

GENERAL DESCRIPTION

The AC 31 is an HF mobile centre-loaded whip antenna which may be tuned remotely from a control position on any frequency within its two octave tuning range. The system consists of three units: the antenna unit proper, the SWR sensor unit, and the control head with interconnecting cables.

The antenna unit proper consists of three main sections: the whip, the body, and the base. The body consists of a strong outside fiberglass tube and a thin-walled inner tube on which the tuning coil is wound. A core composed of powdered iron and copper tuning slugs is moved within this coil by a DC motor and gear drive in the base tube.

The motor drive consists of a permanent magnet DC motor and two nylon reduction gears turning a threaded rod. A block riding on the threaded rod is coupled to the tuning slug by an insulated pushrod. Travel of the block is limited to seven inches by light switches which break the power to relays in the control unit, which control the power to the motor. A loop of nichrome wire is mounted so that as the block moves on the threaded rod a shorting contact changes the resistance of the circuit.

The motor drive and coil assembly slides into the base tube and body of the antenna and is sealed and anchored by tightening three screws which expand a rubber gland at the bottom of the base tube.

The control unit has a frequency scale for approximate tuning and an SWR scale for fine tuning. The variable resistance in the antenna forms one arm of a bridge circuit in the control unit. The circuit provides a reading related to the tuning slug position, so the meter can be calibrated directly in frequency. Fine tuning is accomplished by switching to an SWR scale on the same meter. The meter is then operated by an external SWR detector placed in the coax line to the antenna. This detector has constant sensitivity over the antenna's frequency range and once set-up for an installation requires no further adjustments.

The control unit has a transistorized motor speed control circuit. The initial or low motor speed is set by R-13.

After about half a second C1 has charged through constant current diode D3 to a point where D2 conducts, and the motor rapidly reaches full speed. When the ANT. TUNE switch is released, C1 discharges rapidly so it is possible to get sustained low speed for fine tuning by tapping the ANT. TUNE switch.

When the antenna is used to receive only, or monitor the receive frequency of a cross-band channel, the antenna may be tuned for maximum noise or signal or for maximum receiver "S" meter reading.

A. GENERAL

Tuning Range: Four standard models available.

<u>Model</u>	<u>Range</u>	<u>VSWR</u>
AC-31-A	1.6 to 6.5 MHz.	1.2 to 1 or better
AC-31-B	2 to 8 MHz.	1.2 to 1 or better
AC-31-C	2.3 to 9.1 MHz.	1.2 to 1 or better
AC-31-D	3.5 to 13.4 MHz.	1.5 to 1 or better

RF Power Input: Maximum 60 watts AM, 120 Watts SSB.

Input Impedance: 50 ohms

DC Power Requirements: 24-28 v DC, or 12-15 v DC, .75 amps max. current.

Control Functions: FREQ. - SWR switch
 ANT. - TUNE switch
 Frequency Range - VSWR meter.

Air Speed: Tested to 250 MPH with a 50% safety factor
 - see environmental capabilities.

B. DIMENSIONS AND WEIGHT

Control Unit	5 3/4" x 2 1/4" x 4 3/4", weight 1 lb, 4 oz.
VSWR Sensor	3 7/8" x 2 11/16" x 2 1/4", weight 5 1/2 oz.
Antenna Unit	10' 2" x 2" at the base, weight 5 lbs.
Shipping Length and Weight	5' 6" x 15 lbs.

C. ENVIRONMENTAL

Under the following environmental conditions, the AC-31 antenna will operate satisfactorily with no discernible degradation of performance.

Temperature - 30 deg. C to \pm 50 deg. C.

Vibration Circular, 10 to 60 Hz., .02" deflection,
4 hours duration.

C. ENVIRONMENTAL (continued)

Air Speed Static test equivalent to 250 MPH with a 50% safety factor, and with the antenna inclined 30 deg. in the direction of air flow.

Resonant Frequency. Natural, 5.9 to 6.6 Hz depending on position of internal tuning mechanism.

Aerodynamic Drag. With antenna inclined 30 deg. in the direction of air flow, with the mounting base inside the aircraft.

Drag in Lbs.

Altitude	250 MPH	200 MPH	150 MPH
Sea Level	45.2	28.8	16.4
5000'	38.8	24.8	14
10,000'	33.2	21.3	12

Drag may be reduced by increasing the angle of the antenna until at a fully horizontal position, drag will be reduced to approximately 2.5% of the figures given above.

A. Location and Mounting of Units

1. The antenna unit should be mounted on the vehicle so that all of the central body and all of the whip is in the clear - away from the metal surfaces of the vehicle. This is the primary consideration - as the above sections of the antenna radiate the power - the central body being as important as the whip in this regard.
2. The metallic base tube and the mounting clamps are the grounding path for the antenna and should therefore have a short direct metal to metal contact with the metal frame of the vehicle. This is important to achieve a low SWR ratio and therefore high efficiency.
3. In addition to the above considerations, one should consider any electrical noise generated in the vehicle and attempt to mount the antenna as far away as is practical from this noise source. If (1) and (2) prevent (3) from being effected, filtering and/or shielding of the electrical interference source is mandatory.
4. The antenna unit is completely weatherproof and may be mounted entirely external to the vehicle body. If the antenna is provided with a drain tube in the base of the lower housing, the antenna should be rotated in the mounting clamps so that the drain is on the bottom. Always mount antenna with tip higher than the base. Where air drag is an important consideration such as for aircraft - the mechanical base section may be mounted inside the aircraft with the body protruding through the skin. Air drag figures are given in the specifications, also see diagrams 1 and 2.
5. On cars, trucks and other similar vehicles, the antenna may be mounted on a reinforced bracket on the rear bumper, or on the side of the vehicle. The antenna body and whip should be as clear as possible from the vehicle body.
6. A suitable "fold-down" or swivel mounting arrangement should be used on land vehicles where damage through striking overhead objects is likely.
7. The control unit should be mounted as convenient to the operator as possible (taking note of the directions of operation of switches and observation of the meter). Preferably the unit should be mounted close to the communications equipment control panel - but if the latter is in an inconvenient position for operator control - place the control unit in the most convenient position.

A. Location and Mounting of Units (continued)

8. The SWR Sensor unit may be mounted in any convenient position for insertion in the transmission line between the transmitter and the antenna unit. It is not weatherproof therefore, mounting should be inside the vehicle where it will remain protected from the elements.

B. Interconnections

1. Refer to diagrams 1, 2, and 3 before attempting installation and hook up of the units.
2. Diagram 1 gives more information on routing of wires, providing weather-proof seals, location of mounting brackets, etc.
3. Diagram 2 is a more detailed presentation of the antenna and mounting clamps.
4. Diagram 3 gives the cable color code versus terminal connection numbers on the control unit and location of potentiometers on the printed circuit board.

5. IMPORTANT NOTE

Before applying power to the control unit, double check the wiring hook up.

The unit is protected against reverse battery polarity, but if the relay control or motor control wires are not connected properly, possible injury to the motor or transistor control circuit could result.

6. The units are shipped with the minus (-) battery terminal grounded to the control head frame.

If the battery system of the vehicle has the positive pole grounded, refer to the AC-31-2 Control Unit Schematic for wiring changes to accommodate a positive grounded system.

