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Product Review

Conducted By Paul K. Pagel*, N1FB

The IRL FSK-1000 RTTY Demodulator

Perhaps the present atmosphere of technical interest and innovation among RTTYers can be traced to an old-fashioned attitude. Not so many years ago, all RTTY stations were homebuilt to a greater or lesser extent because commercial demodulators tailored to the amateur market did not exist. Fortunately, that situation has changed. Yet, because many "green key" aficionados are latent homebuilders at heart, they are not content to accept their appliances without scrutiny.

One would think that the process of converting an RTTY signal into current pulses to drive the selector magnets of a printer is a simple process that can be done only one way. Ask two different RTTYers the best method for accomplishing this and you will get four different views! Most advanced TUs (terminal units) are sharp skinning knives — narrow, fixed-frequency audio filters centered on the standard mark-and-space frequencies. Although this tool will secure the greatest amount of information, there are those who prefer the phase-locked loop — an electronic meat cleaver — cheap and quick, but wasteful in tight spots (QRM).

For many years, the beginning RTTYer started his operating career with a phase-locked loop, then graduated to a high-quality, fixed-frequency TU. He soon found that copying different shifts or drifting signals is sometimes more difficult with an advanced demodulator.

IRL's FSK-1000 could be called a third option. Tunable sixth-order Butterworth bandpass filters give one the flexibility of a phase-locked loop TU and the selectivity of a fixed-frequency version. The bandwidth of both mark and space filters is selectable (55 Hz or 100 Hz) to permit operation at data rates of up to 110 Baud (a possible future ASCII standard) or for times when the QRM situation becomes difficult. By coupling these flexible filters with separate, large tuning meters for both mark and space, the FSK-1000 was able to copy a variety of Baud rates at many shifts. One immediately recognizes the 850/425/170-Hz switches. Yet the operator is not limited by preset mark-and-space filters. A delta tuning control permits varying the space filter center frequency from 50 to 1000 Hz. Thus, nonstandard shifts and drifting signals are tuned in with little difficulty. Further flexibility is afforded by the ability to select the mark signal alone, the space signal alone, or a combination of both for normal FSK operation. It is thus possible to use the "low tones" (1275- to 2275-Hz) version for use with an hf transceiver, and utilize the "mark only" mode to copy "high tone" (2125-to 3125-Hz) vhf transmissions. This feature might also prove useful for make-and-break (A1) transmissions used on various satellite-communication links.

Such shining flexibility does entail a slight design compromise, however. Most receiving conditions require some audio limiting before the mark-and-space filters to aid in counteracting the effects of fading and noise. Most fixed-frequency TUs employ a narrow-bandpass input filter before the limiter; otherwise, a strong adjacent signal will tend to capture the limiter and make copy difficult. A close analogy would be the capturing of a repeater by an extremely strong carrier. Because the space filter in the FSK-1000 is tunable from 50 to 1000 Hz, there is no bandbass input filter in the audio input line. The FSK-1000 did an excellent job of separating signals of equal amplitude, but strong QRM captured the limiter and obliterated copy. IRL's solution is ingenious: A control is provided that varies the amount of limiting so if the above situation occurs, it is possible to reduce the level of limiting to the point where capturing will be prevented. An LED is used to indicate the limiting reduction required for AM operation. Some of the time, this procedure was effective. However, this reviewer feels that when the FSK-1000 is used with a receiver lacking a good 400-Hz i-f filter, it would be advisable to insert a homebuilt audio bandpass filter between the receiver and the demodulator. This addition would allow hard limiting under a much wider range of QRM conditions. An audio filter is simple to construct and would provide the operator with the best of both worlds.

The FSK-1000 also features decision-level correction circuitry to compensate for selective fading, automatic PTT, an internal 60-mA (170 V) and RS-232 loop supply, and station-control circuitry. One unique and welcome feature of this TU is the ability to switch between mark-only autostart and FSK autostart. In the latter mode, both mark and space signals are required to start the machine. This mode was found to be nearly immune to triggering by cw and ssb signals. A front panel-mounted threshold control acts as an RTTY "squelch," but it was found to be not quite as effective as autoprint circuitry which is designed to prevent the machine from running open before the motor is shut off.

