K4HJU

Amateur Radio
Woodcreek, Texas

Prototyping and Proof of Concept Models Part 2

Rev 0.01
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A Work in Progress

K4HJU
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1. Introduction

I am a little reluctant and embarrassed to present this material due to the fact that to my knowledge a major part of the system is no longer available. This process has served me so well that I would like to present it and maybe some can either find some old stock to share with the community or inspire someone to produce a likeness of the unavailable product. I will discuss this in more detail below. Fortunately for me, I have sufficient stock to last for the rest of me.

This presentation will be made in two parts. The first part will provide the evolution and the second part will present the details of the current system. I am repeating the introduction of Part 1 for the benefit of those who want to skip the evolution of the technique.

Through out my lengthy career I have been chiefly involved with designing and building prototypes and proof of concept models. A good number of engineers seem to prefer to go directly to PC Boards (PCBs) with their designs. I find that this does not work well for me. Doing it this way there are too many opportunities lost. I find that a design will evolve through the process of building and working through the process in a way that a better end result is achieved.

Through the years I have a developed a process that really works for me and I would like to share my techniques. The problem with a first out system design on a PCB is that there is inadequate flexibility especially with surface mount components. I prefer that my prototypes remain fluid right up to the finish and then commit to a PCB. I have been fortunate in my career in that most of the time I was doing product research and proof of concept modeling for new products and technologies. Most of these designs were of a kind where a similar model had not been made before. I would build the working prototype and then turn the working design over to my client to polish and package. A few times I have gone full cycle with a product. As a result I have developed some techniques that really work for me and I would like to share them with you. I know of no one using these techniques other than myself.

A lot of the time the terms breadboard and prototype are used interchangeably. Most hams are aware where the term breadboard comes; however some of the new folks may not know it's origin. In the "old" days prototypes were built up upon wooden boards. Boards from the kitchen that bread was made on; thus "bread" "board". I still have some Bell Labs breadboards in my lab. Today prototypes and components have changed considerably and different techniques are required, yet the name sticks.

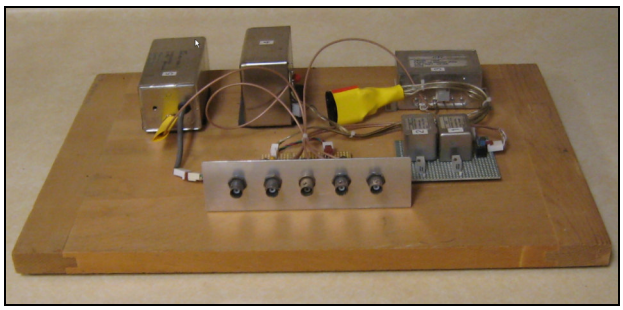


Figure 1-1 Breadboard

I have built systems employing vacuum tubes on aluminum chassis's. Today I am using modules made with surface mount components lashed together using insulation displacement connection (IDC) wiring to build complex flexible systems. There has been quite an evolution in the process. Here is an example of what I have evolved to and then I will go to the evolution of my technique.

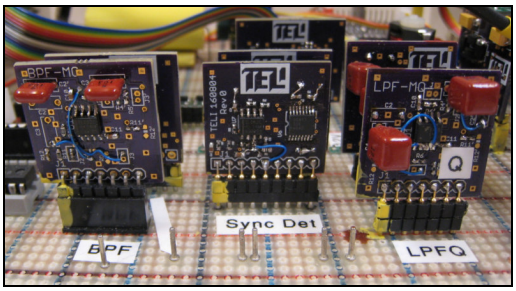


Figure 1-2 Small Functional Modules

At present I am using functional modules that I design and have PCBs made that employ surface mount components to achieve a relatively high density. It turns out that this is an economical approach, as the cost of the PCBs is $5 per square inch for three boards with no setup fee. Therefore, if something needs a little tweaking or an error needs to be corrected, it is economic to do so. The modules once designed are available for other systems in the future.

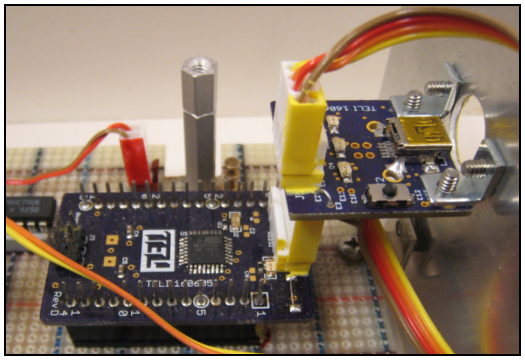


Figure 1-3 Microprocessor and USB-RS232 Modules

One of the modules I designed early on was my version of the early Arduino microcomputer board. The Arduino board did not suit me for a number of reasons. I wanted more pins and I wanted to separate the USB-RS232 function from the microcontroller board. I found that, particularly in those days the USB cable would "man-handle" the board the Arduino was mounted on and I wanted to avoid that by mounting the USB-RS232 module to the panel. Figure 1-3 shows one example of the microcontroller board and the separate USB-RS232 module. I have used this configuration on many of the systems I have designed.

