Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

With the principle of “Quality Parts,Customers Priority,Honest Operation,and Considerate Service”,our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!

Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832
Email & Skype: info@chipsmall.com Web: www.chipsmall.com
Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China

INSTRUCTION MANUAL

MANUAL DE INSTRUCCIÓN

B+K PRECISION®

MODELS 1653A & 1655A

MODELOS 1653A & 1655A

Isolated-Variable AC POWER SUPPLY

Aislada, variable
FUENTE DE PODER DE AC

B+K PRECISION®

TEST INSTRUMENT SAFETY

WARNING

An electrical shock causing 10 milliamps of current to pass through the heart will stop most human heartbeats. Voltage as low as 35 volts dc or ac rms should be considered dangerous and hazardous since it can produce a lethal current under certain conditions. Higher voltages are even more dangerous. Your normal work habits should include all accepted practices to prevent contact with exposed high voltage, and that will steer current away from your heart in case of accidental contact with a high voltage. You will significantly reduce the risk factor if you know and observe the following safety precautions:

1. The **B+K Precision** Models 1655A and 1653A AC Power Supplies are sources of high voltage ac. The person using the instrument should be a qualified electronics technician or otherwise trained and qualified to work with high voltage.
2. Use only a polarized 3-wire ac outlet. This assures that the power supply chassis, case, and ground terminal are connected to a good earth ground and reduces danger from electrical shock.
3. When servicing any equipment equipped with a two-wire ac plug, treat it as "hot chassis" type and connect it to the ISOLATED OUTPUT outlet of the ac power supply. Even some equipment with a polarized plug is the "hot chassis" type.
4. Never connect two pieces of "hot chassis" equipment to ISOLATED OUTPUT outlets simultaneously. There may be a serious shock hazard between two chassis.
5. Don't expose high voltage needlessly. Remove housings and covers only when necessary. Turn off equipment while making test connections in high-voltage circuits. Discharge high-voltage capacitors after removing power.
6. If possible, familiarize yourself with the equipment being tested and the location of its high voltage points. However, remember that high voltage may appear at unexpected points in defective equipment.
7. Use an insulated floor material or a large, insulated floor mat to stand on, and an insulated work surface on which to place equipment; and make certain such surfaces are not damp or wet.
8. Use the time proven "one hand in the pocket" technique while handling an instrument probe. Be particularly careful to avoid contacting a nearby metal object that could provide a good ground return path.
9. When testing ac powered equipment, remember that ac line voltage is usually present on some power input circuits such as the on-off switch, fuses, power transformer, etc. any time the equipment is connected to an ac outlet, even if the equipment is turned off.
10. Never work alone. Someone should be nearby to render aid if necessary. Training in CPR (cardio-pulmonary resuscitation) first aid is highly recommended.

Instruction Manual
for

BK PRECISION

MODELS 1653A & 1655A
Isolated, Variable
AC POWER SUPPLY

BK PRECISION

22820 Savi Ranch Parkway
Yorba Linda, CA 92887
www.bkprecision.com

TABLE OF CONTENTS

FEATURES

Unless otherwise stated, all information in this section applies equally to Model 1653A and 4655A

WIDE VOLTAGE RANGE

Output voltage continuously variable from 0 to 150VAC.

WIDE CURRENT RANGE

Model 1655A

Heavy duty unit handles virtually all servicing needs. Output current up to 3 amps continuous, 4 amps intermittent.

Model 1653A

Handles many servicing needs. Output current up to 2 amps continuous.

WIDE LOAD MEASUREMENT CAPABILITY

Model 1655A

Built in multi-function meter. 0-150V. Two current ranges of 0-2A and 0-4A for improved resolution. Current scales also calibrated in VA at 120V.

Model 1653A

Built in dual-purpose meter measures output voltage from 0-150V and output current from 0-2A.

ISOLATED OUTPUT VOLTAGE

Built-in isolation transformer for safe servicing of "hot chassis" equipment. One isolated outlet on Mode 1653A, two isolated outlets on Model 1655A for greater convenience.

BUILT-IN METER

Model 1655A

3-1/4 inch meter. Multi-color scales. Overrange protection

Model 1653A

2 inch meter. Overrange protection.

---Model 1655A offers the following additional features---

POWER LINE LEAKAGE TEST

OSHA, UL, and CSA power line leakage test capability; fast and safe measurement.

EXPANDED LEAKAGE SCALE

0-5mA (0-5000µA) leakage scale is expanded in most commonly used 100-500µA portion, compressed to 5 mA full scale. Overload protected.

CIRCUIT BREAKER OVERLOAD PROTECTION

Isolated output protected by easily reset circuit breaker.

SOLDERING IRON TEMPERATURE CONTROL

Built-in solid state soldering iron temperature control

SPECIFICATIONS

MODEL 1655A

OUTPUT ISOLATION
Leakage less than 0.1mA (25ºC, 50% relative humidity.)

VOLTAGE ADJUSTMENT RANGE
0-150VAC, with input at 120VAC

VOLTAGE/CURRENT SENSING
Sine wave average, calibrated in RMS

MAXIMUM CURRENT (Isolated)
3A continuous, 4A intermittent (0-130V). Intermittent not to exceed 4 minutes at 4A followed by 5 minutes at 1A max.

METER SCALES

Voltage .....:0-150V
Current:. 0-2A
.....0-4A
Volt-Amps (Voltage Set to 120)..... 0-240VA
..... 0-480VA
Leakage .....0 to 5mA (5,000µA), expanded scale

METER ACCURACY (25ºC)

Volts:.....±5% (typical) of full scale (calibrated @ 120VAC)
Current:.....±5% (typical) of full scale
Leakage:.....±5% @ 500µA

MODEL 1653A

OUTPUT ISOLATION

Leakage less than 0.1mA (25ºC, 50% relative humidity)

VOLTAGE ADJUSTMENT RANGE

0-150VAC, with input at 120VAC

VOLTAGE/CURRENT SENSING

Sine wave average, calibrated in RMS.

MAXIMUM CURRENT (Isolated)

2A continuous (0-130V).

METER SCALES

Voltage:.....0-150V

Current:.....0-2A

METER ACCURACY (25ºC)

Volts:.....±5% (typical) of full scale (calibrated @ 120VAC)

Current:.....±5% (typical) of full scale

SPECIFICATIONS

MODEL 1655A

AC INPUT

120 VAC, 60Hz, 600 VA*

OPERATING TEMPERATURE RANGE

0° C to +40°C.

STORAGE TEMPERATURE

-30° C to +60°C.

WEIGHT

22lb (10kg.)

DIMENSIONS (WxHxD)

10.5” x 5.7” x 12” (267 x 145 x 305 mm)

PEAK CURRENT (Inrush)

30 A max (inrush limited to one cycle at 30A).

SOLDER IRON TEMPERATURE CONTROL

70% - 99% of power line (100W max).

