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ETO Alpha 89 Linear Power Amplifier

Radio Shack DSP Communication Noise Reduction System

Willco Electronics ICM-1024 Memory Replacement Board

Conducted by Mark Wilson, AA2Z
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ETO Alpha 89 Linear Power Amplifier

Reviewed by David Sumner, K1ZZ

The typical ham station contains a *lot* of metal boxes. Some are big, others small; some must be hooked to one another, some stand alone; some must be placed within easy reach of the operator while others, requiring little attention during normal operation, can be tucked away in any available nook or cranny.

Relative to most, the Alpha 89 linear amplifier is a pretty big box: 7 inches high (not counting the feet), 17.3 inches wide, and 16.5 inches deep, weighing 75 pounds. That makes it the same size as the Alpha 87A, reviewed in June 1992 *QST*, and slightly larger than its predecessor in the ETO lineup, the Alpha 86, reviewed in April 1989. It's black, just like the 87A and unlike the two-tone grey of the 86, but in panel layout and functionality it bears more resemblance to the latter.

When you buy an Alpha 89 from ETO you get a conservatively rated, manually tuned, full-legal-limit MF/HF linear amplifier with "smart" circuitry to protect both itself and your antenna system from operator error (feed a "dumb" full-power amp into the wrong antenna and you can do some real damage to both, and to your feed line). The Alpha 89 is intended to be used with a typical transceiver and requires about 50 watts of drive and up to 20 amps of 240-volt ac to deliver 1500 watts of RF output power. Since changing bands or modes requires some fiddling with the controls, unlike the more expensive Alpha 87A, most hams will want their 89 within an arm's length of their chair.

Otherwise, the Alpha 89 is an unobtrusive cohabitator of the ham shack. Like A. Conan Doyle's dog that didn't bark, the first clue to the Alpha's presence is the sound it doesn't make. If your psychic satisfaction comes from blower noise like a Boeing 757 taking off or from feeling the aftershocks of a mammoth TR relay, Dick Ehrhorn, W4ETO (he had the call sign before he named the company) isn't likely to separate you from the contents of your wallet.

If you close your eyes to the pretty front-panel LEDs you literally cannot tell whether or not the amplifier is in the circuit when you hit the key; there's no relay noise (TR switching is all electronic) and no mechanical hum from the power transformer despite its being called upon to deliver about 2500 watts to the pair of 3CX800A7 tubes.

Yes, there's a blower; any amplifier generates a good deal of heat and the heat has to go somewhere—you sure don't want it staying inside the amp! In the Alpha 89 the air intake is on the rear panel, behind the power supply section; air is drawn through the power supply and through the tubes, then out the top. In my shack it was a toss-up as to which was more noticeable, the fan in the computer or the blower in the Alpha.

When your Alpha arrives from the ETO factory in Colorado Springs it will be in two boxes, one containing the amplifier and the other the power transformer. The first order of business after unpacking the cartons is to find the instruction manual, and the instructions on how to install the transformer. The instructions are very clear and complete. The FCC doesn't permit the sale of amplifiers capable of operating between 24 and 35 MHz, so as it's shipped the Alpha doesn't work above 20 MHz. Send ETO a photocopy of your license and they'll give you the key to the mystery of how to put it on 15, 12, and 10 meters. Since you have the cover off anyway, which is the bulk of the work in performing the modification, it would be a good time to get this annoyance out of the way.

Now you're ready to admire your new "shoes."

The Bottom Line

The Alpha 89 is a smooth and solid legal-limit amplifier. Its sophisticated control circuitry protects the amplifier (and your antennas and feed lines) from operator error.

The first thing you are likely to notice is the extensive metering. Three dedicated LED bargraphs provide constant indications of peak RF output (even when the amplifier is in standby and you're running barefoot), reflected power, and grid current. A fourth "multimeter" bargraph does quintuple duty to indicate high voltage, plate current, drive (in watts) from the exciter, SWR, and a **TUNE** function that allows you to tune up properly with reduced drive power (about 10 W). Selection of the multimeter functions is done by pressing one or two buttons, which have their own LEDs to indicate which of the five functions is active. The multimeter default is high voltage and it has no memory; every time you turn the amplifier on, the multimeter resets to the default.

