

Guide to printing barcodes for use in Smart-binder systems



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1 Purpose of the code

Document integrity checking and individual sheet tracking are built into the Smart-binder system. The Smart-binder identifies each sheet by reading a code printed on it as it enters the machine. As well as using information in this code to determine which sheets should be collated together to form a specific book, and uniquely identify that book, the code can be used to selectively apply processes (eg Perforation) to individual sheets or books. Details of the processing of each sheet are logged and information can be recovered from the log files to identify which books have been correctly processed and delivered and which were rejected and the reason why.

The minimum requirement is that the code on each sheet identifies the position of the sheet within a book and the total number of sheets that the book contains.



1.1 **Sheet Number and Number of Sheets**

This information is contained in 2 fields of 2 or 3 numeric characters at the start of each code, for example:



This would be followed by sheet 2 of 4, 3 of 4 and 4 of 4 to form a complete book containing 4 sheets.

This determines which sheets are collated together to form a book, and only books that contain all the sheets from 1 to the total number in the correct order will be delivered.

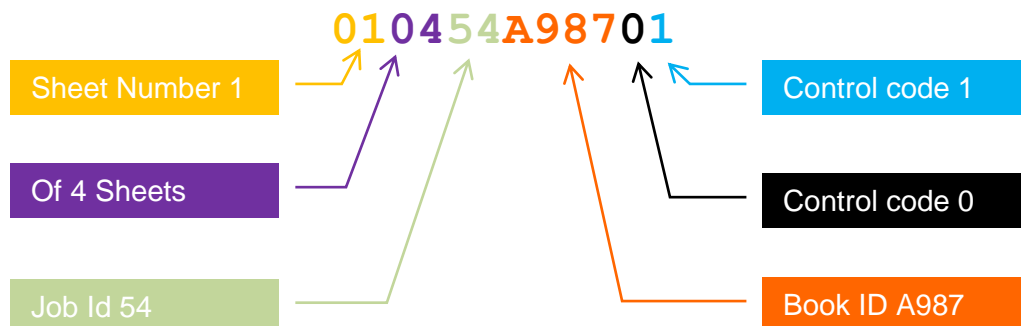
This can be followed by a number of characters (limited by the type of code used, and the capabilities of the code reader) that can be used as:

2/ Book or Document Identifier (Book ID) – if the Smart-binder is set to check Book IDs it will ensure that all the sheets in a book have the same Book ID, rejecting any books that do not. This field can contain a unique book number and be used to ensure that sheets for different books are not collated together. It can also be used to match a separately fed cover or insert, which has the same Book ID printed on it, with content from the printer.

3/ Job Identifier (Job ID) – if the Smart-binder is set to check Job IDs it will create a gap on the delivery conveyor when the Job ID changes.

Book and Job Identifiers can overlap and may contain alphanumeric characters.

4/ Control codes for the various selective processing functions that the Smart-binder can perform.