7. About nine feet of coax and control cable are supplied with the unit. If this is not long enough for the installation, additional cable may be used of the same sized wire as provided with the unit. This wire size is adequate for a twenty-five foot maximum separation between antenna and control unit. If longer distances are necessary, the wire size will have to be increased to prevent loss of power to the motor. The two wires that go from the SWR detector to the SWR jack on the control unit should be a twisted pair. On aircraft the wires must be #22 or larger, stranded copper wire.

B. Interconnections (continued)

8. The best arrangement is to place the SWR unit and a junction terminal strip just inside the vehicle body where the cables fit through. This allows withdrawal of the antenna unit with the least amount of disruption of the interconnecting cables - See Diagram 1.

C. Adjustments

9. After installation is complete, check the FREQ. - MHz. scale of the control unit. If the meter is out more than 10% on the end points of the scale, adjustment of the end points should be made - see special adjustment section.

IMPORTANT NOTE CONCERNING AIRCRAFT INSTALLATIONS

Wherever possible, the AC-31 Antenna should be installed in accordance with with the aircraft manufacturer's design requirements. When details of such requirements are not available, it is recommended installation be made in accordance with some relevant specification such as U.S. Military Specification MIL-A-7772B. In all cases plans of the installation should be submitted to the local Government Aeronautical Engineering Authority for approval.

10. SWR Meter Calibration

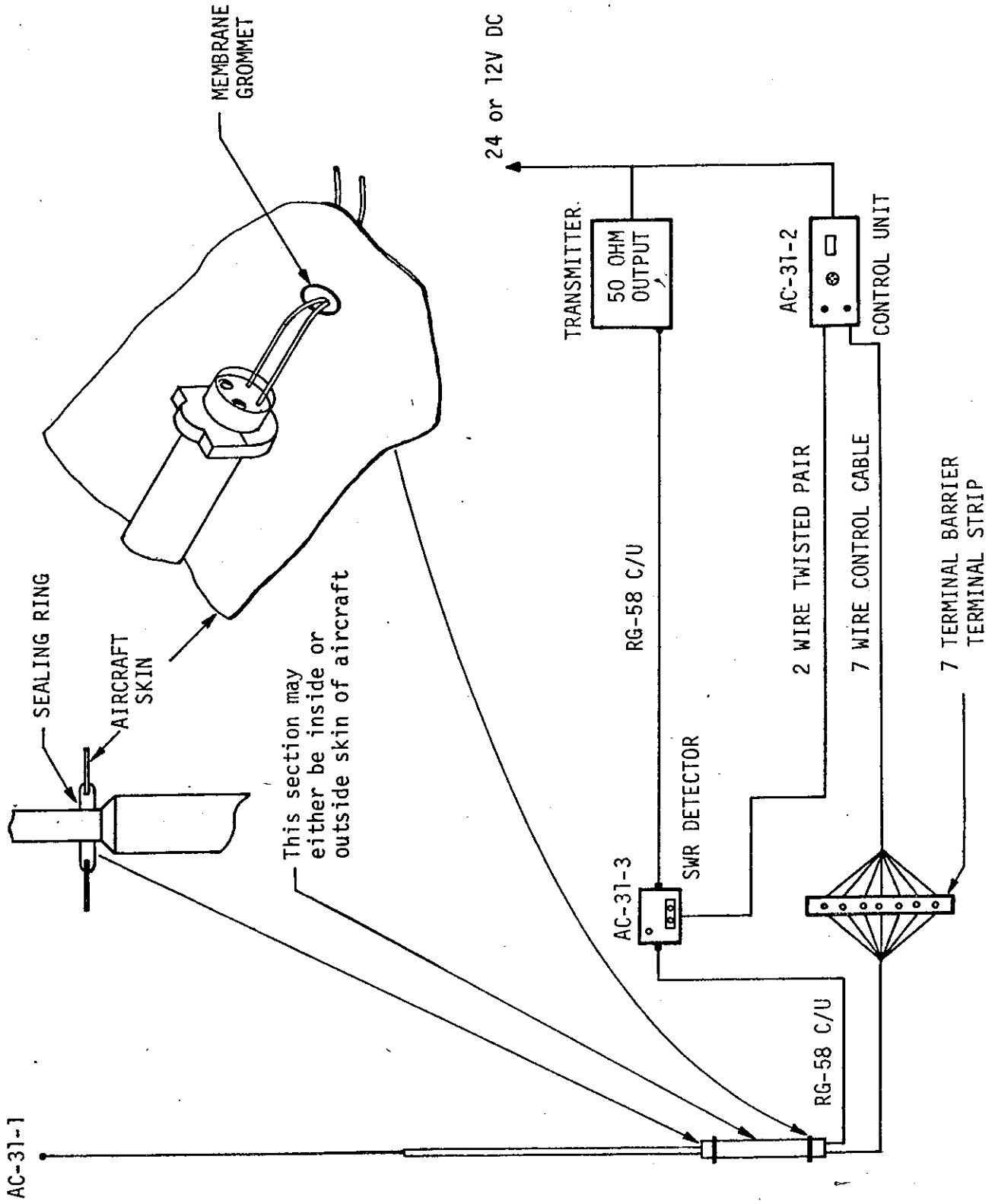
- (a) The transmitter should be tuned and loaded correctly to a 50 Ω dummy antenna load.
- (b) Connect the SWR sensor between the transmitter and 50 Ω load in the reverse direction from that shown on the SWR sensor unit (i. e. transmitter to LOAD, and dummy antenna to TRANS.)
- (c) Turn the SWR SENS. potentiometer on the control unit to maximum CCW.
- (d) Throw the FREQ. - SWR toggle switch to SWR.
- (e) Key the transmitter and adjust SWR SENS. potentiometer until the meter reads to 'SET' on the SWR scale.

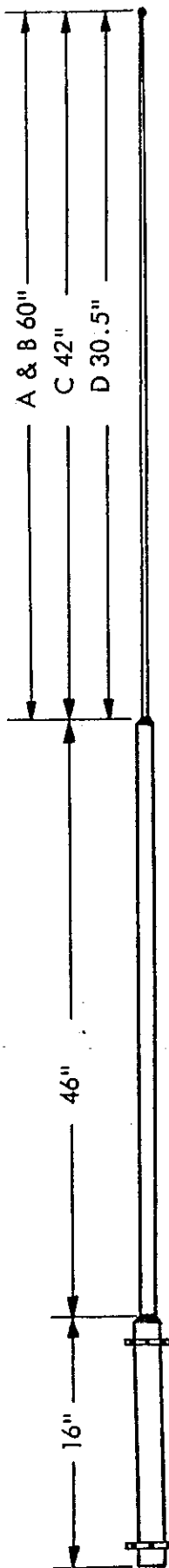
The SWR meter will read to 'SET' on all channels if the transmitter output power is the same.

CAUTION: Do not turn CAL adjustment on SWR sensor unit.

- (f) Disconnect the transmitter and 50 Ω load from the SWR sensor, and reconnect in the correct way, transmitter TRANS. connector, antenna to LOAD connector.
- (g) The system is now ready to use. For antenna tuning procedure see OPERATION section.

SYSTEM - DIAGRAM 1





Body
 1 1/8" O.D. Fiberglass
 Tubing

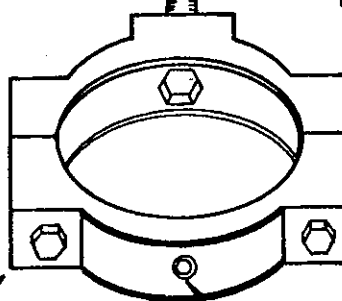
Base Tube
 2" O.D.
 Alum.



