

IJL/3

Ink Jet
Labeling
System

Developer's Guide

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ROM Version 1.7

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Imaging Systems

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Overview



IJL/3 for Panasonic (IJL3-KVS) pictured

The IJL/3 is a third generation ink jet labeling system for labeling, or imprinting, documents as they are scanned by an imaging system. It is a very easy to use system ideal for continuous operation in a high volume production environment.

The host computer is connected to the IJL/3 via a standard serial line. The typical operation sequence starts with the host computer telling the labeling system what should be printed on the document. The IJL/3 stores this information and then, under its own internal computer control, waits to detect that the document is moving past the print head. On scanners where labeling occurs after scanning (Fujitsu models), this is detected by the leading edge of the paper passing over an optical sensor next to the print head. On scanners where labeling occurs before scanning (Panasonic) this is detected by motion of a slotted sense wheel resting on the document. After paper motion is detected, the labeling system will wait for a programmable delay period to indent the label to the proper position on the paper. When the document is in the proper position, the labeling system prints the desired information on the document with no host involvement. This allows the host computer to continue to service the scanner. Since the scan and label tasks are concurrent, there is essentially no reduction in the throughput of the whole system. And there is always an exact one-to-one correspondence between the scanned image and the printed label.

The print head used by the IJL/3 is manufactured by Hewlett Packard. It is a proven design that has been reliably used in many major brands of desktop ink-jet printers. When the cartridge runs out of ink, it is replaced easily in less than a minute.

Specifications

Controller

- Standard RS-422 or RS-232 serial line interface:
 - protocol is x-on/x-off
 - connector is 9-pin D-type
- Baud rates: 9600, 19200
- Maximum text length: 128 characters
- Label indent: 0.00-99.99" (0.01" resolution)
- Startup test: two LED pass/fail indicator

Print head

- Character size: 1/8"
- Dot pitch: 96 dpi
- Arbitrary graphics (including black areas):
 - Maximum document speed: 13 ips (33 cm/sec)
 - Maximum rate for 11" pages: 70 pages per minute
- Characters:
 - Character frame: 12 dot vertical, 12 to 16 dot horizontal, typical
 - Maximum document speed: 20 ips (50 cm/sec)
 - Maximum rate for 11" pages: 100 pages per minute
- Ink supply life:
 - 10 million dots per cartridge
 - 250,000 characters using the triple strike IJL Serif font
- A Hewlett Packard thermal print head with integral ink cartridge is used.
Cartridge replacement takes less than 1 minute

Software control

- Initialization commands:
 - hardware reset that re-boots the IJL controller
 - software reset command
 - status query
- Setup commands:
 - set the label indent
 - set the print width (distance between dot columns)
 - set the print direction (right to left or left to right)
 - set the print orientation (right side up or up side down)
- Print commands:
 - set the print message
 - arm the head to be triggered by the photocell
 - cancel photocell arming / cancel print in progress
- Font selection:
 - two ROM resident fonts are included on board
 - a RAM font can be downloaded
 - bit maps can be downloaded for printing arbitrary graphics, logos, special symbols, etc.
 - bar code fonts are available as a options

Environment

- power requirement: IJL/3S system: 0.5A at 120VAC
- operating temperature range: 15-30°C (60-85°F)
- relative humidity: 20-80% non-condensing

Monitor Mode

The "Monitor" mode is used to control the IJL/3 without any programming. It is useful for evaluating the product, debugging the host to IJL/3 interface or simply setting up a quick document labeling project without requiring any programming. We recommend against writing a program to expect these commands or responses; use Normal mode for computer program control. The Monitor mode software may change without guaranteed backward compatibility. Every effort will be made to keep Normal mode commands compatible with future revisions of the IJL, just as IJL/2 Normal mode commands are compatible with the IJL/3.

