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Product Review

Conducted By Paul K. Pagel*, N1FB

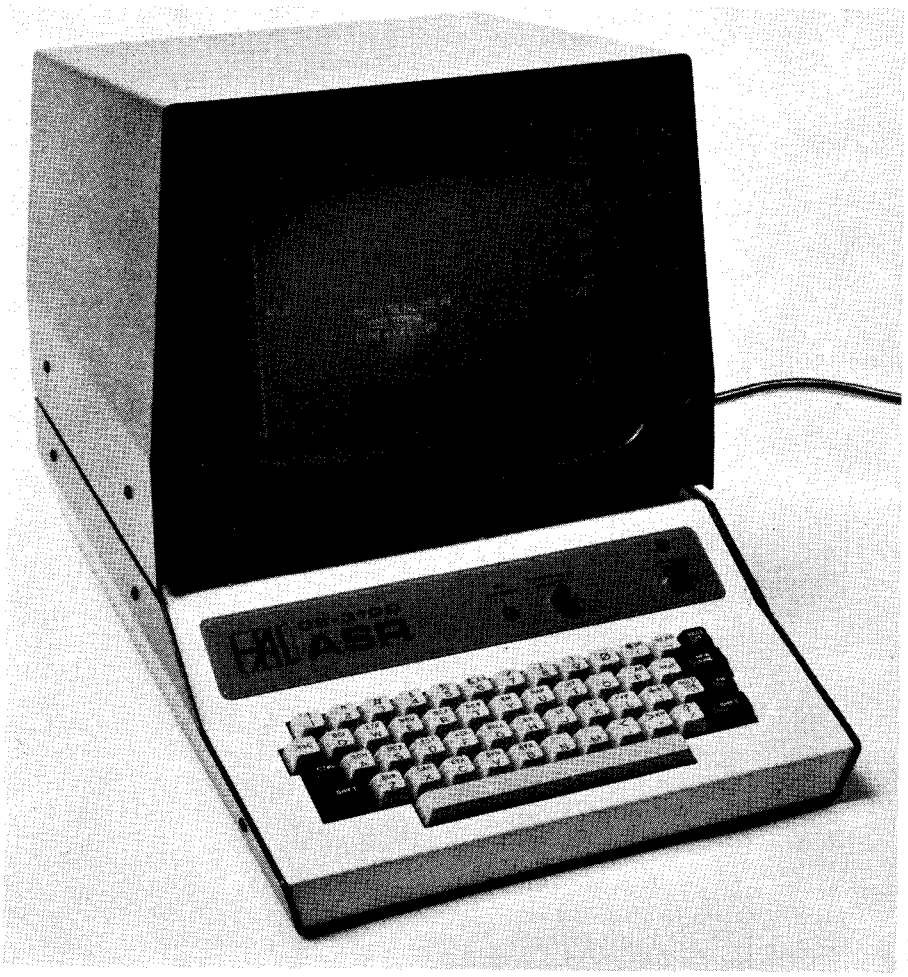
The HAL DS3100 ASR Video Display Terminal

The HAL DS3100 ASR is a tri-mode terminal capable of sending and receiving Morse, Baudot RTTY (with an optional demodulator) and ASCII. It's the latest addition to HAL's lineup and is their "big gun." Unlike a big gun, however, this terminal is q-u-i-e-t. Hardly a sound comes from the neat-looking brown and tan unit as it quickly goes through its paces; just the soft rattle of the keyboard and the sound of the built-in monitor (active during Morse and for certain line indications), which may be hushed to a low-level mewing. During RTTY operation, there are no whirring motors, slamming carriages, clunking line feeds or the whack of type faces on ribbon and paper. Instead, a restful and easy-to-read green phosphor display silently greets the eye, telling you not only what you're receiving but what you're transmitting, as well as a multitude of terminal status reports including the date and time.

The DS3100 arrived for a review complete with the ST-6000[1] RTTY demodulator and a set of cables prepared for connection to my transceiver. (The customized cabling is an extra-cost option.) A loose-leaf binder contains the instruction manual, and a handy pocket reference highlights the important phases of system operation. Thus, one need not consult the instruction manual for its detailed information when one simply desires to know a key function, for instance. The system interfaces with the outside world by means of RS232C levels as well as the standard high-voltage RTTY current loops. Transistor switches are also provided to key either negative or positive circuits simultaneously.

The 12-inch diagonal measure screen of the monitor (which mounts atop the keyboard assembly) displays a total of 24 lines of 72 characters each in a split-screen format. Generally, the upper 12 lines show received characters and the lower 12 are assigned to text that is to be transmitted. The received text is presented with a brighter intensity than the keyboard-generated text. The display may be altered to devote the entire 24 lines to received text or view operator-selected portions of either the receive or transmit buffers. All data passes through the buffers. Received data is stored in a 150-line buffer, and transmit text in a 50-line buffer. The screen is merely a "window" used to view either storage area. Each displayed line of text is numbered at the left-hand margin of the screen. The right-hand side of the screen keeps the operator informed of the terminal status by means of 13 status indicators. Two transmit buffer cursors show the transmit-output location and the keyboard-entry location. A third cursor indicates where the next received character will be placed.

At the keyboard, you may choose: Morse at speeds from 1 wpm to 175 wpm; Baudot RTTY at 45 to 100 baud; ASCII at 110 to 9600 baud, all both send and receive. With the KOS (Keyboard Operated Switch) and the KY (KeY switch) features, receive/transmit and auxiliary-function switching is done automatically; no need for external PTT or foot switches.



The HAL DS3100 ASR Video Display Terminal. This completely buffered terminal offers a multitude of features for completely automated transmission and reception of Morse, Baudot and ASCII RTTY.

If you're not a good typist, the '3100 will make you appear to be a "pro." You need never make an error again — that is, at least so that anyone would notice! Hit the wrong key? Simply go back and correct the error before it is transmitted. You can prepare a complete transmission while receiving then simply sit back and watch it "roll off your fingertips." If typing in real-time, SYNCHRONOUS IDLE will make it appear as though you're thinking of something profound to say while all the while you're looking for the right key! SYNC IDLE works not only in ASCII and Baudot modes, but Morse as well appearing as $\overline{\text{BT}}$ (- · · · -).

QBF (Quick Brown Fox/1 - Ø) and RY test messages are available at the touch of a key. Selectable USOS (UnShift On Space), automatic generation of CR (Carriage Return) and LF (Line Feed) and the non-overprint features help eliminate garbled messages. WORD WRAP-AROUND is a non-overprint feature which transfers all characters following the last space to the following line to prevent splitting of a word.

There is a total of 10 different 32-character messages which may be programmed and used as desired by the operator. Two of these messages may be saved even during power-off periods since they are part of the systems EAROM (Electrically Alterable Read Only Memory). Another EAROM function is a WRU (Who aRe yoU) message which may contain up to 10 characters. SEL CAL (SELective CALling) and IDENT (IDENTification) are available too. The IDENT feature will allow Morse only transmission of one of the EAROM messages regardless of the existing terminal mode. The IDENT status indicator in-

[1]"Product Review," *QST*, May 1977.

*Assistant Technical Editor, ARRL

forms the operator that a 10-minute transmission period has elapsed but it does not insert the Morse identification by itself.

