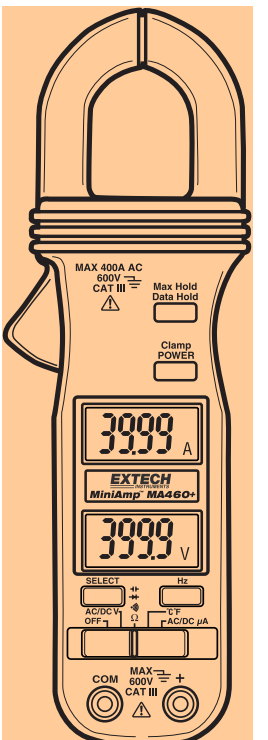
User's Guide

EXTECH INSTRUMENTS

MiniAmp™ Series
Clamp-on Multimeters

Models:

MA400
MA420
MA440
MA460+



WARRANTY

EXTECH INSTRUMENTS CORPORATION warrants this instrument to be free of defects in parts and workmanship for one year from date of shipment (a six month limited warranty applies on sensors and cables). If it should become necessary to return the instrument for service during or beyond the warranty period, contact the Customer Service Department at (781) 890-7440 ext. 210 for authorization. **A Return Authorization (RA) number must be issued before any product is returned to Extech.** The sender is responsible for shipping charges, freight, insurance and proper packaging to prevent damage in transit. This warranty does not apply to defects resulting from action of the user such as misuse, improper wiring, operation outside of specification, improper maintenance or repair, or unauthorized modification. Extech specifically disclaims any implied warranties or merchantability or fitness for a specific purpose and will not be liable for any direct, indirect, incidental or consequential damages. Extech's total liability is limited to repair or replacement of the product. The warranty set forth above is inclusive and no other warranty, whether written or oral, is expressed or implied.

Introduction

Congratulations on your purchase of Extech model MA400, MA420, MA440 or MA460+ clamp-on multimeter. Properly used, this meter will provide many years of reliable service.

Clamp meter functions common to all meters:
- Autoranging
- AC Current Measurements
- Data Hold
- Auto Power Off
- Maximum Hold captures 30ms peaks
- 1.1" (28mm) Jaw size

MultiMeter functions common to all models:
- AC/DC Voltage to 600V
- Resistance to 40MΩ
- Capacitance and Frequency tests

Features unique to the MA440 and MA460+ models:
- Twin 4000 count LCD displays
- Simultaneous display of Current/Voltage, Current/Resistance, or Current/Temperature (MA460+)

Features common to the MA400 and MA420 models:
- Single 4000 count LCD display
- Relative zero function
- True rms (MA420) for current and voltage measurements

Safety

International Safety Symbols


Caution ! Refer to the explanation in this Manual


Warning ! Risk of electric shock


Earth (Ground)


Double Insulation or Reinforced insulation


Fuse


AC--Alternating Current


DC--Direct Current

Safety Precautions

1. Improper use of this meter can cause damage, shock, injury or death. Read and understand this users manual before operating the meter.
2. Make sure any covers or battery doors are properly closed and secured.
3. Always remove the test leads before replacing the battery or fuses.
4. Inspect the condition of the test leads and the meter itself for any damage before operating the meter. Repair or replace any damage before use.
5. Do not exceed the maximum rated input limits.
6. Use great care when making measurements if the voltages are greater than 25VAC rms or 35VDC. These voltages are considered a shock hazard.
7. Always discharge capacitors and remove power from the device under test before performing Capacitance, Diode, Resistance or Continuity tests.
8. Remove the battery from the meter if the meter is to be stored for long periods.
9. To avoid electric shock, do not measure AC current on any circuit whose voltage exceeds 600V AC.
10. Voltage checks on electrical outlets can be difficult and misleading because of the uncertainty of connection to the electrical contacts. Other means should be used to ensure that the terminals are not "live".
11. The product is intended only for indoor use
12. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.
13. Pollution degree: 2

PER IEC1010 OVERVOLTAGE INSTALLATION CATEGORY

OVERVOLTAGE CATEGORY I

Equipment of OVERVOLTAGE CATEGORY I is equipment for connection to circuits in which measures are taken to limit the transient overvoltages to an appropriate low level. Note – Examples include protected electronic circuits.

OVERVOLTAGE CATEGORY II

Equipment of OVERVOLTAGE CATEGORY II is energy-consuming equipment to be supplied from the fixed installation.

Note – Examples include household, office, and laboratory appliances.

OVERVOLTAGE CATEGORY III

Equipment of OVERVOLTAGE CATEGORY III is equipment in fixed installations.

Note – Examples include switches in the fixed installation and some equipment for industrial use with permanent connection to the fixed installation.