To control the IJL/3 with Monitor mode, simply attach a terminal or use a terminal emulator on your computer. The communications settings should be 8 bits per character, odd parity, 1 stop bit. The baud rate can be 9600 by default, or 19.2K and will be detected automatically if the first character received is a space (20H) or STX (02 H). Press the space bar three times and the IJL/3 will enter Monitor mode. All of the Monitor commands are single character, sometimes followed by a space and parameters, and terminated by CR (the newline character). All parameter values are in hex. Commands are prompted for with a '>' character and responded to with an 'OK'. Commands can be aborted with the 'ESC' key. The backspace key can be used to correct typing errors. The command set is as follows:

- F Select Font. The font ID is '0' or '1' to select one of the built in fonts that are shipped with the IJL in ROM fonts. If you have downloaded another font from your host computer, then '2' will select that RAM font.
- D <0 or 1> Select Direction. '0' for forward, '1' for reverse. This controls whether the first dot column (forward) or last dot column (reverse) is printed first.
- O <0 or 1> Select Orientation. '0' for normal, '1' for flipped characters. This controls whether the high bit of the character is on top (normal) or low bit of the character is on top (flipped). Using the 'D' and 'O' commands printing can occur in any orientation.
- G <microsec> Select Gap. Sets the amount time between print columns in microseconds, default for post scanning labeling (Fujitsu) is 3E8H (1000 = 1ms), for pre-scanning labeling (Panasonic) is 4E6H (1254 = 1.25ms). Higher numbers will make the letters more expanded.
- M <microsec> Select Margin. Sets the time to wait after paper sense before printing, default for post scanning labeling (Fujitsu) is 30D40H (200000 = 200ms), for pre-scanning labeling (Panasonic) is EA60H (60000 = 60ms). Value is in hex.
- Z <wheel slots needed> <number of samples>

For pre-scanning labeling systems (Panasonic) this sets the number of slots in the paper sense wheel the system must see moving by before it detects valid paper movement. It also sets the number of consecutive samples of slot presence it must see to be sure it is actually seeing a slot.

Suggested values are 4H and 14H respectively. This command must be given to label on pre-scanning labeling systems.

Y <max time between wheel slots in centi-seconds>

For pre-scanning labeling systems (Panasonic) this sets the maximum allowable time between sensing paper wheel slots to be valid paper movement. If the wheel moves slower than this it is assumed that the paper is not being scanned, but is being moved by the user. Quick paper movement by the user will be detected by the number of consecutive samples value in the Z command above. Default 8 (can go to 3 to prevent printing on paper removed from the tray slowly by the user).

E <leading microsec> <trailing microsec>

Set Edge Times. Sets the length of time of paper sense (leading) and preceding length of time of no paper sense (trailing) to be considered the start of paper, default is 0 0. These values are used for post scanning labeling (Fujitsu) models only. Values are in hex.

H <dot columns> Set no paper hold. Sets the number of dot columns to continue printing after paper sense is lost before holding off (pausing) printing. This value is used for post scanning labeling (Fujitsu) models only. Default FFH (always print). Value is in hex.

Q <dot columns> Set no paper quit. Sets the number of dot columns after paper sense is lost before quitting printing. Default FFH (always print). This value is used for post scanning labeling (Fujitsu) models only. Value is in hex.

S <string> Print String. Waits for paper sense then prints given string (skips the one space after 'S').

R <string> Print String Repeatedly. Waits for paper sense then prints given string (skips the one space after 'R'), then waits for paper sense and prints the same string again. Printing continues until an 'ESC' key is given, no response is given after command until an 'ESC' is seen.

I <string> Print and Increment. Waits for paper sense then prints given string (skips the one space after 'I'). Then the last character of the string is incremented and the IJL waits for the next pages. Printing continues until an 'ESC' command is given, no response is given after command until an 'ESC' is seen. The increment will handle strings ending in multiple digits or letters, for example:

'DOC799' increments to 'DOC800', and
'DOCAZZ' increments to 'DOCBAA'

This is intended for endorsing sequentially labeled documents without requiring a host computer interface.

A Print ASCII. Immediately prints the ASCII set (20H-7FH) in font 0 without waiting for paper sense. This command will produce a cloud of ink if no paper present.

V <num> Print Vertical bars. Immediately prints the indicated number of vertical rows of dots without waiting for paper sense. This command will produce a cloud of ink if no paper present. Value is in hex.

- C <num> Check controller. Performs internal diagnostics the indicated number of times, displaying OK between each pass and stopping if an error occurs. To stop the checking hit the 'ESC' key. Value is in hex.
- X Exits Monitor mode and enters Normal mode.

