

ANAHEIM SCIENTIFIC

User Manual

Model E200
3-Axis RF Field Strength Meter






Table of Contents

| | |
|---|-----------|
| AXIS RF METER QUICK START GUIDE | 4 |
| 1 INTRODUCTION | 5 |
| 1.1 The E200 Features | 5 |
| 1.2 E201 Applications | 6 |
| 2 SAFETY SUMMARY | 7 |
| 3 EMF SAFETY | 8 |
| 4 COMPLIANCE STATEMENTS | 9 |
| 5 PRODUCT CONTENTS AND INSPECTION | 9 |
| 6 DEVICE DESCRIPTION | 11 |
| 7 LCD DESCRIPTION | 12 |
| 8 FUNDAMENTALS | 13 |
| 8.1 Electromagnetic Pollution..... | 13 |
| 8.2 Electric Field Strength (E) | 13 |
| 8.3 Magnetic Field Strength (H) | 13 |
| 8.4 Power Density (S) | 13 |
| 8.5 The Characteristic of Electromagnetic Fields..... | 14 |
| 9 DEVICE OPERATION | 15 |
| 9.1 Battery replacement | 15 |
| 9.2 POWER Button | 15 |
| 9.3 Data Hold Button | 16 |
| 9.4 Units Button..... | 16 |
| 9.5 MAX / AVG Record | 17 |
| 9.6 Manual Data Memory Storing | 17 |
| 9.7 Backlight Display and Reading in The Dark | 18 |
| 9.8 Sensor Axis Selector:..... | 18 |
| 9.9 Alarm ON/OFF Setup..... | 18 |
| 9.10 Viewing Data Records | 19 |
| 9.11 Clock LCD Display..... | 19 |
| 10 SETUP MODE | 20 |
| 10.1 Clock Setup-1 | 21 |
| 10.2 Setting the Alarm Limit Value (ALARM)-2 | 22 |

- 10.3 DEL Data Logger Memory Setup-3 23
- 10.4 Analog bar graph setup-4 24
- 10.5 Auto Power-Off Function Setup-5..... 25
- 10.6 Setting the calibration factor (CAL)-6 26
- 10.7 Calibration Factor (CAL)..... 27
- 11 MAKING MEASUREMENTS 27**
- 11.1 Short-term Measurements 28
- 11.2 Long-term Exposure Measurements 28
- 12 SPECIFICATIONS 29**
- 12.1 General Specifications..... 29
- 12.2 Electrical specifications 30
- 12.3 Units of Measurement 31
- 12.4 Result modes..... 31
- 13 SERVICE, REPAIRS, CALIBRATION..... 32**
- 14 LIMITED TWO-YEAR WARRANTY 34**

Axis RF Meter Quick Start Guide

This meter has many capabilities, including memory, alarm, date/time, average etc. which will require some study of the manual to use properly. However, you can quickly and easily begin making measurements right out of the box. Just follow these simple steps:

- Insert 9V battery
- Press the “” button to turn on the meter.
- Press XYX/MEM “” button until all three (XYZ) letters are displayed on the screen (to the left of the main number
- Press UNIT/ENTER “” button until the desired units are displayed below the main number (we recommend using mV/m... and we recommend a maximum level of 614 mV/m for prolonged exposure).


You are now ready to make your first measurements!

1 Introduction

Thank you for purchasing an E200 3-Axis RF Field Strength Meter from Anaheim Scientific. This meter is designed for measuring and monitoring Radio-Frequency electromagnetic field strength. The meter is calibrated precisely over the frequency range of 50MHz~3.5 GHz.

1.1 The E200 Features


- The meter is a broadband device for monitoring high-frequency radiation in the range from 50MHz to 3.5GHz
- The non-directional electric field antenna and high sensitivity also allow measurements of electric field strength in TEM cells and absorber rooms.
- The auto-ranging units of measurement and the measurement types report in units of electrical and magnetic field strength and power density.
- At high frequencies, the power density is of particular significance. It provides a measure of the power absorbed by a person exposed to the field. This power level must be kept as low as possible at high frequencies.
- The meter can be set to display the instantaneous value, the maximum value measured or the average value. Instantaneous and maximum value measurements are useful for orientation, e.g. when first entering an exposed area.
- Non-directional (isotropic) measurement with three-axis measurement sensor.


