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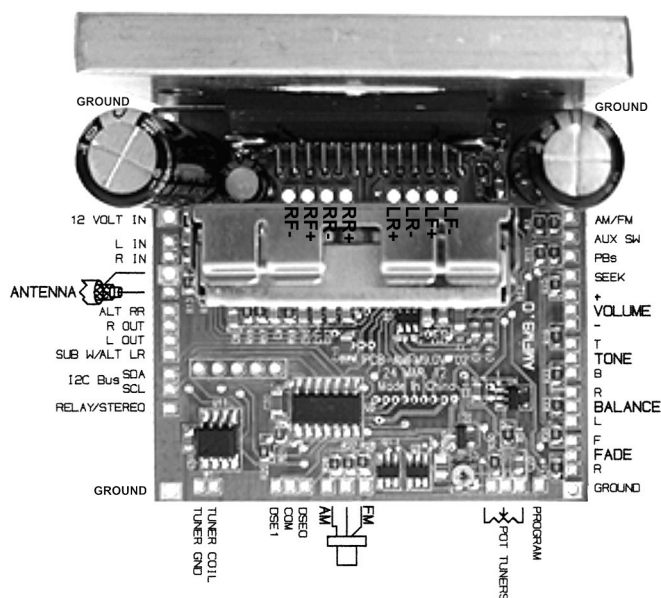
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ANTIQUE AUTOMOBILE RADIO, INC

AMFM9.0

FM STEREO CONVERSION KIT

INSTALLATION AND TECHNICAL MANUAL



Actual Size

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Our objective for this manual is to make FM STEREO conversions as simple and practical as possible. If you encounter difficulties with your installation and feel some areas need further clarification, call us with your ideas. We will include them in future versions. If you feel you do not have the latest version of this manual, ask for a current one.

HANDLING PRECAUTIONS This board uses many CMOS devices. Although all inputs are diode clamped, they can be damaged by static discharge. Care should be exercised when handling boards that are not installed. Get in the habit of always touching the case of the radio or other grounded surface before you touch the board. CMOS devices are less forgiving than tubes, and considerably more difficult to replace!

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Overview

Our objective has always been to provide a simple method of upgrading older car radio performance without altering the original appearance. Our earlier FM kits have shown themselves to be reliable and easy to install. These kits have allowed tens of thousands of vintage car owners to keep their original radio but listen to popular programming which has migrated to the FM band since those radios were built. The AMFM9 tuner is smaller and requires less installation and set-up time than any previous stereo conversion while providing more options, features, and output power! It is different in operation from any other radio on the market today, so an explanation of its characteristics is

offered. Radios are either digital or analog. Analog radios are electro-mechanical devices that have a continuously adjustable dial scale that allows the user to tune (by ear) the frequency of the local oscillator that corresponds to the desired station. An AFC (Automatic Frequency Control) circuit then “fine tunes” the oscillator to the center of the station frequency. Digital radios are electronic devices where the user enters a digital representation of the desired station, and a microprocessor tunes the local oscillator to precisely that frequency. The AMFM9 series radio is a digital radio tuned with analog controls. The analog (FM) dial scale is divided into 205 digital steps representing all 205 possible station locations on the dial. The microprocessor reads the position of the analog dial and tunes the local oscillator to the nearest 1-of-205 stations represented by the analog position of the tuner. The station is “locked” providing the highest degree of stability and accuracy possible. All adjustments to the tuner are done by the microprocessor except that the minimum and maximum inductance of the analog tuner must be “learned” during the initial set up. The AMFM9 can be programmed for 1, 2, 3 or 4 speakers plus 2 line outs with subwoofer or 4 line outs with a maximum output of 180 watts RMS (45watts x 4 channels, 4ohm speaker impedance, 14.4 volts input). A digital audio control section allows any original volume and tone control to be used. There are several unique options for balance and fader controls including one that does not require any additional controls! When practical, the original factory front/rear fader can be assigned to the balance or fader function or both. Where the original radio did not provide for balance or fader controls, they can be programmed using the tone control. Here’s how it works: Tune in any FM station and listen to it for a few seconds until you’re familiar with how it sounds. Now quickly tune to the extreme bottom of the dial. The station you were just listening to will begin playing again. At this point, the tone control becomes the balance control. Adjust the balance for the most pleasing sound, then tune away from the bottom of the dial. The tone control will function normally, and the balance setting you selected will be permanently saved. Tune the radio to the top of the dial. The last station you listened to will again start playing here. Now the tone control is the front/rear fader. Adjust the fader for the most desirable sound. When you tune away from the top of the dial, normal tone operation will resume, and your fader settings will be permanently stored.

