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West Central Florida Section

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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 next issue of the THE EXPERIMENTER. I hope you enjoyed the terrific articles in the reboot issue. Our writers have been at it again and have some more terrific articles for your enjoyment. This is what we will need to stay in existence as a newsletter. My thanks to all of you who have written for the last issue and this one. Keep up the good work.

We are going to change from a bi-monthly to a quarterly publication. We will put out issue supplements in between if something comes up worthy of publication, and needs to be published in a timely manner. This will give our writers more time to write good articles and also gives me the proper time to put together a quality issue for you. We will start this quarterly sequence with October through December issue. All the issues of THE EXPERIMENTER are now available for viewing (including the original issues from 2000-2014) at my website at http://kt4wx.org as well as the section website at http://arrlwcf.org 73!

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CALL FOR ARTICLES

Calling now for articles for the next issue of THE EXPERIMENTER. Please have those articles to Darrell Davis KT4WX by October 15. You may contact Darrell by the following:

Email: kt4wx@arrl.net **Phone: (863) 245-9923**

Website: http://kt4wx.org **US Mail: 6350 Mills Road Fort Meade, FL 33841**

SILENT KEYS

It is with deep sadness we have had two silent keys in our community since the last publications of THE EXPERIMENTER.

Alan Pickering KJ9N: Alan became a silent key on June 30, 2013 after an extended period of poor health. Alan was a retired broadcast engineer and one of our Technical Specialists in the area of Antennas and Feed-lines. Alan until prevented by declining health was a regular for many years on the WCF Section Technical Net and was a favorite to answer antenna and feed line questions. Alan had even moved out to Duette to be able to have the antenna farm and tower he had wanted. Alan's knowledge and modesty will be missed.

Audrey Haines KJ4YMX: Audrey became a silent key on July 16, 2013 after a protracted battle with cancer. Audrey was the XYL of our Technical Coordinator of N1GY. Audrey was an encouragement to all who knew her and encouraged Geoff to participate in ham radio. Audrey will be missed.

COLUMN: BITS AND BYTES

By Darrell Davis KT4WX
ARRL Technical Specialist

Welcome to the next installment of Bits and Bytes. I hope you enjoyed reading the initial installment of this column. Like I stated previously, I will use this column to try to give you a practical education in the area of microcontrollers and how you can use them.

Last time we talked about the difference between a Microprocessor and a Microcontroller. To summarize, A Microcontroller contains the ROM (Program Space) and RAM (Data Space) that are normally external to a Microprocessor. On the other hand a Microprocessor is just execution engine normally with interfaces to ROM and RAM which are external.

MORE MICROCONTROLLER TERMINOLOGY: I wish to introduce you to another two terms: CISC and RISC. You say what are these?

CISC – stands for Complex Instruction Set Computer and is pronounced “sisk”. A good definition is the one I found at Wikipedia, *“Complex Instruction Set Computer is a computer where single instructions can execute several low-level operations (such as a load from memory, an arithmetic operation, and a memory store) and/or are capable of multi-step operations or addressing modes within single instructions.”* The CISC style processor was more popular in the 1970's and 1980's when memory was at a premium and more complex instructions that combined simpler instructions saved program memory. However this comes s at a price. A microprocessor that typically is high in power consumption due to a more complex instruction set. Typical microprocessor that is an example of a CISC is the Intel x86 processor that is used in the desktop computer that runs the Windows Operation System.

RISC – stands for Reduced Instruction Set Computer and is pronounced “risk”. A RISC processor has a significantly reduced number of instructions in its instruction set and is therefore a smaller processor than its CISC cousin. What I mean by smaller is its takes less “silicon real estate”. Therefore it takes less power to operate. This is the secret behind all of our smart phones and tablets. Notice that some of these devices can do almost the same amount of work and take only of a fraction of power to operate. All microcontrollers are RISC in architecture.

BIT – This is one piece of data. It is represented by a 1 or 0. This is represented in a computer memory by a high or low voltage.

BYTE – This is composed of eight bits of data. Memory is generally addressed (grouped) in byte size increments. If a particular bit of data needs to be accessed there are normally microcontroller instruction that tell the microcontroller which bit in a byte needs to be accessed.