Self Locking Nut (5/16 x 24)



Mounting Bolt (5/16 x 24)
 1 1/2" in Length

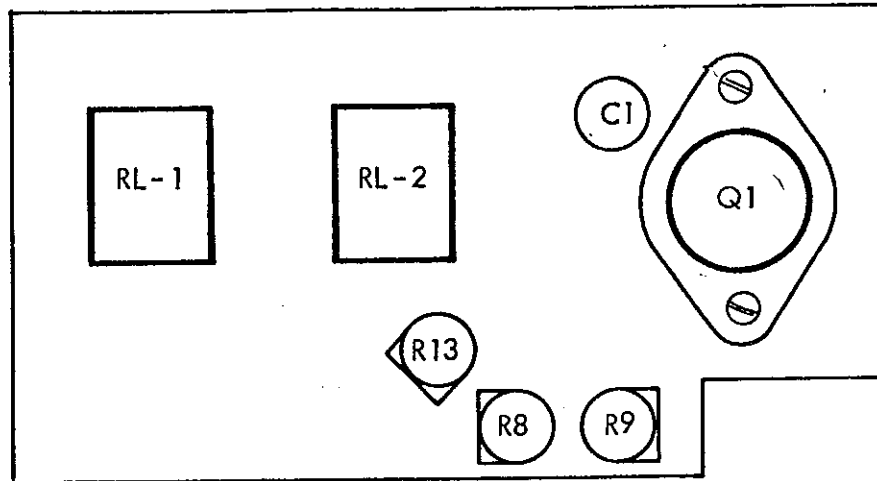


Ground Setscrew

Mounting Clamps - Maintain at least 12" separation.
 Clamps must make good electrical contact with airframe.
 Setscrews provide contact between clamps and base tube.

DIAGRAM 3

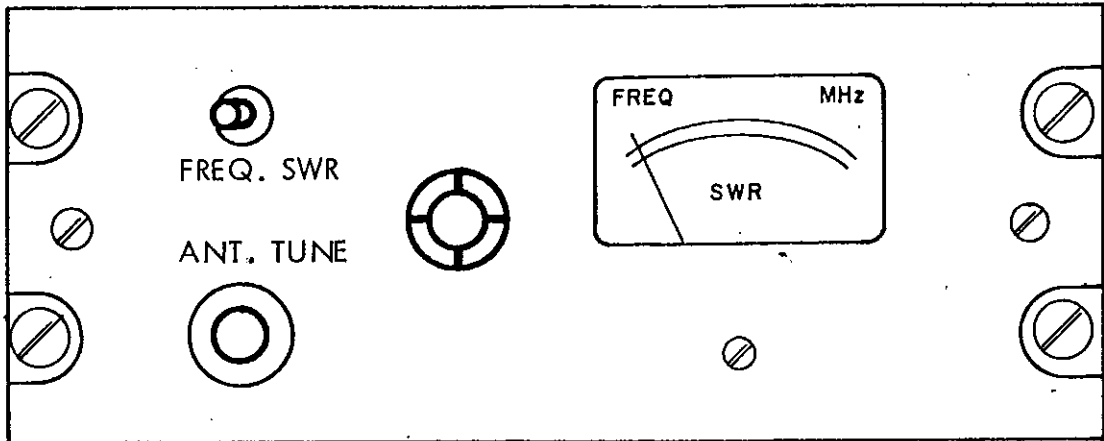
Location of Printed Circuit Adjustment



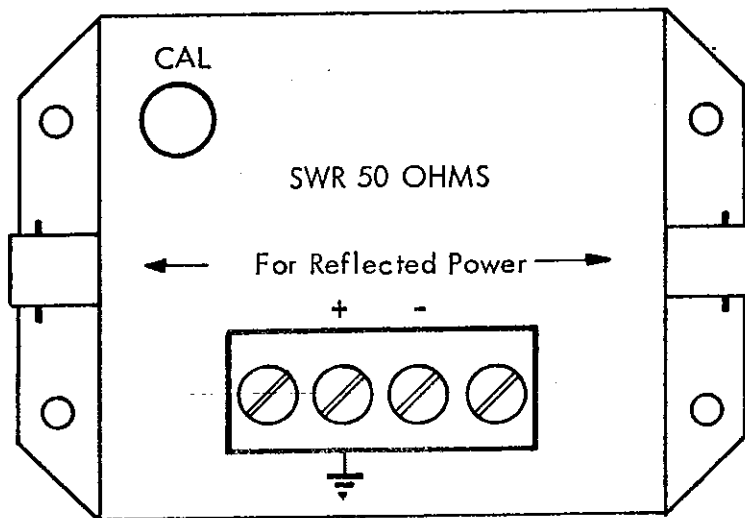
Cable Color Code

<u>AC-31-2 Terminal No.</u>	<u>Wire Color</u>	<u>Wire Size</u>
1	Orange	#22
2	Black/White	
3	Red	
4	Green	
5	Blue	#20
6	White	
7	Black	

DIAGRAM 4

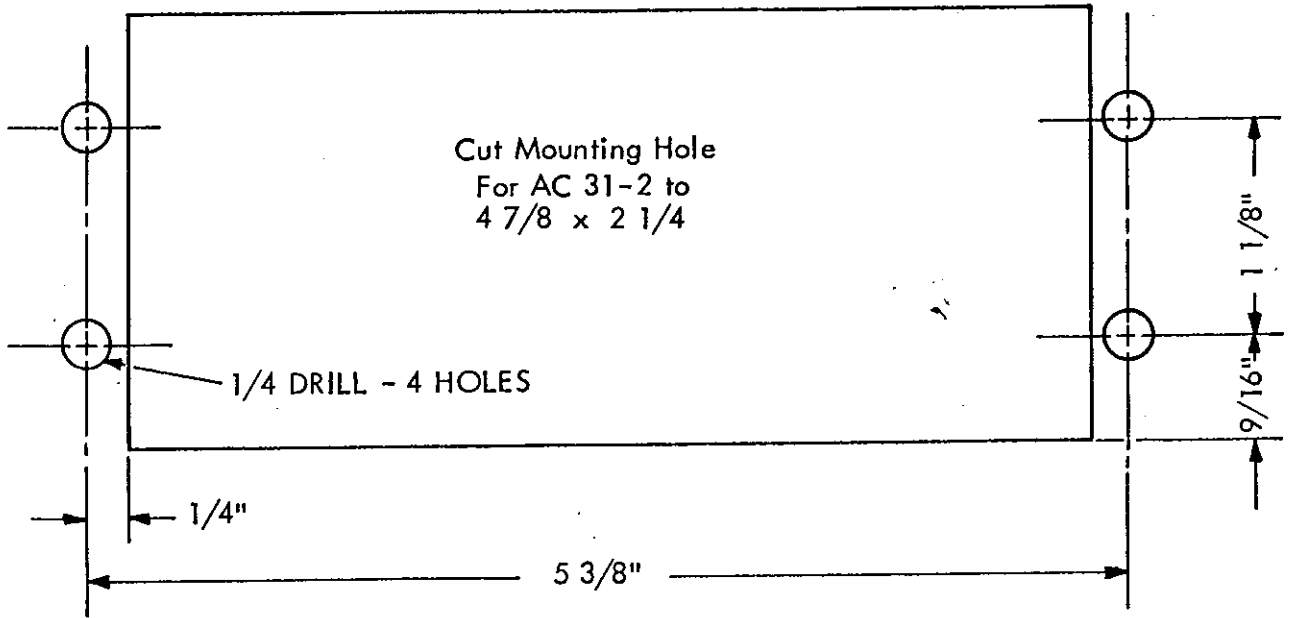


AC 31 - 2 Control Head 5 3/4W x 2 1/4H x 4 3/8Dp.

