G (Gauss), mT (milli Tesla)
SD card real time data logger

AC/DC MAGNETIC METER
Model : MG-3003SD

Your purchase of this AC/DC MAGNETIC METER with SD CARD DATA LOGGER marks a step forward for you into the field of precision measurement. Although this METER is a complex and delicate instrument, its durable structure will allow many years of use if proper operating techniques are developed. Please read the following instructions carefully and always keep this manual within easy reach.

OPERATION MANUAL

TABLE OF CONTENTS

1. FEATURES

* Wide range, general purpose magnetic measurement.
  for industrial, mechanical, material, electrical, laboratory
  field usage.
* Unit : G (Gauss), mT (milli Tesla).
* DC and AC magnetic field measurement
* DC Range : 300.00 mT/3000.0 mT.
   AC Range : 150.00 mT/1500.0 mT.
* Resolution : 0.01/0.1 mT, 0.1/1 G.
* N pole/S pole indicator.
* Use Hall sensor with automatic Temp. compensation.
* Zero button for DC magnetic function.
* Separate probe, easy operation and convenient
  for remote measurement.
* RS232/USB computer interface.
* Microprocessor circuit assures maximum possible
  accuracy, provides special functions and features.
* Heavy duty & compact housing with hard carrying case,
  designed for easy carry out & operation.
* Auto shut off is available to save battery life.
* Real time SD memory card Datalogger, it Built-in Clock
  and Calendar, real time data recorder , sampling time set
  from 1 second to 3600 seconds.
* Manual datalogger is available (set the sampling
  time to 0), during execute the manual datalogger
  function, it can set the different position (location) No.
  (position 1 to position 99).
* Innovation and easy operation, computer is not need
  to setup extra software, after execute datalogger, just
  take away the SD card from the meter and plug in the
  SD card into the computer, it can down load the all the
  measured value with the time information (year/month/date
  / hour/minute/second) to the Excel directly, then user
  can make the further data or graphic analysis by themselves.
* SD card capacity : 1 GB to 16 GB.
* LCD with green light backlight, easy reading.
* Can default auto power off or manual power off.
* Data hold, record max. and min. reading.
* Microcomputer circuit, high accuracy.
* Power by UM3/AA (1.5 V) x 6 batteries or DC 9V adapter.

2. SPECIFICATIONS

Circuit	Custom one-chip of microprocessor LSI circuit.		
Display	LCD size : 52 mm x 38 mm dual function LCD display.		
Measurement Unit	mT	milli Tesla	
	G	Gauss	
Measurement Range, DC	mT	Range 1	300.00 mT x 0.01 mT
		Range 2	3,000.0 mT x 0.1 mT
	G	Range 1	3,000.0 G x 0.1 G
		Range 2	30,000 G x 1 G
Measurement Range, AC	mT	Range 1	150.00 mT x 0.01 mT
		Range 2	1,500.0 mT x 0.1 mT
	G	Range 1	1,500.0 G x 0.1 G
		Range 2	15,000 G x 1 G
Accuracy	DC	± (5 % rdg. + 10 digit)	
	AC	± (5 % rdg. + 20 digit)	
Frequency Response	AC measurement : 50 Hz / 60 Hz		
Sensor	Hall sensor.		
Datalogger Sampling Time Setting range	Auto	1 sec to 3600 sec. *@ Sampling time can set to 1 second, but memory data may loss.*	
	Manual	Push the data logger button once will save data one time. *@ Set the sampling time to 0 second.* *@ Manual mode, can also select the 1 to 99 position (Location) no.*	

Temp. Compensation for hall sensor	Probe head build the Temp. sensor for using the ATC (automatic Temp. compensation).
Field Direction	Uniaxial.
Data Hold	Freeze the display reading.
Memory Recall	Maximum & Minimum value.

