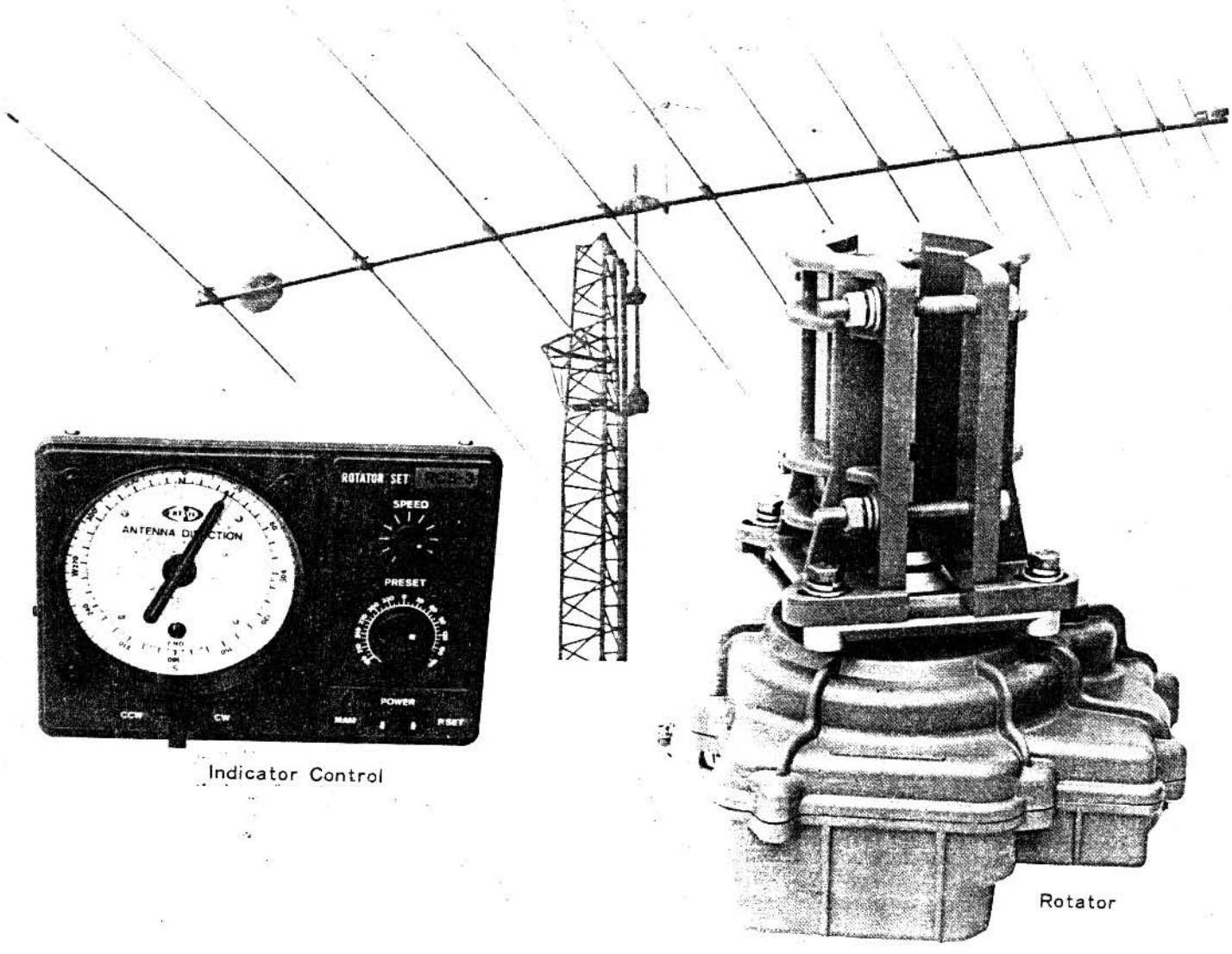
CREATE

ANTENNA ROTATOR ASSEMBLY

RC5-x : for Regurar Type Rotator

RC5A-x: for Heavy-Duty Type Rotator



Indicator Control

Rotator

SECTION 1
INSTALLATION

1.1. UNPACKING AND INSPECTION

Be sure to check the rotor and indicator/control after unpacking, especially if there is noticeable damage to the carton. Inspect the rotor for cracks and the indicator for damaged or loose components. Use the parts list in SECTION 5 to count the accessories.

1.2. INSTALLATION AND WIRING

1.2.1. GENERAL

Description in this manual is for installation on an ordinary rooftop tower or steel tower, but the basic points made here should be observed even when installing the rotor on another sort of fixture.

1.2.2. ROTOR INSTALLATION

The RC-5xx basically consists of a rotor and an indicator/control unit. Place the rotor on top of a flat mounting plate with the mast clamp pointing up, as shown in Fig. 1.1. The mast must be perfectly vertical. Screw the five M8x18 bolts with S-washers up through five of six holes in the mounting plate to secure the rotor. Follow the tightening sequence given in paragraph 1.4. If a mounting plate of thickness other than 1.2-4.0 mm is used, then bolts of different length must be used. Use zinc galvanized or electroplated—not stainless steel—bolts. These will minimize electrical contact with the rotor.

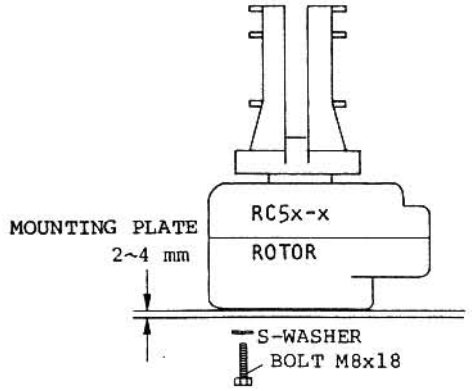


Figure 1-1. Rotor Installation.

CAUTION

1. Be sure to select zinc galvanized or electroplated bolts if not using the bolts provided with the rotator set.
2. The plane of contact between the mounting plate and the rotor must be level to within 0.5 mm.
3. Make bolt holes in the mounting plate no more than 9 mm in diameter. Larger diameters than this will reduce fastening strength.

1.2.3. WIRING

Connect the rotor and indicator/control unit as shown in Fig. 1.2, with 7-core cable. The cable plugs into a 7-pin socket on the rotor and the seven wires are connected to a crimp contact terminal board on the indicator/control unit. Solder must be used to connect the cable to the rotor. For connection to the indicator/control unit, the wires can either be fastened by pliers or soldered to the terminal board. Make a written note of which wires are connected to which connector pins on the rotor so that they can be connected to the corresponding terminals on the indicator/control unit.

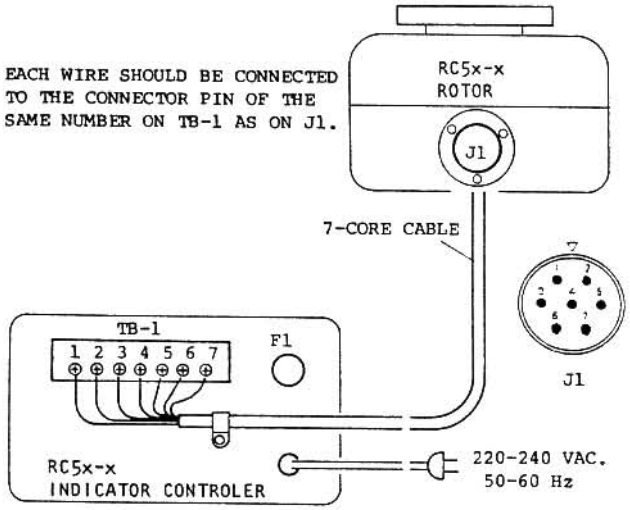


Figure 1-2. Interconnections.

1.2.4. REMOTE CONTROL CABLE

The cable thickness recommended for the RC5xx varies with the cable length and the rotator model. Using cable with cores that are too thin will limit the voltage and reduce the torque. The following table lists recommended sizes.

