Product Review Column from *QST* Magazine

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Product Review

Conducted By Paul K. Pagel,* N1FB

The AEA MorseMatic MM-1 and MK-1 Keyers

How many functions and features can be built into one keyer? Advanced Electronic Applications, Inc., of Lynnwood, Washington, seems to have put just about everything you can think of in their MorseMatic Model MM-1 computerized keyer. The MM-1 can operate as a Morse trainer, a memory keyer, a beacon-transmitter controller or simply as a keyer. To provide all of these functions, each of which we will look at in detail, the MM-1 uses two 3870 single-chip microcomputers. Each 3870 is a complete computer system, containing an 8-bit processor, RAM, 2 kilobytes of mask-programmed ROM and all the logic required for clock generation, control and I/O functions. In addition to the 3870s, the MM-1 contains only two other ICs and 11 transistors. One of the ICs is a 1024-by-4-bit 2114 RAM used to store the Morse messages.

Now let's look at each of the four operating modes of the MM-1. First, in the KEYER/MEMORY send mode the MM-1 provides the following features: speeds from 2 to 99 wpm in 1-wpm steps, selectable dit and dah memories, adjustable dit/space and dah/space ratios, semi-automatic (bug) operation and 10 memories. When used with a dual-lever paddle, keying is iambic. The only option not included is automatic character spacing. Compared to other keyers, the MM-1 produces code as well as the best of them. The operator timing requirements are not overly critical and the feel is very much like an Accu-keyer. The memory has space for a total of about 500 Morse characters, which can be divided in any desired manner between the 10 messages. The memory can be expanded to approximately 2000 characters with the optional ME-1 memory-expansion unit.

A feature of the MEMORY SEND mode that contest operators will like is the automatic serial number. A serial number can be placed at any point in any of the 10 messages and is automatically incremented after the message is sent. As the number is not changed until the message is over, it may be placed in the message more than once. The serial number can be changed to a new value at any time, or it can be decremented by one should you fail to complete a contact. By using one of the memories, the current number can be repeated should the station you are working request a repeat of the number only. This requires pressing three keys on the keypad. After a message is started, the operator can interrupt it by pressing a key on the keypad or simply by tapping the paddle. At that point, the message can either be restarted from the beginning or from the point of interruption.

To make use of the memories, you must load your messages into them beforehand. This is done in the MEMORY LOAD mode. Characters can be keyed into the memory from the paddles in one of two ways. The AUTOMATIC mode controls the spacing between words and characters for you, while the REAL TIME mode records the spacing just as it is sent. The AUTOMATIC mode does have provisions for creating pauses in a message by entering word and character spaces directly from the keypad. Should an error be made in loading a message it can be corrected by playing the message up to the point of the error, stopping the message and then continuing to load the correct characters. For the "long-winded," the MM-1 has an LED indicator to warn the operator when he nears the end of the memory space. The indicator lights when approximately 22 character spaces remain. This is important because, should the memory be overrun, all of the messages will be lost!