Normal Mode

All labeler commands must be preceded with the control character STX (02H). This will reduce the chances of noise being misinterpreted as a command. All characters not preceded by a STX will be silently ignored, so that spurious noise does not cause confusing "unknown char" type responses to be sent to the host. All commands (or even invalid commands as long as they are preceded by an STX) will be responded to with a single byte acknowledgment which will bit encode the ink jet's status and response. A single byte response is used to enable the ink jet to respond while actually printing without upsetting the timing of the print operation. The inkjet will not give any message at boot up, since receiving data during the hosts boot may annoy it, and the application will probably not be listening any way. The inkjet may be polled at any time to find its status. The inkjet may be set to interrupt mode in which case it will inform the host when it has completed a print by sending a status byte. In non-interrupt mode, the host must poll the inkjet to determine when a print is complete.

All commands other than the status command are long commands, and begin with a "STX" (02 Hex) followed by a "L" and are terminated by an "ETX" (03 Hex) followed by two ASCII hex digits of checksum to assure accuracy. If another "STX" is encountered during the command, the command is aborted with no response and the "STX" is assumed to be the beginning of the next command. The checksum is the low byte (i.e. modulo 256) sum of all the characters in the command including the STX and ETX characters. The checksum is transmitted in ASCII, for example a checksum of 4CH is transmitted as the two characters '4' (34H) followed by 'C' (43H) (or 'c' 63H). If the labeler has been armed to print, a cancel command must be sent before any other long command is given.

"S" Status Command

Polls inkjet for status. The status byte sent will be a repeat of the last response to a command (or an ACK if the IJL was just booted).

Status response is:

01XARSPG

Where:

X = ACK bit, if the ACK bit is clear the response will be one of the error codes listed below. If the ACK bit is set the remaining bits will be as follows:

A = Armed to print as soon as paper seen.

R = 1 if no setup information seen since reset (this can be used to determine if the IJL has been manually reset by the user and thus needs new setup information)

S = Paper Sensed

P = Printing

G = Last print operation succeeded

Error Codes:

CMDERR	40 H	Invalid command format or unknown command
TOOLONGERR	41 H	Command was longer than 5000 characters
PAPERR	42 H	Lost paper sense during printing
CKSUMERR	43 H	Bad Checksum in long command
XMITERR	44 H	Transmission error in character(s) received in command
CANCERR	45 H	Print operation canceled by receiving a command other than a status command while actually printing
DIAGERR	46 H	Failure of power up diagnostics
NOPRINTDATA	48 H	No print text received before an arm command
NEEDCANCERR	49 H	Command other than a Status or Cancel command received when the IJL was armed to print. Once the IJL/3 is armed to print it must either print or be cancelled before accepting new commands
NOCONFIGERR	4A H	No setup information given before print command
NORAMFONT	4B H	RAM font requested but none loaded
NOPRINTHEAD	4C H	No Ink cartridge in labeler

The 'G' bit in the response is useful in determining if a successful print occurred. It is cleared as soon as a print command is received and set only after the successful completion of a print operation. The 'R' bit in the response is useful in detecting a reset caused by a power glitch or the user power cycling the unit, it is set on reset and cleared when a 'Global Setup' command has been successfully received.

"G" or 'W' Global Setup Command

The format of this command is as follows:

STX	marks beginning of command
'L'	marks long command
'G' or 'W'	Use 'W' for pre-scanning labeling (Panasonic) or 'G' for post-scanning labeling (Fujitsu).
'F' or 'R'	print direction: 'F' = forward direction or 'R' reverse '+' or '-' print orientation: '+' = Right side up, '-' = upside down printing
'0' , '1' , or '2'	font selection: '0' or '1' for the two ROM fonts or '2' for RAM font
'L' or 'R'	print justification: 'L' = left, 'R' = right
'P' or 'I'	'P' = polled or 'I' = interrupt mode
'0000' - '9999'	indent in 100th inches
'000' - '999'	width in 1000th inches
'0000' - '9999'	paper speed in 100th inches/sec

Then for pre-scanning labeling (Panasonic):

'0000'	currently ignored value
'00' - '99'	Maximum time between slots in wheel transitions {'00','99'} centiseconds (10 works for SS-55, can use values down

	to 3 to avoid printing on paper slowly removed from the tray by the user).
'00' - '99'	Number of consecutive consistent wheel samples to be considered a slot change {'00','99'} (14 works well, higher values to 99 may be used to avoid printing on paper quickly removed from the tray by the user).
'00' - '99'	Number of paper wheel slots to be seen to be considered moving paper{'00','99'} (4 works well).
ETX	marks end of command
'00' - 'FF'	checksum