TABLE 1-1. Remote control cable

Model No.	Cable length and section area of individual cores	
	Less than 40 m	60 thru 100 m
RC5-x	0.3 mm^2	0.5 mm^2
RC5A-x	0.5 mm^2	0.75 mm^2

(Example of cable nomenclature: VCTF-0.5/7 means a 7-wire cable with sectional area of 0.5 mm^2)

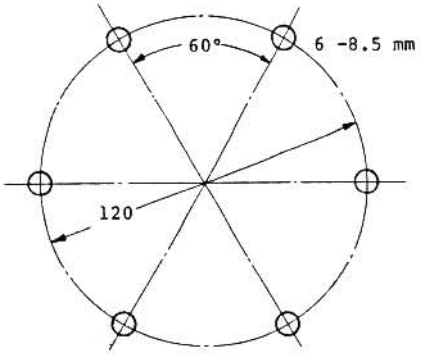
1.2.5. CABLE POSITIONING

The remote control cable linking the rotor and indicator/control unit should be positioned as far as possible from the coaxial antenna cable. When transmitting at over 500 W, the cables should be separated by at least 20-30 cm. Locating them too close to each other can produce high-frequency interference in the indicator circuit that will cause inaccurate readings.

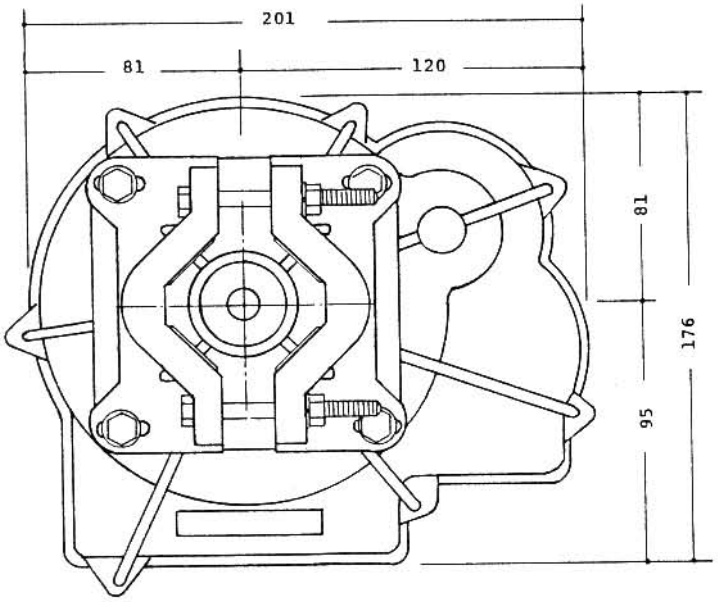
When connecting the remote control cable to the rotor, secure it to a brace on the tower or installation fixture close to the rotor so that its weight will not pull on the connector. Be sure to tape the fitting when connection work is complete.

1.3. INSTALLATION DIMENSIONS

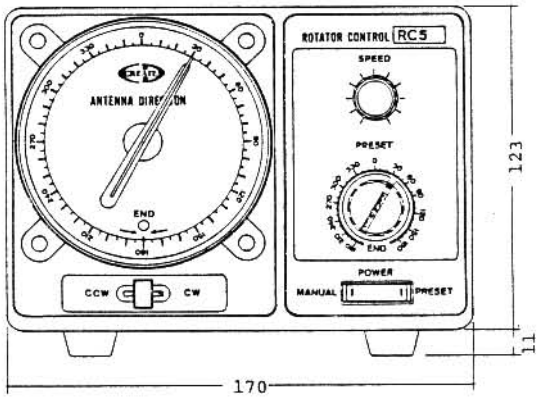
Rotor and indicator/control unit dimensions are given in Fig. 1.3.

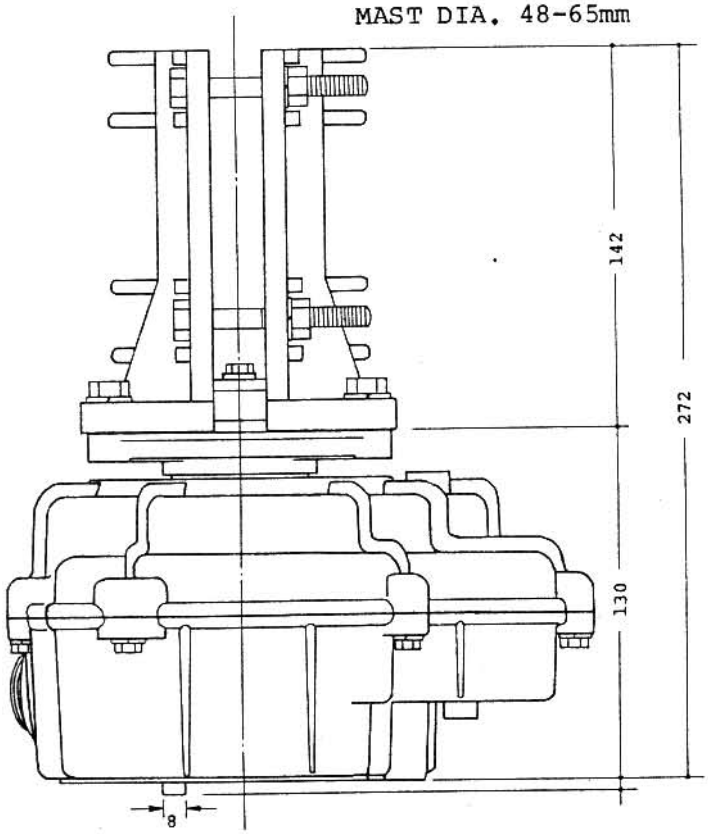


ROTOR-MOUNT FEET DIMENSIONS

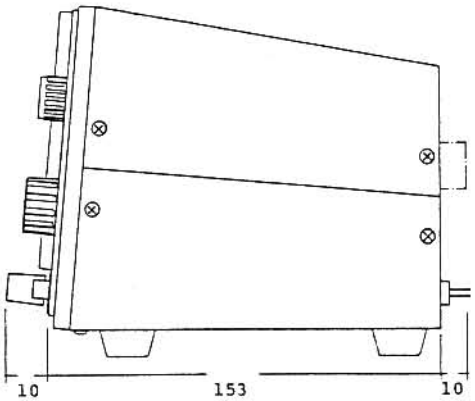


MAST DIA. 48-65mm





ROTOR UNIT



INDICATOR CONTROL UNIT

NOTE: DIMENSIONS ARE IN MILLIMETRES.

Figure 1-3. RC5x-x, Outline and Mounting Dimensions.

1.4. BOLT TIGHTENING SEQUENCE

Tightening the bolts in the wrong order when securing the rotor and the antenna mast will shorten the operating life of the rotor. Tighten them in the order indicated in Fig. 1.4. That is, begin with the mounting plate bolts, then tighten the bolts on the mast clamp, and then tighten flange bolts.

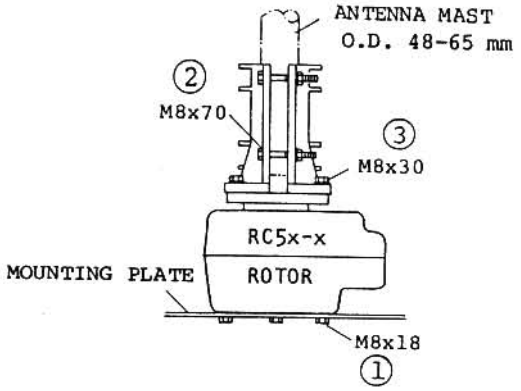


Figure 1-4. Rotor Mounting Bolts.

1.5. EXAMPLE OF RC5xx INSTALLATION

The manner in which the RC5xx is installed will affect its durability and torque. Fig. 1.5 is for installation on a typical steel tower, but the same principles apply to installation on a rooftop tower. The most important thing to keep in mind here is that the central axes of the antenna mast and rotor must be within 0.5° of each other. This is usually not much of a problem with rooftop towers, which tend to be precisely engineered. It can be a problem with large towers, though, where precision is lower and it is difficult to make structural modifications to correct for discrepancies.

