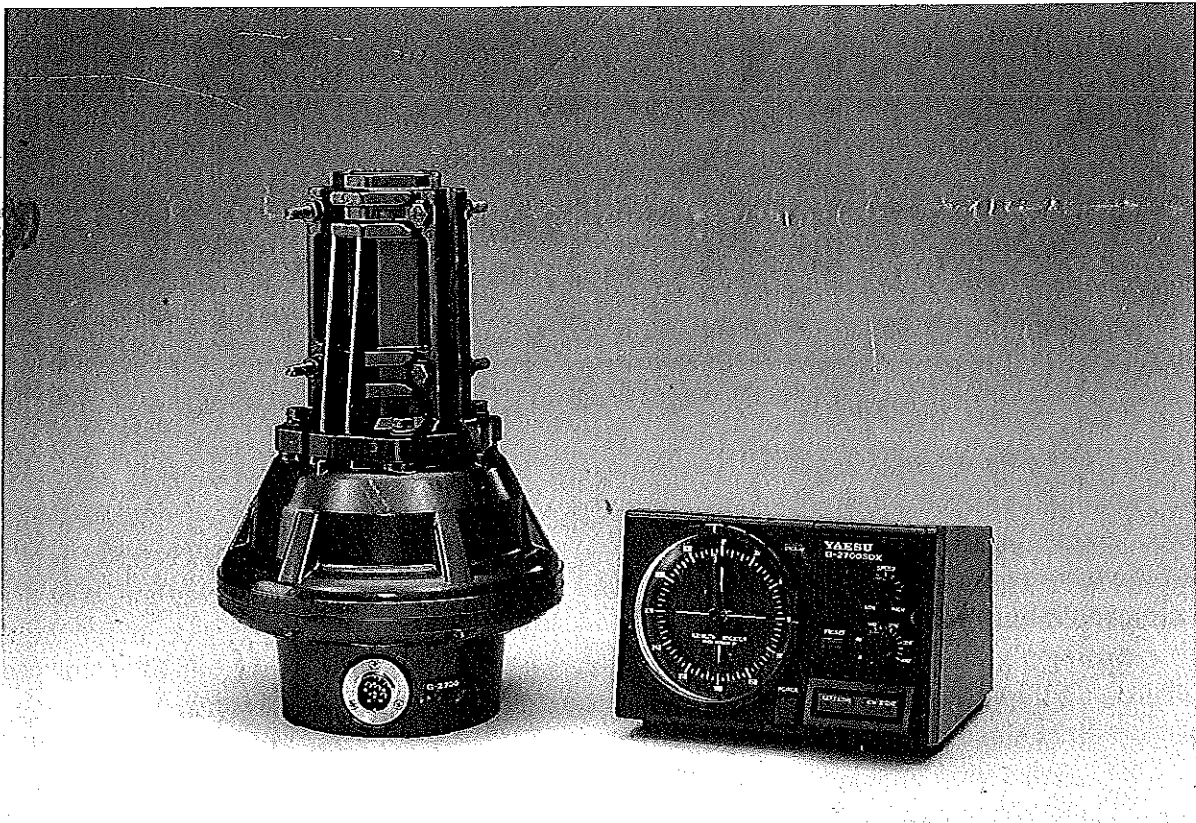


G-2700SDX

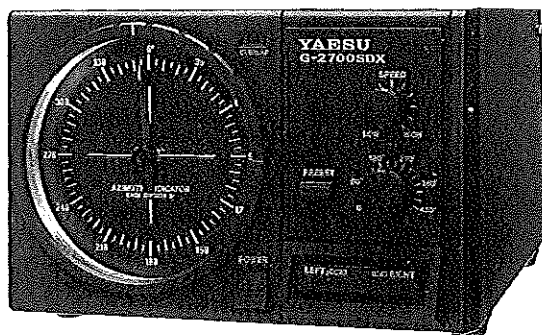
INSTRUCTION MANUAL



YAESU MUSEN CO., LTD.
C.P.O. BOX 1500
TOKYO, JAPAN

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Yaesu G-2700SDX Heavy-Duty Antenna Rotator & Controller



G-2700SDX Controller

The Yaesu G-2700SDX is designed to rotate large tower-mounted amateur and professional antenna arrays under remote control from the station operating position. The clamshell rotator design utilizes 100 $\frac{7}{16}$ -inch dual-stacked circumferential ball bearings to distribute load over the full diameter of the housing. This design minimizes stress and wear, and practically eliminates the possibility of destructive water entry: there is no shaft hole in the top of the housing.

Instead of the usual AC motor drive used in older rotator designs, the G-2700SDX uses a variable-voltage DC motor, obviating the need for a large starting capacitor with its potential for failure exposed to outside temperature variations. The factory-lubricated rotator unit is housed in melamine resin-coated die-cast aluminum, intended to provide maintenance-free operation under all climatic conditions. A mast alignment gauge on the rotator housing simplifies accurate mechanical alignment during installation.

The handsome desktop controller matches the design of modern transceivers, providing 360° radial indication of actual antenna bearing azimuth. You can select rotating speeds from 43 to 120 seconds per (360°) rotation, and can preset a desired heading for the rotator, to which it then turns automatically.

When a fast rotating speed is selected, special "auto slow start" and "auto slow stop" features avoid sharp jolts to the antenna array and tower. Activating

the rotator causes it to begin turning at slow speed, and accelerate up to full speed after one second. As the antenna approaches the desired heading rotation automatically slows before bringing the antenna to a gentle stop. The operator may select the stopper heading (the bearing through which the rotator cannot be turned) most convenient for his location and operation, allowing full rotation through north, south or both, if desired. In any case, 90° overlapping rotation allows rotation through the selected stopper heading (450° total rotation).