Or for post scanning labeling (Fujitsu):

'00' - '99'	pause printing after this many dot columns of lost paper sense (the value of 99 means continue printing regardless of paper sense) (See below)
'00' - '99'	abort printing and generate an error after this many dot columns of lost paper sense (the value of 99 means continue printing regardless of paper sense) (See below)
'00' - '99'	millisecs of paper sense required to be considered the leading edge of the paper (See below)
'00' - '99'	millisecs of paper sense required to be considered the trailing edge of the paper (See below)
ETX	marks end of command
'00' - 'FF'	checksum

During printing the IJL monitors the state of the paper sense circuit. If paper sense is lost indicating that the paper is too far above the print head for accurate printing, the IJL responds by pausing printing after the end of the current character if paper has not been sensed for the number of dot columns indicated by the pause printing value. Printing will be resumed if paper is sensed again. If paper is not sensed for the number of dot columns indicated by the abort printing value, printing will be stopped and a PAPER status byte sent if in interrupt mode or if in polled mode a PAPER is sent in response to the next status command. A value of 99 for pause dot column count will cause the IJL to never pause printing. If the pause printing value is 99, then a value of 99 for the abort dot column count will cause the IJL continue printing regardless of paper sense and never generate a PAPER.

The leading edge paper sense time is the number of millisecs that paper must be sensed to be considered a valid leading edge of a page. The trailing edge paper sense time is the number of millisecs that paper must not be sensed to be considered the trailing edge of a page. These values are useful when arming the IJL to print the next page after printing the previous page if the previous page has not yet passed completely over the IJL print pod. It prevents momentary loss of paper sense of the previous page being considered the start of the next page.

Response:

01X0RS00

Where:

X = ACK bit, if the ACK bit is clear the response will be an error code as listed under the status command. If the ACK bit is set the remaining bits will be as follows:

R = 0 after command has been received because a valid setup now exists

S = Paper Sensed

G = 0, Last print operation succeeded, status cleared by this command

Error Responses:

CMDERR	40 H	Error in formatting or content of the command
CKSUMERR	43 H	Bad Checksum in long command
XMITERR	44 H	Transmission error in character(s) received in command
NEEDCANCERR	49 H	IJL was currently armed to print when setup command was received, a cancel print command is needed first
NORAMFONT	4B H	RAM font requested but none loaded
NOPRINTHEAD	4C H	No Ink cartridge in labeler

"T" Text Command or "P" Print Text Command

This command is followed by up to 128 characters to be printed, an ETX and a checksum. If the IJL is currently armed to print, a cancel print command must be sent first, otherwise a NEEDCANCERR (49H) error will be generated. Characters to be printed must be in the range 20 hex to 7F hex. Characters above 80 hex are assumed to represent direct dot column data and must occur in pairs, but need not be in multiples of the character width. The 6 lower bits of characters above 80 hex are the dot column data, from top to bottom, top six bits in the first character, bottom six bits in the second. Characters 16H through 18H indicate that the next character is from font 0 through 2 respectively (same font numbering as in the "Global Setup" command). Characters below 20 hex except STX, ETX, and 16H through 18H are ignored. If the Print Text form ('P') of the command is used, the IJL immediately goes to the armed state and will print as soon as paper is seen. If the Text command form ('T') is used then the IJL will not print until an "Arm" or "Print Now" command is received.

To automatically print the same label on every page without having to resend the **Print Text Command** between pages, use the 'R' style of the command. The labeller will immediately re-arm after printing and print the same label on every page seen until it receives a **Cancel** command.

To automatically print a sequential number on every page without having to resend the **Print Text Command** between pages. use the 'I' style of the command. The labeller will increment (add one) to the label string (presumably a number) and re-arm after printing and print the next number on the next page seen until it receives a **Cancel** command. Multi-digit numbers will be incremented so '2999' becomes '3000', and letter strings will also be incremented so 'AZZZ' will be incremented to 'BAAA'.

