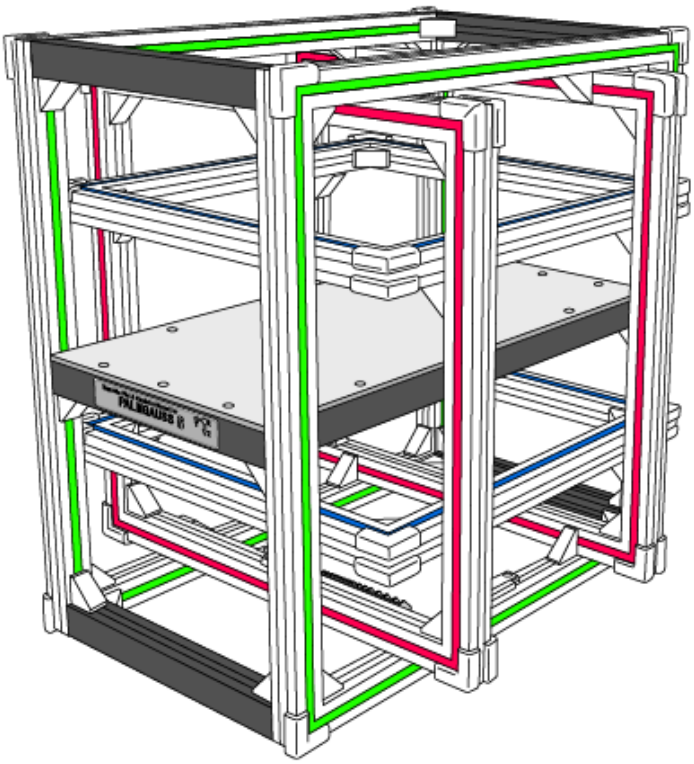
PalmGauss SC

PGSC-5G

Instruction Manual



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PalmGauss SC PGSC－5G Instruction Manual

Thank you very much for purchasing our products. Please, read this instruction manual in order to use our product in safety and correctly before starting to use.

－ Contents －

1. For Safe Operation

(1) This device is a precision instrument. Please handle it with care.
(2) Do not get the device wet or immerse in water.
(3) Do not pull on or excessively bend the cable. It may become disconnected.
(4) Do not apply excessive force to the switches, sampler, etc. They may be damaged.
(5) Do not disassemble the main body of the device. Repairs and exchanges for problems caused by disassembly cannot be accepted.
(6) Turn the device off when it is not in use.

2. Overview

- Within its Helmholtz coils, this device will generate a magnetic field with optional settings or a space with zero magnetic field.
- It uses ultra-high sensitivity MI sensors to measure the magnetic field.
- Three-axis Helmholtz coils controlled by a computer (not included) are used to generate the magnetic field.

3. Equipment Components, Part Names, Functions

3.1 Block Diagram

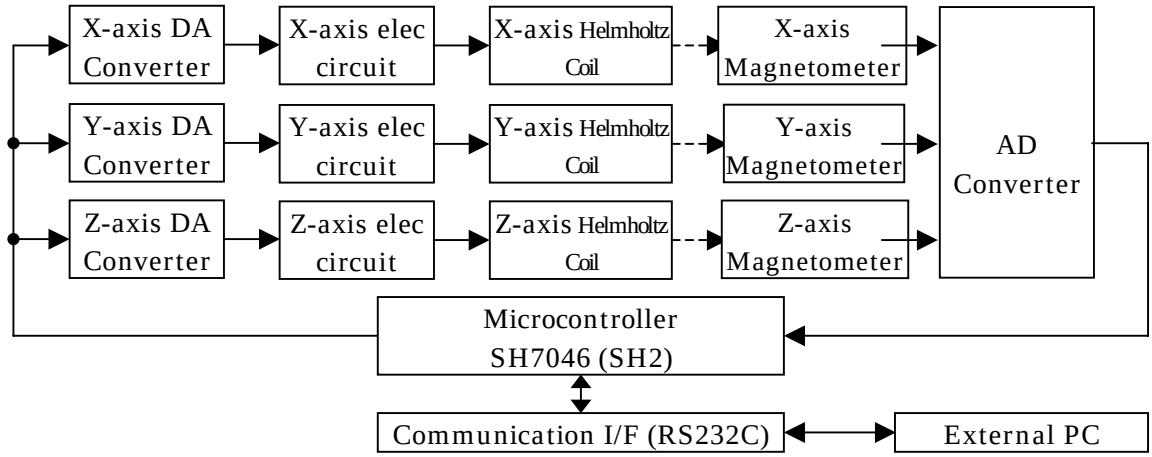

Fig. 1 Block diagram

3.2 Equipment Components

(1) Control Box
Contains a control circuit and microcontroller for controlling the electric current flowing to the Helmholtz coils.

(2) Helmholtz Coils
The Helmholtz coils have a 3 axis construction. By passing electric current to the coil, a magnetic field is generated in proportion to the amount of electric current.

(3) Magnetometer
A magnetic sensor measures the magnetism within the Helmholtz coils. It is located on the bottom side of the sampler within the coils
It uses an MI (magneto-impedance) sensor to measure the magnetic field with very high accuracy.

(4)Software
PalmGauss demo application software ”PalmGaussController.exe”

3.3 PalmGauss Axis Direction, Polarity

(1)Axis Direction
If you have the front (Figure .2) where the nameplate side faces the operator, the axis directions are as follows:
X-axis: depth
Y-axis: left-right
Z-axis: up-down

(2)Polarity
With the Helmholtz Coil placed so that the nameplate side faces the operator, the direction shown in Fig 3 (N to S) is positive.