The rotator is intended for mounting inside a support tower (not supplied), at least 1 meter from the top, with an optional (Yaesu model GS-680U) thrust bearing above. This kit includes one mast clamp and related hardware, plus plug connectors for both the rotator and controller to simplify installation and servicing. A six-conductor cable of the necessary length (station to antenna) is optional.

The GS-23 Computer Control Board is available as an option for installation in the controller, allowing positioning of the antenna by a personal computer, via an RS-232 serial interface.

Please read this manual through carefully before installing the rotator, to acquaint yourself with the procedures that will be required, and to ensure that you have all necessary items for your installation.

Specifications

Voltage requirement:

110 ~ 120 or 220 ~ 240 VAC

Power consumption: 230 VA peak

Motor voltage: 8 to 24 VDC

450° rotation time: 120 ± 10 sec. to 50 ± 15 sec.

Braking torque: 24,000 kg-cm (1736 ft-lbs)

Rotation torque:

800 ~ 1100 kg-cm (57.9 ~ 217 ft-lbs)

Maximum continuous duty: 5 minutes

Rotation range: 450° +5/-0°

Maximum vertical load:

400 kg/800 kg momentarily (880/1760 lbs)

Wind loading area: less than 3 m²

Control cable: 6 conductors: #20 AWG or larger

Mast outside diameter:

48 ~ 63mm (1-7/8 to 2-1/2 inches)

Weight: Rotator - 8.4 kg (18.5 lbs)

Controller - 3.6 kg (7.9 lbs)

Optional Accessories

GS-680U Universal Thrust Bearing

GS-23 Computer Control Board (RS-232C Serial)

Unpacking & Inspection

When unpacking the rotator make sure you find the following items:

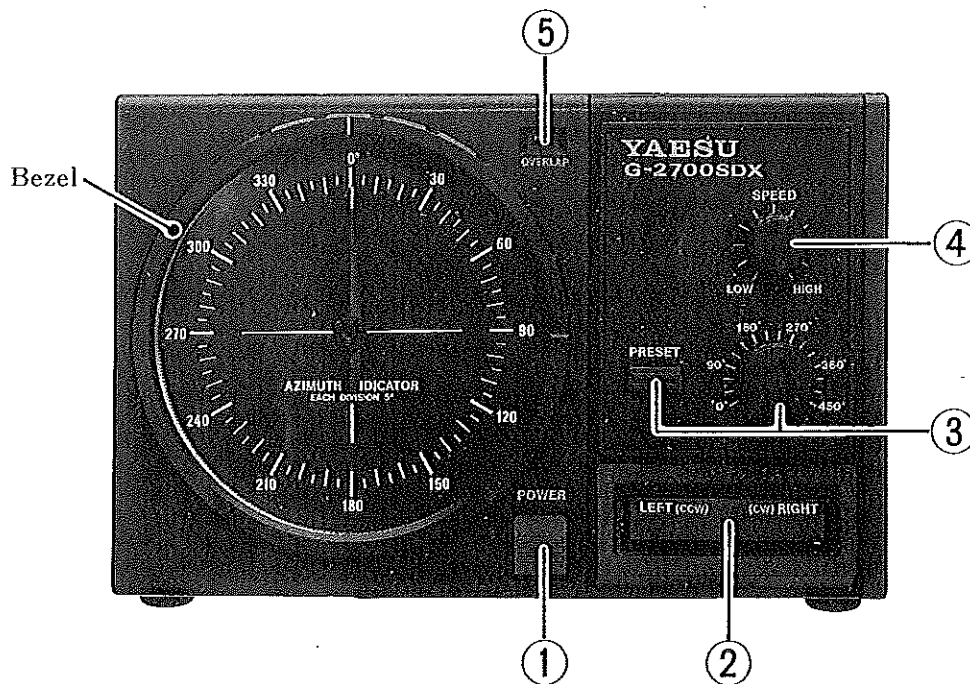
Item	Quantity
Controller Unit	1
Rotator Unit	1
Mast Clamp	1 (pair)
Round Cable Plug	1 ass'y
Rectangular Cable Plug	1 ass'y
M8 × 20 mm Hex Bolts	4
M8 × 30 mm Hex Bolts	4
M8 × 70 mm Hex Bolts	4
Split Washers	12
Flat Washers	8
M8 Nuts	4
Spare Fuse	(117V:3A, 220V:2A)
Plastic Dial Heading Sheet	1

If any of these items are missing or damaged, save the packing material and notify the shipping company (or the shop where you bought it).

Note that control cable is not included, as the length must be determined case-by-case. Contact your Yaesu

dealer to obtain the length of cable your installation requires.

Before proceeding with installation, confirm that the AC voltage label on the rear of the Controller matches your local line voltage: either "117V" for 110 to 120 VAC, or "220V" for 220 to 240 VAC. If the range does not match, return the controller (only) to the selling dealer for replacement. (Different power transformers are installed for the different voltage ranges).



Controller Front Panel

(1) POWER Switch

Press this switch to turn the controller on to rotate the antenna. Turn it off when the rotator is not in use.

(2) LEFT/RIGHT Seesaw Switch

Press the **LEFT** side of this switch to rotate the antenna counterclockwise (CCW). Press the **RIGHT** side to rotate the antenna clockwise (CW).