- High dynamic range due to three-channel digital results processing.
- Configurable alarm threshold and memory function.
- Easy & safe to use
- Low battery indicator “”.
- Manual data memory storing: 200 data sets.
- Over load indication “OL”.

1.2 E201 Applications

- High frequency (RF) electromagnetic wave field strength measurement.
- Mobile phone base station antenna radiation power density measurement.
- Wireless communication applications (CW, TDMA, GSM, DECT).
- RF power measurement for transmitters.
- Wireless LAN (Wi-Fi) detection, installation.
- Spy camera, wireless bug finder.
- Cellular /Cordless phone radiation safety level.
- Microwave oven leakage detection.
- Personal living environment EMF safety.

2 Safety Summary

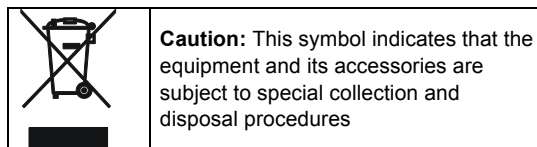
| | |
|---|----------------|
|  | CAUTION |
| Adhere to the following conditions for safe and effective usage of this meter | |

- Do not operate the meter in an environment filled with combustible gas, liquids, dust or fibers
- In order to avoid reading incorrect data, please replace the battery immediately when the symbol  appears on the LCD
- In order to avoid damage caused by contamination or static electricity, do not touch the circuit board before taking adequate precautions
- Operating Environment: This instrument has been designed for usage within an environment of Pollution Degree 2
- Operation Altitude: Up to 2000M
- Operating temperature range: 0°C to + 50°C
- Operating humidity range: 25% to 75 % RH
- Storage temperature range: -10°C to +60°C
- Storage humidity range: 0% to 80% RH
- In the case of prolonged storage, it is preferable to remove the battery from the meter.
- Avoid shaking the meter, particularly in the measurement mode.
- For cleaning the instrument use a soft dry cloth. Never use a wet cloth, solvents or water, etc.
- Weather conditions outside the specified limits and improper handling may adversely affect the accuracy and function of the meter.

3 EMF Safety

- In some cases, work in the vicinity of powerful radiation sources can be life threatening.
- Be aware that persons with electronic implants (e.g. cardiac pacemakers) are subject to particular dangers in some cases.
- Observe the local safety regulations of the facility.
- Observe the operating instructions for equipment which is used to generate, conduct, or consume electromagnetic energy.
- Be aware that secondary radiators (e.g. reflective objects such as a metallic fence) can cause a local amplification of the field.
- Be aware that the field strength in the near vicinity of radiators increases proportionally to the inverse cube of the distance. This means that enormous field strengths can result in the immediate vicinity of small radiation sources (e.g. leak in wave guides, inductive ovens)
- Field strength measuring devices can underrate pulsed signals. Particularly with radar signals, significant measurement errors can arise.
- All field strength measuring devices have a limited specified frequency range. Fields with spectral components outside of this frequency range are generally incorrectly evaluated and tend to be underrated. Before using field strength measuring devices, you should thus be certain that all field components to be measured lie in the specified frequency range of the measuring device.

4 Compliance Statements



- This tester was designed in accordance with EMC Standards in force and its compatibility has been tested in accordance with EN61326-1 (2006) Class B
- IEC 61326-1: 2006
- IEC 61000-4-2: 2009
- IEC 61000-4-3: 2006/A1:2008

5 Product Contents and Inspection

This unit is tested prior to shipment. It is therefore ready for immediate use upon receipt. An initial physical inspection should be made to ensure that no damage has been sustained during shipment.

Inspect the packing box on receipt for any external damage. If any external damage is evident, remove the instrument and visually inspect its case and parts for any damage. If damage to the instrument is evident, a description of the damage should be noted on the carrier's receipt and signed by the driver or carrier agent. Save all shipping packaging for inspection.

Forward a report of any damage to the agent through which the unit is procured.

Retain the original packing in case subsequent repackaging for return is required. Use of the original packing is essential.