The LEDs are very graphic, and are color-coded like stop lights. On the RF output bar graph, up to the US legal limit of 1500 watts is green; stray above the limit and you'll see red. Similarly, the safe operating range for grid current is in green, with one yellow segment above 85 mA and red above 100 mA. As your reflected power exceeds 50 W (about 1.5:1 SWR at the legal limit) you'll light yellow, then red LEDs.

The Alpha 89 uses only 190-250 V, 50-60 Hz AC, with three internally selected taps for 200, 220, or 240 V. There is no provision for operating it from a lower voltage. Once you have the Alpha plugged in to an appropriate power source and once your transceiver and antenna are hooked to it, you're ready to hit the **ON** button. The blower, illumination for the **TUNE** and **LOAD** controls,

Table 1

ETO Alpha 89 MF/HF Linear Amplifier, Serial No. 9403017

Manufacturer's Claimed Specifications	*Measured in ARRL Lab*
Frequency coverage: All amateur bands 1.8 to 29.7 MHz plus most nonamateur frequencies 6.0-19.0 and 20-30 MHz.*	Operation on amateur bands as specified; not tested elsewhere.
Power output: 1.5 kW PEP, keyed CW or continuous carrier, no time limit.†	As specified. Tested at 1.5 kW continuous output for 10 minutes.
Driving power required: Typically 50-60 W for 1.5 kW output.	As specified.
Input SWR: Less than 1.5:1 within amateur bands.	As specified.
Spurious signal and harmonic suppression: Better than 55 dB below rated output.	–55 dB typical; –52 dB worst case.
Intermodulation distortion: Better than 36 dB below rated output.	See Figure 1.

Primary power requirements: 190-250 V ac, fused at 20 A.

Size (height, width, depth): 7×17.3×16.5 inches; weight, 75 pounds.

*The FCC-specified maximum legal output on the 30-meter band for US amateurs is 200 W PEP. As shipped from the factory, operation on 15, 12 and 10 meters is disabled; enabling operation on these bands requires information furnished by ETO upon presentation of a valid amateur license (see text).

†Optional auxiliary cooling fan recommended for extended high-duty-cycle operation

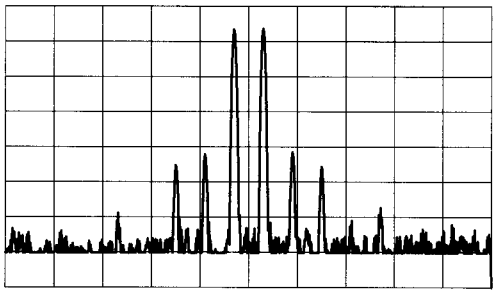


Figure 1—Worst-case spectral display of the ETO Alpha 89 during two-tone intermodulation distortion (IMD) testing. Worst-case third-order product is approximately 42 dB below PEP output, and the fifth-order product is approximately 45 dB down. Vertical divisions are 10 dB; horizontal divisions are 2 kHz. The amplifier was being operated at 1.5 kW PEP output at 14 MHz.

and a few LEDs (including a yellow "standby" [**STBY**] and a red **WAIT** indicator) will immediately light. After about three minutes (in the review unit it took 3:15) the **WAIT** indicator will go dark, as will the **STBY** indicator unless the rocker switch that puts the amplifier in and out of the circuit is in **STBY** position. The delay is to protect the amplifier tubes, which require warm-up for safe operation. When the yellow **STBY** LED is on, the transceiver feeds the antenna directly.

The protective circuitry is even more impressive than the metering. If you do something wrong, the amplifier will put itself into **STBY** mode and a red **FAULT** LED will light. In addition, for example, if you try to feed the wrong antenna (one that exhibits a high SWR), the red LED at the high end of the **REFLECTED POWER** scale will blink accusingly at you. If you forget to retune the Alpha 89 when you change bands, when you try to transmit the three green multimeter indicator LEDs will blink at you. (They don't blink "DUMMY!" in Morse code; that's a refinement to be considered for the 89A.) If you draw too much grid current, either by overdriving or by mistuning, the red LED at the end of the **GRID CURRENT** scale *and* the three multimeter indicator LEDs will take turns pointing the finger. If you draw too much plate current (more than 1.5 A) the multimeter indicator for plate current will blink. If the amplifier is badly out of tune even at low drive levels, the **TUNE** LED will tell you that's the reason the Alpha 89 took itself off line. While the protective circuitry is no substitute for a careful operator, it's an impressive feature that provides some measure of assurance that you won't waste hundreds of dollars worth of tubes, or cook your feed line or antenna, if you make an honest mistake or you develop an antenna problem.

