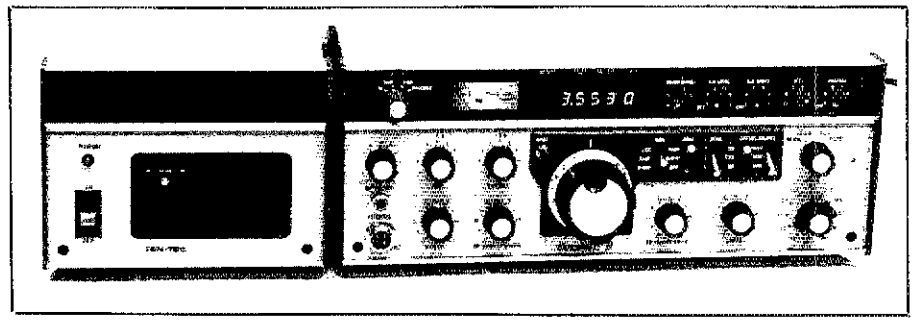
Product Review

Conducted By Bruce O. Williams, WA6IVC
Assistant Technical Editor

Ten-Tec Model 561 Corsair II HF Transceiver



The Corsair II is a 100% solid-state transceiver that covers the amateur bands from 1.8 MHz through 30 MHz, including the WARC bands, with about 40-kHz of overtravel on each band edge. The Corsair II's 30-m coverage begins at 10.0 MHz, allowing coverage of WWV. The rig contains 26 ICs, 94 transistors and 109 diodes (I didn't count the rest of the parts!) in 22 PC-board assemblies. It delivers a respectable 85 to 100 W of output (200 W input) on CW and SSB, and can also be used on RTTY and AMTOR. The Corsair II is designed mainly as a fixed-station rig, but it operates from 12-14 V dc so it can be used for portable and mobile operation. When I was offered the opportunity to write this Product Review on the Corsair II, I accepted gladly. I own a Ten-Tec Argosy I (serial no. 34!) and was anxious to get a look at its new "big brother."

The Corsair II has only 25 controls and switches. The front panel is *not* crowded, and the controls and switches are conveniently located. The KEYER SPEED, N.B. LEVEL, N.B. WIDTH, ALC and PROCESS controls have rather small knobs, and some of the other controls did not have a smooth feel, but they all operated without any problems. The transceiver is easy to use; its features are almost custom-tailored to my straightforward operating habits.

Features

The Corsair II features many of the extras that amateurs want, such as passband tuning (PBT), receive/transmit/transceive (RX/TX/TRX) offset, audio notch and bandpass filters, switch-selectable AGC and crystal filtering, a noise blanker, built-in keyer and speech processor. The six-digit display resolves frequency to 100 Hz, using yellow 0.3-inch LED numerals that can be easily seen in normal or dim lighting. Four front-panel LEDs indicate the status of the RF ATTENuator, OFFSET, speech PROCESSor, and ALC peaks. The ALC peak indicator is not as useful as a meter, but when used according to the operating instructions, it allows the transceiver to produce good-sounding SSB. The Corsair II's single meter is used as an S meter on receive, and is switch-selectable in transmit to show FORWARD and reflected (SWR) power, final transistor collector current (I_C) and the level of compression applied to the MIC input when the PROCESS control is on.

The tuning knob functions smoothly, at about 18 kHz per revolution. The entire 80-m band is covered in 27 turns of the knob. The frequency control in the Corsair II is a permeability-tuned oscillator (PTO), rather than the more common phase-locked loop. This results in better phase noise performance than is available from present synthesizer technology. The PTO is well constructed, and mechanically and thermally stable. The frequency display is *counter* based; it does not just display microprocessor commands, as is common in synthesized rigs. The two-switch OFFSET SELECT circuitry is versatile. One switch selects RX, TRX or TX offset and the second switch range selects (MAX, MIN or OFF). Because the Corsair II has a single PTO (no VFO A/B here!), split-frequency operation is limited to the TRX offset range (±4 kHz, typical). Fortunately, on CW, none of the rare and juicy DX stations that I called was listening more than 5 kHz up, so I was able to get in on the fun. I was not able to work some of the SSB stations that were using wider splits.

