Agilent's AXI History

Agilent AXI Development History Overview:
Ever-Increasing Performance & Capability





	1994 – 1997 5DX Series I SN: 100-184	1998 – 1999 5DX Series II SN: 200-248	1999 – 2000 5DX Series 2 SN: 300-499	2000 – 2002 5DX Series 3 SN: 500-699	2002 – Present 5DX Series 5000 SN: 700 and up	April 2007 – Present x6000 SN: 3000 and up
Throughput	**15 joints/sec**	**30-60 joints/sec**	**30-60 joints/sec**	**120-140 joints/sec**	**120-140 joints/sec (~1in²/sec)**	**~2-3in²/sec**
Key Features & Benefits	**Prototype Testing High Reliability**	**Throughput (Digital Camera)**	**Reduced Footprint CAMCAD 18”x24” boards**	**High Volume Manufacturing Transportability Medalist Repair Tool MTBF & MTTR Improvements**	**Call Performance Programming Ease of Use Medalist Quality Tool**	**2-3X 5DX Throughput Programming Ease of Use Simplified Production Implementation & Supportability**
Featured Coverage		**CSPs & Flip Chips**	**BGA2**	**SMT Connector**	**BGA Open Outlier QFN**	

Throughput Improvement Comparison



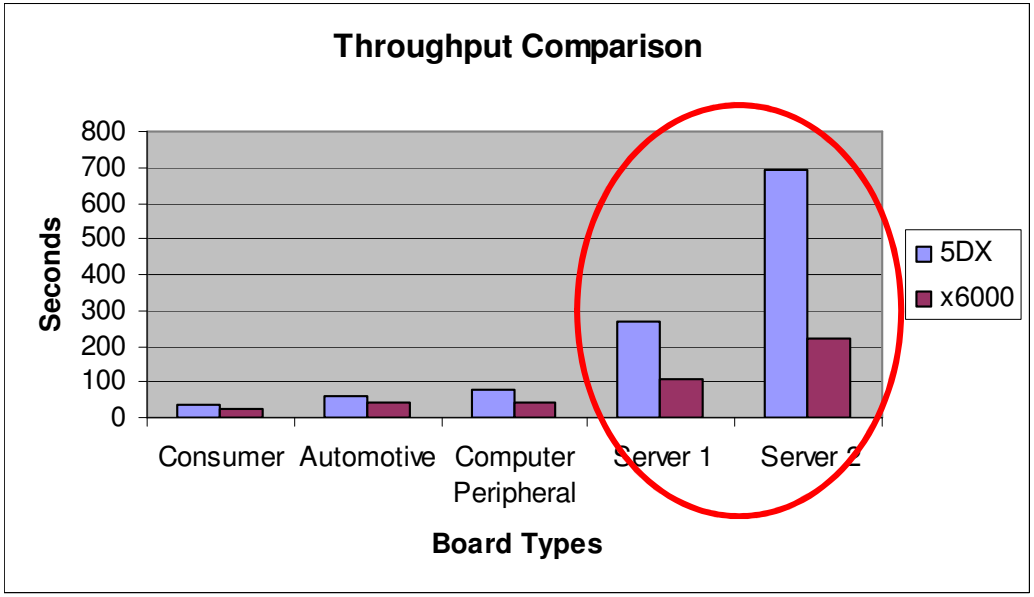


	5DX Series I	5DX Series II	5DX Series 2	5DX Series 3	5DX Series 5000	x6000
Alignment	**6-8 sec**	**2-4 sec**	**2-4 sec**	**3 sec**	**3 sec**	**20 sec***
Surface Mapping	**2-3 pts/sec**	**3-4 pts/sec**	**3-4 pts/sec**	**4-5 pts/sec**	**4-5 pts/sec**	**N/A**
Test Time	**15 joints/sec**	**30-60 joints/sec**	**30-60 joints/sec**	**120-140 joints/sec**	**120-140 joints/sec (~1in^2/sec)**	**~2-3in^2/sec**
Field of View (FOV) Size	**Up to 800 FOV**	**Up to 800 FOV**	**Up to 800 FOV**	**Up to 850 FOV**	**Up to 850 FOV**	**N/A**

* Time includes all panel movement for load, unload, X-ray barrier control, mechanical positioning and compensation, automatic system adjustments, and panel alignment. Alignment time is dependent on the size of the panel.