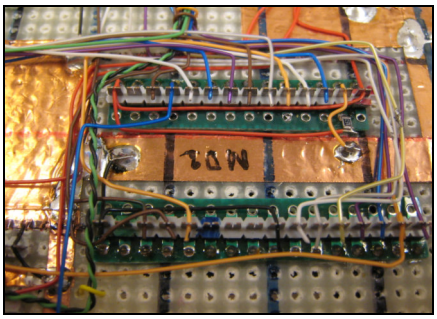


Figure 1-4 Insulation Displacement Connection (IDC) Wiring

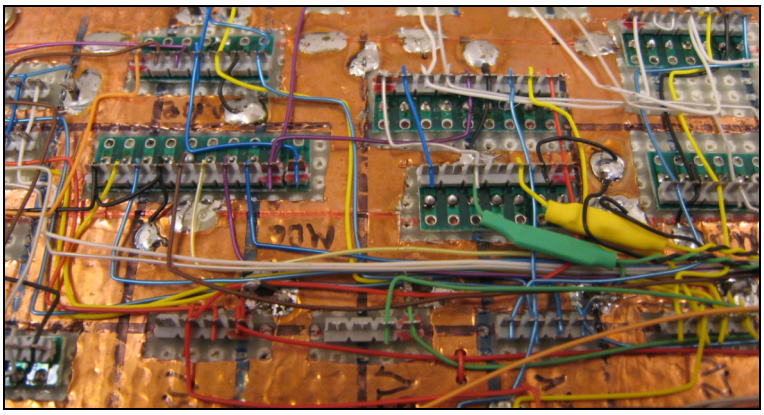


Figure 1-5 IDC Wiring

The connections are made using 3M IDC strips and 30 ga. wire-wrap wire. This allows an easily changeable, traceable and documentable configuration.

2. My Current Prototype System

All of this has lead up to my current prototyping system that will be described in part 2.

Scotchflex®

3M

Scotchflex 3303 Breadboard Kit Assembly Instructions

Basic Breadboard Kit Without P.C. Board

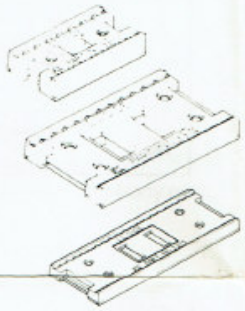
3M Part Number	Description	Quantity
3303-0000	3370-1000 Dual Socket (16 position)	12
	3374-1000 Dual Socket (24 position)	8
	3375-1000 Dual Socket (40 position)	4
	3397-1240 Plug Strip (24 contact)	24
	3397-0240 Solder Strip (24 contact)	16
	3522 Insertion Tool	1
	3527 Universal Breadboard Tool	1
	3369-1000 Break-off Tool	1
	3567 25 ft. of 30 AWG Solid, Insulated Wire	1

3522 Insertion Tool

One end of this 3522 Insertion Tool is used to insert wire into "U" contacts. The other end simplifies insertion of Plug Strips into PC boards.

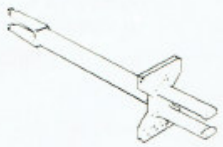
24 Dual Sockets

These contain 16, 24, or 40 contacts, each of which will accept a DIP leg from the top and a plug strip tail from below. The Dual Socket provides interface between a dual in-line I/C and discrete-wiring contacts. (Also available in 8, 14, 18, 20, 22, and 28 positions.)



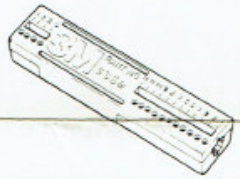
3527 Universal Breadboard Tool

This device lets you extract dual sockets easily and also insert or remove plug strips without depressing or bending contacts.



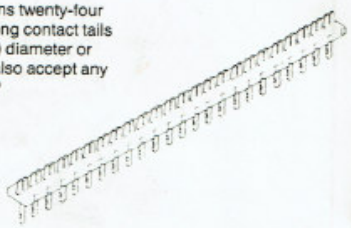
3369-1000 Break-Off Tool

Used to break Solder or Plug Strips to any desired length up to 12 positions.



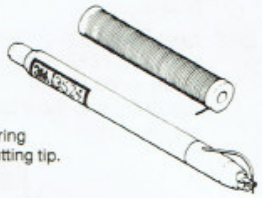
24 Plug Strips

Each of these strips contains twenty-four 2-wire "U" contacts. The long contact tails fit through .035" (0,89 mm) diameter or larger PCB holes and will also accept any of the Dual Sockets for DIP connection.



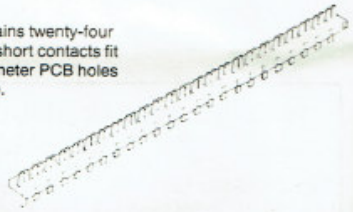
Optional 3524 Insertion Tool and 3567 Wire Spool

This deluxe tool provides fast interconnection throughout wiring network with self-contained cutting tip. Wire spool is easily replaced.



16 Solder Strips

Each of these strips contains twenty-four 2-wire "U" contacts. The short contacts fit into .035" (0,89 mm) diameter PCB holes and are soldered in place.



3567 Wire Spool

25 ft. of 30 AWG Solid Kynar*, Insulated Wire (random colors) for insertion using the 3522 Insertion Tool. No stripping is required.

Breadboard Kit With P.C. Board

3M Part Number	Description
3303-1000	P.C. Board compatible with the Intel SBC-8010* plus all items of the basic kit listed above.
3303-2000	P.C. Board compatible with the Motorola M-6800 Exorciser* plus all items of the basic kit listed above.
3303-3000	P.C. Board compatible with the S-100 plus all items of the basic kit listed above.
3303-4000	P.C. Board compatible with the Zilog Z-80* plus all items of the basic kit listed above.
3303-5000	P.C. Board — single Eurocard format — plus all items of the basic kit listed above.

*SBC-8010 is a trademark of Intel Corp.
M-6800 Exorcisor is a trademark of Motorola.
Z-80 is a trademark of Zilog, Inc.
Kynar is a registered trademark of Pennwalt Corp.

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