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EM420A/420B

DIGITAL MULTIMETER

OWNERS MANUAL

Read this owners manual thoroughly before use

WARRANTY

This instrument is warranted to be free from defects in material and workmanship for a period of one year. Any instrument found defective within one year from the delivery date and returned to the factory with transportation charges prepaid, will be repaired, adjusted, or replaced at no charge to the original purchaser. This warranty does not cover expandable items such as batteries or fuses. If the defect has been caused by a misuse or abnormal operating conditions, the repair will be billed at a nominal cost.

SAFETY INFORMATION

EM420A and EM420B digital multimeters have been designed according to IEC-61010 concerning electronic measuring instruments with a measurement category (CAT II 600V) and pollution degree 2.

⚠ Warning

To avoid possible electric shock or personal injury, follow these guidelines:

a. Do not use the meter if it is damaged. Before you use the meter, inspect the case. Pay particular attention to the insulation surrounding the connectors.
b. Inspect the test leads for damaged insulation or exposed metal. Check the test leads for continuity. Replace damaged test leads before you use the meter.

c. Do not use the meter if it operates abnormally. Protection may be impaired. When in doubt, have the meter serviced.
d. Do not operate the meter around explosive gas, vapor, or dust.
e. Do not apply more than the rated voltage, as marked on the meter, between terminals or between any terminal and earth ground.
f. Before use, verify the meter's operation by measuring a known voltage.
g. When measuring current, turn off circuit power before connecting the meter in the circuit. Remember to place the meter in series with the circuit.
h. When servicing the meter, use only specified replacement parts.
i. Use caution when working above 30V ac rms, 42V peak, or 60V dc. Such voltages pose a shock hazard.
j. When using the probes, keep your fingers behind the finger guards on the probes.
k. When making connections, connect the common test lead before you connect the live test lead. When you disconnect test leads, disconnect the live test lead first.
l. Remove the test leads from the meter before you open the battery cover or the case.
m. Do not operate the meter with the battery cover or portions of the case removed or loosened.
n. To avoid false readings, which could lead to possible electric shock or personal injury, replace the batteries as soon as the low battery indicator ("  ") appears.

o. To avoid electric shock, don't touch any live conductor with hand or skin.

p. Remaining endangerment:
When an input terminal is connected to dangerous live potential it is to be noted that this potential at all other terminals can occur!

q. CATII - Measurement Category II is for measurements performed on circuits directly connected to low voltage installation.(Examples are measurements on household appliances, portable tools and similar equipments .) Do not use the meter for measurements within Measurement Categories III and IV.

Caution

To avoid possible damage to the meter or to the equipment under test, follow these guidelines:

a. Disconnect circuit power and discharge all capacitors before testing resistance, diode, continuity, temperature or capacitor.

b. Use the proper terminals, function, and range for your measurements.

c. Before measuring current, check the meter's fuse and turn off the power to the circuit before connecting the meter to the circuit.

d. Before rotating the range switch to change functions, remove the test leads or the clamp from the circuit under test.

e. Before inserting transistor to the adapter, always be sure all the test leads have been removed from the meter.

f. Remove test leads from the meter before opening the battery cover

or the case.

Symbols

~	AC (alternating current)
⎓	DC (direct current)
≂	DC or AC (alternating current or direct current)
⚠	Important safety information. Refer to the manual.
⚠	Dangerous voltage may be present. Be cautious.
⏚	Earth ground
⏛	Fuse
CE	Conforms to European Union directives
⧈	Double insulated
	Low battery
	Diode
MAX H	The maximum value is being held.
DATA H	The display data is being held.
°F	Fahrenheit
°C	Centigrade
	Continuity test
	Measurement with clamp (optional), widening the field of applications of the meter
AUTO	Autorange

Maitenance

To continue protection against fire, replace fuse only with the specified voltage and current ratings : F 250 mA L 250V, fast action

To clean the meter, use a damp cloth and mild detergent only, do not use abrasives or solvents on it.

GENERAL DESCRIPTION

This digital multimeter is compact 3 1/2 digits digital multimeter for measuring DC and AC voltage, DC and AC current, resistance, temperature, diode, transistor, continuity, capacitance (only EM420B) and battery (only EM420A). It has the functions of polarity indication, data hold, maximum value hold, overrange indication and automatic power-off. It can be operated easily and is an ideal instrument tool.