MODEL 1653A

AC INPUT

120 VAC, 60Hz, 300 VA*

OPERATING TEMPERATURE RANGE

0°C to +40°C.

STORAGE TEMPERATURE

-30°C TO +60°C.

WEIGHT

12 lb (5.5 kg).

DIMENSIONS (WxHxD)

5.5” x 6.5” x 10.5” (140 x 165 x 267 mm).

NOTE: Specifications and information are subject to change without notice. Please visit www.bkprecision.com for the most current product information. *For 220V input, order model number 1655A-220V or 1653A-220V.

CONTROLS AND INDICATORS

FRONT PANEL CONTROLS

(Refer to Fig. 1 and 2)

1. **POWER ON Switch.**
2. **POWER ON Pilot Light.**
3. **Function Switch.**

Model 1655A

Five interlocking pushbutton switches which select function and meter scale. Pressing a button releases the previous selection. The following selections are available:

VOLTS. Connects meter to measure voltage at ISOLATED OUTPUT. Use 0-150 VOLTS scales on meter. Voltage is adjustable with AC VOLTS control.

AMPS 0 – 4. Connects meter to measure current of ISOLATED OUTPUT. USE 0-4 AMPS scale on meter. When voltage is set to 120 VAC, the 0-480 VA scale may be used to measure the output load in volt-amps

AMPS 0-2. Connects meter to measure current of ISOLATED OUTPUT. Use 0-2 AMPS scale on meter. When voltage is set to 120VAC, the 0-240VA scale may be used to measure the output load in volt-amps.

LEAKAGE COM. Connects meter to measure leakage with respect to common side of ac line. Use LEAKAGE scale on meter. Voltage must be preset to 120VAC for accurate leakage measurements.

LEAKAGE HOT. Connects meter to measure leakage with respect to hot side of ac line. Use LEAKAGE scale on meter. Voltage must be preset to 120VAC for accurate leakage measurements.

Model 1653A

Alternate action pushbutton switch selects function of meter. Push once to latch button in AMPS (in) position. Push again to release button to VOLTS (out) position. The following selections are available:

VOLTS. Connects meter to measure voltage at ISOLATED OUTPUT. Use 0-150 VOLTS scale on meter. Voltage is adjustable with AC Volts control.

AMPS. Connects meter to measure current of ISOLATED OUTPUT. Use 0-2 AMPS scale on meter.

4. **Meter.** Appropriate scale is selected by function switch.
5. **AC VOLTS Control.** Adjusts voltage at ISOLATED OUTPUT receptacle(s) from 0 to 150 volts.

6. **ISOLATED OUTPUT Receptacle(s).** Isolated, variable ac voltage outlet(s). The equipment under test plugs in here. Single outlet on Model 1653A. Dual outlets on Model 1655A.

7. ***Leakage Probe.** With LEAKAGE function selected, touching probe tip to exposed metallic parts of equipment under test checks power line leakage.

8. ***SOLDER TEMP Control.** Full counterclockwise rotation turns off soldering iron outlet on rear panel. Initial clockwise rotation turns on outlet at standby (warm) temperature. Further clockwise rotation increases soldering iron temperature. Temperature adjustment is tapered, allowing fine adjustment of "hot" temperature at upper end of adjustment range. This control is completely independent of the POWER ON switch.

9. ***Solder Temp Pilot Light.** Lights whenever soldering iron outlet on rear panel is powered.

REAR PANEL CONTROLS

(Refer to Fig. 3 and 4)

10. **AC Power Cord.**

*=Model 1655A Only.

11. **Fuse.**

Model 1655A

4A fuse protects auto-transformer against excessive output current at low voltages which may not trip the input circuit breaker.

Model 1653A

3A line fuse protects against excessive input current. An internal 3A fuse protects against excessive output current at low voltages which may not blow the input fuse.

12. ***Circuit Breaker.** 3.15A circuit breaker protects against excessive input current. Remove overload and push to reset.

13. ***Soldering Iron Outlet.** AC outlet for soldering iron. Duty cycle, and thus temperature, is variable with SOLDER TEMP control on front panel. This outlet is intended only for non-transformer type soldering irons rated at 100 watts or less.

