Digital Gauss/Tesla Meter

CYGM99A

User's Manual

ChenYang Technologies GmbH & Co. KG

Markt Schwabener Str. 8
85464 Finsing, Germany
Tel. +49-(0)8121-2574100
Fax: +49-(0)8121-2574101
Email: info@chenyang.de
http://www.chenyang.de

The Gaussmeter CYGM99A works according to Hall Effect measuring principle. It is a microprocessor controlled instrument and can be used to measure DC/AC magnetic field strength of permanent magnet materials, motors, speakers, magnetic sensors/ transducers, other machines and instruments etc. with high resolution. It is powered with 3 pieces of AA batteries (+1.5VDC) or via USB cable (+5VDC).

1. Characteristics

- Wide measuring range and high resolution
- A low-cost measuring device, which is easy to operate, portable and convenient to handle and store.
- Ideal for quick quality checks and comparative measurements, with built-in polarity display.
- Data communication with computer via USB cable for further signal processing.
- Remote control by computer.

2. Technical Data

Measuring ranges:	0-50mT, 0-200mT, 0~500mT and 0-2000mT
Basic accuracy:	DC: ±1.0%, AC: ±2.0%
Resolution:	DC x1: 0.0 ~ 50.000mT, 0.001mT DC x10: 0.0 ~ 500.00mT, 0.01mT DC x1 0.0 ~ 200.00mT, 0.01mT DC x10 0.0 ~ 2000.0mT, 0.1mT AC x1: 0.0 ~ 50.000mT, 0.001mT AC x10: 0.0 ~ 500.00mT, 0.01mT AC x1: 0.0 ~ 200.00mT, 0.01mT AC x10: 0.0 ~ 2000.0mT, 0.1mT
Measuring magnetic field:	DC/AC (static & dynamic field)
AC frequency range:	10Hz ~ 10kHz
Functions:	Automatic range x1/x10 selection Automatic unit Gs/mT selection Automatic probe zero adjustment N/S pole display for DC measurement RMS/Peak value for AC measurement Max hold, Min hold, Display hold Local/Remote control

Display:	5 Digit LCD
Display Unit:	mT/Gs (1mT=10Gs)
Ambient temperature:	+5°C ~ +50°C
Storage temperature:	-20°C ~ +70°C
Relative humidity:	20% ~ 80%
Power supply:	3 x 1.5V AA batteries or USB 5V
Dimensions:	190mm x 90mm x 33mm
Weight:	365g

3. Accessories

1. 3 x 1.5V AA batteries (not included if the transport is by air freight)
2. 1 x Hall probe CYTP98B (option: CYTP98A/CYAP98A/CYAP98B)
3. 2 x 0.9m USB Cable
4. 5V DC Voltage adapter (standard mobile phone charger)

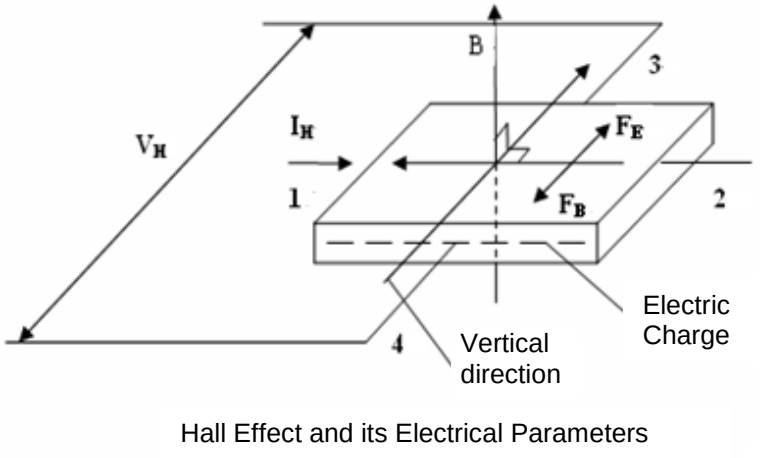
4. Hall probes

Probe Name	transverse probe	
Part number	CYTP98A	CYTP98B
Measuring range	0-50mT, 0-500mT	0-200mT, 0-2000mT
Probe size	1.5 x 4 x 65mm	
Picture		

Probe Name	axial probe	
Part number	CYAP98A	CYAP98B
Measuring range	0-50mT, 0-500mT	0-200mT, 0-2000mT
Probe size	Ø7 x 80mm	
Picture		

5. Measuring Principle

The Gaussmeter works according to Hall Effect principle. There are two kinds of Hall probes: transverse and axial probes, which are used for different magnetization directions.