The '3100 operator may transmit chosen portions of received text. The information is selectively switched from the receive buffer to the transmit buffer to prepare it for transmission. Editing, too, is easy. Not only may one correct "typos" as they happen, but the operator may return to any line, word or letter (prior to its transmission), and alter it to suit his taste. Half-duplex (normal) or full-duplex operation is possible with the system. Full-duplex operation allows *simultaneous* active receive and transmit functions to be operative. CONTinuous, LINE and WORD transmit modes refer to the manner in which transmitted text is handled. In the CONTinuous mode, characters are transmitted as they are released from the buffer without stopping until the end of the text is reached. LINE mode transmits one line at a time; information within a line not being transmitted until after a new line has been typed. WORD mode outputs one word at a time. A word will not be transmitted until the system recognizes the first character of a new word following a space between words.

There is an internal real-time, 24-hour clock within the '3100. This clock may be programmed with the time, zone and date, and the information may be transmitted at the touch of a button. The clock has to be reprogrammed each time the power is removed from the system.

Operating the '3100 proved to be the most fun I've experienced in a while. ASCII operation was not attempted since it hadn't been approved at the time of review, but Morse and Baudot RTTY proved delightful. I first tried the unit on cw. Having used a keyboard cw generator before, I felt somewhat secure. No matter which mode of operation is chosen, the secret to being an errorless emitter of information and rf is to set the speed of the HAL to somewhat less than your typing speed and prepare some transmit text during the receive period. (Now my secret's out!) The only transmitting "hang-up" I had was my inability to use the space bar effectively. I had never "sent spaces" on a key before! The cure for that turned out to be spending a couple of weeks at the keyboard running RTTY. When I went back to cw, the space-bar malady had disappeared.

Receiving cw with the '3100 was interesting. I never could quite break myself of the habit of copying along by ear; I also wouldn't recommend it be done. While the '3100 does a pretty good job of copying cw, it cannot equal the human brain when it comes to copying a really tough "swing" or copying under conditions of heavy QRM and/or QSB. Occasionally, the unit would get "stuck" (usually because of a station tuning up close to the frequency) but a depression of the CLR (CLeaR) key would get it going again. It's also surprising to watch the screen and see the print-out displayed one letter behind the received information. The system does lag to ensure that the transmitting operator is maintaining the same sending speed, and it will attempt to compensate for timing errors. If the received signal speed changes, the system copying speed changes automatically. It isn't necessary to set a received-speed control for cw; the unit clocks the incoming signal and figures this out all by itself.

Although I'd had some limited exposure to transmitting RTTY many years ago, I'd done nothing but copy RTTY in the recent past. I did quite a bit of practicing with the '3100 (while using a dummy load) to get the "feel" of the operation. My first QSO was a success, and from then on I was "hooked." Cw, my favorite mode of operation, fell by the wayside, and the '3100 (coupled with the ST-6000) kept me occupied for the next few weekends on RTTY. My "better half" was all in favor of such noiseless operation as was I. However, I did miss having an occasional "hard copy" for certain situations, such as RTTY picture reception. A mechanical printer can easily be accommodated by the '3100 for use in such circumstances.

Video-terminal RTTY and cw are quite commonplace today: ASCII is sure to follow soon. With the HAL DS3100 ASR, you'll have it all at your fingertips — silently. The HAL DS3100 ASR is available from HAL Communications Corp., Box 365, Urbana, IL 61801. Price class: $2000. — *Paul K. Pagel, N1FB*

THE YAESU FT-207R HAND-HELD 2-METER FM TRANSCEIVER

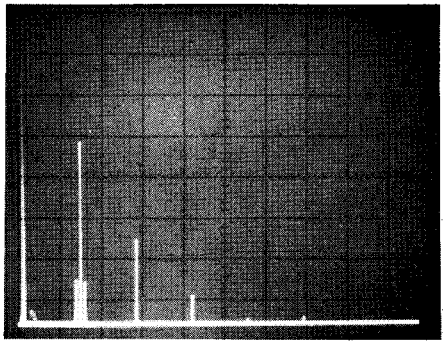
Not long ago, having a synthesized 2-meter rig put you among the "elite" on this popular band. It was also convenient if the transceiver had a built-in Touch-Tone encoder so that one wouldn't have a length of wire and a surplus encoder dangling around the car or shack. A few months ago, the Tempo S-1 arrived (see *QST*, June 1979, page 37). Thanks to the wonders of miniaturization, this hand-held package contained its own built-in frequency synthesizer. The gang wondered where we'd go from there. Well, here's the first microprocessor-controlled hand-held — the Yaesu FT-207R!

This rig has caused a real stir among radio amateurs, and for good reason. Its versatility is remarkable. The keyboard, shown in the accompanying photograph, is the "command center" for all the transceiver functions. While the intent is not to review the '207R's operating instructions, an example of how you put 'er on frequency is in order.

When the transceiver is first turned on, the LED display (yes, a digital display!) shows 7.00, representing 147.00 MHz. This readout will be displayed following any interruption of power to the memory, such as installation of a fresh set of batteries. For operation on 146.28/146.88 MHz, the keyboard entry is "688," then "ENT/DIL." This programs in the frequency. The −600-kHz repeater offset is available as one of the settings on the appropriate control knob on the top of the transceiver case. Simplex operation and ±600-kHz splits are built into the '207R for convenience. But there's more — splits of *any* amount, 10 kHz minimum, are programmable as long as they do not pass outside the 144- to 148-MHz limits of the transceiver. In a case of mistakenly (or deliberately — I tried!) programming a split resulting in possible out-of-band operation, an "E" on the display flashes to indicate that you goofed!

There are four memory channels in the FT-207R, and any of the splits may be used in conjunction with them. One of the more interesting features is the scanner. The band may be scanned in 10-kHz increments from 144 to 148 MHz (or vice-versa) by depressing the UP or DOWN button. The scan will continue for as long as either button is held down and may be set to stop at a clear or busy channel — a boon to locating repeaters in an unfamiliar area. The scan feature may be employed as well with the four memory channels. Touch-Tone operation is built in, too, as a keyboard function. A CTCSS subaudible tone feature will be available

The Yaesu FT-207R 2-meter synthesized hand-held transceiver is shown nestled inside its matching NC-2 charger.



ARRL lab spectral photograph of the output of the Yaesu FT-207R transceiver. In this photo, the rig was operating at 144.00 MHz with 2.5 watts output. Vertical divisions are 10 dB each; horizontal divisions, 100 MHz. The fundamental frequency has been attenuated approximately 30 dB by means of a two-cavity notch filter in order to prevent overload distortion in the spectrum analyzer. The most significant spurious signal, 10 MHz above and below the fundamental, is down approximately 65 dB; the second harmonic is down approximately 55 dB. This photograph represents the worst-case test; other tests within the band showed better attenuation of spurious products. The FT-207R, therefore, complies with current FCC specifications regarding spectral purity.

Yaesu FT-207R 2-Meter FM Hand-Held Transceiver

Claimed Specifications

Transmitter:

Power output: 2.5 W (min.)/200 mW high/low
Deviation: 5 kHz
Spurious radiation: −60 dB or better at 2.5 W output (see spectral photo for ARRL lab measurements)
Frequency coverage: 144.000-147.995 MHz
Transmitter offsets: 600 kHz or simplex built-in, others programmable, 10 kHz minimum.

