INSTRUCTION MANUAL

For

DIGITAL PHASE ANGLE METER

MODEL 175A

It is essential that this instruction book be read thoroughly before putting the equipment in service.
IMPORTANT

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</tbody>
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INTRODUCTION

This instruction manual provides operating and service instructions for Multi-Amp Model 175A Solid State Digital Phase Angle Meter. It is recommended that the instruction manual be thoroughly read prior to using the instrument.

**************************************************IMPORTANT**************************************************

CAUTION

ALL UNITS ARE SHIPPED FROM THE FACTORY SET-UP FOR OPERATION FROM A NOMINAL 115 VOLT POWER SOURCE. IF THE UNIT IS TO BE USED ON A 230 VOLT SOURCE, IT IS NECESSARY FOR THE OPERATOR TO FIRST ADJUST THE POWER SOURCE SELECTOR SWITCH FOR 230 VOLT OPERATION. REFER TO "SELECTION OF POWER SOURCE" ON PAGE 2 FOR DETAILS.

**************************************************IMPORTANT**************************************************
OPERATING FEATURES

CONTROL FUNCTIONS:

POWER ON Switch
On/Off Switch for input power for logic and display.

1/2 Amp, 115 volts
Protects power supply input.

1/4 Amp, 230 volts

ZERO CHECK Switch
Self-checks instrument calibration.

HOLD READING Switch
Instrument will retain whatever measurement is being displayed when this switch is turned on.

LOW SIGNAL Switch
Permit measurement to be made even though input is below minimum of input range.

INPUT 1 & INPUT 2 Binding Posts

1.5-60 amps (black) High current input range.
0.05-2.0 amps (black) Low current input range.
15-600 volts (red) High potential input range.
1-40 volts (red) Low potential input range.
COMMON ± (white) One side of the input signal (both current and potential) connects to either terminal.

INPUT 1 LAGS INPUT 2 Displays
Indicates phase angle in degrees.

SELECTION OF POWER SOURCE VOLTAGE:

All Model 175A units are manufactured as dual voltage 120/240 volt units and are shipped from the factory with the power source voltage selector switch set for nominal 120 volt operation. Power source voltage selection is adjustable by the use of two, three-position slide switches. One switch has positions of 240/OFF/120, while the second switch has positions of LOW/MEDIUM/HIGH.

The switches are located inside the unit near the top of the only circuit board which is mounted vertically (with the instrument laying so its panel is in a horizontal position). Both switches are easily accessible, and no disassembly is required.

The 230/OFF/115 switch is located on the right side of the circuit board with the 230-volt position to the left, the center position off, and the 115-volt position to the right. This switch is in the 115-volt position when shipped from the factory.
The LOW/MEDIUM/HIGH switch is located on the left side of the instrument with the LOW position on the left, MEDIUM position in the center and HIGH position on the right. This switch is in the MEDIUM position when shipped from the factory.

The following table shows the variety of input voltage ranges available.

<table>
<thead>
<tr>
<th>Position Of 230/OFF/115 Switch</th>
<th>Position Of Low/Medium/High Switch</th>
<th>Source Voltage Range in Volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>115</td>
<td>Low</td>
<td>100-114</td>
</tr>
<tr>
<td>115</td>
<td>Medium</td>
<td>115-124</td>
</tr>
<tr>
<td>115</td>
<td>High</td>
<td>125-135</td>
</tr>
<tr>
<td>230</td>
<td>Low</td>
<td>200-229</td>
</tr>
<tr>
<td>230</td>
<td>Medium</td>
<td>230-249</td>
</tr>
<tr>
<td>230</td>
<td>High</td>
<td>250-270</td>
</tr>
</tbody>
</table>

To obtain access to the power source voltage selector switches, disconnect unit from source of power; remove instrument from case by removing four mounting from the back of case and sliding instrument out. When changing power source voltage, it is necessary to change input fuse following the procedure under INPUT FUSES.

INPUT FUSES:

Since all units are shipped from the factory set up for nominal 115-volt operation, a 1/2 ampere fuse is installed in the input fuse socket.

