TE-1100 Test Fixture Kit Instructions
Low Cost High Performance PC Board Test Fixtures

Step by step instructions, highly illustrated for the non-english speaking.
Building a basic bed of nails fixture using a drill press and a few basic hand tools!

Fixture Kit

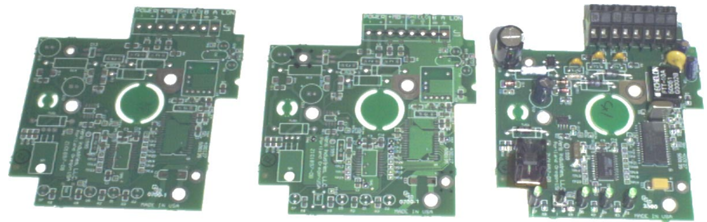
The TE-1100 Bed of Nails test fixture kit is a product specifically designed to make test fixture fabrication a possibility in only 2 days with nothing more than a drill press and a few hand tools.

These instructions will guide you in detail through all the steps required to build a high quality Bed of Nails Test Fixture customized to test your circuit board.

Many small and medium sized electronic manufacturers do not have a full blown CNC machine shop available at their disposal. Typically the job of fixture fabrication is subcontracted to a local CNC machine shop. At the machine shop, you wait for the backlog, and you pay set up charges, and you hope it comes out right. If it doesn't come out right the first time, you wait longer, and you pay more set up charges. All over again! Typical machine shop backlog can be anything between 2-4 weeks. That is just too long to wait when you have a product that needs testing!

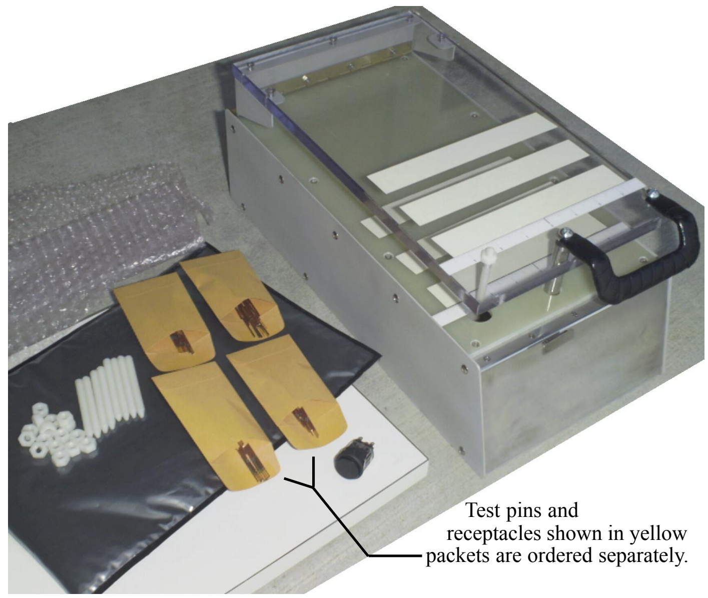
Experienced Machinists

Even if you are one of the lucky ones with a CNC machine shop available at your disposal, and a top notch machinist, browse through this anyway. We have been building fixtures since 1986 and may provide you with many helpful inside tips that you can apply to your CNC fabrication process.



Circuit Boards to be Tested

Shown above is a picture of the circuit boards to be put under test. I will use these boards to demonstrate building this test fixture. You will need 2 bare boards which must be expendable in the fabrication process, and one assembled board which will not be harmed.



Test pins and receptacles shown in yellow packets are ordered separately.

TE-1100 8" x 15" Fixture Kit

Shown above is a picture of the TE-1100 8x15 bed of nails fixture kit as it appears when taken out of the box from Test Electronics. These kits are available in sizes ranging from 8" to 24" wide. I am using the 8" wide version for this example. The TE-1100 fixture kit includes:
10) Threaded nylon press downs
20) Nylon nuts
1) Safety switch (detects cover closed position)
Test pins and receptacles shown in the 4 yellow packets must be ordered seperately because the quantities vary for every individual circuit board.

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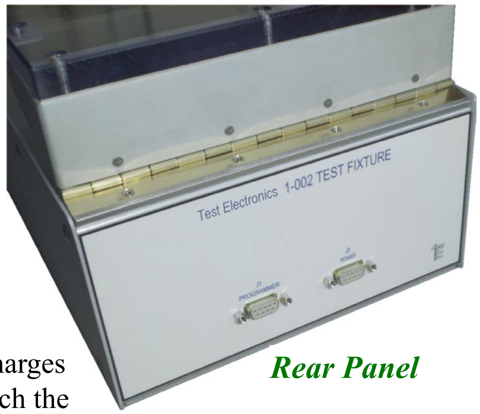
Rear Panel

Shown here is the rear panel. I had predetermined that I would need two 9pin female "D" connectors to connect this test fixture to the computer.



Rear Panel

Test Electronics charges $50 to custom punch the rear panel and they also provide a labeled mylar overlay. This price beats the time I would spend scroll sawing and fine grinding the connector holes with a Dremel tool. I could never match the esthetics of a nice printed mylar overlay either. So, I just ordered my rear panel with the cutouts, overlay and $6 worth of connectors installed. The front and rear panels are made out of 1/16" Aluminum, which is very easy to cut if you rather not spend the $50.

Front Panel


Front Panel

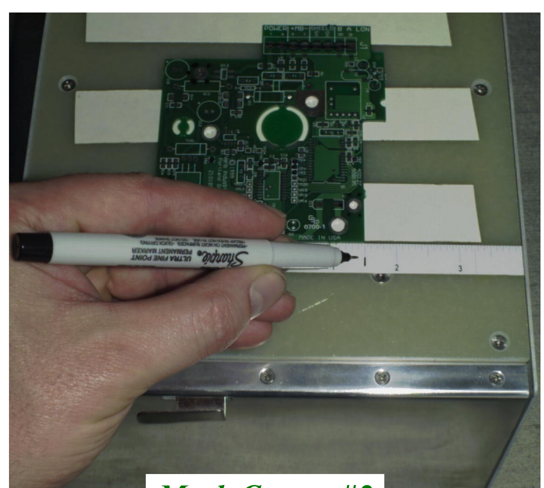
I ordered the polished aluminum front panel. It was only $25. This is really just a pure personal preference. It just gives the test fixture a nice clean look in my opinion.

Aligning the Circuit Board

This odd shaped board is a good example because it makes me show you all the details. If your board is perfectly rectangular centering is simple. But it is not hard with this board either. First, center the widest part of the board. Then, slide the board straight back the mark the two corners on the precision tape ruler.


Find Center


Mark Corner #1


Mark Corner #2

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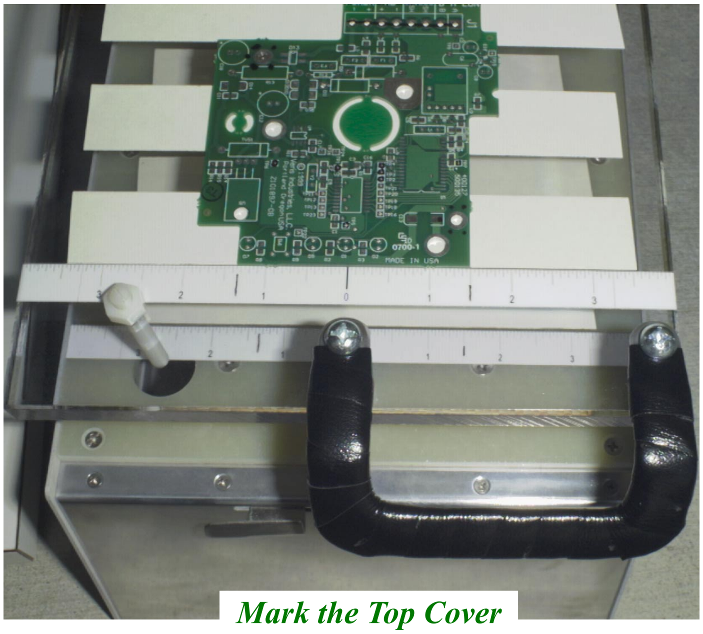
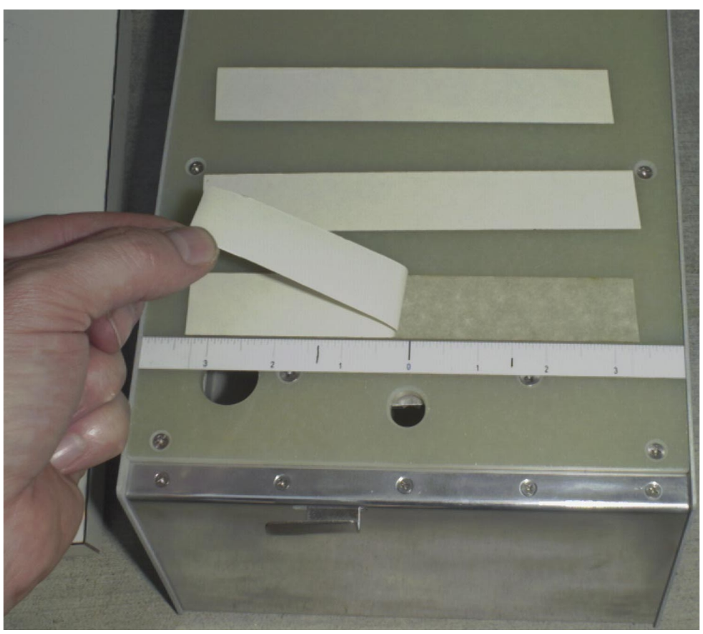
Marking the Top Cover

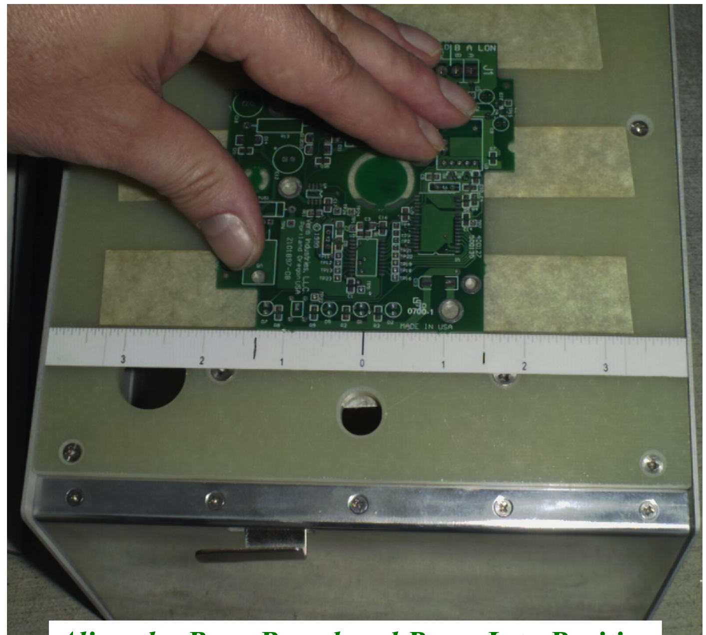


Mark the Top Cover

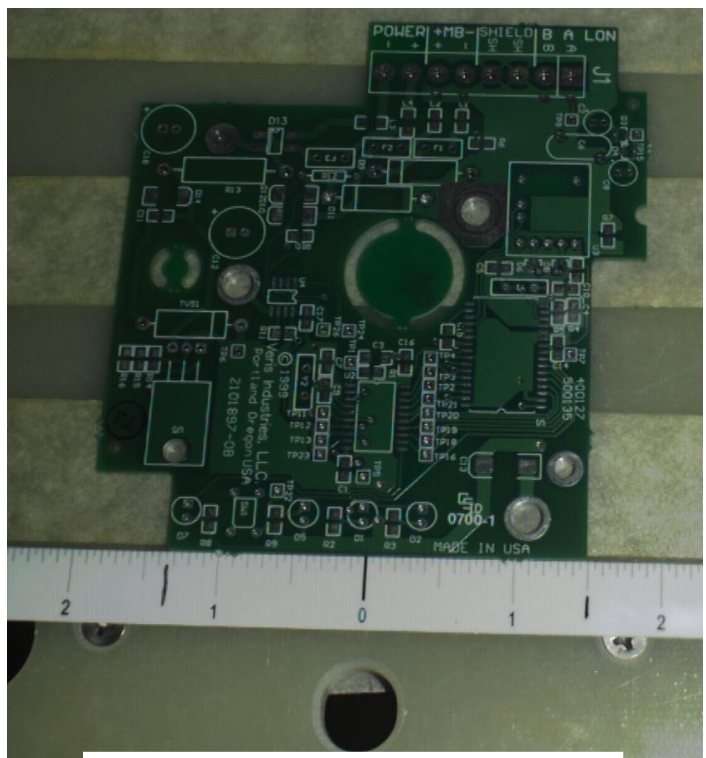
Next, simply transpose the marks to the top cover precision tape ruler.



Peel off the Nonstick Tape Backing



Align the Bare Board and Press Into Position



Adhere the Bare Board Firmly in Place

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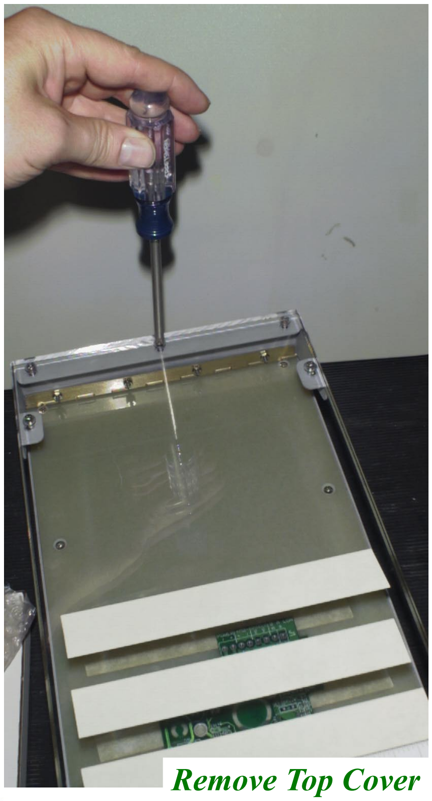
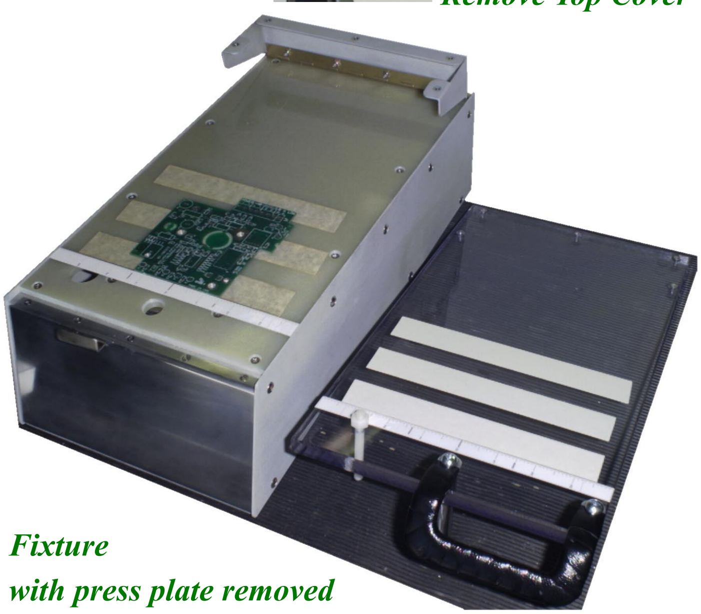
Remove Press Plate

You can actually drill a fixture without removing the press plate Just open the press plate, and tape it open. However, it is much easier to handle the fixture with the press plate removed. The press plate is not hard to remove. Just unscrew the 6 screws shown here.