OVERVOLTAGE CATEGORY IV

Equipment of OVERVOLTAGE CATEGORY IV is for use at the origin of the installation.

Note – Examples include electricity meters and primary over-current protection equipment

Specifications

DC Voltage

RANGE	Accuracy
400.0mV	0.3% + 4d
4.000V, 40.00V, 400.0V	0.5% + 3d
600V	1.0% + 4d
NMRR: >50dB @ 50/60Hz, CMRR: >120dB @ DC, 50/60Hz, Rs=1kΩ Input impedance: 10MΩ, 30pF nominal, 1000MΩ on the 400.0mV range.	

AC Voltage

RANGE (50Hz to 500Hz)	Accuracy
4.000V, 40.00V, 400.0V	1.5% + 5d
600V	2.0% + 5d
CMRR: >60dB @ DC to 60Hz, Rs=1kΩ, Input Impedance: 10MΩ, 30pF nominal, True RMS models specified from 5% to 100% of range	

AC Current (Clamp-on)

RANGE (50/60Hz)	Accuracy
40.00A	1.9% + 8d
400.0A	1.9% + 8d*
600A**	unspecified
True RMS model specified from 10% to 100% of range *Accuracy specified to 350A continuous and 400A for 60 seconds max with a 5 minute cool down interval. ** Added range to indicate instantaneous over-range current values.	

Resistance

RANGE	Accuracy
400.0Ω	0.8% + 6d
4.000kΩ, 40.00kΩ, 400.0kΩ,	0.6% + 4d
4.000MΩ,	1.0% + 4d
40.00MΩ,	2.0% + 4d
Open circuit voltage: 0.4V typical.	

Capacitance

RANGE	Accuracy*
500.0nF, 5.000μF, 50.00μF, 500.0μF, 3000μF	3.5%* + 6d
50.00nF	Not specified
*Accuracies with a film capacitor or better *Specified with battery voltage above 2.8V (approximately half full battery). Accuracy decreases gradually to 12% at low battery warning voltage of approximately 2.4V.	

Frequency

Function	Sensitivity (ACrms)	Range
400.0mV	150mV	10Hz to 2kHz
4.000V	3.2V	5Hz to 40kHz
40.00V	25V	5Hz to 100kHz
400.0V	100V	5Hz to 100kHz
600V	400V	5Hz to 5kHz
400μA (MA440&460+)	500μA	10Hz to 30kHz
2000μA (MA440&460+)	500μA	10Hz to 30kHz
400.0A (MA400&420)	55A	40Hz to 400Hz
Display counts: 4999, Max resolution: 0.001Hz, Accuracy: 0.5% + 4d		

Temperature (MA460+ only)

RANGE	Accuracy
-4°F to 573°F	2% + 6°F
-20°C to 300°C	2% + 3°C
Accuracy does not include the type K thermocouple accuracy	

DC μA (MA440 & MA460+ only)

RANGE	Accuracy	Burden Voltage
400.0μA	1.5% + 4d	2.8mV/μA
2000μA	1.2% + 3d	

AC μA (MA440 & MA460+ only)

RANGE (50 to 500Hz)	Accuracy	Burden Voltage
400.0μA	2.0% + 5d	2.8mV/μA
2000μA	1.5% + 5d	

Accuracy Notes: Accuracy is ± (% reading digits + number of digits), or as otherwise specified, at 23°C ±5°C < 75% R.H. Model MA420 True RMS accuracies are specified from 10% to 100% of range or as otherwise specified. Maximum Crest Factor <1.75:1 at full scale & <3.5:1 at half scale (with frequency component within the specified frequency bandwidth for non-sinusoidal waveforms).

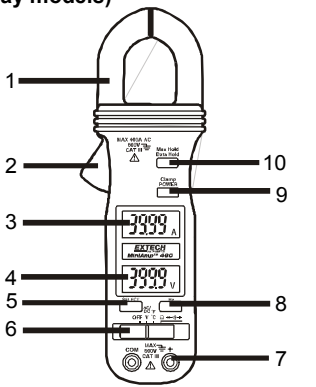
Audible Continuity:	Threshold between 10Ω and 120Ω. Response time < 100μs
Diode Test:	Open circuit voltage < 1.6VDC; Test current 0.25mA (typical)
Max Hold:	Accuracy ± 50 digits for changes > 25ms in duration
Digital Display:	4000-count LCD display(s); 3 per second nominal refresh rate
Low Battery:	Below approx. 2.4V
Operating Temperature:	32° to 104°F (0° to 40°C)
Storage Temperature:	-4° to 140°F (-20 to 60°C), <80% R.H. (with battery removed)
Relative Humidity:	80% to 88°F (31°C), decreasing linearly to 50% at 104°F (40°C)
Altitude:	Operating below 2000 meters
Temp. Coefficient:	Nominal 0.15 x specified accuracy per °C (between 0 and 18°C or 28 to 40°C), or as otherwise specified
AC Sensing:	True RMS on MA420, Average sensing on MA400, MA440 and MA460+
Auto Power Off:	After 30 minutes of inactivity

