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Advanced Electronic Applications AEA MM-3 Morse Machine

Down East Microwave 23-cm and 13-cm Loop Yagis

AEA MM-3 Morse Machine

Reviewed by Jeff Kilgore, KC1MK, and Larry Wolfgang, WA3VIL

AEA's MM-3 Morse Machine offers a host of features previously not found in Morse keyers. The MM-3's features include highly flexible iambic keying, memory operation, the ability to send and receive data via a serial interface (to/from a terminal or computer), random code-practice generation, random word generation and even QSO simulation.

The MM-3 uses an Intel® 8031 8-bit microprocessor running at 11.8 MHz. An Intel 8155 provides system RAM, I/O ports and a programmable timer, a 27C256 PROM contains the software that operates the keyer, and storage for CW messages is provided by a 6264 static RAM.

Jeff reviewed the MM-3's basic operation and on-the-air use. Larry's primary interest in the keyer lies in Morse code training for instructors and individuals trying to improve their Morse code skills, so he reviewed its training features (starting with the section called Morse Code Training Features).

Installation

Installing the MM-3 is straightforward. Connect the keyer to a 9- to 16-V dc power source (an optional wall-cube power supply is available), a pair of paddles and your rig, and you're all set to take advantage of most of the MM-3's capabilities. Separate positive and negative keying outputs are provided for compatibility with most transmitters.

All connections to the MM-3 are made on the rear panel. The transmitter-keying outputs are available at phono jacks, and a separate PTT phono jack can be used to key your transmitter's PTT line. The paddles connect to the keyer through a three-conductor, 1/4-inch phone jack, and a 1/8-inch headphone jack is also included. The serial connection is made through a pair of phono jacks; one for data in and one for data out. Power is applied via a coaxial barrel connector that comes with a mating connector and about four feet of wire. The keyer also comes with mating connectors for all other rear-panel connectors except the headphone jack.

The MM-3 is probably the first CW keyer to include a serial port. The keyer can convert from ASCII to Morse code—and vice versa! This feature can be used in a variety of ways, ranging from loading the keyer's memories from a computer to using the MM-3 as a packet-radio terminal! We'll discuss this feature in more detail later in the review.

A keypad command lets you reverse the paddle connections at the keyer, avoiding the need to rewire the 1/4-inch plug on the cable to your paddle. A lithium battery backs up the contents of the standard 8 kbytes of memory. The 6264 8-kbyte static RAM can be replaced with a 43256 32-kbyte static RAM by merely changing the chip; no trace cutting or jumper installation is required.

The MM-3 draws about 350 mA from its supply. Current drain can be lowered to approximately 250 mA by disabling the internal speaker (this is done via a keypad command), and can be further reduced (by about 20 mA) by disabling the keyer's LEDs and serial-port driver by moving a jumper on the circuit board. Replacing the 8031 IC with an 80C31 CMOS equivalent saves about 100 mA, and replacing the 8155 with an 81C55 saves another 60 mA. (The 80C31 and 81C55 chips are available from Jameco® and other suppliers.) So, you can reduce the MM-3's current requirement to about 70 mA if you need to. This makes the MM-3 a viable candidate for portable operation.

A Multitude of Modes

The MM-3 has five distinct operating modes: Keyer/Memory Send, Memory Load, Beacon, Trainer and ASCII/Morse Converter. A 16-button keypad is used to change modes, select various options within each mode and to change operating parameters.

Keyer/Memory Send

When first turned on, the keyer is in the Keyer/Memory Send mode. Keying speed can be programmed from the keypad or controlled via a potentiometer. Weighting and sidetone pitch are controlled by keypad commands, as are Memory Send operations.

The keying options are automatic (iambic), semiautomatic (bug) and straight-key modes. You can turn off the iambic feature in the automatic mode. (In this case, the keyer sends all dots or all dashes when both paddles are closed—instead of alternating between dots and dashes, as in iambic operation.) You can adjust the dot-to-dash ratio (weighting), and turn the dot and dash memories on or off. A tune-up command is also provided; it's used to key the transmitter continuously for tuning purposes.

Keyer speed can be varied over the 5- to 45-WPM range with a potentiometer, or from 5 to 99 WPM via the keypad. Entering a new speed via the keypad is done by pressing *6nn, where nn represents the desired speed in words per minute. This is a typical MM-3 command sequence. When using the keypad to enter speeds under 10 WPM, you have to enter a leading zero. The SPEED knob operates smoothly and spreads the speed adjustment out in a comfortable and easily controlled manner.

