K4DIA

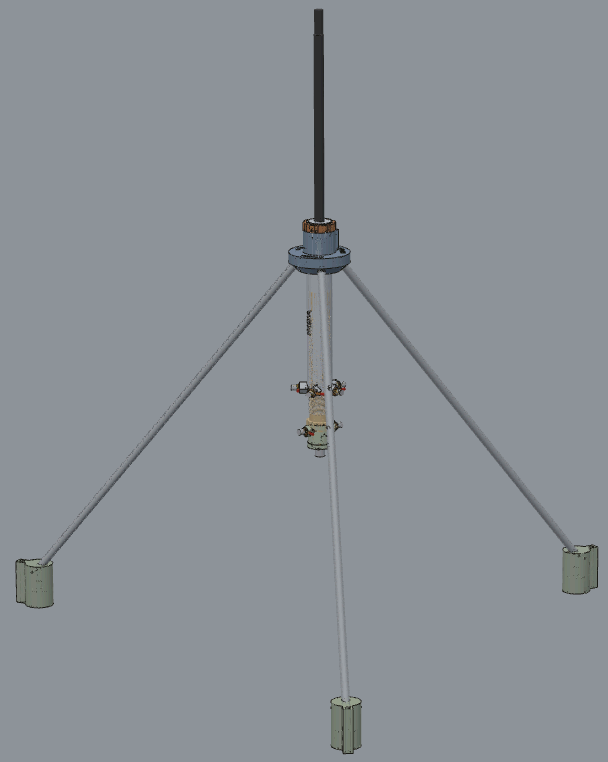
Rev D tripod-hub loading coil

Assembly manual

Eight printed parts, three aluminium legs and a bag of hardware to a tuned 80 through 30 m antenna on a 17 ft whip. Each step shows the parts it needs in the box, and the picture shows where they go. The short text under a picture is there when a picture cannot say it: a temperature, a torque, a thing to measure.

Numbers are millimetres unless marked. Part names match BOM.md in the package. About six hours of bench time plus two overnight epoxy cures. Steps 1 to 17 build the sub-assemblies in any order; 18 to 25 go in sequence.

November 2026



PARTS

Everything in the box



1x
Hub



1x
Housing



1x
Collar



1x
Coil form



1x
Swivel cap



3x
Leg foot

3x
1/2 in tube, 750



3x
3/8-16 x 1-1/2 stud



3x
3/8-16 insert



6x
1/4-20 insert



1x
M5 insert



3x
M3 x 20



3x
M3 nut



3x
1/4-20 x 1-1/2 bolt



45x
1-1/4 in fender washer

3x
8 mm tent stake



1x
1/4-20 x 3/4 bolt



2x
1/4 washer



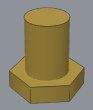
1x
1/4-20 nut



1x
M5 x 16 set screw



1x
3/8-24 coupling nut



1x
3/8-24 x 1/2 bolt



1x
3/8 ring terminal

1x
copper foil tape



7x
brass valve stem, 19



7x
stem nut



7x
5/32 brass ball



7x
PB spring 4.0 x 0.55 x 25



7x
metal valve cap



7x
5/16 ring terminal

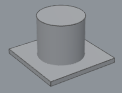
1x
.305-32 tap



1x
K&S 1 in brass ring, 8



2x
M3 x 10



1x
SO-239



4x
#4 x 3/8 screw



1x
18 AWG bare tinned, 9.5 m

1x
18 AWG bus wire

1x
shield wire, 300



1x
CHA SS17 whip



1x
coax, PL-259

Also: radial wire with ring terminals (four to eight), epoxy, thin CA, copper foil tape, solder, heat-shrink, masking tape, a 1/2 in dowel 300 mm long, and a 150 mm lead slug per leg if you want it. Full sources and prices are in BOM.md.

Tools

Tool	For
Soldering iron, temperature controlled, with insert tips for 3/8-16, 1/4-20 and M5	Inserts, steps 1 to 4
60 W iron or gun, chisel tip, 60/40 or SAC solder, flux	Electrical joints; the brass ring needs the big iron
.305-32 UNEF tap (tire valve stem tap) and tap wrench	Seven station bosses, step 8
Drills 3.3, 3.4, 7.0, 9.5, 15/32 in	Cleaning printed holes, foot pins
Hand drill or drill press	Foot pins through the tubes
Hacksaw or tube cutter, file, deburring tool	Legs, valve stems, brass ring
Calipers, multimeter with continuity beep	Every check in this manual
Needle-nose pliers, side cutters, strippers	Stations, winding
Hex keys 2.5 mm; 3/8, 7/16, 9/16 in wrenches	Set screw, bolts, coupling nut
Valve core removal tool	Stems, step 11
Bent paper clip, lighter, heat-shrink	Fishing the bus wire; the center-pin joint
Structural epoxy, thin CA	Leg studs; holding wires in channels
Isopropyl, lint-free rags, 220 grit	Prep
1/2 in dowel or PVC, 300 mm	Pushing the coupling nut up the bore
Masking tape, fine permanent marker	Winding, marking turns

