

XRT SYSTEM 7000™

X-Ray Post Lamination Tooling and Inspection



XRT™ System 7000

The Next Generation in X-Ray Drilled Tooling and Inspection

The XRT System 7000 offers the highest degree of accuracy and repeatability needed for a production x-ray drill with the added flexibility to perform many other functions.

The machine utilizes two x-ray cameras to view two or more targets for panel alignment or data acquisition anywhere along two opposing edges of a Multilayer PCB panel. This provides the ability to view multiple targets or drill multiple holes anywhere along the edges of the panels to within eight inches of the center line of the panel.

This added flexibility also provides the ability to use many existing stack-up targets and coupons for data collection of layer-to-layer registration relationships.

The XRT System 7000 is built with fully programmable X motion for the two X-Ray/Drill Units and full Y motion for the panel. In this way, the machine is flexible to view targets and drill holes anywhere along the opposing edges of any multilayer board from 12" x 14" (305mm x 356mm) to 24" x 30" (609mm x 762mm) whereby the maximum motion of the panel is 24" in the Y-axis. The minimum and maximum motion of the X-axis accommodates panels from 14" to 30".

The XRT System 7000 is designed to be used for:

- Registration of high-layer count panels to drilling, routing or exposure processes,
- Sequential lamination registration tasks.
- Drilling corner target holes for registration to conventional or LDI exposure processes.
- Registration tasks related to HDI, MCM or CSP manufacture.
- Aligning multilayer panels to trimming and edge finishing processes.
- Measuring and collecting data regarding overall registration accuracy and individual inner-layer growth or shrinkage and relationship to other layers.

Multiple Alignment routines are available with this flexible x-ray tooling system:

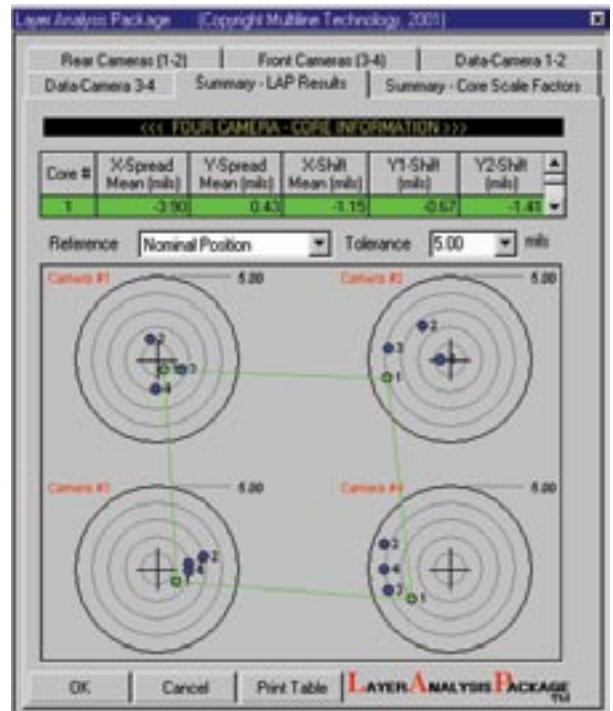
- **Split-the-Difference** looks at 2 or 4 targets and finds a best fit to the target locations and drills the tooling holes a nominal distance from one another. This is the most accurate method of tooling for final drill since all internal layer shifts are compensated for before drilling.
- **Drill-out-Target** locates each target individually and drills a hole through the target to a best fit of each individual target location. (2 or 4 target mode)
- **Bias left / Bias right** - The machine will find the best vertical fit by analyzing right and left targets but will locate the panel with either the right or left as the reference zero location and drill the tooling holes with a nominal distance between. (2 target mode)

The XRT System 7000 X-RAY DRILLING function provides:

- Pin-tooling holes for aligning the optimized average position of internal images for mechanical drilling, laser drilling or routing processes.
- Pin-tooling holes for aligning any selected internal image with mechanical drilling or laser hole drilling processes.
- Pin-tooling holes for aligning any selected internal image with mechanical or laser routing processes.
- Pin-tooling or optical target holes for aligning internal images (either individually or as an averaged composite) for LDI or exposure machines with automatic alignment capability.

