$5.00

# The BrighterWriter™ IP-125/225 Impact Printer

Owner's Manual

Integral Data Systems

# The BrighterWriter™
# IP-125/225 Impact Printer
# Owner's Manual

## Contents



## Appendices




Integral Data Systems, Inc.

14 Tech Circle, Natick, Massachusetts 01760
617 237-7610

## Illustrations



## Tables

# 1. Principles of Operation

## 1.1 Basic Printing Method

The BrighterWriter™ printer is a dot matrix impact printer. It uses a print head with 7 solenoids and print wires. The wires are driven by the solenoids toward the paper, forming a dot where each wire impacts the ribbon onto the paper. By appropriately moving the head and pulsing the solenoids, a 7 x 7 matrix of dots is created to form the required characters.

## 1.2 Physical

The BrighterWriter™ is a table top printer with an internal holder for a roll paper supply. Fan-fold paper can be externally fed through the rear of the printer. The IP-225 model requires pinfed paper, while the IP-125 uses regular paper with a friction feed drive.

The printer is designed to be oriented with the paper coming out toward the user, or facing to the left of the user. In the latter orientation the printing is readable as it exits the printer and the controls are directly accessible. Placing the printer on the left hand edge of a table surface allows the paper to fall free and be torn off easily.

## 1.3 Printing Operation

The BrighterWriter™ printer incorporates a microprocessor controller. The microprocessor controls the motion of the print head, and determines when the print head solenoids are to be energized. When a line is to be printed, the microprocessor starts a synchronous

motor that drives the print head at a constant speed of about 10 inches per second. The microprocessor senses via a LED and phototransistor when the head reaches the beginning of the print portion of a line. By precisely timing the intervals between printing of the columns of dots, characters are formed at the required character density. Different character densities are produced by varying the time intervals between the columns of dots.

The print head moves only as far across the page as is necessary to print the current line. The motor is then reversed by the microprocessor and the print head is returned to the margin rest position in preparation for another line. The time required to print any given line is thus approximately proportional to number of characters in that line.

## 1.4 Paper Motion

Paper motion is performed by a line feed solenoid under microprocessor control. A line feed is initiated either by ASCII control characters received over the interface (LF, VT, CR [if auto line feed switch is "on"], or FF), or the front panel "LINE FEED" or "PAPER" switches.

## 1.5 Character Buffering

Characters for a line are entered into a buffer until a line terminating character is received

(LF, VT, CR or FF). The printing of that line is then initiated. Additional characters for the succeeding lines of print may be received while the current line is printing to the limit of the installed buffer. A control signal is provided to indicate when the microprocessor buffer is full and cannot receive any more data.

## 1.6 Interfaces

### 1.6.1 Serial Interface

The serial interface is designed to accept EIA RS-232 data sources. A Clear-to-Send signal is provided to indicate to the data source when it may send data to the printer. Character data is to be supplied in asynchronous format with 1 start, 8 data/parity and 1 or 2 stop bits. Baud rates of 110,150, 300,600 and 1200 are selectable by switches on the printer controller. The serial interface is wired to the external connector at the factory.

### 1.6.2 Parallel Interface

The parallel interface is an optional interface wiring for the printer and can be done either on request at the factory prior to shipment or by the user. It consists of 7 parallel data lines for character data, a STROBE line for the data source to indicate valid data is present, and an ACKNOWLEDGE line from the printer indicating data has been accepted.

Either positive or negative active logic is available for the STROBE and ACKNOWLEDGE through strapping options on the printer controller.

## 1.7 Paper

Paper in either fan-fold or roll form, and single or multiple copies can be used with the printer. Roll paper is held internally, while fan-fold sheets are fed through the rear of the printer.

## 1.8 Throughput

The rate at which printing can be done is determined by the density of the characters being printed. Since the print head moves at 10 inches per second, the print rates are 83, 100, 120 and 165 characters per second for character densities of 8.3, 10, 12 and 16.5 characters per inch respectively. However, the maximum sustained print rate is generally just under one-half the print rate to account for print head reversal and return time. See Figure 2 for a graph of sustained throughput rates. The rate at which data is received is independent of the print rate.

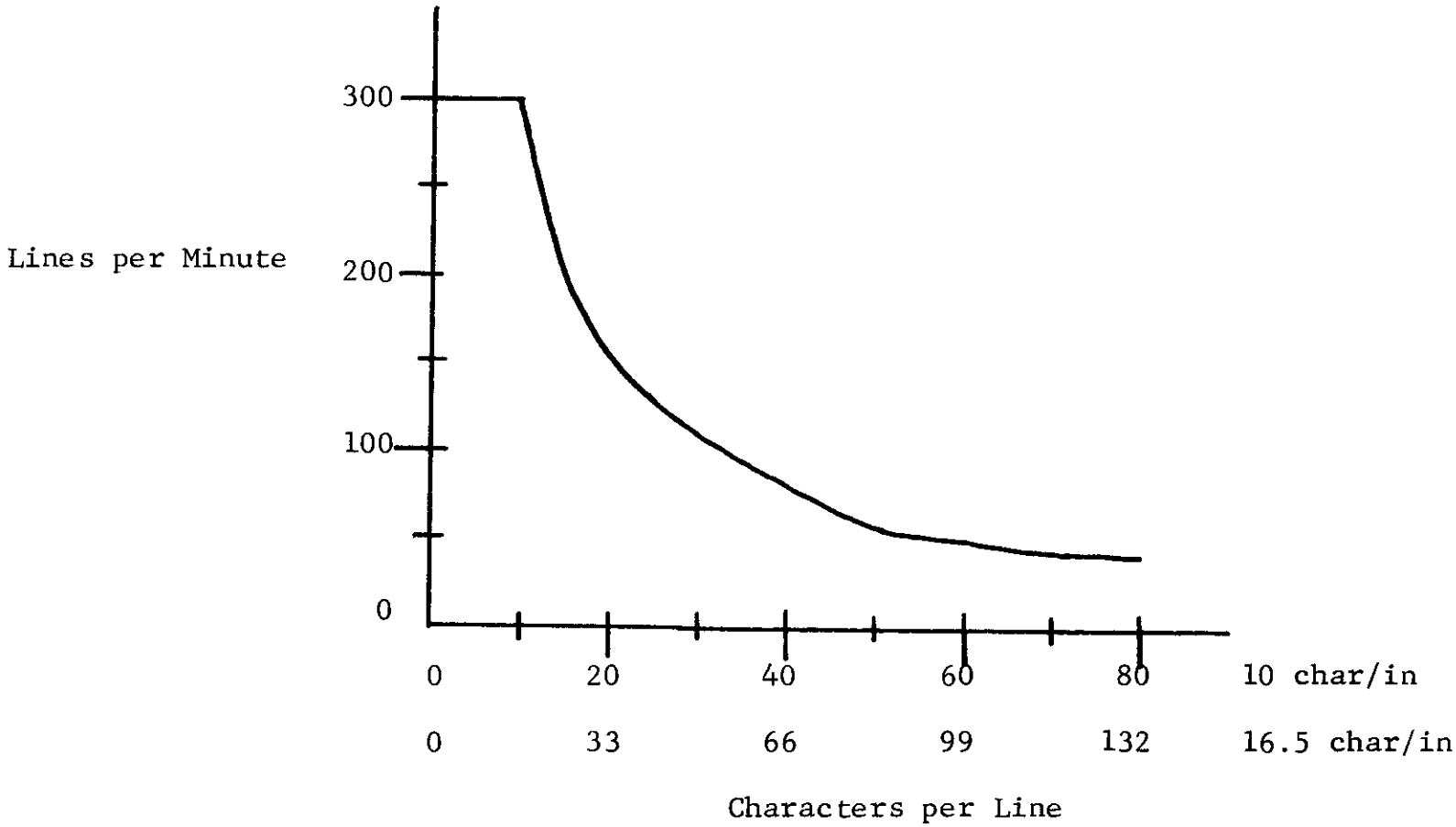



Figure 1

Throughput versus Line Length

The print rate in lines per minute ranges from a maximum of 300 to a minimum of 36 as illustrated in Figure 1.

Caution: Continuous operation for long periods of time at 100 percent duty cycle (continuous characters) at 16.5 characters per inch should be avoided. This can possibly cause excessive thermal load on the print head and result in head failure.

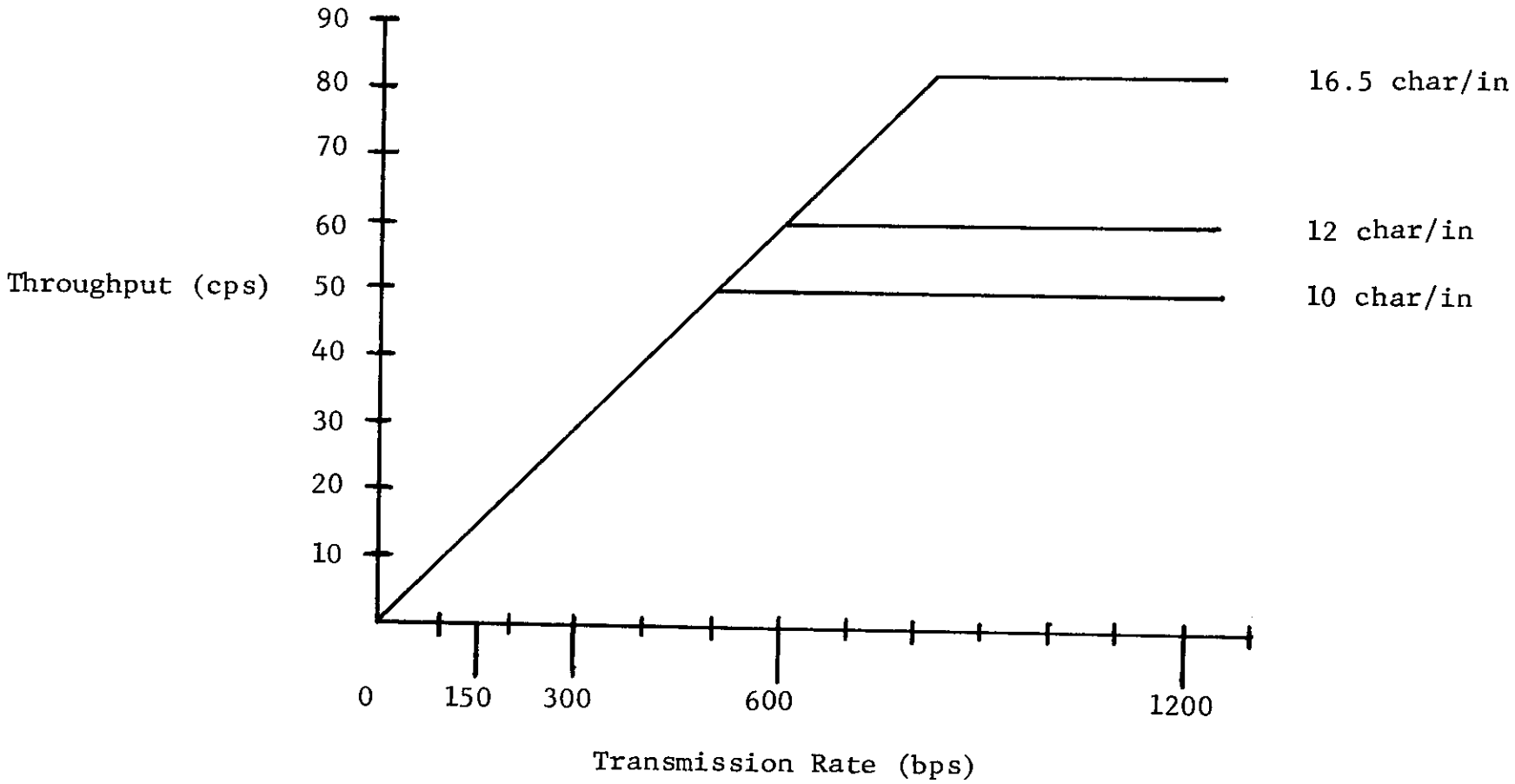



Figure 2

Maximum Throughput versus Transmission Rate

## 2. UNPACKING, INSPECTION AND INSTALLATION

### 2.1 Unpacking and Inspection

After unpacking, temporarily save the packing material in the event of any possible returns. Examine the printer carefully. If there is obvious visable damage from shipping, contact the carrier who assumes responsibility.

