The Printer Working Group

February 13, 2020
IPP Registration

IPP Label Printing Extensions v1.0

Status: IPP Workgroup Approved

Abstract: This registration defines IPP attributes and values needed for common desktop, mobile, and industrial label printers.

This registration is available electronically at:

https://ftp.pwg.org/pub/pwg/ipp/registrations/reg-ipplabel10-20200213.docx
https://ftp.pwg.org/pub/pwg/ipp/registrations/reg-ipplabel10-20200213.pdf

Title: *IPP Label Printing Extensions v1.0*

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1. Introduction

The Internet Printing Protocol [STD92] and various IPP extension specifications define attributes, values, and operations for many different kinds of printing but do not address all of the needs of common desktop, mobile, and industrial label and receipt printers. This registration defines the additional IPP attributes and values needed.

2. Terminology

2.1 Conformance Terminology

Capitalized terms, such as MUST, MUST NOT, RECOMMENDED, REQUIRED, SHOULD, SHOULD NOT, MAY, and OPTIONAL, have special meaning relating to conformance as defined in Key words for use in RFCs to Indicate Requirement Levels [BCP14]. The term CONDITIONALLY REQUIRED is additionally defined for a conformance requirement that applies when a specified condition is true.

The term DEPRECATED is used for previously defined and approved protocol elements that SHOULD NOT be used or implemented. The term OBSOLETE is used for previously defined and approved protocol elements that MUST NOT be used or implemented.

2.2 Printing Terminology

Normative definitions and semantics of printing terms are imported from IETF Printer MIB v2 [RFC3805], IETF Finisher MIB [RFC3806], and IETF Internet Printing Protocol/1.1 [STD92].

Direct Thermal: Printing that uses a thermal print head to heat special media to produce marks.

Document: An object created and managed by a Printer that contains the description, processing, and status information. A Document object may have attached data and is bound to a single Job.

Job: An object created and managed by a Printer that contains description, processing, and status information. The Job also contains zero or more Document objects.

Logical Device: a print server, software service, or gateway that processes jobs and either forwards or stores the processed job or uses one or more Physical Devices to render output.

Output Device: a single Logical or Physical Device

Physical Device: a hardware implementation of a endpoint device, e.g., a marking engine, a fax modem, etc.

Thermal Transfer: Printing that uses a thermal print head to heat portions of a ribbon to transfer marks to media.

2.3 Protocol Role Terminology

The following protocol roles are defined to specify unambiguous conformance requirements:

Client: Initiator of outgoing connections and sender of outgoing operation requests (Hypertext Transfer Protocol -- HTTP/1.1 [RFC7230] User Agent).

Printer: Listener for incoming connections and receiver of incoming operation requests (Hypertext Transfer Protocol -- HTTP/1.1 [RFC7230] Server) that represents one or more Physical Devices or a Logical Device.

2.4 Acronyms and Organizations

IANA: Internet Assigned Numbers Authority, http://www.iana.org/

IETF: Internet Engineering Task Force, http://www.ietf.org/

ISO: International Organization for Standardization, http://www.iso.org/

PWG: Printer Working Group, http://www.pwg.org/

3. Requirements

3.1 Rationale

Given the following existing specifications:

1. Internet Printing Protocol/1.1 [STD92]
2. IPP Job Extensions v2.0 [PWG5100.7]
3. IPP 2.0, 2.1, and 2.2 [PWG5100.12]
4. IPP Everywhere [PWG5100.14]
5. PWG Media Standardized Names v2.0 (MSN) [PWG5101.1]

And given the need to support label and receipt printers with IPP, the IPP Label Printing Extensions v1.0 should:

1. Define attributes and values for Direct Thermal and Thermal Transfer printers,
2. Define attributes and values for label printing from rolls, and
3. Provide guidance on implementation.

3.2 Use Cases

3.2.1 Print Labels from a Roll

Jane manages a shipping warehouse and needs to print shipping labels. For efficiency, she chooses a printer that can print on labels from a roll. She configures her shipping software to select roll-fed cut labels of the correct size, and then prints labels for each shipment.

3.2.2 Control Print Darkness

Jack has selected a heavy permanent thermal label for use with his label printer. Because of the thickness of the label, he needs to configure the printer to use a higher print head temperature in order to produce dark enough marks on the labels.

