User's Manual

EXTECH INSTRUMENTS

Clamp-on Power Datalogger

Model 382060

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 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 the Extech 382060 True RMS Clamp-on Power Meter. This device measures True RMS Voltage, Current, Power, Frequency, Resistance/Continuity, and Phase Angle. The built-in datalogger stores up to 1600 readings. Optional PC software permits meter-to-PC data transfers. An optional 3-phase adapter provides kW, kVA, or PF measurements of unbalanced loads. Careful use of this meter will provide years of reliable service.

Safety

- Read the following safety information carefully before using or servicing the meter
- Do not exceed the maximum input limits published in the specifications below.
- Never measure current while the test leads are inserted in the meter's input jacks.
- Do not use the meter or the test leads if either appears damaged.
- Use extreme caution when working near bus bars or bare conductors.
- Built-in safety protection may be impaired if meter is not used per user's manual.
- Use caution when working with voltages above 60VDC or 30VAC RMS.
- Before resistance/continuity measurements, disconnect power/loads from the circuit.

This symbol, adjacent to another symbol or terminal, indicates the user must refer to the manual for further information.

This symbol, adjacent to a terminal, indicates that, under normal use, hazardous voltages may be present

Double insulation

WARNING: This indicates that a potentially hazardous condition which, if not avoided, could result in death or serious injury.

CAUTION: This indicates that a potentially hazardous condition which, if not avoided, could result in injury or damage to the meter.

General Specifications

Environmental conditions

- Installation Category III
- Pollution degree 2
- Altitude up to 2000 meters
- Indoor use only
- Relative Humidity 80% max.
- Ambient temperature: 32 to 104° F (0 to 40° C)

Maximum voltage	600Vrms
Operational design	Dual slope integration
Display	4-digit (9999 count) LCD display
Bargraph	40 segment display
Over range Indication	LCD displays "OL"
Low battery Indication	Battery symbol display for low operating voltage
Sampling rate	10 times per second (bargraph); 2 times per second (LCD)
Auto power off	After 30 mins. of inactivity
Power supply	9V Alkaline Battery (10 hour approximate battery life)
Jaw size	Cable Φ46mm, 1.8"
Operating Temperature	32 to 104° F (0 to 40° C)
Operating RH	<80% RH non-condensing
Storage Temperature	14 to 140° F (-10 to 60° C)
Dimensions	10.2 x 3.7 x 1.8" (260 x 93 x 45mm)
Weight	16.6 oz. (470g) with battery (approx.)
Accessories	9V battery, Test Leads, Carry Case
Optional Accessories	PC Software and Cable (382062); 3-Phase Adapter (382061)

Function Specifications

Accuracy: ± (% reading + no. of digits) at 64 to 82° F (18 to 28° C) with RH% <80%

True Power (kW)

Range*	Resolution	Accuracy	Frequency
2kW to 600kW	0.1kW	± (2% + 5d)	40 to 400Hz

*Minimum voltage: 100V AC, Minimum Current: 20A AC

Apparent Power (kVA)

Range*	Resolution	Accuracy	Frequency
2kW to 600kVA	0.1kVA	± (2% + 5d)	40 to 400Hz

*Minimum voltage: 100V AC, Minimum Current: 20A AC

Cos f (Power Factor)

Range*	Resolution	Accuracy	Frequency Range	Sensitivity
0.30 to 1.00	0.01	± 0.05	10Hz to 60Hz	>100V / 10A
0.00 to 0.30		Not spec.		

*Minimum voltage: 100V AC, Minimum Current: 20A AC

DC Current

Range	Resolution	Accuracy
1000A	0.1A	± (2% + 5d)

AC Current (True RMS)

Range	Resolution	Accuracy	Frequency
1000A	0.1A	± (2% + 10d)	40 to 400Hz

Peak Indication

Range	Resolution	Accuracy	Acquisition time
1000A	0.1A	± (2.5% + 10d)	≤ 200ms
600V	0.1V		≤ 100ms

DC Voltage

Range	Resolution	Accuracy	Input Resistance
600V	100mV	± (0.75% + 2d)	1MΩ

AC Voltage (True RMS)

Range	Resolution	Accuracy	Frequency	Input Z
600V	100mV	± (1.2% + 10d)	40 to 400Hz	1MΩ

