ADVANCED PROCESS/SURFACE MOUNT TECHNOLOGY LABORATORY

PROCESS DESIGN, SETUP, OPTIMIZATION, AND SUPPORT

CUSTOMER SUPPORT DIVISION OF UNIVERSAL INSTRUMENTS
Automation in Electronic Assembly
Universal Instruments is a global provider of innovative electronic circuit assembly technology and equipment, integrated systems solutions, and process expertise. Universal serves the top manufacturers in every category of the electronics industry worldwide through more than 65 sales, service, product training, and parts distribution centers in more than 30 countries.

Universal has an installed base of more than 18,000 machines worldwide — including surface mount, through hole, odd form, advanced semiconductor assembly, and board handling equipment — and certification to the ISO 9001 and the QS-9000/TE quality standards. Universal is well positioned to offer the service and expertise that only a truly innovative and global organization can support.

A Value-Added Knowledge Base Built on Real-World Scientific Data
Delivering Increased Yields, Process Improvements, and Optimized Life Cycles

The Universal Instruments Advanced Process/Surface Mount Technology Laboratory (SMT Lab) was established in 1987 to identify and investigate current and emerging technologies in electronic circuit assembly. Since that time the SMT Lab has accumulated and applied an extensive body of practical knowledge to help Universal customers with full-service process support.

This support makes it possible for manufacturers to increase their yields, improve their processes, and optimize their product life cycles.

**Increased yields**
By developing fully documented processes for high performance applications, the SMT Lab enables customers to enjoy higher profitability through a greater return on investment. It delivers reproducible results that enhance productivity, increase process yields, and improve product reliability.

**Process improvements**
By continually expanding Universal’s process knowledge and, equally important, leveraging Universal’s existing know-how, the SMT Lab enables customers to realize a faster time-to-market. Universal applies research findings to specific product development/manufacturing projects to provide whole process solutions — cost-effective, optimized, turnkey processes — unique to the customer’s needs.

**Optimized life cycles**
By serving as a resource for assistance with daily process issues, the SMT Lab supports customers through all phases of their product life cycle. It helps shorten product design/development/prototyping cycles at the front end, and provides ongoing utilization and process support through the volume manufacturing and product maturity phases.

Furthermore, the SMT Lab is unique in that it conducts applied research through the efforts of Universal’s professional staff as well as other industry resources. It is also a leader in organizing focused research consortia, through partnerships with the major companies in the industry and integrating the intellectual capital of leading scientists, academic researchers, and industry experts.

The SMT Lab, then, offers the benefit of the best thinking of a truly multi-disciplinary team, specializing in such fields as experimental research, project management, manufacturing planning, materials analysis, board and component design, and the many other areas of expertise needed to identify, analyze, and apply advanced technologies today—and tomorrow.

About Universal Instruments

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Hands-on Experimentation, Testing, and Development

In addition to a dedicated group of process engineers from Universal Instruments, DEK, and Vitronics Soltec conducting applied research, the Advanced Process/Surface Mount Technology Laboratory is also a physical facility at Universal Instruments headquarters in Binghamton, NY. As this layout of the floor plan indicates, ample space is provided for each phase of the SMT Lab’s “real world” work.

A Broad Array of Services

The key services provided by the Advanced Process/Surface Mount Technology Laboratory fall into four primary areas: basic research; product/process development; knowledge transfer; and production/process support.

Research

- Analytical/experimental research on emerging technologies/processes
- Investigation of new materials
- "Parameterization" studies
- Consortia: The Lab has taken the lead in developing and disseminating groundbreaking projects in a number of key developments, including:
  - Area Array Consortium (1999-2001)
  - CSP/DCA Consortium (1997)
  - UFP Consortium (1992)

Development

- Prototyping
- Custom process development
- Start-up, implementation assistance
- PCB design review
- Turnkey solutions, including on-site process start-up
- Quality/reliability testing

Knowledge Transfer

The SMT Lab communicates process knowledge through a variety of vehicles including technology seminars, workshops, webcasts and whitepapers:

- 0201 Webcast (2000)
- Pin-in-Paste Webcast (2001)
- Flip Chip Webcast (2001)
- Heuristic-based smart software: expert advisory systems; simulation software, machine control systems
- Alternative Assembly and Reflow Technology (AART)—also known as intrusive reflow, or "pin-in-paste"—training program, with AART CD
- Surface mount technology assembly workshops and training
- Advanced technology process workshops (for example Flip Chip)

Support

- Process optimization, yield, and quality improvements
- Troubleshooting support
- Equipment/systems/process/materials support
- Component, packaging evaluation/qualification
- Line layout review
- Process audits
- Process improvement
- Failure analysis