x6000 vs 5DX Series 5000 Throughput Comparison

- Consumer:
  - 4x5, 1k joints
  - 50 mil BGA, Jlead, 25.6 mil QFP, 19.7 mil
- Automotive:
  - 6x13, 3k joints
  - BGA, PTH, Fine Pitch Gullwing
- Computer Peripheral
  - 6x10, 5k joints
  - 30 mil BGA, 66 mil PTH, 31.5 mil SMT Connectors, 0605, 19.68 mil QFP, SOTs, Tant Caps
- Server 1 :
  - 15x16, 17k joints
  - 39.4 CGA, 50 mil BGAs, Press Fit, 100 mil PTH, 25 mil SMT connectors, 19.68 QFP, 0402-1206's, PTH discrete, SOT, 25 mil QSOP, 19.68 TSSOP, 50 mil PLCC
- Server 2:
  - 15x16, 40k joints
  - 42 mil PTH connector, 31.5 SMT connector, 25 mil BGA, 19.68 mil QFN, 25 mil QSOP, 39.37 mil BGA, 19.68 mil QFP, 50 mil PLCCs, Res Packs, angled components, 0402-0805, heat sinks



Specific Hardware Differences





	5DX Series I	5DX Series II	5DX Series 2	5DX Series 3	5DX Series 5000	x6000
Controller	**Two 486 controller master/client PCs**	**Micron Pentium II Dual,200MHz , 256MB**	**Pentium III Dual, 500MHz, 256 MB**	**Pentium III Dual, 866MHz, 384MB**	**Pentium IV Dual, 2.8GHz, 1GB**	**Intel Dual Core Xeon processors, 866MHz, 384MB**
Rotary Axis Speed	**600-750 rpm**	**750 rpm**	**750rpm**	**1000rpm**	**1000rpm**	**N/A**
Imaging System	**Analog**	**Digital**	**Digital**	**Digital**	**Digital**	**Digital**
Min/Max FOV`	**200/800mils**	**200/800 mils**	**200/800 mils**	**200/850 mils**	**200/850mils**	**N/A**
Key Hardware Changes	**Loaders** **High Voltage Tank** **Dual Bay Electronics Cabinet**	**Single Bay Electronics Cabinet** **Integrated High Voltage Power Supply**	**Inner/Outer Barrier – Loaderless** **New C&A Panel**	**Digital Camera** **New motion control assembly** **Brushless Motors**	**No New Hardware** **Lead-free C&A Panel**	**Completely new imaging chain** **Monitor/ keyboard and support bays integrated** **Serviceability**

Software Release Comparison





	5DX Series I	5DX Series II	5DX Series 2	5DX Series 3	5DX Series 5000	x6000
Operating System	**Windows for Workgroups 3.1**	**NT 3.5 – NT 4.0**	**NT 4.0**	**NT 4.0**	**Windows XP Pro**	**Windows XP**
Software Release	**4.x**	**5.x**	**6.x**	**7.x**	**8.x**	**1.x**
Key Features & Benefits	**Offline test development Paperless Repair Tab, LCC, Universal & fpgullwing New thickness calibration sw**	**Flip Chip, CSP Auto panel selection Y2k compliance Inspection of non-orthogonal components**	**BGA2 New Thickness Tables 18x24 Panel Inspection Confirmation & Diagnostics Utility**	**SMT Connector Medalist Repair Tool X-Out ASAP Transportability View Focus Editor**	**BGA Open Outlier, Pressfit, CCGA, QFN, Direct FET, Paste Voiding, IPC 7095 BGA Voiding Test Link New Algorithm Tuner Medalist Quality Tool Defect Analyzer QFN PTH and BGA Void improvements**	**Fully integrated & simplified programming model Automatic monitoring of system performance Automatic Calibration and Adjustment (C&A) Automatic focus**

5DX 8.X Software Stream Feature Summary

8.0	8.1	8.2	8.3	8.4
Test Link	Test Link ECO Capability	New CGA Family of Algorithms	BGA2 Voiding2 (IPC 7095A)	Non-wetted Direct FETs
New Algorithm Tuner	Extended Service Life of Laser Assembly	New Press Fit Connector	BGA2 Open Outlier false call reduction	Side fillet capacitors
Patented BGA2 Open Outlier	PCAP Algorithm Improvements	Enhanced BGA2 Open Outlier	PTH2 – accuracy improvements	Quad-Flat No-Lead (QFN)
	Internet Explorer 6.0	New Paste Voiding Algorithm	Paste Voiding	
		Windows XP Pro	Potential throughput increase - faster Defect Analyzer	
		TDW Software Only	New Test Execution Graphical User Interface (GUI)	