Display Sampling Time	Approx. 1 second.
Power off	Manual off by push button or Auto shut off to save battery life.
Operating Temperature	0 to 50 ℃.
Operating Humidity	Less than 85% R.H.
Data Output	RS 232/USB PC serial interface. * *Connect the optional RS232 cable UPCB-02 will get the RS232 plug.* * *Connect the optional USB cable USB-01 will get the USB plug.*
Power Supply	006P DC 9V battery (Alkaline or Heavy duty type). DC 9V adapter input. * *AC/DC power adapter is optional.*
Power Current	Normal operation (w/o SD card save data and LCD Backlight is OFF) : Approx. DC 11 mA. When SD card save the data but and LCD Backlight is OFF) : Approx. DC 35 mA. * *If LCD backlight on, the power consumption will increase approx.3 mA.*
Weight	Approx. 270 g/0.60 LB. (include battery & probe)
Dimension	Main instrument : 177 x 68 x 45 mm (7.6 x 2.7 x 1.9 inch)	Probe : 198 x 25 x 19 mm (7.8 x 1.0 x 0.7 inch).

Accessories Included	Instruction manual.............................. 1 PC Magnetic Probe................................... 1 PC Carrying case, CA-06......................... 1 PC
Optional Accessories	RS232 cable, UPCB-02 USB cable, USB-01 Data Acquisition software, SW-U801-WIN

* *Above specification tests under the environment RF Field Strength less than 3 V/M & frequency less than 30 MHz only.*

3. FRONT PANEL DESCRIPTION

Fig. 1

3-1   Display

3-2   Power Button

3-3   Hold Button

3-4   REC Button

3-5   Range Button , ▲ Button

3-6   Function Button , ▼ Button

3-7   Set Button , Time Button

3-8   Log Button , Enter Button

3-9   Input Socket

3-10 Probe Plug

3-11 SD card socket
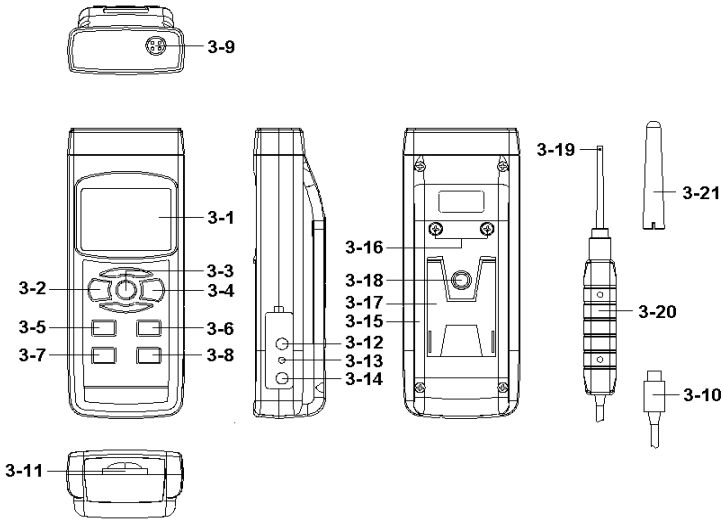
3-12 RS-232 Output Terminal

3-13 Reset Button

3-14 DC 9V Power Adapter Input Socket

3-15 Battery Compartment/Cover

3-16 Battery Cover Screws

3-17 Stand

3-18 Tripod Fix Nut

3-19 Probe Sensing Head

3-20 Probe Headle

3-21 Probe Head Cover

4. MEASURING PROCEDURE

4-1 AC/DC magnetic field measurement

1) Power ON the meter by pressing and holding the " Power
   Button " (3-2, Fig. 1)for at least 1.5 seconds .
2) magnetic field measurement Function 'DC' or 'AC' select
   by pressing and holding the " FUNCTION Button " (3-6, Fig. 1)
   until function DC change to AC or function AC change to DC.
3) magnetic field measuremen range select

   by pressing and holding the " Range Button " (3-5, Fig. 1) until
   ' Range 1' change to' Range 2' or 'Range 2' change to' Range 1' .

4) <u>unit selection :</u>
   How to select the unit (mT, G), the procedures please
   refer to chapter 7-7 " Change the unit (mT, G) ", page 18   .