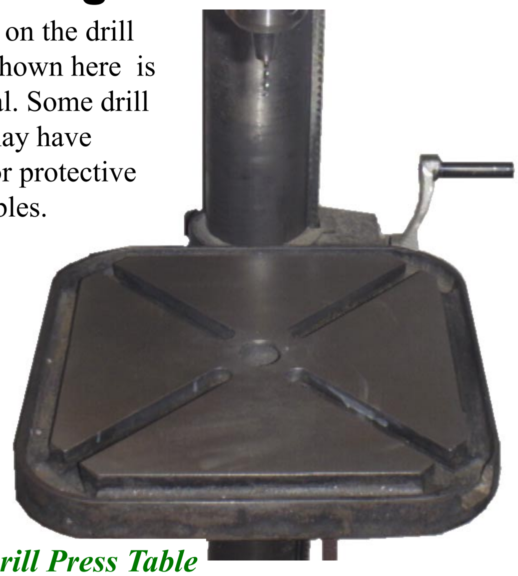
Remove Top Cover



Fixture
with press plate removed

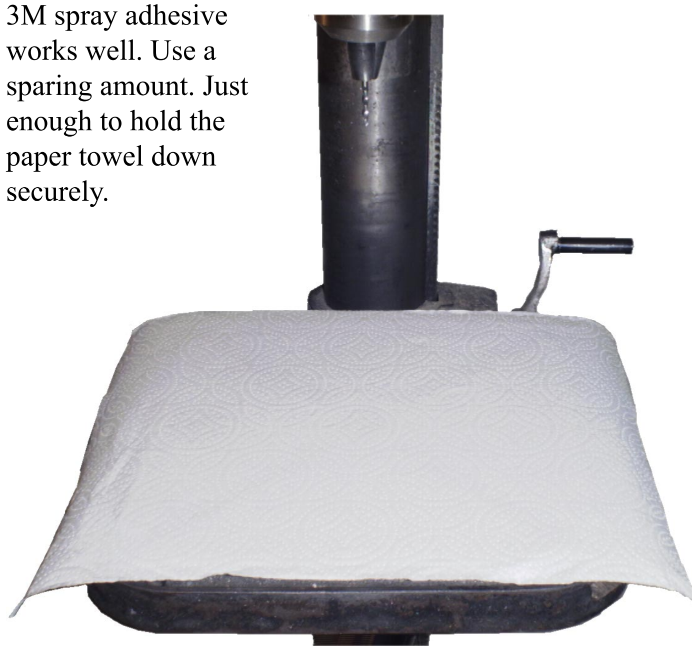
Preparing The Drill Press

The table on the drill press as shown here is hard metal. Some drill presses may have wooden or protective plastic tables.



Drill Press Table

To protect the fixture, I glue a piece of paper towel down on the table as shown below. This just protects from scratching the bottom of the test fixture while working. 3M spray adhesive works well. Use a sparing amount. Just enough to hold the paper towel down securely.



Paper Towel Covering Drill Press Table

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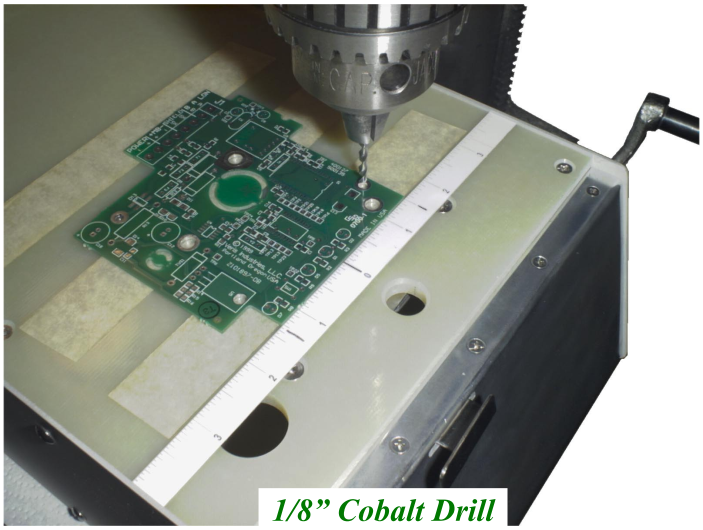
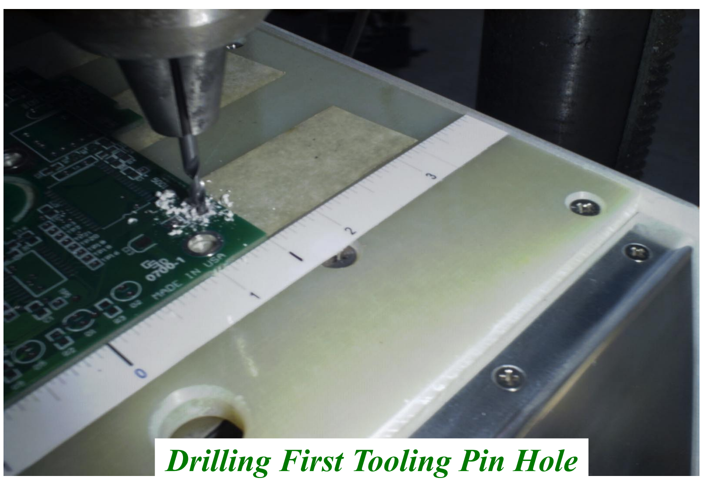
Drilling Tooling Pins



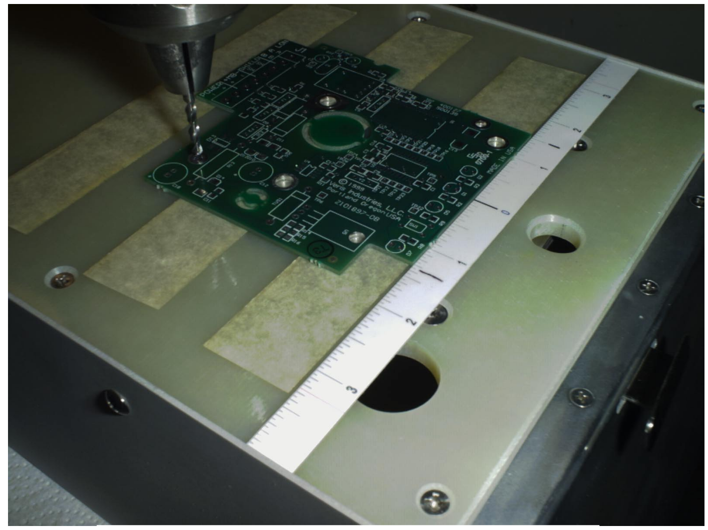
1/8" Cobalt Drill

The first step is to drill the tooling pins. The tooling pins will locate the board on the fixture. Tooling pins will be described in more detail later. The tooling pin holes in this board are 1/8" Diameter. Using the circuit board as a drill guide, I use a 1/8" cobalt drill to drill two holes in adjacent corners for the tooling pins. For a drill press, I recommend using a Cobalt drill. A Machinists Handbook will tell you



Drilling First Tooling Pin Hole

to use carbide for drilling G-10 material. Don't do this unless you have a very steady hand! Carbide drills are way too fragile for a drill press and will snap off leaving you stuck with drilling and plugging. Cobalt will last for at least 30 holes. Just change bits when they dull.



Drilling the Second Tooling Pin Hole

To get a good tight press fit, drill the tooling pin hole using the same size drill bit as the tooling pin. The 1/4" G-10 material drills small. This is because the glass fibers break up as they are drilled and actually lift and stick out in the hole. This makes a perfect press fit for simple tooling pins.

If you want to make a removable pin which is captive with a screw or some method, ream the hole a full .0005" oversize. The tooling pin shown below would be an example of a removable pin. Test Electronics can provide you with tooling pins if you would rather not make them yourself. However, most sizes can be cut easily from standard drill rod. So, in this example I will show you how to make the tooling pins out of drill rod yourself.

Shown above is a sample of a more complex removable tooling pin supplied by Test Electronics. This is not used in this fixture sample, but I will describe the use of larger tooling pins in more detail later.

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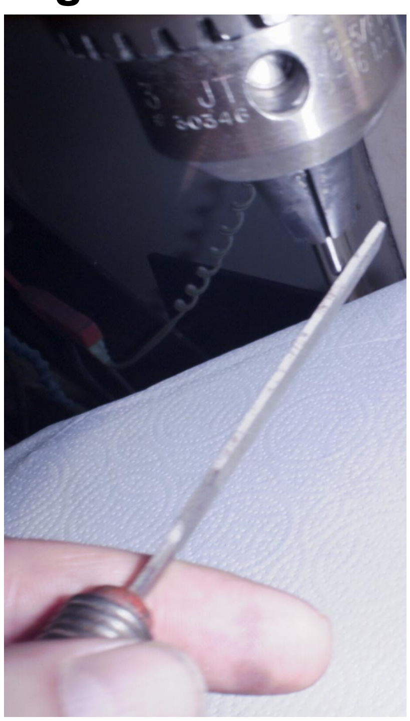
Fabricating Tooling Pins

Hack saw tooling pin

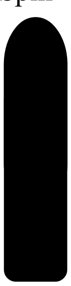
The tooling pin used in this fixture will be a simple straight pin cut from 1/8" diameter drill rod available in all drill sizes from your local machine tool supply store. Some hard-ware stores even stock it. Cut two pieces for two tooling pins. They should be cut to 1" long.

Shaping Tooling Pins

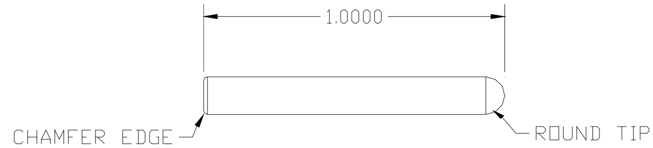


Shaping Tooling Pins

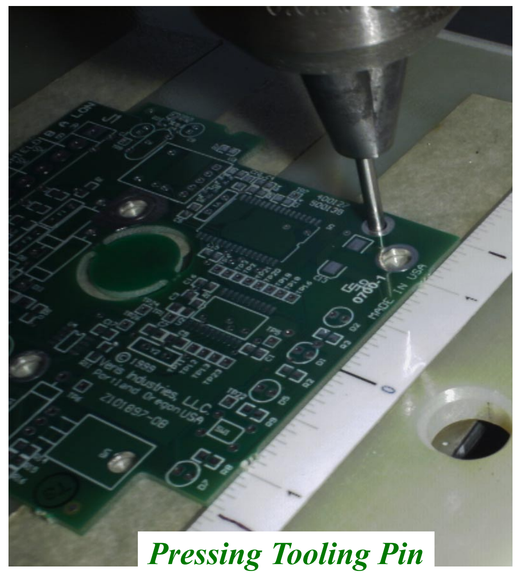
Shaping the top of the tooling pins allow the circuit board to fit smoothly over the tooling pins. File the tops of the tooling pins into a dome shape. Put the pin in a drill press as pictured here. Spin and file to a nice dome shape on the tip. Also, file the base slightly to allow the pin to be pressed in the hole without binding. The black image here shows the proper shape for a simple tooling pin.



Basic Tooling Pin Drawing



Inserting the Tooling Pin

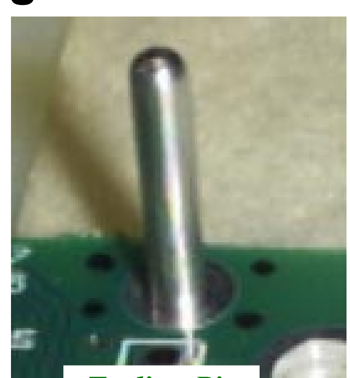


Pressing Tooling Pin

The drill press is OFF. The spindle is not turning! Shown here, the drill press provides a convenient way to hold and insert the tooling pin into the fixture. The drill press holds the tooling pin perfectly perpendicular. The more perpendicular you can hold this tooling pin, the more accurate the test fixture will be. It is very important to hold the tooling pins perpendicular and to not bend them while press fitting them into the bed of nails plate

Press Fit Tooling Pin

Here is a close up view of the tooling pin after it is press fit into the fixture. Notice the nice dome shaped top. This allows the circuit board to self align easily when the test technician puts the circuit board under test on the fixture.



Tooling Pin

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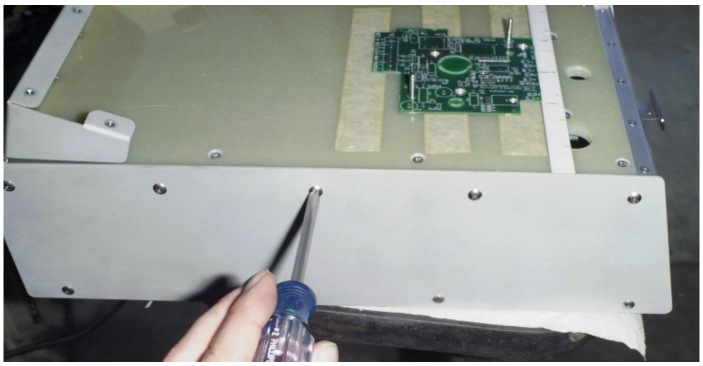
Adjusting Press Depth

The tooling pins should be pressed in flush with the bottom of the bed of nails plate. An easy way to do this is to remove a side plate and look in side to see how deep the press went.

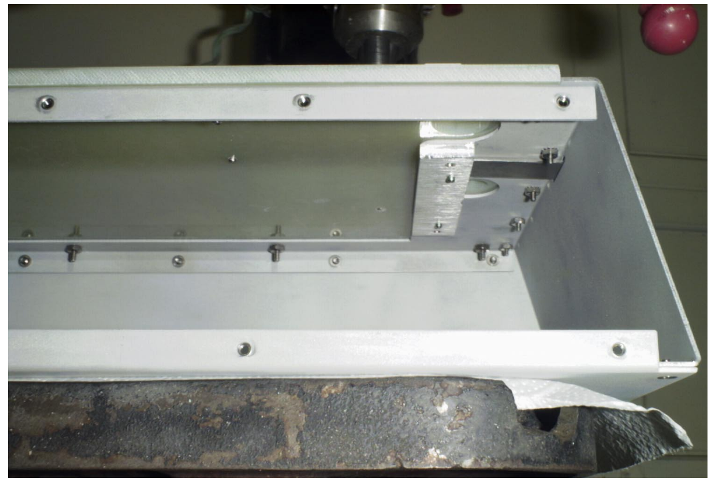


Removing Side Plate

Side Plate Removed

With the side plate removed, it iseasy to view inside the fixture underneath the 1/4" G-10 bed of nails plate. Verify that the tooling pins were pressed in to the proper depth.The bases of the tooling pins should be flush with the bottom surface of the bed of nails plate.

Side Plate Removed



Pressing Far Right Tooling Pin Deeper

In the picture above, the far right tooling pin was not pressed in deep enough. Then the near left tooling pin was pressed in a little to far. Shown above I am preparing to correct this by pressing the far right pin in just a little further. Below shows hammering the near left tooling pin back up a little to make it flush. I used a large ratchet wrench ratchet. Any small heavy metal object will work.

Hammering Near Left Tooling Pin Flush

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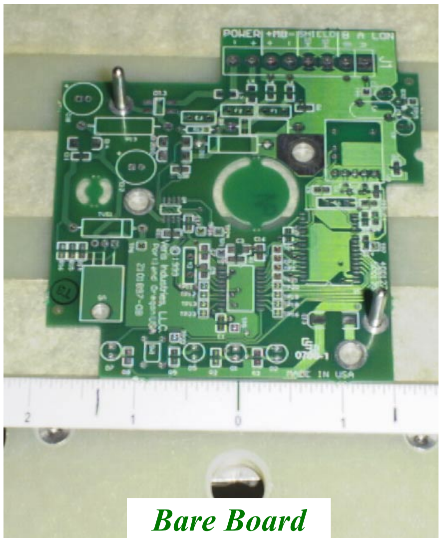
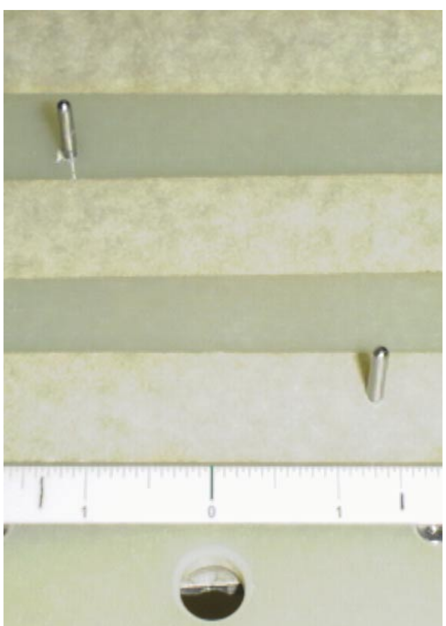
Removing the Bare Board

Next, remove the bare board and replace it with a new bare board. First blow off all drill filings so the tape is clean. Wedge a screwdriver under the board and pry it off slowly.