Being a manually tuned amplifier, the Alpha 89 has familiarly labelled **TUNE** and **LOAD** knobs and a nine-position mechanical band switch to cover all amateur and most nonamateur frequencies between 1.8 and 30 MHz. The **TUNE** and **LOAD** controls are calibrated from 0 to 100 and are geared so that it takes 3¼ turns of each knob to cover their full range. The instruction manual gives starting points for tuning up on each band, and it's necessary to use them because the protective circuitry won't let you start too far off the mark. Once you've followed the instructions and have figured out what the exact settings should be for your own antennas and operating frequencies, it's easy to make up a reference chart so you can dial back to those settings without ever putting another dead carrier on the air. For rapid band-changing this system isn't as good as being able to mark the band settings on a card stuck behind a pointer on the front panel, but it's a bit more elegant and for most operating it's more than adequate. (If you want to change bands *that* quickly, you *really* want an Alpha 87A, don't you?)

There's one more rocker switch on the front panel, labelled **SSB/CW**. In days of yore, before the blanket 1500-W-output power limit, such a switch changed the plate voltage to permit reasonable efficiency at both 1 kW input for CW, and 2 kW input for SSB. On the Alpha 89 the switch simply changes the cathode bias on the 3CX800A7 tubes (which operate in parallel, grounded-grid) to improve linearity on SSB. The tradeoff is a slight loss of efficiency, so ETO gives you the choice. It's OK to leave the switch in the SSB position for all modes.

In operation, the adjectives that come to mind to describe the Alpha 89 are "smooth" and "solid." It generates 1500 watts seemingly effortlessly on all bands, although if your SWR is 2:1 or greater you'll have to back off to avoid tripping the protection circuit. The internal peak-reading wattmeter on the review unit was very accurate, although reflected power read slightly high on the higher bands (15, 12, and 10 meters). During the review period the amplifier survived one serious contest, a couple of semi-serious ones, and hours of casual operating without a hint of trouble. Even deliberate attempts to mistreat it failed; the Alpha just took itself off line and winked mockingly with its LEDs. If you do encounter problems there's a four-year ETO warranty (except on the tubes, which are warranted separately by their manufacturer) and direct telephone and fax lines to the factory to fall back on.

If you want an "ultimate amplifier" but your requirements don't demand the sophisticated band-changing of an Alpha 87A, you'll want to give the Alpha 89 a serious look.

Manufacturer's suggested retail price: $3495. Manufacturer: Ehrhorn Technological Operations, Inc., 4975 North 30th St, Colorado Springs, CO 80919, tel 719-260-1191, fax 719-260-0395.

Radio Shack DSP Communication Noise Reduction System

Reviewed by Jim Kearman, KR1S

Phew! The time lag between the development of new technology and its appearance in consumer equipment seems to be getting shorter and shorter. Okay, I admit I was surprised to learn that Radio Shack was carrying a DSP audio filter. You won't find it in their 1994 catalog; it came out in early 1994.

Unusual Packaging

What makes this DSP filter different from others on the market is its packaging. The box includes a power amplifier and speaker. Surprisingly enough, the unit also includes mounting brackets for installation in a vehicle. You can use the filter as an amplified speaker with your ham rig or scanner. Unfortunately, the speaker is mounted on the top of the case, which may cause it to radiate into the dashboard in some mobile installations. That doesn't matter to me. Mounting anything under the dash is just asking someone to break into the vehicle and steal it, so I don't.

As you might expect from the emphasis on mobile use, the Radio Shack filter operates from a nominal 12-V dc supply. Current consumption is specified at 1 A maximum. I used a plug-in power supply rated at 1 A and had no problems with the supply overheating.