All of the major signal seeking drivers and logic are included, and an incandescent lamp driver is available for late ‘60s and early ‘70s radios that had incandescent stereo indicators. A single LED indicator provides a wealth of information to the user. A stereo auxiliary input is provided to allow Ipod, MP3 or CD connections without any additional circuitry. Any active audio source connected to the auxiliary inputs will cause the outputs to switch. There is also a switch option included. All options are easily programmed during set up. Programmed options are permanently stored in EEPROM, which is read during each power up. The EEPROM memory can be erased and re-written with new data whenever necessary, and power off data retention is hundreds of years!

What's new in AMFM9? The size has been reduced by a third. There are 2 microprocessors – one dedicated to the tuner and one for everything else. The tuner is a high performance self aligning digital narrow band receiver. A new Amplifier and digital audio system provide a noticeably improved sound. Programming is less complicated but provides for more features.

First the Ground Rules

This radio is built for power! There are 8 high current, low impedance speaker drivers on board. Each driver is capable of switching in excess of 3 Amps to the speakers, so no speaker lead can ever be grounded. The output IC must never be operated without a heatsink, and you must avoid putting a continuous 400 or 1000 Hz tone through the amplifier at high volume levels. If the amplifier does not melt down, the speakers will! Part of the reason that these high power levels are achievable is that the path from the battery to the speaker is very low impedance when the drivers are on. If you run this radio on a wimpy bench power supply it may sound a bit flatulent on bass notes. That is a good indication that the power supply has a higher series impedance than the amplifier, and is starving it on peak demands. We keep a gel cell battery on the bench for “wide open” testing. Keep in mind that the DS-501 output transistor you’re replacing could only source about 1 watt and that could do a lot of damage!

When operating on any electrical system other than 12 volt negative ground, we do not recommend configuring this radio for more than 2 speakers. Power output will be considerably less than what is obtainable from a 12 volt supply.

The factory fader option cannot be used with pot tuners. This should not be an issue since all (US) radios that have factory faders are coil tuned.

Chassis Preparation

The tuner (including coils) and front controls should be removed first. The parts you will need to re-use (tuner, volume and tone controls, dial light, etc.) should be cleaned and tested. You will only use the oscillator coil. The RF and Antenna coils are not needed. The rest of the chassis can be removed and discarded. Note: In some cases the chassis is required either to support the tuner, or because it is an integral part of the case i.e. Mopar 802 or some early ‘50s Ford 6 tube radios. In this instance, the chassis should be stripped of all unused components. Front/rear fader controls may be used and assigned as either balance or fader controls (or both). Before painting the sheet metal you will re-use, determine the best location for the board, and punch the holes for the heatsink. Remember that the heatsink must be attached to bare metal in order to be effective. Do not paint the inside of the radio in the heatsink area! If the radio will be operated on a 6 volt system, determine the best location for the Power Supply and punch that mounting hole as well. Determine the best position for the indicator LED. Drill a 3mm hole (1/8” works here). The LED is required for programming. Even if it is not installed in the dial background, it must be connected. Your kit is supplied pre-wired with all standard connections for the LED, controls, speakers, and power.

In its most basic form (12 volt 1 speaker), the following connections are required:

+12 volts

System Grounds (4)

LED Indicator

Volume control

Tone control

Antenna

Oscillator Coil (or Tuning Pot)

Speaker

Optional connections provided are:

Additional Speakers, line outs, subwoofer

Balance control (if more than 1 speaker)

Fader control (if 4 speaker)

AUX Inputs, Aux input switch

Signal Seeker controls or stereo lamp driver

AM/FM switch input

Installation

The first consideration should be the location of the heatsink. It will get very hot when the radio is operating. The idea here is to attach the heatsink to the side of the radio case in a manner that will allow the case to spread and dissipate the heat as evenly as possible. With this in mind, the board should be mounted in a horizontal position preferably near the bottom of the case. Use the heatsink supplied with your kit, and always use a liberal amount of silicon heatsink grease between the case and the heatsink. The mounting screws must be tight, and the case and heatsink must be free from burrs or raised areas that will prevent full metal-to-metal contact.

Electrical Connections

The first connection should be the grounds. Connecting the grounds first will help to prevent the possibility of damage to the board from static electricity. The system grounds should be soldered directly to the case, and be as short as possible. Remember that the system ground is the return path for up to 12.5 amps of current. If your radio seems to break into oscillation on bass notes, you probably forgot that ground. Glue the LED in place and cover the back of it with RTV or black liquid plastic to prevent the dial light from showing through. If you don’t want to use the LED in the dial face, do not cut it off. Leave it inside the case. You will need it for set-up. Each kit is supplied with a pre-wired female 12 pin connector. The male shell is also provided, and the wires that go into it have the pins installed on them. Route the wires with the male pins through the radio case. Next, push them into the appropriate position in the male shell. The objective is to make every radio easy to install and remove as well as to provide a standard hook-up for bench testing. Use the plastic clamp supplied to hold the wire harness securely. The shell/color positions are defined as follows:

- | | |
|---|---|
| 1 Red
+12 input | 7 Orange
Switched +12 |
| 2 Green
Dial Light (option) | 8 Black
Chassis Ground |
| 3 Blue (green band)
Left (+) Rear Speaker | 9 Violet (green band)
Left (-) Rear Speaker |
| 4 Gray (green band)
Right (+) Rear Speaker | 10 White (green band)
Right (-) Rear Speaker |
| 5 Blue (yellow band)
Left (+) Front Speaker | 11 Violet (yellow band)
Left (-) Front Speaker |
| 6 Gray (yellow band)
Right (+) Front Speaker | 12 White (yellow band)
Right (-) Front Speaker |

Refer to figure 1 for connection locations. The **+12 volt** source should come directly from the power switch through 18 Gauge stranded wire. Make sure the switch can handle the power! Some radios (Mopar thumbwheels for example) only have a 1 Amp switch. If your switch won’t handle at least 5 Amps continuously or has an “on” resistance of more than a few hundredths of an ohm, use the switch to drive a relay instead of switching power directly. Use the original spark plate and a new 0.47 µf capacitor to ground ahead of the power switch.

If you're building a radio for use on a **6 volt** system or **12 volt positive ground**, an additional power supply must be installed and a 10 Amp, 5 μ H choke must be connected as close to the input of the power supply as practical. Keep the power supply input and output leads away from any other high impedance wiring and/or RF components. Make the wiring as short as possible. Do not run the dial light, tuning solenoids, motors, or anything else from the power supply. You'll need every milliamp! The "Hot" side of the power switch should be wired through the proper sized fuse to the ignition switch using at least 18 Gauge wire. It should not have any inline chokes or other components that could limit the power available to the amplifiers. The dial light wiring should remain as original. The antenna shield (RF Ground) should be connected to the ANT GND pad shown in FIG. 1.

The **Volume** and **Tone** controls have been designed to work well with anything that's out there. The way we accomplish this is to use a variable voltage for these controls. This way, any pot becomes a voltage divider, and its resistance doesn't make much difference (within limits of course). Controls with a total resistance of 2K Ω to 5 Meg Ω can be used interchangeably. For these controls, a 5 volt supply is connected to the high side of the control and the low side is grounded. The wiper sees a voltage somewhere between the high and low limits, and adjusts accordingly. The higher the voltage, the higher the volume will be. For the tone control, 1/2 of the 5 volts (pot centered) gives maximum bass + treble boost. 0 volts reduces bass (max treble), and 5 volts reduces treble (max bass).

Some older radios used a switch instead of a pot for the tone control. Delco radios in the '40s used a 3 position switch (Voice/Music/Bass) that can be configured to provide some degree of tone control but will not allow the full range of frequencies available with a pot. It may be desirable to replace the switch with a pot or use the switch for an AM/FM/AUX switch and mount another tone control elsewhere. Some '49-'53 Ford, Lincoln, and Mercury radios used a switch that was connected to a rotating drum that indicated LO NOISE, HI FIDELITY, etc. as the switch was rotated through its various positions. The original look, feel and function can be preserved by wiring resistors to the switch to form a divider to provide switch settings from about 1-1/2 to 4-1/2 volts. Some radios ('57 Plymouth for instance) did not have a tone control. We recommend installing one where it is accessible by the end user.

Our electronic controls depend on a linear voltage, however most original radio controls have an audio taper. This will cause most of the change to occur at one end of the control. To make an audio taper pot look more linear, place a resistor from the wiper terminal to the high side terminal (+) on the control. The value of the resistor as a rule should be about 10% of the total resistance of the pot if the total resistance is less than 250k Ω . If the total resistance is more than 250k Ω , try 20%.

The **Balance** control (when used) is the same in principle as the other controls, except that as the wiper approaches the high side, the audio is shifted to the right amplifier(s). Turning the control toward the low side shifts it to the left amplifier(s). **NOTE:** If the balance control or the alternate balance control (if used) is set to either extreme end, the audio will automatically switch to **mono**. Both the left and right audio information will be sent to the selected amplifier(s). The AUX inputs will also switch to **mono**.

If you select the one speaker option, the balance control will not function and the radio will always be in mono mode. With the control centered, both amplifiers are equal. Where the original radio did not have a balance control, and it is not desirable to use the tone control or factory fader as an alternative (see programming options) a 50k Ω linear pot may be mounted on the bottom of the case or on a side where it can be reached for adjustment. If you're not familiar with the car the radio will be installed in, and want to be sure the balance control is accessible by the owner after installation, it is a good idea to mount the pot where the antenna trimmer was originally located. One trick we've found particularly useful is to install a small screwdriver-adjusted pot in the bracket that held the antenna trimmer behind the tuning knob for Delco radios from the 60's. This makes the balance control accessible from the front of the radio. Often, a junk-box tone control can be slid over the tuning shaft to put the balance control on the front of the radio, but keep in mind that you will probably have to supply a knob, and controls are one of the few original parts you'll have to keep on hand for other conversions. Don't be too quick to promise something that may become difficult to deliver!

