Product Review Column from *QST* Magazine

July 1996

Advanced Electronic Applications AEA DSP-232 Multimode Data Controller

JPS NIR-12 Noise and Interference Reducer

AEA DSP-232 Multimode Data Controller

Reviewed by Steve Ford, WB8IMY
Managing Editor

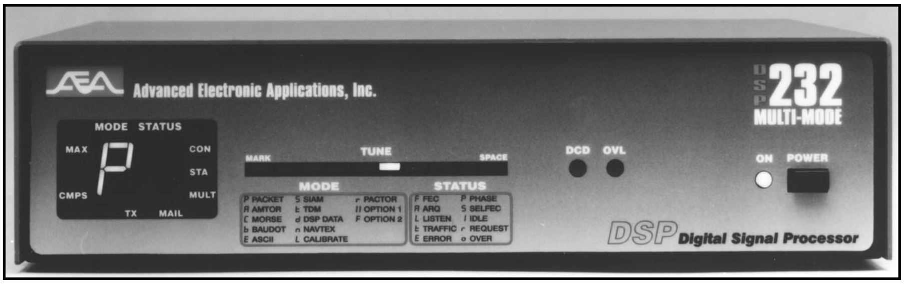

Table 1

DSP-232 Specifications

Modem: Analog Devices 2105 Digital Signal Processor running at 12.3 MHz in conjunction with Analog Devices 28msp02 audio codec (analog to digital/digital to analog converter).
Modulator Output Level: 5 to 100 mV RMS adjustable, with rear-panel controls for each radio port.
Processor System: Motorola 68340 running at 16.7 MHz.
RAM: Battery-backed 32 Kbytes standard, expandable to 128 and 256 Kbytes.
ROM: 128 Kbytes standard, expandable to 256 Kbytes.
Hardware HDLC (High-level Data Link Control): Zilog 8530 SCC.
Power Requirements: 13 V dc @ 1 A.
Radio Interface: One 5-pin DIN and one 8-pin DIN connector.
Direct FSK outputs: Normal/Reverse.
Auxiliary Port: 5-pin DIN.
Terminal Interface: RS-232-C DB-9S with hardware/software handshake.
Terminal Data Rates: 300, 600, 1200, 2400, 4800, 9600, and 19,200 baud.
Receive audio: Port 1 and Port 2.
Transmit level: Port 1, Port 2, and 9600 bps.
Dimensions: (HWD) 2.3×9.4×7.9 in; weight: 3 lb.

You don't need to be a veteran ham to realize that the digital modes are *hot*. Huge numbers of us are active on packet. We're swapping data with bulletin boards, exploring TCP/IP networking, hunting DX and contest contacts with *PacketCluster*, and "mapping" the world with APRS. Others are testing the digital waters on the HF bands, using everything from RTTY to PACTOR II.

The main engine driving the digital rage is the exploding popularity of home computing. According to some surveys, 80% of all hams have computers in their homes. With a computer at the ready, all you need is a radio and something to act as the middleman. (Computers and radios don't speak the same language!) If you only care about packet, a *terminal node controller* (TNC) will do the job for a little over $100. But if you want a cornucopia of digital modes at your fingertips, you must invest in a *multimode data controller*. Such a device is the DSP-232 by Advanced Electronic Applications (AEA), which uses digital signal processing techniques to create a multimode TNC and to get around some of the constraints that deter lesser controllers.

Multimode controllers provide several digital modes in one box. The list usually includes packet, AMTOR, PACTOR and RTTY. Many also throw in CW along with the ability to receive WEFAX, NAVTEX and so on. The typical multimode controller takes the receive audio from your radio, runs it through hardware modems to sort out the correct signaling tones, converts the tones to data, then processes the data into something your computer can display on its monitor. (Multimode controllers also handle handshaking protocols for the modes that use them, as well as other fascinating functions.)

The garden-variety TNC works pretty well for most applications. It shows its limitations, in two areas, however: (1) *Working with signals in poor conditions (fading, noise, interference)*. If you're going to exchange data on the HF bands, your controller must often contend with signals that are fading, plagued with noise or bombarded by interference (or a combination of all three!). Hams have been working for years to invent new digital protocols to get around these problems. That's why you'll find several different HF digital protocols in use today. The latest efforts use complicated modulation schemes, advanced error-correction technology and so on. But even the most robust modes are still at the mercy of your controller. If your fancy box can't decode the tones adequately, performance suffers when the going gets rough. (2) *Upgradability*. New digital modes seem to pop onto the scene every couple of years. That's a trend you can expect to continue almost indefinitely. If you're lucky, when a new mode comes along, the controller manufacturer can upgrade your unit by selling you a chip or two. So far so good. But what if that newfangled mode requires more than just a minor upgrade? Sorry, buddy; you're out of luck.

