 40° to 110°F (4° to 43°C) (not all ink types) Storage (dry): -4° to +140°F (-20° to +60°C)
Humidity	Operating: 10% to 90% R.H. (no condensation) Storage (dry): 5% to 95% R.H. (no condensation)
Electrical Requirements	
Voltage/Frequency	120 VAC, 2 amps maximum; 50/60 Hz
Power Consumption	240 VAC, 4 amps maximum; 50/60 Hz
Nozzle Specifications	
Frequency	66 kilohertz (kHz)
Orifice	66 microns
	Continued on the next page

Table A-1. Technical Specifications

Air Requirements	
Pressure	Minimum 70 psi (4.8 bar); maximum 100 psi (6.9 bar)
Consumption	2 SCFM maximum (3,398 L/hr), 1.5 SCFM (2,548.5 L/hr) typical at 80 psi (5.5 bar)
Quality	Instrument quality (filtered to .03 micron and no more than 1 ppm. oil content, 99% water free)
Pressure Dew Point	Less than 40°F (4°C) at 80 psi (5.5 bars) **Note:** The printer will operate properly when energized with nitrogen rather than air.
Miscellaneous	
Character Set	62 character spaces (standard) using keyboard. Maximum 31 large 16 x 24 characters.
Stored Messages	Message storage capacity: 32 Custom characters per matrix: 10
Fonts	**Single Line**: 5 x 5, 5 x 7, 7 x 9, 10 x 16, 16 x 24 **Twin Line**: 5 x 7/5 x 7, 5 x 7/10 x 16 (16 x 24) **Tri Line**: 5 x 7/5 x 7/5 x 7 (16 x 24)
Printing Specifications	Refer to NO TAG.
Keyboard	Keyboard lockout for security of code. 66 alphanumeric characters, special character keys, symbols, and control keys on moisture and ketone resistant, membrane-type keyboard with a backlit display.
Indexing Display	40 characters by 8 lines plus graphic backlit display (LCD).
External Stroke Rate Input	10,998 pulses per second maximum for 10 characters per inch (4 characters per cm). One pulse required for each 1/60-inch (0.42 mm) of substrate motion.
Character Height	Selectable from the keyboard, sizes range from 1/8 -inch to 1/3 -inch (3.2 mm to 8.6 mm).
Custom Characters/ Logo/Graphics	Keyboard-programmable custom characters/custom logo, graphics available.
Data Interface	128-character ASCII code; RS-232C at baud rates selectable up to 19.2 kilobytes per second.

Table A-1. Technical Specifications, continued

Printing Specifications

Matrix	Software Speed	Chars. per Sec.	Nominal Character Pitch		Maximum Speed		Nominal Character Height Range +/–.02 inch (+/–.508 mm)	
			(char./ inch)	(char./ cm)	(feet/ min.)	(meters/ min.)	min.	max.
5 x 5 SL (single line)	High	1,833	10	4	916	279	0.07 (1.8)	0.13 (3.3)
5 x 7 SL (single line)	High	1,222	10	4	611	1860	0.08 (2.0)	0.15 (3.8)
5 x 7 TL (twin line)	High	524 per line	10	4	262	80	0.08 (2.0)	0.12 (3.0)
5 x 7 TL 10 x 16 (twin line)	Std./Std. tri-line	392 each line	10	4	196	60	0.07 (1.8)	0.11 (2.8)
5 x 7 STL (standard twin line)	Std./Std. triple line	196	10	4	98	30	0.07 (1.8)	0.11 (2.8)
7 x 9 SL (single line)	Std./Std. triple line	407	10	4	203	62	0.13 (3.3)	0.19 (4.8)
10 x 16 SL (single line)	Std./Std. triple line	157	5	2	157	48	0.11 (2.8)	0.22 (5.6)
255 x 16	All	1,880 strokes/ second	60	23.5	157	48	0.22 (5.6)	
Code 39	All	NA	NA	NA	157	48	0.22 (5.6)	
I 2 of 5	All	NA	NA	NA	157	48	0.22 (6.1)	
24-High Bar Code	Std. Triple Line	NA	NA	NA	55	17	0.35 (8.9)	
16 x 24 SL (single line) (16 x 24)	Std. Triple Line	36.6	3.3	1.5	55	17	0.35 (8.9)	
16 x 24 TL (twin line) (5 x 7 + 10 x 16)	Std. Triple Line	55	5	2	55	17	0.10 and 0.20 (2.5 and 5.1)	
16 x 24 Tri-line (up to three 5 x 7s)	Std. Triple Line	110	10	4	55	17	0.10 each line (2.5)	

Note: * at 60 strokes per inch. NA denotes Not Available.