Print settings

Part	File	Orientation and settings
Hub	`revD_tripod_hub_PRINT.stl`	Boss up, chamfer on the bed side. PETG or ASA, 0.2 layers, 6 walls, 40 % infill minimum. The chamfer is 50 deg from horizontal: no supports.
Housing	`revD_sleeve_hub.stl`	Standing, open rim down, threaded end up. 0.16 to 0.2 layers, 4 walls, brim. Station bosses are diamonds and self-support.
Collar	`revD_collar.stl`	Flat, either face down. 0.16 layers, 4 walls, 40 % infill. The thread flanks are shallow enough to print without support.
Coil form	`revD_form.stl`	Standing on the journal end. 0.12 to 0.16 layers so the groove is a smooth half-round, 3 walls, 20 % infill, brim.
Swivel cap	`revD_swivel_cap.stl`	Floor down, open end up. 0.16 to 0.2 layers, 4 walls.
Leg foot, x3	`revD_leg_foot.stl`	The file is exported in its working orientation, pocket down: rotate it 180 deg in the slicer so the top face is on the bed and the ballast pocket opens upward. 0.2 layers, 6 walls, 40 % infill. The socket is 50 deg from horizontal: no supports.

PETG is the minimum; ASA is better outdoors. For MJF PA12 from a print service, upload the six STLs as they are.

Clean-up

Cut the brims off. File the housing rim and the journal end of the form flat; those two faces matter. Run a 3.3 mm drill by hand through the seven lip holes (five at the housing rim, two in the swivel cap): the ball must rattle freely. Run a 7.0 mm drill by hand into each station bore from outside, 10 mm deep only, to clear stringing; the shoulder at the bottom is the stop the stem bottoms on. Push a 9.5 mm drill shank through the ledge hole in the top of the housing; the whip stud passes here. Blow out every hole.

Fit checks, before any hardware goes in

Check	How	Pass
Form in housing	Slide the form, land first, into the housing bore from the rim	Slides the full length under its own weight with light finger drag, no rocking
Whip in housing	Push the whip's base section into the bore at the top of the housing	Goes in 34 mm, slight drag, no wobble
Housing in hub	Push the housing, threaded end first, up through the hub bore from below	Slides through under hand pressure, can be rotated by hand, the thread stands 14 mm above the boss face
Collar on housing	Thread the collar onto the housing top by hand, housing out of the hub	Starts within a quarter turn, runs four turns to the bottom of the thread with light drag, no wobble. If it binds, clean both threads with a brass brush and run it on and off a few times
Coupling nut in pocket	Push the 3/8-24 coupling nut up the bore into the hex pocket with the dowel	Enters, seats against the ledge, does not rotate when you try to turn it with the dowel
Swivel cap on journal	Push the cap over the journal end of the form	Slides on, spins freely
Leg in foot	Push a leg tube into a foot socket	Goes in 22 mm, snug
Inserts in holes	Drop each insert into its hole, cold	Sits in the top of the hole, does not fall through, does not need force

If the form drags hard in the housing, stringing in the bore is the usual cause: wrap 220 grit around the form's land and run it through the bore a few times. If the housing does not drop into the hub, do the same to the hub bore with the housing. Do not sand the whip bore.



1x
Hub



3x
1/4-20 insert



1
Start it square by hand on the hot tip



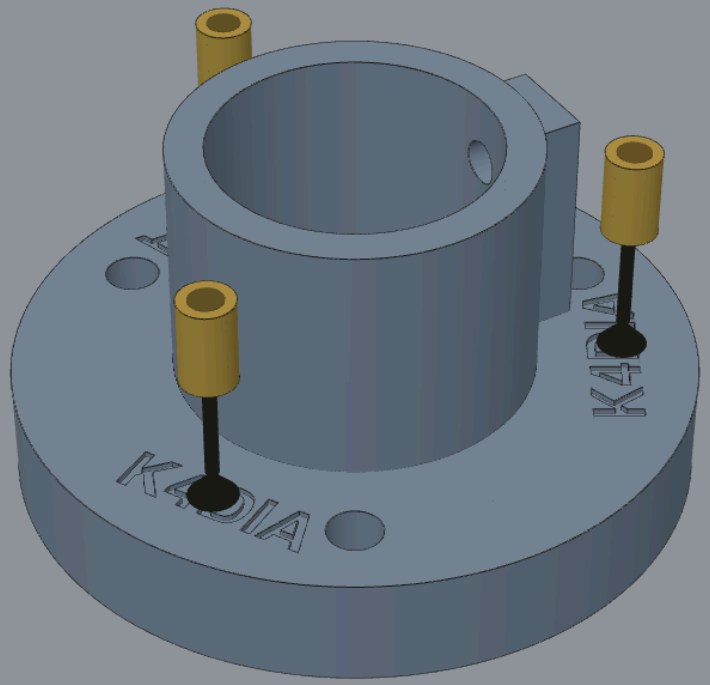
2
Light pressure only: it sinks in 15 to 20 s



3
Stop flush, lift straight up, leave 30 s

1

Top inserts



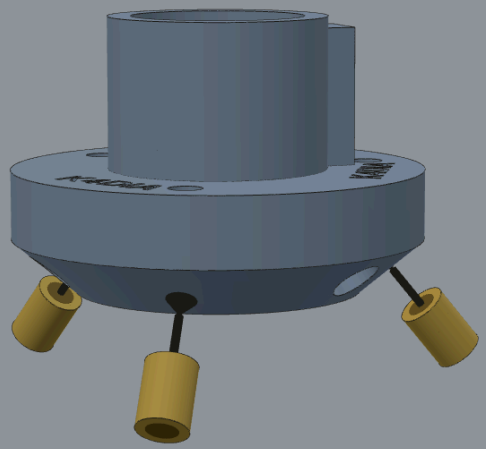
Iron at 200 C for PETG or PA12, 240 C for ASA. Check each insert with a bolt: it threads in smoothly and the insert does not turn.