INSTRUCTION

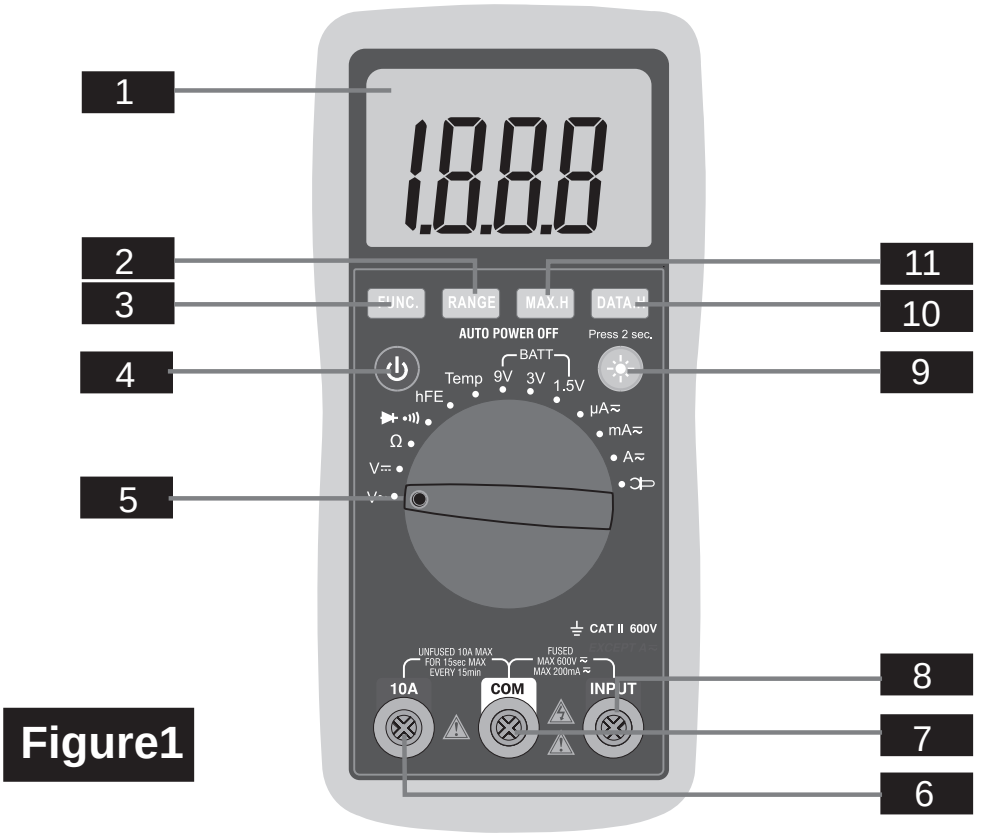

Figure1

1. Display
   3 1/2 digit LCD, with a max. reading of 1999
2. "RANGE" Button
   The meter defaults to the autorange mode when you measure the voltage, current or resistance. When the meter is in the autorange mode, "AUTO" is displayed.
   To enter and exit the manual range mode:
   a. Press "RANGE" button
      The meter enters the manual range mode and the symbol "AUTO" turns off.

Each press of the "RANGE" button increments the range. When the highest range is reached, the meter wraps to the lowest range.

b. To exit the manual range mode, press and hold down the "RANGE" button for 2 seconds, the meter returns to the autorange mode and the symbol "AUTO" is displayed again.

3. "FUNC." Button
   When you measure the current, pressing this button will switch the meter between DC function and AC function.
   When you measure the temperature, pressing this button will switch the meter between * mode and * mode.
   When you measure the diode or the continuity, pressing this button will switch the meter between the diode and the continuity functions.
4. Power Switch
   It can be used to turn on/off the meter.
5. Function/Range Switch
   This switch can be used to select desired function and range.
6. "10A" Jack
   Plug-in connector for the red test lead for current (200mA~10A) measurements.
7. "COM" Jack
   Plug-in connector for black (negative) test lead.
8. "INPUT" Jack
   Plug-in connector for the red test lead for all measurements except current (⩾ 200mA) measurements.
9. " ☼ " Button
   To turn on or off the backlight, press and hold this button for about 2 seconds.