Caution: Do not attempt to pry cover open. Read following instructions.

The printer cover is secured by a nylon retainer latch located under the left hand side of the cover. To release the cover, turn this latch one-quarter turn and the cover should now be free to pivot on the hinge at the opposite side. Turning the latch may be easier with a coin or screwdriver. The cover can be secured by turning one-quarter of a turn after closing the cover.

After opening the cover, remove all shipping restraints. Also be sure and remove the labels from the ribbon spools to allow free movement of the ribbon.

### 2.2 Installation

#### 2.2.1 Ribbon Feed

Check to see that the ribbon is threaded as shown in Figure 3.

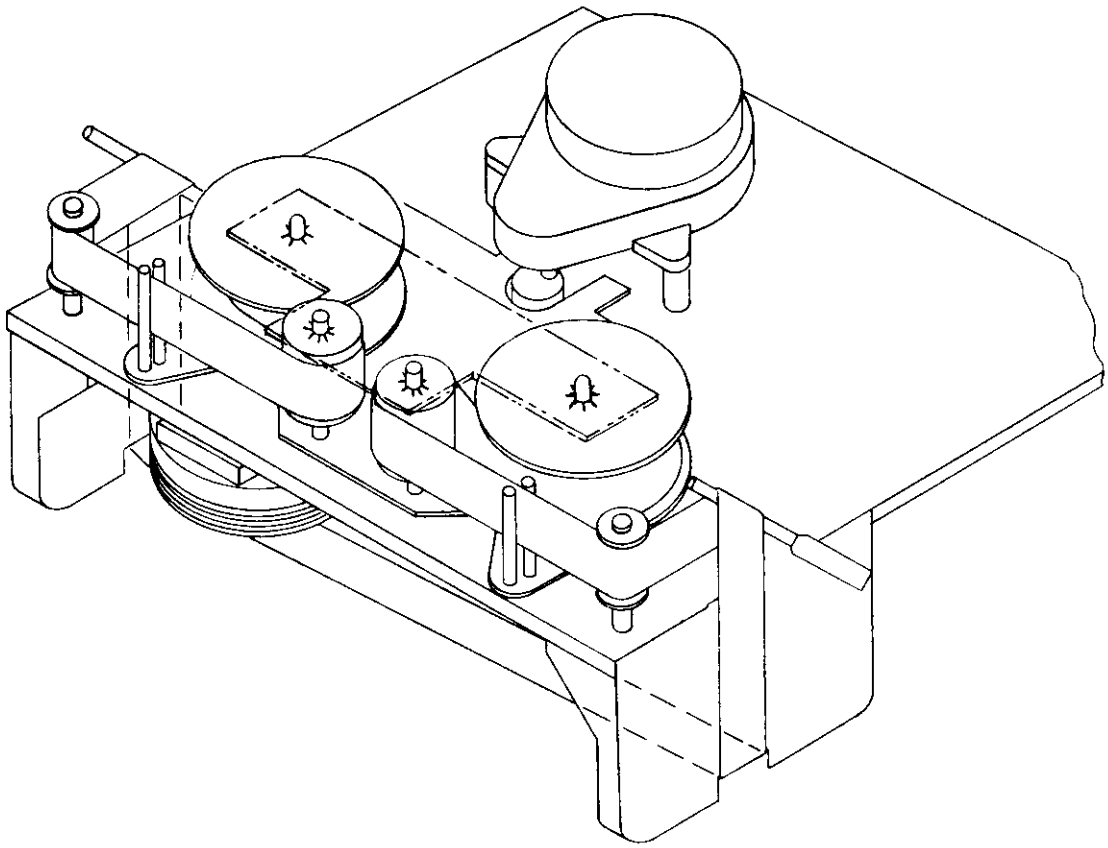


Fig. 3
Ribbon Path

2.2.2 Roll Paper Feed (Model IP-125)

The paper should come off the top of the roll as shown in Figure 4 and go under the pressure plate. The procedure for feeding paper is as follows:

1. Prior to paper loading, unwind approximately 12" and tear or cut square end.
2. Fold end back and up (approximately 2") making a sharp crease square with the edge.
3. Slip folded edge under pressure plate following paper path indicated until contact with advance roller.
4. Depress the LINE FEED or PAPER switch until paper exits from the front.
5. Snap paper roll spindle firmly in place.

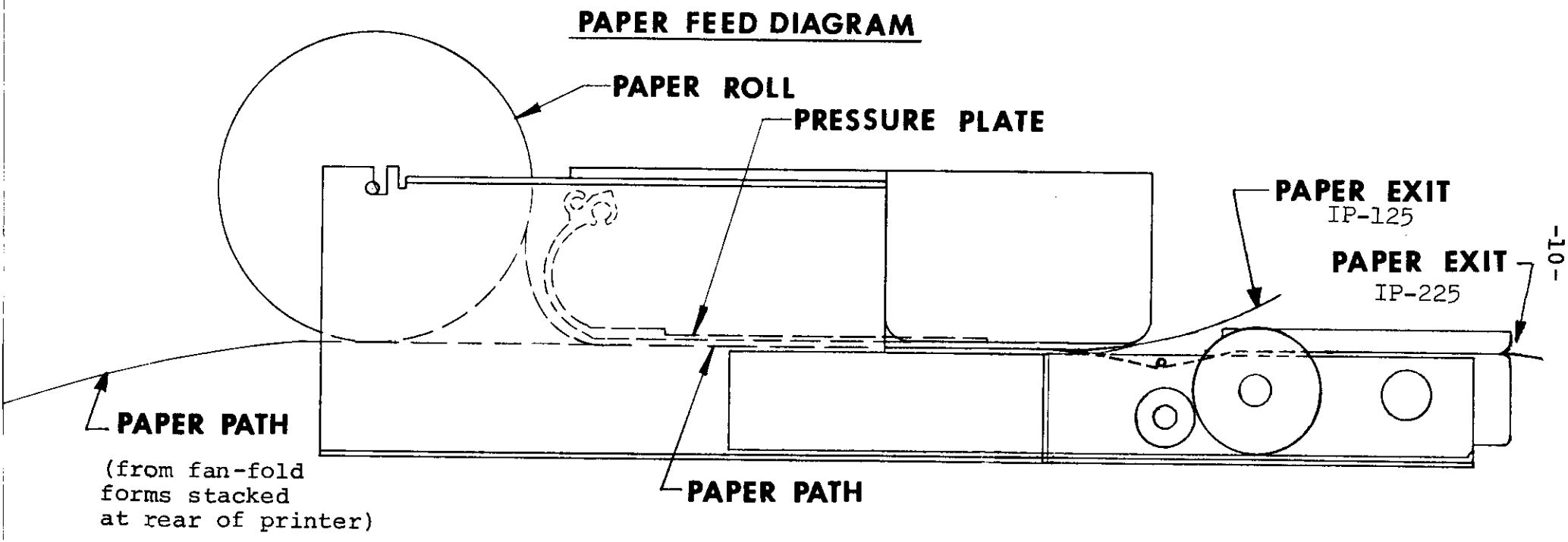



Figure 4

Paper Path

2.2.3 Fan Fold Paper Feed (Model IP-225)

The paper or forms should be stacked at the rear of the printer directly behind the rear opening. Paper should move freely from the top of the stack through the printer as shown in Figure 4. The procedure for feeding paper is as follows:

1. Depress the PAPER switch to reset the form line counter to the top of form. (Note that when the POWER switch is turned on the IP-225 assumes it is on the last line of a form.)
2. Feed the paper through the IP-225, apply slight pressure to the back of the pressure plate to facilitate sliding the paper under the pressure plate.
3. Slide the paper under the thin guide bar between the print head and the tractors.
4. Loosen the tractors by flipping the guide shaft clamp lever up and slide to the correct width. Flip the tractor paper clamps open, insert the paper, and close the paper clamps.
5. Align the tractors carefully so that the paper does not bind on the sides of the print mechansim. Clamp the tractors to the guide shaft being careful to keep the paper slightly taut to prevent bowing of the paper.
6. Use the LINE FEED switch to align the top of the form location, and if desired, verify line position with the TEST switch. Fine adjustment of the vertical position of a line can be accomplished with the LINE FEED switch as each momentary depression of the switch advances the paper one-third of a line.

7. If a line does not appear to be precisely horizontal, or if a finer vertical adjustment of less than one-third of a line is required, the knurled knobs on the tractor drive mechanism can be used to make this fine adjustment. Loosen the knobs and slide the tractor drive mechanism in or out as required. Be sure to tighten knobs securely when positioned correctly.

2.2.4 Initial Test

Plug printer line cord into its AC power source.

NOTE: If upon initial application of power printing starts, depress the alternate action "TEST" switch.

Push the POWER switch. After loading the paper, the printer may be tested with its own self-test mode. Depressing the TEST switch should result in full lines of alphanumeric and graphic symbol test patterns being continuously printed. Depressing the switch again will terminate the test pattern printing.

2.2.5 Initialization and Interconnection

Before attempting to print, verify that the data source format is compatible with the selected state of the printer. The standard factory settings on the internal switches and the power-on defaults will give an initial state as follows:

FACTORY SETTINGS

* 1200 baud, (with 1 or 2 stop bits, and 8 data/ parity bits).
* 10 characters per inch
* Standard text mode.
* All option switches set to OFF.

If the data source requirements are different than above, refer to Section 3 for alternate switch settings.

To connect the printer to the data source, a cable from the source with a female 25 pin EIA-type connector is required. The wiring of this cable and connector must conform to the usage indicated in Appendix A for either the serial or parallel interfaces.

## 3. OPERATION

### 3.1 Operator Front Panel Controls

The four switches on the front panel provide the operator with a minimal set of controls for the printer. The right most switch is the alternating action POWER switch.

The TEST switch is an alternating action switch that is used to put the printer into a self-test mode. When activated, it prints a continuous rotating alpha-numeric and graphic symbol pattern across the full line size.

The PAPER switch is a momentary contact switch that when depressed results in paper being slewed at a rate of approximately 5 lines per second for the IP-225 and 15 lines per second for the IP-125. Slew continues until the top of the next form is reached.

The LINE FEED switch is a momentary contact switch which when depressed results in one-third of a line increment for the IP-225 and one line for the IP-125 with each momentary depression. Holding the LINE FEED switch in for longer than approximately three-quarters of a second results in a continuous paper slew function until the LINE FEED switch is released. The form line count is not affected by the line count during the paper movement. This allows for adjustment of the form position with the LINE FEED switch.

## 3.2 Mode Select Switches

The mode select switches are located in a four pole DIP switch on the controller board. They are used to select parallel or serial mode operation, and to select the baud rate in serial mode. The normal factory setting for these switches is for serial mode at 1200 baud.

To change the switch settings it is necessary first to turn the printer upside down. If you latch the cover and rotate the front of the printer up and over carefully, you can do so without removing the roll of paper. After turning over, remove the rubber feet and base plate.

Caution: Be sure power is removed before removing base plate.

The four pole (smaller) DIP switch should now be visible on the controller. The switch settings are shown in Table 1 where an "x" indicates the switch is "ON".

