

# THE SHERWOOD ENGINEERING SE-3A PLL DETECTOR

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The SE-3 is advertised as a "high fidelity phase locked AM product detector designed for use with a high quality communications receiver for vastly improved AM reception." It sells for \$399 and may be ordered from Sherwood Engineering, Inc., 1268 South Ogden St., Denver, CO 80210. The quality of materials and construction is superb. The price includes four features, now standard, which were previously offered as options when the unit sold for \$299: an audio notch filter factory set for 5 kHz (or set at 9 or 10 kHz for an additional \$15); a synchro-phase detector for conventional operation and band scanning; a 3-position high frequency roll-off tone control; and a 3-position high frequency boost at 5 kHz. When ordering the SE-3 one specifies the receiver with which it is to be used, the receiver's final IF, and the 6 db bandwidths of the IF filters. SE-3's are manufactured only for IFs of 50, 100, and 455 kHz.

The SE-3's input requirement from a receiver is an IF signal level between 30 mV and 2V RMS. Its power requirement is 20-24 V AC at .75 A fed through a Jones connector on the back panel. A wall transformer (120 V primary, 24 V secondary), power cable, and mating Jones socket may be had from Sherwood for \$15.

The SE-3 provides up to 5 W audio (30 Hz to 15kHz at -3db) through a rear panel RCA jack to drive a low impedance ( $\geq 2$  ohms) speaker. Robert Sherwood recommends the Radio Shack Minimus-7 speaker to take advantage of the higher fidelity afforded by synchronous detection. A buffered auxiliary audio output at 300 mV (25K ohms) is also provided through a rear panel RCA jack to drive a recorder or external amplifier. A low impedance headphone jack is provided on the front panel.

Sent with the SE-3 is an installation and instruction manual but no schematic diagram. Special instructions are included for adapting certain receivers for use with the SE-3, namely the NRD-515 and -525, and the Drake R-4C and R-7A. To summarize: with the NRD-525 and the R-7A, existing jacks on the rear panels of these receivers must be wired as IF output jacks to provide the input for the SE-3; with the NRD-515, either a lead to the AM diode detector must be clipped or a buffer-amplifier PC board manufactured by Sherwood for \$20 must be installed (\$20 more if he does it); with the R-4C, an optional interface must be ordered (\$10) with the SE-3 which replaces the synchro-phase detector in the standard model, and Sherwood's PD-4 product detector (\$35) should be installed in the R-4C.

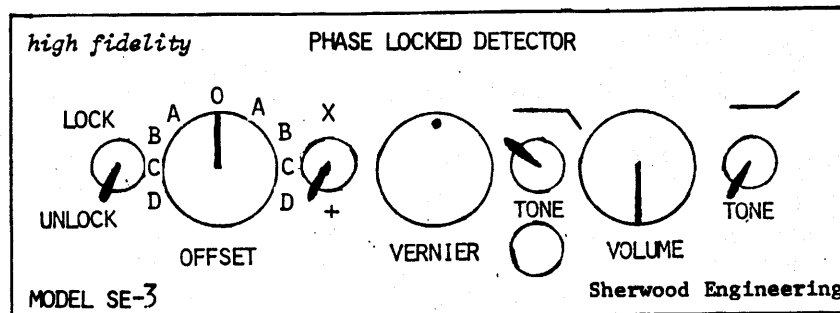
I would recommend to anyone considering the purchase of an SE-3 for any receiver other than the R-390A or one of the sets just mentioned that he or she call Robert Sherwood and ask about its compatibility with the SE-3. I found him extremely helpful by phone, though not by mail. He can be reached at 303-722-2257, 9 AM - 5 PM, Mon. - Fri.

The SE-3's narrow locking range of 30 or 40 Hz requires high frequency stability in the receiver. Therefore the drifty Drakes are best used with the SE-3 after their warm up period is complete. The same holds for the R-390A, the receiver for which the SE-3 was originally designed.

On the front panel are seven controls: the two 3-position tone control toggle switches, one for the high frequency boost (flat, 3 db, or 6 db at 5kHz) and the other for the high frequency roll off (flat, medium, or full roll off); the 2-position toggle switch used to select either the synchro-phase detector or the product detector; the 2-position toggle switch used to lock or unlock the BFO signal onto the transmitted carrier for synchronous detection of AM signals; the on/off-volume control; the offset control used to select one of nine possible BFO frequencies (one at IF center, 4 lower, 4 higher); and the vernier control used to fine tune the BFO frequency to the center of the audible zero beat region.