Receiver:

Circuit type: Double-conversion superheterodyne
Sensitivity: 0.32 μV for 20 dB quieting
Selectivity: 7.5 kHz at −60dB
I-f: First, 10.7 MHz; second, 455 kHz
Audio output: 200 mW at 10% THD

General

Batteries: 450 mA NiCad pack
Current Consumption: Rx, 150 mA (35 mA squelched, display off) Tx, 800 mA (Hi); 250 mA (Low) Memory backup, approx. 4 mA
Voltage requirement: 10.8 V dc, nominal
Dimensions: 68 × 181 × 54 mm (HWD)
Weight: 680 g including batteries
Price class: FT-207R with wall charger, rubber duck antenna, earphone, belt clip and shoulder strap — $399.
Options: NiCad battery pack — $23; YM-24 speaker/microphone — $32; NC-2 desk quick-charger/ac supply — $86; TA-2 telescoping 1/4-wave antenna — $8.50.

soon as an aid to operation with repeaters in congested areas.

There are other conveniences, too: a LOCK switch for disabling the keyboard so that frequencies can't be accidentally changed; a 5 UP position for repeaters needing that extra 5 kHz (this digit doesn't appear on the display), and a DISP switch which is used to turn off the display to conserve battery power. This latter function may appear to be inconvenient, but it's not. Even with the display off, each time a frequency is changed the display momentarily comes on to show just what is happening. The 4-bit microprocessor chip inside the rig makes it all happen! the operator has a choice of 2.5 W or 200 mW of output power, switch selectable from the bottom of the transceiver case. For a hand-held, this certainly is a multitude of functions.

It takes some reading to cover the thorough instruction manual supplied with the '207R, but on-the-air contacts become easy to make once the operator has been "programmed." There is, for memory support, a constant drain on the NiCads in the transceiver. Consequently, if the rig is fully charged and unused for several days, the unit will have to be recharged. The memory draws 4 mA, so the 450 mA NiCads (fully charged) will run the transceiver for about four days with the unit at rest. By means of the offset switch, the memory backup may be disabled, thereby increasing the battery charge life.

One minor inconvenience I've noted during operation outdoors is that the LED display couldn't be read unless it was shaded with my hand. In the car, for ease of operation, I have been using a UG-255/V BNC-to-UHF adaptor to mate the '207R connector to my existing antenna lead in. The 2.5-watt power level is adequate for working repeaters in this area. Yaesu's optional speaker/microphone would be a welcome addition for extended mobile use. During all repeater contacts, I received excellent audio-quality reports.

When the FT-207R arrived here at Headquarters, it was supplied with the optional NC-2 desk charger/ac supply and two optional NiCad battery packs. The charger has a tapering charge rate, from an initial 450 mA to a pulsed 45 mA. Although the charge rate doesn't drop off completely, the LED indicator will show a slow pulsing as the batteries approach a fully charged condition, indicating that the '207R's ready to go. Yaesu does not recommend that the charger be left on indefinitely, as possible damage to the NiCads may occur from overcharging.

There's a lot in this small package, indeed, but it's well presented and housed in a rugged case. A belt clip and shoulder strap are provided. My overall operating impressions are very favorable. Once the operating instructions are mastered — not difficult at all — the FT 207R really shines in 2-meter versatility. — *Sandy Gerli, AC1Y*

MURCH UT-2000-B TRANSMATCH

"Slick and built to handle the power" were my thoughts as I peered into the exposed innards of the Murch UT-2000-B matching network. The fundamental circuit is pretty similar to that of most of today's commercial Transmatches, but the circuit of such a unit is not the only consideration. The matching resolution is just one function to contemplate. Another is whether or not the components can handle the full legal amateur power without arcing, overheating or melting. This Murch unit fills all of these requirements.

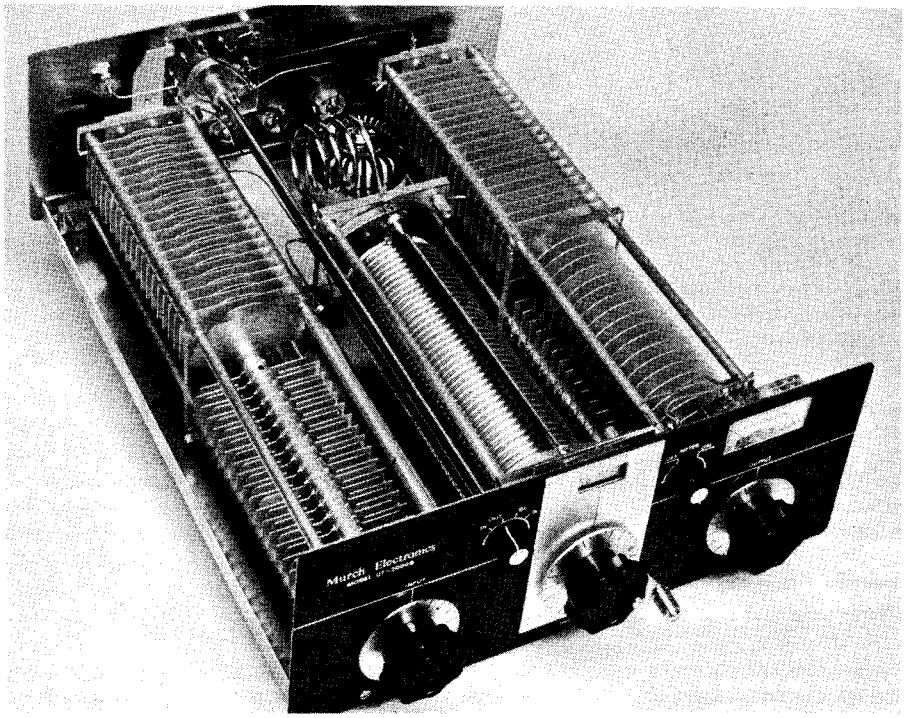
The circuit is essentially the popular T-network that evolved from the James Millen Co. 50-Ohmer matching network which was developed some years ago. Late in the 1960s, a homemade version — The Ultimate Transmatch — was described in *QST* by W1ICP. That innovation of the 50-Ohmer inspired numerous manufacturers to use the design for their marketed wares. Murch was the first to produce a commercial version of the so-called Ultimate Transmatch. The UT-2000-B is the newest model being sold by Murch, and one might well class it as their "super matcher."

Circuit Highlights

Fig. 1 shows the basic circuit of this type of Transmatch. The version at A is found in many commercial products. However, the technique at B (single-section input capacitor) provides equal results at reduced mass and cost. This was demonstrated a few years ago in the ARRL laboratory by Walt Maxwell, W2DU.

It can be seen that under certain load conditions the network functions as a high-pass circuit, and, hence, there is no harmonic attenuation. Under different load conditions, the circuit can perform as a bandpass network (desirable). Furthermore, a match can be obtained at a variety of settings for some load conditions. Minimum insertion loss will occur when the series output capacitor is at the maximum-capacitance setting that will provide an SWR of 1.