TABLE 1

MODE SELECT SWITCHES

| | Parallel | Serial (Baud Rate) | | | | |
|---|---|---|---|---|---|---|
| | | 110 | 150 | 300 | 600 | 1200 |
| Switch 1 | | x | x | x | x | |
| 2 | | x | x | | | x |
| 3 | | x | | x | | x |
| 4 | x | | | | | |

## 3.3 Feature Select Switches

The seven pole DIP switch on the controller is used to control various options. Three switches are used to select one of eight form lengths, one switch is used to select an automatic skip of one inch across a forms boundary, one switch is used to select an automatic line feed when an ASCII CR code is received, and two switches are used to select the character density at power-on.

Refer to Section 3.2 above for obtaining access to these switches.

The standard factory setting is for all switches to be "OFF". The switch settings are shown in Table 2.

## TABLE 2

## FEATURE SELECT SWITCHES

### Form Length

| | 3" | 3.5" | 4" | 5.5" | 7" | 8.5" | 11" | 14" |
|---|---|---|---|---|---|---|---|---|
| Switch 1 | | x | | x | | x | | x |
| 2 | | | x | x | | | x | x |
| 3 | | | | | x | x | x | x |

### Auto Page Skip

| | Disabled | Enabled |
|---|---|---|
| Switch 4 | | x |

### Auto Line Feed

| | Disabled | Enabled |
|---|---|---|
| Switch 5 | | x |

### Characters Per Inch

| | 8.3 | 10 | 12 | 16.5 |
|---|---|---|---|---|
| Switch 6 | x | | | x |
| 7 | | | x | x |

## 3.4 Software Control

### 3.4.1 Print Modes

The print modes of the printer are software controllable through use of ASCII control characters. When the printer receives certain control characters it will change modes. The allowable modes and their corresponding ASCII control codes are:

a. Normal (STX) - Standard character font.

b. Enhanced (SOH) - Enhanced (double width) character font.

c. Graphics (ETX) - Each 7 bit character represents the next column of 7 dots to be printed.

A special case exists when the printer is in Graphics (dot plotting) mode. Any control code must then be immediately preceded by the ETX code in order to be recognized as a legal control code. This allows "transparent" graphic operation while still allowing full use of control codes. An ETX code followed by another ETX code in graphics mode results in the value ETX being used as the data character for the next print column. (See Appendix B for more details.)

### 3.4.2 Character Density

Initial character density is selected at power-on by switch settings on the controller. Subsequently the character density may be changed by use of ASCII

control codes. The four densities and their corresponding ASCII control codes are:

a. 8.3 character per inch (FS) - (66 column per line rate for IP-125; 63 for IP-225)

b. 10 character per inch (GS) - (80 column per line rate for IP-125; 77 for IP-225)

c. 12 character per inch (RS) - (96 column per line rate for IP-125; 92 for IP-225)

d. 16.5 character per inch (US) - (132 column per line rate for IP-125; 126 for IP-225)

The selected character density also controls the graphic dot plotting horizontal density with 8.3 characters per inch being approximately 38 dots per inch to approximately 76 dots per inch at 16.5 character per inch.

### 3.4.3 Graphic Symbols

A 32 character set of graphic symbols (see Appendix D) may be selected for use in place of the ASCII lower case symbols by sending an ASCII EOT character. Sending any print mode select character automatically cancels the graphic symbol set selection.

### 3.4.4 Printer Selection

The printer may be put off-line by sending a DC3 control code. It then ignores all received data except a DC1 control code, which will put the printer back on-line.

### 3.4.5 Printing and Paper Movement

Printing and paper movement is controlled by the ASCII CR, VT, LF and FF codes.

a. Carriage Return (CR) - Results in printing the current line, if any, without advancing to the next line, unless the auto line feed switch is on.

b. Vertical Tab (VT) - Results in printing current line, if any, and then advancing one-third of a line if printer is an IP-225 or one line if IP-125.

c. Line Feed (LF) - Results in printing the current line, if any, and advancing to the next line.

d. Form Feed (FF) - Results in printing the current line, if any, and advances to the top of the next form as selected by the form size switches.

# 4. MAINTENANCE

## 4.1 Paper Loading

Paper loading is illustrated in Figure 4 and described in Section 2.2.1. The straight feed through of the Brighter-Writer™ will allow feeding and printing on fanfold, multiple copy form sets, labels or single sheet letterhead. Thicknesses of 3 to 16 mils can be used without platen adjustment. Roll paper is held on the internal holder, while all other forms are fed through rear of printer. Standard pinfeed 8½" x 11" fan fold paper for the IP-225, and 8½" roll paper for the IP-125 is available from Integral Data Systems or through your local business forms supplier.

## 4.2 Ribbon Inking and Loading

An inked ribbon is used with an automatic reversing and reinking mechanism. The ribbon is inked by porous reinking rollers when the print head is in motion.

Ribbon spools should be interchanged after approximately 5 million characters to expose a fresh ribbon surface for printing. After an additional 5 million characters, both ribbon and reinking rollers should be replaced. Ribbon feeding procedures are illustrated in Figure 3 in Section 2.

The ink is oil based with a shelf life of

approximately one year if wrapping material seal is maintained. Reduced ribbon life expectancy can be expected if ribbon and rollers are not fresh.

## 4.3 Lubrication

After approximately 1 million print lines the print head carriage should be oiled. The head carriage contains a cavity with an oiled felt wick. See Figure 5 for the location of felt wick. NYE-623A Oil or equivalent is recommended. Manufacturer of recommended oil is:

William F. Nye, Inc.
P. O. Box G-927
New Bedford, MA 02742

## 4.4 Margin Adjustment

The starting margin of the print line has been set at the factory and should not normally require adjustment. If the margin does appear to require adjustment, it can be done by adjusting the small metal "flag" in the print head carriage that is used to interrupt the photosensor and mark the margin. Using a finger to slide this flag in or out will adjust the margin correspondingly.

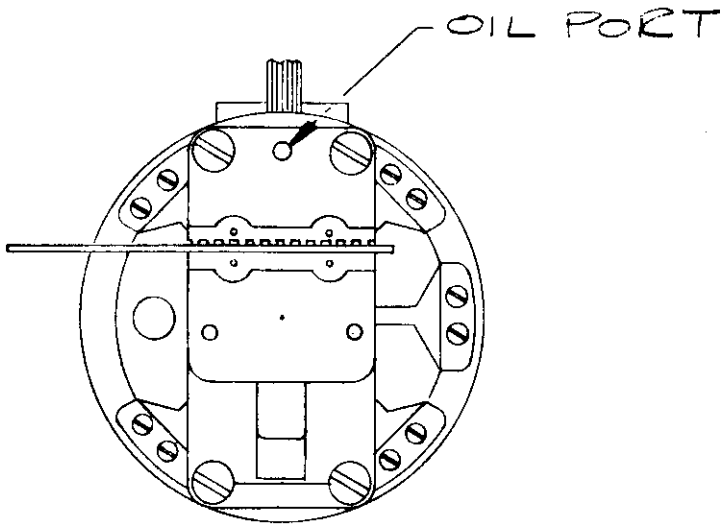



Fig. 5A
Print Head Oil Port Location Pictorial

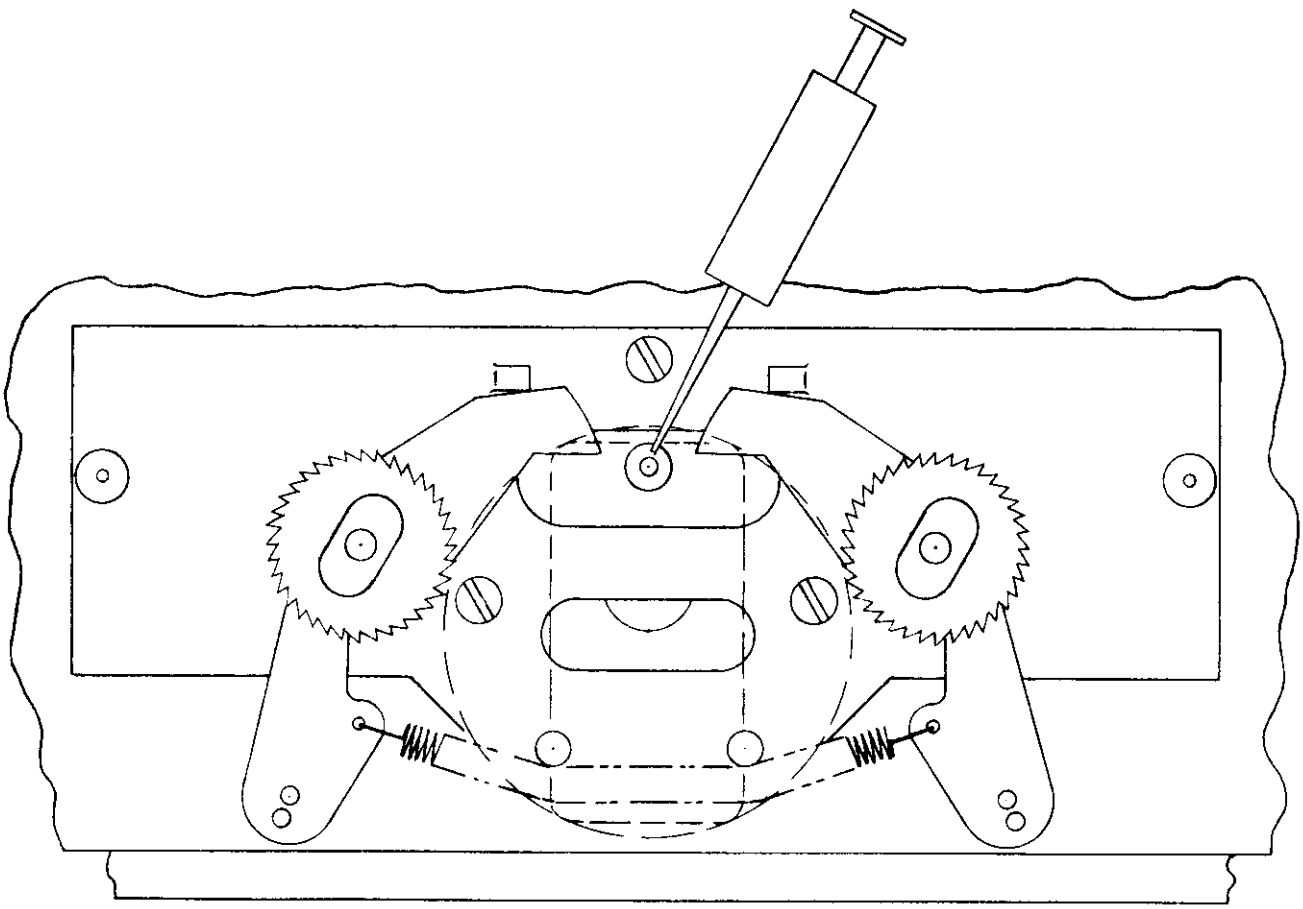


Fig. 5B
Plate Assembly Oil Access Hole Location Pictorial

## 4.5 Platen Adjustment

The platen has been factory set to allow printing on paper or forms with thicknesses of up to about 16 mils. The platen is the black aluminum bar under the paper visible through the front opening of the printer. The platen may require adjustment if there is a smudging of the copy, if one of more of the print wires become faint, or if one of the lines starts to fade or characters break up.

To adjust the platen, the three screws holding the platen must be slightly loosened. The two hex head screws supporting the platen at the ends may now be turned to adjust the platen height. The adjustment procedure is to back off the hex screws while running the printer in TEST mode. When the printing is very faint and/or some of the characters start to appear broken or disappear, reverse the procedure until the printing is clear and crisp. Secure the platen tightly in that position with the three screws on the front of the platen.

## 4.6 Belt Tension Adjustment

The print head is driven back and forth by a toothed Dacron belt. Over a period of time, it is possible for the belt tension to change. Should this happen, the symptom will be compressed or elongated characters at the head home side margin.