The FSK-1000 is a well-constructed and attractive piece of equipment. Most components are mounted on a single glass-epoxy pc board that is well laid out and readily accessible. IRL also offers both AFSK (FSK-1020) and video-terminal options. The price class of the FSK-1000 is $400. Further information can be obtained from IRL, 700 Taylor Rd., Columbus, OH 43230. — *Chris Schenck, W1EH*

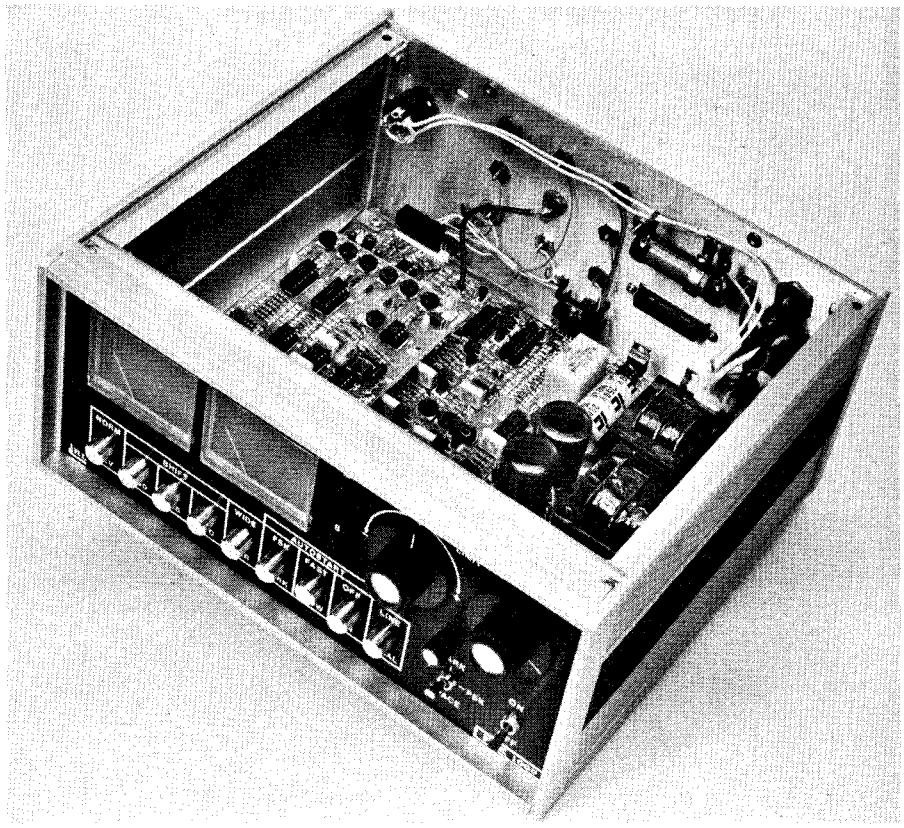


Fig. 1 — The IRL FSK-1000 with the top cover removed. Note the neatness of the internal component layout. The large front-panel meters are easy to read, even at a distance.

*Assistant Technical Editor, ARRL

THE HEATH IM-2215 HAND-HELD DIGITAL MULTIMETER

If you've been looking for an accurate, portable, digital multimeter (DMM) at a price you can afford, Heath has the answer. The IM-2215 is a hand-held, battery-powered, DMM exhibiting a high degree of accuracy and featuring a 3-1/2 digit, liquid-crystal display (LCD). The LCD numerals are large and easy to read (old-timers take note!) — the problem associated with reading an LED display in high ambient light areas is virtually nonexistent. The display also offers automatic decimal-point placement (depending upon the measurement range selected) and polarity indication. A LO BAT display warns you of a low battery condition and is activated during the last 20% of the life of the battery. With an alkaline battery, typical operating lifetimes of up to 200 hours may be expected. Approximately 100 to 150 hours of operation will be provided by the zinc-carbon battery types.