Sending a preprogrammed message is as simple as selecting the message bank (A or B, as indicated by two LEDs) and pressing the desired message number. A five-terminal DIN jack labeled REMOTE MEMORY on the rear panel allows you to use four external, normally open push-button switches to control memories in the selected memory bank. Placing those switches near your paddle allows you to send messages without reaching too far away from the paddle. This feature is limited to controlling memories 1 through 4, but it should prove adequate for most contest-style operations, where this feature will find the most use.

Message 1 in bank A or B can be set to repeat automatically at a user-selected time interval from 1 to 999 seconds. (Zero, the

default, disables the repeat function). This is a handy feature for contest CQing.

Any memory can be programmed to include an automatically incrementing serial number. Pressing **C** repeats the serial number without incrementing it, which is helpful when giving a fill during a contest exchange. Pressing ***0** repeats the last serial number the next time you play the memory with the serial number embedded. You can set the serial number to any desired value by pressing ****0nnnn#**, where *nnnn* represents the four digits of the serial number you want to set. Leading zeros are required to hold the four places, such as to set the number to 0005, but the serial number can be sent with no leading zeros, or with leading zeros for a minimum of two, three or four digits, depending on your requirements. To save time in a contest, the MM-3's serial-numbering feature can be set to send *9* as *N, 0* as *T,* and *1* as *A* in serial numbers. These options are independently selectable.

Another of the MM-3's memory features is particularly appealing to contesters. Desired portions of a message can be sped up by 41 percent by pressing ****3** before the part to be sent faster. Subsequent ****3**s in the message alternate between the normal and faster speeds.

You can interrupt a message in progress to insert text by tapping either paddle or pressing the **#** key. The MM-3 then immediately goes back to normal keyer operation, allowing you to send the desired text with the paddle. Pressing **D** continues the message from where you interrupted it.

Loading Memories

The memories are set up in two banks of 10 messages each, with a total capacity (as supplied by AEA) of approximately 8400 characters, which can be upgraded to approximately 36,500 characters by changing the memory chip. (At first glance, these numbers don't seem to add up. With the 8-kbyte memory chip, it seems like the keyer should be able to hold 8192 characters—8 × 1024. Ah, but each character does not necessarily occupy a full byte—8 bits—of memory! For example, the letter *I* requires only 6 bits: One bit for each dot, one bit for the space between dots and three bits for the letter space.) The actual number of characters that can be stored depends on the relative character lengths. Memories are soft-sectored; you can fill the memory with 20 equal-length messages, one huge one, or anywhere in between.

Operation in the Memory Load mode is straightforward, with all operations under keypad control. Loading memories simply involves entering Memory Load mode, selecting the desired memory bank and message number, then sending the message; at the end of the message, press the **#** key.

You can load messages in real-time mode or with automatic word spacing. With real-time spacing, pauses are recorded in memory exactly as sent. Using automatic word spacing, pauses two to five dots long

count as character spaces, and pauses longer than five dots count as word breaks.

One message can be called from another, as long as both are in the same bank. You can chain several messages together in this way. For example, if Memory 1 contains **CQ** and Memory 2 contains **KC1MK**, you could program Memory 3 to call Memory 1 three times, then send **DE** with the paddle, then call Memory 2 three times and finish by sending **K** (and pressing **#**). Memory 3 would then send **CQ CQ CQ DE KC1MK KC1MK KC1MK K.**

An editing feature allows you to change the contents of a memory after loading. To use this feature, you send that memory from the Keyer/Memory Send mode, and touch either paddle to interrupt the sending at the appropriate time. Then enter Memory Load mode, send the revised text, and end the message with a **#**. The editing feature does not allow you to change text in the middle of a message without changing the text after the change, but it can save you some trouble if you make a mistake near the end of a lengthy message.

When memory is almost full, the sidetone pitch drops. When this happens, memory is available for about 20 more characters. If you try to go beyond that, the sidetone will stop, and you must press **#** to end the message.