If the unit is to be used on 230-volt operation, it is necessary to replace the 1/2-ampere fuse with a 1/4 ampere fuse. The reverse procedure is necessary when converting from 230-volt operation to 115-volt operation.

Five spare fuses of each rating are supplied with each new unit.

INPUT CIRCUITS:

Model 175A measures and displays the phase angle relationship between two single phase ac signals applied to its input circuits.

Two identical input circuits are provided to facilitate measurements between two voltages, two currents or a voltage and a current. Each input circuit has binding posts for connecting the input signals. The two white binding posts labeled COMMON ± are used for both potential and current inputs. Although the two white binding posts are electrically the same point, the larger one should be used for currents in excess of 30 amperes. Either white binding post can be used as the common for potential inputs. Current inputs are applied to a white common binding post and the appropriate black binding post as determined by the value of current. Potential inputs are applied to a white common binding post and the appropriate red binding post as determined by the value of potential.

DIGITAL DISPLAY:
The digital display indicates the phase angle in degrees that the signal applied to INPUT 1 lags the signal applied to INPUT 2.

**LOW INPUT INDICATION:**

If the magnitude of one of the inputs is below the rating of the input range being used, the display will indicate all eights (888.8). The input can be moved to the low range (if it is not already connected there, and the display will indicate the phase angle, provided that the input is within the rating of this range. However, if the input is below the minimum rating of the lowest range, the display will continue to indicate all eights. A reading can be obtained by depressing the LOW SIGNAL switch which will override the all eights display; however, the error in measurement can be greater than that for inputs within the instrument’s rated ranges.

**HIGH INPUT INDICATION:**

If the magnitude of one of the inputs is above the rating of the input range being used, the display will blink (flash on and off). The input can be moved to the high range (if it is not already connected there), and the display will stop blinking provided that the input is within the rating of this range. However, if the input is above the maximum rating of the highest range, the display will continue to blink. When the display blinks, the error in measurement can be greater than that for inputs within the instrument’s rated range.

**ACCURACY LEVELS:**

Model 175A is calibrated at the factory to measure the phase angle within rated accuracy for all input signals that are within the rated input ranges. On most units, if a low or high signal slightly outside the rated input ranges is applied, the meter will continue to accurately make its measurements. This is because the meter is factory calibrated to be within rated accuracy over the complete range at which it indicates without the display flashing or having all 8’s displayed.

**HOLD READING FEATURE:**

If it is desirable to retain the reading displayed, simply use the HOLD READING Switch. Whatever measurement is being displayed at the time this circuit is actuated will be held until the switch is turned off. The reading is held even when the input signal is removed.

**SELECTION OF UPDATE RATE:**

When shipped from the factory, the update rate of the instrument is set for 2 measurements per second. However, the update rate can be easily field adjusted to update rates of 15 to 30 times per second. To change update rate, remove the instrument from the case and locate the update rate switch which is a three-position slide switch mounted near the center of the top circuit board. This switch is easily accessible, and it is not necessary to remove the circuit board. When this switch is in the left position, the update rate is 30 times per second, and when in the center or right positions the update rate is 15 or 2 times per second respectively.
ZERO CHECK FEATURE

Instrument calibration can be readily checked by use of the ZERO CHECK Switch.

To perform zero check, allow instrument to warm up for 10 minutes and then apply either approximately 5 amperes to the 1.5-60 amperes range of INPUT 2 or approximately 120 volts to the 15-600 volts range of INPUT 2. Connection to INPUT 1 is not required. Then turn the ZERO CHECK Switch on and the display should read between 359.8 and 0.2.

