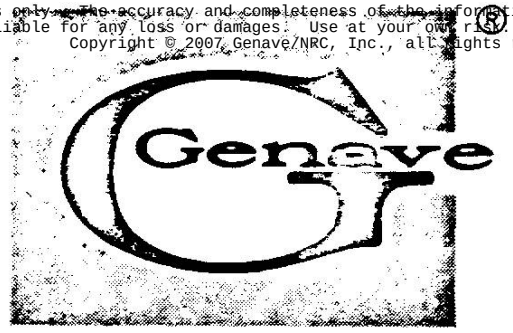


ETA/4

ANTENNA COUPLER

CONTENTS

(Note: All figures are printed on white within their appropriate sections.)

Tech. Pub. No. 0540038

Published by: **General Aviation Electronics, Inc.**
4141 Kingman Drive
Indianapolis, Indiana 46226
Area (317) 546-1111

Price: Single Copy $5.00

SECTION I

GENERAL INFORMATION

1-1. INTRODUCTION

This service manual contains all the information normally required to install, operate, and maintain the Genave Model ETA/4 Antenna Coupler.

1-2. DESCRIPTION

The Model ETA/4 antenna coupler is a compact, easy-to-use, weather-proof and corrosion-resistant unit, designed for use with compatible Genave transceivers within the frequency range from 2 to 9 MHz. Two mounting brackets, supplied with the coupler, allow the ETA/4 to be mounted in any position desired on any convenient horizontal or vertical mounting surface; thus, the coupler may be used for automotive, marine, aircraft, or office installations.

The coupler incorporates three tapped loading coils, plus a tapped impedance-matching input autotransformer. By proper selection of the various taps, a single-wire antenna, between approximately 15 and 35 feet in length, can be matched to the 50-ohm output of a transceiver on any frequency between 2 and 9 MHz. Two 50 ohm co-axial connectors (SO239) on the ETA/4 can be connected to the internal-switch wafers to match two 50-ohm resonant dipole antennas, if desired. To aid in selecting the correct coil taps, the coupler contains an internal current-sensing transformer and a diode detector. A high-impedance voltmeter is connected to the detector output, and different coil taps are selected to obtain a maximum voltmeter reading.

A satisfactory antenna for multi-frequency use with the ETA/4 antenna coupler is a single-wire (inverted "L") antenna with a total length of slightly less than a quarter wavelength at the highest operating frequency; then, the ETA/4 coupler can be adjusted to add sufficient inductance to resonate the antenna at the lower frequencies.

The Genave Model ETA/4 antenna coupler, when used to match a single-wire antenna to the 50-ohm output of a transmitter, will perform as efficiently as the commonly used Pi network - and it eliminates the large number of variable capacitors which would be required for 10-channel operation.

A 10-position stepping solenoid in the ETA/4, actuated by 14 volts from the channel-selector switch in the companion transceiver, positions three switch wafers to select proper coil taps for each of 10 discrete frequencies. One wafer selects taps on the impedance-matching autotransformer; a second wafer supplies RF input to the appropriate loading coil tap, while the third wafer connects the antenna-feedthrough terminal to the desired loading coil output tap.

A momentary push-button switch, mounted on the printed-circuit board in the coupler, provides a convenient method of keying the transmitter while making antenna-coupling adjustments.

1-3. SPECIFICATIONS

Channels	10 (maximum)
Channeling Voltage	13.6 VDC (supplied by external switched source).
Maximum RF-Input Power	100 Watts.
Input Impedance	50-Ohm (SO239)
Output Terminals	Two 50-Ohm (SO239) One High-Voltage Feedthrough, Variable Impedance: 5 - 100-Ohm Resistive 0 - 1,000-Ohm Reactive
Dimensions	5 Inches (12.7 cm) High 7 Inches (17.78 cm) Wide 5 Inches (12.7 cm) Deep
Weight	2 lbs. (4.4 Kgm)

1-4. EQUIPMENT SUPPLIED

a. 1----ETA/4 Antenna Coupler
b. 2----Mounting Bracket
c. 4----#10-32 x 1/2" Pan Head Screw
d. 4----#10 Lockwasher, St. Steel
e. 5'---Belden H.V. Cable
f. 1'---Belden #22 Gage Multi-conductor Cable (Coil Jumpers)
g. 22----Molex Terminals (Coil Jumpers)
h. 1----Connector Plug, consisting of following:

   (1) Amp. Plug
   (1) Amp. Shell Cover
   (1) O-Ring Gasket
   (12) Amp. Male Pins

i. 1----Warranty Card

1-5. EQUIPMENT REQUIRED, BUT NOT SUPPLIED

a. Antenna System
b. Co-axial Connector(s), PL-259
c. Co-ax for RF Input, and #22 Gage Wire for Coupler Switching Cable

SECTION II

INSTALLATION MANUAL

2-1. INTRODUCTION

Due to the many variables encountered in antenna systems, such as antenna height, length, ground system, etc., it is not possible to preset the coupler at the factory during manufacture; therefore, each coupler must be installed and adjusted with the equipment with which it will be operated.

2-2. PRELIMINARY INFORMATION

Loading reactive antenna systems with the ETA/4 consists of jumpering the loading coils to form three different configurations, depending on the operating frequency and antenna length. To simplify coupler "programming," refer to Table 1 for operating frequency and antenna length versus loading-coil configuration. This Table is an approximation only to aid in selecting the proper loading coil, and does not represent absolute values; therefore, variations may occur, depending on antenna height, ground system, etc.

Coil Configuration #1 -- Consists of L402 in series with L403 (coil taps D through G, see ETA/4 schematic). This configuration gives maximum value of inductance (82 - 45 µH), and is used to resonate antennas in the 2 to 4 MHz range.

Coil Configuration #2 -- Is the same arrangement as #1 above, except the output is taken off at tap point F (coil taps D through F, see ETA/4 schematic). This arrangement gives inductance values of approximately 50 - 15 µH, and is used to resonate antennas in the 2 to 6 MHz range.