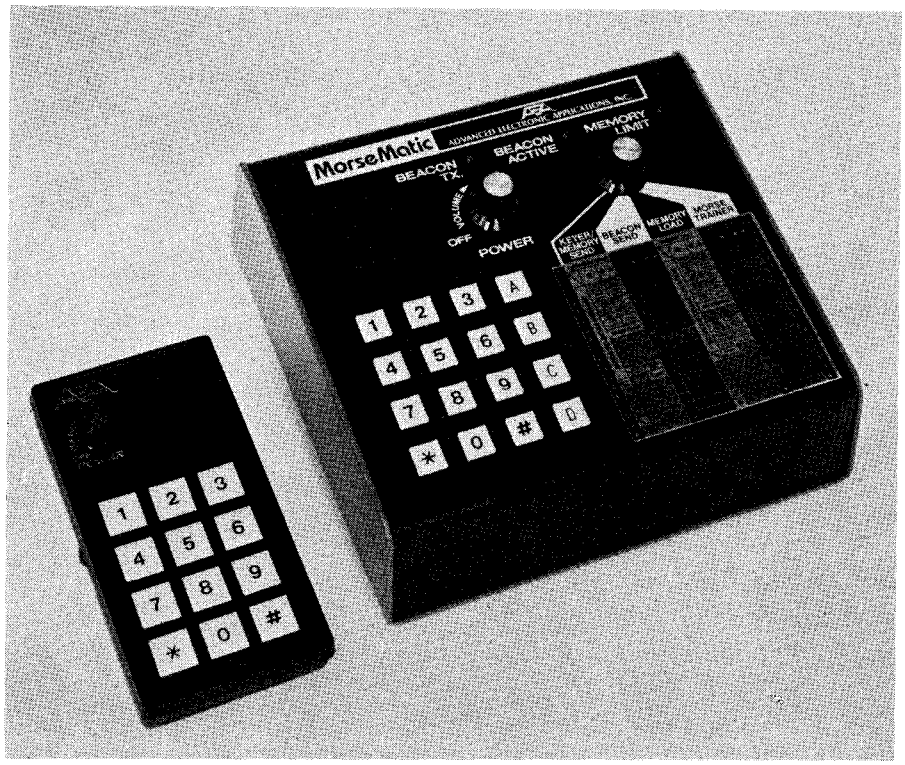


Fig. 1 — Microcomputer controlled, the MM-1 and MK-1 provide a multitude of features which should satisfy any cw operator.

Those of us that feel our cw copying ability is not quite ready for a contest should find the MORSE TRAINER mode of the MM-1 most useful. The Trainer will send perfectly formed characters at speeds of 2 to 99 wpm, and you can even program it to increase the speed as it is sending. Both the start and finish speeds are programmable, as is the time duration of the speed increase.

It is often found, particularly at low speeds, that the Farnsworth or slow-code method is helpful in increasing one's receiving speed. In this method, each character is sent at a relatively high speed, but the spaces between characters is increased so that the overall code speed is low. For example, 5-wpm code might be sent with each character at 18 wpm but with the spacing adjusted such that the word rate is 5 wpm. This is the method used for the W1AW code-practice transmissions up to 10 wpm. The MM-1 offers a choice between the Farnsworth method and standard code. One of two different character sets can be selected, the common set including the letters, numbers and most common punctuation marks, or the advanced set which adds a number of less commonly used punctuation marks and procedural signals such as parentheses and end of message (AR). While not often used, at least by this reviewer, the hyphen has been included in the set of common characters. At first this caused some difficulty, but the character was soon learned and was no longer a problem. Also, the parentheses in the advanced set is coded incorrectly. Again, a relatively minor point, and, as pointed out in the instruction manual, it should not cause anyone difficulty. The character sequence sent by the MM-1 can be any one of 10 fixed strings or a random character string.

The remaining mode of operation of the MM-1 is the BEACON SEND mode. This mode allows a message loaded into one of the 10 memories to be transmitted, repeatedly, at a fixed time interval. Both the transmitter on and off times are programmable from the keypad. The speed at which the message is sent is automatically adjusted so that the message will

*Assistant Technical Editor

fill the transmitter on time. The message can include a serial number that is automatically incremented each time it is sent. That pretty well covers the four operating modes of the MM-1, but we can still find a few more features, such as remote control and positive or negative keying outputs!

Message memories 0 and 1 can be recalled by momentarily grounding one of two pads on the circuit board. Two auxiliary jacks are provided on the back panel of the case. These jacks can be connected to the two pads and then used to activate the remote memory recall. Also located on the back panel are the jacks for headphones, keyed output (a jack for each polarity), paddles and the 9- to 16-volt dc input. A mounting hole for the memory expansion selector switch is also provided on the rear panel. All other controls are located on the top of the unit. Most of the control functions are handled by the 16-key keypad. The power switch is combined with the sidetone volume control, and a four-position rotary switch is used to select the mode of operation. These can be seen in the photograph.