3x
3/8-16 insert

2

Leg inserts, in the chamfer face



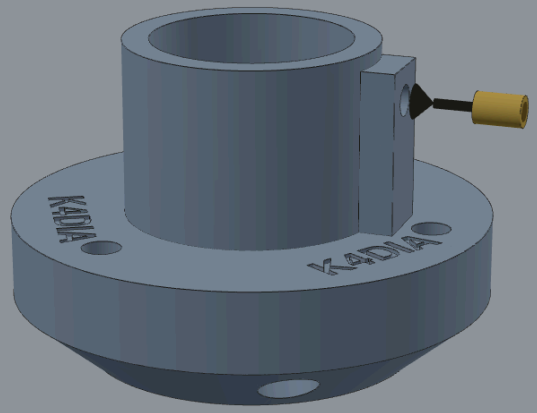
Prop the hub on a folded towel so the hole you are working on points straight up. The hole is 17 mm deep and 40 degrees from vertical; set the insert square to the chamfer face. A big insert takes about 30 s.



1x
M5 insert

3

Set-screw insert, in the boss rib



Lay the hub on its side so the rib points up. The hole is 11.4 mm deep for the 9.5 mm insert; drive it flush with the rib face.



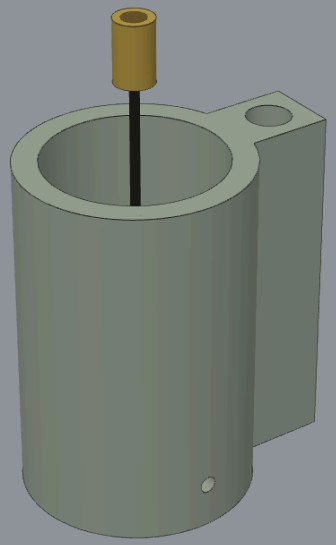
3x
Leg foot



3x
1/4-20 insert

4

Foot inserts, three feet



Each foot sits pocket up, as it was printed. The hole is in the pocket floor, 7.9 x 14. Set the insert flush with the pocket floor.

Check. Thread the matching bolt into every insert by hand. Ten inserts, ten checks: it goes in smoothly and the insert does not turn. Chase a tight one with the bolt and a drop of oil; reheat one that turns, with a drop of CA in the hole.

3x
1/2 in tube, 750



3x
3/8-16 x 1-1/2 stud



1x
epoxy

5

Studs into the tubes, cure overnight



Cut the tubes to 750 mm and deburr both ends. Rough the first 25 mm inside one end and the whole stud with 220 grit, wipe with alcohol. Tape the stud 1 in (25 mm) from the end as a depth stop, butter it with epoxy, push it in to the tape with a twist. 1/2 in shows. Stand stud up and leave 24 h. Three legs.

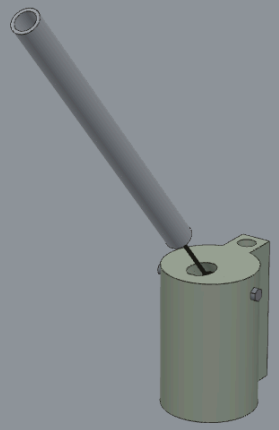


3x M3 x 20

3x M3 nut

6

Legs into the feet



Push the plain end of the tube into the socket until it stops, 22 mm in. Drill 3.4 mm through the foot's cross hole and straight through the tube, using the printed hole as the guide. M3 x 20 through, nut on, snug. If you are using a lead slug in the tube, drop it in from the stud end first.



3x 1/4-20 x 1-1/2 bolt

45x 1-1/4 in fender washer

7

Ballast, three feet



About 15 washers fill the 26 mm pocket (135 g). Thread the bolt up into the insert and tighten; the bolt head is the foot's contact point. Lead in the pocket is about 300 g instead. Indoors, a 1/4-20 rubber bumper screws into the same insert.



1x Housing

1x Swivel cap



1x .305-32 tap

8

Tap the seven station bosses



Five bosses on the housing rim, two on the swivel cap, each printed with a 7.0 mm bore 10 mm deep. By hand, square to the boss face: half a turn in, a quarter back. Stop when the tap touches the shoulder; the chamber below it is where the ball lives. Thread a valve stem in to check: it bottoms with 8 to 10 mm showing.



1x copper foil tape

9

Copper lining in the bore



Mark the outside of the housing 25 mm and 210 mm up from the rim; the lining runs between those marks. Five strips of 25 mm tape, 185 mm long, laid in from the rim with a dowel and burnished hard, each overlapping the last by 3 mm. Slit the last strip along the inside wire channel so the channel stays open. The form must still pass with light drag.