Larry: I ran into some difficulties when I completely filled the memory. While loading some code-practice text into the keyer from a computer file via the serial port (discussed later), I filled the available memory. The sidetone doesn't function when you load messages this way, so I had no idea the memory was full. When playing back the messages, I discovered that the last message was cut short. I used the editing feature to shorten one of the other memories, as suggested by the *Owner's Manual.* As I was sending some code to fill the available memory, I heard the sidetone pitch change, and ended the message when that word was completed. When I next played back the messages, however, I discovered that some of the text from other memories had been deleted and overwritten by the edited text. This problem seemed to come up only when I used the editing feature, and filled (or nearly filled) the memory in the process.

I called AEA's technical assistance service, but they couldn't reproduce this problem. AEA sent me a new EPROM with the latest program version, and suggested that this might solve the problem. It did not, but they are still working on it. This is a minor problem, and of real consequence only to an instructor who might be hoping to load the code practice for a class into the keyer and then use the memories to play the practice for the class.

Beacon Mode

Beacon operation allows a message stored in any memory to be sent at a desired interval. This interval (the time from the start of one transmission to the start of the next) is adjustable in one-second steps from 1 to

999 seconds. You can interrupt beacon-mode transmissions by pressing the **#** key or touching either paddle. Pressing **D** resumes the beacon text where you interrupted it. You can also restart the beacon by pressing the number of the desired message.

The MM-3's accessory **PTT** output can be particularly useful in the Beacon mode. The **PTT** output keys the rig half a second before the beacon starts sending the programmed message, and is held closed until the beacon message is completed. This allows operation of a transmit/receive switch on the beacon transmitter, for example.

Operation

On-the-air operation with the MM-3 is a pleasure. Setting the speed is a simple process, whether performed via the **SPEED** control or the keypad, and the 20 memories are a boon to any type of amateur operation, from contesting to ragchewing.

Control of the many MM-3 functions using the keypad, although not intuitive, is logical and well thought-out. The condensed guide to the keypad and operating modes on the top panel is handy, but you should read the manual before operating the MM-3. It is definitely a good idea to practice a bit with this keyer before using it in a serious contest effort. After doing so, the MM-3 should prove to be a real asset in CW contesting.

The manual is reasonably substantial, containing 48 pages and treating most subjects accurately and in sufficient detail. There are, however, a few cases where the manual falls short. For example, a diagram shows how to wire switches to the **REMOTE MEMORY** jack, but there is no mention of this feature in the text. Similarly, ratings of the three keying outputs (**PTT, +KEYED** and **−KEYED**) are not mentioned in the manual. A call to AEA's technical-support folks brought the answers quickly, though.[1] Overall, the manual is good, and specific information is easy to find.

I spent many enjoyable on-the-air hours using the MM-3, and found it a useful tool in all my CW operations. I recommend the Morse Machine to anyone who has a need (or desire!) for the features it provides.

Morse Code Training Features

I have an interest in Morse code training techniques, especially after serving as ARRL License Manuals Editor for the last several years. I've experimented with several training methods using cassette tapes, and have tried more Morse code training programs for the IBM® PC—each of which was touted by its author as the best ever written—than I care to remember. So when I first heard about the MM-3, I was immediately interested in its training features.

The MM-3 is not just a large-capacity memory keyer, although it's obvious that an instructor could program a lot of classroom practice into this machine. (With the standard 8-kbyte memory, the MM-3 can store about 80 minutes of 20-WPM code practice,

and at 5 WPM there is memory for more than 5½ *hours* of practice!) The ability to connect the keyer to any computer with a serial port makes it easy to store such practice, and to reprogram the keyer for specific needs.

A Keyer with a Serial Port?

The MM-3's serial port is intended for connection to an RS-232-C computer interface. The **SERIAL OUT** port uses TTL-level signals (+5 V and 0 V), so it may not work with a true EIA-232-D interface (the latest version of the standard formerly known as RS-232-C). Most computer serial ports should work fine with the MM-3, however. I had no problems using it with my Apple® //e, and an IBM PC. The **SERIAL IN** port can handle a range of voltage levels, so no external inverters or limiters are needed. Of course, if you're using a computer, you'll also need an unused serial port and a terminal-emulation program or a communications program (such as PROCOMM® for IBM PCs and compatible machines) in order to use this feature.

The Morse Machine requires serial input data with eight data bits and no parity, or seven data bits and any parity. The serial output data is eight bits, no parity. The default data rate is 1200 bauds, and you can select data rates of 150, 300, 600, 1200, 1800, 2400, 4800, 7200 and 9600 bauds.

