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| RFID Specification | | | | | |
| Promo Platform  24 April, 2013 | | | | | |
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| Version | Changes | | | Date | Author |
| V1 | Document creation | | |  | Thomas Bosgiraud |
| V2 | Change of the information carried by the RFID tag and addition of the RFID tray ID information block. | | | 09 Aug 2011 | Thomas Bosgiraud |
| V3 | Filename 🡪 string format  Tray ID 🡪 new info block / string format  Byte 0 🡪 file repetition number in the gang | | | 19 Sept 2011 | Thomas Bosgiraud |
| V4 | Filename 🡪 8 single integers  Byte 4 / bit 4 🡪 single or double print | | | 13 Oct 2011 | Thomas Bosgiraud |
| V5 | Byte 4 / bit 5 🡪 nozzle check  Byte 4 / bit 6 🡪 alignment check | | | 1 Nov 2011 | Thomas Bosgiraud |
| V6 | Introduction of the 2nd brush in the RFID information | | | 20 Dec 2011 | Thomas Bosgiraud |
| V7 | Introduction of the brush fans, special tray and cleaning gutter bits in the RFID information | | | 04 Apr 2012 | Thomas Bosgiraud |
| V9 | Introduction of chapter 4 | | | 24 Apr 2013 | Thomas Bosgiraud |
| V10 | Removal of section 3.1 Data | | | 19 Aug 2013 | Thomas Bosgiraud |

Contents

[1 Introduction 3](#_Toc364670710)

[2 Trays 3](#_Toc364670711)

[Tray circuit 3](#_Toc364670712)

[3 Requirements for the RFID System 4](#_Toc364670713)

[3.1 Requirements 4](#_Toc364670714)

[3.2 Structure of the information carried by the RFID tag 5](#_Toc364670715)

[3.2.1 Profile RFID Data 5](#_Toc364670716)

[3.2.2 RFID Tray ID 6](#_Toc364670717)

[3.3 Description of the data carried by the RFID tags 7](#_Toc364670718)

[3.3.1 Reserve 7](#_Toc364670719)

[3.3.2 Profile RFID Data 7](#_Toc364670720)

[3.3.3 RFID Tray ID 14](#_Toc364670721)

[4 Locations where the RFID information is used 15](#_Toc364670722)

# Introduction

The scope of this document is:

* To define the minimal requirements for the RFID system (read/write, memory size, communication bus...)
* To identify and select an RFID system that fulfills the requirements and needs defined by Vistaprint for the promo platform.

# Trays

|  |  |
| --- | --- |
| Trays are used to carry the Promos through the Promo Platform. The RFID tags will be mounted on these trays. |  |

Figure 1: 2 different views of the trays.

## Tray circuit

The trays will be conveyed from one workstation to a promo printing system (PPS) made of:

* Pre-treatment stations:
  + Brush
  + Ionizer
* CMYK Printer
* UV pinning device
* UV lamp

The PPS will pre-treat the promos on the tray to optimize the adhesion of the ink onto the promos. Thus, each promo type will be pre-treated differently.

The PPS will transfer a print file sent by VIPER to PPS local computer.

The system shall be able to associate the tray ID with the filename.

After print, the tray is conveyed back to the workstation from where it has been released on the conveyor.

# Requirements for the RFID System

## Requirements

|  |  |
| --- | --- |
| **Variable** | **Criteria** |
| Available memory | 14 bytes |
| Maximal time to write all carried information | 2 seconds |
| Write distance in static mode | From 0 mm to at least 25 mm |
| Lifetime | >100’000 writing cycles |
| Dimensions | Max LxWxT = 35 x 35 x 5 mm |

The RFID system shall permit to read/write the information carried by the RFID tag within 2 seconds. The reading/writing actions will be performed in static mode, i.e. when the tray is standing still (e.g. by a stopper).

The maximal reading/writing distance in static mode is at least 25 mm.

