# Analyst *ils*

## Fixture Manual

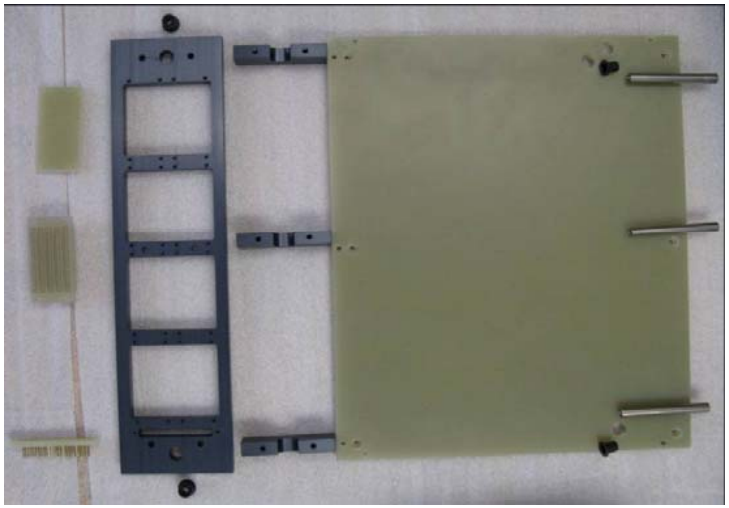
# Table of Contents

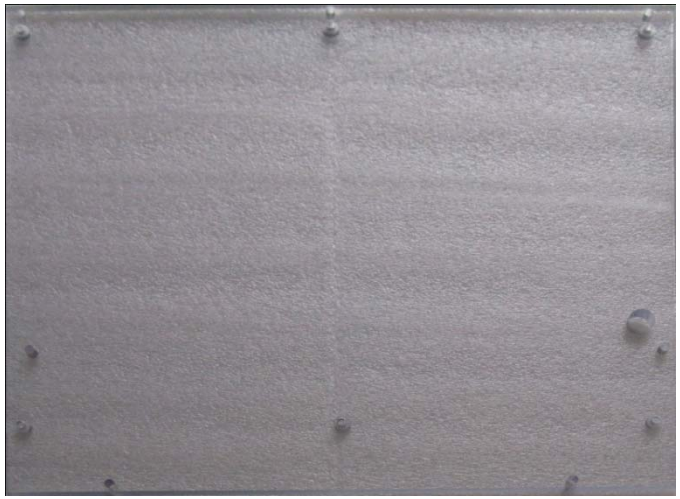
# KIT2000-ILS Fixture Kits

Each kit contains the following:

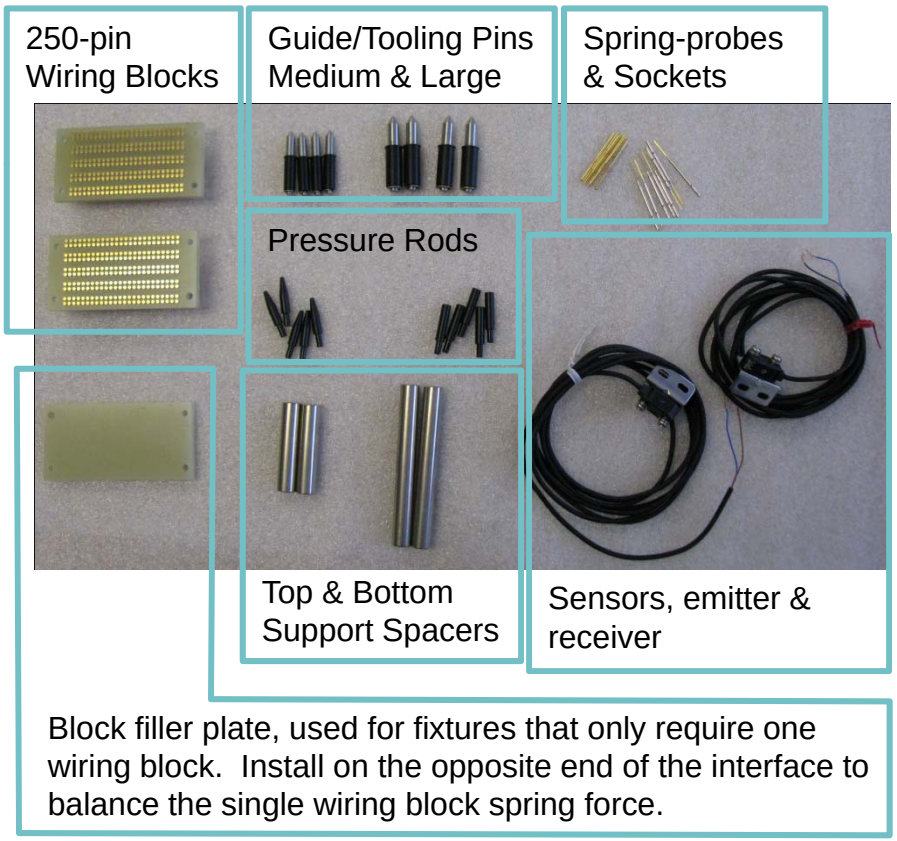
- Probe base plate
- Probe plate
- Press plate
- Top Press plate
- Lock blocks
- Lower support standoffs
- Upper support standoffs
- Guide pins (2)
- Guide pin Bushings (2)
- Interface Plate w/ bushings
- 50 pin system control “fix” block
- Fixture storage kit
- Pressure rods (10)
- Storage / Shipping kit
- Necessary hardware to assemble items above

# Fixture Kits





# Additional Items Needed to Build a Fixture ( and some options)



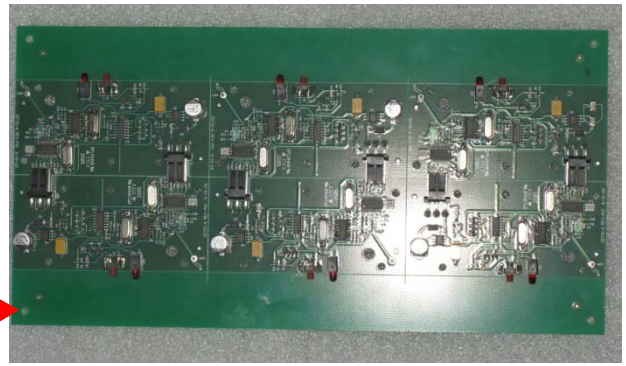

- Fixture wiring blocks
- Additional pressure rods; tapered or flat tipped
- Additional top support spacers
- Additional bottom support spacers
- Guide/tooling pins; spring-loaded recommended
- Spring-probes and sockets/receptacles
- Additional sensors (alternate board arrival and board reverse)
- Customer specific add-ons (LED color sensors, pneumatics actuators, Multi-writer…etc.)
- Balance block filler plate for fixtures with only one wire block (to balance the load across the interface)

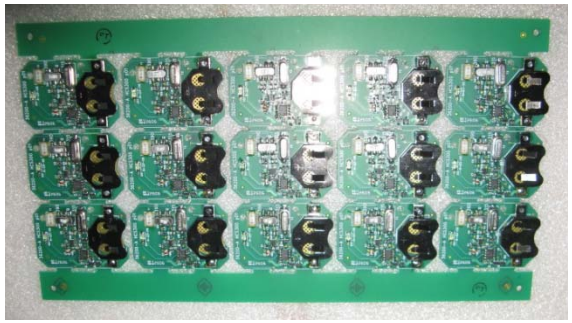
# UUT Guidelines

- In order to effectively test assemblies on an In-Line System (*ils*), the UUT must be designed to meet certain criteria unique to the system.

