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Print Head Specifications:

Horizontal resolution:

HP: 300dpi
Valve: 4-33 dpi

Vertical resolution:

HP: 300dpi
Valve: 24 dpi

Maximum message length:

HP: 108 inches
Valve: 200 inches

Line speed maximum:

HP: 200 ft/min
Valve: 650 ft/min

Daisy chain:

HP: 8 Cartridges (eight ½", four 1" heads, or any combination totaling 8 cartridges)
Valve: 2 print heads

Cartridge firing parameters:

Porous: 12.4 volts, 1.8 microseconds
Non-Porous: 8.8 volts, 1.8 microseconds
45si 8.8 volts, 1.8 microseconds

Connection:

Serial port settings to connect to the print head are 57600,8,n,1 no flow control.

Command structure:

Print head commands are structured as follows: head address (head address is 0 indexed), then the command followed by a carriage return (0x0d) or a line feed (0x0a). For example, to set the horizontal field position of the first head in the daisy chain at 50 columns the command would be:

```
0h0050↵
```

Characters sent to the head are echoed back on the serial port as they are sent, with the exception of the head address. The head address is echoed back upon reception of the first character of the command. If a character is not echoed within one second then the head has not received it. When the head receives a CR (0x0d) or a LF (0x0a) it will respond with a CRLF (0x0d0a). If the command is a request for information, then the response will follow. Command length, excluding the print head address, cannot exceed 169 bytes.

NOTE: If any one character in the command string is a utf-8 (Unicode) encoded character, the entire command string is utf-8 encoded.

A note about HP print head addresses: An HP 1" print head occupies two consecutive print head addresses, with the top half of the head always having the lower number address of the pair.

A complete example of setting up a print message:

This:

```
0z↵  
0fTArial_150,Test↵  
0h390↵  
0v0↵  
0fTArial_75,Hello↵  
0h390↵  
0v75↵  
0fTArial_75,World↵  
0a675↵
```

Prints this:



Printer Commands:

tMMDDhhmmYY – Calendar set

Set time and date of the print head's internal clock. Both time and date must be set in a single command. Setting the clock sets the seconds to 0.

MM - Month (01-12)

DD - Day (01-31)

hh - Hour (00-23)

mm - Minute (00-59)

YY - Year (00-70)

rtHHMM – Set rollover time.

Rollover time is the time that printed day and date codes “rollover” from one day to the next. It is set using a 24 hour format; the default rollover time is 00:00 (midnight).

Example:

```
0rt2330↵          Set rollover time to 23:30.
```

hDDDDD – Set horizontal field position

Set horizontal field position (indent from left edge of product) in print columns, where DDDDD is the number of columns (0-32767). DDDDD is calculated as follows:

HP: $DDDDD = (\text{indent in inches, to 2 decimal places}) \times 300$

Valve: $DDDDD = (\text{indent in inches, to 2 decimal places}) \times 100 / (\text{message dpi setting})$; discard any decimal number in the results. See the **Dxx** command on page 3 for an explanation of the message dpi setting.

For example, to place a field 4.25 inches from the left edge of the product:

HP: $DDDDD = 4.25 \times 300 = 1275$

Valve: (Assume a dpi setting of 4) $DDDDD = 4.25 \times 100 / 4 = 106.25 \approx 106$

vDDDD – Set vertical field position

Set vertical field position in dots; 0 is the top dot.

HP: $DDDD = \text{value (0-149)}$

Valve: $DDDD = \text{value (0-11)}$

uD – Print upside down command

D = 0, print right side up.

D = 1, print upside down.

The upside down command acts like a switch: all fields received between a **u1** command and a **u0** command will print upside down. The Clear command (see the **z** command, page 3), forces right side up print.

aDDDDD – Set product length

Set product length, in print columns, where DDDDD is the number of columns (0-32676).

DDDDD is calculated as follows:

HP: DDDDD = (length in inches, to 2 decimal places) x 300

Valve: DDDDD = (length in inches, to 2 decimal places) x 100 / (message dpi setting); discard any decimal number in the results. See the **Dxx** command on page 3 for an explanation of the message dpi setting.

For example, assuming a product length of 17.75 inches:

HP: DDDDD = 17.75 x 300 = 5325

Valve: (Assume a dpi setting of 4) DDDDD = 17.75 x 100 / 4 = 443.75 ≈ 443

z – Clear the print message buffer

Set horizontal field position, vertical field position, and message length to 0; forces right side up print; restores default barcode properties.

cD[,NNNNNN] – Continuous print

D = 0, non-continuous print (default); prints once each time the photocell is blocked.

D = 1, continuous print; message prints repeatedly as long as the photocell is blocked.

