

6 GHz, with TCXO, SD card datalogger, Bench type **FREQUENCY COUNTER**

Model : FC-6000SD



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Your purchase of FREQUENCY COUNTER marks a step forward for you into the field of precision measurement. Although this FREQUENCY COUNTER 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

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1. FEATURES

- * TFT Display to easy reading measurement result.
- * TCXO (temperature compensated crystal oscillator) time base, high stability & accuracy.
- * High sensitivity for the VHF & UHF & SHF frequency measurement, useful for the CB amateur.
- * Wide measuring range up to 6 GHz.
- * Period measurement Screen can be simultaneously show frequency, Time (mS ,uS ,nS).
- * Width/Duty measurement Screen can be simultaneously show Width/Duty, frequency, Time (mS ,uS).
- * Used the exclusive Microprocessor IC offered the intelligent function: Frequency, Period,Clock Width & Duty, Multi resolution, Data hold, Relative measurement, Data record (Max., Min., Average reading),Data logger.
- * 4.3 " TFT LCD.
- * 0.1 Hz resolution for 10 MHz.
- * LCD display for clear read-out even in bright ambient light condition.
- * RS 232 PC serial interface.
- * Built-in clock and Calendar, real time data record with SD memory card , sampling time set from 1 to 3600 seconds. Just slot 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.
- * SD Card 256GB maximum supported capacity.
- * Powered by AA (UM-3) DC 1.5 V X 6 batteries (Alkaline type) or DC 9V adapter.
- * Computer data output, can cooperate with optional USB Cable/USB-01, RS232 cable/UPCB-02 and Data Acquisition software, SW-E816-32.
- * PATENT.

2. SPECIFICATIONS

2-1 General Specifications:

Circuit	Custom single-chip microprocessor LSI circuit	
Display	TFT LCD Size : 2.2 X3.82 "(56X97 mm). 4.3 " TFT LCD (272 x 480 Dots).	
Measurement	Frequency, Period, Clock Width & Duty, Data hold, Relative, REC (max., min., average) .	
Range	6 GHz	950 MHz to 6 GHz(INPUT A)
	1 GHz	10 MHz to 1 GHz.(INPUT B)
	10 MHz & Period	10 Hz to 10 MHz(INPUT C)
	Clock Width & Duty	10 Hz to 100 KHz(INPUT C)
Resolution Sampling Time	Ref. the following "Table For Resolution & Sample Time".	
Sensitivity (0 dB Function)	6 GHz	≤ 30 mVrms(950 MHz to 6 GHz)
	1 GHz	≤ 30 mVrms(10 MHz to 1 GHz)
	10 MHz & Period	≤ 15 mVrms(10 Hz to 10 MHz)
Max. functional signal input (- 20 dB Function)	6 GHz	≤ 1 Vrms(950 MHz to 1.5 GHz) ≤ 4 Vrms(1.6 GHz to 6 GHz)
	1 GHz	≤ 4 Vrms
	10 MHz & Period	≤ 15 Vrms
	Clock width & Duty	3 Vpp ~ 5 Vpp
Over-input (Max. signal will not hurt the circuit)	6 GHz & 1 GHz range: 4 Vrms	
	10 MHz & Period, Clock Width & Duty Range: Max. 15 Vrms	
Time Base Stability vs. Temp.	1 PPM (- 20 to 70 °C).	

Frequency Accuracy	$\pm (2 \text{ PPM} + 1 \text{ d})$ 23 $\pm$ 5 °C, after calibration.	
Time Base circuit	20 MHz, TCXO (temperature compensated crystal oscillator).	
Input Connector	6 GHz range : N coaxial connector.	
	1 GHz range : N coaxial connector.	
	10 MHz & Period range : BNC connector.	
Case	Durable & strong ABS-plastic housing with handle.	
Datalogger Sampling Time Setting range	Auto	1~3600 sec. <i>@ Sampling time can set to 1 second, but memory data may loss.</i>
Data error no.	≤ 0.1 % no. of total saved data typically.	
Memory Card	SD memory card. 1 GB to 256 GB.	
Advanced setting	* Set Folder Name * Set File Name * Set sampling time * Format SD card * Delete File * Set Decimal * Set beep Sound ON/OFF * Set Auto power OFF * Set (Year/Month/Date, Hour/Minute/ Second)	
Sampling Time of Display	Approx. 1 second.	
Data Output	RS 232/USB PC computer interface. * <i>Connect the optional RS232 cable UPCB-02 will get the RS232 plug.</i> * <i>Connect the optional USB cable USB-01 will get the USB plug.</i>	

