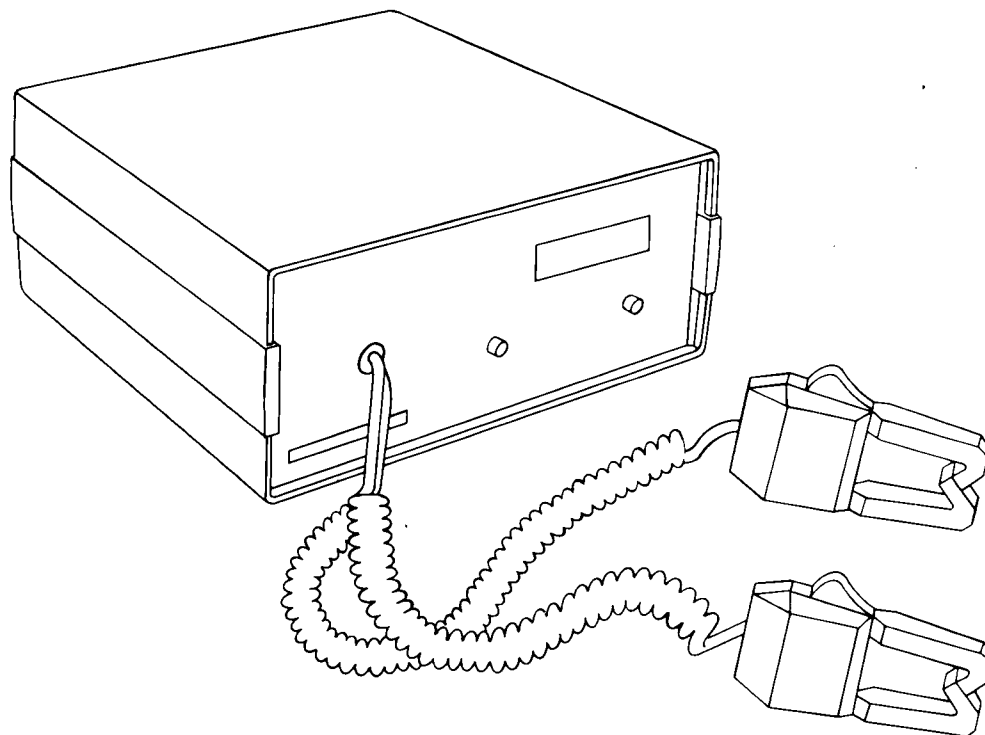




KW220

# Digital Clamp-on Kilowatt Hour Meter

OWNER'S MANUAL



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## INTRODUCTION

The Kilowatt Hour Meter KW 220 is an energy management tool...designed to help you determine precisely how your energy dollar is being used. Now you can easily measure the amount of power required by any complex load up to 100 KW. Automatically, you also obtain accumulated power consumption in kilowatt hours over any period of time.

The KW 220 has a clamp-on current transducer, no expensive and time consuming wiring is required to use this instrument. It has been designed with the highest quality in mind to insure continued accuracy and a long service life.

Complete monitoring of its operation is indicated by an array of front panel L.E.D. warning lamps. Because of its unique design, the KW 220 can handle a wide range of voltage and current input without switching. Its versatility and price are totally unmatched in the test equipment industry. This instrument can pay for itself many times over. To use it properly, please read the operator's manual thoroughly before using the KW 220.

## FUNCTIONAL DESCRIPTION

The KW 220 will perform two primary functions. It will measure the amount of power being supplied to the load and the total power consumed during any time period. Either of these measurements is available at any time.

Battery power is provided so that information will not be lost in the event of a power failure.

An output proportional to the amount of power is available for use by external instruments.