Matching resolution, mentioned earlier, is best achieved by using a roller inductor type of coil. The UT-2000-B contains one. Some commercial Transmatches utilize tapped inductors, which do not always permit a perfect match to a given load. The roller inductor, on the other hand, provides continuously variable inductance, right to a fraction of a coil turn. This becomes especially important at the upper part of the hf spectrum. I had occasion during my VP2MFW operation on Montserrat to use a "brand X" high-power Transmatch which did not have a roller inductor. Consequently, the match on 20, 15 and 10 meters was never 1:1. Admittedly, an acceptable match could be ob-



The Murch UT-2000-B Transmatch. The function switch (see text) is a welcomed operator convenience which eliminates cable switching.

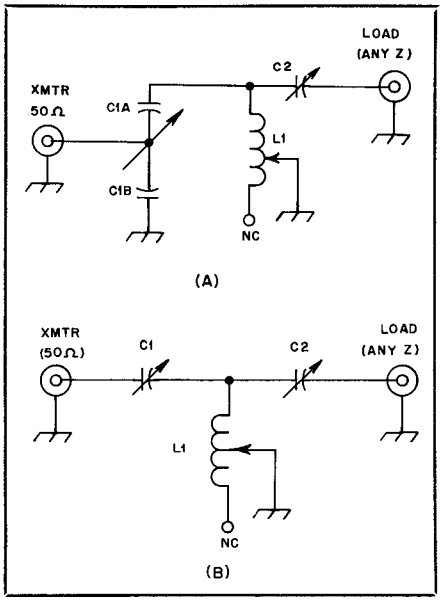


Fig. 1 — The circuit at A is found in most commercial Transmatches. It contains a dual-section variable capacitor at C1, which is not necessary for proper performance. The circuit at B is less expensive and will work as well as that at A (see text).

tained (1.5:1 to 2:1), but most of us like to shoot for a 1:1 condition when possible.

A reflected-power meter is built into the UT-2000-B. A 200-μA dc movement is used to permit good sensitivity even at low power levels. A sensitivity control enables the operator to set the meter response in accordance with the power output of the transmitter. I made comparative tests with a Bird wattmeter and learned that the Murch meter tracks very well with that of the Bird.

The function switch provides for bypassing the Transmatch, placing it in the transmission line or routing the transmitter output into a dummy load. A fourth position grounds the antenna for safety purposes during storms.

This instrument can be used with unbalanced or balanced feed lines. In the balanced condition, a toroidal transformer (broadband) converts the otherwise single-ended output to a balanced arrangement. This is useful when antennas are fed by means of twin-lead or open-wire lines. Similarly, the unit will work well with end-fed wire antennas. The maximum power rating for the Transmatch is 2-kW PEP.

Laboratory and on-the-air tests with 1 kW of dc input power to the amplifier showed no significant power loss through the unit. There was no arcing of the switches or variable capacitors, and none of the network components became unduly warm.

Craftsmanship

Perhaps the most notable aspect of this product is the craftsmanship which is evident throughout. Charlie Murch manufactures nearly all of the components he uses. The roller inductor, including its ceramic form, is made by Murch. The variable capacitors and switches are also made at the factory. The natives of this region like to refer to this kind of endeavor as "good old New England craftsmanship." This ex-Midwesterner certainly must agree with the description!

The only exception to the foregoing was noted after several weeks of daily use. The roller inductor became increasingly difficult to rotate. Eventually, the turns-counter dial no longer provided meaningful readings; the calibration became inaccurate as a result of the mechanical problems attendant to the rotary inductor.

Inspection indicated that the movable contact (small brass wheel) on the rotary-inductor coil had been binding on the brass rod that passed through its center. In fact, the binding had been so severe that the rod had developed shallow grooves that were formed by the restricted wheel during adjustment of the inductor. Excess torque had also caused the brass contact arm at the minimum-inductance end of the roller to bend and become loose, thereby allowing the small brass wheel to skip coil turns. This caused the turns-count calibration to get out of kilter. The loose parts were removed, bent back into the proper shape, then reinstalled. A thin coating of silicone grease was applied to the brass rod on which the wheel travels. This cured the binding problem and made the Transmatch much more enjoyable to use thereafter. Owners of a Murch Transmatch may want to apply silicone grease to the aforementioned area *before* the malady becomes manifest.

Who Needs a Transmatch?

For the newcomers to Amateur Radio, Transmatches are known loosely as "antenna tuners" and "antenna couplers." Some even borrow the E. F. Johnson trade name and call them "Matchboxes." Transmatches provide a matched condition between the *transmitter* and the feed line, but do not correct for a mismatch at the antenna feed point. It is important to remember this basic rule.

What a Transmatch will do for you is permit the transmitter or amplifier to look into a 50-ohm load. Most transmitters are designed for that ouput impedance. A proper match for the transmitter is especially important when using solid-state rigs, as most of them have an SWR shut-down circuit which lowers the power output as the SWR increases. Thus, if you have an antenna that has a low SWR on one end of the band, but has high SWR in some other part of the band, a Transmatch can be used to "fool" the transmitter into delivering full rated power output. I need a Transmatch at my station to work both the cw and phone bands with my tri-band trap Yagi beam. I like to think that I'm getting a bit of additional TVI protection in the process! However, there is no need for a Transmatch if you're using a properly matched antenna system. — *Doug DeMaw, W1FB*

Murch UT-2000-B Specifications

Size (HWD): 5 × 12 × 15 inches (127 × 305 × 380 mm).
Weight: 10 lbs (4.54 kg).
Color: Two-tone gray and black.
Frequency range: 1.8 to 30 MHz.
Power rating: 2-kW PEP.
Price class: $220.
Manufacturer: Murch Electronics, Inc., Box 35, Franklin, ME 04634. Tel. 207-565-3312.

THE AEA ISOPOLE* 2-METER ANTENNA

Let's face it: The ISOPOLE is one of the most unusual antennas this reviewer has ever seen.

*ISOPOLE is a registered trademark of Advanced Electronic Applications.

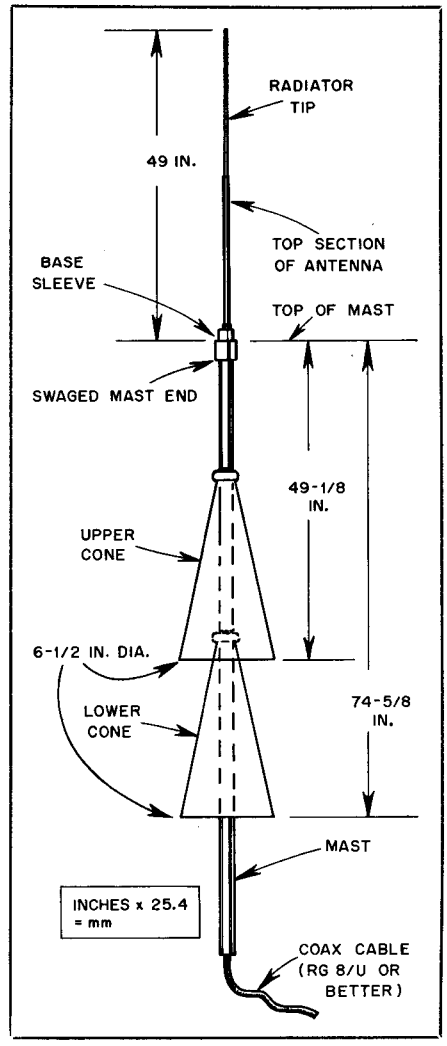


Fig. 2 — A drawing of the AEA ISOPOLE antenna. The purpose of the two cones is discussed in the text.