Operating Temp.	0 to 50 °C (32 to 122 °F).
Operating Humidity	Less than 80%.
Power Supply	1.5 V AA (UM-3) battery x 6pcs.(Alkaline or Heavy Duty) or AC to DC 9V Linear power adapter.
Power Consumption	6 GHz : Approx. DC 310 mA (at -20 dB).
	1 GHz : Approx. DC 220 mA (at -20 dB).
	10 MHz & Period range:Approx. DC150 mA (at -20 dB).
AC Adapter Power Input	Optional 9V DC , 500 mA rating, central positive for socket.
Dimension	295 x 236 x 98 mm (11.6 x 9.3 x 3.9 inch).
Weight	1465 g / 3.23 LB (without battery).
Standard Accessories	* Instruction Manual 1 PC.
Optional Accessories	* SD memory card * USB RS232 cable,USB-01. * RS232 cable,UPCB-02. * Data Acquisition software,SW-E816-32. * PB-21: Direct probe with BNC connector & alligator clip pairs, available for 10 MHz range. * BB-22: Direct probe with double BNC connector, available for 100 MHz & 10 MHz range. * NN-23: Direct probe with double N coaxial connector, available for 1000 MHz, 6000 MHz. * NB-24: N coaxial connector to BNC connector adapter. * AC-110V9 : AC110V to DC 9V Linear power adapter * AC-220V9 : AC220V to DC 9V Linear power adapter

2-2 Table For Resolution & Sample Time

Range	Gate Time Select	Resolution
6000 MHz (6 GHz)	0.5 SEC	1000 Hz
	6.5 SEC	100 Hz
	4 SEC	200 Hz
	2 SEC	500 Hz
1000 MHz (1 GHz)	1 SEC	100 Hz
	9 SEC	10 Hz
	8 SEC	20 Hz
	3 SEC	50 Hz
10 MHz	0.5 SEC	10 Hz
	1.5 SEC	1 Hz
	6 SEC	0.2 Hz
	11 SEC	0.1 Hz

2-3.Electrical Specifications (23 ± 5°C)

Frequency

Range	Resolution	Accuracy
10Hz - 10MHz	Eg 2-2 table	±(2 PPM reading + 1 d)
10MHz – 1GHz		
950MHz – 6GHz		

Frequency Width/Duty (3Vpp ~ 5Vpp)

Function	Range	Resolution	Accuracy
Width	10uS – 200mS	1mS≤T≤200mS:0.001mS 20μS≤T≤1mS:0.001μS	±(3 % reading + 20 d)
Duty	10Hz-15KHz : 5-95% 16Hz-40KHz : 5-90% 41KHz-100KHz : 20-75%	0.01%	± (3 % reading + 20d)