Bottom Line

The AEA DSP-232 combines digital flexibility and upgradability with top-notch performance.

The Answer is DSP

DSP—digital signal processing—has become a familiar acronym to most of us. Using ultra-fast analog-to-digital (A/D) converters, you take receive audio and render it into data almost instantly. From that point onward, the data stream becomes like clay on a potter's wheel. You can manipulate it to extract whatever you want. For example, you can program a DSP audio filter to recognize only that portion of a signal that fits in a 500-Hz wide "window" and reject everything outside that window. Or, you can reprogram the filter to seek out and eliminate those annoying tones you hear when someone tunes up near your frequency. Dramatic mode switches like these are simply a matter of changing the software—*nothing more*!

DSP technology is well suited for multimode controllers. It can be used to create "software modems" with audio filters much sharper than any hardware could possibly achieve. This translates into superior performance in crowded bands. DSP also can enhance signals buried in noise or troubled by fading. If a new mode comes along, new software reconfigures the controller to keep pace. As long as the manufacturer supports the product with upgraded programming, a DSP-based multimode controller will never be obsolete (at least in terms of current trends).

The only skunk at the party is cost. DSP processors and speedy A/D converters don't come cheap. And then there are all the unsung programmers who write the marvelous software. They need to eat, support families and so on. That's why the first DSP multimode controllers debuted with four-digit price tags. They were wonderful devices, but the marketplace balked. In time, hardware costs declined, along with other overhead expenses.

Enter the DSP-232

With the DSP-232, AEA offers serious DSP horsepower for digital modes in a package that many hams at last can afford. This innovative multimode controller includes all the popular digital modes—including 9600-baud packet. From an HF standpoint, the only modes missing are G-TOR, CLOVER and PACTOR II. G-TOR and CLOVER are proprietary, and AEA has chosen—at least for the time being—not to pursue licensing agreements with the owners. As far as PACTOR II is concerned, tantalizing hints in AEA's promotional materials suggest that it may be included at some point in the future. You can bet a number of hams eagerly await that announcement!

Speaking of promotions, when DSP-232 advertisements first hit the ham magazines, satellite users were intrigued to learn that the unit would feature 400-baud BPSK telemetry reception (for OSCAR 13), as well as a 1200-baud BPSK packet modem for working OSCARs 16 and 19. Unfortunately, that's not how it turned out. These modes are *not* available in the current DSP-232. AEA says the modes were excluded because the design engineers were misinformed about the popularity of OSCARs 16 and 19, and about the fact that 400-baud telemetry was going to be a part of the Phase 3-D system. They assumed that few hams cared about the 1200-baud PACSATs, and they figured that 400-baud telemetry would be a useless feature after OSCAR 13 bites the dust later this year. They were wrong on both counts.

Angry messages flew around the globe via the Internet (some hams didn't realize that these modes were not included until after they purchased their units). To its credit, AEA responded to the "flame" chorus by announcing that 1200-baud BPSK packet and 400-baud BPSK telemetry upgrades would be ready by early 1997. As we said, that's the beauty of DSP.

Out of the Box

When you open the box you realize that the DSP-232 isn't a clone of its predecessor, the DSP-2232. Not only is the DSP-232 about half the size, the displays are completely different. In the DSP-232, AEA abandoned the small LED bar graph tuning indicator found on the DSP-2232 and the PK-232. (I had always found this display difficult to see and interpret.) Instead, the DSP-232 has a large, multisegment LED indicator somewhat similar to the one used on the Kantronics KAM controller. It's much easier to see—even from across the room.

A large, square LCD display dominates the left side of the front panel. This display indicates the active mode plus other important information. When you're operating AMTOR or PACTOR, for example, an "O" appears when you switch from transmit to receive ("over"). The letters and symbols are a bit cryptic at first, but you quickly learn to recognize their meanings. And if you ever forget, just check the table right next to the display.