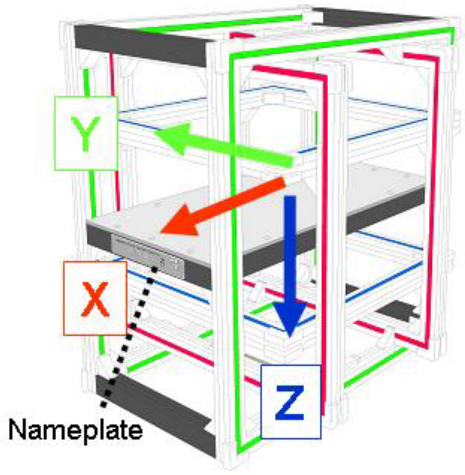

Fig. 2 3-axis Helmholtz coil

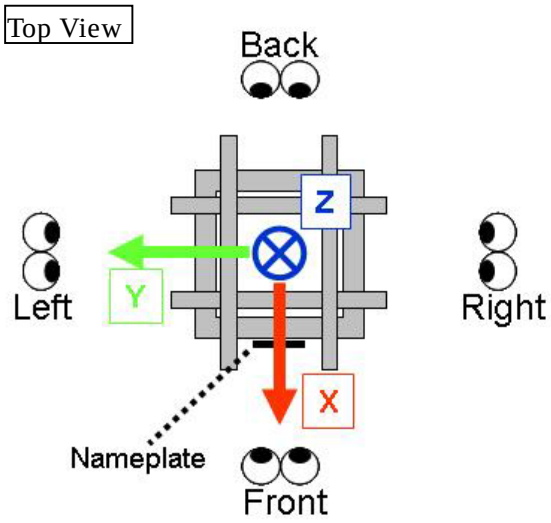

Fig. 3 Coordinate definition

3.4 Component Names

3.4.1 Control Box Front (Fig. 4)

(1) Power Switch
Power switch for the device

(2) Power Lamp
Illuminated when power is on.

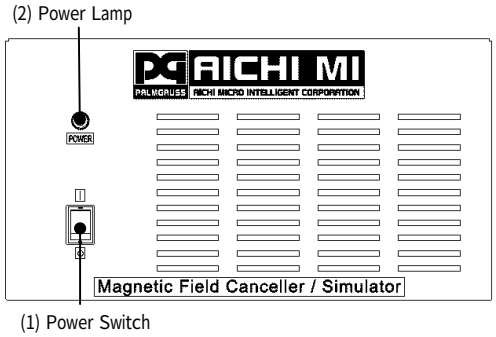

Fig. 4 Control box (front side)

3.4.2 Control Box Back

(3) Coil-1
D-sub15 pin connector (male) for the Helmholtz coils
(4) Earth terminal
(5) Sensor
D-sub9 pin connector (female) for the magnetic sensor
(6) RS232C (Connector)
Connector for computer. Connects to the computer with a RS232C cable.
(7) AC Power
AC90-240V power connection for the device.
(8) Power Fuse
Power fuse for the device.

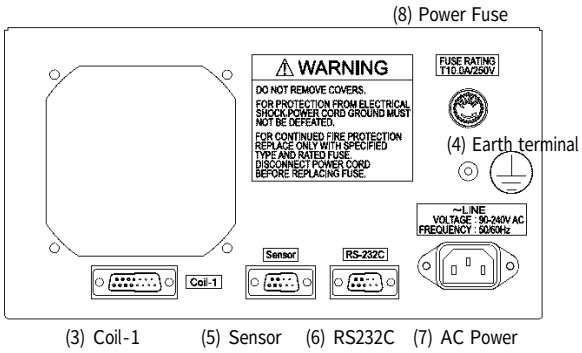

Fig. 4 Control box (back side)

4. Operating Procedure

Describes how to use the PalmGauss software “PalmGaussController.exe”

4.1 To Begin

4.1.1 Driver Installation

No driver is required since the communication is in conformity to RS232C.

4.2 Demo Software Installation

Install “PalmGaussController.exe” from the CD provided.

4.3 Software Specifications

4.3.1 Serial Port Setting

Table 1 Serial port setting

1	Baud Rate	38400
2	Data Bit	8
3	Parity	None
4	Stop bit	1
5	Flow	None
6	Receive	LF
7	Transmit	CR+LF

4.3.2 Command Specifications

The list of commands is shown in Table 2. Please see 4.3.3 for details of each command.

Table 2 Commands

1	2	3	4	5	6	7	8	9
HELP								
HELP	MAG							
INFO								
V								
INIT								
MAG	CANCEL							
MAG	SET	VALUE	x Unit:[Gauss/10000] Min:-50000 Max:50000	y Unit:[Gauss/10000] Min:-50000 Max:50000	z Unit:[Gauss/10000] Min:-50000 Max:50000			
MAG	GET	VALUE						
MAG	START	LINEAR	axis 0: X axis 1: Y axis 2: Z axis	range Unit:[Gauss/10000] Min:1 Max:50000	span Unit:[Gauss/10000] Min:1 Max:50000	interval Unit:1[msec] Min:20 Max:20000		
MAG	START	ROTATE	axis 0: YZ plane (X axis) 1: XZ plane (Y axis) 2: XY plane (Z axis)	radius Unit:[Gauss/10000] Min:1 Max:50000	axis_level Unit:[Gauss/10000] Min:-50000 Max:50000	span Unit:[deg/10] Min:1 Max:3600	turms Min Unit:0[turns] 0 for Infinity Min:0 Max:1000	interval Min Unit:1[msec] Min:20 Max:20000
MAG	START	FIGURE8	radius Unit:[Gauss/10000] Min:1 Max:50000	span Unit:[deg/10] Min:1 Max:3600	turms Min Unit:0[turns] 0 for Infinity Min:0 Max:1000	interval Min Unit:1[msec] Min:20 Max:20000		
MAG	STOP							
MAG	CAL	OFFSET						

Commands are all caps and half width space delineated

4.3.3 Command Details

- "HELP" command
  - Parameter None
  - Return Value Returns list of usable commands
  - Comment "HELP MAG" displays a list of magnetic related commands

- "HELP MAG" command
  - Parameter None
  - Return Value Returns explanations of the command group controlling magnetic values.