3. FRONT PANEL DESCRIPTION

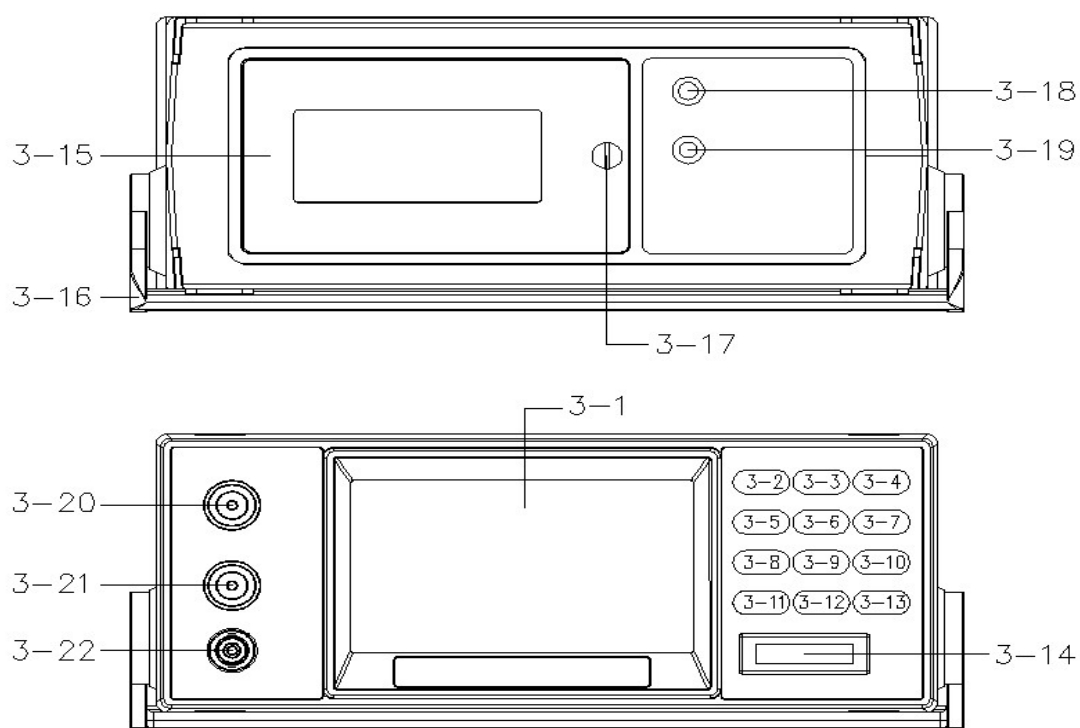


Fig. 1

- | | |
|--------------------------------|---|
| 3-1.Display | 3-12.HOLD key button |
| 3-2.FREQ/REL key button | 3-13.ENTER/SETUP key button |
| 3-3.PERIOD key button | 3-14.SD card socket |
| 3-4.WIDTH/DUTY key button | 3-15.Battery Cover/Battery compartment |
| 3-5.INPUT key button | 3-16.Handle |
| 3-6.REC/LOG key button | 3-17.Battery Cover Screw |
| 3-7.RESO key button | 3-18.RS232 socket |
| 3-8.▲ key button | 3-19.DC 9V power adapter socket |
| 3-9.Power/Backlight key button | 3-20.6000 MHz(RF, INPUT A) input, N type Socket |
| 3-10.▼ key button | 3-21.1000 MHz(RF, INPUT B) input, N type Socket |
| 3-11.EXIT/ 0/20 dB key button | 3-22.10 MHz(LF, INPUT C) input, BNC Socket |

4. MEASURING PREPARATION

4-1 Frequency measurement

- 1) Press the POWER/Backlight KEY(3-9, Fig.1) > 2 Sec to turn ON the Frequency counter.
- 2) Press the INPUT KEY(3-5, Fig.1) to select Measurement Range INPUT A(6GHz), INPUT B(1GHz), INPUT C(10MHz).

Remark:

*When there is no signal input, the meter maybe show some value, because the input terminal will sensing the Noise to the surrounding environment is a normal phenomenon, when there is input signal, the phenomenon not effect correct measurement.

* Select appropriate measurement range to improve sensitivity.

- 3) When measurement signal is (500M~6GHz), use N Type cable (optional, NN-23), connect to INPUT A N Type terminal(3-20, Fig.1).
- 4) When measurement signal is (10M~1GHz), use N Type cable (optional, NN-23), connect to INPUT B N Type terminal(3-21, Fig.1).
- 5) When measurement signal is (10Hz~10MHz), use BNC Type cable (optional, NB-24 and PB-21 or BB-22), connect to INPUT C BNC Type terminal(3-22, Fig.1).
- 6) Depend on different input range to select need sensitivity
In the attenuator function, the factory setting is 0dB (high sensitivity)
Press EXIT(0/20dB) KEY(3-11, Fig.1) > 2 Sec. attenuator will show 20dB(low sensitivity), again press EXIT(0/20dB) KEY(3-11, Fig.1) > 2 Sec. will back 0 dB (high sensitivity).
- 7) In different input range, press RESO KEY(3-7, Fig.1), to select want resolution, according to different resolution, sampling time will also be different, as table 2-2. Table for Gate Time & Resolution.

