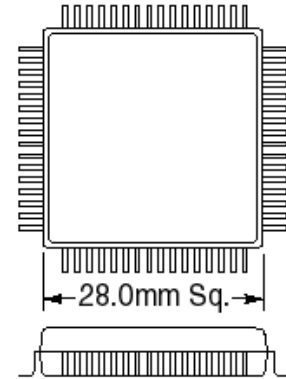


As microcontrollers are getting more complex, and more pins are added, package land patterns are getting finer. This can present a problem when trying to attach an emulator to a target board with a microcontroller such as Infineon's C167 or SGS Thomson's ST10. Without a good connection, even the best emulator is useless. The C167 and ST10 are 144 pin quad flat packs or QFP's with leads at .65 pitch. Nohau has a number of options, each of which has its advantages.

The following is a guide to assist design engineers in setting up a board to best accommodate the Nohau C167 or ST-10 emulator and adapters. If your board is already designed, this will help in identifying obstacles that may interfere with certain adapters.

The dimensions in this document are for reference purposes only. Actual specifications need to be obtained for actual board design. Contact Nohau or your local Nohau representative for assistance in choosing the adapter that's right for your needs.

By Jon Holmen  
Silicon Engines  
Des Plaines, Illinois  
847.803.6860



### BEFORE YOU ADAPT THE NOHAU POD BOARD TO YOUR TARGET

If the design of your target board is already set, there are a number of things to consider and be aware of when deciding how to connect an emulator to your target board.

- ⇒ The proximity of components to the microcontroller.
- ⇒ The height of near-by components and connectors.
- ⇒ The orientation of the microcontroller on the target board.
- ⇒ The orientation of the adapter. The adapter is not usually the same as the special emulation chip (refer to the manual or software)
- ⇒ The orientation of the emulator in reference to the target board. Understand that the adapter is usually connected to the bottom of the pod (the side opposite the special emulation chip)

It is suggested that you ohm out a couple of lines from the pod to the target **before** turning on the power. If a few address lines or port pins ohm out properly, it is likely that the adapter orientation is correct.

*It is the user's responsibility to ensure that the adapter connection is solid. Without doing so, the Nohau emulators do not function properly and can be damaged.*

### Installing Adapters

Care must always be given with any adapter you use. Gently press the adapter halves together, or on the target board. Use **no more than normal finger pressure**. Make sure the adapter is seated evenly.

### Removing Adapters

If it is necessary to remove an adapter once it is installed, use **extreme caution** to avoid damaging the PC board. **Do not use a sharp instrument** (for example, a screwdriver). Instead, we recommend using a plastic or rubber coated instrument, such as the handle of rubber coated pliers. Then, gently raise the adapter up from the board by inserting the coated instrument at each corner between the pins and carefully pushing up *on the adapter* (do not let the instrument touch the board itself). This can result in minor damage to the adapter, but does ensure that no damage is done to the board.

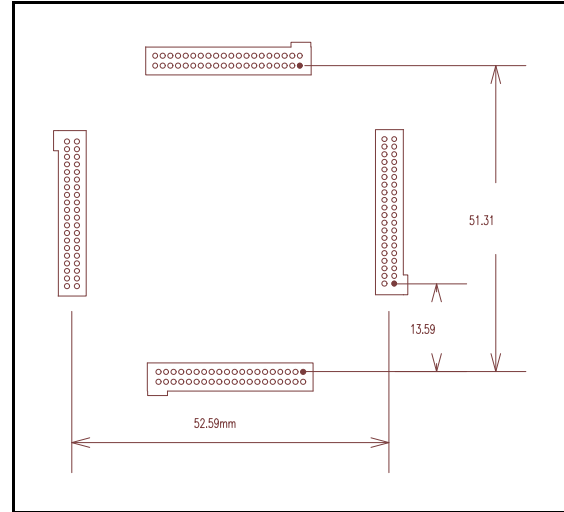
## Pod Direct

The easiest, most reliable, and cheapest method to use is the “pod direct” connection on your target board. This method involves designing the four special dual inline headers shown to the right, onto your target board. Although reliable, this method does take up additional real estate on the board, even if the headers are not populated for production boards..