(3) PRESET Switch and Control

Set this control to the desired antenna heading (according to the angular scale around this control), then press the (momentary) **PRESET** switch to activate au-

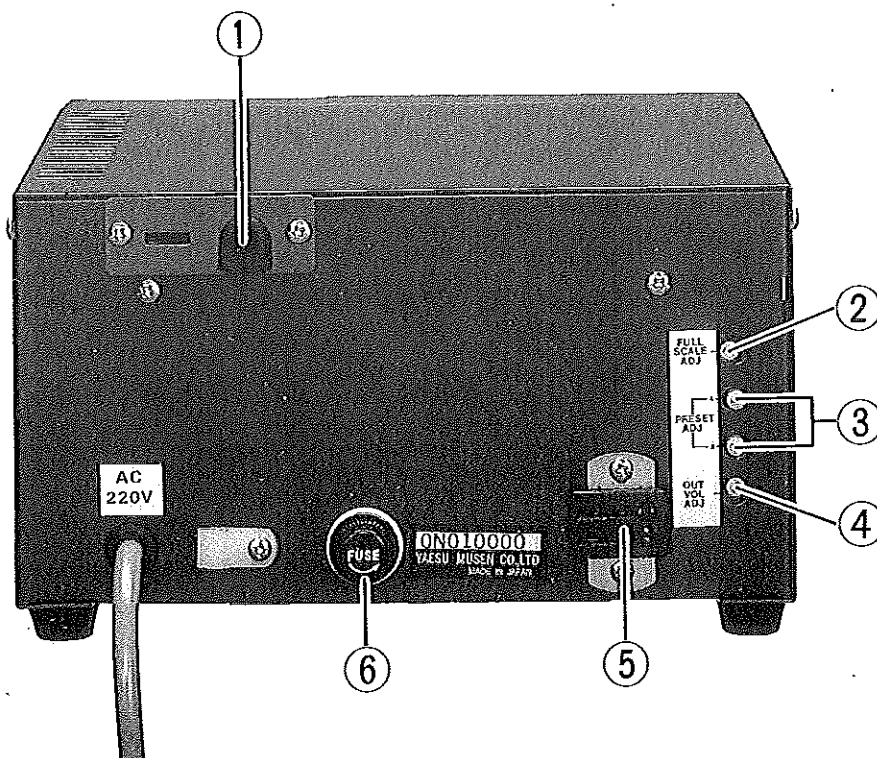
tomatic rotation to the desired heading. You can press the **LEFT/RIGHT** switch to abort preset operation.

(4) SPEED Control

Set this control for the desired rotating speed between approximately 30 and 100 seconds per 360° revolution.

(5) OVERLAP Indicator

This red LED glows when the antenna is rotated beyond about 360° (to 450°) from its fully counterclockwise position. Check this indicator before rotating the antenna clockwise, and turn the antenna counterclockwise to the desired position if the indicator is on.



Controller Rear Panel

(1) RS-232C Cable Grommet

If the optional GS-23 Digital Interface Unit is installed, the RS-232C cable from the computer routes through this grommet, and is affixed in place by the nylon cable clamp below it.

(2) FULL SCALE ADJ Potentiometer

This control calibrates the maximum rotation angle (range) of the azimuth indicating needle to match the maximum angle of the rotator.

(3) PRESET ADJ A & B Potentiometers

These controls calibrate the angle of the PRESET control on the front panel to match the azimuth indicating

needle. Pot A should be adjusted only near the 450° position, and pot B only near the 0° position.

(4) OUT VOL ADJ Potentiometer

This control presets the voltage range at pin 4 of the 8-pin External Control jack inside, for calibration of the A-to-D converter on the (optional) Digital Interface Unit.

(5) Rotator Control Cable Jack

The rotator cable connects to this 6-pin jack, using the supplied rectangular plug.

(6) FUSE Holder

A 3-A fuse must be installed here for AC mains voltages from 110 to 120V. A 2-A fuse must be installed for 220 to 240V.

Control Cable Installation

Before installing the antenna and rotator, we recommend that you prepare the rotator control cable and test rotator operation thoroughly on the ground as described here. After this you should also check the alignment of the controller, as described in the following section.

Control Cable Preparation

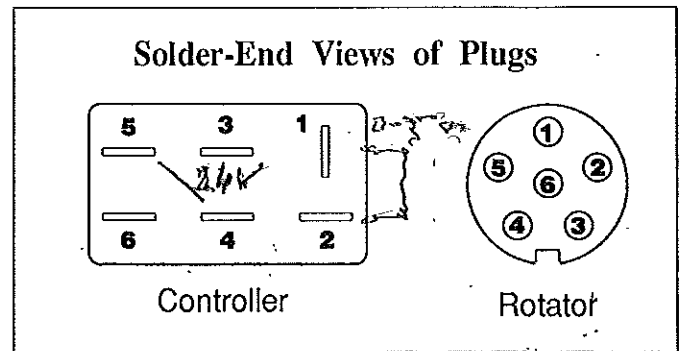
Your control cable should have six stranded conductors of at least 0.5 millimeters diameter (#22 AWG) each if the cable is shorter than 40 meters (125 feet), or 0.75 millimeters (#18 AWG) if longer.

- Disassemble the two supplied cable plugs: slide the rubber boot off the round plug, remove the setscrew in the shell with a small screwdriver, and then unscrew the shell from the plug. On the rectangular plug, just remove the two small screws in the shell. Save the setscrew from the round plug and the two small screws in a safe place until the last step.
- Slide the rubber boot and round shell over the rotator end of the cable, far enough to allow dressing the end of the cable. Slide the rectangular shell over the other (controller) end of the cable.
- Using special care to avoid nicking the insulation of the individual wires, strip back 15 mm of the outer jacket of the cable from both ends, and then strip 5 mm of insulation from each wire.

Note

If your cable has different sizes of wire, connect the largest wires to pins 4 and 5, since these carry the motor current.

- Solder the wires to the round plug pins, noting the color of the wire and number of each pin (see the plug drawing on this page) for reference later. Confirm all solder joints are good and clean, as this part of the cable will be hard to access after installation. Don't slide the shell over the plug just yet.
- Referring to your notes of the wire color at each pin on the round (rotator) plug, connect the wires to the pins of the rectangular (controller) plug so that the wire from each pin on the rotator plug connects to the pin with the same number on the controller, i.e., 1 to 1, 2 to 2, etc. Don't slide the shell on yet.



