K9YA Telegraph

Robert F. Heytow Memorial Radio Club

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4SQRP Group EZKeyer Kit

A Keyer Designed by AAØZZ

Philip Cala-Lazar, K9PL

Here's another fun, feature-packed and economical kit from the Four State QRP Group (http://www.wa0itp.com/aa0zz-keyer.html). Like the 4SQRP Test Set I reviewed in the December 2009 issue of the *K9YA Telegraph*, the EZKeyer designed by Craig Johnson, AAØZZ, packs much performance into a compact package, in this instance the now ubiquitous Altoids® tin.

The kit arrived promptly, only 10 days after mailing my payment, securely packed in a padded envelope with the PIC chip's legs embedded in anti-static foam and enclosed in a Statshield® ESD shielding bag, and with its full complement of parts. The kit's construction and user's manual, a selection of Altoids® tin color-coordinated labels keyed to the variety selected, a tin bottom insulator, and other documentation are available at the above URL. The manual includes detailed instructions for printing and mounting the labels and punching or drilling the enclosure for the included jacks and switches.

"…fun, feature-packed and economical…"

The keyer features an extensive list of user-selectable features and options for your operating pleasure.

- Twelve direct-entry commands
- Three 31-character non-volatile (EEPROM) memories
- 5-55 wpm speed range
- Iambic A or B, straight key and cootie key modes
- Sequenced mute line (Goes low for receiver or T/R switch)
- Default speed and modes stored in non-volatile memory (EEPROM)
- Speed entered by command or changed on the fly via paddles
- Tune mode
- Very long battery life with no power switch–essentially shelf life
- Current speed reported on command
- Operating voltage: 3-5 volts
- Low power, 1ma active and 1uA in sleep mode
- 600 Hz sidetone (selectable)
- Autospacing between characters selectable)
- Dash/Dot swap command
- Keyed line goes low when active

To complete the PCB required 30 minutes–only 10 components need be soldered to the board. Prepping the Altoids® tin: drilling holes for the switches and jacks, mounting the labels and installing the completed board occupied another 90 minutes or so.

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Digital Modes

Part I

Paul W. Ross, W3FIS

Paul, W3FIS

I should point out that I took a 30-year break from ham radio while building a career, raising a family and a lot of other stuff. About nine years ago, I retired to "Slower Lower" Delaware, on the Atlantic Ocean, just above the Delaware/Maryland state line. Now, having a bit more time for hobbies and all sorts of stuff, I decided to get back in to ham radio. First, some background that prompted this line of new activity in digital modes. I faced:

- Limited space in a "downsized" house. No basement, and only a spare bedroom.
- The housing development we moved into is like most newer developments – no outside antennas, other than a satellite antenna for television. Can you spell *stealth antennas*? Buy the ARRL book *Low Profile Amateur Radio* for some excellent insights on the problem.
- Needs to be low power – I really don't want to deal with irate neighbors with RFI and EMI problems in all their fancy electronics. More power means more dollars, and more hassle. QRP is my friend.
- Some cost constraints. I was moving from the age of vacuum tubes to solid state. Literally, the only item left over from that era was a World War II-vintage J-38 telegraph key dating back to my Novice ticket in 1957. This meant I was going to have to essentially build a system from scratch.

Some careful reading and discussions with local hams revealed the following:

- Nice local repeaters here, mostly on 2-meters, some on 70 cm. Good for emergency communications, rag chewing and local nets.
- Modern equipment is generally designed for 12 Volts DC, even though you aren't going to use it in your car. We are in an area prone to storms and hurricanes, so "off the grid" capabilities are a good thing – read ARES and RACES.
- Modern equipment is designed to easily interface to a computer, so "digital" modes are easy to implement. In my prior life I actually taught computer science, so that part was likely to be easier.

So, we take a quantum leap from VHF/UHF AM, "boat anchor" technology, vintage 829Bs, to the digital age and charge ahead.

My basic system objective was getting "the most bang for a buck." I saved up my pennies and acquired a nice Yaesu FT-817ND. This rig provides five watts, all modes, interfaces with a computer, and will be great for "picnic table portable" operation, and EmCOM, if needed. Also, I could cover all of the major ham bands.

"a plethora of digital modes"

Other than the NBFM, CW and AM modes, the transceiver is essentially a SSB unit. This means a signal presented to it gets pumped out as a USB or LSB RF signal, as you wish, at the desired operating frequency. With the rig's multi-mode capabilities I can indulge my experimental interests in a wide variety of ways.