Under mT unit	Under G unit

RANGE 1 $\quad$ (0.00 N mT) $\qquad$ (0.0 N G)

$\downarrow$

RANGE 2 $\quad$ (0.0 N mT) $\qquad$ (0 N G)

RANGE 1 $\quad$ (0.00 AC mT) $\qquad$ (0.0 AC G)

$\downarrow$

RANGE 2 $\quad$ (0.0 AC mT) $\qquad$ (0 AC G)
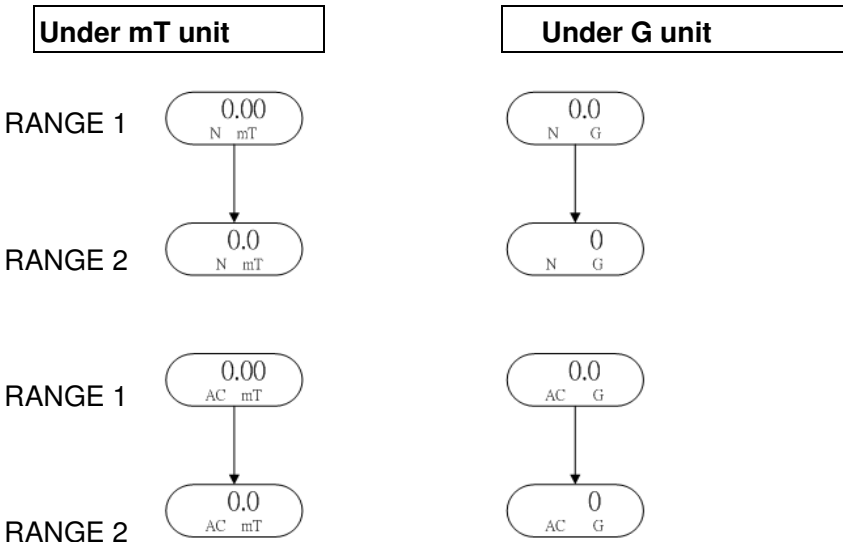
Fig. 2

DC magnetic field measurement

* The Display will show " N " or " S " indicator.
* North pole : Display will show " N " indicator
* South pole : Display will show " S " indicator

AC magnetic field measurement

* Display will show " AC " indicator.
* Display will not show " N (S) indicator.

5) Contact and close the testing material to the probe
   head (refer to Fig. 3) , the Display will show the
   magnetic field value along with the unit (mT,G).

HALL SENSOR —   **TEMP COMPENSATION**
(Magnetic sensing area)   **UNIT**
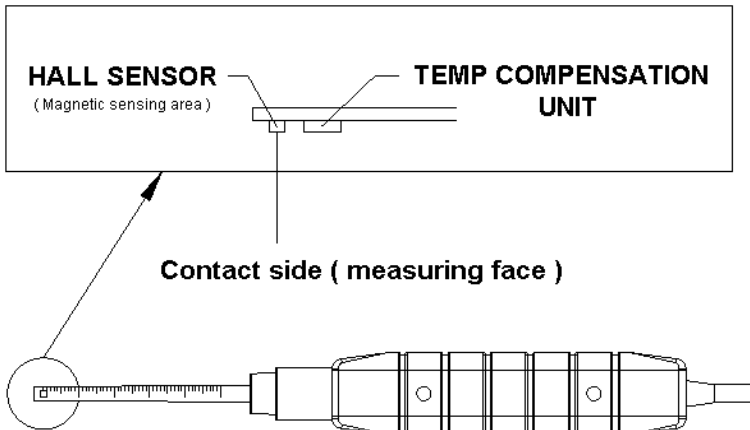
Contact side (measuring face)

Fig. 3

6) <u>Zero adjustment :</u>
   When power ON the meter, due to the environment
   interference, the display may show certain values (not
   zero value), it is normal.

*   Before the measurement, fix the probe at the exact
position, by pressing and holding the" ▲ (3-5 , Fig. 1) "
& "▼ Button (3-6 , Fig. 1) continuously at least
 1.5 seconds until the display show " 0 " value, in the same
 time the Display will show the " 0 " indicator then release
 the finger from the button.

4-2 Data Hold

During the measurement, press the " Hold Button " (3-3,
Fig. 1) once will hold the measured value & the LCD will
display a " HOLD " symbol.
*   Press the " Hold Button " once again will release the data
hold function.

4-3 Data Record (Max., Min. reading)

1) The data record function records the maximum and
minimum readings. Press the " REC Button " (3-4, Fig.
1) once to start the Data Record function and there
will be a " REC " symbol on the display.

2) With the " REC " symbol on the display :
a) Press the " REC Button " (3-4, Fig. 1) once, the "
REC. MAX " symbol along with the maximum value
will appear on the display.

b) Press the " REC Button " (3-4, Fig. 1) again, the
" REC. MIN " symbol along with the minimum value
will appear on the display.

c) To exit the memory record function, just press the
" REC Button " for at least 1.5 seconds. The display will
revert to the current reading.

