

IJ-2000 Journal & Validation Printer

Specification

Provides the electrical, mechanical, and interface specifications of the IJ-2000 Journal & Validation Printer.

Cover Models: IJ-2000

The Addmaster Model IJ-2000 is a quiet ink jet alphanumeric printer. This printer is intended for journal printing, receipt and listing generation, and forms validation in a banking or POS environment.

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1 Specification Overview

This document provides the electrical, mechanical, and interface specifications of the IJ-2000 Journal & Validation Printer. For information concerning the operation of the printer from a user's standpoint, consult the following document:

IJ-2040 Operations Guide
Revision 2, Dated December 6, 1994 (or later)

2. Equipment Specifications

Item	Specification
<i>Power Requirements</i>	
<i>Voltage</i>	120 volts (+/- 10%), 60 Hz, Others available.
<i>Power Consumption</i>	
<i>Operating</i>	14 Watts
<i>Standby</i>	5 Watts
<i>Operating Environment</i>	
<i>Temperature</i>	10 -> 40 C
<i>Humidity</i>	10 -> 90% RH (non-condensing)
<i>Printer Unit</i>	
<i>Type</i>	Ink Jet, 10x12 Dot-Matrix
<i>Capacity</i>	75 columns max., Single-Line Validations 42 columns max., Journal
<i>Speed</i>	100 CPS (Single-Line Validations) 120 CPS (Journal)
<i>Ink Cartridge</i>	Black, Other colors available HP 51604A (plain paper) From Addmaster as P/N 95045
<i>Dimensions</i>	10 1/2" (W) by 4" (H) by 5" (D) (Excluding Journal Paper Roll)
<i>Weight</i>	5.5 lb. (6.5 lb. Shipping)
<i>Noise Level</i>	45 db

3 Printer Specification

Printing: Ink, Characters, & Fonts

<i>Matrix Print Head</i>	10 by 12 matrix
<i>Ink Cartridge Life</i>	11 million dots. Approx. 550,000 characters
<i>Print Contrast Ratio</i>	Constant throughout life of cartridge.
<i>Character Height</i>	0.070 to 0.125 inch (depends on font)
<i>Character Set</i>	96 character ASCII set Optional: full code page 437 or 850
<i>Fonts</i>	4 Fonts Included (All May Be Expanded) Standard & Standard Bold Large & Large Bold

Validations:

<i>Print Speed</i>	100 - 120 CPS. Mode and Font dependent.
<i>Validation Print Position</i>	Bottom dot, first line: approx. 0.5 inch from bottom of form
<i>Print Capacities (Max.)</i>	
<i>Lines</i>	1
<i>Characters</i>	75
<i>Validation Mode</i>	Single-Line
<i>Pitch</i>	5 to 18 CPI. Consult tables, next Section.
<i>Document Thickness</i>	0.0015 to 0.0180 inches
<i>Document Capacity</i>	
<i>Loading</i>	1 form: combined thickness 0.018" max.
<i>Catch Chute</i>	10 forms: combined thickness 0.040" max.
<i>Document Width</i>	
<i>Minimum/Maximum</i>	5.5 to 9 inches
<i>Maximum w/fall-off</i>	12 inches

Journal:

<i>Print Speed</i>	2.5 lines/sec (120 CPS) (journal)
<i>Pitch</i>	5 to 18 CPI (depends on font) 15 to 54 chars/line (depends on font)
<i>Journal Width</i>	
<i>Minimum/Maximum</i>	3.00"/3.00"

4 Operator Controls & Available Options

4.1 OPERATOR CONTROLS

Item	Usage
Power on/off switch.	
Paper-Feed button.	
Validation LED indicator light (green):	<p><i>ON</i> - This indicates a cut-form needs to be inserted for validation. Can also be turned on by host for other purposes.</p> <p><i>FLASHING</i> - Cut-form document jam or Print-head jam. Cut-form must be manually removed before operation can continue.</p>
Self-Test feature:	<p>Test all features of the printer: (1) Prints out Firmware revision levels and installed options, (2) Prints a message on the journal roll, (3) Validates forms continuously. To perform test, follow these steps: (1) Turn off power, (2) Hold down paper-feed button, (3) Turn on power, (4) release button after printing starts.</p>