OK, what is the big deal on digital modes? We can start with our old friend, CW – "Morse code." It isn't actually Samuel F. B. Morse's original code, but is "International Morse." It is simply an on-off way of encoding letters and numbers. RTTY, or radio Teletype is somewhat similar; using FSK to encode letters, and is transmitted as a SSB signal.

The other digital modes, which we will explore, build on the idea of encoding text on as narrow a bandwidth as possible, with the maximum likelihood of it being received correctly. There is a plethora of digital modes to choose from. Probably the most common is BPSK-31, and is a pretty foolproof place to start.

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First, a few general thoughts about digital modes: Excluding CW, the general scheme is to encode an ASCII character as a series of tones with, or without, redundancy. If there is some redundancy that means we transmit more information than we really need, and use some of this to correct for any errors in transmission. This is known as *Forward Error Correction*. More elaborate schemes, such as those used on the Internet, use *Backward Error Correction*, where, if an error is detected, a *retransmission* of the bad block of data is requested. Since languages like English have quite a bit of inherent redundancy, a forward error correction scheme is often overkill. A partly garbled message can be often sorted out just by making a few educated guesses as to its contents.

In fact, if the error rate is small, we can even indulge in some compression of sorts. Consider the fact that "e" and "t" are the most common letters in English. In Morse code, these are a dot and a dash, respectively. Less common letters like "q" and "z" get four elements. Technically, this is known as *varicoding*. The number of bits are inverse to character frequency. This strategy is frequently used, for example, in BPSK-31.

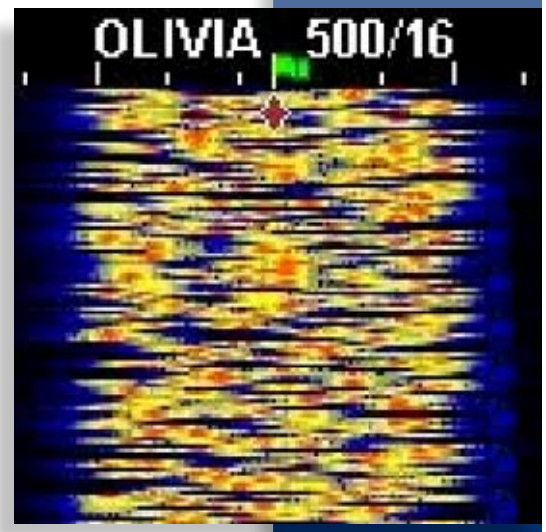
Let's look at one of the most popular digital modes: BPSK-31, or Binary Phase Shift Keying. The "31" refers to the bandwidth of the resulting signal – essentially 31 Hz. Instead of a frequency shift like RTTY, it uses a 180-degree phase shift. Phase reversals indicate the transition between elements of the encoding. If we were to make these abrupt changes, holding the amplitude of the signal constant, we would have a "key click" problem and an undesired great increase in bandwidth.

"dead bang' reliability"

We can easily cure this deficiency by reducing the amplitude of the signal at the crossover point where the phase reversal takes place. This nicely cuts down our bandwidth. An enhancement of BPSK-31 is QPSK – Quadrature Phase Shift Keying, which has error correction capabilities, but requires attention to the proper use of sideband, generally USB. There are a number of variations on this theme, but BPSK-31 is the most common.

The delightful part of BPSK-31 is a very efficient use of bandwidth – it is possible to have 20 conversations in equivalent voice band. I use a 500 Hz CW filter I added to the FT-817ND to cut interference from strong stations for better reception. "Watch and Pounce" is the best strategy for establishing a QSO.

My next favorite digital mode is Olivia, which is a MFSK or Multiple *Frequency Shift Keying* system. In the most common "500/16" mode, the letters are encoded as a series of 16 tones, spread over 500 Hz. The software "takes a vote" on the signals and probabilistically assigns a decoded character. If you hear a signal that sounds like "crickets," you are likely listening to an Olivia signal. That is why I got the 500 Hz filter, as this is nice for Olivia 500/16, and some other modes that work on 500 Hz bandwidths or less.



Olivia 500/16 Signal

There is no free lunch when using digital modes. Olivia can be somewhat slow to code and decode, and can eat CPU cycles on your computer! However, the "dead bang" reliability of the mode for really weak signals can't be beat. Not that it won't work well on older and slower machines, but faster is definitely better! Rag chewing seems to be more common on BPSK-31.