## Structure of the information carried by the RFID tag

### Profile RFID Data

Profile RFID data start address in RFID tag:

* Low byte = 0
* High byte = 1

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **Bit no.** | | | | | | | | | | |
| 7 | 6 | 5 | 4 | | 3 | 2 | | 1 | | 0 |
| **Subaddress** | 00hex=  Bit header | ***Used by the processor - not available for data*** | | | | | | | | | | |
| 01hex=  Repetition ID | Repetition ID | | | | | | | | | | |
| 02hex=  Tray Info | Print result  (OK/NOK) | Delete flag | reserve | | reserve | reserve | | reserve | | reserve | Workstation number |
| 03hex=  Height of tray | reserve | reserve | reserve | Offset  +/- | | Offset  Range 0.0-2  Steps 0.5 | | | | | Use measured height  (yes/no) |
| 04hex=  Pre-treatment | reserve | Alignment check | Nozzle check | Print numbers | | Plasma treatment (3 levels + off) | | | Ionizer  (yes/no) | | reserve |
| 05hex=  UV-curing | UV lamp (16 levels) | | | | | UV-pinning (16 levels) | | | | | |
| 06hex=  Filename | Filename (byte 0) | | | | | | | | | | |
| 07hex=  Filename | Filename (byte 1) | | | | | | | | | | |
| 08hex=  Filename | Filename (byte 2) | | | | | | | | | | |
| 09hex=  Filename | Filename (byte 3) | | | | | | | | | | |
| 0Ahex=  Filename | Filename (byte 4) | | | | | | | | | | |
| 0Bhex=  Filename | Filename (byte 5) | | | | | | | | | | |
| 0Chex=  Filename | Filename (byte 6) | | | | | | | | | | |
| 0Dhex=  Filename | Filename (byte 7) | | | | | | | | | | |
| 0Ehex=  Brush | Special tray  (yes/no) | Gutter clean  (yes/no) | reserve | reserve | | reserve | Brush fans  (yes/no) | | Brush Clean  (yes/no) | | Brush apply  (yes/no) |
| 0Fhex=  Bit header | ***Used by the processor - not available for data*** | | | | | | | | | | |

### RFID Tray ID

RFID tray ID data start address in RFID tag:

* Low byte = 0
* High byte = 0

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **Bit no.** | | | | | | | |
| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| **Subaddress** | 00hex=  Bit header | ***Used by the processor - not available for data*** | | | | | | | |
| 01hex= | Tray ID (byte 0) | | | | | | | |
| 02hex= | Tray ID (byte 1) | | | | | | | |
| 03hex= | Tray ID (byte 2) | | | | | | | |
| 04hex= | Tray ID (byte 3) | | | | | | | |
| 05hex= | Tray ID (byte 4) | | | | | | | |
| 06hex= | Tray ID (byte 5) | | | | | | | |
| 07hex= | Tray ID (byte 6) | | | | | | | |
| 08hex= | Tray ID (byte 7) | | | | | | | |
| 09hex= | Tray ID (byte 8) | | | | | | | |
| 0Ahex= | Tray ID (byte 9) | | | | | | | |
| 0Bhex= | Tray ID (byte 10) | | | | | | | |
| 0Chex= | Tray ID (byte 11) | | | | | | | |
| 0Dhex= | Tray ID (byte 12) | | | | | | | |
| 0Ehex= | Tray ID (byte 13) | | | | | | | |
| 0Fhex=Bit header | ***Used by the processor - not available for data*** | | | | | | | |

## Description of the data carried by the RFID tags

### Reserve

These bits are not yet used for any purpose.

### Profile RFID Data

#### Byte Repetition ID (01hex)

This byte identifies the tray number in the sequence.

Examples:

Repetition ID = 2 means that the current tray carries the iteration 2 of the gang file.

#### Byte Tray Info (02hex)

This byte carries 4 types of information: the workstation number (bit 0), the product ID (bits 1 to 5), the delete flag (bit 6) and the print result (bit 7).