"With all the various functions, features and modes, how can anyone remember how to operate the MM-1?" That was a common comment when other operators saw the MorseMatic, and the same question crossed my mind when I first used the MM-1. The fact is that once the commands used to control the MM-1 are learned, its operation is simple. The commonly used functions are quickly learned, and those functions that are not used often can be found on the reference chart located next to the keypad.

During use at home, the most outstanding feature I found was being able to select the exact sending speed I wanted. After using the MM-1 for a short time, I could match the speed of a station I wished to work without having to "try out" the speed setting as I have had to with other keyers. After using the MorseMatic for about a week, the 2114 memory IC failed and refused to load. Replacement of the 2114 IC solved the problem and no further difficulties were encountered.

All errors in operation of the unit were caused by either pressing the wrong key or not pressing the right keys hard enough. The MM-1 sounds a tone from the sidetone speaker (slightly lower in tone than the normal sidetone) each time a key is pressed. This would eliminate the problem of not pressing the keys hard enough, except that I like to use headphones and listen to the sidetone in my rig. If the sidetone volume of the MM-1 is turned down, you no longer have the auditory feedback when a key is pressed. This caused me to become very careful when changing speeds; if you make a mistake you may not know it until you hit the paddle and nothing happens!

The instruction manual supplied with the MorseMatic was complete and easy to read. The examples shown for programming each mode made it very easy to understand how to operate the MM-1. The optional AC-2 wall-transformer type power supply was used to power the unit during testing. Two C cells were used to maintain the memory in case of a short-term power failure. The cells can maintain the memory for about three hours.

So have you been counting all the features? I gave up, for each time I tried, I found a new one! No matter what the count, any practitioner of the cw art should find that the MorseMatic MM-1 fills his or her needs for a home-station keyer. Oh yes! The MM-1 has a little brother. It's the Model MK-1, and has most of the features of the keyer section of the MM-1. It does not have the memory, beacon or trainer modes and, as shown in the photograph, is much smaller than the MM-1. This makes it a nice unit to carry along on those portable operations. Other differences are that it provides only one keying polarity, a positive voltage to ground. My transmitter requires a negative voltage to ground so I added a single transistor inside the case of the unit. No other parts or changes are required. The connector used for the paddles is a four-pin microphone jack, as there is not enough room in the small case for the standard 1/4-inch phone jack.

The price classes for the MM-1 and MK-1 are $200 and $70, respectively. The ME-1 memory expansion is $60 and the AC-2 power supply for the MM-1 without expanded memory is $10. The AC-1 supply for use with the MM-1 with memory expansion is in the $15 price class. Additional information on these and other products can be obtained from AEA, Inc., P. O. Box 2160, Lynnwood, WA 98036. — *George Collins, AD0W*

CLEGG AB-144 ALL-BANDER RECEIVING CONVERTER

It's said, "Good things come in small packages." Well, there is a whole world of entertainment waiting for you when you hook up the All-Bander. Its small size is no indication of its performance. If you own an all-mode, 2-meter transceiver or receiver, the All-Bander will convert it to a deluxe shortwave receiver. The performance is limited only by the features of your 2-meter receiver. Simply hook an hf antenna to the All-Bander antenna jack, plug in the 12-V dc power supply that comes with the unit, connect a jumper to your 2-meter antenna input jack, and the whole spectrum from 100 kHz to 30 MHz is at your fingertips.

Clegg AB-144 All-Bander Receiving Converter

Specifications

Size (HWD): 2-3/8 × 5-1/4 × 5-3/4 in (60 × 133 × 146 mm).
Weight: 1-1/4 lbs (0.57 kg).
Color: Walnut grain with white front panel.
Power requirements: 10 to 15 V dc @ 30 mA (min); 110 V ac to 12 V dc converter included.
Frequency range: 100 kHz to 30 MHz.
Price class: $130.
Manufacturer: Clegg Communications Corp., 1911 Old Homestead La., Greenfield Industrial Park East, Lancaster, PA 17601, Tel. 717-229-7221.