1x 3/8-24 coupling nut

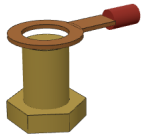
1x 3/8-24 x 1/2 bolt

1x 3/8 ring terminal

1x 18 AWG bus wire

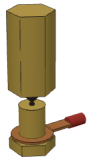
1x 1/2 in dowel

1



Terminal on the bolt

2



Bolt into the nut, tight: the terminal is clamped with its tab past the flats

3



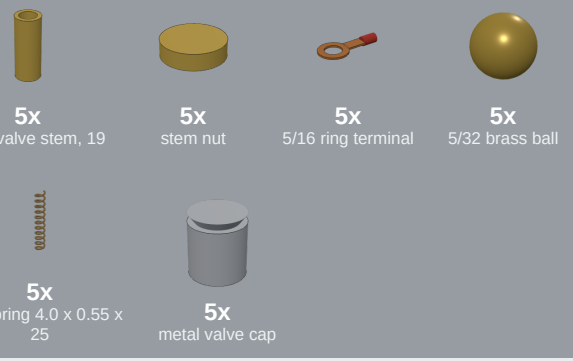
Bus wire, 1.2 m, soldered into the terminal

10

Coupling nut, inside bolt and bus wire



Feed the free end of the wire in from the rim and fish it out through the bus hole, 199 mm up at the top of the outside channel. Lay the inside run into the inside channel, then push the nut up the bore with the dowel, hex to hex, until it sits on the ledge 218 mm up. Pull the outside end to take up slack and fix it at the bus hole with a drop of CA. Check: wire end to nut, continuity.



5x brass valve stem, 19

5x stem nut

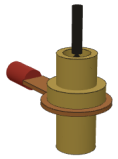
5x 5/16 ring terminal

5x 5/32 brass ball

5x PB spring 4.0 x 0.55 x 25

5x metal valve cap

1



Nut on first, run up loose; ring terminal under it

2



Stem in by hand until it stops on the shoulder; drop the ball down the stem

3



Spring down the stem onto the ball

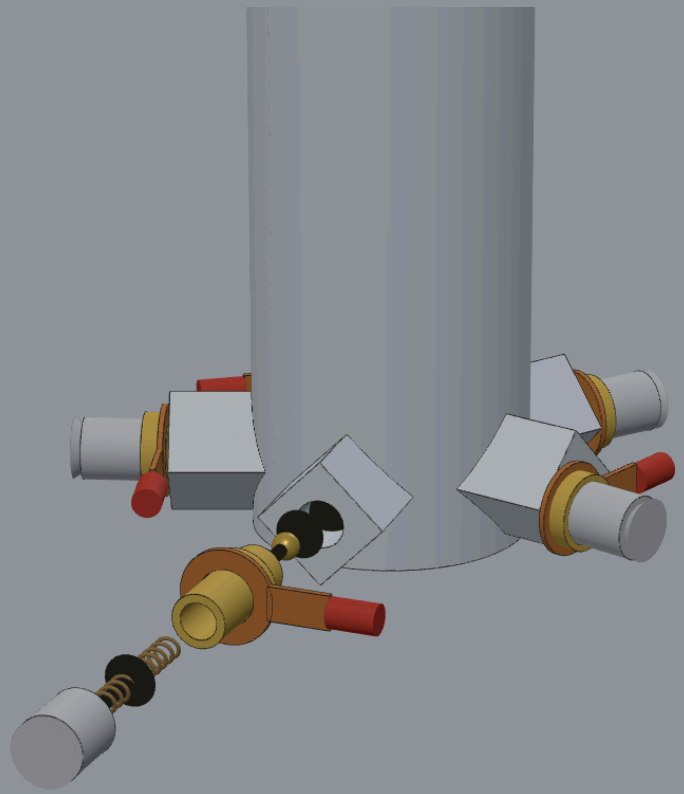
4



Cap on finger tight until it bottoms; nut down to the boss face, a quarter turn past snug

11

Ball stations, five on the housing



Work with the boss pointing up so nothing falls out. Nothing is adjusted: the stem bottoms on the shoulder, the cap bottoms on the stem, and that sets the preload. Point each terminal tab along the housing toward the next station. Check every station: push the ball with a toothpick, it springs back.