The rear panel layout is impressive—and it offers your first hint of the DSP-232's extreme flexibility. Not only are there two radio ports, there is an FSK input/output jack as well. The unit has two audio-only jacks for those who wish to connect their DSP-232s to shortwave receivers. I was particularly impressed when I saw *three* transmit audio level controls: port 1, port 2 and 9600 baud. A dedicated control for the 9600-baud signal level is a blessing (more about this later).

The DSP-232 is shipped with just about everything you need to get on the air. In the box are cables and connectors for both radio ports and the FSK port, a dc power cable, two receive audio cables, and even an RS-232 serial cable to plug into your computer. (The serial cable uses DB-9 plugs on both ends, so you may need an adapter if your PC has a DB-25 serial port.) AEA also now includes *PC PakRatt for Windows 2.0* software. I used the *Windows Terminal* program to test our unit.

The large manual is well written and easy to understand. It includes an extensive catalog of wiring diagrams for the microphone jacks of various transceivers. An entire chapter is devoted to troubleshooting—a topic I wish more controller manuals would stress.

On the Air

RTTY

Baudot RTTY is ideal for putting multimode controllers to the test. With no error-detection ability, RTTY operates in the what-you-see-is-what-you-get universe. If the propagation path gets flaky, the result is usually gibberish or nothing at all. RTTY conversations are also easily trashed by other signals. Therefore, sharp-response modem filters are the order of the day.

There wasn't a RTTY contest going on when I conducted this review. That's too bad. Nothing generates wall-to-wall signals on the digital subbands like a good RTTY contest. I had to settle for a Saturday afternoon on 20 meters instead. The few RTTY signals I encountered were being hammered by HF packet from above and PACTOR from below. Even so, the DSP-232 did a superb job of maintaining reasonably clean copy.

Forty meters at night is another challenging environment, and the DSP-232 acquitted itself well. At one point I answered a CQ from a station in California. His signal was bouncing around the noise floor, and I honestly didn't think we would be able to hold a conversation. To my surprise, he came right back, and we were able to chat for about 30 minutes. Considering the terrible band conditions, I have to credit the DSP-232 for allowing us to talk as long as we did. (His station was vastly superior to my 100-W transceiver and wire dipole! The DSP-232 definitely made the difference on my end.)

Using the LED tuning indicator was a breeze. You simply tune the receiver until two LEDs on the far right- and left-hand sides of the indicator flash in sync with the mark/space tones. With only a little practice I found that I could zero in on RTTY signals within a couple of seconds.

AMTOR

AMTOR has yielded its crown to PACTOR as the king of HF "burst modes," but you'll still find AMTOR activity. Tuning AMTOR was as easy as tuning RTTY. Sweep the VFO until the right- and left-hand LEDs flash in time with the chirp-chirp rhythm; that's all it takes.

As with RTTY, the DSP-232 appeared to make a huge difference in dealing with interference and poor signal-to-noise ratios. Once an AMTOR link was established, I rarely lost it. During one conversation I was astonished to see that the data kept flowing despite the fact that I could not hear the "acks" from the other station. Apparently the DSP-232 heard them just fine!

It's worth noting that the DSP-232 *maildrop* system allows users to share messages on AMTOR, PACTOR or packet. Some controllers offer a maildrop for packet *only.*

PACTOR

The DSP-232's PACTOR performance was outstanding. It handled crowded conditions remarkably well, allowing decent throughput even when other signals were right on top of mine.

I tried an interesting test one evening on 80 meters. I established a link with a station about 300 miles away, and he began sending a long text file. When the transfer was under way, he began gradually reducing his output power. He made it down to 5 W PEP before the throughput finally stalled. Between the superior filtering of the DSP-232 and PACTOR's *memory ARQ*, we were able to exchange data despite high noise levels and occasional fading.

As I was setting up for PACTOR operation, I noticed that the default setting for Huffman data compression is *off* in the DSP-232. The front-panel LCD display lets you know when Huffman compression is active. If you intend to send text data most of the time, activate the Huffman parameter and leave it. The only time you need to turn it off is during binary file transfers.

Packet

You probably won't notice the performance benefits of the DSP-232 when you're operating packet. With most packet connections, you're dealing with fairly good signals and the low noise levels of FM. The exceptions are meteor-scatter packet and—if you're a glutton for punishment—HF packet. I didn't have an opportunity to try the DSP-232 in either of these modes.

