The ARC-5'er – a power supply for the BC-453 and other Command Receivers

By Herb Friedman W2ZLF
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Most everyone knows there are great savings to be had by re-working surplus gear. The only problem is that many of the surplus wonders require extensive modifications which are often beyond the capabilities of the experimenter. But there is one area in which the experimenter can literally mine gold, and the mine is called "Command Receivers".

The Command line consists of a series of receivers and transmitters used through World War II by the military. While the transmitters are of little use to other than amateur radio operators, the receivers are about the cheapest path to short-wave listening.

The Receiver Circuit. The Command receivers are one band superheterodynes with a line-up found in most medium priced equipment: RF amplifier, mixer, two IF amplifiers and an audio output. A typical Command circuit is shown in the schematic on the last page; except for the L-C (tuned) circuits used in the RF and IF amplifiers, Command receivers are essentially alike.

While each receiver covers only a single band, five models cover the spectrum from 190 KHz through 9 MHz. Aside from the broadcast band this range includes the FAA low frequency stations, weather broadcasts, marine ship-to-shore, 80- and 40-meter amateur bands, and the popular SW frequencies.

Command Receivers

Model			
Army	JAN	Range	I.F. FREQ.
BC-453	R-23	190-550 kc.	85 kc.
BC-946	R-24	520-1500 kc.	239 kc.
———	R-25	1.5-3 mc.	N.A.
BC-454	R-26	3-6 mc.	1415 kc.
BC-455	R-27	6-9.1 mc.	2830 kc.

As shown, the IF frequencies for the 3 to 9 MHz receivers are rather high, and selectivity is just passable. But when one considers that a Command set-up can cost less than twenty bucks it's a heck of an inexpensive way to enjoy SWLing.

While the receivers are called "Command" receivers it is the Joint Army-Navy models, the ARC-5 series, which are commonly available today; so the schematic shown is that of an ARC-5 model.

Super-Selective Conversion. We should not overlook the fact that Command receivers have value other than for listening. The 190-550 KHz model is otherwise known as the famous Q-5'er. The 85 KHz IF frequency of this Command model produces fabulous selectivity. If the receiver could be coupled to another receiver, even of the budget type, the overall selectivity would equal the performance of receivers selling for several hundred dollars. And that's exactly what you can do. Since the Command unit tunes 190-550 KHz, the common budget receiver IF frequency of 455 KHz falls right in the tuning range. All that's needed for a super-selective double conversion set-up is to connect the ARC-5's input to the last IF transformer of the communications receiver—it's as simple as two quick solder connections. And sometimes, you can avoid soldering by just placing a short length of wire connected to the ARC-5 input near the receiver's detector.

Building the Power Supply. All Command receiver controls are external, so all that's required to get these receivers on-the-air is a plug-in power supply which also contains the speaker, BFO shut-off switch and a gain control.
The power control center—which we'll call the ARC-5'er—is shown on the bottom of the full page schematic. To keep costs down to absolute rock-bottom we've selected components usually found in the mythical junk-box or which can be obtained at very low cost.
While the unit shown is built on a 5 x 7 x 2-inch aluminum chassis virtually any layout can be used—it's not extremely critical.

Plate transformer *T1* can be any power or plate transformer rated from 400 to 450 volts center tapped (200 or 225 volts either side of center) at 40 mA or higher. Don't use a higher voltage than 450 CT as the receiver's internal filter capacitors cannot withstand excess voltage. If you're using a power transformer cut the filament leads short and tape them, making certain the ends don't short circuit. (The filament leads of *T1* cannot be used since the filaments in Command receivers are series-parallel connected for 24 volts; and it's easier to use a 24-volt transformer than rewire filaments.)

Silicon rectifiers *CR1* and *CR2* must be rated at least 750 PIV (the rule of thumb for full-wave power supplies is PIV equals at least 3 times the RMS voltage). The current rating can be anything above 250 mA.