All the more reason to take it home and put it together.

What makes it look so different are the twin, resonant decoupling sleeves. What makes it work so well is a lot of thought given to decoupling. It is virtually impossible to sufficiently decouple an antenna feed line (and the mast on which a vertical antenna is mounted) from the antenna and thereby preserve the ideal pattern the designer had in mind. In the case of a vertical antenna mounted on a vertical mast and fed with a long vertical run of coax, it is difficult, at best, to prevent distortion of the pattern toward the horizon. Furthermore, a vertically polarized antenna that is poorly decoupled will provide horizontally polarized radiation from any horizontal components in its field, including runs of coax cable.

Each of the above factors tends to reduce the vertical gain toward the horizon, just the opposite of what one hopes to achieve with a vertically polarized 2-meter antenna. Enter the ISOPOLE.

A drawing of the ISOPOLE appears in Fig. 2. The twin, resonant decoupling sleeves are responsible for the decoupling of the antenna from its supporting mast and coax feed line. The decoupling sleeves are conical in shape (something like a small megaphone) and are mounted firmly on the supporting mast.

In fact, part of the supporting mast functions as part of the antenna. Look at it this way. The coax passes up through the mast and terminates in a female coax receptacle at the bottom of the 49-inch, two-section tube and rod that is fastened by set-screws to the top of the mast. This 5/8-wavelength section is the top part of the antenna. Above the coax connector (and part of the same weather-insulated housing) is a sealed matching network, factory adjusted, which provides broadband matching from 142 to 150 MHz. The manufacturer claims that the antenna will exhibit less than 2:1 over this bandwidth. This reviewer measured a VSWR of no more than 1.4:1 over the 144- to 148-MHz amateur band.

The first decoupling sleeve is adjusted so that the bottom of the sleeve is exactly 49-1/8-inches below the top of the mast. The radiating part of the antenna consists of the top 5/8-wavelength long, two-section rod and tube and the top portion of the mast down to the bottom of the first decoupling sleeve. Essentially, the active radiating part of the antenna, as described, may be looked upon as a 1-1/4-wavelength dipole. The manufacturer says it may also be referred to as "two 5/8-wavelengths in phase." The flared end (bottom) of the decoupling sleeve starts the isolation of the radiating part of the antenna from the mast. The second decoupling sleeve, fitted just below the first, completes the decoupling and effectively isolates the radiating part of the antenna from anything below it.

The ISOPOLE assembles in a few minutes on a 1-1/4-inch mast (not supplied). Maximum mast length is unlimited, though the minimum length should not be much less than 8 feet so that the antenna may be attached to its supporting structure.

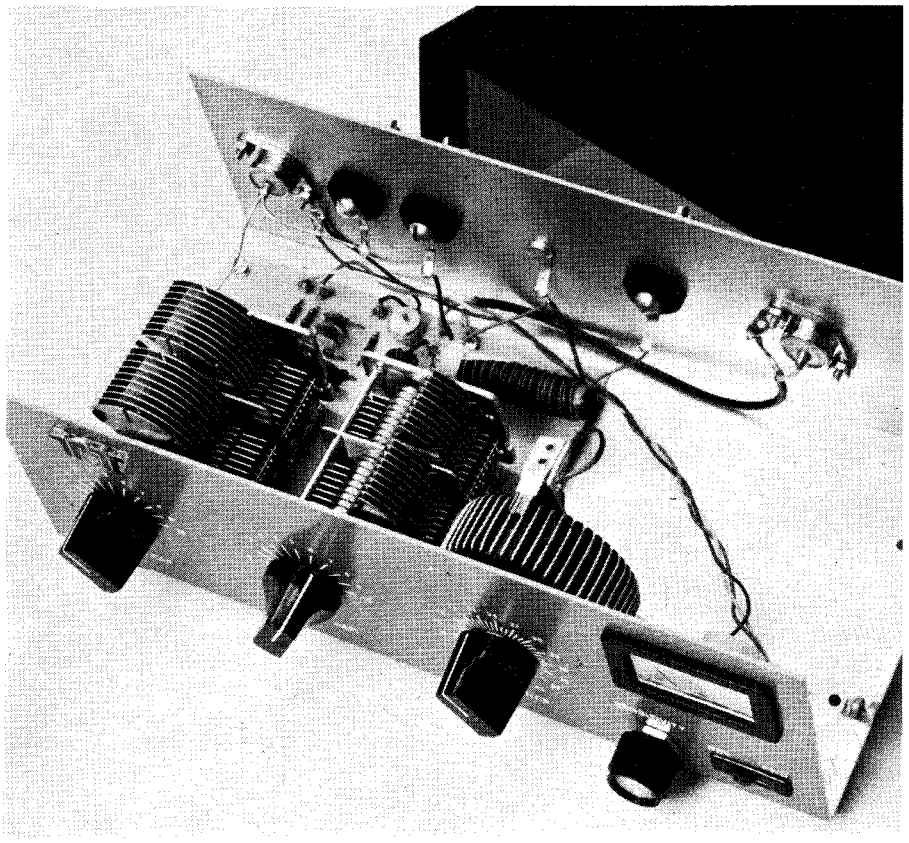
As usual, this reviewer couldn't wait to mount the antenna on roof or tower. As soon as the brief assembly was completed, the mast was strapped to the railing of the rear deck of the house, about 8 feet above ground. A quick check with a quality VSWR bridge good to 150 MHz indicated no more than 1.4:1 over the entire 2-meter band. Armed with the ARRL *Repeater Directory*, and with the antenna at its commanding height of 8 feet, I proceeded to raise 29 repeaters in Connecticut from my centrally located point, along with several in Massachusetts and even a few on Long Island, approximately 50 miles distant. The remaining repeaters in Connecticut were either "down" or private. Most of the repeaters were raised with 5 watts output. Access to a few required 25 watts output for reliable contacts.

The antenna does not appear to be designed to withstand 6-inch ice loads on 10,000-foot mountains, but if you have need for an effective omnidirectional, horizon-oriented antenna you may wish to look into the AEA ISOPOLE. It appears to be ideal for modest repeater and home locations. The antenna offers a projected surface area of 1.75 sq. ft., weighs less than 3 pounds and sells for $49.95.

The ISOPOLE is available from Advanced Electronic Applications, P. O. Box 2160, Lynnwood, WA 98036. — *Lee Aurick, W1SE*

TEN-TEC 247 AND 277 ANTENNA TUNERS

Ten-Tec is currently marketing Transmatch models 247 and 277 which are designed to match the 50- to 75-ohm unbalanced outputs of transmitters and transceivers to both balanced and unbalanced loads. What distinguishes the 277 from the 247 is that the model 277 contains a built-in SWR bridge and meter.



The Ten Tec model 277 Transmatch shown above employs the popular W1ICP Ultimate Transmatch circuit. Provision is made for feeding both balanced and unbalanced loads. The balun is located immediately behind the center capacitor. At the left of the SWR meter is the variable inductor. All terminals are on the rear panel.

