BUYER'S GUIDE TO ANTENNA ROTATORS

How they work and what's available.

BY KRIS CARROLE

TV AND FM signals usually come into a given reception area from all directions and at various strengths. Modern TV and TV/FM antennas are highly directional to provide maximum gain. It is obvious, therefore, that to obtain the best possible reception, an antenna must be accurately aimed in the direction from which a desired signal is coming. When two or more stations are located in different directions, the only practical way of aiming an antenna is with an antenna rotator system. Too, the weaker the signals, the more accurate must be the aiming ability of the rotator system.

Basically, an antenna rotator system consists of two parts. The drive unit does all the heavy work. It mounts atop a mast, just below the antenna, where it is subjected to the elements. The other part of the system, the control box, is usually located near the TV or FM receiver where it is safe from the elements and is easily accessible to the user.

All antenna rotator systems are a great convenience, but some provide more than others. A basic system simply provides a means of rotating an antenna, while a top-of-the-line automatic rotator system can make aiming an antenna easier than tuning a TV channel or FM station. There are rotators designed to bear relatively lightweight loads and others that can accommodate loads of up to 1000 lb (455 kg).

Types of Rotators. There are basically three types or categories of antenna rotator systems in common use. In order of increasing price range, they include manual, semiautomatic, and fully automatic models (see Table).

The manual rotator is a simple system. The controller contains two pushbutton switches (one for turn-left and another for turn-right commands). The antenna rotates while one of the buttons is held in the depressed position. It stops when the button is released. The pushbutton switches are designed so that when one is depressed, the other is locked out to prevent conflicting drive commands from burning out the drive motor. The only visual indication of system operation is a light that comes on when the rotator comes to the mechanical stop at either end of rotation travel.

The major disadvantage of the manual rotator system is that each time you change a channel or station, you must experiment with the controls until you obtain the best possible reception. Except for knowing when the antenna is at one of the rotator's mechanical stop positions, there is no way of telling in which direction the antenna is pointing, short of going outside and looking at the antenna itself. There is no way of marking the controller for future reference to obtain a duplicate setting.

The big advantage of the manual

RCA's Model 10W707 fully automatic controller.

rotator system, of course, is its cost. If you don't mind experimenting with the controls and wish to save money, the manual rotator system might be just the thing for you.

The semiautomatic rotator system offers a bit more operating convenience at additional cost. It provides a visual indication of the antenna's position. The indicator is usually a compass-like dial with a pointer that indicates antenna direction. The pointer is driven by a small motor synchronized with the antenna drive. (Alliance uses a meter movement with a scale calibrated in N, E, S, W, and N to indicate antenna direction.)

The controls in the semiautomatic rotator system are the same pushbutton switches used in the simple manual systems. However, the fact that there is a visual direction indicator gives the advantage that channel and station directions can be marked on the dial for future reference.