Coil Configuration #3 -- Consists of L404 (coil taps B through A, see ETA/4 schematic). This arrangement gives the lowest values of inductance, and is mainly used to resonate antennas to the upper frequency range (6 to 9 MHz); however, it can be used on the middle and lower frequency ranges when the antenna length becomes greater than 30 feet.

The ETA/4 coupler is also equipped with two co-axial connectors to which resonant antennas (dipoles, 1/4 wave verticals, etc) with a radiation resistance between 10- and 100-ohms can be matched. Normally, these connectors are used when a single-antenna system cannot be resonated over the entire frequency range to be covered.

NOTE: A standard marine fiberglass vertical antenna (23 - 26 feet) normally can be resonated over the entire 2 to 9 MHz frequency range with the ETA/4.

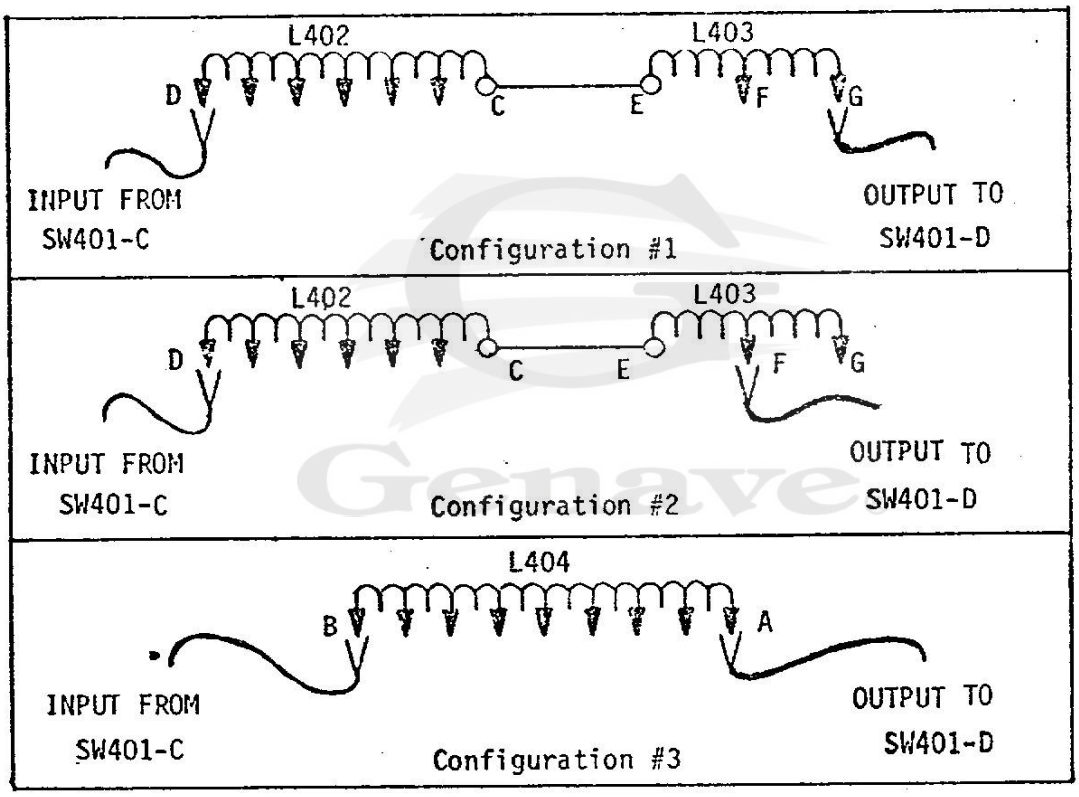
TABLE 1. FREQ/ANT. LENGTH VS COIL CONFIGURATION

Ant. Length (Includes Feedline)

Frequency MHz

	10'	15'	20'	25'	30'	35'
2-3		*1	1	1 & 2	1 & 2	2
3-4	1	1 & 2	2	2	2 & 3	2 & 3
4-5	2	2	2	2 & 3	2 & 3	3
5-6	2	2 & 3	3	3	3	3
6-7	3	3	3	3	3	3
7-8	3	3	3	3	3	**
8-9	3	3	3	3	**	

* High End of 2 MHz Band
** Ant. Should Be Self-Resonant
In This Frequency Range



2-3. ETA/4 COUPLER INSTALLATION

After the companion transmitter/transceiver has been installed in the desired location, the ETA/4 can be installed following the steps listed below. Figures 2-1 through 2-4 in this Section illustrate some typical antenna and coupler installations.

1. Remove six screws retaining top cover to the ETA/4; then, carefully remove cover, being careful not to damage gaskets.

2. Secure two mounting brackets to bottom of ETA/4 - holes in the coupler are located so the brackets can be mounted in line with, or at right angles to, the longitudinal axis of the coupler.

3. Mount antenna coupler in desired location on any convenient horizontal or vertical mounting surface; position coupler for greatest ease in adjusting coil taps, and for connecting antenna.

4. Using #22 wire or multi-conductor cable, and the two plugs supplied with the ETA/4 and its companion transceiver, fabricate the coupler switch cable as shown in Figure 2-5.

5. Connect the coupler switching cable and RF cable between the transceiver and ETA/4; connect antenna(s) to ETA/4, and connect relatively high-impedance voltmeter to red binding-post/jack on coupler. A Simpson Model 260, or equal, is recommended.

   NOTE: Do NOT attempt to use a digital voltmeter with the coupler, as the RF field in the vicinity of the coupler will prevent obtaining a reliable DVM reading.

6. Program the ETA/4 coupler to resonate the antenna(s) on each operating frequency, using the information given in Table 1 and in PROGRAMMING PROCEDURES, Section 2-4.

7. After the ETA/4 has been programmed for each frequency, disconnect the voltmeter, and re-install gasket and top cover - securing cover with the six screws removed in step 1. above.

   CAUTION: Extremely high voltages are present in the coupler during transmission; therefore, the top cover must be well-sealed to keep out moisture, and thus reduce possibility of internal arcing.