*=Model 1655A Only

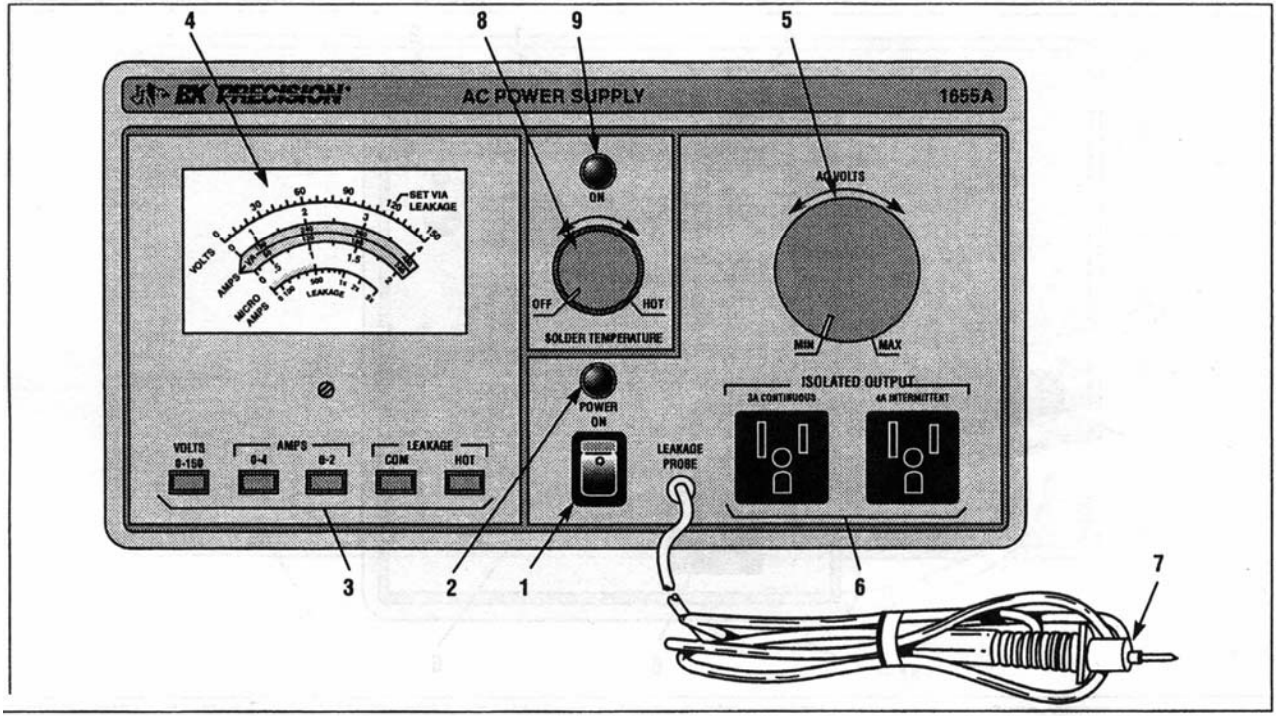

Figure 1. Front Panel Controls and Indicators, Model 1655A

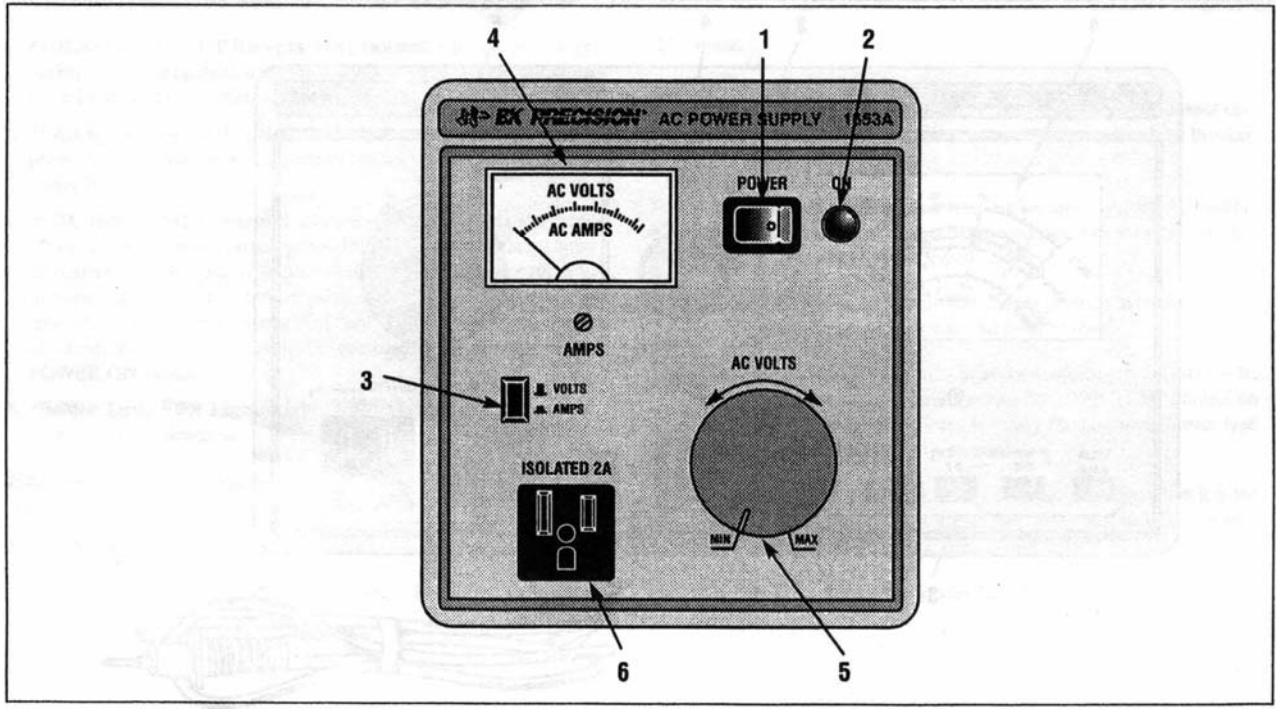

Figure 2. Front Panel Controls and Indicators, Model 1653A

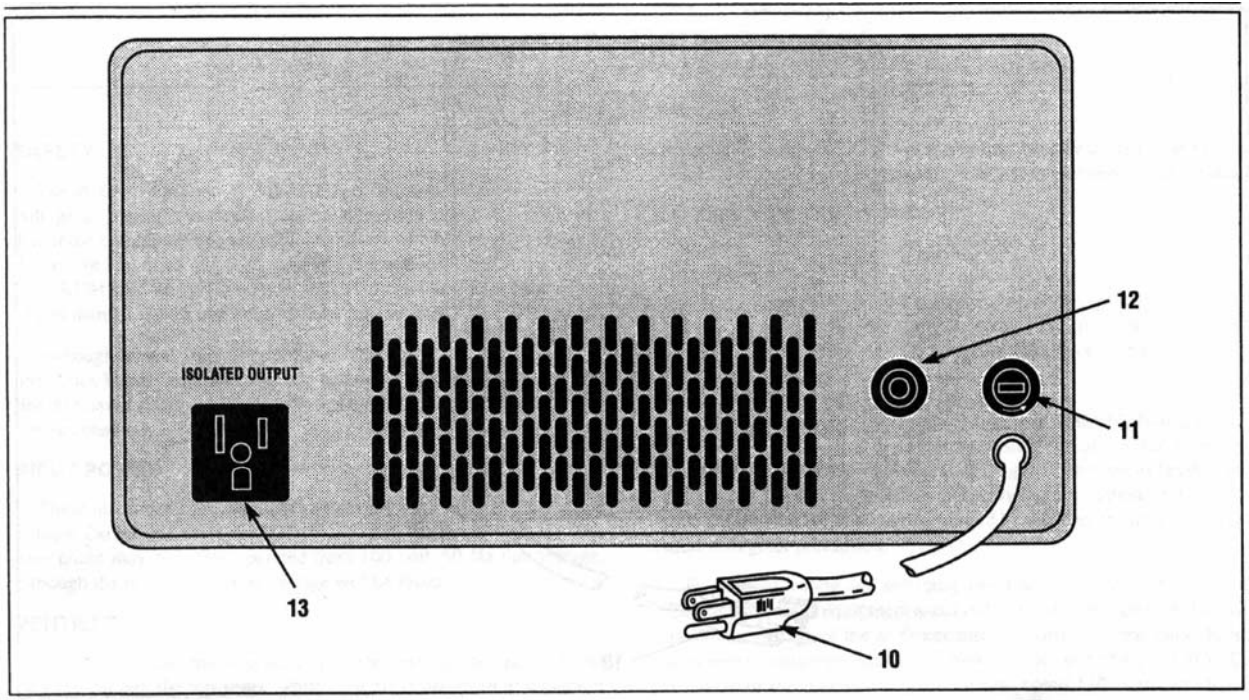

Figure 3. Rear Panel Controls and Indicators, Model 1655A

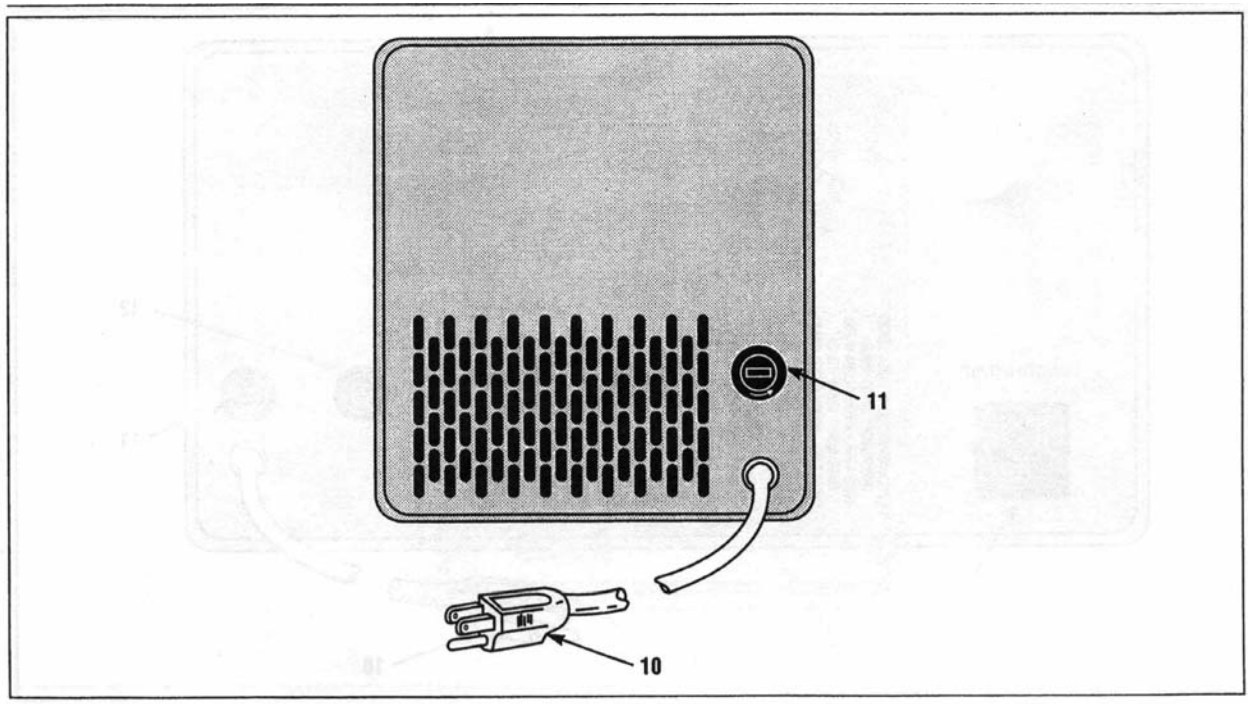

Figure 4. Rear Panel Controls and Indicators, Model 1653A

PRECAUTIONS

SAFETY

The Model 1655A and 1653A AC Power Supplies are sources of high voltage ac. Improper or careless use could result in fatal electrical shock. The most commonly encountered conditions which may pose a shock hazard are identified and corresponding precautions listed in the TEST INSTRUMENT SAFETY section which starts on the side front cover of this manual. Know and observe these precautions.

Although Model 1655A is equipped with dual isolated outlets, only one "hot Chassis" equipment should be connected at a time. Unless the line-to-chassis relationship is identical, a shock hazard will exist between the two chassis.

INPUT POWER

These instruments are intended for use only with 120 volt, 60Hz line voltage. Do not operate from 50Hz, or 220-240 volt power systems. The instrument may be safely operated from 100 volt, 60Hz line voltage, although the maximum output voltage will be lower.

VENTILATION