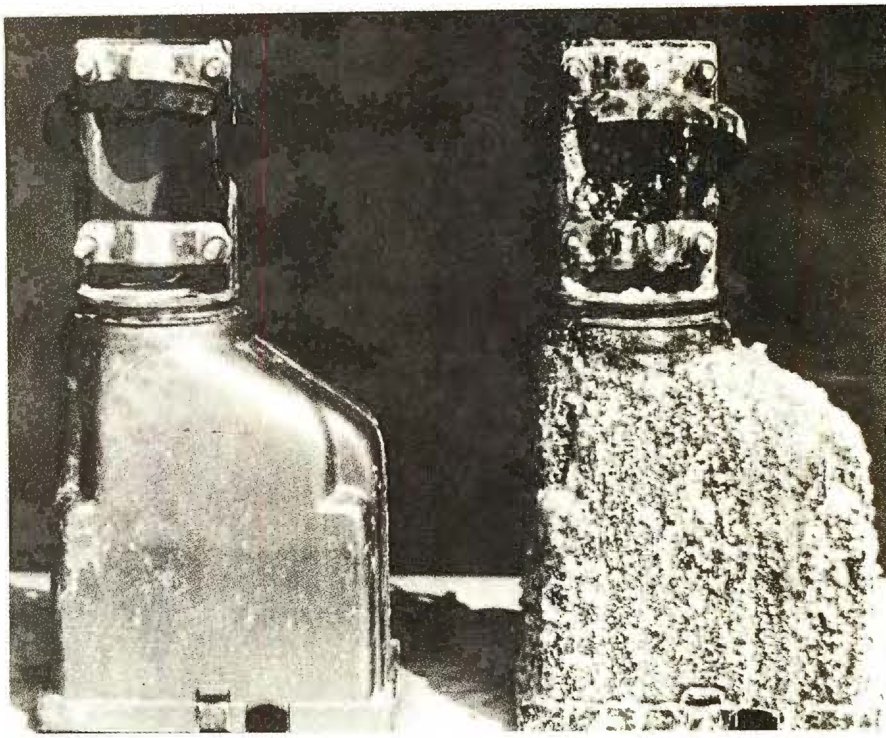
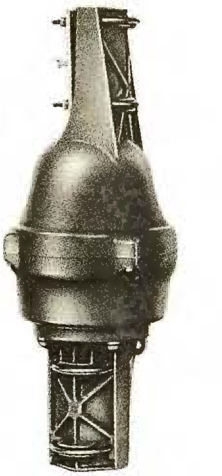


Photo shows effects of salt air (right) on rotator housing as opposed to rotator in normal atmospheric conditions (left).



Example of an in-line antenna rotator design. (Cornell-Dubilier Ham-II)

For most manufacturers, the only step up from a basic manual rotator system is to a fully automatic system. The fully automatic system has no pushbutton switches for the turn commands. Instead, the compass indicator becomes the antenna position selector. As you turn the selector knob to any position on the compass scale, the antenna rotates and automatically stops at the selected heading. Again, you can mark the dial for each channel or station that can be received in your area.

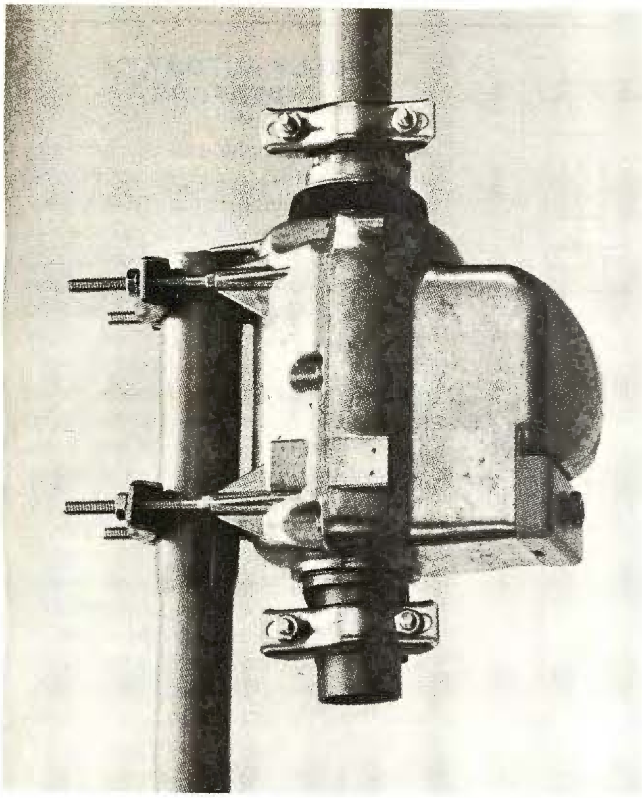
While all fully automatic systems offer a high order of operator convenience, Cornell-Dubilier's Model AR-33 deserves special mention. In addition to the standard compass-dial control, this system's controller has five pushbutton switches that allow the user to "key in" heading commands. Operation of any of the buttons relieves the user of having to turn the compass dial to select the direction for a given station. He just pushes the button, and the antenna automatically rotates to the heading which he had previously set in.

