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PLEASE CHECK FOR CHANGE INFORMATION AT THE REAR OF THIS MANUAL.

PS 503A
DUAL
POWER SUPPLY

Francais Deutsch 日本語

INSTRUCTION MANUAL

Tektronix, Inc.
P.O. Box 500
Beaverton, Oregon 97077

Serial Number _____

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Product Group 75

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INSTRUMENT SERIAL NUMBERS

Each instrument has a serial number on a panel insert, tag, or stamped on the chassis. The first number or letter designates the country of manufacture. The last five digits of the serial number are assigned sequentially and are unique to each instrument. Those manufactured in the United States have six unique digits. The country of manufacture is identified as follows:

B000000	Tektronix, Inc., Beaverton, Oregon, USA
100000	Tektronix Guernsey, Ltd., Channel Islands
200000	Tektronix United Kingdom, Ltd., London
300000	Sony/Tektronix, Japan
700000	Tektronix Holland, NV, Heerenveen, The Netherlands

TABLE OF CONTENTS

WARNING

The remaining portion of this Table of Contents lists servicing instructions that expose personnel to hazardous voltages. These instructions are for qualified service personnel only.

SAFETY SUMMARY

The following text contains a two-part summary of general safety precautions that must be observed during all phases of operation, service, and repair of this instrument.

OPERATIONS SAFETY SUMMARY

The general safety information in this part of the summary is for both operating and servicing personnel. Specific warnings and cautions may be found throughout the manual where they apply, but may not appear in this summary.

TERMS

In This Manual:

WARNING statements identify conditions or practices that could result in personal injury or loss of life.

CAUTION statements identify conditions or practices that could result in damage to the equipment or other property.

As Marked on Equipment:

CAUTION indicates a personal injury hazard not immediately accessible as one reads the marking, or a hazard to property including the equipment itself.

DANGER indicates a personal injury hazard immediately accessible as one reads the markings.

SYMBOLS

In This Manual:


This symbol indicates where applicable cautionary or other information is to be found.

As Marked on Equipment:


DANGER—High Voltage.


Protective ground (earth) terminal.


ATTENTION—refer to manual.

Grounding the Power Module

This instrument is grounded through the grounding conductor of the power module. To avoid electrical shock, plug the power module cord into a properly wired receptacle before connecting to the instrument input or output terminals.

Do not use the power cord grounding conductor as the only grounding connection between two or more devices. To avoid electrical shock, connect the grounding terminals together with separate conductors.

Use the Proper Power Cord

Use only the power cord and connector specified for the power module. Use only a power cord that is in good condition.

For detailed information on power cords and connectors, see the power module manual.

Refer cord and connector changes to qualified service personnel.

Use the Proper Fuse

To avoid fire hazard, use only the fuse specified in the parts list for your instrument, and which is identical in type, voltage rating, and current rating.

Refer fuse replacement to qualified service personnel.

Do Not Operate in Explosive Atmospheres

To avoid explosion, do not operate this instrument in an atmosphere of explosive gases unless it has been specifically certified for such operation.

Do Not Remove Covers or Panels

To avoid personal injury, do not remove the instrument covers or panels. Do not operate the instrument without the covers and panels properly installed.

Do Not Operate Without Covers

To avoid personal injury, do not operate this instrument without covers or panels installed. Do not apply power to the instrument via a plug-in extender.

SERVICING SAFETY SUMMARY

FOR QUALIFIED SERVICE PERSONNEL ONLY

Refer also to the preceding Operators Safety Summary.

Do Not Service Alone

Do not perform internal service or adjustment of this instrument unless another person capable of rendering first aid and resuscitation is present.

Use Care When Servicing With Power On

Dangerous voltages exist at several points in this instrument. To avoid personal injury, do not touch exposed connections and components while power is on.

Disconnect power before removing protective panels, soldering, or replacing components.

Power Source

The power module is intended to operate from a power source that will not apply more than 250 volts between the supply conductors or between either supply conductor and ground. A protective ground connection by way of the grounding conductor in the power cord is essential.

RECAPITULATIF DES CONSIGNES DE SECURITE

Le texte ci-dessous, divisé en deux parties, résume les consignes de sécurité qui doivent être observées à toutes les phases de l'utilisation, de la maintenance et des réparations de l'appareil.

Consignes de sécurité destinées aux utilisateurs. Les consignes générales de sécurité s'adressent à la fois aux utilisateurs et au personnel de maintenance. Avertissements et précautions à respecter sont annotés au long de ce manuel, à chaque fois que l'utilisation du PS 503A l'exige.

TERMES

Dans ce manuel

Les nota dénommés «Attention» indiquent les circonstances ou les manipulations pouvant provoquer des détériorations de l'appareil ou de tout autre équipement associé.

Les nota dénommés «Avertissement» indiquent les circonstances ou les manipulations pouvant entraîner blessures corporelles, éventuellement mortelles.

Gravés sur l'appareil

CAUTION (attention). Ce mot identifie les zones de risque de blessure, non immédiatement perceptibles ou un risque éventuel de détérioration de l'appareil.

DANGER. Ce mot indique les zones de risque immédiat pouvant entraîner blessures ou mort.

SYMBOLES

Dans ce manuel

Ce symbole de sécurité signifie : se reporter au manuel.

Gravés sur l'appareil

DANGER – Haute tension

Protection à la masse

ATTENTION – se reporter au manuel

Mise à la masse du produit

La mise à la masse du PS 503A s'effectue à l'aide d'un conducteur de masse du cordon d'alimentation. Pour éviter tout choc électrique, insérer la prise du cordon d'alimentation dans une prise de distribution correspondante avant de connecter l'entrée ou les terminaisons de sortie de l'appareil. Pour utiliser l'appareil en toute sécurité, une connexion à la borne de masse au moyen du conducteur de masse au cordon d'alimentation est indispensable.

Utiliser le cordon d'alimentation approprié

N'utiliser que lc cordon d'alimentation et la prise recommandés pour votre appareil. N'utiliser qu'un cordon d'alimentation en bon état. Pour effectuer les changements de cordons d'alimentation et de prises, faire appel à un personnel qualifié.

Utiliser le fusible approprié

Pour éviter tout risque d'accident (incendie...) n'utiliser que le fusible recommandé pour votre appareil. Les remplacements de fusible doivent toujours être en harmonie avec le type, la vitesse de tension et la vitesse de courant. Seul, un personnel compétent peut procéder à un changement de fusible.

Ne pas utiliser l'appareil en atmosphère explosives

Pour éviter toute explosion, ne pas utiliser cet appareil dans une atmosphère de gaz explosifs à moins qu'une telle utilisation n'ait été spécifiquement reconnue possible.

Ne pas ôter les capots ou panneaux

Pour éviter tout incident corporel grave, ne pas ôter les panneaux ou capots de protection de l'appareil. Celui-ci ne doit pas fonctionner tant que les panneaux et capots n'ont pas correctement été mis en place.

Ne pas faire fonctionner l'appareil sans les capots et panneaux (pour les tiroirs de la série TM 500 uniquement)

Pour éviter tout incident corporel grace, ne pas utiliser l'appareil alors que les capots ou panneaux ne sont pas remis en place. N'appliquer aucune tension au tiroir par l'intermédiaire d'un cordon d'extension.

CONSIGNES DE SECURITE

UNIQUEMENT DESTINEES AU PERSONNEL DE MAINTENANCE

Il est indispensable de se référer également aux consignes de sécurité à l'attention des utilisateurs.

Ne jamais être seul pour procéder à l'entretien de l'appareil.

Agir avec précaution si l'on effectue une réparation alors que l'appareil est sous tension

Des tensions dangereuses existent en divers points de l'appareil. Pour éviter tout risque de blessure corporelle, ne touchez ni aux connexions exposées ni aux composants alors que l'appareil est sous tension. Couper l'alimentation avant d'enlever les panneaux de protection, d'effectuer des soudures ou de remplacer des composants.

Source d'alimentation

Ce produit est conçu pour fonctionner à partir d'une source d'alimentation qui n'appliquera pas plus de 250 V efficaces entre les conducteurs d'alimentation ou entre chaque conducteur d'alimentation et la terre. Pour utiliser l'appareil en toute sécurité, une connexion à la masse au moyen d'un conducteur de masse dans le cordon d'alimentation est indispensable.

SICHERHEITSANGABEN

Der folgende Text enthält in zwei Teilen Angaben über Sicherheitsvorkehrungen, die jederzeit bei Betrieb, Service und Reparatur des Gerätes beachtet werden müssen.

SICHERHEITSANGABEN FÜR DEN ANWENDER

Die allgemeinen Sicherheitsinformationen in diesem Teil der Angaben dienen dem Anwender- und Servicepersonal. Spezielle Warnungen und Hinweise sind überall im Handbuch zu finden, müssen jedoch in diesen Angaben nicht erscheinen.

BEGRIFFE

In diesem Handbuch:

VORSICHTSHINWEISE erläutern Bedingungen, die zur Zerstörung des Gerätes oder anderer Gegenstände führen könnten.

WARNUNGSHINWEISE erläutern Bedingungen, die zu Personenschäden führen können oder lebensgefährlich sind.

Markierungen auf dem Gerät:

CAUTION – VORSICHT weist darauf hin, daß durch zufälliges Berühren an einer nicht unmittelbar zugänglichen Stelle Personenschaden entstehen kann, oder Schaden am Gerät selbst.

DANGER – GEFAHR weist darauf hin, daß durch zufälliges Berühren an einer zugänglichen Stelle Personenschaden entstehen kann.

SYMBOLE

In diesem Handbuch:

Dieses Symbol zeigt an, wo Vorsicht walten zu lassen ist, oder wo Informationen zu finden sind.

Markierungen auf dem Gerät:

GEFAHR – Hochspannung.

Schutzerdungskontakt

ACHTUNG – beziehen Sie sich auf das Handbuch

Masseanschluß des Gerätes

Dieses Gerät wird über den Schutzleiter der Versorgungseinheit mit Erdpotential verbunden.

Zur Vermeidung von elektrischen Schlägen ist vor der Beschaltung der Ein- und Ausgänge der Netzstecker in eine korrekt verdrahtete Steckdose einzustecken. Verwenden Sie den Schutzleiter nicht als einzige Verbindung zwischen zwei oder mehreren Geräten. Zur Vermeidung von elektrischen Schlägen sind die Geräte untereinander mit separaten Leitungen zu verbinden.

Verwendung eines richtigen Netzkabels

Verwenden Sie nur Netzkabel, die für die Versorgungseinheit geeignet sind und die sich in gutem Zustand befinden.

Für detaillierte Informationen über Kabel und Stecker beziehen Sie sich auf Abbildungen innerhalb des Handbuches.

Ein Austausch von Kabeln und Steckern ist nur von geschultem Personal vorzunehmen.

Verwendung einer richtigen Sicherung

Zur Vermeidung von Brandschäden sind nur Sicherungen zu verwenden, die in den Teilelisten dieses Gerätes aufgeführt sind und die in Spannungs- und Stromwert entsprechend sind.
Ersatz von Sicherungen ist nur von geschultem Personal vorzunehmen.

Arbeiten Sie nicht in explosiver Umgebung

Zur Vermeidung von Explosionen ist die Inbetriebnahme dieses Gerätes in explosiver Umgebung zu unterlassen, wenn das Gerät nicht dafür geeignet ist.

Entfernen Sie keine Gehäuseabdeckungen

Zur Vermeidung von Personenschäden sind keine Gehäuseteile zu entfernen. Auch ist das Gerät ohne Gehäuse nicht in Betrieb zu nehmen.

Arbeiten Sie nicht ohne Gehäuseabdeckung

Zur Vermeidung von Personenschäden ist das Gerät nicht ohne Gehäuse in Betrieb zu nehmen. Der Einschub sollte nicht über einen Verlängerungsadapter betrieben werden.

SICHERHEITSANGABEN FÜR DEN SERVICE

NUR FÜR GESCHULTES PERSONAL

Beziehen Sie sich auch auf die vorangehenden Sicherheitsangaben für den Anwender.

Führen Sie keine Servicetätigkeiten alleine durch

Nehmen Sie an dem Gerät keine Service- oder Einstellarbeiten vor, wenn nicht eine andere Person verfügbar ist, um im Bedarfsfall Erste Hilfe oder Wiederbelebungsversuche zu leisten.

Lassen Sie besondere Vorsicht walten, wenn Sie an einem unter Spannung stehenden Gerät arbeiten

An verschiedenen Stellen im Gerät liegen hohe und damit gefährliche Spannungen. Zur Vermeidung von Personenschäden sind solche Stellen und Bauteile nicht zu berühren, während Betriebsspannung anliegt.

Vor dem Entfernen von Gehäuseteilen, Löten oder Ersetzen von Bauteilen ist immer die Betriebsspannung zu entfernen.

Netzspannungsversorgung

Die Betriebsspannung für dieses Gerät darf 250 V_{eff} nicht überschreiten und ist an die Versorgungsleitungen bzw. an eine Versorgungsleitung und Masse anzulegen. Innerhalb des Netzanschlußkabels muß ein Schutzleiter vorhanden sein, der mit Gerätemasse verbunden ist.

ご使用の前に

PS 503A 型を安全にお使いいただくために、操作、点検、修理上の注意事項が、大きく2項目に分けて述べられています。

操作上の注意

操作上の注意は、オペレータの方にもサービス・エンジニアの方にも共通しています。このマニュアルの各所に特別の注意書きがありますが、これによく従って下さい。

用語

マニュアル中の用語

警告（WARNING）の項は人体に損傷を及ぼしたり危険を与える恐れのある場合の注意です。

注意（CAUTION）の項は本機器または他の接続機器に損傷を及ぼす恐れのある場合の注意です。

機器上の用語

CAUTIONと記されている部分は人体や本機器に損傷を及ぼす恐れがありますので注意下さい。

DANGERと記されている部分は、人体に危険を及ぼしますので手を触れないで下さい。

記号

マニュアル中の記号


注意等が記述されています。

機器上の記号


DANGER　高電圧


保護用接地ターミナル


ATTENTION　マニュアル参照

電源モジュールの接地

PS 503A 型は電源モジュールの接地線によって接地されます。電気的ショックを防止するため、電源プラグを電源に接続するには、入出力コネクタを接続する前に行って下さい。

2台またはそれ以上の機器の間だけで接地線を接続するだけでなく、電気的ショックを避けるため接地端子に接地して下さい。

電源コード

機器に適合する電源コード及びコネクタを使用して下さい。電源コードは損傷のないものをお使い下さい。

電源コードとコネクタに関する詳細は、TM500電源本体のマニュアルをご参照下さい。

コードとコネクタの交換の際は当社エンジニアにおたずね下さい。

ヒューズ

危険防止のため本機器のパーツ・リストに記載されている、形状、定格電圧、定格電流と同等のヒューズをご使用下さい。

ヒューズ交換の際は、当社エンジニアにおたずね下さい。

爆発防止

危険防止のため、爆発性のガスが周囲にあるような所では作動させないで下さい。

カバー、パネル

人体への損傷を避けるため、機器のカバーやパネルは取りはずさないで下さい。カバーやパネルをはずしたまま、機器を作動させないで下さい。

カバーの扱いについて

人体への損傷を避けるため、機器のカバーやパネルを取りはずしたまま作動させないで下さい。またフラグイン・エクステンダによって電源と接続しないで下さい。

サービス上の注意

サービス・エンジニアの方へ

“操作上の注意”を先にお読み下さい。

1人でサービスを行わないで下さい。

機器の内部点検または修理は、万一の場合に備えて応急処置のできる人がいる所で行って下さい。

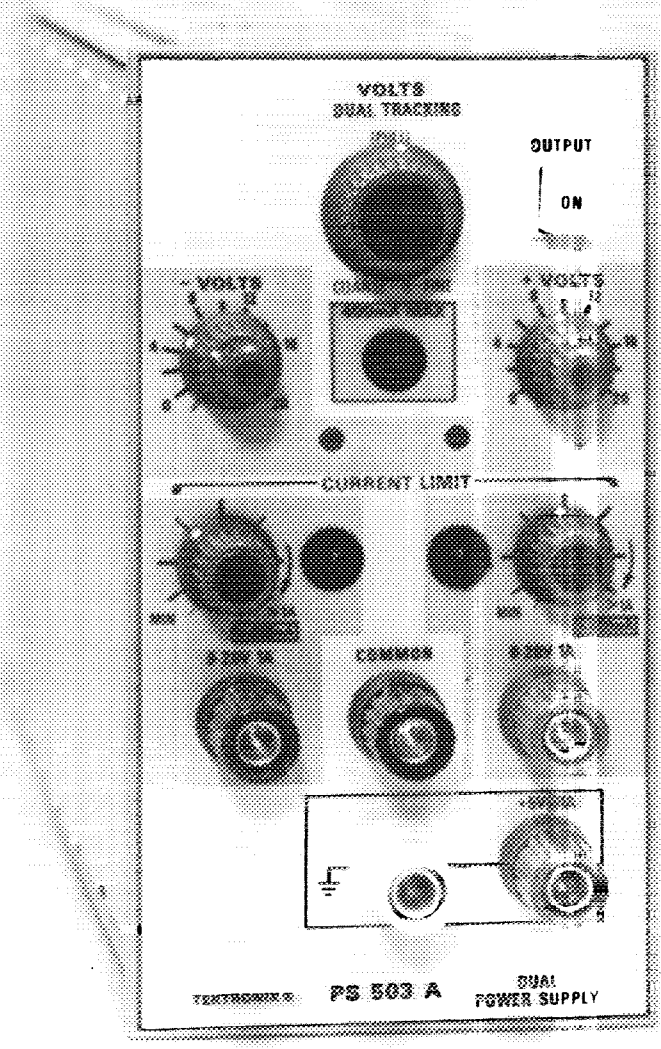
電源を入れた場合の注意

機器内部には高電圧の部分があります。人体への危険を防止するため、電源がはいっている時は、露出している接続部分や部品には手を触れないで下さい。

パネルの取りはずし、ハンダ付、部品の交換を行う前には、電源を必ず切って下さい。

電源

PS 503A型は電源コードの線間あるいは電源コードとグラウンド間が250Vrms以内の範囲の電源で作動します。安全のために電源コードのアース線できちんと接地して下さい。



1364-06

Fig. 1-1. PS 503A Dual Power Supply plug-in module.