These Transmatches are compact and lightweight (only 3 pounds), factors that should interest the vacationer or Field Day operator. Cabinet dimensions (HWD) are 3-1/2 × 10-1/4 × 6-1/2 inches (89 × 260 × 165 mm) for the model 277. Measurements for the model 247 are 2-15/16 × 7-3/4 × 6-11/16 inches (75 × 197 × 170 mm).

The attractive enclosures make either unit a suitable desk-top accessory. Front and rear panels are finished in metallic gray. Both covers (sides and tops) are dressed in a black textured material. Operating controls for the main variable capacitors and the variable inductor are on the front panel.

Mounted on the rear of the cabinets are the PL-259 coaxial connectors which accommodate the transmitter and antenna transmission lines. Terminals are also furnished on the rear panel for a balanced transmission line, a single-wire antenna and a ground.

A decade ago, Lew McCoy, W1ICP, introduced the Ultimate Transmatch circuit. Without doubt, this configuration is the most popular antenna tuner design today. Both the 247 and the 277 Ten Tec tuners follow the W1ICP format, with the exception that Ten Tec elected not to use a differential capacitor in the input. Instead, the differential capacitor is replaced by a ganged, dual-section unit. This capacitor, however, does seem capable of handling most matching requirements.

The shunt inductance of the T-network is wound in a manner that reminds one of a rheostat, especially inasmuch as it is equipped with a rotary slider similar to that on a rheostat. By means of the slider, the operator can select the amount of inductance required for matching.

Although both Transmatch models are designed to match a variety of loads, there are some restrictions. The maximum *balanced* load from 1.8 MHz to 4.0 MHz is 600 ohms. In laboratory tests with *unbalanced* loads, 500 ohms appears to be the upper limit on 160 meters. On the other hand, tests on 80, 40 and 20 meters indicated that on these bands, unbalanced loads as high as 2000 ohms could be accommodated. Loading on 10 and 15 meters at 2000 ohms was not satisfactory. On these bands, loads of 1500 ohms and less presented no problem. After all, not many amateurs would seek to match such high impedances on these bands. Feedpoint impedances of popularly used antennas for 10 and 15 meters are well within the range of either tuner.

Being a 160-meter buff, I rather naturally tried both of these Ten Tec Transmatches on the "top band" first. Antennas that have low-impedance feedpoints (30- to 150-ohm range) proved to be no obstacle. But for the chap who wants to end feed a single-wire half-wavelength antenna on 160, use of the Ten Tec networks is out of the question. Perhaps the manufacturer will, in the future, modify the circuit to overcome this disadvantage. One competitive Transmatch producer does furnish an accessory coil that compensates for a similar shortcoming.

In order to determine the insertion loss of the

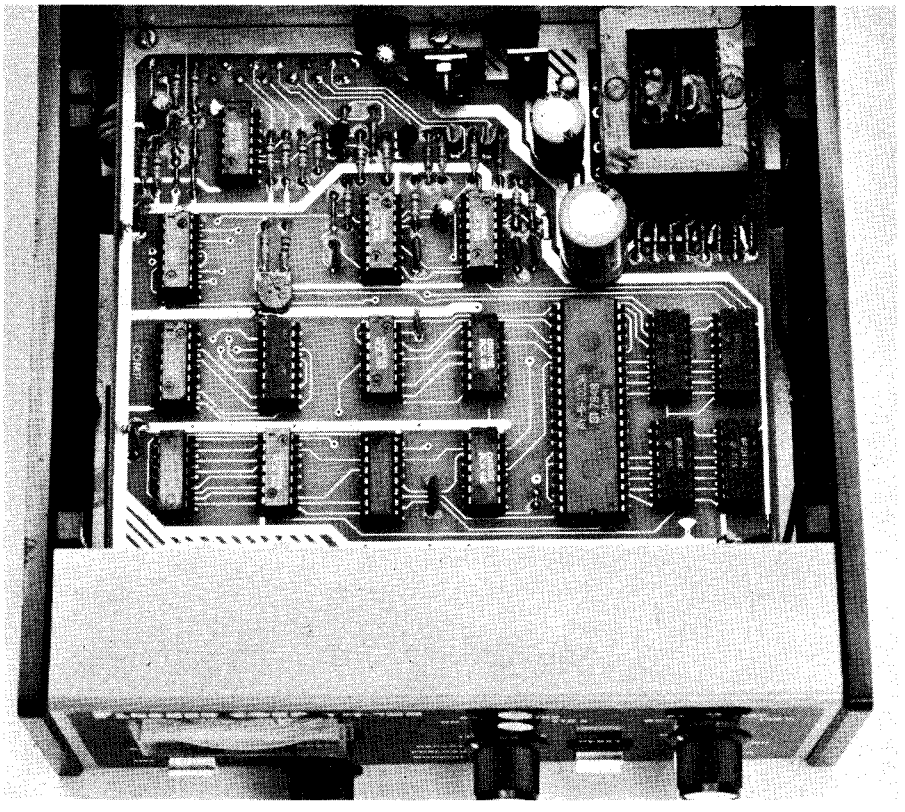
Ten Tec tuners, the test circuit included two Bird Wattmeters and a laboratory type dummy load. From 10 through 80 meters, the loss was constant at 0.46 dB, a value considered normal. The loss was somewhat higher on 160 meters, 0.79 dB.

Ten Tec made an improvement following the examination of an initial pair of these Transmatch units submitted for lab checking last year. We reported back to Ten Tec that the balun severely overheated when subjected to the full rated power, as did the variable inductor. Also, as a result of further discussions with their engineering department, it was agreed that listing the continuous-carrier power rating of these tuners at 100 watts instead of 200 watts would be more appropriate for the specifications.

As a matter of personal preference, I would like to see the model 277 equipped with an SWR meter that has a zero-set adjustment, a feature lacking in the current model. Other than that, I do find that the type of meter Ten Tec employs serves the purpose and agrees fairly well with the Bird Wattmeter.

I wish to commend Ten Tec for the fine set of instructions supplied with these units. Indeed, they form a concise review of transmission-line and antenna theory that is clearly presented in a well-organized manner.

Price class for the model 274 is under $70; the model 277 is in the $85 range. Ten Tec products are available from authorized dealers or from the manufacturer in Sevierville, TN 37802. — *Stu Leland, W1JEC*



The top cover of the Flesher TR-128 has been removed to disclose the neat interior layout of the unit. All ICs are socketed.

FLESHER TR-128 BAUD RATE CONVERTER

Stuck at one RTTY speed? Ever feel frustrated because your printer has only 60-wpm gears while somebody is sending some Star Trek art at 100 wpm? Or, after picking up that model 28ASR at a bargain price, you find it has 100-wpm gears and you now have to spend $50 for 60-wpm gears to slow the machine down to copy everyone else? Maybe you are a hunt-and-peck typist — wouldn't you like to smooth out your transmissions? Well, the Flesher TR-128 is the solution.

Speedy Relief

With the TR-128 on line, one can tune in any RTTY station transmitting at any standard amateur speed (60, 67, 75, or 100 wpm) as well as the commercial speed of 110 wpm. The TR-128 will convert that speed to your local equipment operating speed. Similarly, in the transmit mode, your local equipment speed can be changed to be transmitted at any of the four legal amateur speeds. For example, if you tune in a station transmitting at 75 wpm and your teleprinter is a 60-wpm machine, with a couple of twists of the TR-128 controls the 75-wpm transmission is reduced to your teleprinter's 60-wpm speed, and when you are ready to transmit, your 60-wpm transmission is altered to 75 wpm.