The All-Bander receiving converter is completely solid state, using separate crystals for each oscillator position. Switching is done with an eight-position bandswitch, each position covering four MHz. All tuning and mode selection is performed by the controls on your two-meter receiver. A Schottky-diode doubly balanced mixer is used for improved dynamic range. The hf signals are "up converted" to the 144- to 148-MHz intermediate frequency.

For most situations, a random-wire antenna will suffice, but a multiple dipole or separate dipoles cut for the frequency of operation will improve reception. If your transceiver has a separate antenna input jack, it is recommended that you use it. You can hook the All-Bander directly to the transceiver antenna jack if necessary, but disconnect the microphone and key to prevent accidental transmission into the All-Bander. Although input protection has been provided, this extra precaution may prevent damage to the All-Bander, the transceiver, or both.

One of the most useful aspects of this con-

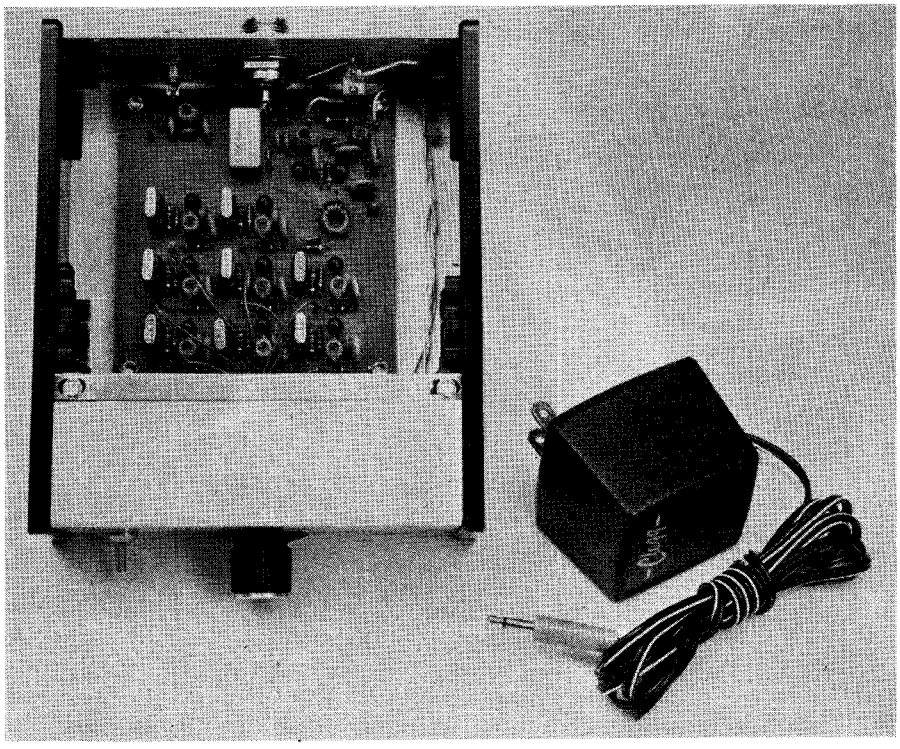


Fig. 2 — The Clegg AB-144 All-Bander and ac converter. The rectangular module close to the rear panel SO-239 connector is the doubly balanced mixer.

verter is using it as a ham-band receiver with your station receiver to check or monitor another portion of the band; it provides dual-frequency operation. The converter was useful for monitoring the frequencies of two nets that were operating at the same time. The shortwave-coverage feature is really a pleasure to use. Many pleasant hours were spent scanning the foreign broadcasts. With continuous coverage, the All-Bander is a valuable addition to your station. Making multiple use of your expensive 2-meter, all-mode receiver gives further justification to owning a Clegg All-Bander. — *Bernie Glassmeyer, W9KDR*

Z.R.C. COLD GALVANIZING COMPOUND

☐ Do you have a steel mast, roof tripod or tower that is showing signs of rust through the once-protective coating of galvanized material? If so, you may be interested in Z.R.C. cold galvanizing compound. This substance should be of considerable value to those who use iron water piping as masting for beam antennas (if the pipe has not been galvanized to protect it from corrosion).