##### Workstation number (bit 0)

There are two similar workstations (each with load and unload functions). The first workstation is indicated by 0 and the 2nd workstation by 1.

##### Delete flag (bit 6)

This bit tells the printer whether the file has to be deleted after print.

Delete flag=0 means that the file shall not be deleted after print (e.g. test images).

Delete flag=1 means that the file has to be deleted after print.

##### Print result (bit 7)

The print result is written by the printer to tell whether the image has been well printed or not.

Print result=1 means that the image has been printed without problem.

Print result=0 (*default value*) means that the image has not been properly printed. The default value is 0.

##### Examples

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Byte value | | Print result  (bit 7) | Delete flag  (bit 6) | Workstation  (bit 0) |
| Decimal | Binary  (bits 7 to 0) |
| 65 | 01000001 | (0)bin = NOK | (1)bin = delete file | (1)bin = workstation 2 |
| 1 | 00000001 | (0)bin = NOK | (0)bin = do not delete file | (1)bin = workstation 2 |
| 192 | 11000000 | (1)bin = OK | (1)bin = delete file | (0)bin = workstation 1 |

#### Byte Tray Height (03hex)

At the current time only the bits 4 to 0 are used.

##### Use measured height (bit 0)

This bit requests that the printer, during the print, uses only the pre-defined promo surface height (according to printer height measurement).without using any offset. This bit has precedence over the bits 1 to 4.

“Use measured height”=0 (*default value*) means that the printable surface detected by a distance sensor will be used as reference for setting the tray height.

“Use measured height”=1 means that the bottom of the tray is used as reference for setting the tray height.

##### Offset range 0.0 – 2 by steps of 0.5 (bits 1 to 3)

A constant distance between every the print head and the promo surface is pre-defined and common to all promo products. The offset (in mm) defines the range around this pre-defined distance that is optimal for the print of a specific type of product. This offset can vary within 0 and 2 mm by steps of 0.5 mm

|  |  |  |
| --- | --- | --- |
| “Offset range 0.0 – 2 by steps of 0.5” | | Offset (mm) |
| Decimal | Binary (bits 3 to 1) |
| 0 (*default value*) | 000 | 0 |
| 1 | 001 | 0.5 |
| 2 | 010 | 1 |
| 3 | 011 | 1.5 |
| 4 | 100 | 2 |

##### Offset +/- (bit 4)

This tells whether the offset has to be added or subtracted to/from the pre-defined promo surface height (according to printer height measurement).

“Offset +/-” = 1 means that the printable surface of the item will go further away from the print head.

“Offset +/-” = 0 (*default value*) means that the printable surface of the item will come closer to the print head

##### Examples

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Byte value | | Offset +/-  (bit 4) | Offset range 0.0 – 2 by steps of 0.5  (bits 3 to 1) | Use measured height  (bit 0) | Result |
| Decimal | Binary  (bits 4 to 0) |
| 14 | 01110 | (0)bin = add offset | (001)bin = 0.5mm | (0)bin = use the bottom of the tray as basis | Use the bottom of the tray as basis and add 0.5mm |
| 17 | 10001 | (1)bin = subtract offset | (000)bin = 0mm | (1)bin = use the printable area of the promo as basis | Use the printable product surface as basis and subtract 0 mm to the pre-defined height |
| 9 | 01001 | (0)bin = add offset | (100)bin = 2mm | (1)bin = use the printable area of the promo as basis | Use the printable product surface as basis and add 2 mm to the pre-defined height |

#### Byte Pre-treatment (04hex)

##### Ionizer (bit 1)

This bit tells whether the ionizer within the printer has to be used to pre-treat the surface of the products carried by the considered tray.

“Ionizer”=0 (*default value*) means that the ionizer shall not be used for the considered tray.

“Ionizer”=1 means that the ionizer has to be used for the considered tray.