The 8 BFO frequencies above and below IF center are set at the factory to achieve the highest possible audio fidelity with the particular receiver's IF bandwidths. (However, these preset frequencies may be adjusted  $\pm 500$  Hz by the user via trimmers easily accessed inside the unit.) Two BFO frequencies are allotted for each bandwidth, one for LSB reception, and one for USB reception. Thus optimal LSB and USB offsets are selectable for up to four IF bandwidths. The vernier control varies the BFO frequency through a range approximately  $\pm 60$  Hz from the frequency selected by the offset control.

DRAWN APPROX. 2/3 ACTUAL SIZE



HWD = 3" x 8 1/8" x 5 3/4"

Using the SE-3 is fun for confirmed knob twisters. One begins by turning the receiver's AF gain to its minimum and the SE-3's volume up to a comfortable level. For non-synchronous reception and band scanning one selects the synchronous detector, or if one prefers the hets, one selects the product detector and the appropriate LSB or USB offset for the IF filter in use. To receive an AM signal in the phase locked synchronous mode one selects the IF bandwidth and corresponding LSB or USB offset one wants in light of QRM conditions. Then, with the SE-3's product detector on, the receiver is tuned to attain zero beat condition between the signal's carrier and the BFO. The vernier control is then tuned to the center of the zero beat range, and the "lock-unlock" toggle is switched to "lock". That's it. With the flip of that toggle on most arm chair signals, a considerable (and yes, sometimes "vast") improvement in audio fidelity is experienced.

Non-synchronous ECSS reception of AM signals with my barefoot NRD-525 or my barefoot R-390A's is a great improvement over ordinary AM diode detection. The distortions caused by selective fades to the transmitted carrier are reduced by virtue of the steady BFO signal near synchronously superimposed on the carrier. Also, twice the range of audio frequencies get through the IF bandpass than get through when center tuned to the transmitted carrier using the same IF filter. However, the fact that the BFO cannot be perfectly and continuously synchronized with the transmitted carrier means that a new distortion is introduced which destroys true reproduction of the harmonic overtones contained in the selected sideband. The synchronous product detection of AM signals, either offset or center tuned, afforded by the SE-3 decisively eliminates this latter type of distortion. To my and my wife's ears, eliminating this distortion makes a considerable difference in program listening. She, who had never listened to more than a few minutes of SWBC programming at a time, was aurally captivated for an hour by a concert over the BBC via my R-390A/SE-3 combo.

The hard core DXer considering the prospect of acquiring an accessory for synchronous product detection of AM, whether it be the SE-3 or some other unit, will want to know: will it enable me to make out an ID I might not otherwise get? It is my opinion that the SE-3 used with the R-390A gives me a slight edge over the barefoot R-390A tuned in the non-synchronous ECSS mode on some signals due to the enhanced fidelity. However, it is not in squeezing out weak signal IDs that the SE-3 justifies its cost, but in general SWBC program listening.

I have only two suggestions for improvement of the SE-3. 1) If Mr. Sherwood could be persuaded to make the notch filter in the SE-3 tuneable, it would be a smashing addition. 2) For the DXer interested in having a maximum degree of control over each receiver function, a continuously variable BFO would be preferable to the step tuned one: it would allow the DXer to tailor his ECSS reception more finely for each situation for maximum QRM rejection. While the offsets provided by Sherwood, which place the transmitted carrier at one or the other edge of each filter's 6 db bandpass, do insure the highest possible audio fidelity attainable with the receiver's IF filters, DXers are willing to sacrifice fidelity to fight QRM in tight places. In such circumstances, I revert to non-synchronous ECSS reception with the barefoot R-390A.

I have yet to rewire the DC output jack on the back of my NRD-525 as an IF output, so I can't evaluate the SE-3's performance with that receiver. However, the rewiring would appear to be easy, judging from the instructions provided in the manual.

In my telephone conversation with Robert Sherwood before I bought the SE-3, he said I would love it. I do.

For further reading:

"Sherwood SE-3", 1983 World Radio TV Handbook, pp. 590 - 592.

"Shortwave's Best Fidelity System - For a Price", 1984 World Radio TV Handbook, pp. 594 - 596.

"General Catalog", Sherwood Engineering, Inc., 1988.