  The necessary criteria are:
  - The UUT / Panel needs a clear edge of at least 3.05mm on the bottom side, front and the back edges (relative to the direction of travel). Any components or component leads will cause the UUT to travel down the conveyor uneven and cause premature wear or damage to the conveyor belt. This requirement is not necessary, but recommended, on the leading and trailing edges of the UUT.
  - Tooling pin holes on the UUT / Panel need to be located 6.35mm (minimum) from panel edge to the EDGE of the tooling hole. Four (4) holes, in apposing corners, should be provided to keep the UUT positioned level over the top of the probe field. These holes can be in either the webbing (side panels) or in the individual PC assemblies (preferred, as it increases the accuracy).
  - Tooling pin holes should be 3.2mm or larger if possible.
  - Bottom side components cannot exceed 31.75mm below the UUT. (components in the path of fixture tooling pins may need to be less than 31.75mm)
  - Pressure rods on the fixture top side are 19mm (standard length), any component exceeding this height will require milling in the fixture pressure plate. Maximum top side component height is 50.8mm.
  - Components should not protrude beyond the front or back edges on the top side. Leading edge components placed over the edge may cause false detection of “board arrival” or interfere with the UUT stop and should also be avoided. Trailing edge components may extend beyond the UUT edge but care should be observed to prevent UUT assemblies from colliding or connecting with other UUTs on the line.

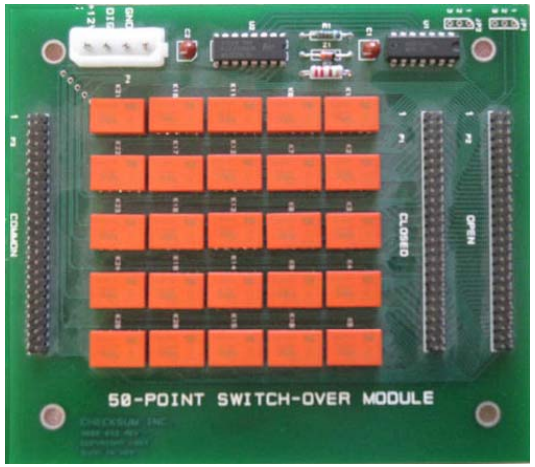
# UUT Guidelines cont.

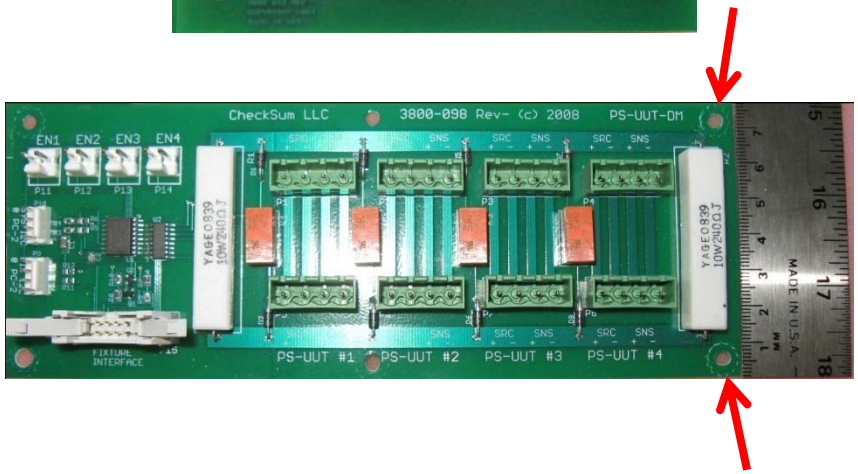




- The top photo shows an example of a UUT that is a good choice for the *ils*. However the side panel tooling holes are too close (< 6.35mm) to the panel edge and will require the fixture to use tooling holes on the individual PCB assemblies. Note, since this assembly is symmetrical in its layout, the fixture will not need the optional “Board Reversed” sensor.
- The bottom photo shows the side panel holes too close to the outside edge as well. Tooling again will be on holes in the individual PCB assemblies. This board also has the problem of edge routing that will not allow the “Board Arrival” sensor to detect the presence of the UUT when it is in the test position. An optional board arrival sensor will need to be installed on a panel that has this type of geometry. If the UUT is placed on the conveyor rails reversed, it may damage the UUT assembly and / or the fixture. This assembly is a good candidate for the optional “Board Reversed” sensor.

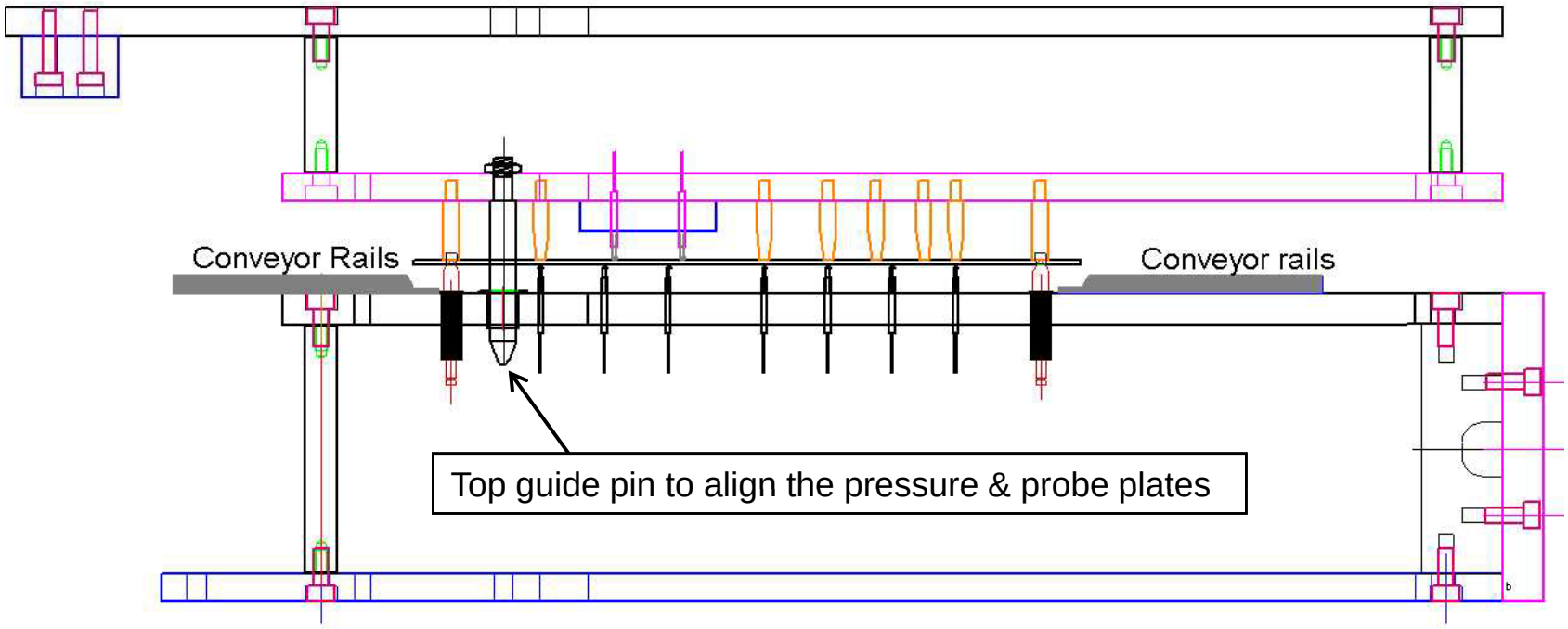
# UUT Guideline Examples




- The top photo shows a single UUT that has no side panels but the tooling holes are far enough in from the edge to allow space from the conveyor rails and the fixture tooling pins. This UUT has no distinct hole pattern to be able to detect “board reversed”.
- The lower photo shows a single UUT that cannot be run on the system since the only holes for the tooling guide pins are too close to the outer edge to allow sufficient clearance from the tooling pins to the conveyor rails. No other holes are present.