Ac and dc voltages and currents as well as resistance-measurement functions are provided. Within the specified limits, the meter is protected against overloads and transients by either a resistor-diode network or an internal clip-mounted fuse (no unsoldering necessary). Overload and over-range indications are relayed to the user by a flashing minus sign and a blanking of the display except for the most significant digit (MSD).

The '2215 may be line operated by using one of the optional 120- or 220-V Heath converter/chargers which are available. Advertised as "line cords," the units are more popularly known as "wall transformers." With the '2215, these converter/chargers operate as battery eliminators and *will not* charge the internal battery. The battery is disconnected when the converter is plugged into the DMM. Another available option is a leather carrying case with an attached belt loop.

Assembly of the '2215 may be accomplished within one evening. Total construction time for the unit assembled by this reviewer was approximately 5 (interrupted) hours. This included time taken to check each resistor, diode and transistor with an ohmmeter and scrape the component leads with a pen knife prior to soldering the part into the circuit board. Heath (thoughtfully) supplied a small plastic magnifying glass to enable the assembler to read the component markings. Unfortunately, the magnifying glass was difficult to focus, so I resorted to using my own illuminated hand-held magnifier. I'd recommend using a magnifying glass no matter how good your eyesight may be; it comes in handy when checking the solder connections on the pc board.

This is the first time that assembly of a unit required me to wash my hands first! The construction manual outlines a couple of important steps which should not be overlooked: Clean hands, handling of the main circuit board by its edges and avoidance of excessive rosin build up are procedures to be followed if contamination of the main circuit board is to be avoided. Heath warns that should contamination occur, the completed DMM may not meet the listed specifications when operated in certain environments, such as one with high humidity conditions. Should it be determined the circuit board is contaminated and requires cleaning, a simple procedure is outlined in the manual.

The components used in the '2215 are of the highest quality. I was pleased to find that even the test leads mated quite securely with their respective jacks, which are tubular aluminum types. There are a few specially selected components employed and these are mentioned during the construction process. You might notice the LCD digits flashing during handling of the display assembly. It's not your imagination; static electricity is causing this. No difficulties were experienced during construction with the exception of the test-point pin pc board holes being too small to allow the pins to pass properly and seat on the board. The two holes were enlarged using a no. 51 drill to permit a snug fit for the pins. A few changes had to be made to the manuals with information supplied by the accompanying errata sheet. One capacitor location on the board is marked incorrectly, but this is mentioned in the appropriate construction step. There is very little point-to-point wiring involved: five wires! Everything, with the exception of the battery and battery connector/fuse-holder, mounts either on the main or read-out circuit board. The meter is ready for calibration after a few operational tests to ensure proper circuit functioning.

