MEDA, Inc.

Advance Information

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MFS100 Magnetic Field Source

Functional Block Diagram
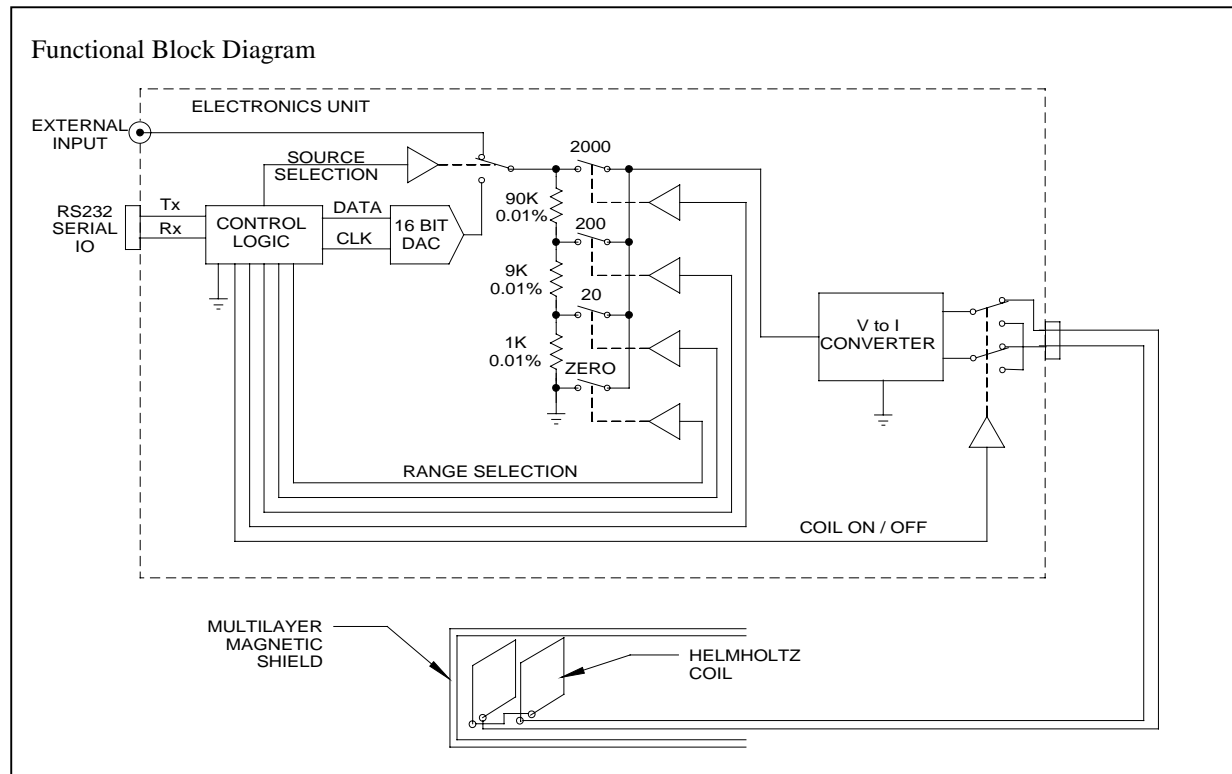
Description

The MFS100 is a computer controlled precision magnetic field source that can generate fields up to 2000 mG. Its accuracy, high resolution, linearity and stability make it particularly suitable for calibrating fluxgate magnetometers.

The MFS100 includes a multilayer mumetal magnetic shield which attenuates external dc fields by as much as 90 dB.

The MFS100 is controlled by a computer through a simple 3 wire RS232 serial communications link such as a "com" port found in personal computers. The operator uses a virtual front panel to set field values and polarity, select the voltage source (external or internal) or select the field range.

An external voltage source, such as a function generator or arbitrary waveform generator, can be used to generate AC fields up to 10 kHz.