THE PICAXE – A GREAT MICROCONTROLLER FOR A BEGINNER:

Most microcontroller these days are programmed in C++ and then compiled down by a compiler which is often part of a fully integrated development environment (IDE) on a desktop computer for that microcontroller platform. Then that compiled software is stored onto the microcontroller by a programmer that goes between that desktop computer, where the software was developed and the target microcontroller. The PICAXE is however is slightly different.

The PICAXE is a PIC Microcontroller that has a preloaded PICAXE Basic Interpreter. You write your program in BASIC, then the development software loads that BASIC routine into the PICAXE and this BASIC routine is run on board by the PICAXE Basic Interpreter. The programs are simple to understand and fairly easy to write.

The program space is more limited due to the fact that the BASIC interpreter takes up some of the available program memory space. However there are several versions of the PICAXE available from 8 Pins up to 40 Pins, with varying program memory and data memory. You may go to the PICAXE website at http://www.picaxe.com. You may download the three part users guide which is well written and easy to understand. It is in PDF form so you can read them on your smart phone or tablet even. Also they have a list of vendors who sell them. Sparkfun Electronics out in Colorado sells them from $2.95 for the 8 Pin PICAXE to $10.95 for the 40 PIN PICAXE. And if you were wondering, they are in Dual Inline Package (DIP) form. No surface mount to worry about if you are not comfortable working with those devices.

In our next column we will go into more of the basics on how to setup these devices for programming and what some of the programming actually looks like. In the meantime, if you are adventurous you may go to the PICAXE website and download the PDF users guide and the programming software, free of charge, and start getting familiar with them.

That is all for this time. Until next time, keep on soldering. 73!

The Yaesu FT 817 – It is not just an IF

Buddy Morgan WB4OMG
ARRL WCF Section Technical Specialist
(Reprinted courtesy of the Southeastern VHF Society)

Back in the 1990s, I was looking to get on 2304. I needed an IF. The Yaesu FT-290 was perfect, for me. Oh, by the way you could use it as a portable, also. That could be interesting. At the time, my daughter lived in North Carolina at an altitude of 2100 feet. We do not do much "hill topping", here in Florida. Operating from the side of a mountain could be fun.

I bought the FT-290 and built a wire Two Meter dipole, with plastic clips on the end. Our next trip to North Carolina, I clipped the antenna to the drapes in my daughter's spare bedroom. It worked well. I took this "rig" along on several business trips. It was amazing what you could hear. Of course, the FT 290, running around 5 watts, was many db down from the average Two-Meter weak signal station transmitter.

I first noticed the FT817, at the Dayton Hamfest, back around 2006. There were these two guys with FT-817s slung over their shoulders. They had these long fiberglass whips mounted on some kind of backpack arrangement. They had a counterpoise "trailing wire" ground. They were just walking around, out in the flea market area, with their (tripping hazard) ground wires, behind them. They were working 17 Meters. This was a cumbersome arrangement – especially the ground wire–and really did not look like anything I wanted to try. But, as a radio, the FT-817 looked appealing.

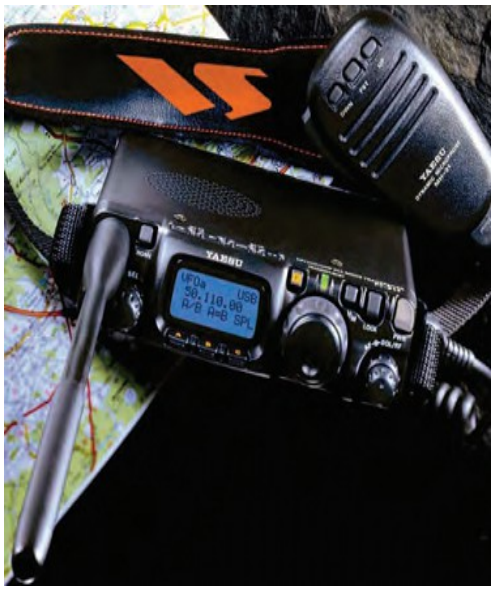


Illustration 1: The subject matter of this article, shown with microphone, carrying strap and rubber ducky. Photo courtesy of Yaesu USA.