With standard VHF/UHF packet, it often boils down to a war of bells and whistles. The DSP-232 excels in this department, offering enough goodies to keep you busy for weeks. I've already mentioned the versatile maildrop, but I neglected to say that it offers plenty of message space. The unit comes standard with 18 Kbytes of mailbox space, expandable to 242 Kbytes. The maildrop system also includes automatic forward and reverse message-forwarding functions. In other words, the DSP-232 will exchange traffic with your local BBS even when you're not at home.

The KISS mode is available for those who want to run TCP/IP packet or PACSAT software. True, the DSP-232 isn't a satellite box in its present incarnation *per se*, but it does offer 9600-baud packet. There is no reason you couldn't use the DSP-232 to work the 9600-baud packet satellites: OSCARs 22, 23 and 25.

As far as terrestrial 9600-baud packet is concerned, the DSP-232 is a winner. Its communication performance with my local packet BBS was very impressive. (Enhanced, no doubt, by the DSP-232's *true* data carrier detector (DCD) circuitry which allows "open squelch" operation.) As I mentioned earlier, having a separate adjustment for the 9600-baud transmit audio level is ideal. I adjusted the pot until I produced about 3 kHz deviation in my transceiver, then left it alone. The transmit audio levels for HF and 1200-baud packet are completely separate. Nice touch!

The engineers at AEA obviously had the *Automatic Packet Reporting System* (*APRS*) in mind when they designed the DSP-232. As a result, it includes Global Positioning System (GPS) firmware and a number of GPS-specific commands. (An entire chapter of the manual is devoted to *APRS* and related functions.) With an adapter cable available from AEA, the DSP-232 interconnects easily with most GPS receivers. Of course, you don't need a GPS receiver to enjoy *APRS*. With the *APRS* software and the DSP-232 you can generate maps and watch all the activity in your area. Still, it's nice to know that you *can* interface a GPS receiver to the DSP-232 when you want to take it on the road.

CW

The DSP-232 manual begins its Morse chapter by putting performance into perspective:

"A strong signal and a good fist are *both* required for the DSP to do a reasonable job of copying code. Don't expect your DSP to perform miracles and produce good copy from incredibly weak signals and bad fists!"

So true! I've yet to meet a multimode controller that could match a human for code-copying ability. Someday, yes; but not now. Having said that, I must confess that the DSP-232 still does an outstanding job of copying CW. The unit balked at bad fists more often than because of poor signals. Poor sending drove the DSP-232's Morse-deciphering algorithm up the wall, making it next to useless. But if the code was well sent, the DSP-232 could copy it well. I eavesdropped on one fellow who was pounding away at 30 wpm or more. His signal quality was almost as good as his fist. The result on my monitor looked like RTTY as the letters marched across the screen.

Of course, you can send CW with the DSP-232 as well, but I have an aversion to sending CW from a keyboard. If you're going to do that, why bother with CW at all?

SIAM

The Signal Identification and Acquisition Mode (SIAM) has been a staple of AEA multimode data controllers since the introduction of the PK-232. SIAM allows you to identify and copy ASCII, Baudot, AMTOR and SITOR. Basically, you tune in the signal in the SIAM mode, wait for identification and then press a key to begin copying.

The only problem with SIAM in the DSP-232 is that protocol technology has outpaced its decoding ability. SIAM would be terrific as a means to untangle all the new HF digital modes on the air these days. Most hams would probably be happy with a SIAM function that simply said, "This is a CLOVER signal, this is a G-TOR signal...." The current SIAM actually functions best outside the amateur bands where you can use it to identify commercial stations—at least those using asynchronous signals.

Conclusion

Flexibility is the hallmark of any DSP multimode data controller, and the DSP-232 is no exception. If you're willing to dabble beyond the basic operating parameters, for example, you can use the innovative "TWIST" commands to optimize the frequency response of your transmit and receive audio. Or you can enter the host mode and make use of the DSP modem features for your own experimental applications. Or you can invest in the proper software and operate the DSP-232 in the so-called "analog" mode and decode HF WEFAX, among other modes.

With two radio ports, you can make the DSP-232 the heart of a complete digital station. Simply connect one port to your HF rig and the other to your VHF or UHF transceiver (for packet). It won't occupy much space on your operating desk.

Best of all, perhaps, is the fact that you'll enjoy superior DSP features and performance without straining your bank account. And as new modes occupy the spotlight (and the bands), your DSP-232 will support them as long as AEA continues to provide the upgrades. Who says advanced technology is becoming more expensive?