After the mechanical inspection, verify the contents of the shipment. The items included in this package are:

- E200 Meter
- User manual
- 9V battery
- Carrying case

6 Device Description



1. 3-Axis RF Sensor
2. LCD
3. MAX / AVG / R Button
4. Record / Time / L Button
5. Power Button
6. UNIT / ENTER switch Button
7. Hold / ALARM On/Off / Up Button
8. Backlight/Set
9. XYZ / MEM / Down Button
10. Tripod Mounting Screw
11. Battery Cover

7 LCD Description



- | | |
|---|---------------------------|
| 1. Primary Display | 13. E symbol |
| 2. Hold symbol | 14. Auto power off symbol |
| 3. Analogue bar graph | 15. Time unit (month:day) |
| 4. MAX symbol | (hour: minute) (second) |
| 5. AVG symbol | 16. MEM reading symbol |
| 6. Low battery symbol | 17. SET symbol |
| 7. x1x10x100 unit | 18. REC symbol |
| 8. X.Y.Z unit | 19. CAL symbol |
| 9. ALARM unit | 20. Secondary Display |
| 10. mV/m, V/m (E) | 21. BUZZER symbol |
| 11. $\mu\text{A}/\text{m}$ mA /m unit (H) | 22. Decimal point |
| 12. $\mu\text{W}/\text{m}$, $\mu\text{W}/\text{cm}^2$ unit | |

8 Fundamentals

8.1 Electromagnetic Pollution

This meter is used to indicate electromagnetic pollution generated artificially. Wherever there is a voltage or a current, electric (E) and magnetic (H) fields arise. All types of radio broadcasting and TV transmitters produce electromagnetic fields, and they also arise in industry, business and the home, where they affect us even if our sense organs perceive nothing.

8.2 Electric Field Strength (E)

A field vector quantity that represents the force (F) on an infinitesimal positive test charge (q) at a point divided by that charge. Electric field strength is expressed in units of volts per meter (mV/m). This meter measures electric field strength directly.

8.3 Magnetic Field Strength (H)

A field vector that is equal to the magnetic flux density divided by the permeability of the medium. Magnetic field strength is expressed in units of amperes per meter (A/m). In far field situations, one can calculate the magnetic field using the electric field value. This meter can display the calculated magnetic field strength.

8.4 Power Density (S)

Power per unit area normal to the direction of propagation, usually expressed in units of Watts per

square meter (W/m^2) or, for convenience, units such as milliwatts per square centimeter (mW/cm^2).

8.5 The Characteristic of Electromagnetic Fields

Electromagnetic fields propagate as waves and travel at the speed of light (C). The wavelength is proportional to the frequency.



$$\lambda \text{ (wavelength)} = C \text{ (speed of light)} / f \text{ (frequency)}$$

If the distance to the field source is less than three wavelengths, then we are usually in the near-field. If the distance is more than three wavelengths, then far-field conditions usually hold.

In near-field conditions, the magnetic field value cannot be calculated from the electric field value. This meter is designed for reliable far-field measurements only.

9 Device Operation



9.1 Battery replacement

| | |
|---|--|
|  | WARNING |
| | If the symbol "  appears on the LCD, please replace the battery immediately |


- Turn off the instrument.
- Remove the battery cover
- Replace the battery.
- Install the battery cover.
- Be sure to turn unit off after use to conserve battery life.




9.2 POWER Button

- Press " button to power on.
- Press " button to power off.

9.3 Data Hold Button

Press the “” button to go into hold mode, and “HOLD” appears on the screen to allow you to read the data.


Press the “” button once again to deactivate it.



9.4 Units Button

Change units with the “UNITS” key as follows.


- Electric field strength (V/m)
- Computed magnetic field strength (mA/m)
- Computed power density (mW/m^2)
- Computed power density ($\mu\text{W}/\text{cm}^2$)

Press “” button to change the unit. Possible units :


mV/m, V/m, $\mu\text{A}/\text{m}$, mA/m, $\mu\text{W}/\text{m}^2$, mW/m^2 , $\mu\text{W}/\text{cm}^2$




9.5 MAX / AVG Record


Press “” key to switch to the next display. The display switches from MAX to AVG to MAX/AVG and back to MAX.