Bare Board

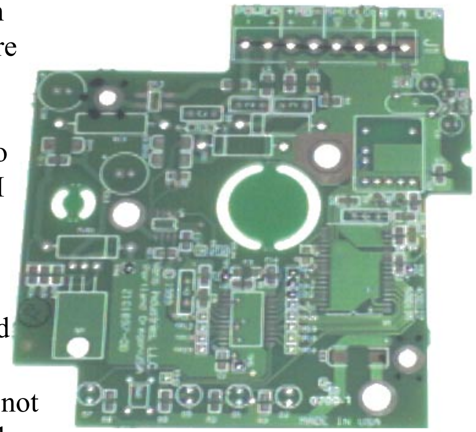
There are two important reasons for removing the board. When drilling the board, the sides may have been scorched slightly as the blank board aligned the drill. Light scorching is OK, but scorching does cause slight inaccuracies. The first reason for changing the board is to make sure that the pinning was accurate enough to allow the new board to slide properly on the tooling pins without binding. The second reason is to prevent tolerances from adding up, by removing stresses. The new bare board will self align to a slightly new position guided by the tooling pins. The new bare board will be used as the drill template for drilling the test pins.



Remove Bare Board

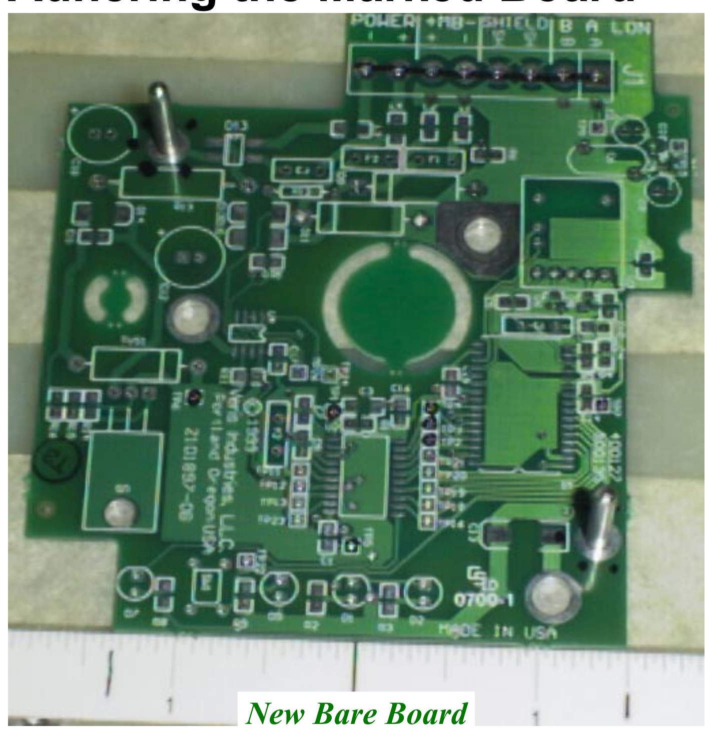
Mark the Test Probe Locations

The black dots on this fresh new bare board show the test probe locations that I plan to drill. Notice that I put 5 dots around both tooling pin holes. These are test probes around the tooling pins. These probes are not used for electrical contacts. Instead, these probes are used simply for the force they provide. They keep the board from binding as it slides up the tooling pins. The exact locations are not critical.



Mark Test Probe Locations

Adhering the Marked Board



New Bare Board

After marking the test probe locations, simply press this marked bare board into place.

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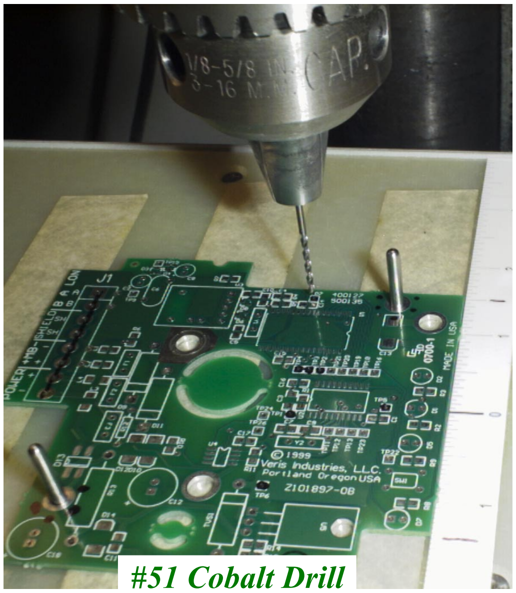
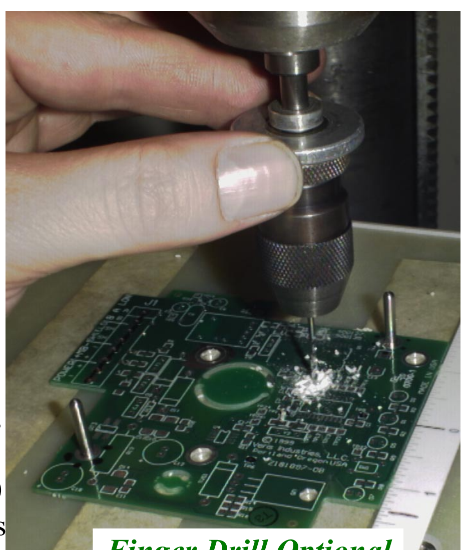
Drilling the Test Probe Holes


#51 Cobalt Drill

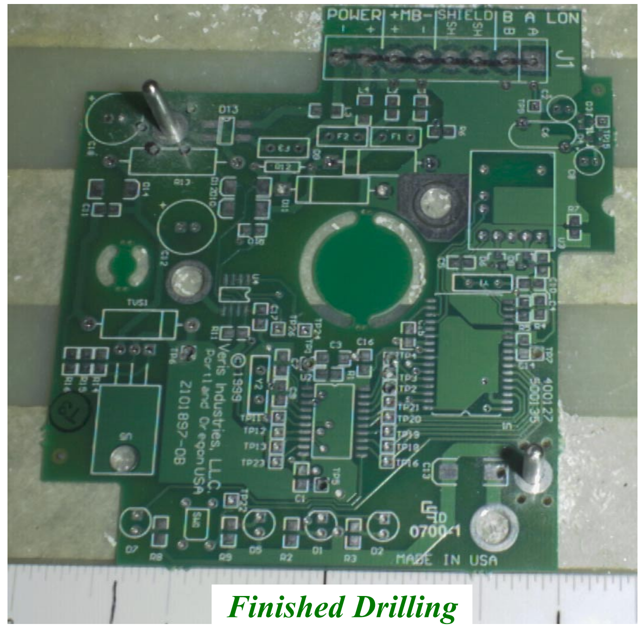
Here is where you see the beauty and simplicity in this technique of using a bare board as the drill guide. The holes in the bare board actually act as a precision template which guides the drill into position with very high accuracy. It is important to use a light touch here. To let everything slide into position. Surface mount boards can be drilled the same way. Simply center punch and predrill from the back side prior to adhering the board.

Finger Drill


Finger Drill Optional

Sometimes the right tool can really help make the job easy. **This finger drill is not necessary**, but it is a handy tool that allows more precise feed and pressure control. They cost about $300. Available at most machine shops supply stores. Shown here is a #30 JO Albrecht Keyless Chuck 0-1/8"
Test Electronics part number **TE-2823A1-3100A45.**

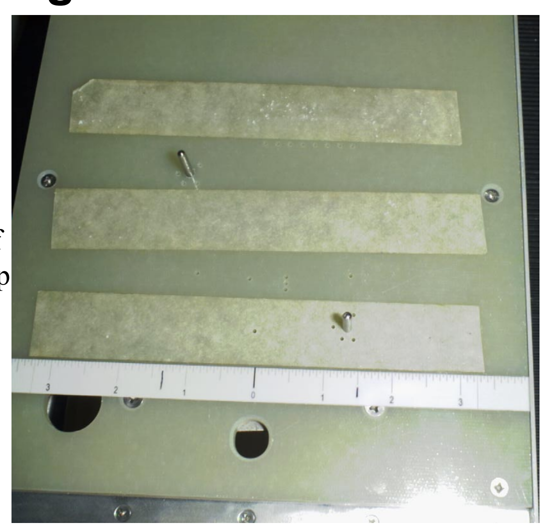
Finished Drilling



Finished Drilling

This shows the board after pin drilling is complete. The bare board is now scrap, but the test plate is now drilled to a very high accuracy. An accuracy comparable to that of a CNC machine. This is possible because the bare board which was used as a drill template was fabricated with a CNC machine.

Removing the Bare Board


Remove Bare Board

Next simply remove the bare baord from the bed of nails plate by gently prying one of the corners up with a flat blade screw-driver. Save this bare board for fabricating the press plate.

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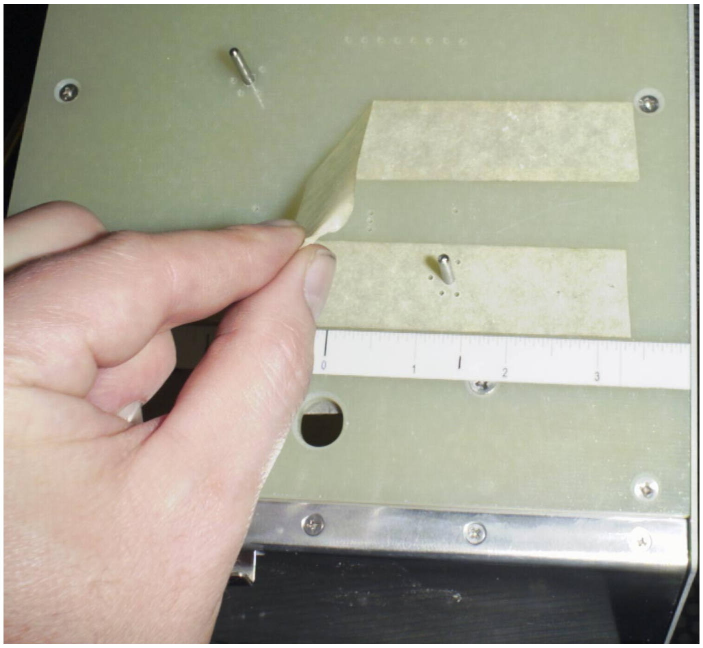
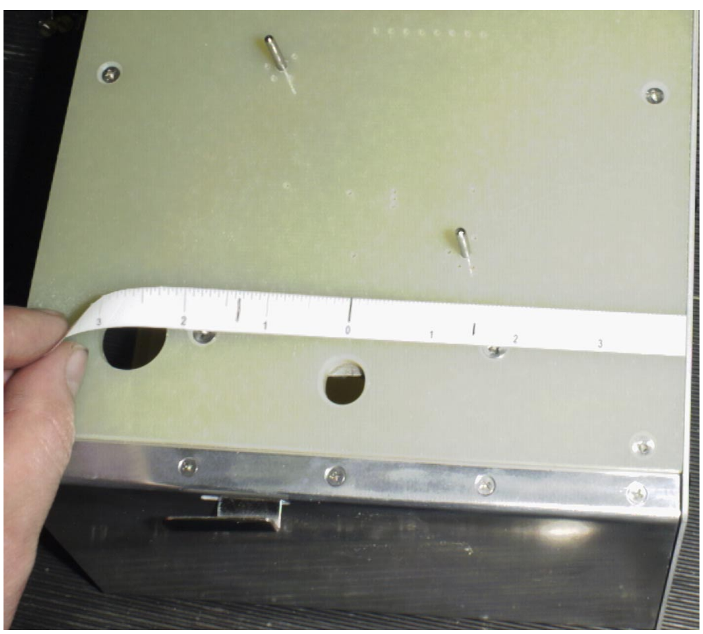


Peel off and remove adhesive strip



Peel off and remove tape guide

Wipe excess adhesive off with isopropyl alcohol

Finished drilling for PCBoard

This finishes all the drilling for mounting this PCBoard. The next page is not necessary for most applications. The next page takes a step back, and shows how to drill the tooling pins if your pins are larger than 3/16” in diameter.

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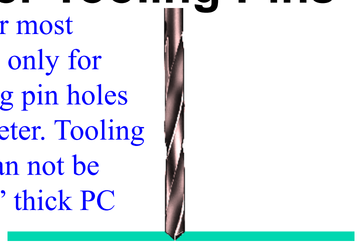
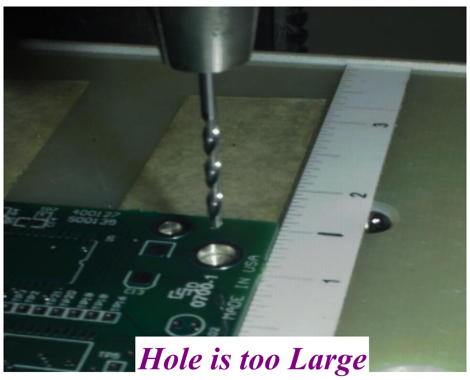
3/16" and Larger Tooling Pins

This page is not necessary for most applications. This is required only for applications where the tooling pin holes are larger than 3/16" in diameter. Tooling pin holes larger than 3/16" can not be drilled using a standard 1/16" thick PC Board as a drill guide.

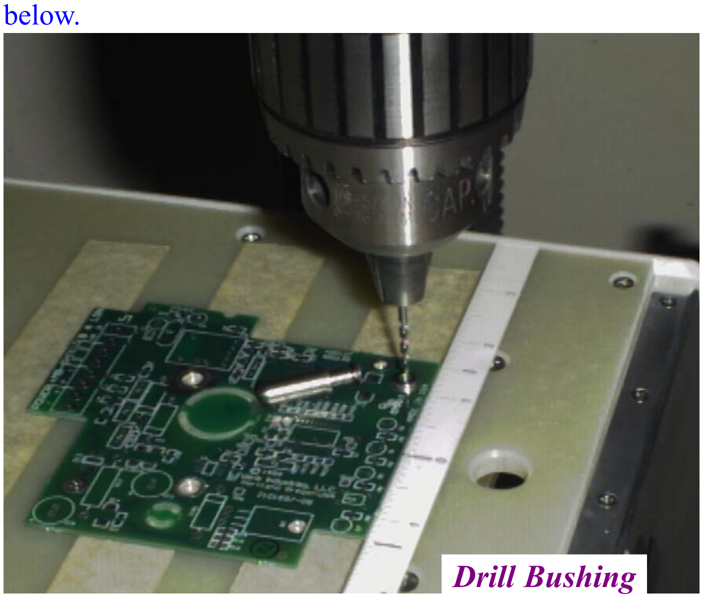


Shown here, a flute angle of 135 degrees on a 3/16" drill raises the drill tip cutting edge distance up to the standard PCB thickness of 1/16". As a result, larger size drills will not center properly.



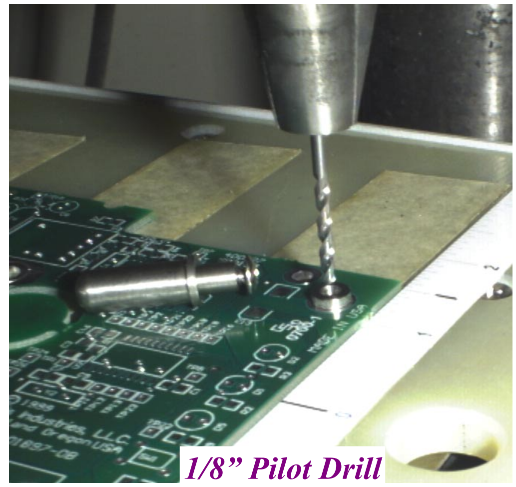
Hole is too Large

In this example, the tooling pin hole diameter is 0.2900". So, a drill bushing is needed. Test Electronics can lathe a custom bushing to match your tooling pin hole and supply the bushing with the custom tooling pin. Or, you can do it yourself. Once the bushing is made, The drill bushing is simply pressed in the blank board and drilled as shown below.



