4. Scanning

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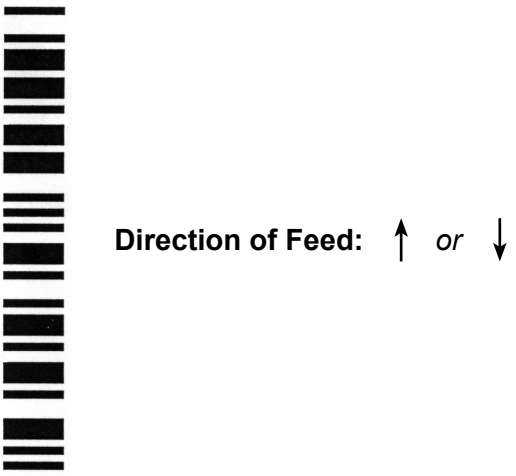
Scanning Overview

The HiCap Sheet Feeder (HCSF) on the tower of the FPi 5100 - 8100 inserter can scan both OMR, 1D (code 3 of 9, interleaved, 2 of 5) and 2D data matrix barcodes. A 1D scanner or a 2D camera can be present on either side of the HCSF. The tower supports 1D ladder scanning on either side or a 2D camera only on the left side.

1D Scanning Overview (includes OMR)

The system offers two types of scanning; both types are optional features:

- **Optical Mark Recognition (OMR)** - uses a dark solid line on a sheet of light colored paper. OMR presents in a "ladder" orientation.
- **Barcode Recognition (BCR)** - a series of vertical bars and spaces presented in "ladder" or "picket" orientation. Barcodes that can be used with your system are 1D (code 3 of 9, interleaved 2 of 5) and 2D data matrix.



Example: "Ladder" Orientation (OMR *and* BCR Marks)

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NOTE: A HCSF is required to scan barcodes in **picket** orientation. Picket orientation uses a moving beam scanner. A moving beam scanner or a 2D camera can be present on either side of the HCSF.

Direction of Feed: ↑ *or* ↓

Example: "Ladder" Orientation (OMR and BCR Marks)

FPi OMR Mark Specifications at a Glance			
Description	**Metric**	**Inches**	**Closest Fraction**
Minimum line width for OMR or barcode marks	10 mm	0.40"	7/16 inch
Minimum spacing between OMR marks	2.5 mm	0.10"	1/10 inch
Maximum spacing between OMR marks	4.5 mm	0.18"	3/16 inch
Minimum space between mark clear zone and paper edge	11 mm	0.42"	7/16 inch
Minimum clear zone on side of marks	3 mm	0.12"	1/8 inch
Minimum clear zone on top of marks	9 mm	0.38"	3/8 inch
Distance from top sheet to first mark	20 mm	0.79"	3/4 inch
Distance from bottom of sheet to last mark	20 mm*	0.79"	3/4 inch
Maximum length of code	89 mm	3.50"	3-1/2 inch

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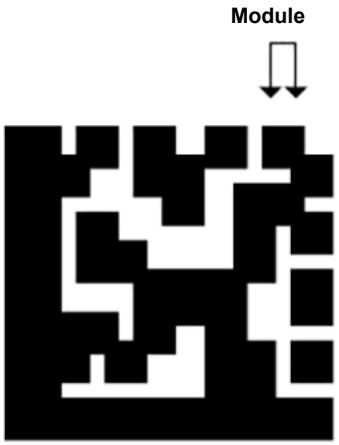
2D Data Matrix Scanning Overview

2D data matrix barcodes provide a compact barcode option to keep the physical size of the barcode to a minimum. This makes it easier to fit a barcode into a document.

2D data matrix barcodes can store a large amount of data in a smaller sized barcode. They can store more data than standard linear barcodes (such as code 3 of 9).

The data capacity of a 2D data matrix barcode is determined by two factors:

- The **dimension** of the barcode measured by the number of modules. A module is either a black or white square.



- The **data encoding method** used when the barcode is generated. The three most common data encoding types are:
  - Numeric (just numbers, highest data density)
  - Alphanumeric (numbers and letters)
  - Binary (just numbers 0 and 1)

Customers may encode their barcodes in any of these three formats. For inserters, the number of characters encoded in the barcode is critical, not the encoding type.

NOTE: Customers should supply samples of their raw barcode data so we can determine if we can support their application.

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Physical Specifications - 2D Data Matrix Barcodes

These are the 2D data matrix barcode physical dimensions supported by the FPi 5100 - 8100 inserters.