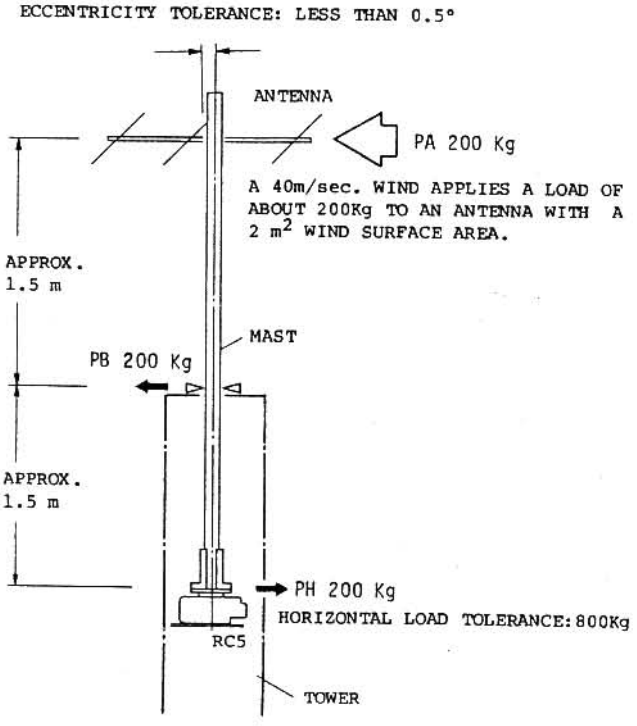


Figure 1-5. Rotor Eccentricity.

Fig. 1.5 also indicates the horizontal load on an antenna with a $2m^2$ wind surface area in a 40 m/sec. wind. Horizontal pressure on the rotor and a bearing can be reduced by increasing the distance between them. This does not affect the load on the internal gears.

1.6. MAST BEARING INSTALLATION

A bearing or similar item is usually installed at the top of an antenna tower to prevent the antenna from swaying. Such a bearing must be used for only this purpose. Using it to support any of the weight of the antenna or antenna mast would have an adverse effect on the rotor. This is not only because the rotor is more thrust-effective than the bearing but also because eccentricity arising from structural imprecision cannot be absorbed at the top of the tower and so the resultant, waste force would work on the bearing and rotor. Accordingly, the fastening bolts should not be tightenend to the point of holding the antenna mast when a standard bearing for "ham" radio antennas is used. With bearing having both top and bottom bolts, the top ones should be removed.

With an antenna having a wind surface area of greater than $2m^2$ padding should be inserted between the bolts and the antenna mast. Do not tighten the bolts down directly onto the mast, as doing so will increase the danger of buckling in strong winds.

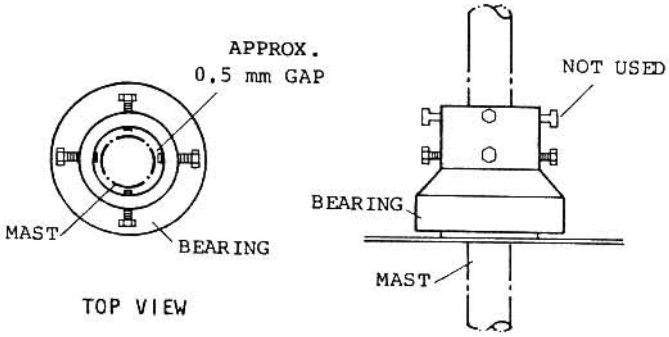


Figure 1-6. Mast Bearing Installation.

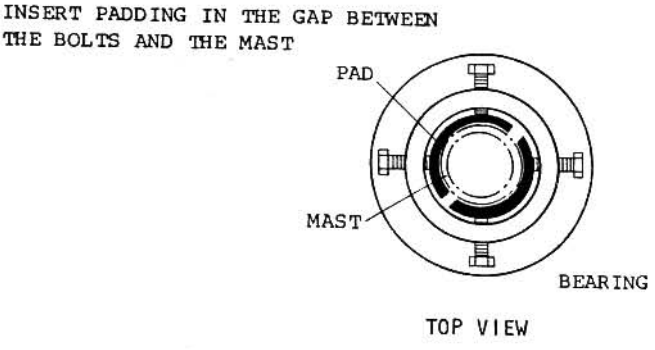


Figure 1-7. Mast Protection.

1.7 PAINTING

Painting the rotor exterior and bolted joints will lengthen the life of these parts. Refer to SECTION 7 for a more detailed explanation.

SECTION 2

OPERATION

2.1. INSPECTION

Carefully check that the rotor and indicator remote control cable connections are as they should be before turning on the power for the first time. Improper wiring can result in damage to the potentiometer in the rotor or to the indicator control unit circuitry when the power is switched on. Setting the power switch to either "MAN" or "P. SET" turns on the RC5x-3. Other models are turned on by setting the switch to "MAN."

2.2. DIRECTION ADJUSTMENT

The indicator pointer must be aligned with the antenna orientation before operating the RC5xx. This adjustment is performed as follows using a magnetic compass.

- Standard direction adjustment

Turn the rotor and stop it when the pointer is under the overlay mark for magnetic north "N". Then turn and secure the antenna so that it is oriented in the direction indicated by the compass as magnetic north. When the desired antenna orientation has been determined beforehand on a map, as for VHF or UHF, the antenna can now be matched to that direction according to the overlay indication.

- Other types of direction adjustment

The RC5xx indicator features an adjustable overlay for bearing indication set on a fixed scale in degrees. Moreover, a semi-fixed mechanism is used for the pointer, and it cannot turn more than 190° away from the "0°" indication.

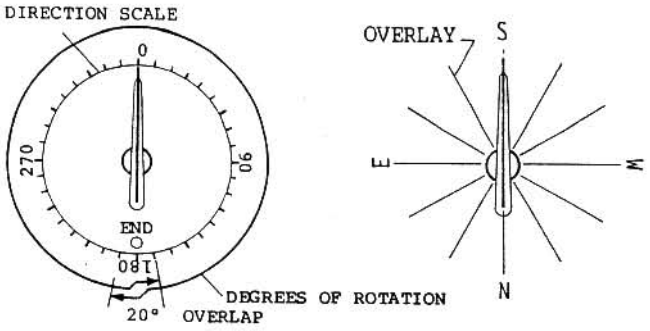


Figure 2-2. Pointer Display.

When changing the beam direction of stacked antennas 45-90°, rotate the overlay to the extent of that difference to allow direct reading of both antenna directions from the respective scales. Or if the wind has altered the beam direction of an antenna, the overlay can be aligned with the new beam direction to compensate for this without having to adjust the antenna itself.

Also, the 190° rotation limit would be a problem with antennas that are ordinarily oriented around due south (180°). Turning the antenna from the 150° position to 200°, for example, would entail bringing it all the way around counterclockwise. This inconvenience can be avoided by turning the overlay in either direction. The overlay can be turned by finger on loosening the screws securing the frame. The overlay is turned 180° at the right in Fig. 2-2.

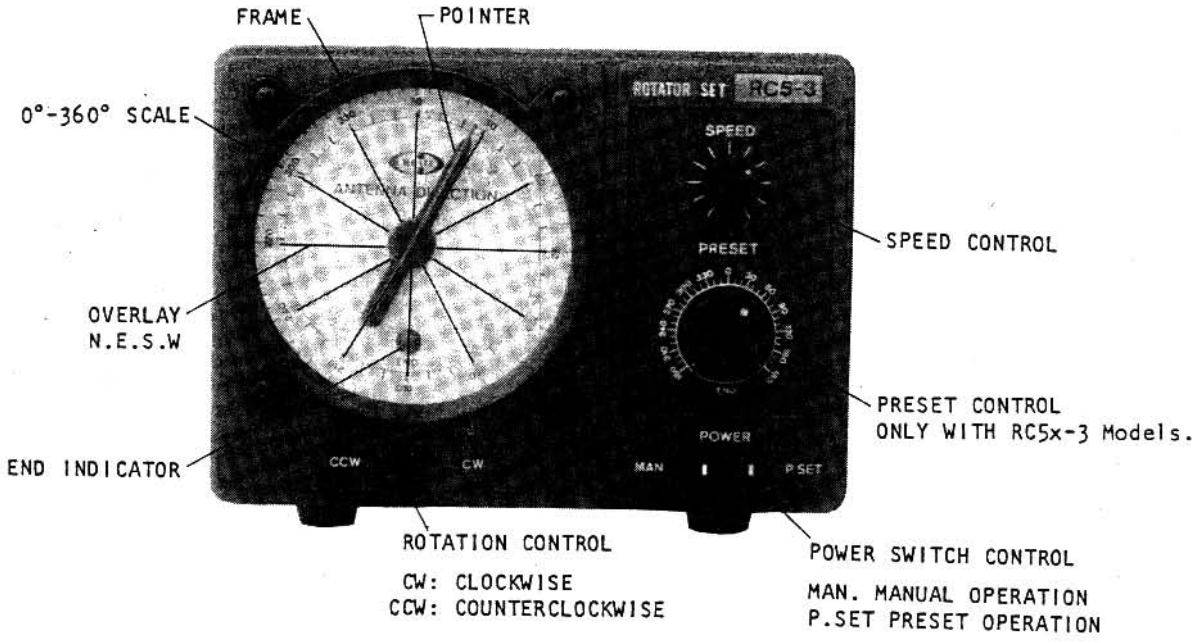


Figure 2-1. Operating Controls.