The TR-128 also transfigures a hunt-and-peck typist into a smooth operator. Simply set the SPEED control as high or low as you wish (one character per second is the lowest, while the top speed is the highest operating speed of your keyboard), and start typing. If you hunt and peck at an average speed of 30 wpm, set the SPEED control for approximately 30 and your erratic hunting and pecking is reshaped into a smooth and consistent 30 wpm. You'll be known on the air as "slow and steady."

Building the Kit

You may purchase the TR-128 assembled and tested ($239.95) or as a kit ($179.95). This reviewer built the kit in less than 8 hours; no problems were encountered. Nearly all the components are mounted on one circuit board and sockets are included for all 23 ICs.

Testing and calibrating the unit is an involved process — the manual has six and a half pages of assembly instructions and nearly five pages of testing instructions. Patience and care in testing and calibration procedures will be rewarded by a flawlessly operating unit.

Buffer and UART

A 128-character memory buffer is the "heart" of the TR-128; a UART is its "soul." The UART converts the incoming serial data into parallel data, and reconverts the parallel data to serial form. Normally, the buffer is a temporary holding register through which data passes. However, in the PRELOAD mode, 128 characters of data may be stored in the buffer to be released for transmission or reception at will. Also, this stored message may be restored and be repeated if necessary. A meter indicates just how full the buffer is at all times.

The '128 is built into a neat little package and is a perfect match for the Flesher TU-170 demodulator/afsk unit (reviewed in March 1979, *QST*, pages 42-43). The front panel contains all of the controls and metering, while the rear panel contains screw terminals for all interconnections — signal connections are TTL-compatible.

If you are interested in controlling the speed of your RTTY station, the TR-128 provides the means. It is available from the Flesher Corporation, P. O. Box 9760, Topeka, KS 66601. — *Stan Horzepa, WA1LOU*

TET 3F35DX TRI-BAND ANTENNA

The TET 3F35DX is an unusual triband antenna — and from all appearances, it is an efficient one as well. At this writing, the antenna has been installed and in use for two months. During that time, the antenna has not been in constant use; it is one of several available to this reviewer. However, it has been the *only* antenna used on 10, 15 and 20 meters. An examination of the station log indicates that, under very casual operating conditions, some 17 different countries on five continents have been worked, some of them many times. Input power was never more than 150 watts, and both cw and ssb were used. DX contacts ranged from the Pacific area to Africa, Europe and Asia; excellent reports were received at all times.

The 3F35DX functions as a 3-element Yagi on each of the three bands. There is a separate driven element for use on each band; these elements have no traps. The traps are confined to the reflector and director. It is because there are no traps in the driven elements to "soak up" transmitted power that the manufacturer makes high-performance claims for this antenna. Testing under actual operating conditions without the benefit of an antenna measuring range makes it difficult to maintain an objective approach and impossible to obtain qualitative answers. However, there is one method of testing at our disposal — that of comparison. That is: How does the 3F35DX fare when compared with a previously installed antenna? The comparison antenna is a 4-element, fully trapped tribander with a much larger (26-foot) boom that had been taken down several weeks earlier. This was to be a test of the antenna's ability to produce results. Here's how they stacked up.

Using the trapped tribander, I needed but

one or two calls to snag a DX station. The 3F35DX usually produced such replies on the second or third call, with other replies on either the first or fourth call. Assuming all other conditions were the same, one would have to conclude that the larger antenna had an edge over the 3F35DX — but not much. There are some real advantages afforded by the '35DX, too. Estimated weight is under 25 pounds; about half the weight of the comparison antenna. Boom length is considerably shorter, just 16 feet. These two factors are definite advantages if one contemplates mounting such an antenna on a modest tower.

Perhaps the greatest advantage that this antenna has to offer is that it is relatively "flat" over both the cw and ssb segments of each of the three bands. With the larger antenna, one selected a portion of the band most frequently worked (either the lower or upper end) during the initial adjustment of the antenna. The high-Q traps in the driven element would not permit one to operate both band segments without a resultant high SWR occurring in the lesser-used portion of the band. The 3F35DX, as a result of the full-length driven elements (and resultant lower Q), offers full-band operation with a modest VSWR. On 20 meters, the maximum VSWR is 2.25 to 1 at 14.35 MHz. On 15 meters, the VSWR is 1.3 to 1 at both band edges, and on 10 meters it is below 1.3 to 1 to beyond 29.5 MHz, rising to 1.6 to 1 at 29.7 MHz.

The assembly instructions are better than many this reviewer has seen; dimensions are given in both inches and millimeters. One piece, a swaged section, has only one hole and one screw, despite the instructions which insist it has two holes and screws. Fig. 5 is supposed to be an assembly drawing of the director and reflector; it isn't. The drawing refers to the assembly of the driven elements and feed system and attachment to the boom. Some day the instructions for all antennas will catch up with reality. (Of course, on that day horses will fly!) Despite the aforementioned annoyances, the beam goes together very easily and there are no complications.

The 3F35DX triband antenna offers wide bandwidth and usual gain in a reasonably compact, lightweight construction. It is manufactured by TET U.S.A., Inc., 425 Highland Pkwy., Norman, OK 73069. Price class: $190. — *Lee Aurick, WISE*

The Optoelectronics PDT 590. This precision digital thermometer provides an LED temperature readout in either Fahrenheit or Celsius scales. The probe cable length may be made quite long for remote temperature-sensing applications.

OPTOELECTRONICS, INC. DIGITAL THERMOMETER

Question: "Where in the world would a radio amateur use a precision digital thermometer?" Well, how many QSOs have you heard start out with the RST report, QTH, name and local weather report? Plenty, for sure, even though that type of QSO is pretty mundane. Those who feel compelled to report local temperatures to other hams must certainly need a good outdoor or indoor/outdoor type of thermometer. The Optoelectronics PDT-590 precision digital thermometer can be used as an indoor/outdoor temperature indicator. It reads temperature in Fahrenheit and Celsius scales with the flick of a switch.

But what if you don't give a hoot about passing out weather data to those you work? Well, think how handy it would be for the amateur experimenter to measure transistor case temperatures, tube-envelope temperatures or the ambient temperature in a VFO compartment. Another application is the monitoring of etchant-bath temperatures, if you make your own pc boards.

Instrument Features

The PDT-590 comes in kit form. It employs large-scale integrated circuitry (LSI) and utilizes two switch-selected temperature probes which can be connected via many feet of cable for sensing at remote locations. The accuracy is ±0.5°C (0.9°F) from −50° to +150°C. This equates to a range of −60° to +200°F. Resolution of the digital readout is 0.1°C or 0.1°F.

The sensor probes function as temperature-dependent current sources. Response time is 3.4 seconds to reach 63.2% of an increment change in temperature, as determined in an agitated liquid bath. The stock cable length for each probe is 10 feet (3 m), but they can be extended to several hundred feet if the need arises.