- Rectangle 2D barcodes are only supported in the High Capacity Sheet Feeder (HCSF).
- Square 2D barcodes are supported in both the HCSF and tower.

Barcode Specifications - HCSF

Item	Minimum	Maximum
# of characters	1	32*
Symbol width	3.3 mm (0.125")	15.875 mm (0.625")
Symbol length	3.3 mm (0.125")	19.05 mm (0.75")
Module size	0.33 mm (0.013")	0.635 mm (0.025")
# of modules (square)	10 x 10	32 x 32
# of modules (rectangle)	8 x 18	16 x 48

**Software ignores any data beyond the 32nd character*

Barcode Specifications - Tower

Item	Minimum	Maximum
# of characters	1	32*
Symbol width	3.3 mm (0.125")	12.5 mm (0.492")
Module size	0.33 mm (0.013")	0.635 mm (0.025")
# of modules (square)	10 x 10	32 x 32

**Software ignores any data beyond the 32nd character*

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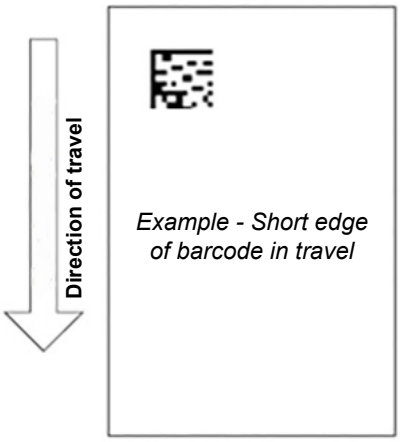
Printing Specifications - 2D Data Matrix Barcodes

- Codes must be printed with black ink on a white background (contrast must be greater than 75%)
- Code cannot be printed over any text or graphics
- Code should not intersect any perforation
- Printer should be set for printing at 600 DPI or higher
- Codes must be barcode quality grade of A (using ISO15415 standard barcode grader)

Supported Square Format

Square format is supported by the HCSF and the tower.
FPi 5100 - 8100 inserters support square 2D data matrix formats and these corresponding data capacities.



2D Square Format Data Capacities

Size	Maximum Numeric Capacity	Maximum Alpha-numeric Capacity	Maximum Binary Capacity	Minimum Supported Module Size (mm)	Maximum Supported Module Size (mm)
10 x 10	6	3	1	0.33	0.635
12 x 12	10	6	3	0.33	0.635
14 x 14	16	10	6	0.33	0.635
16 x 16	24	16	10	0.33	0.635
18 x 18	36*	25	16	0.33	0.635
20 x 20	44*	31	20	0.33	0.635
22 x 22	60*	43*	28	0.33	0.635
24 x 24	72*	52*	34*	0.33	0.635
26 x 26	88*	64*	42*	0.33	0.635
32 x 32	124*	91*	60*	0.33	0.635

**Can be read, but software ignores any data beyond the 32nd character*

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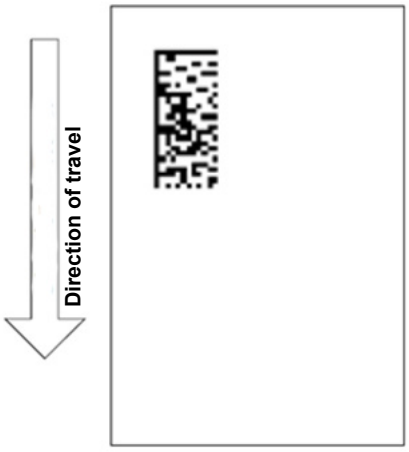
Supported Rectangular Formats

Rectangular 2D data matrix barcodes are only supported by the HCSF. They can be placed on the page in several orientations.

- Short Edge - short edge of barcode in the direction of travel
- Long Edge - long edge of barcode in the direction of travel

Short Edge

Short edge of the barcode goes first.



2D Rectangular Format Data Capacities - Short Edge

Size	Maximum Numeric Capacity	Maximum Alpha-numeric Capacity	Maximum Binary Capacity	Minimum Supported Module Size (mm)	Maximum Supported Module Size (mm)
8 x 18	10	6	3	0.33	0.635
8 x 32	20	13	8	0.33	0.5842
12 x 26	32	22	14	0.33	0.635
12 x 36	44*	231	20	0.33	0.4826
16 x 36	64*	46*	30	0.33	0.4826
16 x 48	98*	72*	47*	0.33	0.381