##### Plasma treatment (bits 2 and 3)

This information tells the plasma intensity (3 levels + off) required to pre-treat the surface of the products carried by the considered tray. The different intensity levels will be set during the printer test phase.

|  |  |  |
| --- | --- | --- |
| Plasma treatment parameter value | | Plasma intensity |
| Decimal | Binary (bits 3 and 2) |
| 0 (*default value*) | 00 | Plasma off |
| 1 | 01 | Level 1 |
| 2 | 10 | Level 2 |
| 3 | 11 | Level 3 |

##### Print numbers (bit 4)

This bit tells whether the image has to be printed once or twice.

“Print numbers”=0 (*default value*) means that the image shall only be printed once onto the tray.

“Print numbers”=1 means that the image needs to be printed twice on the products.

##### Nozzle check (bit 5)

This bit tells whether a nozzle check has to be performed on the current tray.

“Nozzle check”=0 (*default value*) means that a file from the jobs repository shall be printed onto the products.

“Nozzle check”=1 means that the nozzle check pattern has to be printed onto the products.

##### Alignment check (bit 6)

This bit tells whether an alignment check has to be performed on the current tray.

“Nozzle check”=0 (*default value*) means that a file from the jobs repository shall be printed onto the products.

“Nozzle check”=1 means that the alignment check pattern has to be printed onto the products.

##### Examples

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Byte value | | Alignment check | Nozzle check | Print numbers  (bit 4) | Plasma treatment  (bits 3 and 2) | Ionizer  (bit 1) | Brush  (bit 0) |
| Decimal | Binary  (bits 4 to 0) |
| 14 | 0001110 | (0)bin = no alignment check | (0)bin = no nozzle check | (0)bin = print image once | (11)bin = intensity level 3 | (1)bin = on | (0)bin = do not use the brush |
| 49 | 0110001 | (0)bin = no alignment check | (1)bin = nozzle check | (1)bin = print image twice | (00)bin = off | (0)bin = off | (1)bin = use the brush |
| 73 | 1001001 | (1)bin = alignment check | (0)bin = no nozzle check | (0)bin = print image once | (10)bin = intensity level 2 | (0)bin = off | (1)bin = use the brush |

#### UV-curing (byte 05hex)

UV-curing occurs after the print of the image on the promo surface.

##### UV-pinning (bits 0 to 3)

This information tells the UV-pinning intensity (16 levels) required to post-treat the ink at the surface of the products carried by the considered tray. The different intensity levels will be set during the printer test phase.

|  |  |  |
| --- | --- | --- |
| UV-pinning parameter value | | Intensity of the UV-pinning |
| Decimal | Binary (bits 3 to 0) |
| 0 (*default value*) | 0000 | Level 1 |
| 1 | 0001 | Level 2 |
| 2 | 0010 | Level 3 |
| 3 | 0011 | Level 4 |
| 4 | 0100 | Level 5 |
| 5 | 0101 | Level 6 |
| 6 | 0110 | Level 7 |
| 7 | 0111 | Level 8 |
| 8 | 1000 | Level 9 |
| 9 | 1001 | Level 10 |
| 10 | 1010 | Level 11 |
| 11 | 1011 | Level 12 |
| 12 | 1100 | Level 13 |
| 13 | 1101 | Level 14 |
| 14 | 1110 | Level 15 |
| 15 | 1111 | Level 16 |

##### UV-lamp (bits 4 to 7)

This information tells the UV-lamp intensity (16 levels) required to post-treat (after the UV-pinning) the ink at the surface of the products carried by the considered tray. The different intensity levels will be set during the printer test phase.