3.2.3 Control Print Speed

Mary needs to increase the speed of label printing during the holiday rush. She configures her shipping software to use a higher print rate on the printer with a corresponding increase in head temperature to compensate, allowing the labels to print more quickly without a loss of quality.

3.3 Exceptions

This registration does not define any exceptions in addition to those defined in the Internet Printing Protocol/1.1 [STD92].

3.4 Out of Scope

The following are considered out of scope for this registration:

1. Definition of new file formats; and
2. Definition of new protocol bindings.

3.5 Design Requirements

The design requirements for this registration are:

1. Define attributes and values to support label printing modes;
2. Define attributes to support label tear-off offsets;
3. Define attributes and values to support media tracking and offset adjustments;
4. Define attributes to support per-Job and per-Printer darkness adjustment;
5. Define attributes to support per-Job speed adjustment; and
6. Define sections to register all attributes, values, and operations with IANA.

4. IPP Model

Label printing introduces new media, marking engine, and label requirements and data elements.

4.1 Media

Label printers use roll-fed media. Rolls typically consist of:

- Continuous paper for variable-length receipts and reports;
- Continuous labels for variable-length labels; and
- Fixed size cut labels with marks or holes along the roll backing.

Continuous paper and label media are already addressed by existing IPP extensions. This registration defined the "media-tracking" member attribute (section 6.1.2) to support mark and web (hole) tracking.

4.2 Marking Engine

Direct Thermal and Thermal Transfer marking engines use heat to produce marks on label and receipt media. The darkness of the marks depends on a combination of head temperature, print speed, and media. This registration defines the attributes listed in Table 1 to provide vendor-neutral printing intent for common label printer controls.

Table 1 - Marking Engine Attributes

Job Template	Printer: Default	Printer: Supported
print-darkness (integer(-10:100))	print-darkness-default (integer(-100:100))	print-darkness-supported (integer(1:100))
print-speed (integer(1:MAX))	print-speed-default (integer(1:MAX))	print-speed-supported (1setOf (integer(1:MAX) | rangeOfInteger(1:MAX)))
N/A	printer-darkness-configured (integer(0:100))	printer-darkness-supported (integer(1:100))

4.3 Label Printing

Printed labels need to be removed by cutting, peeling, or tearing. This registration defines the attributes listed in Table 2 to allow labels to be removed.

Table 2 - Label Printing Attributes

Printer: Configured	Printer: Supported
label-mode-configured (type2 keyword)	label-mode-supported (1setOf type2 keyword)
label-tear-off-configured (integer(MIN:MAX))	label-tear-off-supported (rangeOfInteger(MIN:MAX))

5. New Attributes

5.1 Job and Document Template Attributes

5.1.1 print-darkness (integer(-100:100))

This REQUIRED attribute specifies a darkness (heat) adjustment to the "printer-darkness-configured" (section 5.2.11) value. Values greater than 0 result in darker output while values less than 0 result in lighter output.

Note: This attribute specifies a relative darkness value while the "printer-darkness-configured" attribute provides an absolute value. Thus, the darkness used for a particular Job or Document will be "printer-darkness-configured + print-darkness" with a lower absolute bound of 0 and an upper absolute bound of 100. The actual number of discrete values that are supported by the Printer is reported in the "print-darkness-supported" (section 5.2.8) and "printer-darkness-supported" (section 5.2.12) attributes, typically between 16 and 32 actual darkness/heat levels.

5.1.2 print-speed (integer(1:MAX))

This RECOMMENDED attribute specifies a roll feed speed in hundredths of millimeters per second.

5.2 Printer Description Attributes

5.2.1 label-mode-configured (type2 keyword)

This REQUIRED attribute controls the operating mode of a label printer. Values include:

'applicator': Printed labels are applied automatically to a letter, package, etc.

'cutter': The carrier backing is cut immediately after printing each label.

'cutter-delayed': The carrier backing is cut after a period of inactivity.

'kiosk': The carrier backing is collected on a pickup roll with labels presented for removal.

'peel-off': Labels are automatically peeled off the carrier backing after printing.

'peel-off-prepeel': Labels are automatically peeled off the carrier backing during printing.

'rewind': The carrier backing and labels are collected on a pickup roll without presenting them for removal.

'rfid': Backfeed between labels is disabled to optimize printing of RFID labels.