The Corsair II is not microprocessor controlled, so frequency memories and keypad frequency entry are not included. This might be a drawback for operators who are accustomed to using these features. I've made little use of memories on other transceivers I've operated, so I did not miss this particular feature on the Corsair II.

The rig's steel case is rugged, and has a snap-down bail stand. The speaker is located on the bottom of the cabinet, muffling the sound somewhat. The rig has an external speaker jack, however, allowing use of the front-facing speaker in the matching Model 260 power supply; this results in crisp audio. There is plenty of room on the Corsair II's rear panel for the addition of the inevitable modifications by tinkerers. The rear panel also contains two 12-V output jacks; these are useful for powering accessories.

A look inside the Corsair II reveals a well-constructed unit. Each circuit function is contained on a separate module, and the modules are interconnected with plug-in wires or cables using the same reliable push-on connectors that Ten-Tec has used for years. The connectors are numbered and keyed, so there is little likelihood of misconnection when they are unplugged and reconnected. Most of the modules are easily removed and replaced, so if you are technically inclined, you can do some of your own servicing.

The Receiver

A bandpass front end eliminates the need for front-panel preselector tuning. An optional high-pass filter may be installed if operation will be in a location that is subject to strong nearby AM-broadcast signals. A 2.4-kHz, 16-pole crystal ladder filter is supplied as standard equipment, and 1.8-kHz, 500-Hz and 250-Hz filters are available as options. Ten-Tec specifies the audio output of the Corsair as 1 W at 2% distortion.

Table 1 shows the results of receiver tests in the ARRL Lab. The receiver's minimum discernible signal (MDS) of −124 dBm on 20 m is adequate for HF operation, and the blocking dynamic range of 113 dB on 20 m is respectable. The RF GAIN/ATTN controls (really a single dual-function control) are useful in reducing interference from strong nearby stations. I used the rig for some afterhours operation at the ARRL HQ club station, W1INF, during the Phone Sweepstakes. At the same time, W1AW (just across the HQ parking lot and running over 1 kW on several bands simultaneously) was transmitting a CW bulletin. There are a few receiver "birdies" that caused me to hear W1AW at several places on the band, but in spite of the nearby multiband, multi-kW operation, most stations were heard quite well.

The Transmitter

Ten-Tec specifies the transmitter output at 85 to 100 W on all bands. The output-transistor heat sink is hefty, so it did not get too warm in casual QSOs, but the owner's manual warns that the sink may get quite hot if the transceiver is used in high-duty-cycle modes (ie, RTTY). The transmitter's broadband "no tune" circuitry allows easy band change. Ten-Tec states that the output transistors will not be damaged by "improper" antennas (high SWR), but for good efficiency Ten-Tec recommends that the SWR be 2:1 or less. The built-in SWR protection is accomplished mainly by a fast-acting overcurrent trip in the Model 260 power supply.

Ten-Tec specifies that all harmonic and spurious emissions are at least 45 dB below full output. Fig 1 shows the worst-case spectral display for full power output at 28.740 MHz. The Corsair II meets the manufacturer's specification at 102 W output. The owner's manual says that the transceiver may be operated at reduced power by decreasing the drive. On 28 MHz at 80-W output, the strongest spurious emissions were approximately 41 dB below full output, just

