Keysight Technologies
Barcode Strategy Considerations When Using the Keysight i3070 Inline In-circuit Test Solution

Application Note

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Barcode labels, whether they are in 2D, 3D or matrix formats, are commonly used on printed circuit boards for identification so that manufacturers can easily find out the board status during automated components assembly, processing, testing, final assembly and packaging through their database tracking system.

The Keysight i3070 Series 5 inline in-circuit tester is equipped with a Zone 1 Infeed stage (buffer zone) to allow barcode scanning before the ICT phase. When the board under test (BUT) flows from upstream system into the Infeed stage, the sensor of the Zone 1 stopper senses the BUT and triggers the PC to read the barcode. If it is accepted, the BUT will flow to the Zone 2 test stage to proceed with testing. If the BUT passes the test, it will be transferred to the next downstream system. If the barcode reading fails, the BUT will be transferred into the reject sorter.

The first step in implementing a barcode strategy is to consider at which stage to scan the barcode, and how to handle the "bad" barcode. Here are two strategies for consideration:
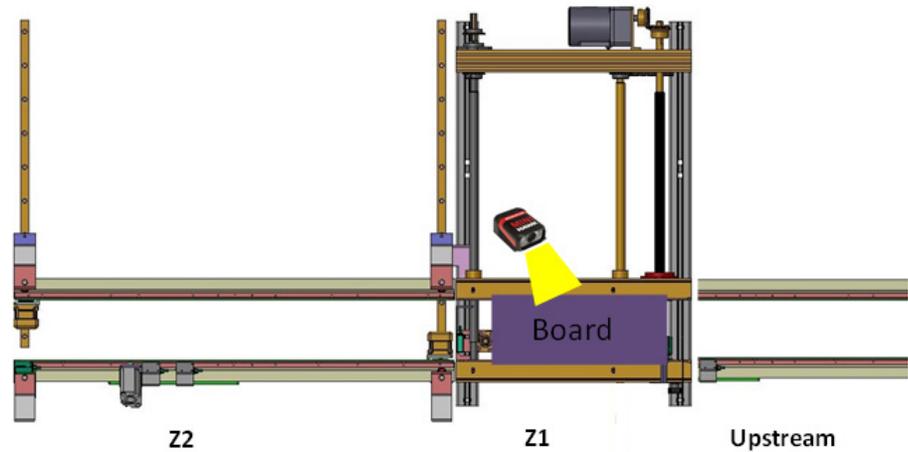

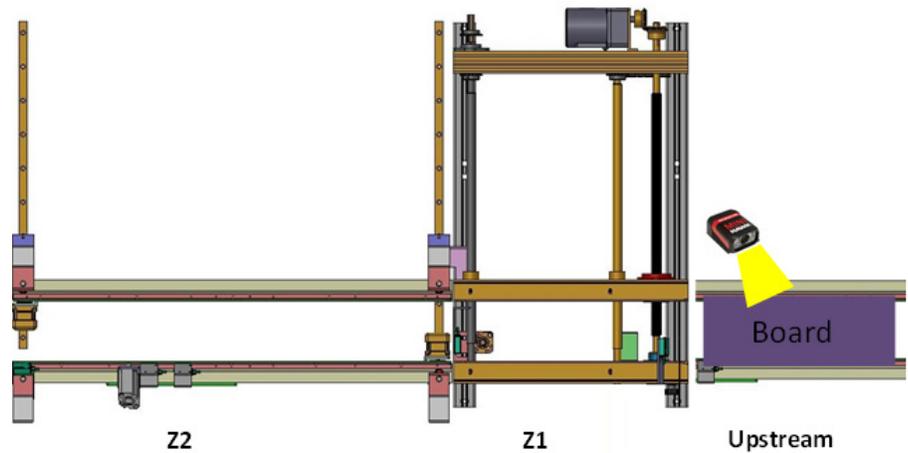Figure 1. Barcode scan at Infeed position