The **FADER** input is only used with 4 speaker systems. When the wiper is at 5 volts, all of the audio is sent to the front amplifiers. At 0 volts, all of the audio is sent to the rear amplifiers. Midrange drives both front and rear. When configured for a 1, 2, or 3 speaker system, the fader is ignored. Where the original radio did not have a fader control, and it is not desirable to use the tone control or factory fader as an alternative (see programming options) a 50k Ω linear pot may be mounted on the bottom of the case or on a side where it can be reached for adjustment.

There are two pads on the board marked **Tuner Coil** and **Tuner Gnd**. These pads should be connected to the oscillator coil on the tuner if the coil tuner option is used. The wires from these pads should be as short as possible. **Do not run the wires to the oscillator coil near the antenna input or across the RF end of the board.** In instances where the oscillator coil is double-wound, don't use the secondary winding. (The winding with the lowest resistance reading). In some radios, one side of the coil will already be grounded. The **Tuner Gnd** wire must be connected to the grounded side of the tuner coil. When the oscillator coil is not grounded, the Tuner Coil and Tuner Gnd wires may be used interchangeably.

The pad marked "**AM/FM**" is left unconnected to use the band switching via the power switch option. In this mode, the radio will power up in FM. Band switching will be controlled by turning the power off, then on again. In instances where it is desirable to use an existing AM/FM switch, connect the AM/FM pad to the switch so that the line is grounded for AM, and open for FM. There is no AM 1st option on this board. In order to use the AM/FM switch option, it must be programmed during setup.

There are four pads associated with the **Line Outs**. They are un-terminated, and AC coupled. The **L OUT** and **R OUT** pads are affected by the Volume and Balance controls. They are always active. The **SUB W/ALT LR** pad is the sub woofer output by default. During set-up you can select the option of having four line outs or two plus sub woofer. If you select 4 line outs, this pad becomes the left rear out. The **ALT RR** pad is only used with the 4 outs option. It is the right rear out.

Use the shielded wire provided with your kit to connect the **antenna** pads to the antenna input jack. Do not use a series capacitor. The original antenna trimmer should not be connected.

There are 3 pads associated with the audio **Aux** Input. These pads are intended to connect to MP3 Players, CD Changers, Ipods or XM tuners. They may also be used to connect to 8 track or cassette inputs. An 8-track head preamplifier will be necessary, but its description is beyond the scope of this manual. If using this input for both 8 track and other options, it will be necessary to install a DPDT relay at the input and activate it with the 8 track motor power supply. By default the inputs become active when an AC signal (audio) is applied to either of these inputs. The audio inputs are switched from the radio to the "**L IN**" and "**R IN**" pads. When the **Aux.** inputs are active, the LED will be off. If the balance control is set to either extreme limit, this input will automatically switch to **mono** mode. The **Aux** inputs will remain active until there has been no audio signal present on either input for more than 15 seconds, at which time the audio system will switch back to the radio. The **AUX SW** pad offers the option of selecting the Aux. inputs with a switch instead of the audio detector. Connecting the **AUX SW** pad to ground will cause the inputs to switch into aux mode.

There are 3 pads labeled **POT TUNERS**. When the radio is not inductively tuned, a potentiometer connected to these pads is used to tune the radio. A more detailed discussion of pot tuners can be found on page 7. Most of the radios you encounter will be coil tuned. When not used for pot tuning, these pads can be used to read a "factory" fader. A "factory" fader is defined as an OEM option fader, typically 100Ω wirewound, often mounted on the tuning shaft. Be aware that many of these faders no longer work, and are difficult if not impossible to repair. That said, in order to use one you must connect a resistor in series with each outer terminal of the fader. Each of the resistors must be 4 times the total resistance of the wirewound fader. For example, a 100Ω fader should have a 390Ω resistor in series with each outer terminal. Adjust VR1 so that the voltage on the wiper does not exceed 5 volts at its high end. The voltage measured at the center terminal should vary between 4 and 5 volts as the fader is

turned from end to end. The fader can be assigned to the balance control.

Another multi-use pad is the **RELAY/STEREO** pad. If the radio is not programmed in setup to be a signal seeker, this high current output can directly drive incandescent STEREO indicator lamps used in early stereo receivers (default). GM's famous "Blue Dot" owners will love this! The open drain mosfet driver will switch to ground whenever a stereo signal is present.