Table 1

Ten-Tec Model 561 Corsair II HF Transceiver, Serial No 58001721

Manufacturer's Claimed Specifications	*Measured in ARRL Lab*
Frequency range: 1.8 to 2.3, 3.5 to 4.0, 7.0 to 7.5, 10.0 to 10.5, 14.0 to 14.5, 18.0 to 18.5, 24.5 to 25.0, 28.0 to 30.0 MHz, plus 40-kHz overtravel at each band edge.	As specified.
Tuning rate: vernier, 18 kHz/rev.	As specified.
Frequency display: 6-digit, 0.3-in LED numerals.	As specified.
Frequency accuracy: ±100 Hz.	As specified.
Transmitter	*Transmitter Dynamic Testing*
RF power output: 85 to 100 W.	160 m, 92 W; 80 m, 93 W; 40 m, 97 W; 30 m, 97 W; 20 m, 97 W; 17 m, 99 W; 15 m, 101 W; 12 m, 101 W; 10 m, 102 W.
Microphone input: High or low impedance, 5-mV sensitivity.	As specified
Spurious signal and harmonic suppression: better than −45 dB relative to full output.	See Figs 1 and 2, and text
Third-order intermodulation distortion: Not specified	See Fig 3.
CW offset: 750 Hz.	Not measured.
CW keying waveform: Not specified.	Rise, 4.0 ms; fall, 2.5 ms; on delay, 3.0 ms; release delay 4.0 ms. See Fig 4.
Transmit/receive turnaround delay: 30 ms.	35 ms; see Fig 5.
Receiver	*Receiver Dynamic Testing*
Receiver sensitivity: Less than 0.25 μV for 10 dB signal + noise/noise	Minimum discernible signal (noise floor) (dBm) *80 m* −127 *20 m* −124
Receiver dynamic range: 95 dB.	Blocking dynamic range (dB) 117
	Two-tone third-order intermodulation distortion dynamic range (dB) 84 80
	Third-order input intercept (dBm) −1 −4
S-meter sensitivity (μV for S9 reading): 50.	160 m, 180; 80 m, 130; 40 m, 137; 30 m, 145; 20 m, 98; 17 m, 130; 15 m, 95; 12 m, 145; 10 m, 81.
Receiver audio output: 1 W into 8 ohms at 2% total harmonic distortion.	1.05 W.
RIT/XIT tuning range: Dual range, ±1.5 kHz and ±4.0 kHz.	As specified.
Power required: 12-14 V dc, 850 mA, receive; 18.5 A max, transmit.	Not measured.
Color: Two-tone gray.	
Dimensions: (HWD) 5¼ × 15 × 14 in.	
Weight: 14 lb.	

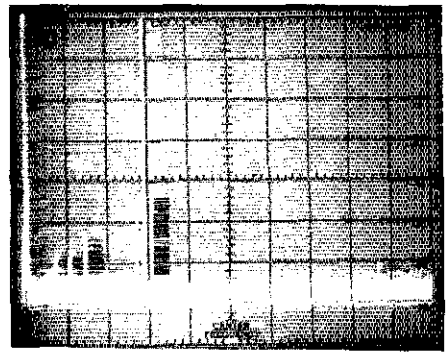


Fig 1—Worst-case spectral display of the Corsair II operating on the 10-m band. Vertical divisions are each 10 dB; horizontal divisions are each 10 MHz. Output power is approximately 102 W at a frequency of 28.740 MHz. All spurious emissions are at least 45 dB below peak fundamental output. The two taller pips on each side of the fundamental are mixing products, but are below the maximum level allowable under FCC regulations. The Corsair II complies with current FCC specifications for spectral purity at this power level.

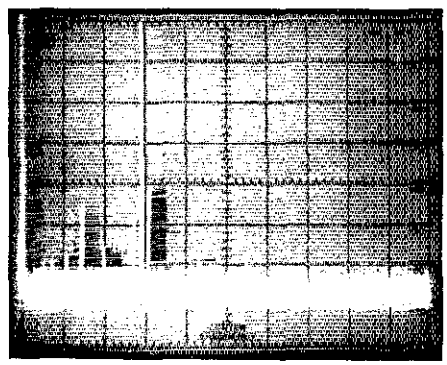


Fig 2—Spectral display of the Corsair II operating on the 10-m band at reduced power output. Vertical divisions are each 10 dB; horizontal divisions are each 10 MHz. Output power is approximately 80 W at a frequency of 28.740 MHz. The worst spurious emission is approximately 41 dB below peak fundamental output, meeting current FCC specifications.

meeting current FCC requirements (Fig 2). I did have some TVI problems (not unusual in my crowded residential area) that were eliminated with a low-pass filter.

