

CLASS 252-50

CDE HAM II ROTOR SYSTEM

Owner's Manual



THE HAM II IS RATED FOR ANTENNAS
WITH UP TO 7.5 SQUARE FEET OF
WIND SURFACE AREA.

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CORNELL-DUBILIER ELECTRONICS

DIVISION OF FEDERAL PACIFIC ELECTRIC COMPANY

Rotor Department

Fuquay-Varina, North Carolina 27526

OWNER'S MANUAL - HAM II

Foreword On the following pages, you will find information obtained from the Engineering Staff where the Ham Rotors are built, the Service Engineering Group, and from amateurs who have Ham Rotors installed. No attempt has been made to detail every possible installation or suggest every maintenance procedure that may be necessary to cover many years of operation. Please feel free to communicate with us at any time that we may be of assistance. Write to:

CORNELL-DUBILIER ELECTRONICS
Division of Federal Pacific Electric Company
CDR Rotor Department
118 E. Jones Street
Fuquay-Varina, North Carolina 27526

General The Ham II Rotor System is designed to accommodate amateur antennas with a maximum of 7.5 square feet of wind area. The Ham II provides a full 360° range of rotation and a meter scale read out for accurate position indication.

The Ham II Rotator is built along the general lines of the original CDE Bell type rotors. The weight of the upper mast and the antenna is carried directly in line with the lower supporting mast. The motor, radial and thrust bearings, electrically operated wedge brake, gear train, and indicating sensor are built into the elongated bell shaped cast aluminum housing.

The Ham II wedge brake system is operated independent of the clockwise and counterclockwise directional controls. However, the directional controls will not function until the brake is released.

Pre-Installation Check

It is recommended that a preliminary operational check be made on the system prior to actual installation.

Check each item of the system for physical damage due to shipping. The Ham II system consists of a control unit, a bell rotator unit, a lower mast support, a hardware package and a service manual. If any of these items are missing or damaged, return the complete system to your dealer or the factory for replacement. Sales receipt must accompany such a return.

After the physical check of the equipment, set up the control unit and the Bell rotator for an electrical check. We recommend the following procedure:

1. Measure out the maximum 8-wire control cable required for your particular installation. (See spec table) strip the insulation from all wires, separate the individual wires back about 2-3 inches, and tightly twist the stranded ends. Soldering these ends improves manageability.
2. With the control unit and the rotator on the work table, connect the cable between the two units. Make sure wires 1, 2, 3, 4, 5, 6, 7, & 8 on the control unit are to 1, 2, 3, 4, 5, 6, 7, & 8 on the rotator, respectively.
CAUTION: No loose strands of wire should touch adjacent terminals or other metal parts of the units.
3. With the rotator sitting in the upright position and connected to the control unit, by the eight (8) wire cable, plug the control unit power cord into a convenience 115 VAC 50/60 Hz wall socket.
4. Turn the power switch on. The meter should be illuminated.
5. Depress the brake release (center) lever then release it. An audible click should be heard in the rotator. This is the

6. Depress the brake release, hold, and simultaneously depress the clockwise direction switch (right). The rotator should turn clockwise (looking from top). This is S-W-N-E-S. Release the direction switch; rotator will coast down and stop. Now release the brake. The rotator is now locked into position.

CAUTION: It is best to release the direction switch, and brake switch prior to end of rotation (extreme clockwise or counterclockwise position) in order not to damage the stop arm and/or the gears.

The rotator is now stopped and the brake is engaged. To turn the rotator counterclockwise, release the brake, hold and simultaneously depress the counterclockwise switch (left). The rotator will turn counterclockwise. This is S-E-N-W-S. After rotator has stopped, release the brake.

Prior to actual installation, check the calibration to familiarize yourself with this procedure. It is best done while the system is still set up for the Pre-installation check.

In Service Operation

The Ham II brake release feature is specifically designed to decrease the effects of torsional forces caused by rapid de-acceleration and instant stopping of large antennas and beams. With practice, smooth and precise stops can be made without overstressing the rotator, tower, antenna or supporting mechanisms. By releasing the direction control switch slightly before the point of intended antenna position, letting the unit coast to a full stop, then releasing the brake, no snap action stops are required. This feature of the Ham II, when properly used, should prolong the life of your rotor system as the major stresses are greatly decreased.

Service Cornell-Dubilier maintains a modern well staffed repair department for all CDE antenna rotors. If service is required, the unit should be packed securely and sent prepaid to:

Cornell-Dubilier Electronics
Rotor Service Department
118 East Jones Street
Fuquay-Varina, N. C. 27526

For units that are in warranty, no charge will be made for repair. If the unit is out of warranty, the following flat rate charges apply:

Control box only	\$ 23.00
Rotator only	25.00
Complete unit	\$ 36.00

A check or money order for the amount indicated above should be included. The flat rate charge includes rebuilding the unit and replacing of defective parts.

Meter Calibration

Rotators are shipped from the factory stopped in the full counter clockwise (South) position. To calibrate the meter, have the rotator full counter clockwise position, on-off switch "off" and use the zero-center screw to line the needle on the left hand "S" limit. With the on-off switch in the "on" position, push in the calibrate knob. The calibrate knob is a push to calibrate type. (Some models: Push, hold in, calibrate, release. Other models, push, release, calibrate, push again to disengage calibrate circuit.) Locate the needle on the right hand "S" limit. This meter calibration can be performed any time it is desired to check the accuracy. When power is off, the needle will fall to the left hand "S". When power is on, the needle will indicate the antenna position. The zener regulated meter supply will minimize reading variations due to line voltage fluctuations.

Rotor Installation

The Ham II rotor is engineered to handle relatively heavy antennas including multi-band arrays having traps at the extreme of the elements. Long and trouble free performance of the system depends on making the installation to properly handle the stresses involved. **CAUTION:** THE ROTATOR IS DESIGNED FOR VERTICAL OPERATION WITH THE BELL SHAPED HOUSING IN THE UP POSITION. Water and other contamination will get into the motor unit if mounted horizontal or up-side-down.

Balanced Weight

produces only down-thrust on the rotor. With 98 ball bearings operating in accurately machined races, the rotor is capable of handling as much as a thousand pounds downward pressure in line with the axis of rotation.

Unbalanced Weight

creates a bending moment of force which is concentrated on the mast at the point where it is clamped to the top of the rotor. This moment tends to strain the mast at that point and also to bind the ball bearings by creating excessive downward pressure on one side and upward pressure on the other. Such unbalance places additional stresses on the motor and gear train. Unbalanced weight becomes critical as the distance from the antenna boom to the clamping point at the rotor is increased.

Wind Pressure

against the boom and elements usually produces a bending force on the mast which causes the same stresses as unbalanced weight. To strengthen the installation to withstand unbalanced weight and wind pressure, the top mast should be as short as possible. In multiple arrays the heaviest sections should be closest to the rotator. In order to distribute the binding stress and prevent fracture of the mast, the HAM rotor includes two long, heavy, specially designed steel clamping plates. These are grooved to grip the mast securely. It is recommended that the mast be reinforced in the area where it is clamped by driving a hardwood dowel of proper size into the end of the mast.

Start-Stop Torsion

Torsional or twisting forces must be given special considerations when using the Ham rotor with large antennas and beams. The acceleration of the antenna array is gradual as the motor picks up the load. However, if the brake release switch is not used properly, stopping will be instantaneous, therefore, subjecting the antenna, rotator, and support system to undue strain. To alleviate instantaneous stops, always release the directional switch, CW or CCW, prior to the intended antenna direction, let the unit coast down to a stop, then release the brake. When the brake wedge is engaged into the groove of the outer casting, the top and bottom of the masts are locked rigidly together. It is absolutely essential that all mechanical assemblies making up the antenna array be solidly clamped so that no slipping occurs under heavy stop/start/wind load conditions.

Torsional Guying of Tower

Average height, well built towers, properly erected, carrying average antennas, are able to absorb the heavy twisting strain at the moment of stopping. Where the antenna is large or heavy, or the tower is tall or of light weight construction, a torsion bar or sway brace (as shown in Fig. 2 on the next page) should be rigidly attached near the top of the tower. Such an arrangement allows the double guy wires to absorb the shock of stopping, which would otherwise tend only to twist the tower on its base.

Mechanical Description

The motor drives a train of stainless steel spur and pinion speed reduction gears which in turn drive the ring gear. The ring gear drives the bell shaped upper mast support, into which the antenna mast is mounted in rigid central alignment.