- "INFO" command
  - Parameter None
  - Return Value Returns the installed firmware and calibration history.

- "V" command
  - Parameter None
  - Return Value Returns the installed firmware version.

- "INIT" command
  - ➢ Parameter baud rate
    Baud rate options →9600 or 38400
  - ➢ Return Value Success returns OK
    Failure returns an error code
  - □ Comment Resets PalmGauss. Default baud rate is 38400
  - □ Example INIT 38400 (If resetting with baud rate of 38400)

- "MAG CANCEL" command
  - ➢ Parameter None
  - ➢ Return Value Before x , Before y , Before z , After x , After y , After z
    Unit: [Gauss/10000]
    Success returns values (6 pieces) of magnetic field before and after cancellation
    Failure returns an error code
  - □ Comment Cancels the magnetic field within the coil creating a zero field. If the magnetic value before cancellation exceeds 1 Gauss, it will return an abnormal field error.
  - □ Example MAG CANCEL

- "MAG SET VALUE" command
  - ➢ Parameter x , y , z Unit: [Gauss/10000]
  - ➢ Return Value Success returns OK
    Failure returns an error code
  - □ Comment Outputs the set magnetic vectors (x, y, z) to the coil
  - □ Example MAG SET VALUE 1000 1000 1000
    (If outputting 100mGauss in all 3 axes)

- "MAG GET VALUE" command
  - ➢ Parameter None
  - ➢ Return Value x , y , z Unit: Gauss/10000]
  - □ Comment Returns the magnetic vector (x, y, z) measured within the coil

- "MAG START LINEAR" command
  - ➢ Parameter axis , range , span , interval
    - axis： Sets the output axis x：0, y：1, z：2
    - range： Sets the output value range Unit： [Gauss/10000]
    - span： Sets the output value span Unit： [Gauss/10000]
    - interval： Sets the output switch timing Unit： [msec]
  - ➢ Return Value timestamp, x, y, z
    - timestamp： Unit： [msec]
    - x, y, z： Current in coil magnetic field setting Unit: [Gauss/10000]

    Success returns "DONE" when command is complete

    Failure returns an error code
  - □ Comment For the axis set in parameter "axis", output shifts in the order "zero→+range→zero →-range→zero for each "span" and "interval"

    The values of the axes not set in parameter "axis" will continue to output the currently set value
  - □ Example MAG START LINEAR 0 4000 200 200

    (Outputs 20mGauss steps at 200msec intervals to ±400mGauss)

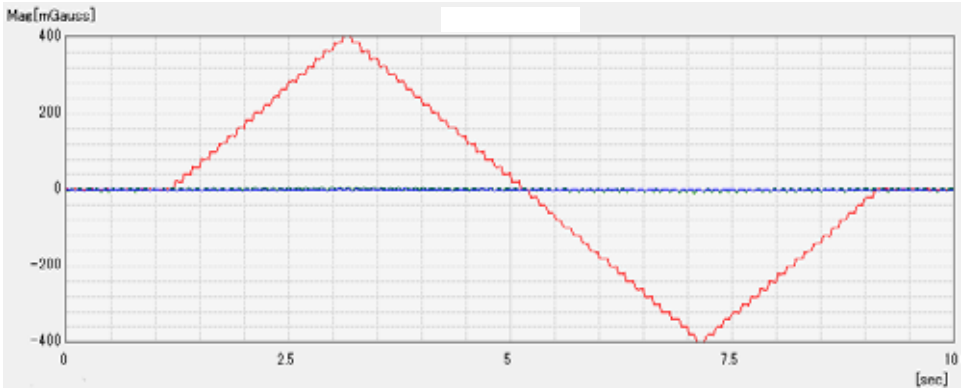

Fig. 7 3-axis magnetometer read value of LINEAR mode simulation

Fig. 7 shows the values measured by an evaluation sensor placed inside the coils when the command "MAG START LINEAR 0 4000 200 200" is run.

- "MAG START ROTATE" command
  - ➢ Parameter axis, radius, axis level, span , turns , interval
    - axis : Designates the output plane (rotational axis)
      yz plane (x-axis):0, zx plane (y-axis):1, xy plane (z-axis):2
    - radius : Sets the radius of the output rotating magnetic field
      Unit: [Gauss/10000]
    - axis level : Sets the magnetic value of the rotational axis set by „axis" parameter
      Unit: [Gauss/10000]
    - span : Designates the rotational angle for each switching „interval"
      Unit: [degree/10]
    - turns : Designates the number of rotations to output magnetic field
      If designation is 0, output will continue
    - interval : Sets the output switching interval Unit: [msec]
  - ➢ Return Value timestamp , x , y , z
    - timestamp : Unit: [msec]
    - x , y , z : The magnetic field currently set within the coils. Unit: [Gauss/10000]
      Success returns "DONE" when command is complete
      Failure returns an error code
  - □ Comment For the plane set as the "axis", outputs a magnetic field indicated as "radius", switching the angle "span" at "interval" time for the duration of "turns".
    The values of the axes not set in parameter "axis" will continue to output the currently set value
  - □ Example MAG START ROTATE 2 4000 0 10 1 20
    (Output a magnetic field with a radius of 400mGauss in the xy plane, shifting 1 degree for a single rotation at 20msec intervals. At this time, the z-axis output is 0mGauss)

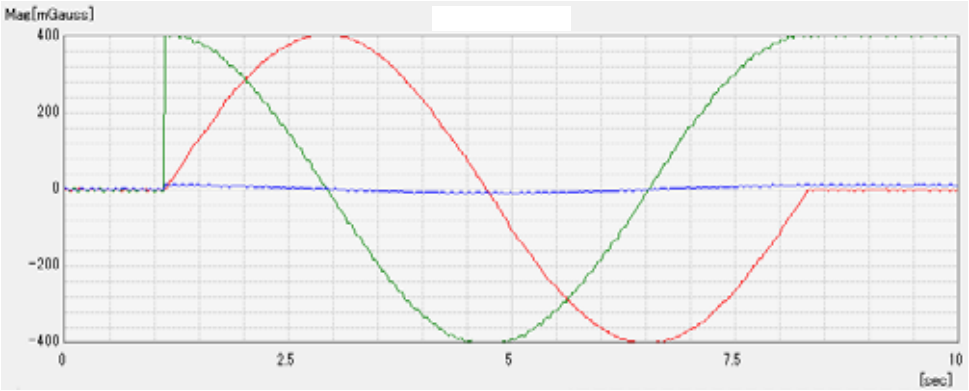

Fig. 8 3-axis magnetometer read value of ROTATE mode simulation

Fig. 8 shows the read values from an evaluation sensor place within the coils when the command "MAG START ROTATE 2 4000 0 10 1 20" is run.