In all modes except the ASCII/Morse Converter mode, the keyer translates Morse code sent with paddles or a straight key to ASCII data and feeds it to the serial port. This is an excellent way to analyze a student's fist and provides immediate feedback to the student. If the computer display shows the same letters the student intended to send, everything is fine. If something different shows up, the student can see immediately that there is a problem with his or her rhythm, and can work to correct it. If the student is trying to send **CQ**, for example, and the computer screen always displays **NN GT**, the keyer can help motivate the student to keep trying until **CQ** pops up on the screen.

The MM-3 interprets ASCII data sent to the **SERIAL IN** port as a command stream in all modes except the ASCII/Morse Converter. Any keyer feature that you can control from the keypad can also be controlled from a computer. So, you can select operating mode, load message memories, change keyer speed, select the message memory for transmission, and much more, from the terminal keyboard.

It was almost *too* easy to prepare a message with my word processor, save it as a file on disk and then send that file to the keyer with my terminal-emulation program. Standard exchanges for various contests could easily be set up in disk files, for example, allowing you to load appropriate contents into the memories before a contest. This feature is even more useful to a Morse code instructor. Imagine being able to prepare practice text—or even a Morse code exam—and load it into the keyer's memories

before class, and then have to carry only the keyer with you!

Unfortunately, the MM-3 isn't as well suited to this application as it first seems. The keyer's specifications mention Farnsworth spacing[2] and the ability to set the MM-3's character speed independently from the word speed, but this feature only functions in the Trainer and ASCII/Morse Converter modes. The message memories are always sent using standard code at the speed set by the keypad or **SPEED** knob. There is no easy way to load the keyer memory and then have it send the code with 18-WPM characters slowed to a 5-WPM overall speed. (There is a way, but you won't like it. You can put the keyer into real-time mode and then load the practice text with a paddle—or straight key. You then set the keyer to operate at 18 WPM and manually allow enough space when loading the text to slow the overall speed down to 5 WPM.) There *is* another way around this, though. See the section about the ASCII/Morse Converter for more details.

Anyone for a Morse Code Packet Terminal?

The serial port adds a number of interesting uses to the normal keyer functions. For example, in the ASCII/Morse Converter mode the keyer sends Morse code as you type the text on the keyboard, so anyone can send perfectly timed code for classroom practice. How about using the Morse Machine as a terminal for your packet-radio TNC? Serial data from the TNC is converted to Morse code. You set the code speed with the keypad. Code sent with the keyer is translated to data for the TNC, to control the TNC or transmit packet text.

My first reaction was that no one would really want to use the keyer as a packet terminal. But let your imagination go for a minute: How about using it as a portable station without the expense of buying a portable computer? Other applications that came to mind involved a handicapped operator, such as a blind person, or someone who has difficulty operating a computer keyboard—but who could operate a keyer by some means.

I was curious, so I connected the MM-3 to my Kantronics All-Mode™ data controller. The keyer translated the received data into flawless Morse code. I was not able to get the KAM™ to respond to data from the keyer, however. I suspect that the 5-V level on the **SERIAL OUT** port was not high enough to operate the KAM. This feature would probably work fine with a TNC that uses TTL signals.

The MM-3 *Owner's Manual* suggests a few other interesting applications of the serial port. For instance, if you were to connect a suitable interface circuit from a receiver's audio output to the dash input on the Morse Machine, then set the keyer to accept straight-key input, received audio would key the MM-3. The serial data from the keyer could then be fed to a computer, and you have a code reader. You could also feed the serial data from a multimode com-

munications processor (MCP) to the keyer. If the MCP is receiving a fast CW signal (or an RTTY signal of some type), that data will go into the MM-3 and be converted to Morse code and sent at the speed you select. The possibilities for Morse code practice and other applications are probably endless!

Morse Trainer Operation

The MM-3 has a Morse Trainer feature that can be very useful for classroom instructors and for individuals who are learning Morse code or trying to increase their code speed. After setting the beginning and ending code speeds and the practice duration, you can choose random code practice with either five-character groups or random-length groups. You can also select the word generator, which selects randomly from more than five thousand four-letter words. (Most of these are not really words, but the letter combinations form pronounceable combinations.)

In the Trainer mode you can select Farnsworth or standard code timing. The keyer is set to send Farnsworth code with 15-WPM characters when you turn it on, but it can be set to send 18-WPM characters (as used on ARRL code-practice cassettes, W1AW code practice and ARRL VEC code exams).

