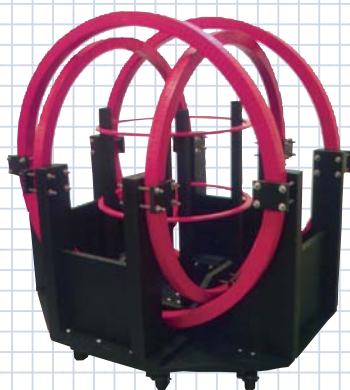
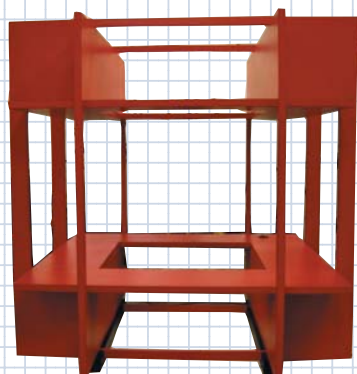


Helmholtz Coil Systems



ROUND, BIAXIAL HELMHOLTZ WITH RF COIL



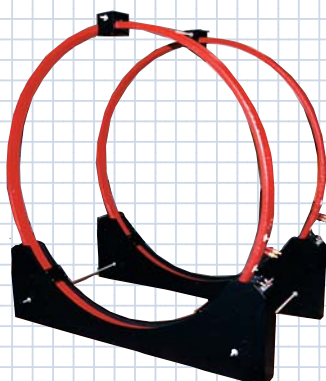
SQUARE, TRIAXIAL HELMHOLTZ



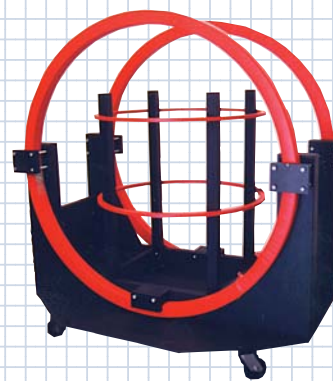
ROUND, BIAXIAL HELMHOLTZ



ROUND, TRIAXIAL HELMHOLTZ



ROUND, SINGLE AXIS HELMHOLTZ



ROUND, SINGLE AXIS HELMHOLTZ WITH RF COIL

Helmholtz Coil Systems

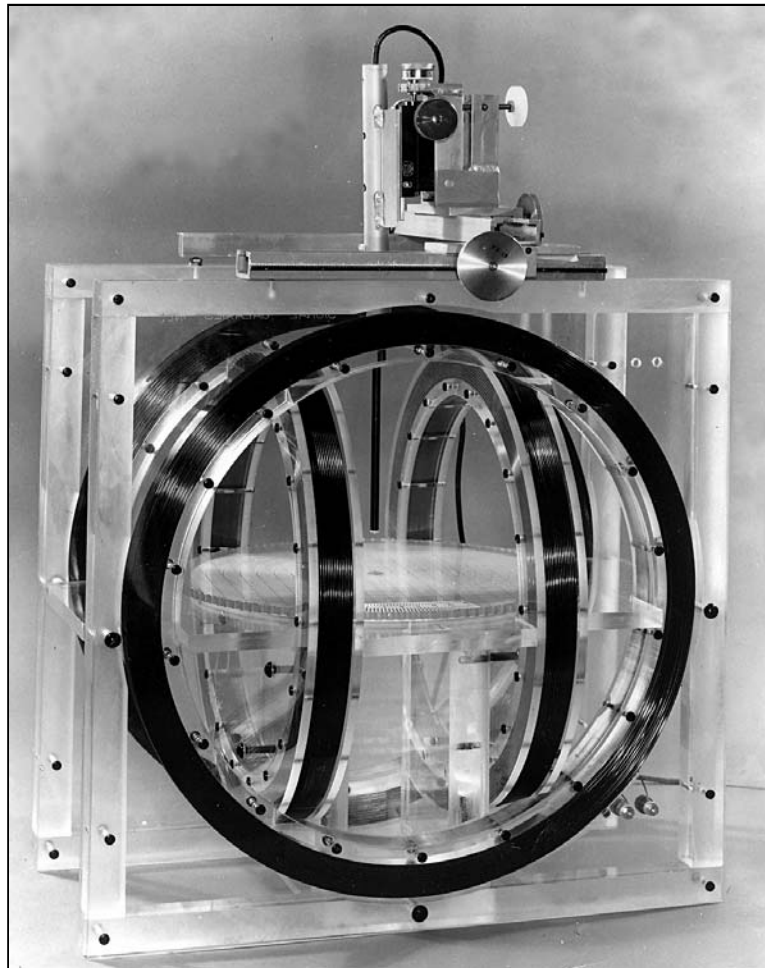
General:

The Helmholtz coil system concept, developed by a German physicist over a century ago, is a system that is normally used to generate magnetic field levels of specified volume and uniformity, allowing scientists and engineers to perform numerous experiments and test functions that require a known ambient magnetic field. Helmholtz field generation can be static, time-varying DC or AC, depending on applications.