- "MAG START FIGURE8" command
  - ➢ Parameter radius, span, turns, interval
    - radius : Sets the radius of the output rotating magnetic field
      Unit: [Gauss/10000]
    - span : Designates the rotational angle for each switching „interval"
      Unit: [degree/10]
    - turns : Designates the number of rotations to output the magnetic field
      If designation is 0, output will continue
    - interval : Sets the output switching interval Unit: [msec]
  - ➢ Return Value timestamp , x , y , z
    - timestamp : Unit: [msec]
    - x , y , z : The magnetic field currently set within the coils. Unit: [Gauss/10000]
      Success returns "DONE" when command is complete.
      Failure returns an error code
  - □ Comment Outputs a simulated figure 8 motion with "radius" as the field strength, switching the angle "span" at "interval" time for the duration of "turns".
  - □ Example MAG START FIGURE8 5000 10 1 20
    (Output radius of 500mGauss, rotating 1 degree per step for 1 rotation at 20msec intervals)

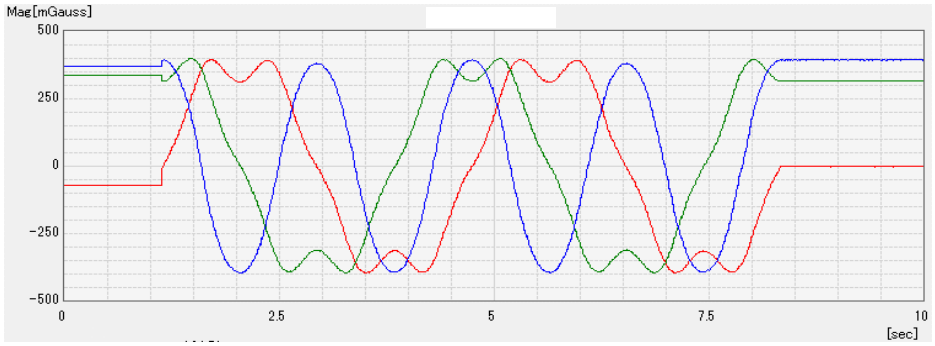

Fig. 9 3-axis magnetometer read value of FIGURE8 mode simulation

Fig. 9 shows the read values from an evaluation sensor place within the coils when the command "MAG START FIGURE8 5000 10 1 20" is run

- "MAG STOP" command
  - ➢ Parameter None
  - ➢ Return Value Success returns "OK"
    Failure returns an error code
  - □ Comment Forcibly stops output when the MAG START command is running

- "MAG CAL OFFSET" command
  - ➢ Parameter None
  - ➢ Return Value Success returns "OK"
    Failure returns an error code
  - □ Comment This command calibrates null magnetic field. Put the sensor in the attached magnetic shield tube and carry out this command.

Error Code

Table 3 Error code

Error Code	Comment
ERROR_UNKNOWN_COMMAND	Returned when command is not recognized
ERROR_OUT_OF_RANGE	Returned when the set parameter value exceeds the range
ERROR_INVALID_AXIS	Returned when the designated axis does not exist
ERROR_INVALID_ARGS	Returned when the parameter numbers of the sent command are invalid
ERROR_INVALID_BAUD_RATE	The set baud rate is not valid
ERROR_RUNNING_OUTPUT	Returned if MAG START command is run when a simulation is already running
ERROR_LARGE_EARTH_MAG	Returned as a warning if geomagnetism exceeds 1Gauss while MAG INIT is running

4.3.4 Control By Terminal

An example of controlling PalmGauss using terminal software. In this example, “INFO”, “MAG CANCEL”, “MAG GET VALUE”, “MAG SET VALUE” commands are run.

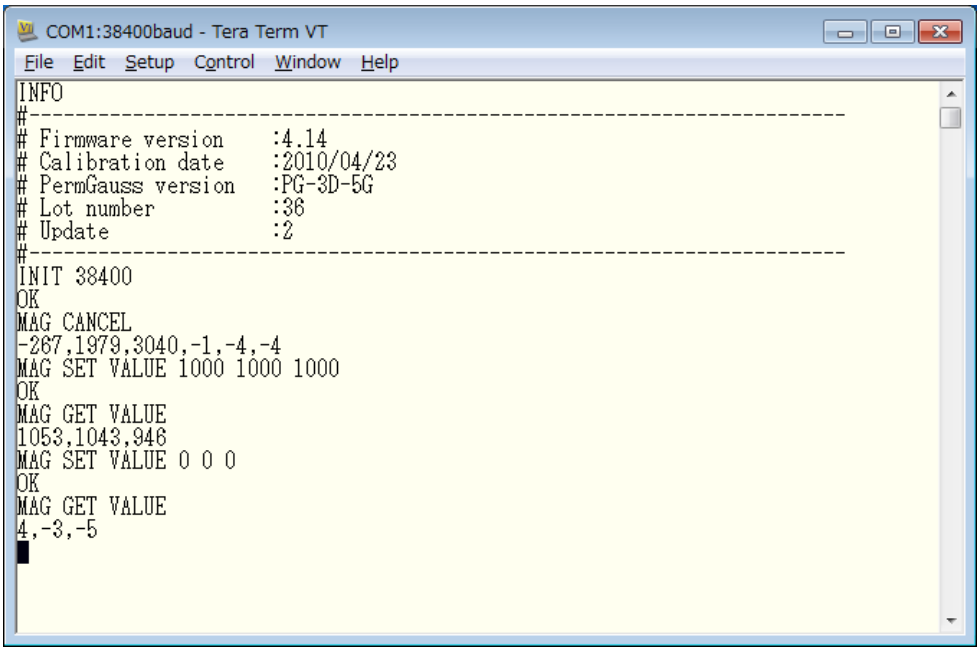

Fig. 10 Example of Control with terminal software (Tera Term)

