Installing Wire Loops for Amplifiers—
Single, Double or Parallel Loops—Which?

1. The reason why we always recommend installing a double wire loop is flexibility after installation. With a double wire loop installed you can use the configuration that will give the best result at any given location, and can even change the amplifier if necessary.
2. Connecting both wire loops in series will create a 2-turn loop. A 2-turn loop will give twice the magnetic field strength compared with a 1-turn loop with the same wire size. In practice this means that a 2x14 gauge wire loop will result in a 6 dB stronger field than a 1x14 gauge wire loop, assuming that the voltage of the amplifier can supply the loop with the same amount of current.
3. What you want to avoid is getting the voltage "stuck" in the amplifier and not "released" in the loop (resistance) as a current. If the voltage stays in the amplifier, the amplifier will get hot which is bad. However, if the resistance of the wire is too much, the voltage will not be enough to create the necessary amount of current, and both the magnetic field and the high-frequency response will not be according to the standard.
4. If the looped area is small in relation to the amplifier's capacity, use a 2-turn loop to create a greater resistance, which avoids the voltage "staying" in the amplifier. However, if the looped area is close to the capacity of the amplifier, the resistance of a 2-turn loop may be too high for the voltage to overcome, thereby limiting the current in the loop. In this case, connect the wires in parallel to create a single turn loop which results in essentially a larger wire size and less resistance.
5. The resistance of the wire that the current has to "travel through" is not only built up by the static resistance, but also an important component called inductance. Resistance and inductance together are referred to as impedance.
6. The impedance of a wire is a combination of resistance (direct current, DC) and inductance (alternating current, AC). The resistance is constant whatever the frequency, and is measured in ohms. The resistance in normal wires varies approximately from 0.3 ohms to 2 ohms. The inductance, however, varies with the frequency of the signal. At low frequencies, the inductance is lower than at higher frequencies. At very low frequencies the inductance is zero or close to zero and the impedance is equal to the resistance. As the frequency increases, the inductance will eventually become larger than the static resistance, thereby increasing the impedance beyond the level of the resistance.

Although a 2-turn loop may deliver the right amount of current at 100 Hz, it may not be enough at 5,000 Hz, as the inductance "kicks in". This might be another reason to use a 1-turn loop. Therefore, it is vital to measure the magnetic field at different frequencies to determine if you need to connect as a 1-turn loop rather than as a 2-turn loop.

7. You need enough voltage to overcome the impedance and push the current through the wire. If, however, the voltage is high and the impedance is low, you will have excess voltage that will not be needed to create the current needed. This extra voltage will then be wasted as heat in the amplifier. The ideal situation is to have the exact amount of voltage to overcome the impedance, but not so much that it will “stay” in the amplifier.

8. Thus, our general recommendation for all standard (PLS) loop amplifiers is to use a twin wire (two wires), then you can either:

   A. Connect the wire as a 2-turn (two wires) loop.

   B. Connect the wire as a 1-turn loop (and not use the second wire).

   C. If the desired magnetic field level is not reached, especially in the higher frequencies, combine the leads and connect in parallel as a 1-turn loop.

   First, connect the wire as a 2-turn (two wire) loop (A). Measure the field strength. Then disconnect the 2nd wire (B) and test as a 1-turn loop (one wire) and measure field strength again.

   If the 1-turn is stronger, leave the 2nd wire unattached.

   You can also attach the ends of the 2nd wire to the ends of the 1st wire thus creating a “parallel connection” which still connects to terminals #1 & #2. Then compare to the stronger of A and B. The best connection is the strongest one—A, B or C.