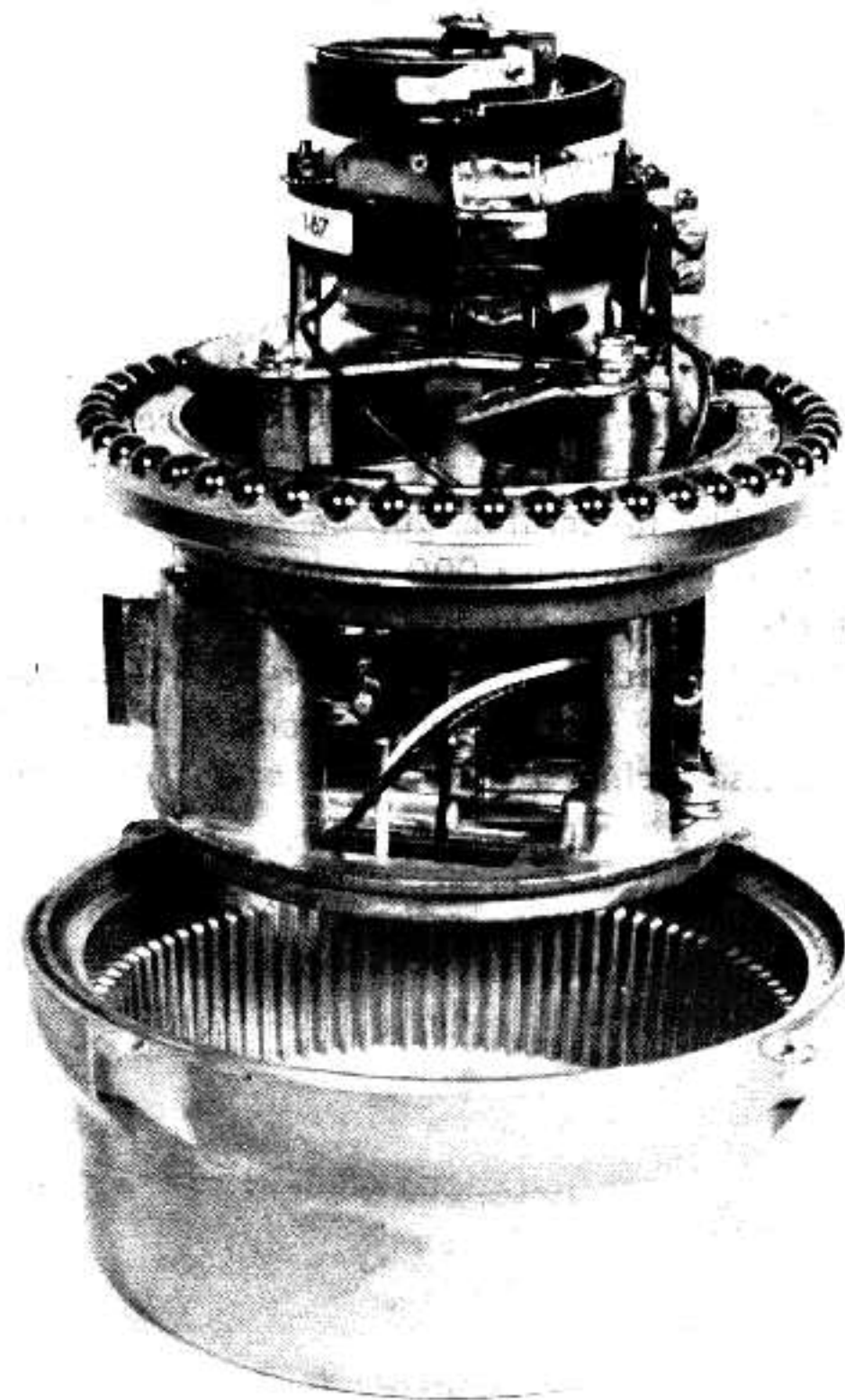


Fig. 1

A boss is cast on the under side and in the center of the cavity of the upper mast support, which engages the serrated edge of the potentiometer arm which is mounted on the top of the inner mechanism.

Maximum support and low frictional loss between the rotating upper mast support and the inner mechanism is assured by the use of two groups of 49 steel balls each riding in the bearing races between the two assemblies, and held in special nylon retainers.

Mechanical stops along with electrical limit switches are built into the rotor mechanism to provide accurate and complete 360 degree rotation.

The brake assembly is released by a 24 volt AC solenoid, the plunger of which is mechanically attached to the wedge. When the wedge is positioned for braking, a cam latch locks the wedge in the teeth of the lower housing. To release the brake, the solenoid is energized. This unlocks the latch automatically and retracts the wedge from the gear teeth in the housing.

Circuit Description

Two transformers are mounted in the control unit. The power transformer supplies approximately 30 VAC for releasing the brake and operating the motor when control levers are depressed. Overheating of the transformer from prolonged operation or possible short circuit is prevented by a thermal cut-out switch in the primary winding.

The motor is a two-phase device with the first winding being supplied AC direct from the transformer while the second has a 120-140 MFD. capacitor in series in order to shift the phase and provide forward rotational torque. To reverse, the capacitor is switched in series with the first winding, while the second is directly supplied from the transformer.

The solenoid which releases the brake operates from the same transformer that supplies power to the motor.

The meter transformer is energized as the on-off control is switched to the "on" position. This illuminates the meter dial

and the meter indicates the position of the antenna. 13 VDC is supplied to the 500 OHM potentiometer in the rotator through a zener regulated supply.

The meter is a high quality DC instrument requiring 1 MA for full scale deflection. It is connected with plus side through the 10 K multiplier to the plus side of supply and potentiometer, which is protected by a $\frac{1}{8}$ AMP fast blow fuse. The meter circuit is completed through the 5000 OHM calibrate control and operate/calibrate switch to ground. The operate/calibrate control is located on front panel. With the zener controlled supply the 5K calibrate control will be set at approximately 3000 OHMS which will give 13,000 OHMS in series with meter to allow for 1 MA deflection at full scale.

Two electrical limit switches in the rotator cut the motor power just before the rotation reaches the extremes. A fuse, located on rear panel is also included on one side of the AC power line.

CONSTRUCTION NOTES

- A. Tape cables securely to mast.
- B. Provide slack for rotation and drip loop.
- C. Anchor securely to standoff to prevent strain on connectors and slipping of cable.

SUGGESTED MATERIALS

- 1. Make from $1\frac{1}{2} \times 1 \times \frac{1}{8}$ angle iron.
- 2. Use cadmium plated hardware, $\frac{5}{16}$ " or $\frac{3}{8}$ " bolts.
- 3. Use standard $\frac{1}{4}$ " bolts.
- 4. Make spacers from $\frac{1}{4}$ " galv. pipe.
- 5. Copper tubing over guys, crimp and tape.
- 6. Wooden spacer to keep bracket level.
- 7. Double standoff.
- 8. Single standoff.