The backlight will turns off automatically about 15 seconds later after you turn on it.

10. "**DATA H**" Button

    After pressing the button, the present reading is held on the display, meanwhile " DATA H " is displayed on the LCD as an indicator. To exit the Hold Mode, press the button again and the indicator " DATA H " will disappear.

11. "**MAX H**" Button

    To hold the maximum value, press this button, and "MAX H" will appear as an indicator, the meter will hold the maximum value of all readings taken since the button was pressed. To exit the maximum value hold mode, just press this button gain, and "MAX H" will disappear.

    In some ranges, the maximum value hold mode is not available.

GENGRAL SPECIFICATION

Display: LCD, 1999 counts, updates 2-3 times/sec
Overrange Indication: "OL" shown on the display
Battery: 1.5V X 3, AAA
Polarity Indication: "–" displayed automatically
Low Battery Indication: "  " shown on the display
Operating Temperature: 0°C to 40°C, <75%RH
Storage Temperature: -10°C to 50°C, <85%RH
Dimensions: 158 X 75 X 35 mm
Weight: about 200g (including battery)

SPECIFICATIONS

Accuracy is specified for a period of one year after calibration and at 18°C to 28°C, with relative humidity < 75%. Accuracy specifications take the form of:
±([% of Reading]+[number of Least Significant Digits])

DC Voltage

Range	Resolution	Accuracy
200mV	0.1mV	± (0.8%+5)
2V	0.001V	
20V	0.01V	
200V	0.1V	
600V	1V	± (1%+5)

Input Impedance: 10MΩ
Overload Protection: 600V DC/AC rms
(200mV range : 250V DC/AC rms)
Max. Input Voltage: 600V DC

AC Voltage

Range	Resolution	Accuracy
2V	0.001V	± (1.0%+5)
20V	0.01V	
200V	0.1V	
600V	1V	± (1.2%+5)

Input Impedance: 10MΩ
Frequency Range: 40Hz ~ 400Hz
Overload Protection: 600V DC/AC rms
Response: Average, calibrated in rms of sine wave
Max. Input Voltage: 600V AC rms

DC Current

Range	Resolution	Accuracy
200µA	0.1µA	± (1.2%+5)
2000µA	1µA	
20mA	0.01mA	
200mA	0.1mA	
2A	0.001A	± (2.0%+10)
10A	0.01A	

Overload Protection:
µA≂ and mA≂ ranges: F 250mA L 250V fuse
2A and 10A ranges: unfused
Max. Input Current:
"INPUT" jack : 200mA
"10A" jack: 10A
(For measurements > 5A : duration <15 seconds,
interval >15 minutes)
Voltage Drop: 200µA, 20mA and 2A ranges : 20mV
2000µA, 200mA and 10A ranges: 200mV

AC Current

Range	Resolution	Accuracy
200µA	0.1µA	±(1.5%+5)
2000µA	1µA	
20mA	0.01mA	
200mA	0.1mA	
2A	0.001A	±(3.0%+10)
10A	0.01A	

Overload Protection:

µA≂ and mA≂ ranges: F 250mA L 250V fuse

2A and 10A ranges: unfused

Max. Input Current:

"INPUT" jack : 200mA

"10A" jack: 10A

(For measurements > 5A : duration <15 seconds, interval >15 minutes)

Voltage Drop: 200µA, 20mA and 2A ranges : 20mV

2000µA, 200mA and 10A ranges: 200mV

Frequency Range: 40Hz ~ 400Hz

Response: Average, calibrated in rms of sine wave

DC Current (with clamp, optional)

	Range	Resolution	Accuracy
meter	⊐⊏ 200A	0.1mV/0.1A	±(1.2%+5)
meter	⊐⊏ 1000A	1mV/1A	±(1.2%+5)

Overload Protection: 250V DC/AC rms
Max. Input Voltage: 200mV

AC Current (with clamp, optional)

	Range	Resolution	Accuracy
meter	⊃⊢ 200A	0.1mV/0.1A	±(1.5%+5)
meter	⊃⊢ 1000A	1mV/1A	±(1.5%+5)

Overload Protection: 250V DC/AC rms
Max. Input Voltage: 200mV
Frequency Range: 40Hz ~ 400Hz
Response: Average, calibrated in rms of sine wave