Drill Bushing

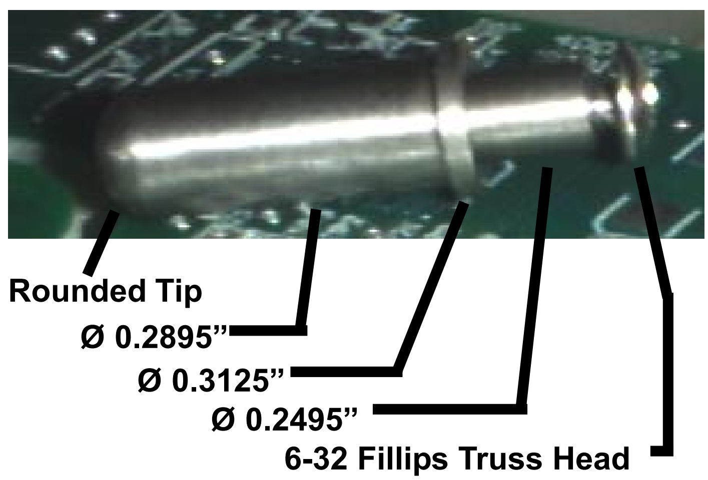
Drill Bushing



1/8" Pilot Drill

Here is a close up view of the drill bushing. A 1/8" pilot hole is drilled followed by a 1/4" final hole to mount the guide pin. The guide pin body size is lathed to 0.2895". 0.0005" under for a nice slip fit in the 0.2900 tooling pin hole. These tooling pins and drill bushings can be custom made by Test Electronics.

Tooling Pin Close Up



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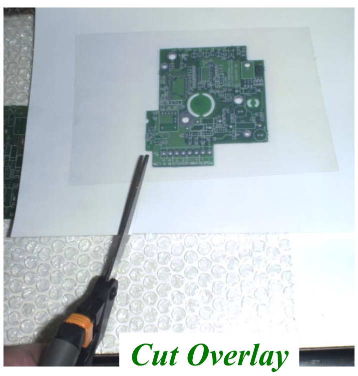
PC Board Overlay

Fabricating a PCBoard overlay is not a necessary step in the fabrication of a test fixture. However, it does add a nice professional touch to the job.
The purpose of this PC Board overlay is simply a visual aid to make the test fixture more user friendly. When the test technician sees this overlay, he will understand at a glance the proper way the circuit board should be oriented on the bed of nails tester. Your technician will also know which product this test fixture is designed for. This helps when you have more than one bed of nails test fixture for more than one product.

Making an Overlay

This step usually requires a drive to your local copy shop. You need a scaleable color copy machine, adhesive backed paper, and adhesive backed clear polycarbonate sheets. These supplies are all available in small quantities for a reasonable price at most copy shops. I suggest going to a copy shop rather than stocking these supplies.



Cut Overlay

I will copy the bare board I used to drill the tooling pins. The copy should be scaled 1:1. You will need to use some math to get this precise because copy machines are not highly calibrated pieces of equipment. First set the copy machine to 100% and copy at least 10" of a 12" ruler. Next, measure the copy. The 10" mark on my copy measured 9.65". So, I set the copy machine to 1000/9.65 = 103.6. I rounded and set my copy machine to 104%. This provided a perfect 1:1 copy.
Next, I copied the circuit board and checked the results. Then using adhesive backed paper, I made two copies of the bare board. Then I laminated these two copies with a protective coating of clear adhesive back polycarbonate as shown above. The second copy is a spare in case I mess up cutting and punching. I recommend two copies as cheap insurance to save a drive back to the copy shop.

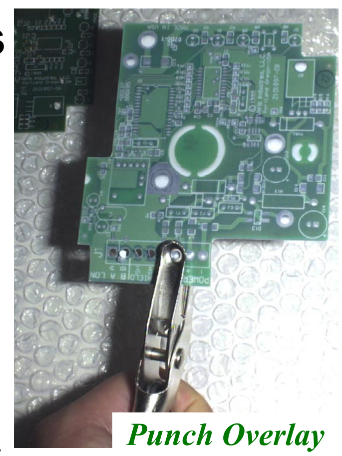
Cutting and Marking Holes

Next the overlay needs to be cut and punched. Simply cut the overlay with scissors. Next, as shown here, I marked the extra 5 holes I drilled near each of the tooling pins. I used the bare board which was the test pin guide as a template for marking. Shown here is this bare board laid over the overlay. Using a permanent fine point marking pen, I marked the 5 holes around each tooling pin. The normal through holes will be seen on the copy and do not need to be marked.

Marking Overlay

Punching Holes

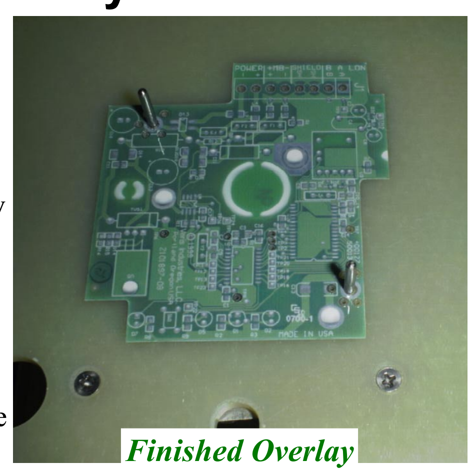
Using a 1/8" paper punch, simply punch out all the tooling pin holes, and the test pin holes so the overlay will fit over the tooling pins and not cover the test pin holes. As shown here.



Punch Overlay

Placing Overlay

Finish by peeling off the nonstick backing. Then carefully align the overlay over the tooling pins. Gently slide the overlay down so that it sticks evenly to the bed of nails plate. Smooth out any air bubbles and you are finished.



Finished Overlay

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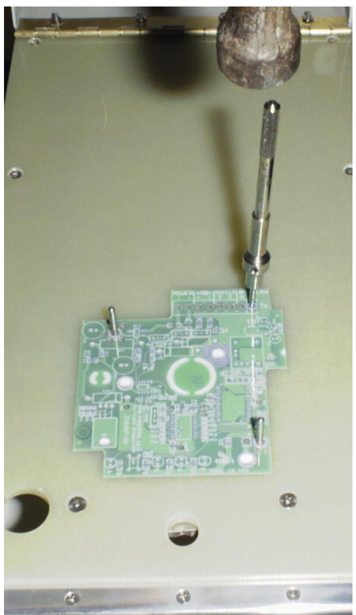
Installing Receptacles

Shown here is the insertion tool required to install the test pin receptacle shown below.

The recommended method for installing these receptacles is to first dial in the correct shoulder set height and hammer it in. In this project I set the receptacle height to 0.200" Hammer the receptacle in place with a light tap while holding the tool perpendicular. As shown here to the right. My hand should be in this picture holding the test pin tool, but I had to stand to the side to make way for the camera. This method works, but accuracy is sacrificed. The holes are drilled very perpendicular and the receptacles are rigid enough to hold their perpendicularity fairly well, but they can be bent. This method typically looses 10-20 mil of accuracy depending on how skilled you are. This is where a great deal of accuracy can be lost in building your fixture. If your application can handle this loss in pointing accuracy, then go ahead and hammer all the pins in. This method is fast and easy.



Hammer Method

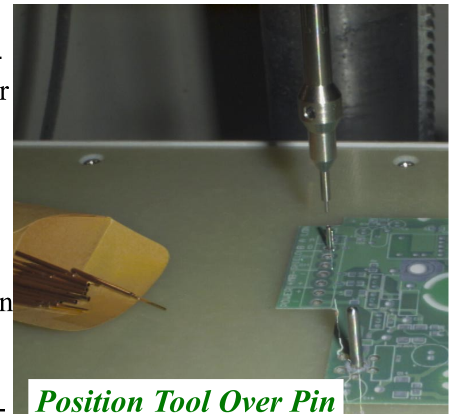
Using a Drill Press Instead

Here in the Test Electronics Test Fixture production line, we maintain a very high level of accuracy using a CNC machine to install the receptacles. You can get close to this by using a drill press to press in the receptacles.

Press Method

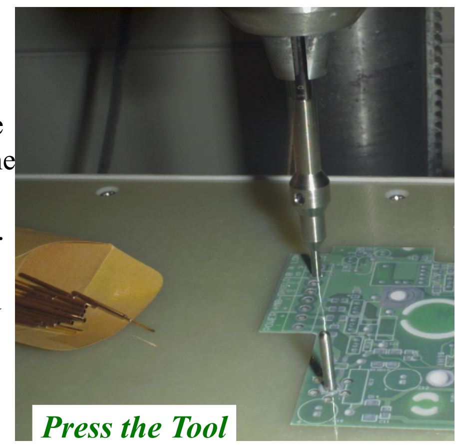
Using a drill press to maintain perpendicularity is a much better method that I highly recommend.

Put the tool in the drill press chuck and press the receptacle in with the drill press. This method ensures excellent perpendicularity.

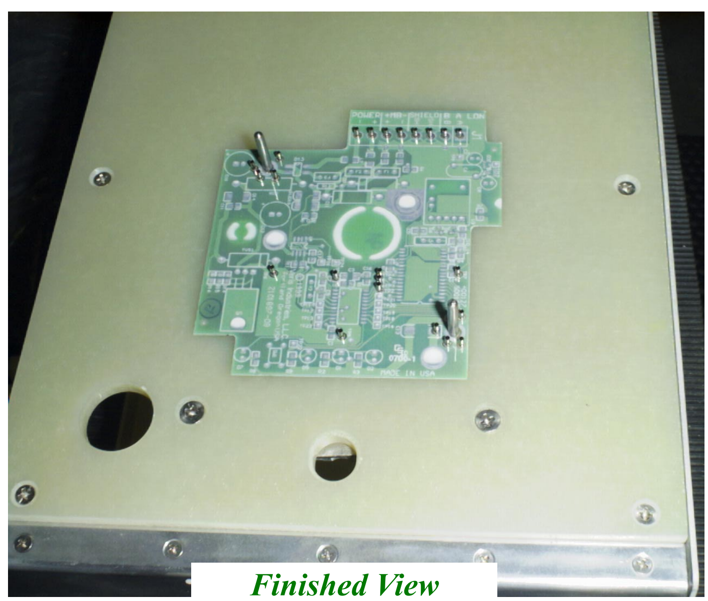


Position Tool Over Pin

Set the receptacle in the hole, position the insertion tool over the receptacle, then gently press in place. Repeat for all the receptacles you need to install.



Press the Tool



Finished View

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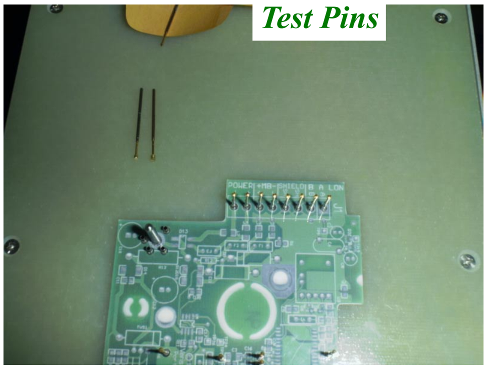
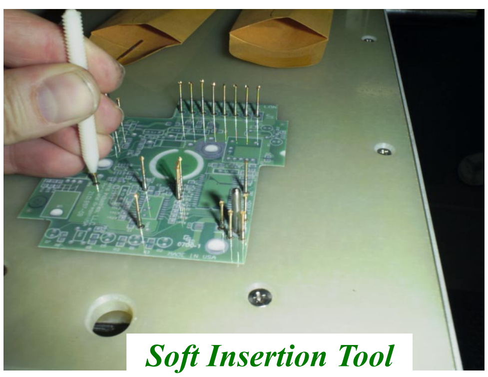
Installing Test Pins


Test Pins

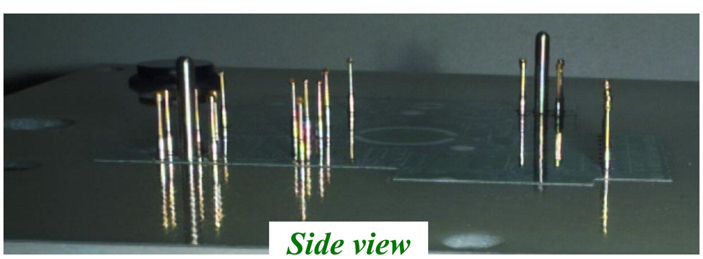
The final step is to install the test pins into the receptacles. The process is simple. Put the test pin in the receptacles as shown here. Use tweezers to handle the test pins. This will prevent corrosives salts and acids on your skin from degrading the surface of the test pins.

Press the Test Pins


Soft Insertion Tool

Press the test pins into place using one of the nylon press rods supplied with the fixture.
Be sure to use this rod or another soft plastic material. Avoid hard metals. Hard metals will dull the tips of the probes.

Side View Test Pins in Place

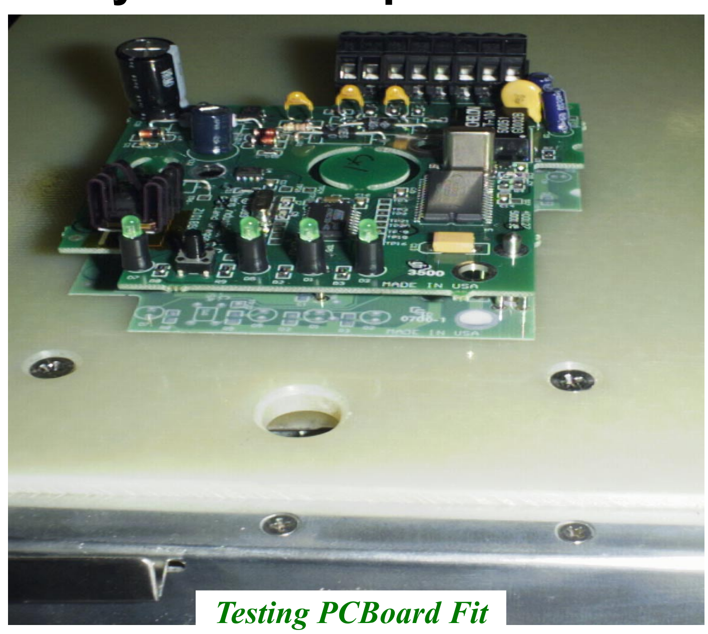

Side view

View from the side to verify all pins are fully pressed in their sockets.

Finish Bed of Nails Plate


Finished Bed of Nails Plate.

Verify Smooth Operation


Testing PCBoard Fit

Place the board under test on the bed of nails and visually inspect for proper fit and alignment.

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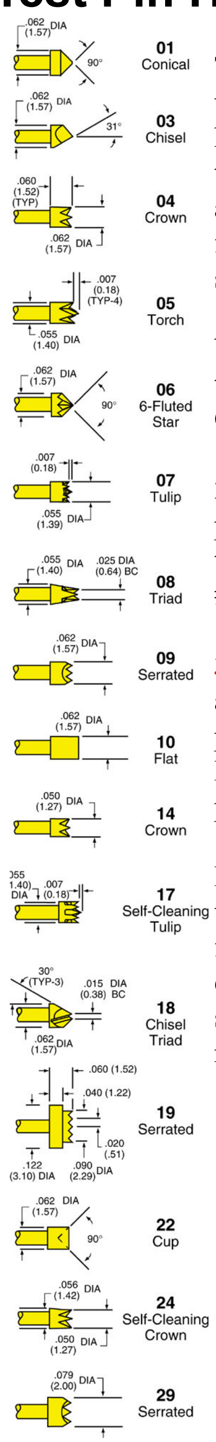
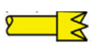
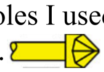
Test Pin Head Styles

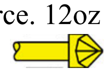


There are a wide variety of test pin head styles available to cover most any application. In this fixture I used 3 head styles.

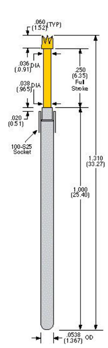
1. To probe the bottoms of connectors I used the #04 Crown. 