Hall Effect and its Electrical Parameters

According to the Hall Effect, a voltage can be measured at right angle to the current path when a conductor or semiconductor with current flowing in one direction is introduced perpendicular to a magnetic field. The Hall voltage can be calculated from:

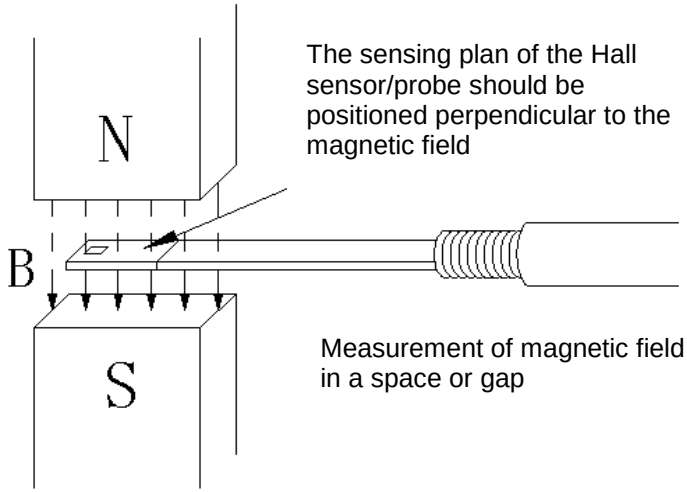
$$V_H = k_H I_H B$$

Where: V_H: Hall voltage in volts
B: the applied field in Gauss
k_H: sensitivity of the element in volts/Gauss
I: bias working current in amperes

The initial use of this discovery was for the classification of chemical samples. The development of indium arsenide semiconductor compounds in the 1950's led to the first useful Hall Effect magnetic instruments. Hall Effect sensors allowed the measurement of DC/AC (static/dynamic) magnetic fields without requiring motion of the sensors.

6. Measuring Method

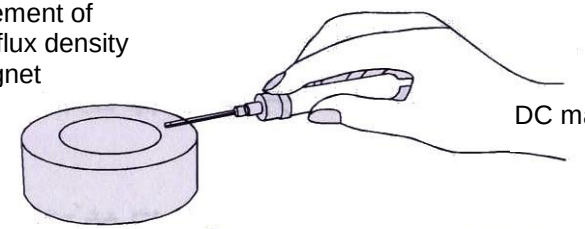
The magnetic lines of the measured magnetic field should perpendicularly pass through the Hall Effect element of the Hall probe.
Put the Hall probe on the surface of the measured magnet or at the measuring point of a magnetic field carefully.



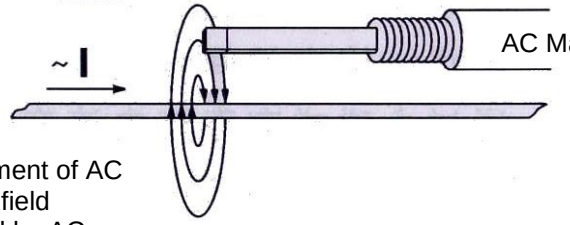
The sensing plan of the Hall sensor/probe should be positioned perpendicular to the magnetic field

