THE EXPERIMENTER

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Darrell Davis KT4WX – Newsletter Editor

FROM THE WORKBENCH

By Darrell Davis KT4WX

Editor – THE EXPERIMENTER and ARRL Technical Specialist

Welcome to the reboot of the THE EXPERIMENTER or the EXPERIMENTER 2.0, if you please. I started this newsletter in the year 2000, when I was Technical Coordinator for the WCF Section. Geoff Haines N1GY, my successor as Technical Coordinator, continued this letter after I stepped down as Technical Coordinator in 2004. But sadly THE EXPERIMENTER went out of publication in approximately in 2010 due to lack of submission of articles and it had become, "What did N1GY do this time?" Geoff is a fine writer, as evidence of his numerous articles in QST attest to his good writing. But the newsletter should not be about one person's work. It should include the works of many of our fellow hams.

I approached Geoff late in 2012 about rebooting THE EXPERIMENTER and reassuming the job of editor and publisher, after missing its publication. Geoff agreed and you are now seeing the fruit of that labor of hopefully what will be first of many issues. What we will need to stay in publication? Articles from ham radio operators and even non hams who would write articles of interest to amateur radio. If you have an idea (Hints and Kinks as they call them in QST), an article or are even interested in doing a regular or periodical column, please let me know. If you feel you need help writing, I can assist you with getting your idea in print with an article that will help your fellow amateur radio operator. You can send those to my email address at the top of this column. Get those articles ready and until next time, 73!

CALL FOR ARTICLES

Calling now for articles for the next issue of THE EXPERIMENTER. Please have those articles to Darrell Davis KT4WX by the end of the month of July. rrell by the following:

Email: kt4wx@arrl.net

Phone: ***(863) 245-9923***

US Mail: ***6350 Mills Road, Fort Meade, FL 33841-9584***

Website: http://www.kt4wx.org

Don’t Timeout The Repeater

Geoff Haines, N1GY
ARRL WCF Section Technical Coordinator

I came across this little circuit on a web site for the Electronics Club which is an English group that is for participants interested in electronics and the DIY building of electronic devices. The circuit on their web site was slightly different than the one shown here. They did not have a reset button (Switch #2) and they used a 1 meg ohm variable resistor (potentiometer) in place of the 440 K ohm resistor shown in the schematic. The circuit as shown is the way I built it but you are free to modify it as you see fit. Of course there are no guarantees that it will function as mine does if modified from the circuit shown. I also used a different PCB than the original. They used strip board to build the circuit on, I used a prototyping board from Radio Shack. Either way works, I just had the RS item on hand.

The circuit uses a 555 timer chip and once the power is applied, or reset with switch # 2, the green LED lights up and the timer begins its work. After about 2 minutes and 20 seconds the red LED lights up and the piezo electric buzzer sounds off until power is shut off or the reset button is pushed. Once the reset button is pushed the current is momentarily interrupted and the timing sequence begins anew. Hit the reset button when you start talking on the repeater and the timer will warn you if you get too long-winded. If you stop before the buzzer and the red LED go off, just hit the reset button to start the timer again.

I chose the value of 440K ohms for R4 because that gave me the time span I wanted. If you choose to substitute the 1 meg ohm potentiometer for R4 you can adjust the time span to another value by adjusting the potentiometer. A note of caution: I originally built this device using a 10 K ohm pot. I was unable to get the time span to last longer than about 30 seconds. When I added a string of series resistors in series with the pot to make 1 meg ohm the circuit never timed out even after 20 minutes. The 440 K ohm value was found by trial and error to give me the time span I wanted.

Radio Shack has all of the parts for the project listed on their web site. The soldering of this project is relatively easy. Use a relatively low power iron (about 25 to 30 watts), small diameter solder with flux and work one step at a time

Have fun and don’t forget: Don’t Time Out the Repeater.