Resistance

Range	Resolution	Accuracy
200Ω	0.1Ω	±(1.2%+5)
2kΩ	0.001kΩ	±(1%+5)
20kΩ	0.01kΩ	
200kΩ	0.1kΩ	
2MΩ	0.001MΩ	±(1.2%+5)
20MΩ	0.01MΩ	±(1.5%+5)

Open Circuit Voltage: about 0.25V
Overload Protection: 250V DC/AC rms

Temperature (°C, °F)

Range	Resolution	Accuracy
-20°C ~ 1000°C	1°C	-20°C~0°C: ±(5%+4)
		0°C~400°C: ±(1%+3)
		400°C~1000°C: ±(2%+3)
-0°F~ 1800°F	1°F	-0°F~50°F: ±(5%+4)
		50°F~750°F: ±(1%+3)
		750°F~1800°F: ±(2%+3)

Overload Protection: 250V DC/AC rms

Battery (only EM420A)

Range	Resolution	Function
1.5V	0.01V	The approx. voltage of the battery is shown on the LCD.
3V	0.01V	
9V	0.01V	

Overload Protection:

1.5V and 3V ranges: F 250mA L 250V fuse

9V range: 250V DC/AC rms

Test Current : 1.5V range: about 50mA

3V range: about 30mA

9V range: about 12mA

Capacitance (only EM420B)

Range	Resolution	Accuracy
20nF	0.01nF	±(8%+10)
200nF	0.1nF	±(5%+5)
2μF	0.001μF	
20μF	0.01μF	
200μF	0.1μF	
1000μF	1μF	±(8%+10)

Overload Protection:

200μF and 1000μF ranges: no overload protection

the other ranges: F 250mA L 250V fuse

Open Circuit Voltage: about 0.5V

Overload Protection: 250V DC/AC rms

Transistor hFE Test

Range	hFE	Test Current	Test Voltage
PNP & NPN	0~1000	Ib ≈ 2μA	Vce ≈ 1V

Diode and Continuity

Range	Introduction	Remark
	The approximate forward voltage drop will be displayed.	Open Circuit Voltage: about 1. 5V
	The built-in buzzer will sound if the resistance is less than about 30Ω.	Open Circuit Voltage: about 0. 5V

Overload Protection: 250V DC/AC rms

For Continuity Test:

When the resistance is between 30Ω and 100Ω, the buzzer may sound or may not sound. When the resistance is more than 100Ω, the buzzer won't sound.

OPERATION INTRODUCTION

Measuring Voltage

1. Connect the black test lead to the "COM" jack, and the red test lead to the "INPUT" jack.
2. Set the range switch to $\underline{\underline{V}}$ or $\underline{\sim V}$ position.
   Select auto range or manual range with the "RANGE" button.
3. In manual range, if the voltage magnitude to be measured is not known beforehand, select the highest range.
4. Connect the test leads across the source or load to be measured.
5. Read the reading on the display. For DC voltage measurement, the polarity of the red test lead connection will be indicated as well.

Note:

1. In small range, the meter may display an unstable reading when the test leads have not been connected to the load to be measured. It is normal and will not affect the measurements.
2. In manual range mode, when the meter shows the overrange symbol "OL", a higher range has to be selected.
3. To avoid damage to the meter, don't measure a voltage which exceeds 600Vdc (for DC voltage measurement)or 600Vac (for AC voltage measurement).

Measuring Current

1. Connect the black test lead to the "COM" jack. If the current to be measured is less than 200mA, connect the red test lead to the "INPUT" jack. If the current is between 200mA and 10A , connect the red test lead to the "10A" jack instead.
2. Set the range switch to desired μA≂, mA≂ or A≂ range. If the the current magnitude to be measured is not known beforehand, set the range switch to the highest range position and then reduce it range by range until satisfactory resolution is obtained.
3. Select DC current measurement or AC current measurement with the "FUNC." button.
4. Select auto range or manual range with the "RANGE" button. In manual range, if the the current magnitude to be measured is not known beforehand, select the highest range.
5. Connect test leads in series with the circuit to be measured.
6. Read the reading on the display. For DC current measurement, the polarity of the red test lead connection will be indicated as well.