Resistance

Range	Resolution	Accuracy
10kΩ	1Ω	± (1% + 5d)

Frequency

Range*	Resolution	Accuracy	Sensitivity
1kHZ	0.1Hz	± (0.5% + 5d)	10V or 10A

*Minimum Current: 10A AC

Overload Protection

Function	Overload protection
kW, kVA, PF, DCV, ACV, Peak ACV	750Vrms
DCA, ACA, Peak ACA	1100A
Continuity, Diode, Resistance	660Vrms
Frequency	750Vrms or 1100A

Crest Factor (ACA, ACA): □ 5*

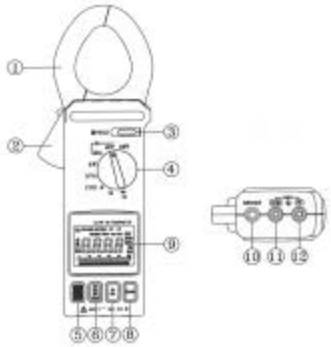
* For sinusoidal waveforms. Additional errors for non-sinusoidal signals are: 1 to 3 (0.5%), 3 to 5 (3%), 5 to 7 (6%)

Audible Continuity: Audible tone sounds when resistance is less than 100Ω ±10%

Description

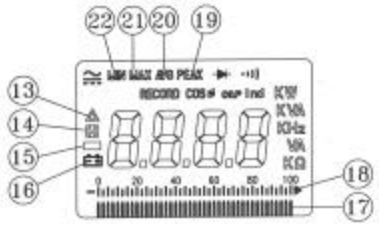
Meter

1. Transformer jaws
2. Jaw open trigger
3. Data Hold button
4. Range selector switch
5. DC/AC/Hz/Continuity/Diode mode button
6. MIN/MAX/AVG/PEAK button
7. Relative mode button
8. Datalogging Record button
9. LCD Display
10. PC Interface jack
11. COM input jack
12. V-Ω–Hz input jack



Display Indicators

13. Relative mode
14. Data Hold
15. Negative polarity
16. Low battery
17. Bargraph display
18. Bargraph display scale
19. Peak Hold
20. Average reading
21. Maximum reading
22. Minimum reading



Measurements

Measurement Considerations and Precautions

1. Ensure that the selected range on the meter matches the measurement to be taken.
2. If the measured current is higher than the selected current range for long periods, overheating may result compromising the safety of the meter's circuitry.
3. Do not measure current on high voltage conductors (>600V).

DC Voltage Measurements

WARNING: Ensure that all test leads are disconnected from the meter terminals

1. Set the rotary function switch to the **V** position.
2. Press the yellow DC/AC/Hz mode button to select DC.
3. Connect the black and red test leads to the COM and + terminals respectively.
4. Connect the test leads to the circuit under test and read the displayed value.

AC Voltage Measurements

WARNING: The maximum input for the AC Voltage range is 600Vrms. Do not attempt to take voltage measurements that exceed 600Vrms. Shock hazard or meter damage could result at higher voltages.

1. Set the rotary function switch the **V** position.
2. Press the yellow DC/AC/Hz button to select AC.
3. Connect the black and red test leads to the COM and + terminals respectively.
4. Connect the test leads to the circuit under test and read the displayed value.

Frequency Measurements (Voltage)

WARNING: The maximum input for the AC Voltage range is 600Vrms. Do not attempt to take voltage measurements that exceed 600Vrms. Shock hazard or meter damage could result at higher voltages.

1. Set the rotary function switch the **V** position.
2. Press the yellow **DC/AC/Hz** button to select Hz.
3. Connect the black & red test leads to the **COM** and **+** terminals respectively.
4. Connect the test leads to the circuit under test and read the displayed value.

Note: The voltage must be at least 10V for proper frequency measurements.

AC and DC Current Measurements

WARNING: Ensure that all test leads are disconnected from the meter terminals

CORRECT

INCORRECT

1. Set the rotary function switch to the **A** position.
2. Press the yellow **DC/AC/Hz** mode button to select DC or AC per the display symbol.
3. Press the trigger to open the meter jaws then snap them open/closed several times to dissipate any residual magnetic fields. Clamp the jaws around the conductor under test. The most accurate reading can be obtained by keeping the conductor as near to the centering marks of the jaws as possible. The direction of current must correspond to the indication pointer on the jaw.
4. Ensure that the jaws are completely closed around the conductor
5. Read the displayed value.