Parts List – 555 Timer

BZ1 – 9 to 12V Piezoelectric Buzzer
C1 – 220µF 16V Electrolytic
C2 – 0.1µF Ceramic
D1 – Green LED
D2 – Red LED
PCB – Radio Shack Cat #276-159
V1 – 9V Battery

R1 – 470Ω ½ W resistor
R2 – 33KΩ ½ W resistor
R3 – 100KΩ ½ W resistor
R4 – 440KΩ ½ W resistor
S1 – Single Pole Single Throw (SPST) Switch
S2 – Normally Closed Push-button Switch
U1 – NE555 Timer – 8 Pin DIP

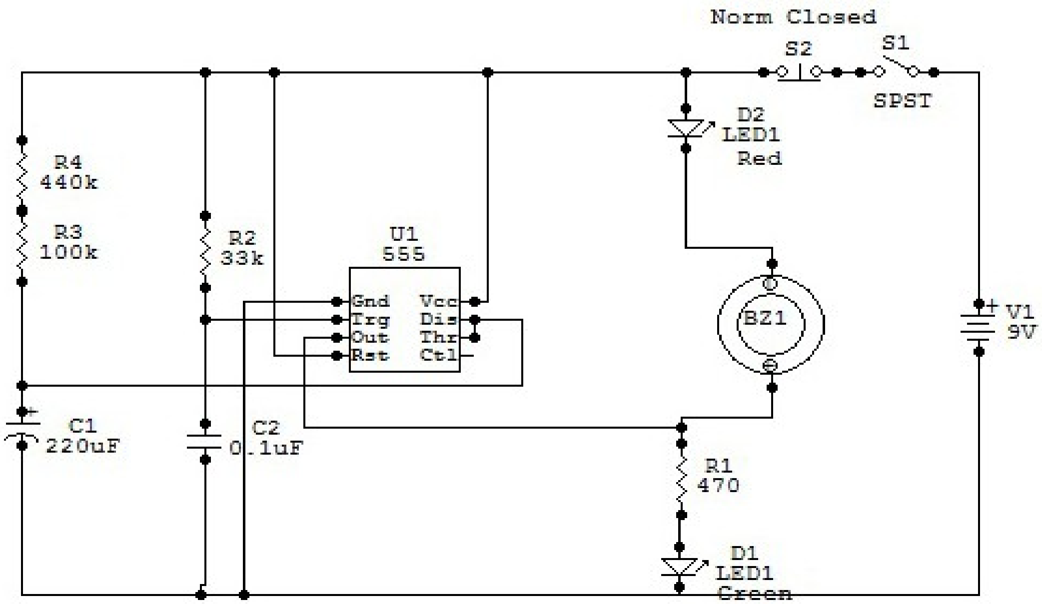


Figure 1 – 555 Based Timer

A Portable "Hamstick" Dipole

Buddy Morgan WB4OMG
ARRL WCF Section Technical Specialist

I purchased Two 80M hamsticks at the 2013 Orlando hamfest. I was thinking that there were 60M models, available, but I did not see any at the hamfest. I only found one website that lists a 60M model. I did make an inquiry. 60M hamsticks not currently being manufactured.

I bought the bracket to make two mobile whips into a dipole. The goal was a small deployable 80 Meter antenna, for EMCOMM purposes. The same techniques, used here, could be used on any band, with two identical mobile antennas, for that band.

The bracket just won't quite mount on a one-inch mast. I went to Home Depot and bought a three-foot length of 3/4" conduit to mount the bracket (less than four bucks, with tax). I used my umbrella base, with sections of five-foot extension mast to mount the antenna. I got the antenna about six feet off the ground: a convenient height for tuning.

The bracket was not well thought out, at all. The machine screw that holds the shield side antenna is too long. The hamstick would not screw in completely. With a short voltage fed antenna, like this, a minor difference in length would cause a noticeable imbalance and would probably make the antenna (system) difficult to tune. I put a couple of washers and a lock washer on the machine screw, to fix the problem.