Transformer *T3* matches the relatively high audio output impedance of the ARC-5 to the low speaker impedance. Most Command receivers are designed for listening with a 4000-ohm or 8000-ohm headset, so the matching transformer is necessary for a speaker connection. However, don't spend too much for a matching transformer; an inexpensive AC/DC radio output transformer which can usually be purchased for about fifty cents is adequate. Some Command receivers have an optional 500-ohm output; if yours is so equipped you can use an inexpensive transistor output transformer with a 500-ohm primary for *T3*.
Any 3.2-ohm speaker is suitable for the ARC-5'er. The inexpensive 2-inch replacement type is recommended as its opening can be easily cut with a

standard multi-size hole saw.

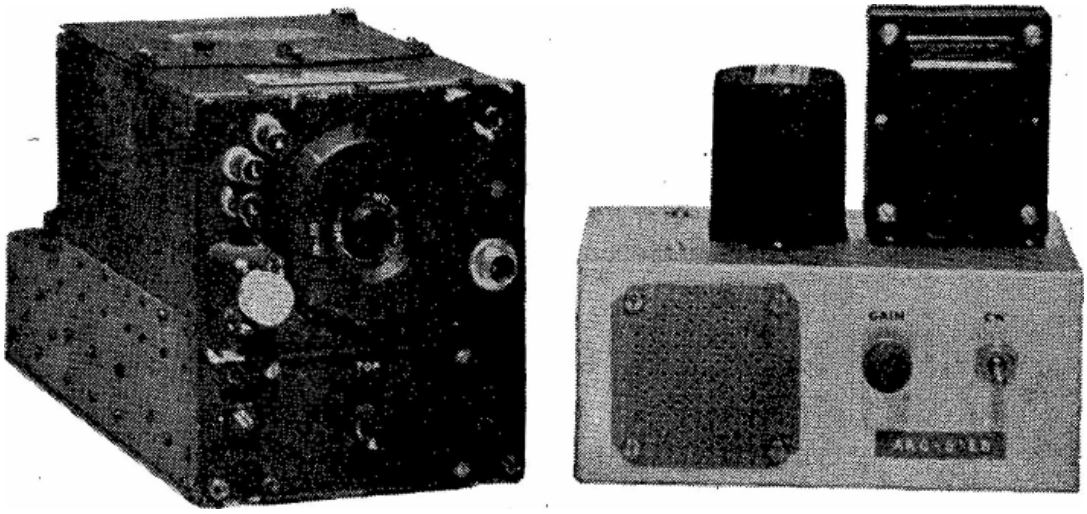
Choke *L1* can be just about anything you've got around; if it came out of 117-volt, 60-cycle equipment and is rated at least 40 mA it's okay to use it.

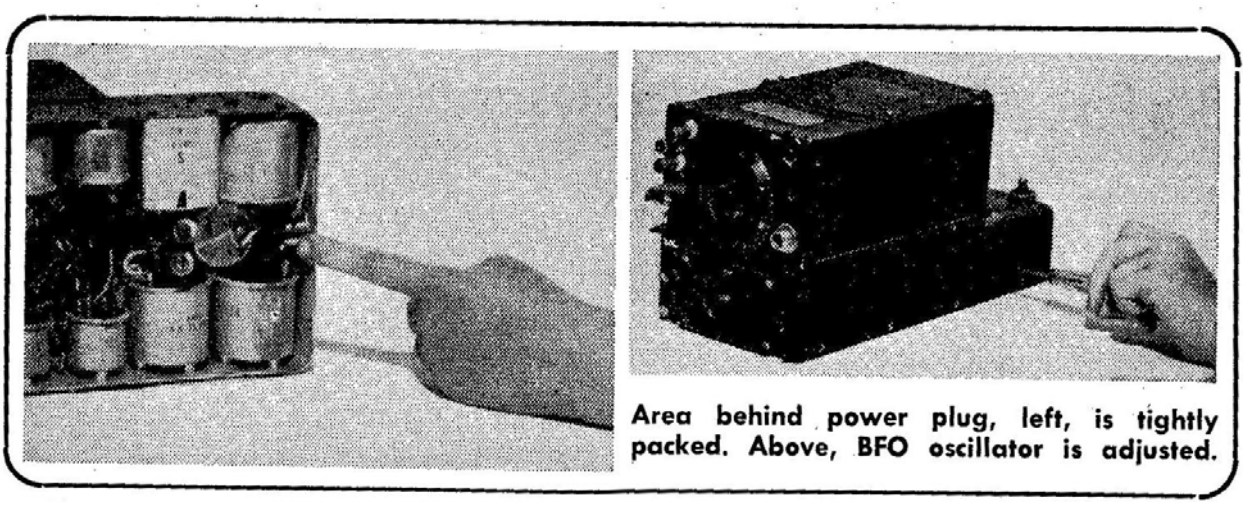
Connecting the ARC-5'er. The Command receivers have two unusual connectors on the rear apron.