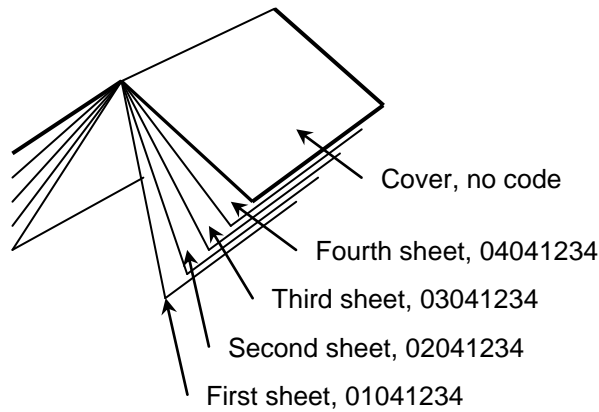




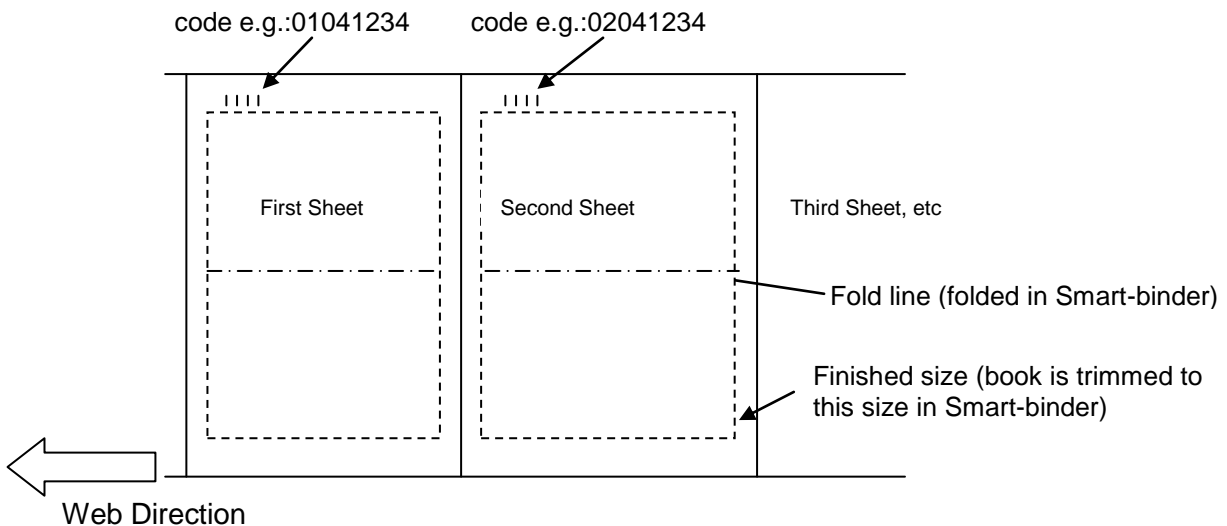
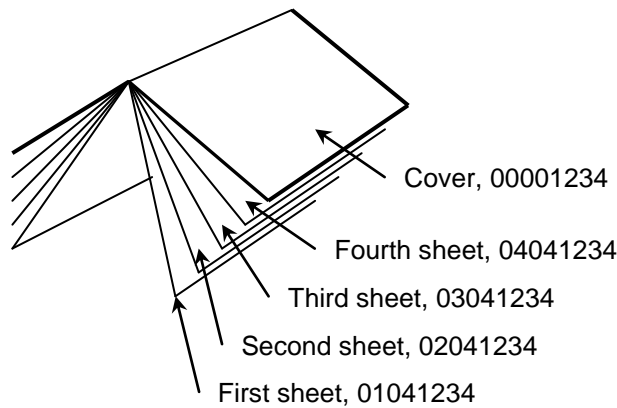
1.2 Example of 2 digit coding for saddle-bound books.

In this example, a “sheet” has 4 printed pages: the 16-page book is made up of 4 sheets of paper. The paper is printed on a web printer running in-line with the Smart-binder. If a separately-fed cover is added, then we describe this as a 16-page book plus cover. A book without a separate cover is usually described as ‘self-cover’.

16-page book, plus non-coded cover



16-page book, plus cover with Book ID





1.3 **Selective functions**

The characters that are used to perform these functions can be chosen from the Operator panel on the Smart-binder, and saved in a 'setup' so for example one application might use selective cover feeding and another not. The operator can change the setup in the Smart-binder, so that the control digit does not have to be included in the barcode when the function is not being used.

Selective functions only work if the appropriate options are fitted to the machine.

1. **Selective perforation**

A single digit selects: no perforation, and either or both heads for each sheet.

2. **Selective binding**

A single digit selects: no binding, stitching, or gluing. Gluing can be selected for each sheet.

3. **Selective cover/insert feeding**

A single digit selects: no cover, feeder 1, or feeder 2. Selective cover feeding can be operated in either:

Cover mode – only the control digit on the last sheet of the book is examined to determine if a cover should be fed.

Insert mode – every sheet is examined to see if a cover is to be fed and the cover is fed on top of the sheet that has the activating value in the control digit.

1.4 **Cover matching functions**

To perform Cover matching each cover must be printed with a Book ID to match the sheets. This must appear in the same 'position' in the code as it does on the sheet with '0' used to fill the unused spaces before the Book ID (either sheet numbering or control codes).

Cover matching can be combined with Selective cover feeding, if the code on the sheet selects a cover but the code does not match the machine will stop with an error.



2 Format of the data in the code

2.1 Data Fields

Name	Description	Number of Characters	Type of characters	Required/Optional
SN	Sheet Number	2 or 3	Numeric	Required
NN	Number of sheets	2 or 3	Numeric	Required
CC	Control Code	1	Numeric	Optional, there can be several Control codes
BID	Book Identifier	Any	ASCII Printable	Optional
JOB	Job Identifier	Any	ASCII Printable	Optional

2.2 Composition of the fields into codes

The data format must be the same on all sheets in a job.

2.2.1 Sheet Number (SN) & Number of sheets (NN)

Leading 0s must be printed (eg 01) white space is not permitted in or between the sheet number and number of sheets fields.