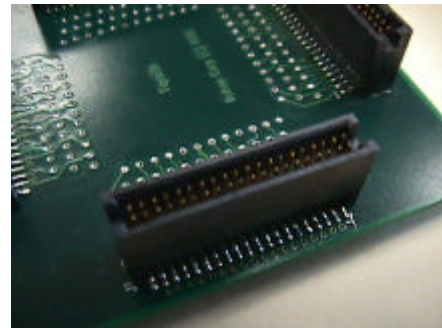
If you are using a Phytex evaluation board and purchased it through Nohau, a direct connect adapter, ADP/EVAL-167CR, with the necessary headers is included with it. For more information on the ADP/EVAL-167CR adapter, check out the article on Nohau’s web site under technical papers.

This adapter is designed to connect Nohau's EMUL166-PC and EMULST10-PC emulators to targets containing a 144 pin Infineon C167 or SGS-Thomson ST-10 processor. An industry standard layout for the target PC board is employed. This connector will adapt the Nohau emulators to the Phytex Kitcon-167 evaluation board sold by Infineon. It will also work on their C161 and C164 boards. For a custom target board, pads must be provided for the four surface mount sockets.

For detailed mechanical specifications for these pads, please contact Nohau Technical Support at support@nohau.com.



**Header layout**



## Extender

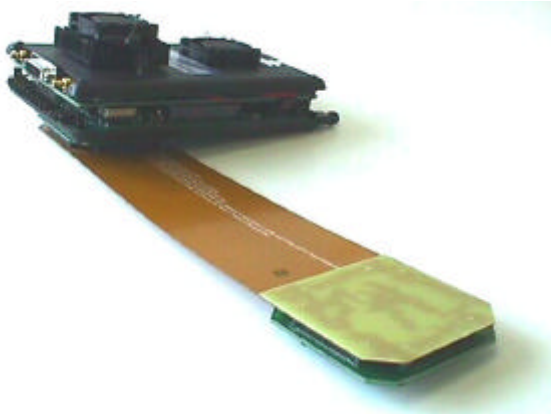
In cases where there is not enough clearance under the pod for taller components or connectors, Nohau has an extender that will work with any of the adapters discussed in this guide. The adapter is easily installed and allows an extra 12mm clearance for your emulator.

**NOTE:** This extender only works with C16x derivatives with no X-Peripherals, or with X-Peripherals on port 4 only, unless additional wires are run from the emulator to the target.

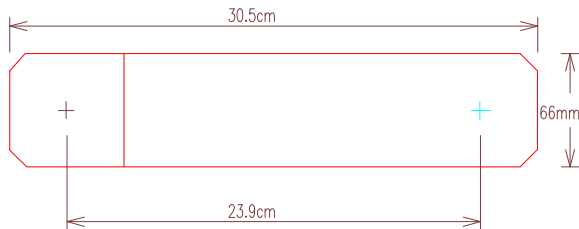


**C166/ST-10 Extender**

# Flex Extension and Extender cards

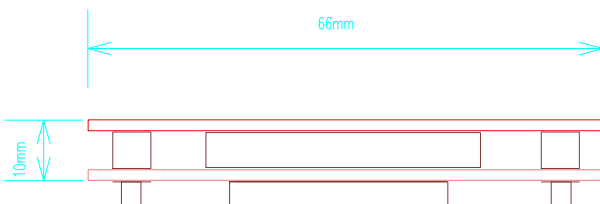


In case you need to access components or test points on your target board that are blocked by the emulator, there is a flex extension that allows you to move the emulator off to the side of your target board. From center to center, you can move the pod about 24cm away. It has been tested up to 100 MHz without signal loss, but at faster speeds it is necessary to use the crystal on the pod.



The unique design of this extension cable has two rotational boards that allow you to offset the pod 0°, 90°, 180° or 270° from the microcontroller socket on your target board. The flex cable is a universal cable for all the emulators, but the removable rotational boards are emulator specific. Check with your local rep or Nohau to see if rotational boards for your emulator are supported.