The antenna tuned nicely. I got the SWR down below 1.5:1 @ 3911. I did not spend a lot of time tuning. I just kind of got it in the ballpark, because I knew I would have to make some changes before final tuning. With any short antenna, like this, you will not be able to change frequency very much. But, with a radio manufactured in the last 15 years or so, with a built in tuner, you should easily have 10 KHz or so to QSY. Note: without an antenna bridge, tuning would have taken a long time. There are two things that I think need to be done to the antenna system to make it work well:

The SO 239 connector is coaxial with the antennas. This means that the cable will parallel the antenna for a few inches. It would be worse using RG-8 sized cable than RG 58 sized cable. I consider this to be a problem. I put a right angle adapter on the SO 239. It brought the SWR down a bit, but did not change the resonant frequency. This should also improve the pattern and cut down on feed line radiation.

Speaking of feed-line radiation. With a voltage fed antenna like this, feed-line radiation is going to be a problem. Moving the coaxial cable around made a difference in tuning. For EMCOMM deployment purposes, this is unacceptable. Not to mention that power is going to be inefficiently radiated by the coax.

I built a current balun out of an Amidon FT-240-77 core, with as many turns of LMR 195 wound on it, as I could get. Please note, LMR 195 or similar foil shield cable will work a lot better than plain old ordinary RG 58, for this purpose. I put a crimp on PL 259, with a very short lead, on the antenna side of the balun. On the radio side of the balun, I used another crimp on PL 259, with a PL 258 adapter. I have found crimp on connectors to be less troublesome, than traditional UHF connectors, for portable antennas.

Adding the balun, lowered the resonant frequency about one KHz. Inductance of the shield choke?

I got the antenna about nine feet off the ground for its final tuning. This gets the antenna high enough that someone could not touch it, while it is being used. (The NVIS people would probably think this was too high!) The antenna tuned nicely. Got the SWR down to 1.2 @ 3911/3913 KHz. I wound up with three feet of metal whip, showing. With the balun, you can move the feed-line anywhere you want and not affect tuning.

We have two hamsticks screwed into the bracket. The bracket is bolted to a piece of 3/4 inch conduit. How to handle the mechanical aspects of this antenna, is going to be up to the user. Cable tie it, Hose Clamp it or U Bolt it to whatever vertical support is available.

For EMCOMM purposes, this should be a great antenna for use at a location that is too far away for VHF FM simplex.

Parts List: Portable "Hamstick Dipole"

2	**80 Meter Hamstick Mobile antennas**	**Tower Electronics**
1	**Dipole Bracket**	**Tower Electronics**
5	**LMR 195 Coaxial Cable or other RG 58 sized cable**	**AES or HRO**
1	**FT-240-77 Ferrite Core (Amidon)**	**Amidon Associates**
2	**Small Cable Ties**	**Local Hardware Store**
2	**PL 259 UHF Male Connectors**	**AES or HRO**
2	**Right angle UHF Adapter UHF F/UHF M**	**AES or HRO**
1	**¾" Conduit**	**Local Hardware Store**

A Neat Little Polarity Tester

Geoff Haines, N1GY
ARRL WCF Section Technical Coordinator

This little gadget is very easy to build and it might save the user some grief when the time comes to hook your radio up to someone's power source. Although the standard for Power Pole connectors is well publicized and has been around for several years, not everyone seems to have gotten the message. The last thing you want during the response to a disaster is to disable your radio by connecting it to an improperly assembled power source. A slick way to determine the proper polarity was shown in the “Hands on Radio” Column by H. Ward Silver, N0AX, in the January 2013 issue of QST.