Signal Seeking Radios There are 3 pads associated with signal seeking radios. They are: **RELAY/STEREO**, **SEEK**, and **PBs**. With these connections, it is possible to control any signal seeking radio. Most wire directly, but all require a thorough understanding of how the particular tuner works. The signal seeking I/O lines from the AMFM9 board operate as follows: When the **SEEK** input is momentarily grounded, the **RELAY** (N-channel open drain) output goes low. The audio signal is muted. The **RELAY/STEREO** output remains active (low) until the tuner locates a station of sufficient strength (either AM or FM). If programmed during setup, the **PBs** input must also be grounded (for Delco E-series and Mopar Electro-touch tuners). The **RELAY/STEREO** output will go inactive under these conditions and remain inactive until the **SEEK** input is again brought low. Audio is restored when **RELAY** is inactive if a station is present. Special Considerations: The seek input is ignored in AUX mode. If the **RELAY** line is active when the AUX inputs detect activity, it will stop before it finds a station. The **RELAY/STEREO** output can sink up to 500 mA and can handle up to 60 volts. For any 12 volt signal seeker, the original control relay can be wired between 12 volts and the **RELAY** pad. High voltage relays will require a NGVB-HV power supply (sold separately).

Ribbon cable color codes

LED: FM = White, Common = Gray, AM = Violet

Volume: (+) = Yellow, Wiper = Green, (-) = Blue

Tone: Bass = Brown, Wiper = Red, Treble = Orange

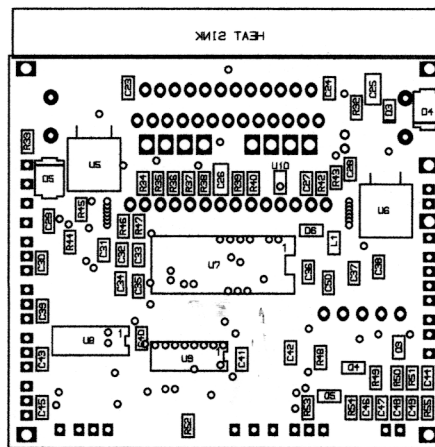
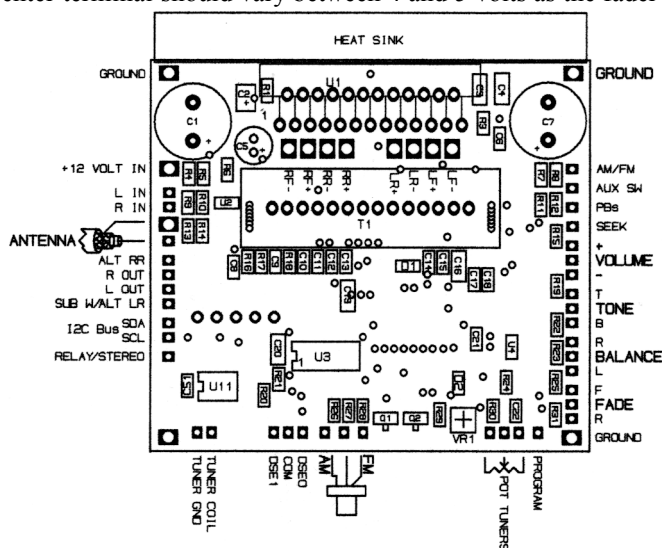
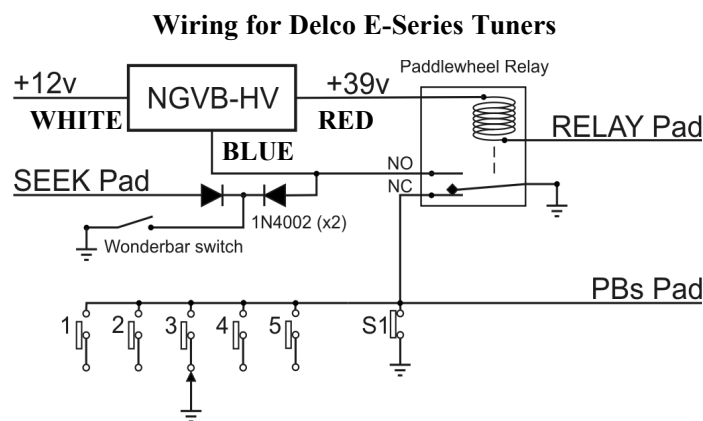


FIGURE 1
Electrical Connections

The **SEEK** pad can be connected directly to the search switch. Hybrid radios from the late '50s and early '60s that run on 12 volts and use a 12K5 or similar vacuum tube to control the relay often use a relay with a 4 to 6 volt coil to compensate for the voltage drop across the tube. In these radios, it will be necessary to use a resistor in series with the coil to lower the voltage to a safe level. Some radios ('56 Ford and T-Bird for example) use a 12 volt drive system with a high voltage relay. It is easier to replace the relay with a 12 volt one than to try to make the original relay work with a high voltage supply. Early Delco tuners use a paddlewheel relay which is controlled by a 12AU7 tube. The relay, which is connected to B+ is designed to operate between 25 and 40 volts, due to the plate-cathode drop across the tube. We can supply a special power supply (#NGVB-HV) to supply the higher operating voltage for this relay. The **RELAY** output can not directly drive 12 volt motors and clutches due to the "locked rotor" current which exceeds the SOA of the driver. **Do NOT** attempt to use this output to drive the high current Delco solenoids!