4.2 AVAILABLE OPTIONS

- 220/240 Volt, 50 Hz, Power Supply.
- Receive Buffer: 4K, 8K, or 32K.
- Cut-form alignment mechanism. Two varieties: fixed or variable.
- Factory can reconfigure character set, firmware, or interface for special applications. Contact factory for information.
- Hardware Interface: (must be configured at factory)
- RS232C *standard model*
- PARALLEL *standard model*
- RS422, RS423, RS485, TTL, *special order only.*

5 Font Selections & Printing

Eight different type styles (fonts) are available. The following chart shows the approximate pitch measured in characters per inch and per line for each font.

For Journal Printing:

Characters Per Inch

Type Style	Single Wide	Double Wide
Standard	15.2	7.6
Standard Bold	15.2	7.6
Large	11.6	5.8
Large Bold	11.6	5.8

Characters Per Line

Type Style	Single Wide	Double Wide
Standard	42	21
Standard Bold	42	21
Large	32	16
Large Bold	32	16

For Single-Line Validation Printing:

Characters Per Inch

Type Style	Single Wide	Double Wide
Standard	18	9
Standard Bold	18	9
Large	13	6.5
Large Bold	13	6.5

Character height is 0.094" (regular) and 0.125" (large) in both journal and validation mode.

Vertical spacing on the journal is 5.5 lines per inch. Vertical spacing on the cut-form (validations) is 6.6 lines per inch. Line spacing can be set by the factory on a custom basis.

Fonts may be mixed within a print line. If so, then the available number of characters per line will depend upon the mixture of fonts. If the print line is longer than the available media width, the print line will be truncated either at the beginning or ending of the print line depending upon the print head direction.

Inter-character spacing is two (2) dots. This can be reduced by the factory on a custom basis. If so, then the characters per inch or per line will increase somewhat.

6 Interface Specification

6.1 SERIAL RS232 INTERFACE

Item	Specification
<i>Baud Rates:</i>	Dip switch selectable: 1200, 2400, 4800, 9600.
<i>Data Bits:</i>	Dip switch selectable: 7 or 8, w/1 stop bit
<i>Parity:</i>	Dip switch selectable: even, odd, none.
<i>Interface Connector:</i>	RJ-45, 8 pin phone jack type connector. RS232C interface levels.

Pin Configurations: at RJ-45 connector

Pin	Signal	Direction
Pin 1	Signal Ground	--
Pin 2	Recv. Data	Input to printer
Pin 3	Tran. Data	Output from printer
Pin 4	CTS	Input to printer
Pin 5	RTS	Output from printer
Pin 6	DTR (High)	Output from printer
Pins 7,8	Frame Ground	--

Serial Interface Cables: Available from Addmaster

95078 Printer to PC compatible DB9 type serial port

95079 Printer to PC compatible DB25 type serial port

Handshaking: Printer toggles RTS, which is connected by standard cables to IBM PC's CTS signal.

6.2 PARALLEL INTERFACE (standard 'PC' type)

<i>Interface Connector:</i>	25 pin, male, 'DB' type connector. TTL interface levels.
<i>Pin Configurations:</i>	Standard assignments. Identical to IBM PC compatible parallel ports.
<i>Parallel Interface Cables:</i>	Available from Addmaster
95529	Printer to PC compatible DB25 type parallel port

6.3 PRINTER BUFFERS: Receive and Print-Line

The printer has two type of buffers to which it receives incoming characters:

<i>Receive Buffer</i>	<p>Stores incoming characters. The printer removes characters from the Receive Buffer when needed.</p> <p>The characters are then "processed."</p> <p>In the standard IJ-2000, the Receive Buffer can store typically 1 character (often 2).</p> <p>The <i>Receive Buffer Option</i>, increases the size to 4096, 8192, or 32256 characters (depending on the option.)</p>
<i>Print-Line Buffer</i>	<p>Stores characters (typically text characters) after processing, but before actual printing.</p> <p>This buffer is used to build up the complete "Print-Line" that will then be printed or validated.</p> <p>In the standard IJ-2000, the Print-Line Buffer is approximately 75 characters. Therefore, you can not print a line with more than 75 characters (including any formatting commands).</p>

6.4 HARDWARE HANDSHAKING)

When the Receive Buffer is full or is otherwise unavailable, then the printer is unable to receive any characters. If any are sent, then they will be lost. This "un-availability" is signaled to the computer by "handshaking" lines on the interface.