This is a very compact device. The first one I built had a separate enclosure for the circuit and was connected to the Power Poles by a short length of zip cord. The next two that I built had all of the circuitry and components right on the end of the Power Pole connector. Sealing the circuitry with a little hot glue at the back of the connector made everything insulated and secure. Just remember to solder all the components to the contacts of the Power Pole connector before you insert the contacts into the connector shells. It also helps to keep the leads as short as possible. In fact, I soldered the 1K resistor right into the back of the contact so just the resistor body and the open lead were visible. Also wise is to solder a short length of bare solid wire into the other contact and then solder the leads from the LEDs to it and trim the excess. The photo on the right is not the best but you can see the red and green LEDs at the back of the Power Pole connectors to the left and right of the prototype. That enclosure, by the way, is the exterior shell of an otherwise dead LED night light bulb. Hint: the way to tell the positive lead on an LED that does not have a flat side is that the positive lead is the longer one. Also, I used some very short pieces of small diameter heat-shrink tubing to isolate the LED leads from one another when making the smaller units because they are quite close together.

This, as I mentioned before, is a really easy project to get you started on building your own accessories. It only has 3 components plus the Power Pole connector. If you like, you could easily add a key ring to it and keep it in your pocket. I will be putting mine right into my “Go-Kit” with the radio. 73!

Parts List: Polarity Checker

D1 – Green LED
D2 – Red LED
R1 – 1kΩ ½ W Resistor
P1 – Anderson Power Pole in size needed

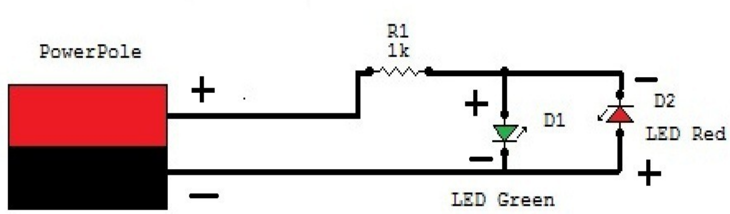


Figure 2 – Schematic of Polarity Checker

Lake Wales Repeater Association
2 Meter Antenna Building Session
Submitted by Christine Duez KK4KJN

The Lake Wales Repeater Association held an antenna building seminar at the Kiwanis Park in Lake Wales on the February 23, 2013. Howard WB4NYT, had demonstrated the simplicity of building a 2 meter antenna at the monthly meeting and offered to oversee a seminar.

Beginners as well as experienced antenna builders attended the event. LWRA provided the tools, materials, and instructions needed for the project. LWRA President, Thomas K4KH, procurred the park, tools, materials, and instructions needed for the project. LWRA provided the needed funds.Howard WB4NYT, again offered his expertise. Each participant built a stacked 5/8 wave VHU antenna. This antenna is very powerful and offers a 6db gain. Many opted for a fold-able model that would allow for easy transport and deployment in emergency situations. All the antennas were tuned to a desired frequency and the position marked for quick assembly. We started our hands-on workshop around 10am and most of the antennas were completed by 12pm.

Editors Note: Howard WB4NYT gave a demonstration of this antenna and how to build it a the LWRA meeting in February 2013. Listed below is the documentation that was given out at the antenna building seminar. The diagram is a drawing of the antenna construction.

Stacked 5/8 Wave VHF Antenna Project

Parts:

1. *(1) 10ft. Section of 3/4” PVC pipe*
2. *(2) Ground lugs made from aluminum ground bars found at Home supply stores Each piece needs to have two lugs each, you will have to cut these from the lug strip.*
3. *14.5 ft of 10 or 12 gauge aluminum wire. Found at radio shack in 25’ foot coils.*
4. *Zip ties to attached to pipe.*
5. *Alternate: (1) 3/4” PVC coupling to facilitate folding the antenna in half for travel in a car.*

Construction:

1. *If this antenna is to travel in a car for deployment then cut the PVC at the 5 foot mark and insert the coupling, and put the section of PVC back together. DO NOT GLUE THIS JOINT!*
2. *Measure 47.51” inches down from the top of antenna and make a mark with a sharpie. This is where you will drill your jmmfirst hole straight thru the pipe.*
3. *Measure 1” inch down from the first hole make a mark, this is where you will drill your second hole straight thru the pipe in line with the first.*
4. *Measure 66” inches down from the second hole center to center make a mark,*