CW Operation

My first love in radio is CW, so the Corsair II got a good workout in this mode. The transceiver is capable of full- or semi-break-in (QSK) operation. The full QSK works! PIN diodes are used to achieve fast TR switching (specified as 30 milliseconds). Other stations were able to break my CW transmissions with a single "dit," even if the stations were quite weak. The semi-QSK mode can be used if you don't like full QSK CW, but I really prefer full break-in, so I found the QSK a joy to use. The semi-QSK mode sounds smooth, with no receiver thumping. Transceive offset is normally fixed at 750 Hz. The Corsair II incorporates a SPOT front-panel push-button switch to zero beat a station easily. Amateurs with a poor sense of pitch (like me) will find this useful.

The optional 500-Hz filter was factory installed in the Product Review unit. I used this filter for most of my CW operating and did not notice any objectionable ringing. Attenuation outside of the filter bandwidth is good. I can eliminate almost all interference using this filter in conjunction with the Corsair II's pass-band tuning. Additional filtering is available from an audio-notch filter and audio-bandpass filter. The audio notch frequency is adjustable from 200 Hz to 3.5 kHz with an audio-frequency notch depth greater than 50 dB. The notch is easy to tune and is effective in eliminating a specific QRM signal. The band-pass filter is centered at 750 Hz, and its bandwidth is variable making it useful on CW and SSB. This is a lot of "selectivity power," and there will be few instances where interference can't be substantially reduced using various combinations of these filters. It took a bit of practice, but once I got the hang of it, I was able to use the various filters effectively. The Product Review unit did not incorporate the optional 250-Hz filter.

The Corsair II incorporates an internal iambic keyer with approximately 40 characters of memory. I found it convenient to use the internal keyer for most of my CW work. It sure is convenient not to have to carry a separate keyer during my portable and mobile operation! The keyer works well, but

weighting, fixed at 3:1 by the factory, is not adjustable. The KEYER SPEED control on the front panel allows a range from about 8 to 50 WPM. The speed adjustment is nonlinear, with higher speeds compressed at one end of the control rotation. The keyer memory works as specified. Users may remove a jumper plug on the rear panel to allow use of their own keyers and straight keys.

The KEYER MEM line is a single phono jack located on the rear panel. This line must be grounded to record a message. For playback of the recorded message, the KEYER MEM line must be pulsed to ground through a 33-kΩ resistor/10-μF capacitor combination. These components are not supplied with the Corsair II, and it's up to you to implement a convenient way to use this feature.

The CW output waveform is shown in Fig 4; rise and fall times are 4 and 2.5 ms, respectively. The resulting CW note is well shaped, generating a minimum of unnecessary keying sidebands. I received several reports (from amateurs who prefer "hard" keying) that the CW note seemed a bit "soft," but they were able to copy my signal at speeds of up to about 50 WPM (the maximum speed of the internal keyer). This shows that the keying characteristics are not too soft for this speed. I listened to the keying myself, and I think it makes for pleasant listening during a long "rag chew."

The CW sidetone signal is fed to the audio system. The LEVEL and PITCH controls are thumbwheel potentiometers that are adjustable through an access hole on the transceiver bottom plate. The controls are a bit awkward to adjust, but because they are "set and forget" controls, this is not a great inconvenience.

I tried using the Corsair II with a linear amplifier. Because the amplifier did not incorporate QSK capability, I used only SSB and semi-QSK CW modes. The Corsair II's internal TR relay worked well in controlling the linear-amplifier TR switching.

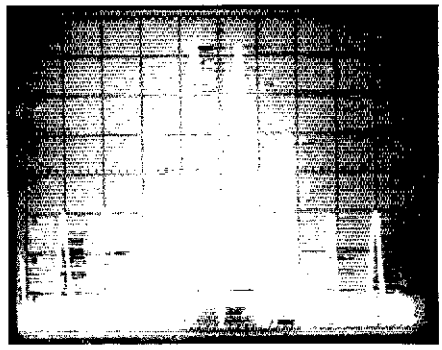


Fig 3—Spectral display of the Corsair II output during transmitter two-tone intermodulation distortion (IMD) testing. The transmitter is operating at rated output power on the 20-m band. Third-order products are 29 dB below PEP, and fifth-order products are 48 dB down. Vertical divisions are each 10 dB; horizontal divisions are each 1 kHz.

