

# Small Magnetic Loops

Made from LMR-400 Coax Cable

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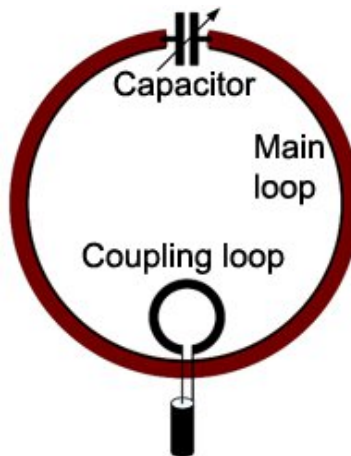
A small magnetic loop antenna is an easy and cheap antenna to build. It can be used indoors or outdoors with near equal results.

Stateside and DX contacts have been made with an indoor small magnetic loop running 3-30 watts using CW, PSK, JT65, and FT8 modes on 10-40 meters. Using wide-spaced variable tuning capacitors allow for higher power with no arcing.

The two small magnetic loops described in this article are for (1) **fixed operation** using a 9-foot circumference loop with a fixed stand, and (2) **portable operation** using an 8-foot circumference loop with a break-down stand.

## Background

The basic configuration of an inductive-fed small magnetic loop consists of the main loop, coupling loop, and a capacitor - fixed or variable. This antenna requires no grounding or counterpoise since it is a resonant circuit. Performance is not limited by low height.



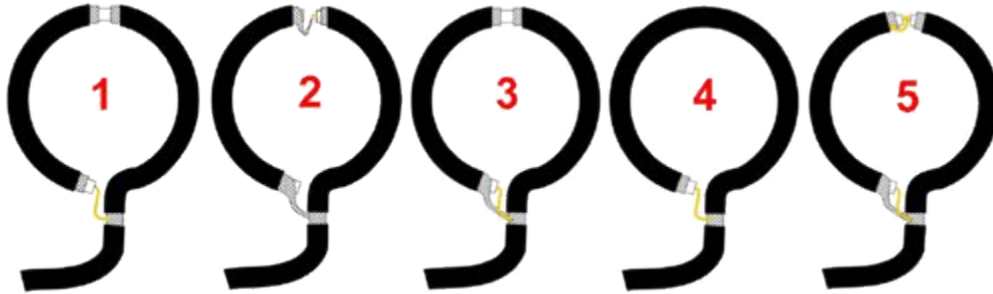
**Main loop:** The main loop can be configured as an octagon, circle, or square. Circle configuration is the most efficient, but all three configurations will work.

Diameter of the loop conductor is generally 3/8 inches or greater. RG-8 (model LMR-400) coaxial cable was chosen over copper tubing since it is easy to work with. LMR-400 requires no tools for bending into a circle, has a solid center conductor for strength, and the two-layer outer conductors (braid plus foil shield) insure less loss due to continual conductivity. The center conductor is generally not used.

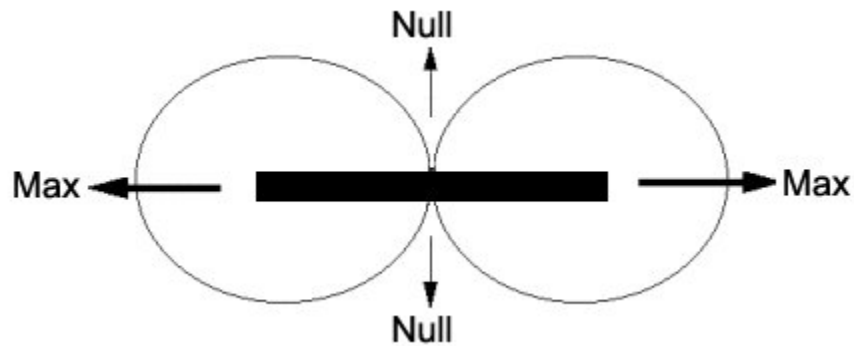
**Capacitor:** The fixed or variable capacitor tunes the loop antenna for lowest SWR. The capacitor is located at either the top or bottom of the main loop, but always opposite the coupling loop. An antenna tuner may also be used for obtaining lowest SWR.