Pressing any number in Trainer mode starts a sequence of random-character practice. This gives you ten different practice sequences to work with. You can also press **D** to begin the practice session, and that will result in a random start.

You can choose from three character sets for your practice sessions. The Easy character set includes all of the characters required for an FCC Morse code exam. You can also select the Medium Difficulty set, which adds some additional punctuation and procedural signals (such as $\overline{AR}$ and $\overline{SK}$). Or, you can select the complete character set, which includes things like the underline character ($\cdot\cdot - - \cdot$), the dollar sign ($\cdot\cdot\cdot - \cdot\cdot -$) and a few foreign characters like the German *ä*.

The Trainer mode includes another feature of interest to instructors and those seeking to increase their code proficiency: a QSO simulator. If you are familiar with the AEA Dr. QSO® firmware cartridge for the Commodore 64™ computer, you will have an idea of how this feature works. The keyer generates Morse code signals from "stations" that call CQ, answer CQs and exchange information similar to typical on-the-air contacts. You can listen to the activity, copying the exchange of information. But why limit yourself to just copying code? Join in the fun, and begin contacting these "stations"!

You can set a maximum code speed to be used by the stations in the simulator. If you get bored with the conversation on a particular "frequency," simply press **C** to change the channel. The simulator doesn't assume any particular band, time of day or season. It does assume good propagation across the United States. All of the call signs are US calls, so you won't "work" any DX,

but how about MM-3 WAS? The simulator is almost as much fun as being there, and provides excellent practice for a would-be ham or someone trying to increase their code speed and self-confidence.

ASCII/Morse Converter

I've mentioned this feature several times. Its primary use is the generation of Morse code from text typed on a computer keyboard. Selecting the Easy character set or the Medium Difficulty character set filters out the more difficult (and very rarely used) ASCII characters that can be typed on a keyboard.

Virtually anyone can produce perfect Morse code for practice or on-the-air operation by using a computer and the ASCII/Morse Converter. The Farnsworth-character-speed command functions in this mode as well, so the code that the keyer generates can be set to come out at any speed, such as 5 WPM, but with 18-WPM characters (or whatever character speed you want).

This mode also provides the best way for an instructor to use the keyer to produce preprogrammed classroom code practice. By saving the desired text to a disk file and then using a terminal program to send that file to the keyer via the serial port, you can set the desired timing parameters. The MM-3 has the advantage over a simple computer program, however, because it can provide all the other assistance and practice opportunities we've discussed.

Software Upgrades

AEA continues to improve the MM-3's software. When new EPROMs become available, you can upgrade your MM-3 at no cost if you purchased the keyer within 30 days prior to ordering the upgrade. (You'll have to provide a copy of your receipt for proof of the purchase date when doing so.) More than 30 days after keyer purchase, an EPROM upgrade costs $30.

Here are some of the new features and improvements in the works. Keypad-command control of upper and lower limits of the **SPEED** knob may be added. In Trainer operation, you may be able to select only letters, only numbers, or letters and numbers as practice characters (in addition to selecting one of the three character sets described earlier). A feature may be added to allow Farnsworth-spaced code to be sent from the memories, with the code-teaching advantages described under Morse Trainer Operation. Message loading and editing functions may be modified for greater flexibility and easier use.

The programmers at AEA are also considering adding the Dr. DX® contest simulator to the MM-3's software. This function, derived from an AEA firmware cartridge developed for the Commodore 64 a few years ago, would be similar to the MM-3's Dr. QSO feature, but simulates a DX contest instead of casual operation.

Mailings to registered MM-3 owners and AEA advertisements will announce the availability of improvements and new features as they become available. Of course, some of the new features mentioned here may have to be abandoned because of lack of available EPROM space or other limitations.

Summary

The AEA MM-3 Morse Machine has many useful features. Other than a few trouble spots, and with only a short reviewer wish list, it performed flawlessly. The keyer is a joy to use in both contest and casual ragchew operation. It also offers valuable assistance in a variety of ways that will please first-time and seasoned instructors. For an individual who is looking for a code-practice device that can also serve as a useful piece of station equipment, the AEA MM-3 keyer is just the thing.