OPERATING INSTRUCTIONS

INTRODUCTION

Description

The PS 503A is a dual 0 to 20 V dc constant voltage, current-limited, floating power supply. It is designed to operate in the high-power compartment of the TM 504 or TM 506 Power Module. In the high-power compartment, it provides a floating dual 0 to 20 V dc at 1.0 A. Operating in a standard compartment of a TM 500-Series Power Module, or in any compartment of the TM 503, the PS 503A supplies a floating dual 0 to 20 V dc at 400 mA. The TM 501 Power Module has a physical barrier on the mating connector to prevent use of the PS 503A, and is thus not compatible with this instrument.

The supply is designed for conveniently powering complementary and linear integrated circuits such as operational and differential amplifiers as well as differential comparators. A ground referenced +5 V auxiliary supply (suitable for bipolar logic, light-emitting diodes, incandescent displays and similar applications) is also included. With the floating supply available for powering discrete interface circuits and level shifting, the PS 503A can be used for many digital/analog applications.

The plus and minus outputs from the dual floating power supplies are independently variable or both variable at a constant ratio by a common control. Each supply provides either a plus or minus 0 to 20 V dc with respect to the common terminal. By connecting across the plus and minus terminals, the PS 503A can provide 0 to 40 V dc. Either terminal may be grounded or floated to 350 V (dc + peak ac). Each supply also features continuously variable current limiting from less than 50 mA to 400 mA (standard compartment) or 1 A (high power compartment) at both 20 V and 40 V output.

The presence and variability of the output voltage is verified by the VOLTS indicator light on the front panel. The brightness of this light varies with output voltage. A panel-mounted light-emitting diode (LED) indicates when the PS 503A is operating in a standard compartment of a TM 500 Series Power Module and the output current is limited to a maximum of 400 mA. Other panel-mounted, light-emitting diodes indicate when either the + or − supply goes into current-limiting. Hard limiting is indicated by maximum brightness of the light-emitting diode as well as a dimming of the VOLTS indicator light if the supply output voltage is above approximately 10 V. These functions are easily verified by momentarily shorting the output of the supply.

Installation and Removal

CAUTION

Turn the power module off before inserting the plug-in; otherwise, damage may occur to the plug-in circuitry. Because of the high current drawn by the PS 503A, it is also recommended that the power module be turned off before removing the PS 503A. Refer to Fig. 1-2. Check to see that the plastic barriers on the interconnecting jack of the selected power module compartment match the cut-outs in the PS 503A circuit board edge connector.

Align the PS 503A chassis with the upper and lower guides of the selected compartment. Push the module in and press firmly to seat the circuit board in the interconnecting jack.

To remove the PS 503A, pull on the release latch located in the lower left corner, until the interconnecting jack disengages and the PS 503A will slide out.

Controls and Connectors

Refer to Fig. 1-3. Even though the PS 503A is fully calibrated and ready to use, the functions and actions of the controls and connectors should be reviewed before attempting to use it. Press the OUTPUT button to apply power to the PS 503A.

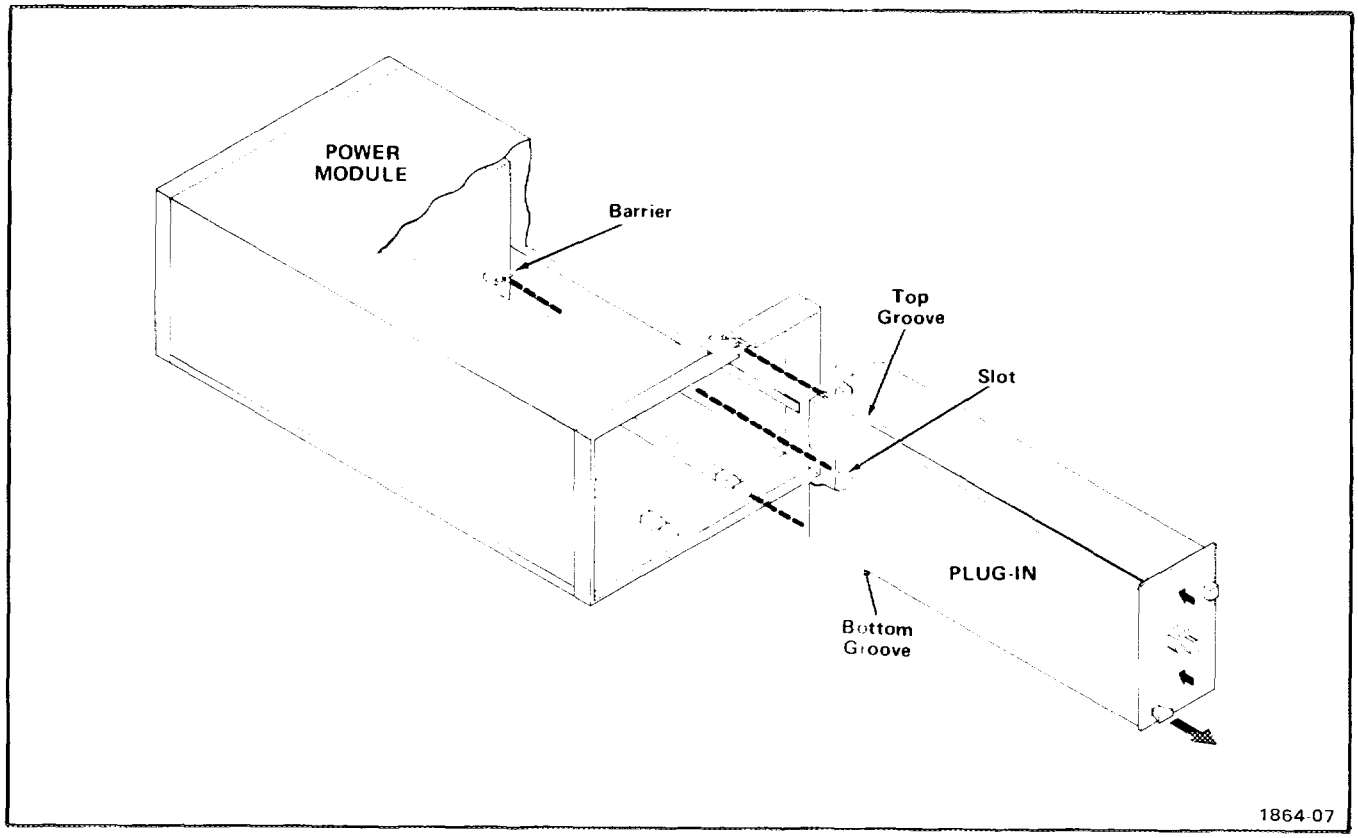


Fig. 1-2. Plug-in module installation/removal.

OPERATING CONSIDERATIONS

Overheating

The PS 503A is designed to operate at an ambient temperature from 0°C to +50°C. However, when operating several power supplies in a multi-plug-in power module, especially at low output voltages, or when operating close to other heat-producing equipment, internal temperature may exceed safe limits and actuate a thermal cutout in the power module. Refer to the power module instruction manual for more complete information.

Load and Monitor Connections

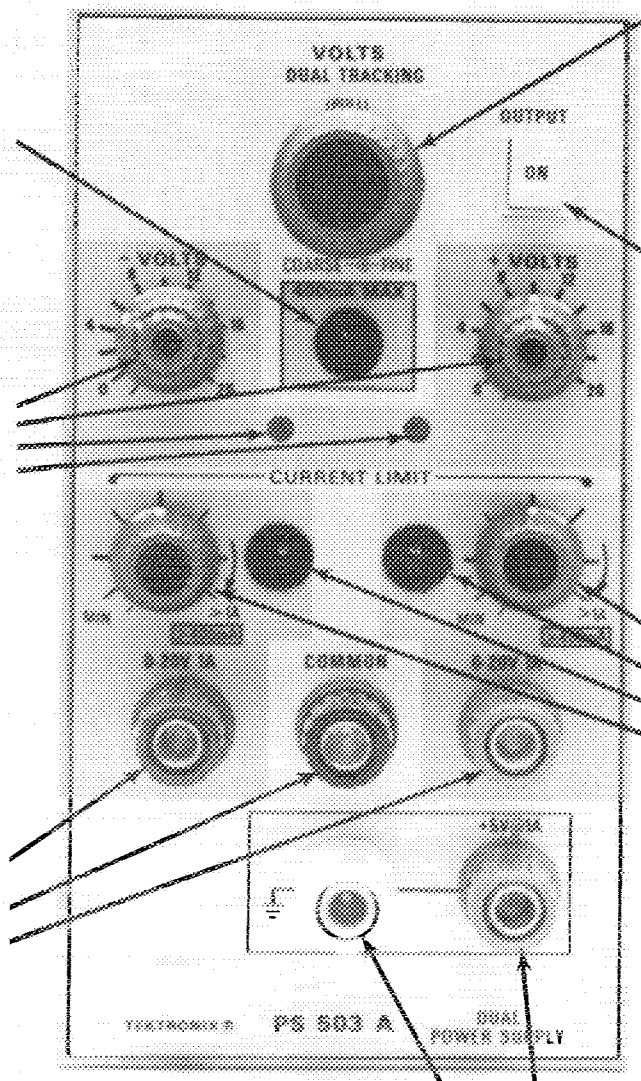
Improper connections between the power-supply output and the load(s) or monitoring device(s) are a common cause of errors. Multiple loads or monitoring devices must be connected directly to the output terminals with separate pairs of leads as shown in Fig. 1-4. Avoid using clip leads, since their contact resistance can exceed the output impedance of the PS 503A and cause significant measurement error.

Grounded and Floating Operation

The PS 503A is a +20 and -20 V "floating" supply since no internal connections are made to either the chassis or ground. The supply can thus be used as a positive or negative supply by simply connecting between the common and the negative or positive output terminal. However, there may be undesirable effects caused by grounding the supply to the chassis while the load is grounded at some point removed from the supply chassis. For example, if a remote load is connected as shown in Fig. 1-5, ground currents containing the power-line frequency could result and create excessive noise and ripple in series with the load. Thus, floating operation is recommended to ensure against problems caused by undersirable ground currents.

Reverse Current Loading

In some bias supply and digital circuitry applications the load might behave as a current source for part of its operating cycle. Since the output circuit of a series-regulated supply is unidirectional, current will not pass in the opposite direction except through undesirable paths. The internal reverse-current diodes conduct only when the PS 503A terminal voltage reverses and therefore will not work when the voltage is correctly polarized. Connec-



400 mA LIMIT Indicator

Light emitting diode indicates when PS 503A is installed in a standard compartment of a power module, limiting the current output.

VOLTS Controls and Indicators

Variable coarse and fine controls provide continuously variable + or − voltage selection from the respective 0-20 volt supply. The presence and variability of output voltage is verified by voltage indicator lights (OUTPUT button pressed). Brightness of lights varies with output voltage.

Floating Output Terminals

5-way binding post terminals that provide either a positive 0-20 volts between the binding post on the right (red) and COMMON, or a negative 0-20 volts between the binding post on the left (green) and COMMON. When the PS 503A is installed in the high power compartment of a TM 504 or TM 506 power module that has a high power compartment, the current available at either the + or − outputs is from less than 100 mA to at least 1 A. When the PS 503A is installed in a standard compartment, the current available is from less than 100 mA to at least 400 mA. 0 to 40 volt output is obtained between the + and − output terminals.

VOLTS DUAL TRACKING Control

When pulled out, varies both the + and − outputs from 0 volts to the value set on the + and − VOLTS controls. The ratio between the + and − outputs is maintained throughout the range of the VOLTS DUAL TRACKING control.

OUTPUT Pushbutton

When pressed, applies power to both 0-20V binding post terminals and the +5V binding post terminal.

CURRENT LIMIT Controls and Indicators

Continuously variable controls that select the + and − output current limit. Light-emitting diode indicates when hard limiting occurs.

+5 Ground-Referenced Output Terminals

5-way binding-post terminals that provide a ground-referenced +5 V, 1 A, fixed output.

1864-05A

Fig. 1-3. PS 503A controls and connectors.

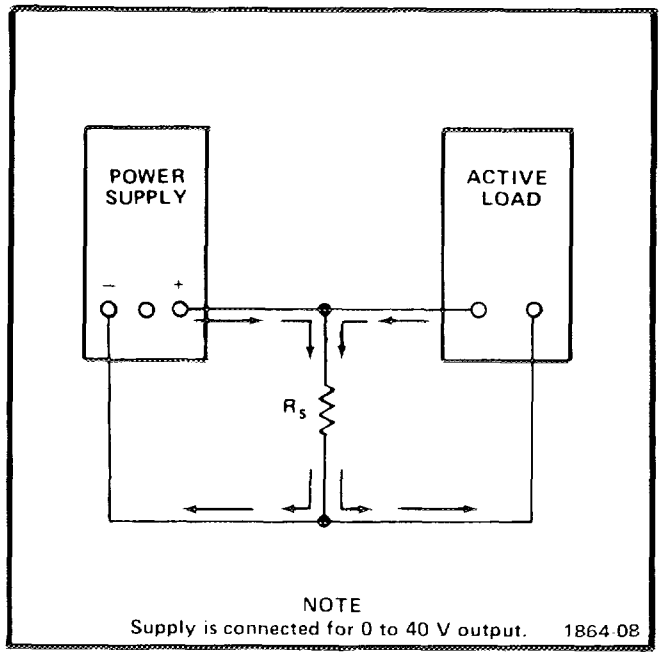


Fig. 1-4. Monitor and load connections.

ting a shunt resistor (R_S) as shown in Fig.1-6 provides an external, reverse-current path to the power supply sources or delivers current only.

Over-voltage

The PS 503A is protected from over-voltage conditions by an over-voltage protection circuit that shuts down the power supply when the voltage rises to about 26 V dc.

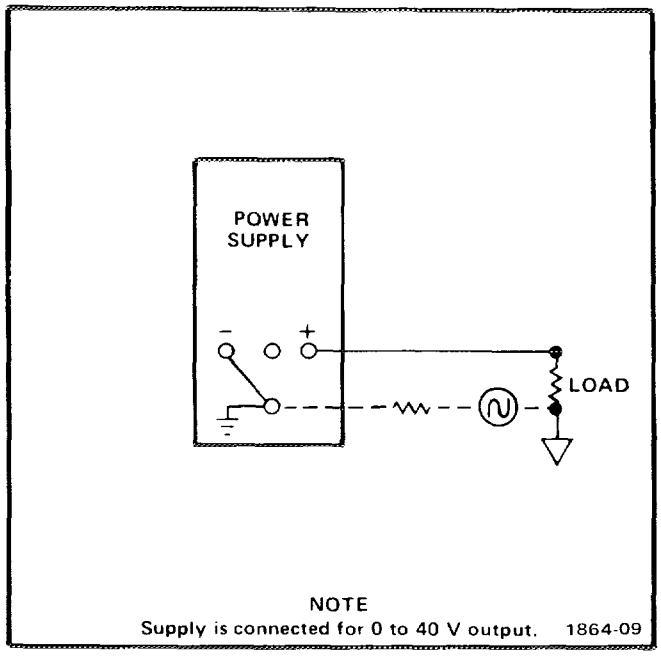


Fig. 1-5. Ground loop created by grounded remote lead.