**Coupling loop:** A coupling loop is used for feeding the magnetic loop inductively. N4SPP suggests five configurations for constructing the Faraday coupling loop.

Configuration #4 below was chosen due to simplicity and ease of construction. The coax is not split at any point as illustrated in the other configurations. RG-8X coax is used for the coupling loop.



**Radiation pattern:** Maximum radiation of a loop is off the vertical ends with a figure-8 pattern similar to a dipole antenna. Theoretically, a loop can be rotated using the null side to reduce QRM. In practice, contacts have been made off the ends and null side without a need to rotate the loop.

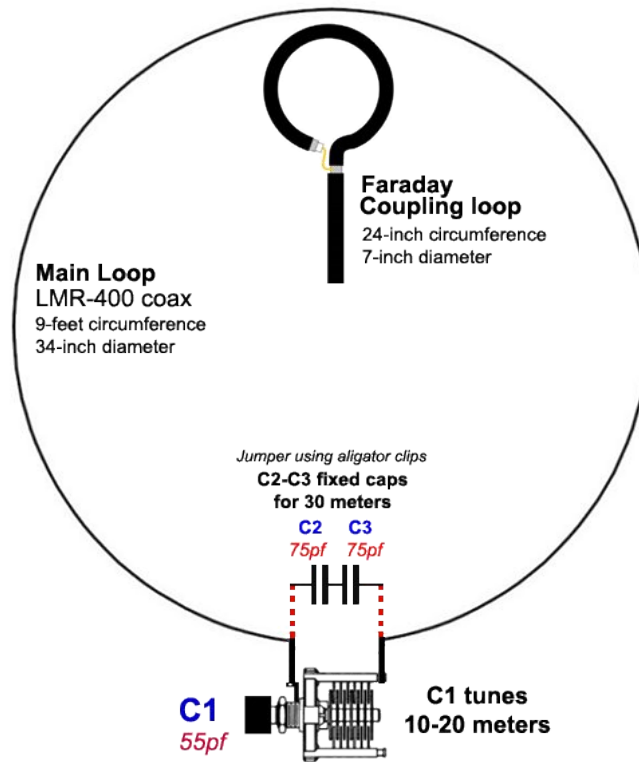


**Tuning:** Tuning is simple, but touchy due to hand and body capacitance from being too close to the loop and variable capacitor. Try to tune at arms length.

- **Course tuning** - adjust the variable capacitor initially for loudest background noise when changing bands
- **Fine tuning** - adjust the variable capacitor for lowest SWR reading
- **Antenna tuner** can be used for obtaining a better match, especially on 10 and 12 meters

## Fixed Operation

10-12-15-17-20-30-40 meters  
9-foot circumference  
34-inch diameter  
LMR-400 coax



Magnetic loop mounted on 67-inch wood stand



Ferrite beads attached to coupling loop for suppressing common mode currents



55pF variable capacitor located at bottom of loop. Plastic handle on knob added to avoid hand capacitance. Capacitor tunes loop for 10-20 meters with ATU for lower SWR on 10-12 meters. Holes show experiments with capacitor configurations.

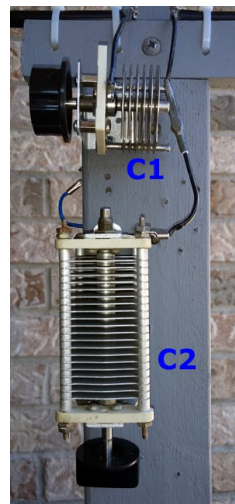


Jumper allows operation on 30 meters and consists of two 75pF 5KV door-knob capacitors in series. When paralleled with variable capacitor, result is a good 30m match. 60 watts RF applied with no arcing due to wide plate spacing.