For more information on Olivia, check out: http://hflink.com/olivia/. You'll find details of commonly used Olivia formats and "watering holes" where you are likely to find Olivia activity.

In Part II of this article, I'll explore more of the interface issues, some other interesting modes and what's available for control and encoding/decoding software. ■

Call for Articles

Have a story to share? An experience to relate? Some gear to review? A technical tip to dispense? Feeling didactic or pedantic? Write it up, add a couple of appropriate photographs and send them off to the *K9YA Telegraph*. Hams worldwide will thank you, and so will we.

Here's the place to start:

http://www.k9ya.org/write_for_us.htm

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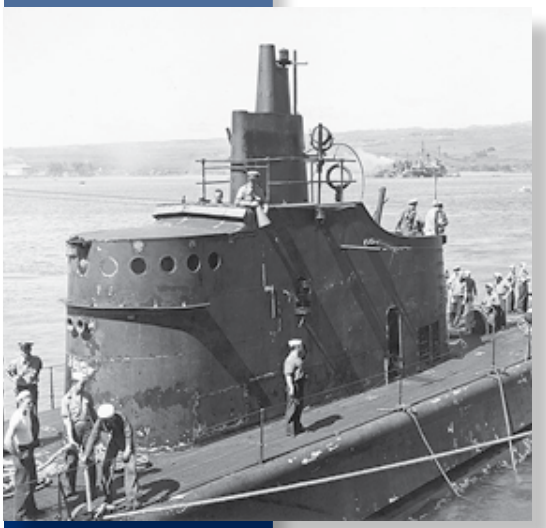
Earning A Wartime WAC

Scott B. Laughlin, N7NET



Taylor Sullivan was in the fourth grade when he found a damaged issue of *Boy's Life* magazine. It was lying on the curb of a Portland street and the wind had flipped it open, exposing an illustration of a boy speaking into a tomato can. Pausing, he stooped and studied the picture. The article described how to build a crude telephone using things commonly found around the house–a length of string and two vegetable cans.

His mother had scolded him about handling things he found on the ground. He considered her words, but this seemed important enough to put her warning aside. Rolling up the tattered publication he shoved it into his hip pocket and headed home.

Taylor built a tin can telephone and he and Carl, his little brother, used it on the staircase. That's where he learned that the string had to be taut and in a straight line. If the cord touched anything it stopped transferring audio. It seemed like a perfect solution for communicating between their bedrooms, so he built a second system and cut a hole through the wall solely for that purpose.

> *"'…there's good news tonight.'"*

"Hold the can still, Carl."

"I am."

"No, you're not. You're letting the cord touch the edge of the hole."

Carl didn't have a steady hand. After several failures, Taylor enlarged the hole. When that didn't solve the problem he expanded it even more. Then their father discovered the damaged wall.

The telephone didn't work well outside and Taylor quickly lost interest in it, but he was hooked on communications. Commercial radio had taken the nation by storm and he couldn't get enough of it.

In 1937 Taylor's father purchased a large, floor model radio. The adults gathered around it for the evening news, and he watched them await Gabriel Heatter's opening statement: "Good evening folks—there's good news tonight." While he was curious about the AM broadcasts, he found more adventure in listening to the three shortwave bands. That was where Taylor became acquainted with Morse code and heard his first ham, a man called Marvin.

A neighborhood hardware store sold radio parts and the owner knew Marvin well. He even gave Taylor directions to his house. On his third visit he began learning Morse. In a short time Taylor experienced the thrill of making his first two-way contact, operating under Marvin's call. After that he began preparing for the test that would fetch him a radio license of his own. Then he set out to earn his WAC (Worked All Continents).

Taylor was 19 when the attack on Pearl Harbor occurred and the United States entered World War II. For national security reasons ham radio privileges were revoked. He enlisted in the Navy and soon thereafter he was a radioman aboard a submarine. After a week at sea he found two others who, as civilians, had plied the night skies with electromagnetic waves.

Because receivers transmitted a weak signal that the enemy could follow to its source, radio silence was invoked, keeping strict transmission schedules. When not in use, the antennas were disconnected.

However, operating a receiver without an external antenna while the boat was submerged didn't breach radio silence, so Taylor created a spare time radio activity of his own.