The holes in the case provide convection cooling (hot air rises and escapes through the top vents, while cool air is drawn in to replace it through the bottom). Never block these ventilation holes with a manual, schematic diagram, other equipment, etc. If the air is blocked, the temperature inside the ac power supply may become excessive and cause failure of the unit. Similarly, avoid operating locations near sources of heat.

MAXIMUM OUTPUT VOLTAGE

CAUTION

Exceeding the maximum input voltage rating of the equipment under test (typically 130VAC) may cause severe damage to the equipment.

The output voltage of the ac power supply is adjustable from 0 to 150VAC. This is very useful in certain testing situations for stressing equipment beyond its normal operating range to determine its breakdown point. However, for most testing and servicing applications, input voltages higher than the maximum specified by the manufacturer should be used with great precaution.

For normal testing and servicing, check the maximum input voltage specification of the equipment under test and make sure you do not adjust the output voltage of the ac power supply higher than that value. Most ac powered equipment has a maximum input voltage rating of 130VAC. If unsure of the maximum rating, do not exceed 130 VOLTS. On Model 1655A, the 130-150 volt portion of the VOLTS scale is red as a reminder that caution should be observed.

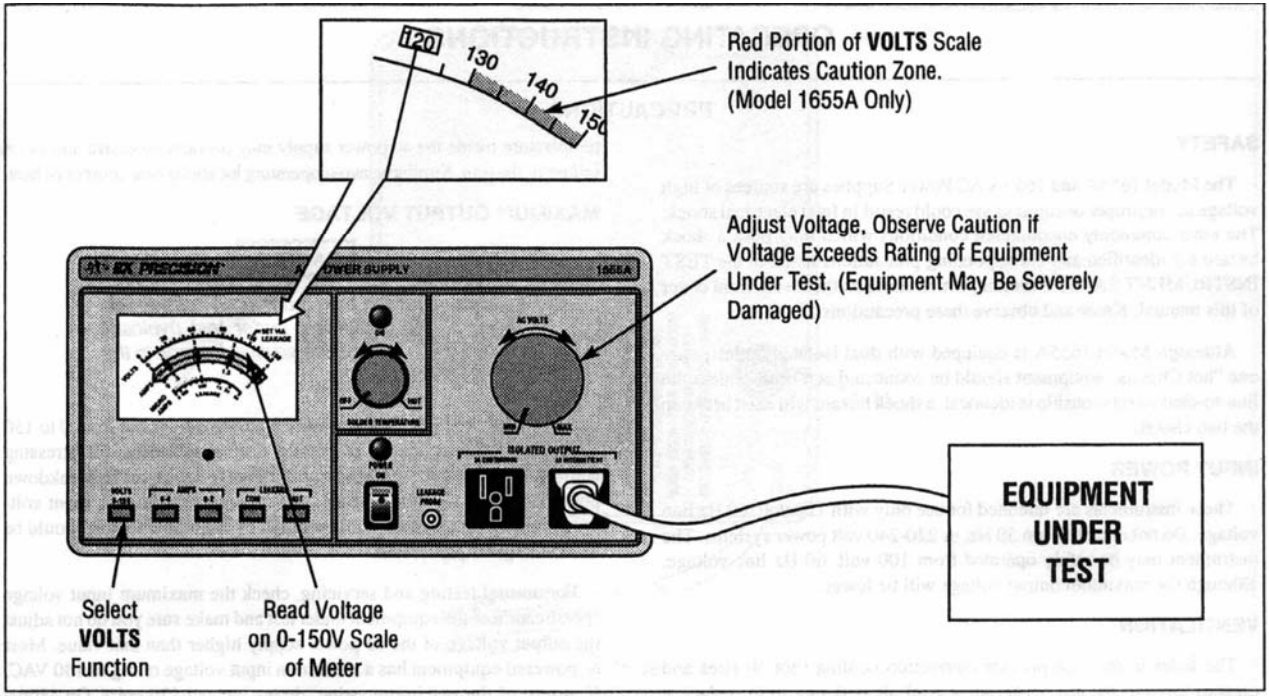

Figure 5. Observe Caution Above 130V.