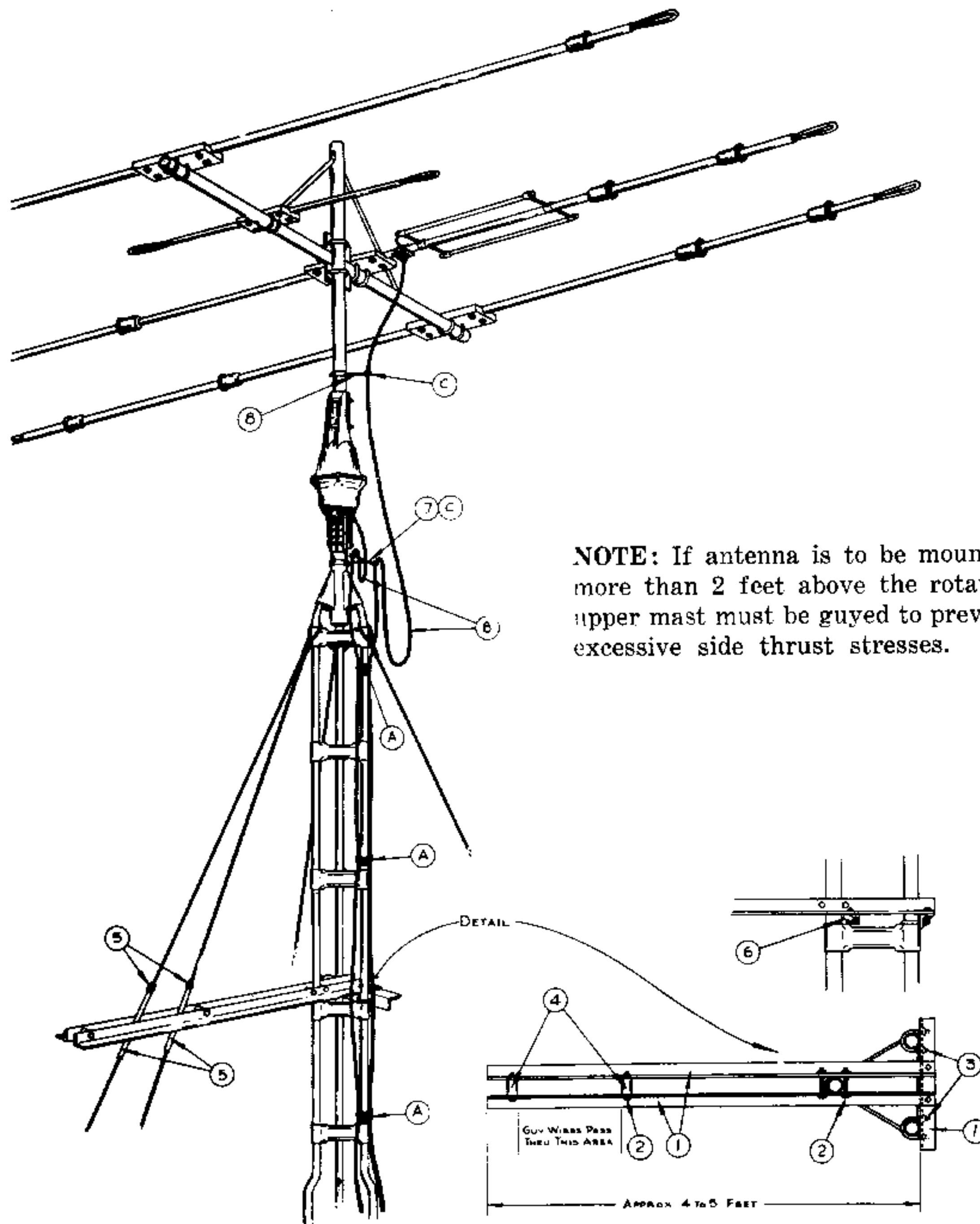


Fig. 2—Top Tower Installation with Torsion Bar

Checking Control Unit

To check the control unit, plug line cord into 115 volt AC power. With no connections to terminals turn the on-off switch to on position, the meter light will illuminate. Meter needle will remain on left hand "S".

To check the power circuit connect an AC voltmeter between terminals No. 1 and No. 2 on the rear panel and see that approximately 30 volts is indicated when brake release lever is depressed. Connect meter leads between terminals No. 1 and No. 5 and read approximately 30 volts with brake release lever and clockwise lever depressed. Now connect meter leads between terminals No. 1 and No. 6 and read approximately 30 volts with brake release lever and counterclockwise lever depressed.

Checking Rotator

Connect all 8 terminals of the control box to the corresponding 8 terminals of the rotor using the coil of cable obtained for the installation. The 2 heavy wires in the cable should be used for terminals 1 and 2 (Refer to Schematic). CAUTION — SHORTS BETWEEN TERMINALS OR GROUNDED LEADS MAY BURN UP THE POT STRIP IN ROTATOR.

With the rotor in an upright position without the lower mast support assembled, operate rotator by means of control unit lever in both directions. The operation of control unit lever on and off, releases the brake mechanism in rotator. This is audible to the operator.

Checking Rotator From the Ground

One may possibly avoid bringing the rotator down from the mast by making electrical checks from the position of the control box. This is done by disconnecting the eight wires from the screw terminals and tagging them carefully No. 1 through No. 8 to correspond with the terminal numbers from which they are removed. From the schematic diagram it is apparent that the resistance of the lead wires will be added to the resistance of the motor windings and potentiometer strip in making the resistance checks.

Leads No. 1 and No. 2 of No. 18 AWG have approximately 0.64 OHM resistance per 100 feet and leads No. 3 through No. 8 of No. 22 AWG have approximately 1.6 OHMS resistance per 100 feet. Use a low resistance ohmmeter to check the values shown in table one to an accuracy of 10 percent after adding the resistance of the leads involved.

To Check	Read Resistance	Between Terminals
Brake Solenoid	.75 ohms + leads	1-2
1/2 Motor Winding	2.5 ohms + leads	1-8
1/2 Motor Winding	2.5 ohms + leads	1-4
1/2 Motor + Switch	2.5 ohms + leads	1-5
1/2 Motor + Switch	2.5 ohms + leads	1-6
Entire Motor	5 ohms + leads	8-4
Right Limit Switch	0 ohms + leads	8-5
Left Limit Switch	0 ohms + leads	4-6
Entire Pot	500 ohms	3-7
Pot Arm to + End	0 to 500 ohms	3-1
Pot Arm to - End	0 to 500 ohms	1-7

Table 1

Servicing the Control Unit

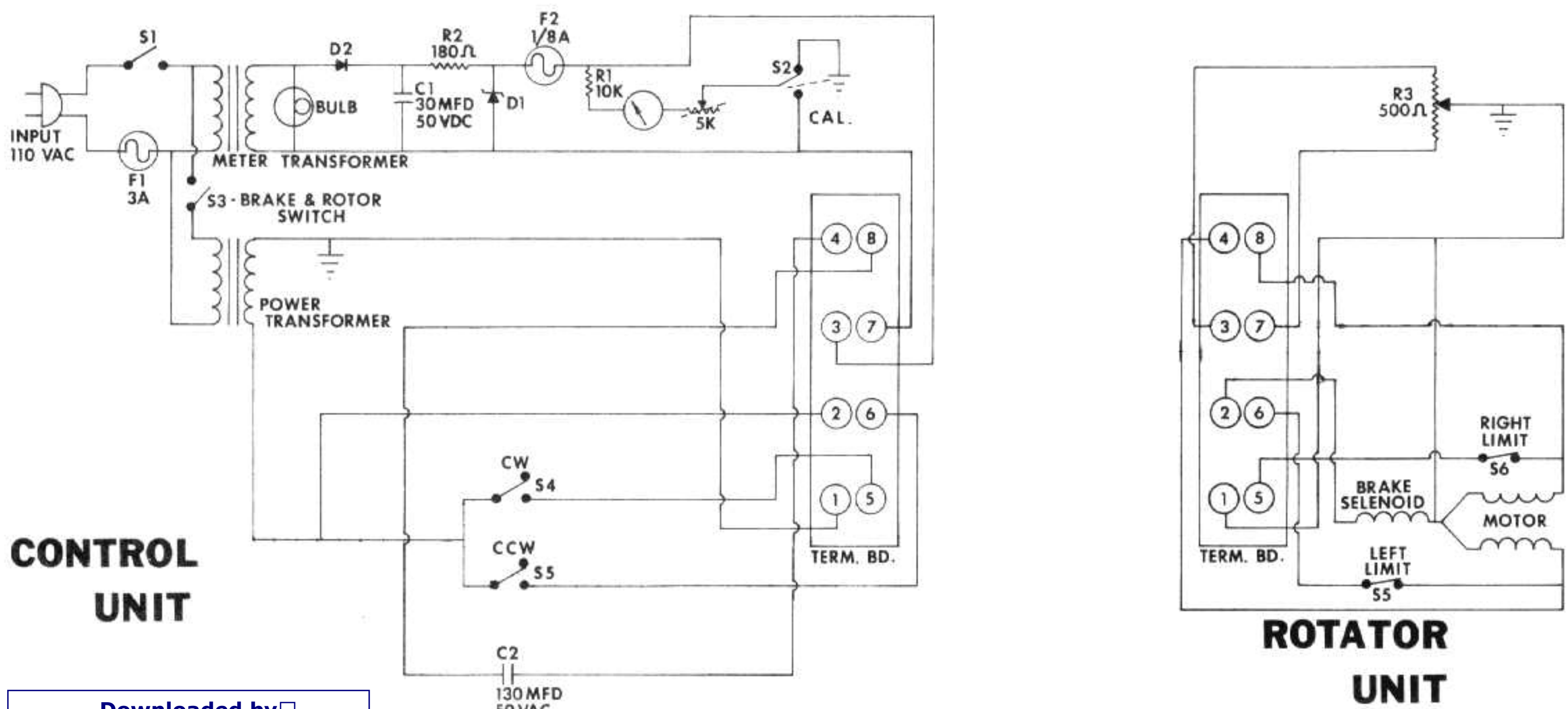
Disconnect the AC power source and remove the eight wire control cable. Be sure to tag each wire with the corresponding terminal number.