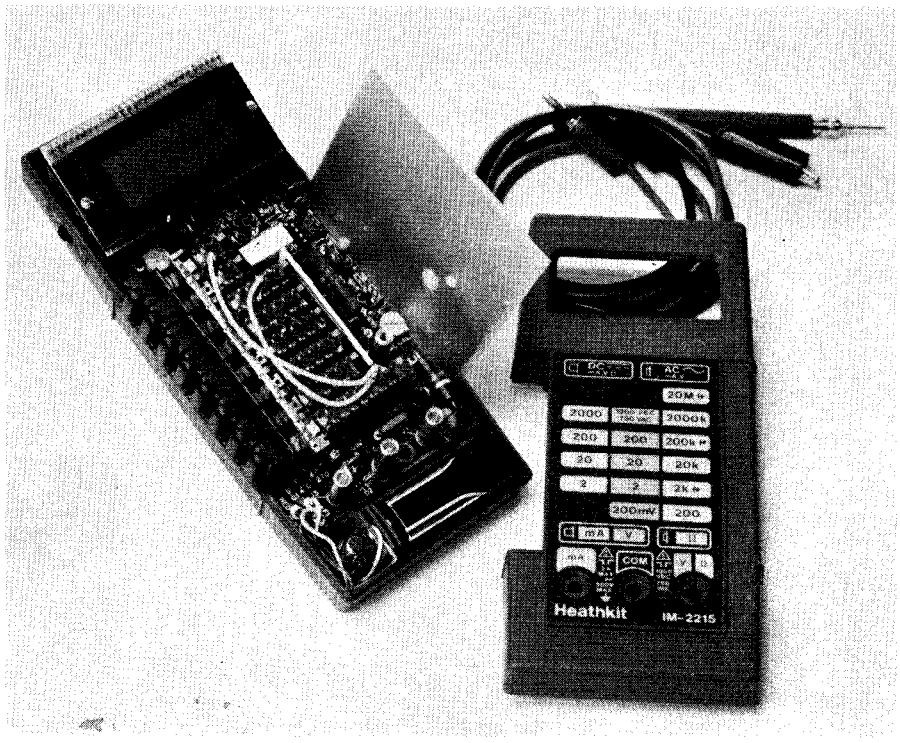


Fig. 2 — The Heath IM-2215 digital multimeter. The vertical panel to the right of the meter case is a flexible shield that is secured over the switch assembly during construction. The switch assembly requires the only point-to-point wiring necessary.

Two calibration methods are possible: internal, using the built-in standards, or laboratory, by means of external voltage sources. The latter method requires the amplitude of the calibration voltage to be controlled to a great degree of accuracy — ±0.05% for a resultant meter accuracy of ±0.25%. I used the internal-standards method and with two voltage mesurements and corresponding adjustments, calibration was completed in less than five minutes. The internal references used to calibrate the '2215 are in themselves highly accurate. One reference voltage is obtained by using a selected low-voltage reference device made by Micro Power Systems, Inc. (MPS5010). The reverse-breakdown voltage for the device, which is used for dc calibration, has been measured accurately and recorded. This device is packaged separately with the reference voltage value noted on the envelope. The voltage value is transferred to a label which is affixed to the inside of the meter for referral during recalibration procedures. The ac mode is calibrated by using the rectified backplane signal of the A/D converter.

The user should read the operations section of the manual carefully. Although the DMM is protected, there are some practical limits to the degree of protection of the '2215. High-voltage and rf probes may also be used with the meter and such use is explained thoroughly. Three ranges of the meter do not produce a full-scale measurement voltage sufficient to forward bias silicon junctions, but there are three others that do. The latter ranges are useful when checking and matching diodes and transistors, while the former ranges may be used to make in-circuit resistance measurements.

When measuring voltages, the display reading is in millivolts or volts. For dc voltages, negative polarity is indicated by the appearance of a minus sign to the left of the MSD. The absence of the minus sign indicates a positive polarity. No sign is displayed during ac-voltage measurements, except during recovery from an extreme overload. During current measurements, the foregoing polarity rules apply. Current readings are displayed in milliamperes. No polarity sign will be indicated during ac measurements, except during an overload recovery. When measuring resistances, the display is expressed in ohms, kilohms, or megohms with no polarity sign exhibited. The possible exception may occur during connection of the meter to an energized circuit. The overload/overrange condition is indicated by the blanking of all display digits except the MSD "1". It is normal for the units position of

the display to alternate one digit above and below a reading. This does not indicate a malfunction. During the measurement of ac voltages, it may take a few seconds (typically 8 to 10) for the display to stabilize at a ± 1 count indication and this, too, is normal.

It was noted that the '2215 was susceptible to RFI when operated close to an operating 300-watt transmitter that had been removed from its case. This came as no surprise. The degree of interference was greatly reduced when the meter was placed on the desk rather than being held in the hand.