Belt tension can be adjusted by the following method:

1. Loosen the slotted screw head in the top plate behind the ribbon mechanism and to the right of the ribbon drive motor. This screw head sets the position of the tension idler roller beneath the top plate. The screw should be loosened only enough to move it forward or backward with a screwdriver used as a chisel, so that once moved, the roller will stay in place.
2. Run the printer in test mode. By tapping the screw head forward or backward with the screwdriver, set the tension so that all the characters are of even width at the head home margin.
3. Tighten the screw head when adjustment is completed.

## 5. Specifications - Integral Data Systems BrighterWrighter™

### 5.1 Printer

Controller: Microprocessor controller with integral asynchronous serial RS-232C and parallel TTL interfaces.

Diagnostics: Built-in self test capability prints repeating alphanumeric and graphic symbol pattern.

Maximum Print Speed: 165 characters per second instantaneous at print density of 16.5 characters per inch.

Maximum Sustained Throughput: 50 characters per second at print density of 10 characters per inch; 80 characters per second at optional print density of 16.5 characters per inch.

Maximum Line Length: (Model IP-125) 80 columns at print density of 10 characters per inch. (Model IP-225) 77 columns at print density of 10 characters per inch; optional 92 and 126 columns at 12 and 16.5 characters per inch, respectively.

Maximum Paper Width: Full 8½ inches, including pinfeed holes (IP-225).

Minimum Paper Width: (Model IP-225) 1-3/4 inches, including pinfeed holes.

Paper Feed: Internal roll or through rear opening.

Paper Form: Roll, fan-fold or single sheet (IP-125).

Paper Type: Ordinary paper; multiple copies without adjustments.

Paper Drive: (Model IP-125) Friction roller. (Model IP-225) Adjustable width pinfeed tractors.

Forms Control: Eight switch selectable form sizes and automatic page boundary skip (optional on IP-125).

Line Spacing: Six lines per inch.

Character Format: 7 x 7 dot matrix.

Character Set: Full 96 ASCII characters, upper & lower case.

Graphics Symbol Set: 32 special graphic symbols, control code selectable (optional).

Graphics Dot Plotting: Full dot pattern control for graphics plotting (optional). Contiguous vertical spacing in one-third line increments (4 vertical dots) with model IP-225 only.

Character Size: 0.110" high standard print density of 10 characters per inch; optional print densities of 8.3, 10, 12 and 16.5 characters per inch.

Ribbon: 1/2" nylon ribbon of 2" spools; automatic re-inking mechanism yields expected ribbon life of 10 million characters.

## 5.2 Interface

Electrical: Serial RS-232C interface factory wired; handshake control via EIA CTS control signal. Parallel TTL interface, factory wired upon request.

Connector: 25 pin Male EIA (Cinch DB25P or equivalent) mounted on back of printer. Interface cable optional.

Data Format: Asynchronous bit serial; 1 start, 8 data/parity, 1 or 2 stop bits.

Character Codes: Full 96 ASCII characters (upper and lower case); 14 control codes (9 optional).

Line Buffering: Automatic multiple line buffering. Standard buffer of 256 bytes; optional buffer sizes to 2048 bytes for full CRT screen and graphics buffering.

## 5.3 Controls

### A. Operator Front Panel Switches

POWER: On/Off.

TEST: Self-test with continuous full line repeating alphanumeric and graphic symbol pattern at selected character print density.

PAPER: Paper slew. Automatically advances to top of next form if Forms Control Option is installed.

LINE FEED: One line (Model IP-125), or one-third line (Model IP-225) advance per momentary switch depression. Paper slew when held in for more than 3/4 second.

B. Programmable Control (ASCII Control Codes)

Standard

LF: Initiates print of line buffer. Does carriage return and line feed.

CR: Initiates print of line buffer, and does carriage return. If automatic line feed (optional) is selected, a line feed is generated.

VT: Same as LF, except advances only one-third of a line on IP-225.

SOH: Selects enhanced print mode (double width characters).

STX: Selects normal print mode.

Optional

FF: Advances paper to top of next form.

DC1: Selects printer to receive data and control characters from interface.

DC3: Deselects printer from interface until DC1 received. Printer ignores all characters but DC1.

ETX: Selects graphics dot plotting mode.

EOT: Selects set of special graphic symbols for use in place of ASCII lower case character set.

FS: Selects 8.3 character per inch print density.

GS: Selects 10 characters per inch print density.

RS: Selects 12 characters per inch print density.

US: Selects 16.5 character per inch print density.

C. Mode Select Switches

Interface Mode: Serial or parallel.

Serial Baud Rate: 110, 150, 300, 600 or 1200 bits per second.

D. Feature Select Switches (Optional)

Default Character Size: Selects print density of 8.3, 10, 12 or 16.5 characters per inch at power-on.

Form Length: Selects one of eight form lengths (3, 3.5, 4, 5.5, 7, 8.5, 11 and 14 inches).

Automatic Page Skip: Selects automatic skip across page boundary at end of form.

Automatic Line Feed: Selects automatic line feed on carriage return character.

5.4 Physical

(Model IP-125)

Dimensions: 17.25" wide x 7.0" high x 11.5" deep.

Weight: 24 pounds (including full roll of paper).

Power: 105-120VAC, 60Hz
210-240 VAC, 50Hz (optional)

(Model IP-225)

Dimensions: 20.25" wide x 7.0" high x 13.5" deep.

Weight: 25 pounds.

Power: 105-120VAC, 60Hz
210-240VAC, 50Hz (optional)

## 6. Warranty and Repair

Integral Data Systems, Inc. warrants each new printer to be free from defects in material and workmanship. Our responsibility is limited to repairing or replacing this printer, or portion thereof, for a period of 90 days after shipment when, in our opinion, the repair or replacement is covered by warranty. When the printer is not so covered, we will repair it at standard rates. Factory authorization is required before any printer is returned for repair.

ANY PRINTER BEING RETURNED MUST HAVE A FACTORY AUTHORIZED REPAIR ORDER NUMBER.

Repair costs will be minimized if a full description of the experienced difficulties are outlined on a tag attached to the printer as well as in the covering repair order.

NOTE: All specifications contained in this manual are subject to change without prior notice.

## 7. Trouble Shooting Hints

The following table summarizes some of the more common problems encountered. If the problem cannot be readily solved, contact Integral Data Systems for suggestions or return authorization. Do not return the printer without authorization from Integral Data Systems. (See section 6, Warranty and Repair, for return procedures.)

| Trouble | Suggestion or Cause |
|---|---|
| Printer totally inoperative even in test mode. | 1. No AC power applied.<br>2. Line fuse blown. |
| Printer operates in test mode, but not in serial or parallel mode. | 1. Poorly seated or incorrectly wired connector.<br>2. Incorrectly set mode or baud switches on Controller card.<br>3. Defective home photo detector receiver IC (MC14093). |
| Printer operates in test mode, but not in serial mode. | 1. Parallel input lines are connected to an input source.<br>2. Mode or baud switches incorrect. |
| Printer loses or garbles characters in serial mode. | 1. Clear-to-Send signal not honored by data source.<br>2. Incorrect baud rate, or baud frequency off at source (try two stop bits).<br>3. Poor grounding or noisy conditions on input. |
| Printer fully operative at 300 BPS or less, but eventually misses characters or garbles data at 600 BPS or greater. | 1. Clear-to-Send signal not being honored by data source. |
| Printer operates in test mode, but not in parallel mode. | 1. Mode switches incorrect (mode switch 4 must be on and all other mode switches must be off).<br>2. Strobe was active at Power On.<br>3. Parallel handshake timing is in error.<br>4. Polarity of Strobe and/or Acknowledge signals are incorrect.<br>5. Data source misses Acknowledge pulse from controller. |
| Printer loses characters in parallel mode. | 1. Parallel timing incorrect. |

| Trouble | Suggestion or Cause |
|---|---|
| Printer prints incorrect characters | 1. In parallel mode, data input lines are wired incorrectly or shorted.<br>2. Defective buffer memory or address register. |
| Printer not responsive to control codes. | 1. Printer options not installed.<br>2. Feature select switches not set correctly. |
| Printer becomes inoperative during use. | 1. Printer was deselected and not reselected.<br>2. Printer was put into graphics mode and not restored to normal mode.<br>3. Buffer was filled before an end of line character was received. |
| Print head jams and motor grinds at home or end of line position. | 1. Home photo detector defective.<br>2. Defective processor/memory. |
| Printer drive motor grinds in arbitrary line positions. | 1. Defective motor or phase shift capacitor.<br>2. Excessive loading. |
| Print head jams momentarily at end of line, and characters are slightly elongated. | 1. Printer options set for 50 hertz operation but is being operated at 60 hertz. |
| Printer continuously feeds paper with power on. | 1. Line feed switch defective. |
| Printer always double spaces. | 1. Auto line feed switch is set and CR/LF is received at the end of each line. |
| Printer skips approximately one inch every so often. | 1. Auto page skip switch set. |

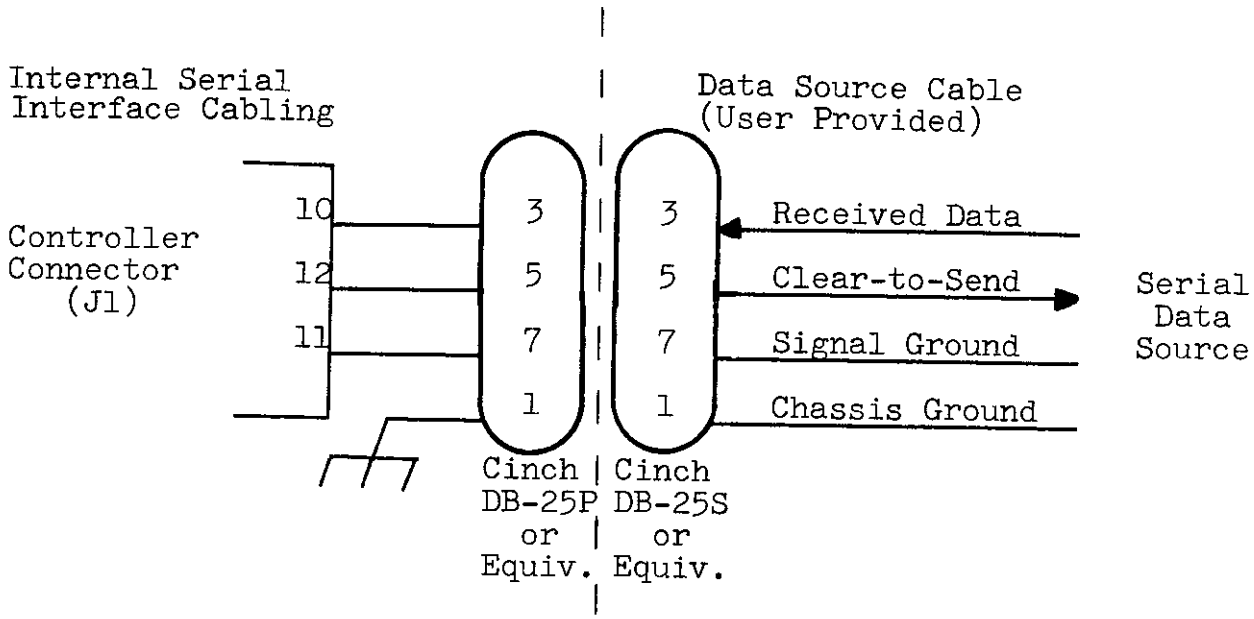
| Trouble | Suggestion or Cause |
|---|---|
| Graphic symbols printed instead of lower case. | 1. Received character selected graphic symbol set and normal mode not reselected. |
| Printer has incorrect print size. | 1. Feature select switches are set incorrectly.<br>2. Received character changed print density. |
| IP-225 spaces only one-third of a line for each line. | 1. Personality IC missing.<br>2. Line feed switch defective. |
| Poor print quality. | 1. Dry or worn ribbon; invert or change ribbon.<br>2. Dry or worn rollers; replace rollers.<br>3. Platen height incorrect.<br>4. Ribbon mechanism defective or not reversing.<br>5. Defective print head. |
| Elongation or compression of characters. | 1. Drive belt tension needs adjustment. (See Maintenance.)<br>2. Felt bearing needs lubrication or is overlubricated. (See Maintenance.)<br>3. Traverse shafts corroded or rusted.<br>4. Motor power source unstable or voltage low.<br>5. Defective motor or clutch. |
| Characters break-up at one end of the line or across the whole line. | 1. Platen height adjustment necessary. |
| Print registration problems. | 1. Print head dragging.<br>2. Control character timing compensation needed if mode or density change. |
| One or more print wires fainter than the others. | 1. Platen height adjustment needed.<br>2. Defective print head. |