2.2.1.1 2 digit scheme for saddle binding

SN, in the range 01..NN, followed by NN, in the range 01..50. Optionally followed by 'CC', 'BID' and 'JOB' in any order.

2.2.1.2 3 digit scheme for perfect binding.

Typically used when perfect binding single sheets or once folded sheets from cut-sheet printers. Not available in saddlebinding machines.

SN, in the range 001..NN, followed by NN, in the range 001..999. Optionally followed by CC, 'BID' and 'JOB' in any order.

2.2.1.3 2 digit scheme combining saddle binding and perfect binding

Typically used in SB4 systems in which the Smart-binder makes thin sections (of up to 9 sheets) which are then fed into a perfect binder which binds the sections together. The code is recognised automatically when the first digit is '9'.

Consists of a saddle binding part of 4 digits:

'9' followed by a single digit (1..number of sheets) sheet number followed by '0' followed by single digit 'number of sheets' (1..9).

Followed by a perfect binding part of 4 digits:

SN, in the range 01..NN, followed by NN, in the range 01..50.



Optionally followed by CC, 'BID' and 'JOB' in any order.

All schemes also support 'Reverse Numbering' in which sheet NN of NN arrives first followed by NN-1, NN-2.. and sheet 1 of NN is the last sheet. This is selectable at the machine setup.

2.2.2 Control codes (CC)

Control codes must be in the range 0..9, white space cannot be used. They can be placed at any position after the sheet number/number of sheets, and configured in the job setup at the Smart-binder, they must be on every sheet if configured, but can be un-configured simply by changing the setup in the Smart-binder.

Perforation codes – apply to the sheet on which they are printed.

0= No perforation

1= Perforation with the operator side head

2= Perforation with the non-operator side head

3 = Perforation with both heads.

See appendix 3 for coding when using 4 heads.

Binding codes

0= No binding, the sheet will not be glued & the book will not be stitched.

1 = Stitch – the value on the first sheet of the book determines whether the book is stitched.

2 = Glue – applies specifically to the sheet, but will be ignored on the first sheet.

Cover selection codes

0 = No cover or insert

1= Cover/insert from first feeder (nearest the stitcher)

2= Cover or insert from second feeder (further from the stitcher).

In 'Cover' mode – only the last sheet is checked

In 'Insert' mode – every sheet is checked, note that you can only insert following a sheet so it is not possible to put a centre insert in using this system. It is possible to feed multiple inserts from one feeder and to add inserts from both feeders to the same book.

2.3 Book ID

Book IDs are used to identify the sheets of a specific document, if a Book ID is selected all the sheets (and the cover if cover matching is used) must have the same Book ID or the book will be rejected.

Software from version 1.7.24 allows the inclusion of generic sheets without a book ID in a book by printing a book ID consisting of the '*' character in each position of the Book ID. This will match any Book ID printed on the other sheets and the book will be delivered.



For example a 3 sheet book with the following codes will be accepted:

01 03 540AZ
02 03 ****
03 03 540AZ

This would allow sheet 2 to be offset printed, collated with digitally printed sheets 1 & 2 to form a pile, and fed into the Smartbinder from a Pile feeder.

The generic Book ID feature cannot be used with ITF barcodes as they do not provide the '*' character. Use 2D codes, CODE39 or CODE128.