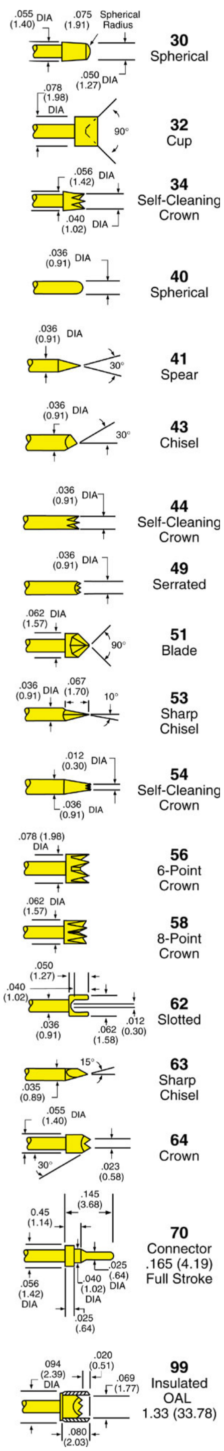
2. To probe solder pads and empty through holes I used #51 Blade. 

3. The probes placed around the tooling pins were a #51 Blade with a medium probe force. 12oz



Probe head selection varies on many factors. Consult test electronics technical support for your needs.





Probe Sizes

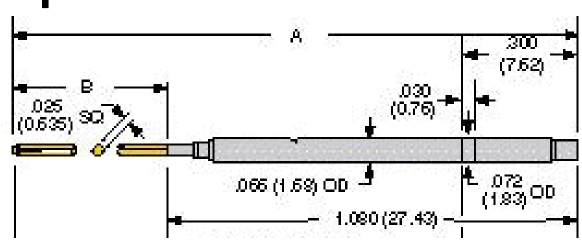
Test probes are readily available in three sizes:

0.060 diameter body for probing points100mil center to center or larger.

0.040 diameter body for probing points 75 mil center to center

0.030 diameter body for probing points 50 mil center to center

Receptacle



Receptacles are available for all sized probes. Shown above is the wire wrap version. Solder cups and crimp styles are also available. The wire wrapped version shown above are used most of the time and will be used in this project.

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Fabricating the Press Plate

Fabricating the press plate is simple. Drill holes that cover the area of the circuit board under test, and put the threaded nylon press rods in.

Marking Rod Locations

Find and mark good locations for the press down rods. These press down rods must clear components and be spaced evenly along the top surface of the board. It is desirable to put the press down rods near groups of test pin locations, but avoid putting the rods directly over the test pins. Fixtures with press rods placed directly over test pins will need special handling. You will not be able to close the fixture without a circuit board in place because the press rod will hit and could bend the test pins.

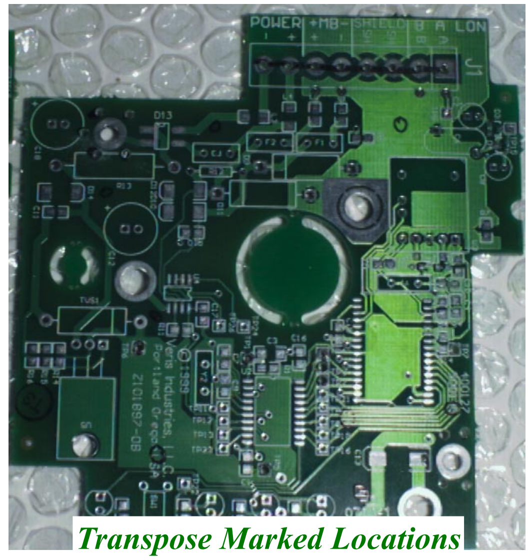

Marking Rod Locations

Black Circles Mark Rod Locations

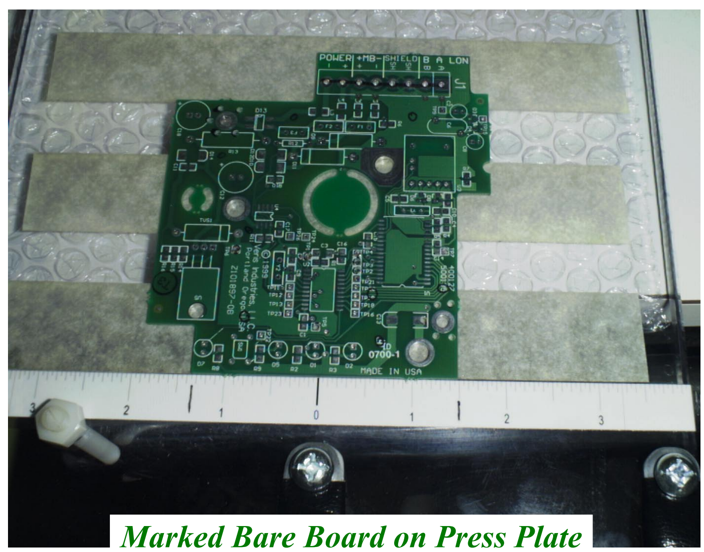
Here is a close up view of 8 locations I chose for 8 of the press rods. I will only use 8 of the 10 press rods.

Marking the Bare Board

Next copy the 8 marks from the stuffed board to a bare board as shown here. This is all done free hand as you are using you best judgment to simply make these marks in clear areas and near but not on test pins. I used the bare board, which was previously drilled on the bed of nails plate so that I can easily see all the test pin locations to avoid.


Transpose Marked Locations

Adhere the Bare Board


Marked Bare Board on Press Plate

Peel off the nonstick tape. Then align and adhere the blank board to the press plate. Reference the precision tape ruler to align the board to the exact same location on the press plate that the board was on the bed of nails plate.

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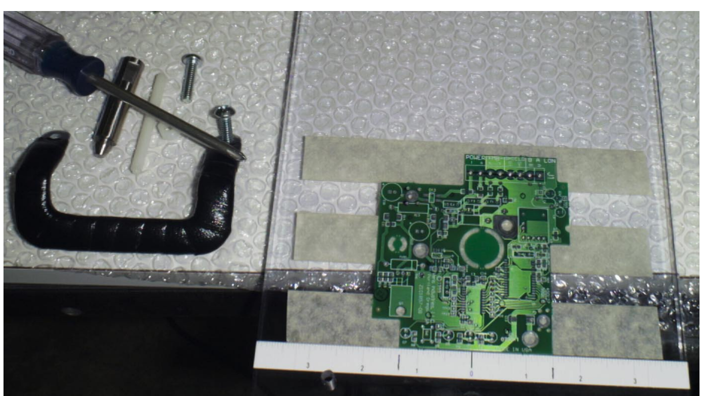
Remove the Handle and Pin

Temporarily Remove Parts

Removing the handle and pin is not necessary, but helps keep things flat on the drill press table. Another method would be to reassemble the press plate on the test fixture. I prefer to work with the parts disassembled. It is easier to handle the lightweight cover rather than the whole test fixture.

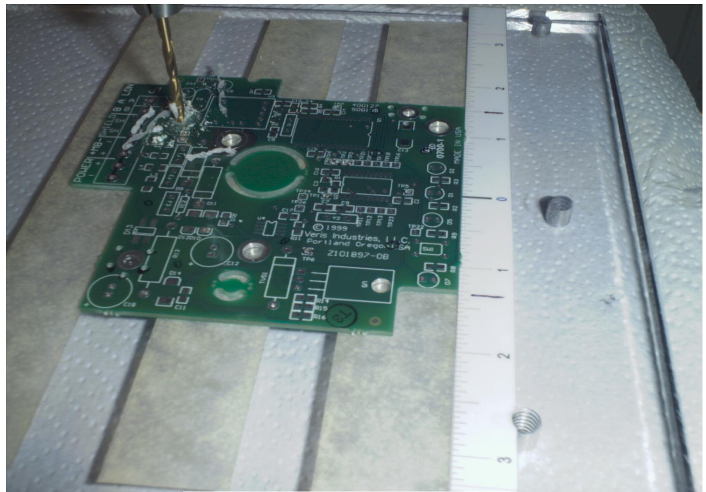
Parts Removed and Ready



Parts Removed

This shows the handle, latch pin, and safety switch press rod removed, and circuit board adhered properly in place ready for drilling.

Drilling Press Plate



Drilling 1/8" Pilot Holes

This shows drilling the press plate in the marked locations. All marked locations are drilled with a 1/8" cobalt drill. These are 1/8" pilot holes. It is important to use a small drill to avoid lifting the blank board off of the adhesive tape. This machining quality tape is very strong for holding forces parallel to the work surface, and even perpendicular shock forces. However, as you know the board can be pried up slowly with the constant force of a flat blade screwdriver. Larger drills will tend to pull burrs up between the clear polycarbonate press plate and the blank board. These burrs could slowly build up the constant force necessary to lift the board. So, I recommend using a 1/8" cobalt drill to make pilot holes. Then remove the board and drill through the pilot holes with the final drill size of you choice.

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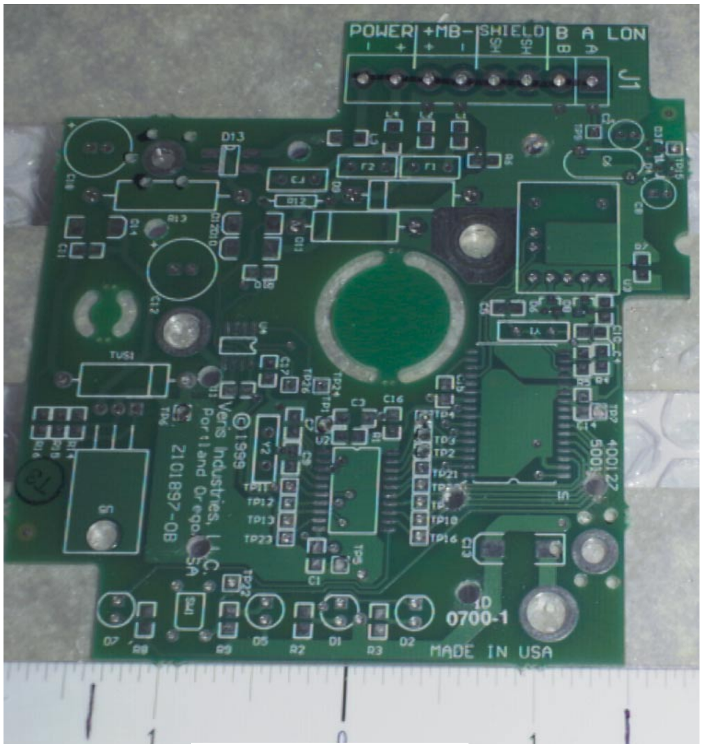
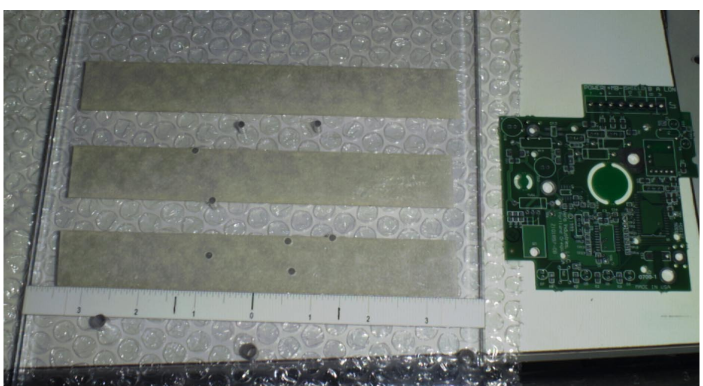
Close Up of Pilot Holes



Pilot Holes Drilled

Close up view of all the pilot holes after drilling.

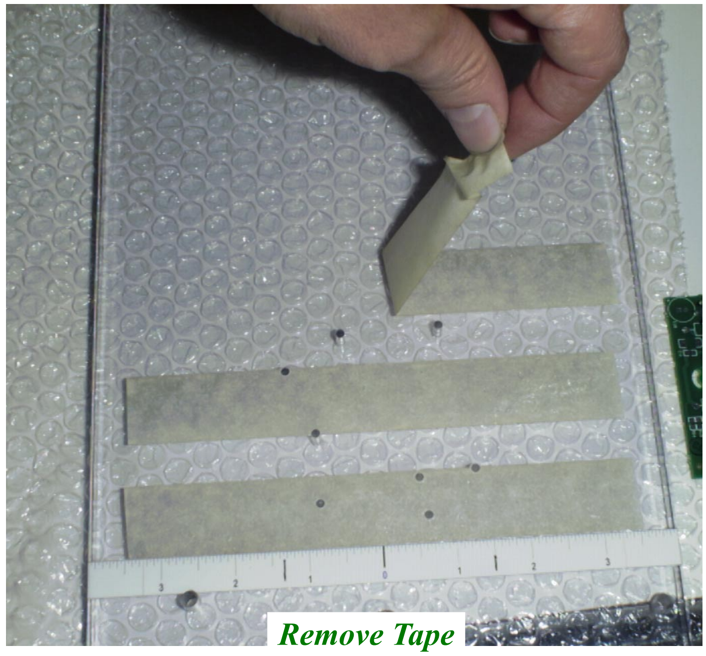
Remove Blank Board



Remove Bare Board

Remove the bare board

Remove Tape and Ruler



Remove Tape

Peel up the adhesive tape and peel off the ruler.

Cleanup

Clean

Wipe excess adhesive off with Isopropyl Alcohol.

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Updated Oct 2010. If this date is old, check for a newer version at http://www.testelectronics.com/bon.html

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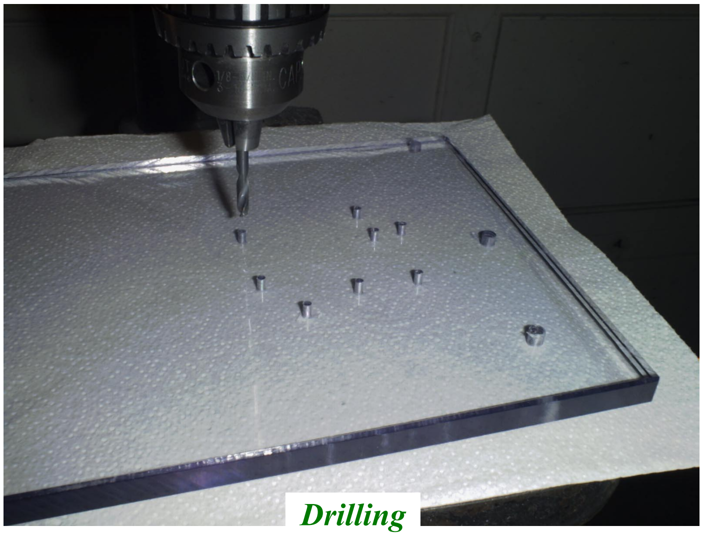
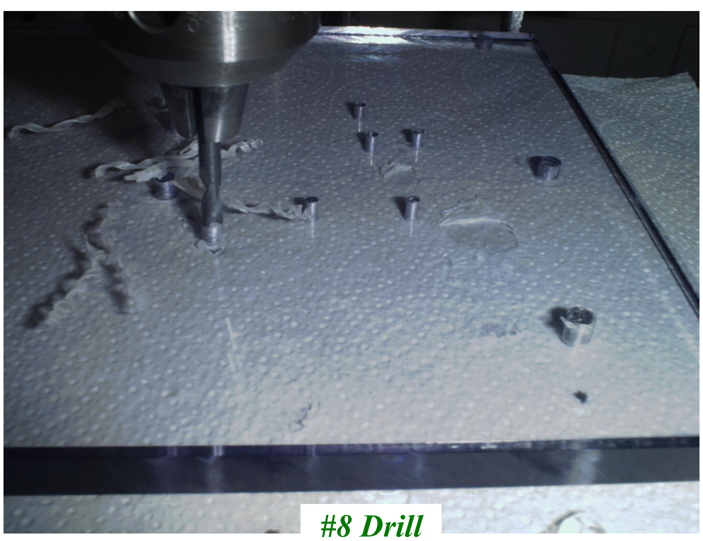
Drilling Out Pilot Holes



Drilling

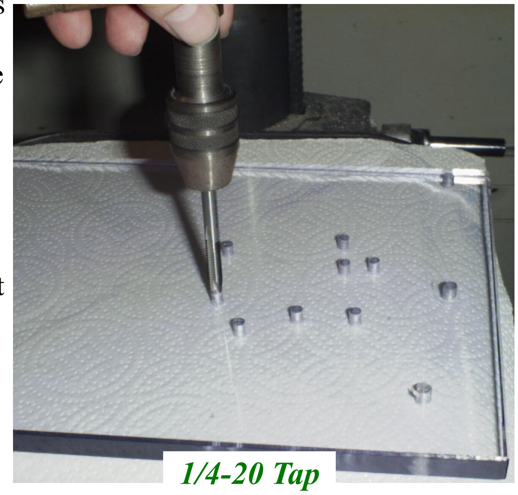
Drill out the pilot holes. There are two possible ways to make a fixture. You can drill and tap the hole, or just drill a 1/4" hole which is large enough to slip the threaded press rods through. There are 20 nuts supplied with the kit for this purpose. I like to do the extra work of tapping because it makes it easier to adjust the press downs and level the board after the fixture is assembled.