The external and internal appearance of the '2215 bear a striking resemblance to another multimeter which is currently available. On the "other" unit, the on/off switch is reversed and access to the battery and protective fuse is by means of a sliding plate on the rear of the multimeter; the '2215 requires the rear of the case be removed for access to these two components. There are some circuit differences and (of course) a price difference, too.

The IM-2215 has been a pleasure to construct and use. It has become a mainstay of my "shack." With its $95 price class, the IM-2215 will occupy a prominent position in the hand-held DMM market. The IM-2215 is available from the Heath Co., Benton Harbor, MI 49022. — *Paul K. Pagel, N1FB*

THE CURTIS EK-480M CMOS DELUXE KEYER

The Curtis 8044 "keyer-on-a chip" is available in many forms, from the 8044 IC alone to one of the latest additions to the line, the EK-480M. The 8044 is an LSI CMOS IC which was designed specifically for use as a keyer. According to the manufacturer, this single chip replaces eight standard ICs in addition to many other discrete components and related interconnections. The circuitry of this single chip provides automatic dits, dahs (both with memories), key debouncing, sidetone generation and provisions for variable weighting. The variable weighting, sidetone pitch/volume and speed adjustment are made possible by connection of external components connected to the chip. The IC is protected from harmful voltages applied through the paddle and manual key leads by means of opto-isolators. The LEDs of the opto-isolators are in turn protected by silicon diodes. Protection circuitry is extended to include reverse-polarity protection diodes at the output circuit as well. Rf immunity is provided by effective bypassing. When W1FB mentioned that he'd had some RFI problems on 10 and 15 meters with another keyer that he was using, I asked him to try the '480M. At a kilowatt input level with no provisions made for grounding the keyer chassis (a necessity with the other keyer), no problems were encountered with RFI.

The '480M is designed to key ±300-volt, 100-mA circuits. Keying polarity is switch-selected at the rear of the unit. The current handling capability of the output circuits may be increased to 200 mA, if required, by the addition of a resistor to either one or both of the output keying circuits. Circuit-board mounting holes are provided for such a circumstance. (If the keyer is powered by a battery, this modification will decrease the battery life by 20 to 30 percent.) One precaution is to be observed when accommodating a negative key line: The shield common for the paddle and/or straight key is at the keyer power supply positive voltage potential. This means the key frames must be prevented from shorting to other equipment or the keyer power supply will be shorted. A length of cable (three-conductor only) and connectors are provided for interconnection of the keyer to the key(s) and transmitter. Standard 1/4-inch (6.4 mm) jacks and plugs are used for the key inputs and an external speaker output. The key line output is a phono jack. An accessory socket (14-pin DIP socket) is accessible from the bottom of the keyer cabinet through a rectangular cut-out; no mating connector was supplied with the review model.