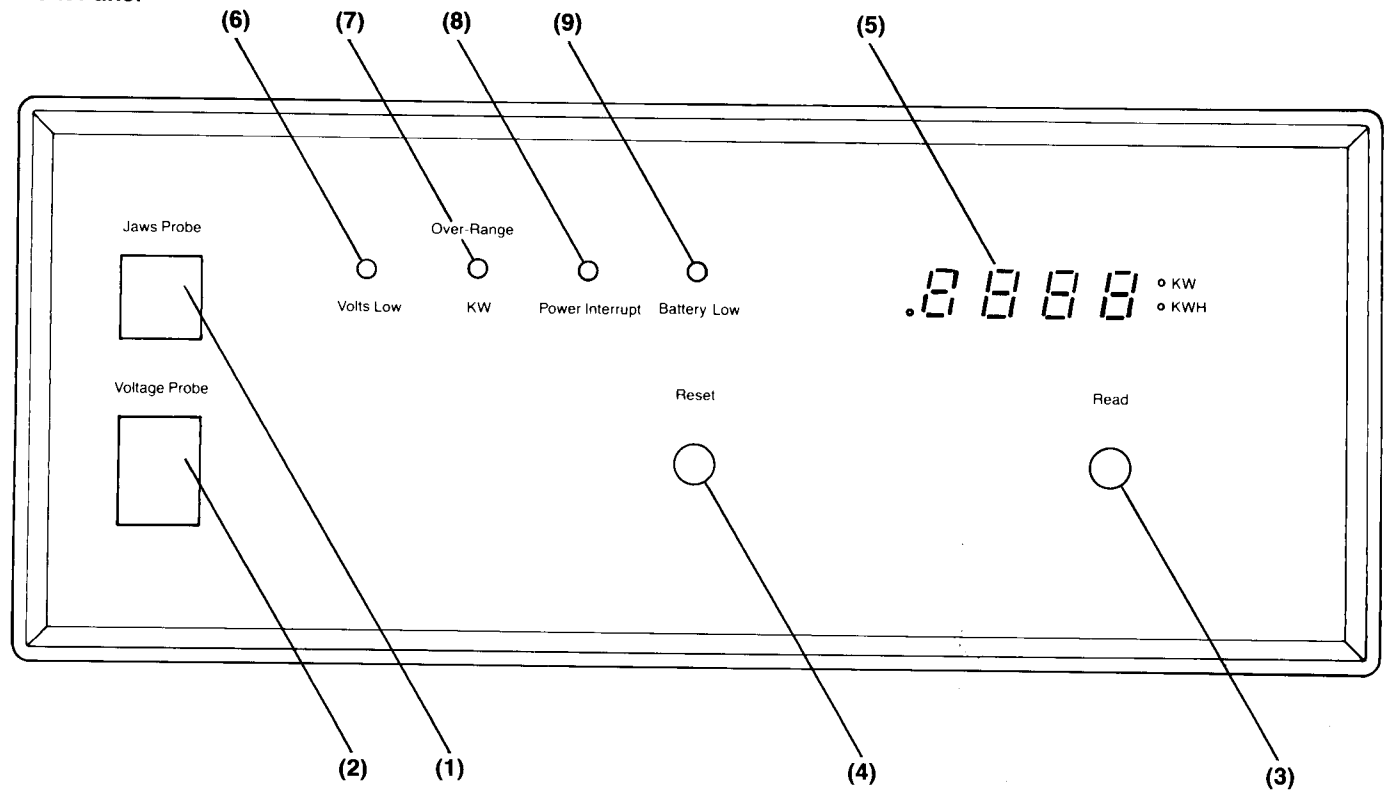
A number of valuable indications are provided as detailed later in the Operator's Manual.