For the Serial Interface:

The printer toggles its RTS line which is connect through the standard cables to the computer's line called "CTS". If the computer tests CTS high, then data can be sent, and if tested low, then do not send data. This testing is usually accomplished automatically via the computer's BIOS routines. For DOS based computers, set the "mode" command as follows:

```
C> mode com1:9600,n,8,1,p
```

The "p" parameter sets the appropriate retry on the CTS line when used with printers in general.

For units with Receive Buffers, CTS goes low (or BUSY goes high on Parallel units) when the Receive Buffer reaches 256 characters from full.

For the Parallel Interface:

The printer signals that it is busy by holding the line called "BUSY" high. No characters may be sent when BUSY is high.

6.5 DIP SWITCH SETTINGS)

DIP Switches set functional features of the IJ-2000. The Switches are accessible from the bottom of the unit.

Position 4 3	Baud Setting	
1 1	1200	1 = On
0 1	2400	0 = Off
1 0	4800	
0 0 *	9600	

Position	Setting
1 *	On = odd parity Off = even parity
2 *	On = 8 data bits, no parity Off = 7 data bits, with parity
5 *	On = Defaults to Journal Print Mode Off = Defaults to Single-Line Validation Mode
6 *	On = Auto-LF on CR Disabled Off = Auto-LF on CR Enabled, see notes
7A *	On = Validations enforced Off = Validations optional
7B *	On = Send ACK after CR processed Off = Don't send ACK after CR
8 *	On = Automatic validation pitch selection Off = Manual validation pitch selection

Notes: • Defaults marked with an asterisk "*"

- For Parallel Units, DIP Switches 1 through 4 are not used.
- For standard units use 7A, for units with Receive Buffer option, use 7B.

7 INTERFACE CONTROL CODES

Host to Printer

<i>NUL</i>	<i>Null. Ignored.</i>
<i>CAN</i>	<i>Hard Reset. Clears the entire Receive Buffer and resets the printer.</i>
<i>STX</i>	<i>Clear Print-Line Buffer.</i>
<i>ENQ</i>	<i>Request Printer Status. See notes.</i>
<i>SYN</i>	<i>Turn on Cut-Form LED. STX will turn off LED if it was turned on by SYN.</i>
<i>DC1</i>	<i>Set Journal Print Mode.</i>
<i>DC2</i>	<i>Set Single-Line Validation Mode.</i>
<i>CR</i>	<i>Print Line. If Auto-LineFeed mode is enabled, then the paper is also advanced 1 line.</i>
<i>LF</i>	<i>Usage depends on Auto-LineFeed mode.</i> <i>If Auto-LineFeed mode is disabled: LF causes the paper to be advanced 1 line. If any data was previously received, it will first be printed. This mode is NEW.</i> <i>If Auto-LineFeed mode is enabled: LF causes 1 additional line feed after the current line is printed.</i> <i>Multiple LFs may be sent. LF does not initiate the printing. CR is used to initiate printing.</i>
<i>BS</i>	<i>Back-Space. Move the buffer pointer back one character, if possible.</i>
<i>SO</i>	<i>Selects Single-Wide pitch (cancels Double-Wide).</i>
<i>SI</i>	<i>Selects Double-Wide pitch.</i>
<i>GS</i>	<i>Selects Large Font.</i>
<i>FS</i>	<i>Selects Large Bold Font.</i>
<i>RS</i>	<i>Selects Standard Font.</i>
<i>US</i>	<i>Selects Standard Bold Font. Obsolete: Do not use.</i>
<i>DC3</i>	<i>Set "Packed Print Mode." See notes before using.</i>
<i>DC4</i>	<i>Reset "Packed Print Mode." See notes before using.</i>
<i>SUB</i>	<i>Set "Upside-Down Mode" printing.</i>
<i>EM</i>	<i>Reset "Upside-Down Mode" printing.</i>