The cable and rotational boards are clearly marked, and very easy to configure for the proper angle. The rotational board adds an additional 10mm from the top of the connectors on your existing adapter. This should not cause a problem



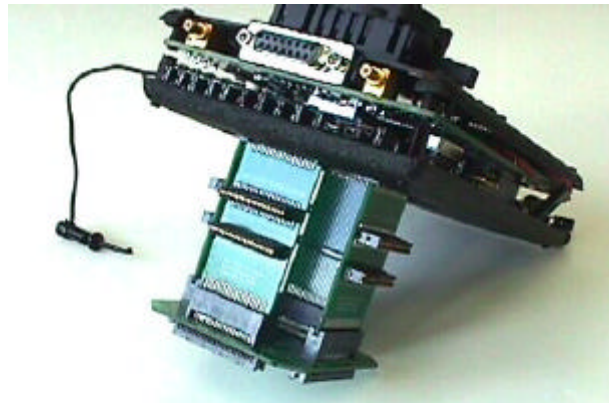
Side view of pod side rotational board

unless you are trying to attach to a target board in a tight card cage.

The flex cable is not designed for dynamic flexing. The cable will bend, but the bend radius should be one inch or greater, and preferably bent in only one direction. If you are using the flex cable for multiple applications, the flex connectors must be inserted and removed with care, otherwise it could result in solder pad lifting and/or trace breakage.

Another very helpful accessory is the extender card set shown below. This is a set of four circuit boards that insert into each of the headers and raise the pod 56mm. Each board has a set of jumpers for every line which will allow you to monitor or disconnect any single pin from the pod to the target board.

Each line is easily identified with a silk



Extender cards on an ST10 pod



Jumpers on extender card

screened number next to the jumper. The jumpers can be removed or pushed down allowing space above them for connecting a probe while they are still attached. Any combination of jumpers can be removed or monitored for trouble shooting.

These extenders will work on either end of the flex extension, or connect directly into any of the adapters in this document.

To see if either of these will help solve a target board access or signal isolation problem, contact Nohau or your local Nohau representative.

# Solder-down Adapter



The two part solder-down adapter is also a very secure and reliable part. The bottom has the same footprint as the microcontroller, and is soldered onto the target board in place of the microcontroller. A removable transition board that attaches to the emulator, plugs on top. Although this is a very secure method, the bottom portion cannot easily be removed and should be considered a one time use, permanent part.

If you need to alternate between the emulator and the actual microcontroller, an additional board for this adapter is available from the vendor. The microcontroller can be soldered on top to make a removable microcontroller board that can be inserted instead of the emulator.



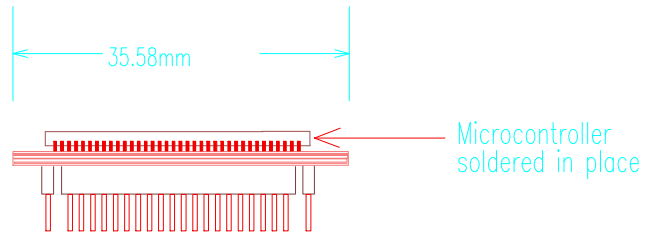
**Bottom solder-down portion**

The fine leads of this connector, however, can make it difficult to solder in place, and can easily be damaged if an inexperienced operator attempts to install it. Usually this is not repairable once it's damaged and replacing will cost \$400.00. If you don't have the equipment or experience to install one of these, find a repair or

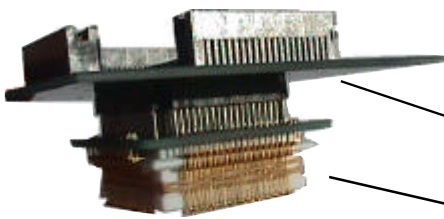
assembly facility that has the equipment to do it. You should be able to get it soldered on for about \$40.00.

The transition board that attaches to the emulator is about 71mm square, and sticks out about 20mm past the microcontroller on all four sides, (see the diagram below). The bottom of this transition board sits about 23mm above the surface of your target board. This should clear most larger components most commonly used.