Connect the NGVB-HV power supply as shown. The phenolic board above the pushbutton assembly has 2 wires attached at the right rear corner. Do not remove these wires. They are difficult if not impossible to re-attach. The wire closest to the center of the board (gray) connects to the PBs pad on the Stereo 9 board. The wire nearest the edge of the board (yellow) connects to the normally closed contact on the paddlewheel relay. Add 2 blocking diodes as shown between the SEEK pad on the Stereo 9 board and the normally open contact on the paddlewheel relay. The top lug on the Wonderbar switch connects to the cathodes of both diodes.

S1 (internal on the pushbutton assembly) normally holds the PBs line at 0 volts. The Wonderbar will not stop seeking unless the PBs line is grounded. When any pushbutton is pressed, S1 opens and the Wonderbar switch is pulsed. This causes the NGVB-HV to turn on and provide the voltage for the relay coil. When the relay is energized it then latches the NGVB-HV on and starts the spring-loaded tuner moving. The tuner will not stop until the radio finds a station of sufficient strength AND the PBs line becomes grounded through the contact on the dial pointer which can only occur when the dial pointer lines up with the red tab that

corresponds to the button that is pushed. When that happens the relay is turned off and the radio stops seeking. If there is no station, the seeking mechanism will not stop. Any time the Wonderbar is pressed, the buttons are disengaged and S1 closes so that the Wonderbar will stop on the next station.

Another signal-seeker variation is the Chrysler Electro-Touch Tuner used in the mid '50s. It connects similarly to the Delco E series tuners. You will need to use the PBs pad. While the wiring is fairly straightforward, setting the pushbuttons may not be. Here's how it's done: Tune in the desired station using the touch bar. Turn the radio off. Push the button in that you want to set. Turn the radio on. NOTE: If the station is in the FM band, you must wait at least 7 seconds to prevent the radio from coming on in the AM band. Pull the chrome cover off the pushbutton. Turn the adjusting screw in or out until the LED indicator lights brightly. Rock the adjustment back and forth until it is centered. Replace the chrome cover. Pushbuttons can be set for AM or FM stations.

Line Outputs and Sub Woofer: Line output options are new for the AM/FM9 receivers. They may provide a new revenue stream for those of you who want to add a line of amplifiers and accessories. You can choose between 4 line outputs or 2 plus a sub woofer. The options are selected in programming mode (see next page). While we do not sell or endorse any particular amplifier or brand, we do our testing with a JBL model GTO-3EZ (for 2+Sub) or GTO-5EZ (4 channel). They're ready to plug in and play right out of the box, the instructions are clear and easy to follow, and they sound great!

6 Volt power considerations: 180 watts from a 14.4 volt supply requires about 12.5 amps (peak). 180 watts from a 6 volt battery requires about 30 amps. That is nearly the entire capacity of a 6 volt generator! Our 6 to 12 volt boosters and inverters supply a constant 12 volts. Now, 12 volts into a 4 ohm load will consume 3 amps or 36 watts (peak). This is about the capacity of a PGPI-HC, which is why we recommend no more than 2 speakers for 6 volt positive ground systems. When operating from a 6 volt negative ground system with a NGVB-HC you can get nearly twice the power, so you can often get away with running 4 speakers. You may want to further limit the output power by inserting a resistor in series with the + lead of the volume control. A resistor with a value equal to 10% of the volume control will limit the volume output to about 90% of maximum.



SWITCH POS	LED OFF	LED GREEN	LED RED	LED ORANGE	NOTES *Indicates default setting
1	1 Spkr Mono	2 Speakers	3 Speakers	4 Speakers*	Fader is only active with 4 speakers
2	Europe	USA*	Not used	Not used	Channel spacing
3	2 Sp + Sub*	4 Speaker	Not used	Not used	Line Output options
4	No Switches*	Use FM Sw	Use Aux Sw	Use Both	Aux input & AM/FM switch options
5	No Seek	Seek*	Speed adj.	Seek w/PBs	Signal Seeker options (see instr.)
6	No FFader*	FF=Balance	FF=Fader	FF=Both	Factory Fader options
7	Coil Alignment (see instructions)				

PROGRAMMING AND SETUP: All programmed options and features unique to a particular radio are “learned” during setup, and stored in non-volatile memory. Programming is very simple. It should only take a few minutes after you become familiar with it. Don’t worry if you make a mistake. You can re-write every option each time you enter setup. Default parameters are preset and will remain if you don’t over-write them.