MAXIMUM OUTPUT CURRENT

CAUTION

NEVER EXCEED THE MAXIMUM OUTPUT CURRENT RATING OF THE UNIT (Table 1). Excessive output current can damage the variable auto-transformer.

Keep output current as low as possible; power only one piece of equipment at a time. Use the ISOLATED OUTPUT only for the equipment under test – not for the test equipment.

It is very important to observe the maximum current derating (Table 1) above 130 volts, and to allow sufficient cooling time when operating Model 1655A in the intermittent duty region.

Even at low voltages, the maximum output current should never exceed 4 amps for Model 1655A or 2 amps for Model 1653A. Higher current may damage the variable auto-transformer where the brush contacts the winding. A 3.15A circuit breaker limits maximum input current to Model 1655A, while a 3A fuse is used for Model 1653A. Additionally, output fuses limit the output of the 1655A to 4 amps and the 1653A to 3 amps at low voltages that would not open the input protective device. Never bypass the circuit breaker or fuses, or replace fuses with a higher value.

Remove the overload to reset the circuit breaker or replace a fuse. Turn off the unit when connecting or disconnecting equipment from the ISOLATED OUTPUT receptacle(s).

For Model 1655A, the red portion of the 0-4A scale of the meter indicates the caution zone (over 3A). This is a reminder that only intermittent duty operation is permitted.

For Model 1635A, the output current should not exceed 2 amps for continuous duty or intermittent duty operation. The full scale meter indication of 2A is a reminder that this is the maximum permissible output current.

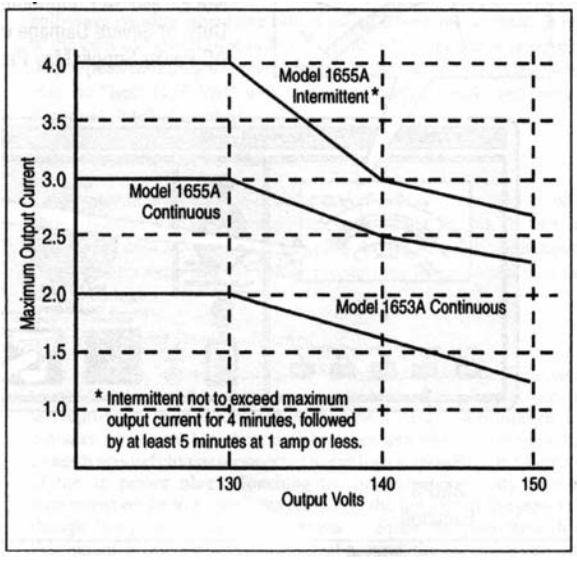

Table 1. Maximum Output Current Derating.

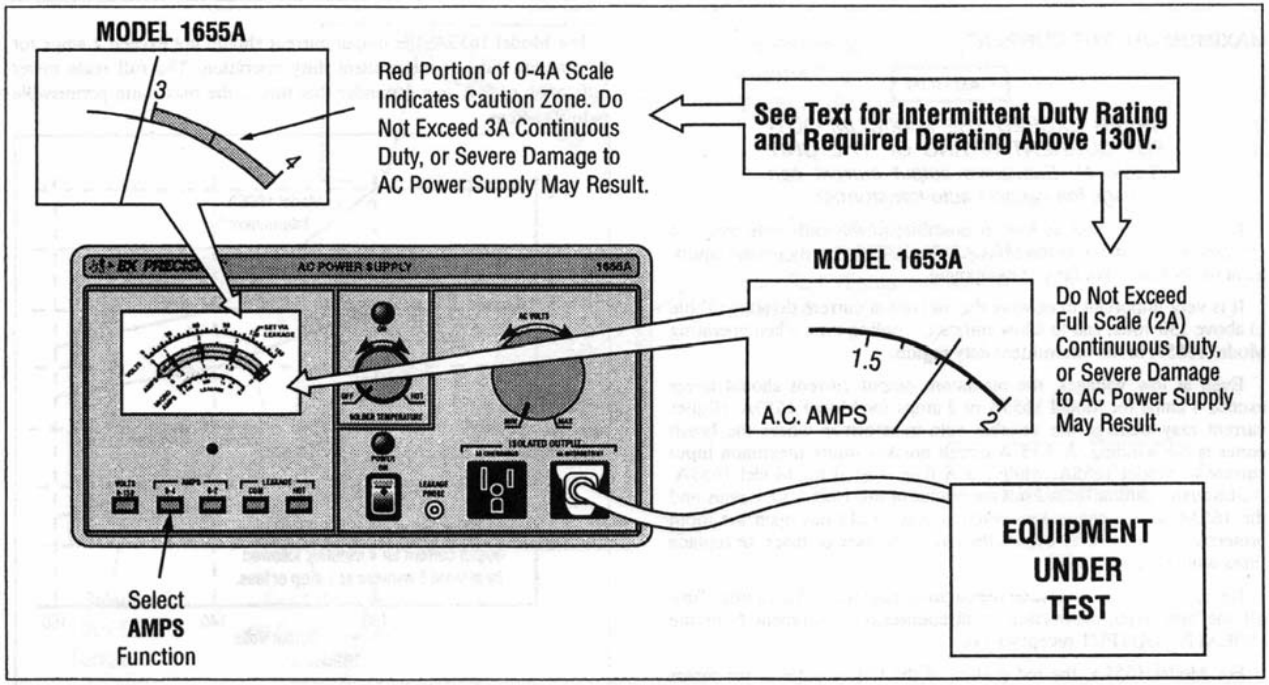

Figure 6. Maximum Current Considerations.

TROUBLESHOOTING: USING THE AC POWER SUPPLY AS ISOLATION TRANSFORMER

THE HAZARD

Most equipment with a 2-Wire Plug is Transformerless

Most recent television receivers and other consumer products such as stereo amplifiers, tuners, tape decks, etc. do not contain an isolation transformer. Such products often have a plastic or wood cabinet which completely insulates the chassis and prevents the user from touching it. However, when the cabinet is removed for servicing the product, the chassis is exposed and may become an electrical shock hazard to the service technician.

Bridge Rectifier Transformerless Equipment

One of the most commonly used types of power supply circuits in television receivers and audio equipment is the transformerless full wave bridge rectifier shown in Fig 7. In such cases, the chassis is always "hot", regardless of which way the 2-wire ac plug is inserted. Touching a "hot" chassis is hazardous and can cause fatal electrical shock.