Supportability Comparison





	5DX Series I	5DX Series II	5DX Series 2	5DX Series 3	5DX Series 5000	x6000
End of Support	**June 30, 2003**	**June 30, 2005**	**June 30, 2005**	**TBD***	**TBD***	**TBD**
Mean Time to Repair	**Varies**	**Varies**	**8.5 hours**	**3.5 hours**	**3.5 hours**	**Target - 3.5 hours****
Mean Time Between Failures	**Varies**	**Varies**	**400 hours**	**750 hours**	**750 hours**	**Target - 750 hours****

* EOS for the 5DX will be at least 7 years post discontinuance

** Will be updated when 1 year of production data is available

Agilent Technologies

History of the Agilent's AXI

Series I 5DX

Serial Numbers: 100 – 199

Models: 5100, 5200, 5300

Series II 5DX

Serial Numbers: 200 - 299

Models: 5100, 5300, 5400

Series 2L 5DX

Serial Numbers: 300 – 499

Models: 5100, 5300, 5400

Series 3 5DX

Serial Numbers: 500 – 699

Models: 5100, 5300, 5400

Series 5000 5DX

Serial Numbers: 700 and up

Models: 5300, 5400

x6000

Serial Numbers: 3000 and up

Major Change History

Series I 5DX – original release

Large High Voltage Power Supply (HVPS) tank
External Loaders
Dual monitors – 1 for machine control, 1 for image viewing
Micron PC with EISA buss
Windows 3.11 operating system

Series II 5DX

Integrated HVPS into x-ray tower
Single monitor for machine control and image viewing
Introduced high resolution system (5400)
Introduced Hewlett Packard PC
Windows NT 4.0 operating system
Slimmer Electronics Cabinet – single door

Major Change History (cont)

Series 2L 5DX

Eliminated external loaders

Added an Inner Barrier

Added a second Panel-In-Place Sensor

Enabled automatic testing of large boards (up to 23.5 inches)

Series 3 5DX

Changed X and Y stage movement motors from DC to AC

Added option of adding a middle rail

New CCD camera which provided a better signal to noise ratio

Added the 850 FOV

Updated the HP PC to a PCI buss (not backward compatible)

Increased Rotary Scintillator Assembly rotation to 1000rpm

Major Change History (cont)

<u>Series 5000 5DX</u>

Eliminated the model 5100 option

Released 8.0 software for easier program development

Replaced the HP PC with an IPC

<u>x6000</u>

Completely redesigned imaging chain

Completely redesigned software – 1 user interface

Integrated support bay, monitor, keyboard – smaller overall footprint

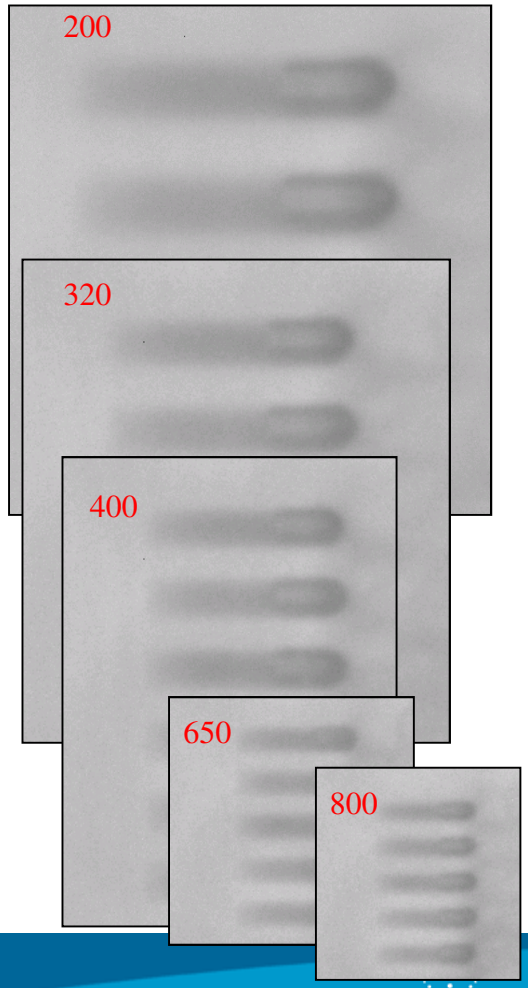
Model Differences

Model 5100

- 400 FOV – only used for Surface Map
- 650 FOV
- 800 FOV

Model 5200

- 320 FOV
- 400 FOV
- 650 FOV
- 800 FOV



Model 5300

- 200 FOV
- 260 FOV
- 320 FOV
- 400 FOV
- 650 FOV
- 800 FOV
- 850 FOV – Series 3 and 5000