| Trouble | Suggestion or Cause |
|---|---|
| One side of line slightly darker than other; darker side changes with ribbon mechanism reversal. | 1. This is normal and will become uniform with continuous printing. |
| Single needle does not print. | 1. Open driver transistor.<br>2. Open or short in solenoid drive circuit.<br>3. Open or shorted needle solenoid.<br>4. Broken needle or beam. |
| Single needle prints every rank time. | 1. Shorted driver transistor. |
| No needles print, paper advances properly, motor operates. | 1. Print head cable not firmly in socket on controller. |
| No needles print, paper does not advance, motor operates. | 1. No 38V; check fuse (1.2A, SB) on controller. |
| Improper or unequal paper advance, including over-printing of lines. | 1. Improper paper or threading of paper.<br>2. Insufficient pressure on pressure plate rollers.<br>3. Improper engagement between ratchet and pawl assembly.<br>4. Defective paper advance solenoid.<br>5. Paper roll jammed. |
| Printer intermittent. | 1. Printer, cabling, connectors not fully seated. |

# Appendix A

## Interface Specification

### I. Serial EIA Interface




The Clear-to-Send (CTS) signal provided by the printer is to be used to regulate any data source that can overrun the printer. The printer anticipates buffer fullness and drops the CTS signal several characters before the buffer is actually full. This allows for transmission propogation delays in the CTS and data circuits without overrunning the buffer. The printer also provides some hysteresis for the CTS signal by making the buffer fullness threshold for the "clear" state lower than the "stop" state.

## II. Alternate EIA Signal Connections

The printer does not provide any other EIA signals than those shown. For compatibility with some other EIA printer interfaces, the CTS signal may need to be rewired as a Reverse Channel signal, usually pin 11 on the EIA connector.

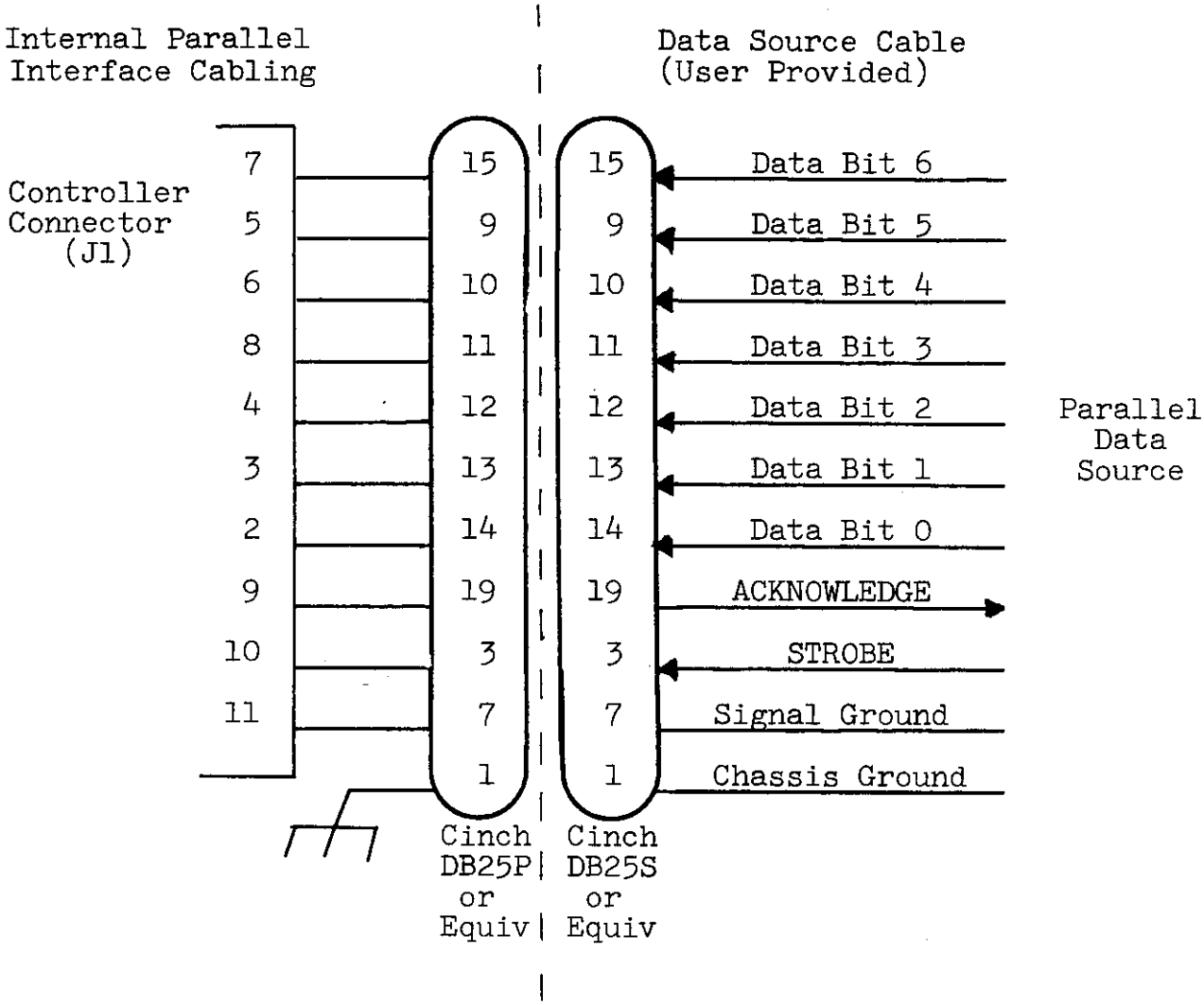
In some cases, the data source may not support a CTS signal, but may support a Data Terminal Ready (DTR) input (pin 20) if it is configured as a modem (DCE) interface, or a Data Set Ready (DSR) input (pin 6) if the source is configured as a terminal (DTE) interface. In either of these cases, the CTS signal could be connected to the appropriate EIA pin if the DTR/DSR signal is effective in stopping the data source. Note also that if the data source is configured like a terminal (DTE) interface, the Received Data signal (pin 3) must be connected to EIA pin 2 at data source, since the printer is also configured as a terminal (DTE) interface.

## III. Non-EIA Level Serial Connections

Some data sources, notably some microcomputer systems, do not provide EIA level data and/or Clear-to-Send signals, but do provide equivalent TTL level serial signals. In most of these cases the serial interface can still be used. The Received Data circuit (pin 3) will accept either a

TTL or EIA level input, if the polarity is correct. The EIA level Clear-to-Send signal generated by the printer, however, should not be used with a TTL level input. Instead the ACKNOWLEDGE signal normally used with the parallel interface should be used. In the serial mode, the ACKNOWLEDGE signal is a negative logic TTL equivalent Clear-to-Send signal. The ACKNOWLEDGE signal is on pin 9 of the controller connector and should be wired to the external EIA connector according to the user's requirements.

## IV. Parallel TTL Interface

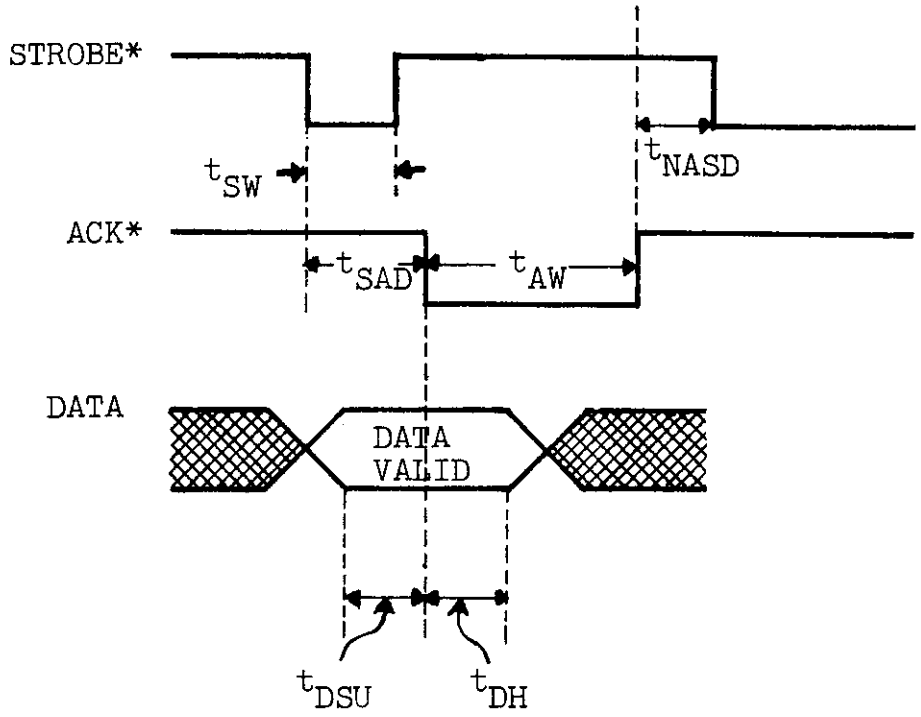



ASCII data is presented in parallel form (positive logic) to the printer and STROBE is made active (negative logic) by the data source. ACKNOWLEDGE is made active (negative logic) by the printer when it reads the data. If the printer becomes "busy" (e.g. its buffer is full) it will not make ACKNOWLEDGE inactive again until it can accept the next data character.

The data source may proceed with the next data transfer after the trailing edge of the ACKNOWLEDGE pulse. A diagram of the parallel interface handshake and timing specifications follows.

## V. Optional Strappings

The active levels of the STROBE and ACKNOWLEDGE signals may be changed through strapping options on the printer controller. Normally both signals are negative logic (active = LOW) as supplied from the factory. To make the STROBE signal a positive logic signal (active = HIGH), cut etch jumper Y1 to Y3 and connect Y2 to Y4 on the printer controller. These jumper locations are accessible by removing the base plate of the printer. To make the ACKNOWLEDGE signal a positive logic signal, cut etch jumper Z2 to Z4 and connect Z1 to Z3. (See Appendix H for jumper locations.)




| SYMBOL | PARAMETER | LIMITS MIN | LIMITS MAX | UNITS |
|---|---|---|---|---|
| $t_{SW}$ | STROBE pulse width | 4 | | usec |
| $t_{SAD}$ | STROBE to ACK delay | 100 | Approx. 2000 | usec |
| $t_{AW}$ | ACK pulse width | 100 | See Note 1 | usec |
| $t_{DSU}$ | DATA set-up time before ACK | 0 | | usec |
| $t_{DH}$ | DATA hold time after ACK | 10 | | usec |
| $t_{NASD}$ | ACK* to STROBE delay | 0 | | usec |

NOTE 1: Maximum $t_{AW}$ is variable depending on printer state and print rate. If the printer buffer becomes full with this character, the ACK pulse will not terminate (indicating a printer "BUSY" state) until the printer buffer has partially emptied.