|  |  |  |
| --- | --- | --- |
| UV-lamp parameter value | | Intensity of the UV-lamp |
| Decimal | Binary (bits 7 to 4) |
| 0 (*default value*) | 0000 | Level 1 |
| 1 | 0001 | Level 2 |
| 2 | 0010 | Level 3 |
| 3 | 0011 | Level 4 |
| 4 | 0100 | Level 5 |
| 5 | 0101 | Level 6 |
| 6 | 0110 | Level 7 |
| 7 | 0111 | Level 8 |
| 8 | 1000 | Level 9 |
| 9 | 1001 | Level 10 |
| 10 | 1010 | Level 11 |
| 11 | 1011 | Level 12 |
| 12 | 1100 | Level 13 |
| 13 | 1101 | Level 14 |
| 14 | 1110 | Level 15 |
| 15 | 1111 | Level 16 |

##### Examples

|  |  |  |  |
| --- | --- | --- | --- |
| UV-curing parameter value | | Intensity of the UV-lamp  (bits 7 to 4) | Intensity of the UV-pinning  (bits 3 to 0) |
| Decimal | Binary (bits 7 to 0) |
| 69 | 01000101 | (0100)bin = (4)dec = level 5 | (0101)bin = (5)dec = level 6 |
| 13 | 00001101 | (0000)bin = (0)dec = level 1 | (1101)bin = (13)dec = level 14 |
| 200 | 11001000 | (1100)bin = (12)dec = level 13 | (1000)bin = (8)dec = level 9 |

#### Filename (bytes 06hex to0Dhex)

The file name sent by VIPER to the printer and to the conveyor is made out of 64 bits. For this reason the filename is divided in 8 bytes (=8 x 8 bits).

The printer receives from VIPER a pdf file (all files have the pdf extension) whose name will look like 268205625-3.pdf. As the extension of the filename will always be the same, the RFID does not carry the extension (.pdf).

The RFID divides the rest of the name (268205625-3) as 8 successive bytes arranged as follows:

* Byte 7 (RFID byte 0Dhex) to byte 1 (RFID byte 07hex) express the number before the hyphen sign (in this case 268205625)
* Byte 0 (RFID byte 06hex) expresses the number after the hyphen sign (in this case 3).

The following table shows examples that permit to better understand the transformation of the filename into RFID information.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Name of the file stores by VIPER in the printer hot folder | File name sent by VIPER to the conveyor | Filename as carried by the RFID tag | | | | | | | |
| Filename byte 7  RFID byte 0Dhex | Filename byte 6  RFID byte 0Chex | Filename byte 5  RFID byte 0Bhex | Filename byte 4  RFID byte 0Ahex | Filename byte 3  RFID byte 09hex | Filename byte 2  RFID byte 08hex | Filename byte 1  RFID byte 07hex | Filename byte 0  RFID byte 06hex |
| 268205625-3.pdf | 0,0,0,15,252,126,57,3 | (00000000)bin  =(0)dec | (00000000)bin  =(0)dec | (00000000)bin  =(0)dec | (00001111)bin  =(15)dec | (11111100)bin  =(252)dec | (01111110)bin  =(126)dec | (00111001)bin  =(57)dec | (00000011)bin  =(3)dec |
| 543210987-4.pdf | 0,0,0,32,96,189,235,4 | (00000000)bin  =(0)dec | (00000000)bin  =(0)dec | (00000000)bin  =(0)dec | (0100000)bin  =(32)dec | (1100000)bin  =(96)dec | (10111101)bin  =(189)dec | (11101011)bin  =(235)dec | (00000100)bin  =(4)dec |

#### Byte Pre-treatment (0Ehex)

At the current time only the bits 1 and 0 are used.

##### Brush apply (bit 0)

This bit tells whether the brush apply (1st brush of the brush system) has to be used to apply the magic fluid onto the surface of the products carried by the considered tray.

“Brush Apply”=0 (*default value*) means that the brush shall not be used for the considered tray.

“Brush Apply”=1 means that the brush has to be used for the considered tray.

##### Brush clean (bit 1)

This bit tells whether the brush clean (2nd brush of the brush system) has to be used to clean the surface of the products carried by the considered tray.

“Brush Clean”=0 (*default value*) means that the brush shall not be used for the considered tray.

“Brush Clean”=1 means that the brush has to be used for the considered tray.