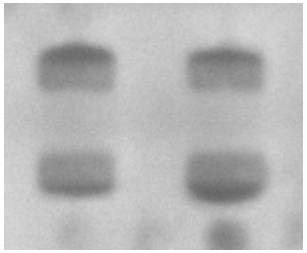
Model 5400

- Same FOVs as 5300
- High resolution X-ray tube

Model Resolution

Model 5100 (No longer available)

- Standard Pitch
- 20 mils & up

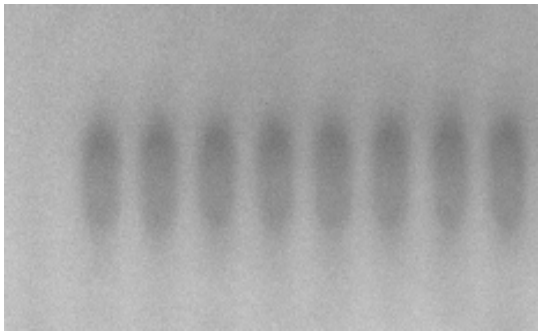


Model 5400

- Ultra Fine Pitch
- 8 mils & up

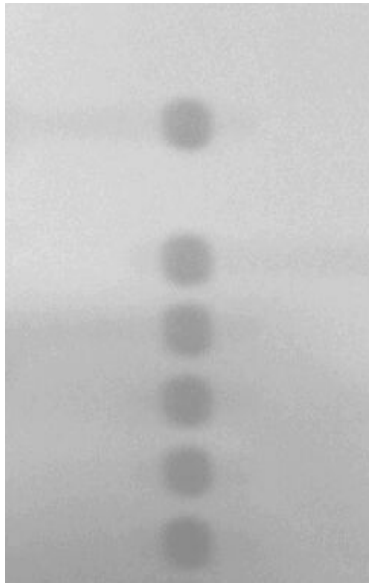
Model 5200 (No longer available)

- Fine Pitch
- 16 mils & up



Model 5300 and x6000

- Very Fine Pitch
- 12 mils & up



* Assuming pad width is 50% of pitch

Current 5DX and x6000 Specifications – Board Related

Board Size

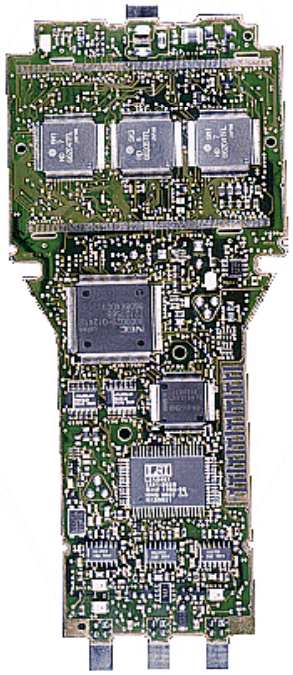
- Max – 18 x 24 inches
- Min – 4 x 5 inches

Board Thickness

- Max – 125 mils
- Min – 20 mils

Board Weight

- Max – 10 lbs
- Min - .066 lbs



Edge Clearance

- Min – 0.118 inches on parallel edges of the board

* min/max board thickness and edge clearance limits can be exceeded with the use of a board carrier

Current AXI Specifications – System Related

Maximum Test Area

- x6000: 17.5 x 24 in.
- 5DX: 17.5 x 23.5 in.

Image Acquisition Time

- x6000: 5in^2/second
- 5DX: Up to 5 images / second

Component Clearance

- x6000:
  - Top – 0.37 to 1.0 in.
  - Bottom – 2 in.
- 5DX:
  - Top – 0.37 to 1.0 in.
  - Bottom – 1.2 in.

Alignment Time

- x6000: 20 seconds*
- 5DX: 3 to 8 seconds

Test Speed

- x6000: ~2-3in^2/sec
- 5DX: ~1in^2/sec

Surface Map Time

- x6000: N/A
- 5DX: Up to 5 points / second

* Time includes all panel movement for load, unload, X-ray barrier control, mechanical positioning and compensation, automatic system adjustments, and panel alignment. Alignment time is dependent on the size of the panel.

Pocket Slides →

Minimum Feature Detection

5400 System at 200 FOV		
Short Width:	0.035 mm	0.0014 in.
Solder Height	0.0127 mm	0.0005 in.
Solder ball Diameter:	0.05 mm	0.002 in.
Void Diameter:	0.25 mm	0.010 in.