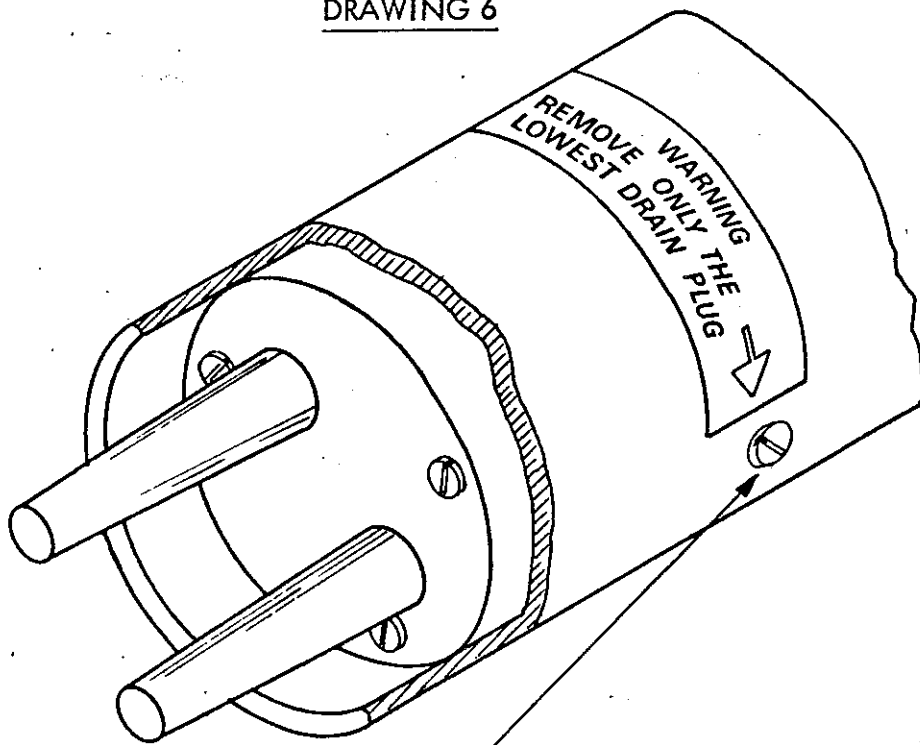


AC 31-3 SWR Sensor 3 7/8W x 2 3/4H x 2 1/4Dp.

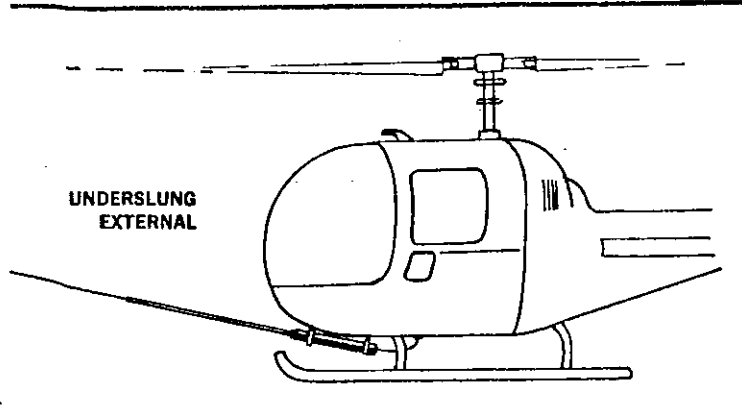
DRAWING 5



DRAWING 6



DRAIN HOLE (When installing position antenna so drain is at lowest point).

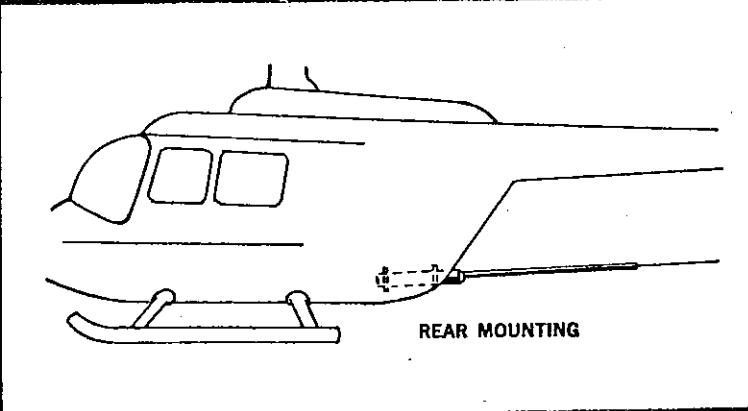
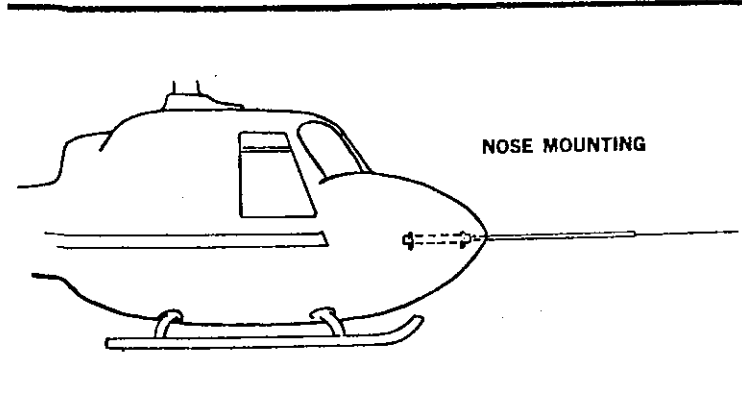


THE AC-31 'STINGER' ANTENNA

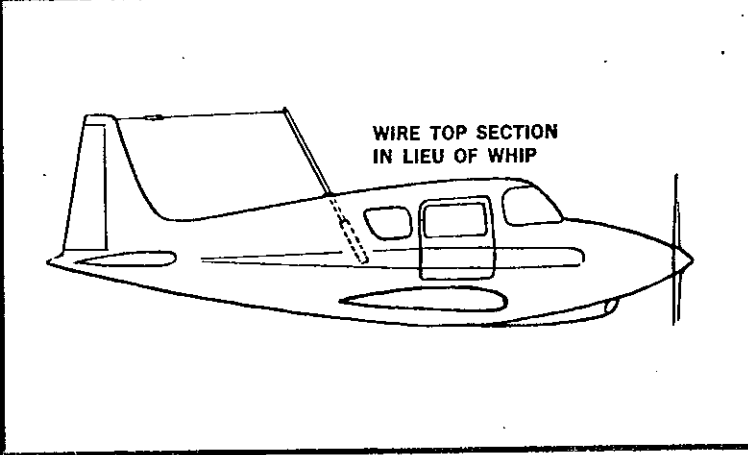
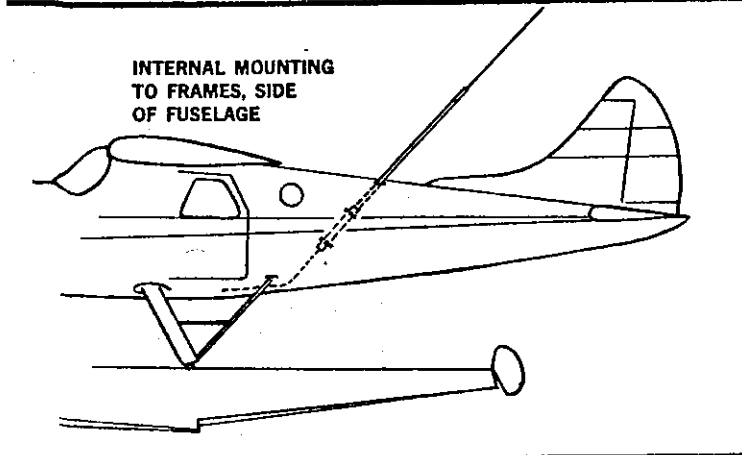
SUGGESTED PLACEMENT
FOR MAXIMUM EFFICIENCY