Measurement of magnetic field in a space or gap

Measurement of surface flux density of a magnet

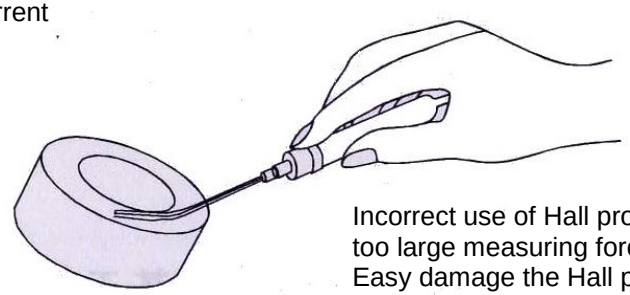


DC magnetic field



AC Magnetic field

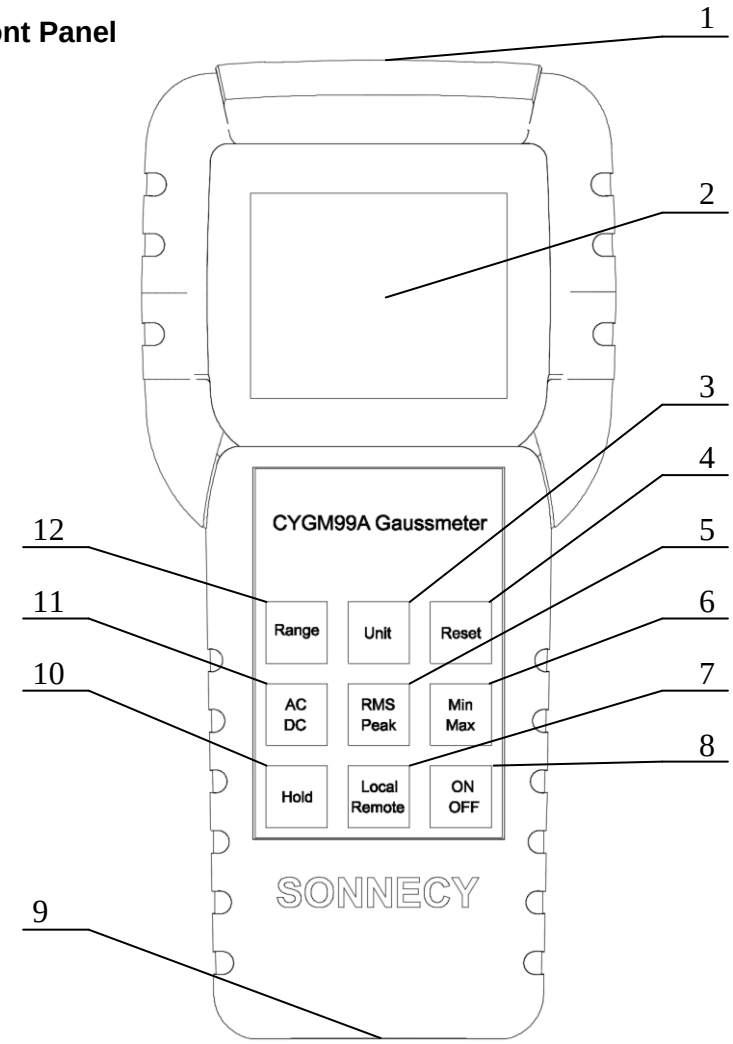
Measurement of AC magnetic field generated by AC current



Incorrect use of Hall probe, too large measuring force, Easy damage the Hall probe!!