2.3. ROTATION CONTROL: CCW/CW

The rotation control lever is tipped toward "CW" or "CCW" to turn the antenna either clockwise or counterclockwise. "CW" and "CCW" are used to avoid the confusion that could arise, depending on the pointer position, with "right" and "left" indications. This lever cannot be used with a unit equipped with the preset feature (model RC5x-3) when the unit is in the present mode (power switch set to "P. SET").

Models other than the RC5-1 are provided with and RDC (reversal delay control) function to extend rotor life by preveniting sudden reversals of turning direction. This feature imposes a two or three second delay when the operator reverses directions in turning the antenna. Since RC5-1 sets are not equipped with this feature, be careful not to reverse direction suddenly when rotating an antenna with this model.

2.4. SPEED CONTROL: SPEED

Every RC5xx model is equipped with a circuit for varying the rotor turning speed. Turn the knob clockwise to increase the speed, counterclockwise to reduce it. Rotation is constant at high speed, regardless of antenna size, but is uneven at low speed. Turning the rotor fast is not desirable for the durability of the rotor braking mechanism, so low speed should be used when operating the rotator in strong wind or near to its rated limits.

2.5. TURNING LIMIT INDICATOR: END

All RC5xx models are also provided with a turning limit feature. This limits rotation in one direction to 380° in order to prevent the coaxial antenna cable from being wound onto the antenna. The redlamp lights when the pointer—being in the 170-190° range (see Fig. 2-2)—has reached the turning limit.

2.6. PRESET: P. SET (RC5-3, RC5A-3)

RC5x-3 models contain a preset control circuit. To use this feature, set the power switch to "P. SET." The antenna will turn automatically to the direction set in degrees on the preset dial. Manual control is not operable at this time. RDC functions in the preset mode, too, so the rotor will not respond for two or three seconds if the preset dial is turned in one direction while the antenna is turning in the other. Since stopping precision in the preset mode is only within 8°, the rotor will not turn if the preset dial is set less than 8° from the current antenna position.

SECTION 3
PRINCIPLES OF OPERATION

3.1. ELECTRICAL CONFIGURATION

Fig. 3-2 shows an electrical block diagram of the RC5-3/RC5A-3, which contains the most electrical circuitry of any RC5/RC5A model. Complete circuit diagrams are given in Section 6. The rotor unit is the same with all models. Only the indicator units are different. RC5A-2 rotators have no preset circuit, while model RC5-1 is not equipped with RDC. There are major mechanical differences between RC5 and RC5A models. All models offer the direction indicator and speed control feature with the indicator/control unit.

3.1.1. INDICATOR CIRCUIT

A highly-accurate servo mechanism keeps the indicator pointer on the antenna direction. Bridging between R30 in the rotor unit and R11 in the indicator unit, the DC servo circuit amplifies any discrepancy between the two resistances and drives the servo motor accordingly to turn the pointer, which is mounted on the motor shaft.

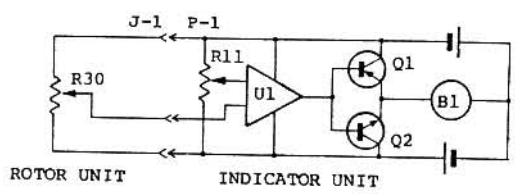


Figure 3-1. Indicator Servo Amplifier.

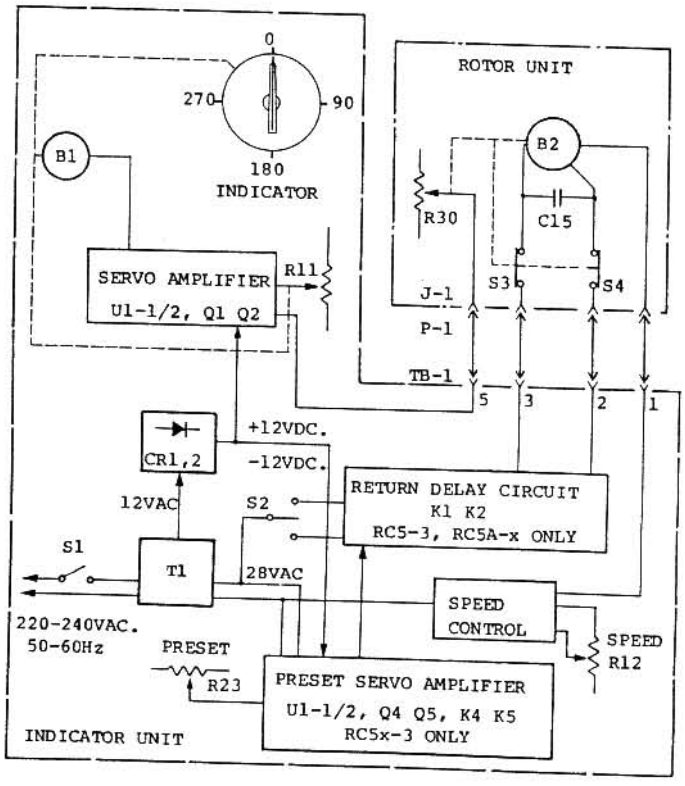


Figure 3-2. RC5x-x, Rotator Circuitry.

3.1.2. SPEED CONTROL

Fig. 3-3 illustrates the current that flows to the drive motor in the rotor unit. Turning the speed control knob causes the speed control device to vary the triac electrification time. This changes the overall speed of rotor turning by varying the periods of motor rest, not the speed at which the motor actually turns when powered. Rotor rotation therefore becomes less constant as the speed is reduced. Speed control is thus different than with ordinary, rheostat systems, and maintains full torque and reliable starting even at low speeds.

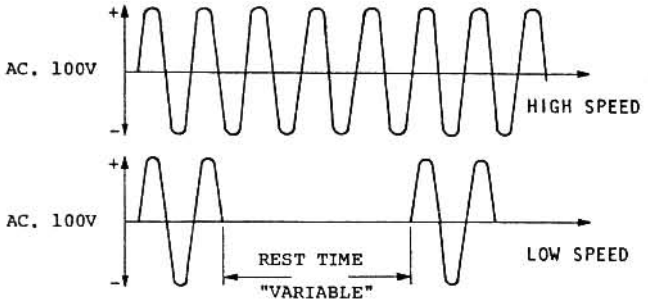


Figure 3-3. Speed Control.

3.1.3. PRESET

This circuit (RC5x-3) works like the indicator circuit. It amplifies the resistance differential between the potentiometer in the rotor and that on which the preset knob is mounted and drives the CCW/CW relays accordingly.

3.1.4. RDC

The reversal delay circuit (RDC) uses a relay, capacitor and resistor to protect the rotor from shock by delaying motor response by two or three seconds when the operator reverses direction while turning the antenna. The circuit also works to stop the rotor promptly when it is turned for only a second or two.

3.2. MECHANICAL CONFIGURATION OF ROTOR UNIT

RC5 braking torque withstands external force of at least 70 kg-m, RC5A braking torque at least 150 kg-m. A cut-away view of an RC5A rotor is shown in Fig. 3-4. This rotor is designed for powerful braking during rotation and oterhwise, without relying on an auxiliary braking mechanism. Gears are made of high-tensile special steel (or of special zinc alloy in the case of some RC5 gears). Other parts are aluminum or zinc alloy.

The initial gear in RC5 rotors is a 1/60 worm gear, making for quiet operation and effectively countering any backlash from the antenna. The worm gear mechanism is enclosed in a sealed grease chamber to reduce the coefficient of friction. Broad, 30 mm teeth are used on the final gear, which is the most vulnerable point in the gear assembly. Three-stage speed reduction takes the speed down at an overall rate of 1/1,800.