Structural attachment details
will vary according to equipment
type and location of other
apparatus

HELICOPTER

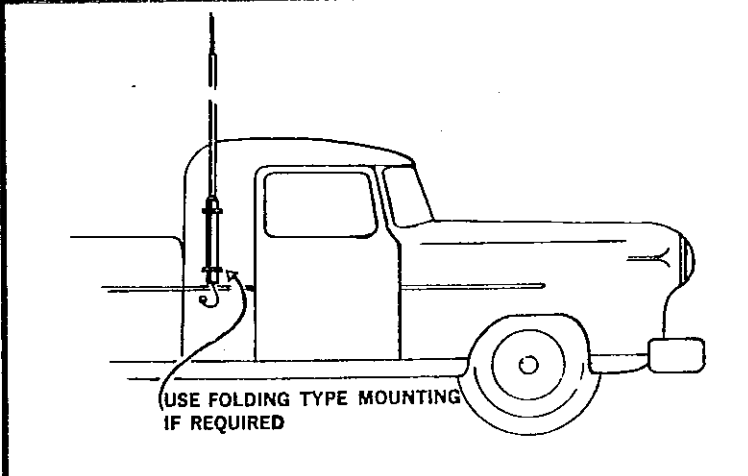
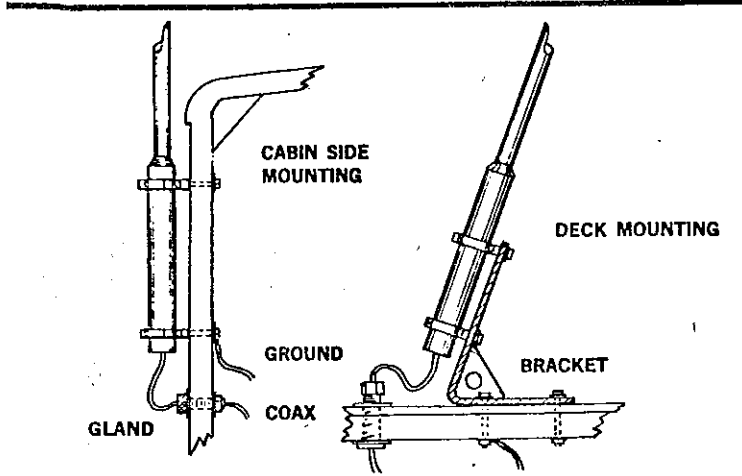


AIRCRAFT



MARINE

MOTOR VEHICLE



OPERATING PROCEDURE

1. Select the desired transmitting frequency.
2. Place toggle switch marked **FREQ. - SWR** to '**FREQ.**'.
3. By means of the switch labelled **ANT. TUNE** and the frequency scale on the meter, tune the antenna to approximately the desired frequency.

NOTE: When tuning an SSB transmitter, it must be switched to the AM or DSB Mode.

4. Key the transmitter and tune the antenna for a minimum reading on the SWR meter by pressing **ANT. TUNE** switch. (Pressure to the right increases frequency and to the left decreases frequency).

Once the SWR begins to decrease, it is best to rhythmically tap the **ANT. TUNE** switch in a direction to make the SWR decrease in small steps for a minimum reading. If this position is overshot a few taps in the other direction should bring the reading to a minimum. The final SWR should be 1.2 or less on the SWR scale. (1.5 on 3.5 to 13.4 MHz. range).

If it is now desired to transmit SSB; switch transmitter to SSB.

On aircraft it may be necessary to retune when airborne.

NOTE: Since the tuning range of the antenna covers two octaves of frequency it is possible in some cases to erroneously tune the antenna to the second harmonic of the operating frequency instead of the fundamental. If two distinct dips in SWR reading are found tune always to the lowest frequency dip. Correct pre-tuning to the **FREQ.** scale will avoid this occurring. If doubt exists switch back to '**FREQ.**' scale and check.

5. When used for receiving only, the antenna may be tuned for maximum noise on the receiver or for maximum receiver "S" meter reading on a signal.

A. Suggested Monthly Maintenance

Make a visual inspection of the antenna, cable and coax lines. Check mounting clamps and whip for tightness. Operate antenna motor to both extremes of travel to distribute lubrication on the threaded rod located in the antenna base tube.

B. Suggested Annual Maintenance

Remove motor and coil assembly from the body and base tube of antenna. The procedure is:

1. Loosen the three screws which compress the sealing gland.
2. Thread a 10/32 screw into the hole provided in the sealing gland plate and pull on screw to remove mechanism. Never pull on cable or coax lines.
3. Inspect gear train, tuning slugs and slide wire for signs of wear.

Lightly lubricate the gears and threaded rod with silicone oil such as G. E. Versilube F-50.

Do not use other oils which thicken at low temperatures.

4. To inspect the tuning slug, the coil form must be removed. Remove the self tapping screw holding the tube to the top moulding and unsolder the coil wire. The coil tube can now be removed.
5. To reassemble, reverse the above procedure. Use care when inserting the tuning mechanism as undue force can distort the assembly and cause binding.
6. Run antenna to both ends of travel and test the antenna at the frequencies in use.

CAUTION

The tuning core is a fragile mechanism when removed from its protective tube and extreme care must be exercised to avoid chipping or bending the slugs.

- 1 & 2. Frequency scale and adjustments.
3. Tuning motor speed adjustment.

NOTE: Do not attempt any of these adjustments unless it is ascertained that they are necessary.

Frequency scale adjustments are made by potentiometers R-8 and R-9. Refer to Diagram #3 for their exact location on the printed circuit board.

If the antenna is a standard model using a whip supplied by the factory, the end travel of the pointer may be adjusted as in procedure (1) below.

If for any reason the length of the whip has been changed to accommodate a non-standard frequency range use procedure (2) below to adjust the pointer.