## DUAL CURRENT TRANSDUCERS

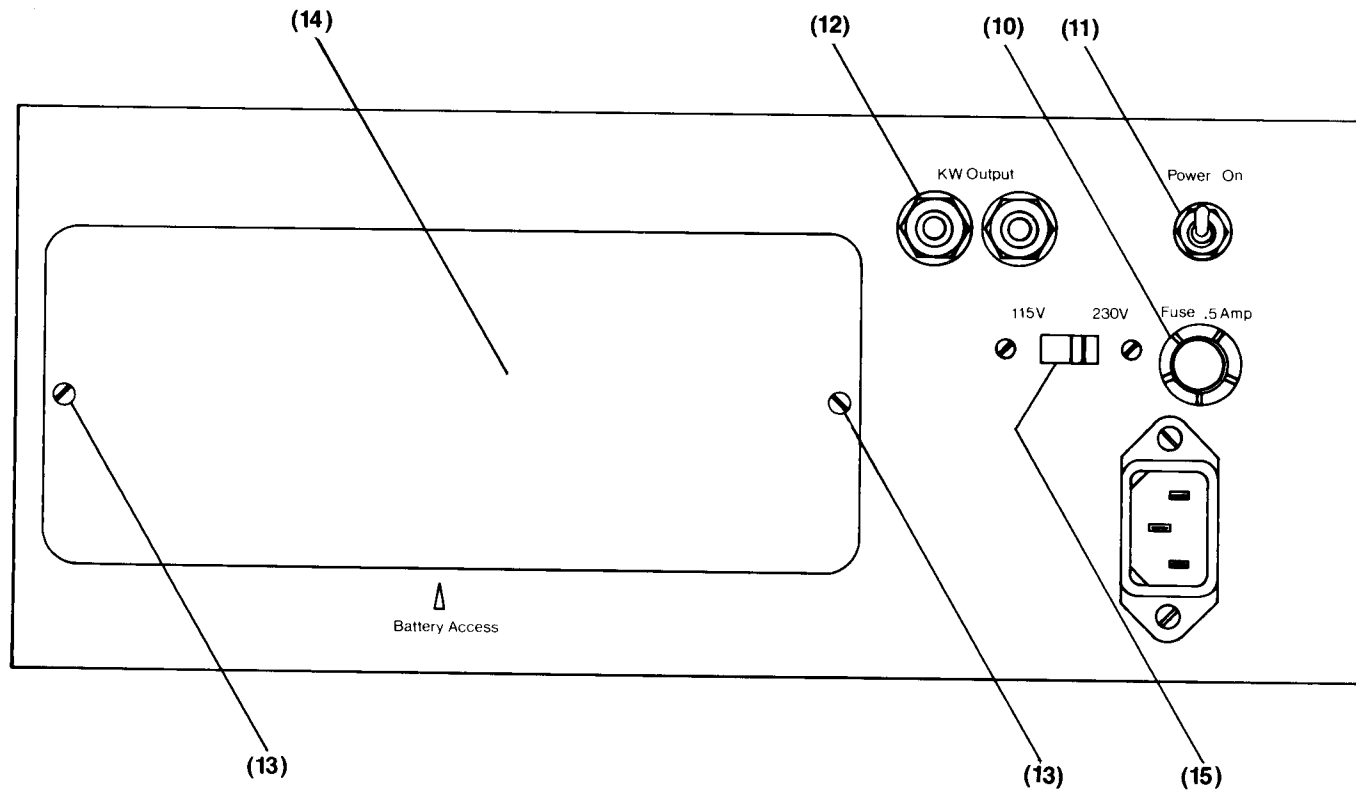
The dual current transducer will allow you to measure 220V split phase systems that have unbalanced loads. These are the common 220V/110V systems found in homes, office buildings, shopping centers, etc. You can now get an accurate measurement of the total power being used on these circuits, even though some of the loads are on the 110V legs and the others are on 220V.

Of course, by using only one of the two transducers, you can measure single phase and three phase balanced loads in the same manner described elsewhere in the owners manual.

**KW220 Kilowatt Hour Meter/50-60 HZ**  
**Front Panel**



**KW220 Kilowatt Hour Meter/50-60 HZ**  
**Rear Panel**



### CONNECTING INSTRUMENT POWER

#### 60 HZ model (without line voltage switch):

1. Plug the instrument into a 115 V, 60 HZ, 3 wire circuit. The line frequency must be a stable 60 HZ such as that produced by power utilities.