- Temporarily connect the round plug to the rotator, and the rectangular plug to the jack on the controller. Make sure that the **POWER** switch is in the off (■) position, confirm that your AC line voltage matches that of the controller, and then connect the cord to the AC power outlet.
- Turn on the **POWER** switch. The pilot lamps should light, and the direction indicator may move to the position of the rotator and stop.
- Press the **LEFT** side of the seesaw switch, and confirm that the top side of the rotator and indicator needle turn counterclockwise together. Then press the **RIGHT** side of the seesaw switch and confirm that the rotator and indicator turn clockwise. If rotation does not occur as described, recheck your cable connections.
- If the rotator and indicator work as described, replace the plug shells, setscrew, two small screws and rubber boot removed in the first step.

Controller Checkout & Calibration

These procedures are most easily carried out after connecting the rotator cable, but before installing the rotator and antenna on the mast or tower. They may be repeated after installation to confirm controller calibration.

- Turn the **SPEED** control fully clockwise, and hold the **LEFT** side of the seesaw switch until the rotator turns counterclockwise as far as it will go, and stops. The indicator needle should now point precisely to 0°. If it does not, or if you want to change the starting angle, see *Reorienting the Azimuth Indicator* following the tracking alignment procedures.

Azimuth Indicator Tracking Alignment

- Mark the position of the upper part of the rotator just above the cable socket (or note the bearing of

the boom if the antenna is already installed). Then hold the **RIGHT** side of the seesaw switch until the rotator turns clockwise exactly 360° (according to your mark on the housing or actual antenna position).

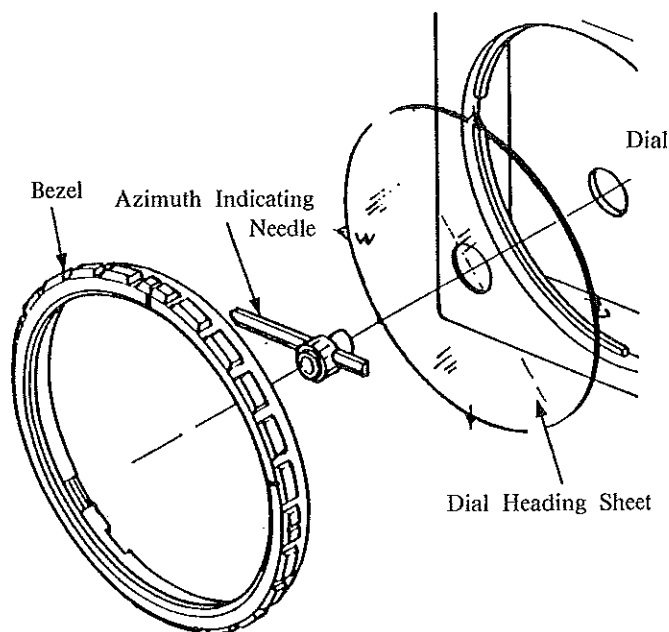
- The indicator needle should now point to exactly the same position as in the first step above. If not, adjust the **FULL SCALE ADJ** potentiometer on the rear panel so that it does (check both 0 and 360° points several times, readjusting if necessary). The **OVERLAP** indicator should come on at about 350° .
- Press the **RIGHT** switch again to continue clockwise rotation until the rotator reaches its end-stop. The indicator should now point to about 90° , and the **OVERLAP** indicator should be on.
- Turn the rotator back and forth to each end-stop several times, readjusting the potentiometer, if necessary, until the indicator matches the rotator angle at all settings.
- Change the **SPEED** setting and confirm that rotation speed changes accordingly.

PRESET Dial Tracking Alignment

- Set the **PRESET** control to 90° , and press the **PRESET** button (see the box below). Rotation should stop at 90° . If not, adjust the **PRESET ADJ B** (lower) potentiometer until it does (you may need to press **PRESET** after adjusting). If adjusting the potentiometer cannot bring the needle to 90° , recalibrate the **PRESET** knob as described on the next page.
- Set the **PRESET** control to 360° (CW). Rotation should again stop at 0° . If not, adjust the **PRESET ADJ A** (upper) potentiometer until it does (you may need to press **PRESET** after adjusting). If adjusting the potentiometer cannot bring the needle to 0° , recalibrate the **PRESET** knob as described on the next page.

Preset Mode Operation

Pressing the **PRESET** button activates the preset mode: the rotator will turn until the indicator matches the **PRESET** control, and resetting the control will start the antenna turning again automatically. Pressing the seesaw switch or turning power off will cancel the preset mode until the **PRESET** button is pressed again.



- repeat the last two steps several times until the indicator responds reliably to presetting small angles when the rotator is near both ends of its range.

Note

If you want to reposition the direction indicator or dial heading sheet after the antenna is installed, make sure the antenna is aimed in the same direction as the new needle heading.

Reorienting the Azimuth Indicator

The azimuth indicating needle may be repositioned, if desired, so that the rotator stopping point is down (or right or left) instead of up (as shipped from the factory). Of course the rotator and antenna will have to be installed to match the resulting direction of the indicator, and the **PRESET** dial markings will no longer correspond with antenna bearing. A compass heading sheet is supplied for positioning north on the azimuth dial, as described in the next procedure. This procedure sets only the angle of the needle on the dial.

- Turn on the controller and press the seesaw switch to set the indicator needle to 0° (straight up). Then turn off the **POWER** switch.
- Grasp the edge of the bezel around the bearing window, turn it 10° counterclockwise, and pull it off. Do the same with the cover glass.

- Gripping the small knob at the axis of the needle, pull the needle off and move it to the desired direction (we suggest only multiples of 90° – up, down, left or right, since the orange and blue markers on the bezel can only be installed in these directions). Press the needle back on the shaft.
- Replace the cover glass, and then the bezel so that the orange marker ends up aligned with the needle (unless also installing the dial heading sheet).