A potentiometer for detecting direction is linked to the rotor shaft and gears. The drive motor is a high-starting-torque, AC 28V capacitance motor. Motor output capacity is 12 W with RC5 rotors, 30 W with RC5A rotors. Limit switches S3 and S4 stop the motor to keep the rotor from turning more than 380°. Voltage is output to light the "END" lamp when one of these switches has been actuated.

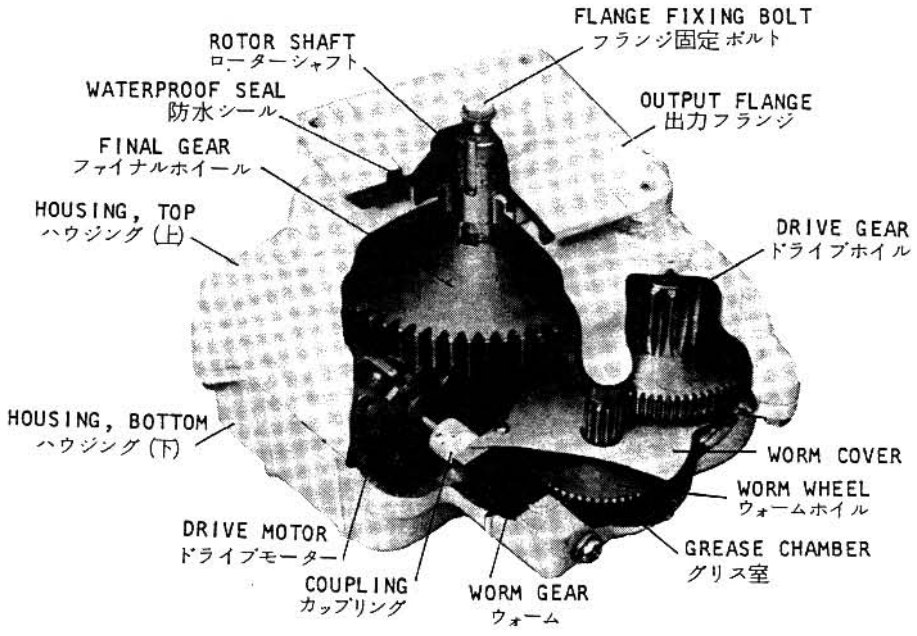


Figure 3-4. Cut-away view, RC5A-x Rotor.

SECTION 4

SPECIFICATIONS

4.1 OUTLINE

The RC5/RC5A antenna rotators are for medium-sized to super-large "ham" radio antennas. Based on our mid-sized rotators for professional use antennas, these highly original and durable models offer unparalleled reliability.

4.2. ROTOR UNIT

Just like with mid-sized rotators for professional-use antennas, a separate mechanism is not used to furnish braking torque and protect the gears. Speed-reducing gears themselves withstand external torque and provide sure and steady speed reduction. The speed reduction mechanism consists of a powerful motor, a worm gear, and large-diameter, broad-toothed super gears (10-30 mm thick). These minimize backlash and noise. Moreover, consideration has been given to even the finest detail, as with the mast guide that simplifies installation.

4.3. INDICATOR CONTROL UNIT

The indicator/control unit features control circuits and design suitable for professional use. Use of an overlay on the direction indicator enables double readings for beam direction and permits the free setting of directional reference points. All models are equipped with a speed control circuit, while RC5x-2 and -3 models offer various additional functions for easier operation.

4.4. PERFORMANCE

Braking torque and rotation torque are the most important considerations in selecting an antenna rotator. Different antenna weights and mast thinness impose widely varying demands on rotators. A long-boomed antenna, for instance, will require greater braking torque than one of the same weight with a shorter boom.

Table 4-1 lists specification, including maximum torque capacity for smooth operation, and suitable antenna loads for main models. Specifications are for a wind velocity of 30 m/sec. and single antennas. Allow for the additional torque, etc. when selecting a rotator for stacked antennas. The torque figures given are maximum specifications for smooth operation. Moreover, the braking torque figures can be increased 20-30 percent for low-speed operation.

4.5. BRAKING TORQUE

Braking torque is the amount of external rotation force that the rotor can withstand without budging. Exceeding this amount of force will either break the rotor or cause it to turn. Braking torque is ordinarily expressed, like bendingmoment, as kilogram meters.

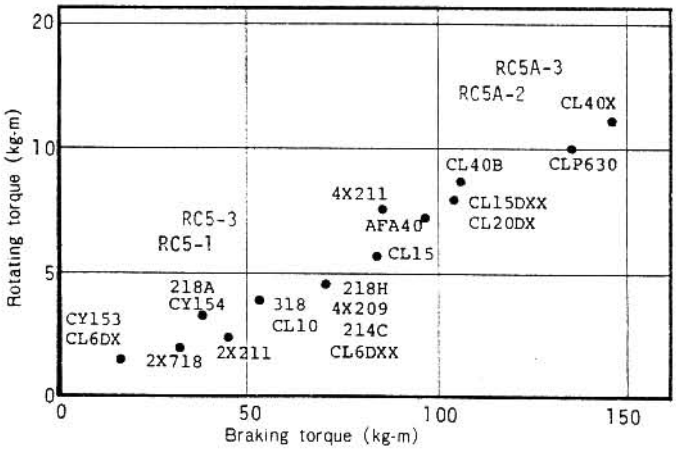
As illustrated n Fig. 4-2, braking torque of 100 kg-m means that a force of 100 kg applied 1 m from the rotor axis will neither turn nor break the rotor. Similarly, rotation torque of 10 kg-m means that starting the motor will apply a 10 kg force 1 m from the rotor axis.

Torque, then, is rotational force around a given axis. The forces that rotation torque must overcome or that braking torque must withstand are not merely a matter of wind force acting on the antenna but are a function of the inertia of both antenna mass and wind force as it acts on an eccentric antenna.

TABLE 4-1. SPACIFICATIONS

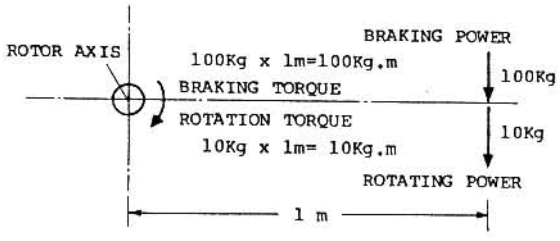
Model NO.	RC5-1	RC5-3	RC5A-2	RC5A-3
Rotation torque	6kg·m	6kg·m	16kg·m	16kg·m
Brake torque	70kg·m	70kg·m	150kg·m	150kg·m
Mast size mm	48~65	48~65	48~65	48~65
Vertical load	400kg	400kg	700kg	700kg
Horizontal load	800kg	800kg	1000kg	1000kg
Rotation sped (sec.) 50Hz	75~180	75~180	75~180	75~180
Reversal delay (sec.)	—	1sec.	3sec.	3sec.
Preset control	—	Provided	—	Provided
Required power 120, 230V AC	80VA	90VA	140VA	150VA
Indicator accuracy	±5°max.	±4°max.	±4°max.	±4°max.
Control cable	7-core	7-core	7-core	7-core
Weight (Rotatorunit)	6kg	6kg	8kg	8kg

Note: Unit of torque: kg-m = 100kg-cm



SEE TABLE 7-1, FOR DETAILS OF EACH ANTENNAS

Figure 4-1. Rotor Torques with Differrent Antennas.



WHERE BRAKING TORQUE IS 100 Kg.m AND ROTATING TORQUE IS 10 Kg.m

Figure 4-2. Braking and Rotating Torque.

SECTION 5

PARTS LIST

5.1. PARTS PROVIDED WITH ROTATOR SET

The RC5xx rotator sets come complete with an indicator/control unit, rotor unit, and accessories (see Fig. 1-3). Rotator set components are listed in Talbe 5-1.

5.2. GROUP ASSEMBLY

Group assmbly can be ordered as needed for maintenance or repairs. Main rotor and indicator/control unit components of one model are shown in Figs. 5-1 through 5-6. Multiple part numbers are given where different parts are used in different models.