NNNNNN = optional, print NNNNNN number of times before canceling. For example c0,10 would print 10 times before cancelling.

i – Print trigger

The print trigger command functions only when the print direction is set to 'l' or 'r' (see the **pdD** command), and the print head is configured for fixed print speed (see the **psDDD** command) or external encoder (see the **peD** command).

pu – Purge the print head

Example of purging the first print head:

0pu←

Dxx – Set print resolution (dpi)

HP: Not applicable; HP print heads are fixed at 300 dpi.

Valve: xx = value (3-25), where 100 / xx = the printed dots per inch. For example, a setting of 3 equals 33.33 dpi, a setting of 4 equals 25 dpi, a setting of 5 equals 20 dpi, etc. The default setting is 5.

wDDD – Set horizontal character width

Set horizontal character width as a percentage; default is 100.

DDD = value (25-600); accepted values: 25, 33, 50, 66, 75, 100, 150, 200, 300, 400, 500, 600

SDDD – Spacing between characters

Specified in print columns.

HP: DDD = value (3-252), in increments of 3 print columns. The default setting is 3.

Valve: DDD = value (1-252), in increments of 1 print column. The default setting is 1.

pCD – Total Product Count command

D = 0, tells the print head to reset the total product count to zero.

D = 1, tells the print head to report the current total product count.

Example:

0pC1↵

PC:xxxxx

Where xxxxx is the total number of all products printed since the count was last reset.

The product count is a maximum 10-digit number with values that range from 0 – 4,294,967,296. Leading zeros and commas are not included as part of the reported count.

pdD – Set print direction of the print head

D = l (lower case 'l'), package travels left to right past the print head (default).

D = r, package travels right to left past the print head.

D = 0 (zero), print direction is automatically detected by the print head's internal photocells.

A setting of 'l' or 'r' requires the print head be configured for fixed print speed (see the **psDDD** command) or external encoder (see the **peD** command).

psDDD – Set the print head's print speed

Specified in feet per minute.

HP: DDD = value (000-200)

Valve: DDD = value (000-650)

A setting of 0 tells the print head to automatically determine the print speed using its two internal photocells. The print speed setting is ignored when the print head is configured for external encoder (see the **peD** command).

poDDDDD – Set the photocell offset

Specified in print columns, where DDDDD is the number of columns (0-32676). The photocell offset is the distance from the center of the photocell to the center of the print head. DDDDD is calculated as follows:

HP: DDDDD = (offset in inches, to 2 decimal places) x 300

Valve: DDDDD = (offset in inches, to 2 decimal places) x 100 / (message dpi setting); discard any decimal number in the results. See the **Dxx** command for an explanation of the message dpi setting.

For example, assuming an offset of 2.5 inches:

HP: DDDDD = 2.5 x 300 = 750

Valve: (Assume a dpi setting of 4) DDDDD = 2.5 x 100 / 4 = 62.5 ≈ 62

ppD – Pause print command

- D = 0, normal print head operation.
- D = 1, print is paused (photocell trips are ignored) at the end of the current print cycle.

pfD – External Photocell command

- See the **Connector Pinout** section for physical connections and signal specifications.
- D = 0, print is triggered by the print head’s internal photocells (default).
 - D = 1, print is triggered by an external photocell or other device.

peD – External Encoder command

- See the **Connector Pinout** section for physical connections and signal specifications.
- D = 0, print speed is determined by the print head’s internal encoder (default).
 - D = 1, print speed is determined by an external encoder.

pSD – 45si Cartridge command, HP print head only

- D = 0, tells the print head it is operating with a standard print cartridge (default).
- D = 1, tells the print head it is operating with a 45si print cartridge.

pbD – Bulk Ink command, HP print head only

- D = 0, tells the print head that it is operating with a regular print cartridge.
- D = 1, tells the print head that it is operating with a bulk ink system fed print cartridge.

paD – Alternate Banks command, HP print head only

- D = 0, tells the print head not to alternate print banks
- D = 1, tells the print head to alternate print banks (default)

moD – Beacon Mode command

Set beacon output to respond to system status as per the table below. Values of **D** other than those shown are not supported. All print heads in a daisy chain should be set to the same value of **D** (remember that a 1” HP print head occupies two consecutive addresses). The easiest way to do this is to send the **moD** command as a broadcast command (see the **Pcmd** command, next page).

D	OK	Ink Low	Ink Out	System Error
0 (default)	Off	On	Slow Blink	Fast Blink
1	Off	On	On	On
2	Off	Off	On	On

pcDDD – Calibration command, 1” HP print head only

The calibration command vertically aligns the print for the top and bottom print cartridges on a 1” HP print head. Misalignment is most noticeable when printing with the Arial_300 (1”) font, or when printing logos taller than 1/2” (see illustration below).

DDD = calibration value (310-350).