Installing the Dial Heading Sheet

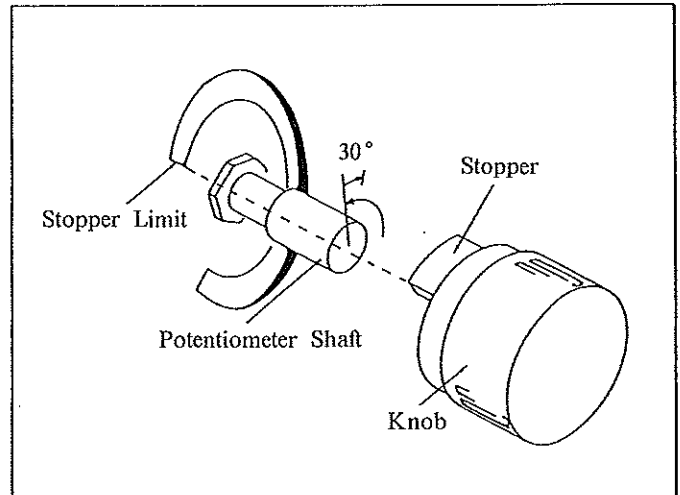
A clear plastic round dial heading sheet is provided with the kit, which can be installed with north at any position you desire. This is particularly useful when you need to have south at the top of the dial (or east or west) instead of north. To install the heading scale:

- Perform the first two steps of the above procedure, *Reorienting the Azimuth Indicator*.
- Note the position of the needle, then grasp it at its center, and pull it straight off.
- Determine which compass direction you desire to be upmost, and install the compass heading label sheet against the azimuth scale, so that the small teeth in the edges of the sheet lock around the edge.
- Replace the needle, cover glass and bezel in the same direction as they were before (see diagram on previous page).

PRESET Knob Calibration

Perform this procedure only if it is not possible to align the PRESET knob tracking using the A and B potentiometers on the rear panel, as described on the previous page.

- Press the manual rocker switch to disable the Preset feature, and turn the rotator so the azimuth indicator points to 0°.
- Set the PRESET ADJ A and PRESET ADJ B potentiometers to the center of their ranges.
- Press the PRESET button to activate the Preset feature.
- Pull off the PRESET control knob and adjust the potentiometer shaft so that the azimuth indicator points to 0°.
- Using care not to disturb the PRESET potentiometer, push the knob back on the shaft so that the knob



stopper is aligned with the counterclockwise edge of the slot in the panel behind the knob, as shown above.

- Return to the **PRESET Dial Tracking Alignment** procedure on the previous page.

Rotator Installation

The G-2700SDX rotator unit is designed to accommodate large antenna arrays, but you should still confirm that your particular antenna/support configuration does not exceed the rotator loading specifications. The maximum safe load depends on the wind surface area, size and weight of the antenna(s), method and quality of mechanical installation, and maximum wind velocity at the installation site. If your antenna specifications do not include a figure for wind surface area, refer to the tables on the next page.

Mounting Considerations

Mount the rotator inside of the tower at least 1 meter (3 feet) below the top, and use our GS-680U universal (angle) tower bearing or equivalent at the top of the tower to support the vertical load. During installation, keep in mind that the bearing will need to be precisely

Caution!

The G2700SD rotator is designed for vertical mounting only. One half of the housing is marked "BOTTOM SIDE". Water and contaminants will damage the motor unit if it is mounted horizontally or upside-down.

aligned with the center of the rotator, so the mast is exactly vertical. We recommend against installing the rotator on the topmost plate of the tower, as the supporting capacity is much lower in such configuration. Also note that the G-2700SDX is too large to be safely mounted inline on a mast (without being affixed to the tower).

Ensure that the wind surface area of your antenna(s) plus supporting mast do not exceed 3.3 m² (32 ft²). In addition to antenna wind loading and regardless of the type of installation, the overall size and weight of the antenna should be considered. As a general rule for the G-2700SDX, the product of the rotating radius and weight of the antenna should not exceed 900 kg-m (7960 ft-lbs).

Where multiple antennas are to be installed on the same mast, make sure to add the wind loading for each antenna, and the products of weight and radius for each when calculating the wind loading.

Make certain that the antenna attaches to the mast at the center of gravity of the antenna. That is, the antenna should be balanced, providing only downward force on the mast (when there is no wind). The G-2700SDX can support up to 400 kg (880 lbs) continuously, but depending on the strength of the rotator support platform in your tower, it may be better to let the thrust bearing carry the weight.

During installation, don't forget to leave just enough slack in the coaxial cable feedline around the mast so that it can rotate 450°, plus a little extra. Also remember to carefully tape over the rotator cable connector where it attaches to the rotator, and also at the end of the rubber boot.

- Center the rotator precisely on the support plate in the tower, and affix it in place from the bottom with the four supplied short bolts and split washers (flat washers are not used on these bolts).

Mast Bracket Assembly & Antenna Positioning

- Loosely fasten the mast bracket halves ① to the rotator housing using four medium bolts, split washers and flat washers ②, as shown on the next page.
- Insert the mast into the bracket, and finger-tighten the four long bolts ③ with split washers, flat washers and nuts ④. Note that one side of the bracket has ridges on either side of the bolt holes: the bolts should be inserted from this side, so the ridges hold the bolt head from turning.
- With the rotator connected, set the controller so that it indicates precisely 0° (North). Then, using an accurate map and known landmarks, position the antenna (without using the controller) so that it points to true North. Alternatively, consult a Geodetic Survey map for your area to determine the Magnetic Deviation at your location, and then use a compass to position the antenna so that it points to true North (Magnetic North + Magnetic Deviation). Be careful not to disturb the antenna direction when tightening the mast bracket in the next step.
- When you are satisfied with the orientation of the antenna, center the mast on the top of the rotator, and begin tightening the bolts on each side alternately so that the gap on each side of the mast remains the same. Markings are provided on the top of the rotator to assist this process.