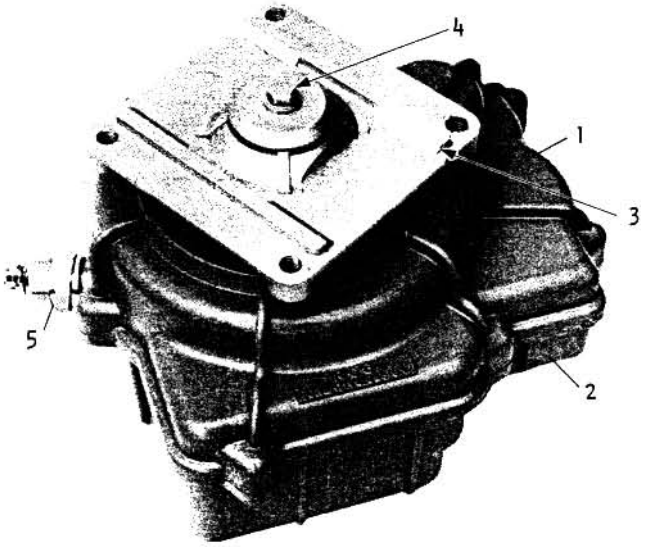


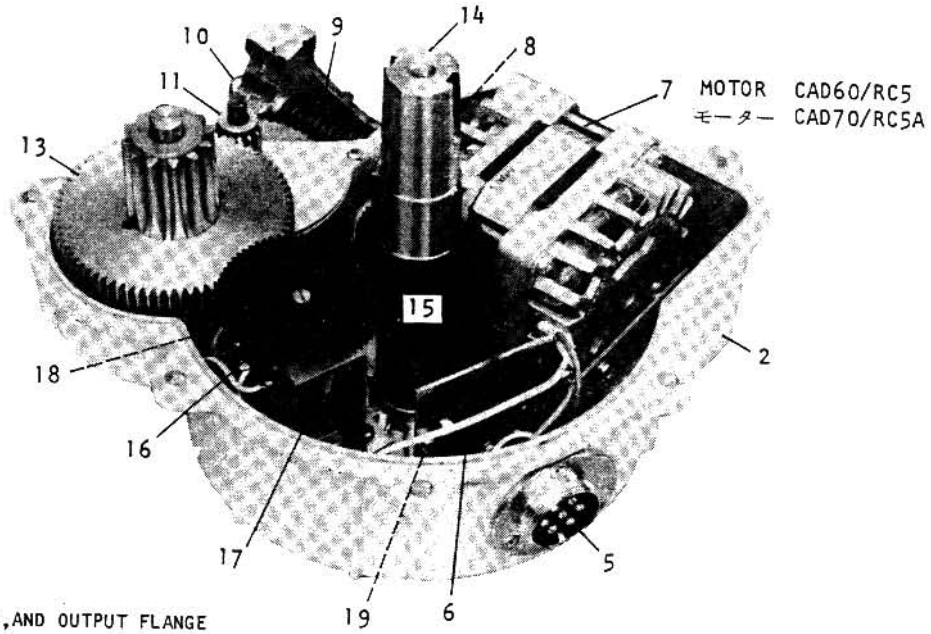
Figure 5-1. RC5x-x, Rotor.

TABLE 5-1. Rotator Assembly List RC5x-x.

ITEM	DESCRIPTION	QTY.
INDICATOR CONTROLLER UNIT/RC5x-x		1
ROTOR UNIT/RC5x-x		1
MC60	MAST CLAMP	2
D1,D2	LAMP, 12v, 0.1amp;	2
F1	FUSE, 2amp.	1
P1	CONNECTOR PLUG, type 7-25	1
S1	BOLT, M8x30, SW	4
S2	BOLT, M8x18, SW.	5
S3	BOLT SET, M8x70, PW, SW	4
T1	SOLDERLESS TERMINAL, type 1.25Y-3	7

TABLE 5-1.1 RC5x-x Rotor Unit

ITEM	DESCRIPTION
1	HOUSING, Top
2	HOUSING, Bottom
3	OUTPUT FLANGE, MC-61
4	HEXAGON HEAD SCREW, M6x15
5	CONNECTOR, type 7-25J, 7-25
6	S3, S4, LIMIT SWITCH ASSY;
7	B2, DRIVE MOTOR, CAD60/RC5, CAD70/RC5A
8	COUPLING,
9	WORM GEAR, SW1-R1
10	SCREW, M6x12
11	WORM WHEEL, CG1-60R1-M
12	WORM MECHANISM COVER
13	DRIVE GEAR, M2-12/M1-72
14	ROTARY SHAFT
15	GEAR, potentio-meter, Mo.75-48
16	GEAR, potentio-meter, Mo.75-66
17	R30, potentio-meter, RA25x 1K ohms
18	C15, CAPACITOR, dry electrolytic, 180uF
19	R31, RESISTER, 4.3K ohms 1/2w



NOTE: THE FINAL GEAR, UPPER HOUSING, AND OUTPUT FLANGE ARE OMITTED IN THE PHOTOGRAPH.

Figure 5-2. Rotor Assembly Parts.

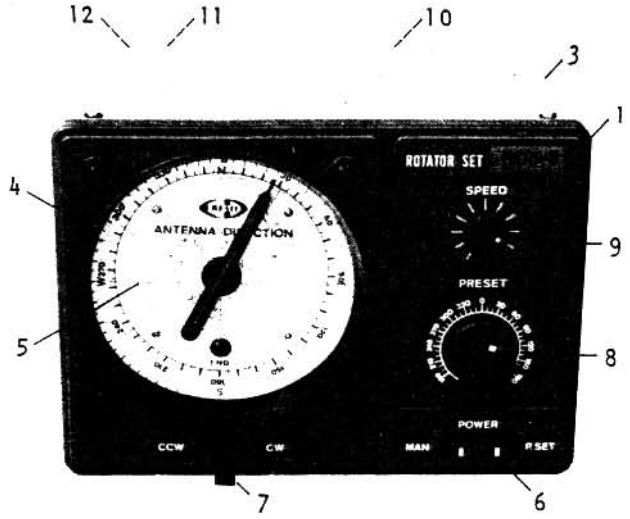


Figure 5-3. RC5x-3. Indicator Control.

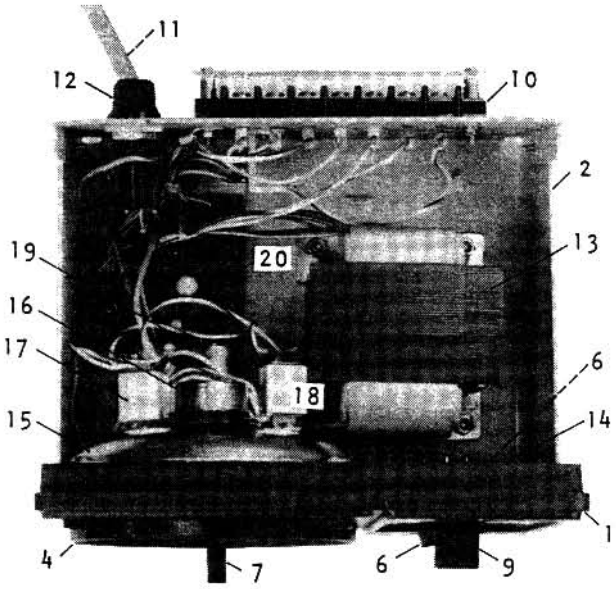


Figure 5-4. RC5-1, Indicator Control.

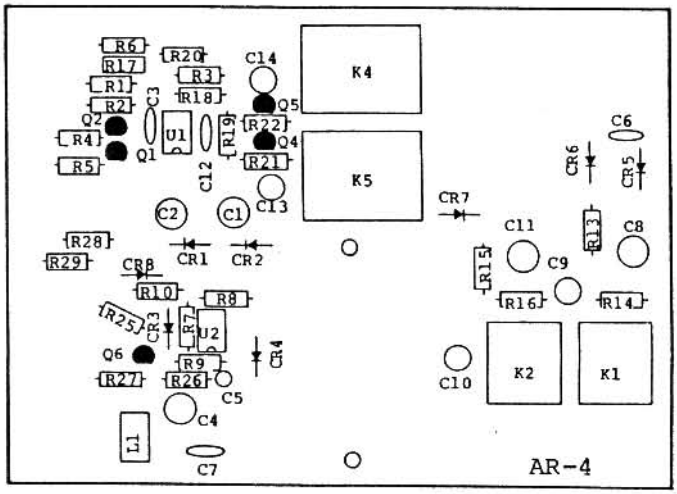


Figure 5-5. Indicator Circuit Board.