INTERFACE CONTROL CODES (continued)

Host to Printer: New "Level 2" Commands

<i>VT</i>	<i>Feed Journal</i> roll past tear-bar. Any data in line-buffer is printed first.
<i>ESC @</i>	<i>Clear All</i> . Clear print buffer, resets all fonts and modes to default, ejects cut-form if present, returns the unit to journal mode.
<i>ESC ACK</i>	<i>Send ACK</i> after sequence is processed. See notes.
<i>ESC T</i>	Sets "Turbo" operating mode. Contact factory before using.
<i>ESC R</i>	Clears "Turbo" operating mode.
<i>ESC n</i>	All other escape sequences are ignored.
<i>others</i>	Others to be added for additional fonts and pitches.

Printer to Host

<i>ACK</i>	<i>Acknowledge</i> . Sent in two cases: Sent after <i>CR</i> is processed. If the Receive Buffer Option is included, the <i>ACK</i> is sent in response to <i>CR</i> only if DIP Switch #7 is OFF. Sent in response to the <i>ESC ACK</i> command. The <i>ACK</i> will be sent after the escape sequence is processed.
<i>NAK</i>	<i>Transmission error</i> . Host should send <i>CAN</i> or <i>STX</i> and resend message. Not sent if unit has Receive Buffer Option.
<i>inquiry responses</i>	See table in next section.

7.1 ASCII Control Code Table

The following table of control codes lists only those used in the IJ-2000 printer interface specification.

Code Symbol	Ctrl Char	Decimal Value	Hex Value	Code Symbol	Ctrl Char	Decimal Value	Hex Value
NUL	^@	0	00	DLE	^P	16	10
SOH	^A	1	01	DC1	^Q	17	11
STX	^B	2	02	DC2	^R	18	12
ETX	^C	3	03	DC3	^S	19	13
EOT	^D	4	04	DC4	^T	20	14
ENQ	^E	5	05	NAK	^U	21	15
ACK	^F	6	06	SYN	^V	22	16
BEL	^G	7	07	ETB	^W	23	17
BS	^H	8	08	CAN	^X	24	18
HT	^I	9	09	EM	^Y	25	19
LF	^J	10	0A	SUB	^Z	26	1A
VT	^K	11	0B	ESC	^[27	1B
FF	^L	12	0C	FS	^\	28	1C
CR	^M	13	0D	GS	^]	29	1D
SO	^N	14	0E	RS	^^	30	1E
SI	^O	15	0F	US	^_	31	1F

8 Interface Software Notes:

Reset and Clear Commands

The *CAN* control code clears the entire Receive Buffer and resets the printer. These actions occur immediately after receiving the command. This is a "hard" reset and emulates all the actions taken when the printer is powered on.

These actions include mechanical movements which can take perhaps 250 milliseconds. The printer lowers the handshaking line to indicate that it is unavailable to receive data during this reset. If the computer sends data contrary to this signal during this time, that data will be lost. If your software or hardware cannot stop on character in response to hardware handshaking lines, then appends NULLs (0x00) after the *CAN* command.

The *STX* control code clears the current Print-Line Buffer and any pre-set modes with the following exception:

if Multi-Line validation mode is active, it remains active. These actions occur when *STX* is processed from the Receive Buffer, if present.

The *ESC @* clears the Print-Line Buffer, any selected fonts, any selected mode, ejects any cut-form if present, and returns the printer to journal mode. These actions occur when *ESC @* is processed from the Receive Buffer, if present.

Information Request Commands

The *ENQ* control code is sent as a single character. The IJ-2000's responses are given in the table provided on the next page. The response is sent immediately after receiving the *ENQ*.

When *ESC ACK* is processed, an *ACK* is sent to the host. This can be used by the host to monitor the printer. For example, if *ETB ESC ACK* is sent, the printer enters Multi-Line Validation mode, and will send an *ACK* after a cut-form is inserted. This sequence has no use unless the Receive Buffer Option is included.

Journal/Validation Selection Commands

See also Section 8 for information on validations.