The control box can be checked without removing the cover by using a volt-ohmmeter to check values across terminals. Resistance across terminals No. 1-2 should read .4 Ohms. Read same value across terminals No. 1-5 with clockwise switch lever (right-hand) depressed and across terminals No. 1-6 with counter clockwise switch lever (left-hand) depressed. Resistance across input line cord with on-off switch in the "on" position and the brake lever depressed should read 3.8 Ohms.

With power cord connected and on-off switch in the "on" position and brake release lever depressed read approximately 30 VAC across terminals No. 1-2. With on-off switch in "on" position read $13 \pm 10\%$ VDC across terminals No. 3-7.

The electrolytic motor capacitor must be of proper value to give adequate motor torque. If a new capacitor is not available for check by substitution, a quite reliable check may be made using the power transformer in the control box and an auxiliary 1 Ohm 10 Watt resistor.

To make this capacitor check, remove cable from terminals and tie terminal No. 2 to No. 4. Connect one end of resistor to No. 1 and the other end to No. 8. Turn on-off switch to "on" position and depress brake release lever. If capacitor is ok it will draw sufficient current to cause a voltage drop of 1.4 to 1.6 volts to be present across the resistor. Measure with an AC voltmeter.



NOTE: USE # 18 WIRES FOR TERMINALS

1 & 2.

Fig 3

Disassembly of Rotator

1. Remove the bottom mast support to permit the rotator to be set on a flat bench.
2. Remove four screws and carefully raise top casting to expose potentiometer and drive mechanism.
3. Carefully remove upper ball retaining ring. Keep it circular, and lay it on clean paper.
4. Inspect inside of top housing for small scratches or burned spots on the ribs. These are an indication that a switch blade or connection is rubbing during rotation. See that the pot strip is clean and not burned at either end. See that pot body is secure and that pot arm is clean at the point of contact. Use only fine rouge cloth to polish contact arm. Check limit switch to see if wires are secure and insulation is undamaged. Contacts should be clean. Check for 1/32" clearance between switch blades and motor—particularly alongside of lockwasher under motor fastening. Greater clearance gets switch too close to top bell housing ribs.
5. If the drive ring happens to be near end of rotation, operate the top spur gear to rotate the mechanical stop on the drive ring away from the area of the limit switch. See that the mechanical stop lever (which is positioned between the two limit switches) will open each electrical contact before it hits the corresponding mechanical stop. Also see that the stop lever has not been deformed and that the electrical contacts are clean and uncorroded.
6. Rotate the top spur gear several revolutions to determine that the motor and its bearings are operating freely. Look for broken teeth in any of the gears.
7. Lift the motor and brake mechanism out of the brake housing. Carefully remove the lower ball bearing retainer and place it on a clean piece of paper.
8. Remove the drive ring gear from the base housing. This is accomplished by first pulling up on the side opposite the gear train. Then raise the entire ring slightly upward with the side away from the gear train higher so that it will slide out from the under the gears. Examine closely for evidence of broken or worn teeth.
9. Examine the inside of the screw terminal strip to see that there is proper clearance between the solid lugs and frame and that there are no faults in the insulation. Pay particular attention to the insulation at the point where the wires are held in metal clips.
10. Examine the teeth in the brake casting.
11. To separate motor, pot, and gear assembly from the brake assembly, unsolder the solenoid leads from terminals 1 and 2. Remove screws holding terminal board to casting. Then remove four large screws in the base. Be careful to clear wires and terminal strip through opening.
12. The latch mechanism, accessible only after step 11 disassembly, slides down into grooves in the casting and provides the top bearing surface for the brake wedge. The latch itself, which is held down by the compression springs, should prevent the brake wedge from being pushed into the casting from the outside. When the plunger is pushed into the solenoid by pressure applied on the latch pin, where the retracting springs are attached, the wedge is withdrawn and may then be pushed clear into the casting.
13. To remove potentiometer, pry the spring fasteners with a sharp instrument. Remove hex nuts. Unsolder leads. Mounting studs are welded to the motor frame. Be sure that the pot strip is clean and that pot arm is not corroded. Use only fine rouge cloth as an abrasive. In replacing the pot be sure the connections are on the side which overhangs the motor.

14. To replace the motor, first remove the pot per Paragraph 13, then unsolder black motor lead from screw terminal 1, the red lead from inside left limit switch lug, and the blue lead from inside right limit switch lug. Fastenings holding motor on studs may then be removed and the motor pulled up and out. In replacing a motor, be sure to see that the round hole in the motor is next to the limit switch. Use a double lock nut on this stud near the limit switch, to provide clearance with the leads. Use special internal-external lockwasher over the stud that works in the slotted hole in the motor. Be sure that the pinion is snug against the spur gear before tightening this fastening over the slot.
15. When it is necessary to closely inspect or replace gears, it is possible to remove motor, limit switch, pot, and terminal strip without unsoldering more than the solenoid leads from terminals 1 and 2. Remove motor fastenings from the mounting studs. Work motor up and out, exercising care in pulling leads and terminal strip through the window in the gear housing. Remove plate to expose gears. Carefully note positions for proper replacement.

Final Reassembly of Rotator

It is assumed in the following instructions that the brake mechanism is assembled and operative. The motor and gear train along with potentiometer and limit switch are likewise assembled and wired and operative.

It is not likely that the brake wedge will be exactly positioned in relation to the teeth in the brake housing to permit proper assembly unless the brake mechanism is retracted. For this reason it is necessary to operate the brake mechanism electrically during step 8 of the assembly of the rotator unit.

1. See that a small amount of low temperature, high quality, light weight grease is conservatively distributed around the ball bearings, ring gear, and spur gears. Only an even film of grease is desirable (approximately one thimbleful of grease should be used to lubricate a completely dry rotator). Excessive grease will only run out in high temperatures or cause power loss in low temperatures. A few drops of light weight No. 10 lubricating oil should be applied to the motor bearings.
2. Rotate upper spur gear until the inwardly protruding mechanical stop on the ring gear engages the channel shaped stop lever and pushes it far enough to the right to just open the right hand limit switch contact (it is assumed that the rotator is viewed from the side of the limit switch). This situation represents the extreme counterclockwise end of rotation. The potentiometer arm must then be rotated to its extreme counterclockwise position against the top brass stop.
3. Secure the upper bell housing upside down by the mast support in a vise with the open end of the "V" toward the bench. The boss which drives the potentiometer arm which is located in the bottom part of the ball housing will then be to the left of center.
4. Clean the inner portion of the housing and apply a small amount of grease to the ball race. Then carefully insert one ball bearing assembly with the flanged rim up and against the outer edge of the casting.
5. Grasp the operating mechanism by the flat base, steady the ring gear, invert the mechanism and lower it into the housing. In doing this, note that the serrated portion of the potentiometer arm must engage the driving boss in the housing and that the three driving lugs on the ring gear must engage the mating lugs in the top housing. This situation will result automatically if the previous instructions have been followed.

6. Determine that the top bearing surface is clean and apply a film of grease on the top ball race and the top bearing assembly. Then apply the top bearing assembly to the race with the rim downward.
7. Clean the brake housing and apply a light film of grease to the ball race only. Lower the brake housing into place so that the assembly holes will approximately line up with the threaded holes in the upper housing. **DO NOT MECHANICALLY FORCE AN EXACT ALIGNMENT OF THESE HOLES WITHOUT ELECTRICALLY RELEASING THE BRAKE MECHANISM.**
8. Connect the control terminals No. 1 and No. 2 only to the corresponding terminals on the rotator while it remains clamped in the vise. Momentarily operate the lever on the control box to retract the brake. This will permit the brake housing to be freely rotated for exact alignment of the holes. With the power applied to the brake, insert the 4 assembly screws and run them down to a reasonably tight position. Keep the brake retracted electrically while all 4 screws are being tightened. Release the brake electrically and use a heavy screwdriver with wrench to completely tighten the 4 assembly screws. Torque to 85 inch pounds.
9. It is suggested that all 8 wires be connected from the control box while the rotor is still on the bench and that its complete operation be checked.

TROUBLE SHOOTING SUGGESTIONS

Field experience has shown that most operational difficulties with the HAM rotor are traceable to broken, shorted, or grounded wires—usually at the terminal strips. Time spent in cutting the leads to exact lengths, tinning, forming, and wrapping around terminals, cutting insulation to exact length, and clamping to prevent strain on any single wire, will pay big dividends later in long and trouble-free performance. Put it up right—and leave it up!