You can use the internal speaker, or connect an external 8-Ω speaker or headphones. In conditions where an audio filter is required for good reception, I prefer to use headphones. I was sorry to see the designers of this filter specified a monaraul headphone jack. Radio Shack alone sells at least ten different models of stereo headphones, but only one serious mono headphone. That ought to tell something to the people who decide what kind of headphone jack to include. All the scanner receivers I've seen (including those sold by Radio Shack) also have mono headphone jacks, but it's time for change. Meanwhile, buy stock in the companies that make mono-to-stereo adaptors.

A Digital Bandpass Filter

The filter has three modes. Each mode has three selectivity positions. Table 2 lists the specified bandwidths for each mode and selectivity setting. The NR (noise reduction) mode rolls off high-frequency response much like the SSB (perhaps more properly called "VOICE") mode, but the low-frequency response in NR mode extends down an additional 100 Hz. Reducing the high-frequency response is an effective means of dealing with random noise; at the same time, high-frequency components of speech are necessary to understand what's being said. Extending the low-frequency response at the same time gives "body" to voices, and partially compensates for the loss of the high frequencies.

The narrowest NR mode setting makes voice reception nearly impossible; the narrowest setting in SSB mode is actually a little better, I think. In narrow NR mode the lows are so unbalanced with respect to the highs that voices sound very unnatural. Listening to them is rather uncomfortable. The wide and medium settings are much more useful, and I use them most of all. I really didn't notice any reduction in noise, other than that obtained by limiting the audio passband, although Radio Shack specified 20 dB of noise reduction. This observation was confirmed by tests performed in the ARRL Lab. Experiences of other users of this filter, which were posted on the Internet newsgroups, bears out the lack of true noise-reduction algorithms in this filter. The 21-543 achieves