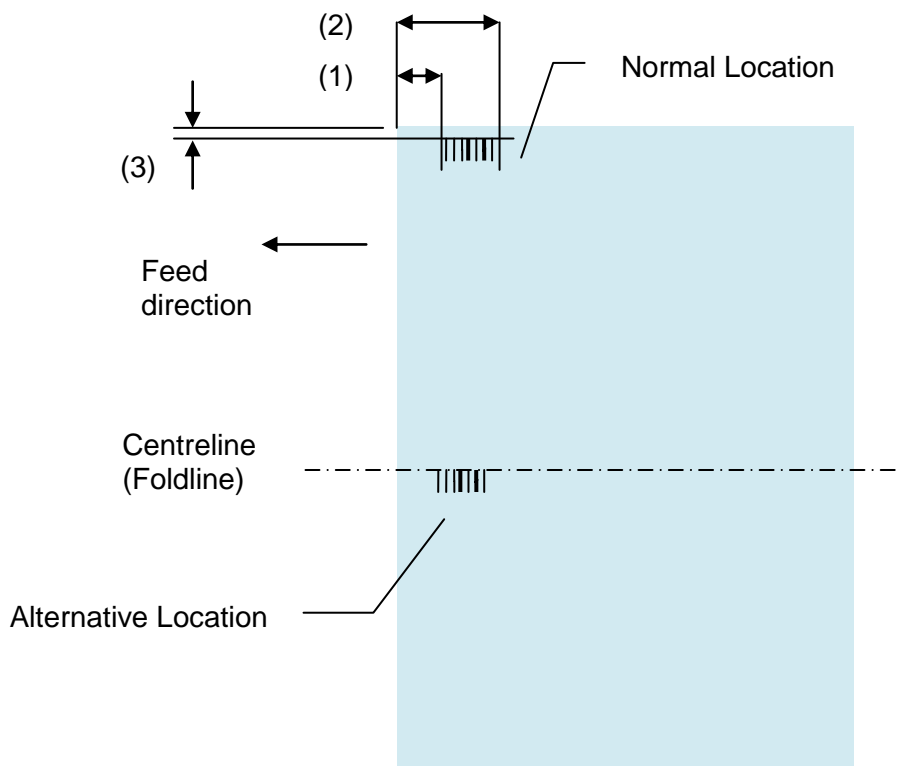
2.4 ***Job ID***

Job IDs can be used to separate booklets on the delivery, by creating a gap when the Job ID changes, generic codes '*' are **not** recognised in the Job ID.



3 Where to print the code

3.1 When reading on the infeed of the Smart-binder



For inline operation with cutters (see Appendix 4 for position of code on Smartbinders up to serial #145).

Dimension	Linear code	2D code
(1) Minimum distance from leading edge of sheet	110mm (4.3")	110mm (4.3")
(2) Maximum distance from leading edge of sheet	Up to trailing edge of sheet	140mm (5.5")
(3) Minimum distance from side of sheet	Can be printed to edge of sheet	Quiet zone defined for code (see 4.2)
Minimum width	Depends on reader (see 4.1)	

For SBS100 Buffer

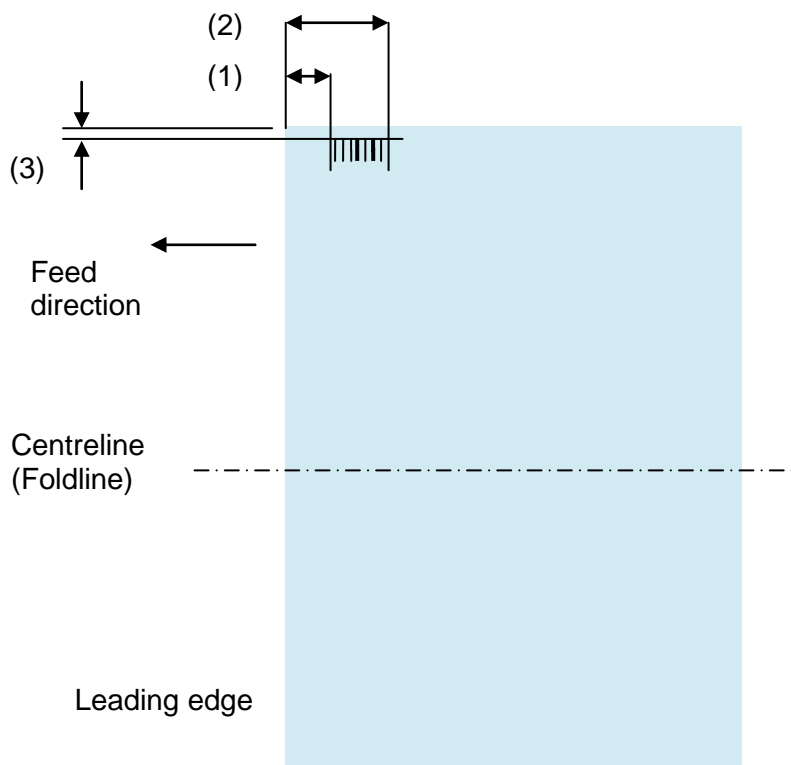
Dimension	Linear code	2D code
(1) Minimum distance from leading edge of sheet	5mm (0.2")	5mm (0.2")
(2) Maximum distance from leading edge of sheet	15mm (0.6")	15mm (0.6")
(3) Minimum distance from side of sheet	Can be printed to edge of sheet	Quiet zone defined for code (see 4.2)
Minimum width	Depends on reader	



(see 4.1)

3.2 *When reading the code in a sheet pile feeder*

Applies to options: SB-095 (off-line operation) or SB-097.