Wind Loading Areas of Common Aluminum Tubing Antennas

Full Size Monoband Yagis (no traps or loading)																							
Band (MHz)	7	7	14	14	14	21	21	21	21	28	28	28	50	50	50	144	144	144	144	430	430	430	430
Elements	1	2	3	4	5	3	4	5	6	3	4	5	4	5	6	10	10x2	10x4	10x2 x4	12	12x2	12x4	12x2 x4
Area (m ²)	0.2	2.2	0.7	1.2	1.7	0.45	0.6	0.8	1.3	0.3	0.42	0.6	0.25	0.3	0.37	0.2	0.44	0.95	2	0.06	0.12	0.3	0.6

Trapped or Loaded Mono- and Multibanders and Swiss Quads													
Band (MHz)	7	7	7/14	7/14	14/21	14/21	21	21/28	21/28	14/21/28	14/21/28	28	50
Elements	2 (w/loading coils)	3 (w/loading coils)	3	4	5	3	Swiss Quad	4	5	6	3	Swiss Quad	Swiss Quad
Area (m ²)	0.6	1.1	0.5	0.8	1.7	0.5	0.3	0.6	0.8	1.3	0.3	0.3	0.3

- ☐ Confirm that the mast and bracket are precisely centered on the rotator, and tighten the four bolts affixing the mast bracket to the top of the rotator.

The rotator motor is rated for five-minutes intermittent duty. However, it can safely run continuously for as long as ten minutes providing that it be brought to rest for at least ten minutes afterwards.

Electrical Troubleshooting Data

Resistances between the pins of the rotator socket should be as follows:

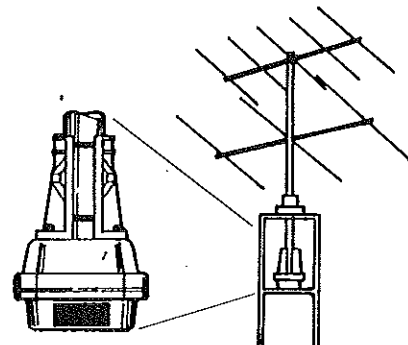
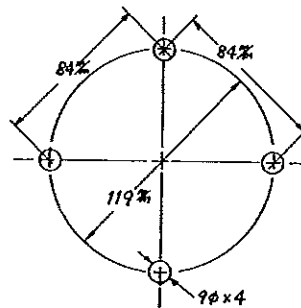
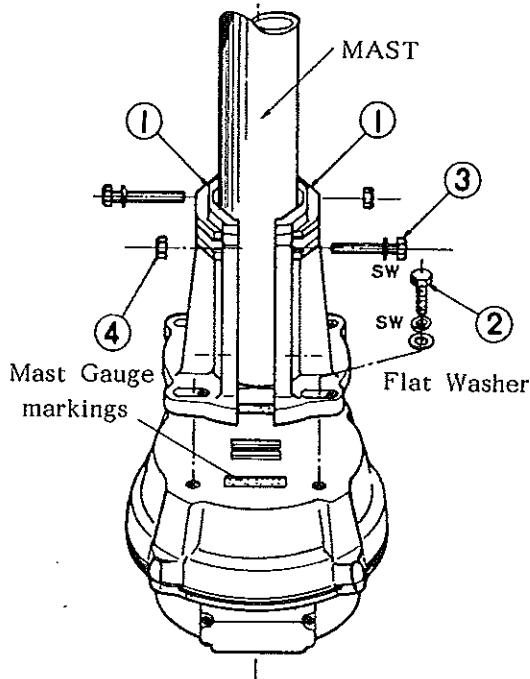
Pin 1 to pin2 : 0 to 500 ohms

Pin 1 to pin 3: 500 ohms

Pin 2 to pin 3: 0 to 500 ohms

Pin 4 to pin 5: 8 ohms with the rotator in mid-range, 20 ohms (polarized) with the rotator at either end of rotation.