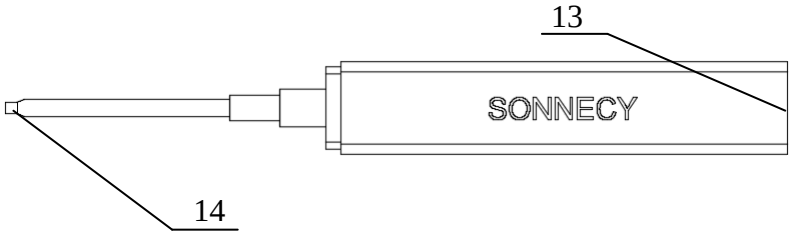
7. Part and Functions

Front Panel

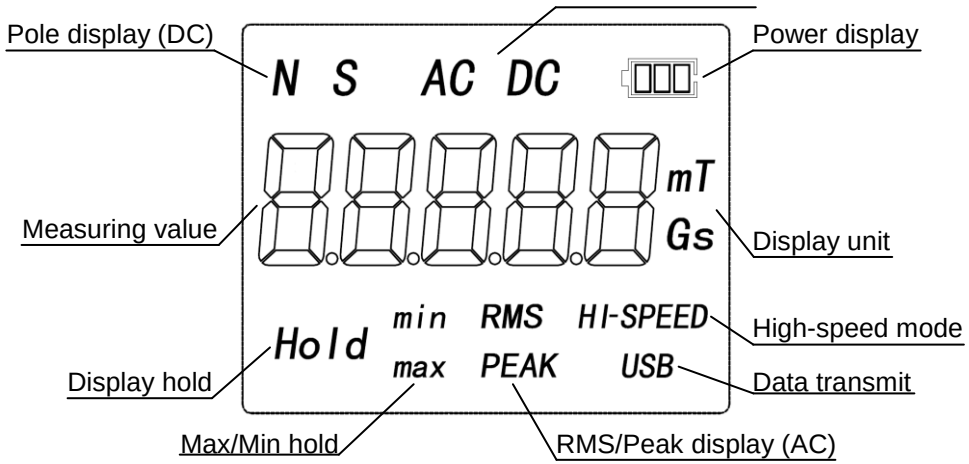


1: USB A port for probe
2: LCD
3: Unit select
4: Zero reset
5: RMS/Peak select
6: Max/Min hold
7: Local/Remote select
8: Power switch
10: Display hold
11: AC/DC mode
12: Measuring range
9: USB micro B port for PC connection or voltage adapter

Hall probe



13: USB micro B port for measuring instrument 14: Hall chip



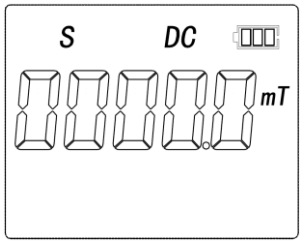
Functions:

1) **USB A port for probe**: to connect the Hall sensor/probe to the measuring instrument.
2) **LCD**: to display the field strength and pole direction (“N” north pole, “S“ south pole) etc.
3) **Unit select**: to select the display unit (Gs or mT).
4) **Zero reset**: to reset the measuring value.
5) **RMS/Peak select**: to select the display format of AC signal (RMS value or Peak value).
6) **Max/Min hold**: to hold the max/min value.
7) **Local/Remote select**: to select the control mode (local or remote).

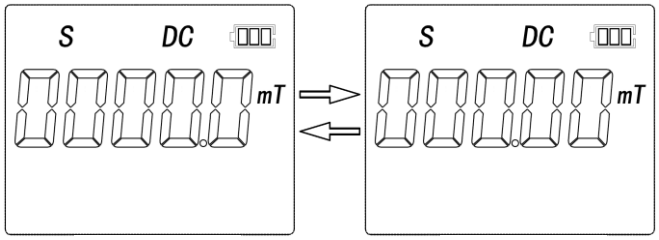
8) **Power switch**: to switch ON/OFF the measuring instrument.
9) **USB micro B port for PC connection**: to connect the external 5V power supply and for data communication between Gaussmeter and PC
10) **Display hold**: to hold the current value.
11) **AC/DC mode**: to select the measurement of AC or DC magnetic field.
12) **Measuring range**: to select the measuring between range 0-50mT and 0-500mT for Hall Probes CYTP98A and CYAP98A or between 0-200mT and 0-2000mT for Hall Probes CYTP98B and CYAP98B
13) **USB micro B port of Hall probe**: to connect the Hall probe to the measuring instrument.

8. Measuring Procedure

1) Connect the Hall probe (13) to the measuring instrument (1) via micro USB cable.
2) Install 3 x 1.5V AA battery to the battery compartment or connect the +5V power supply via USB cable to the measuring instrument.
3) Switch on the power of measuring instrument by pressing “ON/OFF” button (8), LCD display shows 0000.0mT or other value.