More About Automatics. You pay top dollar for a good automatic antenna rotator system, but with it you get more than just operational convenience. Materials and design considerations are top quality, and the accuracy of the system is greater. The latter is especially important if you happen to live in a deep-fringe reception area.

The less expensive automatic antenna rotator systems employ a small dc motor in the controller to turn the position indicator in unison with the drive motor at the antenna end. A cam-actuated switch in both the controller and antenna drive keeps the system in synchronization. However, because of electrical and mechanical tolerances, each control "step" requires from 3° to 6° of rotation. Since the system is electromechanically synchronized, it is possible for the motors to eventually move out of sequence.

The more expensive systems are totally electronic. The direction control

Blonder-Tongue SA-1000 manual rotator controller.



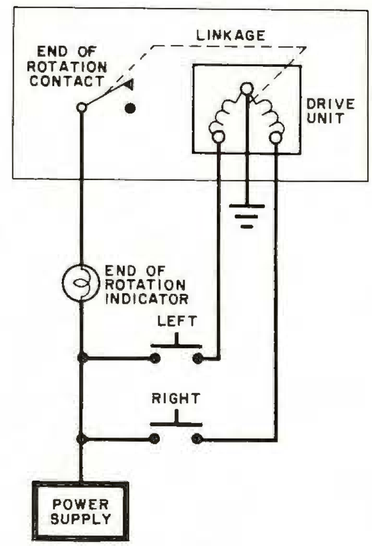
Radio Shack 15-1220 drive system is an example of the offset design.

in the controller forms half of a bridge circuit. The other half of the bridge is a disc potentiometer that is turned when the drive motor rotates the antenna; this pot is located in the drive unit. Turning the direction control unbalances the bridge, which then signals the drive unit to rotate the antenna until the bridge balances. When the bridge is balanced, antenna rotation ceases.

The elimination of mechanical elements in the all-electronic system brings the tolerance down to about 2° steps, providing as many as 60 more set points on the controller dial. Another extra of the all-electronic system is completely silent operation, except for the click of a relay at the end of rotation. Even the relay click is eliminated in Blonder-Tongue's Ultramatic system, which uses SCR's for the switching.

Drive Units. No matter which model you choose, from simple manual to top-of-the-line fully automatic, the drive unit in the rotator system is the weakest link. It does all the heavy work and is generally subjected to a wide range of weather conditions. The drive unit must be able to bear up under the mechanical stresses placed upon it by weight and loading factors, heat, cold, water, ice, and corrosive elements (usually salt) in the air. To beat the elements, manufacturers have devised quite reliable housing and sealing designs for their drive systems.

Inside the drive unit, a worm or spur (planetary) gearing system is used for the final power train between the motor and turning head to which the antenna is mounted. The spur gear has the greater efficiency, averaging about 80% to 90% as opposed to the 50% or so of the worm drive. This per-