Press and hold “” key for 3 seconds to disable this function.

The maximum averaging storage is up to 99 minutes and 99 seconds. After this period of time, updating will stop automatically and the LCD displays .

9.6 Manual Data Memory Storing



Push “” button, the meter will save the current measured result, and REC with a number 001~200 will appear.

Manual data memory storing: 200 data sets.


Over load indication: “OL”.



9.7 Backlight Display and Reading in The Dark

Press the “” key to turn the backlight on. Press “” again to turn it off. The backlight turns off automatically after 30 seconds.



9.8 Sensor Axis Selector:

Press “” key to change sensor axis selector:

“All axis” □ “X axis” □ “Y axis” □ “Z axis”



9.9 Alarm ON/OFF Setup

Press and hold “” then press “” key to switch the alarm function on. The “ALARM” symbol in the display indicates that the alarm function is on. Press

and hold "O" and "RECALL" keys to turn off the alarm function. When the Alarm sounds, the display shows



9.10 Viewing Data Records

Press and hold the "O" button and press the "PAGE DOWN" button to view the saved data records. Use "PAGE UP" or "PAGE DOWN" button to see the next or previous records. Press the "ENTER" key to close and exit this mode.



9.11 Clock LCD Display

Press and hold the "O" and "PAGE DOWN" buttons to select the display method of the Year, Month, Date, Hour and Second.

This meter's clock uses 24 hour time setting.

Default time mode setting is "2010/01/07 00: 02" ":00".

00:2012,3 12009

:15

10 Setup Mode

Press and hold "0" button and then "SET" button to enter the setup mode.

Press "SET" button to scroll through the setup functions.



Push "ENTER" button to save setup data.

You can set up 6 different functions in setup mode:



- Setup 1: Clock Setup-1
- Setup 2: Setting the Alarm Limit Value (ALARM)-2
- Setup 3: Clear Data Logger Memory-3
- Setup 4: Analogue Bar Graph Setup-4

- Setup 5: Auto Power-Off Time Function Setup-5
- Setup 6: Setting the Calibration Factor (CAL)-6



10.1 Clock Setup-1


Press and hold the “” button and then press “” button to enable Clock Setup.

This meter clock is 24 hour time setting.

Use “” or “” to change the setting (Hour Day

Month Year Minute).

Use “” or “” to select the setting you want to adjust.

Press “” button to save the setting.

Date/Time default format : 2009/12/21 12:12.

Year format: 2000~2099 display as 00 ~ 99.

1231 1231 1231
 08:38 2009 08:38 2009 09:38 2009
 1221 1221 1221
 09:38 2009 09:38 2009 09:38 2009


10.2 Setting the Alarm Limit Value (ALARM)-2


The alarm limit value determines the level at which the alarm will sound. The alarm limit value can be edited only in the V/m unit. The ALARM setting range is from 0.001 to 999.9V/m.


ALARM default is set at 999.9V/m.



Alarm limit function is only used for total three axial value.


While the meter in ON, press and hold "⊖" button and press "⊕" button to enter Setup Mode.

Press “” button 1 more time to enter the alarm setting mode, the readout value is flashing and “V/m” unit is displayed.

Press “” key to move decimal.



Press “” key to select the desired digit.


Press “” and “” button to change digit.

Press “” key to store the new setting value and exit.




10.3 DEL Data Logger Memory Setup-3



While the meter in ON, press and hold the “” button and press “” button to enter Setup Mode.

Press “” button 2 more times to enter clear data logger memory mode.






“ 000 ” will show on the display.

To exit without clearing memory, press “” key



To clear the memory, press “” then press “”.

10.4 Analog bar graph setup-4


While the meter in ON, press and hold the “” button and then press “” button to enter Setup Mode.

Press “” button 3 more times to enter analog bar graph setting mode. The “graph” unit is flashing.






Current setting of x1, x10, or x100 is displayed at bottom of graph. X1 is normal setting. X10 is 10 times more sensitive, x100 is 100 times more sensitive.


Press “” or “” to select the desired value:



Press “” key to store the new setting value and exit.