# Conveyor Side Rails



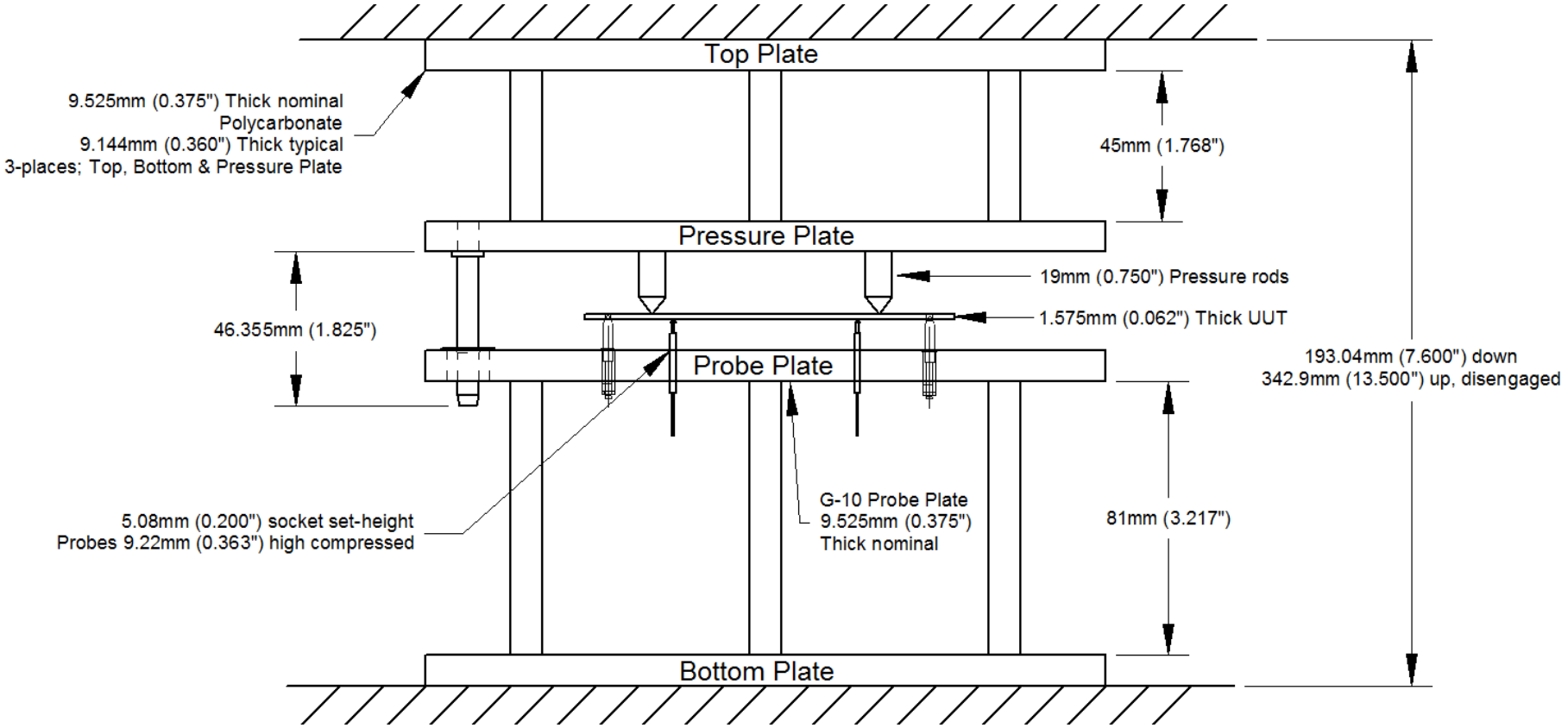

- This view shows the relationship between the conveyor rails, the UUT, and the guide pins.
- Spring-loaded guide pins align the UUT to the probe plate. The top guide pins align the pressure plate to the probe plate. This insures top probes properly align to the UUT.

# Fixture Design Specifications

- The overall performance of the fixture starts with the proper layout and design of the fixture. Careful attention to the following details will result in the best operation of your fixture. Please review the following drawings for the proper stack-up information.

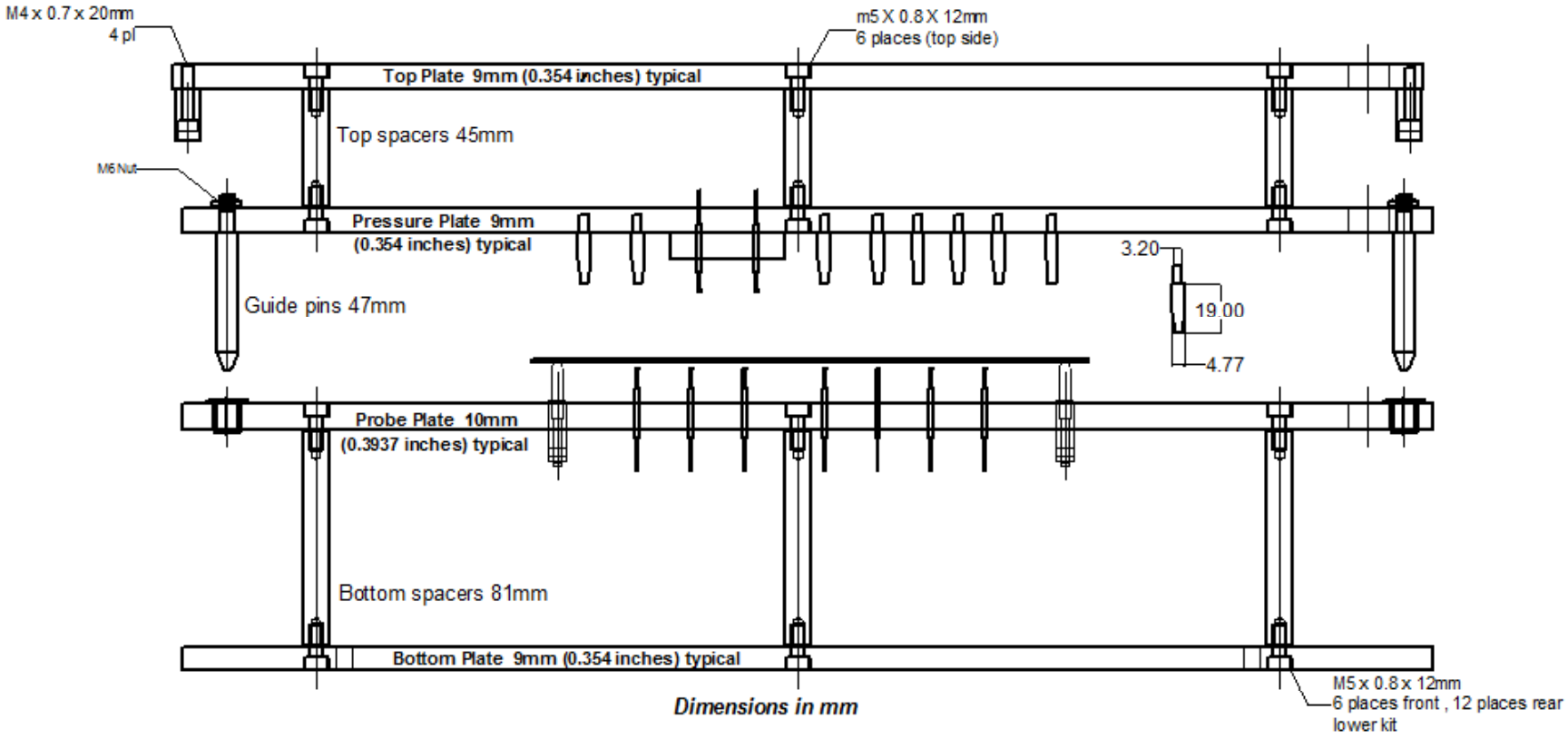
- “Stack-up” means the individual piece thicknesses, socket set height, pressure rods, etc that when “stacked up” or added up equal the design criteria.