Fig. 11 shows an example of the terminal software settings

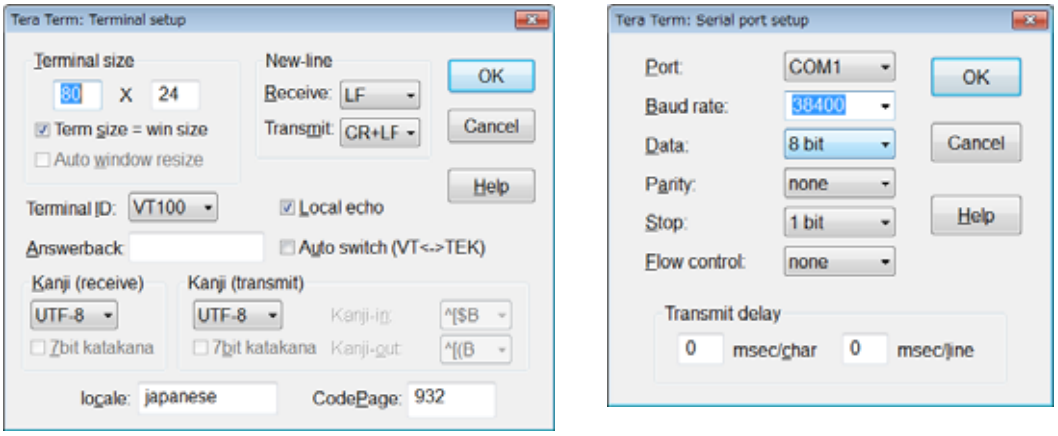

Fig. 11 Settings of terminal software

4.4 Demo Application

Running the included demo application ”PalmGaussController.exe” will give the window below. It is divided into 6 areas:

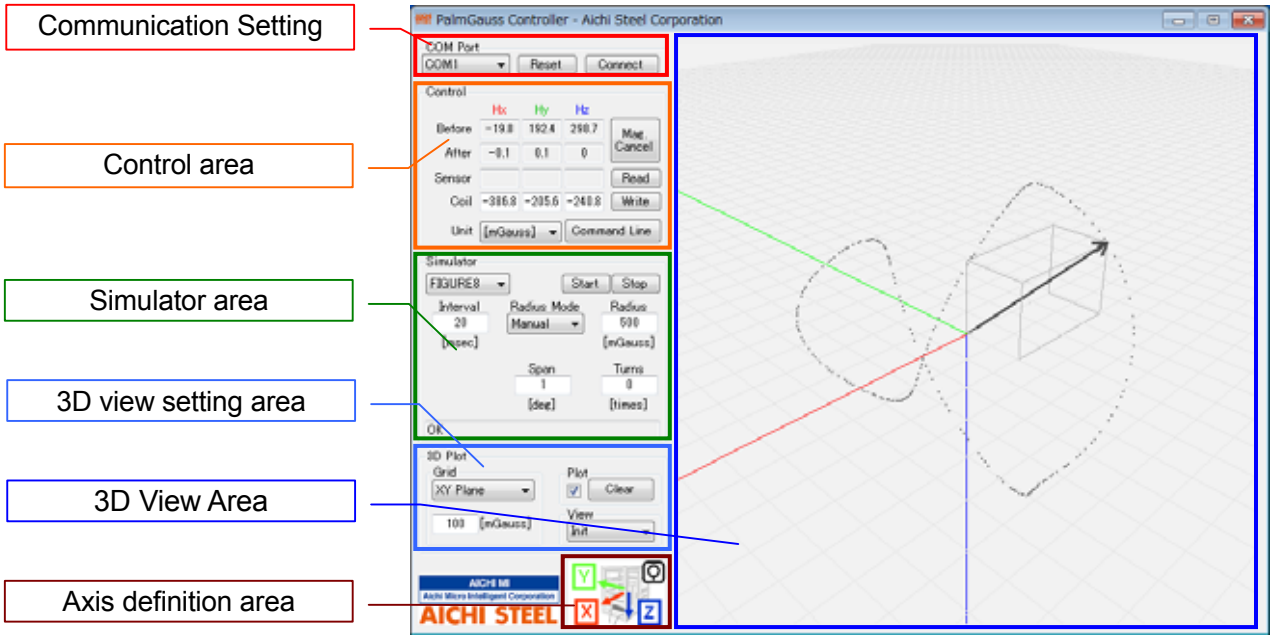

Fig. 12 Windows demo software (PalmGaussController.exe)

4.4.1 Communication Setting Area

“Reset” Automatically detects the port the PalmGauss is connected to.

“Connect” Connects to and initializes the displayed port.

Fig. 13 COM Port

4.4.2 Control Area

Allows setting for geomagnetism cancelling or creation of magnetic vectors. Clicking the "Command Line" button opens the "Command Line Control" window, allowing text based control.