No adjustment is necessary if the reading is within these limits. Model 175A is designed to minimize drifting; however, if zero check is outside these limits, the instrument can be recalibrated as follows:

1. Turn POWER ON Switch and HOLD READING Switches OFF and disconnect all inputs, including the input line cord, from their source.
2. Remove the instrument from the case by removing the four mounting screws on the back of the case and sliding the instrument out.
3. Place unit on table or bench top with its panel horizontal.
4. Apply current or potential input to INPUT 2 as outlined above.
5. Turn ZERO CHECK Switch ON.
6. Locate and adjust trim pots R1 and R21 (Input 1 and 2) until display indicates between 359.8 and 0.2. These trim pots are located at the bottom left side of the board. No other adjustments should be made without contacting the factory.
8. Re-install instrument in its case.
OPERATION INSTRUCTIONS

THEORY OF OPERATION:
The Model 175A Digital Phase Angle Meter operates by measuring the elapsed time between the zero cross-over of Input 2 versus Input 1. The input signal of each input is filtered to minimize the harmonic distortion that may be present. The filtered sine wave is then converted to a square wave. The two square waves are compared by the logic circuit. The result of the comparison is a square wave pulse train, which is an accurate measurement of the elapsed zero cross-over between the two inputs. This pulse train is then converted by the logic circuit to a phase angle and displayed on the digital readout.

POWER CONNECTION AND TURN-ON PROCEDURE:
1. Refer to Selection of Power Source Voltage on Page 2 before connecting instrument to a power source.
2. Check to insure POWER ON Switch is in the OFF position.
3. Connect the instrument to a suitable source of power. Check third wire in line cord to insure that the instrument is properly grounded to prevent any shock hazards.
4. Check to insure that the HOLD READING Switch is OFF. Turn POWER ON Switch ON. Display should light and indicate all eights (888.8).

PHASE ANGLE MEASUREMENTS:
1. Connect either a current or potential to the appropriate binding posts of INPUT 1. Do not connect more than one input. For example, do not connect a current and a potential source simultaneously to INPUT 1.
2. Connect either a current or potential source to the appropriate binding posts of INPUT 2. Again, do not connect more than one source to INPUT 2.

CAUTION: DO NOT CONNECT A POTENTIAL SOURCE TO THE CURRENT INPUT TERMINALS.

3. Display will now indicate the phase angle that INPUT 1 lags INPUT 2. If display is blinking or all 8’s are indicated - a high or low level input is present. See Page 4 for further details on LOW INPUT INDICATION, HIGH INPUT INDICATION and ACCURACY.

NOTE: It is suggested to use color-coded test leads with the same color to the binding posts with the polarity marks.
OPERATION INSTRUCTIONS (cont'd)

OPERATION BELOW RANGE LIMITS:

The Model 175A can be used for measuring phase angles below the meter's normal range limits.

In the lower current range 0.05-2.0 amperes, the Model 175A can be used to measure phase angles with as little as 0.015 amperes input. In the lower voltage range 1-40 volts, the Model 175A can be used to measure phase angles with as little as 0.25 volts input. However, the error in measurement will be greater than that for inputs within the instrument's rated ranges. When the magnitude of either the voltage or current drops below the lowest rating of the lowest input range, the display will indicate all eights (888.8). A reading can still be obtained by depressing the LOW SIGNAL switch.

OPERATION ABOVE RANGE LIMITS:

The Model 175A may be used for measuring phase angles above the meter's normal range limits; however, it is not recommended.

In the upper current range 2-60 amperes, the Model 175A may be used to measure phase angles with currents above 60 amperes input. In the upper voltage range 20-600 volts, the Model 175A may be used to measure phase angles with voltages above 600 volts input. When the magnitude of either the current or voltage rises above the rating of the highest input range, the display will begin to flash on and off. In no case should an overload greater than 100% be applied to the meter. If a reading is still required, and the inputs are below the 100% overload limit a reading may be obtained by connecting the inputs to the proper terminals. However, if an overload is applied for more than one minute, damage may result to the meter.

APPLICATIONS:

The phase angle meter has many uses. Certain terms will be used in this section which need to be defined.

1. Phase Angle is normally expressed in degrees. It is the angle between two sources, ie. voltage leading or lagging current between 0° and 359.9°

2. Power Factor is the cosine of the leading or lagging phase angle between a voltage and a current. It is either expressed as a decimal fraction or as a percent.