Remark :

***When make the DC magnetic field measurement
and execute the " RECORD " function, it can not
change from the " North pole " to " South pole "
or from the " South pole " to " North pole "
during the measurement. It can make the
measurement under the same pole (S pole or N
pole) only, otherwise the Max., Min. value will
be no sense.***

5. DATALOGGER

5-1 Preparation before execute datalogger function

a. Insert the SD card
   Prepare a " SD memory card " (1 G to 16 G, optional),
   insert the SD card into the " SD card socket " (3-11, Fig. 1).
   The front panel of the SD card should face against the
   the down case.

 * *It recommend use memory card $\leqq$ 4 GB.*

b. SD card Format
If SD card just the first time use into the meter, it
recommend to make the " SD card Format " at first. ,
please refer chapter 7-6, (page 18   ) .

 * *It recommend strongly, do not use memory cards that*
    have been formatted by other meter or by a computer.
    Reformat the memory card with your meter.
 * *If the SD memory card exist the trouble during*
    format by the meter use the computer to
    reformat again can fix the problem .

c. Time setting
If the meter is used at first time, it should to adjust the
clock time exactly, please refer chapter 7-1 (page 15   ).

d. Decimal for the numerical data structure of SD card is

default used the " . " as the decimal, for
example "20.6" "1000.53" . But in certain
countries   (Europe ...) is used the " , " as the
decimal point, for example " 20, 6 "
"1000,53". Under such situation, it should
change the Decimal character at first, details
of setting the Decimal point, refer to Chapter
7-5, page 17.

5-2 Auto Datalogger (Set sampling time ≥ 1 second)

a. Start the datalogger

Press the " LOG Button (3-8, Fig. 1) > 1.5 seconds
continuously, the LCD will show the text of " LOGGER "
indecator and flashing per sampling time, at the same
time the measuring data along the time information will
be saved into the memory circuit.

Remark :
 * **How to set the sampling time, refer to Chapter 7-2,
   page 16 .**
 * **How to set the beeper sound is enable, refer to
   Chapter 7-4, page 17   .**

b. Pause the datalogger

During execute the Datalogger function, if press the
" LOG Button " (3-8, Fig. 1) once will pause the
Datalogger function (stop to save the measuring data
into the memory circuit temporally). In the same time
the " LOGGER " symbol will stop flashing.

Remark :
**If press the " LOG Button " (3-8, Fig. 1) once again
will execute the Datalogger again, the " LOGGER "
symbol will flashing.**

c. Finish the Datalogger

During execute the Datalogger function, press the
" LOG Button (3-8, Fig. 1) > 1.5 seconds continuously
again will finish the Datalooger function, the " LOGGER "
text will be disappeared and finish the Datalogger function.

5-3 Manual Datalogger (Set sampling time = 0 second)

a. Set sampling time is to 0 second

Press the " LOG Button (3-8, Fig. 1)>1.5 second, the LCD
 will show the indecator " LOGGER " and " Position no. " symbol
 then press the " LOG Button " (3-8, Fig. 1) once , the
 " LOGGER " symbol will flashing once and Beeper will sound once
at the same time the measuring data along the time
information will be saved into the memory circuit .

Remark :
During execute the Manual Datalogger, it can use the " ▲
Button " (3-5, Fig. 1) or " ▼ Button " (3-6, Fig. 1) to
set the measuring position (1 to 99, for example room 1
to room 99) to identify the measurement location , the
lower Display will show P x (x = 1 to 99).

b. Finish the Datalogger

During execute the Datalogger function, press the " LOG
Button (3-8, Fig. 1) > 1.5 seconds continuously again will
finish the Datalooger function, the Position no. " PXX " will
be disappeared and finish the Datalogger. function.

5-4 Check time information

During the normal measurement (not execute the
Datalogger), If press " Time " (3-7, Fig. 1))
once , the LCD display will present the time
information of Year/Month, Date/Hour, Minute/Second
and the Sampling time information in sequence.

5-5 SD Card Data structure

1) When the first time, the SD card is used into the meter, the SD card will generate a folder :

   MGA01

2) If the first time to execute the Datalogger, under the route MGA01\, will generate a new file name MGA01001.XLS.
   After exist the Datalogger, then execute again, the data will save to the MGA01001.XLS until Data column reach to 30,000 columns, then will generate a new file, for example MGA01002.XLS

3) Under the folder MGA01\, if the total files more than 99 files, will generate anew route, such as MGA02\ ....