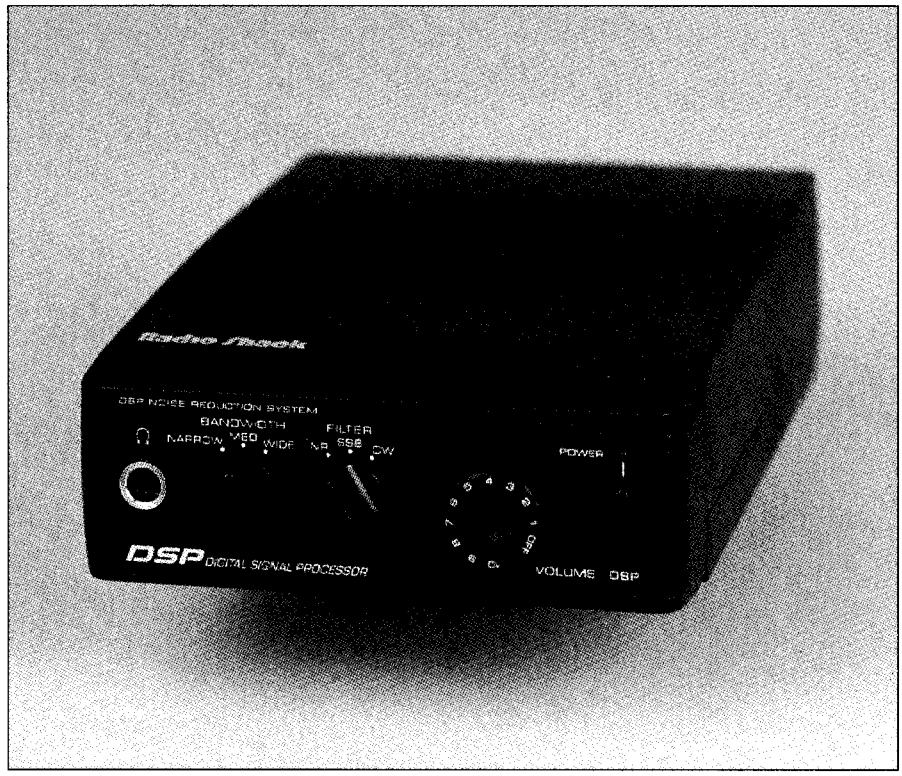


Table 2

Radio Shack 21-543 DSP filter, Serial No. 108893

Manufacturer's Claimed Specifications	*Measured in ARRL Lab*
Frequency response: (–6 dB) by mode	
DSP OUT: 300-3000 Hz	9 Hz-16.7 kHz
CW wide: 269-1231 Hz	255-1258 Hz
CW med: 469-1031 Hz	462-1055 Hz
CW narrow: 597-903 Hz	580-925 Hz
SSB wide: 300-3000 Hz	300-3110 Hz
SSB med: 500-2600 Hz	400-2770 Hz
SSB narrow: 800-2000 Hz	650-2170 Hz
NR wide: 200-2950 Hz	200-3100 Hz
NR med: 200-2500 Hz	200-2660 Hz
NR narrow: 200-2000 Hz	200-2160 Hz
Total harmonic distortion: 1% (typical).	0.36% (typical)
Signal-to-noise ratio: 55 dB (typical).	55 dB
Audio input level: 3 V peak-peak (max).	Not measured.
Power requirements: 11-15 V dc, 1 A (max).	12 V at 1 A (full audio output) and 110 mA no input signal, min. volume.
External speaker output: 8 Ω.	As specified.
Audio output power (external speaker): 6 W, 10% THD.	As specified.
Heterodyne rejection (SSB/NR mode): 40 dB (max).	45 dB
Noise Reduction (NR mode): 20 dB (typical).	See text.
Input-to-output delay: Not specified.	8 ms (CW wide mode).
Time to notch: Not specified.	5.5 ms (SSB wide mode).

Size (height, width, depth): 1.7×4.4×6.6 inches; weight, 1.1 lb.

noise reduction in all modes by limiting bandwidth. It does not make use of noise-reduction algorithms to reduce noise. The noise-reduction specification is really a specification for stop-band attenuation. The Radio Shack engineering department told us that they are going to change the specification sheet to be more clear.

One slick feature of a DSP filter is its ability to eliminate continuous tones. While I'd have expected the increasing number of no-tune HF rigs to eliminate the need for tuning up on the air, the opposite seems to be the case. Fear not! Just leave this filter in SSB or NR mode and you'll never hear another whining carrier. I found this feature useful in other ways. I sometimes use a portable receiver for shortwave-broadcast listening (SWLing). Its AM selectivity leaves something to be desired, but the Radio Shack DSP filter makes the heterodynes go away. I also use the filter when I'm scanning the local police. Now I no longer hear the CW identifier on the police department repeater, which is set to a particularly piercing frequency.

Other than limit bandwidth, I guess there isn't much the DSP filter designers can do for us CW fans right now. I would have been happier if this filter at least came with a tunable center frequency for CW reception, but I guess the marketplace for such filters is not large enough to justify the additional cost. The nominal center frequency of the CW filter is 750 Hz. I'd like to know how we ever got stuck with 750-800 Hz as the default CW sidetone frequency of our rigs. About 10 minutes of listening to CW at 750 Hz and I start thinking about taking up another hobby. If you're primarily looking for a CW bandpass filter and you prefer to listen at 500-600 Hz (surely, nobody listens to frequencies higher than 800 Hz!), I'm afraid this filter isn't for you. The widest CW selectivity will work, but the bandwidth is too great to be of much use.