**CAUTION:** You should never connect or operate the instrument unless it is grounded. Do not attempt to defeat the three wire plug provided.

#### 50 HZ model (with dual voltage switch):

1. Set the line voltage switch (15) on the rear panel to 115 V AC if your line voltage is between 105 V AC and 130 V AC or to 230 V AC if your line voltage is between 205 V AC and 250 V AC.

**CAUTION:** Serious damage to the instrument may result if the line voltage selector switch is not correctly set for the line voltage used.

2. Connect the instrument to the power line.

**CAUTION:** You should never connect or operate the instrument unless it is grounded. Do not attempt to defeat the three wire plug provided.

### HOW TO MAKE MEASUREMENTS

#### Single phase measurements

1. Connect the single phase voltage probe (two black cables) to jack (2) on instrument front panel.
2. Connect the dual current probe to jack (1) on front panel.
3. Turn instrument power on, then clamp one current jaw around one line.
4. Clip the voltage probes on the two lines. NOTE: The Volts Low indicator will come on if the connection is bad or there is no voltage above 70 V. See fig. 1.
5. The KW 220 should now indicate the power being used. At the same time the KWH is being accumulated. To read KWH press Read momentarily.
6. Pressing Reset will turn off all indicators and reset KWH memory to 0.

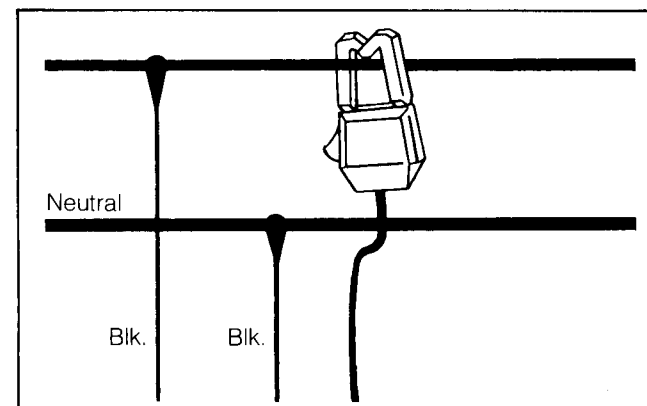


fig. 1  
Single Phase Measurement

### 220 V Split Phase Measurements

1. Connect the probes as in single phase measurements steps 1 and 2.
2. Use the single phase voltage cable and connect it across one leg to a neutral (110 V circuit on a 220 V system). See fig. 2.
3. Clamp one current transducer around each high leg (hot wire) with both transducers oriented in the same direction. (Proper orientation will produce the highest reading on the KW 220).
4. Total voltages of up to 530 volts and currents of up to 600 amps may be used as long as 100 KW is not exceeded.
5. Steps 4, 5 and 6 of single phase measurement apply.