XRT Layer Analysis (LAP™)

The XRT is more than a production machine. Its Layer Analysis Software becomes a powerful tool to inspect multilayer boards directly after lamination. The Layer Analysis Package is an effective non-destructive method of measuring layer shift without the need to drill the board or drill coupons on the board. Core shift and spread data is provided to accept or reject individual multilayer boards before more value-added work is performed. Data is provided to determine scaling factors for up and down stream processes to improve yields and produce the highest quality boards with the most stringent registration demands.



LAP provides:

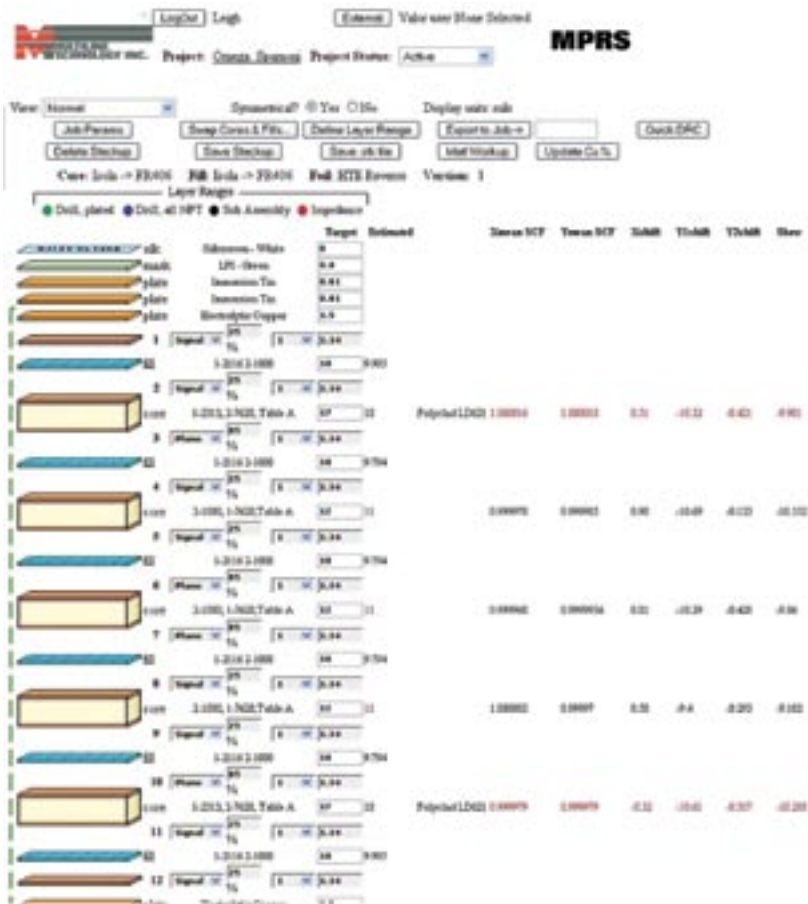
- Data on internal layer growth or shrinkage and shift per layer
- Data on the relationship of movements of each internal layer with respect to movements of other layers in the same board.
- Correction factors for scaling of artwork and drill.

Optional Software:

Run and Trend Analysis® software for LAP™ calculates scaling factors that can be applied to drilling (Drill Scale Factor) to improve drill to pad (annular ring) registration and calculates scaling factors that can be applied to original photo tools for improved registration of laminated cores (Artwork Scale Factor). Trend analysis, a utility in the Run Analysis© software package illustrates graphically the spreads and shifts of individual cores for each lot of multilayer boards processed by Extended LAP™.

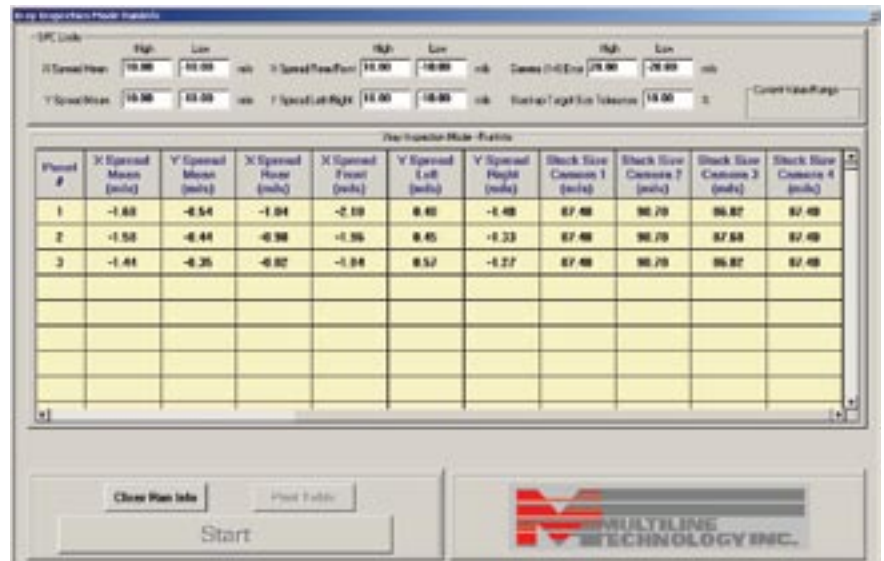
Multiline Predictive Registration Software (MPRS™) with Registration Design Rule Check (RDRC™)