### Alternate capacitor configuration for 30-40 meters



**C1 only** tunes 10-12-15-17-20m  
**C2 bypassed** using alligator clips



**C1 + C2 in parallel** tunes 30-40m  
**C1=3-55pF**      **C2=17-252pF**

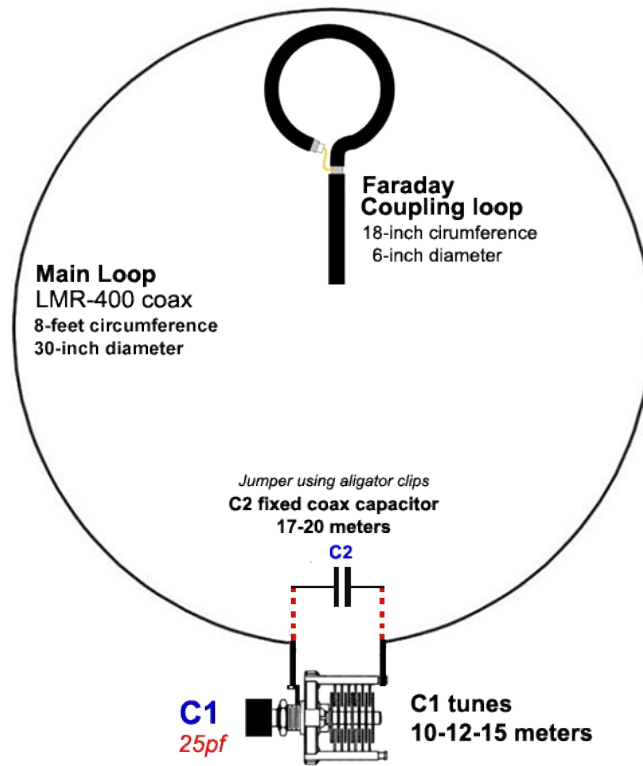
## Portable Operation

10-12-15-17-20 meters

8-foot circumference

30-inch diameter

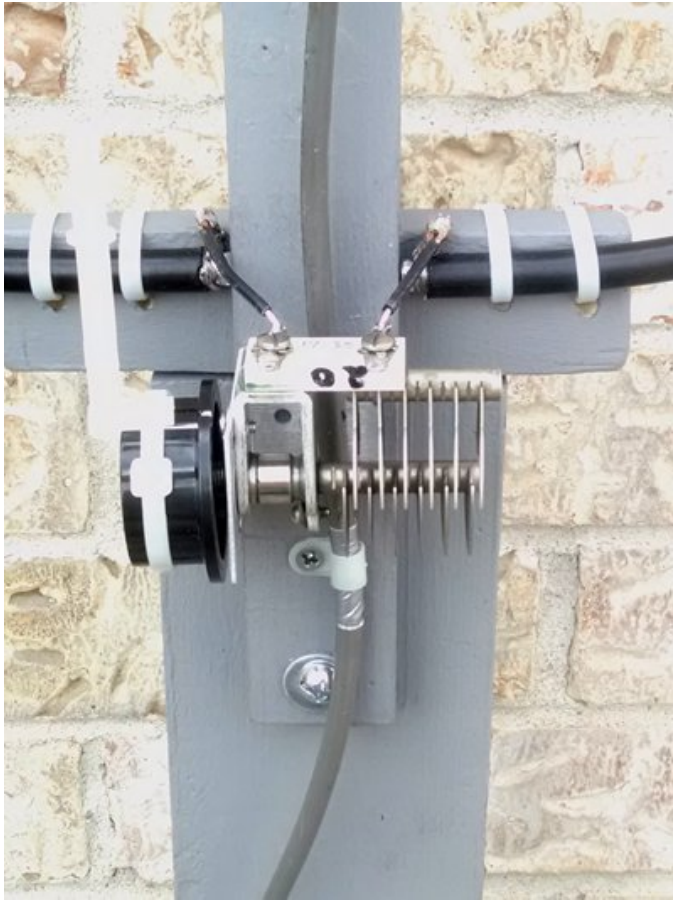
LMR-400 coax



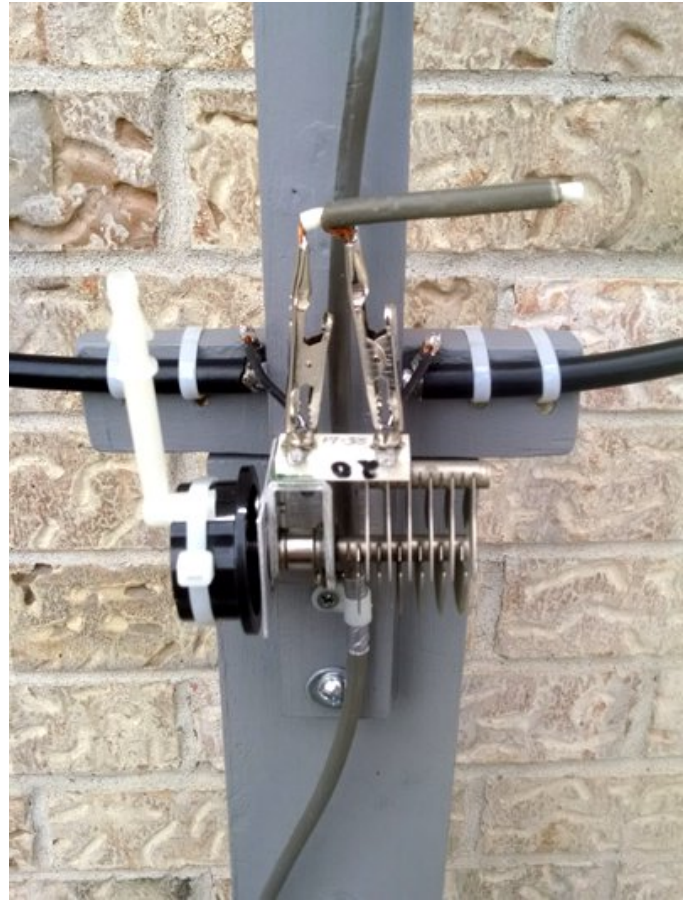
Magnetic loop mounted on 55-inch wood stand.



Magnetic loop with wood stand disassembled.



25pF variable capacitor located at bottom of loop. Plastic handle on knob added to avoid hand capacitance. Capacitor tunes 15-12-10. ATU used on 10 meters for better match.



Fixed coax capacitor jumper allows operation on 17 meters. 2.5-inch coax capacitor uses RG-8X. Good match obtained when paralleled with variable capacitor.



Ferrite beads attached to coupling loop for suppressing common mode currents

## Tuning the Loop

Placing SWR meter at base

Resonance is obtained by changing the fixed capacitors and/or adjusting the variable capacitors for lowest SWR.

Since my stand-alone or built-in SWR meters were difficult to view accurately from 5-8 feet away from the rig, I decided to place another stand-alone SWR meter at the base of the loop. I have used this method in adjusting HF mobile antennas instead of running back and forth from front seat to rear bumper.

A J-38 telegraph key was used to key the transmitter when using CW with 10 feet of zip cord. Alligator clips were soldered at the transmitter end to clip to the existing paddle or straight key terminals.

The SWR meter is shown mounted (actually glued) at the base of the 9-foot circumference loop.



## Summary

Both small magnetic loop antennas were interesting to build and use. Five magnetic loops have been built, but the two described in this article have been the most successful. The magnetic loop is placed at least 5 feet away from the operating position with the null side facing the operator.

Many stateside and DX contacts have been made on 40, 30, 20, 17, 15, 12, and 10 meters using CW, JT65, FT8, and PSK31 modes. Power used for both loops ranged from 3 to 30 watts during general QSOs. Full CW key down was tested using 100 watts for 5 seconds. No arcing resulted due to wide spacing of each variable capacitor.

The indoor small magnetic loop might be an option if an outdoor antenna is not possible.