# KIT2000-ILS-QC Fixture Stack-up




Note that the plate material thickness can vary depending on the manufacturer. Use your material to determine the best socket set height for the spring-probe receptacles.

# KIT2000-ILS-43 Fixture Stack-up




Note that the plate material thickness can vary depending on the manufacturer. Use your material to determine the best socket set height for the spring-probe receptacles.

# Fixture Stack-up

- The information shown on the stack-up drawings does not take into account the variation of the material used in making the fixture kit. Verify each part of the fixture and compensate as needed as the fixture is developed. All dimensions shown are with the components being dimensionally correct and the UUT being the most common thickness of 1.6mm (.062 inches)
  - The overall distance between the system press top and the base plate is 193mm (7.60 inches) in the compressed position.
  - The individual plates are specified as 9mm or 10mm, these plates are nominal and will vary from piece to piece. The variations in these plates can be compensated in the socket set height and the pressure rod length or the standoffs.
  - Standard socket set is 5.08mm (0.200”). This is measured from the probe plate top surface to the probe end of the socket. It does NOT take into account component leads, part heights or open thru holes. To compensate for these variations, set heights may need to be lower or higher than the standard. The goal is to get each probe/socket combination to reach 2/3 of the probe’s full stroke travel when the press is in its final or full-compressed position.
  - UUT thickness may vary and should be compensated as needed (i.e. longer pressure rods, taller set height or some combination)

# Fixture Top & Bottom Assemblies

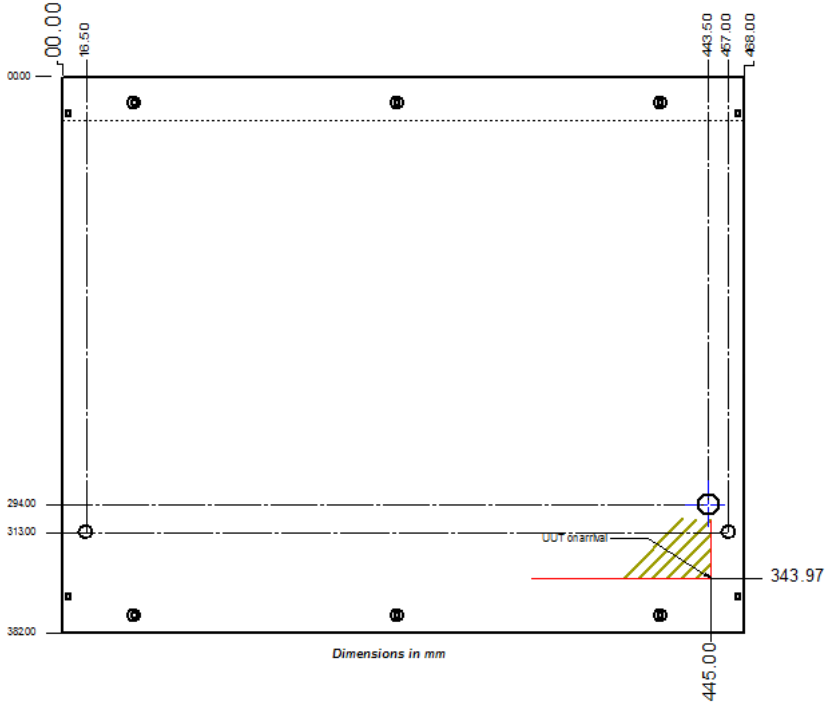
The complete fixture assembly consists of the top assembly and the bottom assembly:

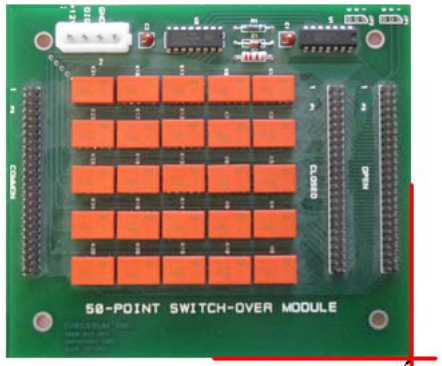
•The top assembly consists of the upper press plate and lock blocks, which keep the top assembly from sliding out of the press when installed correctly, the pressure plate (lower plate) normally contains the pressure rods (19mm long) and the fixture guide pins (alignment to the probe plate). It is important to note that this complete assembly is not rigid when installed into the system press housing. It should remain "floating" for proper alignment with the probe or base assembly. Manually operating the press to the lower position should be done slowly to verify alignment to the top and bottom fixture assemblies prior to running in the automatic mode.

•The bottom assembly consists of the lower base plate, the interface assembly and the probe plate. The probe plate contains the fixture alignment bushings, UUT guide tooling pins, sockets/probes for the UUT and any other items needed in the base assembly for testing. This assembly should mount rigid onto the base alignment pins and be captured with the press interface.

•The overall height from the bottom of the base plate to the top of the probe plate should be 100mm (3.937"). This height should not exceed that dimension as it will interfere with the conveyor rails and anything below that height will effect the top plate guiding and probe compression.