Price class: MM-3 keyer, $210; AC-1 power supply, $21; AC-4 power supply, $34. Manufacturer: Advanced Electronic Applications, Inc, PO Box C-2160, 2006 196 St SW, Lynwood, WA 98036-0918, tel 206-775-7373.

Notes
[1]Ratings: **PTT**, 200 mA max, 25 V max; **– KEYED**, 30 mA max, 40 V max; **+ KEYED**, 200 mA max, 60 V max.
[2]For a discussion of Farnsworth-spaced code, see J. Bloom, "A Standard for Morse Timing Using the Farnsworth Technique," *QEX*, Apr 1990, pp 8-9.

DOWN EAST MICROWAVE 23-cm AND 13-cm LOOP YAGIS

Reviewed by Mark Wilson, AA2Z

If you ask any 10 hams operating on the 23-cm (1.2-GHz) or 13-cm (2.4-GHz) bands what they're using for antennas, almost all will say, "loop Yagi(s)." Loop Yagis are popular for good reasons: They work well in wet and dry weather, they can take abuse and they have relatively low wind loads. Many amateurs have had good luck building loop Yagis from various construction articles in the amateur literature.

Down East Microwave supplies a wide variety of loop Yagi kits and built-and-tested antennas for popular frequencies in the 900- to 3500-MHz range. Two Down East Microwave antennas are reviewed here. The 2355LY "Super Looper," designed for the 23-cm band, has 55 elements on a 15-foot boom. This antenna has 10 more elements (and is 3 feet longer) than the standard 45-element design. The 1345LY, designed for the 13-cm band, features 45 elements on a 6¾-foot boom. Each antenna has two reflectors and a driven element; the remaining elements are directors. All Down East Microwave loop Yagis share the same basic construction techniques; the main difference is in dimensions.

Materials

The 23-cm antenna uses a 1-inch OD boom that is divided into three sections for shipping. The boom joints are reinforced with short lengths of smaller tubing. The 13-cm version uses a 1/2-inch OD boom that is shipped in two pieces. Boom material is high-quality 6061-T6 aluminum.

The loop elements on the 23-cm antenna are 3/8 inch wide, except for reflector 1 and directors 1-4, which are 1/4 inch wide. The largest loop is just over 3 inches in diameter. Elements on the 13-cm antenna are 1/4 inch wide, and the largest loop is about 1-1/2 inches in diameter. Parasitic elements are made from 0.032-inch-thick 5052-H32 aluminum alloy, chosen for its strength and corrosion resistance. The driven elements are made from brass and are fed with short lengths of 0.141-inch semirigid coaxial cable.

All hardware (except the boom-to-mast U bolts) is stainless steel, so you won't have to worry about rust. A female N connector is standard on both antennas, but other
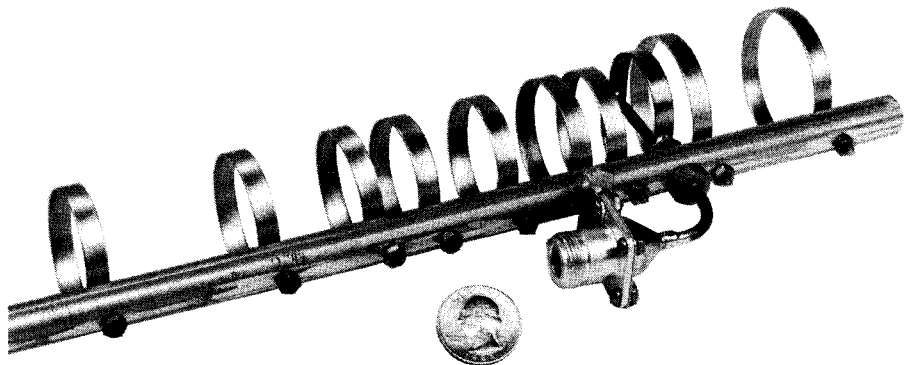
Details of the 1345LY from the antenna's driven-element end. Although the elements and half-inch boom may seem small, they're also quite rugged.

Table 1	
Down East Microwave 2355LY 55-Element, 23-cm Loop Yagi	
Manufacturer's Claimed Specifications	*ARRL Evaluation*
Frequency range: 1270-1300 MHz.	Tested only at 1296 MHz.
Maximum power: 550 W.	Tested only up to 100 W.
Typical SWR: Less than 1.2:1.	1.35:1 at 1296 MHz.
Boom length: 15 ft.	
Boom diameter: 1 in.	
Mast diameter: Up to 1 in.	
Weight: 6 lb.	