Features

- ±2000 mG Field Range

- 0.01 mG Resolution on the 20 mG Range

- Computer Controlled Through RS232 Serial Port

- 0.15% Basic Accuracy

- Magnetic Shield Residual Field Under 0.02 mG

- Can be Driven by an External Voltage Source

Virtual Front Panel
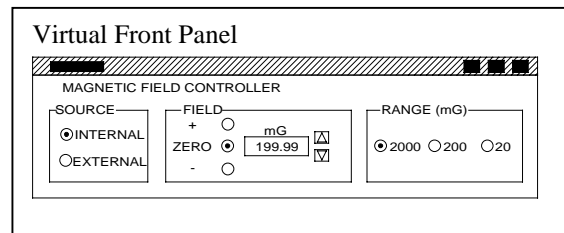
Technical Specifications

DC Magnetic Fields

Range:	±2000 mG
Resolution	
0 to 20 mG:	0.01 mG
>20 mG to 200 mG:	0.1 mG
>200 mG to 2000 mG:	1.0 mG
Accuracy @ 25 °C:	±(0.15% of setting + 0.05 mG)
Accuracy drift:	50 ppm/°C

External Source Input

Full Scale Ranges:	±20, ±200, ±2000 mG
Scale Factor	
Value:	Range/10 mG/Volt
Accuracy @ 25 °C:	±0.15%
Accuracy drift:	50 ppm/°C
Frequency Response:	DC to 10 kHz
Input Impedance:	100 kΩ

Serial Port: Three wire RS232 port operating at 9600 baud, one start bit, one stop bit and no parity.

Shield Residual: < 0.02 mG within 12 inches of the rear inside end wall after degaussing.

General Specifications

Temperature Range: 0 to 50°C.

Input Power: Switch selectable 110/220 VAC at 50/60 Hz.

Maximum Power Consumption: 20 Watts.

Coil To Electronics Cable Length: Ten feet**.**

Physical Characteristics

Item	Size	Weight
Electronics Unit:		
Shield:		
Helmholtz Coil:		

Theory Of Operation

A microprocessor inside the MFS100 controls all internal operations in response to commands received from an external computer through the RS232 port. These functions include:

- Source selection

- Range selection

- Coil on/off control

- Field application

The MFS100 can select either the internal DC voltage source or an external source to control magnetic field generation. The internal source is normally used to generate accurate and precise DC magnetic fields. An external source could be used to generate AC fields, for example, when measuring the frequency response of a magnetometer.

The selected source is applied to a precision voltage divider. The divider has taps for voltage divisions of 1, 10 and 100 which correspond to the 2000, 200 and 20 mG ranges. The tap selected by the operator is connected to a voltage-to-current converter that drives a single axis Helmholtz coil. The Helmholtz coil, which is located at the closed end of the shield, produces a uniform field between the two individual coils that is parallel to the line joining the centers of the coils. The field uniformity is better than $\pm 0.016\%$ within a 1" cubic volume about the geometric center. The probe of a magnetometer being tested is placed in this region with its sensitive axis parallel to the field.

RS232 Connections

The MFS100 comes with a six foot cable that connects it to a serial port of a computer. One end of the cable has a miniphone plug that connects to the MFS100. The other end is a standard 25 pin D connector that plugs into the communications port.

The MFS100 operates at 9600 baud with one start bit, one stop bit and no parity bit.

Software

The MFS100 comes with the virtual front panel program described earlier. The program requires Microsoft Window 95 or Windows NT 4.0.

An Active X control is also provided that can be embedded in a computer program. The Active X control provides all of the interfaces (properties and methods) required to communicate with the MFS100.

Typical Application

The MFS100 can form the foundation of a magnetometer calibration system. Figure 1 shows a typical calibration system setup. The probe of the magnetometer being calibrated is placed in the MFS Helmholtz coil. The magnetometer analog output is connected to a digital multimeter that is attached to the computer through an IEEE-488 instrumentation buss.

The arbitrary waveform generator (AWFG) plug-in card generates AC fields to measure the magnetometer's frequency response. The software supplied with the MFS100 and AWFG could be used to perform a manual calibration. Alternatively, a special computer program that embeds the MFS100 Active X control could be developed to automate the calibration procedure.