Frequency Measurements (Current)

1. Set the rotary function switch the **A** position
2. Press the yellow **DC/AC/Hz** button to select Hz per display symbol.
3. Follow the directions for AC Current measurements above.
4. The meter detects the frequency of the current for the conductor under test.

Note: For proper frequency measurements, the current through the jaw should be at least 10A (minimum threshold).

Kilowatt (KW) and Apparent Power (KVA) Measurements

WARNING: The maximum input for the AC Voltage range is 600Vrms. Do not take voltage measurements exceeding 600Vrms. Shock hazard and meter damage could result.

1. Set the rotary function switch the **KW** or **KVA** position.
2. Connect the black and red test leads to the **COM** and **+** terminals respectively and then in parallel with circuit under test.
3. Clamp the jaw around one conductor ensuring that the jaws are completely enclosed around conductor.
4. Read the displayed value.

Notes:

1. The + sign printed on the jaw must face the power source for correct readings,
2. For 3-phase unbalanced systems, use the optional 3-phase adapter (380261). Refer to Appendix C.

Power Factor (PF) Measurements

WARNING: The maximum input for the AC Voltage range is 600Vrms. Do not attempt to take voltage measurements that exceed 600Vrms. Shock hazard and meter damage could result at higher voltages.

1. Set the rotary function switch the **Cos ö** position.
2. Connect the black and red test leads to the **COM** and **+** terminals respectively and then in parallel with the circuit under test.
3. Clamp the jaw around one conductor ensuring that the jaws are completely enclosed around the conductor.
4. Read the displayed value.
5. If the displayed value is negative, the reading is capacitive (current leads voltage). If the displayed value is positive, the reading is inductive (current lags voltage).

Notes: The + sign printed on the jaw must face the power source for correct readings,

Resistance Measurements

WARNING: Remove power from the circuit under test and discharge all capacitors before performing resistance measurements.

1. Set the rotary function switch the **Ù** position.
2. Connect the black and red test leads to the **COM** and **+** terminals respectively.
3. Connect the test leads to the circuit or component under test.
4. Read the displayed resistance value.

Continuity and Diode Tests

WARNING: Remove power from the circuit under test and discharge all capacitors before performing resistance measurements.

Continuity

1. Connect the black and red test leads to the **COM** and **+** terminals respectively.
2. Set the rotary function switch the continuity position.
3. Press the yellow mode select switch to select continuity per the display icon.
4. Connect the test leads to the circuit or component under test.
5. If the resistance of the circuit or component is < 100Ω, an audible tone will sound.

Diode

1. Connect the black and red test leads to the **COM** and **+** terminals respectively.
2. Set the rotary function switch the diode position.
3. Press the yellow mode select switch to select diode test per the display icon.
4. Connect the red test lead to the anode side of the diode and the black test lead to the cathode side of the diode.
5. Read the forward voltage value of the diode on the LCD. The value for a good diode should be 0.3 to 0.7VDC
6. Reverse the test lead connection to the diode, the reading should indicate an open circuit if the diode is good.

Data Hold

To hold a displayed value, press the violet colored data hold button (above the rotary switch). The reading will freeze and the **H** symbol will appear on the LCD. To release the display and return the meter to normal operation, press the data hold button again.

Minimum, Maximum, Average, and Peak Readings

1. To begin a session, first select the desired function using the rotary select switch.
2. Press the **MIN/MAX** button once. The **MIN** icon will appear on the display and the meter will begin keeping track of the lowest, highest, average, and peak readings.
3. Pressing the **MIN/MAX** key repeatedly scrolls through the **MIN** (minimum), **MAX** (maximum), **AVG** (average), and **PEAK** (peak capture) readings since the measurement session began. The meter will continue to monitor the session keeping track of the minimum, maximum, etc. until the session is halted.
4. To exit the measurement session and return the meter to normal operation, press and hold the **MIN/MAX** key for 2-3 seconds until the audible tone sounds.