Drilling #8 and Tapping1/4-20



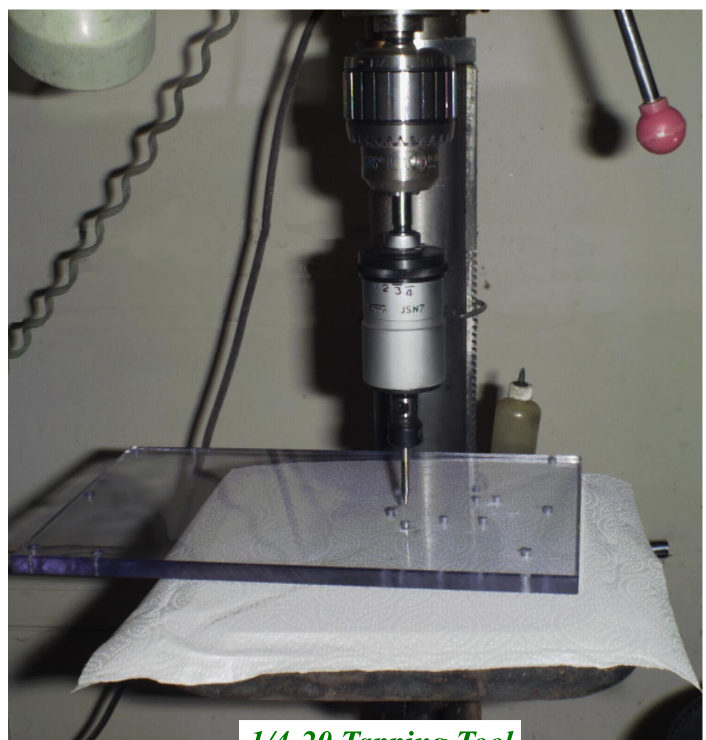
#8 Drill

Tapping 1/4-20



1/4-20 Tap

Hand tapping is perfectly acceptable. The press plate is not a super accurate plate like the bed of nails plate. Holding perfect Perpendicularity accuracy is not such an important issue in fabricating the press plate. However, there is a better way if you don't mind investing in a tapping tool. The tapping tool will give better perpendicularity, a smoother tap, but most important, it will save time when you have a lot of holes to tap.



1/4-20 Tapping Tool

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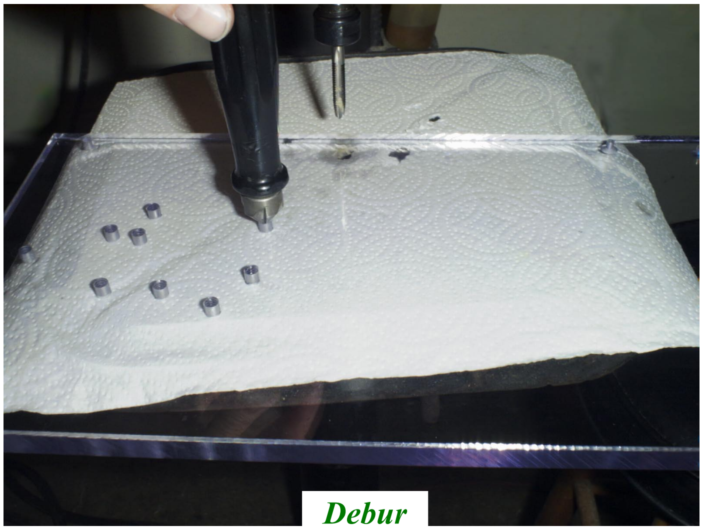
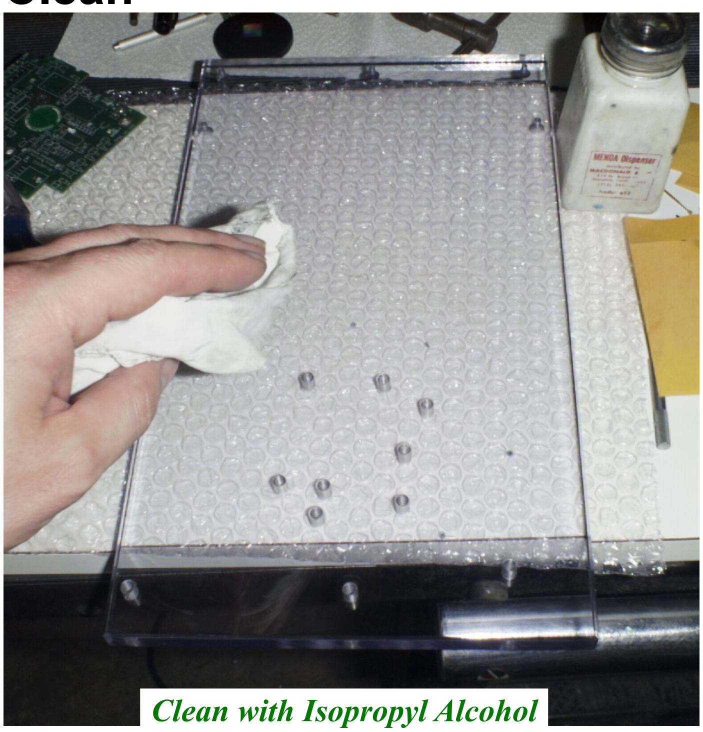
Debur



Debur

This shows a deburring tool used to clean up the tapped holes. Debur on both top and bottom sides.

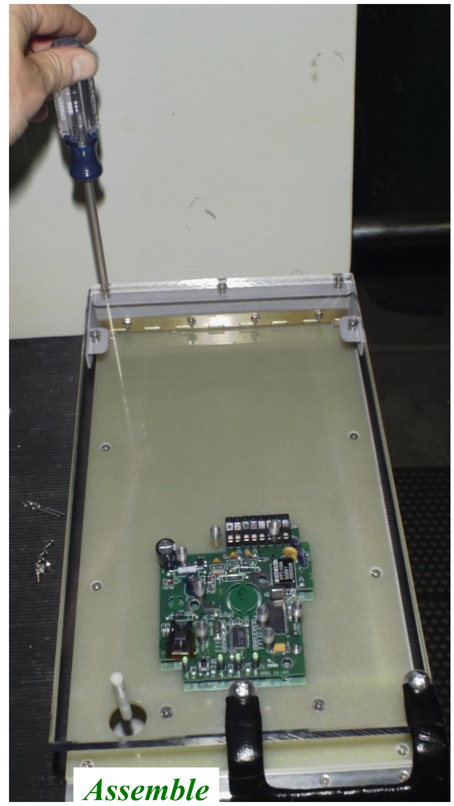
Clean



Clean with Isopropyl Alcohol

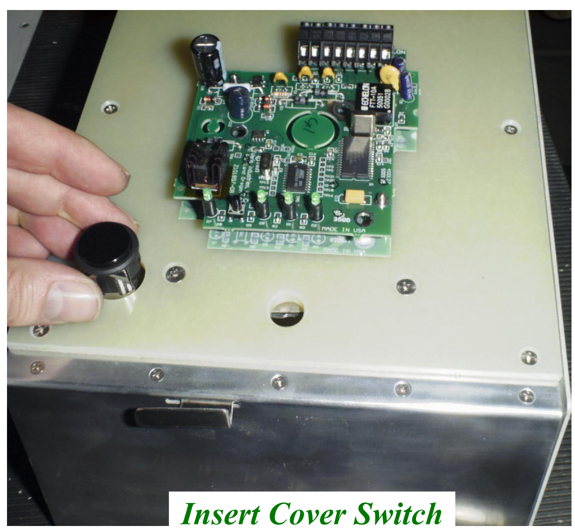
Reassembly

Reassemble press plate to the fixture kit.



Assemble

Insert Cover Closed Switch



Insert Cover Switch

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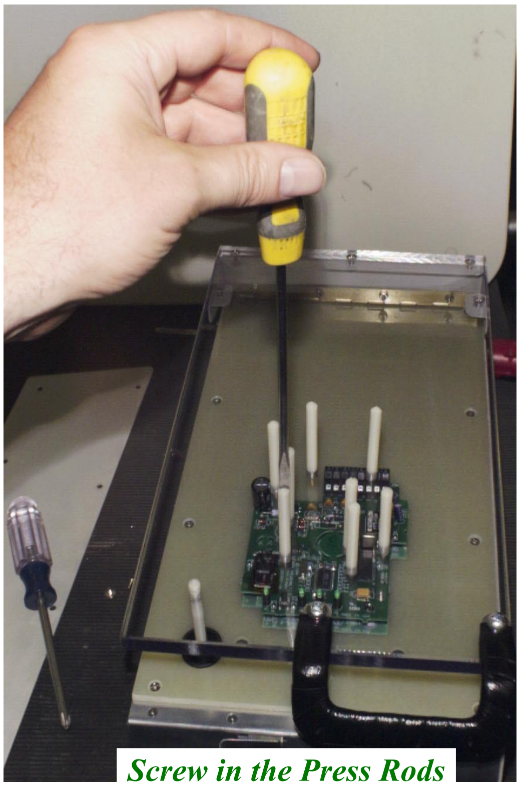
Screw in the Press Rods



Screw in the Press Rods

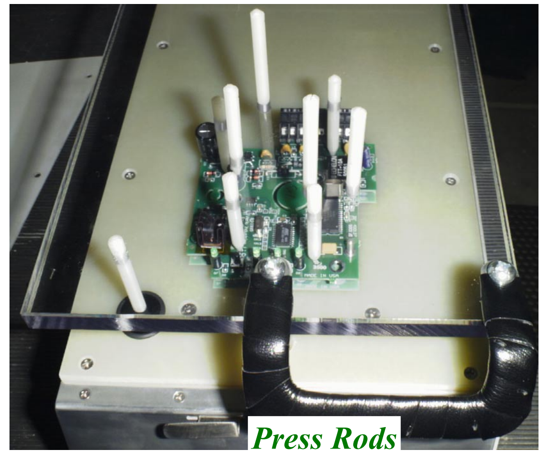
Adjust Press Rods

Adjust Press Rods for 1/3 travel

Set the press rod depth to compress the spring pins to between 1/2 travel and 1/4 travel. The optimal test pin travel is compressed to 1/3 of full stroke. Note: compressing the pins more than 1/4 travel shortens pin spring life.

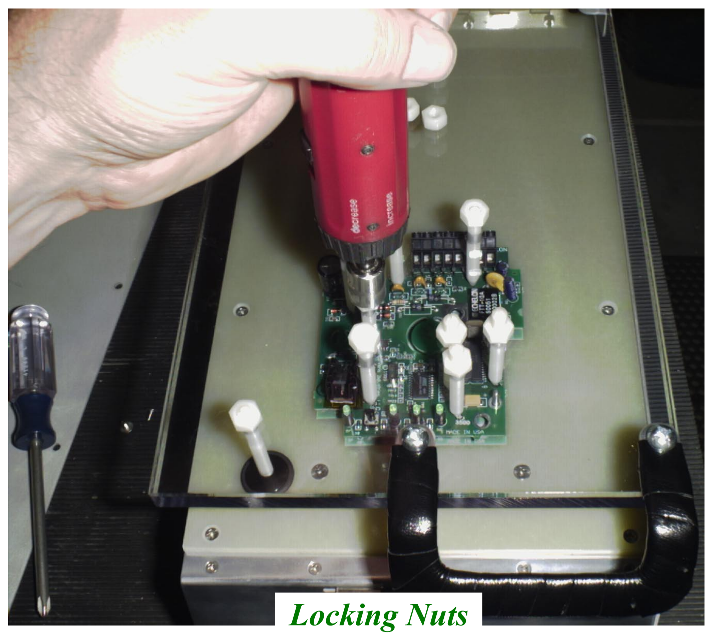
Fixture with Press Rods

Top view of the fixture with the threaded press rods installed and adjusted.



Press Rods

Installing Locking Nuts



Locking Nuts

One locking nut is installed on top of each threaded press rod to lock it in place. I am using an electric screwdriver set to the lowest torque setting of 1 foot pound. The torque is not critical, just do not use too much torque. The nylon parts will strip if over torqued. It doesn't take much torque to correctly and permanently lock the press rods in place. So, there is no need to overdue it.

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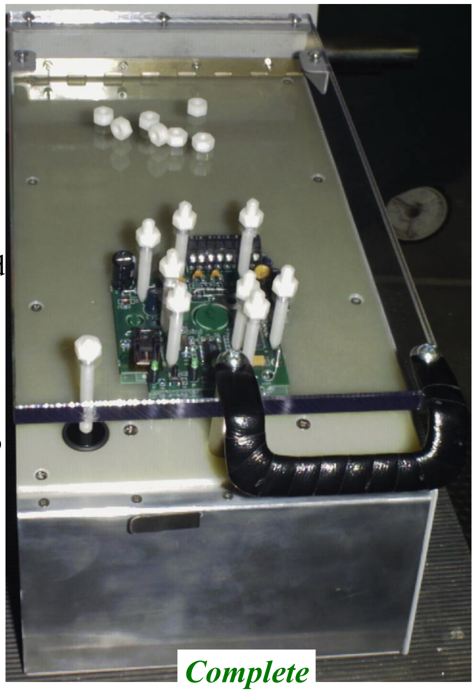
Mechanically Complete


Complete

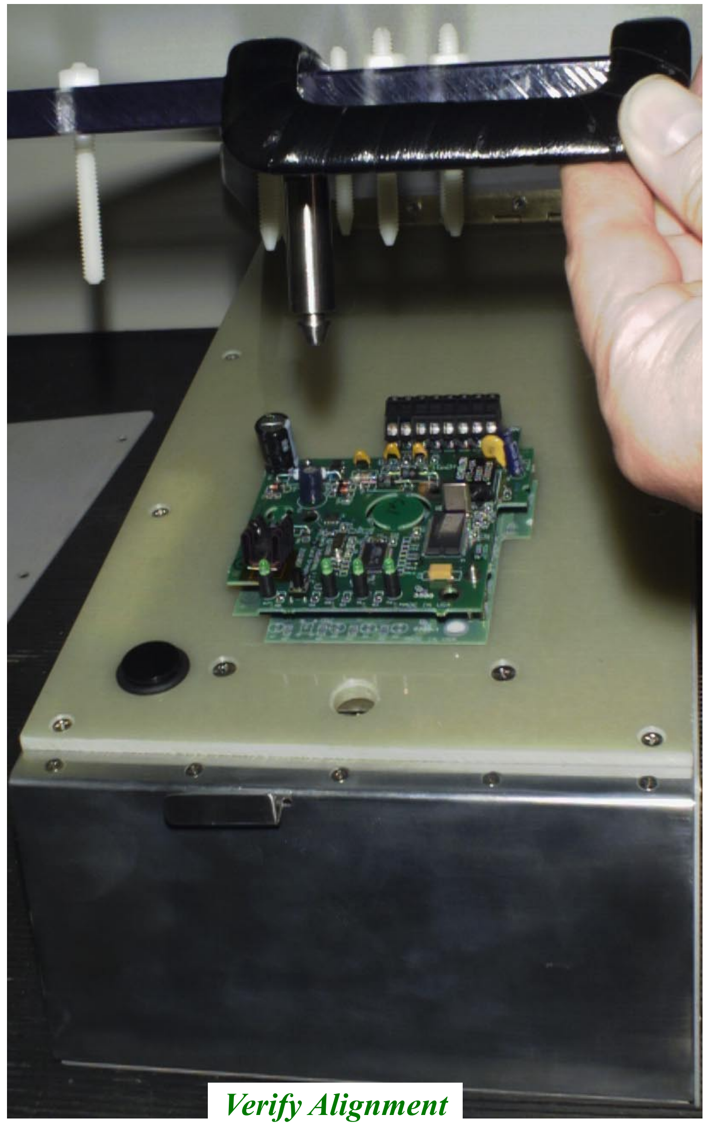
The fixture is now mechanically completely customized to match the board under test. The extra nylon nuts shown here are not needed since this fixture was tapped. The extra nuts are supplied for those who do not want to tap the press plate and instead drill their press plate out to 1/4". They will need to put these nuts both above and below the test plate to hold the press rods in place.