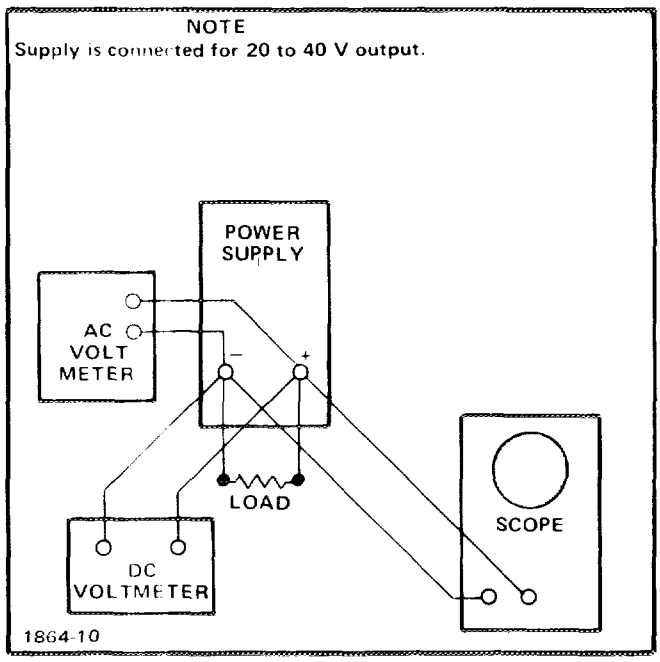


Fig. 1-6. Reverse current shunt (R_S) with active load.

NOTE

The point at which the overvoltage protection blows the fuse may be changed for specific applications by changing the Zener diode.

OPERATION

The following steps demonstrate the use of the PS 503A controls and connectors.

1. Install the PS 503A into (preferably) the high-power compartment of the power module.

2. Press the OUT button to apply power to the PS 503A. Observe that the + and – VOLTS indicator lights come on (the lights will be very dim at low voltages).

Single Supply Operation (±20 V Maximum)

1. Set the + and – VOLTS controls for approximately 2 V.

2. Turn the CURRENT LIMIT controls fully ccw (to protect the ammeter). Connect an ammeter between the common terminal and the + or – terminal and adjust the appropriate CURRENT LIMIT control for the maximum desired current output.

3. Remove the ammeter. Connect the load between the common terminal and the · or terminal. Adjust the + or VOLTS control for the desired output.

Combined Supply Operation (40 V Maximum)

1. Set the · and VOLTS control for approximately 2 V and turn the CURRENT LIMIT controls fully ccw (to protect the ammeter).

2. Connect an ammeter between the + and − terminals. First adjust one CURRENT LIMIT control for the maximum desired current output; then adjust the other CURRENT LIMIT control until the CURRENT LIMIT indicator just reaches maximum brightness, i.e., both supplies at the same CURRENT LIMIT setting.

3. Remove the ammeter. Connect the load between the · and terminals and set the + and VOLTS controls so that both settings added together equal the desired output voltage. (See Dual-Tracking Operation for varying the output with the VOLTS DUAL TRACKING control.)

Dual-Tracking Operation

When pulled out, the VOLTS DUAL TRACKING control varies the output of both supplies at a constant ratio from zero to the value set on the + and − VOLTS controls. For example, if the + and − VOLTS controls are set for maximum output (approximately 20 V), both outputs can be varied from zero to 20 V with the VOLTS DUAL TRACKING control (1:1 ratio). Likewise, if one supply is set for 10 V and the other for 20 V, each 1 V change in the 10 V output will be matched by a 2 V change in the 20 V output (2:1 ratio).

Note also that no matter where the VOLTS DUAL TRACKING control is set, the outputs will return to the voltage selected by the · and VOLTS control when the VOLTS DUAL TRACKING control is pushed in. Therefore, rapid selection of two preset outputs from each supply is achieved by merely switching the VOLTS DUAL TRACKING control in or out.

When the + and supplies are connected as described under Combined Supply Operation, the VOLTS DUAL TRACKING control will vary the output from zero to the value selected by the · and VOLTS controls added together.

Stair-Step Operation

The PS 503A can be operated to provide a "stair-step" output characteristic by choosing certain load limits and control settings. For example, Fig. 1-7 shows the stair-step output from the PS 503A when a variable load (R_L) is connected between the + and − output terminals. With each supply set for maximum voltage and current (40 V, 1 A) the output voltage remains constant from open circuit until the load reaches approximately 40 Ω as illustrated by the solid line in Fig. 1-7. At this crossover point, the output voltage decreases with the load and the output current is limited at 1 A. Therefore, below approximately 40 Ω, both supplies act as current sources with output voltage variable with the load. Since both supplies are set for the same output voltage, each supply shares equally in the power output I^2R. If one supply is set for a lower output voltage than the other, output power is shared at the same ratio as the output voltage.

Now, by setting supply E_2 for a current limit of 0.5 A and varying the load over the same range, the supplies act as constant-voltage sources until the load reaches approximately 80 Ω. At that crossover point, the supply set for 0.5 A (E_2) becomes a current source and its output

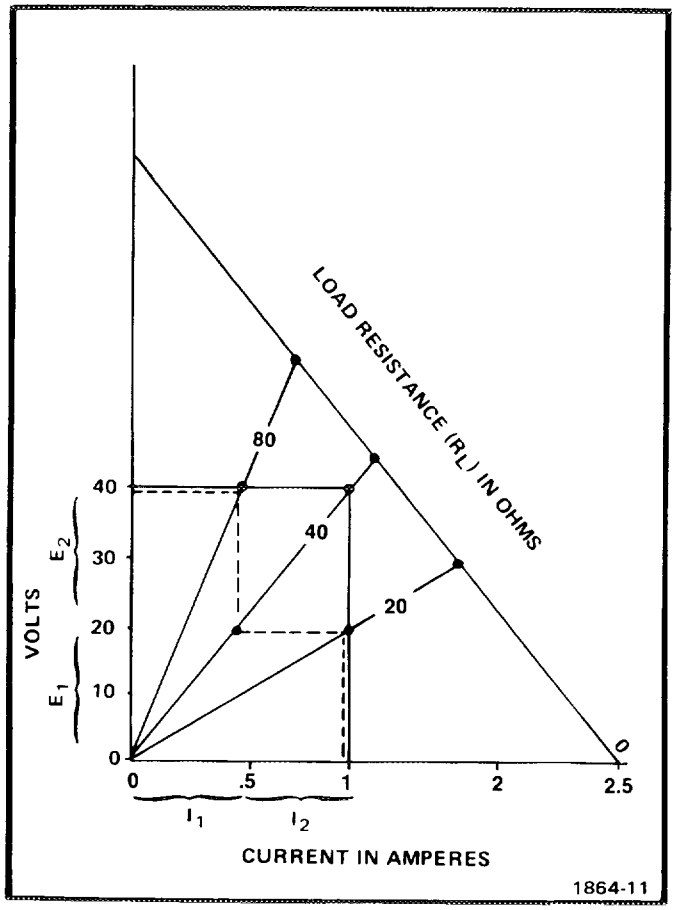


Fig. 1-7. Output characteristics with various currents, voltages, and loads.

voltage decreases with the load. At approximately 40 Ω and 20 V, supply E_2 no longer contributes to the power output. Subsequently, supply E_1 supplies all the output power and operates as a constant-voltage source with output current variable with the load. Then, at approximately 20 Ω, supply E_1 crosses over and becomes a current source at its maximum output of 1 A. Thus, by choosing the appropriate load limits and control settings, any of the four operating characteristics is possible.

A second stair-step output can be preselected and switched in or out with the VOLTS DUAL TRACKING control (see Dual-Tracking Operation for details on the function of the VOLTS DUAL TRACKING control).

Series-Connected Supplies

The outputs of two or more PS 503A's can be connected in series as shown in Fig. 1-8 to obtain an output voltage equal to the sum of the output voltages from each supply. Each supply must be adjusted individually to obtain the desired output voltage (see Dual-Tracking Operation for varying the output of both supplies with the VOLTS DUAL TRACKING control).

NOTE

The PS 503A has internal diodes connected across the output to protect the series-connected supplies against reverse polarity if the load is shorted, or one of the supplies is not on.

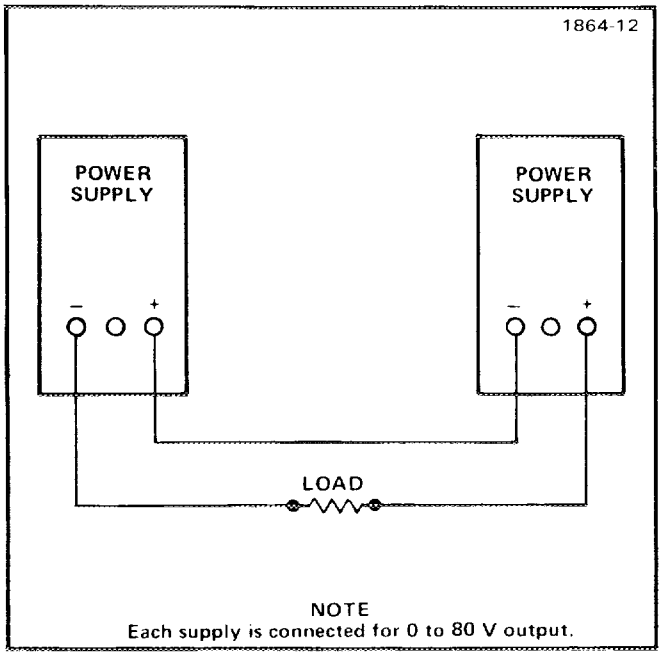


Fig. 1-8. Supplies series-connected.

Parallel-Connected Supplies

CAUTION

Parallel operation is not recommended unless a forward biased diode capable of handling the required current and voltage is inserted between each power supply and the load. Failure to do this may cause power supply damage.

The outputs of two or more PS 503A's can be connected in parallel as shown in Fig. 1-9 to obtain an output current equal to the sum of the output currents from each supply. Each supply must be adjusted individually to obtain the desired output current. Also, each supply must be in the high-power compartment of a TM 500-Series Power Module (TM 504 or TM 506) to obtain outputs above 0.8 A (such as is shown in Fig. 1-9).

NOTE

The + and − supplies are internally connected in series. Therefore, the + and − supplies cannot be externally connected in parallel to obtain an output current equal to the sum of the currents from each supply.

One supply should be set for the desired output voltage and the other for a slightly higher voltage. The supply set for the desired voltage will then become a constant voltage source, while the supply with the higher voltage output becomes a current source (due to automatic crossover), which results in their output voltage decreasing to that of the supply with the lowest output voltage.

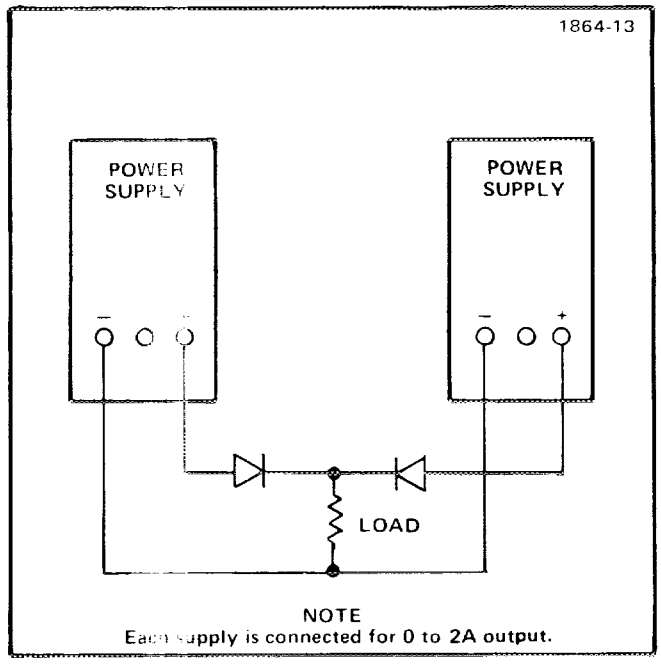


Fig. 1-9. Supplies parallel-connected.

INSTRUCTIONS D'UTILISATION

INTRODUCTION

Description

La PS 503A est une double alimentation continue, à tension régulée et à sortie flottante (de 0 à 20 V), possédant une limitation de courant. Elle est conue pour fonctionner dans un compartiment forte puissance du châssis d'alimentation TM 504 ou TM 506 de la série modulaire TM 500. Utilisée dans le compartiment forte puissance, cette alimentation délivre une double tension flottante de 0 à 20 V continu et un courant maximal de 1 A. Utilisée dans un autre compartiment, la PS 503A délivre les mêmes tensions mais le débit maximal est limité à 400 mA. Le châssis d'alimentation TM 501 est pourvu d'un détrompeur interdisant l'utilisation de la PS 503A (qui, par conséquent, n'est pas compatible avec le châssis).

Cette alimentation est conçue pour alimenter des circuits tels que circuits intégrés linéaires, amplificateurs opérationnels et différentiels ou comparateurs, etc... Une alimentation auxiliaire +5 V, référencée à la masse, est également disponible (alimentation de circuits logique bipolaire, de diodes électroluminescentes, d'afficheurs à incandescence et autres applications similaires). Les tensions flottantes délivrées par la PS 503A sont destinées à être utilisées pour alimenter n'importe quel circuit pouvant fonctionner à des niveaux de tension différents, dans tous les domaines tant analogiques que numériques.

Les tensions de sorties + et — issues des alimentations doubles flottantes peuvent être réglées indépendamment par commandes séparées ou ensemble, dans un rapport constant, à l'aide d'une commande commune. Chaque alimentation fournit une tension continue positive (+) ou négative (—), de 0 à 20 V continu, par rapport à un point commun. En se connectant entre les bornes + et —, la PS 503A fournit une tension continue de 0 à 40 V. Chacune de ces bornes de sortie peut être reliée à la masse ou laissée flottante, jusqu'à un potentiel de 350 V (continu + alternatif crête). Chaque alimentation possède également, par rapport à la masse, un dispositif de limitation de courant continûment variable, de moins de 50 mA à 400 mA (dans un compartiment banalisé et jusqu'à 1 A (dans un compartiment forte puissance)

L'indicateur lumineux VOLTS, situé sur le panneau avant signale la présence et la variation de la tension de sortie. La luminosité de cet indicateur varie en fonction de la tension de sortie. Une diode électroluminescente montée sur le panneau avant indique lorsque la PS 503A est utilisée dans un compartiment banalisé de la série modulaire TM 500. Le courant de sortie est limité à 400 mA maximum dans ce cas. D'autres diodes électroluminescentes situées sur le panneau avant indiquent lorsque le dispositif de limitation de courant de l'une des alimentations fonctionne. La limitation maximale du dispositif correspond à une luminosité maximale de la diode électroluminescente et à un assombrissement du témoin lumineux VOLTS si la tension de sortie est supérieure à environ 10 V. Ces fonctions se vérifient aisément en court-circuitant momentanément les sorties de l'alimentation.

Installation et extraction de l'appareil

ATTENTION

En raison du courant élevé exigé par la PS 503A, il est recommandé d'éteindre le châssis d'alimentation avant d'insérer ou d'extraire ce tiroir de son compartiment, ceci pour éviter toute détérioration des circuits de l'appareil. Se reporter à la figure 1-2. Vérifier que les détrompeurs du châssis d'alimentation sélectionné correspondent bien aux encoches du circuit imprimé de la PS 503A.

Afin d'installer la PS 503A, aligner les rails de guidage de celle-ci avec les guides du châssis d'alimentation. Insérer à fond le module afin que le circuit imprimé soit correctement mis en place, sur le connecteur.

Pour extraire la PS 503A, tirer sur le loquet de verrouillage, situé au coin inférieur gauche, jusqu'à ce que la PS 503A soit libérée et puisse glisser à l'extérieur du châssis

Commandes et bornes de sortie

Se reporter à la figure 1-3. Bien que la PS 503A soit livrée complètement étalonnée et prête à être utilisée, il est bon de se familiariser avec le rôle des commandes et bornes de sortie de l'appareil avant de l'utiliser. Pour mettre la PS 503A sous tension, appuyer sur le bouton OUTPUT.