4) The file's route structure :
   MGA01\
       MGA01001.XLS
       MGA01002.XLS
       ....
       MGA01099.XLS
   MGA02\
       MGA02001.XLS
       MGA02002.XLS
       ....
       MGA02099.XLS
   MGAXX\
       ....
   *Remark : XX - Max. value is 10.*

6. Saving data from the SD card to the computer (EXCEL software)

1) After execute the Data Logger function, take away the SD card out from the " SD card socket " (3-11, Fig. 1).
2) Plug in the SD card into the Computer's SD card slot (if your computer build in this installation) or insert the SD card into the " SD card adapter ". then connect the " SD card adapter " into the computer.
3) Power ON the computer and run the " EXCEL software ". Down load the saving data file (for example the file name : MGA01001.XLS, MGA01002.XLS) from the SD card to the computer. The saving data will present into the EXCEL software screen (for example as following EXCEL data screens) , then user can use those EXCEL data to make the further Data or Graphic analysis usefully.

EXCEL graphic screen (for example)

	A	B	C	D	E
1	Place	Date	Time	Value	Unit
2	8	2012/11/30	13:35:01	0.7	N mT
3	9	2012/11/30	13:35:03	0.8	N mT
4	10	2012/11/30	13:35:05	0.8	N mT
5	11	2012/11/30	13:35:07	0.8	N mT
6	12	2012/11/30	13:35:09	0.8	N mT
7	13	2012/11/30	13:35:11	0.8	N mT
8	14	2012/11/30	13:35:13	0.8	N mT
9	15	2012/11/30	13:35:15	1.1	N mT
10	16	2012/11/30	13:35:17	9.8	N mT
11	17	2012/11/30	13:35:19	11.6	N mT
12	18	2012/11/30	13:35:21	23.9	N mT
13	19	2012/11/30	13:35:23	30.2	N mT
14	20	2012/11/30	13:35:25	16.8	N mT
15	21	2012/11/30	13:35:27	13.2	N mT
16	22	2012/11/30	13:35:29	12	N mT
17	23	2012/11/30	13:35:31	42.4	N mT
18	24	2012/11/30	13:35:33	10.8	N mT
19	25	2012/11/30	13:35:35	18.9	N mT
20	26	2012/11/30	13:35:37	19.1	N mT
21	27	2012/11/30	13:35:39	26.4	N mT
22	28	2012/11/30	13:35:41	27	N mT
23	29	2012/11/30	13:35:43	22.5	N mT
24	30	2012/11/30	13:35:45	26.8	N mT
25	31	2012/11/30	13:35:47	21.7	N mT
26	32	2012/11/30	13:35:49	15.2	N mT

EXCEL graphic screen（for example）
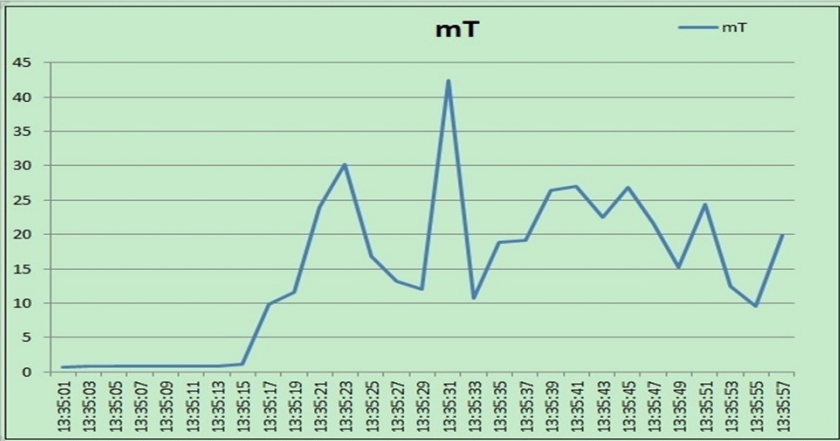
7. ADVANCED SETTING