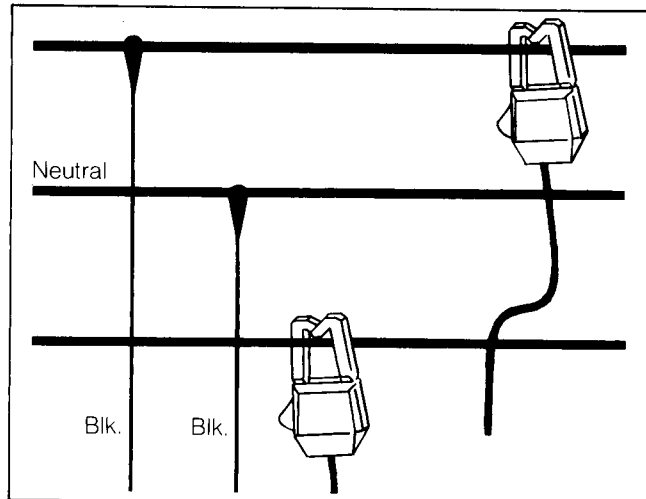


fig. 2  
220 V Split Phase Measurement

### 3 Phase Balanced Load Measurement

1. Connect the three phase voltage probe (two black, one red cables) to jack (2) on instrument front panel.
2. Connect the dual current probe to jack (1) on front panel.
3. Turn instrument on, then clamp one current jaw around one line.
4. Attach the voltage probe to each of the three lines with the Red wire connected to the same line the current jaw is on. See fig. 3. A volts low indication shows a bad connection or line voltage below 70 volts.
5. Steps 5 and 6 of single phase measurements apply.
6. NOTE: If the 3 phase load is unbalanced (different currents in each leg) the KW and KWH measurement will be in error.

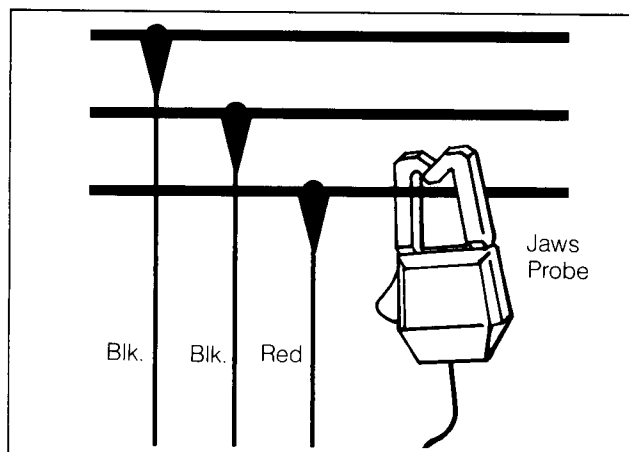


fig. 3  
3 Phase Balanced Load Measurement

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### **OPERATING THE INSTRUMENT**

Once the KW 220 is connected, turn on the power switch (11) at the rear of the instrument. The KW 220 will immediately begin to measure power and total power consumed. The display (5) will indicate the power, in KW, being supplied to the load.

To read the total power consumed, press the button labeled KWH (3). The display will indicate total power consumed in kilowatt hours.

Do not hold the KWH button depressed for extended periods as this will interfere with the instrument's operation.

To begin a new measurement, press the reset button (4). This resets all readings to zero and extinguishes all indicators. Please note that this eliminates all information that has been accumulated.

### **Indicators**

Several lamps are provided to indicate possible errors in your measurement. All lamps will be off under normal conditions.

#### **Low Input Volts (6)**

The Low Input Volts Lamp indicates that one or more of the voltage sensing leads is connected to an excessively low voltage (70 volts or less). This will usually indicate a faulty contact or an incorrect connection of the voltage sensing leads. This lamp will extinguish when the fault is corrected.

Please note that this indication does not affect the operation of the instrument. If this low voltage is a valid condition, then you may ignore this indicator. The accuracy of the measurement will not be affected.

#### **KW Overrange (7)**

This lamp indicates that the power being supplied to the load has exceeded 100 KW. When this occurs, the KW 220 will stop operation. The reset button must be pressed to restart the instrument.

#### **Power Interrupt (8)**

The Power Interrupt Lamp indicates that instrument power was lost. It will remain lit even after power is restored. When power is lost, the battery will maintain the information already gathered until the power is restored.

Please note that the KW 220 makes no measurements during the power interrupt period. If power to the instrument is lost, and power to the circuit under test is not, the measurement may be in error.

#### **Battery Low (9)**

This lamp indicates that the battery is near the end of its useful life. The cells should be replaced at the earliest opportunity.

#### **KW Output (12)**

The KW Output is a DC voltage that is directly proportional to the power being measured. It is a continuing output and does not depend on the 3.6 second sampling of the digital section. The output is 1 V per 20 KW so 0 to 100 KW would equal 0-5 volts. A higher output may be obtained by clamping on the current jaw so the red terminal produces a positive voltage. Even though the display will lock out at 100 KW the KW output on the rear panel will go to 175 KW.