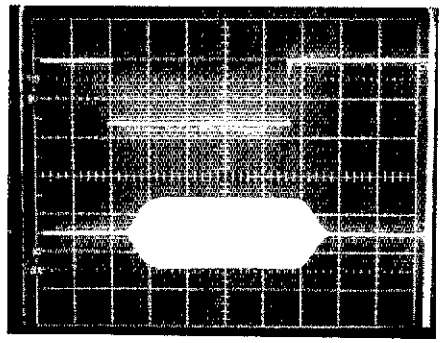


Fig 4—Keying waveform for the Corsair II. Each horizontal division is 5 ms. The top trace shows voltage at the key jack, which drops to zero at key closure; the bottom trace is the RF output.

SSB Operation

This rig gave me a good reason to be more active on SSB. The review unit did not include a Ten-Tec microphone, so I furnished my own. The DRIVE control serves as a mic gain control; there is no separate control for microphone gain. I tried the Corsair II with several different microphones, including an amplified type, and received good audio reports, so this arrangement seems to be able to handle different microphone output levels. The owner's manual cautions that the output of an amplified microphone must be adjusted so that the Corsair's microphone input circuitry is not overdriven (5 mV max).

Lower sideband is selected automatically on 160, 80, 40 and 17 meters, and USB on 20, 15, 12 and 10 meters if the MODE switch is in the SB-N position. The opposite sideband is selected by setting the MODE switch to the SB-R position.

The Corsair II can be used in either PTT or VOX operation, selectable by a front-panel toggle switch. The VOX GAIN, DELAY and ANTI-VOX controls are located on the rear panel, and once they were properly set I had no need to readjust them. The VOX action is smooth, and the TR switching is quiet even when I use headphones.

The transceiver also incorporates a built-in speech processor. The manual's detailed instructions on proper processor use and adjustment must be followed to obtain good-sounding processed audio. The processor level (PROCESS) and RF DRIVE controls interact, so take care that the ALC LED is lit only on voice peaks. I enlisted the aid of a local amateur for some on-the-air speech processor tests. With the processor level set at minimum, he could hardly tell that it was on. I tried several different settings of the processor level, and my audio never sounded distorted. When I set the processor for maximum, I sounded "just like a contester," and my signal was a bit wider than it was without processing. The ARRL Lab did not perform any tests to verify processor performance. My audio did not sound bad, and was still intelligible. The tests were performed on 75 m in heavy static, and, as expected, the processor seemed to improve my speech power.

The 2.4-kHz sideband filter works well on receive. I used the audio bandpass filter (BP FILTER) and the passband tuning (PBT) to minimize any adjacent channel splatter. The audio notch filter was effective in minimizing interfering carriers.

Mobile Operation

Because the Corsair II operates from a 12-14 V supply, and I am an avid mobileer, I just *had* to try it mobile. The rig is large and is not suitable for under-the-dash mounting in many smaller cars (my 1979 Subaru pickup included). A caution about mobile operation: The Model 260 power supply contains overcurrent protection circuitry that shuts down the power supply if the Corsair II draws too much current. The operating manual says that if the transceiver is operated from an external power supply (including batteries) similar protection must be used. A fast-blow fuse does not react quickly enough to protect the rig. The Corsair II has a push-pull power on/off switch in the AF GAIN/POWER control. Its contacts are intended for use in switching only the 117-V ac input to the power supply. The contacts are not rated to switch the 12-14 V, 18.5 A drawn in transmit. Ten-Tec recommends using their Model 1140 circuit breaker, which also contains an on/off switch, for operation from a battery or from a power source other than a Ten-Tec power supply.

The transmitter draws a lot of current, and it is possible to discharge the auto battery if the transmitter is used for long periods of time with the engine shut off. I learned this the hard way, but I had jumper cables and found someone to help me jump-start my pickup! The Corsair II only draws 850 mA in receive, so it is possible to listen for quite a while without draining the vehicle battery.