10.5 Auto Power-Off Function Setup-5



While the meter is on, press and hold the “” button and press “” button to enter the auto power-off setup mode. Press “” button 4 more times. Press “” and “” button to change the value. Auto power-off time default setting is 15 minutes. Maximum auto power-off time: 99 minutes. Set value to 00 to disable auto power-off.


Press “” key to store the new setting value and exit.



The symbol  is displayed.






10.6 Setting the calibration factor (CAL)-6

Press “” button and press “” button to enter Setup Mode.

Press “” button 5 more times to enter the calibration factor setup mode. The CAL setting range is from 0.10 to 9.99. Default is 1.00 which is appropriate for most situations.

Use “” or “” to select the desired digit.

Press “” and “” button to change the digit

Press “” key to store the new setting value and exit.



10.7 Calibration Factor (CAL)

The calibration factor CAL serves to calibrate the display for a specific frequency when the frequency of a single signal is known. The field strength value measured internally is multiplied by the value of CAL that has been entered and the resulting value is displayed. The CAL factor is often used as a means of entering the sensitivity of the field sensor in terms of its frequency response in order to improve measurement accuracy.

11 Making Measurements

Important: The following effect will be noted with all field strength meters. If the sensor is moved quickly, excessive field strength values could be displayed. This effect is caused by electrostatic charges.

Recommendation: Hold the meter steady during the measurement.

11.1 Short-term Measurements

Application: Use either the “instantaneous” or the “Max. instantaneous” mode if the characteristics and orientation of the field are unknown when entering an area exposed to electromagnetic radiation.

Procedure: Hold the meter at arm’s length. Make several measurements at various locations around your work place or the interested areas as described above. This is particularly important if the field conditions are unknown and possibly dangerous. Pay special attention to measuring the vicinity of possible radiation sources. Apart from active sources, those components connected to a source may also act as radiators. For example , the cables used in diathermy equipment may also radiate electromagnetic energy. Note that metallic objects within the field may locally concentrate or amplify the field from a distant source.

11.2 Long-term Exposure Measurements

Location: Place the meter between yourself and the suspected source of radiation. Make measurements at those points where parts of your body are nearest to the source of radiation.

Note: Use the “Average” or” Max average” modes only when the instantaneous measurement values are fluctuating greatly. You may fix the meter to a wooden or plastic tripod.

12 Specifications

12.1 General Specifications

| | |
|----------------------------|--|
| Display Type | Liquid-crystal (LCD), 4-1/2 digits, maximum reading 19999 |
| Measurement Method | Digital, triaxial measurement |
| Directional Type | Isotropic (triaxial) |
| Range Selection | One continuous range |
| Resolution | 0.1mV/m, 0.1 μ A/m, 0.001 μ W/m ² , 0.001 μ W/cm ² |
| Setting Time | Typically 1.5s (0 to 90% measurement value) |
| Sample Rate | 3 times per second |
| Units | mV/m, V/m, μ A/m, mA/m, μ W/m ² , mW/m ² , μ W/cm ² |
| Display Value | Instantaneous measured value, maximum value, average value, or maximum average value |
| Audible Alarm | Buzzer |
| Alarm Function | Adjustable threshold with ON / OFF |
| Calibration Factor | Adjustable |
| Data Storage/Recall | 200 Data Sets |
| Batteries | 9V |
| Battery Life | Approximately 15 hours |
| Auto Power-Off | Default time 15 minutes. Adjustable threshold 0~99 minutes |
| Dimensions | 60(L) x 60(W) x 195(H) mm |
| Weight | Approx. 200g (including battery) |

12.2 Electrical specifications

Unless otherwise stated, the following specifications hold for the following conditions:

- The meter is located in the far field of a source
- Sensor head is pointed towards the source
- Ambient Temperature: +23 °C, ±3°C
- Relative Humidity: 25%~75%

| | |
|---|--|
| Sensor Type | Electrical field (E) |
| Frequency Range | 50MHz ~ 3.5GHz |
| Specified Measurement Range | <ul style="list-style-type: none"> ● CW signal (f >50MHz): <ul style="list-style-type: none"> ▪ 38mV/m to 20.00V/m ▪ 53.0µA/m to 53.74mA/m ▪ 0.1µW/m² to 1.089W/m² ▪ 0.001µW/cm² to 108.9µW/cm² |
| Dynamic Range | <ul style="list-style-type: none"> ● Dynamic range: Typically 75dB |
| Absolute error at 1V/m and 2.45GHz | <ul style="list-style-type: none"> ● 2.45GHz: ±1.0 dB |
| Frequency Response | <ul style="list-style-type: none"> ● Sensor taking into account the typical CAL factor: <ul style="list-style-type: none"> ▪ ±2.4dB (50 MHz to 1.9 GHz) ▪ ±1.0 dB (1.9 GHz to 3.5GHz) |
| Isotropy Deviation | <ul style="list-style-type: none"> ● Typically ±1.0 dB (2.45GHz) |
| Overload Limit | <ul style="list-style-type: none"> ● 0.42mW/cm², (11 V/m) per axis |
| Overload Limit | <ul style="list-style-type: none"> ● (0 to 50°C): ±0.2dB |

12.3 Units of Measurement

The meter measures the electrical component of the field; the default units are those of electrical field strength (mV/m or V/m). The meter converts the measurement values to the other units of measurement, i.e. the corresponding magnetic field strength units ($\mu\text{A/m}$ or mA/m) and power density units ($\mu\text{W/m}^2$, mW/m^2 or $\mu\text{W/cm}^2$) using the standard far-field formula for electromagnetic radiation.

12.4 Result modes

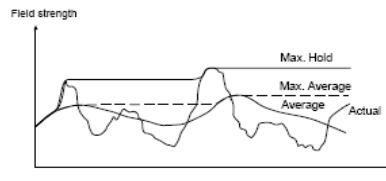
The bar graph display always shows the instantaneous measured dynamic range value. The digital display shows the result according to one of three modes, which can be selected.

Instantaneous: The display shows the last value measured by the sensor, no symbol is displayed. Instantaneous mode is the default setting when the meter is turned on.

Maximum instantaneous (MAX): The digital display shows the highest instantaneous value measured so far, the "MAX" symbol is displayed.

Average (AVG): The digital display shows the average value measured, the "AVG" symbol is displayed.

The following graph shows Instantaneous (actual), MAX (hold), AVG and MAX/AVG:



13 Service, Repairs, Calibration

- The following are instructions regarding policies for servicing, repairing or calibrating Anaheim Scientific products. Turnaround time is usually less than ten (10) working days unless expedited service is requested and pre-arranged.
- Send an email to requesting an RMA number specifying your request for either service/repair and/or calibration with your product's model number.
- Once you receive a reply from , you will be asked to ship prepaid to the address below. Package the unit carefully using filler or bubble wrap, and if possible, ship in the original box. Ship each unit separately. (Anaheim Scientific is not responsible for any shipping damage that may occur.)

- Include a packing list with each unit shipped stating what type of service is required and include the return shipping information: name, address and telephone number.
- If the unit is in warranty, please provide the following: proof of purchase or copy of the original invoice.
- If the unit is out of warranty, prepayment is required by Check, Money Order or Credit Card.
- Return all merchandise to Anaheim Scientific with pre-paid shipping. The flat-rate repair charge for Non-Warranty Service does not include return shipping. Return shipping to locations in North American is included for Warranty Service.
- For overnight shipments and non-North American shipping fees please contact Anaheim Scientific
-

14 Limited Two-Year Warranty

- Scientific warrants to the original purchaser that its products and the component parts thereof, will be free from defects in workmanship and materials for a period of two years from date of purchase.
- Anaheim Scientific will, without charge, repair or replace, at its option, defective product or component parts. Returned product must be accompanied by proof of the purchase date in the form of a sales receipt.
- To help us better serve you, please complete the warranty registration for your new instrument via our website [_____](#)
- Exclusions: This warranty does not apply in the event of misuse or abuse of the product or as a result of unauthorized alterations or repairs. The warranty is void if the serial number is altered, defaced or removed.
- Anaheim Scientific shall not be liable for any consequential damages, including without limitation damages resulting from loss of use. Some states do not allow limitations of incidental or consequential damages. So the above limitation or exclusion may not apply to you.
- This warranty gives you specific rights and you may have other rights, which vary from state-to-state.