The calibration value is factory set, and normally does not need to be adjusted by the user.



ptD – Trailing print head command, 1” HP print head only

D = 0, indicates the leading print head, the one seen first by a passing product.

D = 1, indicates the trailing print head.

D should always be 0 for a 1/2” print head.

Pcmd – Broadcast command

Sends a command to all print heads in the daisy chain simultaneously.

cmd = the command to be sent. The print head address in the command is the address of the last print head in the daisy chain. Examples:

P1pp1↵ Pause print on all print heads in a two head daisy chain.

P3ps60↵ Set the print speed of all print heads in a 4 head daisy chain to 60 ft/min.

The broadcast command does not operate with the status (**ss**), print buffer (**sb**), or list files (**sf**) commands.

pVssssssssss – Variable String command

Where **ssssssssss** is the variable string data. Sets the data used by the **fVT** and **fVB** fields, the variable text and variable barcode fields, respectively.

Example:

0pV13579024683215↵ When printed in a variable text field, it prints “13579024683215”.

When printed in a variable barcode field, it prints as:



13579024683215

ss – Status command

Example:

```
0ss↵
v:10.31604120731tj
i:gp
f:o
e:00
s:0
t062811131042
rt2330
ps0
pd0
pf0
pe0
pp0
po0
pc330
pt0
pa1
```

Description:

```
v:10.31604120731tj
i:gp

f:o
e:00
t062811131042

rt2330

ps0
pd0
pf0
pe0
pp0
po0
pc330
pt0
pa1
```

Print head **Firmware version** number

Ink Status: 1 to 3 characters

1st char: g = good, l = low, o = out, ? = status unavailable/error

2nd char: p = porous ink, n = nonporous ink, S = HP 45si cartridge.

3rd char: b = bulk ink cartridge, none = regular cartridge

Photocell Status: o = off, l = left, r = right, b = both, e = external

Error Code, factory use only.

Time and date, formatted as follows:

Month	06	28	11	13	10	42	Seconds
Day							Year
Hour							Minute

This is the same format as in the Calendar command, with the addition of the seconds.

Rollover time, formatted as follows:

Hour	23	30	Minutes

Print speed, see the **psDDD** command for format

Print direction, see the **pdD** command for format

Photocell, see the **pfD** command for format

Encoder, see the **peD** command for format

Pause, see the **ppD** command for format

Photocell offset, see the **poDDDDD** command for format

Calibration, see the **pcDDD** command for format and details.

Trailing print head, see the **ptD** command for format and details.

Alternate print banks

si – Ink supply status command

Reports the amount of ink in the print cartridge as a percentage of a full cartridge.

Example:

```
0si↵
i:xxx Where xxx is a value of 0 - 100. Leading zeroes are not included in
the response.
```

sf – List files command

Lists all fonts and logos currently resident on the print head.

Example:

```
0sf↵
Arial_30
Arial_75
Arial_150
Arial_225
Arial_300
CompanyLogoLg
CompanyLogoSm
```

rm <filename> – Remove file command

Removes (deletes) the font or logo file specified by <filename> from the print head. The command format is 'rm', followed by a space, followed by the file name.

Examples:

```
0rm CompanyLogoLg↵
0rm Arial_300↵
```

rc D xxxx – Reset count in print buffer

D = *, all counts reset to the value provided

0-9, reset a specific count

xxxx = value to reset the count to

sR – Refresh Status command

The Refresh Status command is used to request the current print message refresh status. "Refresh" refers to the process of preparing a print message for printing – variable text and barcode fields are filled with the latest variable data, count codes are incremented, and date and time codes are updated. Refresh occurs at the beginning of each print cycle, immediately after the photocell is tripped. The refresh status automatically resets to '0' after every refresh status request.

Example: 0sR↵

The print head returns one of three responses to an **sR** command:

- R:0 Indicates no print message refresh has occurred since the last **sR** command.
- R:1 Indicates at least one successful print message refresh since the last **sR** command.
- R:2 Indicates an unsuccessful refresh attempt. That is, the line speed is too fast for the distance between the photocell and print head to allow a print message to successfully complete the refresh process. Either decrease the line speed or increase the photocell-to-print head distance. Once the refresh status goes to '2' it remains at '2', even when subsequent refresh attempts are successful, until the print head receives an **sR** command.

sb – Dump print buffer contents command.

The end of the print buffer is indicated by a blank line.