# Probe Plate

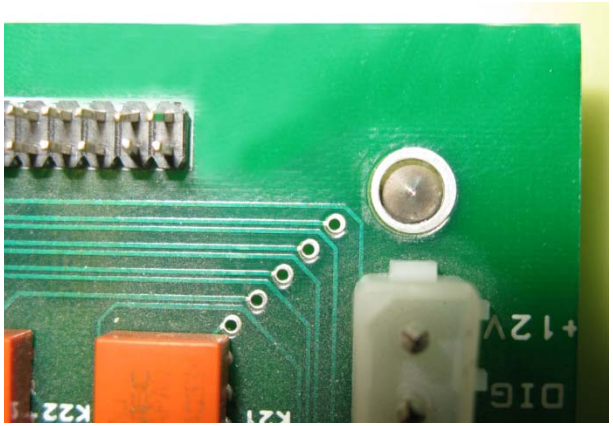



UUT Direction of Travel

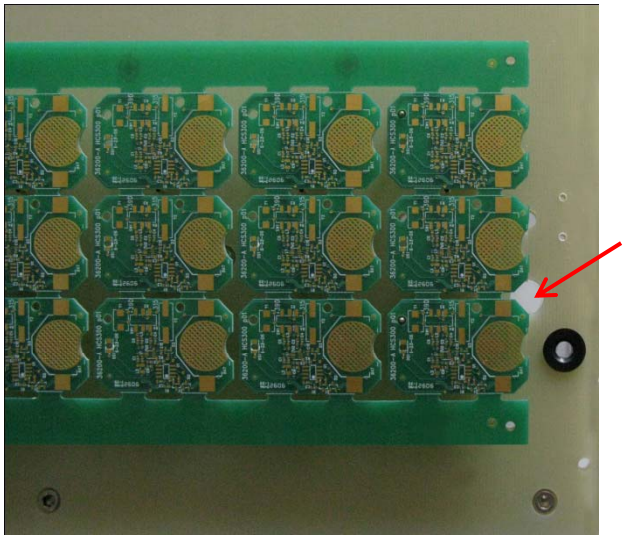
- The probe plate has a definite location for the UUT stop point. This location is fixed and cannot be changed. This location is noted as 445mm by 343.97mm from the left rear corner of the probe plate to the leading right and front edge of the UUT.
- DIRECTION OF THE UUT TRAVEL MUST BE ESTABLISHED PRIOR TO DRILLING THE FIXTURE.
- For drilling, setup accuracy and consistency, the centerline of the bushing holes (10mm without the bushing) on this plate aligns with 6mm holes on all the other plates required for the complete fixture. It is advisable to use these as drilling alignment holes.

# Fixture Tooling Pins

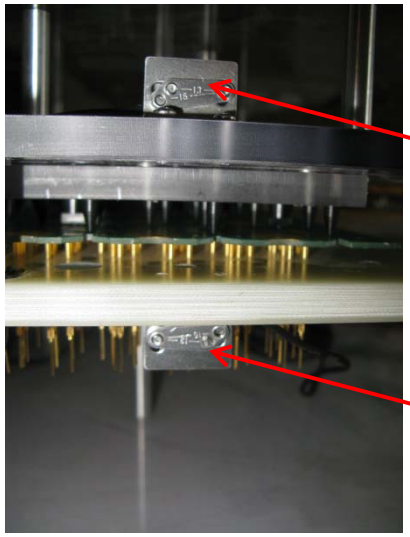


- On In-line systems, it is preferable to use spring-loaded guide pins. This type of guide pin minimizes the chance of tooling pin binding and allows the fixture designer to ensure that the UUT upon arrival stays above the probes to ensure better probe accuracy. These types of guide pins usually are available in two to three different sizes to accommodate a wide range of UUT holes. When using spring-loaded guide pins, it is preferable to place an appropriately hollowed out pressure rod over the top of each pin of equal length of the UUT pressure rods. This will minimize the upward flex on the UUT caused by the spring inside the tooling pin.
- Tooling pins should have enough travel to allow the UUT to reach proper compression without bottoming out the internal spring and also to allow the UUT to sit above the probes prior to the top pressure rods. Failure to keep the UUT above the probes may cause side excessive side loading on the probes and possibly probe inaccuracy.

# UUT Anomalies



UUT with angled-edge profile



Light Source

Light Receiver

- Some UUT's will not work with the system's board arrival sensor:
  - The left photo shows a UUT with an angled-edge profile over the system sensor that will not be detected reliably by the system board arrival sensor.
  - The right photo shows a light sensor used to allow the UUT to operate on the system. The light source is mounted on the pressure plate and a light receiver is mounted on the bottom of the probe plate.

# UUT Arrival Sensor Holes

- The UUT arrival (board arrival) is sensed by breaking a light beam that is located in the top press unit and a receiver located under the press base plate. When the UUT is traveling down the conveyor it interrupts this light beam as it arrives against the UUT stoppers. This turns off the conveyor drive system and sequences the press to lower the UUT onto the fixture, verifies that the UUT is not in reverse, then sequences the top press lid to lower onto the UUT and probe field.
- Each plate has a hole to allow the light beam to pass from below the bottom plate to above the top plate.
- This area should always remain clear of fixture wiring, dirt, UUT components or anything that would cause a false detection of the board arrival.

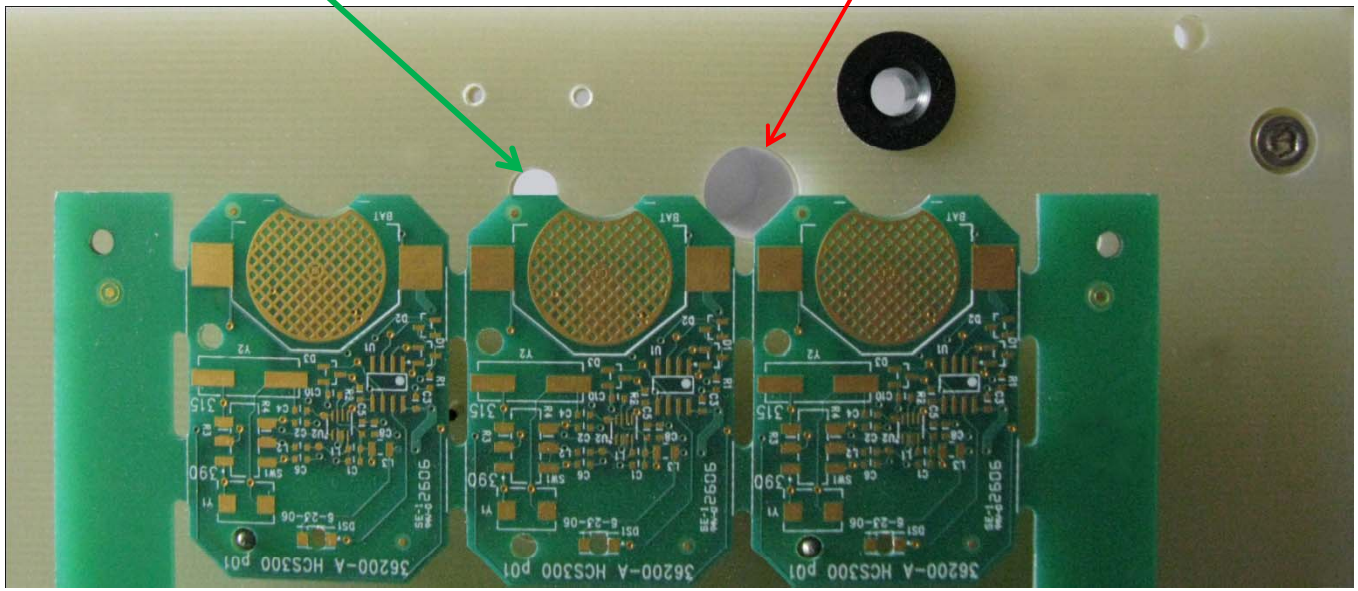
# Board Arrival / Sensor Location Problems

- With some UUTs, there can be issues dealing with the topology of the panel/UUT. Some UUT's have notching in the location of the board arrival sensor hole, some may have nets (test points) that locate in the same area as the board arrival hole. To help resolve these issues an alternate board arrival sensor can be placed on the fixture. In some cases, it may also be necessary to have a probe and pressure plate made that does not have the board arrival sensor hole machined into the plate.
- The optional board arrival sensor, when used, needs to be located as close to the "X" centerline of the original hole (445 mm). The "Y" should be positioned to sense the UUT leading edge without interfering with any probes.