TO ENTER SETUP: Turn the power on to adjust the pot tuner voltage or factory fader voltage if used, then turn the radio off. If the radio has a balance and/or fader control, set them to midrange. The processor will read them during setup to determine if they were installed. If it can’t read them, it will assign a default (alternate) control for these functions. Connect a jumper from the program pad to ground. Connect the programmer to the seek pad and ground. Turn the radio on. The LED will turn **ORANGE**. There should be no audio. When the jumper to the program pad is removed the state of the LED will be determined by the table above. Each of the 1st 6 positions has a default setting marked with an *. If you don’t want to change it, skip to the next position. To change the setting, lightly tap the button. The led should change every time you tap it (If you hold it down, it will loop thru all the settings repeatedly). If you don’t want to change the coil settings, ground the program pad momentarily, remove the programmer and turn the radio off.

IF THE RADIO IS COIL TUNED: While in setup, tune the radio to the highest point on the dial. Select the 7th position and push the button. The LED should be **GREEN** and alternating between bright and dim. Tune to the bottom of the dial. Push the button again. The LED should be **GREEN** but flash red briefly. You are done. Remove the programmer and turn the radio off.

ERRORS: When you enter setup if the LED starts pulsating wildly, the programmer is not connected. If the LED turns red when you attempt to program the coil, the processor isn’t able to read the coil. It may be open or have a capacitor connected across it. If you’re programming a signal seeker and the radio won’t stop seeking after it’s programmed, you probably forgot to disconnect the programmer.

SPEED: The radio is programmed to seek with a typical tuner. If your tuner runs much faster or slower than normal, you can go back into setup, select option 5 and tap the button until the LED turns RED. Now select option 6. Tap the button to set different values. If LED is off, there is no compensation for speed (very slow mechanism). Red is default, Green is -1 (slower) and Orange is +1 (faster). After setting your choice you will need to go back to option 5 and re set your signal seeker options, then go to option 6 and re set your Fader options.

IF THE RADIO IS POT TUNED: Skip coil setup, see page 7.

OTHER THINGS TO CONSIDER: Normally, if the radio has a Factory Fader it would be used to fade front and rear, but if there is no balance control installed you may assign the Factory Fader to the balance control or the fader or both. If it is assigned only one function, it will always perform that function. If you select both, it will be a balance control only at the bottom of the dial, and fader only at the top (It will function as an alternate control) If there is no fader control but there is a balance control, then the balance control will also function as the alternate fader control (4 speaker only). If there is no balance control the tone control will function as an alternate balance and/or fader control.

TO EXIT SETUP: If you program the coil, setup exits automatically (coil must be reset each time you enter setup). If the radio doesn’t use a coil tuner, momentarily ground the program pad. You will see the LED output a quick, bright red flash while the processor stores the data in non-volatile memory. The LED will remain green, but no further changes will be accepted. Remove the programmer and make sure the program pad is not still grounded. Turn the radio off. The next time it is turned on, and every time thereafter, all of the proper data will be read from non-volatile memory. There are no back-up batteries or constant power requirements for this radio. Data retention is designed to be greater than 200 years!

WHAT IF IT WON’T PROGRAM? The processor can read inductances from 10 μ H to 300 μ H. When teaching the processor the coil range, the processor must see enough change in inductance to tune the entire band, and the “ends” of the inductance range in order to center the range to the dial scale. If the LED turns Red during coil setup, the processor can not read the coil. Check to make sure the coil is not open or shorted, and that it is correctly wired. If the white coil wire is connected to the grounded coil terminal it can’t oscillate! Check for a capacitor connected across the coil inside the tuner (’58 Buick has this) or maybe you’re using the wrong coil or winding. Some oscillator coils are designed to work with a shunt coil. Many early postwar radios had 2 parallel coils, one fixed and one adjustable. Look at the schematic. Use the original shunt coil if possible. If the original coil is not useable, you can usually make it work by installing a 270 μ H choke directly across the coil. Other things that can cause problems might be a broken or improperly adjusted tuning slug. The easiest way to adjust the slug is with an inductance meter. Tune to the bottom of the dial and read the inductance while turning the core in and out. The highest reading is the correct setting for the full range of the coil. Often if the oscillator coil is defective or requires a shunt coil you can use the RF or Antenna coil instead. This trick won’t work in all cases, but may be worth a try!

Alignment procedure for pot tuned boards. The boards for pot tuned kits will require one adjustment. See below for examples of tuning pot configurations. The tuning pot connects to the stereo9 board at the 3 pads marked “Pot Tuners”. The tuning pot should be 10K Ω linear taper. It should be mechanically installed so that the center (wiper) terminal measures 0 volts to ground when the dial position is at the extreme low end. Next, set the tuning pot to the top of the dial (full travel is not necessary, but it should go to at least $\frac{3}{4}$ of full travel). Adjust the VR1 pot for exactly 4.10 volts at the high end of the dial. That’s all there is to it! A voltage between 0 and 4.10 tunes 87.9 – 108.1 mHz. FM, or 530 – 1700 kHz AM.