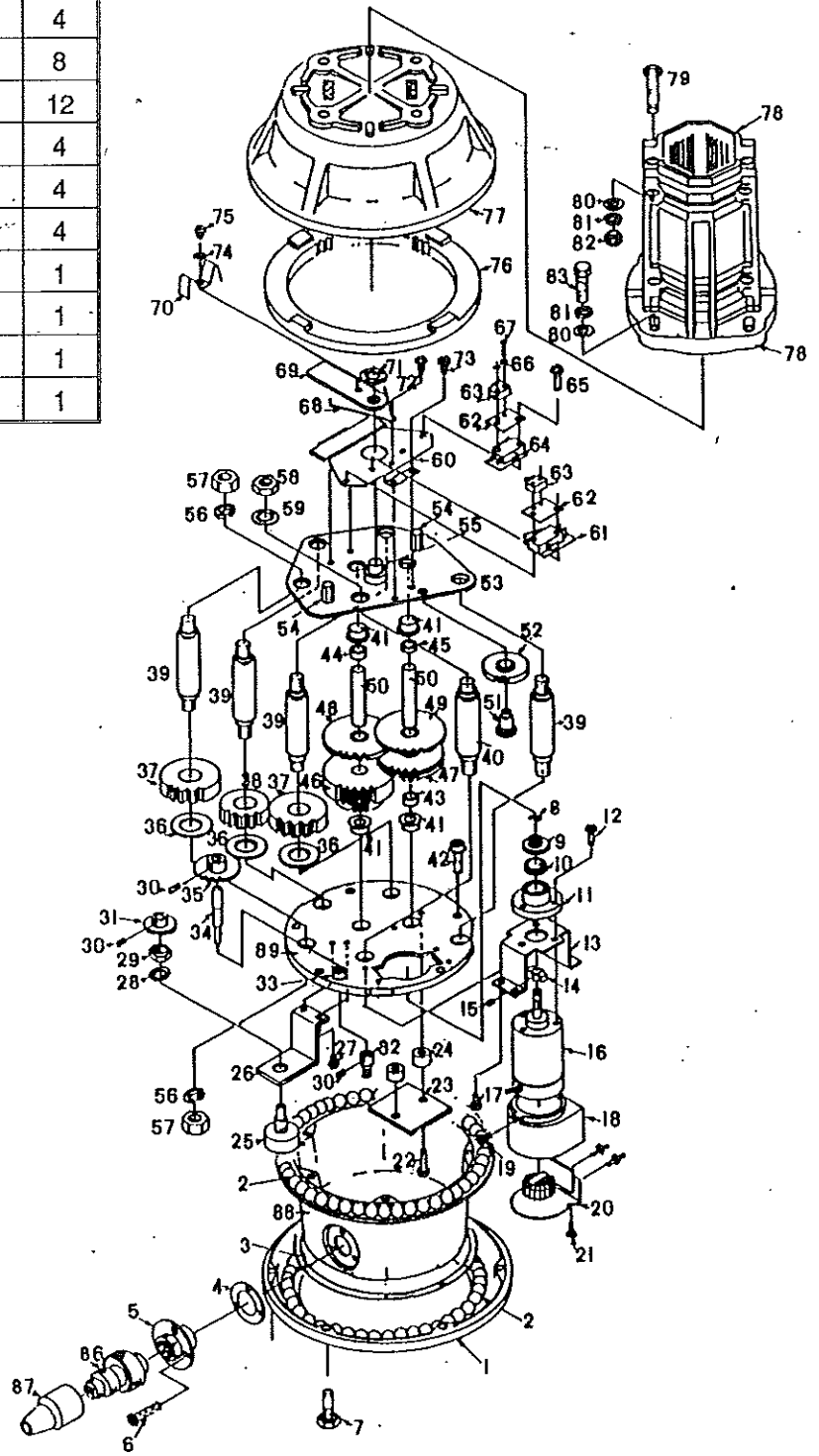
At the controller socket, approximately 6 VDC should be present between pin 1 (+) and pin 3. Also, 12 to 24 VDC should be present between pins 4 and 5, with the actual voltage depending on the **SPEED** control setting, and the polarity determined by the **RIGHT** and **LEFT** switches. If the **PRESET** mode is active, voltage between pins 4 and 5 of the controller will vary.



Rotator Unit Parts List		
No.	Description	Qty
1	Housing Ring	1
2	Ball Bearing	100
3	"O"-Ring	1
4	Socket Gasket	1
5	6-Pin Socket	1
6	3 x 20 Flat Head Screw	3
7	M6 x 20 ⊕ Phillips Head Bolt	6
8	"E"-Ring Retainer	1
9	Motor Pinion Gear	1
10	Brake Coil Spring	1
11	Brake Drum	1
12	M3 x 14 Screw (Motor Mount)	3
13	Motor Mounting Bracket	1
14	Brake Spring Winder	1
15	M3 x 3 Set Screw (Winder)	1
16	DC Motor (DME44B)	1
17	M3 x 8 Screw (Motor Bracket)	4
18	Shield Housing	1
19	M3 x 8 Screw (Shield Housing)	1
20	Toriod Circuit Ass'y	1
21	M3 x 6 Tapping Screw (Circuit)	2
22	M3 x 14 Screw (Diode Board)	2
23	Diode Circuit Board	1
24	Standoff Bushing (Diode Board)	2
25	Potentiometer (Azimuth Sensing)	1
26	Potentiometer Mounting Bracket	1
27	M3 x 8 Screw (Pot. Bracket)	2
28	M9 Split Washer (Pot. Shaft)	1
29	M9 Nut (Pot. Shaft)	1
30	M3 x 6 Set Screw (Gears)	3
31	Potentiometer Gear #1	1
32	Shaft Retainer (for No. 34)	1
33	Boss (for No. 34)	1
34	Gear Shaft (for Pot. Gear #2)	1
35	Potentiometer Gear #2 Ass'y	1
36	Flat Washer (for Idler Gears)	3
37	Idler Gear #1	2
38	Idler Gear #2	1
39	Shaft Stud	4

Rotator Unit Parts List		
No.	Description	Qty
40	Support Stud	1
41	Gear Shaft Bearing Cup	4
42	M5 x 16 Cap Screw (for No. 89)	5
43	Lower Bearing Collar	1
44	Upper Bearing Collar #1	1
45	Upper Bearing Collar #2	1
46	Final Gear Ass'y	1
47	Tertiary Gear	1
48	Secondary Gear	1
49	Primary Gear	1
50	Main Gearshaft	2
51	Bearing Pin (for No. 52)	1
52	Small Gear	1
53	Upper Gear Baseplate Ass'y (includes No's 54 & 55)	1
54	End Stop Pin (for Rotation Limiter)	2
55	Boss (for Rotation Limiter Arm)	1
56	M12 Split Washer	9
57	M12 Lock Nut	9
58	M12 Special (Thin) Nut	1
59	M12 Inside Star Lockwasher	1
60	End Stop Microswitch Mounting Plate	1
61	Microswitch (CCW End Stop)	1
62	Speed Limit Microswitch Mount. Plate	2
63	Microswitch (Speed Reducer)	2
64	Microswitch (CW End Stop)	1
65	M3 x 16 Screw (Large Microswitches)	4
66	M2 Washer	4
67	M2 x 8 Screw (Small Microswitches)	4
68	Speed Reducer Wire Spring	1
69	Stopper Arm	1
70	Speed Reducer Leaf Spring	1
71	Push Nut	1
72	M3 x 6 Screw (Wire Spring Mounting)	1
73	M3 x 6 Screw (Microswitch Plate)	4
74	M3 Washer (Leaf Spring)	1
75	M3 x 4 Screw (Leaf Spring)	1
76	Internal Ring Gear	1
77	Top Housing	1