**Can be read, but software ignores any data beyond the 32nd character*

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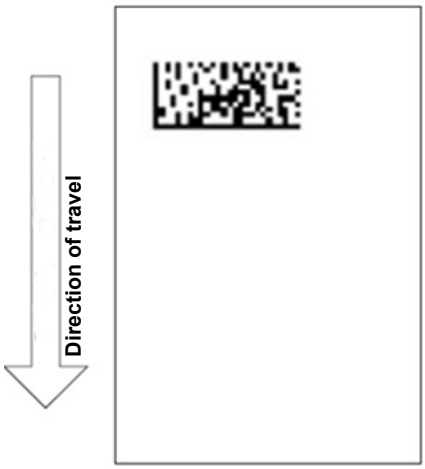
Long Edge

Long edge of the barcode goes first.



2D Rectangular Format Data Capacities - Long Edge

Size	Maximum Numeric Capacity	Maximum Alpha-numeric Capacity	Maximum Binary Capacity	Minimum Supported Module Size (mm)	Maximum Supported Module Size (mm)
8 x 18	10	6	3	0.33	0.635
8 x 32	20	13	8	0.33	0.453
12 x 26	32	22	14	0.33	0.559
12 x 36	44*	231	20	0.33	0.432
16 x 36	64*	46*	30	0.33	0.432
16 x 48	98*	72*	47*	0.33	0.330

**Can be read, but software ignores any data beyond the 32nd character*

NOTE: There are some combinations that are not supported and result in a barcode length or width that exceeds 15.875 mm maximum length or width specification.

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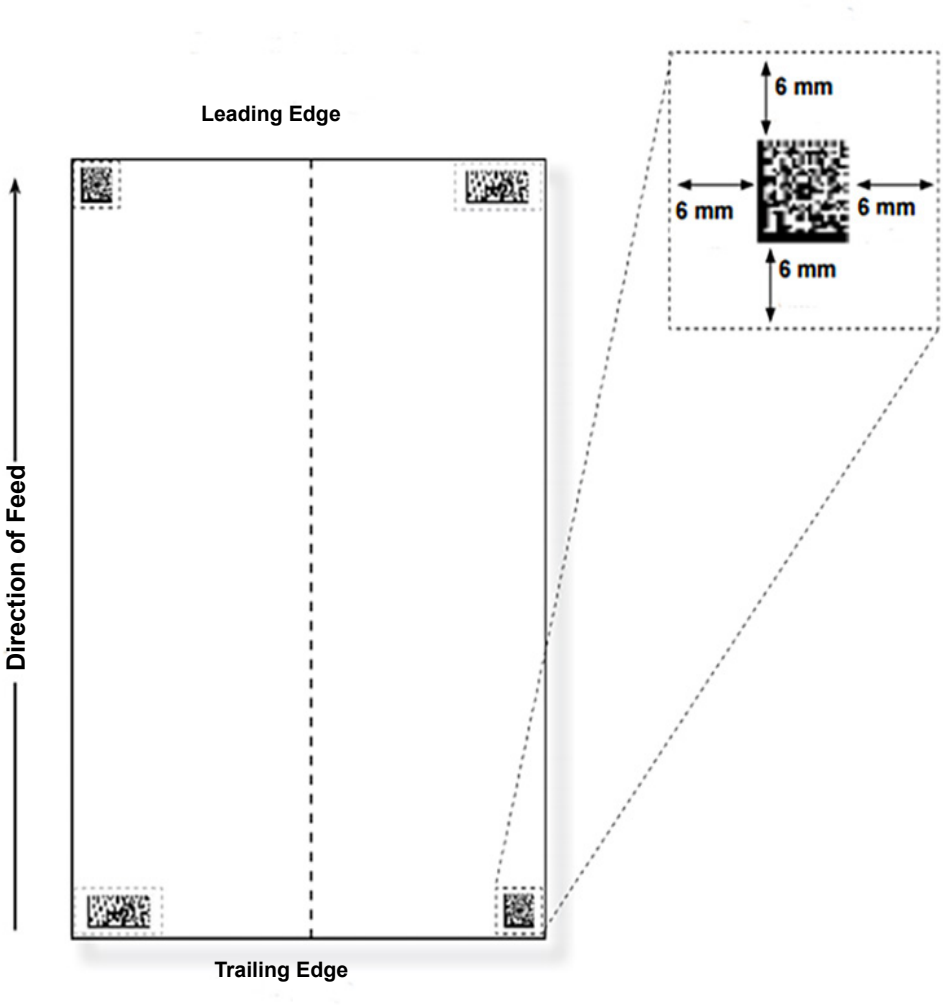
Clear Zone Requirements

The area around the barcode should be kept clear from print, etc. This area is called the clear zone. Keeping this area clear prevents print being read by the scanner in error.