Applications range from cancelling the earth's magnetic field for certain experiments as well as generating magnetic fields for applications such as determining magnetic shielding effectiveness, determining the susceptibility of electronic equipment to magnetic fields, calibration of magnetometers and navigational equipment and for many bio-magnetic studies, just to name a few.

Helmholtz coils can also be used to sense magnetic fields when coupled with an integrating fluxmeter. This becomes a convenient way to determine the open circuit intrinsic characteristics of permanent magnet materials.

Accessory equipment such as Walker gaussmeters and magnetometers are available for magnetic field verification or incorporated as part of a closed loop system. Walker fluxmeters are also widely used in the Helmholtz/fluxmeter magnet measurement systems.



Typical Applications:

- Susceptibility measurements
- Calibration for navigational equipment
- Permanent magnet inspection
- Earth's field cancellation for bio-magnetic studies, etc.
- Magnetometer calibration
- Magnetoresistance measurement
- Hall probe calibration
- CRT adjustments



**ROUND,
SINGLE AXIS HELMHOLTZ**
For susceptibility testing.

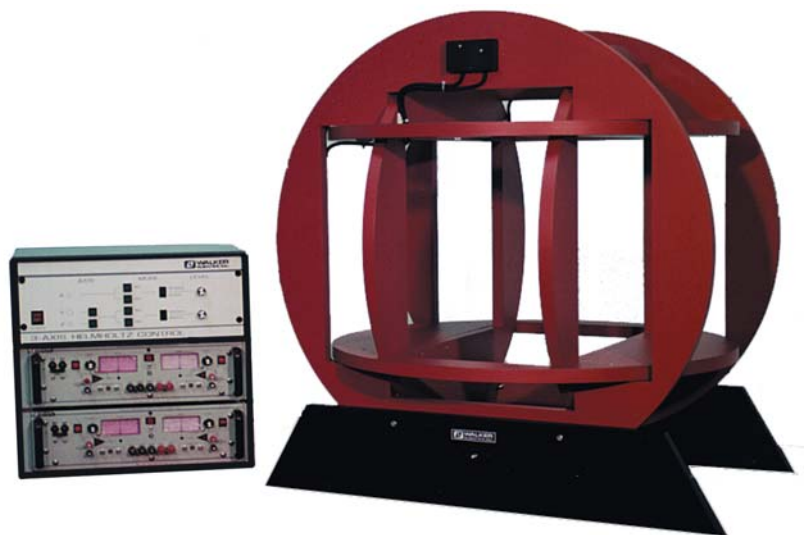
Description:

The basic, typical single axis Helmholtz coil system consists of two identically wound layered coils, wired in series, with a specific geometry wherein the mean radius is equal to the mean coil spacing. When either AC or DC power is applied to this coil geometry, a magnetic field volume is produced in which uniform conditions exist. The strength of the magnetic field generated is directly proportional to the number of conductor turns in the coils, the applied current, the physical size and the intercoil spacing between the coils.

Coil configurations of greater complexity are sometimes necessary in order to accommodate a particular application. Systems that consist of two (biaxial) or three (triaxial) coil pairs are often required. Each coil pair or axis is usually independently controlled through a dedicated power supply. As a result, the magnetic vector generated by each coil pair can be regulated to complement other coil pairs in providing a desired uniformity over a specified sample volume or coil center line. Triaxial systems, for example, can be used to negate the effects of the earth's field (between 400-750 milligauss).



ROUND, SINGLE AXIS HELMHOLTZ
With stand included as part of the coil design.



ROUND, TRIAXIAL HELMHOLTZ SYSTEM
With controller to test magnetic compasses.

Helmholtz Design Requests:

The combined values of Walker Scientific experience, reliability, quality and performance has resulted in the production of many proven AC and DC Helmholtz coil system designs. Single, biaxial or triaxial Helmholtz coils with single or multi-pair coil sets, fixed or rotatable, are offered in round, square or rectangular configurations. Field levels from the gamma range (1 gamma = 1nT = 10⁻⁵ G) to the kilogauss level can be generated with uniformity in parts per million (ppm) over a specified sample volume.

Information related to any Helmholtz design request should be provided by completing the Helmholtz questionnaire and returning a copy of the completed form for processing.

All unusual installation constraints should be noted on the application.

With our unique engineering and design approach and our unique manufacturing techniques, we are able to provide cost effective systems with features that meet your exact application requirements.



ROUND, TRIAXIAL HELMHOLTZ SYSTEM
With built-in platform and closed loop, feedback system.