# Appendix B

## Graphic Dot Plotting

### I. General Function

Graphic dot plotting provides the BrighterWriter™ with the capability of plotting arbitrary dot patterns across a horizontal print line. On the IP-225, (tractor drive, pin feed model) horizontal print lines may be vertically abutted, or overlapped, giving the capability of plotting arbitrary dot patterns anywhere horizontally or vertically on the printed page.

### II. Graphic Control

Graphic dot plotting is a software selected printer mode. By sending the ASCII control code ETX (hex 03), the printer is put into the graphics mode. Once in the graphics mode, the seven bits of each subsequent character code represent the seven vertical dots of the next column of dots to be printed. The least significant bit of the character is the top most vertical dot. In effect, graphics dot plotting is a raster scan of up to seven dots at a time.

After putting the printer into the graphics mode, the ETX character is subsequently used as an "escape" character to allow use of other control codes. Sending the ETX character immediately followed by one of the other control codes will result in the function

designated by that control code. To leave the graphics mode, an ETX, STX or ETX, SOH sequence must be sent to the printer. Example control codes sequences are:

| | | |
|---|---|---|
| 03, 02 | ETX, STX | - Leave Graphics mode and revert to Normal text mode. |
| 03, 0D | ETX, CR | - Do a carriage return without line feed. |
| 03, 0A | ETX, LF | - Do a line feed. |
| 03, 03 | ETX, ETX | - This sequence results in the value of ETX being the next dot column value (i.e. - hex 03). |
| 03, 0B | ETX, VT | - (IP-125) Do a line feed.<br>(IP-225) Do a line feed with a vertical displacement of only one-third of a line. |

# Appendix C

## Horizontal Registration of Mixed Mode/Density Printing

### I. Graphic Symbols

The 32 graphic symbols are shown in Appendix D. The graphic symbols do not have any inherent inter-character spacing as the normal ASCII characters do so that they may abut each other to form contiguous patterns, as is seen in the printer TEST mode print out. As a consequence the horizontal space required for a graphics symbol is less than that of a normal character -- roughly 4/5 that of a normal character. These differences in size must be taken into account when printing if horizontal registration is required from one line to the next.

### II. Mode and Density Control Codes

To get more precise registration, one needs also to take into account any mode or density changes that occur, since each of the control characters that effects a mode or density change results in a very small "null" space of approximately 1 dot column in width (less than .015 inch) on the line. Multiple mode or density changes on a line could lead to registration problems unless compensation is made for these "null" spaces.

## III. Symbol, Character Widths

Each of the character or symbol widths are precisely determined by a time interval derived from the microprocessor controller crystal. Each width size is an integral multiple of a 167 microsecond time interval. A table of the number of time intervals per character, control code, or symbol is given below. Character widths listed include any applicable intercharacter space.

## IV. Graphics Dot Column Intervals

In the graphics dot plotting mode, the graphic dot column interval is determined by the current selected density. The distance between columns for each density is given in the table below.

## Character, Symbol, Graphics Column And Control Code Widths

(In 167 Microsecond Time Intervals)

| Density | Graphics Column Width | Normal ASCII Character | Normal Graphic Symbol | Enhanced ASCII Character | Enhanced Graphic Symbol |
|---|---|---|---|---|---|
| 8.3 | 16 | 74 | 61 | 138 | 125 |
| 10 | 12 | 61 | 47 | 109 | 95 |
| 12 | 10 | 51 | 40 | 91 | 80 |
| 16.5 | 8 | 37 | 33 | 69 | 65 |

Mode & Density Control Codes (STX, SOH, ETX, FS, GS, RS and US)

9 time intervals each

One 167 usec, interval $\cong$ .00164 inches at 60 Hz;
.00137 inches at 50 Hz

Maximum number of intervals per line $\cong$ 4900 at 60 Hz;
5900 at 50 Hz

# Appendix D

## ASCII CHARACTER SET

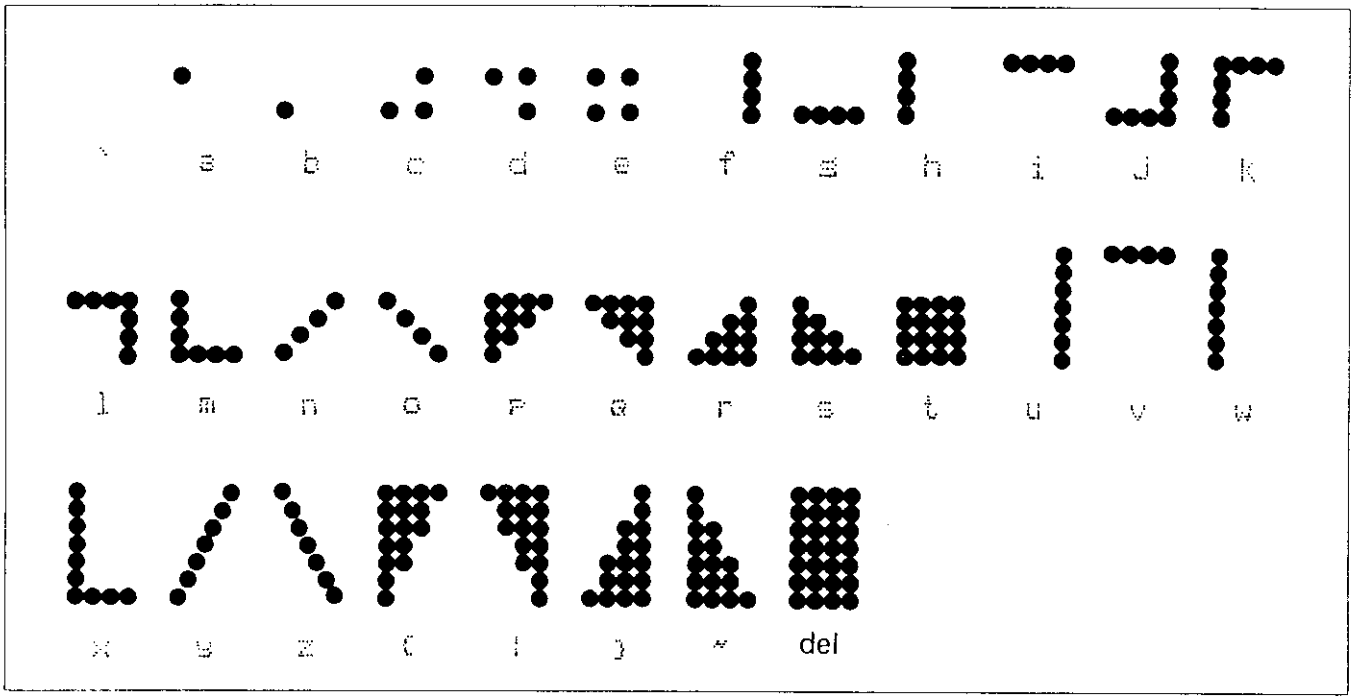
| BITS | b7 → | | | | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | b6 → | | | | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 |
| | b5 → | | | | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |
| | b4 ↓ | b3 ↓ | b2 ↓ | b1 ↓ | COLUMN / ROW ↓ 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| | 0 | 0 | 0 | 0 | 0 | NUL | DLE | SP | 0 | @ | P | ` | p |
| | 0 | 0 | 0 | 1 | 1 | SOH | DCI | ! | 1 | A | Q | a | q |
| | 0 | 0 | 1 | 0 | 2 | STX | DC2 | " | 2 | B | R | b | r |
| | 0 | 0 | 1 | 1 | 3 | ETX | DC3 | # | 3 | C | S | c | s |
| | 0 | 1 | 0 | 0 | 4 | EOT | DC4 | $ | 4 | D | T | d | t |
| | 0 | 1 | 0 | 1 | 5 | ENQ | NAK | % | 5 | E | U | e | u |
| | 0 | 1 | 1 | 0 | 6 | ACK | SYN | & | 6 | F | V | f | v |
| | 0 | 1 | 1 | 1 | 7 | BEL | ETB | ' | 7 | G | W | g | w |
| | 1 | 0 | 0 | 0 | 8 | BS | CAN | ( | 8 | H | X | h | x |
| | 1 | 0 | 0 | 1 | 9 | HT | EM | ) | 9 | I | Y | i | y |
| | 1 | 0 | 1 | 0 | 10 | LF | SUB | * | : | J | Z | j | z |
| | 1 | 0 | 1 | 1 | 11 | VT | ESC | + | ; | K | [ | k | { |
| | 1 | 1 | 0 | 0 | 12 | FF | FS | , | < | L | \ | l | ! |
| | 1 | 1 | 0 | 1 | 13 | CR | GS | - | = | M | ] | m | } |
| | 1 | 1 | 1 | 0 | 14 | SO | RS | . | > | N | ↑ | n | ~ |
| | 1 | 1 | 1 | 1 | 15 | SI | US | / | ? | O | ← | o | del |

Non-Printable Control Codes

Translated to special graphics symbols when in graphics mode.

# Appendix E

## Special Graphic Symbols



# Appendix F

## Software Control Codes

| Function | ASCII Code | Keyboard | Hexadecimal | Decimal | Octal |
|---|---|---|---|---|---|
| Line Feed | LF | Line Feed/ (CTRL-J) | 0A | 10 | 12 |
| Vertical Tab | VT | CTRL-K | 0B | 11 | 13 |
| Form Feed | FF | CTRL-L | 0C | 12 | 14 |
| Carriage Return | CR | Return (New Line)/ (CTRL-M) | 0D | 13 | 15 |
| Enhanced Mode | SOH | CTRL-A | 01 | 01 | 01 |
| Normal Mode | STX | CTRL-B | 02 | 02 | 02 |
| Graphics Mode/ Graphics Escape | ETX | CTRL-C | 03 | 03 | 03 |
| Graphics Symbols | EOT | CTRL-D | 04 | 04 | 04 |
| 8.3 Character/ Inch | FS | CTRL-\ | 1C | 28 | 34 |
| 10 Character/ Inch | GS | CTRL-] | 1D | 29 | 35 |
| 12 Character/ Inch | RS | CTRL-↑ | 1E | 30 | 36 |
| 16.5 Character/ Inch | US | CTRL-← | 1F | 31 | 37 |
| Select Printer | DC1 | CTRL-Q | 11 | 17 | 21 |
| Deselect Printer | DC3 | CTRL-S | 13 | 19 | 23 |

# Appendix G

## INTEGRAL DATA SYSTEMS

### IP-125/225 IMPACT PRINTERS

The basic IP-125/225 includes both upper and lower case characters at 10 per inch and the ability to print **enhanced characters.** Available options, if installed, provide many additional features.

The **Printer Control Option** (P1210) allows the IP-125/225 to print 8 different character sizes interchangeable. They range from this [illegible] this small size (which gives 132 columns per line). Of course, you can mix enhanced and regular size characters any way you want for [illegible] or [illegible] effects.

The **Printer Control Option** also allows you to remotely select and deselect the printer and generates an automatic line feed on a carraige return if you wish.

The **Forms Control Option** (P1250) is standard on the IP-225 and optional on the IP-125. It provides software and front panel top-of-form control in eight different switch selectable form sizes from 3 to 14 inches. An automatic one inch page boundary skip is switch selectable.

The **Graphics Options** (P1240,P1241) provide the ability to do graphics using either the built-in graphics symbols or by exercising complete control over every printable dot using the graphics dot plotting mode. (Note, however, that vertical dot contiguity requires the IP-225.)