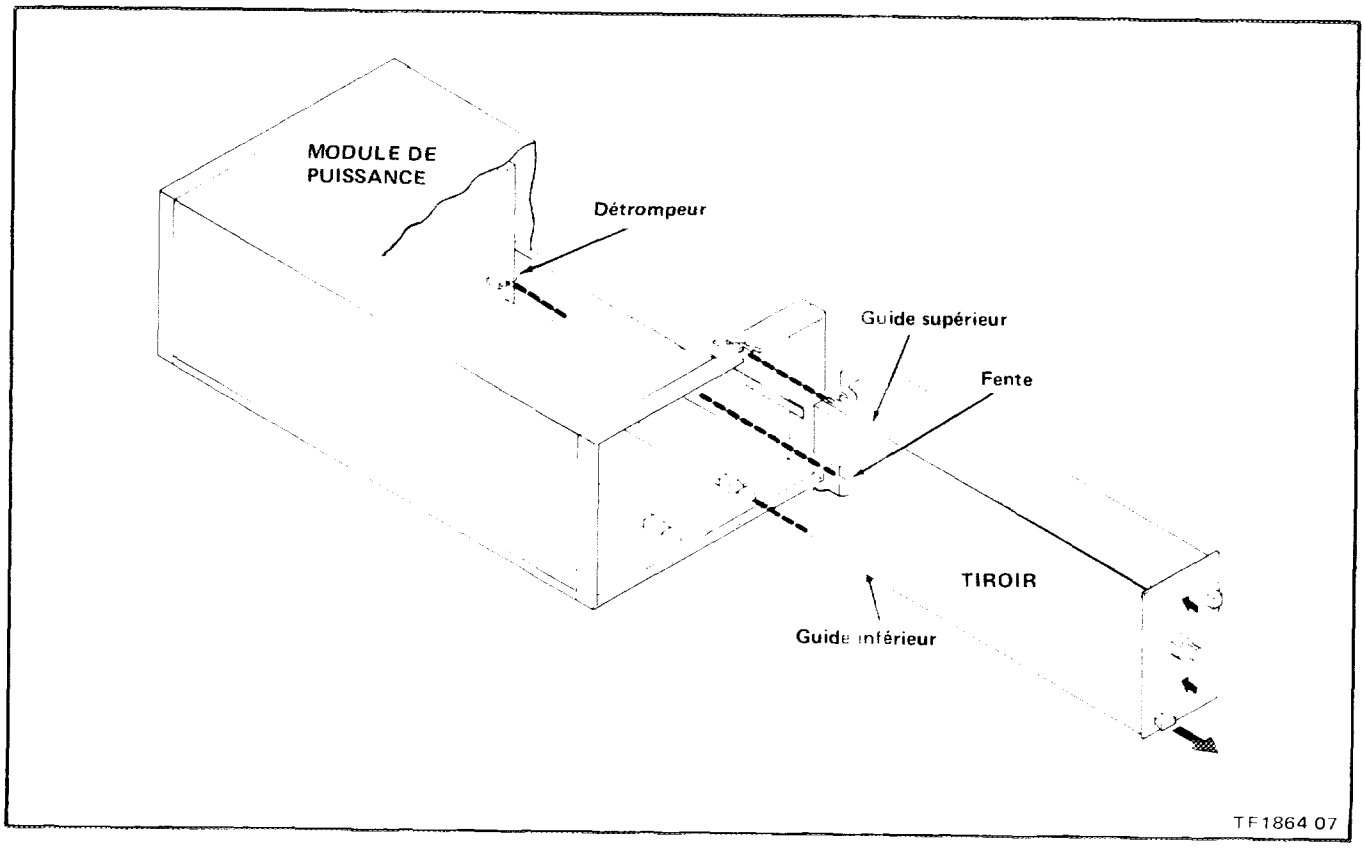


Fig. 1-2. Installation et extraction du tiroir.

INSTRUCTIONS D'UTILISATION

Surchauffe

La PS 503A est conçue pour fonctionner à une température ambiante comprise entre 0°C et +50°C. Cependant, lorsque l'on utilise plusieurs alimentations dans un châssis à plusieurs tiroirs, plus particulièrement avec de faibles tensions de sortie, ou à proximité d'un équipement produisant de la chaleur, la température interne peut excéder les limites de sécurité et mettre en service le disjoncteur thermique du châssis d'alimentation. Se reporter au manuel d'instructions du châssis d'alimentation pour de plus amples informations.

Connexions entre la charge et l'appareil de mesure

Les connexions incorrectes entre la sortie de l'alimentation et la (les) charge(s) ou de l'appareil(s) de mesure constituent une source classique d'erreurs. Les charges multiples ou les appareils de mesures doivent être reliés directement aux bornes de sortie à l'aide de conducteurs séparés selon l'illustration de la figure 1-4. Eviter d'utiliser des liaisons de type «pince crocodile» à cause de leur résistance de contact pouvant être supérieure à l'impédance de sortie de la PS 503A et pouvant donc entraîner des erreurs de mesure non négligeables.

Utilisation de la PS 503A en «flottant» ou référencée à la masse

La PS 503A est une alimentation «flottante» de ± 20 V, du fait qu'il n'existe aucune connexion interne, que ce soit avec le châssis ou la masse. L'alimentation peut, par conséquent, être utilisée comme une source de tension positive ou négative, simplement, en reliant à la masse la borne de sortie négative ou positive. Cependant, des effets indésirables peuvent se produire lorsque l'alimentation est référencée à la masse (en la reliant au châssis), alors que la charge est mise à la masse en un point autre que le châssis d'alimentation. Par exemple, si une charge éloignée de l'alimentation est connectée selon l'illustration de la figure 1-5, des courants de masse contenant des composantes à la fréquence réseau peuvent en résulter constituant ainsi un générateur de bruit et d'ondulation résiduelle en série avec la charge. De ce fait, une utilisation en «mode flottant» est recommandée pour éviter tout problème provoqué par ces courants indésirables.

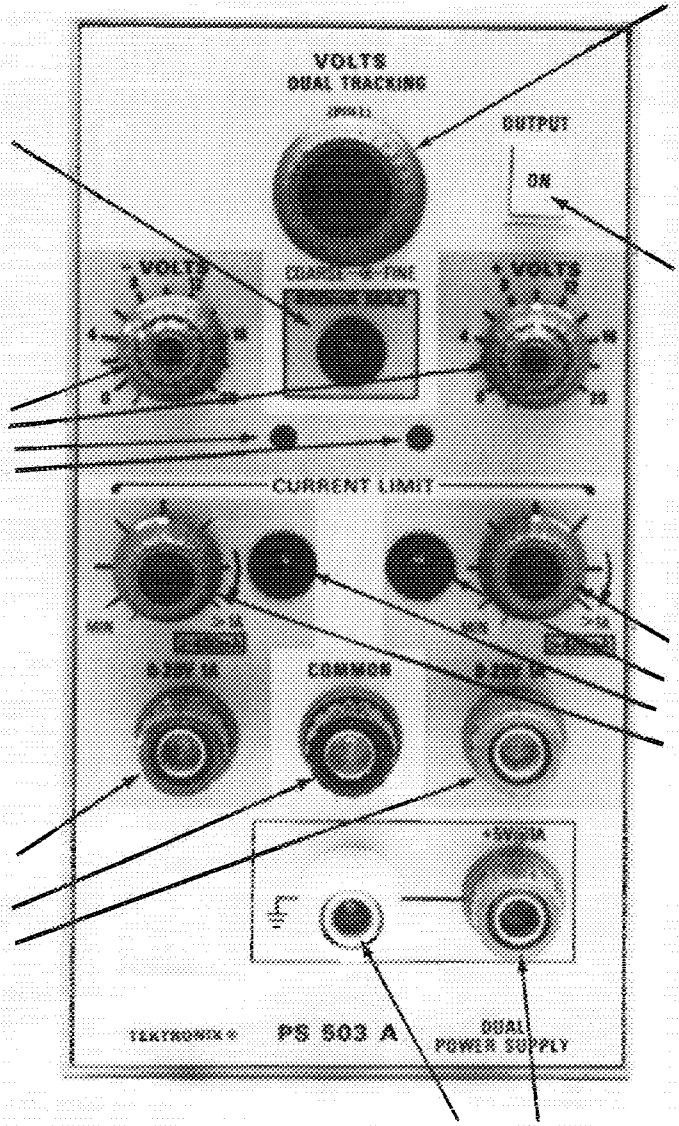
Charges actives

Dans certaines applications, la charge se comporte comme une source de courant pendant une fraction de son cycle d'utilisation. Etant donné que le circuit de sortie d'une alimentation régulée (en série) est unidirectionnel, le courant ne passe pas dans la direction opposée (sauf à travers des chemins indésirables). Les diodes internes ne débitent que si la

400 mA LIMIT
Témoin lumineux à diode électroluminescente indiquant que la PS 503A est installée dans un compartiment banalisé d'un châssis d'alimentation et limitant le courant de sortie

VOLTS
Commandes et témoins lumineux continûment variables (réglage principal et réglage fin) sélectionnant la tension de sortie de 0 à 20 V en positif ou en négatif. Les témoins lumineux de tension indiquent la présence et la variation de la tension de sortie (bouton OUTPUT en position engagé). La luminosité de l'indicateur varie avec la tension de sortie.

Bornes de sortie (flottantes)
Fournissant soit une tension positive de 0 à 20 V, entre la borne de droite (rouge) et la borne commune COMMON, soit une tension négative de 0 à 20 V, entre la borne de gauche (verte) et la borne COMMON. Lorsque la PS 503A est utilisée dans un châssis d'alimentation TM 504 ou TM 506 comportant un compartiment forte puissance, le courant disponible est compris entre moins de 100 mA et 1 A. Lorsque la PS 503A est installée dans un compartiment banalisé, le courant disponible est de moins 100 mA à au moins 400 mA. Une sortie de tension de 0 à 40 V est obtenue entre les bornes de sortie positive ou négative (rouge et verte)



Commande VOLTS DUAL TRACKING
Lorsque cette commande est en position sortie, elle permet la variation des deux sorties + et −, de 0 V à la valeur indiquée par les commandes + et − VOLTS. Le rapport entre les sorties + et − est maintenu dans la gamme de la commande VOLTS DUAL TRACKING.

OUTPUT
Bouton poussoir
En position «enfoncé» permet le fonctionnement de la PS 503A et rend disponible les tiroirs ± 0-20 V.

CURRENT LIMIT
Commandes et voyants lumineux
Continûment variables sélectionnant les valeurs limites du courant de sortie positif ou négatif. Une diode électroluminescente indique lorsque la limitation est en service.

Bornes de sortie +5 V
Bornes fournissant une tension fixe de +5 V, référencée à la masse et un courant maximal de 1 A.

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Fig. 1-3. Commandes et bornes de sortie de la PS 503A.

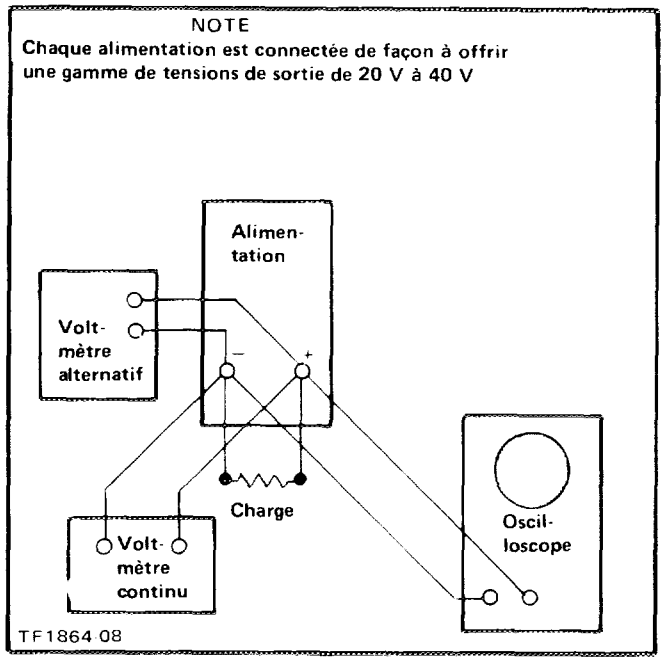


Fig. 1-4. Connexions d'appareils de mesure et de charge.

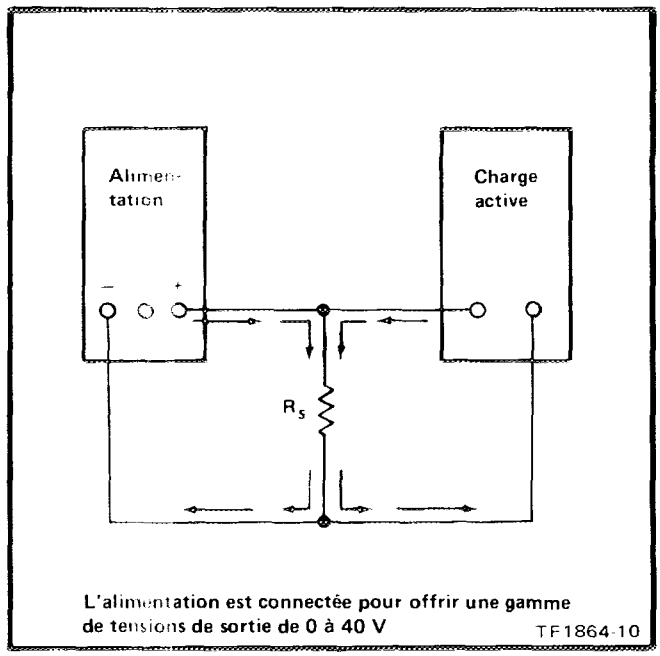


Fig. 1-6. Résistance d'absorption du courant inverse en présence de charge active.

tension aux bornes de sortie de la PS 503A s'inverse et par conséquent ne conduisent pas lorsque la tension est correcte. La connexion d'une résistance en parallèle (Rs), telle que représentée sur la figure 1-6, permet le passage des courants externes inverses.

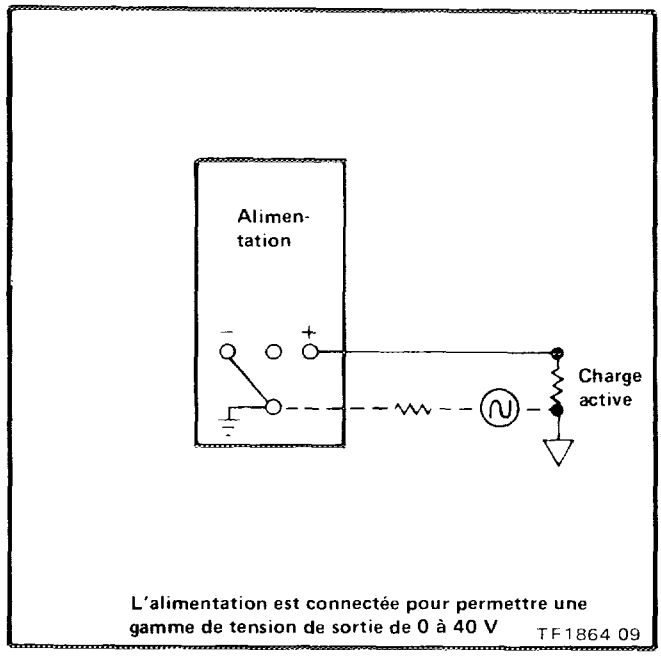


Fig. 1-5. Tension parasite générée par des mises à la masse en différents points.

Surtension

La PS 503A est protégée contre les surtensions par un circuit de protection qui coupe l'alimentation lorsque la tension atteint 26 V continus.

NOTA

La tension de fonctionnement du circuit de protection contre les surtensions peut être modifiée en fonction d'application spécifique par simple changement de la diode Zener.

UTILISATION

Les indications ci-dessous mettent en évidence l'utilisation des commandes et bornes de la PS 503A.

1. Installer la PS 503A dans le compartiment haute puissance (de préférence) du châssis d'alimentation.

2. Appuyer sur le bouton OUT de façon à mettre la PS 503A sous tension. Vérifier que les témoins lumineux + et − VOLTS s'allument (pour des tensions faibles, la luminosité des témoins sera faible).

Utilisation en alimentation simple (± 20 V max.)

1. Régler les commandes + et − VOLTS de façon à obtenir une tension de l'ordre de 2 V.

2. Tourner les commandes CURRENT LIMIT à fond dans le sens anti-horaire (afin de protéger l'ampèremètre). Insérer un ampèremètre entre la borne commune et la borne + ou −. Agir sur la commande CURRENT LIMIT afin d'obtenir le courant de sortie maximal désiré.

3. Oter ensuite l'ampèremètre. Relier la charge entre la borne commune et la borne + et/ou −. Agir sur la commande + et/ou − VOLTS pour obtenir la tension de sortie désirée.