##### Brush fans (bit 2)

This bit tells whether the brush fans need to be used to dry the surface of the products carried by the considered tray.

“Brush Fans”=0 (*default value*) means that the fans shall not be used for the considered tray.

“Brush Fans”=1 means that the fans have to be used for the considered tray.

##### Gutter clean (bit 6)

This bit tells whether the tray currently is meant to circle around the conveyor for gutter cleaning or production purposes.

“Gutter Clean”=0 (*default value*) means that the tray is not running for gutter cleaning purposes.

“Gutter Clean”=1 means that the tray is running for gutter cleaning purposes.

##### Special tray (bit70)

This bit tells whether the tray is a regular production tray or a special tray (nozzle check, alignment...).

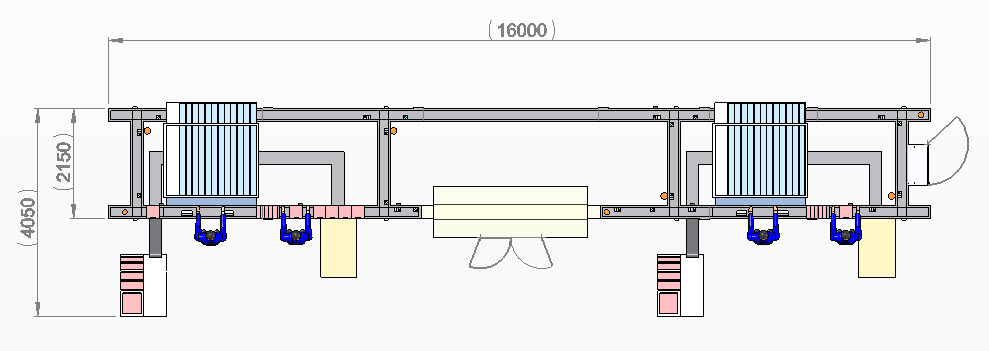
“Special tray”=0 (*default value*) means that the tray is a regular production tray.

“Special tray”=1 means that the tray is a test tray.

### RFID Tray ID

This information is in the form of a string limited to 14 bytes. This information is represented in the same manner as the filename.

# Locations where the RFID information is used



brush

printer

1

4

5

6

3

2

2

1

3

Figure : footprint of the promo platform with the location of the RFID RW heads (green squares)

|  |  |  |
| --- | --- | --- |
| Position | Purpose |  |
| 1: loading station | * Write the job information on the RFID tag * Assign the job to a tray ID | 1. The tray ID is read 2. Viper assesses whether the tray corresponds to the requested product type 3. Viper writes the job information on the RFID tags (all 14 bytes) 4. Viper assigns in its internal database the tray ID with the said order |
| 2: unloading station | * Recover the job of the tray * Check whether the printer detected a print error | 1. The tray ID is read 2. Viper recovers the order number 3. The print OK/NOK is read 4. Based on the print OK/NOK bit a reprint will be requested by Viper |
| 3: crossings BF and CE | Based on the workstation they belong to the trays will be routed to workstation 1 or 2 | 1. The workstation bit is read 2. The tray is routed accordingly 3. The print OK/NOK bit is read 4. If the print is not OK, the signal tower briefly beeps |
| 4: brush entrance | * Assess by which brush(es) the tray will be treated and whether the drying fans are needed (always the case per 24 April 2013) * Assess whether the product requires a double pass print or not | 1. The brush bits are used and the tray brushed accordingly 2. The double-pass print bit is used to delay the entrance of the trays inside the cell. As a matter of fact, a double pass tray needs more time to be printed. Thus, to avoid jams inside the brush, a maximal (2 by default) number of double pass trays can be in the brush at a given time. |
| 5: printer entrance | * Assess whether ionizer treatment is needed * Get the filename * Set the UV-pinning level * Set the UV-lamp level |  |
| 6: printer exit | Write whether the printer detected an error during the print |  |