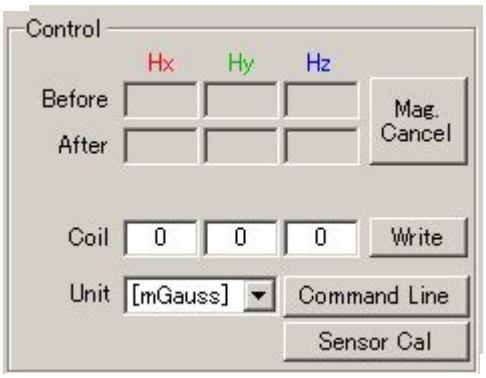

Fig. 15 Control group box

(1) Geomagnetism Cancellation

"Mag. Cancel" Creates a zero field within the effective controlled area within the coils

"Before" The magnetic vector (geomagnetism) within the coils before cancellation

"After" The magnetic vector within the coils after cancellation

□Do not place objects that could be affected by magnetism inside the coils when cancelling geomagnetism.

(2) Setting a controlled magnetic vector

"Write" Output the magnetic field set in "Coil"

"Coil" Text box for inputting the magnetic vector to be applied.

The setting parameter specifications are shown in Table 4.

Table 4. Input range to coil

	Min	Max	Resolution
Coil[mGauss]	-5000	5000	0.1

□Max value (5000mGauss) is the maximum coil output.
(e.g.) If geomagnetism is 500mGauss, the maximum value will be 4500mGauss

(3) Unit setting

"Unit" Select units (mGauss / uTesla)

(4) Command Line

"Command Line" Displays Command Line Control window. The commands that can be used in the Command Line Control window are defined in Table 2.
□Note: Does not display the return value for running "MAG START ****"command.

(5) Sensor Cal

"Sensor Cal" Calibrates null magnetic field. Put the sensor in the attached magnetic shield tube and carry out this command.

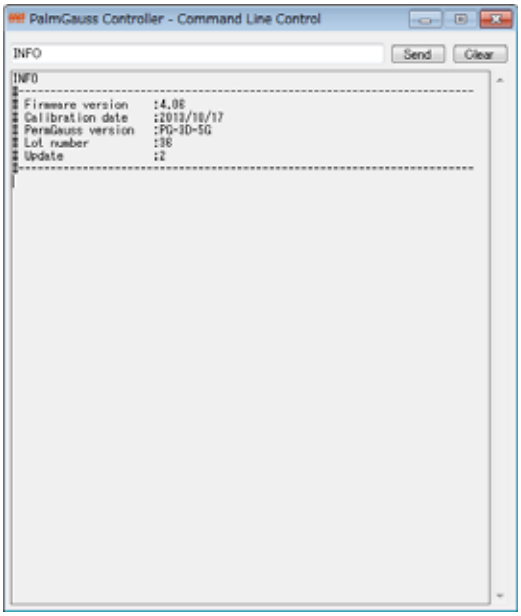

Fig. 16 Command line control window

4.4.3 Simulator Area

Controls the magnetic simulator. Creates continuous magnetic fields in a range of patterns.

”FILE”	Outputs the 3-axis magnetic data in the selected file at the designated interval.
”LINEAR”	Magnetic vector changes in a linear fashion according to the designated conditions (axis, min/max field, interval, amount of variation)
”ROTATE”	Magnetic vector rotates according to the designated conditions (frequency, angle, size, plane)
”FIGURE8”	Outputs a simulated figure 8 magnetic vector according to the designated conditions (frequency, angle, size)

(1)”FILE” mode

Selecting ”FILE” opens the following window.

“Open”	Select file
“File format”	Designate units (mGauss / uTesla)
“Interval”	File data output interval
“Start”	Start file data output

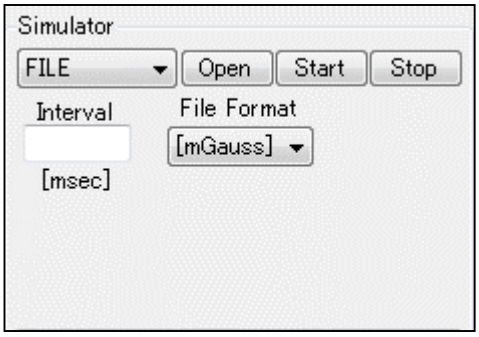

Fig. 17 FILE mode

The input file format is csv, the input data format is 3-axis data.

Table 5 Input file format

X axis	Y axis	Z axis
[0]	[0]	[0]
[1]	[1]	[1]
[2]	[2]	[2]
[3]	[3]	[3]
[4]	[4]	[4]

Test.csv

```
-67,-80.5,-257.7
-65,-81.5,-257.7
-66,-80.5,-256.7
-65,-80.5,-257.7
```

See attached CD for format

Setting parameters are shown in Table 6.

Table 6 Parameter for FILE mode simulation

	Min	Max	Resolution
Interval[msec]	20	1000	1

Simulation progress is shown in the 3D viewer area.

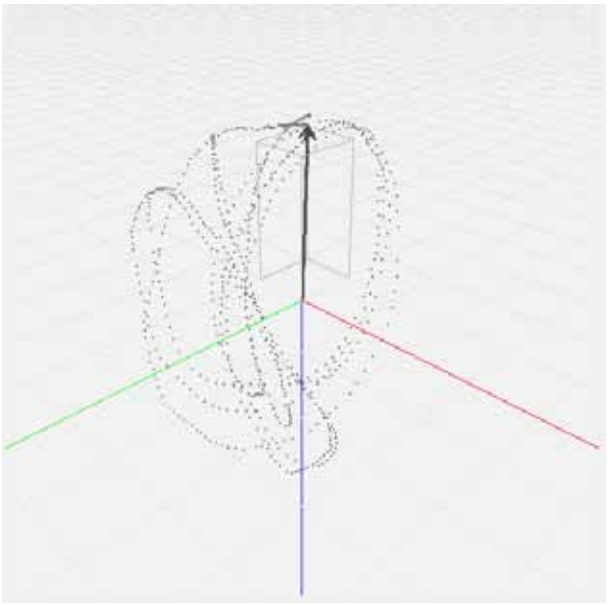

Fig. 18 Example of FILE simulation

(2)"LINEAR" mode

Selecting "LINEAR" opens the following window.