'tear-off': Printed labels are positioned so the carrier backing can be torn off manually.

5.2.2 label-mode-supported (1setOf type2 keyword)

This REQUIRED attribute lists the supported values of the "label-mode-configured" attribute (section 5.2.1).

5.2.3 label-tear-offset-configured (integer(MIN:MAX))

This CONDITIONALLY REQUIRED attribute controls the distance that labels are fed for tear-off in hundredths of millimeters. Printers that support the 'tear-off' mode (section 5.2.1) MUST support this attribute.

5.2.4 label-tear-offset-supported (rangeOfInteger(MIN:MAX))

This CONDITIONALLY REQUIRED attribute specifies the range of values that are supported for the "label-tear-off-configured" attribute (section 5.2.3). Printers that support the "label-tear-off-configured" attribute MUST support this attribute.

5.2.5 media-top-offset-supported (rangeOfInteger(MIN:MAX))

This RECOMMENDED attribute specifies the range of values that are supported for the "media-top-offset" member attribute (section 6.1.1). Printers that support the "media-top-offset" member attribute MUST support this attribute.

5.2.6 media-tracking-supported (1setOf type2 keyword)

This REQUIRED attribute lists the supported values of the "media-tracking" member attribute (section 6.1.2).

5.2.7 print-darkness-default (integer(-100:100))

This REQUIRED attribute specifies the default value of the "print-darkness" attribute (section 5.1.1).

5.2.8 print-darkness-supported (integer(1:100))

This REQUIRED attribute specifies the number of discrete values that are supported by the "print-darkness" attribute (section 5.1.1).

5.2.9 print-speed-default (integer(1:MAX))

This RECOMMENDED attribute specifies the default value of the "print-speed" attribute (section 5.1.2). Printers that support the "print-speed" attribute MUST support this attribute.

5.2.10 print-speed-supported (1setOf (integer(1:MAX) | rangeOfInteger(1:MAX)))

This RECOMMENDED attribute lists the supported values and ranges of values of the "print-speed" attribute (section 5.1.2). Printers that support the "print-speed" attribute MUST support this attribute.

5.2.11 printer-darkness-configured (integer(0:100))

This REQUIRED attribute controls the base print darkness (heat) as an absolute percentage, where 0 represents the lightest output and 100 represents the darkest output.

Note: This attribute specifies an absolute darkness value while the "print-darkness" (section 5.1.1) attribute provides a relative value. Thus, the darkness used for a particular Job or Document will be "printer-darkness-configured + print-darkness" with a lower absolute bound of 0 and an upper absolute bound of 100. The actual number of discrete values that are supported by the Printer is reported in the "print-darkness-supported" (section 5.2.8) and "printer-darkness-supported" (section 5.2.12) attributes, typically between 16 and 32 actual darkness/heat levels.

5.2.12 printer-darkness-supported (integer(1:100))

This REQUIRED attribute specifies the number of discrete values that the Printer supports for the "printer-darkness-configured" attribute (section 5.2.11).

6. New Member Attributes and Values

6.1 media-col (collection)

6.1.1 media-top-offset (integer(MIN:MAX))

This RECOMMENDED member attribute specifies a feed offset from the top of the current label in hundredths of millimeters.

6.1.2 media-tracking (type2 keyword)

This REQUIRED member attribute specifies how labels are tracked on the carrier backing. Values include:

'continuous': Labels are continuous and there is no media tracking.

'mark': Cut labels are separated by a visible mark on the carrier backing.

'web': Cut labels are separated by a hole in the carrier backing.

6.2 media-type (type2 keyword | name(MAX))

This registration defines a new "media-type" [PWG5100.7] keyword value 'labels-continuous' for continuous roll labels.

7. Implementation Recommendations

7.1 document-format (mimeMediaType)

Printers SHOULD support the following MIME media types:

- The PWG Raster Format ('image/pwg-raster') [PWG5102.4] for general printing;
- The Portable Network Graphics format ('image/png') [RFC2083] for shipping label image printing; and
- Vendor-specific PDLs using vendor media types, e.g., 'application/vnd.example-series'.