The KW Output is provided so that a record of power versus time could be made using a strip chart recorder. Other applications such as overpower or underpower alarms are also possible.

Chart recorders with a 0-5 volt input for full scale and at least a 50,000 ohms input impedance or a 0-5 ma input with 25 ohms or less input impedance are necessary.

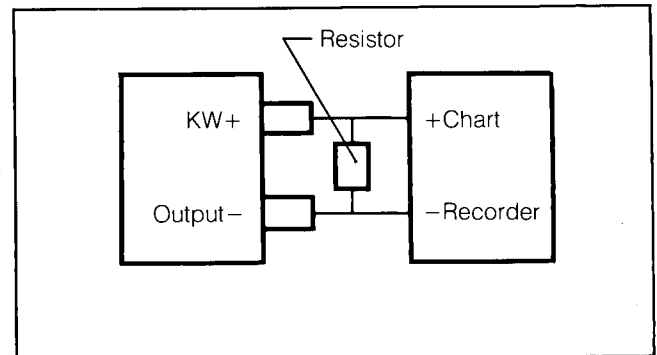
We recommend the following:

1. Minigraph Analog Recorder  
Model #MO5A-01-A5-000 or Model #MO4A-01-A5-000\*  
Chart paper #69176  
Available from:  
Easterline Angus Instrument Corp.  
PO. Box 24000  
Indianapolis, Indiana 46224  
Phone (317) 244-7611

\* Connect a 3920 ohm 1/4 watt 1% resistor in series with the recorder.

2. Rustrak Strip Chart Recorder  
Model #288  
0-5 ma full scale or 0-1 ma full scale\*  
115 V AC, 60 HZ, 2 RPM Motor  
Gear Train Assembly #1  
Chart Style A  
Available from:  
Gulton Industries, Inc.  
Measurement and Control Systems Division  
East Greenwich, Rhode Island 02818  
Phone (401) 884-6800  
These recorders move at 1 inch per hour.

If a smaller full scale output voltage is required for your Chart Recorder, it may be obtained by connecting a resistor across the KW Output terminals as shown below:





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To select the value of the resistor, use the following procedure:

$$\text{Resistor} = \frac{E \times 1000}{5 - E}$$

Where E is full scale output voltage you require.

For example: If your Chart Recorder requires one volt full scale input, then you write the formula as follows:

$$\text{Resistor} = \frac{1 \times 1000}{5 - 1}$$

This works out to 1000 divided by four or a 250 ohm resistor. Since the accuracy of this resistor determines the full scale accuracy you should use the closest value available. The one percent resistor value closest to the value calculated will usually be satisfactory.

The polarity of KW output may either be positive or negative. If you cannot reverse your Chart Recorder connections, you may change the polarity of the output. This can be accomplished by removing the current transformer from the conductor, rotating it 180° and clamping it back around the wire.

#### **Fuses**

The KW 220 has two types of fuse protection. The main power fuse (10) is located on the rear panel. If the display will not light, you should check this fuse and replace, if necessary, with an AGC ½ amp fuse only.

The KW 220 has input fuses to protect the user and the instrument in the event of severe overload or instrument failure. The failure of one or more of these fuses will probably

cause large errors in the KW reading or even a constant zero reading.

#### **Caution**

An input fuse failure may indicate a condition that would damage the meter or render it unsafe to operate. These fuses should only be replaced by qualified service personnel. Do not attempt to bypass them or substitute other devices for them. Consult the factory for detailed information.

#### **Battery**

The KW 220 incorporates a battery which will provide a backup power supply for selected areas of this instrument. This will insure that data will not be lost if the power to the instrument is lost.

An electronic circuit constantly monitors the condition of the battery. When the battery's remaining life is less than 20 hours, the Battery Low Indicator will light.