4-2 Data HOLD Function

- 1) Short Press HOLD KEY(3-12, Fig.1), LCD will show HOLD text and measure value will be hold.
- 2) Short Press again HOLD KEY(3-12, Fig.1), HOLD Function will be release.

4-3 Relative Function (Frequency only)

- 1) Press and hold FREQ/REL KEY(3-2, Fig.1) > 2 SEC. LCD will show REL text, and memory measure value (regarded as old value), and measure value regarded as 0 (LCD will show 0 value).
- 2) When measure new value, the old measure value will with new measure value to do increase or decrease calculator.
- 3) Press FREQ/REL KEY(3-2, Fig.1) > 2 SEC. LCD REL text, and measure value will be release.

4-4 Data Record(Max., Min., Average reading) Function

- 1) Short Press REC/LOG KEY(3-6, Fig.1), LCD will show REC text, and into REC Function measure.
- 2) Short Press again REC/LOG KEY(3-6, Fig.1), LCD will show REC Max. text, and REC Max. value.
- 3) Short Press again REC/LOG KEY(3-6, Fig.1), LCD will show REC Min. text, and REC Min. value.
- 4) Short Press again REC/LOG KEY(3-6, Fig.1), LCD will show REC Ave. text, and REC Ave. value.
- 5) Press and hold REC/LOG KEY(3-6, Fig.1) > 2 sec., will release Data Record Function.

4-5 Period Function

- 1) Select to (10Hz-10MHz) range, frequency signal input to C (BNC) , (3-22, Fig.1) terminal.
- 2) Press Period KEY(3-3, Fig.1), into Period function measurement.
- 3) Measurement frequency period value show as:
A. $10\text{Hz} \geq \text{Frequency} \leq 1\text{KHz}$: Period(ms) = 1000 ms/frequency(Hz).
B. $1\text{KHz} > \text{Frequency} \leq 1\text{MHz}$: Period(us) = 1000000 us/frequency(Hz).
C. $1\text{KHz} > \text{Frequency} \leq 10\text{MHz}$: Period(ns) = 1000000000 ns/frequency(Hz).
- 4) Screen at the same time show frequency, Time (mS , uS, nS).

4-6 Clock Width & Duty Function

- 1) Select to (10Hz-10MHz) range, frequency signal input to C (BNC) , (3-22, Fig.1) terminal.
- 2) Short press WIDTH/DUTY KEY(3-4, Fig.1), into square wave (10Hz to 100 KHz) width measure Press and hold WIDTH/DUTY KEY(3-4, Fig.1) > 2 sec. , into square wave duty function measurement.
- 3) Short press WIDTH/DUTY KEY(3-4, Fig.1), back to width measure function.
- 4) Measurement range 10Hz ~ 100KHz.
- 5) Screen at the same time show width, frequency, Time (ms , us,).

4-7 Data Logger Function

- 1) SD Card into SD Card socket (3-14, Fig.1).
- 2) Select sampling time 1 ~ 3600 sec.
- 3) Select data recorder format (USA or EURO).
- 4) Press and hold REC/LOG KEY(3-6, Fig.1) > 2 SEC., into data recorder function.
- 5) Again press REC/LOG KEY(3-6, Fig.1) KEY > 2 SEC., quit data recorder function.

6) file rule :

A.FCAXX: 10 folders in total FCA01~FCA10

B.FCAXXxxx: Every one ,can be recorder 50 filed

FCAXX001.XLS~PAAXX050.XLS .

C.Filed path structure

FCA01\ FCA01001.XLS FCA01002.XLS FCA01050.XLS	FCA02\ FCA02001.XLS FCA02002.XLS FCA02050.XLS
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4-8 Over Range Indicator:

6GHz (A), 1GHz (B), 10MHz (C) measurement range,
when input signal over it measurement range, LCD display will
be show -- OL -- symbol and meter issue -- BI BI -- sound.