3. Power Factor Angle is the leading or lagging phase angle between the voltage and current.

A. Determining Polarity of Current Transformers

When current is induced into polarity of the primary of a current transformer, the current will flow out of polarity on the secondary, see figure 1.
FIGURE 1: Direction of Secondary Current in a C.T.

Using a current transformer of known polarity, the current transformer of unknown polarity can be determined with a phase angle meter. Connect the two current transformers to the phase angle meter as shown in Figure 2.

FIGURE 2: Determining Current Transformer Polarity

CAUTION: DO NOT OPEN THE SECONDARY OF THE CURRENT TRANSFORMERS WITH THE CURRENT SOURCE ENERGIZED.

If the polarities are the same, a phase angle of zero degrees should be indicated. If a reading of 180 degrees is indicated, the polarity is opposite that of the known current transformer.

B. Determining the Power Factor Angle of an Inductive Circuit.

The current in a power system represents both real and reactive power. To determine how much of the current is being used to power an inductive load, connect the phase angle meter as shown in Figure 3. Note that the current lags the voltage in an inductive circuit, therefore, the current is supplied to INPUT 1. The phase angle displayed is the Power Factor Angle between the lagging current on INPUT 1 and the voltage on INPUT 2. If the load were a pure inductive load the phase angle would be close to 90° or a Power Factor of 0% (cosine of 90° is 0.0).
C. Determining the Power Factor Angle of a Capacitive Circuit.

To determine how much of the current is being used to power a capacitive load, connect the phase angle meter as shown in Figure 4. Note that the current leads the voltage in a capacitive circuit, therefore, the current is supplied to INPUT 2. The phase angle displayed is the Power Factor Angle between the lagging voltage on INPUT 1 and the current on INPUT 2. If the load were a pure, capacitive load the phase angle would be close to 270° or a Power Factor of 0% (cosine of 270° is 0.0).
D. Determining Real and Reactive Power Flow in a Power System.

The phase angle meter shown in FIGURE 5, will read any angle from 0 to 359.9 degrees depending upon the direction of real and reactive power flow. If real power is leaving the bus and reactive is entering, the reading should be from $270^\circ$ to $359.9^\circ$. If on the other hand real power is entering and reactive is leaving the bus, the reading should be from $90^\circ$ to $180^\circ$. If both real and reactive power are entering the bus, the reading should be from $180^\circ$ to $270^\circ$. If both real and reactive power is leaving the bus, the meter should read from $0^\circ$ to $90^\circ$.

FIGURE 5: Determining Real and Reactive Power Flow
E. Verifying Connections to a Power Directional Relay with a Delta Connected Potential.

When checking power directional relays, or any three-phase relay with a Delta-connected potential source, the voltage reference is phase-shifted $30^\circ$. With the phase angle meter connected as shown in FIGURE 6, the meter will read $30^\circ$ lagging when the current is leaving the generator at unity power factor.
FIGURE 6: Verifying Connections to a Power Directional Relay With a Delta Connected Potential.

F. Verifying Connections to Transformer Rated Watthour Meters.

This section covers the use of the phase angle meter to check connections of transformer rated watthour meters. The procedure outlined provides a simple means where the average meter technician can easily and accurately check the connections of
transformer rated watt-hour meters.

Three types of meters are shown: 3Ø 4 wire delta, 3Ø 4 wire Y, and 3Ø 3 wire 2 Element. There are other types, the techniques shown in this section may be modified to verify other forms of metering.

The vectors shown are plotted as conventional polar and are shown in a counter-clockwise rotation.

It is assumed that the operator of this equipment has the knowledge and technical ability to properly connect the meter as shown in the examples. If the operator is unfamiliar with the meter and its operation, it is suggested that he thoroughly read and understand the Operating Instructions beginning on page 6.

When making phase angle measurements, it is suggested that the operator put an ammeter in series with the current leg to the phase angle meter. Measure the phase angle when the currents are about equal (this will insure higher accuracy for changing load conditions).