8. The antenna coupler installation is now complete, and is ready for service.

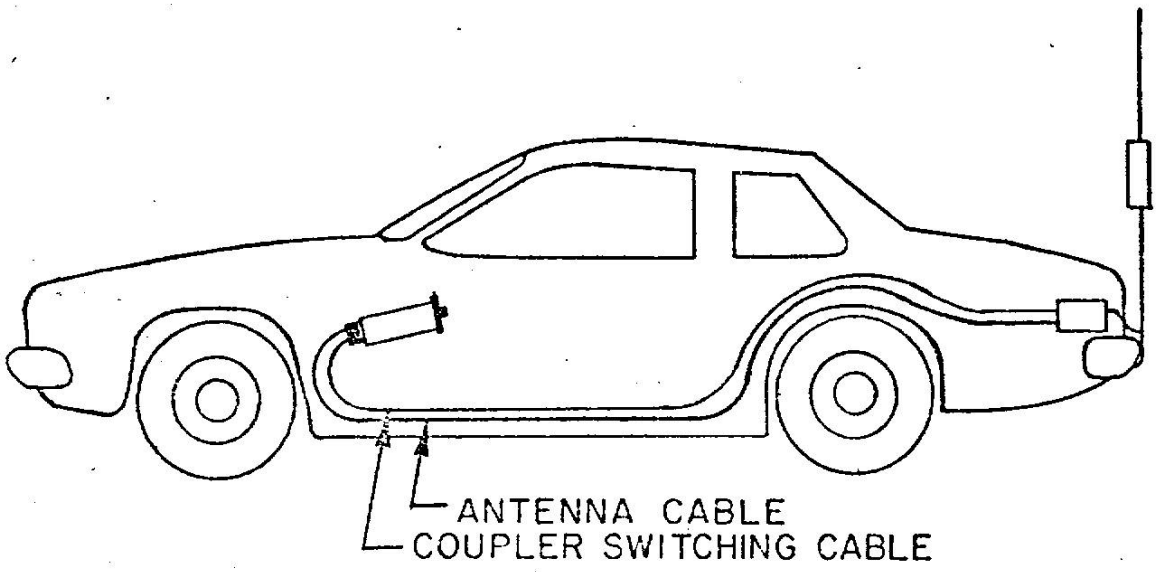


Figure 2-1
Automotive Multiple-Frequency Installation

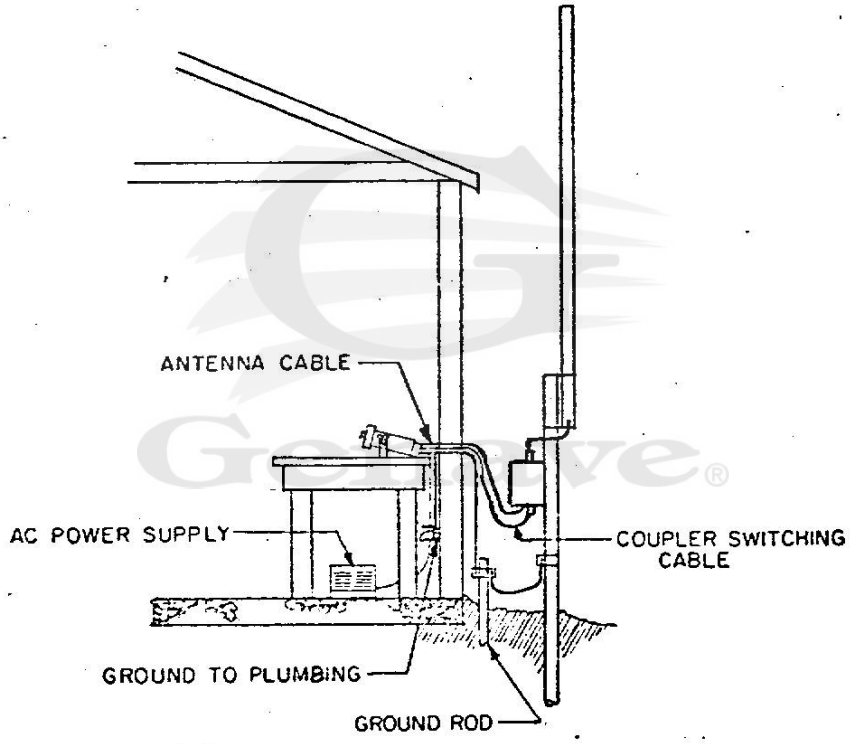


Figure 2-2
Multiple-Frequency Fixed Antenna

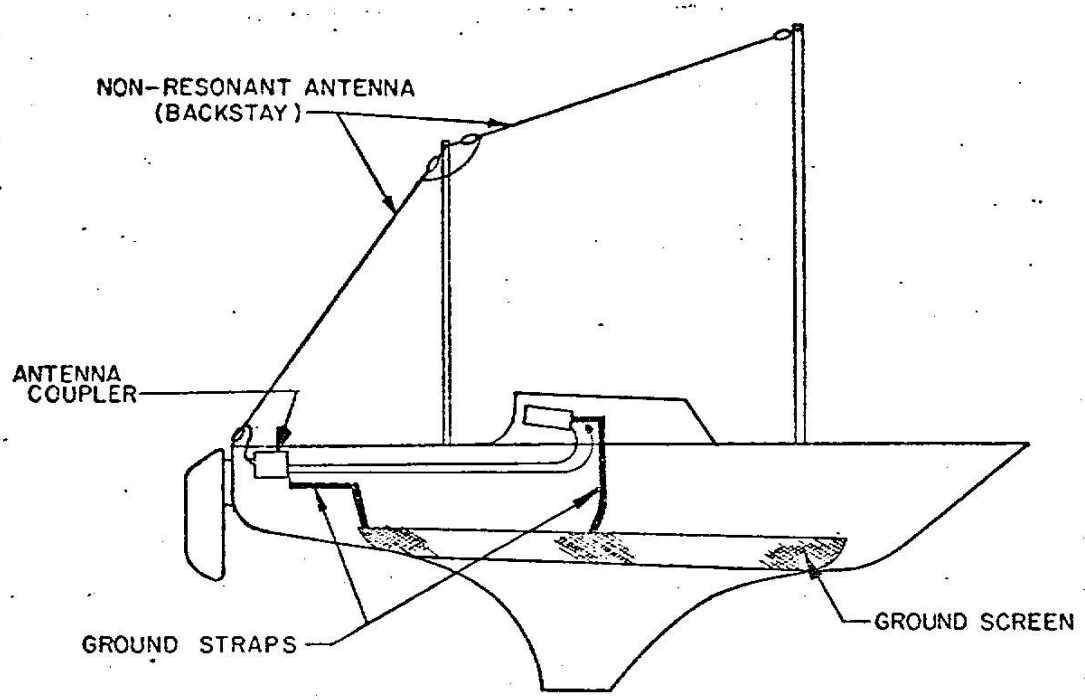


Figure 2-3
Sailboat Installation

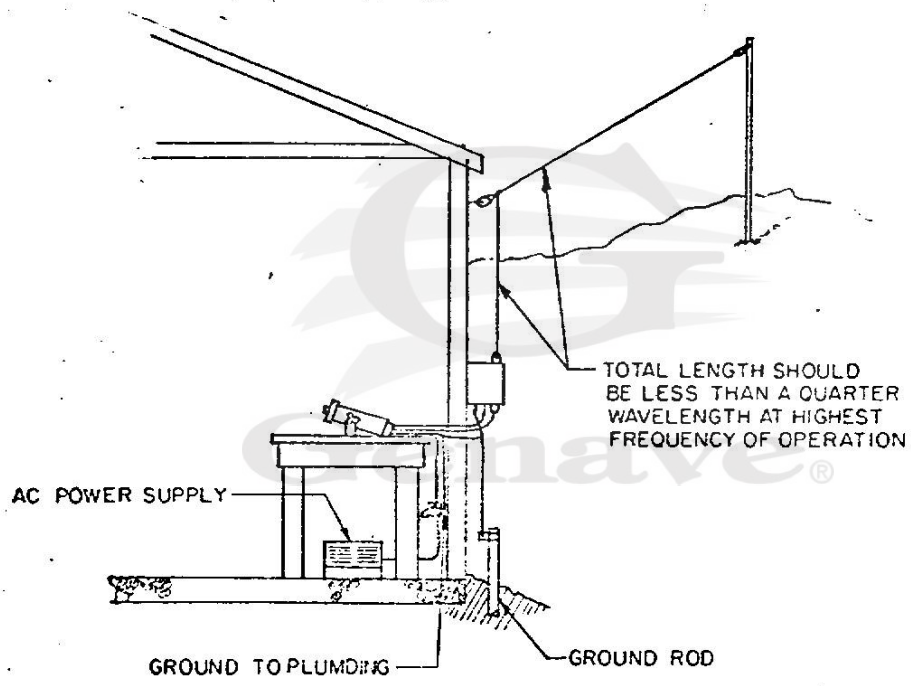


Figure 2-4
End-Fed Antenna Installation

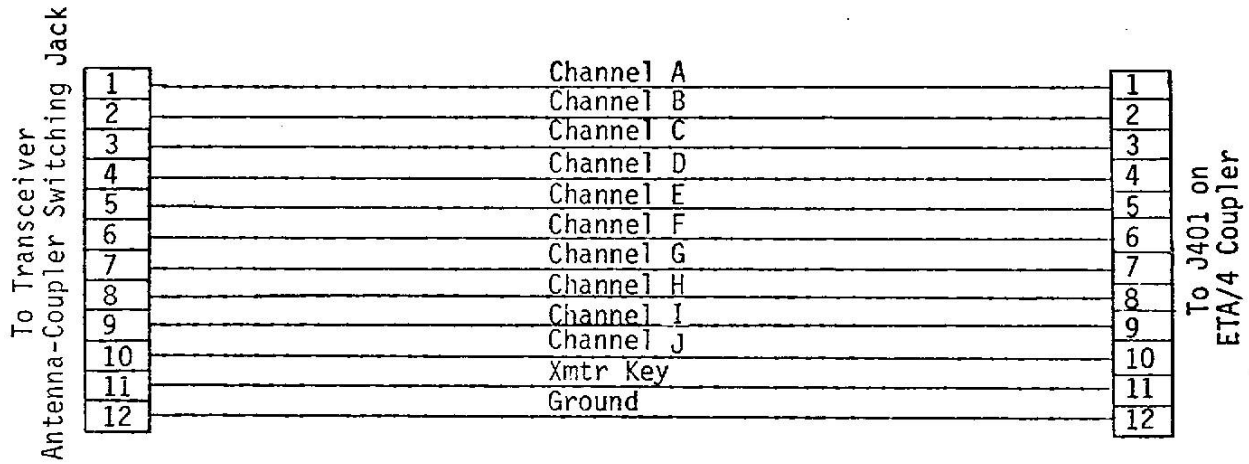


Figure 2-5. Coupler Switching Cable.

2-4. PROGRAMMING PROCEDURES

First, the procedure for preparing the switch-to-coil jumpers is outlined; then, "loading a reactive antenna" is explained, followed by a procedure for "loading resonant antennas."

1. Determine how many channels are to be used, and the frequency of each channel.

2. Determine length of non-resonant antenna to be used. Refer to Table 1 for guidance on selecting loading coil(s) to use, considering channel frequency and antenna length.

3. Switch wafer SW401-B selects taps on the impedance-matching autotransformer. Because of the difficulty in reaching this wafer, the jumper wires have been pre-wired to it using the standard resistor-capacitor color code for the channels. I.e. brown is channel A (1), red is channel B (2), orange is channel C (3), etc. Solder one of connectors supplied with ETA/4 on free end of each SW401-B channel wire to be used.

4. Switch wafer SW401-C supplies RF input to the appropriate loading coil. To prepare these jumpers, cut a 6-1/2 inch length of #22 hook-up wire for each channel to be used; solder a connector to one end, and strip 1/4 inch of insulation from the other end. Solder one of these jumpers to each SW401-C terminal to be used, using color code as in step 3. See Figure 2-6 for terminal locations on SW401.

5. Switch wafer SW401-D connects the antenna feed-through to the desired output point on the loading coil(s). Since Table 1 is an approximation and variations probably will occur, make a temporary jumper using 6 inches of the H.V. wire supplied with the ETA/4 and two small alligator clips. This jumper allows a terminal of wafer switch SW401-D to be connected easily to different loading coil configurations to resonate the particular antenna. This jumper lead will be used in step 4 of "Loading a Reactive Antenna."