Example:

STX	Indicates command
'L'	Indicates long command

'T' or 'P'	Indicates text to print (the 'P' form causes the IJL to go to the armed state)
'0', 'R' or 'I'	Use '0' for ordinary print, use 'R' to automatically re-arm and print the same label on every document, use 'I' to increment the label string and re-arm to print sequential numbers on every document.
'C'	Prints letter 'C' in current font
17H	Switches to font 1
'D'	Prints letter 'D' in font 1
'E'	Prints letter 'E' back in current font
' '	Prints space character in current font
8FH, BFH	Prints one vertical row of dots
ETX	Marks end of command
'00' - 'FF'	Checksum

Response:

01XARS0G

Where:

X = ACK bit, if the ACK bit is clear the response will be an error code as listed under the status command. If the ACK bit is set the remaining bits will be as follows:

A = Armed to print as soon as paper seen (= 1 if 'P' form used, = 0 if 'T' form used)

R = 0 (Setup information must be received before text)

S = Paper Sensed

G = 0, Last print operation succeeded, status cleared by this command

Error Responses:

CMDERR	40 H	Error in formatting or content of the command
CKSUMERR	43 H	Bad Checksum in long command
XMITERR	44 H	Transmission error in character(s) received in command
NEEDCANCERR	49 H	IJL was currently armed to print when setup command was received, a cancel print command is needed first
NOCONFIGERR	4AH	No setup information given before text or print text command
NORAMFONT	4B H	RAM font requested but none loaded
NOPRINTHEAD	4C H	No Ink cartridge in labeller

"F" Download RAM Font Command

This command is followed by the font width as two decimal digits (this is the number of dot columns per character), and then character descriptions for the RAM font. Each character is described by the font width * 2 codes, representing the dot columns of a character from left to right. Each pair of codes describes one 12 dot column, six dots per character in the lower 6 bits of the code. The top bit of the code is always on making the codes in the range (80-BF) hex. The first code describes the top six dots of the character, the second the bottom six dots. The bottom dot of the character is bit 0 of the second code, the top dot of the character is bit 5 of the first code (numbering bits 0 lowest to 7 highest). The font contains descriptions for characters in the range 20H to 7FH, the first character sent is

assumed to be the description for the space (20H) character and up to 96 characters may be given. Optionally each character description may be preceded by the character code of the character described as a single ASCII character, this allows downloading of selected characters rather than the whole font. There may be up to 32 dot columns per character as specified by the width. Blank space between characters must be encoded as blank columns in the character.

Example:

STX	Indicates command
'L'	Indicates long command
'F'	indicates font command
'00' - '99'	indicates number of columns per character (width)
'J'	indicates next char description is a 'J' (example)
80H-BFH ...	width * 2 chars with 6 pixels each
'M'	indicates next char description is a 'M' (etc.)
80H-BFH ...	width * 2 chars with 6 pixels each
ETX	
'00' - 'FF'	checksum

Response:

01X0RS00

Where:

X = ACK bit, if the ACK bit is clear the response will be an error code as listed under the status command. If the ACK bit is set the remaining bits will be as follows:

R = 0 if valid setup command has already been received or 1 if no setup command received since reset

S = Paper Sensed

Error Responses:

CMDERR	40 H	Error in formatting or content of the command
CKSUMERR	43 H	Bad Checksum in long command
XMITERR	44 H	Transmission error in character(s) received in command
NEEDCANCERR	49 H	IJL was currently armed to print when setup command was received, a cancel print command is needed first

An example of a download command to download a 'J' and 'M' character is as follows (all numbers are in hexadecimal):

02, 4C, 46	STX, 'L', 'F' (start of font command)
31, 30,	'1', '6' - Character width = 16 (vertical columns per character)
4A,	indicates following character is a 'J'
80, 80 (000)
80, 8C XX. (00C)
80, 9E XXXX. (01E)
B0, 8B	XX. X. XX (C0B)
B0, 83	XX. XX (C03)
B0, 83	XX. XX (C03)