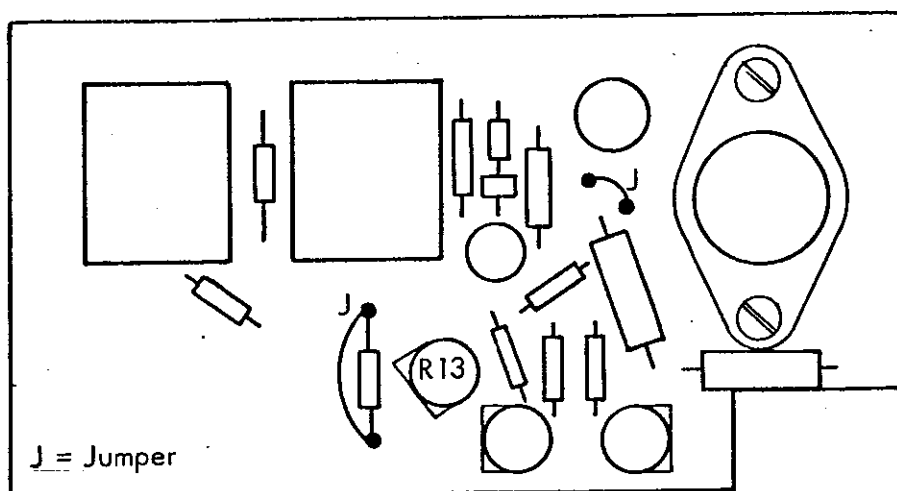
1.
 - (a) Switch the **FREQ. SWR** switch to **FREQ.**
 - (b) Press the **TUNE** switch to the left until it is certain that the motor in the antenna unit has reached its end stop.
 - (c) Adjust R-8 until the meter pointer indicates on the extreme left hand end of the frequency scale.
 - (d) Press the **TUNE** switch to the right until the motor has reached its end stop.
 - (e) Adjust R-9 until the meter pointer indicates on the extreme right hand end of the frequency scale.
2. Following the sequence outlined in (1) above make the first adjustment to coincide with the lowest transmitting frequency in use, and the second adjustment to the highest transmitter frequency in use.
3. R-13 sets the initial tuning motor speed. It is adjusted until the motor just begins to turn whenever the antenna tune switch is depressed. If, when tuning for an exact SWR null, the tuning is too fast or slow, R-13 can be turned CCW or CW by a small amount respectively.

VOLTAGE OR POLARITY CHANGE

NOTE: The control units are wired for 24-28 VDC negative ground at the factory

A. To convert to 12 V operation.

1. The pilot bulb must be changed from #327-28 V to #330-12 V.
2. Two jumpers must be added on the circuit board. See the diagram below for the locations.



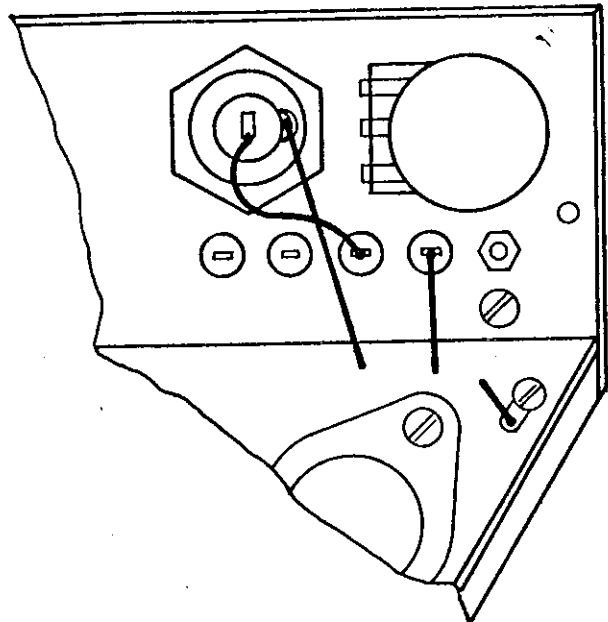
NOTE: R-14 will be found below board in some units.

3. R-13 must be readjusted using the procedure given under special adjustments.

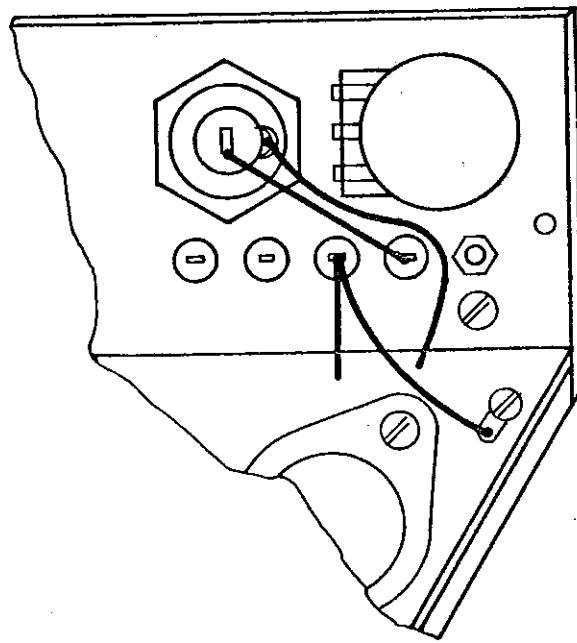
VOLTAGE OR POLARITY CHANGE

- B. To change from negative polarity to positive polarity, remove the four wires shown on negative ground diagram and rewire as shown on the positive ground diagram with insulated wires .

Inside Views of Rear Panel



Negative Ground



Positive Ground

1. AC-31-2 Control Unit

<u>Symbol</u>	<u>Description</u>			<u>Type</u>	<u>S & T Part No.</u>
<u>1.1 Resistors</u>					
R-1	820	1/2w	+ 5%	Carbon film	09-053
R-2	10 K	1/4w	+ 5%	Carbon film	19-008
R-4	330	1w	+10%	Composition	10-006
R-5, 6	270	1/4w	+ 5%	Carbon film	14-057
R-7	18	1/4w	+ 5%	Carbon film	14-074
R-11	470	1w	+10%	Composition	10-040
R-12	390	1/4w	+ 5%	Carbon film	14-066
R-14	1 M	1/4w	+ 5%	Carbon film	14-019
<u>1.2 Potentiometer</u>					
R-8	100	1/10w	+20%	Carbon	13-085
R-9	470	1/10w	+20%	Carbon	13-080
R-10	100 K	1/4 w	+20%	Carbon	13-051
R-13	1 M	1/10w.	+20%	Carbon	13-081
<u>1.3 Diodes</u>					
D-1, 2	10 D 6			Silicon	
D-3	1N5288			Silicon	
Z-1, 2	Zener MZ 1000 - 25 33 v			Silicon	
Z-3	Zener MZ 500 - 1 2-4 v			Silicon	
<u>1.4 Capacitors</u>					
C-1	50 uF	25 v		Electrolytic	19-031
C-2, 3	.02 uF	100 v		Ceramic	24-025
C-4, 5	.01 uF	100 v		Ceramic	24-111
C-6	0.1uF			Ceramic	24-101
<u>1.5 Meter</u>					
M-1	50 u A	Special Scale			31-009A
<u>1.6 Transistors</u>					
Q-1	2N3055			Silicon	
Q-2	2N3567			Silicon	
<u>1.7 Relay</u>					
RL -1, 2	12 v DC	DPDT		Plug-in	49-082
<u>1.8 Switches</u>					
SW-1	DPDT	Miniature			36-066

1. AC-31-2 Control Unit (continued)

<u>Symbol</u>	<u>Description</u>	<u>Type</u>	<u>S & T Part No.</u>
<u>1.8 Switches</u>			
SW-2	SPDT		36-079
<u>1.9 Fuses</u>			
F-1	3/4 A Fast Blow		43-039
<u>1.10 Lamps</u>			
PL-1	#327 - 28V or #330 - 12V		

2. AC-31-3 SWR Sensor Unit2.1 Resistors

R-1	Resistor composed of ten, 10 ohm 1/2W resistors in parallel		09-066 (10 req'd)
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2.2. Capacitors

C-1	100 pf 500V	Mica	15-040
C-2	500 pf 500V	Mica	15-012A
C-3	0.5 - 3.0 pf	Ceramic	17-038