Analytical Lab (Perkin Elmer)
- TGA
- DSC
- DMA
- FTIR
- Materials characterization

Analytical Lab (WYKO)
- Topographical Measurement
- Coplanarity of bumped wafers

Sem/energy dispersive x-ray (EDX)
- Failure analysis
- Materials characterization

Environmental testing
- Materials evaluation
- Reliability studies-JEDEC moisture sensitivity testing

Production simulation and manufacturing test area
- Prototyping
- Process development
- Process optimization
- Troubleshooting

Metallurgical lab and sample preparation
- Failure analysis
- Cross-sectioning
- Materials characterization (viscosity measurements)
The Advanced Process/Surface Mount Technology Laboratory employs the latest production equipment and analytical tools to conduct basic research and develop optimized products and processes for customers. Even a partial listing of these sophisticated resources indicates the broad scope of the SMT Lab’s far-ranging capabilities.

**Production equipment**

- **Screen printing:** DEK Infinity screen printer with vision; 2 DEK GSX screen printers with vision.
- **Laser measurement:** General Scanning-Lumonics 8100.
- **Component placement:** Universal GSMx™ linear motor platform; Universal GSMxs™ small footprint linear motor platform.
- **Oven:** Vitronics-Soltec 720N XPM forced convection reflow oven (N₂ capable); Vitronics-Soltec 1030N XPM forced convection reflow oven (N₂ capable).
- **Rework:** SRT Sierra 1100 forced convection rework station; METCAL BGA5500 BGA and CSP rework system.

**Analytical equipment**

- **Environmental scanning electron microscopy:** Philips XL-30 ESEM with secondary and backscatter electron detection; Edax digital EDX analyzer.
- **Non-destructive imaging:** Fein Focus transmission X-ray analysis system with image processing; Sonoscan C-SAM scanning acoustic microscope; VI Technologies VI-1000 DIG High Resolution X-ray system.
- **Thermal analysis:** Perkin Elmer Pyris 1 TGA; Perkin Elmer Spectrum 1 FTIR Spectrometer; Perkin Elmer DMA 7e DMA; Perkin Elmer Pyris 1 DSC.
- **Dimensional characterization:** Cyberoptics 250 laser profiometer; Cordax CMM with digital video printer; WYKO NT-2000 wafer bump measurement white light interferometer; Capacitec precision capacitance linear displacement measurement system.
- **Cross-sectioning:** Buehler metallurgical cross-sectioning equipment; Struers Rotopol and Rotoforce semi-automated cross-section polishing equipment; Tukon microhardness tester.
- **Optical inspection:** Bausch & Lomb Research II metallograph microscope; Wild M28 and M5A stereo microscopes with photographic capabilities; Vision Engineering Dynascope 3D viewer with photographic capabilities; Leica DMRX high resolution stereo microscope with hot stage.
- **Image capture:** Kodak Mega Plus XRC digital microscope camera; Fuji FLJX HC-300Z digital microscope camera; Sony Mavica hand-held digital camera; Sony TRV8 digital handycam; Kodak high speed camera.

**Materials characterization**

- **Process characterization:** ECD Super Mole/Thin Line Mole and Gold Mole temperature profilers; Delta “F” series 100 series 100 trace oxygen analyzer; Ametek TM-1B oxygen analyzer.

**Reliability monitoring**

- **Environmental/test chambers:** Analysis Tech model 256 event detector; Hewlett Packard 3457A programmable digital volt and ohm meter with PC interface.

**Mass measurement**

- **Multi-range tabletop viscometer:** Brookfield RVTDI viscometer/temperature bath; Instron 5500R-4502 materials testing machine with Merlin and series IX software; Alphametals SMD 600 ionograph; Alphametals 300-64 sirometer with electromigration option; Kester KWB-1000 automated wetting balance.

- **Micro-balances:** Denver Instruments digital balance.

- **Trace oxygen analyzers:** Delta “F” series 100 trace oxygen analyzer; Ametek TM-1B oxygen analyzer.

- **Event detectors:** Analysis Tech model 256 event detector; Hewlett Packard 3457A programmable digital volt and ohm meter with PC interface.

- **Temperature chambers:** Lunaire CE 205 forced convection batch oven; Quincy Labs 20GC and 10G natural convection oven; Revco ULT 72586 ultra-low temperature freezer; Cascade 1X TTV02 N2-capable vacuum oven; Ransco Double Duty Thermal Shock Chamber; Cincinnati Sub Zero Liquid to Liquid Shock Chamber.