A badly rusted tower or mast can be restored to almost new condition by applying Z.R.C. with a brush after the rust has been removed. The success of the treatment is highly dependent upon cleaning the old metal thoroughly with sandpaper or a wire brush — preferably a brush that can be used with a drill motor. All oil and old paint must be removed before the Z.R.C. compound is applied. The manufacturer can provide a special cleaning fluid (metal conditioner) for the purpose, although any good degreaser should be suitable.

Once the work is ready to be treated you can apply the Z.R.C compound with a paint brush. It has the consistency of paint, and is a slate-gray color. Two coats are suggested to ensure good coverage of the metal. The finished product, after drying, has a bluish-gray nongloss coat. The protectant dries to the touch in 30 minutes and is sufficiently aged to permit application of a second coat in 24 hours. Proper application is realized when the compound has a dry thickness of 3 mils (0.08 mm). This is comparable to a hot-dip galvanize treatment.

A 24-pound (10.8-kg) container of Z.R.C. compound will cover 400 to 500 square feet (37 to 46 sq. meters) of surface at a 1.5-mil (0.04-mm) dry thickness. It can be applied with a brush or by means of a paint sprayer. Accelerated drying is possible by placing the coated work in an oven.

The compound consists of 95% pure zinc metal. It is flammable because it contains petroleum distillate. Since this material should not be ingested, and because the fumes should not be inhaled, it must be handled with care. It should be kept out of the reach of children.

Our sample was shipped in a 1-1/2-pound (680-g) can. Other quantities are available. We cannot attest to the longevity of the protective coating, since this review would have to be delayed 5 or 10 years as we watched for signs of deterioration. The steel pipe to which this material was applied certainly looks nice, and the coating appears to be tough and durable. The manufacturer is Z.R.C. Chemical Products Co., Quincy, MA 02171. A letter of inquiry will be answered with the name of the nearest distributor. Price class for the 1-1/2-pound (680-g) can is $5; the metal conditioner is $8.25 per gallon (3.8 liters). — *Doug DeMaw, W1FB*

BENCHER ZA-1 AND ZA-2 BALUNS

☐ The *QST* ad reads, "The Ultimate 1:1 Balun," in a manner similar to Lew McCoy's July 1970 *QST* article title, "The Ultimate Transmatch." Just how *ultimate* any product or circuit design might be is a matter for the beholder to judge. Some may settle for the term "penultimate" (next to the last word), since there is probably no product on earth that can't be improved upon in some manner! Nonetheless, the Bencher baluns have the desired attributes to make them superior to some other baluns — under specific operating conditions.

Both balun models are devoid of magnetic core material. This means that the core is air rather than a ferrite rod or toroid. Each unit has a trifilar winding of heavy-gauge enameled copper wire. The transformer is wound on a 1-inch (25-mm) tubular coil form to represent the circuit shown in Fig. 3. This is the standard 1:1 balun configuration that appears in the transmitting chapter of recent ARRL *Handbooks*. So, there is nothing magical about the transformer concept. But, the absence of a magnetic core is an item of interest, since without a core the transformer will not saturate when subjected to high levels of rf power, or when a serious mismatch occurs. When a magnetic-core transformer saturates, square waves develop, and they can cause TVI through the presence of strong harmonic currents. In fact, if you've been experiencing a TVI problem that defies resolution after trying all of the usual cures, try removing the balun from your antenna. Chances are that the TVI will vanish after you remove the potential source of the problem.

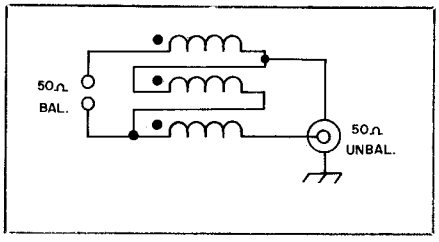


Fig. 3 — Schematic diagram of a 1:1 balun transformer. The black dots indicate the polarity of the windings.