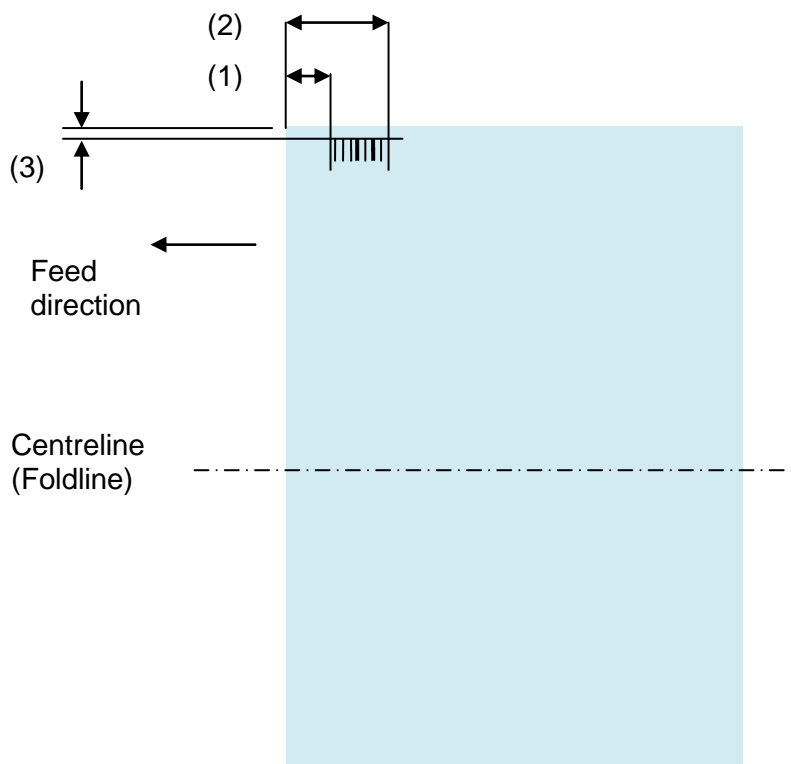
Dimension	Linear code	2D code
(1) Minimum distance from leading edge of sheet	80mm (3.15")	80mm (3.15")
(2) Maximum distance from leading edge of sheet	Up to trailing edge of sheet	Up to trailing edge of sheet
(3) Minimum distance from side of sheet	2mm (0.1") ⁽¹⁾	2mm (0.1") ⁽¹⁾
Minimum width	Depends on reader (see 4.1)	

⁽¹⁾ Codes must be printed away from the edge of the sheet because the sheet moves slightly as it is picked up by the separator and this can expose the code on the sheet below, this can prevent the reader from decoding the code on the top sheet.

The range of positions for the code is restricted by various parts of the feeder which obscure parts of the sheet.



3.3 When reading the code in a cover/insert feeder



Dimension	Linear code	2D code
(1) Minimum distance from leading edge of sheet	50mm (2")	45mm (1.75")
(2) Maximum distance from leading edge of sheet	140mm (5.5")	65mm (2.5")
(3) Minimum distance from side of sheet	Can be printed to edge of sheet	Quiet zone defined for code (see 4.2)
Minimum width	Depends on reader (see 4.1)	



4 Code types

4.1 Linear codes

ITF – Industrial 2of5, numeric characters only (0-9), digits are encoded in pairs so there must be an even number of them.

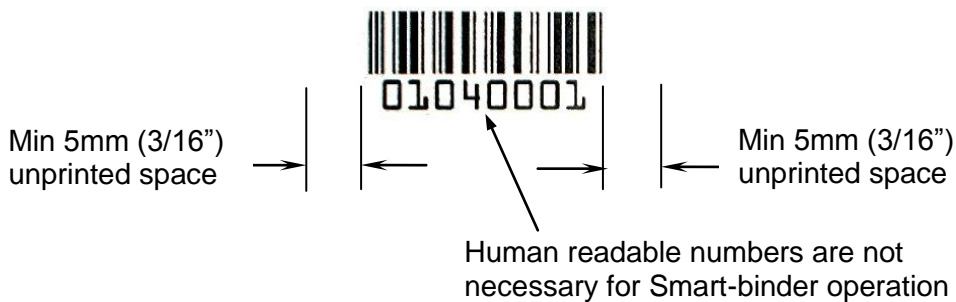
CODE39 – alphanumeric characters, however, it takes up more space because it encodes more characters.

CODE128 – has numeric only & alphanumeric forms, the reader automatically detects the correct type, the numeric form is compact like ITF.

Quiet zones

Linear codes require space ahead of and following the code to allow the reader to discriminate it from other printer marks.