Should trouble occur, first follow the suggestion on Page 5 for "Service Control Unit" and "Checking Rotor From Ground". Compare resistance values with Schematic Diagram to localize trouble. The following "symptoms" and "treatments" may also be helpful.

Mechanical Play

To prevent binding under adverse operating conditions, a small amount of play is designed into the rotor. Even a degree or so of rotary play will permit several inches movement at the end of a wide antenna boom, or at the tips of the elements. Frequently the slight motion of the antenna array in gusts of wind is due more to the natural flexing of the elements and masts than it is due to actual play in the rotor mechanism.

Antenna Rotates in Heavy Wind

This is usually a matter of the mast slipping in the support. For large arrays it is often necessary to drill a $\frac{3}{8}$ " hole through clamping plate, mast and mast supports and pin them together with a non-corrosive fastening. A false indication of suspected "slipping" can be obtained by comparing meter readings at different times when the beam has not been "rotated officially". Since the indication varies directly with line voltage, a change of 10% will make 36° difference in indicator at full scale of 18° difference at mid-scale. If the rotor is actually turning, the brake latch is not engaging properly. Since it is pulled into place by springs and only retracted electrically, it will be necessary to disassemble the rotor per instructions on page 6 and follow suggestions of step 12 regarding the latch mechanism.

Lack of Power so that antenna rotation is slow or sluggish. Be sure that the heavy leads in the cable were used for Terminals No. 1 and No. 2, as these

leads must carry about 5 amps. to handle power for both the brake and motor. Use method on page 5 to check motor from ground. Check the capacitor. Check transformer for AC output. If the electrical circuit is OK, then check for mechanical binding. Pay particular attention to bearings and alignment of shaft on an inside tower mount. As a last resort, dismantle the rotor to check gears, bearings, etc.

No Meter Indication

The brake and motor operate independent of the indicating system. If the pilot lights burn at proper brilliancy, the instrument transformer is OK and output is not shorted. Check for about 21 VDC across terminals No. 3 and No. 7 with switch operated. If this is present, check for 500 ohms across these leads to rotor (disconnected at control box). If 500 ohms is present from No. 3 and No. 7, see if the readings from No. 3 to ground and No. 7 to ground total 500 ohms. If this is so, connect an auxiliary meter from terminal No. 3 to ground and see that voltage runs from zero to about 12 volts as antenna is rotated from left to right extremes.

No Rotation — Indication OK

Either the thermal cutout in the power transformer has opened to protect the motor or capacitor from excessive heat of prolonged operation or there is actually trouble on the motor circuit. After allowing time for the thermal cutout to restore service, proceed with suggestions above for "lack of power".

Grounded Leads

Grounds on cable leads will burn out either the line fuses or the small fuse in the DC circuit. For full explanations, refer to Schematic. If lead No. 3 is grounded, it shorts out part of the pot, so that as rotation progresses to the other end, the full DC voltage is applied across a decreasing portion until current becomes so high that it burns out. Note also that any grounds either put an overload on the power transformer which causes the line fuse to blow, or overload the rectifier circuit so that the $\frac{1}{8}$ amp fuse blows.

Meter Fluctuation

An intermittent condition in any component in the rectifier or meter circuits within the control box, as well as in the cable or potentiometer circuit in the rotator itself can cause meter fluctuation or error. Possible causes of such trouble may be localized by placing a test DC meter across terminals No. 3 and No. 7 and comparing the action of the test meter with the panel meter.

If the test meter fluctuates along with the panel meter, either a component in the rectifier circuit is intermittently defective, or an intermittent trouble-ground is drawing excessive current. To further localize such a condition, leave the test meter on terminals No. 3-No. 7 and remove the corresponding leads to the rotator. This removes the load from the DC circuit so the test meter will show about 12 volts. The panel meter sensitivity will be cut about in half, so it will show about $\frac{3}{4}$ scale. Fluctuation of the test panel meters will now point to trouble in the DC rectifier circuit. Fluctuation of panel meter only, will point to intermittent trouble in the meter, multiplier resistors, or the "cal." pot.

Where the meters are steady in preceding tests, and there is fluctuation with rotator leads connected, it indicates trouble in the lead wires or rotator itself. The resultant fluctuations usually cause the meter to pulse UPWARD from a given reading. Any dirt, grease or corrosion that breaks or interferes with the ground return from the potentiometer slide will cause the needle to fluctuate from a true reading toward a center scale point. In such cases it is necessary to open the rotator per instructions on page six.

The ground connection is carried through the potentiometer pivot directly to the frame.

PARTS AND PRICE LIST

CONTROL UNIT HAM - II/CD-44

50940-10 PART NUMBER	Control Unit, Complete (115 VAC) DESCRIPTION	Quantity	\$89.95 Price Each
ELECTRICAL			
10344-03	Fuse, 3 Amp, F-1	1	.30
10733-01*	Transformer, Power 115 VAC-Std on 50940-00	1	14.50
30112-05	Switch, Micro S-3, S-4, & S-5	3	1.60
50040-00	Capacitor (120-140 Mfd.) C-2	1	2.50
50153-00	Diode, Zener, D-1	1	4.50
50177-00*	Transformer, Meter 115 VAC-Std. on 50940-00	1	7.00
50183-00	Capacitor (30 MFD) C-1	1	1.30
50501-00	Diode, 100 Piv. D-2	1	1.00
50513-11	Resistor (10K Ohms 1/2W) R-1	1	.35
50513-12	Resistor (180 Ohms 1W) R-2	1	.35
50563-00	Fuse, 1/8 Amp., F-2	1	.30
50861-00	Line Cord, 3 Wire	1	2.00
50883-00	Meter, Lamp Holder, and Bezel ("N" Center)	1	23.10
50895-00	Bulb, Meter	1	.90
50899-00	Switch, On-Off, S-1	1	2.00
50900-00	Switch, Calibration, S-2	1	5.60
SHEET METAL AND HARDWARE			
10555-00	Strip, Solder Terminal	1	.50
10563-00	Holder, Fuse, F-1	1	1.90
30362-05	Spring, Extension (Meter Bezel)	2	.30
50185-00	Holder, Fuse, F-2	1	.60
50187-00	Knob, Switch	2	1.00
50194-00	Clamp, Cable	1	.20
50300-00	Bumper, Rubber	4	.15
50399-00	Strip, Terminal (8 Pin)	1	.70
50884-00	Lever, Switch (Direction & Brake)	3	.60
50885-00	Cover, Top (Tan)	1	4.00
50886-00	Cover, Bottom (Brown)	1	4.50
50890-00	Face Plate	1	3.10
50891-00	Chassis	1	6.00

*Note: 115 VAC control unit can be converted to 220 VAC by installation of the 220 VAC power and meter transformers.

10735 - 01 Transformer, Power, 220 VAC

50202 - 00 Transformer, Meter, 220 VAC

To order parts, remit check or money order for total parts cost plus \$1.00 for postage and handling to: Cornell-Dubilier Electronics, Department "C", 118 E. Jones Street, Fuquay - Varina, N. C. 27526