The location for printing (journal roll or cut-form validation) is determined using the following procedure:

If *DC1* is sent, then the journal roll is specified. If *DC2* is sent, then the Single-Line validation is specified.

If neither *DC1* nor *DC2* is sent, then DIP SWITCH position #5 is read. If DIP#5 is *On*, then the journal roll is specified. Conversely, if DIP#5 is *@i(Off)*, then the Single-Line Validation Mode is specified.

Single-Line Validations may be either *enforced* or *optional*. If DIP Switch #7 is *On*, then the printer will require that any print line message intended for cut-form

validation must be validated before operation can continue. If DIP#7 is *Off*, cut-form validation print lines are optional, and the computer can overwrite a previous validation message by sending a new one at any time before validation has begun.

If the Receive Buffer Option is included, then Single-Line Validations are always *enforced*, and DIP Switch #7 takes an alternate meaning.

Font and Pitch Selection Commands

Print pitches, bold print and print destination commands may be selected from the interface at any time, even in the middle of a line.

At the end of every printed line (journal or validation) the font and pitch selects are reset to *Standard Font* and *Single-Wide* pitch.

The total number of characters and formatting commands can not exceed 75 characters per Print-Line.

For Single-Line Validation, if DIP Switch #8 is ON, then the printer determines the font & pitch automatically using the following procedure.

1. The default font is changed to Large, all commands specifying Standard font are changed to Large, all commands specifying Standard Bold font and changed to Large Bold. If the new print line fits on the cut-form, it is printed.
2. All repeated spaces are stripped from the print-line. If the new print line fits on the cut-form, it is printed.
3. The default font is changed to Standard, all commands specifying Large font are changed to Standard, all commands specifying Large Bold font and changed to Standard Bold. If the new print line is printed.

Operating Mode Commands

The operating modes affect the entire Print-Line. These modes remain in effect until changed by a software command, that is, they are never automatically reset. These operating modes include: (A) Auto-LineFeed mode, (B) Pack mode, (C) Upside-Down mode, and (D) Turbo mode.

Auto-LineFeed mode is selected by DIP Switch #6. If OFF, the mode is enabled, meaning that a *CR* also performs a line-feed. In addition, *LF* is used in a delayed sense and is executed AFTER the next *CR* is received.

If Auto-LineFeed mode is disabled (DIP Switch #6 = ON), then *CR* will print 1 line, but will not feed the paper. *LF* will feed the paper 1 line. *LF* is not delayed, but acted upon immediately. If any data is pending in the line-buffer when *LF* is received, it will be printed before the paper is advanced.

9 Host Status Request

Host may request status at any time by sending the single ASCII character *ENQ* (05h). The IJ-2000 will respond immediately with a single ASCII character specifying its status.

IJ-2000 Status Response

The single character response shall consist of 8 bits as follows:

MSB	8	0	
	7	(BEMP)	<i>Receive Buffer Empty</i>
	6	1	<i>reserved</i>
	5	(LMPS)	<i>Last Message Printed Status</i>
	4	(LMP)	<i>Last Message Printed</i>
	3	(VMP)	<i>Valid Operation Pending</i>
	2	(PRDY)	<i>Printer Ready</i>
LSB	1	(FORM)	<i>Form Inserted</i>

(BEMP)	<i>Buffer_Empty</i>	=1 if the Receive Buffer is empty and has processed all received data (processed data may not yet have been printed), =0 if Receive Buffer has any unprocessed data.
(FORM)	<i>Form_Inserted</i>	=1 if right or left form sensors detect form, =0 otherwise.
(PRDY)	<i>Printer_Ready</i>	=1 if printer is ready and no error conditions are sensed, =0 if an error condition: Jam, PowerLow, Improper cut-form insertion, others. If a cut-form is inserted, but covers only 1 of the 2 form sensors, <i>PRDY</i> is cleared.
(VMP)	<i>Valid_Message_Pending</i>	=1 if a valid message has been received and machine is performing an action or awaiting a form for printing. =0 otherwise.
(LMP)	<i>Last_Message_Printed</i>	=1 if the Last Message Received (not including any Valid Pending Messages) was printed, =0 if the Last Message Received was never printed.