TABLE 5-1.2 RC5x-x Indicator Controller Unit

ITEM	DESCRIPTION
1	FRONT PANEL
2	CASE, Bottom
3	CASE, Top
4	OVERLAY FRAME
5	OVERLAY, type-1/N.E.S.W
6	S1, POWER SWITCH, BLP-51
7	S2, ROTATION SWITCH, BEP-01
8	KNOB, PRESET
9	KNOB, SPEED
10	TERMINAL BOARD, 7P/M1105
11	POWER CORD, type-P368-H
12	F1, FUSE, cartridge, 2 amp.
13	T1, TRANSFORMER, power; pri 115/230vac.
14	R12, VARIABLE RESISTOR, 1000K ohms
15	INDICATOR ASSEMBLY
16	R11, POTENTIO-METER, 1K ohms
17	LAMP, incandescent, 12v, 0.1 amp.
18	LAMP, incandescent, 12v, 0.1 amp.
19	B1, SERVO MOTOR, pointer, type-M0575Y
20	AR-1, INDICATOR AMPL CIRCUIT BOARD/RC5-1.
21	AR-4-1, INDICATOR AMPL CIRCUIT BOARD RC5A-2
	AR-4-2, RC5-3, RC5A-3.

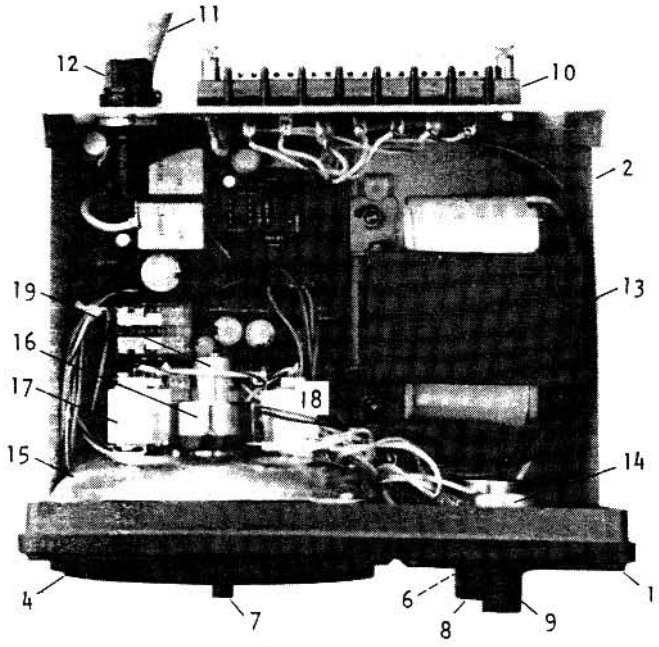


Figure 5-6. RC5A-x, Indicator Control.

★SPEED (Speed control)

This control circuit was originally developed by Creative Design for speed control of a rotator, and is standard in all RC5 models. It varies the speed without reducing rotating torque. For large-size antennas with long inertia times and to enable V·UHF band antennas to pick up narrow beams, it is possible to reduce the moment of inertia and search for delicate beam bearings by reducing the rotating speed. The variable speed range is 60-200 seconds per rotation.

★P.SET (Preset control)

If the dial of this preset control is set in the direction in which the antenna is to be guided, the rotor will automatically rotate in the same direction and stop in that position. Stopping accuracy is ±8°max. The unit is available as an option and may be added later.

★RDC (Reverse delay control)

This control circuit operates only when quick reversing is performed while the antenna is rotating, and provides a delay of 2-4 seconds before reversing starts. It does not function during rotation operations of 2-3 seconds or less.

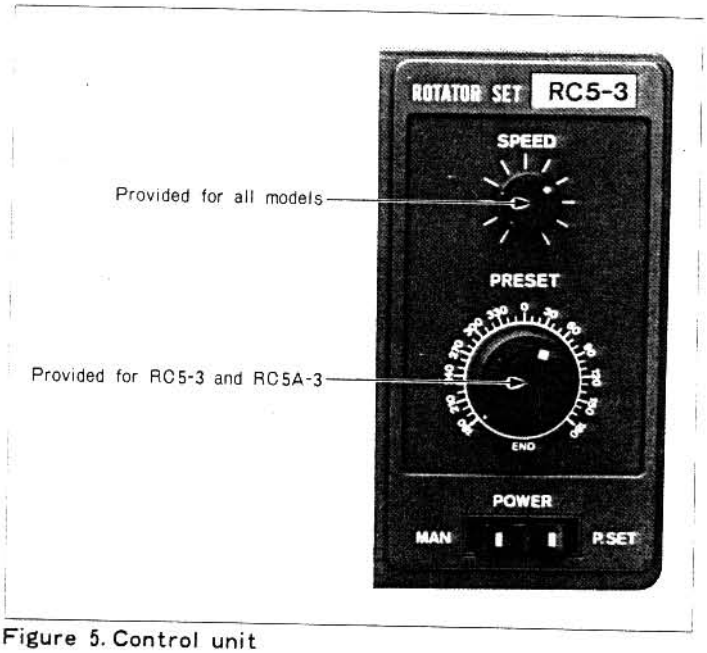


Figure 5. Control unit

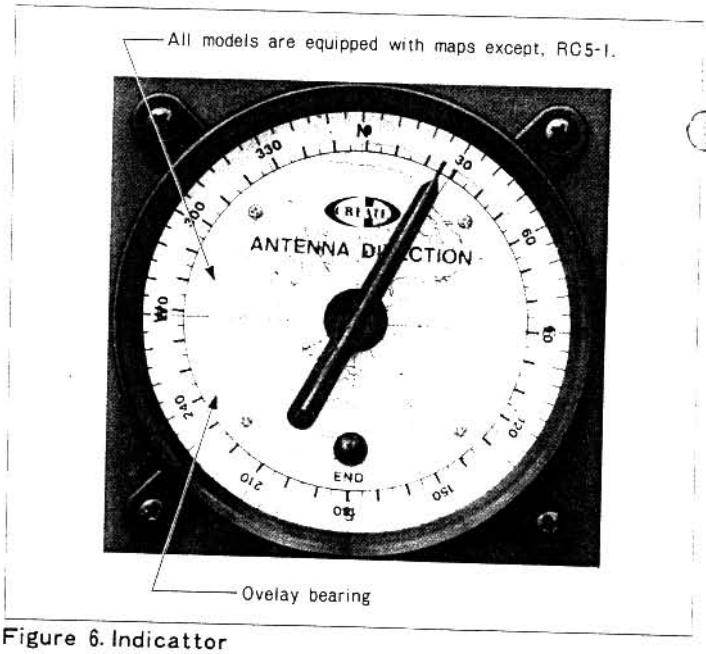


Figure 6. Indicattor

TABLE-2 Wind surface aria of antennas

Model	Description	☆	Model	Description	☆	Model	Description	☆
2X718	435MHz 18ele×2	0.28	CL6DXX	50MHz 7ele	0.4	CL40B	7MHz 3ele ※	1.2
2X211	144MHz 11ele×2	0.8	CL10	28MHz 5ele	0.6	CL40X	7MHz 3ele	2.5
4X211	144MHz 11ele×4	1.7	CL15	21MHz 5ele	0.7	218A	21,28MHz 4ele	0.55
4X209	144MHz 9ele×4	1.1	CL20DX	14MHz 5ele	1.5	CLP630	6~30MHz L.P.	2.5
CL6DX	50MHz 6ele	0.3	AFA40	7MHz 2ele ※	1.0	318	14,21,28MHz 3ele	0.6