Note:

1. When the display shows the overrange symbol "OL", a higher range has to be selected.

Measuring Current (with clamp, optional)

1. If you want to measure DC current, you must use the DC clamp. If you want to measure AC current, you must use the AC clamp.
2. Connect the negative (–) output lead of the selected clamp to the "COM" jack, connect the positive (+)output lead of the clamp to the "INPUT" jack,
3. Set the range switch to ⊐⊢ position.
4. Select DC current measurement or AC current measurement with the "FUNC." button.
5. Select auto range or manual range with the "RANGE" button. In manual range, if the the current magnitude to be measured is not known beforehand, select the highest range.
6. Clamp the circuit to be measured with the clamp.
   Note: Each time only one cable should be clamped and the cable should be in the center of the clamp jaws.
7. Read the reading on the display. For DC current measurement, the polarity of the positive (+) output lead of the clamp will be indicated as well.

Note:

1. In manual range mode, when the display shows the overrange symbol "OL", a higher range has to be selected.
2. Don't touch the circuit under test with hand or skin.
3. Matching problem about the meter and the sensitivity of the clamp :
   a. The sensitivity of the matching clamp is 0.1A/0.1mV. If you use a matching clamp, the present indicated value is same to the measured value.

b. If you use a clamp whose sensitivity does not equal 0.1A/0.1mV, you should multiply the present reading by a factor which is determined by the used clamp, the result is the measured value.
To determine the factor, plese refer to the instruction of the clamp which you use.

Measuring Resistance

1. Connect the black test lead to the "COM" jack and the red test lead to the "INPUT" jack (Note: The polarity of the red test lead is positive "+").
2. Set the range switch to Ω range.
3. Select auto range or manual range with the "RANGE" button. In manual range mode, when the display shows the overrange symbol "OL", a higher range has to be selected.
4. Connect the test leads across the load to be measured.
5. Read the reading on the display.

Note:

1. For resistance measurements > 1MΩ, the meter may take a few seconds to stabilize reading. This is normal for high-resistance measurement.
2. When the input is not connected, i.e. at open circuit, the symbol "OL" will be displayed as an overrange indicator.
3. Before measuring in-circuit resistance, be sure that the circuit under test has all power removed and all capacitors are fully discharged.

Measuring Capacitance (only EM420B)

1. Connect the black test lead to the "COM" jack and the red test lead to the "INPUT" jack.
2. Set the range switch to desired "1000µF","20µF" or "nF" position.
3. Select auto range or manual range with the "RANGE" button.
4. Connect test leads across the capacitor to be measured. Make sure that the polarity of connection is observed (The red test lead should be connected to the anode of the capacitor, the black one should be connected to the cathode of the capacitor).
5. Read the reading on the display.

Note:

In small range, before the test leads are connected to the capacitor, the display may show a reading, it is normal because of the stray capacitance of the test leads and input circuit of the meter. It will not affect the measurement accuracy.

Continuity Test

1. Connect the black test lead to the "COM" jack and the red test lead to the "INPUT" jack (Note: The polarity of the red test lead is positive "+").
2. Set the range switch to •)) range.
3. Press the "FUNC." button to select continuity measurement mode, and the symbol " •)) " will appear as an indicator.
4. Connect the test leads to the circuit to be measured.
5. If the circuit resistance is lower than about 30Ω, the built-in buzzer will sound.

Diode

1. Connect the black test lead to the "COM" jack and the red test lead to the "INPUT" jack (Note: The polarity of the red test lead is positive "+").
2. Set the range switch to ⊣◀ range.
3. Press the "FUNC." button to select diode measurement mode, and the symbol "⊣◀" will appear as an indicator.
4. Connect the red test lead to the anode of the diode to be tested and the black test lead to the cathode.
5. The meter will show the approximate forward voltage of the diode. If the connections are reversed, "OL" will be shown on the display.

Transistor Test

1. Set the range switch to h_{FE} position.
2. Refer to the Figure 2 , connect the adapter to the "COM" jack and the "INPUT" jack. Don't reverse the connection.
3. Identify whether the transistor is NPN or PNP type and locate emitter, base and collector lead. Insert the leads of the transistor to be tested into the proper holes of the transistor test socket of the adapter .
4. LCD display will show the approximate hFE value.