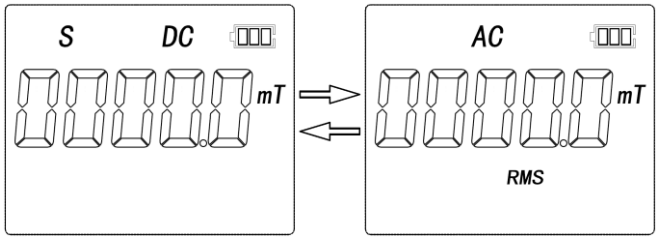


4) **Select measuring range** by pressing the “Range” button (12), the measuring range changes between 0-200mT and 0-2000mT as follows (as example by using Hall probe CYTP98B or CYAP98B):



0-2000mT 0-200mT

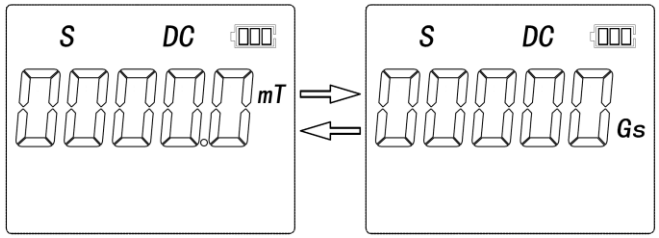
5) **Select AC/DC Mode** by using the “AC/DC” button (11), the display shows the following DC or AC measuring mode:



DC magnetic field AC magnetic field

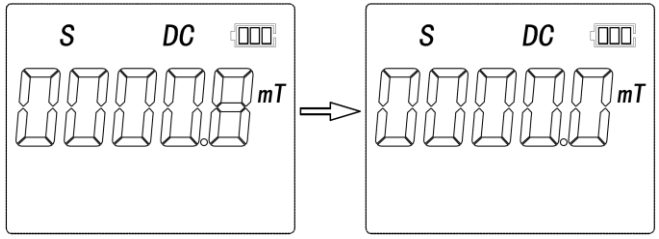
“N” north pole, “S“ south pole for DC magnetic field

6) **Select unit** by pressing “Unit” (3), unit changes between Gs and mT



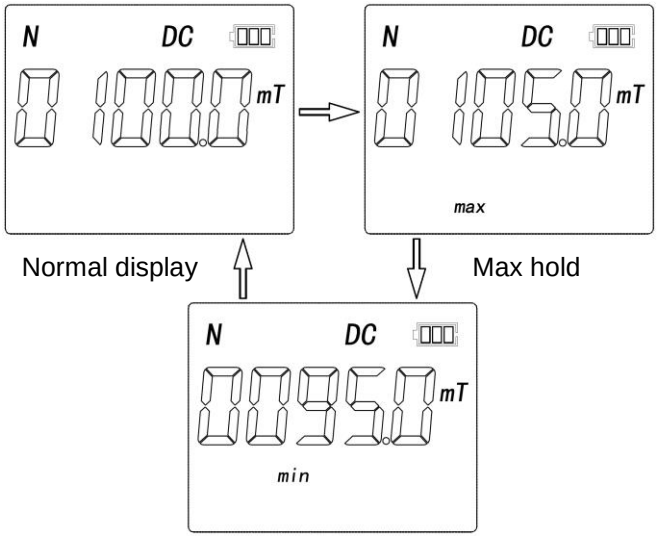
Unit: mT Unit: Gs

7) **Reset Gaussmeter**. Keep the Hall probe far away from magnetic field or put it in a Zero point calibrator , LCD display shows zero after pressing “Reset” button (4):



Note: You must reset the Gaussmeter before you start a new measurement after you have changed the measuring range (12) and AC/DC mode (11).

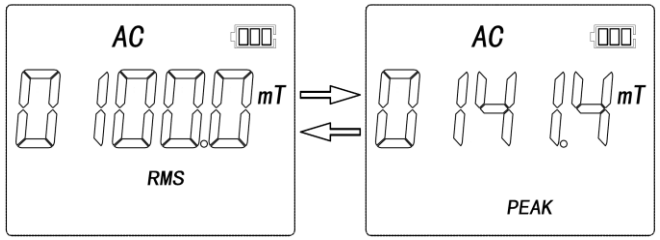
8) **Select Max/Min hold** by pressing the “Min/Max” button (6).