# Appendix H

## Controller Cabling and Strapping Options

### MEMORY OPTIONS (with correct personality IC installed)

| Buffer Size | IC's | Etch/Strap Connections |
|---|---|---|
| 256 | U3-2112<br>U5-2112 | X2-X13<br>X4-X11<br>X7-X8 |
| 1024 | U4-2114<br>U6-2114 | X1-X14<br>X3-X12<br>X6-X9 |
| 2048 | U3-2114<br>U4-2114<br>U5-2114<br>U6-2114 | X1-X14<br>X3-X12<br>X6-X9 |

### STROBE, ACKNOWLEDGE Option

| Signal | Negative Logic | Positive Logic |
|---|---|---|
| ACKNOWLEDGE | Z2-Z4 | Z1-Z3 |
| STROBE | Y1-Y3 | Y2-Y4 |

### CONNECTOR WIRING

Logic Connector (J1)

| Pin | Signal Name | Wire Color | |
|---|---|---|---|
| 1 | - | - | |
| 2 | DBØ | Red | |
| 3 | DB1 | Orange | |
| 4 | DB2 | Yellow | For Parallel Only |
| 5 | DB5 | Green | |
| 6 | DB4 | Blue | |
| 7 | DB6 | Violet | |
| 8 | DB3 | Gray | |
| 9 | ACKNOWLEDGE | White | |
| 10 | RCV DATA/STROBE | White | |
| 11 | SIGNAL GND | Black | |
| 12 | CTS | Red | |
| 13 | TEST* | White | |
| 14 | PAPER* | Green | Parallel & Serial |
| 15 | LF* | Yellow | |
| 16 | - | - | |
| 17 | SWITCH GND | Black | |
| 18 | - | - | |

## Mechanism Connector (J2)

| Pin | Signal Name | Wire Color |
|---|---|---|
| 1 | EMITTER | Black |
| 2 | COLLECTOR | Yellow |
| 3 | LED CATHODE | Orange |
| 4 | LED ANODE | Red |
| 5 | MOT REV* | Yellow |
| 6 | MOT FWD* | Blue |
| 7 | 28 VAC | Black |
| 8 | 28 VAC | Black |
| 9 | RIBBON* | Yellow |
| 10 | 28 VAC | Yellow |
| 11 | FEED* | Yellow |
| 12 | 36 VDC | Blue |

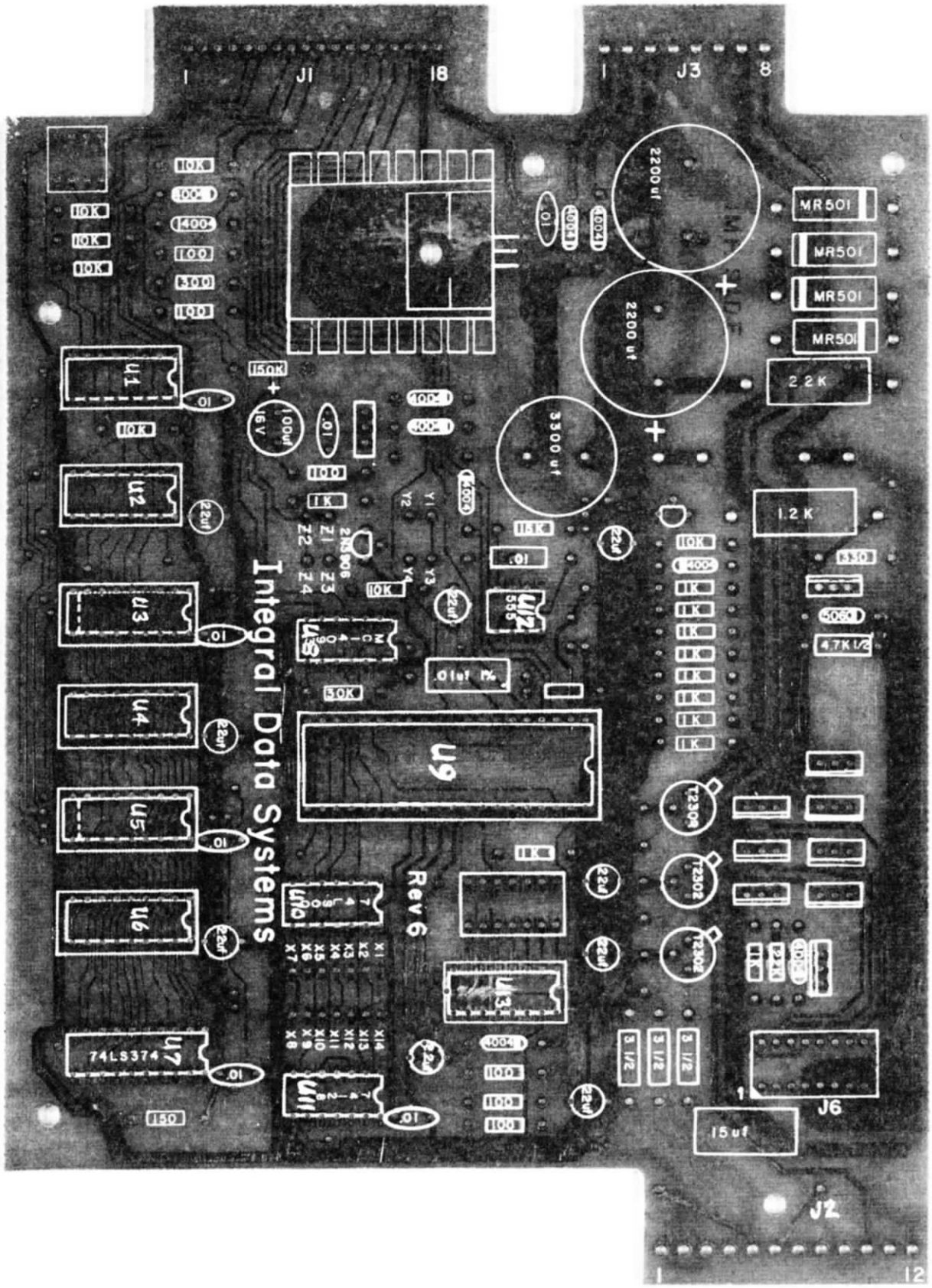
## Power Connector (J3)

| Pin | Signal Name | Wire Color (ALT.1) | Wire Color (ALT.2) |
|---|---|---|---|
| 1 | 8 VAC | Blue | Red |
| 2 | 8 VAC | Blue | Red |
| 3 | GND (C.T.) | Black | Red/Yellow |
| 4 | 26 VAC | Orange | Green |
| 5 | - | - | - |
| 6 | 26 VAC | Orange | Green |
| 7 | MTR GND | Violet | Blue |
| 8 | 28 VAC | Violet | Blue |

## Print Head Connector (J6)

| Pin | Signal Name | Wire Color |
|---|---|---|
| 1,2,3 | - | - |
| 4 | VN | White |
| 5 | VN | White |
| 6 | VN | White |
| 7 | VN | White |
| 8 | - | - |
| 9 | NDL1* | Violet |
| 10 | NDL2* | Blue |
| 11 | NDL7* | Black |
| 12 | NDL6* | Red |
| 13 | NDL5* | Orange |
| 14 | NDL3* | Green |
| 15 | NDL4* | Yellow |
| 16 | - | - |

NOTE: Pin 1 of J6 is oppositely oriented from other IC sockets.


J1
J3
J2
J6
Integral Data Systems
Rev6
U1
U2
U3
U4
U5
U6
U7
U8
U9
U10
U11
U12
74LS374
555
2200 uf
3300 uf
MR501
2.2K
1.2K
4.7K 1/2
.01uf
15 uf