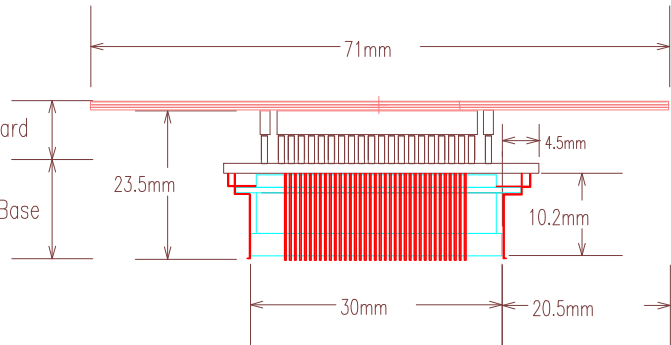
An additional board for the microcontroller that plugs directly into the solder-down base is also available. This board has the land pattern for the C167 on top allowing the microcontroller to be soldered in place. The emulator can easily be unplugged, and replaced with the microcontroller for final testing of your target board. This microcontroller board sells for \$150.00.



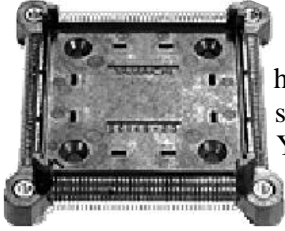
**Microcontroller board**



Transition Board  
Solder-down Base



# Yamaichi



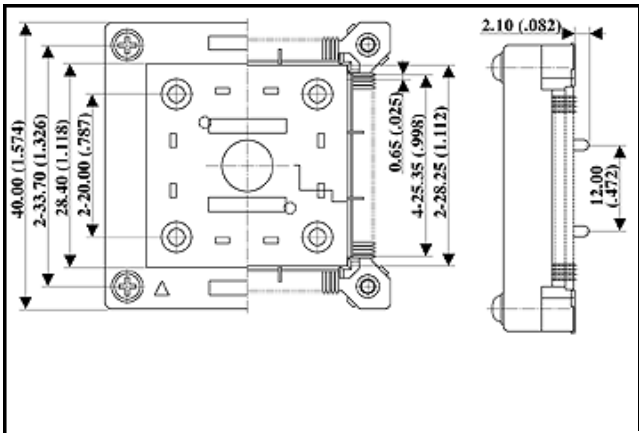
The Yamaichi adapter has proven to be a very reliable solution. This adapter needs a Yamaichi IC149 series socket, (shown at left), which is not included in the price of the adapter, and is not available from Nohau.

A Yamaichi IC149 socket is soldered onto the target board. The adapter then screws down onto the socket via threaded mounting holes, in each corner. The adapter can easily be removed and a microcontroller can be placed into the IC149 socket. Neither the microcontroller or the adapter are soldered into the socket, so they can be changed back and forth for the life of the project. If you need to do frequent changes, however, special care will be needed to make sure leads and contacts are kept clean.

The IC149 socket, however, is not a production socket and would only be used for your target board. It would be difficult to transfer from one board to another. There can also be a long lead time in getting these sockets, so make sure you get enough the first time you order them. Although not as costly as the base of the solder-down adapter, they average about \$100.00 apiece.

The Yamaichi adapter uses the same transition board as the solder-down adapter. Since the Yamaichi socket and adapter are shorter than the solder down, the transition board sits closer to the target allowing you only 19mm of clearance for a 13mm parameter around the adapter, (see the diagram below).

This socket also takes up more real estate

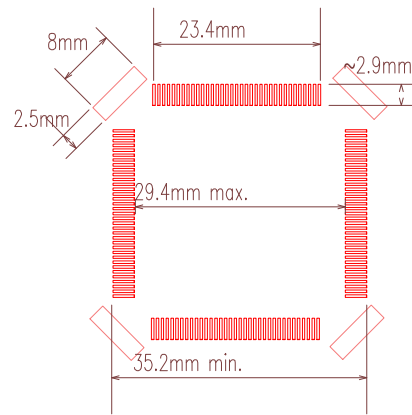


Yamaichi C149 socket dimensions

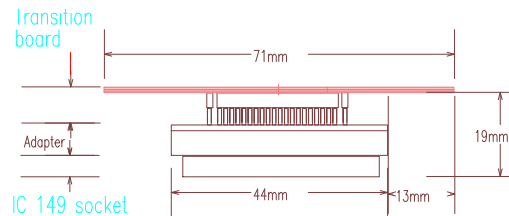
on your target board. The socket is 40mm square, and the adapter is 44mm square. The socket uses a slightly larger land pattern than the 167 microcontroller, and will not work with a conventional C167/ST-10 foot print.