4-9 LCD brightness select

Depending on the brightness of the environment,
can use the "Backlight Button " (3-9, Fig. 1) select Hi or Low brightness
LCD Backlight brightness.
when meter 5 minutes not any key operation, the backlight brightness
will auto select to low brightness.

4-10 Auto power off

Auto shut off is available to save battery life.
when the instrument power supply is using batteries
if no buttons operation for around 10 minutes. the instument
will be Auto shut off .

Remark:

When power use adapter, the auto power off Function will be disable.

5. ADVANCED SETTING

5-1.Folder Name:

- 1) Press ENTER/SETUP KEY(3-13, Fig 1) > 2 SEC.,into setting function.
- 2) Use ▲(3-8, Fig 1) 、▼(3-10, Fig 1) KEY, select to **Folder Name** position,then short press ENTER/SETUP KEY into FCA01 ~ FCA10 position.
- 3) At FCA01 ~ FCA10 position,Use ▲ 、 ▼ KEY, select want to number, then short press ENTER/SETUP KEY, back to **Folder Name** position.

5-2.File Name:

- 1) Use ▲ 、 ▼ KEY, select to **File Name** position,then short press ENTER/SETUP KEY into FCA01001 ~ FCA01050 position.
- 2) At FCA01001 ~ FCA01050 position,Use ▲ 、 ▼ KEY, select want to number, then short press ENTER/SETUP KEY, back to **File Name** position.

5-3.Sampling Time:

- 1) Press ▲ or ▼ KEY, select to **Sampling Time** position,then short press ENTER/SETUP KEY into 1 ~ 3600 second select position.
- 2) At 1 ~ 3600 position,Use ▲ 、 ▼ KEY, select want to seconds number then short press ENTER/SETUP KEY, back to **Sampling Time** position.

5-4.Delete File:

- 1) Press ▲ or ▼ KEY, select to **Delete File** position,then short press ENTER/SETUP KEY > 2 sec. Y or N screen appears.
- 2) At Y or N screen,Use ▲ 、 ▼ KEY, select Y to do File delete , at this time screen will show 0 to 100% counting ,when counting to 100% express **File delete** finish.

5-5.SD Card Format:

- 1) Press ▲ or ▼ KEY, select to **SD Card Format** position,then short press ENTER/SETUP KEY > 2 sec. Y or N screen appears .
- 2) At Y or N screen,Use ▲ 、 ▼ KEY, select Y to do SD Card Format , this time screen will show 0 to 100% counting ,when counting to 100% express SD Card Format finish.

5-6.Decimal:

- 1) Press ▲ or ▼ KEY, select to **Decimal** position,then short press ENTER/SETUP KEY into Basic or Euro select position.
- 2) At Basic or Euro position,Use ▲ 、 ▼ KEY, select Basic or Euro, then short press ENTER/SETUP KEY, back to **Decimal** position.

5-7.Beep:

- 1) Press ▲ or ▼ KEY, select to **Beep** position,then short press ENTER/SETUP KEY into ON or OFF select position.
- 2) At ON or OFF position,Use ▲ 、 ▼ KEY, select you want , then short press ENTER/SETUP KEY, back to **Beep** position.

5-8.Auto Power OFF :

- 1) Press ▲ or ▼ KEY, select to **Auto Power OFF** position,then short press ENTER/SETUP KEY into Y or N select position.
- 2) At Y or N position,Use ▲ 、 ▼ KEY, select you want, then short press ENTER/SETUP KEY, back to **Auto Power OFF** position.

Remark:

When power use batteries, the auto power off will be enable .

5-9.Year 、 Month 、 Date 、 Hour 、 Minute 、 Second:

- 1) Press ▲ or ▼ KEY, select to **Year** position,then short press ENTER/SETUP KEY into 2000 select position.
- 2) At 2000 position,Use ▲ 、 ▼ KEY, select you want number , then short press ENTER/SETUP KEY, back to **Year** position.
- 3) **Month 、 Date 、 Hour 、 Minute 、 Second**,Setting method same as 1 and 2.

6. LCD Backlight ON/OFF

Short press POWER/Backlight KEY(3-9,Fig.1),
to select LCD Backlight ON or OFF.