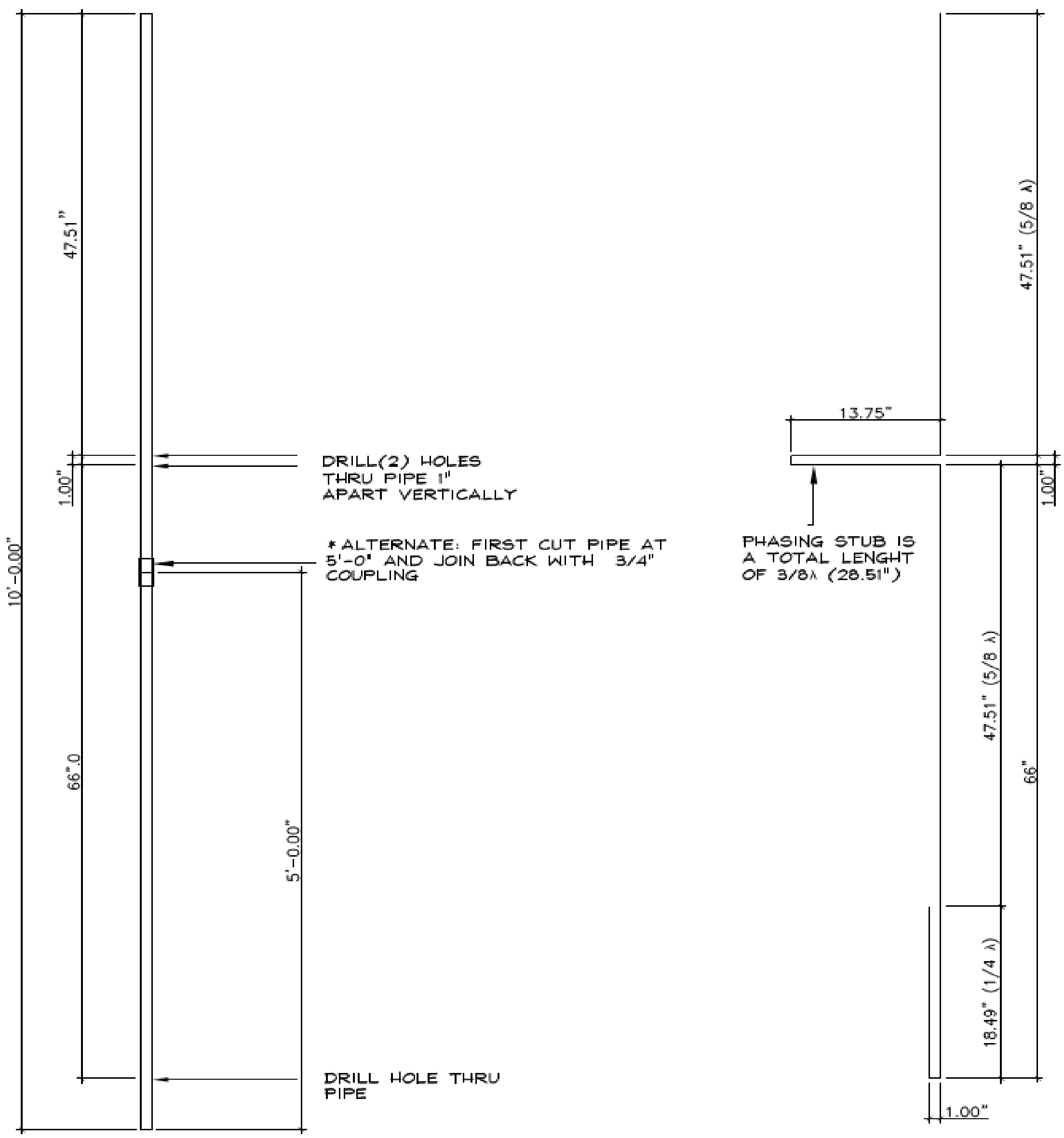
this is where your will drill your third hole straight thru the pipe in line with the second.