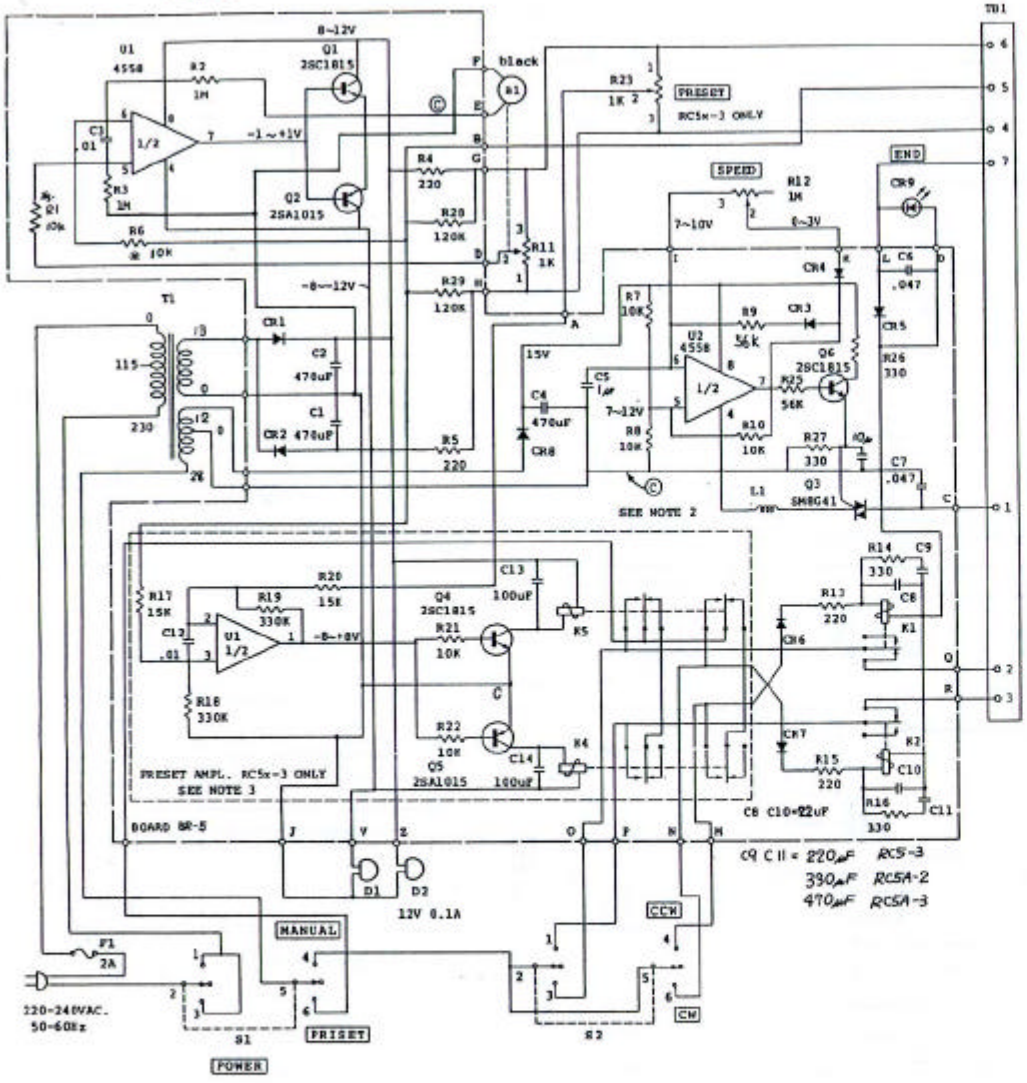
Note: ☆=Wind surface aria(m²) ※=Reduced-scale version

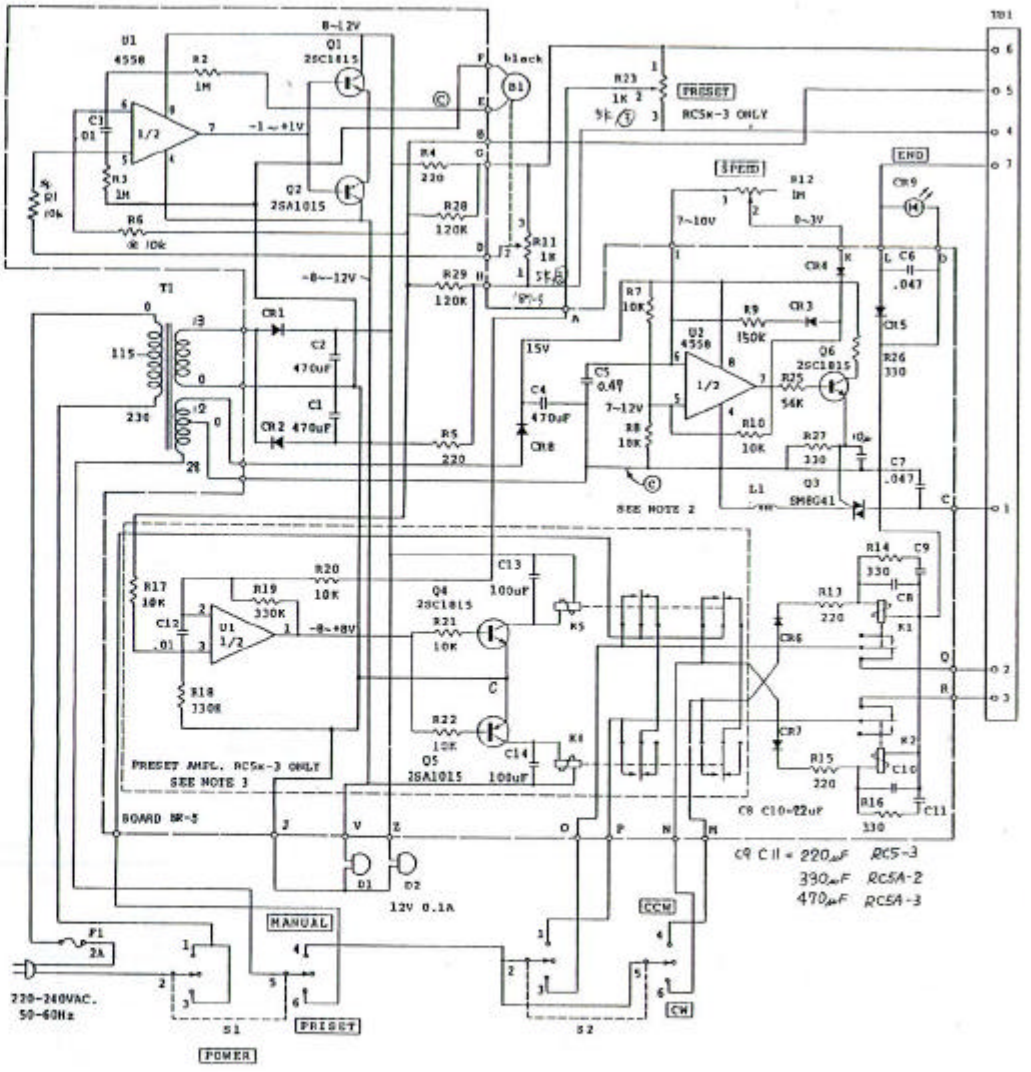
CREATE
Creative Design Co., Ltd.

CREATIVE DESIGN CO., LTD.

4-8 ASANO-CHO, KAWASAKI-KU, KAWASAKI 210, JAPAN
TELEPHONE 044-333-6681

Printed in Japan 1983-04-3,000M





RC5 RC5A
輸出モデル

SECTION 6

CIRCUIT DIAGRAM

6.1 ROTATOR CIRCUIT

Fig. 6-1 presents a circuit diagram of RC5-series of rotor. Although the circuitry is all the same in all the model, the only differences are capacity of the capacitor and motor in each model.

6.2 INDICATOR CIRCUIT

RC5-1 indicator circuitry is as shown in the diagram of Fig. 6-2, RC5A-3 as in Fig. 6-3. Some portions of circuitry marked in dotted-line is lacked in the RC5A-2 type of rotator controller. There have still some minor different portions in the circuitry between each model as indicated in NOTE.

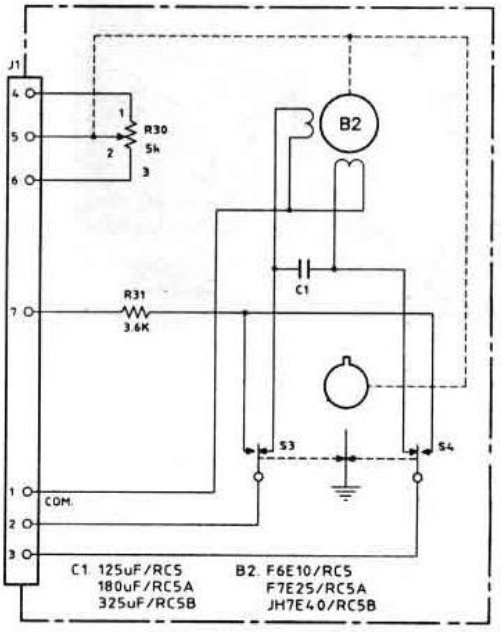


Figure 6-1. Circuit Diagram, Rotor