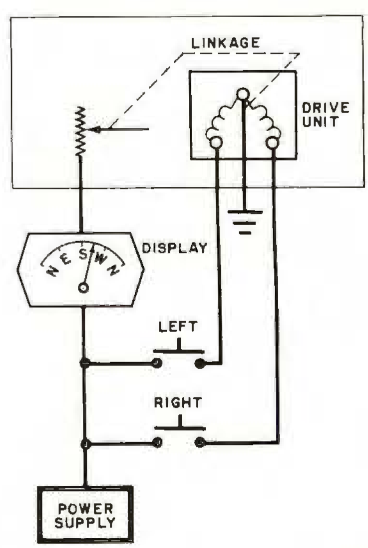


MANUAL ROTATOR

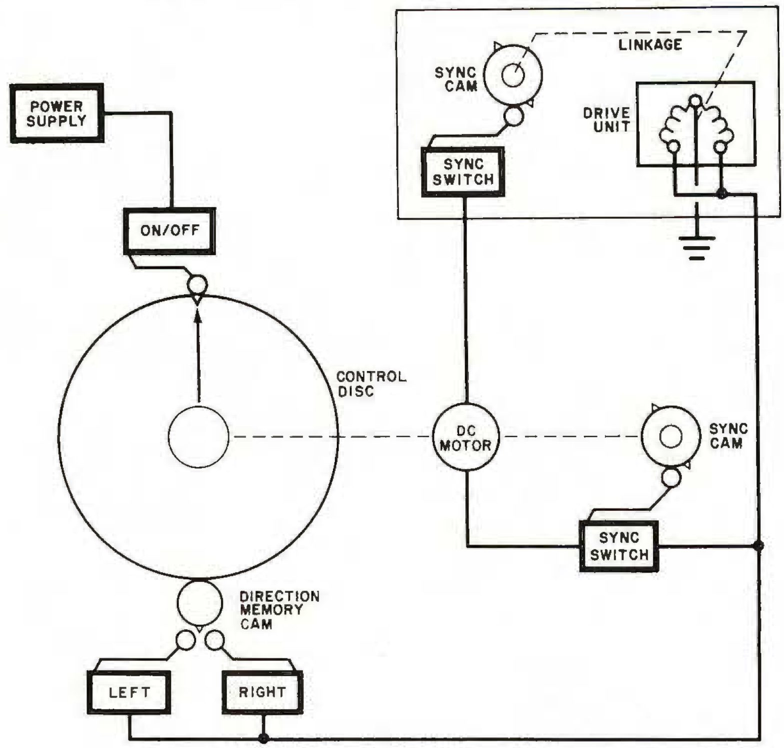
In a manual antenna rotator system, power is supplied to either the turn-right or the turn-left ac motor windings of the drive motor when the respective pushbutton is held in the closed position. Button contacts are mechanically locked out to prevent both from being closed simultaneously. Mechanical linkage between the drive motor and contact switch actuates an indicator light in the controller at the end of rotation.

SEMIAUTOMATIC ROTATOR

Operation of the metered semiautomatic antenna rotator is identical to that of the manual rotator. Mechanical linkage from the drive system, however, turns a potentiometer in the drive housing as the antenna rotates. The amount of current through the meter is proportional to the direction in which the antenna is pointing. Semiautomatic systems that use a revolving disc as an indicator are basically identical to fully automatic systems, except that the automatic-stop mechanism is not included.

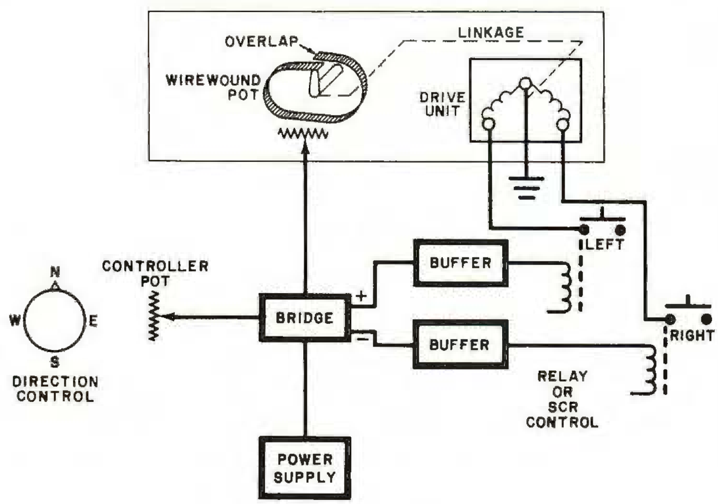


Alliance's T-45 controller uses meter indicator.



FULLY AUTOMATIC ROTATORS

As the control knob on a fully automatic antenna rotator system is turned, switches around the control disc are actuated. The power switch senses the change and turns on power to the system. The direction of change is mechanically sensed and stored by the memory cam. Power is supplied from the memory cam switches to the turn-left or the turn-right winding on the ac drive motor to rotate the antenna. Simultaneously, power is applied to the dc motor in the controller through the two sync switches that control the phase. The mechanical linkage in the drive turns the sync cam, actuating an internal sync switch. Inside the controller, a second sync cam and control disc and antenna position indicator are linked to the dc motor. Antenna position and indicator are kept synchronized by alternate action of the sync switches. The antenna rotates until the knob position and indicator agree. Power is then removed by the power switch and rotation stops.