Table 2	
Down East Microwave 1345LY 45-Element, 13-cm Loop Yagi	
Manufacturer's Claimed Specifications	*ARRL Evaluation*
Frequency range: 2.2-2.3 GHz.	Tested only at 2.3 GHz.
Maximum power: 400 W.	Tested only up to 5 W.
Typical SWR: Less than 1.2:1.	1.26:1 at 2304 MHz.
Boom length: 6¾ ft.	
Boom diameter: ½ in.	
Mast diameter: Up to 1 in.	
Weight: 3 lb.	

types are available upon request. The machine work on the review antennas was excellent—there were no surprises.

Installation

The review antennas were purchased assembled, but are available in kit form at a lower price. Both antennas arrived in sturdy cardboard boxes. To get the 2355LY ready for installation, I had to unpack the antenna, remove two directors, slide the three boom sections together, and replace the directors. The 1345LY was similarly easy.

If you're interested in saving some money and have a spare hour or so, buy the kit version. The parts are well marked and the elements come preformed into loops, so putting one of these antennas together is not too much different from assembling a conventional VHF or UHF Yagi. You'll need a screwdriver and a nut driver or small wrench, as well as a small soldering iron (to make two easy connections to the driven element).

Loop Yagis require some care in mounting—a metal mast shouldn't pass through the plane of the elements. This generally means putting the loop Yagi at the top of the mast. I didn't have much spare room at the top of my tower, so I put two loop Yagis on a single cross boom. I mounted both antennas with the loops pointing down to minimize damage from birds and ice. These are sturdy antennas, and I haven't had any problems.

I fed each antenna with about 120 feet of 7/8-inch Heliax® cable. Although I don't live on a mountaintop, I was able to work my share of stations with these antennas and modest equipment. I found that these loop Yagis have very narrow beamwidths, which took some getting used to. Aiming errors of, say, 10° make a big difference on signals that are usually weak to begin with.

Another nice feature of loop Yagis is that they travel well. They're lightweight, easy to break down into manageable lengths, and are very tolerant of abuse. These are key qualities for the many operators who pack up their stations and head for the hills on contest weekends.

With all of the interest in computer-based antenna analysis, we may see the popularity of conventional Yagis for 23 and 13 cm increase. But for now, you can't go wrong with the proven workhorse, the loop Yagi. If you need more gain, stacking kits for arrays of two and four antennas are available as well.

Price class: 2355LY, $124 assembled, $99 kit; 1345LY, $89 assembled, $75 kit. Versions optimized for satellite use are also available. Manufacturer: Down East Microwave, Box 2310, RR 1, Troy, ME 04987, tel 207-948-3741. [QST-]

New Products

TELEPHONE RFI FILTERS

☐ K-COM, a Randolph, Ohio, based firm owned by Pete Krieger, WA8KZH, has introduced a line of filters (pictured) designed to eliminate telephone RFI generated by Amateur Radio transmitters operating in
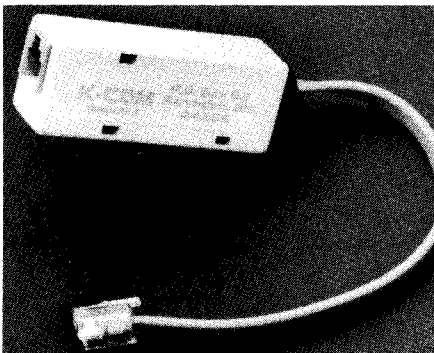
the 3- to 30-MHz range. Model RF-1 uses standard, modular telephone connectors, and is intended for use adjacent to an affected telephone. Model RF-2 filters can be installed at any point in the wiring of an affected telephone system (service entrance, protector housings, inside jacks), and come with wiring connectors. Prices: RF-1, $11.99; RF-2, $6.99. Shipping and handling charges: $1 per filter. For more information, contact K-COM, PO Box 82, Randolph, OH 44265.

Strays

UF-USSR OBLAST 013

☐ K1ZZI, KP4DQ, WD2S, AA6PY and 12 Soviet hams will operate in a joint Soviet/American DXpedition organized by RW6AC. They will operate portable along the coast of the Black Sea and Caucasus mountains signing UF7V from July 1-15. Operation will be 80-10 meters on CW/SSB.