(LMPS) *Last_Message_Printed_Status* =1 if the Last Message Received was printed properly,
=0 if the Last Message Received was printed with an error condition detected, such as JAM, no Paper, etc.

LMPS is only meaningful if LMP=1.

LMP and LMPS are used only on Single-Line Validations at this time.

10 Validation of Forms

There is 1 mode only of validation:

Single Line Validation The IJ-2000 prints by holding the printhead stationary, ejecting the cut-form horizontally into the catch-chute, and printing during ejection.

Available: IJ-2000, and IJ-2000.

Capacity: 1 Line of about 75 characters.

11 Interfacing Examples

To illustrate the various modes, this section presents examples. The following type-styles are used:

- print text -the text to be printed
- (CC) -control characters

Except for Example #3, we assume Auto-LineFeed on CR mode is enabled.

Example #1: Print 1 line on journal

This prints 1 line on the journal, if DIP5=ON. (CR)

or

(DC1) This always prints 1 line on the journal (CR)

Example #2: Single Line cut-form validation

This will validate 1 line on the cut-form (DC2) (CR)

or

(DC2) This also validates 1 line on the cut-form (CR)

Examples #3: Auto-LineFeed on CR

If Auto-LineFeed on CR mode is Off: (DIP6=ON)

This will be the 1st line (CR)

This 2nd line will overprint the 1st (CR) (LF)

This will be the 3rd line, (No overprint) (CR) (LF)

If Auto-LineFeed on CR mode is On: (DIP6=OFF)

This will be the 1st line (CR)

This will be the 2nd line, (No overprint) (CR)

Examples #5: Inquiries

Host	Printer	Meaning
ENQ	62H	Printer Ready, No Form, Not awaiting Form

ENQ	63H	Printer Ready, Form Inserted, Not awaiting Form

ENQ	61H	Printer Not Ready, Form Inserted, Form needs removal or adjustment

Printer responses are bit specific, refer to previous section.

Examples #6: Monitoring Validations when NO Receive Buffer Option

Host	Printer	Notes
	CTS=1	Prompt Operator to insert cut-form
DC2		Send print data
CR		Print command
	CTS=0	While printing
	CTS=1	When done printing

Host	Printer	Notes
<i>SYN</i>		Prompt Operator to insert cut-form Wait for cut-form insertion
<i>ENQ</i>	<i>62H</i>	Printer Ready, No Form

<i>ENQ</i>	<i>63H</i>	Printer Ready, Form Inserted
<i>DC2</i>		
<i>Send print data</i>		
<i>CR</i>		Eject Form

Examples #7: Monitoring Cut-Form Validation with Receive Buffer Option

These steps are optional and only purposeful if the Receive Buffer Option is included.

Host	Printer	Notes
<i>ETB</i>		Prompt Operator to insert cut-form Wait for cut-form insertion
<i>ENQ</i>	<i>62H</i>	Printer Ready, No Form

<i>ENQ</i>	<i>61H</i>	Printer Ready, Form Inserted
<i>DC2</i>		
<i>Send print data</i>		
<i>CR</i>		Print command

Host	Printer	Notes
		Prompt Operator to insert cut-form
<i>DC2</i>		
<i>Send print data</i>		
<i>CR</i>		Print command
<i>ESC ACK</i>		
<i>ACK</i>		ACK response after form ejected

Host	Printer	Notes
<i>DC2</i>		Prompt Operator to insert cut-form
<i>Send print data</i>		
<i>CR</i>		Eject Form
<i>STX</i>		Clear command used as place marker
<i>ENQ</i>	<i>23H</i>	Buffer not empty, printing in progress...
<i>----</i>		
<i>ENQ</i>	<i>62H</i>	Buffer empty, printing complete...

Host	Printer	Notes
<i>ENQ</i>	<i>23H</i>	Buffer not empty, printing in progress...
<i>----</i>		
<i>ENQ</i>	<i>62H</i>	Buffer empty, printing complete...
<i>DC2</i>		Prompt Operator to insert cut-form
<i>Send print data</i>		
<i>CR</i>		Print command

12 Revision Information

No information at this time.