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Recommended Barcode Content

Inserter Barcode Setup						
Function	**Abbreviation**	**Character**	**Bits**	**Size**	**Options**	**Comment**
					Code Type: Datamatrix First Page Only: No	
Job ID	JID	1	4	8	Controlling: No Coding Type: String Code Base: 32 LSB: Last	The Job ID is a string-based function and not a number-based function. It is typically a 6 or 8 digit number that remains constant throughout the job. When Trial Piece is pressed the Job ID is read from the first piece and then compared to the Job ID numbers of the rest of the run. If the job ID number changes within the same job, the system stops processing the material and displays a Job ID mismatch error.
Match Code	MC	9	4	6	Controlling: Yes Code Base: 10 Coding Type: CCD Wrap at: 999999 Include Zero: No Count Direction: Down LSB: Last	This function is used as the Piece ID in an open or closed loop control system in conjunction with an external host computer. In this case, the Match Code should be unique within the run.
Page Number	PN	15	4	2	Controlling: No Coding Type: CCD Count Direction: Down LSB: Last	This code represents the page number within the current collation.
Page Count	PC	17	4	2	Controlling: No Coding Type: CCD Code Base: 10 LSB: Last	Sets the number of documents fed per collation.
Client Use	CU	19	4	2	They are compacted bits and do not need to be set up. The inserter ignores.	These two characters are used for specific clients use, such as select feeds or edge marking.

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Adjusting the Scan Heads

Once the system administrator or system supplier sets up the scan configuration, the key to maximizing barcode or OMR performance lies in proper adjustment/positioning of the scan heads to be able to read the mark.

The scan heads are located in the feeder tower or the HCSF (if present on your system.) There are two scan heads in either location. This allows the system to read the mark regardless of the mark's location on the sheet.

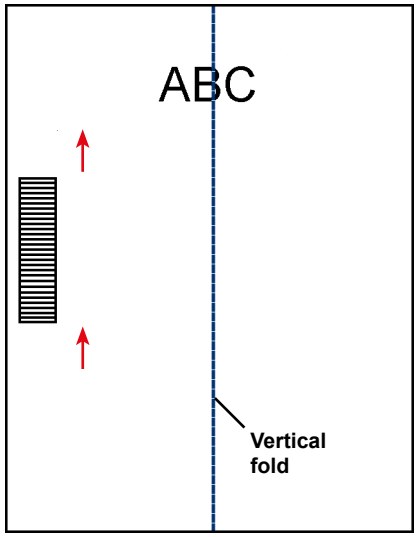
Additionally, more than one sheet within a set can be marked. If multiple sheets are using the same scan head, the marks on each sheet must be oriented so they pass over the scan head in the same position.

If both scan heads are used, they must be offset by at least 0.787" (20 mm) to avoid errors.

IMPORTANT: The side guides must be set properly in order for the scan heads to read the marks correctly. Additionally, material must be jogged back into place and loaded as an even stack to ensure the scan head and marks align properly. Refer to *Load Material into the Trays* for more information.

Adjusting Scan Heads for Ladder or 2D Orientation Marks

1. Fold one of the sheets to be scanned in half vertically (side with mark facing up.)
2. Draw two arrows, one at the top of the mark, and one at the bottom of the mark, pointing towards the top of the sheet.



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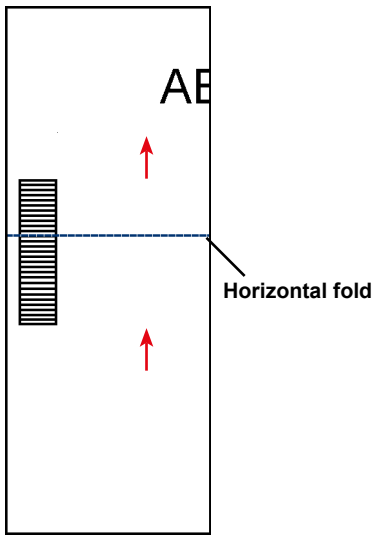
3. Fold the sheet horizontally, so the barcode appears on either side of the fold line.