Example:

```
0sb↵
h0000
v0000
u0
fTArial_150,ITW
h0330
v0000
u0
fTArial_75,TJ
h0330
v0075
u0
fTArial_75,500
c0
a0900
```

Description:

h0000	Field #1 horizontal position.
v0000	Field #1 vertical position.
u0	Print field right side up.
fTArial_150,ITW	Field #1 – text field, Arial_150 font, text = “ITW”
h0330	Field #2 horizontal position.
v0000	Field #2 vertical position.
u0	Print field right side up.
fTArial_75,TJ	Field #2 – text field, Arial_75 font, text = “TJ”
h0330	Field #3 horizontal position.
v0075	Field #3 vertical position.
u0	Print field right side up.
fTArial_75,500	Field#3 – text field, Arial_75 font, text = “500”
c0	Continuous print is off.
a0900	Product length, 900 print columns (3.00 inches).

Print Field Commands

All print field commands begin with a lower case **f** when all characters in the field are in the normal ASCII character set (0x20-0x7f), and an upper case **F** when one or more characters in the field are utf-8 encoded. All of the examples used here use the lower case **f** (ASCII) form of the commands.

fTxxxx,sssssssssss – Text field

Prints simple text.

xxxxx = Font name (for a list of available fonts, use the **sf** command).

sssssssssss = text to be printed. The maximum space available for text is 169 bytes minus the command length (**fT** + font name length + comma). The maximum number of printable characters this corresponds to depends on the character encoding, which is one byte per character for ASCII, and one, two, or three bytes per character for utf-8 encoding.

Example: `fTArial_75,ACME ICE CREAM NOVELTIES`

fVTxxxx,sssssssssss – Variable Text field

Prints a text field using the variable data set by the most recent **pV** command.

xxxxx = Font name (for a list of available fonts, use the **sf** command).

sssssssssss = text sent with the command as a place holder. Place holder text should contain enough characters to equal or exceed the number of characters in the worst case variable string to be printed. The place holder text does not print.

Example: `fVTArial_75,ABCDEFGHIJKLMN` prints a variable string having a maximum 16 characters.

Sequence (Count) Field

There are two sequence field command formats, short and long. The short format command is compatible with all versions of print head firmware. The long format command is compatible only with print head firmware versions 7.5 or later.

With either format, a count's value is incremented when the photocell is tripped initiating a print cycle. This means two things when interfacing directly to a print head:

1. The count value initially sent to the print head must be one less than the desired starting count.
2. The count value returned in a print buffer dump (see the 'sb' command) is the last count printed.

The **short format** sequence command prints a simple incrementing numeric count. Its format is:

fSxxxx,ddddddd – Short format

xxxxx = Font name.

ddddddd = first number in the count to be printed - 1. Counts may be up to 9 digits long, and must include leading zeros as the number of digits in the command specifies the number of digits in the count.

The print count can begin at any value except zero, but when it rolls over it goes from all 9s to 1. It is not possible to print a count of zero with the short format command.

Examples: `fSArial_75,000000` prints a six digit count starting at 000001.
`fSarial_75,999999` also prints a six digit count starting at 000001.
`fSarial_75,0999` prints a 4 digit count starting at 1000.

The **long format** sequence command can print incrementing or decrementing product and pallet counts, counting with numbers or letters, in increments from 1 to 9999, and with or without leading zeros. The long command format is:

fSxxxx,sssssssss,SSSSSSSS,z,iiii,pppp,cccc,dddddddd – Long format

xxxx = Font name.

sssssssss = Starting count value, 1-9 digits for numeric counts, 1-7 digits for alpha counts. When the count rolls over it rolls over to the starting count value.

SSSSSSSSS = Stopping count value, 1-9 digits for numeric counts, 1-7 digits for alpha counts.

When SSSSSSSS > ssssssss the count is an incrementing count. When an incrementing count exceeds the stopping count value it resets to the starting count value.

When SSSSSSSS < ssssssss the count is a decrementing count. When a decrementing count dips below the stopping count value it resets to the starting count value.

z = Leading zeros flag; 1 = print leading zeros, 0 = do not print leading zeros.

iiii = Print-to-print count increment or decrement, 1-4 digits.

pppp = Items per pallet, 1-4 digits. When 0 the count is a product count, when other than 0 the count is a pallet count, and the value pppp is the number of items per pallet.

cccc = Pallet item count, 1-4 digits, normally begins at 0. When a count is defined as a pallet count, that is, pppp is non-zero, this value is incremented at the beginning of every print cycle. When it exceeds pppp it is reset to 1 and the print count (dddddddd, below) is incremented/decremented by iiiii.

dddddddd = This is the actual count printed, and its initial value depends on the type of count being printed. When printing a normal incrementing or decrementing count that begins at the starting count value, make this value equal to the stopping count value. If the count begins between the start and stop values, make it the desired value plus or minus the iiiii value. For pallet counts it should be set equal to the desired starting value.