2x brass valve stem, 19

2x stem nut

2x 5/16 ring terminal

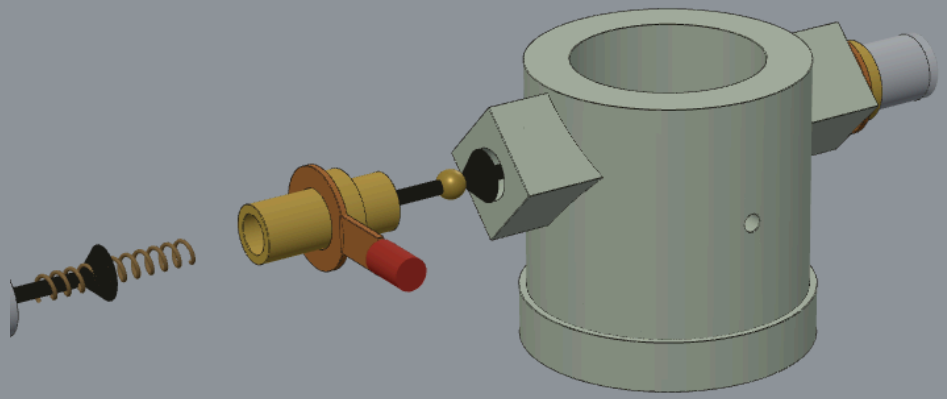
2x 5/32 brass ball

2x PB spring 4.0 x 0.55 x 25

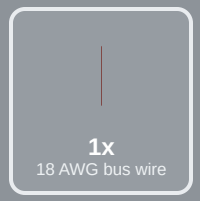
2x metal valve cap

12

Ball stations, two on the swivel cap



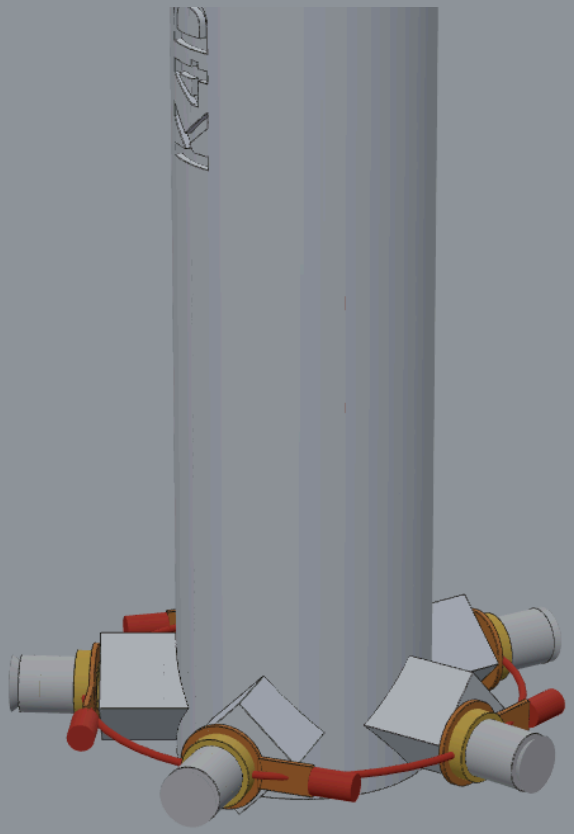
Same build. These two balls ride on the brass ring of the form journal. Point both terminal tabs toward the side hole in the cap wall.



1x
18 AWG bus wire

13

Bus the five stations



The bus wire is hanging out of the bus hole. Lay it down the outside channel to the first terminal, 10 mm above the rim, tape it every 50 mm. Loop it round through all five terminal rings, snug against the bosses, back to the first, solder every terminal, cut the surplus. A bead of thin CA along the channel, then pull the tape. Check: each valve cap to the coupling nut, continuity; cap to the copper lining, continuity.



1x
Coil form



1x
18 AWG bare tinned, 9.5 m

14

Wind the form



Straighten the wire first. Leave a 150 mm tail down the channel on the outside of the form, through the slot in the grip to the ring band on the journal; tape it there. Stand the form on its journal, channel toward you, and wind: 80 turns at 2.0 mm pitch, 48 mm up to 208 mm, keeping tension and thumbing every turn into the groove. Tape every ten turns. At the top the groove ends at a 2.2 mm hole: cut 25 mm past it, bend 90 degrees, push the end into the hole and leave it. Mark every tenth turn on the land side.



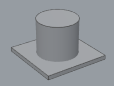
1x
K&S 1 in brass ring, 8

15

Brass ring over the tail



Cut an 8 mm ring from the K&S 1 in tube, deburr. Untape the tail, lay it across the ring band in the channel, push the ring over it into the recess 8 to 16 mm from the journal end. Solder the ring to the tail with the big iron, fast, and cut the tail flush. Check: ring to the top turn, about 0.2 ohm; ring to the journal end, open.



1x
SO-239



4x
#4 x 3/8 screw

1x
18 AWG bus wire

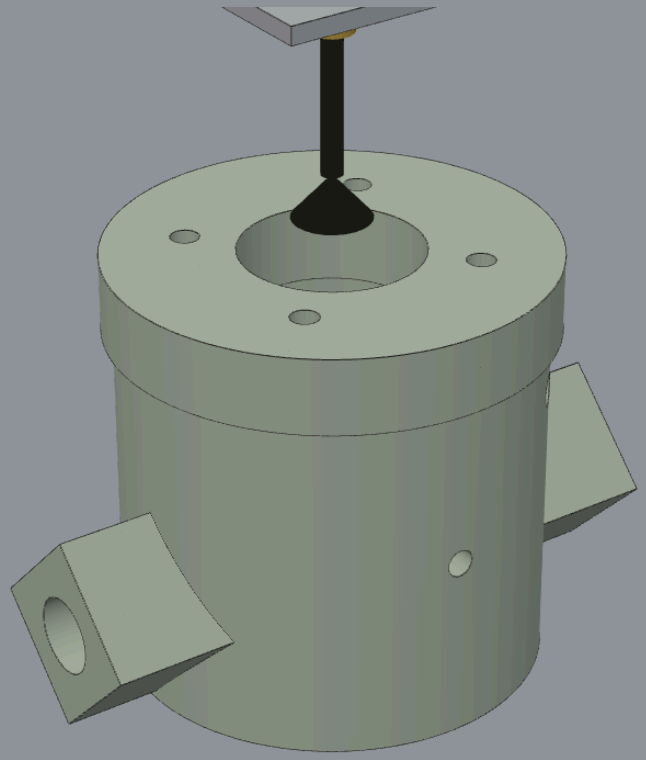
1



100 mm of insulated wire soldered to the center-pin tail, heat-shrink over the joint