With the Captain's permission, he used a receiver and began transmitting verses from the New Testament.

When time allowed, a receiver was moved from one strategic location to another. The noisy environment of the boat while underway coupled with a very weak signal made copy a sincere challenge. At a given point in time Taylor declared the quest finished.

Both hams scored high and were issued a WAC, a certificate stating that the bearer had successfully Worked All Compartments. ■

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Ray and Don

Rich Glassner, NØEAX

Your March 2010 articles on "Nautilus to the Pole" and "Lifelong Radio Jamboree" were excellent. I recall being influenced by Ray Meyers, W6MLZ, sometime around 1960. Ray was one of a few local hams who lived a couple of blocks away from where I lived in San Gabriel, California. I was around 10 or 11 when I visited Ray's shack on several occasions. It may have been as part of a Cub Scout den meeting or just an inquisitive visit from a kid down the street that started these visits. It was the first ham shack I ever visited. I had little knowledge until recently that Ray had accomplished so much. Thanks for the great article on Ray.

The influence of seeing Ray operate his radios contributed to the purchase of my first receiver, a Knight Kit Star Roamer. My enthusiasm as an SWL is pretty much described by W2CRW in his article. These SWL years, the exotic QSL cards, Mao's Little Red Book, all of the accompanying literature and propaganda from all over the world made SWL'ing a wonderful hobby in the early 60's.

We moved to another LA suburb, Long Beach, in 1964. Those were my high school years. Sure enough, I quickly became acquainted with Don Wallace, W6AM, who also lived a couple of blocks away. Don invited me to his "shack" which was about a 20-minute drive from his home. It had to be one of the most amazing shacks anywhere as described in many publications over the years. Don was a pretty good operator too, as I can remember driving the freeways with him while he was sending high-speed CW. I soon got my Novice license (WN6PYL) changing my interests from SWL to ham operator. Your articles reminded me of the people and events that influenced my interest in radio during those years. I appreciate the trip back in time in the March issue and all of the great articles in the *K9YA Telegraph*. ■

Italia

From Dieter, DL2BQD: Radio station Bremen broadcast a feature on the rescue of the airship *Italia* in 1928 when Russian ham Nikolaj Schmidt received the weak signals. The feature is of special value since it was originally composed by German author Friedrich Wolf.

So, for the German-speaking hams among your readers this, perhaps, might be a hint to try to get access to the tape from the radio service.

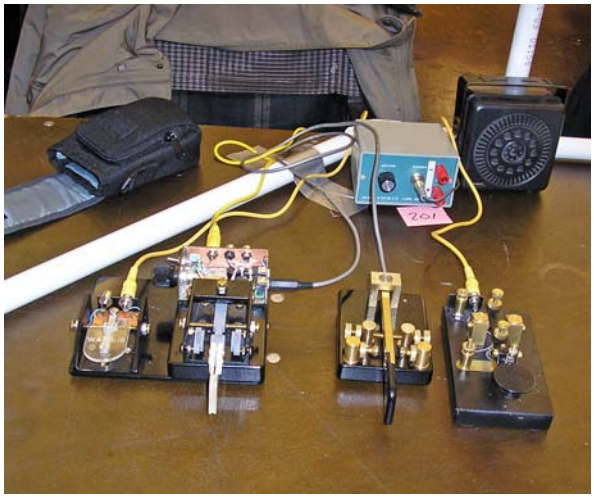
http://www.radiobremen.de/nordwestradio/sendungen/hoerspiel/krassin100.html

For more on General Umberto Nobile, Nikolaj Schmidt and the *Italia*'s last flight, see the article in the October 2007 issue of the *K9YA Telegraph*, "Disaster in the High Arctic."

WCRA Mid-Winter Hamfest

St. Charles, Illinois

L to R - Duke Wahl, WA9WJB; Philip Cala-Lazar, K9PL; and Mike Dinelli, N9BOR, at the Sunday Morning Group Booth



Duke Wahl, WA9WJB's, FB Collection of Homebrew Straight Keys, Sideswipers and Paddles

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Volume 7, Issue 4

All-Bands, Legal-Limit Dipole Project

Hal Mandel, W4HBM

Photo 1: Fifty Feet of Rolled-up Ladder Line

After retiring from the relative flatlands of New England the hills of eastern Kentucky and Appalachia seemed the perfect place to go. The weather is greatly varied, the economy slow, the people laid back and best of all, the big city far, far away.