For linear codes leave 5mm clear paper at either end.



Size

The minimum width of the code depends on the reader:

BL180	6mm
MS3	4mm

However, wider codes can always be read more reliably so we recommend that codes are as wide as possible.

For ITF codes:

When using a font based code we recommend that the font is at least 26pt (which produces a code approximately 29mm (1 1/8") for an 8 digit code.



Do not include check digits in the code, ITF code generators add a padding digit because an ITF code must have an even number of digits, typically they place this at the start of the code which prevents the sheet number & number of sheets fields from being decoded.

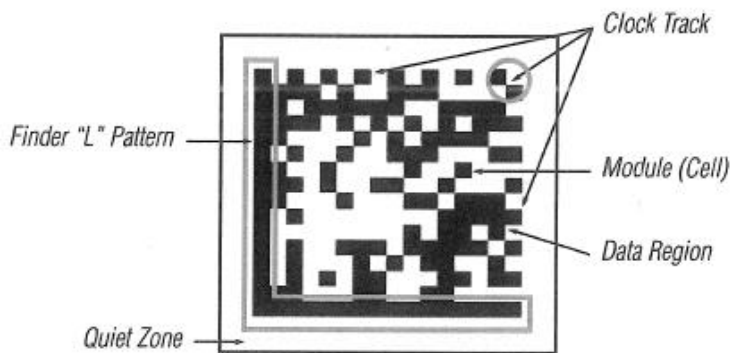
4.2 2D Codes

Datamatrix – 2D code is a compact way of encoding alphanumeric data, can contain hundreds of characters (whereas it is usually not possible to read linear codes containing more than 16 characters on moving sheets).

QR – similar to Datamatrix, commonly used in Japan as it can encode Kanji/Kana character sets. Widely used these days to encode URL's that you can scan with your phone.

Quiet Zone

2D codes require a quiet zone of at least 1 cell width all round which is why they cannot be printed up to the edge of the sheet.



Size

For web speeds up to 150m/min the minimum cell size for use with the 2D reader (Microscan Mini Hawk) is 0.4mm (0.015"). Larger cells can help to make reading more reliable.

Capacity of Datamatrix ECC200 codes

Size (cells)	Size (mm) for 0.4mm square cell	Numeric characters only	Alphanumeric characters
10x10	4	6	3
12x12	4.8	10	6
14x14	5.6	16	10
16x16	6.4	24	16
18x18	7.2	36	25
20x20	8	44	31
22x22	8.8	60	43



Larger capacity codes (using more cells) are available but they have to be more than 10mm square in order to meet the minimum cell size needed to read the moving code.

4.3 *Selecting the reader*

Code	BL180	MS3	Quadrus mini velocity	Quadrus mini hawk
ITF	✓	✓	✓	✓
CODE39	✓	✓	✓	✓
CODE128	✓	✓	✓	✓
DataMatrix			✓	✓
QR			✓	✓

BL180 CCD reader, fitted as standard to Smart-binders until 2014, will read codes of up to about 14 characters at web speeds up to 100m/min. The code must be 6mm wide for this reader.

MS3 Laser reader, fitted as standard to new Smart-binders from 2014 on, will read codes of up to about 16 characters at web speeds up to 150m/min.

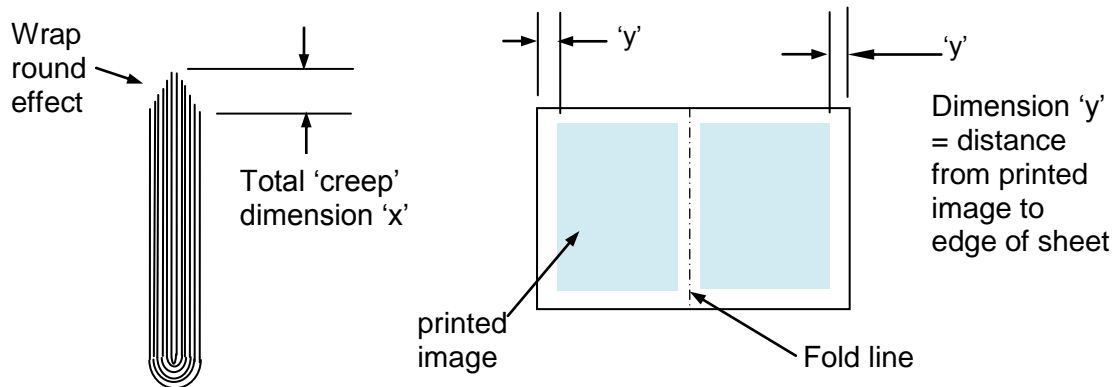
Quadrus mini velocity, fitted as an option to read 2D codes on Smartbinders and as standard on SCFs until 2014, will read on web speeds up to 100m/min.