Min hold

Note: Under the Max/Min mode the display changes only when the actual measuring value is larger/smaller than the last value displayed. Therefore you must firstly reset to the normal mode by using button (6), if you need to measure a magnetic field, which is smaller/larger than the previously measured value.

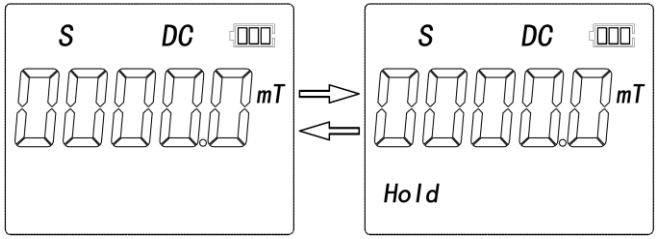
9) **Select display format of AC signal** by using the “RMS/Peak” button (5). The measuring results are shown in RMS or peak value as follows:



RMS Peak

Note: AC measuring results are assumed as sinusoid magnetic field signal. The RMS or amplitude of fundamental wave is displayed on LCD.

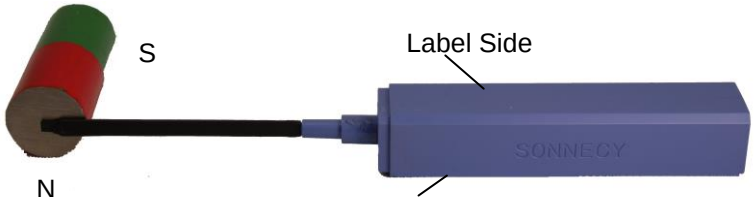
10) **Display hold** can be selected by pressing “Hold” button (10).



Normal display Hold mode

11) Take off the protective tube of the Hall probe, position the Hall probe (14) on the surface of the measuring object (such as permanent magnet), and read the display value (measuring value and pole display “N” or “S“, N for north pole, S for S pole).

Note: The magnetic pole of the measuring object is N pole if the display shows “N” while the label side of a transverse Hall probe is faced towards the surface of the measuring object. In this case you can read the mark SONNECY of the Hall probe (see picture below).



The magnetic pole of the measuring object is N pole if the display shows “N” when the end of an axial Hall probe is put on the surface of the measuring object.

12) After the measurement please put the protective tube on the Hall probe in order to protect the Hall element and switch off the power

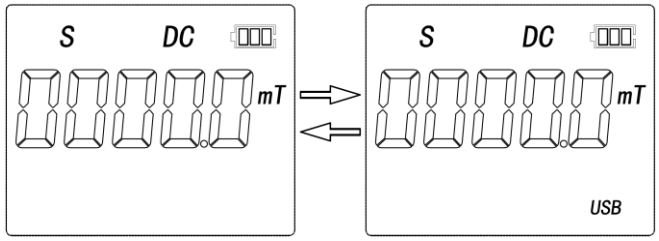
13) The Hall probes delivered are calibrated by using an identical reference Gaussmeter CYGM99A. Therefore all of our Hall probes are compatible for the Gaussmeter CYGM99A.

9. Control with PC

1) Connect the measuring instrument (9) to PC via USB cable and install the CH340G driver for new detected device. This measuring device is identified as a serial port COMx.
2) The measuring instrument has a full duplex serial port, which is configured with 1MHz baudrate, no parity check and one stop bit. User can send following 1 byte ASCII code to select corresponding functions.

No.	ASCII Code	Explanation (for CYTP98B and CYAP98B)
1	I	Measuring range is 0-2000mT (larger range)
2	J	Measuring range is 0-200mT (smaller range)
3	A	AC magnetic field
4	D	DC magnetic field
5	Z	Zero reset
6	M	Max hold
7	W	Min hold
8	R	RMS value for AC measuring
9	P	Peak value for AC measuring
10	O	Hold mode
11	Y	Normal display
12	C	Remote control (PC)
13	K	Local control (keypad)
14	B	Start sending data to PC
15	E	Stop sending data to PC
16	H	High-speed mode
17	N	Normal-speed mode

3) In order to enable the remote control, “C” must be sent firstly. The measuring instrument is back to local control, when “K” is sent or “Local/Remote” button (7) is pressed.