The KW 220's battery consists of six 1.5 V size C Alkaline cells. These should be replaced with Alkaline cells. The use of standard C cells will drastically reduce the period for which the instrument can retain data during a power failure.

The cells may be replaced by unscrewing the battery cover retaining screws (13) and removing the battery cover (14).

#### **Caution**

The instrument should be turned off and disconnected from the circuit under test before removing the battery cover.

## Analog Computer Module

## Digital Computer Module

## Display and Control Module

## Power Supply Module

The diagram illustrates the KW 220 Basic system architecture. It consists of five main components: an Analog Computer Module, a Digital Computer Module, a Display and Control Module, a Battery, and a Power Supply. The Analog Computer Module is at the top, connected to four external input/output lines. It has a bidirectional connection with the Digital Computer Module below it. The Digital Computer Module is also bidirectionally connected to the Display and Control Module. The Display and Control Module is connected to the Battery and the Power Supply. The Battery provides power to the Power Supply, which then distributes power to all three main modules (Analog, Digital, and Display/Control).

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graph TD; In1(( )) --- ACM[Analog Computer Module]; In2(( )) --- ACM; In3(( )) --- ACM; In4(( )) --- ACM; ACM <--> DCM[Digital Computer Module]; DCM <--> DCM2[Display and Control Module]; DCM2 --- B[Battery]; B --- PS[Power Supply]; PS --- ACM; PS --- DCM; PS --- DCM2; PS --- Out1(( ))
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**KW 220 BASIC BLOCK DIAGRAM**

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### **SPECIFICATIONS**

#### **Input Voltage**

Range: 90-530 Volts AC  
Frequency: 60 HZ Nominal  
(E Model) 50 HZ Nominal

#### **Input Current:**

Range: 1-500 Amps Continuous  
Maximum: 600 Amps Intermittent

#### **Input Power:**

Range: 100 KW Maximum  
(at any power factor)  
Accumulated: .0001-10,000 KWH

#### **Power Readout:**

Kilowatts: Normally displayed  
Kilowatt Hours: Selected from front panel  
Maximum display: 100 KW  
10,000 KWH  
Resolution: .1 KW  
Accuracy:  $\pm 2\%$  at unity power factor  
(above 90 Volts input)  
Phase Angle Accuracy:  $\pm 1^\circ$  from  $+90^\circ$  to  $-90^\circ$

#### **KW Output:**

Output: 0-5 Volts DC equals 0-100 KW input  
Output Impedance: 1000 Ohms

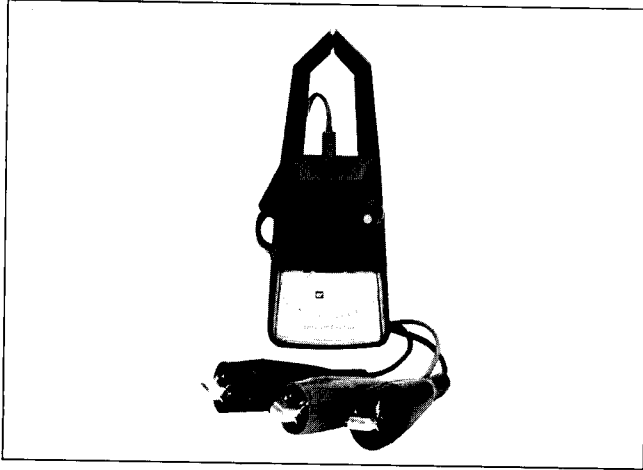
#### **Instrument Power:**

Voltage: 105-130 Volts AC  
(E Model) 115/230 Volts AC  $\pm 10\%$   
Power: 5 Watts  
(E Model) 5 Watts  
Frequency: \*60 HZ  
(E Model) 50-60 HZ

\*The line frequency must be a stable 60 HZ source. Within the continental United States, the normal power distribution system will be satisfactory in almost all cases. If operation under varying line frequency conditions is contemplated, an option is available. Consult the factory for details.