"Interval" Output interval
"Max" Maximum produced output value
"Axis" Set output axis
"Span" Amount of change in output field
"Start" Start output
"Stop" Stop output

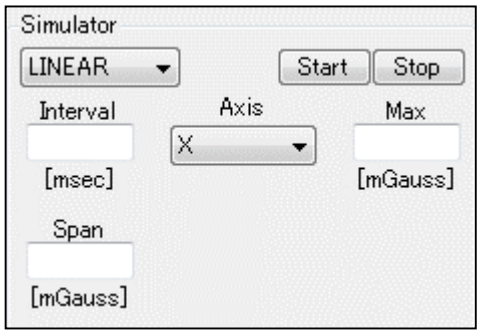

Fig. 19 LINEAR mode

Setting parameter specifications are shown in Table 7.

Table 7 Parameters for LINEAR mode simulation

	Min	Max	Resolution
Interval[msec]	20	20000	1
Span[mGauss]	0.1	5000	0.1
Max[mGauss]	0.1	5000	0.1

□Max value (5000mGauss) is the maximum coil output.
(e.g.) If geomagnetism is 500mGauss, then maximum value is 4500mGauss

After clicking "Start", simulation begins, producing a field for the axis designated in "Axis" with the variation set in "Span" at the interval designated in "Interval" beginning at 0[mGauss] and increasing to +Max[mGauss] then decreasing to -Max[mGauss] then returning to 0[mGauss] to finish.

(3)"ROTATE" mode

Selecting "ROTATE" will open the following window

"Interval" Frequency
"Plane" The plane the field will rotate in
"Radius" Radius of the rotating field
"Axis" Size of the rotational axis magnetic field
"Span" Change angle of the rotating field
"Turns" Number of turns. If 0, output will continue until "Stop" is clicked.
"Start" Start output
"Stop" Stop output

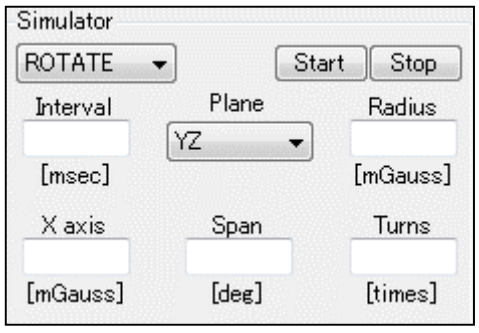

Fig. 20 ROTATE mode

The setting parameter specifications are shown in Table 8.

Table 8 Parameters for ROTATE mode simulation

	Min	Max	Resolution
Interval[msec]	20	1000	1
X/Y/Z axis[mGauss]	-5000	5000	0.1
Span[deg]	0.1	360	0.1
Radius[mGauss]	0.1	5000	0.1
Turns	0	1000	1

□Max value (5000mGauss) is the maximum coil output.
(e.g.) If geomagnetism is 500mGauss, then maximum value is 4500mGauss

After clicking “Start”, simulation begins, outputting a rotating magnetic vector in the plane designated in “Plane” with the variation set in “Span” at the interval designated in “Interval” and the radius designated in “Radius”. Table 9 shows the calculation of the output.

Table 9 ROTATE mode simulation

	Rotating magnetic field vector definition (θ:angle)
XY plane	X= Radius*Sin(θ), Y= Radius*Cos(θ), Z= Value of [Z axis]
XZ plane	X= Radius*Sin(θ), Z= Radius*Cos(θ), Y= Value of [Y axis]
YZ plane	Y= Radius*Sin(θ), Z= Radius*Cos(θ), X= Value of [X axis]

(3)”FIGURE8” mode

Selecting ”FIGURE8” will open the window shown in Fig. 21.

“Interval”	Frequency
“Radius Mode”	Selecting “Manual” allows selection of the value; “Geo-mag” automatically sets the current geomagnetic vector as the value.
“Radius”	The radius of the rotating field
“Span”	The angle of change of the rotating magnetic field
“Turns”	Number of turns. If 0, output will continue until “Stop” is clicked.
“Start”	Start output
“Stop”	Stop output

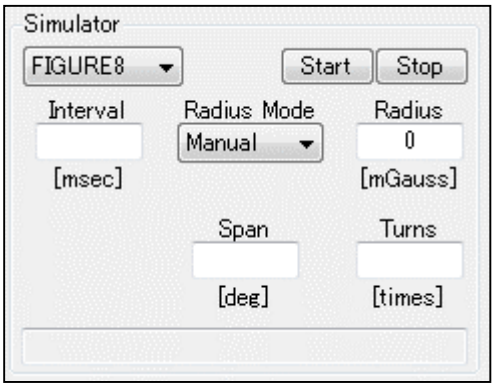

Fig. 21 FIGURE8 mode

The setting parameter specifications are shown in Table 10

Table 10 Parameters for FIGURE8 mode simulation

	Min	Max	Resolution
Interval[msec]	20	1000	1
Span[deg]	0.1	360	0.1
Radius[mGauss]	0.1	5000	0.1
Turns	0	1000	1

□Max value (5000mGauss) is the maximum coil output.
(e.g.) If geomagnetism is 500mGauss, then maximum value is 4500mGauss

After clicking “Start”, simulation begins, outputting a simulated figure 8 motion magnetic vector with the variation set in “Span” at the interval designated in “Interval” and in a sphere with the radius designated in “Radius”.