- Notes:**
1. ssssssss, SSSSSSSS, and dddddddd must always have the same number of digits or characters.
 2. To print an alpha count, that is, with letters instead of numbers, ssssssss, SSSSSSSS, dddddddd, and iiiii are specified using letters. Explanations and examples are below.
 3. When not printing leading zeros, space characters take the place of zeros in ssssssss, SSSSSSSS, and dddddddd.
 4. pppp and cccc are always numbers, and must have the same number of digits.
 5. All fields in the command must contain data, even if only a '0' (zero).
 6. Not following the above will cause undefined operation.

Examples:

1. A five digit count which begins at 1, counts to 99,999, prints leading zeros, and increments by 1:

```
fSArial_75,00001,99999,1,1,0,0,99999
```

2. A five digit count which begins at 5, counts to 25,000, does not print leading zeros, and increments by 5. Note the 4 spaces before the 5 in the starting value, which gives the start count, stop count, and print count 5 characters each.

```
fSArial_75,    5,25000,0,5,0,0,25000
```

A print buffer dump a few prints after print starts would return:

```
fSArial_75, 5,25000,0,5,0,0, 15
```

3. A six digit count that counts down from 500,000 to 1 and prints leading zeros:

```
fSArial_75,500000,000001,1,1,0,0,000001
```

4. A four digit incrementing pallet count, 50 items per pallet. Note that the pallet item count is initially set to 00, and the print count to the desired starting value:

```
fSArial_75,0001,9999,1,1,50,00,0001
```

The next two are examples of alpha counts. There are two alpha count formats, one for printing a count with leading zeros, and one for printing a count without leading zeros. The formats are based on what is expected of the count for each format.

- When printing leading zeros, A = 0 by definition, so B = 1, C = 2, etc. The counting sequence is AAB, AAC, AAD, ..., AAY, AAZ, ABA, ABB, ABC, ...
 - When printing without leading zeros, A = 1, B = 2, C = 3, etc. The counting sequence is A, B, C, ..., X, Y, Z, AA, AB, AC, ...
5. A three digit incrementing alpha count, with leading zeros, that prints from B to ZZZ, and increments by 1 (equivalent decimal count is 00001 – 17575):

```
fSArial_75,AAB,ZZZ,1,B,0,0,ZZZ
```

6. A three digit incrementing alpha count, without leading zeros, that prints from A to YYY, and increments by 1 (again, equivalent decimal count is 1 – 17,575):

```
fSArial_75, A,YYY,0,A,0,0,YYY
```

fCxxxxx,DDDD,(format) – Calendar field, short command format

Prints a date/time code.

xxxxx = Font name.

DDDD = Date offset, optional, default value is 0. The date offset is added to the base date to determine the actual date printed. The base date is specified by adding a prefix to the offset:

No prefix: the base date is the current date.

Prefix = w: the base date is the date of the most recent Monday. (Set the offset to zero to print a “week of” code.)

Prefix = f: the base date is the date of the first day of the current fortnight. Fortnights are calculated from a starting date of Saturday, Jan. 1, 2000.

The offset can be specified in either days or months as determined by a suffix:

No suffix, or suffix = D: the offset is specified in days, using 1-4 digits, maximum value is 9999.

Suffix = M: The offset is specified in months, using 1-3 digits, maximum value is 300.

Format characters can be any of the following, used in any combination or sequence:

JJJ = day of the year (001-366)
MM = 2-digit month (01-12)
MON = Month (JAN-DEC)
DD = Day of month (01-31)
Y = 1-digit year (0-9)
YY = 2-digit year (00-70)
YYYY = 4-digit year (2000-2070)
hh = Hour (00-23)
mm = Minutes (00-59)
ss = Seconds (00-59)

Any characters not included in the formats listed above, when included as part of the format, will print 'as is' in the position they occupy in the format string. For example, assuming the current date is June 30, 2015, the following calendar field commands will produce the print shown.

<code>fCArial_150,0000,MM/DD/YY</code>	will print as 06/30/15.
<code>fCArial_150,MM/DD/YY</code>	will also print as 06/30/15.
<code>fCArial_150,0001,MM-DD-YY</code>	will print as 07-01-15.
<code>fCArial_150,w001M,MM-DD-YY</code>	will print as 07-08-15. (June 10, 2015 is a Wednesday. The most recent Monday is June 8. June 8 plus 1 month is July 8.)

fCxxxxx,DDDD,%w,t,ss,o,SS,T – Calendar field, long command format

Use the long command format to print custom and alpha date/time codes that are sequential, periodic (a shift code, for example), or defined in a lookup table. The components in the long command format are:

xxxxx = Font name.

DDDD = Date offset, optional, default value is 0. The date offset is added to the base date to determine the actual date printed. The base date is specified by adding a prefix to the offset:

No prefix: the base date is the current date.

Prefix = w: the base date is the date of the most recent Monday. (Set the offset to zero to print a "week of" code.)