Manufacturer: Advanced Electronic Applications, PO Box C2160, Lynnwood, WA 98036; tel 206-774-5554. Manufacturer's suggested retail price: $495.

JPS NIR-12 Noise and Interference Reducer

Reviewed by Emil Pocock, W3EP
ARRL Technical Advisor

During the past half-dozen years, digital signal processing (DSP) has become all the rage for top-of-the-line amateur equipment. DSP offers significant improvement in receiver noise reduction, nonringing narrow-frequency selectivity, and superb notch filtering. Several manufacturers have integrated DSP as a standard feature on their latest HF transceivers.

Fortunately, you do not need to spend thousands of dollars for a new rig in order to enjoy the advantages of DSP. Accessory DSP audio filters have been on the market for several years now, and their features have been improving rapidly. One of the newest models is the JPS NIR-12 dual digital signal-processing noise- and interference-reduction unit, a worthy successor to the NIR-10 (see "Product Review," *QST*, Oct 1991). Among features new to the NIR-12 are easier-to-use controls, continuously variable filter bandwidth and center frequencies, improved dynamic noise filter, and much faster processing time.

Bottom Line

The NIR-12 offers four DSP filter modes in one box that effectively enhance selectivity and help reduce the impact of noise and interference.

Table 2

JPS NIR-12 Noise and Interference Reducer, serial number 010990

Manufacturer's Claimed Specifications	***Measured in the ARRL Lab***
Power requirements: 11-16 V, 600 mA (avg); 1 A (max).	As specified. Tested at 13.8 V.
Size (HWD): 1.8×7.8×7.2 inches; weight: 3.8 lb.	
Frequency response: 200-3400 Hz, ±2 dB.	Range at –6-dB points, (bandwidth): Full audio bandwidth (BW max): 242-3415 Hz (3173 Hz). Nominal CW settings: 550-1195 Hz (645 Hz). Narrowest CW settings: 891-958 Hz (67 Hz). Nominal data settings: 2000-2853 Hz (853 Hz). Nominal SSTV settings: 1198-3145 Hz (1947 Hz). Voice: FREQ at min, BW at 12 o'clock: 241-2048 Hz (1807 Hz); FREQ at 10 o'clock, BW at nominal voice (V) setting: 241-2545 Hz (2304 Hz).
White noise reduction (NIR mode): ≈20 dB (at max setting).	As specified.
White noise reduction (Dynamic Peak mode): 6-20 dB (typical).	As specified.
Notch rejection (1 to 4 tones): >50 dB (typical).	As specified.
Ultimate out-of-band attenuation: >60 dB.	As specified.
Filter shape factor (–60 dB/–6 dB): 1.18:1 (typical at voice frequencies).	As specified. 1.20:1 (max) in CW.
Output delay: 130 ms (NIR mode), <19 ms (all other modes)	≈175 ms (NIR mode); ≈18 ms (all other modes).
In-band ripple: Not specified.	±0.5 dB or less.
Speaker jack output power: 2 W at 10% THD into 8 Ω.	2.3 W at 10% THD into 8 Ω.
Line output (J3): –18 dBm (nominal) into 600 Ω.	–17 dBm into 600 Ω.
Headphone jack output power: Not specified.	11.3 mW at 0.5% THD into 8 Ω.

Description

The NIR-12 incorporates four separate filter functions inside one rather weighty and rugged steel box with a face somewhat less than 2×8 inches. (JPS has a reputation for making desktop accessories you wouldn't want to drop on your foot; the NIR-12 weighs almost 4 lb!) At the heart of the unit are two 40-MHz TMS320C26 DSP chips. The NIR-12's noise interference reduction (NIR) mode and the dynamic peak filter modes are designed to significantly reduce receiver background noise and help to combat troublesome interference, including static crashes, power-line hash and noise generated by other electronic devices. The band-pass filter provides nonringing selectivity down to a very narrow bandwidth, with a variable center frequency. At the same time, the notch filter can eliminate multiple continuous tones (such as heterodynes) automatically. Best of all, you can use all four filter modes simultaneously or in any combination for CW, voice, data, and slow-scan television.

The NIR-12 installs easily between the receiver headphone or auxiliary audio output jack and low-impedance headphones or speaker. An internal audio amplifier provides more than enough output for headphones or a small speaker. An external 12-V supply capable of delivering 1 A is required, but JPS offers a suitable power cube as an accessory.