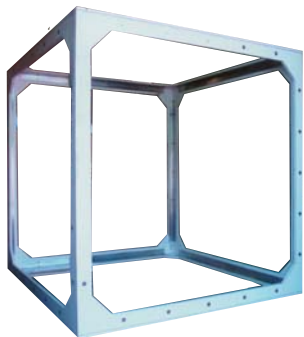
ROUND, SINGLE AXIS, MULTI-COIL HELMHOLTZ
For high field, high uniformity space restricted application.



SINGLE AXIS SPLIT BASE HELMHOLTZ
Equipment testing for the transportation industry.
Compliance with SAE J1113/22.



SQUARE, TRIAXIAL HELMHOLTZ COIL SYSTEM
Earth's field cancellation for bio-magnetic studies.



SQUARE, BOX TYPE, TRIAXIAL HELMHOLTZ
Designed specifically for CRT adjustments in the manufacturing environment.



SQUARE, SINGLE AXIS, MULTI-COIL HELMHOLTZ
Another concept of a space restricted application.



SQUARE, TRIAXIAL HELMHOLTZ SYSTEM
Computer controlled, closed loop feedback system.

HELMHOLTZ QUESTIONNAIRE

Request for Quotation

Please copy this form and fax or e-mail information to: Walker LDJ Scientific, Inc.

NAME		DATE	
ORGANIZATION			
ADDRESS			
CITY	STATE/PROV.	COUNTRY	POSTAL CODE
TELEPHONE	FAX	E-MAIL	

1. The active magnetic field volume is a: Rectangle Cube Cylinder Sphere
with the following dimensions: Length (X) _____ Height (Y) _____ Width (Z) _____ Diameter _____

2. Field orientation is: • Horizontal X, Z • Vertical Y
A. Single Axis B. Biaxial (X, Y) or (X, Z) C. Triaxial (X, Y, Z)

3. Specifications:

	X Axis Horizontal	Y Axis Vertical	Z Axis Horizontal
• DC Field Strength (Gauss)	_____	_____	_____
• AC Field Strength (RMS Gauss)	_____	_____	_____
• Frequency (Hz)	_____	_____	_____
• Field Uniformity Over Active Volume (%)	_____	_____	_____
• Minimum Inner Diameter	_____	_____	_____
• Maximum Outer Diameter	_____	_____	_____
• Maximum Axis Length Overall	_____	_____	_____
• Minimum Inter-Coil Spacing	_____	_____	_____

4. Is water available for cooling? Yes No

5. Power supply requirements:

- Recommend an appropriate power supply
 Quote any required power supplies
 Quote a coil system using my existing power supply/supplies:

Manufacturer: _____ Model: _____ Current: _____ Voltage: _____

6. Other considerations: (available AC power, unusual access requirement, weight limits, etc.)

7. Describe application briefly: _____

8. Budget – If you have a specific budget goal, please let us know. Even though our designs are very cost effective, we might find that it is not possible to meet your budget with a specific design. Being aware of your budget will allow us to discuss trade-offs early in the quotation process and save you time: _____

Table I
Conversion Factors for Magnetic Measurements
CGS to SI

To convert the CGS value in	To the following in SI units	Multiply the CGS value by
Gausses	Webers/square meter	10^{-4}
Gausses	Tesla	10^{-4}
Gausses	Ampere-turns	0.7958
Gilberts/cm	Ampere-turns/meter	79.58
Maxwells	Webers	10^{-8}
Oersteds	Ampere-turns/meter	79.58

SI to CGS

To convert the SI value in	To the following in CGS units	Multiply the SI value by
Webers/square meter	Gausses	10^4
Tesla	Gausses	10^4
Ampere-turns	Gausses	1.257
Ampere-turns/meter	Gilberts/cm	0.01257
Webers	Maxwells	10^8
Ampere-turns/meter	Oersteds	0.01257

Table II
Tesla-Oersted-Gamma Relationship

Tesla	Oersted	Gamma
1 T	10,000 O ϵ	—
0.1 T (100 mT)	1,000 O ϵ	—
0.01 T (10 mT)	100 O ϵ	—
0.001 T (1 mT)	10 O ϵ	—
1×10^{-4} T (100 μ T)	1 O ϵ	100,000 γ
1×10^{-5} T (10 μ T)	100 mO ϵ	10,000 γ
1×10^{-6} T (1 μ T)	10 mO ϵ	1,000 γ
1×10^{-7} T (100 nT)	1 mO ϵ	100 γ
1×10^{-8} T (10 nT)	100 μ O ϵ	10 γ
1×10^{-9} T (1 nT)	10 μ O ϵ	1 γ
1×10^{-10} T (0.1 nT)	1 μ O ϵ	0.1 γ

T = Tesla
m = milli

O ϵ = oersted
 μ = micro

γ = gamma
n = nano

Note: in the cgs system, when the medium has a permeability of 1 (air or a vacuum) $B = H$; for example, 1 Gauss = 1 Oersted