WARNING

Just because a unit uses a polarized power plug does not guarantee safety. Some equipment with a bridge rectifier uses a polarized power plug, and as mentioned above, always has a "hot" chassis.

Transformerless Half-Wave Rectifier Equipment

Another commonly used transformerless power supply circuit is a half-wave rectifier where one side of the ac power line connects directly to the chassis (also shown in Fig. 7). Unless the equipment is equipped with a polarized plug to prevent insertion the "wrong" way, the chassis may be "hot" (120VAC with respect to earth ground) and cause an electrical shock if touched.

Other Transformerless Hazards

Equipment with voltage doubler power supplies may also be of the "hot Chassis" variety and pose the same safety hazard. In fact, and equipment with a 2-wire ac power plug should be treated as hazardous "hot" chassis type and the safety precautions listed on the next page should be taken.

Test Equipment Damage Hazard

In addition, to the electrical shock hazard if the "hot" chassis is touched, there is also a high probability of damaging any ac-powered test equipment used to service the equipment. Most test equipment with a 3-wire power cord, such as oscilloscopes and signal generators, have an earth ground chassis (connected to earth ground through the third wire of the ac power plug). Touching the ground lead of any such test equipment probe to a "hot" chassis shorts the hot side of the power line through the ground lead and instrument. Since the path through the instrument is intended only as a signal ground, the excessive current of a direct power line short may cause extensive damage to the test equipment or to the equipment under test.

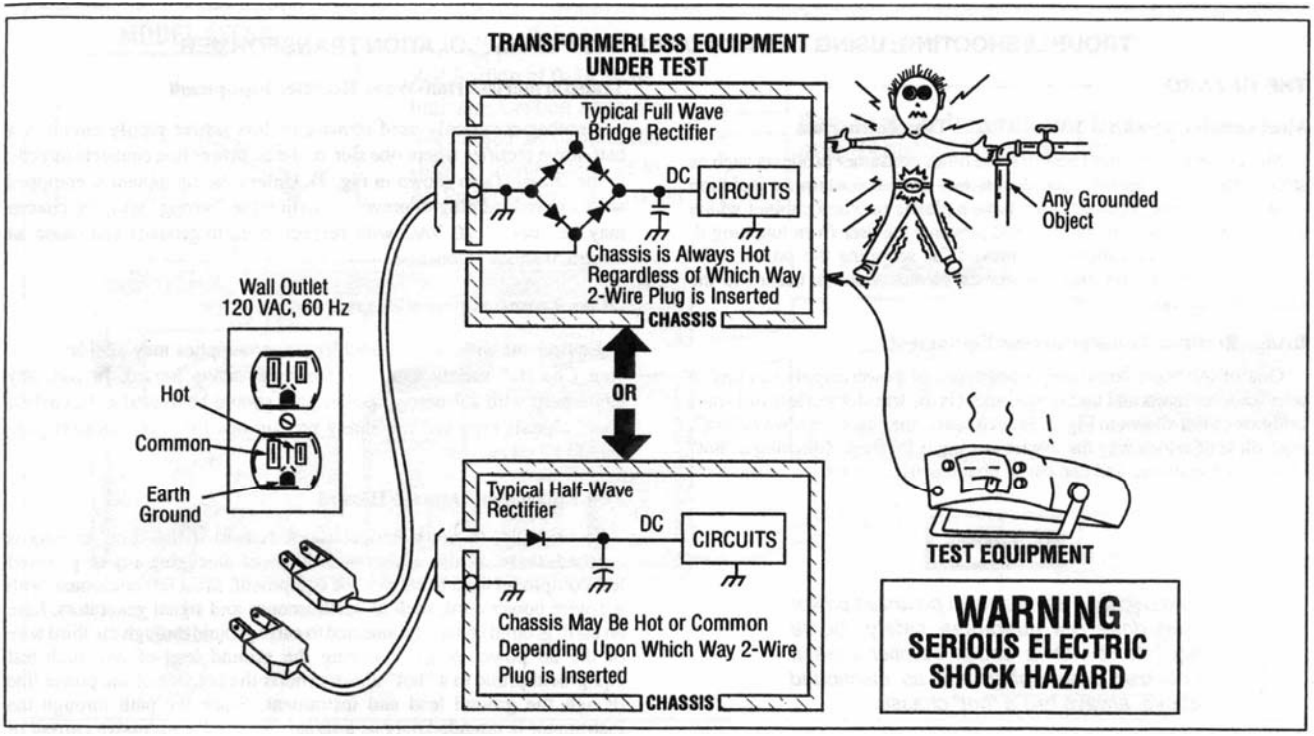

Figure 7. Servicing "Hot Chassis" Equipment Can Pose a Serious Shock Hazard.

THE SOLUTION

Don't Ground the Chassis

Simply connecting a test lead from the chassis to a good earth ground is not a satisfactory solution. If the chassis is "hot", this places a direct short from the "hot" side of the power line to earth ground. Hopefully, this would only trip the circuit breaker for the wall outlet. But a wall outlet is a very high energy source, and before the circuit breaker is tripped, the grounding test lead may "weld" or "disintegrate", or severe damage may occur to the equipment under test.

Use An Isolation Transformer

For servicing "Hot Chassis" equipment, always connect an isolation transformer between the wall outlet and the equipment under test. The Model 1655A or 1653A AC Power Supply includes such an isolation transformer, among its many other features.

As shown in Fig. 8, when an isolation transformer is used, the chassis of the equipment under test is electrically isolated from both sides of the power line. The chassis of the equipment under test may not be grounded by connecting a test lead from the chassis to a convenient earth ground (such as an earth ground terminal of the test equipment).

Summary

Any piece of equipment with a 2-wire power plug may be the "hot chassis" type, even if it is equipped with a polarized plug. There is not disadvantage to using an isolation transformer, even if the equipment under test already includes its own isolation transformer. Therefore, for safety, treat all equipment with a 2-wire power cord as "hot chassis" and use the ISOLATED OUTPUT of the 1655A or 1653A AC Power Supply for servicing such equipment.

PROCEDURE

(refer to Fig. 9)

1. Turn off the 1655A or 1653A AC Power Supply and set AC Volts control to MIN.
2. Connect the power plug of the ac power supply to a 120 volt, 60 Hz ac wall outlet. The wall outlet must be the 3-wire type with the third wire returned to a good earth ground.
3. Connect any ac powered test equipment to be used to an ac wall outlet (do not use the ISOLATED OUTPUT receptacles of the ac power supply for test equipment).
4. Connect the ac power plug to the equipment under test to the ISOLATED OUTPUT receptacle of the ac power supply. This provides the isolation as shown in Fig. 8.

WARNING

CONNECT ONLY ONE "HOT CHASSIS" EQUIPMENT AT A TIME. Unless both have an identical line-to-chassis relationship, there is a shock hazard between two chassis.