2.3 Chokes

L-1, 2 & 3	2.5mH		02-015
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2.4 Diode

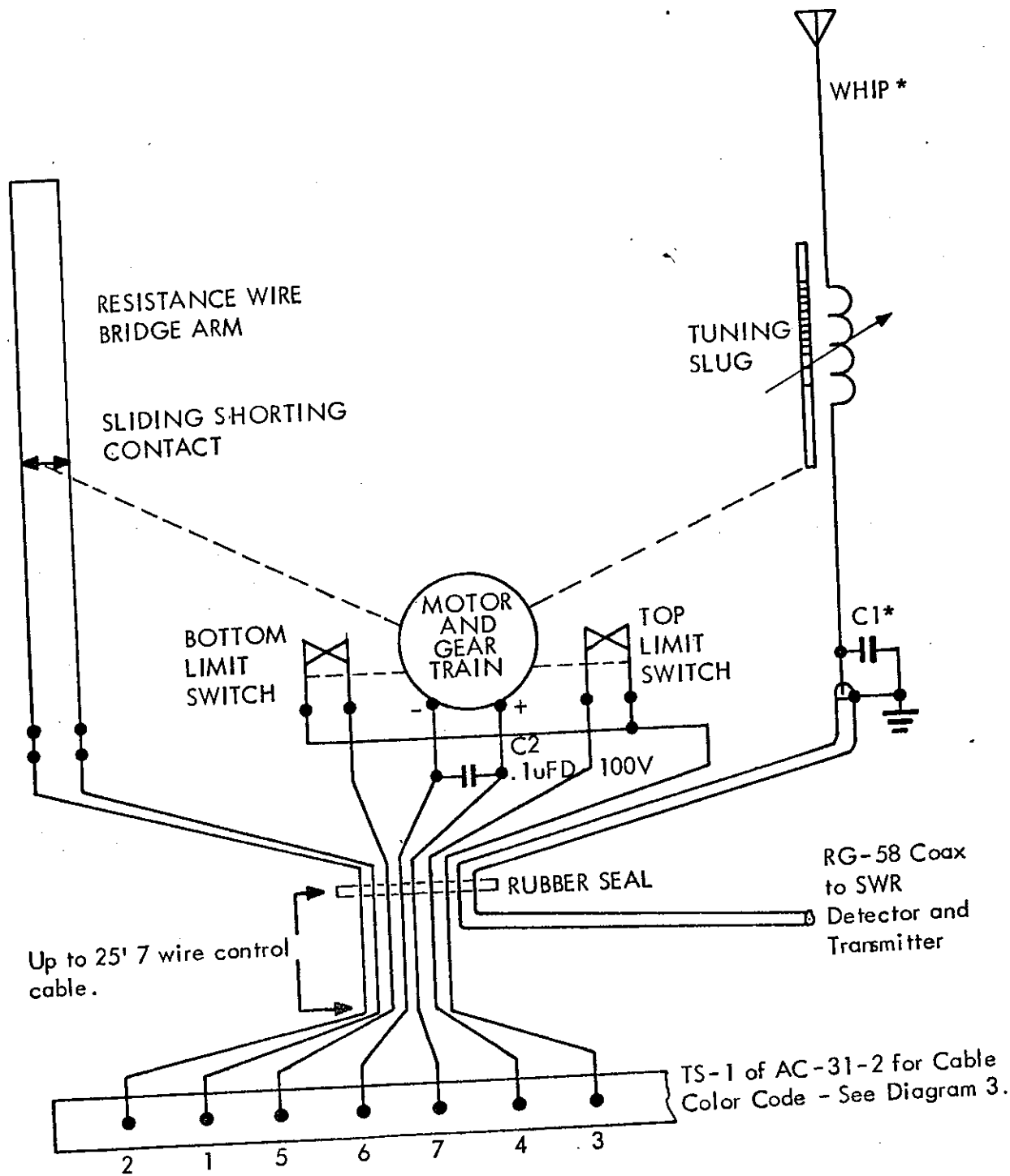
D-1	1N55A		1N55A
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2.5 Connectors

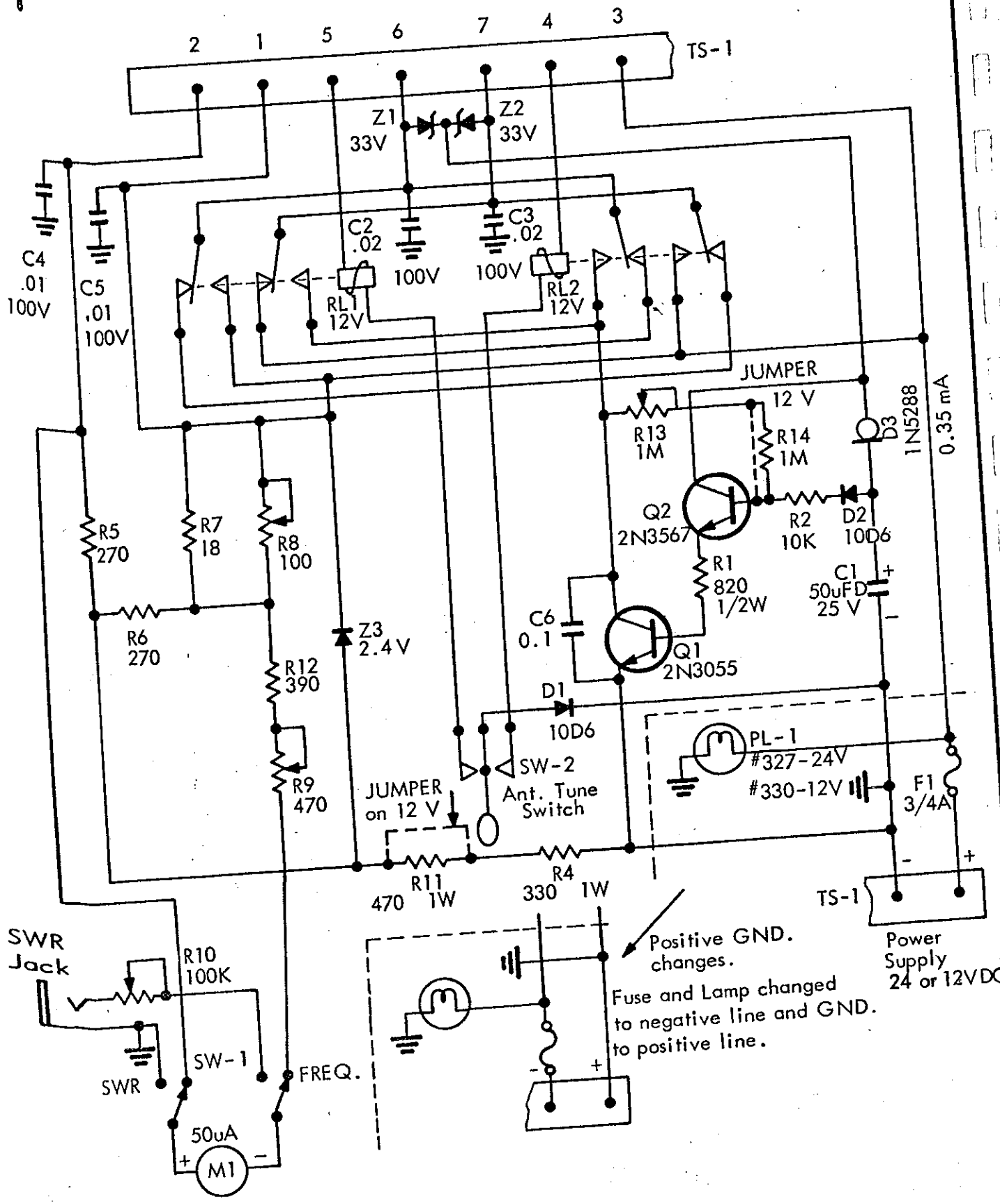
-	BNC Chassis Mt.		38-060
-	Plug Dot		51-033