- The plug on top is for the dynamotor power supply which clipped onto the receiver. Since the full B+ will be available on one terminal, wrap the plug with several layers of tape. Unless you're highly skilled at servicing don't try to remove the plug; it's almost impossible to avoid destroying several under-chassis components.
- The power socket is on the rear apron. Matching plugs are not generally available, though you should always check with the dealer from whom you purchased the receiver.
- If you cannot obtain a matching plug remove the socket and substitute an octal plug—not a socket.
- Carefully reconnect all the internal wires to matching pins. For example, if the receiver ground was connected to socket pin 1 connect it to octal plug pin 1, etc., etc. This way your schematic will still be correct. This plug substitution is the only receiver modification that might be necessary.
- Once the power center is plugged-in, the receiver is ready for operation. Naturally, the connections to the power center's matching connector must match the connections on the receiver.

PARTS LIST

C1—8 mfd., 450-volt capacitor
C2—20 mfd., 450-volt capacitor
CR1, CR2—Silicon rectifiers, 750 PIV minimum (Lafayette Radio 19R4203 or equiv.)
L1—5 henry, 50 ma (see text)
R1—270,000-ohm, ½-watt resistor
R2—25,000-ohm linear potentiometer with s.p.s.t. switch
S1—S.p.s.t. switch (see R2)
S2—S.p.s.t. toggle switch
SO1—Octal cable socket (see text: "Connecting the ARC-5'er")
T1—Plate power transformer (see text)
T2—24-volt, 1.0-ampere filament transformer (Olson Electronics T-290 or equiv.)
T3—50L6 output transformer (Lafayette Radio 33R3701 or equiv.; see text)
1—3.2-ohm speaker
1—5″ x 7″ x 2″ aluminum chassis box (Premier ACH-426 or equiv.)
Misc.—Terminal strips, perforated speaker grill, line cord, panel marking, hardware, hookup wire, solder, etc.
NOTE: Connector plugs for Command receivers are generally available for $1.50; spin tuning knobs for $1.00, from Fair Radio Sales, 2133 Elida Road, Lima, Ohio, 45802.
Estimated cost: $9.00
Estimated construction time: 5 hours





Area behind power plug, left, is tightly packed. Above, BFO oscillator is adjusted.

Using the Receiver. The power is applied via *S1*, which is part of volume control *R2*. *R2* is actually an RF gain control; there is no audio gain control per se. *S2*, when closed deactivates the BFO.

The Command receiver's antenna input is designed for long wire antennas, so just connect a long wire to the antenna terminal on the receiver's front panel. If you utilize a coaxial lead-in, connect the center conductor to the antenna terminal and the shield to the nearest cabinet screw. Command receivers have a front panel antenna trimmer which compensates for any detuning to the receiver's front end by the antenna. Simply adjust the trimmer for maximum signal or noise level.

While there is no BFO pitch control on the front panel, Command receivers have an adjustable BFO.
Located on the right side of the chassis is a small hole—the only hole—which is the access to the BFO pitch control. You can either adjust the control with a small screwdriver, or you can cement a small shaft to the control.