5. Turn the POWER ON.
6. Select VOLTS function and adjust AC VOLTS control to desired voltage (typically 120V).
7. It is recommended that the chassis of the equipment under test be grounded with a test lead.

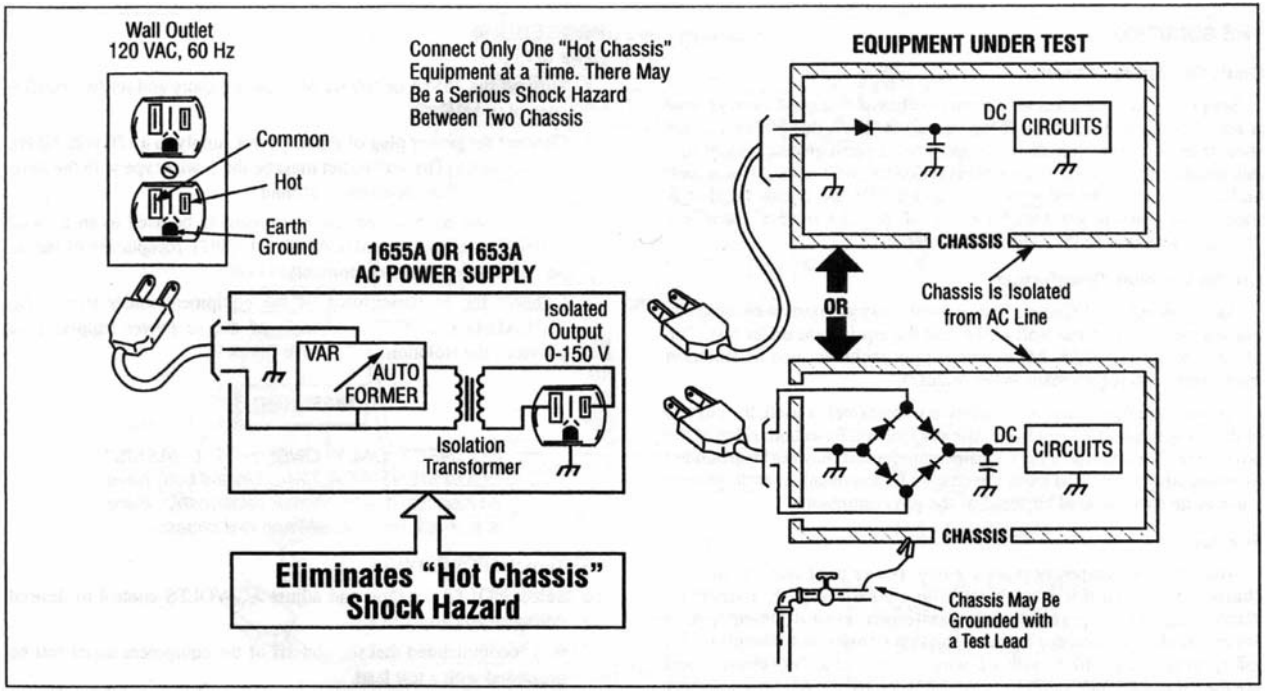

Figure 8. Eliminating the Hazard of Servicing Transformerless Equipment

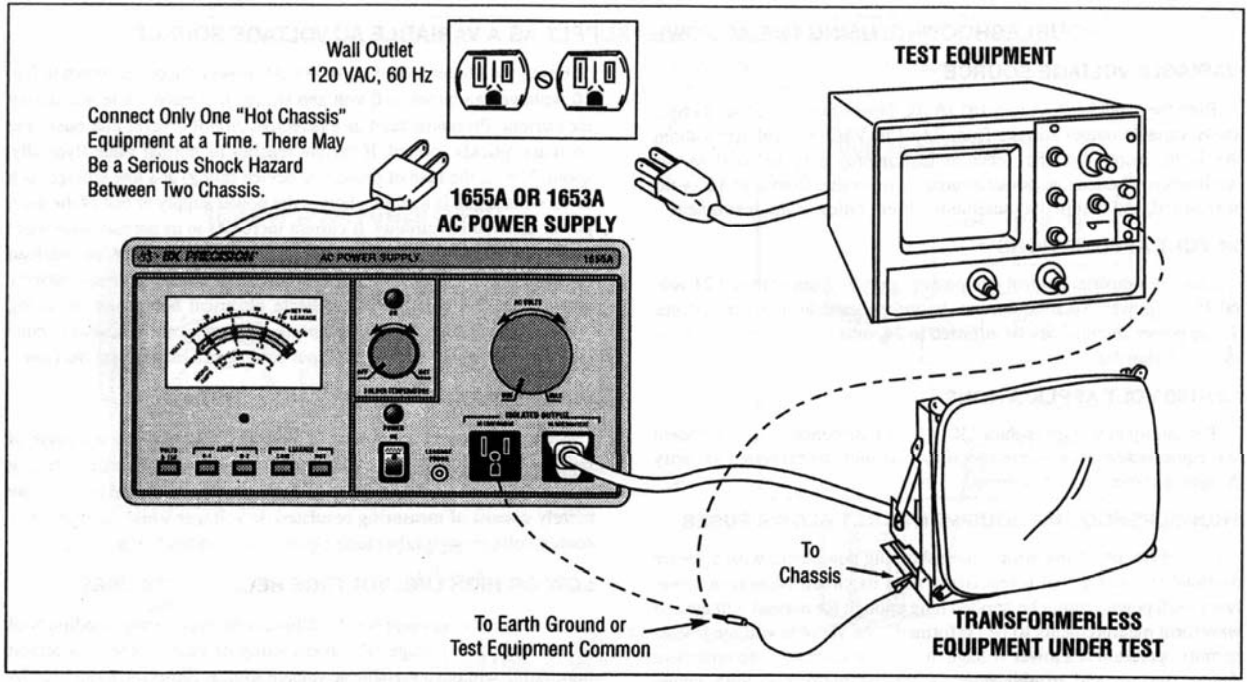

Figure 9. Using the AC Power Supply as an Isolation Transformer

TROUBLESHOOTING: USING THE AC POWER SUPPLY AS A VARIABLE AC VOLTAGE SOURCE

VARIABLE VOLTAGE SOURCE

Both the Model 1655A and 1653A AC Power Supplies offer continuously variable output voltage from 0 to 150VAC. Several applications are listed below, but the versatile instruments may be used in any application where an ac power source of any value from 0 to 150 volts is required, and within the maximum current rating of the instrument.

24 VOLT APPLICATIONS

Class II industrial control equipment operates from nominal 24 volt, 60 Hz ac power. Such equipment is widely used in industrial plants. These power supplies can be adjusted to 24 volts ac for bench servicing of the equipment.

130-150 VOLT APPLICATIONS

The ability to go higher then 130 volts is indispensable in component and equipment testing where specifications must be exceeded to verify designs and overvoltage margins.