Utilisation en alimentation combinée (40 V max.)

1. Régler la commande + et − VOLTS afin d'obtenir 2 V et tourner les commandes CURRENT LIMIT à fond dans le sens anti-horaire (afin d'assurer la protection de l'ampèremètre).

2. Relier un ampèremètre entre les bornes + et −. En premier lieu, agir sur une commande CURRENT LIMIT pour obtenir le courant de sortie maximal souhaitée, puis agir sur l'autre commande CURRENT LIMIT jusqu'à ce que le voyant atteigne la brillance maximale (les deux alimentations seront alors réglées pour le même débit).

3. Oter alors l'ampèremètre. Relier la charge aux bornes de sortie + et − et régler les commandes VOLTS + et − afin que la somme des tensions correspondant aux deux réglages soit égale à la tension de sortie souhaitée (se reporter à l'utilisation en alimentation double pour faire varier la tension de sortie à l'aide de la commande VOLT DUAL TRACKING).

Utilisation en alimentation double à commande unique

Lorsqu'elle est en position «sorti», la commande VOLTS DUAL TRACKING permet la variation de la tension de sortie des deux alimentations dans un rapport constant, à partir du niveau 0 jusqu'à la valeur indiquée par les commandes VOLTS positive et négative. Par exemple, si les commandes VOLTS positive et négative sont réglées pour obtenir une tension de sortie maximale (environ 20 V), il est possible de faire varier les deux tensions de sortie de zéro à 20 V, à l'aide de la commande VOLTS DUAL TRACKING (rapport 1 : 1). De même, si une alimentation est réglée pour une tension de 10 V et l'autre pour une tension de 20 V, chaque variation de un volt de la tension de sortie de l'alimentation réglée à 10 V se traduira par une variation de 2 V pour la tension réglée à 20 V (rapport 2 : 1).

Lorsque la commande VOLTS DUAL TRACKING est en position «enfoncée», les tensions de sortie correspondront à la tension sélectionnée par les commandes VOLTS + et −. Par conséquent, on peut opérer une sélection rapide de deux sorties de tension préréglées à partir de chaque alimentation simplement en commutant la commande VOLTS DUAL TRACKING sur l'une ou l'autre des deux positions («enfoncé» ou «sorti»).

Lorsque les alimentations + et − sont connectées conformément aux informations de la rubrique «Utilisation de l'alimentation en mode combiné», la commande VOLTS DUAL TRACKING permet la variation de la tension de sortie de zéro à la valeur égale à la somme des tensions de sortie déterminées par les commandes + VOLTS et − VOLTS des deux alimentations.

Utilisation en caractéristique rectangulaire (tension/courant)

Le fonctionnement caractéristique rectangulaire peut être obtenu en sélectionnant des valeurs de charge limite et des positions particulières des commandes. Par exemple, la figure 1-7 montre la sortie en caractéristique rectangulaire de la PS 503A lorsqu'une charge variable $R(_1)$ est reliée entre les bornes de sortie + et −. Chaque alimentation étant réglée pour une tension de sortie maximale et un courant (40 V et

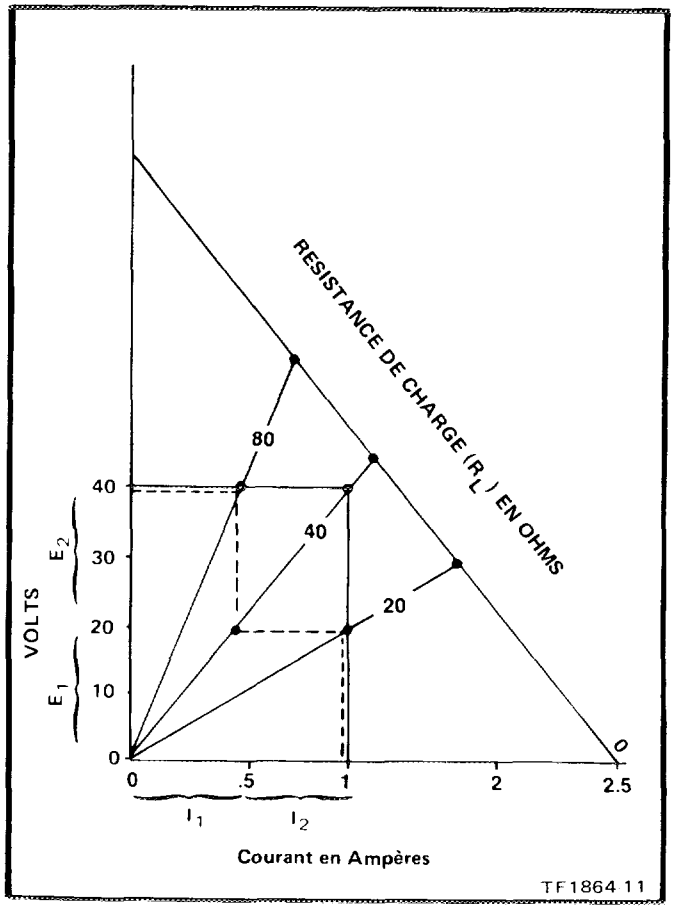


Fig. 1-7. Caractéristiques de sortie avec différents courants, tensions et charges.

1 A), la tension de sortie reste constante à partir d'un circuit ouvert jusqu'à ce que la charge atteigne environ 40 Ω, comme l'indique la ligne en trait plein de la figure 1A. A partir de ce point, la tension de sortie décroît avec la charge et le courant de sortie est limité à 1 A. Par conséquent, lorsque la charge est en-dessous de 40 Ω, les deux alimentations se comportent comme sources de courant avec une tension de sortie variable selon la charge.Puisque la tension de sortie est la même pour les deux alimentations, chaque alimentation fournit la même puissance (P/2). Si une alimentation est réglée pour une tension de sortie inférieure à l'autre, la puissance de sortie est répartie selon le même rapport que la tension de sortie.

En réglant maintenant la limitation de courant de l'alimentation E_2 à 0,5 A et en faisant varier la charge sur la totalité de la gamme, les alimentations se comportent comme des sources de tension constantes jusqu'à ce que la charge atteigne environ 80 Ω. A partir de ce point, l'alimentation (E_2) dont le courant est limité à 0,5 A, devient une source de courant et sa tension de sortie décroît avec la charge. A partir d'environ 40 Ω et 20 V, la puissance en sortie, fournie par E_2 devient nulle. En conséquence, l'alimentation E_1 fournit toute la puissance de sortie et fonctionne comme une source de tension constante, avec un courant de sortie variable en fonction de la charge. Lorsque la valeur de la charge atteint 20 Ω, l'alimentation E_1 devient une source de courant avec un courant de sortie maximal de 1 A. Par conséquent, grâce à un choix judicieux des valeurs limites de la charge et des positions des commandes n'importe laquelle des quatre caractéristiques d'utilisation est possible.

Une autre sortie en caractéristique rectangulaire peut être présélectionnée et mise en service ou hors service, en agissant sur la commande VOLTS DUAL TRACKING (se reporter à l'utilisation en alimentation double pour toute information complémentaire sur le rôle de la commande VOLTS DUAL TRACKING).

Alimentations reliées en série

Les sorties de deux ou plusieurs alimentations PS 503A peuvent être reliées en série selon les indications de la figure 1-8 afin d'obtenir une tension de sortie égale à la somme des tensions de sortie de chaque alimentation. Il faut régler chaque alimentation individuellement pour obtenir la tension de sortie souhaitée (voir la rubrique «Utilisation en alimentation double» pour faire varier la sortie des deux alimentations à l'aide de la commande VOLTS DUAL TRACKING).

NOTA

La PS 503A possède des diodes internes connectées sur les bornes de sortie pour protéger les alimentations connectées en série contre les inversions de polarité, si la charge est court circuitée ou si l'une des deux alimentations n'est pas sous tension.

Alimentations connectées en parallèle

ATTENTION

L'utilisation en parallèle n'est pas recommandée sauf si une diode utilisée dans le sens passant et capable de supporter le courant et la tension délivrée est insérée en série entre chaque alimentation et la charge. Sans cette précaution une détérioration de l'alimentation peut survenir.

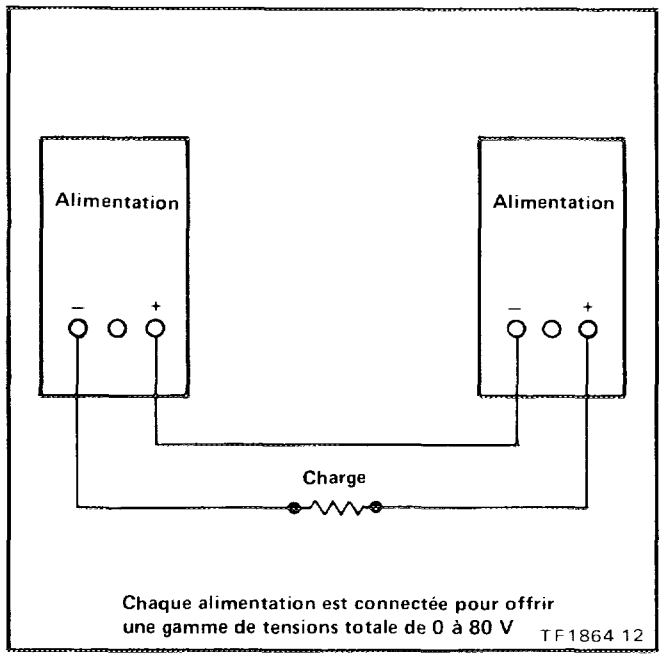


Fig. 1-8. Alimentations connectées en série.

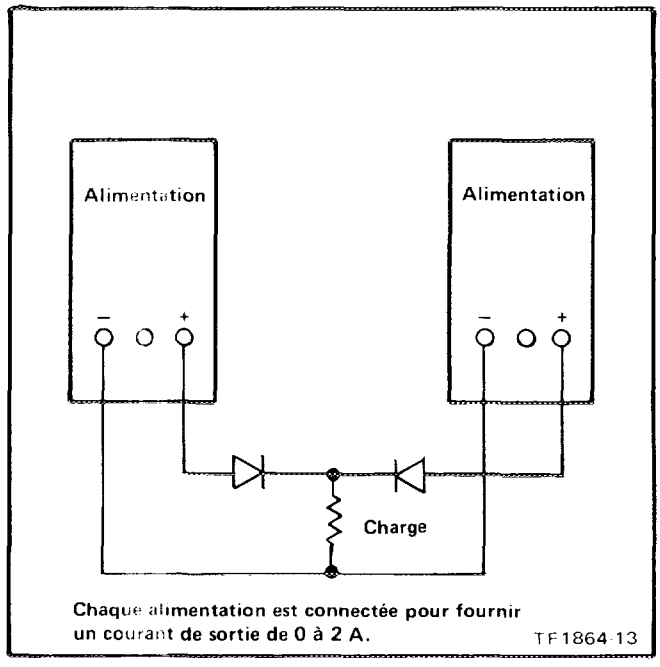


Fig. 1-9. Alimentations connectées en parallèle.

Les sorties de deux ou plusieurs PS 503A peuvent être connectées en parallèle selon l'indication de la figure 1-9, pour obtenir un courant de sortie égal à la somme des courants de sortie de chaque alimentation. Chaque alimentation doit être réglée individuellement pour obtenir le courant de sortie désiré. De même, chaque alimentation doit se trouver dans le compartiment haute puissance d'un châssis d'alimentation de la série modulaire TM 500 (TM 504 ou TM 506) pour pouvoir obtenir des courants supérieurs à 0,8 A (selon l'illustration de la figure 1-9).

NOTA

Les alimentations + et − sont connectées intérieurement en série. De ce fait, les alimentations + et − ne peuvent pas être connectées extérieurement en parallèle pour obtenir un courant de sortie égal à la somme des courants de chaque alimentation.

L'une des alimentations doit être réglée à la tension de sortie désirée et l'autre à une tension légèrement supérieure. L'alimentation réglée à la tension de sortie désirée devient alors une source de tension constante alors que l'alimentation ayant une tension supérieure devient une source de courant (en raison du croisement automatique) ce qui provoque une réduction de cette tension de façon à la rendre égale à la plus faible.

BEDIENUNGS-ANLEITUNG

EINFÜHRUNG

Beschreibung

Das Netzgerät PS 503A ist eine Konstantspannungsquelle für zwei Spannungen von 0 V bis 20 V mit Strombegrenzung und Bezugspotentialfreiheit. Es ist für den Betrieb in einem der Hochleistungseinschubkanäle der TM 504- oder TM 506-Versorgungseinheit konstruiert. In den Hochleistungseinschubkanälen liefert es zwei Spannungen von 0 V bis 20 V bis 1 A. In allen normalen Einschubkanälen der TM 500er-Versorgungseinheiten liefert das PS 503A bezugspotentialfreie Spannungen von 0 V bis 20 V bei max. 400 mA. Die Versorgungseinheit TM 501 hat eine mechanische Sperre im Verbindungsstecker, die die Benutzung des PS 503A verhindert und ist dadurch nicht kompatibel.

Das Netzgerät ist konstruiert für die bequeme Versorgung von kompletten Schaltungen und IC's wie Operations- und Differenzverstärker ebenso wie für Differenz-Komparatoren. Außerdem ist eine separate mit Massebezug versehene 5 V-Hilfsspannung vorhanden für die Versorgung von bipolaren Logiken, Leuchtdioden, Leuchtdisplays u.a.m. Die bezugspotentialfreie Versorgung kann für diskrete Interface-Schaltungen, Pegel-Veränderungen und viele andere Digital/Analog-Anwendungen benutzt werden.

Der positive und negative Ausgang sind einerseits unabhängig voneinander einstellbar, andererseits aber auch gemeinsam in einem konstanten Verhältnis einstellbar über einen separaten Einstellknopf.

Jede Versorgung bietet für sich eine positive oder negative Spannung von 0 V bis 20 V in Bezug auf den gemeinsamen Anschluß. Bei Anschluß an die Plus- und Minus-Buchse liefert das PS 503A 0 V bis 40 V. Alle Buchsen können geerdet oder mit Spannungen von bis zu 350 V_S unterlegt werden. Jede Versorgung hat eine kontinuierlich einstellbare Strombegrenzung von < 50 mA bis 400 mA (Standard-Einschubkanal) oder 1 A (Hochleistungs-Einschubkanal) bei beiden 20 V-Ausgängen oder bei 40 V.

Durch die Anzeigelampen VOLTS wird angezeigt, daß die Ausgangsspannung vorhanden und einstellbar ist. Die Helligkeit der Anzeigelampen ändert sich mit der Ausgangsspannung. Eine Frontplatten-Leuchtdiode leuchtet, wenn das PS 503A in einem Standard-Einschubfach einer Versorgungseinheit betrieben wird und der Ausgangsstrom auf max. 400 mA begrenzt ist. Die weiteren Frontplatten-Leuchtdioden zeigen an, ob die positive oder negative Versorgungsspannung im Strombegrenzungsbereich arbeitet. Eine starke Begrenzung wird durch die max. Helligkeit der Leuchtdiode und durch die dunkler werdende VOLTS-Anzeigelampe kenntlich gemacht, wenn die Ausgangsspannung über ca. 10 V liegt. Diese Funktion kann leicht durch momentanes Kurzschließen des Ausgangs überprüft werden.

Ein- und Ausbau

VORSICHT

Schalten Sie die Versorgungseinheit aus, bevor Sie den Einschub einschieben, andernfalls könnten die Schaltkreise des Einschubs beschädigt werden. Wegen des hohen Stromverbrauchs des PS 503A wird außerdem empfohlen, die Versorgungseinheit vor Herausziehen des Einschubs auszuschalten (siehe Bild 1–2). Prüfen Sie ob die Plastikstege auf der hinteren Kontaktleiste der Versorgungseinheit mit dem Ausschnitt in der Kontaktleiste des PS 503A übereinstimmt.

Setzen Sie das PS 503A-Chassis in die obere und untere Führung des gewählten Faches und schieben es mit dem nötigen Druck soweit ein, bis die rückseitige Steckverbindungsleiste einrastet.

Zum Herausnehmen des PS 503A ziehen Sie die Entriegelungsklinke an der linken unteren Ecke des Einschubes, bis sich die rückseitige Steckverbindung löst. Nun kann das PS 503A dem Fach entnommen werden.

Bedienungselemente und Anschlüsse

Beziehen Sie sich auf Bild 1–3. Obwohl das Netzgerät PS 503A kalibriert und gebrauchsfertig ist, sollten die Funktionen und Möglichkeiten der Bedienungselemente und Anschlüsse vor Gebrauch durchgesehen werden. Drücken Sie die Taste OUTPUT um den Einschub PS 503A mit Strom zu versorgen.