The FT-817 looked like a better radio than the '290. It worked Six Meters, Two Meters and 432. If I ever needed a 28 MHz IF, it would do that, too. I could not resist. I bought one.

For the uninitiated, the FT 817 is a compact all mode transceiver that operates 160 Meters through Two Meters, plus 70 cm. It operates off internal batteries or from 13.8 volts. Power output is around four watts. Comes with a carrying strap and a rubber ducky. Better IF filters are an option as is a 5 ppm TCXO. Between the Data and Accessory Jacks, on the back panel, about anything you would want is available. It is essentially a full service radio, with built in batteries. But, it is only puts out four watts. Buy a big PA and you are all set!

There has been much written about using the FT-817, on HF, as a portable. Looks like a lot of fun. But, unless you are renting a house, at your destination, an efficient antenna for 80 Meters is kind of hard to come by. The use of the FT 817, on VHF and UHF has not received much attention. Many hams take a FM or digital Handy Talkie with them when they travel. For me, over time, this got boring. The HF types don't seem to realize that the FT 817 even works

on SSB and CW, on VHF and UHF. Most weak signal operators seem to forget that the FT 817 can be much more than an IF. Why not take a complete three-band weak signal station when I travel? Ten meters even looked feasible, for hotel room operation.

For EMCOMM purposes, operating from a hotel room would be similar to operating from a shelter, during a hurricane. So, there is another motive, besides fun, for this paper. The FT-817 and I are an on-going experience. What follows a report of what I have found, thus far.

The power cord is small wire. I would guess it is #28 or #30. It is about six feet long. There is considerable voltage drop and no fuse.

The FT-817 does not have any filtering on the 13.8-volt DC in. I found out the hard way, after a lightning hit on my tower. The 13.8-volt bus, in the ham shack went negative, during the lightning strike. The FT-817 was on of the casualties. After that I built a simple circuit, with a diode for reverse polarity protection, a .01 microfarad capacitor and a Zener Diode for over voltage protection. I put this circuit across the power cord. The radio survived the next lightning hit, with no damage.

For operation from a power supply or external 12volt battery, I recommend cutting the power cord off, a few inches from the connector and placing the above mentioned circuit and a fuse, in line. Run #18 or #16 to your 13.8 volt source. The FT-817 doesn't have power to spare. So, you need as much DC voltage to the radio as you can get.

Yaesu does not make a mounting bracket for the FT-817. I use the Hamsource 817/BKT bracket, in the ham shack, to mount the radio, under a shelf. This bracket could be used in a mobile environment, also. The radio comes with a 1400 mAH NiMH battery. If you are doing a lot of transmitting, the batteries do not last too long. I will be talking and the radio will turn itself off, due to low voltage.

The charger that comes with the radio, only charges the batteries. You cannot operate the radio, while using it. I bought an inexpensive 12-volt, 3 amp computer type power supply. It is small and light. It charges the battery and operates the radio, just fine. A real 13.8-volt power supply will give you about 0.7 db more transmitter power.

Illustration 2: I got this at a conference, some years ago. My entire portable set-up fits into this small knapsack. Put it on your back or carry it like a briefcase.

I have used the radio, mobile, on Two Meters, a few times. I put a M2 loop on the roof of the car. Works great. The only problem is lack of transmitter power. Using the internal battery, I get 3.4 watts. Connecting to the vehicle electrical system, I get 5.6 watts. It can be quite frustrating to be able to hear someone and not have enough power, to get back to them. But, under dead band conditions I have talked 140 miles, to a well equipped base station. For

mobile use, a filter on the power cord would be prudent.

Really, the most fun I have had with the FT-817 has been taking it on trips. Putting together a trouble free portable setup, that works well has required some thought.

Getting the radio through airport security has been interesting. I carry the radio and associated gear, in a small backpack. I take it as one of my personal carry-on items. About half the time, it goes right through security. The other half of the time requires lengthy explanations: Let me see your ID! What is this stuff? Why I am taking it on the plane? Oh well, that's life, these days.

I have tried operating 10M, 6M, 2M and 70cm, with differing results. I have never been anywhere that a lower HF band antenna was feasible. As I said above, there has been plenty written about the FT-817, on HF.