Testing Operation


Open

Test the fixture for smooth operation. Close the press plate and make sure it latches properly and the board under test slides smoothly down the guide pins to contact the test pins.

Opening Fixture


Verify Alignment

Open the fixture verify the circuit board raises without binding. Verify operation is smooth. View from the sides to make sure the circuit board remains level as it slides up and down the guide pins.

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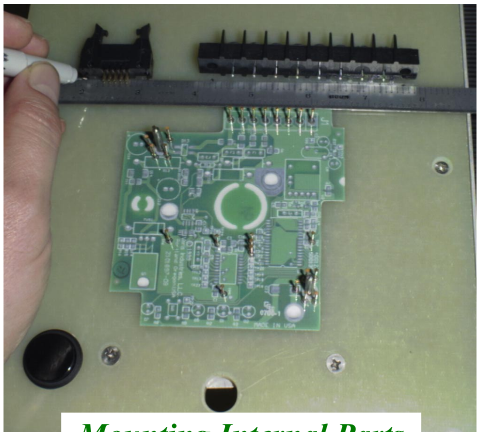
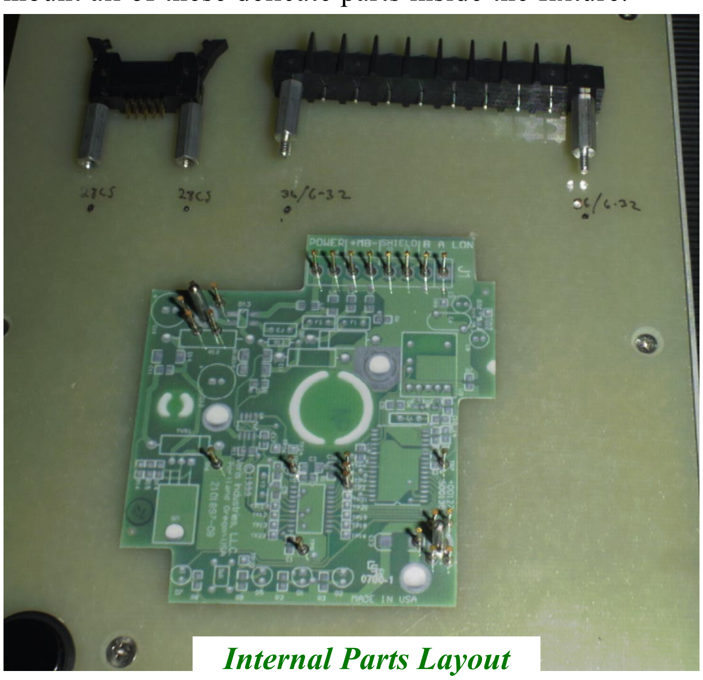
Internal Parts



Mounting Internal Parts

I plan to put a ribbon cable header connector, terminal strip, and a combination amplifier, controller, power supply board inside this fixture. This picture shows centering and marking the two connectors which will be mounted up inside underneath the bed of nails plate. Your customizations will differ depending what you need to mount inside your fixture, if anything. The simplest way to make a fixture is to wire all the pins to a back panel and then process all the signals externally. I have a nice driver board that will fully drive this board under test. So in my case, it will make a much more rugged and user friendly package to mount all of these delicate parts inside the fixture.



Internal Parts Layout

Setup For Drilling

Drilling

Setup for drilling hardware mounting locations. This picture also shows how a fixture could be drilled without removing the press plate.

Drilling Mounting Holes

Mounting Holes

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Tapping Holes

Using an electric screwdriver and a tapping block to tap the two 6-32 holes for the two 1/2” standoffs. These standoffs provide a mounting method for the terminal block.

Tapping Small Holes

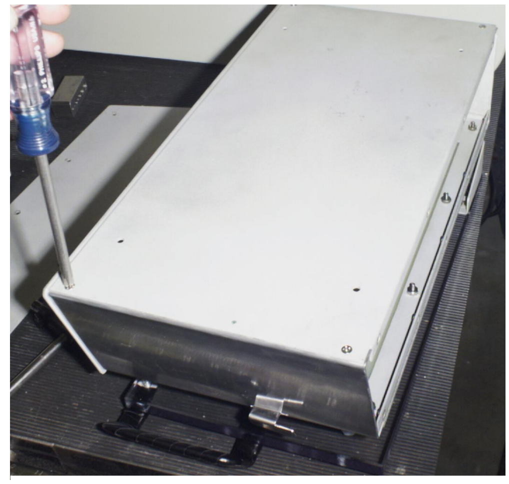
Clean

Clean off drill location marks with Isopropyl Alcohol.

Clean

Remove Bottom Panel

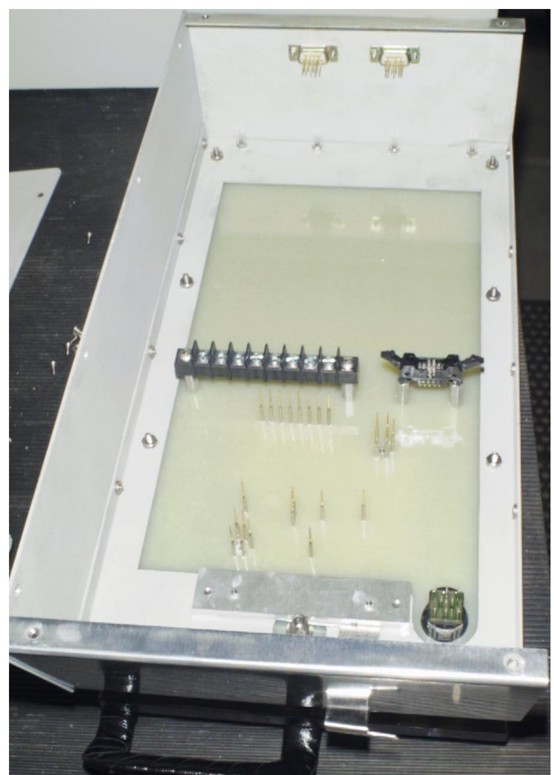
Remove bottom panel to access the inside of the fixture



Remove Bottom Panel

Set the Hardware in Place

Temporarily set the hardware in place to prepare for wiring.



Internal Hardware Mounting Locations

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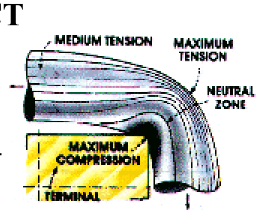
The Technology of Wire Wrapping

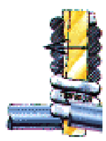
A wire wrapped connection is made by coiling the wire around the sharp corners of a terminal under mechanical tension. This method of connection was fist developed by Bell Telephone Laboratories, Western Electric Company.

METAL-TO-METAL CONTACT

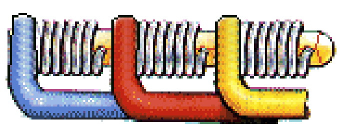
By bending the wire around the sharp corner of the terminal, the oxide layer on both wire and terminal is crushed or sheared, and a clean, oxide-free metal-to-metal contact is obtained.



HIGH PRESSURE CONTACT



TRIPLE CONNECTION

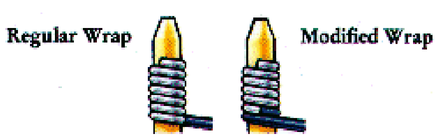


EASY REMOVAL

A distinct advantage of wire wrapping is the ease with which a wire may be removed from a terminal to correct errors or modify wiring. An unwrap tool is slipped over the terminal, engaging the first turn of the connection. Rotating the tool, the connection is removed in seconds, without damage to the terminal.

TYPES OF WRAP

A "Regular" bit wraps the bare wire around the terminal. A "Modified" bit wraps a portion of insulation around the terminal in addition to the bare wire. This greatly increases the ability to withstand vibration. Modified wrap style is recommended for a good durable bed of nails test fixture.



STRENGTH OF CONNECTION

The strength of a wire wrapped connection is considerably in excess of that of a soldered one. It is less easily stripped from the terminal and is less subject to breakage.

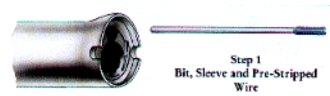
GAS TIGHT CONTACT AREAS

The contact areas of a wire wrapped connection remain gas tight when exposed to temperature changes, corrosive atmospheres, humidity and vibration.

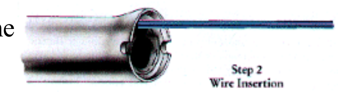
Hints on Making Wrapped Connections

PROPER WIRE WRAP

1. Strip 3/4" of insulation off of the wire

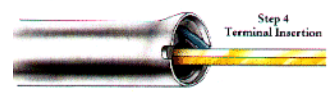


2. Insert the wire all the way into the side hole of the wire wrap tool.

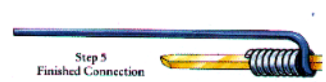


3. Anchor the wire by wrapping back through one of the two side slots

4. Insert wire wrap tool over the terminal post of the receptacle.



5. The finished connection should look as shown here.



OVER PRESSURE

Do not press too hard. Let the tools do the work. Excessive pressure can lead to over wrapping.

TOOL PULLING

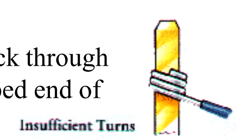
Do not pull the tool. Let the tool do the lifting. Pulling the tool can lead to spiral wrapping.

STAY WITH IT

Just keep the tool on the terminal until the wrap is complete. Early removal can result in spiral and open wraps.

INSERT WIRE CORRECTLY

Be sure to anchor the wire by wrapping back through one of the two side slots. Be sure the stripped end of the wire is "pushed-in" all the way.



USE THE CORRECT TOOL

Wire Wrapping is a precision technique and the tool must fit the wire gage correctly. The wrong tool just cannot do the job. Improper selection can cause problems ranging from "Pigtails" to loose wraps.

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Wire Wrapping


Wire Wrapping

These fixtures are typically wired using wire wrap techniques. This is adequate for most applica-tions. In some cases high current applications may require soldering a larger gage wire. In this example all connections will be done using wire wrapping techniques.
This page will quickly review wire wrapping. If you know how to wire wrap, you can skip this page.

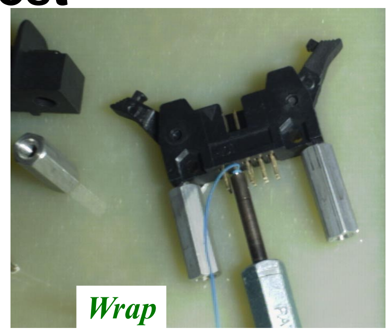
Wire Wrap Tool


Wire Wrap Tool

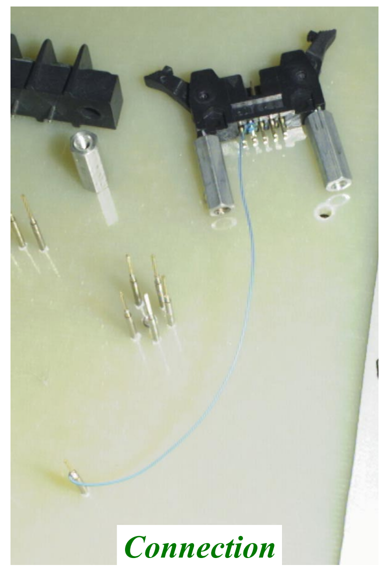
Shown above is the wire wrap tool. You simply strip about 1/2" of insulation off of the end of the wire wrap wire and then stick this wire into the offset hole on the tip of the wire wrap tool

Wrapping a Post

Next place the center of the tool over a wrap post terminal and turn the tool until all the wire is wrapped tightly around the post as shown here.

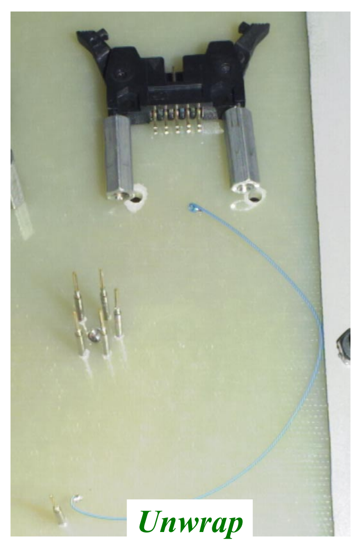

Wrap

Connect the other end of the wire using the same procedure to make the wired connection as shown here.


Connection

Unwrap

The opposite side of the wire wrap tool unwraps the wire in case you make a mistake.


Unwrap

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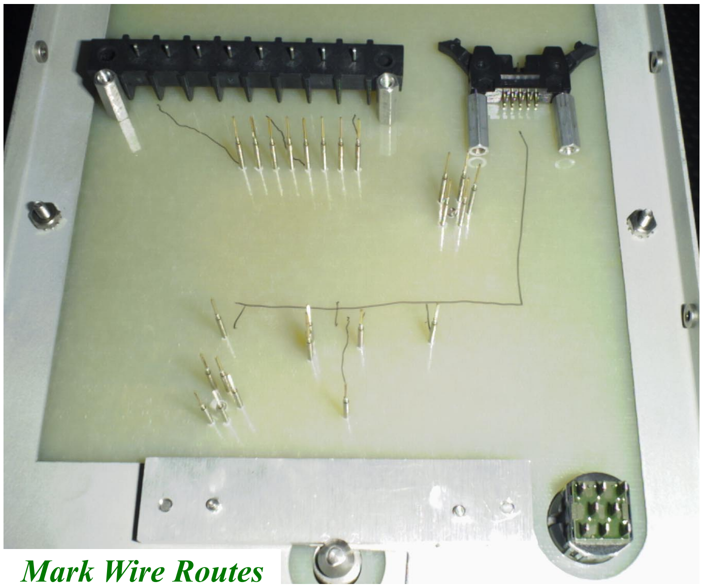
Plan and Mark Wire Routes



Mark Wire Routes

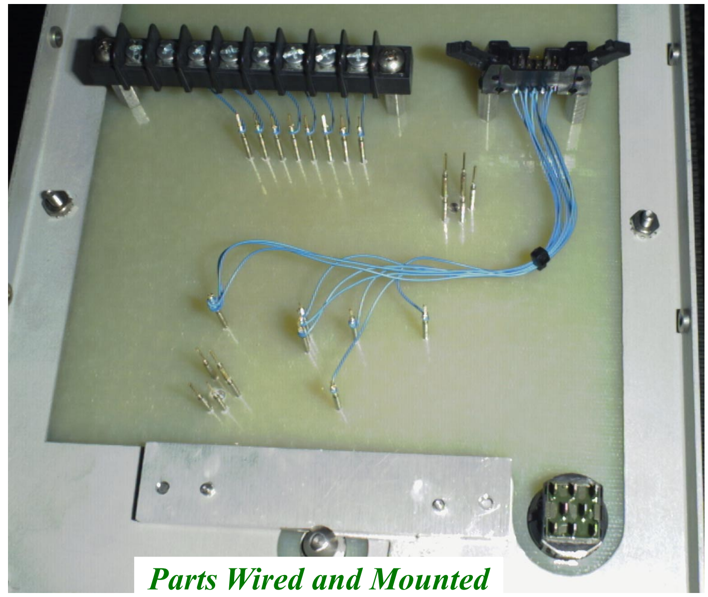
Planning and marking the planned wire routes with a fine point marker helps make the job of wire wrapping turn out much neater.

Wipe Off Wire Rout Markings

Wire, and Clean off Marks

Wire the fixture and then wipe markings off with Isopropyl Alcohol.