7.2 media (type2 keyword | name(MAX))

Most common label sizes are not reflected in the PWG Standardized Media Names v2.0 (MSN) [PWG5101.1] specification. Printers MUST use the self-describing naming convention with keyword media values and SHOULD:

1. Use the 'oe' and 'om' class prefixes for cut labels;
2. Use the 'roll' class prefix for continuous labels and paper; and
3. Report the dimensions in the feed presentation.

For example, a Printer that has a 3" wide roll of 3" x 1" labels SHOULD report the size name 'oe_3x1-label_3x1in' instead of 'oe_1x3-label_1x3in' to minimize processing (rotation) of Document data on both the Client and Printer. This is also consistent with roll-fed media size guidelines, for example a 4" x 3" receipt would use the roll size 'roll_custom_4x3in'.

7.3 print-color-mode (type2 keyword)

Direct Thermal and Thermal Transfer Printers are best suited for bi-level (threshold) output, as small features are harder to reproduce. Monochrome (continuous tone) printing is typically done in a limited way using dithering with a suitable algorithm or matrix. Label Printers SHOULD support the values 'auto', 'bi-level', and 'monochrome'.

8. Conformance Requirements

8.1 Printer Conformance Requirements

In order for a Printer to claim conformance to this document, a Printer MUST support:

1. The required attributes and values defined in section 5;
2. The required member attributes and values defined in section 6;
3. The internationalization considerations defined in section 0; and
4. The security considerations defined in section 10.

Printers SHOULD support the recommendations in section 7.

8.2 Client Conformance Requirements

In order for a Client to claim conformance to this document, a Client MUST support:

1. The required attributes and values defined in section 5;
2. The required member attributes and values defined in section 6;
3. The internationalization considerations defined in section 0; and
4. The security considerations defined in section 10.

Clients SHOULD support the recommendations in section 7.

9. Internationalization Considerations

For interoperability and basic support for multiple languages, conforming implementations MUST support:

1. The Universal Character Set (UCS) Transformation Format -- 8 bit (UTF-8) [STD63] encoding of Unicode [UNICODE] [ISO10646]; and
2. The Unicode Format for Network Interchange [RFC5198] which requires transmission of well-formed UTF-8 strings and recommends transmission of normalized UTF-8 strings in Normalization Form C (NFC) [UAX15].

Unicode NFC is defined as the result of performing Canonical Decomposition (into base characters and combining marks) followed by Canonical Composition (into canonical composed characters wherever Unicode has assigned them).

WARNING – Performing normalization on UTF-8 strings received from Clients and subsequently storing the results (e.g., in Job objects) could cause false negatives in Client searches and failed access (e.g., to Printers with percent-encoded UTF-8 URIs now 'hidden').

Implementations of this specification SHOULD conform to the following standards on processing of human-readable Unicode text strings, see:

Unicode Bidirectional Algorithm [UAX9] – left-to-right, right-to-left, and vertical

Unicode Line Breaking Algorithm [UAX14] – character classes and wrapping

Unicode Normalization Forms [UAX15] – especially NFC for [RFC5198]

Unicode Text Segmentation [UAX29] – grapheme clusters, words, sentences

Unicode Identifier and Pattern Syntax [UAX31] – identifier use and normalization

Unicode Collation Algorithm [UTS10] – sorting

Unicode Locale Data Markup Language [UTS35] – locale databases

Implementations of this specification are advised to also review the following informational documents on processing of human-readable Unicode text strings:

Unicode Character Encoding Model [UTR17] – multi-layer character model

Unicode Character Property Model [UTR23] – character properties

Unicode Conformance Model [UTR33] – Unicode conformance basis

10. Security Considerations

The IPP extensions defined in this document require the same security considerations as defined in the Internet Printing Protocol/1.1 [STD92].

Implementations of this specification SHOULD conform to the following standard on processing of human-readable Unicode text strings, see:

Unicode Security Mechanisms [UTS39] – detecting and avoiding security attacks

Implementations of this specification are advised to also review the following informational document on processing of human-readable Unicode text strings:

Unicode Security FAQ [UNISECFAQ] – common Unicode security issues

11. IANA Considerations

11.1 Attribute Registrations

The attributes defined in this registration will be published by IANA according to the procedures in the Internet Printing Protocol/1.1 [STD92] in the following file:

http://www.iana.org/assignments/ipp-registrations

The registry entries will contain the following information:

```
Document Template attributes:                                   Reference
-------------------------                                       ---------
media-col (collection)                                          [PWG5100.7]
  media-top-offset (integer(MIN:MIN))                           [IPPLABEL]
  media-tracking (type2 keyword)                                [IPPLABEL]
print-darkness (integer(-100:100))                              [IPPLABEL]
print-speed (integer(1:MAX))                                    [IPPLABEL]

Job Template attributes:                                        Reference
-------------------------                                       ---------
media-col (collection)                                          [PWG5100.7]
  media-top-offset (integer(MIN:MIN))                           [IPPLABEL]
  media-tracking (type2 keyword)                                [IPPLABEL]
print-darkness (integer(-100:100))                              [IPPLABEL]
print-speed (integer(1:MAX))                                    [IPPLABEL]

Printer Description attributes:                                 Reference
-----------------------------                                   ---------
label-mode-configured (type2 keyword)                           [IPPLABEL]
label-mode-supported (1setOf type2 keyword)                     [IPPLABEL]
label-tear-offset-configured (integer(MIN:MAX))                 [IPPLABEL]
label-tear-offset-supported (rangeOfInteger(MIN:MAX))           [IPPLABEL]
media-top-offset-supported (1setOf (integer(MIN:MAX) |
rangeOfInteger(MIN:MIN)))                                       [IPPLABEL]
media-tracking-supported (1setOf type2 keyword)                 [IPPLABEL]
print-darkness-default (integer(-100:100))                      [IPPLABEL]
print-darkness-supported (integer(1:100))                       [IPPLABEL]
print-speed-default (integer(1:MAX))                            [IPPLABEL]
print-speed-supported (1setOf (integer(1:MAX) | rangeOfInteger(1:MAX)))
                                                                [IPPLABEL]
printer-darkness-configured (integer(0:100))                    [IPPLABEL]
printer-darkness-supported (integer(1:100))                     [IPPLABEL]
```


11.2 Type2 keyword Registrations

The attributes defined in this registration will be published by IANA according to the procedures in the Internet Printing Protocol/1.1 [STD92] in the following file:

http://www.iana.org/assignments/ipp-registrations

The registry entries will contain the following information:

Attributes (attribute syntax) Keyword Attribute Value	Reference
label-mode-configured (type2 keyword)	[IPPLABEL]
applicator	[IPPLABEL]
cutter	[IPPLABEL]
cutter-delayed	[IPPLABEL]
kiosk	[IPPLABEL]
peel-off	[IPPLABEL]
peel-off-prepeel	[IPPLABEL]
rewind	[IPPLABEL]
rfid	[IPPLABEL]
tear-off	[IPPLABEL]
label-mode-supported (1setOf type2 keyword)	[IPPLABEL]
< all label-mode-configured values >	[IPPLABEL]
media-tracking (type2 keyword)	[IPPLABEL]
continuous	[IPPLABEL]
mark	[IPPLABEL]
web	[IPPLABEL]
media-tracking-supported (1setOf type2 keyword)	[IPPLABEL]
< all media-tracking values >	[IPPLABEL]
media-type (type2 keyword | name(MAX))	[PWG5100.7]
labels-continuous	[IPPLABEL]

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12.1 Normative References

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[UAX29] Unicode Consortium, “Unicode Text Segmentation”, UAX#29, February 2019, https://www.unicode.org/reports/tr29

[UAX31] Unicode Consortium, “Unicode Identifier and Pattern Syntax”, UAX#31, February 2019, https://www.unicode.org/reports/tr31

[UNICODE] Unicode Consortium, "Unicode Standard", Version 12.0.0, March 2019, https://www.unicode.org/versions/Unicode12.0.0/

[UTS10] Unicode Consortium, “Unicode Collation Algorithm”, UTS#10, April 2019, https://www.unicode.org/reports/tr10

[UTS35] Unicode Consortium, “Unicode Locale Data Markup Language”, UTS#35, March 2019, https://www.unicode.org/reports/tr35

[UTS39] Unicode Consortium, “Unicode Security Mechanisms”, UTS#39, May 2019, https://www.unicode.org/reports/tr39

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[UTR33] Unicode Consortium “Unicode Conformance Model”, UTR#33, November 2008, https://www.unicode.org/reports/tr33

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13. Author's Address

Primary author:

Michael Sweet
Lakeside Robotics