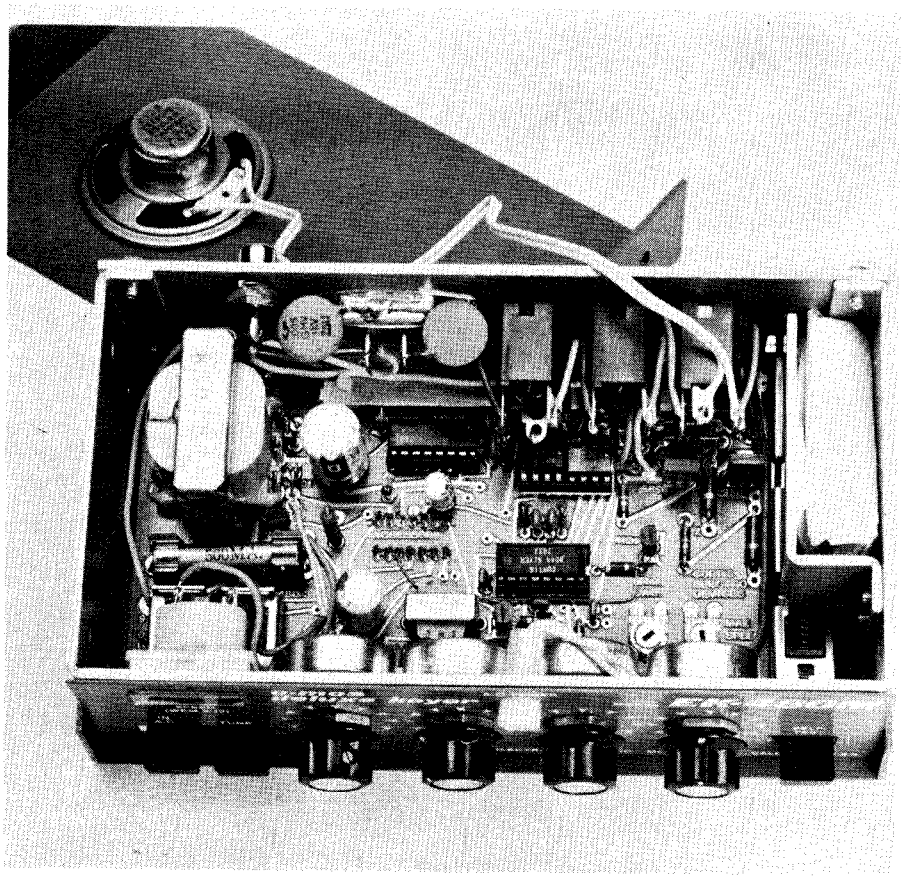


Fig. 3 — The Curtis EK-480M keyer. This keyer features a built-in speed-indicating meter and is well protected against harmful voltages and RFI.

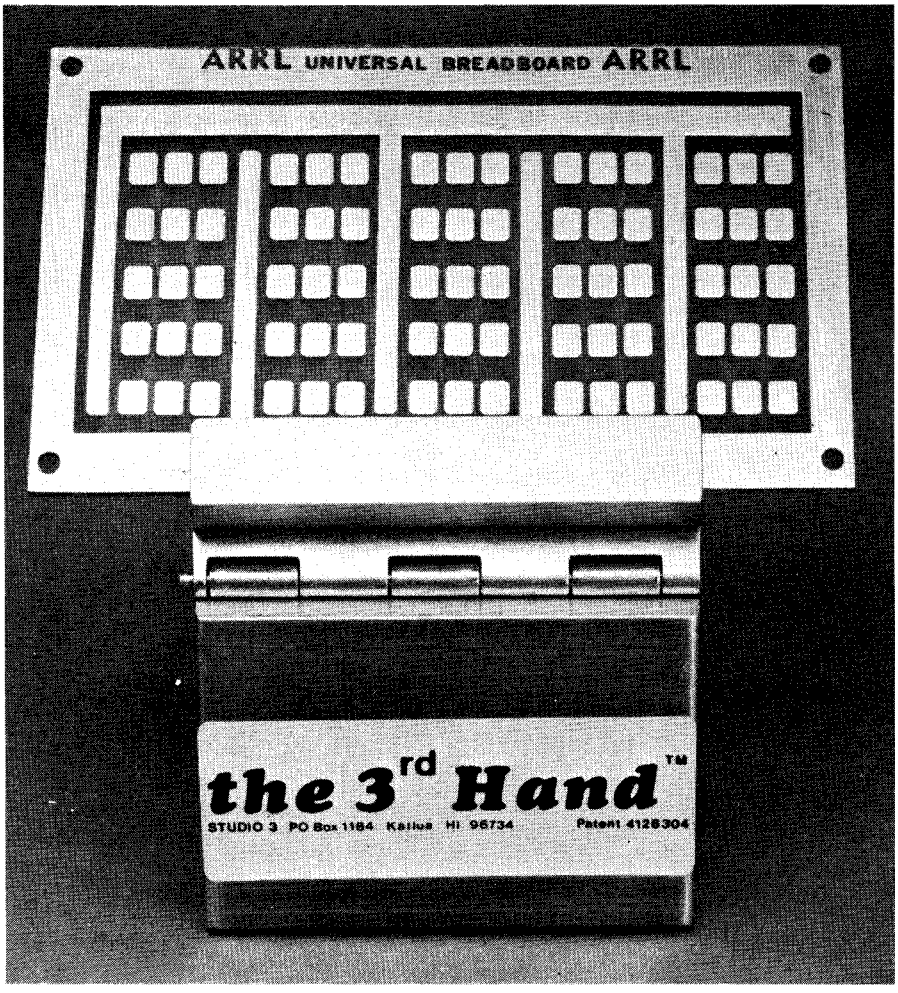
The '480M may be operated from a standard 117-V ac line, internal 9-V battery or an external battery. A carbon-zinc battery will provide up to 15 hours of operation. For protracted operational periods requiring battery usage, alkaline or mercury batteries are recommended. The ac cord supplied is a TV "cheater cord" type which plugs into a rear-panel socket. Battery or line operation is switch selected from the front panel.