Quadrus mini Hawk, fitted as an option to read 2D codes on Smart-binders and as standard on SCF's from 2014, will read on web speeds up to 150m/min.



5 Appendix 1 – Image creep

When producing saddle-stitched or thin ISG-glued books, the thickness of the spine causes the outer sheets to appear shorter than the inner sheets when looking at the front edge of the untrimmed book. This is called the ‘wrap round’ effect. The Smart-binder trims this edge to create a square edge to the book, but, unless this effect is taken into account when imposing the pages of the book, the print on the inner pages will not line up with that on the outer pages. The effect of this is referred to as image ‘creep’.



When imposing the printed image on each sheet dimension ‘y’ must increase by the amount ‘x’ from the outer sheet to the innermost sheet. If there are 32 sheets in the book then ‘y’ increases by ‘x’/32 from one sheet to the next sheet.

The relationship between the total creep dimension ‘x’ and the total number of sheets and pages in the book for different paper weights is shown in the table below. For book thicknesses not shown, interpolate values from the table, e.g.: for a 9-sheet (36 page) book, use the value for ‘x’ half way between those for 6 and 12 sheets. For thinner books than those shown, it is not usually necessary to compensate for image creep.

If a separate cover is used, its page layout should be arranged to align with the outer sheet.

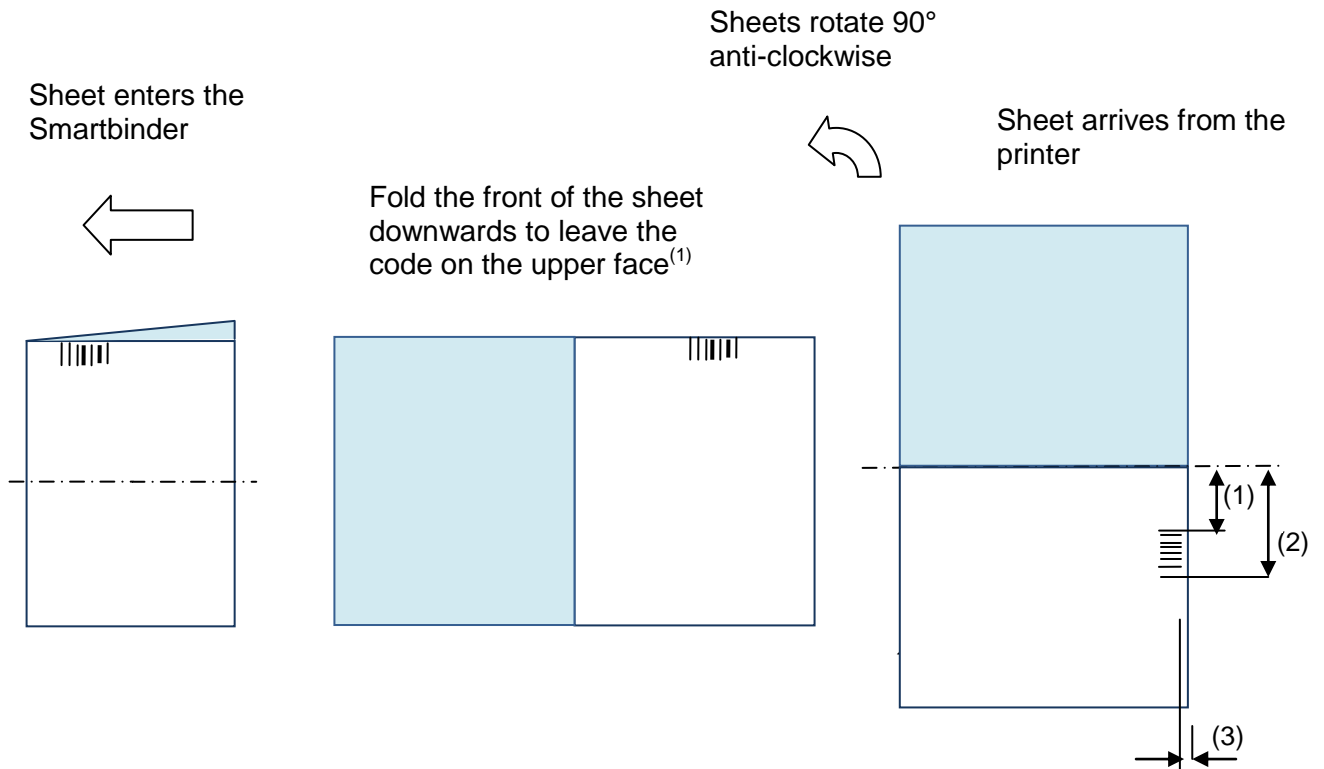
Paper stock weight													
		Gsm	60	70	80	90	100	110					
		Lb bond	16	19	21	24	27	29					
		Lb offset	41	47	54	61	67	74					
Sheets in book	Pages in book	Approximate total creep dimension ‘x’											
		mm	inch	mm	Inch	mm	inch	mm	inch	mm	inch	mm	inch
6	24	1.2	0.05	1.4	0.06	1.6	0.06	1.8	0.07	2.0	0.08	2.2	0.09
12	48	2.3	0.09	2.7	0.11	3.1	0.12	3.5	0.14	3.9	0.15	4.3	0.17
18	72	3.5	0.14	4.1	0.16	4.7	0.19	5.3	0.21	5.9	0.23	6.5	0.25
24	96	4.7	0.19	5.5	0.22	6.3	0.25	7.1	0.28	7.9	0.31	8.7	0.34
30	120	5.9	0.23	6.9	0.27	7.9	0.31	8.9	0.35	9.9	0.39	10.9	0.43
36	144	7.1	0.28	8.2	0.32	9.4	0.37	10.6	0.42	11.8	0.46	NA	NA
42	168	8.3	0.32	9.6	0.38	11.0	0.43	NA	NA	NA	NA	NA	NA
48	192	9.5	0.37	11.0	0.43	NA	NA	NA	NA	NA	NA	NA	NA