Assemble Components

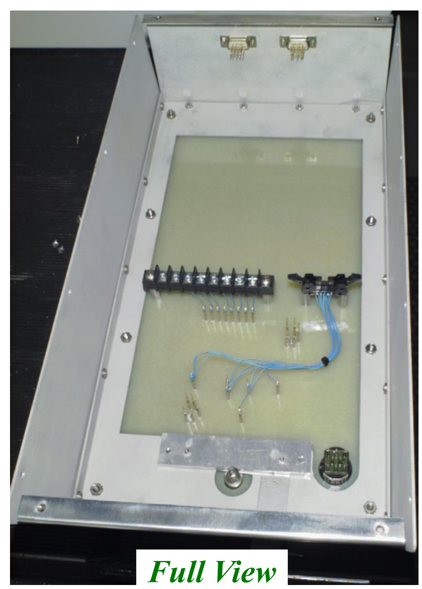


Parts Wired and Mounted

Shown above is the connector and terminal strip fully wired and mounted in place.

Full View of Fixture

Shows a full view of the inside of the fixture. The blank area in the back is where the controller board will be located. A flat cable will connect from the header connector to the controller board. The controller board will be controlled by RS-232 via two 9pin D connectors mounted on the rear panel of the fixture. The terminal strip is used for custom configurations in testing a various versions of the same board.



Full View

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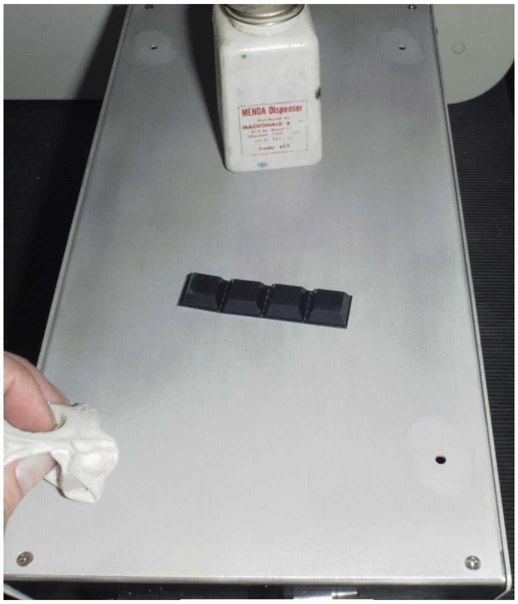
Adhere Rubber Feet

Assemble bottom plate and adhere the rubber feet supplied with the fixture kit. Use the 4 holes in the bottom panel as guides for locating the rubber feet. Prior to adhering the rubber feet, wipe off all oils and contaminates with Isopropyl alchohol to allow the feet to adhere better. These holes may also be used to perminently mount the fixture to a table top or a stand.



Rubber Feet

Bottom View

Completed Fixture

Completed bed of nails test fixture ready for production testing

Front View

Back View

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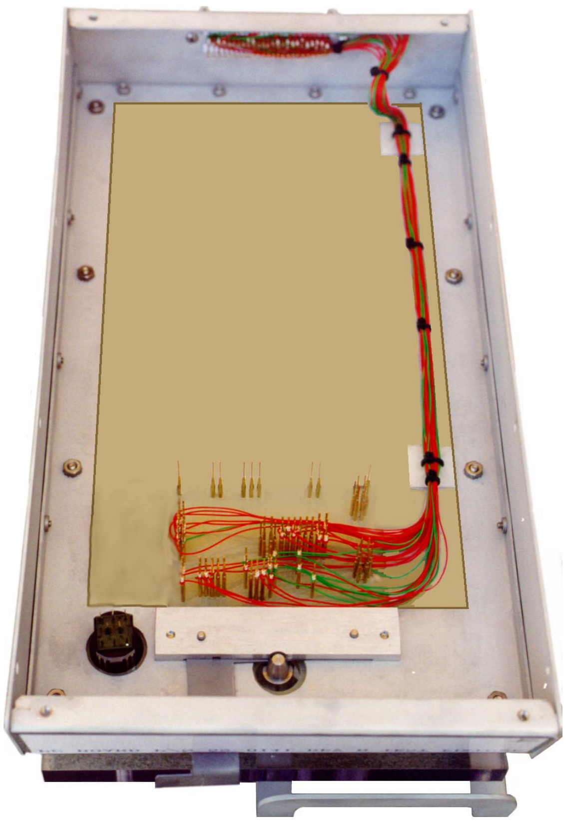
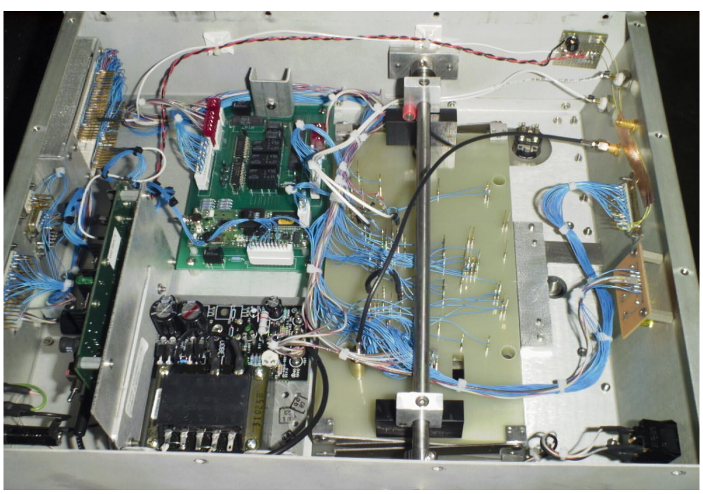
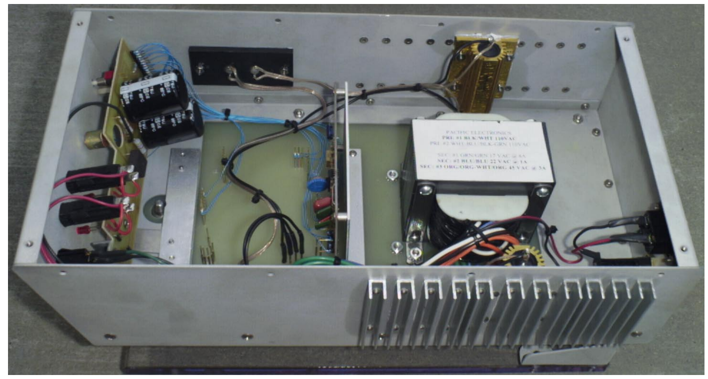
Other Internal Examples



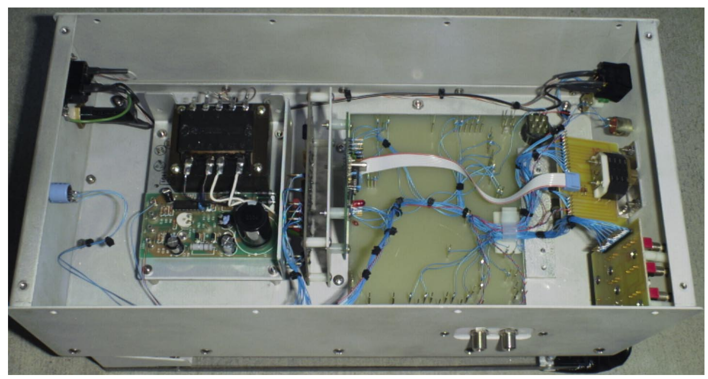
Simple Test Fixture Wired to Rear Panel Connector



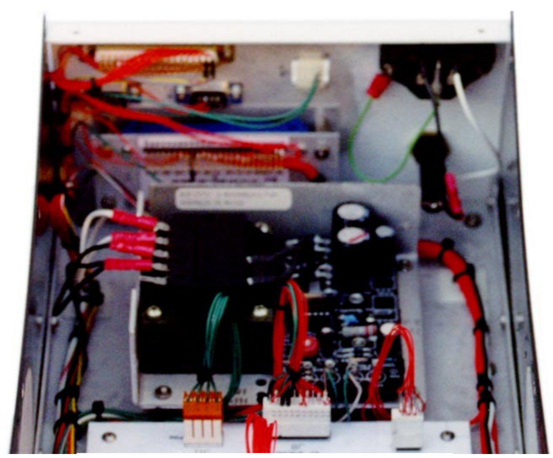
Complex



Heat Sinking Power Load Resistors



Perpendicular Board Mounting Saves Space



Internal Power Supply

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Updated Oct 2010. If this date is old, check for a newer version at http://www.testelectronics.com/bon.html

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Supply List

Receptacle Insertion Tools

TE100 or TE100M
TE075 or TE100M
TE050 or TE100M

Adjustable tools for mounting sockets at varying set heights. Available in inch or millimeter increments.
TI-100 are for setting size 0.100" rated receptacles
TI-075 are for setting size 0.075" rated receptacles
TI-050 are for setting size 0.050" rated receptacles
The "M" suffix designates millimeter dial increments.
Test Electronics **TI-100**
Test Electronics **TI-075**
Test Electronics **TI-050**

Wire Wrap Tool

Low cost hand wire-wrapping, stripping, unwrapping tool for AWG 30 on standard .025" (0.63mm) square test pin post
Test Electronics **TE-73365WWT**

Wire Wrap Wire

Kynar® Insulated Wire for Wire Wrapping is made with solid silver-plated, copper conductor, extruded kynar (polyvinylidene fluoride) insulation. Extremely tough, high cut-through resistance. Self-extinguishing, will not support combustion. Excellent ultraviolet and weathering resistance. UL rated at 105°C. Maximum temperature rating: 135°. AWG 30. Nominal thickness: 0.005. Nominal OD: 0.02.
Test Electronics **TE-4391430AWG**

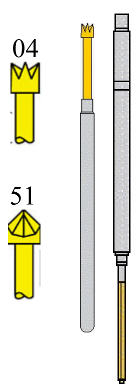
Test Pin Kits

Qty 10 test pins and receptacles per kit.
Part number specifies head style and size

Test Electronics ....**TP100-_ _ - _ _ _**

04 **100**
51 **075**
050

head style
size center to center

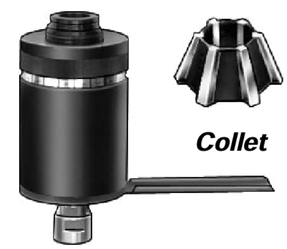


Finger Sensitive Drill

This handy attachment can convert your large drilling, milling, and jig boring machine into a slow-speed, finger-sensitive drill. This extra-sensitive adapter helps prevent rapid drill dulling and breaking as well as drill "walking" and deflection. Fingertip control allows you to feel the correct drilling pressure. Driller has a ball-bearing drill feed that's spring loaded. It automatically retracts when the gripping ring is released. Driller has a #0 JacobsT taper; hardened and ground ½" dia. shank (which fits into a drill chuck or collet); and ¾" travel length.

Finger Drill #30 J0 Albrecht Keyless Chuck 0-1/8" (0-3 mm)
Test Electronics..........**TE-2823A1-3100A45**

Self-Reversing Tapping Tool



Move from forward tapping to reverse smoothly and quietly. Designed for manually-operated drilling and milling machines, these attachments have a rolling ball that provides a friction free transition. Attachments reverse at 1.75 times the forward speed for increased productivity. They're self feeding to ensure gauge-perfect threading. Torque-control clutch stops tap when it bottoms to prevent breakage.
Cushioned drive eliminates cross threading and allows tap to pick up the lead of a previously tapped thread. Taps not included. Flexible collets are made of synthetic rubber bonded to hardened steel jaw inserts.

Tapping Tool 33 JT ....0-1/4" (1.6- 6.3mm)
Test Electronics **TE-8317A65**

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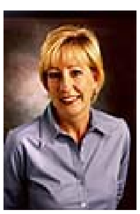
OEM Contacts

David R. Lay, President, Chairman and CEO
David has been Chairman, President and Chief Executive Officer of Test Electronics, Inc. since October 1997. Prior to October 1997, he served as the President of the Test Fixture Group since September 1990. From October [1986] until September 1990, Mr. Lay was Vice President, Finance and Chief Financial Officer of Test Electronics.

Mike Haskins, Sr. VP/Distribution Unit
Mike has been Senior Vice President, Distribution Unit of Test Electronics, Inc. since September 2000 and Vice President, Distribution from October 1997 until September 2000. Prior to October 1997, Mr. Haskins served as Vice President, Distribution of the Test Fixture Group since March 1993. He joined the Test Fixture Group in March 1992 as Vice President for European Distribution.

Joe Fritz**, **Sr. VP/Test Fixture Group
Joe has been Senior Vice President, Test FixtureGroup of Test Electronics, Inc. since September 2000. From October 1997 until September 2000, he served as Vice President and General Manager of the OEM business unit of Test Electronics, Inc. Prior to October 1997, Mr. Fritz served as Vice President and General Manager of the OEM business unit for the Test FixtureGroup since January 1996. He joined the Test Fixture Group in July 1988 as Manufacturing Manager.



Dr. Luan A Hinkle, Sr. VP/Test Equipment Group
Luan has been Senior Vice President, Equipment Group of Test Electronics, Inc. since September 2000. From October 1997 until September 2000, she served as Vice President and General Manger of the Industrial and Scientific Test Equipment business unit of Test Electronics, Inc. Prior to October 1997, Dr. Hinkle served as Vice President and General Manager of the Industrial and Scientific Equipment business unit of the Test Equipment Group since April 1995. She joined the Test Equipment Group in 1986 and advanced from fixture technician through a number of management positions to her current position.

Charles V. Chandler**, **Sr. VP/Assembly Equipment Group Charles has been Senior Vice President, Assembly Equipment Group of Test Electronics, Inc. since September 2000. From October 1997 until September 2000, he served as Vice President and General Manager of the OEM business unit of Test Electronics, Inc. Prior to October 1997, Mr. Chandler served as Vice President and General Manager of the OEM business unit for the Test Fixture Group since January 1996. He joined the Test Fixture Group in July 1988 as Manufacturing Manager.

About the Authors

Dr. Edward A. Armstrong Director of Engineering /Test Fixture Group
Edward has been Director of Engineering, Test Fixture Group of Test Electronics, Inc. since 1986. Prior to 1986 Dr. Strohm was VP Engineering at Test Point 1 Fixture design group. Prior to that, he served on the faculties of Stanford University, Stanford Linear Accelerator Laboratories, Harvard University and the Massachusetts Institute of Technology.

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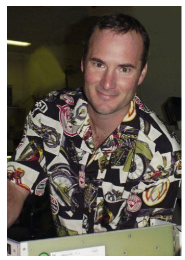
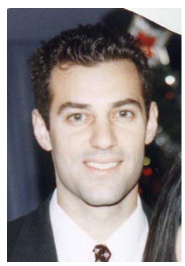


Matt P. Strohm, Sr. Design Engineer /Test Fixture Group
Matt has been Senior Design Engineer, Test Fixture Group of Test Electronics, Inc. since August 1993. Prior to August 1993 he was VP Engineering at Test Eng Inc. since 1986. Prior to 1986 Mr. Strohm was a test fixture design engineer at Genrad Inc.

Email: matt@testelectronics.com



Brian Clevenger, Technical Writer /Test Fixture Group
Brian has been a Technical Writer, Test Fixture Group of Test Electronics, Inc. since October 1997. Prior to October 1997, Brian served as Graphic Artist-Illustrator Test Fixture Group since March 1993. He joined the Test Fixture Group in March 1992 as an assistant publications technician.

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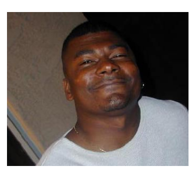
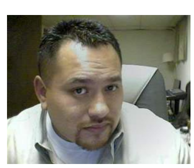
Rudy Hoffman, Machine Shop Supervisor Journeyman Machinist /Test Fixture Group.
Rudy has been a Machinist, Test Fixture Group of Test Electronics, Inc. since 1990. Prior to 1990, Rudy served as a Journeyman Machinist at Walkins Johnson Inc. Where he fabricated precision wafer handling equipment.



Rodney Drumming, Machinist/Test Fixture Group
Rodney has been a Machinist, Test Fixture Group of Test Electronics, Inc. since 1993. Prior to 1993, Rodney served as a machinist at Seagate Technology Inc. Where he fabricated IR reflow pallets for flex circuit board assembly.



Martin Herrera, Machinist/Test Fixture Group
Martin has been a Machinist, Test Fixture Group of Test Electronics, Inc. since September 1995. Martin Joined Test Electronics in 1991 as an entry level machinist. Prior to that he was an assistant machinist at Walkins Johnson Inc.

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