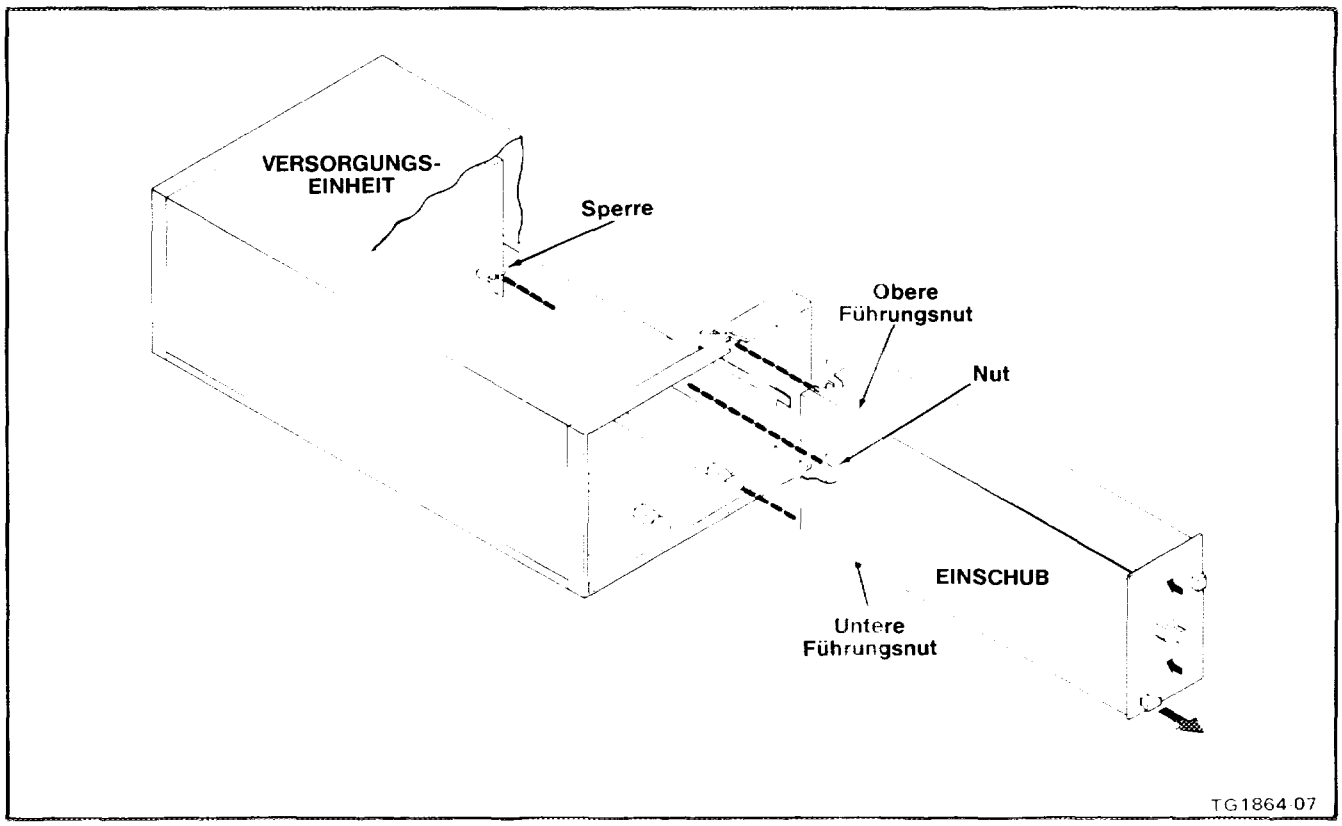


Abb. 1–2. Ein- und Ausbau des Einschubs.

BEDIENUNGSERLÄUTERUNGEN

Überhitzung

Das PS 503A ist für den Betriebstemperaturbereich von 0°C bis 50°C entwickelt. Wenn allerdings mehrere Netzgeräte in einer Mehrkanal-Versorgungseinheit betrieben werden, besonders mit niedriger Ausgangsspannung, oder wenn die Einheit in der Nähe von hitzeerzeugenden Geräten steht, kann die interne Temperatur die Sicherheitsgrenzen überschreiten und eine thermische Abschaltung der Versorgungseinheit auslösen. Weitere Informationen entnehmen Sie bitte der Bedienungsanleitung der Versorgungseinheit.

Last- und Meßanschlüsse

Falsche Verbindungen zwischen dem Ausgang des Netzgerätes und der Last oder dem Meßobjekt sind die häufigsten Fehlerursachen. Die Lasten und Meßgeräte müssen über getrennte Leitungspaare an die Ausgangsbuchsen angeschlossen werden (siehe Abb. 1–4). Vermeiden Sie die Benutzung von Leitungen mit Klemmanschlüssen, da ihr Kontaktwiderstand die Ausgangsimpedanz des PS 503A überschreiten und wesentliche Fehlmessungen verursachen kann.

Geerdeter und Bezugspotentialfreier Betrieb

Das PS 503A ist ein bezugspotentialfreies +20 V und −20 V Netzgerät, das keine interne Verbindung zum Chassis oder zur Masse hat. Die Versorgungsspannung kann positiv oder negativ sein, je nachdem, ob die Anschlüsse zwischen dem gemeinsamen Bezugspunkt und der positiven oder negativen Ausgangsbuchse angeschlossen sind. Allerdings können unerwünschte Einflüsse durch Erdung der Versorgungsspannung auftreten, wenn gleichzeitig die Last an einem anderen Erdpunkt angeschlossen ist. Als Beispiel zeigt Abb. 1–5, wenn eine entfernte Last angeschlossen ist und der Strom auf der Masseleitung Teile der Netzspannung enthält, die Rauschen und Brummüberlagerungen in der Last zur Folge haben. Deshalb wird der bezugspotentialfreie Betrieb empfohlen, um die in Verbindung mit unerwünschten Massesträmen auftretenden Probleme zu verhindern.

Sperrstrombetrieb

In einigen Vorspannungsversorgungen und Digitalschaltungen kann die Last für einen Teil des Arbeitszyklus als Stromquelle arbeiten und somit Strom abgeben. Da die Ausgangsschaltung der Serienreglung Strom

400 mA-Begrenzungsanzeige

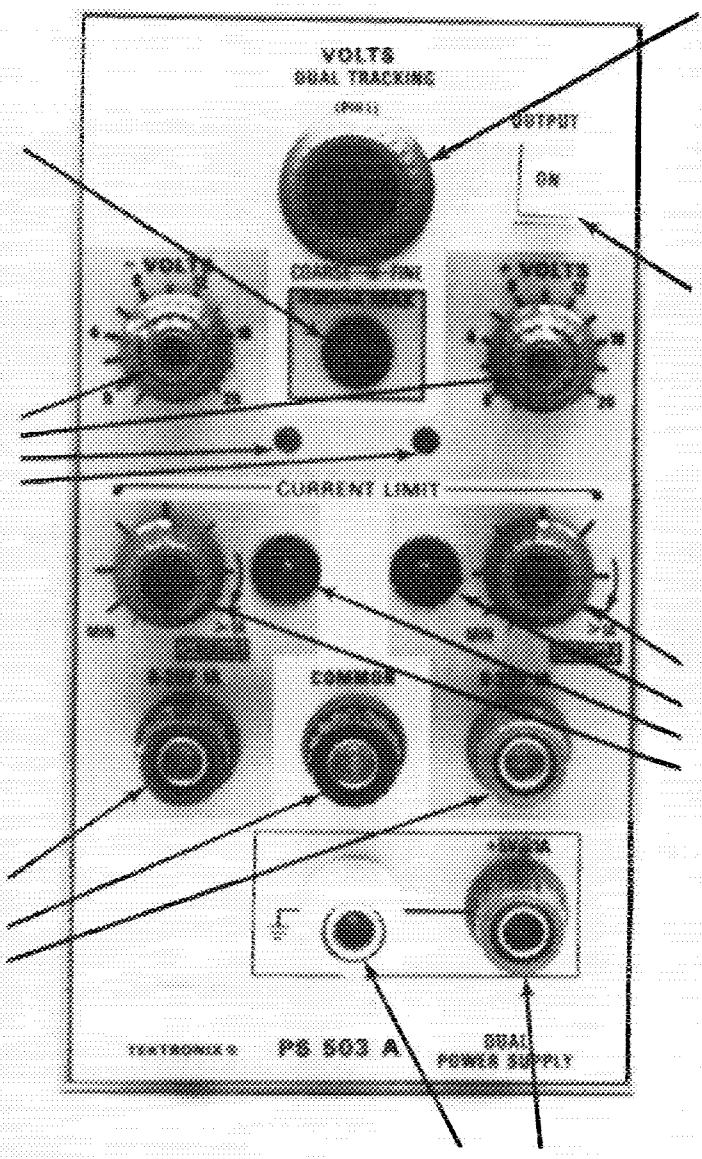
Die Leuchtdiode leuchtet, wenn das PS 503A in einen Standard-Einschubkanal einer Versorgungseinheit eingeschoben wird, um damit der Ausgangsstrom begrenzt wird.

VOLTS-Einstellung und Anzeigelampen

Die variable Grob- und Feineinstellung bietet kontinuierlich einstellbare + und – Spannungswahl von der jeweiligen 0 bis 20 V Versorgung. Das Vorhandensein und die Einstellbarkeit der Ausgangsspannung wird durch das Leuchten der Anzeigelampen kenntlich gemacht (Drucktaste OUTPUT gedrückt). Die Helligkeit der Anzeige ändert sich mit der Ausgangsspannungshöhe.

Bezugspotentialfreie Ausgangsanschlüsse

Klemmschraubanschlüsse für positive Ausgangsspannungen 0 V bis 20 V zwischen dem rechten Anschluß (rot) und dem COMMON-Anschluß (gemeinsamer Bezugspunkt), oder negativen Ausgangsspannungen (0 V bis 20 V) zwischen dem linken Anschluß (grün) und COMMON.
Wird das PS 503A in einem Hochleistungseinschubkanal der Versorgungseinheiten TM 504 oder TM 506 betrieben, reicht der zur Verfügung stehende Strom von weniger als 100 mA bis 1 A. Wird das PS 503A in einem Standard-Einschubkanal betrieben, beträgt der zur Verfügung stehende Strom mindestens 400 mA. Eine Ausgangsspannung von 0 V bis 40 V kann durch Anschluß an die + und – Klemmen abgenommen werden.



VOLTS DUAL TRACKING-Einstellung

Im gezogenen Zustand können mit der Tracking-Einstellung gleichzeitig die + und – Ausgangsspannungen von 0 V bis zum eingestellten Spannungswert (mit VOLTS eingestellt) variiert werden. Das Verhältnis zwischen der + und – Ausgangsspannung bleibt über den gesamten Tracking-Bereich konstant.

OUTPUT-Drucktaste

Bei Drücken erhält der Einschub und die Ausgangsanschlüsse ihre Spannungen.

Strombegrenzung, Einstellung und Anzeige

Kontinuierlich einstellbare Strombegrenzung für die + und – Versorgung. Die Leuchtdioden leuchten bei Strombegrenzung.

+ 5 V-Ausgang mit Massebezug

Klemmschraubanschlüsse für + 5 V mit Massereferenz und 1 A.

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Abb. 1–3. Bedienungselemente und Anschlüsse des PS 503A.

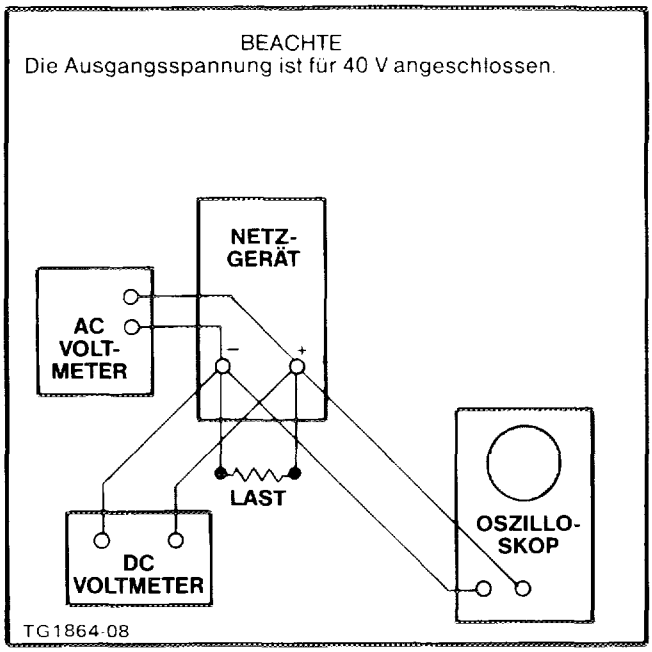


Abb. 1–4. Meß- und Lastanschlüsse

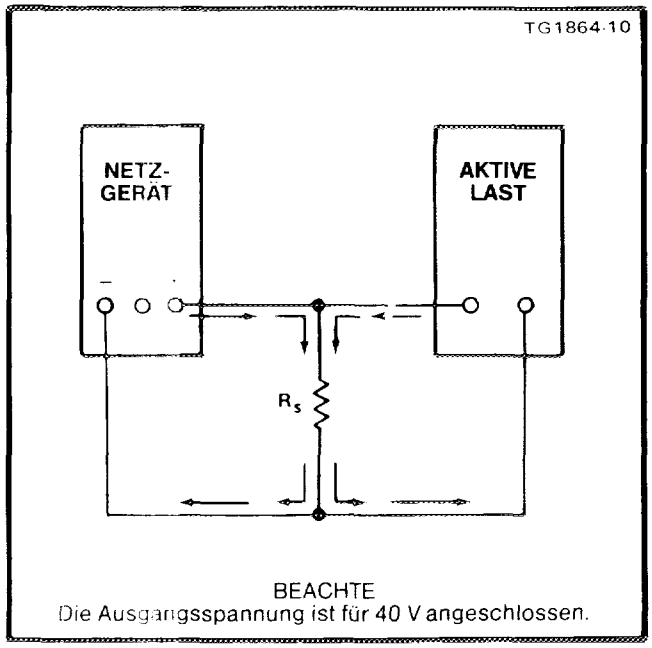


Abb. 1–6. Sperrstrom-Shunt (R_S) mit aktiver Last.

in einer Richtung durchläßt, kann der Strom nicht in die entgegengesetzte Richtung fließen, außer über unerwünschte Pfade. Die internen Sperrstromdioden leiten nur, wenn sich die Ausgangsspannung des Netzgerätes umkehrt, und nicht im normalen Betrieb bei richtiger Polarität. Der Anschluß eines Shunts (Rs in Abb. 1–6) bietet einen externen Sperrstrompfad für die Stromquelle oder liefert Strom.

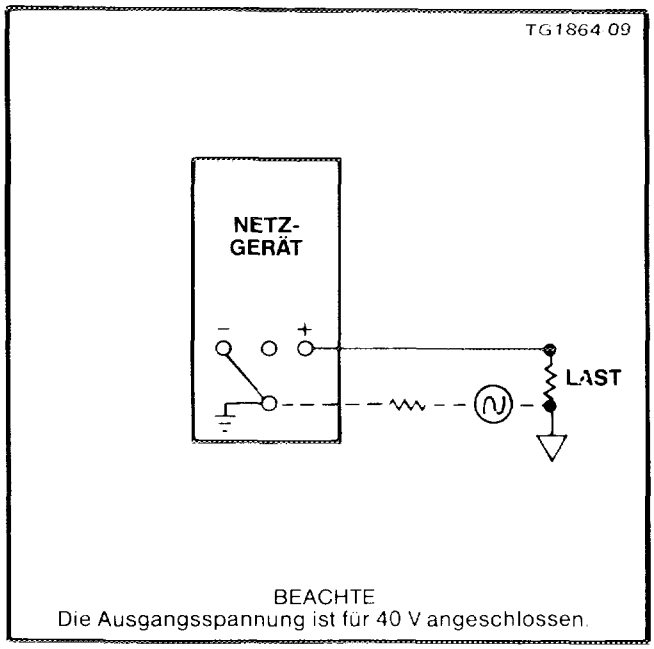


Abb. 1–5. Masseschleife durch entfernten Masseanschluß.

Überspannung

Das Netzgerät PS 503A ist durch einen Überspannungsschaltkreis gegen Überspannungen geschützt. Wenn die Spannung 26 V überschreitet, schaltet die Schutzschaltung das Netzgerät runter.