The front panel has silk-screened labels, and the knobs and switches are conveniently laid out. These include the **POWER** switch, variable controls for center frequency (**FREQ**) and bandwidth (**BW**), push-button switches for the **NOTCH** filter and the **DYN**amic **PEAK** filter, and variable controls for **NIR** mode and **VOL**ume. Green LEDs beneath the **DYN PEAK** and **NIR** buttons indicate when those functions are engaged. The back panel has a **HEADPHONES** output phone jack plus phono jacks for **SPEAKER OUT**, **LINE OUT** (600 Ω), **AUDIO INPUT** and **BYPASS CONTROL** (grounding the bypass line takes the NIR-12 out of line while transmitting, so you can hear your CW sidetone unembellished by filtering or time delay). The power-input connection is via a coaxial jack. There's also a ground lug. A three-position **PEAK FACTOR** slide switch selects the aggressiveness of the filter's peaking algorithm (more on that later).

Passband Performance

As with any new device, it takes some practice before you feel comfortable with its features—and the NIR-12 has quite a few. The bandwidth (**BW**) and center frequency (**FREQ**) knobs adjust the bandpass filter. ARRL Lab testing (see Table 2) confirmed that you can adjust the bandwidth from 3173 Hz down to 67 Hz (at the –6 dB points). The typical shape factor, 1.18:1 (at the –60 dB/–6 dB points), means that there are very steep skirts and excellent selectivity. It is quite marvelous to narrow the selectivity and hear one CW signal after another completely drop out of the bandpass until only one station—the one you want to hear—remains. There is also no trace of ringing even in the narrowest settings. It is hard to imagine room for improvement in audio selectivity.

For CW, the ability to widely adjust the center frequency provides significant flexibility over filters that offer one set pitch (generally 600 to 800 Hz). With some practice, you can also use the center frequency adjustment to bring in a station just outside a narrow passband setting. A convenient CW listening strategy is to tune the band with a fairly wide passband, say 1000 Hz, until a desired station is found. If there is a lot of competition, slowly narrow the bandwidth until interfering stations drop out. This sometimes requires retuning slightly or adjusting the center frequency.

On SSB, the continuously variable bandpass was smooth and very convenient. On crowded or noisy bands, leaving the bandpass at around 1800 Hz or so (**BW** control at approximately 12 o'clock position on our unit) provided adequate selectivity for tuning around. Once you find a station, you can narrow it up a bit further before speech starts to become unintelligible. On AM broadcast stations, the filtering arrangement also worked nicely, but you had to widen the bandpass to capture the typically greater fidelity of such transmissions.

At least in terms of audio response, you are not likely to notice much difference between the intermediate frequency (IF) filters on your transceiver and comparable filter bandwidths on the NIR-12. Keep in mind, however, that your transceiver's IF filters are inside the AGC loop and any outboard DSP box is outside. Nevertheless, the NIR-12 does have the advantage of greater flexibility over IF filters that make big jumps in selectivity, typically 6.0, 2.4, 1.8, and 0.5 kHz. In addition, the narrowest settings on the NIR-12 are probably as sharp as those found on the best transceivers on the market, and there is no ringing. These may present a distinct advantage for ardent CW enthusiasts and for weak-signal VHF operators.

Notch Filter

The notch filter for voice mode is the easiest to use because you just push a button to activate it or to turn it off. The notch filter automatically removes one or more single tones, such as a stations tuning up or heterodynes, but also some types of multiple tone interference caused by nearby electronic devices. This feature worked well on SSB or AM, taking just a fraction of a second to eliminate an offending signal. If there were an SSB signal beneath the tone, it would then pop into the clear.

Dynamic Peaking and Noise Interference Reduction

These two filter modes are perhaps the most impressive features of the NIR-12. Both work (in different ways) to eliminate any signals in the receiver passband that do not fit the profiles of a CW signal or human speech—noise or interference, in other words. Dynamic peaking mode accomplishes this by forming a dynamic bandpass around the desired SSB or CW signal. In effect, the bandwidth is automatically adjusted to the minimum necessary to pass the desired signal. This happens so quickly that you don't even notice it while tuning across the band. The NIR mode recognizes speech, CW or data signals and reduces the amplitude of anything that doesn't fit those patterns.