After one trip house hunting to eastern Kentucky a great shack was found down in a "dark holler," where the sun hardly shines. It's at the confluence of three sets of steep hills and populated well with tall trees. Just not a great antenna QTH is all, but a solution was found: ladder line.

To get to the center point in a dipole would take just over two hundred feet of feedline. Being at the bottom of a hollow means getting as much signal to the wire as possible, and coax is just too lossy. The purchase of commercial feedline was considered, but no one offers a wire diameter that a legal limit amplifier might feel comfortable with, so I decided to homebrew my own using stuff right off the shelf at the hardware store.

The first edition of the ladder line dipole lasted five years through ice storms and was even partially submerged when we had small floods. Finally, the copper in the antenna wire's 11AWG Flex-Weave corroded and it came down. The herd of horses occupying the antenna farm during daylight hours tangled what the farmer's tractor didn't chew up. I found pieces of it spread over twenty-nine acres of wooded pasture. Seriously, I think they chewed on the spreaders like candy. It was time for a new antenna.

Photo 1 depicts approximately fifty feet of ladder line with six-inch spreaders. My old antenna used similar ladder line, but spreader spacing was seven inches and that led to much chafing and wear of the feedline conductors. You would be surprised how many extra pieces of PVC pipe are needed to accommodate a one inch change over a 250-foot-long feedline. The old feedline was a real mess because of the various methods–none of which worked–used to secure the spreaders, so I removed it. I found the best method is to use a heat gun, partially melt the spreaders and bash them down on the wires, but that leads to excess chafing, so you're damned if you do and damned if you don't.

Photo 2

Photos 2 & 3 show the ladder line where it goes through the shack wall. Photo 2 shows the two beehive insulators mounted on a Glastic plate. These beehives are duplicated on the other side of the wall, and use brass ¼-20 rod mounted in ½" PVC pipe for conductors. Inside, the beehives are mounted on a finished piece of oak, with a big knife switch above them to open the line.

Photo 3 depicts where the feedline attaches to a porcelain knife switch mounted on the surge arrestor ground bar outside the house. This buss bar secures multiples grounds and is attached to the a.c.

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Photo 3

electrical ground. The green 4/0AWG lead going off to the left passes through the wall and attaches to the RF ground buss bar behind the rig. The important thing is that the feedline dips down towards the earth before continuing up to the feedthrough. Lightning doesn't like to change direction and will follow the easiest and straightest path to earth if provided one. Likewise, a house itself may provide that pathway if nothing else is given.

Maintaining the feedline's spacing and design impedance is important. Unsecured spreaders will eventually slip with the line twisting on itself, crossing the conductors and creating a hot spot that will burn the wires right through.

Using a spreader as a fulcrum with the wire bent right around it and securely taped offers good support. The wires then take the load instead of the spreader. Any time a spreader exerts force on a wire it will chafe.

This line uses 12AWG Type XHHW-2 stranded cable. The feedline it replaced used 10AWG. We will see how reliable this reduced cable diameter is. The 10AWG didn't hold up too well over five years in the air.


Photo 4

Photos 4 & 5 show the feedline going through the "jungle" that makes up the back yard. Here in eastern Kentucky this terrain is called a "bottom," where a small creek runs at the lowest point in a small valley. The house is on one side of the valley, about sixty-five feet higher than the creek, and the distant point of the dipole is on an abandoned thirty-foot-high telephone pole, but this side of the valley is only fifty feet higher than the creek. The dipole itself is two hundred feet on each side. Using a true, "balanced-balanced" antenna tuner with two adjustable inductors, the antenna system will tune up from 160 through 10. Having the tuner sited near the beehives on the wall reduces RF in the shack, too.