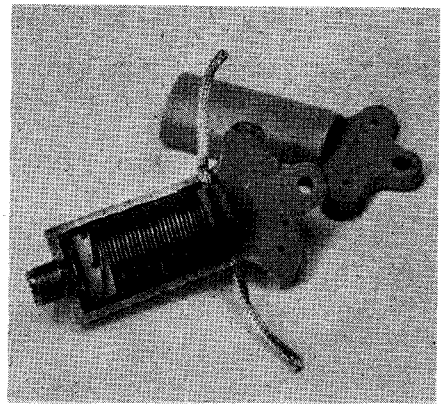


Fig. 4 — Photographic view of the Bencher ZA-1 balun, showing the interior of the assembly. Half of the molded-plastic case was removed for this picture, thereby breaking the weather seal.

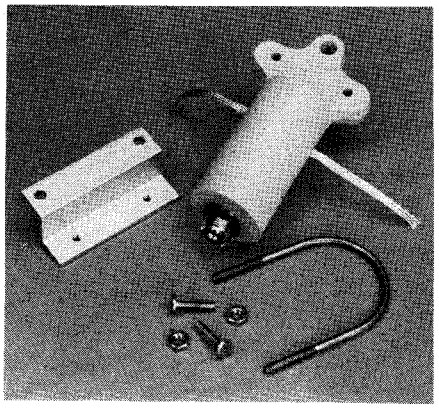


Fig. 5 — The Bencher ZA-2 balun is designed for use with mono- or triband beams and is supplied with mounting hardware.

The foregoing is by no means an indictment of the magnetic-core balun you bought or built. Rather, it may suggest that your antenna system is poorly matched to the feed line, that the ferrite core is too small in cross-sectional area, or that you're running more power than the balun is rated for (shame!).

The model ZA-1 is designed for use from 3.5 to 30 MHz. A typical application would be at the feed point of, say, a 40-meter dipole. This would provide a balanced-to-unbalanced transformation between the dipole and a 75-ohm coaxial transmission line. The plastic housing is built to accommodate dipoles and has a center-support hole at the top, which makes it ideal for use in supporting inverted-V antennas. Silver-plated shield braid emerges from each side of the assembly for making connection to the halves of the dipole. An interior view of the ZA-1 is shown in Fig. 4. The SO-239 style of coax connector at the bottom of the balun is equipped with an "O" ring to provide a seal against dust and moisture when the feeder is attached.

For those wishing to use a 1:1 balun on single-band or triband 50- or 75-ohm beam antennas, the model ZA-2 can be employed. It is similar to the ZA-1, but has fewer coil turns and comes with appropriate boom-mount (2-inch or 51-mm OD) hardware (see Fig. 5).

Among the claims made by Bencher is that the baluns will handle 5 kW of peak power. We were unable to verify this claim in the ARRL lab because we have no means by which to generate more than 1 kW of rf power. At the 1-kW continuous level, into a 50-ohm balanced load, no heating of the coil was observed at 14 MHz. The VSWR from 3.5 to 29 MHz under this condition (ZA-1) was less than 1.5:1, with the worst-case reading at 3.5 MHz. The ZA-2 showed a VSWR of less than 1.5:1 on 14, 21 and 29 MHz. Return-loss measurements with a Hewlett-Packard spectrum analyzer verified this set of conditions and showed the power loss to be substantially less than 1 dB.

Because of the type of winding the transformer has (see Fig. 3), the antenna is effectively grounded at dc. This is a useful feature in the event of rain-static buildup or voltages induced by lightning strokes in the area.