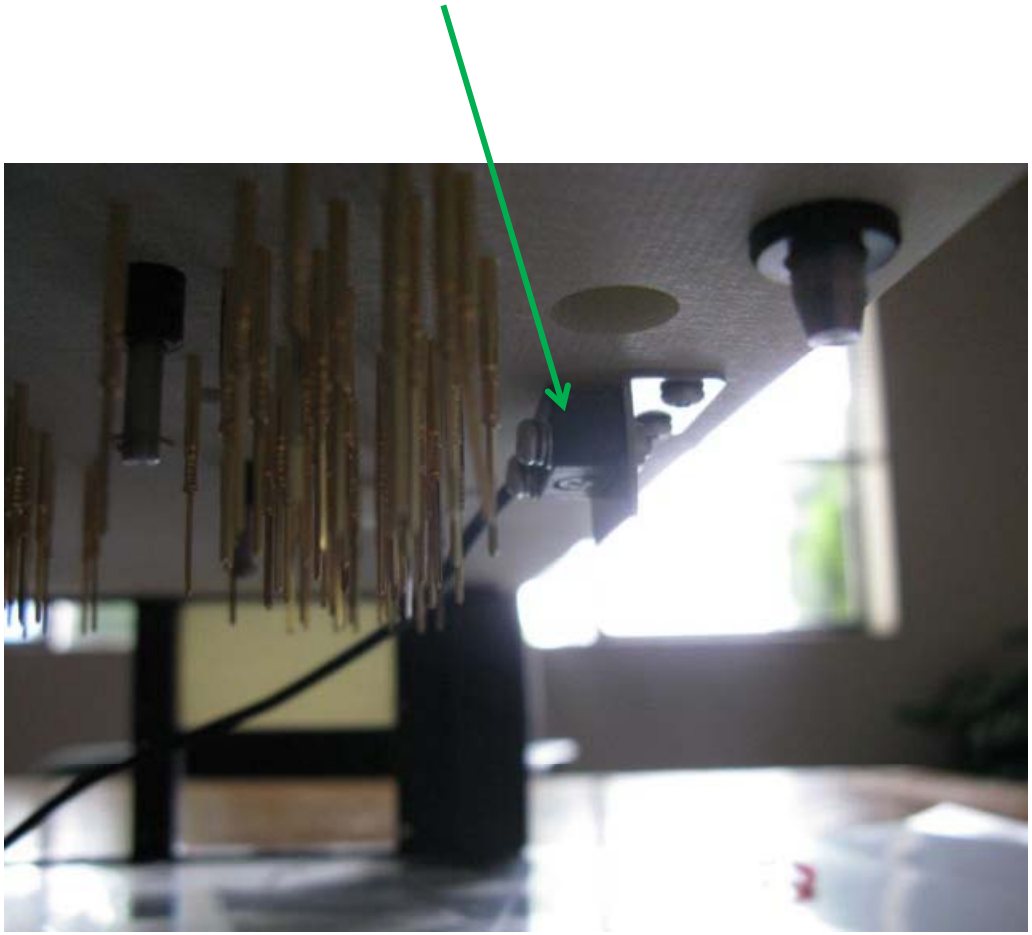
# Alternate Sensor Placement

Alternate sensor location selected to sense the UUT “Board arrival”. Sensor will be placed under the plate using the 2 nearby screw holes.

Standard “Board Arrival” hole, can not be used.