3. AC-31-1 Antenna

Motor	12VDC Permanent Magnet with gear and sleeve.	Prior to serial #25993 Serial #25993 - #52100 Serial #52104 and up	45-041 45-004 45-002 4-5-316 24-101
Capacitor	.1 μ F 100V		

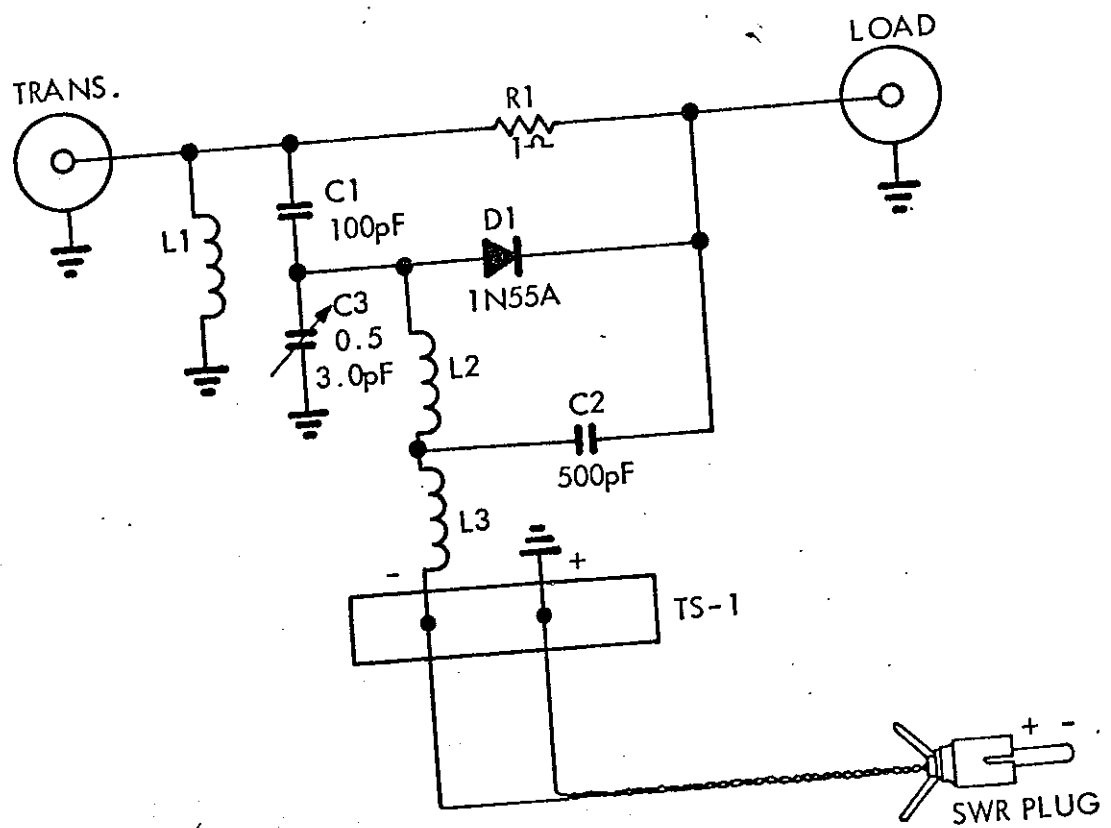


*Length of whip, size of coil and C1 depend on Frequency Range. Frequency Range is designated by a letter A, B, C or D after 31 in AC-31-1.



Resistors 1/4W ± 5% Unless stated otherwise.

Positive GND. changes.
 Fuse and Lamp changed to negative line and GND. to positive line.



NOTES:

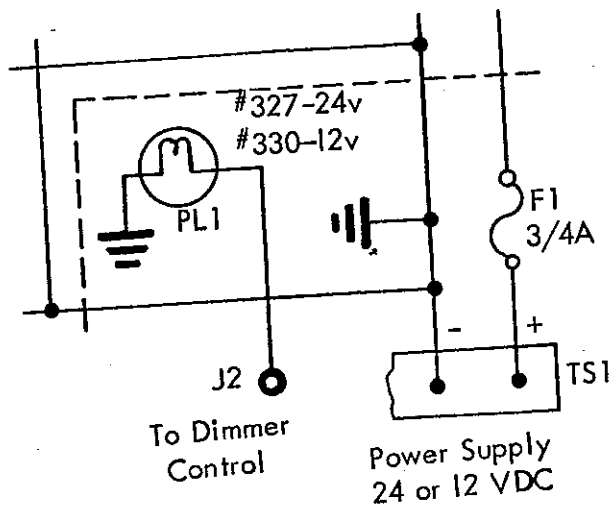
1. R1 is ten, 10 Ω resistors in parallel.
2. L1, L2 and L3 are 2.5 mH.
3. Wire from TS-1 to SWR Plug should be twisted #22 or larger stranded copper wire.

AC-31

OPTION 1 - DIMMER CONTROL

The standard AC-31 anti-control unit is normally supplied with fixed brightness panel lighting. If light dimming is desired, the unit is modified as shown below:

- 1) Remove lead between lamp holder PL-1 and circuit board.
- 2) Install terminal jack J2 S & T Part #30-033 into the holes provided. Cut off part of the soldered end of the terminal to clear relay.
- 3) Connect J2 with PL-1 as shown.



WARRANTY POLICY

Spilsbury Communications Ltd., will repair or replace, at its sole option, without charge, F.O.B. our factory, any equipment, parts or accessories manufactured by it which are defective in design, workmanship or material provided that:

- (a) Such defects occur and are reported in writing to Spilsbury Communications Ltd., within one year (or as otherwise specified) from date of shipment to the original customer from Spilsbury Communications Ltd.
- (b) The equipment, parts or accessories to be repaired or replaced are returned to Spilsbury Communications Ltd., at its factory, transportation prepaid.
- (c) Such defects are the result of normal wear and tear, under proper use and installation.
- (d) Such defects are not the result of exposure to excessive moisture, atmospheric or otherwise, encountered following shipment of the equipment from Spilsbury Communications Ltd.
- (e) The equipment, parts or accessories have not been altered or repaired by other than Spilsbury Communications Ltd., or its authorized service dealers.

Replacement equipment, parts or accessories supplied under warranty prior to the return of the related defective equipment, parts or accessories will be invoiced at the then current prices published by Spilsbury Communications Ltd. Full credit will be issued when Spilsbury Communications Ltd., has received and inspected the defective equipment, parts or accessories provided that these are received prior to 30 days following the warranty expiry date. Equipment, parts, accessories, tubes, semi-conductors and batteries not manufactured by Spilsbury Communications Ltd., or manufactured from its designs are subject only to the warranty offered by the supplier or manufacturer thereof. No other warranties, expressed or implied are applicable unless rendered in writing and signed by an authorized officer of Spilsbury Communications Ltd.

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