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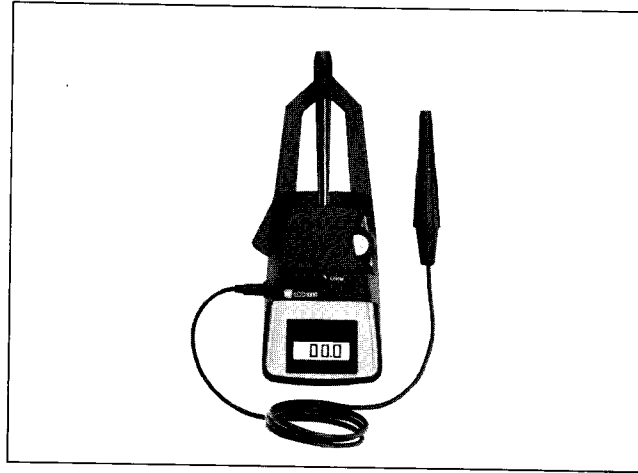
## OTHER TIF PRODUCTS



### **Power Factor Meter.**

TIF quality in a full feature precision instrument that is ultra-compact. Reads power factor directly, 0 to unity, lagging or leading. Use with single, split phase and three phase power sources. No batteries; automatically powers self from the "hot" line. Interchangeable jaw for large loads. This is the latest technology in electronics. Use to check out motor efficiency and much more.

**Model No. TIF2300**



### **LCD Clamp-on Volt-Ohm Ammeter.**

An advanced compact LCD, volt, ohm, ammeter clamp-on with sophisticated internal design. One year battery life. Captures millisecond power surges and has a built-in low ohmmeter, auto zero and auto ranging. The meter display is a new LCD made for maximum contrast. Ranges: 0-1000 amps, volts, ohms. Interchangeable jaw for large loads. Now TIF gives you the incomparable choice of LCD or LED.

**Model No. TIF LCD1000**

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#### OTHER TIF PRODUCTS



##### **Clamp-on Digital Wattmeter.**

Another first from TIF. We're pioneering the field with our TIF2000A; the world's first battery operated LCD digital clamp-on wattmeter. Read watts anytime, anywhere. Bright digital display; reads as low as 10 watts as high as 199.9 KW. The TIF2000A auto zeros and auto ranges. Reads true power not apparent power: use it to calculate power factor. TIF's exclusive pointed jaws get into tight places. Includes two voltage probes, battery and carrying case.

**Model No. TIF2000A**

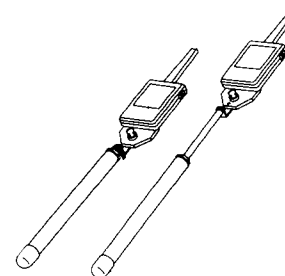
#### LIMITED WARRANTY

The KW 220 is guaranteed against defects arising in normal use for a period of one year from the date of purchase, provided that the fault has not been caused by any type of misuse.

This guarantee is offered as an extra benefit and does not affect consumer's statutory rights.

Defective instruments should be returned, freight paid, to the Service Department, TIF Instruments, Inc. Careful packing is essential—retain the original packing material. If the guarantee has expired or if the fault is the result of misuse, the repair will be carried out and charged unless other instructions are received.

Customers outside the United States should contact the dealer from whom the meter was purchased to ascertain service arrangements for that country.



**An ounce of prevention that's worth looking into. The TIF 300HV "High-voltage" connectionless AC Voltage detector.** A Hi/Low switch lets the TIF300HV detect voltage from 25 to 1500 volts and 1500 to 122,000 volts. An optional Hot Stick (the TIF310HV) is available. Stand away safely from high voltage with the optional 32" Hot Stick.

**Ask for the TIF300HV with "Hot Stick."**

U.S. Patent #3,621,392