Safety:	The MiniAmp™ Series meters meet IEC61010-032(1994), EN61010-2-032(1995), UL3111-2-032(1999). MA440 and MA460+: Category III 600V AC & DC MA400 and MA420: Category II 600V AC & DC and Category III 300V AC & DC
E.M.C.:	Meets EN61326(1997, 1998/A1), EN61000-4-2(1995), and EN61000-4-3(1996) In an RF field of 1V/m: Capacitance function is not specified μA function: Total accuracy = Acc.+50 digits Other functions: Total acc. = Acc+ 30 digits Performance above 1V/m is not specified.
Overload Protection:	ACA Clamp-on jaws; AC 400A continuous +, COM and μA terminals; 600VDC/AC rms
Power Supply	1.5V alkaline button batteries (IEC/JIS LR44, GAP76 or V13GA). Two batteries for MA400 & MA420, four batteries for MA440 3V CR2032 button battery x2 for MA460+
Power Consumption:	2.5 mA typical. Power consumption during auto-power off; 0.8μA (typical). 25μA typical on the MA460+ temperature function and 150μA typical on the MA440 voltage and current functions
Dimension:	L7.5 x W2.5 x H1.26" (190mm x 63mm x 32mm)
Weight:	6.6oz. (187g)

Meter Description

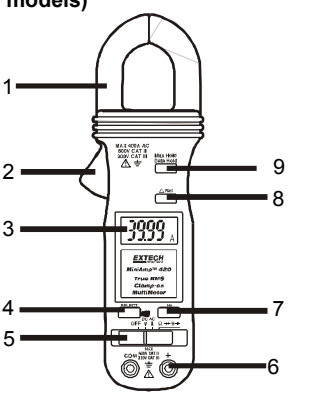
MA440 and MA460+ (double display models)

1. Clamp jaw
2. Jaw trigger
3. ACA LCD display
4. Multimeter LCD display
5. Select button
6. Multimeter function switch
7. Multimeter input jacks
8. Hz button
9. Clamp power button
10. Data Hold/Max Hold button



MA400 and MA420 (single display models)

1. Clamp jaw
2. Jaw trigger
3. LCD display
4. Select button
5. Multimeter function switch
6. Multimeter input jacks
7. Hz button
8. Relative button
9. Data Hold/Max Hold button



Operation

NOTICE: Read and understand all **warning** and **caution** statements listed in the safety section of this operation manual prior to using this meter.

AC/DC Voltage Measurements

1. Connections are made through the test lead terminals.
2. Insert the black test lead into the negative **COM** jack and the red test lead into the positive **+** jack.
3. Slide the function switch to the **"V"** position. Press the SELECT key momentarily to toggle between ACV and DCV.
4. Read the voltage measurement on the display.

Note: The 400mVDC range has 1000MΩ input impedance for the least current drain in small signal measurements. Also, the non-zero reading experienced when the test leads are open is normal.

AC Clamp-on Current Measurements

CAUTION: Do not make current measurements above 350A for longer than 60 seconds. Exceeding 60 seconds may cause damage to the meter.

1. For the MA400 and MA420, slide the function switch to the ACA position. For the MA440/MA460+, press the Clamp Power button.
2. Press the jaw trigger and clamp on a single conductor (fully enclosing it; do not allow a gap to open between the two halves of the jaw).
3. Read the current measurement on the display.

uA AC/DC Current Measurements (MA440 & MA460+ only)

1. uA Measurements are made through the test lead terminals.
2. Insert the black test lead to the **COM** terminal and the red test lead to the **+** terminal.
3. Slide the function switch to the "**uA"** position.
4. Press the SELECT button to choose AC or DC current.
5. Connect the test leads in series with the circuit under test.
6. Read the current measurement on the display

Resistance and Continuity Measurements

1. Insert the black test lead banana plug into the negative **COM** jack and the red test lead banana plug into the **+** jack.
2. Slide the function switch to the **"Ω •))"** position.
3. Press the SELECT key momentarily to select Continuity.
4. Touch the test probe tips across the circuit or part under test. It is best to disconnect one side of the part under test so the rest of the circuit will not interfere with the resistance reading.
5. For Resistance tests, read the resistance on the display.
6. For Continuity tests, If the resistance is < 10Ω to 120Ω, an audible tone will sound

Capacitance Measurements

1. Insert the black lead into the negative **COM** jack and the red test lead into the positive **+** jack.
2. Slide the function switch to the "⊣⊢" position.
3. Press the SELECT key repeatedly until capacitance units (F) are displayed in the LCD.
4. The **Rel** function (models MA400 and MA420) can be used to zero stray lead and circuit capacitance.
5. Touch the test leads to the capacitor to be tested and read the measured value.