BEACHTE

Der Punkt, an dem der Überspannungsschutz die Sicherung durchbrennt, kann für spezielle Anwendungen durch Austausch der Zener-Diode verändert werden.

BETRIEB

Die folgenden Stufen zeigen die Benutzung der Bedienungselemente und Anschlüsse des PS 503A.

1. Installieren Sie das PS 503A in einem Hochleistungseinschubkanal (falls vorhanden) einer Versorgungseinheit.

2. Drücken Sie die Taste OUT, um den Einschub mit Strom zu versorgen. Beachten Sie, daß die VOLTS-Anzeigenlampen für die + und – Spannung angehen (bei niedrigen Spannungen sind die Lampen sehr dunkel).

Einfach-Betrieb (±20 V Maximum)

1. Stellen Sie die + und – VOLTS-Einsteller auf etwa 2 V.

2. Drehen Sie die Einsteller CURRENT LIMIT an den Anschlag im Gegenuhrzeigersinn (zum Schutze des Am-

peremeters). Schließen Sie ein Amperemeter zwischen den gemeinsamen Anschluß und dem + oder – Anschluß und justieren Sie CURRENT LIMIT auf den gewünschten Ausgangsstrom.

3. Entfernen Sie das Amperemeter. Verbinden Sie die Last mit dem gemeinsamen Anschluß und dem + oder – Anschluß. Stellen Sie die + oder – Spannung auf den gewünschten Wert.

Kombinierter Betrieb (40 V Maximum)

1. Stellen Sie die Einsteller für + oder – VOLTS auf etwa 2 V und drehen Sie die Einsteller für CURRENT LIMIT im Gegenuhrzeigersinn bis zum Anschlag (zum Schutz des Amperemeters).

2. Verbinden Sie ein Amperemeter mit dem + und – Anschluß. Zuerst justieren Sie einen der CURRENT LIMIT-Regler auf den maximal gewünschten Strom, dann justieren Sie den zweiten, bis die Anzeigelampe gerade die höchste Helligkeit hat; beide Spannungsquellen haben dann die gleiche Strombegrenzung.

3. Entfernen Sie das Amperemeter. Verbinden Sie die Last mit dem + und – Anschluß und stellen Sie die VOLTS-Regler so ein, daß die Addition der eingestellten Werte der gewünschten Spannung entspricht. (siehe Tracking-Betrieb für die gleichzeitige Variation der Ausgangsspannung).

Tracking-Betrieb

Wenn der Regler VOLTS DUAL TRACKING gezogen wird, kann die Ausgangsspannung von beiden Versorgungsspannungen gleichzeitig in einem konstanten Verhältnis von Null bis zu dem mit VOLTS eingestellten Wert variiert werden. Sind beispielsweise die + und – VOLTS-Regler auf maximale Ausgangsspannung eingestellt (ca. 20 V), können mit dem VOLTS DUAL TRACKING-Regler beide Ausgangsspannungen zwischen 0 V und 20 V variiert werden (Verhältnis 1 : 1). Ist andererseits eine Versorgungsspannung auf 10 V und die andere auf 20 V eingestellt, hat jede 1 V-Änderung der 10 V-Versorgung eine 2 V-Änderung im 20 V-Ausgang zur Folge (Verhältnis 2 : 1).

Beachten Sie, daß unabhängig von der Einstellung des VOLTS DUAL TRACKING-Reglers, die Ausgangsspannung bei Eindrücken des Reglers ihren vorher eingestellten Spannungswert annimmt. Dadurch ergibt sich eine schnelle Umschaltmöglichkeit für zwei voreingestellte Ausgangsspannungen durch Drücken oder Ziehen des Reglers VOLTS DUAL TRACKING. Wenn die + und – Versorgung im kombinierten Betrieb angeschlossen sind, variiert die Ausgangsspannung zwischen 0 V und dem durch die + und – VOLTS-Regler eingestellten Werte.

Treppenspannungsbetrieb

Das PS 503A kann durch bestimmte Wahl der Lastbegrenzungen und Einstellungen eine Treppenspannung erzeugen. Beispielsweise zeigt Abb. 1–7 einen Treppenspannungsausgang, wenn an die + und – Anschlüsse des PS 503A eine variable Last angeschlossen wird. Wenn jede Versorgung auf Ihre Maximalwerte (40 V, 1 A) eingestellt ist, bleibt die Ausgangsspannung konstant, solange die Last zwischen unendlich hohem Widerstand und 40 Ω liegt. In Bild 1–7 durch die durchgehende Linie dargestellt. Bei diesem Kreuzungspunkt sinkt die Ausgangsspannung mit der Last und der Ausgangsstrom bleibt bei 1 A begrenzt. Deshalb arbeiten beide Ausgangsspannungen unterhalb von etwa 40 Ω als Stromquellen mit lastabhängiger variabler Ausgangsspannung. Da beide Versorgungsspannungen auf die gleiche Ausgangsspannung eingestellt sind, teilt sich jede Versorgung die Ausgangsleistung nach I^2R. Falls eine Versorgung auf eine niedrigere Ausgangsspannung als die andere eingestellt wurde, teilen sich die Ausgangsleistungen im gleichen Verhältnis wie die Ausgangsspannungen.

Durch Einstellen der Versorgung E_2 auf eine Strombegrenzung von 0,5 A und durch Variation der Last wie im vorherigen Beispiel, arbeiten die Versorgungen als Konstantspannungsquellen bis die Last etwa 80 Ω erreicht.

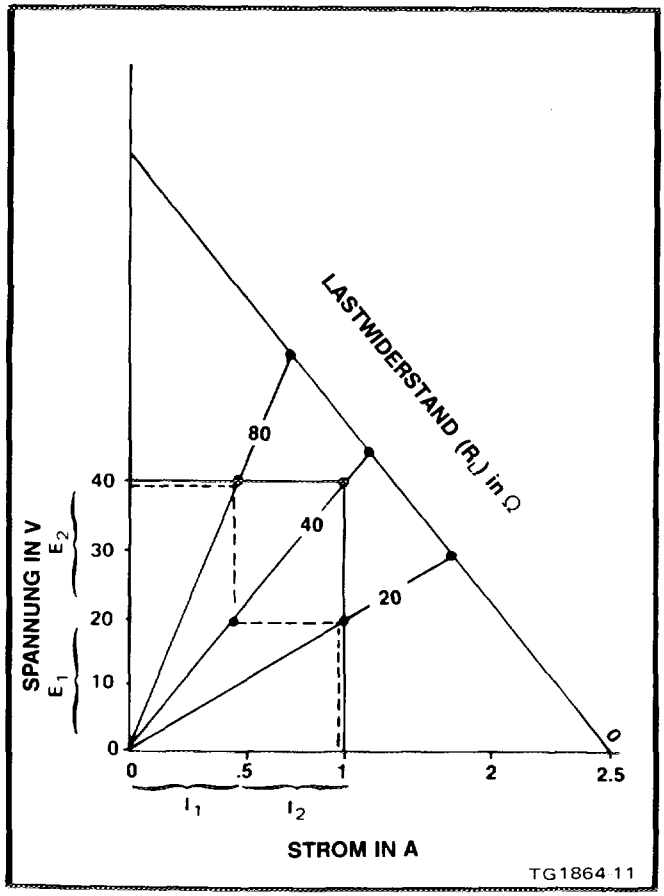


Abb. 1–7. Ausgangscharakteristik bei unterschiedlichen Strömen, Spannungen und Lasten.

Bei diesem Punkt wird die Versorgung E_2 mit Ihrer 0,5 A-Begrenzung zur Konstantstromquelle und ihre Ausgangsspannung fällt mit der Last. Bei etwa 40 Ω und 20 V leistet die Versorgung E_2 keinen Beitrag mehr zur Ausgangleistung. Danach versorgt die Versorgung E_1 die Last mit der gesamten Ausgangsleistung und arbeitet als Konstantspannungsquelle mit einem Ausgangsstrom, der abhängig ist von der Last.

Bei etwa 20 Ω wird die Versorgung E_1 zur Konstantstromquelle mit einem maximalen Ausgangsstrom von 1A. Deshalb ist bei der richtigen Wahl der Lastgrenzen und der Einstellungen jede von den vier Betriebscharakteristiken möglich.

Ein zweiter Treppenspannungsausgleich kann durch den Regler VOLTS DUAL TRACKING ein- oder ausgeschaltet werden (siehe Tracking-Betrieb zur Funktionserläuterung des Reglers VOLTS DUAL TRACKING).

In Reihe geschaltete Netzgeräte

Die Ausgänge von zwei und mehr PS 503A können, wie in Bild 1–8 gezeigt, in Reihe geschaltet werden, um eine Ausgangsspannung zu erreichen, die der Summe der Einzelspannungen entspricht. Um die gewünschte Spannung zu erzielen, muß jede Versorgung individuell eingestellt werden (siehe auch Tracking-Betrieb zur gemeinsamen Einstellung der Ausgangsspannungen über den VOLTS DUAL TRACKING-Einsteller).

BEACHTE

Das PS 503A hat interne Dioden, die über dem Ausgang liegen und diesen im seriellen Betrieb mit weiteren Netzgeräten gegen Spannungen mit umgekehrter Polarität schützen, falls eine Last kurzgeschlossen oder eine Versorgungsspannung noch nicht eingeschaltet ist.

Parallel geschaltete Netzgeräte

VORSICHT

Parallel-Betrieb von Netzgeräten kann nur dann empfohlen werden, wenn eine in Durchlaßrichtung geschaltete Diode, die die gewünschten Spannungs- und Stromwerte verarbeiten kann, jeweils zwischen Netzgerät und Last geschaltet wird. Das Fehlen einer solchen Diode kann zur Beschädigung des Netzgerätes führen.

Die Ausgänge von zwei und mehr PS 503A's können wie in Abb. 1–9 gezeigt, parallel miteinander verbunden werden, um einen Ausgangsstrom zu erhalten, der der Summe der Einzelströme entspricht. Um den gewünschten Strom zu erhalten, muß jedes Netzgerät individuell auf den gewünschten Ausgangsstrom eingestellt werden. Außerdem muß jedes Netzgerät in einem Hochleistungseinschubkanal betrieben werden (TM 504 und TM 506) um Ströme von mehr als 0,8 A zu erzeugen (wie in Abb. 1–9 gezeigt).

BEACHTE

Die + und – Versorgung sind intern in Reihe geschaltet. Deshalb kann die + und – Versorgung nicht extern parallel geschaltet werden, um einen Ausgangsstrom zu erhalten, der der Summe der Ströme aus beiden Versorgungen entspricht.

Eine Versorgungsspannung sollte auf die gewünschte Ausgangsspannung eingestellt werden, die andere auf eine etwas höhere Spannung. Die Versorgung, die auf dem gewünschten Spannungswert eingestellt wurde, wird dann zur Konstantspannungsquelle, während die Versorgung mit der höheren Ausgangsspannung zur Konstantstromquelle wird, was durch die Abnahme der Ausgangsspannung auf den niedrigeren Spannungswert bedingt ist.

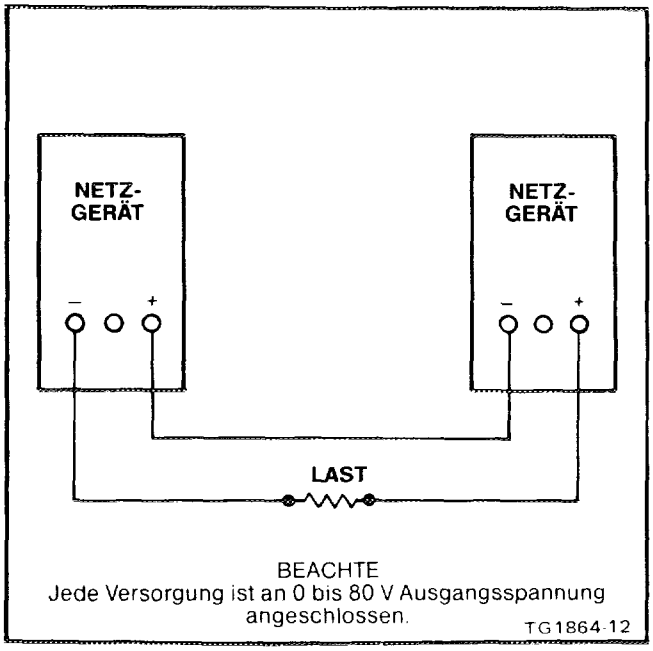


Abb. 1–8. Reihenschaltung von Netzgeräten

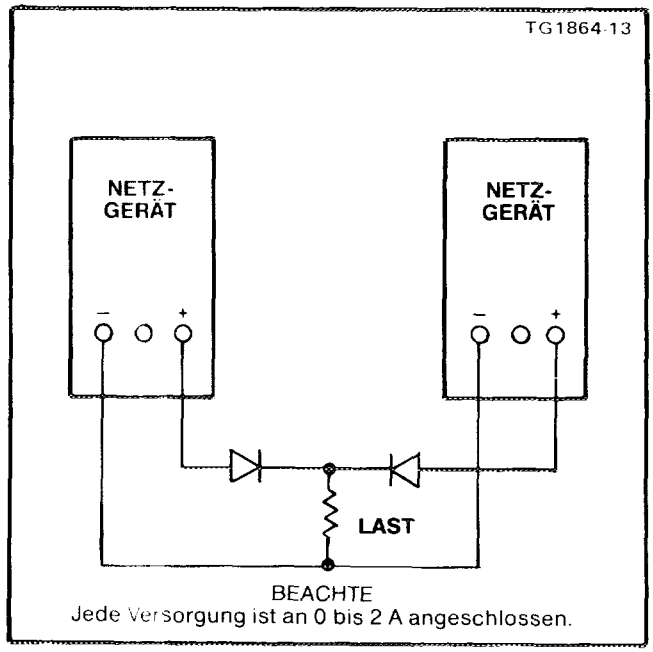


Abb. 1–9. Parallelschaltung von Netzgeräten.

取扱説明

はじめに

概要

PS503A型は2出力で0～＋20VDCまでの安定化電圧、電流制限機能付のフローティング電源です。**TM504型**または**TM506型**本体の高電力ホールで使用しますと、**PS503A型**は±1A、0～±20VDCまで得られます。**TM500**シリーズの本体の通常のプラグイン・ホールまたは**TM503型**で使用しますと、±400mA、0～±20VDCまで得られます。**TM501型**本体は、本体コネクタ上に仕切りがあるので、**PS503A型**は使用はできません。

PS503A型は差動コンパレータや演算増幅器、差動増幅器のようなリニアICに対して簡単に電源が供給できるように設計されています。グラウンド基準の＋5Vの補助電源（バイポーラ・ロジック、発光ダイオード、自熱表示および同様のアプリケーションに適しています）も含まれています。

ディスクリートのインターフェイスやレベル・シフト回路にフローティングされた電源を供給できるので多くのデジタル／アナログのアプリケーションに用いることもできます。

2フローティング電源からの＋および－出力は、共通のコントロールによって、独立可変または一定比で両方とも可変にすることができます。各電源は＋および－0～20VDCをコモン・ターミナルで供給できます。＋と－の端子を交差して接続すると0～40VDCまで供給できます。どちらかの端子は接地されるか350V（DC＋ピークAC）までフローティングさせられます。各電源は、20V、40V出力のいずれの場合でも50mA以下より400mA（通常のプラグイン・ホールにて使用の場合）または1A（高電力プラグイン・ホールにて使用の場合）までの可変電流制限機能があります。

出力電圧の有無と変化は前面パネル上のVOLTSインジケータ・ランプによって知ることができます。このランプの輝度は出力電圧によって変化します。パネルに取り付けられた400mA MAXのLEDは、**PS503A型**が**TM500**シリーズ本体の通常のプラグイン・ホールに取り付けられ、出力電流が最大の400mAに制限されているときに点燈します。他のCURRENT LIMITのLEDは＋または－の電源が電流制限されている時に点燈します。設定した電流制限に近くなるほどLEDの輝度は上がり、それと同時にVOLTSインジケータ・ランプは電源の出力電圧が約10Vを超えている時には暗くなります。これらの機能は出力端子を瞬間的に短絡することにより簡単に確認できます。