16

SO-239 on the swivel cap floor



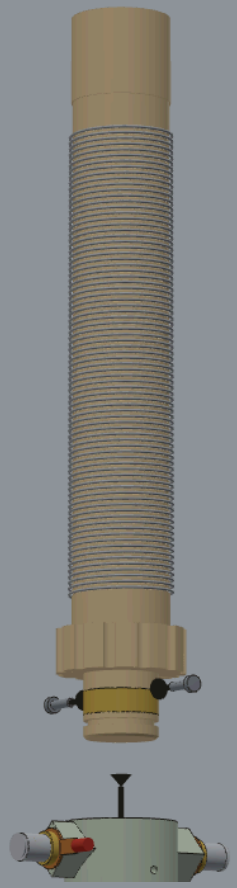
Turn the cap over. Push the wire up through the connector hole in the floor and out the small side hole between the two stations. Seat the flange on the floor, three #4 screws in, snug not stripped. Leave the fourth hole empty for now; the shield wire goes under that screw at the end. Cut the wire to reach both station terminals with a little slack, strip, solder to both. Check: center pin to each valve cap, continuity; center pin to the shell, open.



2x
M3 x 10

17

Swivel cap onto the journal



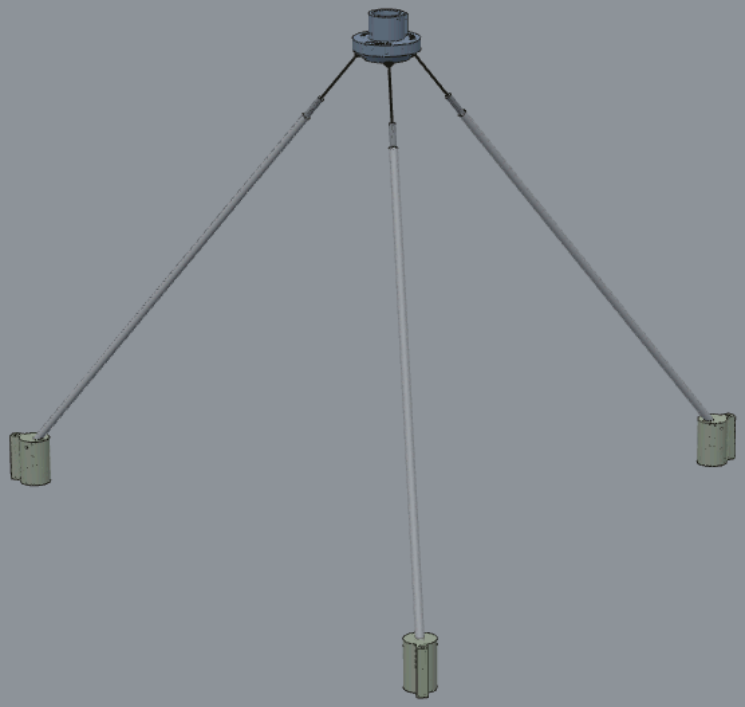
Slide the cap over the journal end, open end first, until the two balls click onto the brass ring; the cap floor is now about 10 mm below the journal end. The retaining screw holes are 90 degrees from the stations: thread an M3 x 10 into each until its tip touches the groove floor, then a quarter turn back. The cap cannot come off and the form spins in it. Check: spin it, no catch; center pin to the top turn, about 0.5 ohm, steady through a full turn.



1x
Hub

18

Legs into the hub



Screw each leg in by hand until the tube shoulder seats on the chamfer face. Hand tight only; the inserts are in plastic. Stand it up: all three feet flat, hub level. A rocking foot means that leg is not seated.



1x
Housing

19

Housing up through the hub, from below



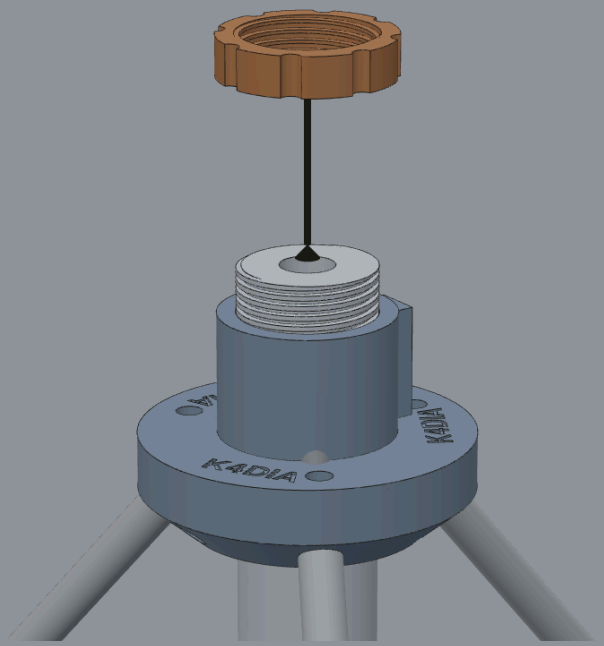
From below, between the legs, push the housing threaded end first up through the hub bore until the thread stands clear above the boss face. Hold it there for the next step.