### 3Ø 4 Wire Y 3 Element

Connect the phase angle meter to phase A, see FIGURE 7. Note, in this example the phase angle meter is shown connected to phase C for simplicity. After connecting the phase angle meter, measure the angle, record, and plot as shown in FIGURE 8. Repeat the procedure for B and C phases. If the measurements and installation are correct, the potentials will be 120° apart.

If the load is closely balanced, the Power Factor can be determined by averaging the three angles together. As in the example, in FIGURE 8 the average of the three angles is 30°. The cosine of 30° is 0.87 or a Power Factor of 87%.

### 3Ø 3 Wire 2 Element

Connect the phase angle meter as shown in FIGURE 9. In this example, the phase angle meter is connected to C phase for simplicity. Measure the potential vectors $V_{A-B}$, $V_{B-C}$ and $V_{C-A}$. Repeat the procedure for $I_A$ and $I_B$. After the polar plot is completed, similar to FIGURE 10, plot a system delta diagram paralleling the original polar vectors, see FIGURE 11. The hypothetical $V_{A-O}$ and $V_{C-O}$ are established by bisecting the angles B-A-C and A-C-B. These vectors will be 30° away from the basic potential vectors and establish the unity power factor point for a 3 wire delta system. With a protractor determine the angle between $V_{A-O}$ and $I_A$ and $V_{C-O}$ and $I_C$. The cosine of the average of these two angles is the calculated power factor, see Figure 12.
3Ø 4 Wire Delta 3 Element

Connect the phase angle meter as demonstrated in FIGURE 13. In FIGURE 13, the phase angle meter is connected to C phase for simplicity. Measure the potential vectors $V_{A-B}$, $V_{B-C}$ and $V_{C-A}$. Repeat the procedure for $I_A$ and $I_B$. After the polar plot is completed, similar to FIGURE 14, plot a system delta diagram paralleling the original polar vectors, see FIGURE 15. The hypothetical $V_{A-O}$, $V_{B-O}$, and $V_{C-O}$ are established by bisecting the angles. These vectors will be 30° away from the basic potential vectors and establish the unity power factor point for a 4 wire delta system. With a protractor determine the angle between $V_{A-O}$ and $I_A$, $V_{B-O}$ and $I_A$, and $V_{C-O}$ and $I_C$. The cosine of the average of these three angles is the calculated power factor, see Figure 16.
FIGURE 7: Verifying Connections of 3 Ø 4 Wire Y 3 Element Meters

3 Ø 4 Wire Y Meter

<table>
<thead>
<tr>
<th></th>
<th>IA</th>
<th>IB</th>
<th>IC</th>
</tr>
</thead>
<tbody>
<tr>
<td>VA-N</td>
<td>28°</td>
<td>VB-N</td>
<td>30°</td>
</tr>
<tr>
<td>VB-N</td>
<td>268°</td>
<td>VC-N</td>
<td>270°</td>
</tr>
<tr>
<td>VC-N</td>
<td>148°</td>
<td>VA-N</td>
<td>150°</td>
</tr>
<tr>
<td></td>
<td></td>
<td>VB-N</td>
<td>152°</td>
</tr>
</tbody>
</table>

Part _12448_
Rev. 0
3 & 3 Wire Meter Phase Angle Vector

PHASE ANGLE VECTOR

IA
VA-B ______ 60 °
VB-C ______ 300 °
VC-A ______ 180 °

IC
VA-B ______ 300 °
VB-C ______ 180 °
VC-A ______ 60 °
FIGURE 10

System Vector
<table>
<thead>
<tr>
<th>IA</th>
<th>VA-B</th>
<th>60°</th>
</tr>
</thead>
<tbody>
<tr>
<td>VB-C</td>
<td>300°</td>
<td></td>
</tr>
<tr>
<td>VC-A</td>
<td>180°</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IC</th>
<th>VA-B</th>
<th>300°</th>
</tr>
</thead>
<tbody>
<tr>
<td>VB-C</td>
<td>180°</td>
<td></td>
</tr>
<tr>
<td>VC-A</td>
<td>60°</td>
<td></td>
</tr>
</tbody>
</table>