As soon as I was ready to go mobile, I checked into the CW County Hunter's net. The County Hunters know me pretty well, so they were happy to help me check out the new setup. My signal reports ranged from S2 to 30 dB over S9. A few European stations gave me S9 signal reports. To put this account into proper perspective, I should add that 20 m was in good shape with most stations booming in. With my pickup's engine off, the transceiver was rock steady, with no frequency instability or chirp observable by me or the stations I was working. In-motion results were also good. I went over some pretty bumpy roads in Rhode Island and was told that the frequency remained steady. I did some of this mobile operation during the winter (brrrrr!). I didn't notice any drift as the heater warmed up the pickup. I repeated some of my stability experiments on SSB, specifically asking other stations to look for drift, or "FMing." The reports I received indicate that the rig is clean for mobile SSB use.

My home location is unsuitable for the CW and Phone Sweepstakes contests (no outside antennas allowed), so I operate both contests mobile. On the 1986 CW weekend I worked over 200 stations, and for the first time ever, I worked a KH6 in the Sweepstakes. I didn't have much time for the phone weekend, but I put in about 6 hours mobile on 75 m.

My vehicle is plagued with moderate ignition noise. The Corsair II's noise blanker reduces this quite a bit, but it is still audible. The noise blanker is a complex circuit with blanking threshold and pulse width adjustable via front-panel controls. These controls didn't seem to have much effect. For various types of noise, including power-line "hash," the noise blanker either worked or it didn't, regardless of the settings of its controls. The noise blanker had little effect on the "Woodpecker". As mentioned in the owner's manual, it was possible to set the noise blanker sensitivity too high and overload the

blanker. At times, the noise blanker accentuated received key clicks.

A mobile whip, especially on the lower HF bands, is inefficient. I found the receiver to have adequate sensitivity, even with an inefficient mobile whip antenna. The Corsair II receiver also measures up well in terms of dynamic range and phase-noise performance.

Digital Modes

The Corsair II's specified TR turnaround time of 30 ms is acceptable for AMTOR, so I decided to try this mode. Fig 5 shows the turnaround time measured in the ARRL Lab. Because of my AMTOR inexperience, I secured the help of an "expert" to aid me with equipment hookup and operating procedures. It took me a while to familiarize myself with the mode, but after some initial hesitation, I finally had my first AMTOR QSO! I worked only a few stations, but the rigperforms well on both strong and weak signals. AMTOR will never become my main operating mode, but it sure is fun to play with something different.

The Manual

I am familiar with Ten-Tec equipment, so the operation of most of the Corsair II's features was pretty self-evident, and all features function as described in the 54-page owner's manual. A section at the front of the manual shows the important operating requirements at a glance. The Corsair II's operating features are adequately explained in the manual, and I had no trouble making things work. Hookup diagrams are conspicuously absent. Less experienced users might want more information about connecting the TR relay or break-in control signals to an external amplifier. RTTY and AMTOR operation are treated only briefly in the manual. I would have liked to see more information to help me in the use of these modes. The information on the noise blanker is sketchy, with no explanation on the use of the N.B.LEVEL and N.B.WIDTH controls.

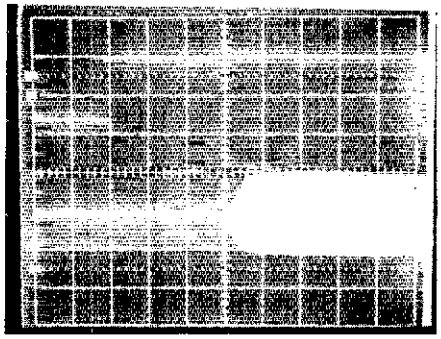


Fig 5—Receiver recovery time (turnaround) for the Corsair II. Horizontal divisions are each 10 ms. The top trace shows the voltage on the PTT line, which drops to zero as the PTT switch is closed. The bottom trace shows receiver audio output. The recovery time of approximately 35 ms is marginally acceptable for AMTOR operation.

The manual devotes 33 pages to alignment and service, including full schematics of each circuit board. Each schematic includes a parts list, although little information is given about the various toroid transformers throughout the Corsair II's circuitry. There is a brief description of circuit functions and step-by-step instructions for performing most of the adjustments for each circuit. The charts of nominal transmit and receive voltages are invaluable to those who choose to do their own troubleshooting. Block diagrams show most of the interconnections between modules. There is also a good technical discussion of the relationship between SWR, final-amplifier efficiency and measured power output.