Note: Battery voltage can affect the accuracy of capacitance measurements. Ensure that the battery is new when using the capacitance function. Refer to the specifications.

Frequency Measurements

1. Frequency measurements are available by pressing the HZ button when one of the following functions is selected;
   * Voltage (all models via the test leads)
   * ACA (MA400 and MA420 via the clamp)
   * μA (MA440 and MA460+ via the test leads)
2. Perform measurements as described for the function selected.

Notes on frequency sensitivity:
Input sensitivity varies automatically with range selected when the HZ function is selected. Activating the HZ function *while* measuring a signal will select the best sensitivity to avoid

electrical noise that may produce an unstable reading. However, if the HZ reading displays zero due to insufficient sensitivity, activate the HZ function *before* measuring the signal to select the highest Hz sensitivity.

Diode Test

1. Insert the black lead into the negative **COM** jack and the red test lead into the positive + jack
2. Slide the function switch to "▶|" position.
3. Press the SELECT key twice until "▶| " and "**V**" appear in the display.
4. Touch the test probe tips to the diode or semiconductor junction you wish to test. Note the meter reading.
5. Reverse the test lead polarity by reversing the red and black leads. Note this reading.
6. The diode or junction can be evaluated as follows:
   A. If one reading displays a value (typically 0.400V to 0.900V) and the other reading displays "OL", the diode is good.
   B. If both readings display "OL", the device is open.
   C. If both readings are very small or 0, the device is shorted.

Temperature Measurements (MA460+)

1. Insert the **Type K** thermocouple into the **COM** and + input jacks observing polarity.
2. Slide the function switch to the **"°C/°F"** position.
3. Use the SELECT key to toggle between °C and °F.
4. Place the Thermocouple in the area under test.
5. Wait 30 seconds for the measurement to stabilize.
6. Read the temperature on the LCD display.

Data Hold

1. Press the **Data Hold** key to "freeze" the reading in the display. The annunciator "H" will appear in the display.
2. Press the **Data Hold** key to exit the mode.

Note: On the MA440 and MA460+ double display models, the Data Hold feature applies only to the upper current display (ACA).

Max Hold

1. Press and hold for 1 second the **Max Hold** key to capture and hold the maximum measured value (up to 30ms). The annunciators "H MAX" will appear in the display
2. Press and hold for 1 second the **Max Hold** key to exit the mode.

Note: The Max Hold feature applies only to the upper current display (ACA) on the MA440 and MA460+ double display models. It applies to the ACA, DCV and ACV functions on the single display MA400 and MA420 models.

△ Relative (MA400 and MA420 only)

1. Press the **△ Rel** key once to a store the displayed reading as the reference value. The display will now show readings relative to the stored reference value. (display = reading - stored value)
2. Press the Relative key again to exit the Relative mode.

Auto-ranging

If the function selected has more than one range, the meter will auto-range to the best range and resolution. No manual ranging is required.

Auto Power Off

The meter will enter a "sleep" mode after 30 minutes of function switch or push button inactivity. To wake the meter up, press a button or move the slide switch. Always slide the function switch to the **OFF** position when the meter is not in use.

Maintenance

WARNING
To avoid electrical shock, disconnect the meter from any circuit, remove the test leads from the input jacks and turn OFF the meter before opening the case. Do not operate with open case.

Cleaning and Storage
Periodically wipe the case with a damp cloth and mild detergent; do not use abrasives or solvents. If the meter is not to be used for periods of longer than 60 days, remove the battery and store it separately

Battery replacement

1. Remove the two Philips head screws from the case bottom and remove the bottom case.
2. The batteries (two LR44's for the MA400 and MA420, four LR44's for the MA440, and two CR2032's for the MA460+) are located in button battery holders.
3. Slide the battery out the side of the holder and replace with a new battery (observe polarity).
4. Replace the bottom case and secure with the two screws.

REPAIR AND CALIBRATION SERVICES

Extech offers complete repair and calibration services for all of the products we sell. For periodic calibration, NIST certification or repair of any Extech product, call customer service for details on services available. Extech recommends that calibration be performed on an annual basis to insure calibration integrity.

Tech Support Hotlines
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