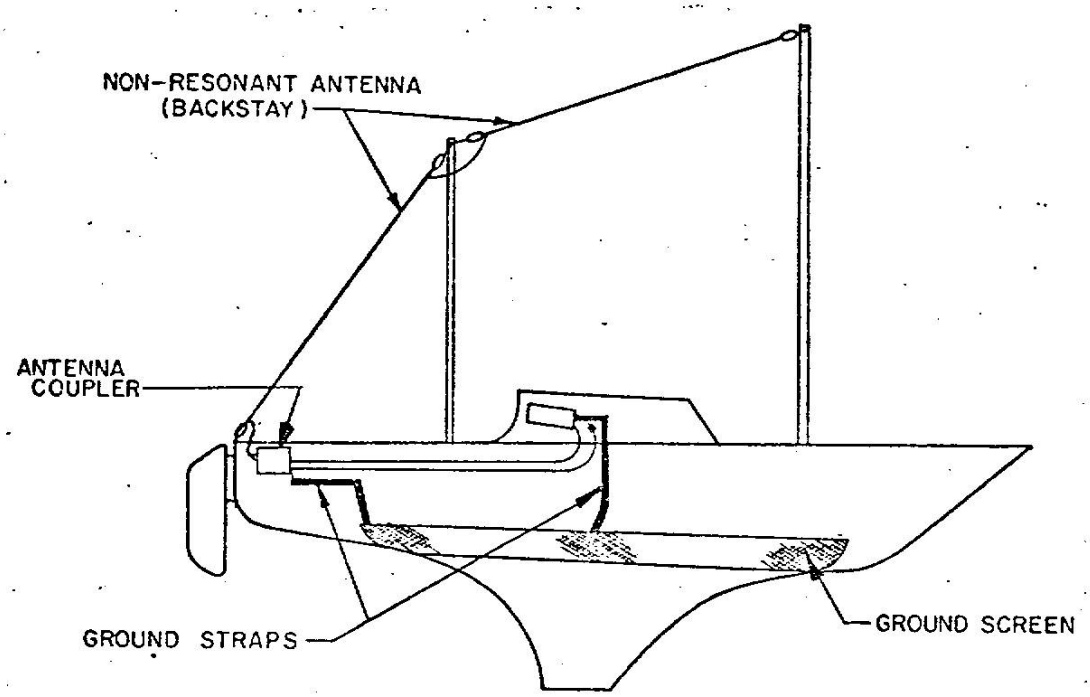
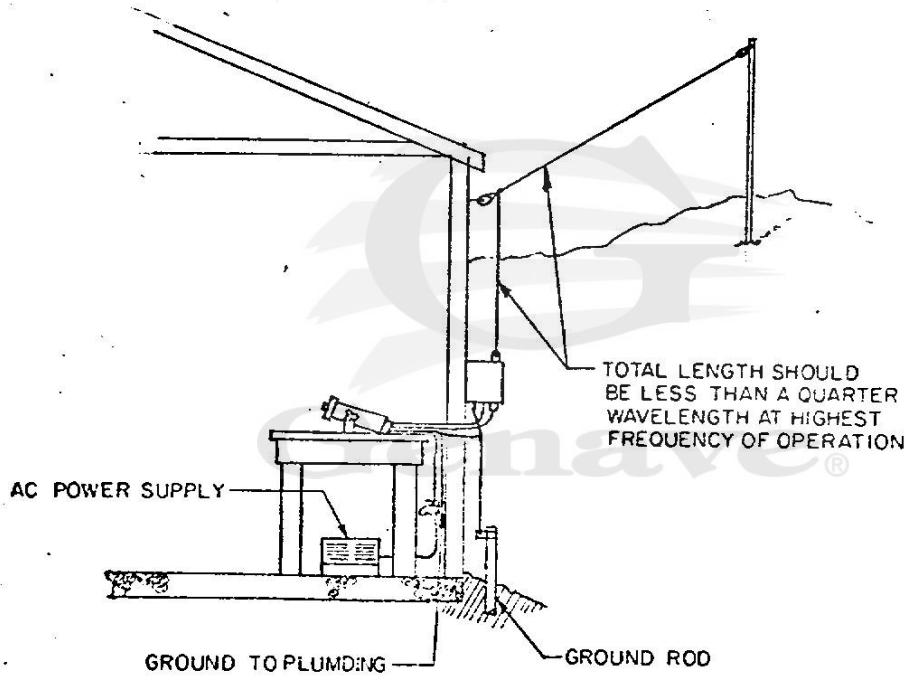


Figure 2-3
Sailboat Installation



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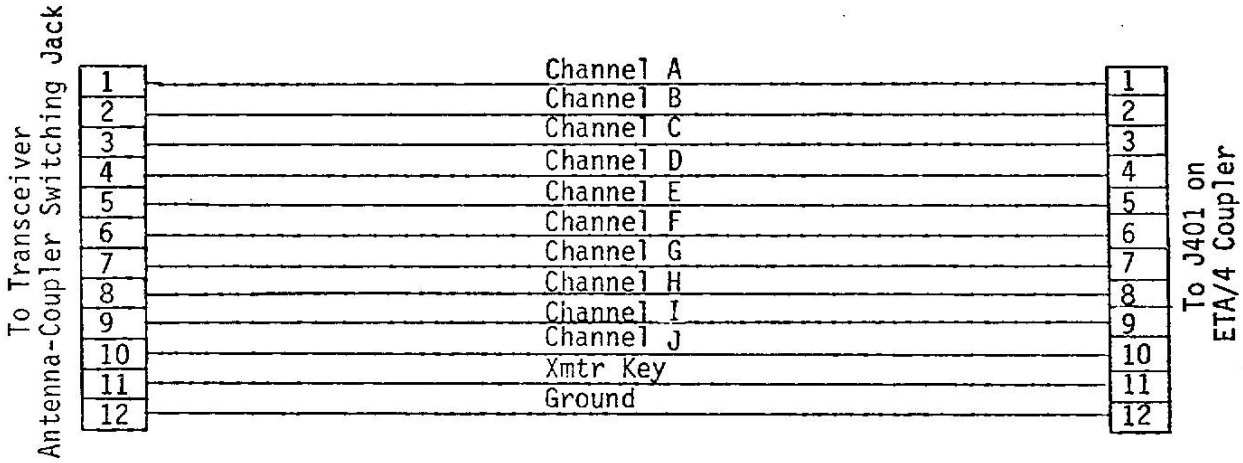