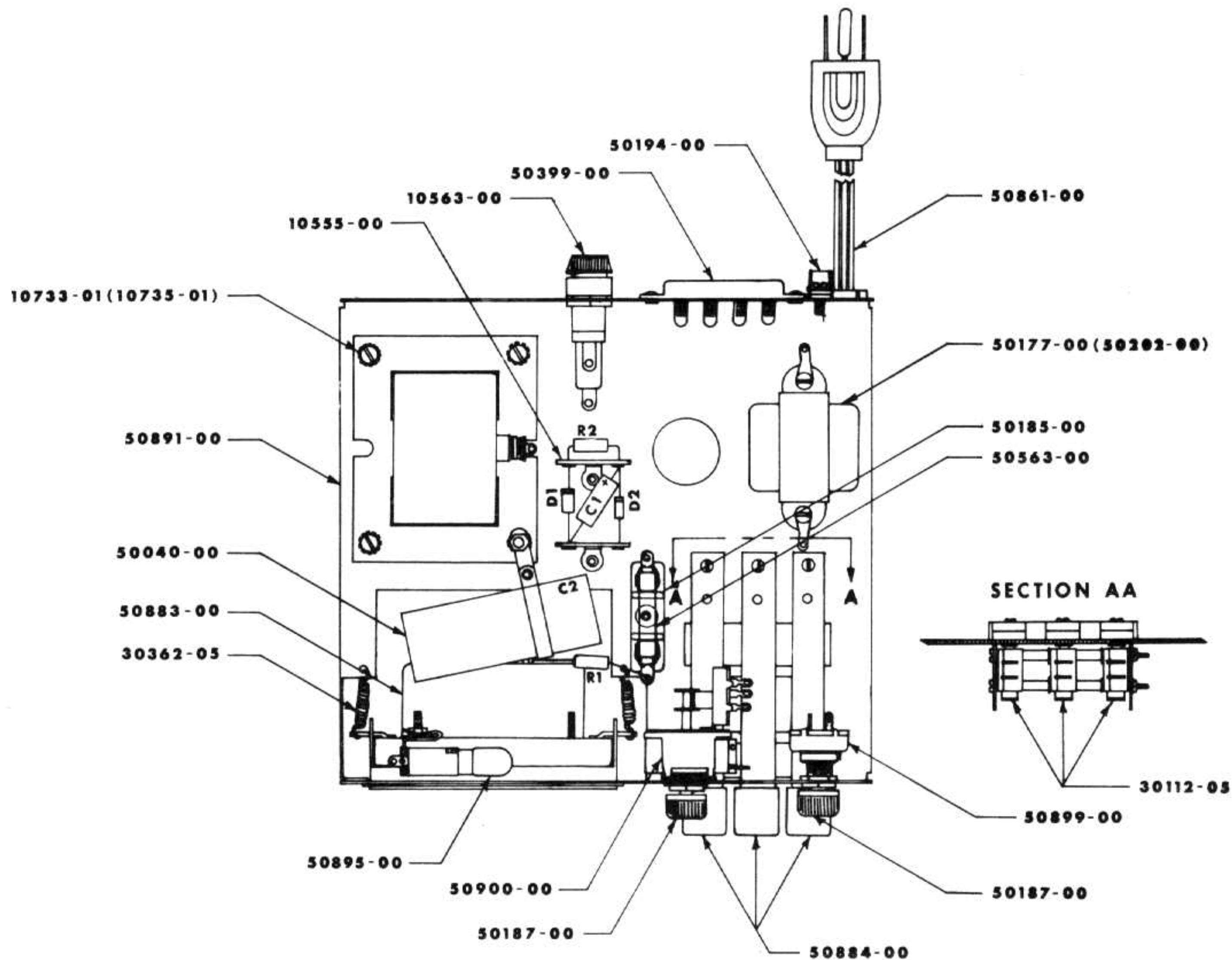


Fig. 4

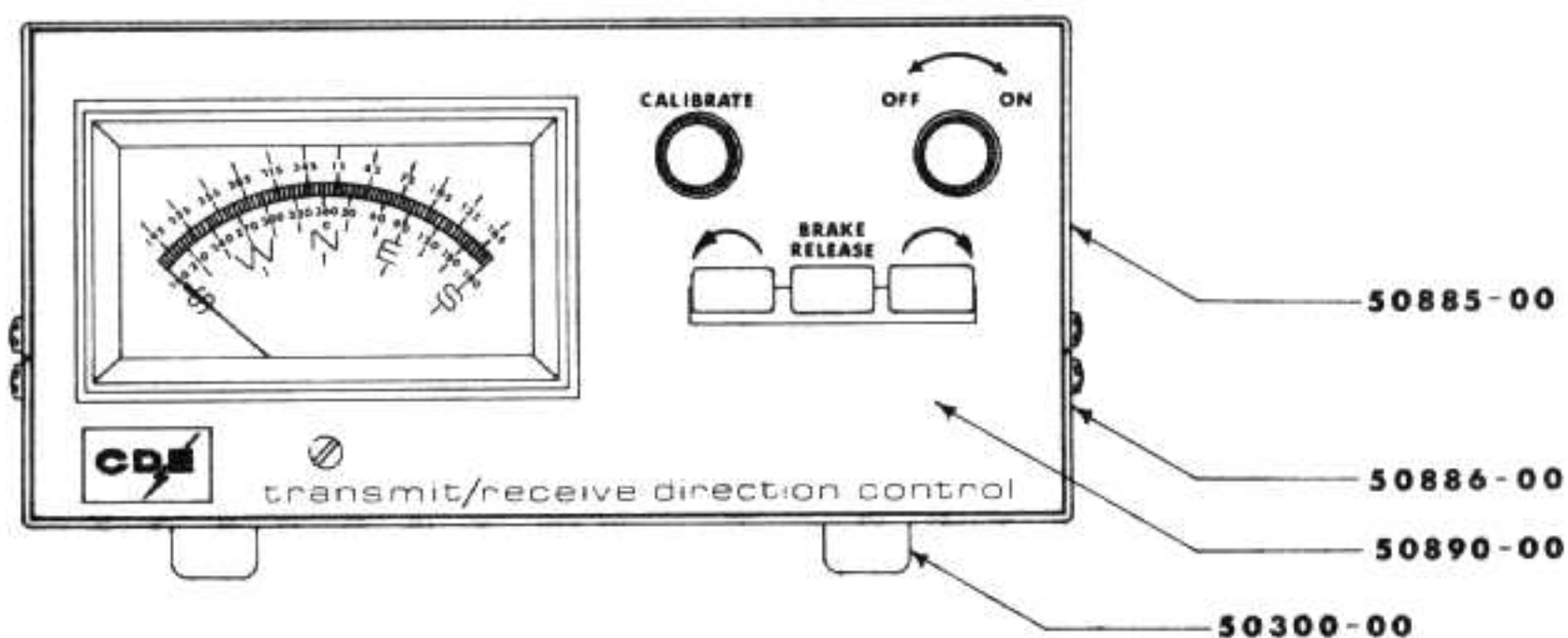


Fig. 5

LIMITED WARRANTY

CORNELL-DUBILIER ELECTRIC CORPORATION (CDE) warrants that your new ROTOR has been manufactured free of defects in design, material and workmanship. If this product fails to give satisfactory service due to defects covered by warranty, including any warranty implied by law such as WARRANTIES OF MERCHANTABILITY OR FITNESS, for a period of ONE YEAR FROM THE DATE OF PURCHASE, CDE will, at its option, replace or repair the unit, or any defective part free of charge.

To obtain warranty service, return the ROTOR to your dealer, or pack it securely, and send it with proof of purchase date and a letter explaining the problem, shipping cost prepaid, to: CORNELL-DUBILIER ELECTRIC CORPORATION, WARRANTY REPAIR DEPARTMENT, 118 E. JONES ST., FURQUAY-VARINA, N. C. 27526.

IMPORTANT

Warranty service covers only repair or replacement of the ROTOR only. CDE is not responsible for costs of removal or reinstallation, or shipping to the place of repair. The warranty period is not extended due to repair or replacement.

CDE reserves the right to make reasonable charges for service if there is evidence of damage due to alteration, misuse or installation not according to the enclosed instructions.

CDE IS NOT RESPONSIBLE FOR DAMAGE TO OTHER EQUIPMENT OR PROPERTY OR FOR ANY OTHER CONSEQUENTIAL OR INCIDENTAL DAMAGES OF ANY KIND, WHETHER BASED ON CONTRACT, NEGLIGENCE OR STRICT LIABILITY. MAXIMUM LIABILITY SHALL NOT, IN ANY CASE, EXCEED THE PURCHASE PRICE OF THE UNIT.

(Some states do not allow limitations on how long an implied warranty lasts, or the exclusion or limitation of incidental or consequential damages, so the above limitations and exclusion may not apply to you.)

(This warranty gives you specific legal rights. You may also have other rights which may vary from state to state.)