Table A-2. Printing Specifications

Printer Dimensions

Refer to Figure A-1 for the dimensions of the printer.

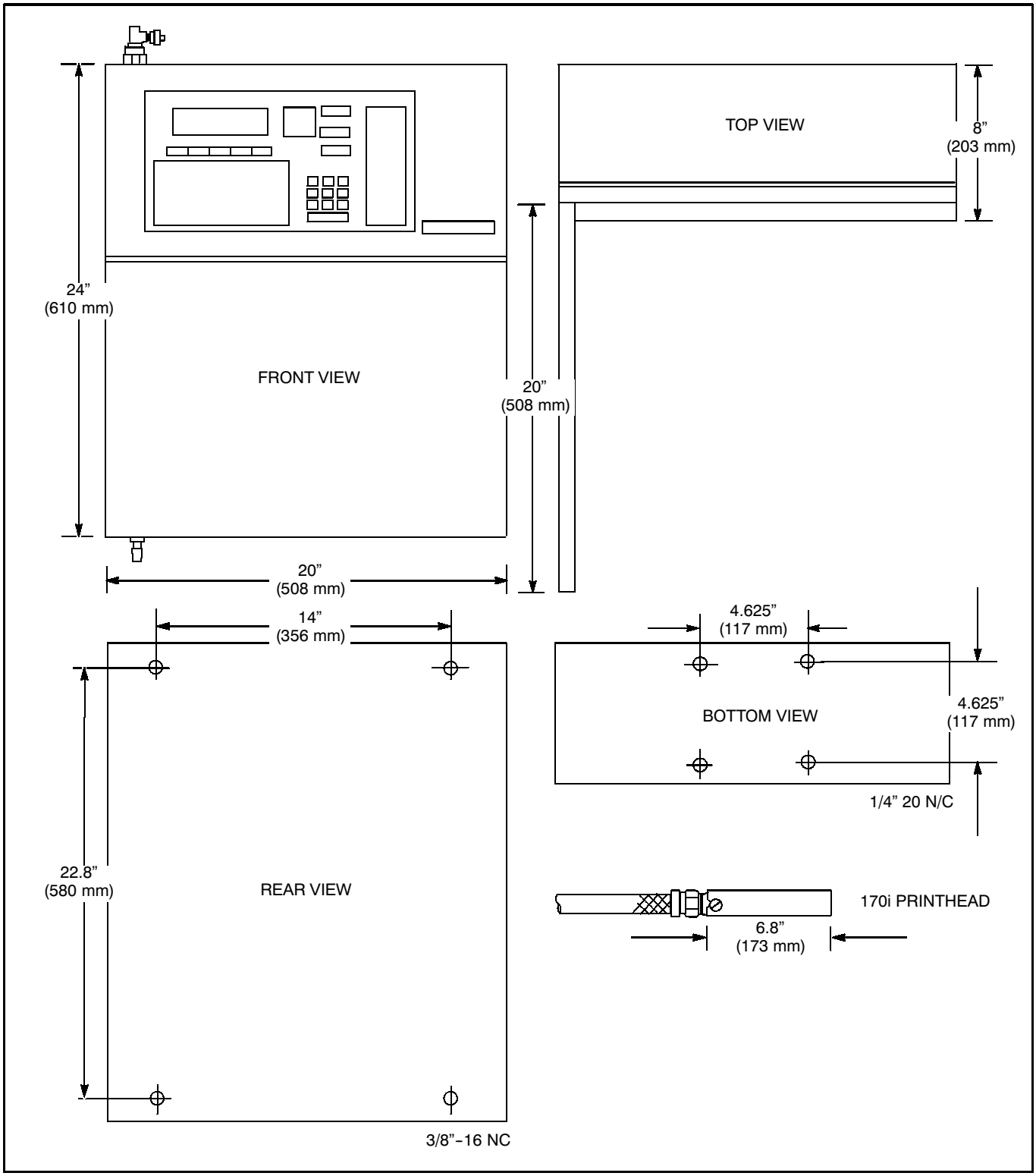


Figure A-1. Printer Dimensions

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