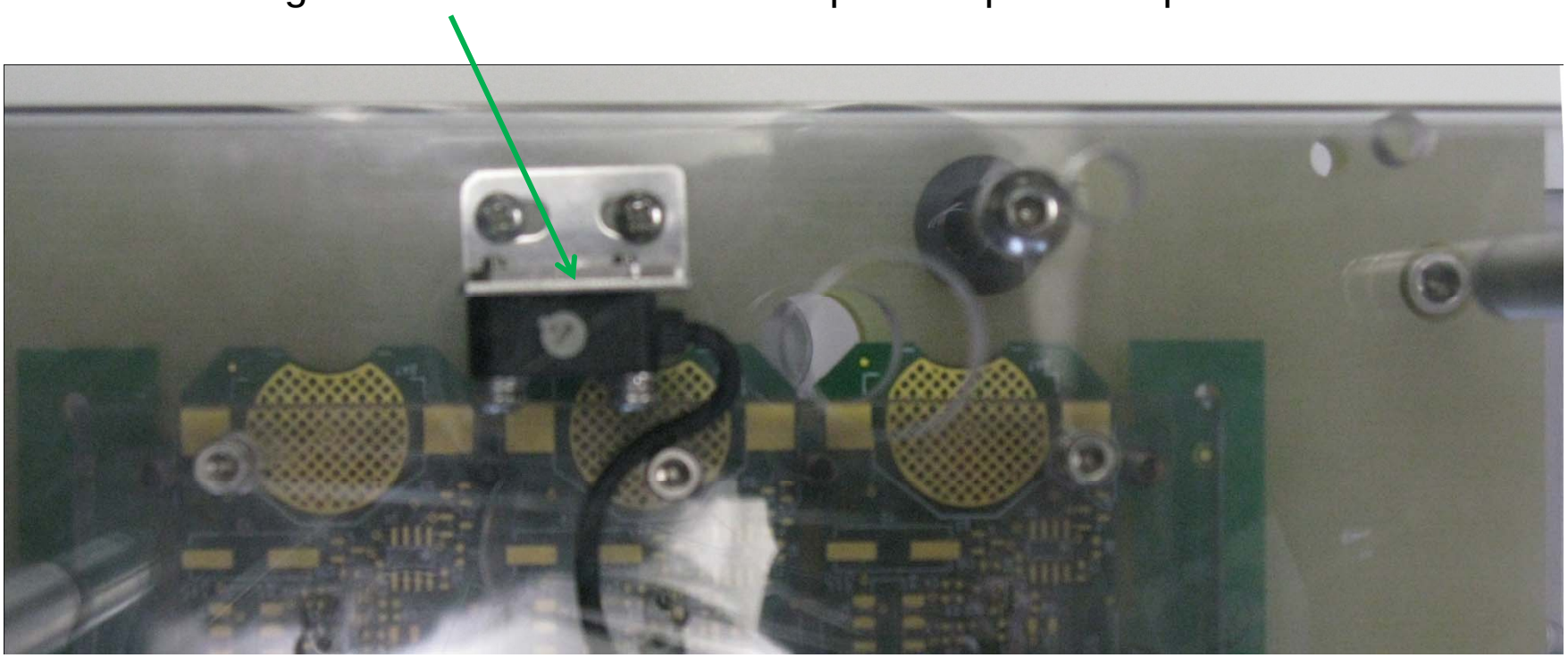


# Alternate Sensor Receiver Location



# Alternate Sensor Emitter Location

Light source mounted to the top of the pressure plate

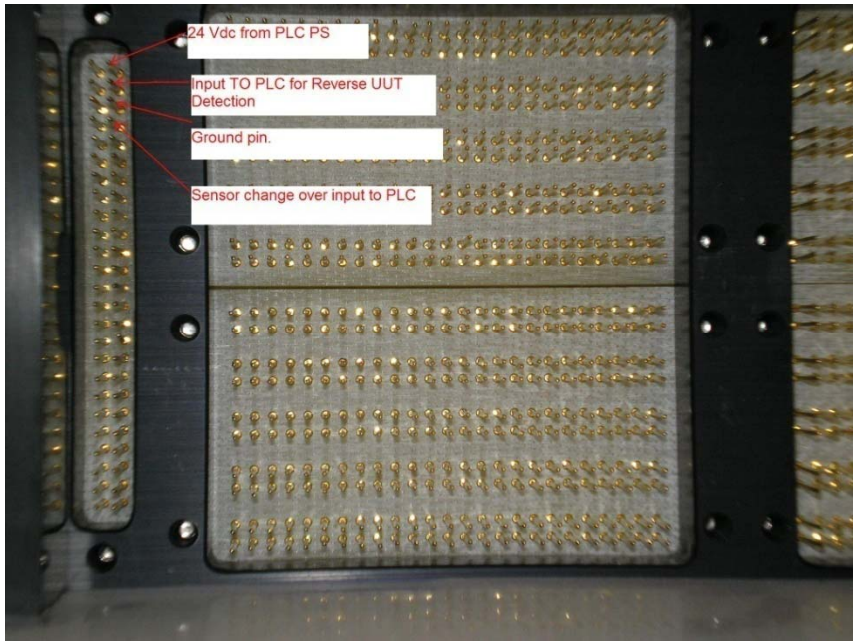


# Sensor Assemblies

Optional board arrival and / or board reversed sensor, one emitter and one receiver.

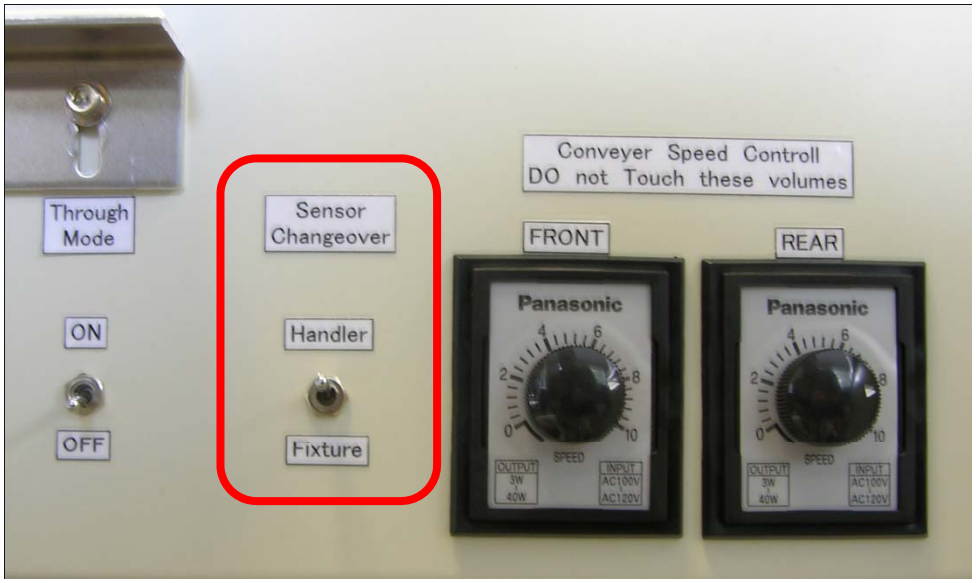
Sensor type can be any 24 Vdc through beam style. We recommend SUNX Model EX-23 or Omron E3T-ST11. On both units the mounting brackets need to be ordered separately

# Sensor Wiring




- Using the pin-out shown, wire the sensor emitter(s) to the 24 Vdc power. An optional cable from the PLC power block to the press top plate may be installed and connected to that cable instead of the through the fixture interface.
- For a “Board Reversed” sensor
  - Wire the receiver to pins 1 (24Vdc), 5 (GND) and 3 (PLC - 209 Reverse board detection)
- For “Board Arrival” sensor
  - Wire the receiver to pins 1 (24Vdc), 5 (GND) and 7 (sensor changeover switch)

# Sensor Changeover Switch

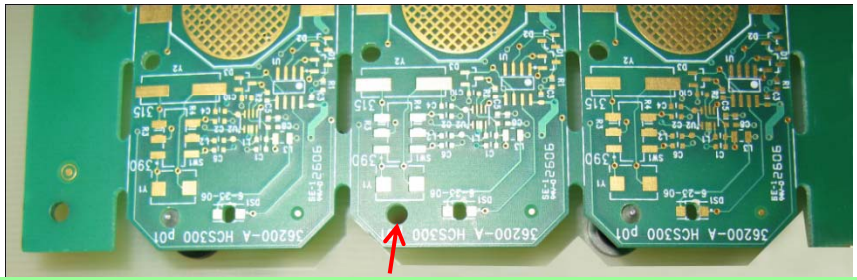



- When a fixture uses the optional board arrival sensor then the system **Sensor Changeover** switch will need to be set to the "**Fixture**" position.

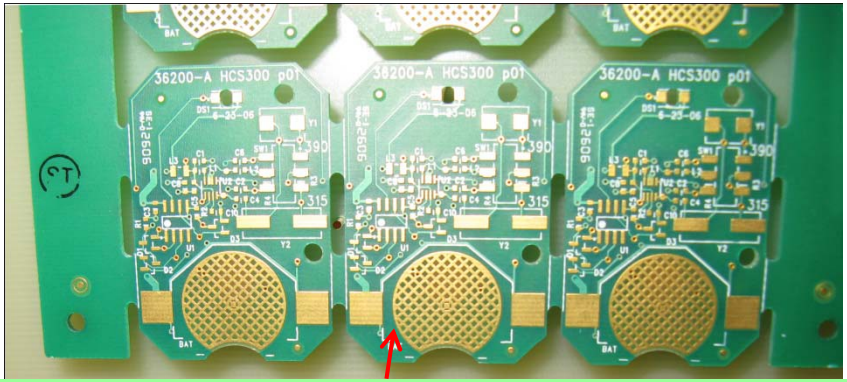
# Sensors (continued)

- If the reverse board detection sensor is NOT used then a wire short must be installed between Pins 3 and 5 of the 50-pin  system “FIX” connector.

# Reverse Sensor Examples



Possible location of “UUT reversed” sensor (see below). If the board is at arrival, the sensor would detect a hole and the system will assume the board is on the conveyor correctly.