Note: Peak Hold is only available for Current and Voltage functions. MIN/MAX/AVG functions do not apply to COS and KVA parameters.

Relative Mode

This meter has to ability to store a reference value so that measurements can be displayed relative to the reference value. To store a reference value and use the relative mode:

1. Press the **REL** key when the desired reference value is on the display, the triangular relative symbol will appear on the LCD.
2. All subsequent measurements will be displayed relative to the reference value. For example, if 100 is displayed at the time of the REL key-press and the next measurement is 105, the LCD will read 5 (105 - 100 = 5).
3. To exit the Relative mode, press and hold the **REL** key for 2-3 second until the audible tone sounds.

Datalogging and the RS-232 PC Interface

This meter has the ability to store 1600 measurements. Stored data can be transferred from the meter to a PC using the optional PC Interface kit (382062). Data can then be exported to and manipulated in spreadsheet, word processor, or graphical software programs. The PC Interface kit also permits the user to operate the meter remotely from the PC. Instructions for the RS-232 PC Interface are included with the kit. The following steps detail how to record data

1. To start recording data, press the **RECORD** key (**RECORD** will appear on the LCD); the meter will begin recording data one reading per second. Note: Using the optional Data Acquisition software, the sample rate is adjustable. To stop recording, press the **RECORD** key again.
2. When the meter's memory is full, the RECORD display icon will flash.
3. To delete data from the meter's memory hold the **RECORD** button while powering up the meter. Do not release the **RECORD** button until the **CLEP** display appears.

Note: Press the **RECORD** key to stop recording before shutting down the meter. Powering off the meter before pressing the **RECORD** key to stop recording prohibits the datalogger from marking the address of the last data record. The datalogger updates the last record address every 100 records.

True RMS Measurement Notes

The Model 382060 is a True RMS responding device that can correctly measure non-sinusoidal waveforms such as triangle, square, and distorted sine waves.

Conventional average-sensing meters convert the measurement signal into an average value and then multiply the average by 1.1. If the measurement signal is anything but a true sine wave the reading will be incorrect.

Single Phase, 3-Wire Measurements

To perform this test, two separate measurements are required: W_{L1G} and W_{L2G} (refer to the diagram below). Measure W_{L1G} first (steps 1 –5). L1/L2/G must be correctly identified.

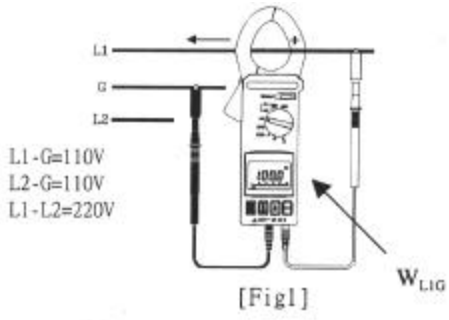
1. Set the rotary function switch to the KW range.
2. Connect the red test lead to the meter's red voltage terminal and then to the L1 conductor.
3. Connect the black test lead to the meter's COM input jack and then to the G conductor.
4. Clamp the meter around the L1 conductor.
5. Note the W_{L1G} reading displayed on the LCD for later use.

Measure W_{L2G} as described in steps 6 – 9.

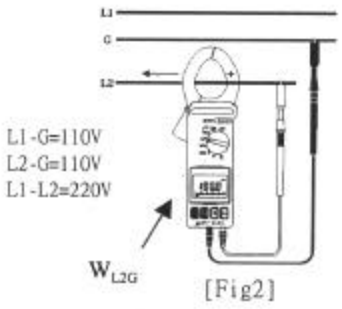
6. Connect the red test lead to the meter's red voltage terminal and then to the L2 conductor.
7. Connect the black test lead to the meter's COM input jack and then to the G conductor.
8. Clamp the meter's jaws around the L2 conductor
9. Note the W_{L2G} reading.