This software runs in conjunction with the LAP-RA optional software package. A Stack-up Engineering Module net-worked together with any of Multiline Predictive Registration System machines (Artwork Punch, Post Etch Punch, XRT or Automatic Alignment Exposure Frames) will give the user the capability to utilize production data collected from the production equipment to predict the registration capability of a stack-up design. This software allows the producer to develop their own algorithms with the help of the DirectLogix applications DRC engine. Variables such as material type, manufacturer, glass-cloth type of inner-layer material, inner-layer thickness, glass-cloth type of pre-pregs, resin content of pre-pregs, copper weights, copper percentages by core-layer, presence of heat-sink layers, and all other user-defined stack-up attributes as well as environmental influences and time factors can be tracked for registration effects. The software can be programmed to return expected growth or shrinkage rates at various points in the production process. Multiline Predictive Registration Software (MPRS) provides users with an automated data feedback and engineering action loop.



LAP also provides:

- Inspection Mode is a function of the production drill mode which performs a preliminary inspection of the internal registration on every panel prior to drilling. If the registration tolerance exceeds the parameters set by engineering, the panel will be flagged and NOT drilled. This panel can now be run through LAP for further analysis.



Specifications:

- **Panel size range:** 12" x 14" (305mm x 356mm) to 24" x 30" (610mm x 762mm)
- **Panel thickness range:** 0.018" (.46 mm) to .250" (6.35 mm)
- **Drilled-hole-to-drilled-hole accuracy:** $\pm .0005"$ (12 μm)
- **Drill repeatability:** $\pm .0002"$ (5 μm)
- **Drilling Accuracy:** $\pm .0008$ (20 μm) multiple point
- **Physical size:** 82" (2083mm) wide x 77.5" (1969mm) long x 70" (1778mm) high; pass height: 39" (990mm) high
- **Weight:** Approx. 5100lbs (2300Kg)
- **Power requirements:** Electrical; 120/ 220 VAC; 30/15 amp service; single phase
- **Drilling Hole Capacity:** 6.0mm max.
- **Spindle Speed:** 0 - 50,000 rpm
- **Spindle Type:** Brushless DC Servo
- **Spindle Distance:** X-axis 337~762mm Y-axis 0~600mm
- **Spindle Run-out Accuracy:** within 1 μm
- **X-ray Tube:** 100W (50kV@2.0mA)
- **Maximum X-ray Leakage:** <1 $\mu\text{Sv/hr}$ (0.5mr)
- **X-ray Spot Size:** 100 μm
- **Pneumatics:** 90 psi; clean; water, dirt and oil free; 5 cfm 0.6MPa @142 l/min
- **Through-put:** is dependent upon numbers of targets, drilled holes and amount of motion required.
- **Cycle time:** for two-target or four-target alignment with the drilling of three holes will be between 20 and 30 seconds per panel.



Optional Off loader (XRO):

Off loader- an off loader can be provided which delivers panels to a conveyor table at the rear of the machine.

Optional Software:

Run and Trend Analysis (RA™) and Multiline Predictive Registration Software (MPRS™)

Features:

- Selectable drill sizes: Four drill heads allow for two different drill sizes without drill change
- Drill motors are electrically controlled with speed and torque feedback.
- Drill spindles are air cooled with ceramic bearings.
- Multiline Technology's own State-of-the-Art image-capture and image-recognition technology.
- 100 W x-ray tubes; liquid cooled.
- Split axis precision motion control system; servo and linear servo technology.
- Inspection mode and layer analysis prevents scrap and improves processes.



MANUFACTURERS OF REGISTRATION SYSTEMS
AND LAMINATION FIXTURES FOR THE MULTI-LAYER
PRINTED CIRCUIT BOARD INDUSTRY.

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