Annual Calibration

The MFS100 is initially calibrated prior to shipping. This calibration is traceable to NIST and valid for one year. An annual recalibration is recommended. In order to claim traceability to NIST, a secondary standard such as Schonstedt Instrument Co.'s HSM-2 must be used to calibrate the MFS100.
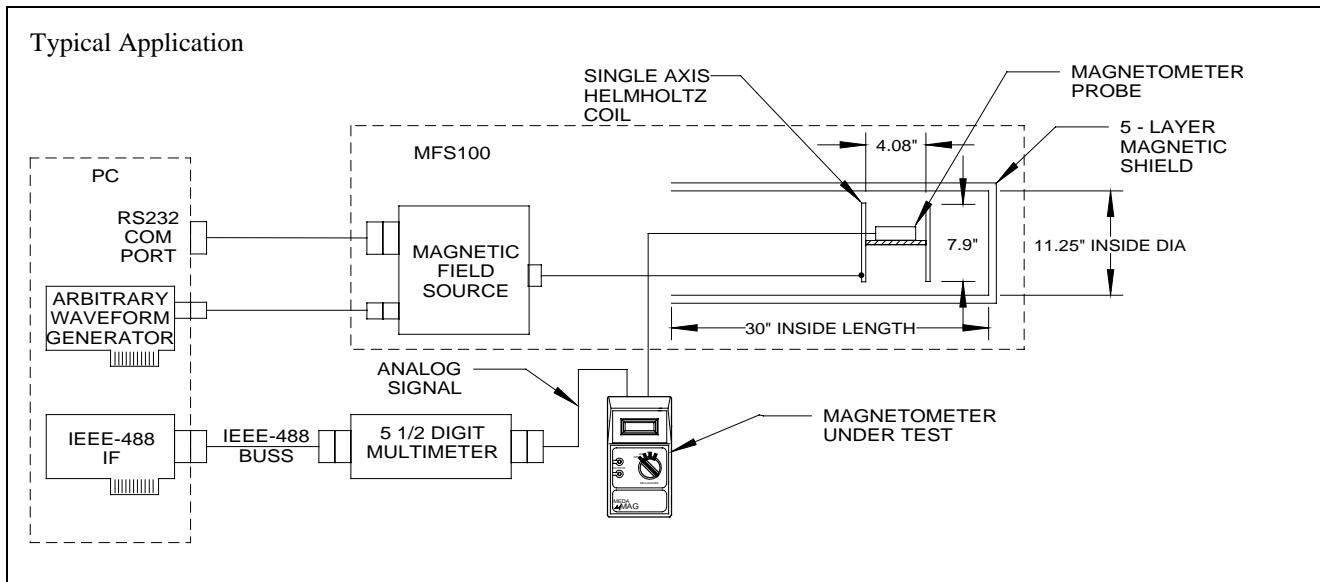
Typical Application

SINGLE AXIS HELMHOLTZ COIL

MAGNETOMETER PROBE

5 - LAYER MAGNETIC SHIELD

MFS100

PC

RS232 COM PORT

ARBITRARY WAVEFORM GENERATOR

MAGNETIC FIELD SOURCE

4.08"

7.9"

11.25" INSIDE DIA

30" INSIDE LENGTH

ANALOG SIGNAL

IEEE-488 IF

IEEE-488 BUSS

5 1/2 DIGIT MULTIMETER

MAGNETOMETER UNDER TEST

Figure 1 The MFS100 can be used to calibrate magnetometers

Example Equipment List for Magnetometer Calibration System

Item	Description	Mfg.	Part No.	Price
1	Magnetic field source	MEDA	MFS100	TBD
2	IEEE-485 interface card	Computer Boards	PCI-GPIB	$299
3	Arbitrary Waveform Generator	Keithley	PCIP-AWFG	$1,049
4	5 ½ digit multimeter	Fluke	8840A	$1,400
5	Station Magnetometer	Schonstedt Instrument Co.	HSM-2	$16,400