ELECTRONIC-CONTROL AUTOMATIC ROTATOR

The direction control knob in an all-electronic controller makes up half of a bridge circuit. Once the control is turned, the bridge is offset from null, in a positive or a negative direction, depending on the direction in which the antenna is to be moved. The offset voltage is buffered and used to actuate a relay or SCR. Turn-left or turn-right power is sent to the respective winding of the drive motor, and the antenna begins to rotate. The mechanical linkage from the drive motor repositions the wiper of a wirewound potentiometer. (The ends of the pot overlap to provide full-rotation sensing.) The resistance of the drive-mounted pot is used as the other half of the bridge. When the resistance of the drive pot is the same as the controller pot, the bridge is balanced and the output is null. The relay then cuts out (or SCR turns off), removing power from the drive motor. A power indicator comes on while the antenna is rotating and shuts off when power is removed from the drive motor.

mits a higher starting torque for moving a heavy antenna and breaking through ice.

Although somewhat less efficient on start-up, the worm drive is better than the spur for stopping antenna rotation. The gear itself acts as a positive brake and is less prone to windmilling. However, unlike the spur, which uses the weight of the armature as a clutch, the worm drive can be stripped and permanently damaged if windmilling does occur.

In-line and offset drive arrangements are design considerations that depend primarily on the gearing system used in the drive unit's housing. It's simpler, for example, to package a worm drive in an offset arrangement than to try to use an in-line arrangement.

An offset system can usually be made more compact and lighter in weight than an in-line design. The result is less resistance to wind, since the top and bottom masts overlap to minimize the mounting area. However, the offset design lowers the center of gravity, placing more stress on the bottom mast. As a result, it is often necessary to lower the drive unit so that the additional strain is placed on the chimney or wall mounting brackets.

In-line arrangements evenly distribute antenna weight and wind stress

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Manufacturer	Model No.	Type	Control Accuracy	Price	Remarks
Alliance	K-22	manual	N/A	$38.95	
	T-45	semi	5°	46.95	Meter direction indicator
	U-100	auto	10°	54.95	
	C-225	auto	3°	69.95	All-electronic control
Blonder-Tongue	SA-1000	manual	N/A	64.70	
	U-1000	auto	2°	86.60	All-electronic, SCR control
Channel Master	9513A	semi	4°	49.95	Available wired for 220 V ac
	9512A	auto	4°	59.95	Available wired for 220 V ac
Cornell-Dubilier	SA10L	manual	N/A	39.95	
	AR-20XL	auto	6°	49.95	
	AR-22XL	auto	6°	74.95	Heavy-duty version of AR-20XL
	AR-40	auto	3°	94.95	All-electronic control
	AR-33	auto	3°	114.95	All-electronic & preset controls
	CD-44	semi	2%	129.95	For ham and CB antennas up to 500 lb
	HAM-II	semi	2%	159.95	Same as CD-44 for antennas up to 1000 lb
Radio Shack (Realistic)	15-1223	auto	3°	39.95	Dial resettable for initial correction
	15-1220	auto	2°	49.95	All-electronic control
RCA	10W606	auto	3°	54.95	Dial resettable for initial correction
	10W707	auto	2°	64.95	All-electronic control