Summary

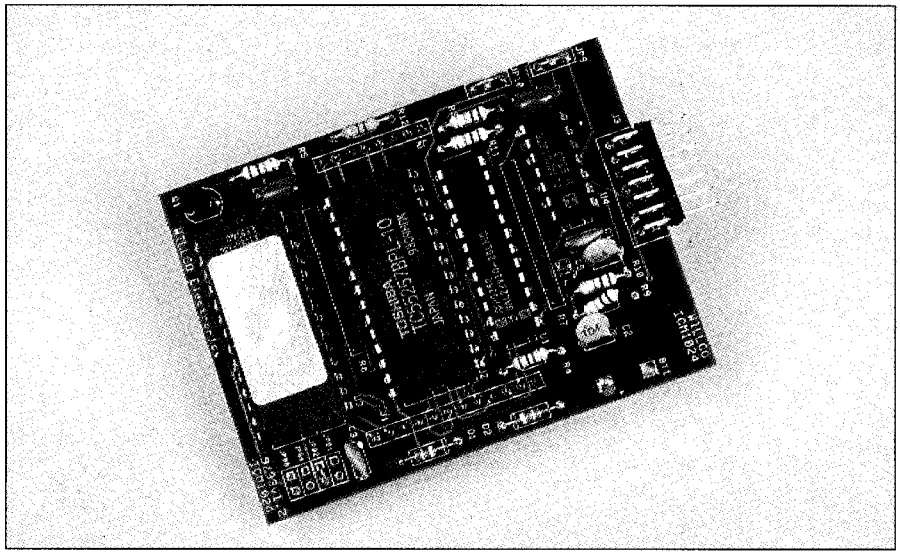
This filter couldn't be much easier to use. A supplied cable (with 1/8-inch mono plug) plugs into the speaker jack of your transceiver or receiver. Another cable connects to your 12-V dc supply. Adjust the volume level on your transceiver or receiver until you see an LED blink. Now adjust volume with the control on the filter and select the appropriate filter/selectivity combination with two rotary switches. The DSP filter supplies no signal to its internal speaker or an external speaker or headphones unless it is turned on and power is supplied. This means you can't bypass the filter without reconnecting the cables. The only time this might be a problem is when you're operating from batteries, so I don't consider it a large disadvantage.

If you mostly operate SSB or enjoy SWLing or scanning, I think you will enjoy using this filter.

The DSP Communication Noise Reduction System is available at Radio Shack stores nationwide, catalog no. 21-543. Manufacturer's suggested retail price: $80.

Willco Electronics ICM-1024 Memory Replacement Board

Reviewed by Jim Kearman, KR1S



Feeling a little like Dr. Frankenstein, I turned on my ICOM IC-751A transceiver. I had, after all, just given it a new brain. Happily, the radio sprang to life and provided even wider receive coverage than before. Anyone who owns an ICOM R71 receiver or an IC-745 or IC-751/751A transceiver should know that the clock is running out. The complex operating systems of these radios are maintained by an on-board battery. When that battery fails, the radio stops working—period! Until now, the only cure was to send the entire radio to an ICOM service center for reprogramming and a new battery. Fortunately, Jack Albert, WA9FVP, has developed a cure you can apply at home.

The Willco Electronics ICM-1024 Memory Replacement Board is an easily installed replacement for the battery-backed RAM (random-access memory) operating system provided by ICOM. The concept is so simple, I can't imagine why ICOM didn't do it this way. Instead of volatile memory, the radio's operating system is maintained on a permanent read-only memory (ROM). Battery-backed RAM maintains the user-programmable memories—the ones you'll want to personalize and sometimes change.

It was easy to install the ICM-1024 in my IC-751A. I had to remove the bottom cover from the transceiver and replace the original memory board with the ICM-1024. This step requires removing one screw and plugging in a couple of ribbon cables. Even if you're all thumbs, just follow the illustrated instructions—it's that simple. Oh, yes, I had to add a wire jumper and cut a resistor on the ICM-1024 to personalize it for the IC-751/751A.

The ICM-1024 RAM is backed up by a lithium battery when power is off. When you replace the battery sometime in the future, you'll have to initialize the ICM-1024 RAM. This procedure seems a little cumbersome but you only have to replace the battery (a Panasonic BR2330 or equivalent) about every five years. Best of all, the ICM-1024 offers up to 1024 memories, a far cry from the 32 supplied with my transceiver! Using all these memories involves wiring some unused front-panel switches to select banks of memory. Frankly, I have a hard time remembering to eat breakfast; I sure don't want to try to remember what's stored in 1024 memories! Still, I use the general-coverage receiver of the IC-751A a great deal for utility station monitoring, and it would be useful to have my favorite frequencies in memory.... The new operating system in the ICM-1024 also expands the general-coverage range of the IC-751 receiver. It now covers 10 kHz to 32 MHz; previous coverage was 100 kHz to 30 MHz.

Expanded coverage and more memories are nice to have, but the real benefit of the ICM-1024 is peace of mind. Every time I turned on my radio I wondered if the internal battery had expired, taking the radio's mind with it. We should all be able to buy peace of mind so cheaply!

Manufacturer: Willco Electronics, PO Box 788, New Lenox, IL 60451. Manufacturer's suggested retail price: $150.