Dynamic Peaking mode is activated by pressing the **DYN PEAK** button. The only adjustment is a three-position switch on the back panel that provides for 6, 12, or 20 dB of dynamic noise reduction. The 6-dB position provided a significant decrease in noise, leaving only a trace of processor distortion on SSB. In the 12-dB position, noise was more aggressively removed, but the resulting erosion of audio quality and signs of processing were annoying. CW signal quality suffered less from dynamic peaking, perhaps because a single tone is narrower and easier to identify. The 20-dB position was overkill for most situations. For nearly all operating situations, I simply left the dynamic peaking filter on the 6-dB position. On an already-quiet band, it eliminated nearly all traces of receiver "white noise." In some especially noisy situations, it helped reduce power-line hash and other sorts of continuous background interference. Desired signals stood out in the clear, as if by magic.

The Noise Interference Reduction (NIR) mode filter is activated by adjusting the **NIR** knob from minimum to maximum. In the full-clockwise position, NIR level adjusts automatically. In SSB, NIR mode removes noise by canceling all nonspeech frequencies. The filter also can pass CW and data signals, but at the highest settings, slow-speed CW can be eliminated as "noise." It took some practice to adjust the NIR mode filter to an optimal setting. In the 8 or 9-o'clock position, you barely notice its effects. Turning the knob further clockwise increases noise reduction but also introduces a characteristic processing sound. As the manual points out, unremoved residual noise tends to surge at short intervals, sometimes clipping speech syllables or CW characters. More noise is removed with a higher setting, but so are some weaker signals. The trick is to find the setting that reduces the greatest amount of noise with the least objectionable deterioration of the desired signal. This varies considerably with signal strength and noise level, but for most situations, I found the 10 o'clock position was a good compromise.

Judicious use of *both* filter modes usually made it possible to copy SSB and CW signals competing with the noise. After filtering, stations often seemed to jump into the clear. The effect was more noticeable with strong stations, but noise surrounding even weak signals often could be reduced enough for clear copy. The manual makes it clear that the NIR-12 cannot enhance the clarity of signals that are *below* the noise level, but sometimes the effect made it seem as though it did!

All Together Now

The NIR-12 really shows off its stuff when all of its filter modes are used together. A convenient table in the *Instruction Manual* lists suggested control settings for various modes and band conditions. For general tuning around on SSB, for example, a combination of an 1800-Hz passband (approximately 12 o'clock **BW** setting on our unit), dynamic peak filter on (in the 6-dB position), and the NIR mode around the 9-o'clock position made a significant improvement in noise reduction and listening ease. It was easier to make further adjustments after a particular station was found. Then, you could narrow the bandwidth a bit and nudge up the NIR mode, if necessary.

The general procedure on CW was similar, except that you can tune around with a narrower bandpass. Sometimes it was a toss-up whether to use the receiver's 500-Hz IF filters on CW or the NIR-12's passband filter. Often, I found it a lot easier to adjust the audio passband on the NIR-12 to fit the circumstances. In any case, many receivers do not have the additional filtering features that make the NIR-12 a knockout.

Other Uses

The NIR-12 also can be used with RTTY, AMTOR, packet, and SSTV; we did not test the unit in those modes, however. Additionally, you can use the NIR-12 to process your transmit audio, which can be especially helpful in high-noise environments to eliminate background noise (while mobile, for example). JPS also offers its RS-232 Interface Option with software that allows developers to design their own DSP filters. This package allows you to upload experimental software directly to the NIR-12 without having to program EPROMs.

Conclusion

The NIR-12 offers an impressive array of noise and passband audio filters in one convenient unit, and the 53-page *Instruction Manual* is clear, concise, and helpful. For receivers lacking sufficient selectivity, the NIR-12 can significantly improve performance. Even on a receiver with good 500-Hz IF filters, the NIR-12 can provide additional selectivity and welcome flexibility. The digital noise-reduction filters will improve any receiver that does not have such features built in. In addition, the notch filter is hard to beat. For getting rid of line noise, computer hash, and other troublesome interference, the NIR-12—despite its generally excellent performance—is not as effective as the JPS ANC-4 antenna noise canceller (see "Product Review," *QST*, Feb 1996).

Manufacturer: JPS Communications, PO Box 97757, Raleigh, NC 27624; tel 919-790-1048; fax 919-790-1456; e-mail **jps@nando.net**. Manufacturer's suggested retail price, $349.95.