**FIGURE 11**

3Ø3 Wire Meter Overlay System Vector on Meter Phase Angle Vector

```
IA  
VA-B  60°  
VB-C  300°  
VC-A  180°  

IC  
VA-B  300°  
VB-C  180°  
VC-A  60°  
```
FIGURE 13: Verifying Connections of 3Ø 4 Wire Delta Meters

\[\begin{array}{ccc}
I_a & I_b & I_c \\
VA-B & 55^\circ & VA-B & 195^\circ & VA-B & 315^\circ \\
VB-C & 295^\circ & VB-C & 75^\circ & VB-C & 195^\circ \\
VC-A & 175^\circ & VC-A & 315^\circ & VC-A & 75^\circ \\
VC-N & 145^\circ & VC-N & 285^\circ & VC-N & 45^\circ \\
\end{array}\]
System Vector
FIGURE 15

3 & 4 Wire Delta Meter Overlaying System Vector on Meter Phase Angle Vector
CALIBRATION CHECK:

It is recommended that the Model 175A be periodically tested to check calibration.

A quick and easy calibration check can be made by following the ZERO CHECK procedures on Page 5. This calibration check will provide an easy and efficient test of the instrument's circuits. If out of calibration, follow the step by step calibration procedures on that page.

If the meter is still out of calibration, it is recommended that the meter be sent to Multi-Amp Corporation, Instrument Division for repair and recalibration. However, if desired, the problem may be isolated. To isolate the problem, it is recommended that the user refer to the following TROUBLE-SHOOTING AND REPAIR PROCEDURE.

TROUBLE-SHOOTING AND REPAIR PROCEDURE:

Trouble-shooting Procedures list steps to follow to locate the cause of abnormal conditions encountered during checkout or operation of the Model 175A.

Trouble-shooting

Some of the most common problems in making correct phase angle measurements are due to incorrect connections. The following are typical abnormal indications and probable causes.

<table>
<thead>
<tr>
<th>METER INDICATION</th>
<th>PROBABLE CAUSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital Readout all 888.8's</td>
<td>One or both units are below input range. Go to next lower range. Refer to Page 7, Operation Below Range Limits.</td>
</tr>
<tr>
<td>Digital Readout Flashing</td>
<td>WARNING OVERLOAD One or both inputs are above range limit, disconnect inputs and refer to Page 7, Operation Above Limits.</td>
</tr>
<tr>
<td>Phase Angle appears to be 180° above or below expected value.</td>
<td>Polarity of either input is reversed. Reverse leads on one input.</td>
</tr>
<tr>
<td>Phase Angle appears to be</td>
<td>Connections to Input 1 and Input 2 have</td>
</tr>
</tbody>
</table>
grossly inaccurate been reversed causing the lead and lag to be reversed. Reverse inputs.
### TROUBLE-SHOOTING AND REPAIR (cont'd)

<table>
<thead>
<tr>
<th>Problem Description</th>
<th>Possible Cause and Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>The digital Readout does not change</td>
<td>Check the Hold Reading Switch.</td>
</tr>
<tr>
<td>Digital Readout Dim</td>
<td>Input voltage to the meter too low, refer to SELECTION OF POWER SOURCE INPUT, Page 2.</td>
</tr>
<tr>
<td>No Digital Readout</td>
<td>Check input fuses. Input voltage may be too low, refer to SELECTION OF POWER SOURCE INPUT, Page 2</td>
</tr>
<tr>
<td>Last Two Digits of Digital Readout Changing Rapidly</td>
<td>The update rate is too fast. Slow the update rate by switching the update rate switch to a slower update, refer to SELECTION OF UPDATE RATE, Page 4.</td>
</tr>
</tbody>
</table>

If the problem is not external to the meter, it may be isolated internally by following the recommended repair procedures.