PARTS AND PRICE LIST

HAM-II ROTATOR

PART NO.	DESCRIPTION	QUANTITY	PRICE EACH
50232-00	Rotator Unit Complete	1	\$83.95
50349-01	Lower Mast Support Assy.	1	5.00
50339-00	Terminal Cover Plate for Lower Mast	1	.50
50155-00	Grommet for Terminal Cover	1	.18
50304-01	Upper Mast Support (Bell Casting)	1	7.50
50095-00	Brake Housing (Lower Casting)	1	8.00
50335-01	Ball Bearings	98	.12
50113-00	Ball Retainers	2	1.10
50097-00	Brake Support Casting	1	6.25
50370-00	Base Casting & Gear Shaft Assy.	1	5.10
50310-00	Motor Pinion (Nylon)	1	.50
50112-00	Gear and Pinion (1st, 2nd, and 3rd from Motor)	3	4.50
50111-00	Gear and Pinion (Thick pinion 4th from Motor)	1	5.25
50107-00	Final Spur Gear	2	2.40
50313-00	Ring Gear (Cast Aluminum)	1	2.50
50341-00	Small Gear Spacer (Brass)	1	.30
50378-00	Large Gear Spacer (Steel)	1	.40
50379-00	Bushing for Final Spur Gear	1	.40
50460-00	Motor & Pinion Assy.	1	18.10
50122-00	Motor Mounting Plate with Studs	1	2.50
50231-00	Potentiometer Assembly (Complete)	1	9.60
50090-00	End of Rotation Switch Assembly (Complete)	1	3.30
50338-00	Stop Lever Assembly	1	1.00
50099-00	Solenoid Only	1	9.10
50100-00	Solenoid Pin	1	.40
50101-00	Solenoid Pin Spacers	3	.30
50282-06	Solenoid Pin Retaining Ring	2	.15
50114-00	Solenoid Retracting Springs	2	.25
50096-00	Retracting Spring Clip	2	.15
50103-00	Brake Wedge	1	4.40
50098-00	Connecting Links	2	.50
50102-00	Connecting Link Pin	1	.35
50117-00	Brake Wedge Support	1	.95
50104-00	Brake Latch	1	1.00
50106-00	Latch Pins	2	.25
50282-04	Latch Pin Retainers	2	.15
50105-00	Latch Springs	2	.25
50399-00	Terminal Board Assembly (8 Terminals)	1	.70
51234-00	Retainer for Stop Lever Assembly	3	.15
51120-00	Washers	3	.10
02-06006-061	Self-Top Screw 6-32x $\frac{3}{8}$	2	.10
51057-00	Hex Hd. Screw (Taprite) 12-24x $\frac{3}{4}$	4	.15
50463-00	Mounting Kit	1	6.00
	(2) 50115-00 Mast Clamp		
	(4) 50382-00 "U" Type Bolt (Stn. Stl.)		
	(4) 50502-00 Spacer		
	(6) Screw, Hex Hd. $\frac{1}{4}$ -20 x 1 $\frac{1}{4}$		
	(10) Hex Nut $\frac{1}{4}$ -20 (Stn. Stl.)		
	(14) Lockwasher, Split $\frac{1}{4}$ "		

To order parts, remit check or money order for total parts cost plus \$1.00 for postage and handling to: Cornell-Dubilier Electronics, Department "C", 118 E. Jones Street, Fuquay - Varina, N. C. 27526