5. *Measure and cut 14.5' Feet of the aluminum wire.*
6. *Measure and mark with a sharpie pen on the wire in the following order: 47.51" inches, (The phasing stub is a 3/8 wave total so distance so mark this way 13.75" inches, after that 1" inch, after that 13.75" inches), after that 66"inches. Or you could do it this way 47.51", 61.26", 62.26", 76.01", 142.01", if you have a long enough measuring tape to stretch along the wire. Keep the wire as straight as possible during this time.*
7. *Take the upper half of the wire and feed thru the upper hole until the first mark just comes thru, bend 90 degrees upwards along the PVC pipe and attach against the pipe with the zip ties.*
8. *Take the lower half of the antenna and feed thru the lower hole until the fourth mark just comes thru, bend the wire 90 degrees downward and zip tie to the pvc pipe in line with the upper wire, BUT remember to check and make sure you have the two 28.51" runs of wire with 1" separation, form those up neatly (see drawing).*
9. *Now take the lower part of the wire and push on one of the ground lugs you cut, (use the outer most lug slide it up past the 5th mark and lightly tighten.*
10. *Now push the wire thru the lowest and third hole until the 5th mark is against the pipe, take the remaining stub of wire and slide the other lug on, again use the outer most lug hole, line up the lugs and lightly tighten.*
11. *Fold the last bit of wire up vertically against the pipe on the opposite side of the other wire and zip tie both against the pipe.*
12. *Construction is done!*

Tuning:

Attach coax feed line to remaining unused lug holes, center conductor to the element side (ie long side) and the braid to the stub (ie short side). Tuning is accomplished using your radio, or antenna bridge, or MFJ antenna analyzer and by sliding the lugs up and down and squeezing the parallel wires at the bottom closer and father apart. A decoupling choke can be made by coiling 5 or 6 turns in the coax either around the bottom of the pipe or in a 2" diameter. And then tape to the pipe. Remember J-Pole type antennas are very sensitive to their environment so try to place the antenna in its location for final tuning, and step away from it during tuning. Once you are happy with the tuning just use some RTV cement on the stub wires and pipe to lock it in.

STACKED 5/8 WAVE VHF ANTENNA



3/4" DIA. SCH 40 PVC FORM

10 OR 12 GAUGE
ALUMIN. WIRE (14.50 FT.)

<u>SPEED OF LIGHT IN INCHES REDUCE FORMULA:</u>
300(meters) X 3.28(feet) X 12(inches) = 11,808" (inches)
11,808" = (X) for use in the following formulas

(X / freq.. (mhz) = 1λ in inches in free space)

(11,808" / 146 mhz) = 80.88"

Speed of light is 300,000,000 meters per second.
We can scale that down to work with any antenna construction projects, to 300 meters we convert that to feet by multi. by 3.28 and finally convert that to inches by multi. by 12.
So answer to life, the universe and everything is: 11,808".

λ = 1 wave length
VF = Velocity Factor .94 for the alum. wire used in this project.

5/8 λ = 80.88" x 5/8 = (80.88" x 5) / 8 = 50.54" x .94 (vf) = 47.51"
3/8 λ = 80.88" x 5/8 = (80.88" x 3) / 8 = 30.33" x .94 (vf) = 28.51"
1/4 λ = 80.88" x 1/4 = (80.88" x 1) / 4 = 20.22" x .915 (vf of parallel wires) = 18.50"