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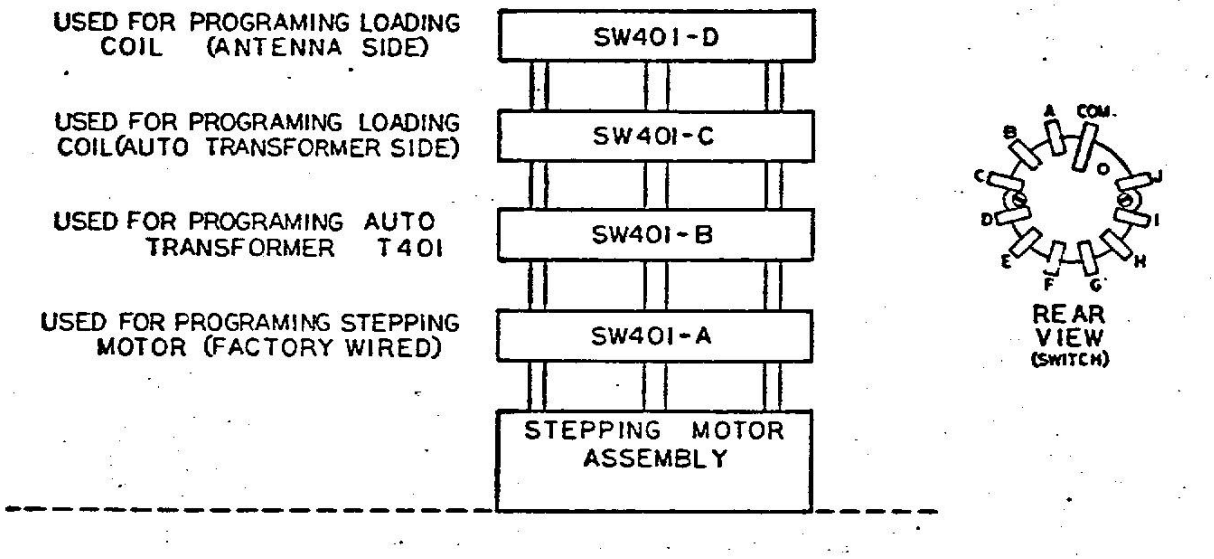


Figure 2-6. Stepping Solenoid Wafers

2-4-1. Loading a Reactive Antenna

After the coupler has been installed (Section 2-3) and the coil jumpers prepared (Section 2-4), resonate the antenna on each operating frequency by following steps listed below:

1. Set transceiver channel selector to Channel A (or to channel to be adjusted). This will automatically position ETA/4 switch wafers to proper channel.

2. Connect wire attached to Channel A (or channel being setup) terminal on wafer SW401-B to pin 3 on autotransformer T401.

   NOTE: Wires from wafers SW401-B and SW401-C are color coded according to channel designations: Brown for Channel A; Red for Channel B; and Orange for Channel C; etc.

3. Connect wire attached to Channel A (or channel being setup) terminal on wafer SW401-C to maximum inductance point of loading coil being used. That is, tap point D for loading coil configurations 1 and 2, or tap point B for loading coil #3.

4. Use the temporary H.V. jumper to connect Channel A (or channel being setup) terminal on wafer SW401-D to top of loading coil being used: Tap point G for coil configuration #1; tap point F for configuration #2; or tap point A for loading coil #3. Refer to Table 1. Connect voltmeter as given in Section 2-3, step 5.

WARNING: To avoid contact with possible High-Voltage RF in the following steps, always release remote momentary "key" switch before changing taps on loading coils.

5. Key transmitter with remote switch SW402, located on ETA/4 P-C Board, and note reading on voltmeter. This reading will probably be low, but will increase gradually as wire from SW401-C is moved from tap to tap on the loading coil; continue to try different taps until maximum antenna current is indicated on the voltmeter.

   NOTE: If antenna current is still on the increase at the minimum or maximum inductance tap on loading coil being used, try loading coil with the next lower or next higher inductance. If none, the antenna may be too long or too short for the ETA/4 to resonate.

6. After finding correct tap on the loading coil, the next step is to locate correct impedance tap on autotransformer T401. Move wire from pin 3 on T401 to a higher pin number on T401 - each time keying transmitter to check voltmeter reading. The correct point on T401 is the pin which delivers maximum antenna current.

7. Verify tap position on loading coil by moving connector (from SW401-C) to either side of present tap until maximum antenna current is shown on voltmeter. Find best combination of taps for autotransformer and loading coil which will deliver maximum antenna current. This may require moving tap back and forth on autotransformer T401.

   NOTE: Some taps on autotransformer T401 will be used on more than one frequency. To facilitate setting up channels, record which tap on T401 is used on channel just setup; then temporarily disconnect this lead from T401. After loading antenna on last channel reconnect all leads from wafer SW401-B to correct tap points on T401 as follows: When more than one lead connects to a single tap point, place one lead connector on this pin; then clip off connectors from remaining leads and solder leads directly to tap point.

8. After finding proper coil configuration to resonate antenna on channel being set up, remove temporary H.V. jumper installed in step 4 and replace it with H.V. wire supplied with ETA/4 - solder wire to correct terminal on wafer SW401-D and use connector on coil-end of wire.

   NOTE: Coil taps G, F, or A may each be used on more than one frequency. In this event, use jumpers between the appropriate terminals on wafer SW401-D.

9. Proceed to resonate antenna on next channel, using procedures outlined in steps 1 through 8 above.

2-4-2. Loading 10 Ω - 100 Ω Resonant Antennas

After the coupler has been installed (Section 2-3), load the resonant antenna(s) on appropriate frequency(ies) by following steps listed below:

1. Connect antenna to one of the two co-axial connectors (SO-239) provided on the ETA/4; set transceiver to desired channel.