If a spare replacement logic boards are stocked, the following repair procedure should be followed:

1. Install a complete set of logic boards.
2. If problem is corrected, install original logic boards one at a time until problem reoccurs.
3. Last board installed is the defective logic board. Replace original logic boards except for defective board, which is replaced by the spare replacement board.
4. Check calibration of unit by following the Zero Check Procedure on Page 5.
5. If unit cannot be recalibrated, it is recommended the unit be returned with defective boards to Multi-Amp Corporation, Instrument Division for repair and recalibration.

If a spare replacement printed circuit board is not available, the following equipment will be required to isolate the defect:

1. Millivoltmeter capable of measuring a voltage of 500 mVac rms with accuracy of ±1%.
1 ea. D.C. voltmeter capable of measuring from 5-20 volts d.c. with an accuracy of ± 1%. 
TROUBLE-SHOOTING AND REPAIR (cont’d)

1 ea. Oscilloscope for observing waveform.

1 ea. Voltage source, see below.

1 ea. A.C. Voltmeter capable of measuring up to 120 volts with an accuracy of ± 1%.

1 ea. Extender card for PC boards.

If the required equipment is not available or trained technical personnel are not available, it is recommended the unit be returned to the factory for repair and recalibration.

Additionally, before starting trouble-shooting repair procedure, it is recommended that if the test technician has not read the instruction manual, that he or she do so before starting repair procedures.

WARNING: CIRCUITS WILL PRESENT A SHOCK HAZARD DURING TROUBLE-SHOOTING PROCEDURE.

TESTING AC POWER SUPPLY AND ANALOG/LOGIC SECTION

1. Turn POWER ON Switch OFF. Check to insure HOLD READING Switch is in the OFF position. Disconnect the inputs and power line cord from their sources.

2. Remove the instrument from the case by loosening the four mounting screws from the back of the case and sliding the instrument out.

3. Place unit so that the circuit board can be easily obtained.

4. Connect the 1-40 volt terminals of Inputs 1 and 2 in parallel with a.c. voltage source, see below.

CAUTION: DO NOT connect the voltage source to the current terminals.

5. Connect the Model 175A to a proper voltage source and switch POWER ON Switch to ON position.

6. Using the d.c. voltmeter, measure the voltage levels of the Power Supply, refer to schematic for pin numbers and proper voltage levels. If proper voltage levels are not present, Power Supply needs to be replaced or repaired. If proper voltage levels are present, proceed to next step.

NOTE: Before removing or inserting the PC extender card, check to insure power is disconnected.

7. Turn power OFF to inputs 1 and 2. Also, turn power OFF to the meter and disconnect power cord from source.

8. Pull out the Filter Board. With the meter on its "back," the filter Board will be the lower P.C. board. Insert the extender card and plug the Filter Board into the extender card.

9. Reconnect the power source and Inputs 1 and 2. Turn Power ON and set 120 volts on Inputs 1 and 2.
10. With the use of the millivolt meter measure the voltage levels at pins 1 and 14, refer to the schematic for circuit location and voltage levels. With the use of the oscilloscope observe the wave form at pins 1 and 14. If the wave form is not a sine wave and if the voltage level is not approximately 275 mvac, check the main frame for loose connections as well as T1 and T2 for shorted turns. If pins 1 and 14 check good, go to the next step.

11. With the use of the oscilloscope observe the wave form and voltage level at pins 4 and 11. If the wave form is not a sine wave with a voltage level of approximately 1.22 vac, the problem is in the filter board. It is recommended the board be returned to the factory for repair or replaced. If the wave form and voltage check good, go to the next step.

12. With the use of the D. C. voltmeter and oscilloscope, measure the voltage level and wave form at pins 5 and 10. The voltage should be approximately 5 volts d.c. and the wave form a square wave. If the voltage or wave form are not correct, the problem is in the Filter Board and it is recommended, the board be returned to the factory for repair or replaced. If the wave form and voltage check good, go to the next step.

13. If, by this point, all circuits have checked good, the problem must be in the last remaining circuit, the Logic Board. Replacement of the Logic Board is recommended, or return the defective board to the factory for repair.

If the problem is still present, it is recommended the unit be returned to the factory for repair and recalibration.