Figure 3 – Mechanical Drawing of Stacked 5/8 Wave Antenna

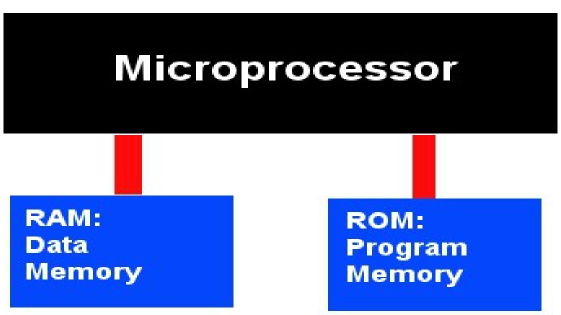
BITS AND BYTES

By Darrell Davis KT4WX

Editor – THE EXPERIMENTER and ARRL Technical Specialist

Welcome to the initial Bits and Bytes. This will be the initial installment of a reoccurring column on Microcontrollers. As I learn and expand my knowledge of Microcontrollers, I am willing to share with you what I have learned and hope you enjoy reading about them. In this column I wish to introduce the concept of what are Microcontrollers are and their significance to you. First of all, there are Microprocessors and Microcontrollers. What are they and what is the difference between them?

A Microprocessor is an integrated circuit than can process tasks according to its instructions in memory and is the "heart" of the modern computer. The first microprocessor was introduced by Intel in 1971, the 4004. It was a 4-bit processor and was quite a leap in technology at the time. There were electronic computers that have been in use since the mid 1940's, but they were composed of vacuum tubes or transistors. A prime example of an early computer was Colossus, a computer composed of vacuum tubes, that helped the Allies during World War II decode the Engima traffic generated by the Nazi armed forces. However these early computers had a discrete main processor bank made up of vacuum tubes or transistors. However that all changed when Intel introduced the 4004 and then the 8008 shortly thereafter. Now the computer had a main data processor that was on one integrated circuit. The first IBM PC Compatible computers were based on the 8088 processor that Intel introduced in 1978. All Windows based PC on the market today were based on the Intel 8088 and its subsequent successor microprocessors.



Microprocessors typically have data and program memory separate from the Microprocessor itself. This is illustrated in Figure 4. They are interfaced to the microprocessor via a data bus that goes to and from the microprocessor. Depending upon the architecture of the microprocessor, the data and program memory can be on the same bus to the microprocessor or on separate buses. Each method has it advantages and disadvantages.

Figure 4 – Microprocessor and Memory Interface Block Diagram

A Microcontroller combines the microprocessor, data memory and program memory onto one integrated circuit so there is no need for external memory. Microcontrollers that are of recent design often have the following in addition to data and program integrated memory a multiple number of integrated peripherals: serial ports, analog to digital converters, general purpose input and output ports, etc. Now you can understand why microcontrollers have become very popular. The first microcontroller was the Intel 8051 and was introduced in the late 1970's. Since that time the number of microcontroller architectures and chip configurations of memory and interfaces have just proliferated.

Microcontrollers are used in computer peripherals (keyboards, mice, etc.), automobiles, consumer electronics, appliances, smart phones and tablets. Microcontrollers are probably in operation in your radio room and you may not even know it. Virtually all modern amateur radio transceivers have a microcontroller of some kind that operate the display, read your menu buttons, and operate the "radio" portion of your radio.

Microcontrollers go from just 6 pins up to several hundred pins depending upon the capabilities of the microcontrollers. Microcontrollers are made in DIP and SMT packages. SMT Packages are becoming the majority of newer microcontroller packaging due to the fact it is more cost efficient to build with surface mount technology than thru hole components (such as Dual Inline Package). Figure 3 shows a few pictures of what a few varieties of microcontrollers look like.

Have I wet your appetite yet for wanting to play with microcontrollers? I hope so. If I have and you are new there are some microcontrollers that are easy to start with and even the documentation is free. The ARRL has published a new book (March 2013) called, "Ham Radio for the Arduino and PICAXE" which is an excellent resource for the ham that is new experimenting with Microcontrollers. The cheapest source I have found for purchasing this book is Amazon. If you are a Amazon prime member, the shipping is even free. The price of the book is a little over $26 at the time of publication.

That is all for now. In my next column I will introduce the PICAXE and the Arduino. These are two different microcontroller platform that are easily suited for the beginner. I will go into each of them and give the pros and cons of using them.

73 and happy programming.