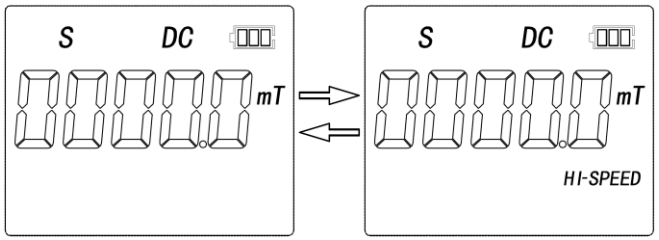


Local control Remote control

In the remote control mode all ASCII instructions can be responded. Remote control instructions 1-11 are identical with keypad functions. Therefore the rest of instructions should be only explained in following.

4) **Enable or disable data sending** by using “B” or “E” instruction. The measuring results in unit “mT” are sent to the computer continuously. The sampling frequency is 1024 samples per second. (Data format is shown in chapter 10.)
Note: The tracing values are sent to PC via USB. It means that the received value should be identical to the value shown on LCD in DC mode. But in AC mode, the received data is the tracing value of AC magnetic field, which is different from the RMS or peak value shown on LCD.

5) **Enable or disable high-speed mode** by using “H” or “N” instruction. In order to reach a higher data throughput, high-speed mode can be enabled for transmitting 10240 samples per second.



Normal-speed High-speed

Note: These two instructions are only responded when data sending is disabled.

10. Data Format

When data sending is enabled, the measuring instrument sends data to PC continuously, which indicates the tracing value of magnetic field in unit “mT”. The sampling frequency is 1024 S/s in normal-speed mode and 10240 S/s in high-speed mode.

1) In normal-speed mode the measuring results are sent in ASCII form. Each 7 bytes represent a complete result with sign, as shown below.

Measuring range 0-2000mT:

Sign	Integer Part	Decimal Point	Decimal Part
1 byte	4 bytes	1 byte	1 byte

Measuring range 0-500mT and 0-200mT:

Sign	Integer Part	Decimal Point	Decimal Part
1 byte	3 bytes	1 byte	2 byte

Measuring range 0-50mT:

Sign	Integer Part	Decimal Point	Decimal Part
1 byte	2 bytes	1 byte	3 byte

For example, in the measuring range 0-2000mT following bytes mean 1234.5mT with N polarity.

Binary	0x2B	0x31	0x32	0x33	0x34	0x2E	0x35
ACSII	+	1	2	3	4	.	5

2) In high-speed mode the original binary codes are sent, which are the conversion result of a 14-bits ADC. Theoretically the data range 0-16383 of the converted result corresponds the minimum and maximum magnetic field strength of current measuring range.

Conversion result of ADC
2 bytes

For example, under measuring range 0-2000mT following bytes mean 586.9mT with N polarity

Binary	0x32	0xC8
Decimal	50	200

((50*256+200)-Offset)/nADC*MR=586.9mT

where Offset=8192 is the theoretic offset of ADC conversion result, nADC=16384 is the ADC data range and MR=2000mT is the current measuring range.

11. Packing List

Net weight: 735g

1 3 x 1.5V AA batteries (not included if the transport is by air freight)
2 1 x Hall probe CYTP98B (CYTP98A or CYTP98A or CYTP98B)
3 2 x 0.9m USB Cable
4 1 x 5V DC Voltage adapter

12. Warranty

Measuring instrument:	12 months
Hall sensor/probe:	no guarantee. However we offer you Replacement for reduced price (10% discount)

Please contact us for technical questions, repairing and replacement etc.

ChenYang Technologies GmbH & Co. KG
Markt Schwabener Str. 8
85464 Finsing, Germany
Tel. +49-(0)8121-2574100
Fax: +49-(0)8121-2574101
Email: info@chenyang.de
http://www.chenyang.de