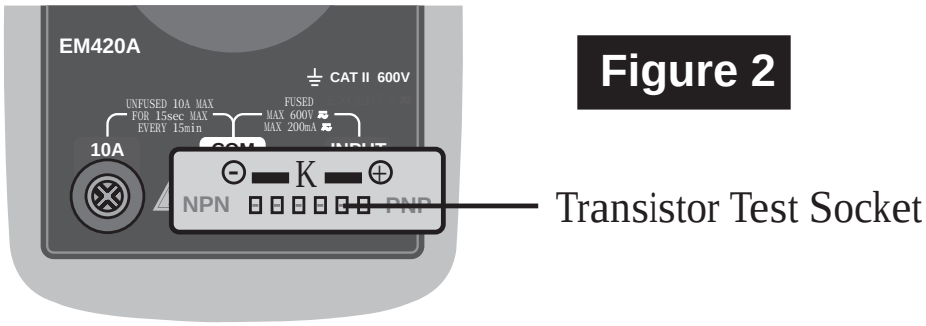

Figure 2

Measuring Temperature

1. Set the range switch to Temp range.
2. Press the "FUNC." button to select °C or °F mode, and the symbol " °C " or " °F " will appear as an indicator.
3. Insert the black (or "−") plug of the K type thermocouple to the "COM" jack, and the red (or "+") plug to the "INPUT" jack.
4. Carefully touch the end of the thermocouple to the object to be measured.
5. Wait a while, read the reading on the display.

Battery Test (only EM420A)

1. Connect the black test lead to the "COM" jack and the red test lead to the "INPUT" jack (Note: The polarity of the red test lead is positive "+").
2. According to the different type of the battery (1.5V, 3V, 9V) to be tested, set the range switch to the desired BATT range.
3. Connect the test leads to the battery to be tested.
4. Read the reading on the display. The polarity of the red test lead connection will be indicated .

Auto Power Off

If you don't operate the meter for about 15 minutes, it will turn off automatically. To turn on it again, just rotate the range switch or press a button.
If you press the "DATA H" button to arouse the meter after it turns off automatically, the automatic power-off function will be disabled.

BATTERY REPLACEMENT

When the symbol " " appears on the display, it shows that the battery should be replaced. To replace the battery, use an appropriate screwdriver to gently rotate the rotary lock on the battery cover by 90^{o} in the indicated direction (refer to Figure 3). Remove battery cover, replace the exhausted batteries with new batteries of the same type ("AAA" type). Reinstall the battery cover, and gently rotate the rotary lock by 90^{o} clockwise to lock the battery cover.

Note:
Excess force will cause damage to the rotary lock.
Don't use a screwdriver which is not big enough.

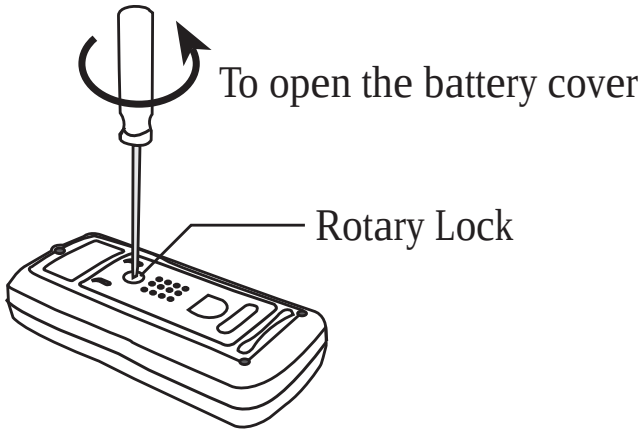

Figure 3

FUSE REPLACEMENT

Fuse rarely needs replacement and is blown almost always as a result of operator's error. This meter uses a fuse: F 250mA L 250V*fast action
To replace the fuses, open the battery cover, replace the damaged fuse with a new fuse of the specified ratings.
Reinstall the battery cover and lock this cover.

ACCESSORIES

Owners manual : 1 piece
Test leads: 1 pair
K type thermocouple : 1 piece
Adapter : 1 piece
DC Clamp*optional*
AC Clamp *optional*

http://www.all-sun.com

DISPOSAL OF THIS ARTICLE

Dear Customer,
If you at some point intend to dispose of this article, then please keep in mind that many of its components consist of valuable materials, which can be recycled.
Please do not discharge it in the garbage bin, but check with your local council for recycling facilities in your area.