The ZA-1 sells for a price class of $16 and the ZA-2 for $18. The manufacturer is Bencher, Inc., 333 West Lake St., Chicago, IL 60606, Tel. 312-263-1808. — *Doug DeMaw, W1FB*

E-TEK FR-4TR FREQUENCY READOUT/COUNTER

☐ What can one say about a frequency display? Yes, it displays frequencies — to six places (to the nearest 100 Hz) and the 3-inch (76 mm) digits are bright red, perfect for overtaxed eyes. But be advised: This product is essentially a digital dial; don't expect to see the unit register 75- or 100-Hz shift when operating cw. The manufacturer states that the calibration has been adjusted to within ±2 ppm. A front-panel 3-position toggle switch serves as the band selector — 80, 20 and normal (40, 15, 10 meters). The decor matches the Drake styling.[1]

Installation of the E-Tek unit requires connection to V1 of the TR-4CW transceiver (premixer/crystal oscillator) and to one circuit board. Accomplishing this was fairly simple, although, being a dedicated appliance operator, I looked upon probing into the entrails of the rig with as much enthusiasm as, say, spending the weekend in the Sahara Desert. A sigh of relief was heard upon completion of the minor surgery. Unfortunately, everything was not copacetic.

Bizarre (and incorrect) frequencies were being displayed on 10 and 15 meters. A call to E-Tek indicated that tweaking up the injection crystal oscillator would alleviate the problem (this procedure is outlined in section 5-10, page 5-2, of the TR-4CW instruction manual). With that completed, we thought we were "golden." The unit, however, was still unstable on 10 meters when the RV-4C external VFO was being used.

Another call to E-Tek and we received a modification kit which consisted of a 100-ohm resistor and an L-C network. Salvation at last! Well, not quite. The 33-pF capacitor that E-Tek sent disintegrated upon touch. The ARRL hq. lab supplied a replacement, and this modification concluded on a successful note. The FR-4tr then functioned properly on all five bands, regardless of which VFO was being employed.

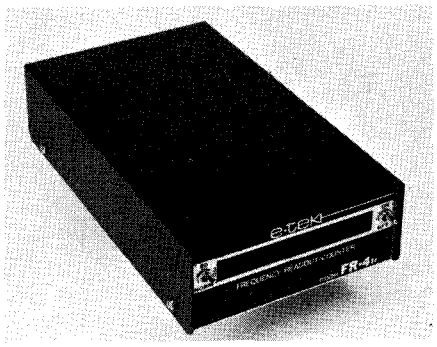
I enjoyed using this product and would recommend it to any active ham. It's great for split-frequency DX chasing as well as pinpointing a net or sked frequency. Nevertheless, an item with this price tag should already contain the appropriate refinements. E-Tek has indicated that all future runs will include the modification and that the FR-4tr instruction book will contain the injection crystal oscillator information.

There is one piece of bad news to report. The unit generates spurious signals. The spurs are practically inaudible when an antenna is connected. With one's skyhook removed, however, a continual "beep beep beep" is quite evident. This was first discovered on the 20-meter band, at approximately every 28 kHz. Further investigation revealed an equivalent on the 80-meter band. No spurious signals were discovered on the other three bands. Table 1 lists the spurious signals found on 20 and 80 meters. (Note: Because of the design of the transceiver, 20-meter tuning is right to left using the bottom scale of the linear dial, while all other bands tune from left to right per the top scale.) — *Robert Halprin, K1XA*

Table 1

FR-4tr Spurious Signals

20 meters		*80 meters*	
14.0004	14.2637	3.9996	3.7363
14.0284	14.2945	3.9716	3.7055
14.0566	14.3258	3.9434	3.6742
14.0852	14.3575	3.9148	3.6425
14.1142	14.3895	3.8858	3.6103
14.1433	14.4221	3.8567	3.5779
14.2729	14.4549	3.8272	3.5451
14.2028	14.4882	3.7972	3.5118
14.2331	14.5219	3.7670	3.4781



The FR4tr is designed to provide a digital frequency readout for the TR3/TR4 series of Drake transceivers.[1]

E-Tek FR-4tr Frequency Readout/Counter

Dimensions (HWD): 3-3/8 × 5 × 8-3/4 inches (60 × 127 × 222 mm).
Weight: 4.5 pounds (2 kg).
Power requirements: 105 to 130 V ac, 60 Hz.
Price class: $170.
Distributor: E-Tek, 1028 Greene St., Marietta, OH 45750.