Figure 2. Barcode scanning at upstream position

Strategy	How the strategy works
Scan barcode at Infeed (Zone 1. See Figure 1.	When using this strategy, cycle time is minimized due to shorter board travel distance.
	Production output is also optimized as the operator does not need to manually scan the barcode of each board.
	All the BUTs with "bad read" barcodes are automatically transferred downstream to the reject sorter, where the operator will need to separate the "failed test" boards from the "bad read barcode" boards.
	This option can handle board dimensions only up to 350 mm x 350 mm due to the limited space in the Zone 1 area.
Scan barcode upstream; for example, at the link conveyor. See Figure 2.	This strategy is suitable for any board size. When using this strategy, you are able to attend to the board immediately when a bad read occurs. In this case, the **"Failed test board"** and "bad read" barcode boards will not get mixed up at the rejects sorter.
	It requires human intervention for clearing the "bad read" board. The production output will be affected if bad boards are not cleared in time.

If you have 2-up, 4-up panels or more, you may have to consider various implementation strategies. There are several methods or strategies to consider and each of them may impact cycle time, cost of implementation and operation risks. Let's take a closer look at the available options:

1. Manual adjustable
   A. One barcode scanner
   B. Two barcode scanners
   C. Matching the number of barcode with barcode scanners

2. Auto-XY barcode reader

1. Manual adjustable

A. One barcode scanner:
   i. Scan the panel barcode, using software to append or assign the board numbers based on the panel serial number of the boards.
   ii. Alternatively, scan the barcode of the first board, using software to add or subtract so that it can automatically assign the barcode or serial number of the consecutive boards. In this case, the serial number must be in series.
   iii. Scan the panel barcode, based on the panel barcode using data in the server to grab the board's barcode or serial number. In this case, the serial number must be in consecutive series and the board/panel orientation must be correct.

B. Two barcode scanners:
   i. This is the ideal and practical method for 2-up panels. Both barcodes can be physically scanned. However, you need to monitor and adjust the distance between the scanners to ensure they do not interfere with each other.
   ii. If you have 4-up panels or more, and the boards are arranged in two rows, you can scan the barcode of the first leading board, and use the software to add or subtract the assignment of the serial numbers. In this case, the serial numbers must also be in consecutive series.

C. Matching the number of barcodes with barcode scanners:
   i. This is the ideal method for more than 2-up panels as you are ensured that all the board barcodes are scanned physically without missing any. However, you need to consider housing the number of barcode scanners due to size and space needed for scanning during the Infeed stage, such that they do not interfere with each other. Furthermore, buying multiple barcodes scanners is not cost effective, and therefore, this may not be a very practical solution.

2. Auto-XY barcode reader

This strategy allows reading the barcode from only either the top or bottom of the board at any one time. The system must be pre-configured to enable scanning the barcode from either the top or bottom only.

The advantage of this XY scanning method is that the XY coordinates can be pre-set into the memory. During production changeover, the barcode reader will move to the desired XY location automatically. This will cut short the setup time on adjusting the barcode reader manually.

The auto-XY method is not recommended as a strategy to use if you need to read more than one barcode, as the barcode scanner needs to be moved from one barcode to another, causing the cycle time of the system to increase.
The following table illustrates the operation time needed depending on the number of barcodes to be read.

A +((B + A) x (D - 1)) + ((D-1) x C)) where A = scan and confirm barcode B = time taken to move to next barcode C = time delay (if any) D = No of boards/barcodes	Example: 4 barcodes A = 2 sec B = 1 sec C = 1 sec D = 4	2 + ((2+1)x(4-1)) + ((4-1)x1)) = 2 + 9 + 3 = 14 sec
	Example: 2 barcodes A = 2 sec B = 1 sec C = 1 sec D = 2	2 + ((2+1)x(2-1)) + ((2-1)x1)) = 2 + 3 + 1 = 6 sec
	Example: 1 barcode A = 2 sec B = 1 sec C = 1 sec D = 1	2 + ((2+1)x(1-1)) + ((1-1)x1)) = 2 + 0 + 0 = 2 sec

Conclusion

With the various considerations listed here, you can opt for the most suitable barcode scanning strategy for deployment on your manufacturing floor to help you automate this repeatable task and hence, speed up your production changeover time.

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