Under do not execute the Datalogger function,
press the " SET Button " (3-7, Fig. 1) continuously at
least >1.5 seconds will enter the " Advanced Setting " mode.
then press the " SET Button " (3-7, Fig. 1) once a while
in sequence to select the ten main function, the lower
display will show :

    DATE......... Set clock time (Year/Month/Date, Hour/Minute/Second)
    SP-T........... Set sampling time (Hour/Minute/Second)
    POFF......... Auto power OFF management
    BEEP......... Set beeper sound ON/OFF
    DEC........... Set SD card Decimal character
    SD- F......... SD memory card Format
    UNIT.......... Select the magnetic field. unit to mT or G

Remark :
During execute the " Advanced Setting " function, if
press " SET Button " (3-7, Fig. 1) > 1.5 seconds will exit
the " Advanced Setting " function, the LCD will return to
normal screen.

7-1 Set clock time (Year/Month/Date, Hour/Minute/ Second)

When the lower display show " DATE "

1) Use the " ▲ Button " (3-5, Fig. 1) or " ▼ Button "
   (3-6, Fig. 1) to adjust the value (Setting start from
   Year value). After the desired value is set, press the
    " Enter Button " (3-8, Fig. 1) once will going to
   next value adjustment (for example, first setting
   value is Year then next to adjust Month, Date, Hour,
   Minute, Second value).

   Remark :
   The adjusted value will be flashed.

2) After set all the time value (Year, Month, Date, Hour, Minute, Second), press the " ENETER Button " (3-8, Fig. 1) once will save the time value.

Remark :
After the time value is setting, the internal clock will run precisely even Power off if the battery is under normal condition (No low battery power).

7-2 Set sampling time (seconds)

When the lower display show " SP-T "

1) Use the " ▲ Button " (3-5, Fig. 1) or " ▼ Button " (3-6, Fig. 1) to adjust the value (0, 1, 2, 5, 10, 30,60, 120, 300, 600, 1800,3600 seconds).
2) After the Sampling value is selected, press the " Enter Button " (3-8, Fig. 1) will save the setting function with default.

7-3 Auto power OFF management

When the lower display show " POFF "

1) Use the " ▲ Button " (3-5, Fig. 1) or " ▼ Button " (3-6, Fig. 1) to select the upper value to " YES " or " NO ".

   YES - Auto Power Off management will enable.
   NO - Auto Power Off management will disable.

2) After select the upper text to " YES " or "NO", press the " ENTER Button " (3-8, Fig. 1) will save the setting function with default.

7-4 Set beeper sound ON/OFF

When the lower display show "BEEP "

1) Use the " ▲ Button " (3-5, Fig. 1) or " ▼ Button "
   (3-6, Fig. 1) to select the upper value to " YES " or
   "NO".

   YES - Meter's beep sound will be ON with default.
   NO - Meter's beep sound will be OFF with default.

2) After select the upper text to "YES " or " NO ", press the
   " ENTER Button " (3-8, Fig. 1) will save the setting
   function with default.

7-5 Decimal point of SD card setting
The numerical data structure of SD card is default used
the " . " as the decimal, for example "20.6" "1000.53" .
But in certain countries   (Europe ...) is used the " , " as
the decimal point, for example " 20,6 " "1000,53".
Under such situation, it should change the Decimal
character at first.

When the lower display show "DEC "

1) Use the " ▲ Button " (3-5, Fig. 1) or " ▼ Button "
   (3-6, Fig. 1) to select the upper text to " USA " or
   " Euro ".

   USA - Use " . " as the Decimal point with default.
   EURO - Use " , " as the Decimal point with default.

2) After select the upper text to " USA " or " EURO ",
   press the " ENTER Button " (3-8, Fig. 1) will save the
   setting function with default.

7-6 SD memory card Format

> When the lower display show " SD- F "

1) Use the " ▲ Button " (3-5, Fig.1) or " ▼ Button " (3-6
   , Fig.1) to select the upper value to " YES " or " NO ".

YES - Intend to format the SD memory card
NO - Not execute the SD memory card format

2) If select the upper to " YES ", press the " Enter Button
   " (3-8, Fig. 1) once again, the Display will show text
   "YES Enter " to confirm again, if make sure to do the
   SD memory card format, then press " Enter Button "
   once will format the SD memory clear all the existing
   data that already saving into the SD card.