The selected temperature probe Celsius or Fahrenheit output voltage is measured by means of a 3-1/2-digit DVM (digital voltmeter). The DVM has a −1.999 to +1.999 voltage range. Hence, when the scaled output voltage falls below the internal reference voltage a negative temperature is displayed. Because the input voltage is 10 mV per degree C or F, the decimal point is placed between the 1- and 10-mV position to obtain a readout in degrees C or F.

A complete diagram of the digital thermometer is provided in Fig. 3. It has been reproduced directly from the Optoelectronics operating manual ($2 per copy). Therefore, the symbology of the diagram does not match the IEEE symbology used by the ARRL. The

Optoelectronics PDT 590 Precision Digital

Specifications

Dimensions (HWD): 1-1/4 × 4-1/4 × 5-1/4 inches (32 × 108 × 133 mm).
Weight: 14 ounces.
Operating temperature environment: 0 to 50°C.
Power requirements: 9 to 14 volts ac or dc at 175 mA (1.7W).
Readout range: −50° to +150° Celsius, −60° to +200° Fahrenheit.
Readout resolution: 0.1°C and 0.1°F.
Price Class: $100.
Manufacturer: Optoelectronics, Inc., 5821 N.E. 14th Avenue, Ft. Lauderdale, FL 33334. Phone: 305-771-2050.

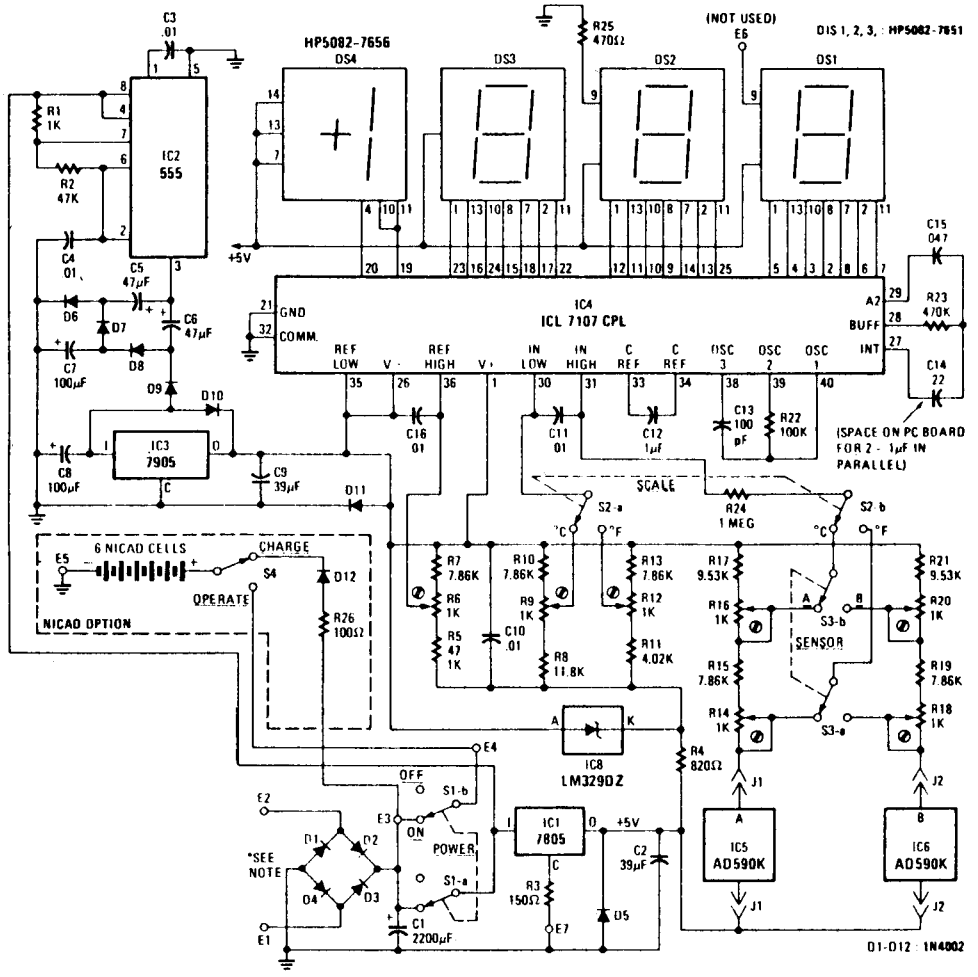


Fig. 3 — Exact reproduction of the manufacturer's schematic diagram for the PDT-590. The symbols differ in style from those used in ARRL publications.

diagram is, however, very clean and easy to follow.

Assembly of the Kit

This kit may be slightly beyond the capability of an inexperienced amateur. A modicum of technical knowledge and experience is needed to comprehend some of the step-by-step assembly instructions. The dialogue is a bit terse in spots, requiring some "decision logic" which is based necessarily on practical experience with circuits. Also, the assembler needs to have good vision to read the parts numbers and the labeling on the pc board: The unit is fairly miniature, and so seems the aforementioned printing to those (like the reviewer) with aging eyes! A magnifying glass is highly recommended for this project. One of the greatest aids to assembly of this kit was the black-and-white matte-finish photograph of an assembled kit (pc-board view with compartments in place). Apparently, the photograph is part of the instruction manual. It helped in determining where some of the parts belonged.

A double-sided pc board is used, but without plated-through holes. Instead of through-hole plating, the component leads are soldered to pads on each side of the board, where applicable. Yellow squares or rectangles are painted on the pc board at each location where soldering on both sides is required. In the long term this technique may prove better than that of the plated-through hole. Many "through-hole" boards seem to be failing these days as a function of time and heat cycling. Assembly time for an experienced kit builder should be approximately 10 hours, inclusive of calibration.

The calibration procedure is interesting. First, the builder must prepare a pot of boiling water, insert the probes, then adjust a Trimpot to obtain a reading of 100.0°C. There is a Trimpot for each probe. Next, a bowl of ice cubes and an equal volume of water is stirred until it stabilizes. The probes are inserted in the ice water and allowed to stabilize. Two more Trimpots are tweaked so that each sensor provides a readout of 0.0°C. The Fahrenheit calibration is done after the probes are dry and allowed to stabilize at room temperature. A pair of Trimpots are used to accomplish this. The Celsius reading is simply converted to Fahrenheit during this final adjustment step. The constructor must have access to an accurate digital voltmeter. The initial calibration calls for adjusting the voltage references by means of internal Trimpots. Since decimal-value voltages are involved (2.73 and 4.59 volts), resolution and accuracy are vital.

Using the Instrument

Both sensor probes must be plugged in at all times in order for the remainder of the circuit to function correctly. Furthermore, one must keep track of probes A and B with respect to the A and B jacks on the thermometer. This is so because the calibration is done with specific probes in the jacks. Differences in sensor characteristics dictate that A and B probes always be used with the inputs for which they were calibrated.

For use as an indoor/outdoor thermometer one probe can be placed out-of-doors while the remaining one is located in the shack. Since the sensor ends are the cases of small ICs (metal), they can be placed in contact with tube envelopes, transistor cases, IC cases or whatever is being checked by direct-contact means. I even measured my body temperature by placing one of the sensors under my tongue — however unrelated to radio that might have been.

If the sensors are placed in etching solution, be sure to clean them thoroughly after use — preferably before any of the etchant can dry on the probes. — *Doug DeMaw, W1FB* QST