Rotator Unit Parts List		
No.	Description	Qty
78	Mast Clamp	2
79	M8 x 70 Hex Bolt (Mast Clamp)	4
80	M8 Flat Washer	8
81	M8 Split Washer	12
82	M8 Nut	4
83	M8 x 30 Hex Bolt (T11, Clamp-Rot.)	4
84	M8 x 20 Hex Bolt (T11, Rot. Mount)	4
86	6-Pin Plug (NCP256)	1
87	Connector Boot (Rubber)	1
88	Bottom Housing	1
89	Lower Bearing Plate	1



Controller Unit Parts List		
No.	Description	Qty
1	Front Panel	1
2	Control Panel	1
3	3 × 8 ⊕ Tapping Screw	4
4	Control Panel Label Plate	1
6	Speed Control Knob	1
7	M7 Nut (Speed Pot.)	1
8	M7 Washer (Speed Pot.)	1
9	Speed Potentiometer	1
10	Preset Knob	1
11	M7 Nut (Preset Pot.)	1
12	M7 Washer (Preset Pot.)	1
13	Preset Potentiometer	1
14	Preset Pushbutton	1
15	CW, CCW & Preset Switch	3
16	Preset Switch PC Board	1/4
17	3 × 8 ⊕ Tapping Screw	2
18	Seesaw Button	1
19	Seesaw Switch Spring	1
20	3 × 8 ⊕ Tapping Screw	1
21	Seesaw Switch Retainer Bkt	1
22	3 × 8 ⊕ Tapping Screw	1
23	Seesaw Switch Mntg Plate	1
24	3 × 8 ⊕ Tapping Screw	2
25	Seesaw Switch PC Board	1/4
26	3 × 6 ⊕ Tapping Screw	2
34	Power Switch Button	1
35	Power Switch Mntg Plate	1
36	3 × 8 ⊕ Tapping Screw	2
38	M3 × 6 ⊕ Machine Screw	2
39	Power Switch	1
40	OVERLAP LED	1
41	Bezel	1
42	Cover Glass	1
43	Azimuth Dial Scale	1
44	3 × 10 ⊕ Tapping Screw	3
45	Spacer	3
46	Dial Scale Mounting Plate	1
47	M3 × 8 ⊕ Screw	4
48	Indicator Needle	1

Controller Unit Parts List		
No.	Description	Qty
49	Controller Gear #2	1
50	Controller Gear #1a	1
51	Insulator	1
52	2mm "E" Ring	1
53	Controller Gear #1b	1
54	Large Pulley	1
55	Gear Shaft	1
56	Small Pulley	1
57	Rubber Belt	1
58	DC Motor	1
59	M2.6 × 5 ⊕ Machine Screw	2
60	Azimuth Potentiometer Gear	1
61	M3 × 3 Machine Screw	1
62	Pot. Nut w/Washers	1
63	Azimuth Potentiometer	1
64	Rear Gearbox Cover, incl Nos. 55 & 77	1
65	3 × 6 Tapping Screw	4
66	3-p Leaf Switch Ass'y (Incl Nos. 67-76) 2-p Leaf Switch Ass'y (Includes Nos. 66, 67 & 70-76)	1
67	M5 × 8 Machine Screw	2
68	Insulating Bushing	2
69	Contact Spring #3	1
70	Insulating Bushing	2
71	Spring Contact #1	2
72	Insulating Spacer	2
73	Spring Contact #2	2
74	M2 Flat Washer	4
75	M2 Lockwasher	4
76	M2 × 12 ⊕ Machine Screw	4
77	Support Stud	4
78	Motor PC Board Ass'y	1
79	M3 × 6 ⊕ Machine Screw	4
80	Lower Chassis	1
81	3 × 8 ⊕ Tapping Screw	3
82	3 × 6 ⊕ Tapping Screw	2
83	Power Transformer	1
84	M4 × 10 ⊕ Machine Screw (Xfmr)	2
85	M4 Nut (Transformer)	2

Controller Unit Parts List		
No.	Description	Qty
87	Main Controller PC Board	1/4
89	3 × 6 ⊕ Tapping Screw	2
90	Fuse Holder (Includes Nos 91-93)	1
94	Rotator Cable Socket	1
95	3 × 6 ⊕ Tapping Screw	2
96	RS-232 Cable Clamp	1
97	M3 × 8 ⊕ Tapping Screw	1
98	RS-232 Cable Cutout Cover	1
99	3 × 6 ⊕ Tapping Screw	2
100	Rubber Grommet	1
102	Heatsink	1
103	3 × 6 ⊕ Tapping Screw	2
104	Regulator Transistor Ass'y (Includes Nos 103-110)	1
111	Bridge Rectifier	1
112	3 × 12 ⊕ Tapping Screw	1
113	Expansion Board Chassis	1
114	3 × 6 ⊕ Tapping Screw	2
115	M3 × 6 ⊕ Machine Screw	2
117	Driver PC Board	1/4
118	3 × 6 ⊕ Tapping Screw	2
119	3 × 6 ⊕ Tapping Screw	1

Controller Unit Parts List		
No.	Description	Qty
120	3 × 6 ⊕ Tapping Screw	1
121	Cover	1
122	Rubber Foot	4
123	3 × 8 ⊕ Tapping Screw	4
124	Terminal Lug	2
125	Axial Lamp <i>10V</i>	1
126	Reflective Tape	1
128	Bushing	1
129	Heading Sheet	1
130	Expansion Board (Option)	1
131	M3 × 8 ⊕ Machine Screw	1
132	3 × 6 ⊕ Tapping Screw	2
133	Control PC Board Mntg Bkt	4
134	3 × 10 ⊕ Tapping Screw	4
135	Control PC Board (Front)	1
136	M3 Flat Washer	4
137	M3 Split Washer	4
138	Separator Stud	4
139	Control PC Board (Back)	1
140	M3 × 6 Machine Screw	4
141	Transformer Cushion	1