# Appendix I

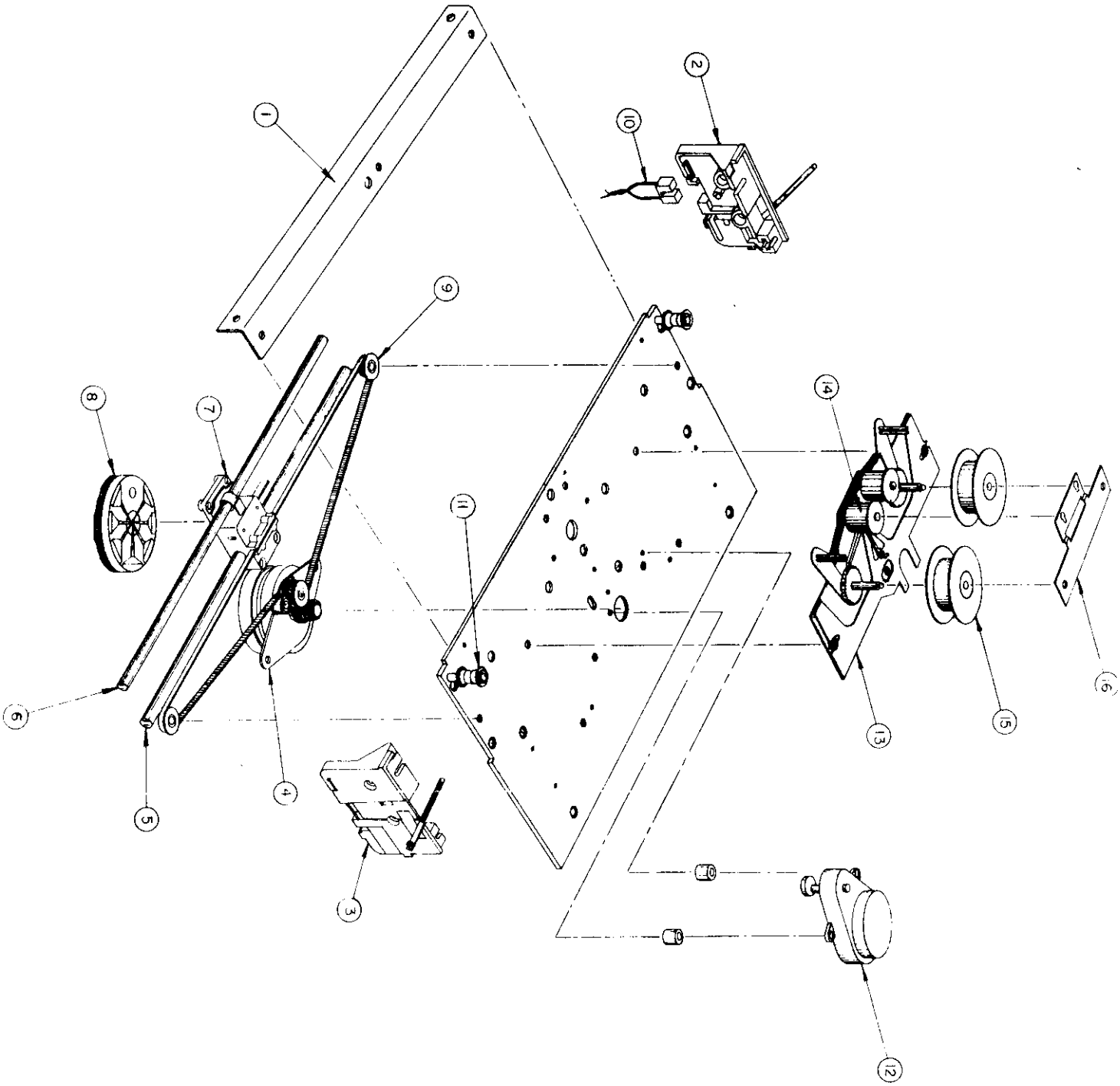
Integral Data Systems

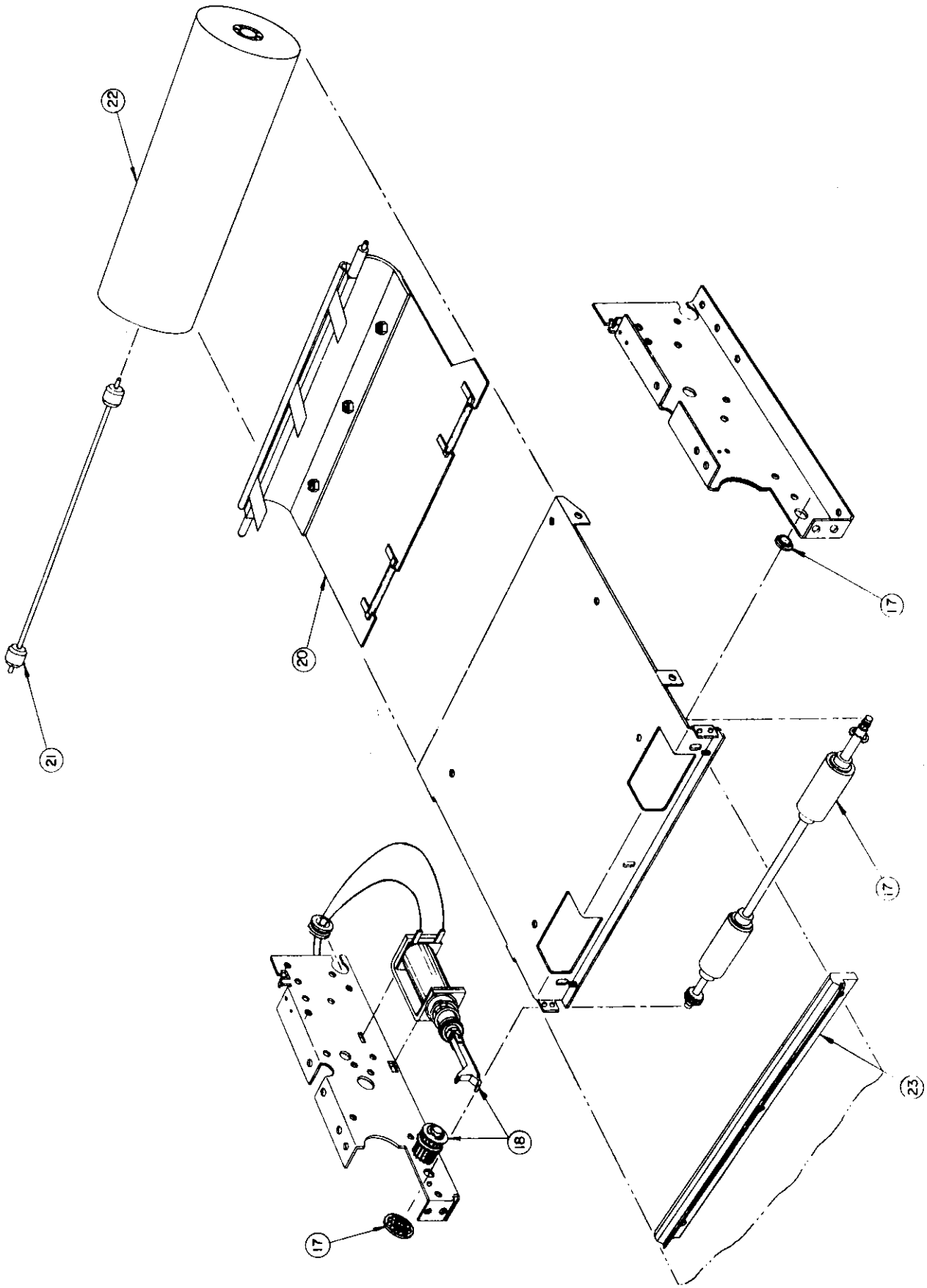
BrighterWriter Printer

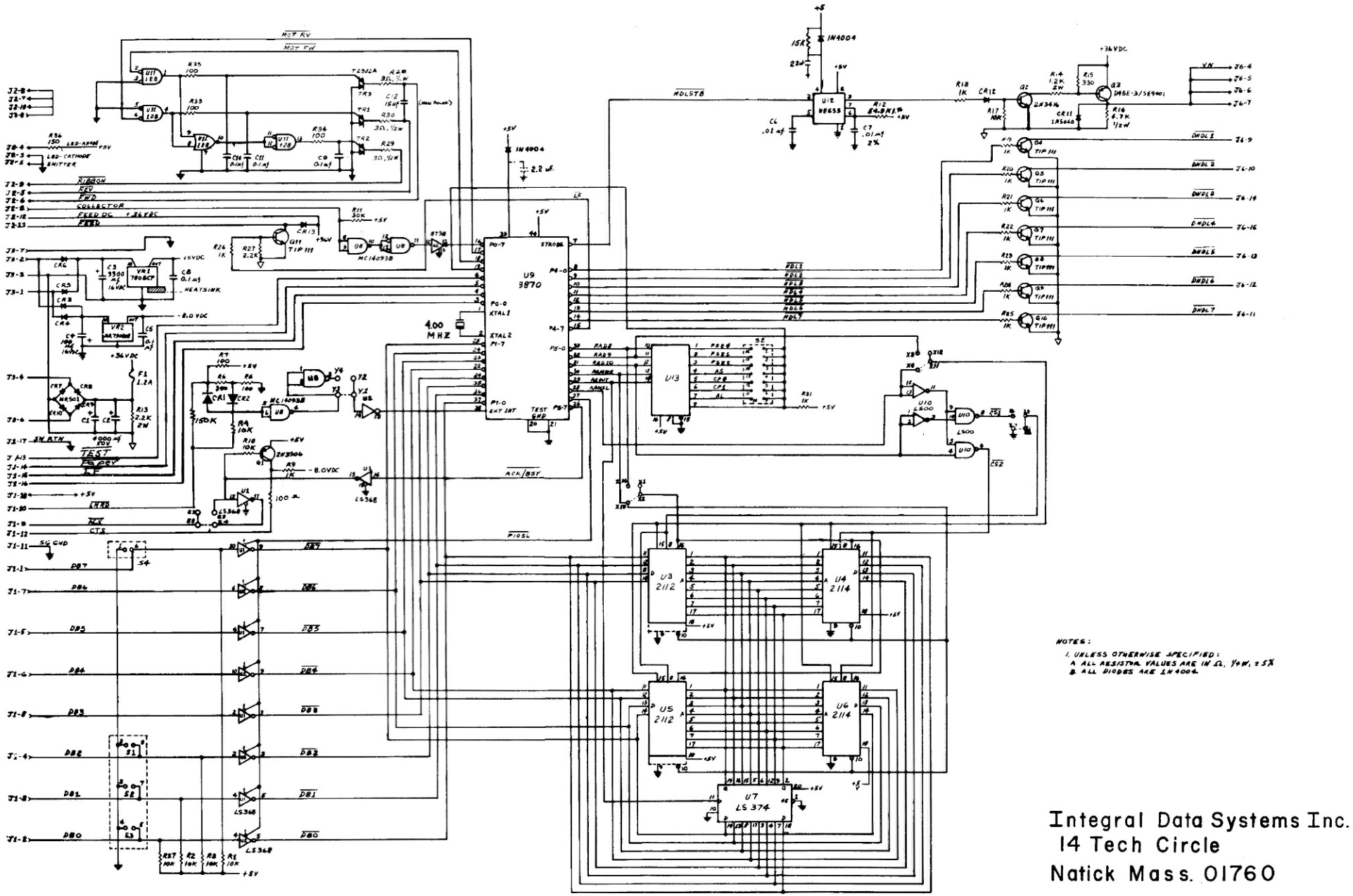
## Sub-Assembly and Parts Lists

| Description | Part No. | ID Number |
|---|---|---|
| Printer Mechanism, Complete | P12-11000 | |
| Carriage Sideplate Assy. (LH) | B11-10143-1 | 2 |
| Carriage Sideplate Assy. (RH) | B11-10143-2 | 3 |
| Print Head Motor | B11-80119-3 | 4 |
| Carriage Shaft (Rear) | B11-40036-11 | 5 |
| Carriage Shaft (Front) | B11-40036-12 | 6 |
| Carriage & Belt Assy. | A11-10265-3 | 7 |
| *Print Head | C11-10038-8 | 8 |
| Timing Belt Pulley Set | A11-10257 | 9 |
| *Home Position Sensor | B11-80121-2 | 10 |
| Ribbon Pulley | A11-40055 | 11 |
| Ribbon Advance Motor | B11-10123-2 | 12 |
| *Ribbon Mechanism (w/o rollers) | C11-10097-1 | 13 |
| Reinker Roller Assy. | B11-10101 | 14 |
| *Ribbon Retainer | B11-20116 | 16 |
| Paper Advance Roller (w/bearings) | A11-10258-3 | 17 |
| *Paper Advance Solenoid (w/ratchet) | A11-10259 | 18 |
| Pressure Plate Assy. | A11-10260-3 | 20 |
| Paper Roll Shaft | B11-10201-3 | 21 |
| Platen | B11-10207 | 23 |
| *Printer Controller, Complete (w/o Options) | P12-12000 | |
| Controller Microcomputer IC | P12-12100 | U9 |
| Memory IC (2112 type) | P12-12201 | U3, U5 |
| Memory IC (2114 type-large buffer) | P12-12202 | U3, U4, U5, U6 |
| Buffer IC (74LS368) | P12-12203 | U1, U2 |
| Register IC (74LS374) | P12-12204 | U7 |
| Sensor Buffer IC (MC 14093B) | P12-12205 | U8 |
| Solenoid Drive Transistor (TIPIII) | P12-12301 | Q4-Q11 |
| Master Drive Transistor (D45E3) | P12-12302 | Q3 |
| Motor Control Triac (T2302A) | P12-12303 | TR1, TR2, TR3 |
| Motor Phase Shift Cap (15ufd,16VNP) | P12-12310 | C12 |
| Option Kits--IP-125 | | |
| Option Kit P1240 | K125 (P1240) | |
| Option Kit P1241 | K125 (P1241) | |
| Option Kit P1240, P1250 | K125 (P1240, P1250) | |
| Option Kit P1241, P1250 | K125 (P1241, P1250) | |
| Option Kits--IP-225 | | |
| Option Kit P1240 | K225 (P1240) | |
| Option Kit P1241 | K225 (P1241) | |

| Description | Part No. |
|---|---|
| Printer Chassis Assy., Complete (w/o mechanism, controller & cover) | P12-13000 |
| Switch, Cable, Connector Assy. | P12-13100 |
| *Line Feed/Paper Switch | P12-13101 |
| *Power/Test Switch | P12-13102 |
| *Switch Cap | P12-13103 |
| Printer Base, Transformer, Line Cord Assy. | P12-13200 |
| Transformer | P12-13201 |
| Printer Base Plate, Feet | P12-13300 |
| Printer Cover | P12-14000 |
| *Spare Parts Kit | P12-19000 |


1
2
10
9
8
7
11
14
6
6
5
4
13
15
6
3
12


22
21
20
17
17
17
18
23




Integral Data Systems Inc.
14 Tech Circle
Natick Mass. 01760

J1

Integral Data Systems, Inc.

14 Tech Circle, Natick, Massachusetts 01760

GRAPHICS OPTION UPGRADE

# IP-225 UPGRADE KIT

## OPTION P1241

Prerequisite: IP-225 Printer, 60Hz

Contents: 4 - 2114 1K x 4 memory IC's

3 - Jumper straps

1 - Personality IC, Code 5F

Update Procedure:

1. If red jumper straps ARE NOT installed at IC location X then

   a. Cut etch at IC location X as shown by "/" on diagram (X 2 to X 13, X 4 to X 11, X 7 to X 8). Be careful not to cut any other etch running between leads.

   b. Solder jumper straps provided from X 1 to X 14, X 3 to X 12, X 6 to X 9 as shown by dotted line connections on diagram.

2. If red jumper straps ARE installed at Ic location X then

   a. Move jumper straps provided from X 1 to X 14, X 3 to X 12, X 6 to X 9 as shown by dotted line connections on diagram.

3. Remove current personality IC (U13) and replace with supplied personality IC, code 5F

4. Remove 2112 memory IC's from locations U3 and U5.

5. Insert 2114 memory IC's provided into locations U3, U4, U5 and U6.

6. Set feature select switches (S2) as desired as specified in IP-125/225 Owner's Manual (e.g. - form size, character pitch, etc.).

# Controller Card