B0, 83	XX. XX (C03)
B8, 87	XXX. XXX (E07)
BF, BF	XXXXXXXXXXXXX (FFF)
BF, BE	XXXXXXXXXXXXX. (FFE)
BF, BC	XXXXXXXXXXXXX. . (FFC)
B0, 80	XX. (C00)
B0, 80	XX. (C00)
B0, 80	XX. (C00)
80, 80 (000)
80, 80 (000)
4D,	indicates following character is an 'M'
A0, 81	X. X (801)
B0, 83	XX. XX (C03)
BF, BF	XXXXXXXXXXXXX (FFF)
BF, BF	XXXXXXXXXXXXX (FFF)
BE, 81	XXXXX. X (F81)
8F, B0	.. XXXXX. (3E0)
83, B8 XXXXX. ... (0F8)
80, BC XXXX. . (03C)
83, B0 XXXX. ... (0F0)
8E, 81	.. XXX. X (381)
BF, BF	XXXXXXXXXXXXX (FFF)
BF, BF	XXXXXXXXXXXXX (FFF)
BF, BF	XXXXXXXXXXXXX (FFF)
B0, 83	XX. XX (C03)
A0, 81	X. X (801)
80, 80 (000)
ETX	indicates end of command
??, ??	checksum characters

"A" Arm Command

Arms inkjet to print, inkjet will print when it senses paper for the amount of time given in the setup command for a leading edge preceded by not sensing paper for the amount of time given in the setup command for a trailing edge. The labeler will stop printing immediately if a cancel print command is received. If a command other than a status poll command or cancel print command is received before printing is complete a NEEDCANCERR will be generated.

Response:

010ARS0G

Where:

A = 1 (Armed to print as soon as paper seen)

R = 0 (Setup information must be received before text)

S = Paper Sensed G = 0, Last print operation succeeded status cleared by this command

G = 0, Last print operation succeeded, status cleared by this command

If the labeler is in interrupt mode, another status byte will be given immediately after the last dot row is output and printing is complete:

01X00100

Where:

X = ACK bit, if the ACK bit is clear the response will either be a PAPER or a CANCELL as defined under Status command. If the ACK bit is set the printing completed successfully.

Error Responses:

CMDERR	40 H	Invalid command format or unknown command
CKSUMERR	43 H	Bad Checksum in long command
XMITERR	44 H	Transmission error in character(s) received in command
NOPRINTDATA	48 H	No print text received before an arm command
NEEDCANCELL	49 H	New arm command received before previous print text was printed or cancelled

"C" Cancel Print Command

Immediately stops labeler from printing.

Response:

0100RS0G

Where:

R = 0 if valid setup command has already be received or 1 if no setup command received since reset
S = Paper Sensed
G = 0, Last print operation succeeded, status cleared by this command

Error Responses:

CMDERR	40 H	Invalid command format or unknown command
CKSUMERR	43 H	Bad Checksum in long command
XMITERR	44 H	Transmission error in character(s) received in command

"N" Now Print Command

Immediately causes the labeler to start printing as though it had seen the leading edge of the paper. This is useful in applications where the paper sensing circuit is not used and the printing is done on demand when external timing determines that paper is over the print head. A response is given immediately to acknowledge receipt of the command. Status will be sent after printing is complete if in interrupt mode.

Response:

010ARS0G

Where:

A = Armed to print as soon as paper seen. (=1 if 'P' form used, = 0 if 'T' form used)
R = 0 (Setup information must be received before text)
S = Paper Sensed
G = 0, Last print operation succeeded status cleared by this command

Error Responses:

CMDERR	40 H	Invalid command format or unknown command
CKSUMERR	43 H	Bad Checksum in long command
XMITERR	44 H	Transmission error in character(s) received in command
NOPRINTDATA	48 H	No print text received before an arm command
NEEDCANCERR	49 H	Now print command received before previous print text was printed or cancelled

"R" Request Next Label to be Printed Command

This command is only useful when using the print and increment feature described in the **Print Text Command** described above. It causes the labeller to send back the next label that will be printed. This is useful in determining how many pages were successfully labeled if you are not sending status commands. Just subtract the first label given in the **Print Text Command** from the next label to be printed value received to get the number of pages labeled. The response to this command will be an STX, label string, ETX, checksum just like the commands send to the labeller.

Response:

STX	Indicates start of response
<next label to be printing string>	
ETX	marks end of response
'00' - 'FF'	checksum (includes STX and ETX characters)

Error Responses:

CMDERR	40 H	Invalid command format or unknown command
CKSUMERR	43 H	Bad Checksum in long command
XMITERR	44 H	Transmission error in character(s) received in command
NEEDCANCERR	49 H	'R' Command received before previous print text was printed or cancelled

"D" Diagnostics Command

Causes the labeler to perform its internal diagnostics, a ROM checksum, RAM test and FIRING circuitry test.