I use LMR 195 for feedline, on all bands. I recommend using crimp connectors on all the coaxial cables. Crimp connectors seem to be much less troublesome than clamp type connectors, for portable use. If you are using the front panel BNC jack, a Right Angle BNC Male connector keeps the coax out of your way. Every right angle adapter I tried seemed to be intermittent. You touch it and the SWR changed. I got this at a conference, some years ago. My entire portable set-up fits into this small knapsack. Put it on your back or carry it like a briefcase.

Illustration 3: My hotel room setup. The FT-817, with the 10M telescoping antenna on the rear panel SO-239. In the background,to the right is the 70 cm and 2M antenna. The triplexer is on the left. The 10M counterpoise is coming off the back of the radio, going out of the picture to the right. The 6M antenna is not shown.

The VHF and UHF antennas feed into a triplexer, which is connected to the front panel BNC jack. 10M is fed from the SO 239, on the back of the radio.

Almost all Ten Meter SSB, local activity is vertically polarized. A short vertical antenna, for indoor use is quite challenging. I tried building a helical whip. I could get the SWR down, no problem. Bandwidth was acceptable. But, it was very sensitive to its surroundings. You move something, the SWR went through the roof. A loaded mobile whip on a Mag. Mount was not satisfactory, either. Finding enough metal for a ground plane was impossible. Counterpoises did not seem to work, with the mobile whip. The best antenna, for 10M, seems to be the MFJ 1810T telescoping antenna, with a counterpoise.

The MFJ antenna comes with a BNC connector. It was apparently made to use with the front panel BNC connector, with the radio's carrying strap on

your shoulder. I sit the radio on a table. So, I use a BNC F/UHF M adapter and a right angle UHF F/UHF M adapter and simply plug-in the antenna to the back of the FT-817. I have a counterpoise ground wire that I clip to the radio.

You have to play with the counterpoise to get the SWR down, but it is doable. Fortunately, the FT-817 has a built-in SWR bridge. Operating from the ground floor, the SWR is usually high. But, on the second floor and up, you should be able to get a good SWR.

For 6M, I use a wire dipole. Just string it between whatever supports are available. I suspect my 6M dipole strung around the hotel room has been an eyebrow raiser for several maids. On 2M, I started with a wire dipole, like 6M. Now on 2M and 70 cm, I use M2 HO Loops. These seem to be the only commercial omni antennas that lend themselves well to this type of operation. I use a small camera type tripod, with an integral PL 258, that I bought at a hamfest. I actually support the Two Meter Loop with Comscope WBC 400 coax feed line. This is an LMR 400 type cable (RG-8 sized). Most of the LMR 400 type cables are stiff enough to support the antenna. The antenna is about a foot above the tripod. I made a mast for the 70 cm loop, out of 3/8" rod. I stack the 70 cm Loop about a foot above the 2M Loop, which is supported by the cable.

For my "hotel room" kit, I use the power supply that I described above. It is small, lightweight and easy to pack. I typically run the batteries down and charge them back up.

All of the above listed equipment fits into a small knapsack. I carry a pad of paper and a pen. I also have the radio's carrying strap and rubber ducky, in it. I also have a few pages of the radio's manual, in the knapsack. I have never taken a key with me, for CW and it has never been an issue. As I said above, sometimes my radio backpack goes right through airport security. Sometimes, it doesn't.

The biggest problem I have found with hotel room operation is noise. It can be horrendous. I have interfered with a few TV sets, but it was not bad. I have never found a room, where I could not string up my Six Meter Dipole. With all the websites that are available, you can ascertain your grid square, in a minute or two.

My hotel room setup. The FT-817, with the 10M telescoping antenna on the rear panel SO-239. In the background, to the right is the 70 cm and 2M antenna. The triplexer is on the left. The 10M counterpoise is coming off the back of the radio, going out of the picture to the right. The 6M antenna is not shown.

My operating results, from hotel rooms has been mixed and varies with the band. When calling CQ, say, "Portable, running four watts with an indoor antenna". It attracts attention. When you check into the hotel, ask for a room on the highest floor.

I have heard stations on 10M, 25 miles away. But, I have never actually made a contact on 10M SSB. Most locations are quite noisy on 10 meters.