TROUBLESHOOTING EQUIPMENT THAT BLOWS FUSES

One of the problems with troubleshooting equipment with a severe overload or short is that it repeatedly trips its circuit breaker or blows fuses. Full power cannot be applied long enough for normal voltage and waveform measurements to be performed. The variable voltage feature permits operation at a lower voltage that does not activate the protective device; testing and troubleshooting can be performed with power applied.

Using the Model 1655A or 1653A AC Power Supply as shown in Fig. 10, voltage can be set to 0 volt and slowly increased while monitoring the current. Problems such as a defective circuit breaker that open too soon are quickly spotted. If current reaches its normal value (typically, about 70% of the fuse of protective device rating) at a low voltage such as 20 volts, there is a major short in the power supply or one of the main power distribution circuits. If current increases to its normal value more gradually, allowing voltage to approach 100 volts or more, an overload in one of the circuits is probably the cause. Current that increases sharply above a certain voltage may indicate electrical breakdown or arcing within a component. Voltage or current measurements in various circuits (see Fig. 10) while varying the input voltage can help isolate the fault.

INPUT VOLTAGE SPECIFICATION TESTING

Most ac powered equipment is specified to operate over a range of input voltage such as 120VAC ±10%. Complete performance testing cannot be conducted without a variable ac source. Some testing may merely consist of measuring regulated dc voltages while varying the ac source voltage; with other tests conducted at nominal line voltage.

LOW OR HIGH LINE VOLTAGE RELATED FAILURES

Occasionally, an equipment malfunctions only during conditions of low or high line voltage. Troubleshooting of such problems is almost impossible without a variable ac voltage source. Either Model 1655A or 1653A AC Power Supply serves as a variable ac voltage source.

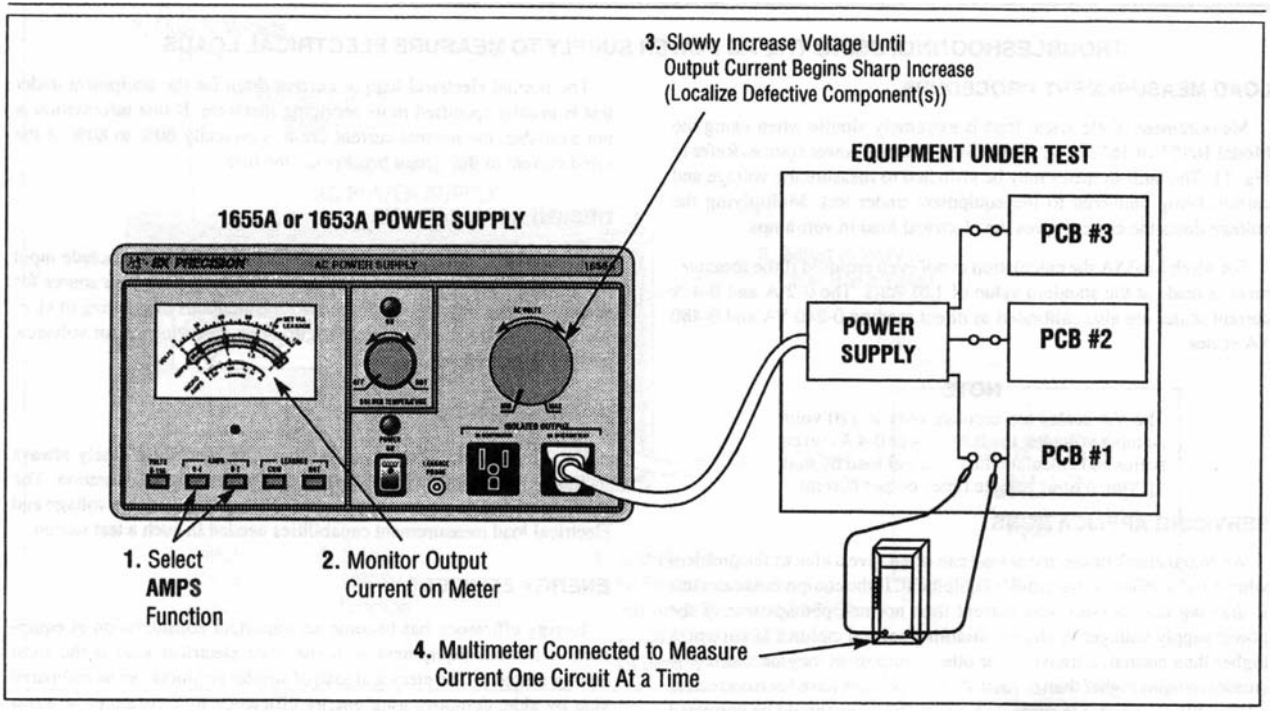

Figure 10. Using the Variable Voltage Feature to Troubleshoot Equipment with Short Circuit

TROUBLESHOOTING: USING THE AC POWER SUPPLY TO MEASURE ELECTRICAL LOADS

LOAD MEASUREMENT PROCEDURE

Measurement of electrical load is extremely simple when using the Model 1655A or 1653A AC Power Supply as the power source. Refer to Fig. 11. The built-in meter may be switched to measure the voltage and current being delivered to the equipment under test. Multiplying the voltage times the current give the electrical load in volt-amps.

For Model 1655A the calculations is not even required if the measurement is made at the standard value of 120 volts. The 0-2A and 0-4A current scales are also calibrated as direct reading 0-24VA and 0-480VA scales.

NOTE

The VA scales are accurate only at 120 volts. At other voltages, use the 0-2A or 0-4A current scales and calculate the electrical load by multiplying output voltage times output current.

SERVICING APPLICATIONS

An initial check of electrical load can often give a clue to the problem when troubleshooting electronics equipment. If the equipment under test is drawing considerably less current than normal, perhaps one of the power supply voltages is absent, disabling several circuits. If current is higher than normal, a transistor or other component may be shorted. If current remains higher than normal after other faults have been corrected, a leaky filter capacitor is suspected. Such problems should be corrected to prevent another impending failure.

The normal electrical load or current drain for the equipment under test is usually specified in its servicing literature. If that information is not available, the normal current drain is typically 60% to 80% of the rated current of the circuit breaker or line fuse.

DESIGN APPLICATIONS

The design goals of any ac powered electronic product include input power requirements. Using the ac power supply as the power source for breadboard and prototype units provides continuous monitoring of electrical load for various circuit configurations, at various input voltages, and at various temperatures.

PRODUCTION TESTING

Final testing of electrical and electronics equipment nearly always includes monitoring of electrical load in all modes of operation. The **B+K Precision** ac power supplies provide both variable voltage and electrical load measure meant capabilities needed in such a test station.

ENERGY EFFICIENCY

Energy efficiency has become an important consideration in equipment selection. Equipment with the least electrical load is the most energy efficient. The electrical load of similar products can be compared side by side, demonstrating energy efficiency to a customer in terms readily understood by a layman.