Status response is:

0100RS0G

Where:

R = 0 if valid setup command has already be received or 1 if no setup command received since reset

S = Paper Sensed

Error Responses:

CMDERR	40 H	Invalid command format or unknown command
CKSUMERR	43 H	Bad Checksum in long command
XMITERR	44 H	Transmission error in character(s) received in command
DIAGERR	46 H	Diagnostics failed

"V" Version Command

Causes the labeler to respond with its version number currently 47H for IJL/3

"B" Reboot

Immediately reboots labeler, No Status response is given.

Hardware

This section describes the hardware interconnections of the IJL/3. This information is useful for the design and debug of the host to IJL/3 cable and for troubleshooting the ink jet system.

Serial Port Setup

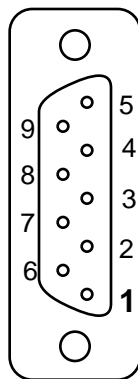
The IJL/3 communicates with the host computer through an RS-422 serial line via the 9-pin D-type connector. The serial port circuit is compatible with the older RS-232 serial standard. See Application notes 1 and 2 for cabling details.

The host computer should be set to the following to establish communication with the IJL/3:

- 1 stop bit (or auto stop bits)
- odd parity
- 8 bits per character
- software handshaking (x-on/x-off)
- 9600 baud (will auto-sense 19.2 KB if the host computer is set to that baud rate, and the first character received after reset is a STX (02H) or SPACE (20H)).

Communications Signals

The RS-422 serial communications connection to the IJL/3 is via a 9 pin D-type connector. The signals for each pin and the location of the pin numbers, as viewed from the face side of the cable (i.e. the outside of the case) are shown below.



DB-9 connector		Internal PCB header
signal	pin	pin
Ground	1	1
n/c	2	3
Ground	3	5
Data Out +	4	7
Data Out -	5	9
n/c	6	2
Reset +	7	4
Data In +	8	6
Data In -	9	8

The Reset line in the IJL/3 is an edge triggered signal. When the line goes high (at least 2 to 3V), the IJL/3 CPU resets. The red Reset LED on the front panel is lighted when the CPU is in reset. After about a second, the CPU executes a boot-up sequence and the self test diagnostics. If this sequence is successful, the CPU turns off the red LED and turns on the amber Ready LED. For performance reasons, the memory test is not executed when the IJL/3 is reset. Use the software command to execute the memory test when testing is desired.

The Reset line is often connected to the host computer's DTR signal. Toggling the DTR line at the host provides a hard reset function that can be used for recovery from serious errors. Resetting the IJL/3 immediately halts all processing and stops all ink jet printing activity that may have been pending or in progress.

The Data In and Out signals are as viewed from the IJL/3. Data In refers to data transmitted to the IJL/3, and Data Out refers to data transmitted to the host.

Print Pod Signals

The DB-25 connector on the back of the IJL/3 is for connection to the Print Pod.

Do not connect this port to a serial peripheral device. It is likely that the signal voltages generated by the Labeling System will damage the peripheral and the peripheral may also damage the IJL/3 controller board.



Print Head Cartridge

The IJL/3 uses a removable cartridge that contains the ink supply and print head jets. When the ink runs out, you must replace the cartridge with a new one. Prime new cartridges using the procedure documented with the cartridge.

If the IJL/3 has been idle for more than one day, the print head may become clogged with dry ink or dust. Symptoms of a clogged print head jet are missing dots in the characters, especially a whole row of missing dots which appears as a horizontal white stripe through all of the characters. Usually, printing a few characters clears out the clog and character quality recovers. If, however, clogs are not cleared, blot the top of the print head with a soft tissue or rag for a second or two. Ink should wick up into the rag. Do not wipe the print head. Try printing characters again. If the clog persists, prime the print head by pressing on the ink bladder through the hole provided for priming. Ink will puddle up on the surface. Release pressure on the ink bladder and the ink will drop back into the cartridge. Blot off any remaining excess.