Six meters works, quite well. I have worked stations 40 miles away from a second story hotel room. Noise is a little less of a problem, on Six than Ten.

Two Meters works, at least as well as Six Meters. I have made S-9 QSOs, with stations 25

miles away. Noise can be a problem on 2M.

I have made several 432 contacts. 432 sneaks it's way out of windows better than the lower bands and I have never had a noise problem. I think 432 has a lot of promise. But, there is less activity than the other bands and it is going to take time to evaluate.

I have listened around the FM part of the bands with the rubber ducky antenna that comes with the FT-817. You can hear as much as you can with a FM Handy Talkie. Interesting, even with the polarity isolation, the M2 Loops work a lot better than the rubber ducky. There has got to be some kind of subtle hidden message here. I built an antenna to use with the FT 817 as a true, walk around with you, portable. I use a 432 MHz M2 HO Loop mounted on a one-foot length of WBC 400 coaxial cable, with a BNC on the other end. I put heat shrink tubing over the cable to add stiffness. With the '817 on its carrying strap, this puts the Loop just above my shoulders.

Illustration 4: My "true portable" 70 cm rig, modeled by Lydia, KF4TPW.

Talking to an identical FT 817, with both of us at ground level, we have communicated over a twelve-mile path, through buildings and Oak Trees, using SSB. This was not marginal communications. We could have passed traffic. Over this same path, two FM Handy Talkies would only provide communications over about three miles. Two 50-watt FM mobiles, with gain antennas only made it, a little over five miles. I think we can do considerably better than 12 miles. Time will tell.

I have tried talking to base stations a few times, using my "true portable" set up. One night after the Florida Weak Signal Society (FLWSS) Net, from my back yard, surrounded by my Oak Tree Faraday Shield, I talked 54 miles to a station with a long Yagi at 50 feet. On another occasion, I almost made a contact with a station at 70 miles. Tell your repeater denizen friends: You can talk a lot further using a SSB portable, than with an FM Handy Talkie.

You could make a Two Meter portable, using a M2 loop. But, the size of the antenna is just a little more than what I want to walk around with. For those of you that don't mind looking like a space cadet, try mounting a loop on a hardhat. I use the FT 817 to locate power line noise and other interference. It is not as good as the equipment that a (paid) utility RFI investigator uses. But, I have found several sources of noise. The rubber ducky, that comes with the radio, works fine for locating noise on Six, Two or 432. I have even used an external Yagi, to locate

noise, on Two Meters and 432. My “true portable” 70 cm rig, modeled by Lydia, KF4TPW.

When I am looking for noise, on HF, I use the rubber ducky antenna and switch the HF antenna, from the rear panel UHF connector to the front panel BNC connector. You would be surprised what all you can hear on 80M, with a 12-inch antenna.

If you have a portable microwave station, the FT-817, of course, makes a great IF. It also gives you a built in 432-liaison radio. Just mount a small Yagi, along with your dish. Connect the transverter through the front panel BNC connector. Connect the 432 antenna via the rear panel UHF connector.

The FT 817 is a fun radio for travel. Radios like the ‘817 have great potential for EMCOMM deployments. But, don’t expect to just throw together some antennas, at the last minute and make it work well. As I said, earlier in this document, the FT-817 and I are an on-going experience. We will know each other better, in a few years.

TECHNICAL SUPPORT RESOURCES

If you think you do not have help when you need it, that is not true. No matter the project or problem, help is closer than you think. The following are resources that are available to help you with that project or problem:

ARRL Technical Information Service: For ARRL members, this is a valuable resource that is probably under utilized. The ARRL Technical Information Service is available on the ARRL website at http://arrl.org/tis. You can look up the online index and search for an article from QST or QEX magazines. And of course all QST articles are now available for download free for ARRL members. There is material also available there on popular technical topics. Also, you can request assistance by email and someone from the ARRL Lab will reply and try to get you going in the right direction. Your newsletter editor recently inquired about RF Transceiver IC and Zack W1VT from the ARRL lab corresponded back and gave some valuable pointers on that topic.