2. Connect voltmeter to ETA/4 red binding-post as given in Section 2-3, step 5.

3. Connect wire attached to desired channel terminal on wafer SW401-B to tap point 9 on autotransformer T401. See Figure 2-6 for terminal locations on stepping switch SW401.

4. Add a wire from correct channel terminal on wafer SW401-C to co-axial connector (J403 or J404) desired.

5. Key transmitter with remote switch SW402, located on ETA/4 printed-circuit board, and note reading on voltmeter. Move wire connected to T401 pin 9, in step 3 above, from tap to tap until maximum antenna current is noted on the voltmeter.

6. If a second resonant antenna is to be used with the ETA/4, repeat steps 1 through 5 of Section 2-4-2 for this channel.

7. Proceed with step 7 of the ETA/4 Coupler Installation (Section 2-3).

SECTION III
OPERATING MANUAL

3-1. OPERATING INSTRUCTIONS

After the ETA/4 has been properly installed and programmed to load the antenna(s) on each operating frequency, the operation of the antenna coupler is fully automatic; therefore, no attention or adjustments are required of the operator. A channeling voltage, supplied by the channel-selector switch in the companion transmitter/transceiver, causes internal switching in the ETA/4 to automatically provide proper antenna tuning on each operating frequency.

SECTION IV
MAINTENANCE MANUAL

4-1. INTRODUCTION

The Model ETA/4 antenna coupler, designed for long trouble-free operation, should require little attention in the field. The antenna-current readings for each channel should be checked periodically, and compared with previous readings; then, any degradation of performance will become apparent.

Routine maintenance procedures will consist primarily of a visual inspection and cleaning, if necessary, of the antenna, coupler, and ground system. Note particularly any loose or corroded connections in the installation. Since type of service and environmental conditions will vary with each application, maintenance scheduling is left to the discretion of the licensee/user.

4-2. THEORY OF OPERATION

The ETA/4 antenna coupler provides a convenient and efficient method of coupling a 15 to 35 foot single-wire antenna to the 50-ohm output of a transmitter/transceiver within the frequency range of 2 to 9 MHz. Internal switching automatically provides proper antenna tuning on each operating frequency, up to a maximum of ten channels. Any fairly high-impedance voltmeter can be connected to Tuning Indicator terminals on the ETA/4 to measure relative antenna current on each channel. Easy to use push-on terminal connectors allow proper taps to be selected on ETA/4 loading coils to resonate antenna on each operating frequency.

Refer to the ETA/4 antenna coupler schematic in conjunction with the following circuit description.

4-2-1. Channel Selection

The channel-selection circuit consists of a 10-position stepping solenoid which positions four switch wafers, a transient-suppression diode, and a 12-pin coupler-switching cable receptacle.

The schematic shows channel "A" selected by the stepping solenoid. To change the coupler to channel "C," apply 13.6 VDC to pin 3 of receptacle J401; this voltage is then connected through "open-circuit seeking" wafer SW401-A and normally-closed SW401 to the stepping-solenoid coil. The solenoid armature now starts to advance, opening switch SW401. As the armature completes the first step (channel "B"), SW401 again closes applying voltage to the solenoid coil. The solenoid armature again advances one step, to channel "C"; however, when SW401 closes, no voltage will be applied to the stepping coil since wafer SW401-A is in the "open-circuit" position. The stepping solenoid will remain at channel "C" until 13.6 VDC is applied to a different pin on receptacle J401; then, the solenoid will advance to the appropriate channel.

Diode CR402 is connected in parallel with the stepping-solenoid coil; when a positive voltage is applied to the coil, CR402 is reverse biased and has no function in the circuit. As switch SW401 opens during channeling, the magnetic field sur-

rounding the coil collapses - inducing a reverse-polarity voltage in the coil, which forward biases CR402. The low-impedance path provided by the diode prevents a high-voltage spike from being developed across the stepping solenoid coil.

4-2-2. Impedance-Matching Autotransformer

The impedance-matching circuit consists of the input co-axial connector J402, autotransformer T401, and wafer switch SW401-B.

RF input from a transmitter having a 50-ohm output impedance is applied through J402 to tap point #7 on autotransformer T401. Jumper wires, terminated in push-on connector clips, are soldered to the various terminals (A-J) on wafer SW401-B; the jumper for each terminal (operating channel) is then connected to the appropriate tap point on autotransformer T401 to match the antenna impedance to the transmitter. tap points 1 through 7 are for antennas of 50-ohms or less, while tap points 7 through 9 are for 50-ohms or greater. The "common" terminal of wafer SW401-B connects the RF signal to the loading coil(s) through the tuning indicator circuit.

4-2-3. Tuning-Indicator Circuit

The tuning-indicator circuit consists of current-sensing transformer T402, detector CR401, detector load and filter R401/C401, the binding post/jack and grounding screw for attaching a voltmeter to read the relative antenna current.

The RF signal flows from the common terminal on wafer SW401-B through the primary of step-up transformer T402 to the common terminal on loading-coil wafer SW401-C. When the antenna is properly resonated, maximum current will flow in this circuit - resulting in maximum RF voltage being developed across the secondary of T402. The RF signal across the secondary of T402 is rectified by positive detector CR401, and produces a DC voltage across load resistor R401. The external voltmeter used to read the antenna current is connected in parallel with detector load resistor R401; therefore, the greater the RF current flowing in the antenna circuit, the higher the DC reading on the voltmeter. Regardless of the antenna type, the applicable coil taps are selected to deliver maximum reading on the voltmeter.