Fig. 6

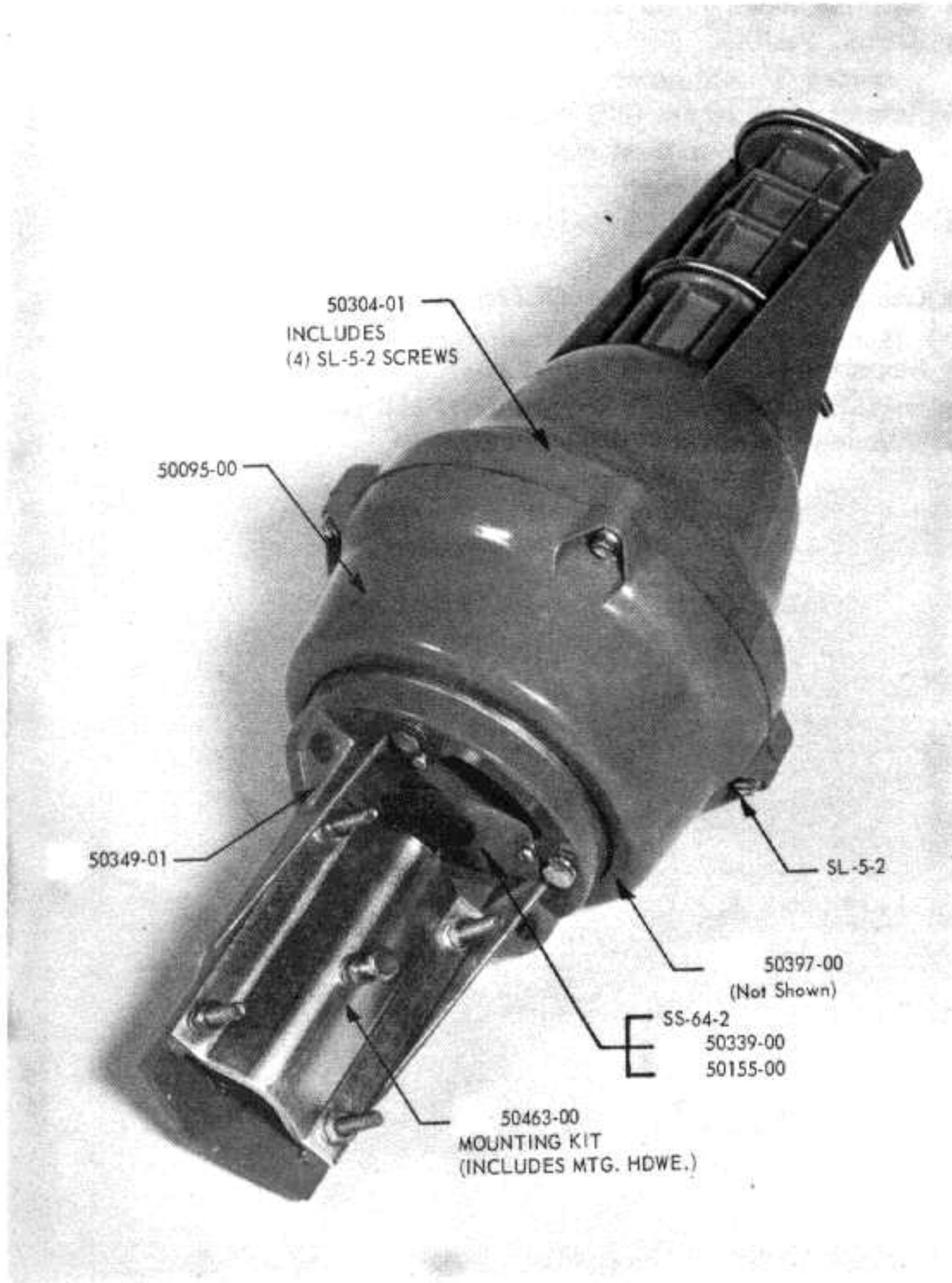


Fig. 8

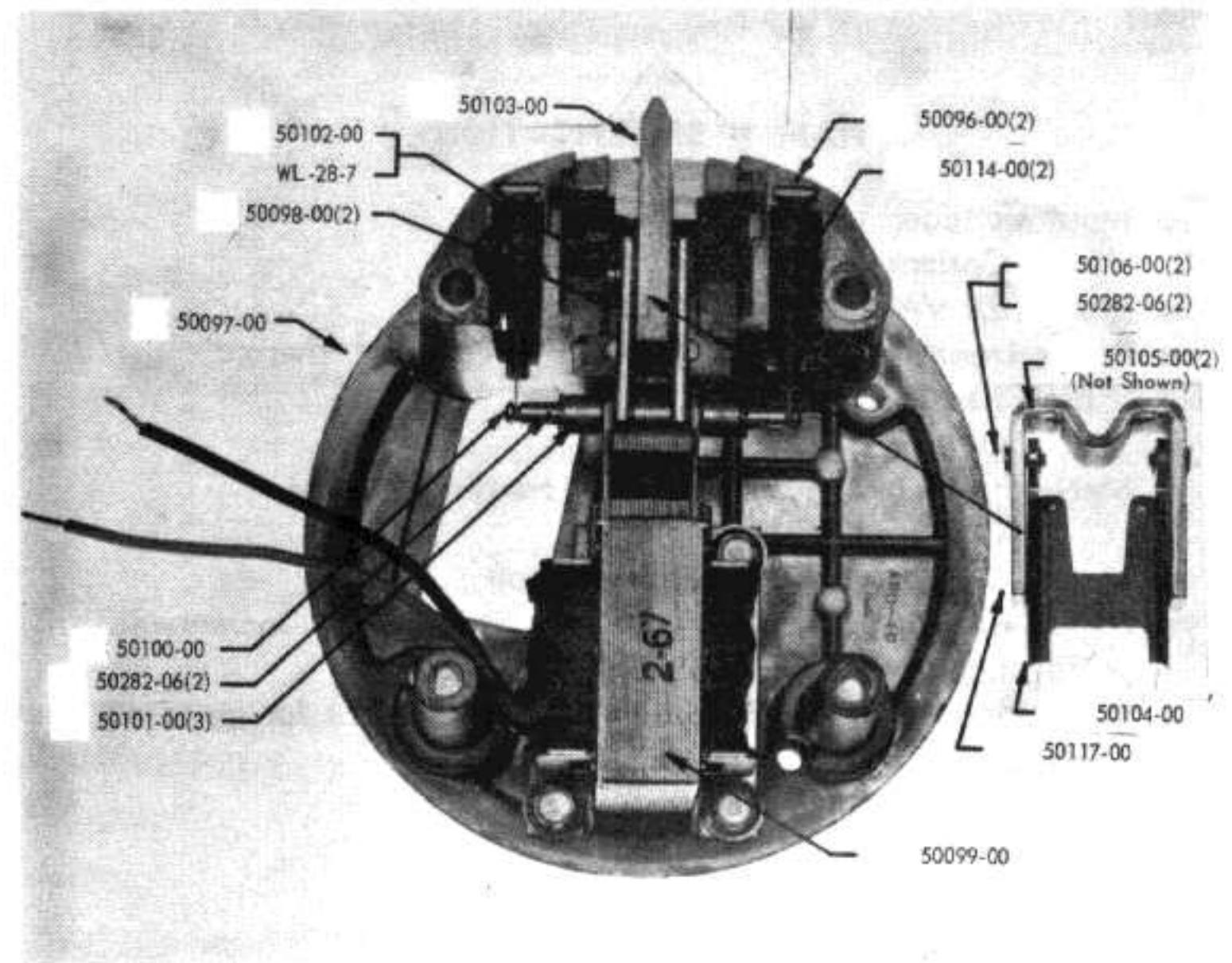
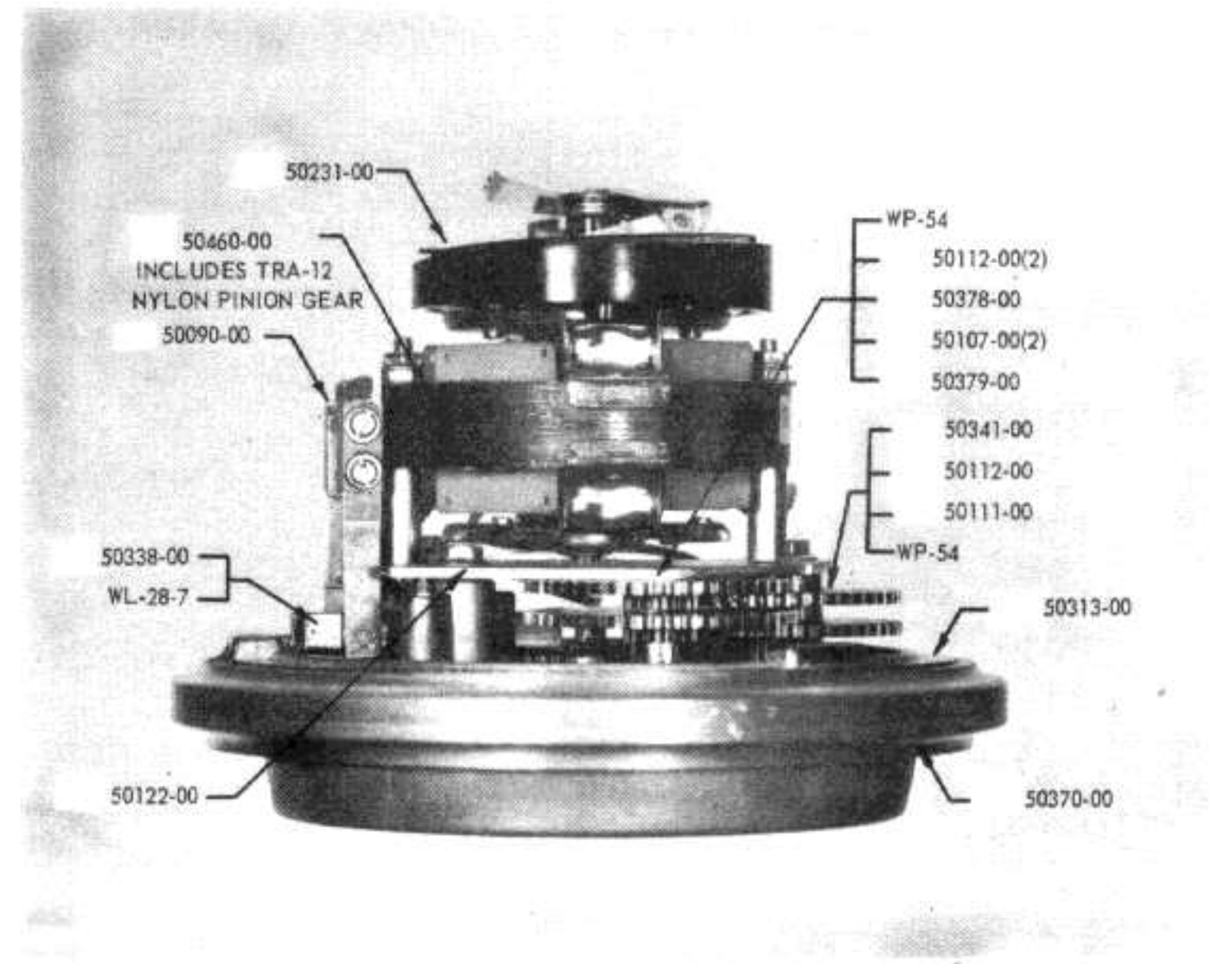


Fig. 7



ACCESSORY KITS

ALTERNATE METER SCALE

50924 - 10 South Center Meter Scale Kit 3.00

SOUTH CENTER SCALE KIT

The stock Ham II/CD-44 control unit is produced with a North Centered meterscale. Since some locations and/or popular working areas may favor rotation stops at North, we provide a South Centered meter scale kit for field modification.

INSIDE TOWER MOUNTS

50559 - 10 Tower Spacing Plate Kit 4.50

A cylindrical space of 21.6 cm (8.5 inches) diameter and 38.1 cm (15 inches) height will accommodate the Ham-II rotor bolted to a flat plate without the lower mast support attached. To facilitate such mounting, a steel plate, cut out to fit against the bottom of the brake housing and clear the terminals, is available. This plate, part number 50559-10, has four heavy bushings drilled to match the screw holes and to hold the rotor 12.7 mm (.5 inches) above the tower plate in order to provide clearance for the control cable.

On any inside tower installation, care must be exercised to get the top mast shimmed to the exact rotational center of the rotor upper mast support. The geometry is such that a mast of 52 mm (2.062 inches) will be exactly centered. For each 1.6 mm (.0625 inches) less mast diameter used, .8 mm (.031 inches) of shim must be wrapped around the mast at the clamping points.

HAM II SPECIFICATIONS

- Input Voltage: 115 VAC 50-60 HZ
Optional: 220 VAC 50-60 HZ
- Motor: 24 VAC, 2.25 Amp, Split Phase
- Power transformer: 115/26 VAC, 10% duty, thermal protected.
Optional: 220/26 VAC
- Meter transformer: 115/23 VAC, continuous duty.
Optional: 220/23 VAC.
- Meter: D.C. voltmeter 1000 ohms/volt
- Meter scale: Direct reading, North centered. 5° increments.
Optional: South Centered.
- Recommended cable: Belden 8448 or equivalent for up to 45 meters (150 feet).
Two wires No. 18, 6 wires No. 22.
- Maximum Cable Resistance: Not over 1 ohm for conductors 1 and 2. Not over 2.5 ohms for conductors 3 through 8.
- Rotation time: 45-60 seconds with 60 HZ input.
- Brake: Positive, electrically operated wedge. 96 segments spaced 3° 45' apart.
- Rotator size: 20 cm (8") maximum diameter by 50 cm (20") high with lower mast support. Without lower mast support, 34 cm (13.5") high.
- Permissible mast size: From 35 mm (1.37") to 52 mm (2.062").
- Control box size: 20.5 cm (8.125) wide x 21 cm (8.25") deep x 10.5 cm (4.125") high.
- Mounting hardware: Stainless steel.
- Shipping cubature: 37,350 cu. cm (2280 cu. in.).
- Shipping weight: 13.15 kg (29 pounds).

CDE HAM II ROTOR