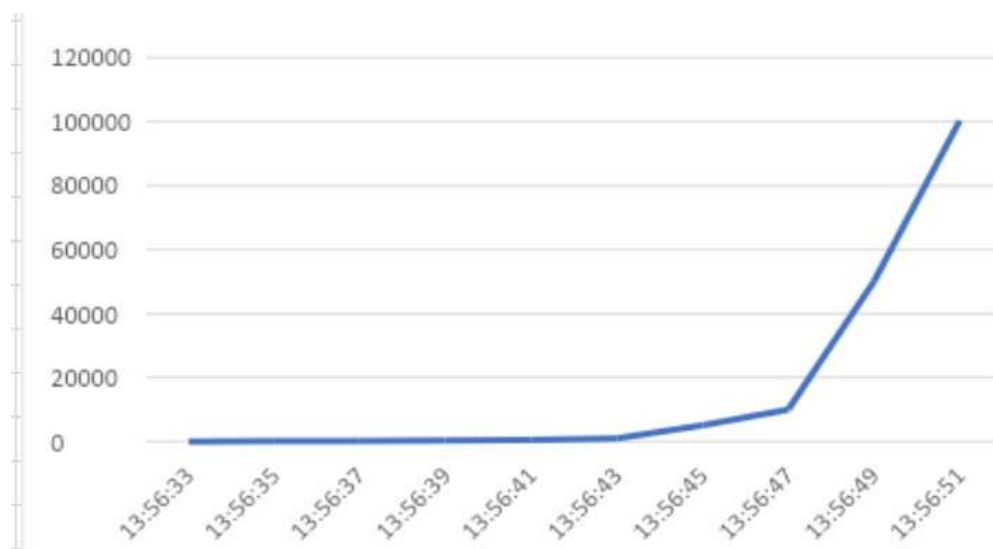
7. Saving data from the SD card to the computer (EXCEL software)

- 1) After execute the Data Logger function, take away the SD card out from the " SD card socket " (3-14, 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 : FCA01001.XLS, FCA01002.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.

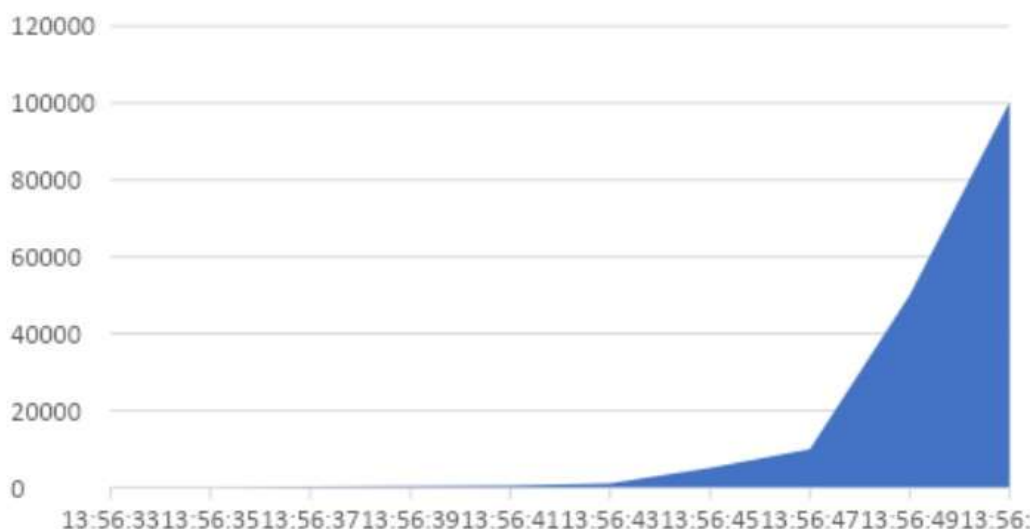
EXCEL data screen (for example 1)