Since the pads are longer than the actual microcontroller needs, there will be extra land protruding around the microcontroller when the boards go into production. This may cause a wicking problem with your finished product. A diagram of the necessary land pattern is shown below. Two alignment holes are also needed in your target board for the alignment pins on the socket.

The sockets are available directly from Yamaichi via the web at [www.yeu.com](http://www.yeu.com).



Land pattern needed on target board for Yamaichi C149 socket.

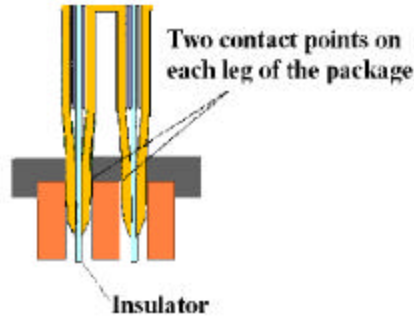


Adapter clearance

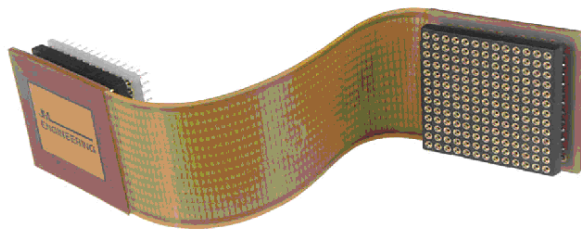
# Delta Probe

The Delta Probe is a good solution for a tight fitting adapter, development work with the microcontroller in place, or testing boards in production. Even if you are using another adapter for development, the Delta Probe is a good back-up adapter for testing field problems.

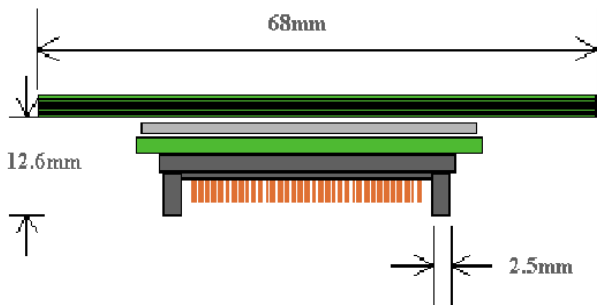
The Delta Probe is different from other clip-over adapters in the way it attaches. The conductors of the Delta Probe actually penetrate between the legs of your IC. Each wedge-shaped conductor of the Delta Probe consists of two separate conductors insulated from each other by a center insulator. Each leg of your IC package has two contact points, one on each side of the leg. The redundant physical connection between the wedges and the legs on the package increases the reliability of the electrical connection.



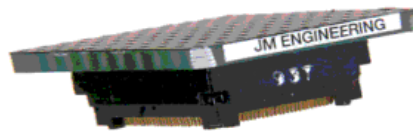
JM Engineering also has a flexible cable extension as shown below.



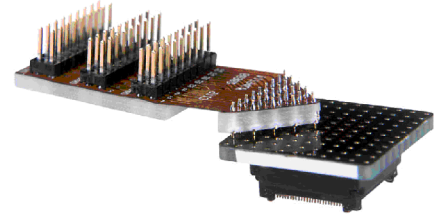
**JM Engineering's flexible cable**



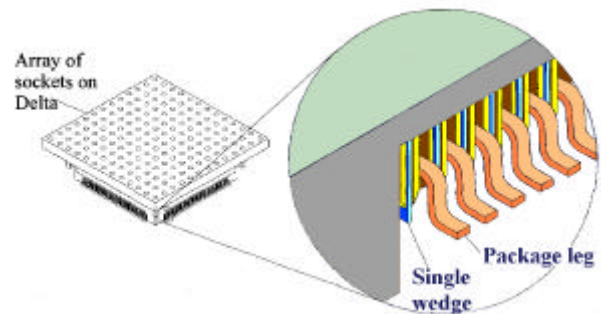
**DeltaProbe with Nohau transition board**



If you are not using an emulator, the Delta Probe also has flex quadrant adapters, shown below, that allow easy connection to a logic analyzer.