ARRL WCF Section Technical Net – NI4CE Repeater System – 9:00 P.M. - Thursday: Do not forget about the ARRL WCF Section Technical Information. This net is hosted mostly by Geoff Haines N1GY our Technical Coordinator. Some of the WCF Section Technical Specialist check in on the net as well. This net is typical a question and answer style. Stations that need help indicate they have a question for the net when they check in and then the NCS gets back to them, takes the question, and ask if anyone has an answer or suggestion. Even the NCS often answers questions as well. One never knows what kind of questions will be posed. For frequencies and coverage maps of the NI4CE Linked Repeater System go to http://ni4ce.org. The system covers all the ARRL WCF Section.

N1GY.COM and KT4WX.ORG: Geoff N1GY has an extensive list of projects he has undertaken over the years. He has documented them well and published them on his website at http://n1gy.com. Also Darrell KT4WX is doing some projects and documenting in the projects section of his website at http://kt4wx.org. Just click on the Project at the top or in the navigation menu and take a look at the latest.

An Easy Variable Power Supply for Your Work Bench

Geoff Haines, N1GY and Steve Senft KG4LJB
ARRL WCF Section Technical Coordinator

The inspiration for this project was the need for calibration of another project, as yet upstarted at several different voltages. A search of the Internet gave me a good start but in the end I needed some assistance from a fellow ham with much more skill and training than I.

Because I needed a variable power supply to add to the tools on my workbench, I first surveyed the commercial market to see what was available. Right off the bat I was put off by the cost of many of the manufactured units. I then began to look for a DIY version that I could build. After some major surfing around the web I cam across the data sheet for the LM-317T variable voltage regulator which had a suggested circuit that looked like it would do the job. I also came across a web site where someone had powered his version of this same circuit using the switching power supply of an old printer.

Looking around my shop I discovered a similar "brick" power supply from a long defunct laptop. I also had most of the components for the data sheet circuit in hand. I needed only a pair of binding posts and a heat sink for the LM-317. At least that is what I thought. The initial build went very well. For an enclosure I used the case from an old data switch about 2" x 7" x 5" roughly in size. The circuit was built on a generic circuit board from Radio Shack, where I also obtained the binding posts and the heat sink.

Once it was all put together I tried it out and it worked quite well except for one flaw. I had used an audio taper potentiometer instead of the linear taper called for in the data sheet. This meant that the adjustment of the voltage was pretty much all crammed into the first 90 degrees of the pots 300 degree swing. Another more esthetic "flaw" was that the laptop "brick" just sat on top of the VPS. This looked "goofy" to my eye so I set about making some changes. One of the changes was to add a second enclosure on top of the first one to house a panel meter that displayed volts and also I decided to wire the on off switch to the AC input to the laptop brick and add a fuse on the AC side to protect against a short circuit. Unfortunately, during the installation of the second enclosure and an attempt to place the laptop "brick" inside said enclosure, a short circuit occurred and the "brick" let all of it's smoke out. I "firmly believe" that keeping the smoke in is what keeps the device running. :-)

For the next attempt, I purchased new components for everything except the binding posts, the enclosures, and a few other mechanical components. My son found me another laptop brick and reminded me that this particular model has three connections in the DC plug. The outer shield is ground, the inner shield is actually +19.5 VDC and the center conductor (very thin) is merely a sensor line that tells the laptop that it is OK to charge the battery. Hmm, maybe I should have thought of that on build one. (A similar power module for a printer probably would not have that third conductor so a printer brick might be the easier way to go.)

Then I did the smartest thing I did during the entire project. I called my friend and fellow ham, Steve, KG4LJB, who has done some repairs on my radios over the years and asked him to take a look at the circuit to try and figure where it could be improved. Steve agreed so I dropped it off at his place. He promised to get to it in a couple of days and let me know what he found. Next week, the device was back at my house fully functional. Steve had suggested that it might be better to use another similar circuit also in the data sheet for the LM-317. This circuit was the same in concept but added a couple of diodes to keep the circuit being powered by the VPS from dumping energy from its capacitors back through the regulator. An event, by the way, that was sure to let the smoke out of the regulator.