Variable Capacitor to pot tuned conversion. There are 3 common tuner styles and several variations that you will encounter. We use one of 3 pots to convert all of these. The pots are made by Spectrol and are readily available through most electronic distributors. They are industry standards and cross to Bourns, Allen Bradley and other manufacturers. The first pot is a 10k Ω series 249 pot with a $\frac{1}{4}$ ” diameter shaft. We use it for tuners like the 1940 Ford example shown. The second pot is also a 10k Ω series 249 pot but with a $\frac{1}{8}$ ” diameter shaft. It is used for tuners like the Metropolitan example shown. Both of these pots are single turn with a travel of 270 \oplus The third pot is a 20-turn pot that is used with a snap-on panel mount adapter. It has a .118” diameter shaft. It is used with worm gear tuners or where it can be attached directly to the tuning shaft and will require multiple turns for an “end-to-end” tuner travel. The panel mount adapter kit is available from Mouser Electronics (part # 594-613).

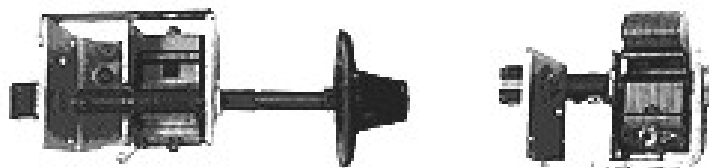
The first example shown is a 1940 Ford (Zenith) tuner. You simply remove the drive gear, the rotor and stator, install a pot with a $\frac{1}{4}$ ” shaft (shaft length is cut to fit) and attach the gear to the new shaft with JB Weld or other suitable epoxy. Note: We do not recommend using “super glue” because it doesn’t allow time to adjust the position, and it may run down the shaft and permanently seal it to the bushing. The new pot will have a greater rotational angle than the original tuner. In order to make the tuner travel 180 \oplus like the original, a piece of buss wire can be formed to fit the gear teeth as shown, which will prevent full travel of the pot. The buss wire needs to be positioned so that it stops the gear travel before reaching either end of the pot travel.



1940 FORD (Zenith) TUNER

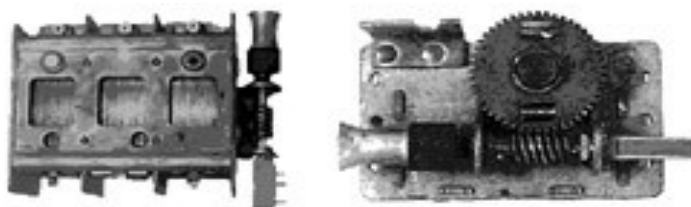
The second tuner is typically used on Nash Rambler and Metropolitan radios. It has a reduction drive, which prohibits the use of the method in the first example. In this case, it is

necessary to remove the rotor and stator from the last section only (the “front” section provides the correct amount of travel). Drill a $\frac{1}{8}$ ” hole about 1” down the brass rotor shaft using the pilot bearing hole for centering the drill. Next, cut about $\frac{1}{2}$ ” off the rotor shaft. Drill and tap the side of the rotor shaft for a set screw as shown. Drill through the pilot bearing hole in the end frame to install the 249 series pot with the .118” diameter shaft. Re-install the rotor in the frame and install the pot so that the shaft goes into the $\frac{1}{8}$ ” hole. Adjust the front rotor spacing by locking down the set screw in the proper position.



METROPOLITAN TUNER

The Third type of tuner is used when mounting does not permit use of the second method and the first method is not easily adapted. It can also be used on any manual tuner (i.e. 1955-59 Chevy Truck) or any tuner with electric pushbuttons, for instance Mopar 802, if you also replace the pushbutton coils with multi-turn pots. This system works very well with ’39 Mopar, ’40 Ford and some foreign radios where space is limited. The example shown is from a 1937 Ford, but is typical of most prewar Philco tuners. Remove the worm gear from the bracket. Drill a $\frac{1}{8}$ ” hole approx. $\frac{1}{2}$ ” into the gear, using the pilot bearing hole for center. Partially fill the hole with JB Weld or similar epoxy, and re-assemble using the multi-turn pot for the pilot bearing as shown below. The panel mount adapter will need to be glued to the pot to prevent it from pushing out when the worm gear reaches the end of its travel. The multi-turn pot will idle at the end of its travel, so the starting position is not important.



1937 FORD (Philco) TUNER

To order kits: Since we have no way of knowing which options you are using, we will ship all kits with only the basic wires installed in the connectors. We will include a “starter kit” with your first order that contains some of all the other connector wires you may need. These wires easily snap into the connector shell. We will refill your stock of wires as you request them. We have found it is much easier to add the wires you need than to remove the ones you don’t need.

The programmer that is needed to set up your radio will be provided with your initial order. Check our “dealer area” at www.radiosforoldcars.com for updates to this manual. We appreciate your comments and suggestions to simplify installations. For on line technical assistance, Email us at support@radiosforoldcars.com