Prefix = f: the base date is the date of the first day of the current fortnight. Fortnights are calculated from a starting date of Saturday, Jan. 1, 2000.

Prefix = s: this is a special prefix that, when used, makes all count fields in the print message reset to their starting values when the printed time or date code changes. When using the 's' prefix DDDD must have a value of 0. Operation is undetermined when the value of DDDD is other than 0. See calendar field examples 9 and 10.

The offset can be specified in either days or months as determined by a suffix:

No suffix, or suffix = D: the offset is specified in days, using 1-4 digits, maximum value is 9999.

Suffix = M: The offset is specified in months, using 1-3 digits, maximum value is 300.

%w = The **width** of the printed code in bytes. The '%' character is required, i.e. %2.

t = The **type** of code printed – hour, minute, day, month, etc. The code types and their ranges are:

m = minute, 00-59
 q = quarter hour, 00-95
 h = hour, 00-23
 D = day of week, 0-6 (0 = Sunday)
 d = day of month, 01-31
 w = week of year, 01-53
 M = month, 01-12
 y = year, 00-99

ss = Sequence **size**, specifies the number of items in a sequential code.

o = Optional **offset** value to add before performing code conversion/lookup.

SS = Table of **start** times, days, dates, etc., required for periodic codes. All entries are 2 digits, i.e. 010203...

T = **Table** of codes to be printed. For sequential codes this is only the first code in the sequence. For periodic codes, and codes defined in a lookup table, the table contains the entire code set. All entries in the code table require the same number of bytes of storage space as specified by %w.

- Notes:**
1. The byte-width of the printed code (%w) will be more than one byte per character if any single code in the code table contains a utf-8 (Unicode) encoded character. For example, %w = 3 for an English language 3-letter month code as all characters are encoded in standard ASCII. For a French language 3-letter month code, however, %w = 4, as the abbreviation for August is AOÛ, and the utf-8 encoded letter Û requires two bytes. In such a case use leading or trailing space characters (0x20) to fill the extra bytes in the other months' codes.
 2. The long format command cannot exceed 169 bytes, including the command, font name, date offset, code lookup table if appropriate, and delimiting commas.
 3. The commas delimiting the command components must always be included, even if a component is not used, and when a component is not used its delimiting commas are placed back-to-back.

Examples:

1. Prints a sequential, single letter day of the week code where A = Sunday, B = Monday, etc.:

```
fCArial_150,,%1,D,7,,,A
```

2. Prints a 3-character day of the week code, with the code obtained from a lookup table:

```
fCArial_150,,%3,D,,,,SunMonTueWedThuFriSat
```

3. Prints a 3-character month code, with the code obtained from a lookup table. Note the -1 offset, which compensates for the months starting at 01 instead of 00.

```
fCArial_150,,%3,M,-1,,JanFebMarAprMayJunJulAugSepOctNovDec
```

The same code can be printed without the -1 offset if a dummy month is the first entry in the table:

```
fCArial_150,,%3,M,,,,xxxJanFebMarAprMayJunJulAugSepOctNovDec
```

4. Prints the month code of example 3 with a 6-month date offset:

```
fCArial_150,6M,%3,M,-1,,JanFebMarAprMayJunJulAugSepOctNovDec
```

5. Prints a 2-character shift code using the quarter hour code and an interval table, with shifts S1, S2, and S3 starting at 00:00 (qtr hour 01), 07:30 (qtr hour 31), and 16:00 (qtr hour 65), respectively:

```
fCArial_150,,%2,q,1,013165,S1S2S3
```

6. Prints a quarter-of-the-year code using the month code and an interval table, with quarters beginning the first of January, April, July, and October:

```
fCArial_150,,%2,M,,,01040710,Q1Q2Q3Q4
```

7. Prints the hour in 12-hour format, i.e. 01-12 for 1:xx a.m. to 12:xx p.m., then again for 1:xx p.m. to 12:xx a.m., with the code obtained from a lookup table (remember that midnight is hour 00):

```
fCArial_150,,%2,h,,,,120102030405060708091011
```

The same 12-hour clock code can also be printed with this command, which lists the codes in order from 01-12, and uses an offset of 11 to convert the hour to the correct code:

```
fCArial_150,,%2,h,,11,,010203040506070809101112
```

8. Prints a 1-character sequential year code for years xxx0-xxx9, beginning with the letter 'H'.

```
fCArial_150,,%1,y,10,,,H
```

9. Prints a 1-character shift code using the quarter hour code and an interval table, with shifts codes A, B, and C starting at 00:00 (qtr hour 01), 08:00 (qtr hour 33), and 16:00 (qtr hour 65), respectively. All print counts in the message are reset to their starting values at the start of each new shift.

```
fCArial_150,s0000,%1,q,,1,013365,ABC
```

10. Prints a sequential, single letter day of the week code where A = Sunday, B = Monday, etc. All print counts in the message are reset to their starting values at the start of each new day.

```
fCArial_150,s0000,%1,D,7,,,A
```

fLxxxxx – Logo field

Prints a logo field that was downloaded to the print head

xxxxx = Name of logo to be printed. A Logo name is limited to 15 characters.