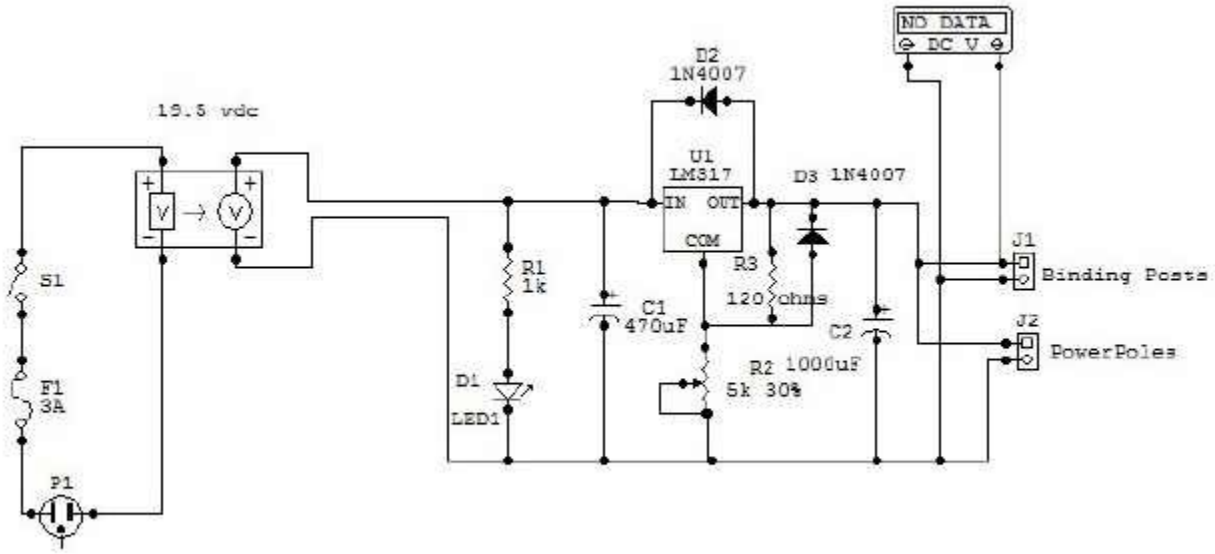
As I had not included the diodes in my circuit initially, we suspect that the LM-317 was dead almost from the start of the third build. What Steve sent me back was really a whole new circuit. He replaced the 317 with an LM-350 which has a higher amperage rating. He added a pair of diodes to protect the new regulator and added several polar capacitors to further smooth the output from the regulator and even a few polar caps on the input side. Now I had a really good variable power supply. When the new laptop "brick" arrived I installed it properly this time. I ran the AC cord through a toggle switch so that the entire circuit gets shut down, not just the variable part of it. I also added a 3 amp blade fuse and holder to the "hot" side of the AC feed. Instead of trying to force fit the "brick" inside the enclosure I wisely chose to simply adhere it to the rear of the enclosure using hot glue and keeping its plastic outer case intact.

In the final build I decided to add a second set of connections to the front panel of the VPS. It not only has the binding posts, it also has a set of Powerpole connectors in parallel with the posts. The second identical enclosure on top of the first one houses a panel mounted meter that reads DC volts and the on off switch. If I had a larger enclosure to begin with all of the components could have been mounted on one level, but I didn't so this was the result.

I had planned to mark the specific voltage points on the front panel around the knob for the potentiometer, but since I added the voltmeter I decided to just mark the minimum and maximum limits of the knob sweep and let the voltmeter read out the actual voltage. The VPS is capable of going to 18.1 volts but the meter only reads to 15. Since I doubt that I will go up to 18 volts anytime soon the lower range of this meter will be adequate. The meter will be easy to replace if I need a broader scale. I can always measure the exact voltage at the binding posts on the rare occasion that I might need a voltage between 15 and 18 VDC.
This variable voltage power supply circuit (as rebuilt by Steve) has a range of 1.5 volts to 18.1 volts and a capacity for about 3 amps with a good heat sink on the LM-350. You will find the final circuit below along with some photos of the completed project on this page.

A couple of advisories are in order. This project starts with 120 VAC at one end and puts out a wide range of DC voltages at the other. AC is serious and can be lethal. Be extremely careful around the AC side of the circuit. All I killed was an inexpensive switch mode power supply, you might not be so lucky. Another point that should be made is that sometimes a circuit has to have a little more complexity to be the best possible circuit for its intended purpose. Simple often works but with a little sophistication, it can work much better. And last but by no means least, when you run into a problem, do not be afraid to ask for some help. Steve is a professional with electronics. He easily discovered what went wrong and was able to put the project back on track and significantly improved its performance.