If the board is rotated 180 degrees at arrival, the UUT blocks the sensor hole and would cause a “UUT in reverse” error to be generated and stop the system from actuating the press lid.

- In this example, the UUT has a tooling hole that is blocked when installed reverse (on the conveyor / fixture). Locating an emitter / receiver under this location would detect that the UUT was reversed (or possibly the wrong UUT) when the conveyor lowered the UUT onto the fixture.

# Design Checklist

- As the UUT is lowered on the (spring-loaded) tooling pins by the conveyor side rails, it should be centered on the pins such that the UUT does not move left, right, forward or backward as it comes to rest on the tapered tip of the spring-loaded tooling pins. To insure the UUT always settles down properly, check to verify that the UUT does move more than 0.25mm or 0.1” off-center as it comes to rest on the tooling pins.
- No spring-probes should touch the UUT after the side rails lower the UUT onto the spring-loaded tooling pins. The UUT should be held above ALL the spring-probes by the tooling pins. Check for proper spring-probe to UUT clearance before the top plate moves down to compress the spring-probes.
- The fixture top and bottom alignment guide pins should be checked for smooth engagement and disengagement (not overly tight) prior to placing the unit in the press. This will minimize the problem of the guide pins sticking in the probe plate bushings and lifting the lower section of the fixture up off the press base as the system lid moves to the up position.

# Drilling information

- Prior to any drilling or fixturing project, it is important to know which probe and socket manufacturer (vendor) you intend to use. Each vendor may have steps or procedures unique to their product that may not be compatible with other vendors product. Please refer to the vendor's documentation for drilling details.

- The intent of this document is not to endorse any one vendor's product but to give guidance to the way CheckSum manufactures fixtures for the Analyst *ils* press. The information in this document is strictly for reference and should be used as a starting point to develop your own methods and procedures for fixture development.

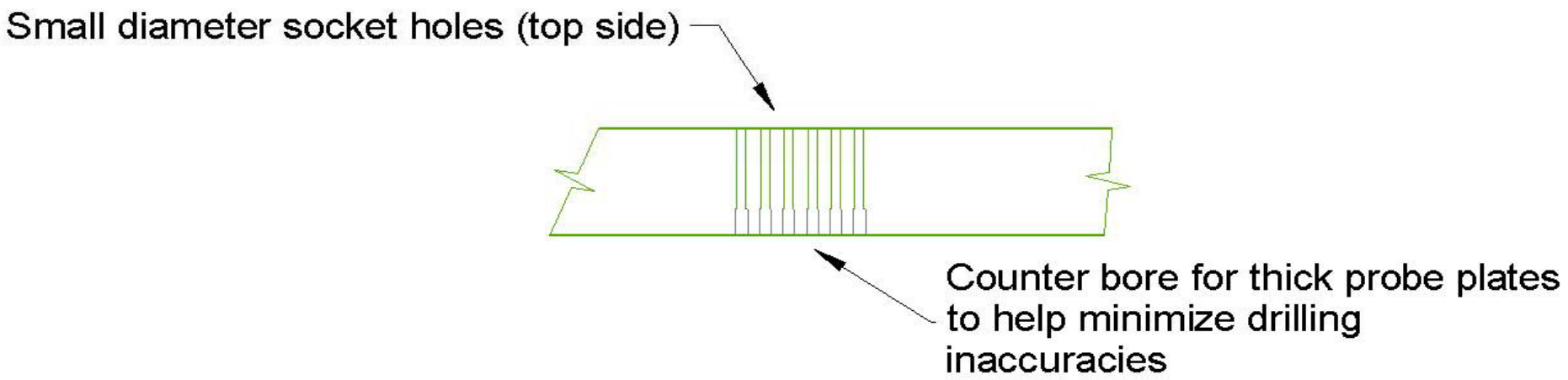
# Drilling Tolerances (General)

When machining the assembly holes in the Probe-Plate, it is necessary to differ between the diameter of the drilled hole and the diameter of the actual drill. The hole sizes in the various vendor catalogs are related to the diameter of the actual drilled hole. This size can be measured with a common plug gauge. Parameters such as drill speed, feed rate and tool cooling also play an important role.

**Note**: It is vital to carry out drilling tests on sample material beforehand to confirm actual hole sizes.

The materials like FR4/G10 (glass-fiber enforced synthetic material) and CEM1/Trolitax (hard-paper impregnated with resin) have proven to be especially suitable as probe-plate materials. In the case of small hole diameters (.99mm or smaller), it is possible for the drilled holes to become off perpendicular, which leads to the Receptacles and the Test Probes pointing-accuracy to be reduced. In this case, it is recommended that the assembly holes in probe-plates that are thicker than 10mm are counter-bored from the under-side. Furthermore, drilling the holes in steps (peck drilling and spot drilling) is also advisable.

# Counter bore profile view



# Drill bits

- When drilling or milling G10 material, it is important to use only solid carbide tooling.  The use of high speed steel drills or end mills will result in unsatisfactory holes and as a result of the high abrasive nature of the G10 material, premature failure of the drill or end mill will result.

- Flute length and LOA should be determined to allow proper removal of material and depth of penetration.

- When drilling polycarbonate or similar plastics care should be observed to not over heat the material causing deformation of the hole.

- Coolant used for the specified drilling is standard compressed air but fluid types of coolant may be used.

# Feed and speeds

As with any milling and drilling process, correct spindle speeds and the appropriate feed rate must be maintained. The following is what we use at CheckSum for drilling on our Fadal CNC. This CNC unit has a maximum standard spindle speed of 7,500 RPM.

**Note:** For drilling .79mm diameter drills or smaller we incorporate a 30,000 rpm pneumatic operated spindle installed in a tool holder.

# Drill feeds and speeds for G10/FR4 AT7000*

| Probe size | Drill size | Notes | RPM | Feed (IPM) | Peck depth |
|---|---|---|---|---|---|
| 39 mil | .792mm (.0312”) | .031” pre drill to .03” depth | 30K (air spindle attachment) | 10 | .4mm (.016”) |
| 50 mil | .99mm (.039”) | .031” pre drill to .03” depth | 7500 | 15 | .5mm (0.02”) |
| 75 mil | 1.4mm (.055”) | | 7500 | 25 | none |
| 100 mil | 1.75mm (.0689”) | | 7500 | 30 | none |
| 125 mil | 2.7mm (0.108”) | | 7500 | 30 | none |

* Drill sizes and the resultant feed/speeds are for use with QA Technology Company, Inc. sockets. Please refer to www.qatech.com for any additional information needed.

# Drill speed and feeds for Polycarbonate pressure plates*

| Probe size | Drill size | Notes | RPM | Feed (IPM) | Peck depth |
|---|---|---|---|---|---|
| 39 mil | .792mm (.0312”) | G10 material preferred | - | - | - |
| 50 mil | .99mm (.039”) | G10 material preferred | - | - | - |
| 75 mil | 1.4mm (.055”) | | 2200 | 20 | .76mm (0.03”) |
| 100 mil | 1.75mm (.0689”) | | 2000 | 30 | .9mm (.035”) |
| 125 mil | 2.7mm (0.108”) | | 1800 | 30 | 1.37mm (.054”) |

* Drill sizes and the resultant feed/speeds are for use with QA Technology Company, Inc. sockets. Please refer to www.qatech.com for any additional information needed.