**Flex quadrant adapter**



Two clearance concerns with this adapter are the corner feet and the side overhang of the transition board.

The corner feet extend 2.5 mm out in each corner, so a small surface mount component in this area would prevent the adapter from seating.

The transition board is 12 mm off the target board and overhangs 18 mm past the edge of the microcontroller. Unless you have tall components very close to your microcontroller, there should not be any clearance problems with this. Additional extensions and JM Engineering's flexible cable are available to lift or move the transition board for additional component clearance.

These DeltaProbes are available for a wide variety of package types, but the only Nohau transition board presently available is for the 144-pin C167/ST-10 emulator.

## Elastomer 'clip-over' adapters

The elastomer 'clip-over' adapters, like the DeltaProbe, allow you to attach the emulator to your target board while the microcontroller is in place. Unlike the DeltaProbe, these adapters are highly unreliable.

Contact with the microcontroller is made through elastomer strips that press on the sides of the microcontroller. If not careful, however, when adjusting the emulator, you may dislodge the adapter.

The two most common adapters of this type are Emulation Solution's RoboClip and Emulation Technologies Hitex Press-on adapter.

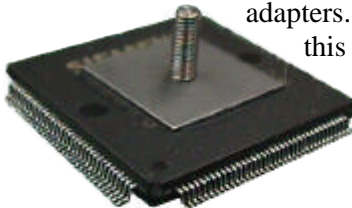
Due to the difficulties with these parts, they have been removed from the Nohau price list and are neither recommended nor sold through Nohau any more. It is extremely easy to damage these adapters or create shorts by offsetting the pins when positioning the adapter.

Clip-over adapters for 132+ SQFP pin packages and low profile PLCC sockets have the highest potential for failure due to bad connections, and only get worse with wear.

Contamination is also a concern and care needs to be taken not to touch the elastomer strips with your bare fingers.

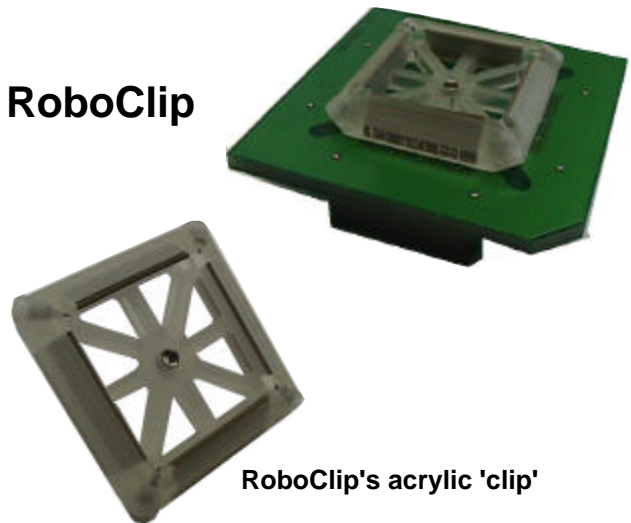
Multiple removals of these adapters are not recommended because the insertion number is low. They would not be a good choice if you need to continually change your target system or alternate between the emulator and microcontroller.

These elastomer strip adapters are included in this document for recognition and warning only. Your time is too valuable to waste it on a bad adapter. If you need to work on your target system with the microcontroller in place, I highly recommend the DeltaProbe.



**Microcontroller with bolt attached**

### RoboClip



**RoboClip's acrylic 'clip'**

The RoboClip is a two-part adapter. The elastomer strips are in an acrylic 'clip' that attaches to the existing microcontroller with four set screws. The transition board is then screwed on top using two guide pins for alignment.

### Hitex Press-On Adapter

The present Hitex Press-On adapter, needs a bolt glued on to the top of the microcontroller in order to hold the adapter to the chip. A new version is being developed that will grip the microcontroller's corners, eliminating the need for the bolt.



As in the RoboClip, there are four elastomer strips in the acrylic clip-over portion. Four short flexible cables attach the clip-over portion to the transition board. This allows more flexibility and better clearance for the location of components close to the microcontroller, but does still have some limitations.

The Hitex Press-On adapter is also the most expensive adapter available for the C166, at three times the price of the solder-down or Yamaichi adapters. For the high cost and low reliability, this adapter should only be used as a last resort.