1x
Collar

20

Collar on from above



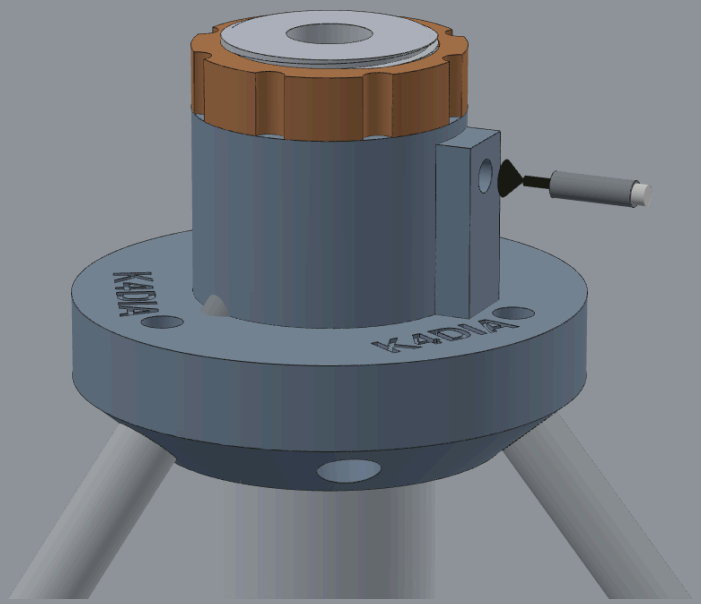
Screw the collar onto the housing clockwise until it seats on the boss face. Let go of the housing: the collar is carrying it now. Hand tight; the flutes are the grip. Turn housing and collar together so the outside wire channel faces away from where you stand to tune.



1x
M5 x 16 set screw

21

Set screw



Thread the M5 x 16 nylon-tip set screw into the rib insert until it touches the housing, then a quarter turn more. It only stops rotation. If you cannot feel it touch, turn the housing a few degrees: the groove is 10 mm below the boss face and the screw must land in it.

22

Form up into the housing, then twist

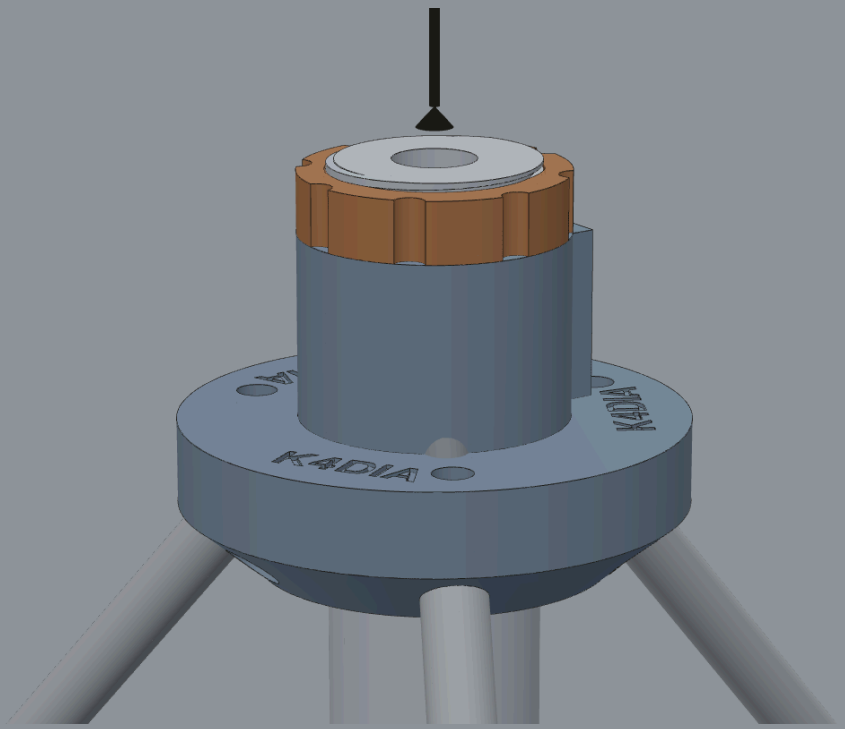


From below, offer the form up land first (the end without the grip). Push until the land meets the five balls; a firm push clicks it past them. Keep pushing until the first groove reaches the balls: they click into the valley and the form now wants to turn. Twist the grip clockwise as seen from below. One revolution is one turn and the form rises 2 mm. Twist until one turn shows below the rim: the form is fully in. Nothing in this joint needs force.