MSL DIGITAL QSK KIT

☐ The Micro Systems Labs Digital QSK board provides a cw QSK type of operation at moderate code speeds for ssb/cw transceivers (or with separate receivers and transmitters) that employ VOX-keyed cw transmission systems. The kit I received and assembled was tested with my Yaesu FT-101ZD transceiver and later with the Kenwood Twins, the R599D/T599D combination.

The MSL Digital QSK system uses a delay timer, shift register and sidetone oscillator. When the cw key is closed, the transceiver PTT line is closed, the delay timer started and the sidetone oscillator triggered. The keyed code is entered into the shift register, where it is sampled and delayed approximately 50 ms to allow the T-R relays to switch before rf is generated. (The normal 50-ms delay time may be extended to 100 ms if desired by the addition of another shift register.) When sending ceases for 60 ms or more, the shift register empties and the timed delay runs out, placing the station in the receive mode again. The switching delay between transmit and receive can be made adjustable by means of a potentiometer.

Instructions are provided to permit the MSL board to key both positive and negative PTT and keying lines. An instructional wiring error involving Q4 was discovered during assembly of the unit. The positive keying line modification (which involves installing different jumper wires) left the base of the keying transistor "floating." The correct jumper installation should have the base of Q4 connected to resistor R11.[2]

It was noted that the diode junction voltage drop of the keying-line polarity-protection diode (D3) was sufficient to prevent the internal audio oscillator of the '101ZD from being keyed. If the diode is placed between the collector of Q4 and ground, protection will still be afforded and the oscillator can be keyed.[3]

Basically, the MSL circuitry produces a keyed relay type of QSK system, which means that the effectiveness of the system depends upon the shift-register delay and the speed with which the T-R relays actuate. (Most vacuum relays used in other QSK systems operate at speeds of less than 10 ms.) If an average keying speed of 24 wpm is assumed, one dit will occupy a time period of 100 ms.[4] At a speed of 48 wpm, the dit will occupy the same time span as that offered by the shift register and the drop out time delay, 50 ms. The relationship between relay transfer time and keying speed becomes quite obvious.

No adverse keying characteristics were introduced when the system was in use. The MSL system does definitely eliminate the truncation of the initial dit or dah experienced with normal keyed-VOX circuits; the T-R relays are switched "cold." On-the-air testing proved that a breaking station could be heard without difficulty at most speeds normally encountered. At keying speeds of approximately 12 wpm or less, the MSL system will transfer between code elements; at higher speeds this transfer occurs between code groups.

In reality, most operators will not find the MSL onboard audio oscillator necessary. It will be virtually impossible for the operator to discern the 50 ms delay between key closure and the generation of the sidetone at most keying speeds.

When using the system I was bothered by the constant cycling of the transceiver or receiver/transmitter T-R relays and the accompanying noise. By using headphones, noise disturbances were reduced to a tolerable level, but the T-R relays are nevertheless still operating much more frequently than they would be under normal operating conditions. When the MSL unit was used with my '101ZD, I experienced popping in the receiver during the relay transfer, which also disturbed me. Another staffer tried the unit with a Yaesu FT-101E and found similar difficulties. Additionally, at speeds above 35 wpm, QSK was no longer possible and the '101E operated much like a VOX-keyed rig.

I can understand the possibility of transceiver owners using such a system for QSK operation, but I would personally prefer to use a faster, quieter system with separate receiver/transmitter combinations. A singular exception to this rule would be to utilize the board solely to eliminate the initial dit or dah truncation. The drop-out delay time may be lengthened, as mentioned earlier, thus avoiding the constant cycling of the T-R relays.

The MSL QSK system is available from Micro Systems Laboratory, 1429 Oak Grove Circle, Santa Ana, CA 92705. Pc board and instructions, $4; parts kit (includes board), $20; assembled and tested board, $40. — *Paul K. Pagel, N1FB* QST

[1]A model is also available for the Drake Twins. It requires no modification and no band-switching.

[2,3]The manufacturer was informed of these findings and has taken steps to correct them.

[4]*The 1980 Radio Amateur's Handbook*, 57th edition, p. 11-6.