If the character quality issue is not cleared by the cleaning and priming procedure above, it is likely that a jet has burned out in the print head cartridge. Replace it with a new one.

Print Position Adjustment, Ink Cartridge Installation

Most of the configuration of the IJL/3 is controlled by software. The only hardware adjustment is the horizontal position of the printed label. The print head is housed in a pod that can be moved. Please refer to your Field Installation Guide for information about adjusting the print pod on your scanner and installing your ink cartridge. These procedures vary with different brands of scanners.

If you disconnect the cable from the controller to the print pod, ensure that the IJL/3 power is off. Removing or attaching this cable with the power on may damage the circuits or the print head.



Appendix 1. Servicing and Debugging

If the IJL/3 is not responding to your host computer as expected, the following procedure may help you determine the cause.

If you are getting no response at all from the IJL/3, begin by checking the LEDs on the front panel. They are labeled "Power", "Reset", and "Ready".

1. If the "Power" LED is off, there is most likely a power failure in the system. When +5V is on, the "Power" LEDs should always be lit (check the external power supply unit and cables).
2. If the "Ready" LED remains lit even when Reset is attempted, then the Reset line has probably not been asserted, i.e. has not been driven high. The IJL/3 is designed to reset when the Reset line is driven from low to high and then go into the Ready state when the Reset line is left at a constant logic level.
3. If the "Reset" LED remains lit, then the IJL/3 probably has an internal hardware failure.
4. If the "Ready" LED lights momentarily after reset but then goes back off, it indicates that the self test has failed. The "Ready" light stays on after reset if the self test passes. This test takes about one second to complete. The IJL will not send self test failure messages out the serial line, but will respond with a RAMERR code to a status request.

With the "Ready" LED on, the "Monitor" mode may be useful for further debug. To use the Monitor, try the following procedure.

- 1) connect the RS-422 serial port to an ANSI terminal emulator (e.g. VT-220/320 emulation),
- 2) set the terminal to 1 stop bit, odd parity, 8 bits per character
- 3) set the terminal to software handshaking (x-on/x-off)
- 4) set the terminal to the baud rate of 9600
- 5) reset the IJL/3 by asserting the Reset (DTR) line (if your host cannot assert the Reset line, turn the power off for about five seconds and then turn it back on)
- 6) observe that the "Reset" LED comes on momentarily and then goes off
- 7) observe that the "Ready" LED is lit
- 8) press the space bar three times and the IJL/3 will enter Monitor mode

The Monitor Version notice should appear on the screen, followed by a prompt character '>'. Typing a question mark followed by a CR should give a list of available commands. The IJL/3 uses the ASCII Newline character for CR (not the older CR/LF combination). When you type the question mark, it should be echoed by the IJL/3 to your screen on the terminal. Use the Monitor commands as needed in an interactive debug session.

At the caret, type "V 1000" followed by a CR to cause the ink jet print head to immediately begin printing 1000 vertical bars (all 12 pixels). If no ink is sprayed from the head, then check all connections to the Print Pod and IJL/3 Controller. Check that the ink cartridge is correctly installed in the Print Pod. If there is still no printing on the paper, very gently wipe

the gold contact pads in the Print Pod to ensure a good connection with the ink cartridge. If you still get no response to the "V 1000" command, the IJL controller and Print Pod may need to be serviced.

As a final check, type "A" followed by a CR and drag a piece of paper over the print head at about 5-10 inches per second. The IJL/3 should print the alphabet. If you see some printing, but the characters are poorly formed, it is probable that you have a clogged jet on the print head. This is especially true if this is the first time the head has printed in a day or more. The clog often clears itself by just printing more characters. But if it doesn't clear within 10 or 20 characters, follow the procedure for priming the print head (see the "Print head cartridge" section of this guide).

To test the paper sense circuitry, try typing "S abcdef" followed by a CR. The IJL/3 should wait until paper is placed over the Print Pod. Slide paper over the Print Pod and the string "abcdef" should be printed. This sequence of commands uses all of the IJL/3 circuitry. If they work, then the IJL/3 system is in good working order.

Note on RS-232 vocabulary: The RS-232 state of "asserted" is sometimes called "space" (these are synonyms) and refer to positive voltage levels. The "negated" state is synonymous with "unasserted" and "mark" which refers to negative voltage levels.