We'd be less than honest if we didn't point out that volume is not outstanding. Command receivers were designed for headphones, so in the conversion, while the speaker volume is adequate, it's not loud. -30-

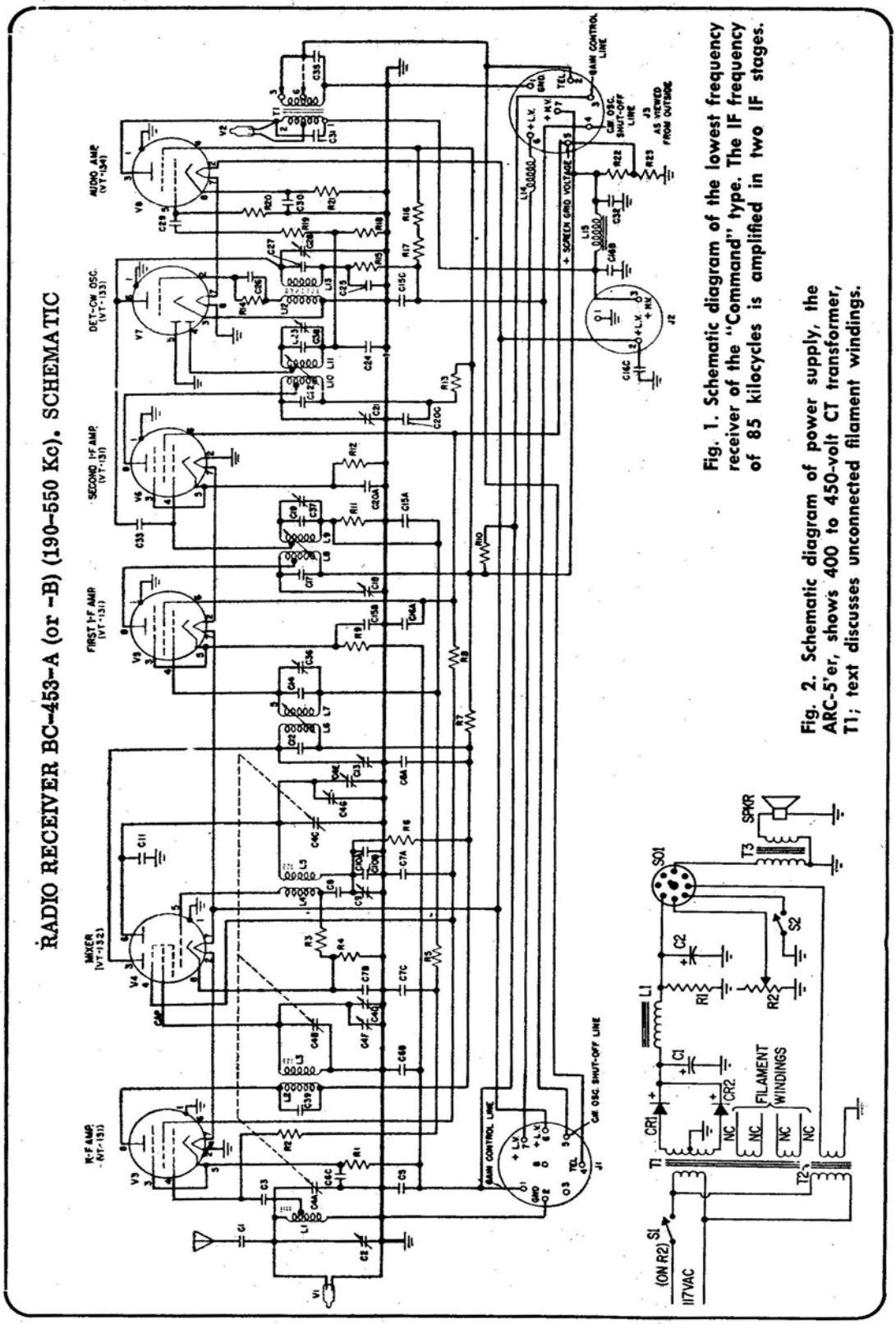


Fig. 1. Schematic diagram of the lowest frequency receiver of the "Command" type. The IF frequency of 85 kilocycles is amplified in two IF stages.

Fig. 2. Schematic diagram of power supply, the ARC-5'er, shows 400 to 450-volt CT transformer, T1; text discusses unconnected filament windings.