A TUNE switch on the front panel provides a continuous key-down condition for transmitter-tuning adjustments. At the opposite side of the panel, a SELF TEST switch disables the key line output while leaving all other keyer functions normal. With this feature, the operator need not disconnect any cables or operate other switches when making keyer adjustments practicing with the keyer.

The internal sidetone generator of the keyer produces a healthy amount of output to either the self-contained, top-mounted speaker or to an external, plug-in speaker. Both the pitch (variable from approximately 250 Hz to 15 kHz) and volume are adjustable from the front panel, as are the speed and weighting. (A weighting control position beyond the 2:30 o'clock position had virtually no effect; just a "blurb" of sound was produced during keying.) The speed range is factory-adjusted for a nominal 6 to 50 wpm. The upper end of this range may be adjusted higher or lower by means of an internally mounted potentiometer. If speeds of 30 wpm or less are to be used, the upper end of the speed range should be reduced to allow a smoother speed adjustment over the control range.

The "M" in the model number stands for "meter." This keyer has a speed readout meter nestled in the upper left-hand corner of the front panel. The meter scale markings run from 0 through 5 and the resultant indication is multiplied by a factor of ten to produce a fairly accurate means of judging one's sending speed. A rapid string of three or four dits or two or three dahs will "hang" the meter long enough to enable the operator to discern the speed of transmission. The meter needle doesn't bounce except at very slow speeds, typically below 10 wpm.

The keyer is housed in a sturdy gray, U-shaped, aluminum cabinet. The accompanying manual is 12 pages long and includes operating instructions, circuit feature descriptions and some trouble-shooting procedures. Price class is $150. The EK-480M is available from Curtis Electro Devices, Box 4090, Mountain View, CA 94040. — *Paul K. Pagel, N1FB*



This inexpensive and versatile circuit-board holder provides easy access to both sides of the pc board.

THE 3RD HAND

Sound like something you might see in a thriller movie? Well, it's not. This little item supplies that extra helping hand you've so frequently wished you had when working on pc boards. Combining simplicity with ingenuity, the manufacturer has devised an inexpensive and versatile circuit-board holder that requires no adjustments to accept or hold different-sized boards. When clamped to the edge of the workbench, it holds the board at a convenient angle to allow placement of parts on the board and then flips forward for access to the solder (or wire-wrap) side of the board.

The model we received is a manufacturer's sample, identical to the commercial model except in length (about 1-1/4 in. shorter). Secured to the bench mounting bracket is a hinged aluminum channel. Within the aluminum channel is a section of spring-loaded PVC gasket. The circuit board edge is simply slid into the PVC gasket and is held firmly by the spring action; there are no arms or knobs to adjust. The 3rd Hand is manufactured in three different sizes. There's also an extension bench clamp which allows the work to be placed further back from the front edge of the bench. The 3rd Hand is available from Studio 3, P. O. Box 1184, Kailua, HI 96734. Price class: Model 3 B/C (4 in.), $9.95; Model 3 A/C (5-3/4 in.), $12.50; Model 3 C/C (7-5/16 in.), $14.95; and the extension bench clamp. $4.95. — *Paul K. Pagel, N1FB*

TRAVEL-PAK QSL KIT

Wayfaring amateurs take notice! Save time and money with Samco's Travel-Pak QSL Kit. With this convenient system it's a simple matter to convert a picture postcard or photograph to a QSL card — in one minute or less! The results can be very professional.