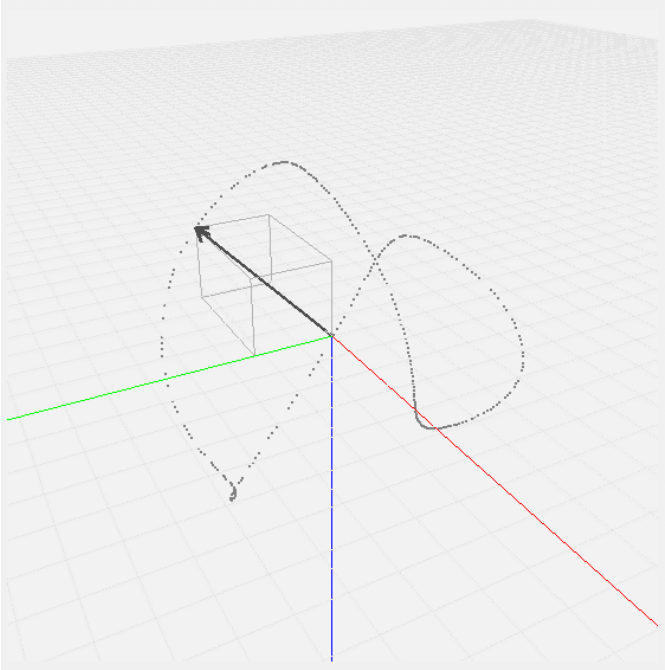

Fig. 22 FIGURE8 motion

4.4.4 3D View Setting Area

Allows basic setting 3D view area screen.

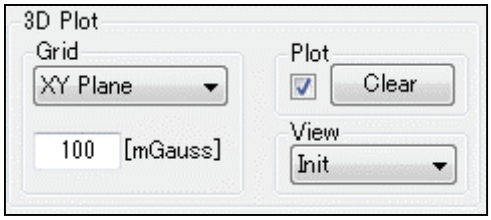

Fig. 23 3D Plot setting

"Grid"	Assign a plane grid (XY, YZ, ZX) of the setting size
"Plot"	Clicking the check box plots the output results
"Clear"	Deletes the currently displayed plot
"View"	Changes the view. The 7 view selections are 45 degrees (Init), Top, Bottom, Front, Back, Left and Right

4.4.5 3D View Area

- Draws the magnetic vector in 3D.
- Place the mouse pointer inside the area and use the scroll wheel to zoom in/out.
- Right click and drag inside the area to rotate the graph.
- To return the rotated graph to the start position, click "View".

4.4.6 Axis Definition Area

Can confirm the PalmGauss axis and view definitions.
Clicking the Axis Definition Area opens the following detailed window.

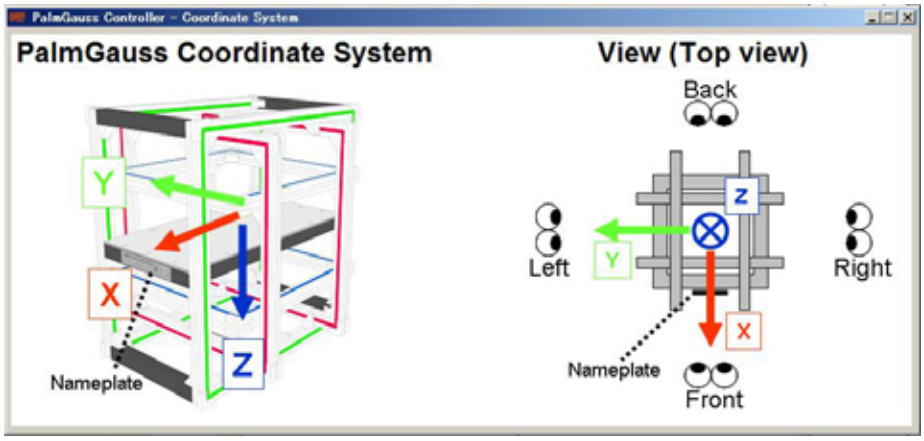

Fig. 24 Coordinate and view definitions

4.4.7 List of Demo Application Error Messages

Table 11 Error messages

Message	Comment
ERROR: Can't find COM port.	Com port error. Confirm that the power is connected.
ERROR: Can't connect. Please check the RS232C connection.	Connect error. Confirm that the power and RS232C are connected.
ERROR: Can't open file.	File reading error. Confirm the file format.
ERROR: Command send error.	Command sending error
ERROR: Data receive error	Data reception error
ERROR: Please check input data.	Setting value error. Confirm the setting values.

5. Specifications, Warranty

Table 12 Hardware specifications

Power supply voltage		AC90~240V (50 / 60 Hz)
Power consumption		<400(V • A)
Magnetic field control direction		3 axes (X,Y,Z)
Effective controlled area		±70×±70×±70 mm
Maximum cancellable field		5.0Gauss
Detected field		DC magnetic
Sensing method		Amorphous MI (Measurement range ±3Gauss)
Field inside cancelled area		<10mGauss (typical)
Helmholtz coil dimensions	X-axis	481×481×265 mm
	Y-axis	542×542×299 mm
	Z-axis	420×420×230 mm

The measurement range of the supplied sensor is ±3Gauss.
If a field exceeding ±3Gauss is applied, the accuracy of the sensor readings cannot be guaranteed.

6. Precautions Concerning Handling

(1) Do not place items producing strong magnetic fields (such as speakers) near the sensor. The sensor origin cannot be guaranteed.
(2) Place the Helmholtz Coils on a flat surface. Avoid placing in the following places:
- Places with high temperatures or high humidity
- Near items that create strong magnetic disturbances such as steel desks, steel reinforced walls, motors, speakers, CRTs etc
- Other locations or environments not suited to the operation of electronic instruments

(3) Place the Helmholtz Coils and control box as far apart as possible (at least 0.5 m).
(4) Be sure to keep the pair of control box and helmholtz coils with same serial number.

PalmGauss S ”PGSC-5G” Warranty Card

In the following cases the warranty will be null and void;
-The warranty card is not presented
-The warranty card is incomplete
-The warranty card has been altered
Warranty cards are not reissued. Please store carefully with the device.

Product Name	PalmGauss SC ”PGSC-5G” Warranty Card	Year Month Day Purchase Date / /
Name		Warranty Period: 1 year from purchase date
Telephone		Sales Agent:
Address		

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