1x
CHA SS17 whip

23

Whip into the top



Push the whip's base section into the bore at the top of the housing. It goes in 34 mm and stops on the ledge; the stud passes through into the coupling nut. Turn the whip to thread the stud into the nut, tight by hand. The stud carries nothing but its own tension; the bore carries the bending.



1x
1/4-20 x 3/4 bolt



1x
1/4 washer

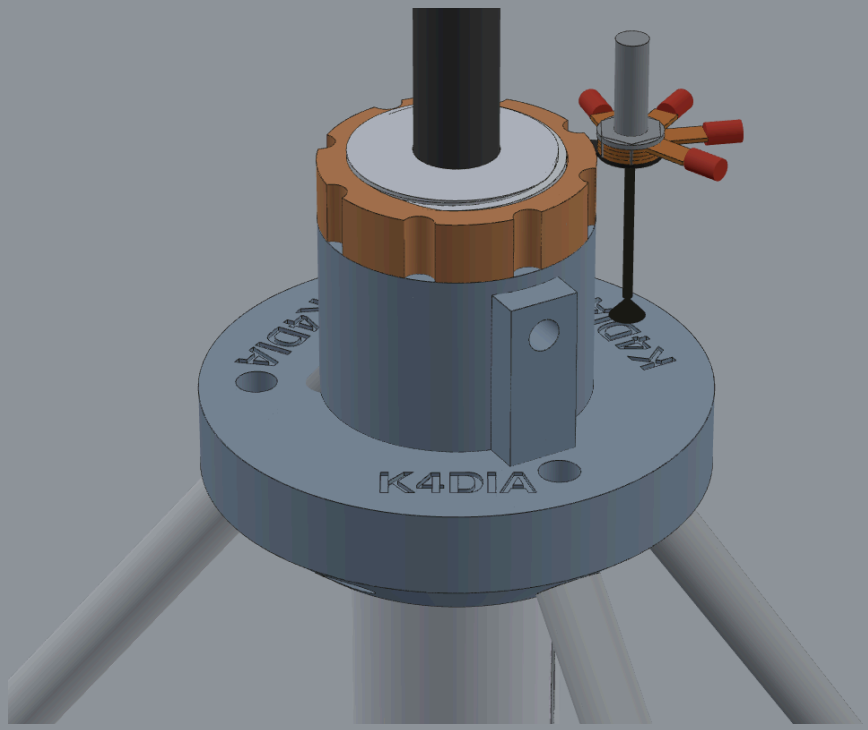


5x
3/8 ring terminal

1x
shield wire, 300

24

Ground bolt: radials and the shield wire



Into one of the three top inserts: ring terminals of the four to eight radials and the shield wire, then the washer, then the bolt head. The shield wire's other end goes under the SO-239 screw you left out on the swivel cap, 300 mm of 18 AWG so the form has room to travel. That ties the coax shield to the radials; without it the shield's only ground is the coax itself. Spread the radials on the ground, then coax onto the SO-239.



1x
coax, PL-259

25

Coax



PL-259 onto the SO-239 under the swivel cap. The coax hangs still while the form turns. Then the electrical checks on the next page, before any power.

Electrical checks, before power

Probe	Reads	Means
Whip (any section) to SO-239 center pin, form fully in	under 1 ohm	Whip, nut, bolt, terminal, bus, five balls, one turn, ring, two balls, pin: the whole path
Same, form fully out	still under 1 ohm (9 m of 18 AWG is 0.2 ohm)	80 turns
Same, while turning the form through ten turns	steady, no dropouts	Balls riding the groove
Whip to SO-239 shell	open	Nothing on the whip side touches ground
SO-239 shell to each radial	short	Shield wire and ground bolt
SO-239 shell to a leg	open	The hub is plastic; the legs are not in the circuit

If whip to center pin is open with the form fully in, turn the form one turn: the balls may be sitting between the land and turn 1.

First tune-up

Full whip, form fully in: 20 m. Check SWR at 5 W; expect under 2:1 somewhere in the band and trim with the top whip section. Unscrew the form 20 turns (count the marks): 40 m. Check SWR, adjust the whip. The operating manual, section 6, has the turn counts for every band and what the whip does on each.

First-day problems

Symptom	Cause
SWR jumps as you turn the form	A ball not riding the groove; open each station and check the ball is in the chamber and the spring is on it
SWR high on every band, whip trim does nothing	Shield wire missing, or the ground bolt loose
Tunes but drifts in wind	Set screw not in the groove so the housing rotates, or the collar has backed off: check it is seated on the boss
Form hard to turn	Wire proud of the groove somewhere; find it with a fingernail and press it down
Tunes on 40 m but not 80 m	Lining not connected; the dead turns are resonating. Check cap to lining continuity

Maintenance

Noisy contact: unscrew one valve cap, tip out spring and ball, wipe them and the wire crests with isopropyl, reassemble. Nothing else moves. The form comes out by twisting it down and out of the housing; the swivel cap stays on it. Never coat the winding; if it tarnishes, wipe it with isopropyl and a rag while turning the form. Check the set screw and the leg inserts at the start of each season. Stake the feet through the ears whenever the forecast is over about 12 mph, or whenever you walk away from it.