4. Open the main transport deck cover. Use the ruler to measure the distance from the center of the sheet (lined up at 0 on the ruler) to the center of the marks.
5. Refer to the loading instructions to determine:
   - Scan head location for this sheet (left or right)
   - If the sheet will be loaded top or bottom first
6. Open the tower cover:
   - If the scanner is in the Feeder Tower (Feeders A, B, C, D) open the feeder tower cover
   - If the scanner is in the HCSF (High Capacity Sheet Feeder J, K, L, M), open the HCSF tower cover.

   TIPS:
   - Remove the left feeder trays from the feeder tower to allow the HCSF tower cover to open freely.
   - If you have two HCSFs on your system, the first HCSF Tower will prevent the second tower (farthest) from opening fully. For best results, be sure you have proper lighting when adjusting the scan head in the second tower.
7. Determine the direction the scan head needs to be moved (to the left or right of 0 on the ruler):
   - Make sure the center of the sheet (the vertical fold) is lined up with the center of the inserter (at 0 on the ruler.)
   - If the sheet is loaded top first, make sure the arrows point DOWN.
   - If the sheet is loaded bottom first, make sure the arrows point UP.

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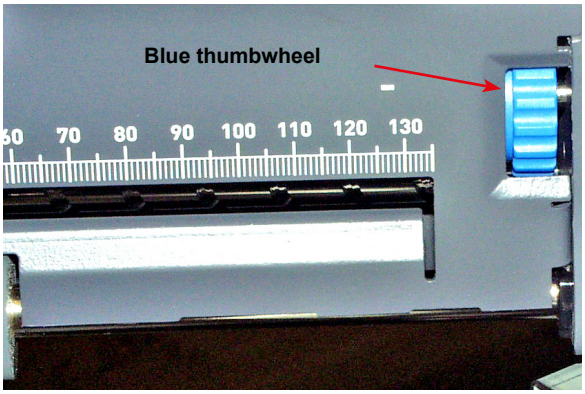
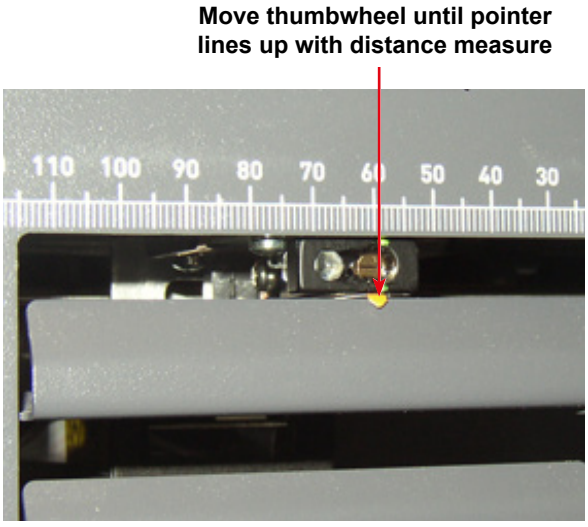
8. Determine the direction the scan head needs to be moved (to the left or right of 0 on the ruler):
   - Make sure the center of the sheet (the vertical fold) is lined up with the center of the inserter (at 0 on the ruler.)
   - If the sheet is loaded top first, make sure the arrows point DOWN.
   - If the sheet is loaded bottom first, make sure the arrows point UP.
9. Use the blue thumbwheel to move the scan head. Move the thumbwheel until the pointer lines up with the measurement (distance from the center of the page to the center of the mark) defined earlier.



Blue Thumbwheel - Adjust Scan Head Position

NOTE: The scanning area on your system may appear different, but operation concepts are the same.



Pointer Ensures Correct Scan Head Position

NOTE: The scanning area on your system may appear different, but operation concepts are the same.

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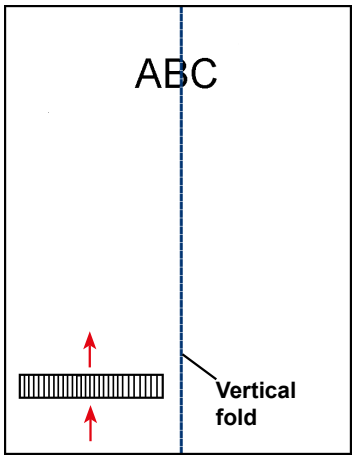
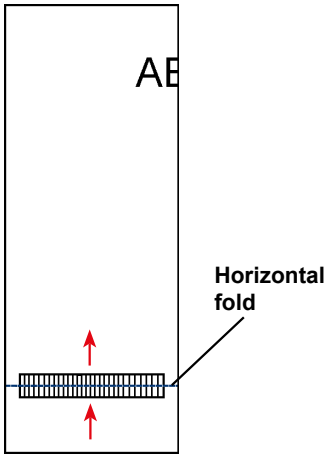
10. If additional scan heads are to be used, repeat step 1 to 8 for each.
11. To verify the adjustment is correct:
    a. From the home screen, select **Loading Instructions and Pre-Run Adjustments>Scanner Setup**.
    b. Use the UP/DOWN arrow keys to select a feeder to run.
    c. Press **TRIAL PIECE** to feed a piece from the highlighted feeder.
    d. Select **Finish**.