Now use the W_{L1G} & W_{L2G} readings noted above in the equation shown below:

$$W1f3W = W(L1G) + W(L2G)$$



[Fig1]

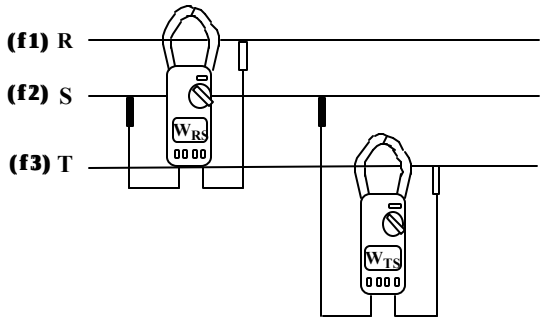


[Fig2]

$$W1\phi 3W = W(L1G) + W(L2G)$$

3 phase, 3-Wire Measurements

3f/3wire Balanced Measurements



$W_{3f} = W_{RS} + W_{TS}$

$VAR_{3f} = Sqr\,(3(W_{RS}-W_{TS}))$

$VA_{3f} = Sqr\,(W_{3f}^{\ 2} + VAR_{3f}^{\ 2})$

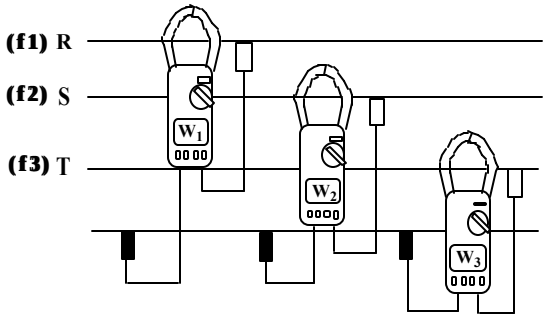
Miscellaneous formulae

KVA: $KVA = \frac{V * A}{1000}$; **KVAR:** $KVAR = \sqrt{(KVA)^2 - (KW)^2}$; **Power Factor:** $PF = \frac{KW}{KVA}$

KVAR is a calculated value and its accuracy greatly depends on the accuracy of V, A, KW, and PF (if it is close to 1). For better accuracy when PF is greater than 0.91 (ϕ<25°), measure the phase angle and obtain KVAR using the following equation for a pure sine wave.

$$KVAR = KVA * \sin f$$

3f/4wire Measurements



$W_{3f} = W_1 + W_2 + W_3$

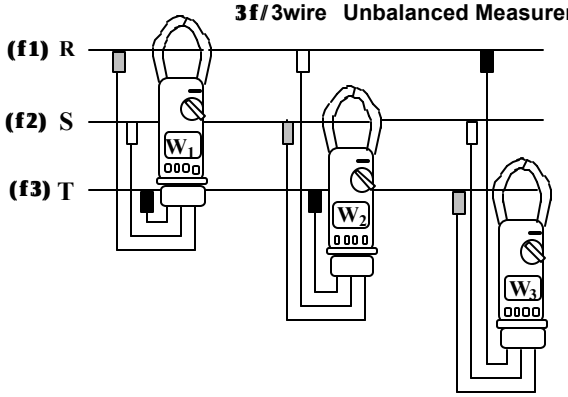
Optional 3-Phase Adapter (382061)

Connect the adapter to the bottom of the meter (over the input terminals). Use of this adapter permits three phase measurements of:

1.True Power (KW)
2.Apparent Power (KVA)
3.Power Factor PF (Cosine of Phase Angle)

Set the Clamp Meter's rotary switch to KW, KVA, or COS f position depending upon which parameter is to be measured. Refer to the diagram and equations below:

3f/3wire Unbalanced Measurements



$$W_{3f} = W_1 + W_2 + W_3$$

$$VA_{3f} = VA_1 + VA_2 + VA_3$$

$$PF_{3f} = \frac{W_{3f}}{VA_{3f}}$$

Maintenance

Battery Replacement

Warning: To prevent electrical shock, power down the clamp meter and disconnect the test leads before removing the meter's back cover.

When the 9V battery voltage falls to a critical level, the battery symbol will appear on the LCD. Replace the battery as follows:

1. Set the range switch to the OFF position.
2. Remove the 3 rear screws and remove the meter's rear cover.
3. Replace the 9V battery and reinstall the back cover.

Cleaning

Warning: To avoid electrical shock or damage to the meter, do not permit water inside the case.

Periodically wipe the case with a damp cloth and mild detergent. Do not use abrasives or solvents.

Calibration and Repair 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.

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