Barcode Field (HP print heads only)

There are two barcode field related commands: the 'o' (lower case 'o') command for selecting the barcode type, mil setting, and height, and the fB command for setting the barcode data. Strictly speaking, the 'o' command is a printer command, not a print field command, and as such does not use the 'f' prefix. It is included here simply to keep the barcode commands together.

o<type>,<mil>,<height>,<error correction> – Set barcode properties

Where <type> is the barcode type represented as a one or two digit number (see table below), <mil> is the width in mils of a narrow bar, <height> is the barcode height in print dots (300 dots = 1 inch), excluding human readable, and <error correction> is the error correction level (used by QR Codes only). Error correction levels are 0-3, where 0 = low, 1 = medium, 2 = quartile, and 3 = high. The commas are part of the command format.

<u>Barcode Type</u>	<u>No.</u>
GTIN-12 (UPC-A)	1
UPC-E	2
GTIN-13 (EAN-13)	3
GTIN-8 (EAN-8)	4
Code 39	5
I 2 of 5	7
GTIN-14 (UCC-128)	14
Code 128	8
GS1-128	14
GS1 DataMatrix	9
Data Matrix	11
QR Code	12

Example:

0o8,20,115┘ Specifies a Code 128 barcode with a narrow bar width of 20 mils and a height of 115 dots (0.38 inches).

- NOTES: 1. Default barcode properties are type = GTIN-12 (UPC-A), mil = 20, height = 100.
2. The Clear command (**z**) restores the default barcode properties.
3. The **o** command must precede the **fB** command.

fBnnnnnnnnnnnn – Barcode field

Prints a barcode of a type and height as specified by the most recent Barcode Properties command (o<type>,<mil>,<height>,<error correction>).
nnnnnnnnnnnn = Barcode value

NOTE: Barcodes printed by the **fB** do not include a human readable element. To print human readable use the **fT** command to print a separate text field.

fVBnnnnnnnnnnnn – Variable Barcode field

Prints a barcode field using the variable data set by the most recent **pV** command, and of a type and height as specified by the most recent Barcode Properties command (o<type>,<mil>,<height>,<error correction>).
nnnnnnnnnnnn = data sent with the command as a place holder. The number of characters should be equal to that needed to meet the requirements of the selected barcode type. If the barcode type accepts data of varying length, the number of characters should equal or exceed the longest data string to be printed.

NOTE: Barcodes printed by the **fVB** do not include a human readable element. To print human readable use the **fVT** command to print a separate variable text field.

Complete Barcode Example

The sequence of commands to print a complete barcode, including human readable, would look like this:

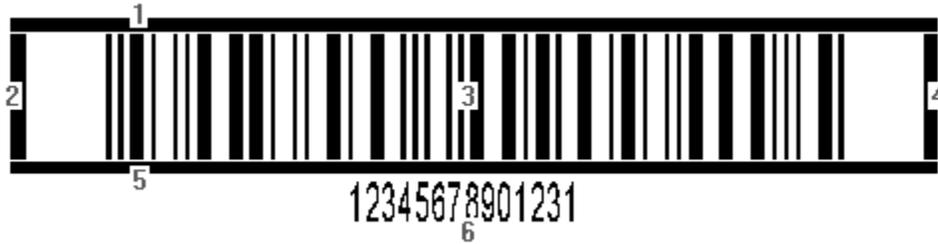
<u>Command</u>	<u>Description</u>
0o8,20,115↵	Code 128, 20 mil, height = 115
0v0000↵	Barcode's vertical position
0h0300↵	Barcode's horizontal position
0fB1234567890↵	Barcode data = 1234567890
0v0120↵	Human readable vertical position (5 dots below barcode)
0h0444↵	Human readable horizontal position
0fTArial_30,1234567890↵	Human readable text field w/same data as barcode field

fRwww,hhh - Print a solid region

With specified width (www = 1-9999) and height hh = (1-599); used primarily to print bearer bars for barcodes. The complete sequence of commands to print a barcode with bearer bars and human readable is shown below, grouped vertically to more clearly show the commands for each field. The bearer bars are sized and positioned to provide a 0.4" quite zone on either side of the barcode.