7-7 Select the magnetic field. unit to mT or G

> When the lower display show "UNIT "

1) Use the " ▲ Button (3-5, Fig.1)" or " ▼ Button "(3-6,
    Fig. 1) to select the upper Display text to " mT " or " G ".

mT - magnetic field unit is mT
G - magnetic field unit is G

2) After Display unit is selected to " mT " or " G", press the
   " Enter Button " (3-8, Fig. 1) will save the setting
   function with default.

8. POWER SUPPLY from DC ADAPTER

The meter also can supply the power supply from the DC 9V Power Adapter (optional). Insert the plug of Power Adapter into " DC 9V Power Adapter Input Socket " (3-14, Fig. 1). The meter will permanent power ON when use the DC ADAPTER power supply (The power Button function is disable).

9. BATTERY REPLACEMENT

1) When the left corner of LCD display show "   ", it is necessary to replace the battery. However, in-spec. measurement may still be made for several hours after low battery indicator appears before the instrument become inaccurate.
2) Loose the screws of the " Battery Cover " (3-16, Fig. 1) and take away the " Battery Cover "(3-15, Fig. 1) from the instrument and remove the battery.
3) Replace with DC 1.5 V battery (UM3, AA, Alkaline/heavy duty) x 6 PCs, and reinstate the cover.
4) Make sure the battery cover is secured after changing the battery.

10. SYSTEM RESET

If the meter happen the troubles such as :
CPU system is hold (for example, the key button can not be operated...).
Then make the system RESET will fix the problem.
The system RESET procedures will be either following
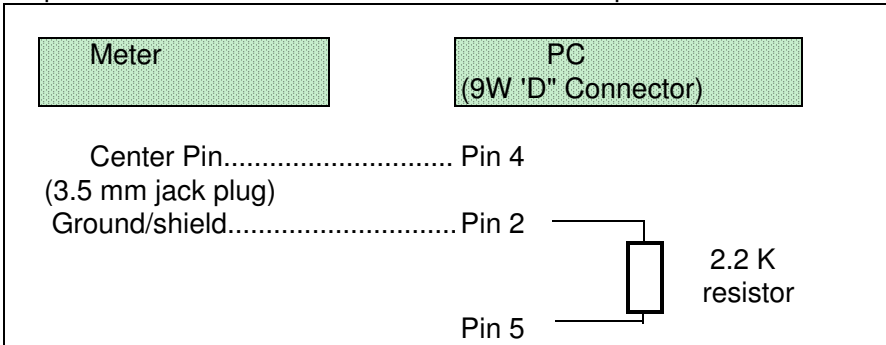
method :
During the power on, use a pin to press the " Reset Button " (3-13, Fig. 1) once a while will reset the circuit system.

11. RS232 PC SERIAL INTERFACE

The instrument has RS232 PC serial interface via a 3.5 mm terminal (3-12, Fig. 1).

The data output is a 16 digit stream which can be utilized for user's specific application.

A RS232 lead with the following connection will be required to link the instrument with the PC serial port.

Meter	PC (9W 'D" Connector)

Center Pin.............................. Pin 4
(3.5 mm jack plug)
 Ground/shield............................. Pin 2

2.2 K resistor

Pin 5

The 16 digits data stream will be displayed in the following format :

D15 D14 D13 D12 D11 D10 D9 D8 D7 D6 D5 D4 D3 D2 D1 D0

Each digit indicates the following status :

D0	End Word = 0D	
D1 & D8	Display reading, D8 = MSD , D1 = LSD For example : If the display reading is 1234, then D8 to D1 is : 00001234	
D9	Decimal Point(DP), position from right to the left 0 = No DP, 1= 1 DP, 2 = 2 DP, 3 = 3 DP	
D10	Polarity 0 = Positive 1 = Negative	
D11 & D12	Annunciator for Display	
	mT = E3	G = B5
D13	When send the upper display data = 1	
D14	4	
D15	Start Word	

RS232 FORMAT : 9600, N, 8, 1

Baud rate	9600
Parity	No parity
Data bit no.	8 Data bits
Stop bit	1 Stop bit

12. PATENT

The meter (SD card structure) already
get patent or patent pending in following
countries :

Germany	Nr. 20 2008 016 337.4
JAPAN	3151214
TAIWAN	M 358970
	M 359043
CHINA	ZL 2008 2 0189918.5
	ZL 2008 2 0189917.0
USA	Patent pending