Although the manual is well written in almost all areas, it is not without its flaws. The LED frequency display shows the CW receive frequency. The displayed frequency *does not change* during transmit. The transmit frequency is 750 Hz *higher* than the reading on the digital display below 14 MHz (160, 80, 40 and 30-m bands) and 750 Hz *lower* than the reading on the digital display on frequencies above 14 MHz (20, 17, 15, 12 and 10-m bands). This section of the manual is rather confusing, and I had to read it several times before I understood exactly what was meant. If you fail to properly account for the 750-Hz offset, it could result in out-of-band transmissions!

Conclusions

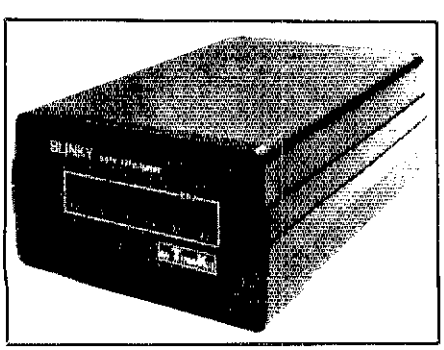
I used the Corsair II for several months. Did I have fun with it? You bet! As I weigh the pros and cons of this transceiver, I find that, for me, the Corsair II comes out ahead of some of the more complex HF transceivers. I am happy with a transceiver that is easy to use and can perform well for my favorite activities—mobile/portable operation, QSK CW and "simple" sideband. Every ham's operating requirements are different, so manufacturers make equipment with a range of features; every operating feature cannot be incorporated into every transceiver. For some people, a given feature is a must, for others it just gets in the way. The Corsair II *does* incorporate many fine features, and performs well. Before spending money on any transceiver, you should carefully weigh operating requirements and choose a rig solely on your preferences.

The Corsair II is manufactured by Ten-Tec, Highway 411 East, Sevierville, TN 37862, tel 615-453-7172. Recommended list price: Model 561, $1345; Model 263 remote VFO, $219; Model 260 power supply/speaker, $229.—*Ed Hare, KA1CV*

New Products

TIMEKIT BLINKY SSTV/RTTY TUNER

☐ The Blinky SSTV/RTTY tuner is an operating aid that indicates received audio frequencies and their shifts on a calibrated and easy-to-read analog-type scale. Blinky comprises an amplifier/limiter that drives six sharply tuned and temperature-stabilized op-amp filters. The filter outputs feed LED drivers that energize the appropriate frequency LEDs to illuminate the front-panel display. Blinking indicators are provided at 1.2, 1.5, 1.7, 1.9, 2.1 and 2.3 kHz. As the receiver is tuned across a RTTY signal, the unit indicates employed frequencies and shifts.

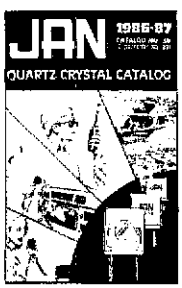


In spite of the manufacturer's name (TimeKit), Blinky is supplied fully assembled, tested and tuned. Blinky is housed in a small black plastic case measuring 2 × 3 × 5½ inches, and operates from an external (not furnished) power source, or an optional 12 V dc wall adapter. An internal dc-to-dc voltage converter allows operation from 9 to 12 V dc.

For more information, contact Fred Sharp, W8ASF, TimeKit, PO Box 22277, Cleveland, OH 44122. Price class: Blinky, $100; Model 60 wall adapter, $10.—*Bruce O. Williams, WA6IVC*

JAN CRYSTAL CATALOG

☐ A free booklet with general information on frequency-control quartz crystals and listings of various types is available from JAN Crystals. JAN has been a manufacturer of high-quality crystals since 1935.



The booklet includes data and current prices for crystals for CB, amateur (Novice to General), scanners, microprocessors and business radio. For a free copy, write to JAN Crystals, 2400 Crystal Dr, PO Box 06017, Fort Myers, FL 33906.—*Bruce O. Williams, WA6IVC*