

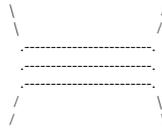
L1 Module Assembly Procedure

This procedure is for the assembly of L1 modules for D0 Run IIb. The module mechanical drawing associated with this work is 399391. The sensor drawing is 399436. The module assembly fixture is 399783. Bonding and module transfer uses 399507. Flipping for backside Kapton circuit gluing is done using 295654.

Gluing Modules

- ❖ Setup 8-8 fixture on Zeiss 500. Center puck should be pushed back and to the right against the alignment pins and then secured by applying vacuum (white vacuum line). Check that syringe holder is properly mounted to CMM.
- ❖ Wipe down all vacuum surfaces with alcohol and inspect for debris, glue, burrs etc.
- ❖ Run CMM program D0LAYERL2-L5 (**check that this will also work for L1**) to establish a coordinate system from the fixture. The reference plane should contain 4 points taken near the extents of each of the 3 vacuum chucks on which the silicon will sit. The 4 pins should be measured in the following order: near left, far left, near right, far right.
- ❖ Record sensor and hybrid information on traveler and in database.
- ❖ Place silicon on vacuum chucks and secure in place using vacuum on outer chucks only (red and blue vacuum lines).
 - Place left-hand sensor first (3 pins locate sensor in XY). Bond pads along sensor edge should be towards the LEFT, at the outer end of the fixture.
 - Place right-hand sensor (2 pins locate sensor in Y only). Bond pads along sensor edge should be towards the RIGHT, at the outer end of the fixture. The right-hand sensor should be placed with its right edge near the edge of the empty dowel pin hole; the right vacuum chuck may need to be moved towards the right to allow extra space at the sensor-sensor joint while placing this sensor.
- ❖ CHECK THAT THERE ARE NO BOND PADS AT THE SENSOR-SENSOR JOINT. Bond pads should be ~24 mm to either side of the joint for the hybrid.
- ❖ Align left sensor. Centerline fiducials should be located at:
 - X = -79.250, Y = 0.000
 - X = -0.250, Y = 0.000
- ❖ Align right sensor. Centerline fiducials should be located at:
 - X = 79.250, Y = 0.000
 - X = 0.250, Y = 0.000
- ❖ Turn on central vacuum chuck (green vacuum line) and vacuum to end pucks (clear lines) and then verify alignment of both sensors one final time.
- ❖ Mount hybrid in alignment jig and attach hybrid handle.
- ❖ Mix and degas epoxy
 - Mix TDR1100-11 epoxy (5.0g resin + 2.1g hardener).
 - Transfer to 10cc syringe with orange cap. Do not add plunger yet.
 - Centrifuge for 8 minutes to degas.
 - Check glue station: 40-60 psi, steady, slight audible back pressure.
 - Install white plunger being careful not to introduce bubbles into epoxy and removing orange cap to allow air out of syringe.
 - Install PURPLE syringe tip.

- ❖ Apply glue to sensor-sensor joint
 - Move CMM to X=0, Y=12.4 (far edge of joint).
 - Adjust OVP magnification to minimum (25X).
 - Adjust travel on syringe holder to ~ mid-travel.
 - Attach air hose from glue dispenser to syringe.
 - Use dispenser to eliminate air from syringe tip.
 - Install syringe in holder being careful not to hit silicon with tip. Syringe tip should be located in the lower half of the CMM field of view.
 - With syringe tip above sensor surface, move CMM so that the syringe tip is centered on the sensor-sensor gap and about 3-4 tip diameters in from the upper (far) edge of the sensors.
 - Use stage on syringe holder to lower syringe onto silicon. The syringe tip will deflect and self-center in the joint. The syringe tip should deflect until it is about 1 tip diameter from the sensor edge.
 - Depress glue dispenser foot pedal and move CMM when glue begins flowing from the syringe tip. Move at a steady rate and maintain steady glue flow. The glue should remain well contained in the joint.
 - If the glue "disconnects" from the joint and wants to flow on one sensor or the other stop immediately. Move the syringe back over the affected region to wet the glue into the joint. Lift the syringe using the vertical stage and check that the X positioning is still centered over the joint. Adjust as needed. If there is glue on the syringe tip, wipe with a foam swab. Lower the syringe tip, leaving a small gap to the problem region, and resume.
- ❖ Inspect the joint
 - After reaching the end of the joint, raise the syringe.
 - Go back over the joint and inspect it for gaps and over-flow. If there is too little glue in the joint gaps will form at the two ends of the joint. If this is the case, simply add additional glue at the ends of the joint.
 - If fiducials along the edge have been obscured by epoxy they can be wiped carefully with a foam tip swab.
- ❖ If glue has migrated beyond the edge metallization there is a serious problem. [\(Should we stop here and clean the sensors completely and start over?\)](#)
- ❖ Remove syringe from holder, being careful to do so far from silicon.
- ❖ Swap purple tip for LARGE CHARCOAL tip.
- ❖ Set glue station for 40psi, 6.8 (?) second pulses.
- ❖ Lift hybrid from alignment tool by the handle and hold upside down to apply glue to bottom surface.
- ❖ Apply glue to hybrid, total of 8 pulses per hybrid
 - Use one pulse each along the end ~3mm wide rectangular raised regions
 - Use 3 pulses each on the wider (~ 1cm) raised regions at each end as shown.
 - First pulse makes upper "U" or "V"-like pattern
 - Second pulse make lower, inverted "U" or "V"-like pattern
 - Third pulse adds glue to central beads, ensuring no gaps or bubbles



- ❖ Install hybrid on module with HV side of hybrid away from you.
- ❖ Apply weight on hybrid handle (110-220 grams).
- ❖ Let module cure for a minimum of 16 hours.