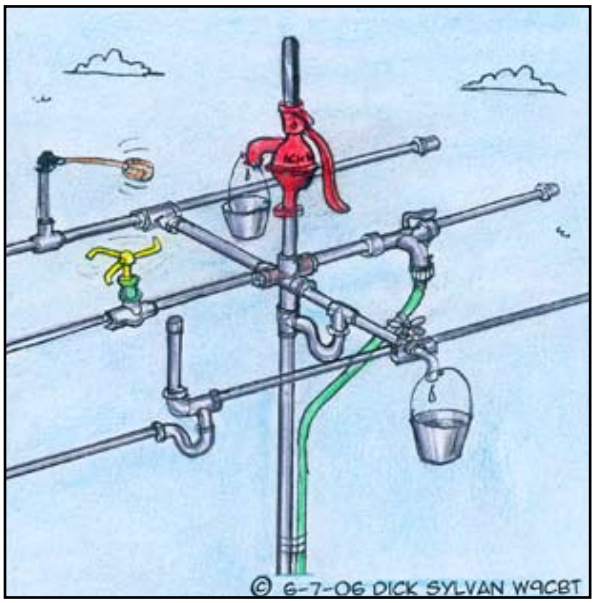

Photo 5

There is no way coax cable could be deployed here, without a severe attenuation of receive and transmit signal strength because of the necessity of running two hundred feet of feedline just to get to a "sweet spot" for the dipole center. A longwire for 600 meters runs along some power poles, about 30 feet under the line, and this antenna accumulates 660 volts! Needless to say, this particular wire was abandoned in place.

With thousand-foot hills on three sides there is little to be done for a world class signal from eastern Kentucky. Having a 75,000 volt power line close by eliminates any thoughts of a tower, so the wire will need to do it here for the time being.

Ham Lingo

DICK SYLVAN, W9CBT



"PLUMBER'S DELIGHT" BEAM ANTENNA

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Continued - 4SQRP Group from Page 1

To keep the tin from crushing when drilling holes, the manual suggests a block of wood cut to the tin's interior dimensions. For me, a fortuitously sized (3.5" by 2" by .75"), still in the wrapper, bar of Jergens® soap, backed up the tin and lubricated the drill bit! The lid's label, laminated with 2" wide transparent shipping tape, was mounted using 3M's Photo Mount™ spray adhesive. Jack labels were created with a Brother QL-570 label printer and cut to size.

The EZKeyer's three function switches are mounted to the tin's lid with a bit of Super Glue-type gel adhesive, I used more than a bit of glue and wound up with three non-functioning tactile switches. After a gracious exchange of e-mail the gentlemen at 4SQRP expeditiously sent me three replacement switches. At this point I departed from the kit's construction manual and used an alternative method by Rick Bennett, KCØPET, to mount the switches. His technique solders the switches to a strip of scribed PCB material that is then mounted to the tin's lid with foam tape and hot glue. Worked great for me.
http://www.wa0itp.com/aa0zzbuildersnotes.html

For reference, the tactile switches are available from these vendors, and likely others.

- Digi-Key part #P8072SCT-ND
- Jameco part #2095120

I went with the manual's suggestion of three AAA cells to power the keyer. Powered on I was rewarded with an "R" that indicated all's well.

Indeed, all was well, but for a bit of Holmesian deduction needed. With the paddle plugged in and keyed, the little piezo speaker emitted alternating dits and dahs no matter the paddle arm activated. Checked paddle, cable and miniature stereo plug solder joints and connections–no problem. Jumpered PCB stereo jack's tip, ring and sleeve solder pads and A-OK. Tried two other miniature stereo plugs–problem persisted. Under magnification checked EZKeyer PCB paddle stereo jack–no problem detected. Reheated all solder joints although they appeared fine. Decided to try a "deluxe" all-metal stereo plug rather than the cheapie plastic shell plugs–problem solved–keyer now working flawlessly.

Calipered the plug shafts—they are all nominal 1/8", but the "deluxe" plug is a tight fit in the caliper's jaws whereas the plastic-housed plugs are a sliding fit.

The EZKeyer

Commands are entered via button one. Press button one, hold, wait for the "R" and key in your single-letter command. Rather than repeat all the available commands and functions available, including the very nifty receiver mute mode, I suggest you download the manual and check it out for yourself.

Hooking up the Black Widow paddle (see: *K9YA Telegraph*, October 2006) to the EZKeyer it played impeccably with my rigs including the non-keyer endowed NorCal 2N2/20 (see: *K9YA Telegraph*, June 2009). The EZKeyer recommends itself by its fluid code making and its lack of vices as I walked it back and forth between 20- and 40-wpm. I guess the best thing you can say about a keyer is that it behaves like there's nothing between the paddle and the rig–it responds instantly and transparently to operator inputs–without adding its own coloration or swing, no hesitation or missed code elements. The 4SQRP EZKeyer offers the CW op a pack of features, compact size and high performance that belies its low price. Plus, as a kit, the pleasure of knowing all that Morse music comes courtesy of you. ■

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