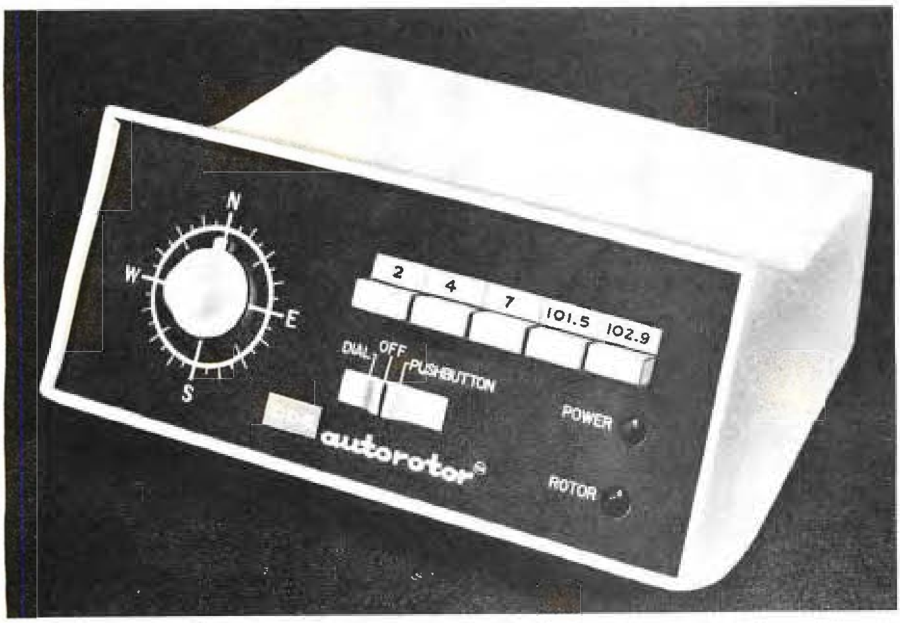
throughout the entire mounting assembly. The major disadvantage of the in-line arrangement is that it must be larger to accommodate the two masts end to end.

The overall strength of either type of arrangement depends on the quality of the materials used, which is generally quite high. Hence, strength need not be much of a concern for most conditions. Of course, where the wind and/or weight loading stresses are severe, special thrust-bearing brackets (turnable brackets that clamp to the masts) will give additional support.

The offset systems are more susceptible to problems when it comes to water and icing because the top of the drive mast must be open to accept the top mast. Special gasketing and mounting hardware inside the drive unit provide water sealing.

To move a massive antenna and break through ice, and also to provide reliable operation for a long time, most drive systems are equipped with high-torque drive motors. Within the first year, a rotator system's torque can decline by as much as 10%, due mainly to the loss of lubricant efficiency, hysteresis losses in the motor, and changes in the characterics of the starting capacitor in the controller. By providing a high initial torque rating for the drive motor, a longer useful life can be expected. Typically, you can expect 12 or more years of operation from today's antenna rotator systems.

If you live near the ocean, salt air will become your biggest enemy. There are few materials that will bear up to the corrosive action of salt and water. Even though new alloys of aluminum and zinc are being used in modern rotator drive systems, salt air is likely to reduce the life expectancy of the system by as much as 25%.



Cornell-Dubilier's AR-33 permits preprogramming for special channels. Unit is all electronic.

Installation Notes. For new antenna rotator installations, you'll have to plan on some extra-cost items, such as new masts, mounting brackets, and cable to connect the rotator's controller to the drive unit. These items are not usually included with the rotator system itself.

For runs up to 150′ (45.7m), 20-gauge cable will be sufficient. For longer runs, use 18-gauge or larger cable. Also, if you're considering extra drops for control from several stations not located in a single room, you'll have to add wall jacks and additional cable when making your purchases.

When installing the rotator system, leave at least 24″ (61 cm) of slack antenna cable to allow for the antenna's turning radius without interference. For initial alignment, check the drive housing for orientation marks.

The maximum heights of the top and bottom masts on the roof will depend on the type of rotator system and antenna you're using. To obtain greater antenna height than is recommended for your rotator/antenna setup, use extra guying and thrust bearings. However, before you take this step, check with your dealer to draw on his experiences with local wind and weather conditions.

According to most manufacturers, maintenance of antenna rotator systems is very easy—there's nothing to do. Actually, there is one thing you can do to extend the life of your rotator system — lubricate the drive unit periodically with the lubricant prescribed by the manufacturer. ◈