I just noticed an error in the circuit diagram when I posted it. The regulator is designated an LM-317T. It should say LM-350. No big thing as far as the circuit itself goes, either regulator will work with this circuit, but in the interest of accuracy, the unit in the variable PS is actually an LM-350 which gives it a little more headroom in amperage.



(Editors Note: You can use in place of the Laptop Power Supply you can use a 120VAC to 24 VAC Transformer, a Bridge Rectifier, and Electrolytic Filter Capacitors properly rated for a 1.5 Amp power supply. The parts can be procured at Radio Shack)

BAD ELECTROLYTIC CAPACITORS
By Darrell Davis KT4WX
ARRL Technical Specialist

Many causes of failure in the last 10 years or less in switching power supplies that are used in computer power supplies, switching power supplies on motherboards of computers, consumer electronics can be attributed back to defective manufacturing process used by some electrolytic capacitor manufacturers in the formulation of the electrolyte paste used in the capacitor construction. By the time the problem was discovered by these manufacturers, millions of switching power supplies had been manufactured with these capacitors with manufacturing defects. Although the problem has now diminished somewhat since approximately 2010, there are no doubt still many computers and consumer electronics out there with these faulty capacitors in them that are like a ticking time bomb just simply waiting to go off or already have started to fail and have not failed completely yet.

I have run across this problem in computer motherboards and computer power supplies before. There is even a website out there almost exclusively devoted to this problem and is run by an individual that has devoted much research into this problem. That website is called BadCaps.net.

What motivated me to document this problem was the recent experience I had. I have a 32 inch Samsung flat screen TV given to me by a fellow school bus driver friend of mine. She said it would not go on like it should. I initially thought it could be a problematic power supply issue so I took it off of her hands. At first it was only stubborn to power up and so I mounted it on my bedroom wall and waited for it to quit entirely before attempting repair. Shorty after turning the TV on, it would turn on and off, as if it were losing power intermittently and then finally stay on after running for a while. Finally the TV failed to turn on altogether. Now it was time for a visit to my workbench.

Figure1: The seven defective electrolytic capacitors I removed from the TV power supply board. Notice the tops of all the capacitors are swelled, broken, and two of them have visible electrolyte paste that has run out.

These capacitor are all open and cannot hold a charge.

Upon removing the back cover, I immediately located the power supply. I noticed immediately seven electrolytic capacitors with swollen tops on them and two of them with paste running out of the top. These capacitors were integral to several switching power supplies. When these capacitors failed they were open and could no longer hold a charge. Therefore the switching power supplies dependent on the charge held by these capacitors could no longer produce any power.

I unsoldered them by removing the solder from the leads of the capacitor with soldering wick but being careful not to apply to much heat from the soldering iron, thus damaging the printed circuit board traces to which the capacitors are soldered. After unsoldering the defective capacitors I bought five capacitors new from Radio Shack and unsoldered what appeared to be two good capacitors off of another printed circuit board. I soldered all seven of the replacement capacitors in, being careful to observe the correct polarity when putting them in the printed circuit board or else the new capacitors could explode due to having reverse polarity applied to them. Also I made sure that the new capacitors were the same value in capacitance and voltage rating or slightly higher than the capacitors they were replacing. If you put a capacitor in with a lower voltage rating than the original capacitor you are replacing, the new capacitor could also explode from having excess voltage applied to it as well.

I put the power supply board back in the TV and pushed the power button. It turned on just like it was supposed to: power up in about three or four seconds after depressing the power button. Also now the remote control could operate the TV like it was supposed to and would not before the new capacitors were installed.

Figure 2: The TV Power Supply with the five new capacitors and two good used capacitors installed. Notice how all the capacitors are sealed on top and flat.

Also notice that they are used in the switching circuits are several of the switching power supplies on this board

For more information on these defective electrolytic capacitors in your piece of electronics, go to the Bad Caps Website – http://badcaps.net I wish you success with your bad capacitor replacement projects.