Position	Date	Time	FREQ.	Unit	Period	Unit	Width	Unit	Duty	Unit
1	2022/8/24	13:56:33	5	Hz	179.79	mS	94.59	mS	52.26	%
1	2022/8/24	13:56:35	100	Hz	10	mS	5	mS	50	%
1	2022/8/24	13:56:37	200	Hz	5	mS	2.5	mS	50	%
1	2022/8/24	13:56:39	299	Hz	3.34	mS	1.67	mS	50	%
1	2022/8/24	13:56:41	500	Hz	2	mS	1	mS	50	%
1	2022/8/24	13:56:43	1000	Hz	1002.49	uS	501.07	uS	49.98	%
1	2022/8/24	13:56:45	5009	Hz	199.62	uS	99.68	uS	49.93	%
1	2022/8/24	13:56:47	10020	Hz	99.8	uS	49.77	uS	49.86	%
1	2022/8/24	13:56:49	50100	Hz	19.96	uS	9.85	uS	49.34	%
1	2022/8/24	13:56:51	100300	Hz	9.97	uS	4.86	uS	48.74	%

EXCEL data screen (for example 2)



EXCEL data screen (for example 3)



8. Power supply indicator

- 1)  Express the instrument Currently use DC 9V ADAPTER(3-19, Fig.1).
- 2)  Express the instrument Currently use DC 1.5V, AA(UM-3) Alkaline Battery X 6 PCS(3-15, Fig.1).

9. BATTERY REPLACEMENT

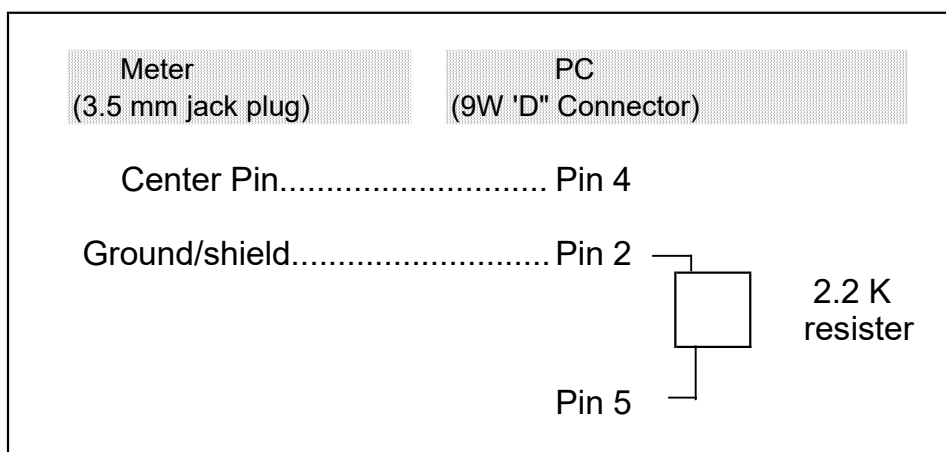
- 1) When the right up corner of LCD display show red  symbol and flashed, it is necessary to replace the battery.
However After the battery low voltage indication, the instrument still can be made for several minutes measure and the measure value meet the specification.
- 2) Loose the screws of the (3-17, 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 (AA,UM-3 , Alkaline/heavy duty) x 6 PCs, and reinstate the cover.
- 4) Make sure the battery cover is secured after changing batteries.

10. RS232 PC SERIAL OUTPUT

The instrument is provided an 3.5 mm dia. phone socket (3-18, Fig. 1) for RS232 computer interface socket.

The connector output is a 16 digits data stream which can be utilized to the user's specific application.

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



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 indicate the following status :

D15	(02) Start Word		
D14	2		
D13	1 CH = 1		
D12 & D11	Frequency for Display		
	Hz=31	MHz = 67	%=03
	KHz=33	μS= 75	mS= 74
	S= 76	nS= H3	
D10	Polarity 0 = Positive 1 = Negative		
D9	Decimal Point(DP), position from right to the left 0 = No DP, 1= 1 DP, 2 = 2 DP, 3 = 3 DP		
D8 to D1	Display reading, D1 = LSD, D8 = MSD For example : If the display reading is 1234, then D8 to D1 is : 00001234		
D0	(0D) End Word		

RS232 setting

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

11. PATENT

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

Germany	Nr. 20 2008 016 337.4
JAPAN	3151214
CHINA	ZL 2008 2 0189918.5 ZL 2008 2 0189917.0

12. THE ADDRESS OF AFTER SERVICE CENTER

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