NA = Not available (this is outside the Smart-binder SB-1, SB-2, SB-3 thickness specification)



6 Appendix 2 – Rotating and folding sheets in the RF100

Rotating and folding A3+ sheets to make 8pp A4+ signatures, shown in a typical right to left flow



⁽¹⁾It is also possible to fold the front half upwards, in which case the barcode must be printed on the under side of the front half of the sheet.

For inline operation with cutters (see Appendix 4 for position of code on Smartbinders up to serial #145).

Dimension	Linear code	2D code
(1) Minimum distance from centreline of sheet	110mm (4.3")	110mm (4.3")
(2) Maximum distance from centreline of sheet	Up to trailing edge of sheet	140mm (5.5")
(3) Minimum distance from edge of sheet	Can be printed to edge of sheet	Quiet zone defined for code (see 4.2)
Minimum width	Depends on reader (see 4.1)	



7 Appendix 3 – Control codes for 4 Perforator Heads

The 1 digit Control Code uses a hexadecimal representation of a 4 bit binary code in which bits 0-3 control heads 1-4 respectively.

CC 1 digit	Head 1	Head 2	Head 3	Head 4
0				
1	✓			
2		✓		
3	✓	✓		
4			✓	
5	✓		✓	
6		✓	✓	
7	✓	✓	✓	
8				✓
9	✓			✓
A		✓		✓
B	✓	✓		✓
C			✓	✓
D	✓		✓	✓
E		✓	✓	✓
F	✓	✓	✓	✓

The 2 digit Control Code (for use when only numeric characters are available) uses the numbers decimal (0-3) representation of 2 bits with the first digit controlling heads 1 & 2, and the second heads 3 & 4.

CC 1 st digit	CC 2 nd digit	Head 1	Head 2	Head 3	Head 4
0					
1		✓			
2			✓		
3		✓	✓		
	0				
	1			✓	
	2				✓
	3			✓	✓

1 or 2 digit Control codes can be selected on the Smart-binder touchscreen (and saved as part of a setup).

For example, to select all 4 heads:

With 1 digit **F**

With 2 digits **33**



8 Appendix 4 Position of codes for operation inline (older machines).

For machines up to serial number #145 (unless retrofitted with cover autoloader)

Dimension	Linear code	2D code
(4) Minimum distance from centreline of sheet	50mm (2")	60mm (2.35")
(5) Maximum distance from centreline of sheet	Up to trailing edge of sheet	80mm (3.15")
(6) Minimum distance from edge of sheet	Can be printed to edge of sheet	Quiet zone defined for code (see 4.2)
Minimum width	Depends on reader (see 4.1)	

9 Revision History

Rev	Date	Changes
0	18/1/16	Original release
1		Updated Book ID description to include generic matching. Revised position information for 2D codes as result of moving the code reader to accommodate the cover autoloader.