BILLINGSLEY AEROSPACE & DEFENSE

APEX-CS HELMHOLTZ CONTROLLER
Precision Magnetic Field Calibration System

I. DESCRIPTION

- Integrated" stand alone" Helmholtz coil control/ data collection controller

- Automatic self-calibration capability (when single axis reference sensor is purchased)

- New technology Helmholtz coil current drivers*. The drivers are low power consumption** switching type with > 90% energy efficiency. They are ideally suited for use with both our 2.2 meter and 1 meter triaxial Helmholtz coils. Low noise convection cooling with no fans.

- 20-bit resolution (~.3 nT) of magnetic field setting with range of ± 1 Gauss (2-3 Gauss special). Closed loop servo amplifiers maintain the set field values stable to < 0.1 nT over extended time periods and < 0.5 nT change in 24 hours at constant ambient temperature.

- Triaxial fluxgate magnetometer sense head. The sense head senses changes in the ambient field (Earth's Field diurnal variation or local disturbances) and feeds an error signal back to the current drivers which cancels the change. The loop response time is fast enough to reduce 50 or 60 Hz power line noise.

- Optional (4th) single channel, precision reference magnetometer for system self calibration. The optional 4th channel sensor is connected by an 8 meter cable which allows the sensor to be placed in different orientations.

- External input of 6 channels of analog data which are digitized to 24-bit resolution by the internal A/D converter. This allows collection of data from an *"instrument under test"*. These measurements can be displayed on the controller front panel and/or transmitted to a remote computer. This has an input range of ± 9 volts.

- Front panel Vacuum Fluorescent Display indicating magnetic field values and resultant coil currents and other parameters.

- Front panel buttons enable the user to set magnetic fields and calibration of system without a computer connection.

- Optional handheld R.F. remote control enables single person system operation. This miniature (non-magnetic) control can be taken into the coil system with the operator. This enables the operator to perform testing and calibration without getting in and out of the coil system. This is particularly useful when doing sensor axial alignments by "flashing" perpendicular fields on and off.

- Labview control software that allows automatic control of magnetic field (rotating, static or stepped magnetic fields). The software can automatically collect linearity data and perform a "least squares fit" on the collected data set.

Available drive voltage/current from the APEX-CS controller is 40-24 volts @ 5 amps maximum. Existing coils must be capable of producing the (user) desired magnetic fields within this range to be compatible. Otherwise we recommend the use of the Billingsley 0.38 Meter, 1 Meter or 2.2 Meter coils.

**Power consumption can be reduced even further by using a standby mode, under software control, turning power on to the coils only during the interval that the internal A/D Converter is acquiring data. This reduces power consumption to near zero while still allowing the overall controller to remain powered up and ready for immediate use without warm-up.*

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II. FEATURES

- Totally digital with no potentiometers to set.

- Two operating modes – Closed or Open loop
  - Active noise cancellation - system has both closed loop operation mode with better than 90 dB rejection of changes in background magnetic field at D.C. and ~ 40 db at 60 Hz. This allows stable, noise free, operation of the system even with significant background noise.

  - The system has a second operating mode which is open loop with the triaxial sense head monitoring the ambient field and transmitting the 24-bit resolution field value over an RS232 link to a remote computer. This mode is useful in situations where the size of the Helmholtz system, relative to the particular item under test, is too small to generate a uniform field value over the volume of the test item. The controller can be commanded in/out of the open loop mode under software or front panel control.

- This allows the user to subtract out the changes in ambient magnetic field (in software) without a Helmholtz coil system.

- The system can be used as a magnetic observatory. A null mode allows the background magnetic field to be subtracted out and only the changes in field values displayed.

- Stand alone operation or with a computer and software interface. The instrument front panel has a numeric keypad which enables the user to control magnetic field values without a computer attached.

- The entire system consumes < 120 Watts peak power (coil dependent) and is housed in a single instrument case of 37 W x 30 D x 13.5 H centimeters. It weighs < 5 kilograms.

- The front panel includes individual displays for the X, Y and Z axes. It can also display applied coil current or magnetic field data from the triaxial sense head when in the Observatory mode or field measurement data from the 4th (single axis) calibration sensor.

- Optional RF remote control: CMD-HHTX remote command unit for the APEX-CS Helmholtz coil controller.
  - Standard operating frequency 418MHz (315 or 433.92 MHz options) .
  - Transmission range 100+ft. Choice of 256 selectable addresses. Powered by a single 3 volt Lithium cell.
  - Compliant with limits for Class B digital devices pursuant to Part 15 of the FCC Rules.

  - This miniature 8 button remote control allows an operator to control magnetic fields from within the Helmholtz coil without need for another person to change field settings. These functions can also be invoked using the Apex Cs front panel function keys.