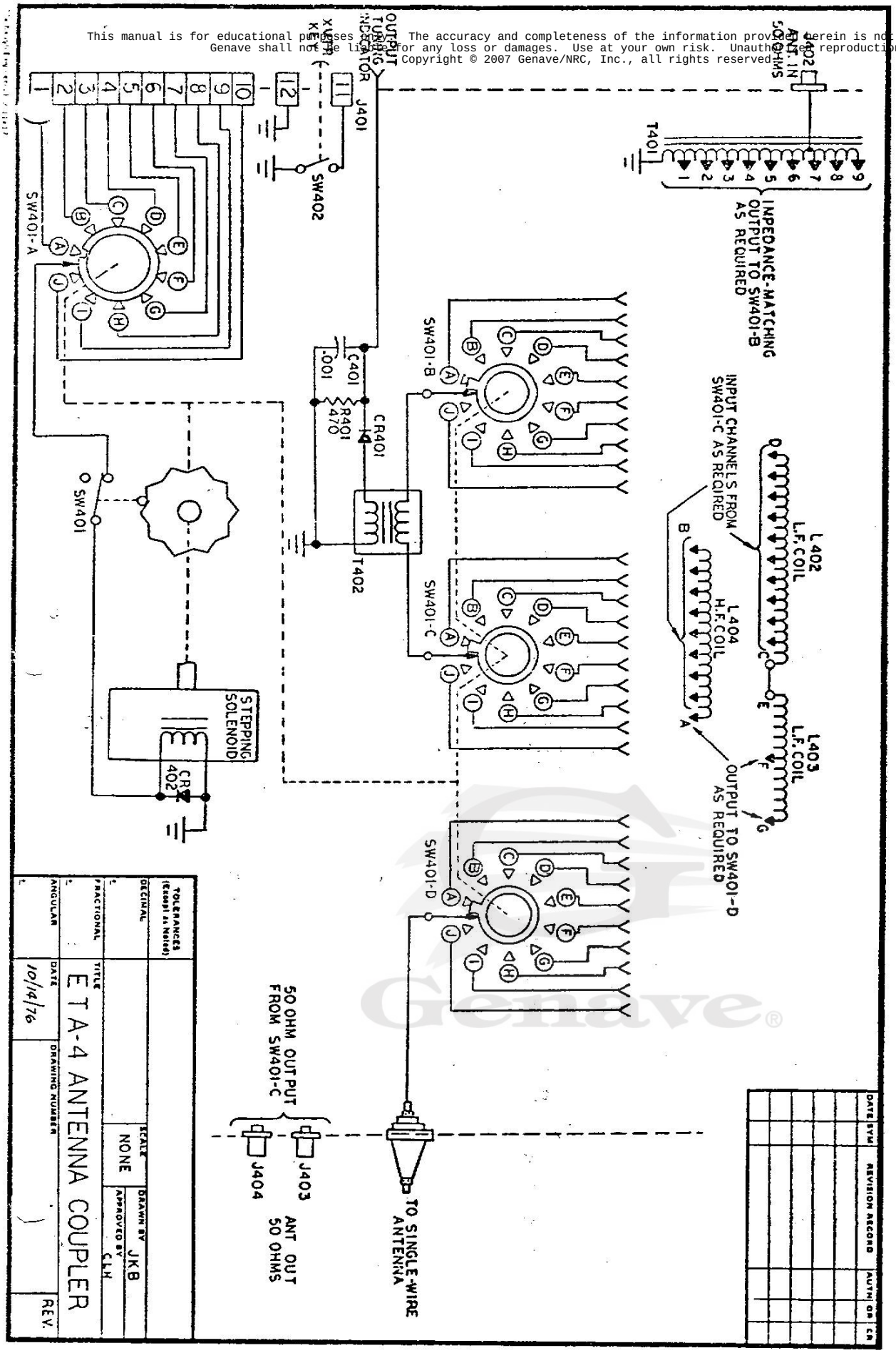
4-2-4. Antenna Loading Coils

Three "tapped" coils (L402, L403, and L404) are used to load non-resonant antennas between 2 MHz and 9 MHz. L402 and L403 are connected in series, and give inductance values between 15 and 82 µH, depending on the tap points used. L404 gives the lowest values of inductance, and normally is used at the higher frequencies.

RF input from the impedance-matching circuit is applied to the "Common" terminal on switch wafer SW401-C. Jumper wires, terminated in push-on clips, then connect the RF from the operating-channel terminal on SW401-C to the desired input tap on loading coil L402 or L404. The input tap (between "D" and "C" on L402/L403; between "B" and "A" on L404) is selected to resonate the antenna at the operating frequency, and thus provide maximum antenna current.

NOTE: For a resonant antenna, such as a 50-ohm dipole, the jumper wire from the appropriate operating-channel terminal on SW401-C is connected to co-axial connector J403 or J404, instead of to the loading coils.

RF output from the proper loading coil (tap point "F" or "G" on L402/L403; tap "A" on L404) is connected via a high-voltage jumper to the operating-channel terminal on wafer SW401-D. The "common"terminal on SW401-D connects the RF output to the single-wire antenna high-voltage feedthrough insulator.



SECTION V
PARTS LIST

Reference Number	Genave Part No.	Description
	CAPACITORS	
C401	1520071	Z5P, Disc, .001 µF, ±10%
	DIODES	
CR401	4810022	1N295
CR402	4810013	General Purpose, 100V, 1A
	CONNECTORS	
J401	2100053	Receptacle, 12-pin
P401	2100054	Plug, 12-pin mates with J401
J402	2100239	Receptacle, co-ax SO239
J403	2100239	Receptacle, co-ax SO239
J404	2100239	Receptacle, co-ax SO239
	INDUCTORS	
L403	5600071	Coil, Antenna Loading
	RESISTORS	
R401	4700021	470 ohm, ±10%, 1/2 W
	SWITCHES	
SW401	5100095	Steppeing Motor Switch
SW402	5100045	Momentary, Pushbutton, 30-1
	TRANSFORMERS	
T401	5600066	Autotransformer
T402	5600070	Transformer, Current Sensing
	MISCELLANEOUS	
--	2510121	Standoff, #8-32, 1/4 x 1.969
--	1700077D	Printed-Circuit Board
--	1870014	Torroid, Core, Epoxy-Coated
--	2100201	Terminal Post
--	2100202	H.V. Feedthrough (Antenna)
--	2510112	Box
--	2510113	Cover
--	2510118	Mounting Bracket
--	2510115	Washer Gasket
--	2510116	Neoprene Gasket