<u>Command</u>	<u>Description</u>
1. 0v0000↵	Top horizontal bearer bar's vertical position
0h0000↵	Top horizontal bearer bar's horizontal position
0fR1399,010↵	Region field for top bearer bar, 1399 dots wide, 10 dots high
2. 0v0010↵	Left side bearer bar's vertical position
0h0000↵	Left side bearer bar's horizontal position
0fR0024,095↵	Region field for left side bearer bar, 24 dots wide, 95 dots high
3. 0o7,30,095↵	I 2 of 5, 30 mil, height = 95
0v0010↵	Barcode's vertical position
0h0144↵	Barcode's horizontal position (0.4" right of left bearer bar)
0fB12345678901231↵	Barcode data = 12345678901231
4. 0v0010↵	Right side bearer bar's vertical position
0h1375↵	Right side bearer bar's horizontal position (0.4" right of barcode)
0fR0024,095↵	Region field for right side bearer bar, 24 dots wide, 95 dots high
5. 0v0105↵	Bottom bearer bar's vertical position
0h0000↵	Bottom bearer bar's horizontal position
0fR1399,010↵	Region field for bottom bearer bar, 1399 dots wide, 10 dots high
6. 0v0120↵	Human readable vertical position (5 dots below bottom bearer bar)
0h0513↵	Human readable horizontal position
0fTArial_30,12345678901231↵	Human readable text field w/same data as barcode field

The illustration below shows all six fields that make up the complete barcode, with vertical separation added for clarity. The numbers 1-6 indicate the order in which the fields are added to the message. They must be added in the order shown – top to bottom and left to right – for the image to print properly.



– Comment

Any line beginning with # is ignored by the print head.

Print Head Firmware Upgrade Procedure (see 5765-392N)

Refer to document 5765-392N for Print Head Firmware Upgrade Procedure.

Connector Pinouts

9-Pin Male	Signal	I/O, Type
1	RESERVED	OEM USE ONLY, DO NOT CONNECT
2	TRANSMIT	OUTPUT, RS232
3	RECEIVE	INPUT, RS232
4	RESERVED	OEM USE ONLY, DO NOT CONNECT
5	GND	SIGNAL GROUND
6	ENCODER	INPUT, ACTIVE<2VDC, 4VDC<INACTIVE<28VDC OR TRISTATE
7	BEACON	OUTPUT, OPEN COLLECTOR (15VDC @ 2.1A max)
8	EXT. PHOTO	INPUT, ACTIVE<2VDC, 4VDC<INACTIVE<28VDC OR TRISTATE
9	POWER	OUTPUT, 15VDC

9-Pin Female	Signal	I/O, Type
1	RESERVED	OEM USE ONLY, DO NOT CONNECT
2	TRANSMIT	OUTPUT, RS232
3	RECEIVE	INPUT, RS232
4	RESERVED	OEM USE ONLY, DO NOT CONNECT
5	GND	SIGNAL GROUND
6	RESERVED	OEM USE ONLY, DO NOT CONNECT
7	RESERVED	OEM USE ONLY, DO NOT CONNECT
8	RESERVED	OEM USE ONLY, DO NOT CONNECT
9	RESERVED	OEM USE ONLY, DO NOT CONNECT

Revision Table

Rev.	EC No.	Description	Date
A	19389	Release	2/2/09
B	19749	Added Photocell Offset	5/6/09
C	19844	Added connector pinouts, updated for new board, and bulk ink	4/20/10
D	19861	Updated for print head firmware ver. 6.3, added 1" print head	6/30/10
E	19928	Updated for print head firmware ver. 6.5: added 'o' command, 'u' command, 'rt' command, expanded barcodes	3/3/11
F	19973	Added ITF, Region, Count Reset, Alternating Banks	7/11/11
G	19988	Continuous print – added print N times	8/24/11
H	20025	Updated for print head firmware ver. 7.5: added long format Sequence Field, long format Calendar Field, example of barcode using region fields to print bearer bars.	3/22/12
J	20016	Added the moD command; added instructions for upgrading print head firmware; misc. edits.	6/29/12
K	20110	Updated for print head firmware ver. 9.2: added valve type heads; added SDDD command; added Dxx command; misc. edits.	1/15/13
L	20248	Added cartridge interface values.	3/12/14
M	20385	Corrected page numbering.	5/27/15
N	20379	Updated for print head firmware ver. 10.2: added the pSD (45si) command, added the 'S' (45si) flag to ink status reporting, added 's' prefix to offset for long format calendar fields, added regular Data Matrix 2D barcode type.	9/8/15
P	20540	Updated to print head firmware ver. 10.4: max command length changed to 169 bytes; added pV (variable data) command; added sR (refresh status) command; added fVT (variable text) and fVB (variable barcode) fields; added QR codes; added total product count (pCD command).	6/1/16
Q	20670	Added Table of Contents. Added si to Printer Commands. Changed Print Head Firmware Upgrade Procedure to reference document 5765-392N.	4/11/17