Transfer module to bonding fixture for OGP survey

- ❖ Remove weight from hybrid handle.
- ❖ Disconnect vacuum lines to sensor (green, red and blue lines).
- ❖ Using hybrid handle, lift module off of fixture and place on bonding fixture.
 - Hybrid handle dowel pin holes are used to reference module to bonding fixture.
- ❖ Apply vacuum to bonding fixture.
- ❖ Install clamps to secure silicon in place.
 - Clean clamps with ethanol prior to use.
 - Inspect clamp bars to make sure they are free of debris and that the Teflon tape is in good condition.
 - Measure step height of clamps to verify that it is 0.011-0.012".
- ❖ Remove hybrid handle.
 - Back nuts off to release screws.
 - Unscrew screws using L-key Allen wrench and remove.
 - Lift handle off module.
- ❖ Disconnect vacuum line (as needed).
- ❖ Record transfer on traveler and in database.
- ❖ Move module to OGP on bonding fixture.
- ❖ Reconnect vacuum during survey.
- ❖ Run survey program (insert name once we have one).
- ❖ Transfer data file to (insert destination when we pick one)
- ❖ Record survey on traveler and in database.

Flip module and apply backside Kapton circuit

- ❖ Apply vacuum to bonding fixture.
- ❖ Remove clamps from sensors.
- ❖ Carefully lower flipping fixture into place.
 - Pins align flipping fixture to bonding fixture.
- ❖ Apply vacuum to flipping fixture.
- ❖ Flip mated assembly (leave BOTH vacuum lines connected).
- ❖ Disconnect vacuum line to bonding fixture.
- ❖ Carefully lift bonding fixture off module and flipping fixture.
- ❖ Wipe backside of sensors with ethanol.
- ❖ Wipe L1 Kapton circuit with ethanol.

- ❖ Align circuit to module using corner targets.
- ❖ Tape one side of Kapton circuit to flipping fixture. (???)
- ❖ Prepare adhesives.
 - TDR-1100 (follow directions above for mix/degas).
 - Tracon 2902 silver epoxy – MIX WELL.
- ❖ Apply adhesives
 - We need some clear directions here.
- ❖ Fold circuit back into place.
- ❖ Apply flat weight. (or flip onto granite and weight fixture?)
 - After 10 minutes inspect glue joint. Glue run-out more than 250 microns past sensor edges is not going to be acceptable. (What do we do if it is bad?)
- ❖ Re-apply weight and allow to cure fully (12-16 hours)
- ❖ Trim Kapton circuit around module.
 - Trim to 0.010-0.015" (250-380 microns) of sensor edges. (What tool?)
- ❖ Enter information on traveler and in database.

Flip module back and complete HV and GND connections

- ❖ Apply vacuum to flipping fixture.
- ❖ Carefully lower bonding fixture into place.
 - Pins align bonding fixture to flipping fixture.
- ❖ Apply vacuum to bonding fixture.
- ❖ Flip mated assembly (leave BOTH vacuum lines connected).
- ❖ Disconnect vacuum line to flipping fixture.
- ❖ Carefully lift flipping fixture off module and bonding fixture.
- ❖ Clean pads on hybrid and Kapton circuit tabs with ethanol.
- ❖ Install tab-securing bars on either side of bonding fixture.
- ❖ Prepare adhesives.
 - Tracon 2902 silver epoxy – MIX WELL.
 - DP190(?) to tack in place mechanically.
- ❖ Apply small dot of silver epoxy to HV and GND pads on hybrid using syringe (manual?, what tip?)
- ❖ Fold tabs up onto hybrid pad and secure in place with setscrews in tab-securing bars.
- ❖ Verify that tabs do not extend more than 400 microns (0.016") past hybrid edge. (Gauge?)
- ❖ Use DP190(?) to tack end of tab to hybrid mechanically.
- ❖ Cure for at least 6 hours so silver epoxy is well set before releasing setscrews.
- ❖ Enter information on traveler and in database.

Transfer module to storage box and install digital jumper cable (DJC)

- ❖ Loosen setscrews and remove tab-securing bars.
- ❖ Install hybrid handle and secure to hybrid with #0-80 SHCS and nuts.
 - Lower handle into place.
 - Install #0-80 SHCS. Do not drive these too far in or you will break nuts off hybrids. They should go in about 3 full turns.
 - Tighten nuts down on to hybrid handle to secure module to handle.
- ❖ Lift module off of bonding fixture and place in storage box.

- HV side of module must be towards the hinge of the box.
- ❖ Install clamp bars across silicon to secure module in place.
 - Wipe clamp bars with ethanol prior to use.
 - Inspect clamp bars to make sure they are free of debris and that the Teflon tape is in good condition.
 - Measure step height of clamps to verify that it is 0.013-0.014".
- ❖ Remove hybrid handle.
 - Back nuts off to release screws.
 - Unscrew screws using L-key Allen wrench and remove.
 - Lift handle off module.
- ❖ Install DJC
 - Inspect cable connectors at each end to be sure they are in good condition.
 - Verify which end of the cable goes to the hybrid ("inner" end).
 - With the box hinge away from you the cable should be exiting to the **LEFT**. If not the module may be in the box in the wrong orientation.
 - Plug cable in to hybrid.
- ❖ Close lid and move box to storage to testing/burn-in area.
- ❖ Enter information on traveler and in database.