The reviewer had a need for a limited number of QSL cards each year after vacationing on the various islands of the Caribbean. Some years the DXpedition is merely a token type of exercise, with skin diving and other tropical activities dominating. As a result, fewer than 100 or 200 QSL cards are required to confirm contacts with those who need a new country. The cost of having quality QSL cards printed, plus the wait for delivery, can be discouraging. A speedy and low-cost technique for developing QSL cards was discovered while reading *QST* Ham Ads. An inquiry to Samco brought a hasty response, complete with samples.

How does the technique work? Well, your call is printed on clear acetate strips which are adhesive-backed. Similarly, the QTH line (or lines) is printed on a similar strip. The protective backing is peeled away easily, then the strip is affixed to a postcard, photograph or existing

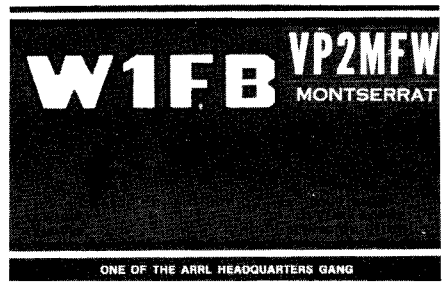


Fig. 4 — Sample of an existing QSL card that was modified to include VP2MFW and the QTH, "Montserrat."

QSL card. Fig. 4 shows how the VP2MFW call and the word "Montserrat" were added to the existing W1FB cards. A standard-format report strip is also available. These are handy for pasting on the back side of postcards which are converted to QSLs.

There are three letter-size choices for the call letters (5/8-, 1/2- and 3/16-inch heights — 16, 13 and 5 mm, respectively). Color choices are white, red, blue, gold, green, black and copper. A variety of prices is listed for various kits, but the "quantity discount kit" gives you 250 calls, QTH lines and report forms (enough to make 250 QSL cards) for $15. This reviewer chose to order 100 calls and 100 QTH lines, but no report forms. The cost was $6, postpaid.

Those who take vacations in the USA and operate Amateur Radio from various states and counties may find this type of QSL card fabrication excellent for use with picture postcards from the area where the operation took place. You can mail the QSL card right from the location without delay!

The quality of the product is excellent. It was a wonderful surprise to get both the samples and the order a couple of days after the requests were sent. In both instances the merchandise was shipped the day the order was received! A few more amateur equipment merchandisers could benefit from that kind of turnaround time!

A brochure and samples are available at no charge, provided an s.a.s.e. accompanies the request. The address is Travel-Pak QSL Kit, Box 203, Wyantskill, NY 12198. — *Doug DeMaw, W1FB*

THE 1980 *ARCHER SEMICONDUCTOR REPLACEMENT GUIDE*

There's a new 1980 edition of the *Archer Semiconductor Replacement Guide* available at your nearby Radio Shack dealer or store. This 224-page, 8-1/4 × 11-inch book features cross-reference and substitution listings for over 100,000 devices. These listings have been totally computer generated and based on careful analysis of the important parameters of the listed devices. Information is given relating to transistor testing, case styles and dimensions, the care and handling of transistors and integrated circuits, optoelectronic devices and displays. A glossary of words, symbols and abbreviations relating to semiconductor devices is included, too. A pair of pages is devoted to major semiconductor components and lists the name of the device, the circuit symbol, electrical characteristics and major applications. Some typical applications and circuit diagrams are given for a number of ICs. The new guide is priced at $1.99. — *Paul K. Pagel, N1FB* QST