Adjusting the Scan Heads for Picket Orientation Marks

1. Fold one of the sheets to be scanned in half vertically (side with mark facing up.)
2. Draw two arrows, one at the top of the mark, and one at the bottom of the mark, pointing towards the top of the sheet.



3. Fold the sheet horizontally, so the barcode appears on either side of the fold line.
4. Open the main transport deck cover. Use the ruler to measure the distance from the center of the sheet (lined up at 0 on the ruler) to the center of the marks.
5. Refer to the loading instructions to determine:
    - Scan head location for this sheet (left or right)
    - If the sheet will be loaded top or bottom first.
6. Open the HCSF Tower cover.



TIPS:

- Remove the left feeder trays from the feeder tower to allow the HCSF tower cover to open freely.
- If you have two HCSFs on your system, the first HCSF tower will prevent the second tower (farthest) from opening fully. For best results, be sure you have proper lighting when adjusting the scan head in the second tower.

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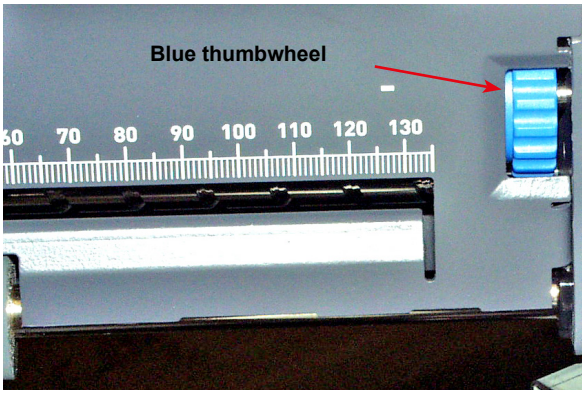
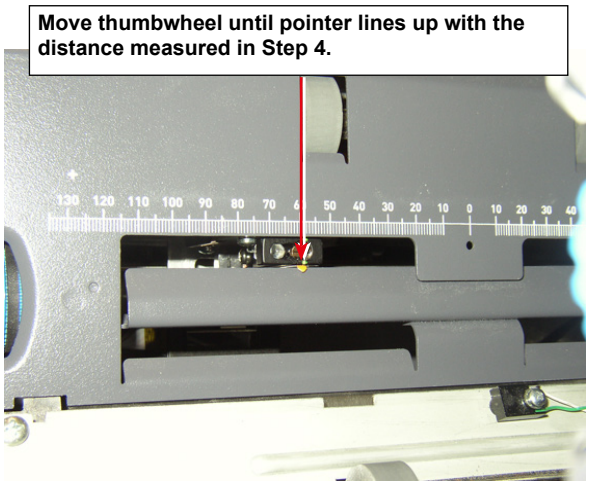
7. Determine the direction the scan head needs to be moved (to the left or right of 0 on the ruler):
   - Make sure the center of the sheet (the vertical fold) is lined up with the center of the inserter (at 0 on the ruler.)
   - If the sheet is loaded top first, make sure the arrows point DOWN.
   - If the sheet is loaded bottom first, make sure the arrows point UP.
8. Use the blue thumbwheel to move the scan head.



Use Blue Thumbwheel to Adjust Scan Head Position

NOTE: The scanning area on your system may appear different, but operation concepts are the same.

9. Move the thumbwheel until the pointer lines up with the measurement (distance from center of page to center of the mark) defined earlier.



Use Pointer to Ensure Correct Scan Head Position

10. If additional scan heads are to be used, repeat step #1 - 8 for each.

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Additional Information

- Paper weight range for OMR is 18 lb. (70 gsm) to 32 lb. (120 gsm).
- Feeder linking will only work correctly if the operator has started with the correct sheet (i.e. linking can only be done reliably on a collation break). The feed order and print order determines if feeder linking is possible. Some sort of collation integrity (WAS or MC) ensures right pieces are in the right collations.
- Selective feed of additional sheets is always available up to the maximum limits of either folder (8 sheets of 80 gsm paper or equivalent) or 25 sheets into a flat envelope.

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