取付けと取りはずし

注　意

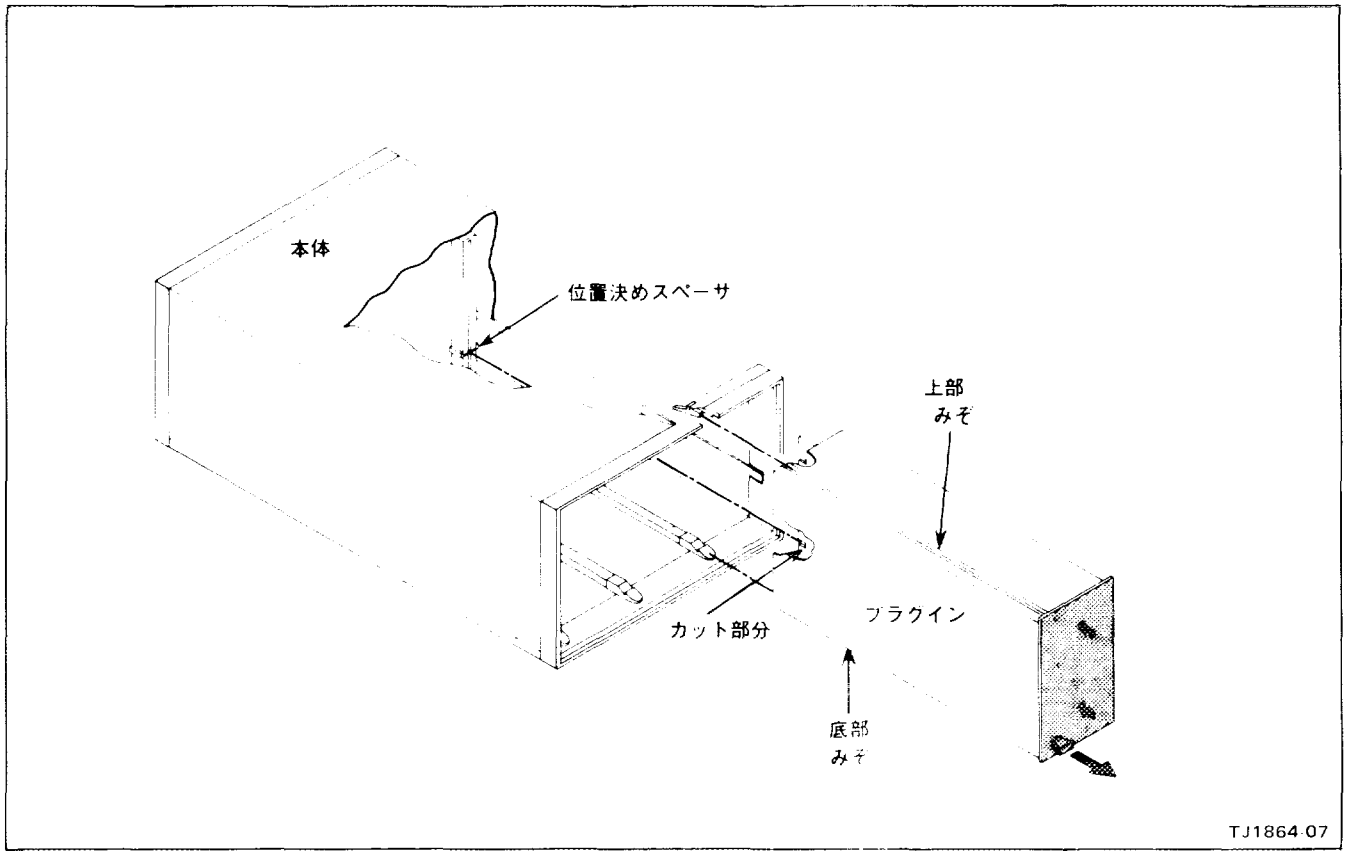
プラグインを本体に取り付ける場合は、本体の電源を切ってから行って下さい。切らずに行うとプラグインの回路に損傷を与えます。またPS503A型に大電流が流れるので、プラグインを本体から取りはずす時にも電源を切ってから行って下さい。（1－2図参照）本体のコネクタ内に入っているプラスチックの位置決めスペーサとPS503A型のエッジ・コネクタのカット部分とが一致していることを確認します。

本体のプラグイン・ホールの上下のガイドに沿って**PS503A型**を押し込み、さらに本体のコネクタに**PS503A型**のエッジ・コネクタがしっかりと固定されるまで押して下さい。

PS503A型を取りはずす場合には、左下隅にあるつまみを引っぱりそのまま引き抜きます。

コントロールとコネクタ

PS503A型は出荷時に完全に校正されていますので、そのままご使用になれます。コントロールやコネクタの機能や動作については1－3図をご参照下さい。まずOUTPUTボタンを押して**PS503A型**に電源を投入します。



1　2図　取付および取はずし方法

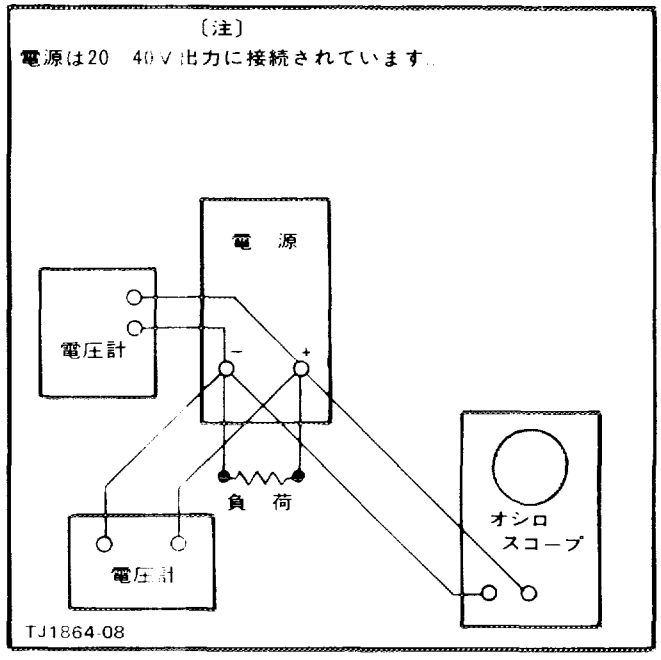
操作上の注意

過熱について

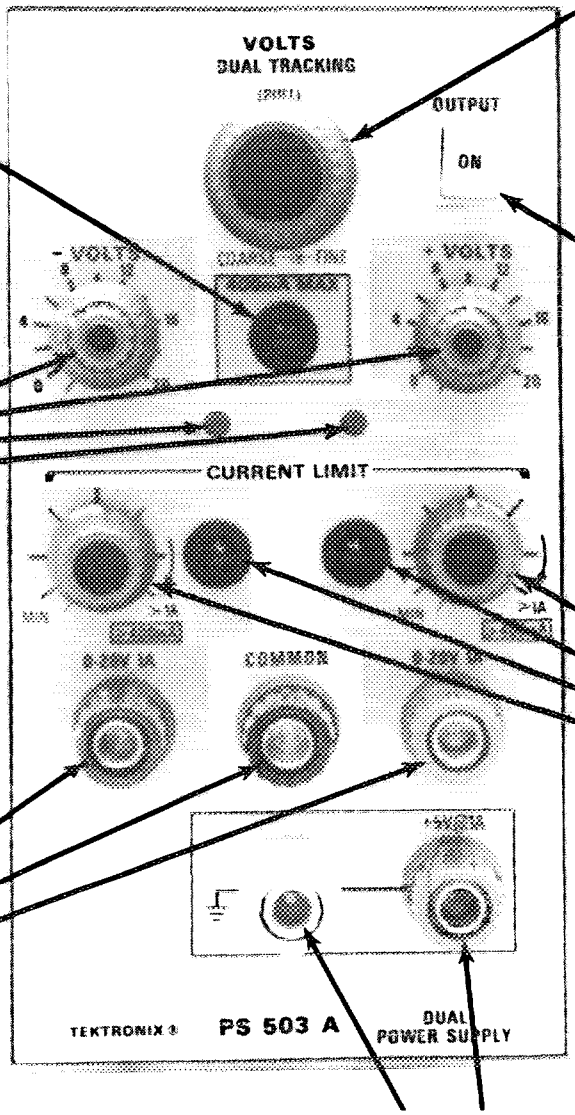
PS503A型は0℃　+50℃の周囲温度で作動します。しかし、本体にいくつかの電源プラグインが組み込まれている時、特に出力電圧を低くして使用する場合、または熱を発生する機器が近くにある時は、内部温度が安全範囲を超えることがありますか、その時は本体のサーマル・カットアウトが作動します。くわしくは本体のインストラクション・マニュアルをご覧下さい。

負荷とモニタの接続

電源の出力と負荷およびモニタ機器の不適切な接続は、エラーの原因となります。複数の負荷またはモニタ機器は1－4図のように、分離した2本のリード線を使って直接接続します。クリップ・リードの使用は、接触抵抗がPS503A型の出力インピーダンスより大きくなり、測定誤差が生じる恐れがありますので避けて下さい。



1-4図　モニタと負荷の接続



VOLTS DUAL TRACKING コントロール

このつまみを引き出すと0Vから＋および－VOLTS コントロールの設定値までの＋および－出力を変化させることができます。＋および－の出力の比はVOLTS DUAL TRACKING コントロールの全範囲にわたって保持されます。

400mA LIMITインジケータ

PS503A型が本体の通常のフロアイン・ホールに取付けられ、電流制限を受けている場合に、LEDが点燈します。

OUTPUT押しボタン

このボタンを押し込むと、0～20Vの両出力端子と＋5V出力端子に電圧が供給されます。

VOLTSコントロールおよびインジケータ

＋および－0～20Vの電圧を連続可変で選択するコントロールです。出力電圧の有無、および出力電圧の変化は電圧インジケータによって示されます。OUTPUTボタンを押します。フェアの輝度変化は出力電圧の変化を示します。

CURRENT LIMITコントロールおよびインジケータ

＋および－出力電流制限を設定する連続可変コントロールです。電流制限付近の電流出力の時はLEDが点燈します。

フローティング出力端子

右の赤い出力端子とCOMMON端子間で0～＋20V、左の緑色の出力端子とCOMMON端子間で0～－20Vの出力が得られます。**PS503A型**か、**TM504型**または**TM506型**本体の高電力フロアイン・ホールに取り付けられている時は、＋または－出力での電流は100mA以下から少くとも1Aまで得られます。

PS503A型が通常のフロアイン・ホールに組み込まれている時は、電流は100mA～400mAまで得られます。＋と－出力端子間では0～40Vまで電圧出力が得られます。

＋5Vグラウンド基準出力端子

グラウンド基準の＋5V、1Aの固定出力が得られる出力端子です。

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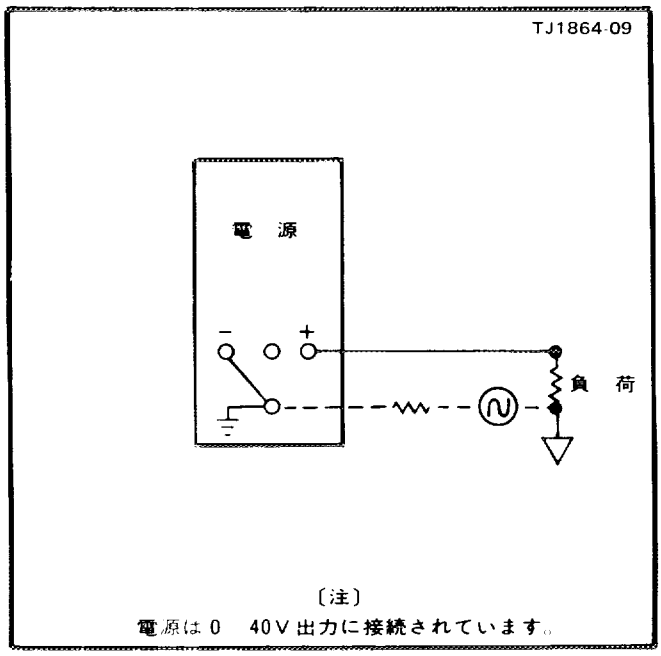
1-3図　PS503A型のコントロールとコネクタ

グラウンドおよびフローティング作動

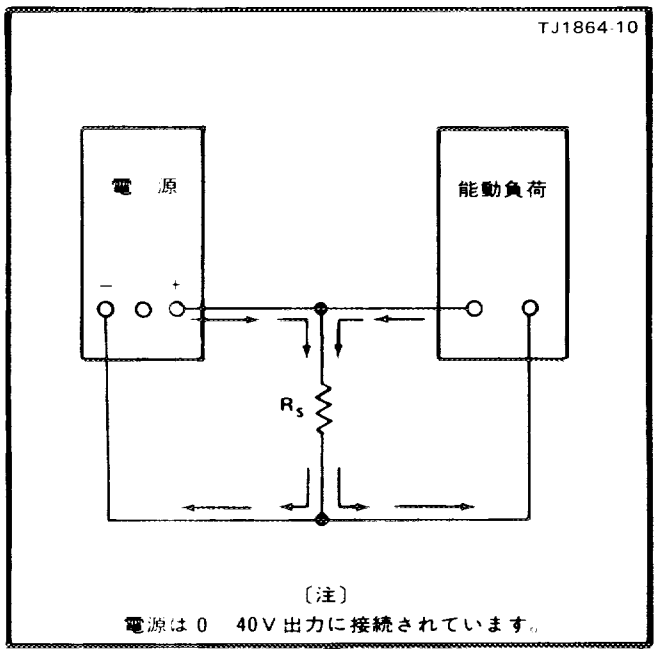
PS503A型は＋および－20Vのフローティング電源で、内部でシャーシまたはグラウンドへの接続はされていません。コモンおよび正または負の出力ターミナル間を接続することによって正または負の電源として用いることができます。しかし、負荷が電源のシャーシから離れた点で接地されている場合、電源をシャーシに接地することによって、好ましくない効果が引き起こされることもあります。たとえば、**1－5図**のように、離れた所の負荷と接続されている時、電源ライン周波数を含んだグラウンド電流が、過大なノイズやリップルを負荷に及ぼします。フローティング作動は、好ましくないグラウンド電流によってひき起こされる悪影響を避けたい時にお奨めします。



1-5図　離れた所で接地された負荷により生じたグラウンド・ループ

逆電流ローディング

誘導負荷を駆動するようなアプリケーションにおいては、負荷はその動作周期の一部において電流源として振るまうこともあります。直列の安定化電源の出力回路は単方向性であるので、電流は、通常逆方向に流れることはありません。内部の逆電流を通過させるダイオードは、**PS503A型**のターミナルに逆電圧がかかった時のみ導通し、電源の出力回路を保護します。電圧の極性が正しい時は動作しません。スイッチングや誘導負荷を駆動させる場合に**1－6図**のようにシャント抵抗（Rs）を接続することによって、外部で逆電流の経路を与え、電源は電流のみを供給します。



1-6図　シャント抵抗(Rs)と能動負荷

過電圧

PS503A型は、電圧が約26VDCを超えると電源を遮断する保護回路で、過電圧から保護されています。

注

特別のアプリケーションとしてツェナ・ダイオードを交換することにより、過電圧保護用のヒューズが溶断する電圧を変えることができます。

操　作

PS503A型のコントロールとコネクタの使い方を知るために次の順序に従って操作して下さい。

1．**PS503A型**を高電力ホールに組み込んで下さい。（通常のホールでもかまいませんが、高電力ホールの方が機能をフルに発揮できます。）

2．OUTボタンを押して、**PS503A型**に電源を入れて下さい。＋および－VOLTSインジケータ・ランプが点燈するのを確めて下さい。（電圧が低い場合には、ランプは暗く点燈します。）

単電源作動（最大 ±20V）

1. ＋および－VOLTSコントロールで約2Vに設定して下さい。

2. CURRENT LIMIT コントロールを左回しいっぱいまで回します。(電流計を保護するため。) 電流計をコモン・ターミナルと＋または－端子の間に接続し、CURRENT LIMIT コントロールで、希望する最大の電流出力が得られるように調整します。

3. 電流計を取りはずします。コモン端子と＋または－端子の間に負荷を接続します。希望する出力が得られるよう、＋または－VOLTS コントロールを調整します。

結合電源作動（最大 40V）

1. ＋および－VOLTSコントロールで約2Vに設定し、CURRENT LIMIT コントロールを左回しいっぱいまで回して下さい。（電流計保護のため。）

2. 電流計を＋および－端子の間に接続して下さい。まず一方の CURRENT LIMIT コントロールで、希望する最大の電流出力が得られるように調整します。次にもう一方の CURRENT LIMIT コントロールを、CURRENT LIMIT インジケータが最大の輝度になるように調整します。すなわち両電源の CURRENT LIMIT の設定を同じにします。

3. 電流計を取りはずします。＋および－端子の間に負荷を接続し、＋および－VOLTS コントロールで両方の設定値の和が希望する出力電圧に等しくなるように調整します。（VOLTS DUAL TRACKING コントロールで出力を変化させるには、デュアル・トラッキング作動の項をご覧下さい。）

デュアル・トラッキング作動

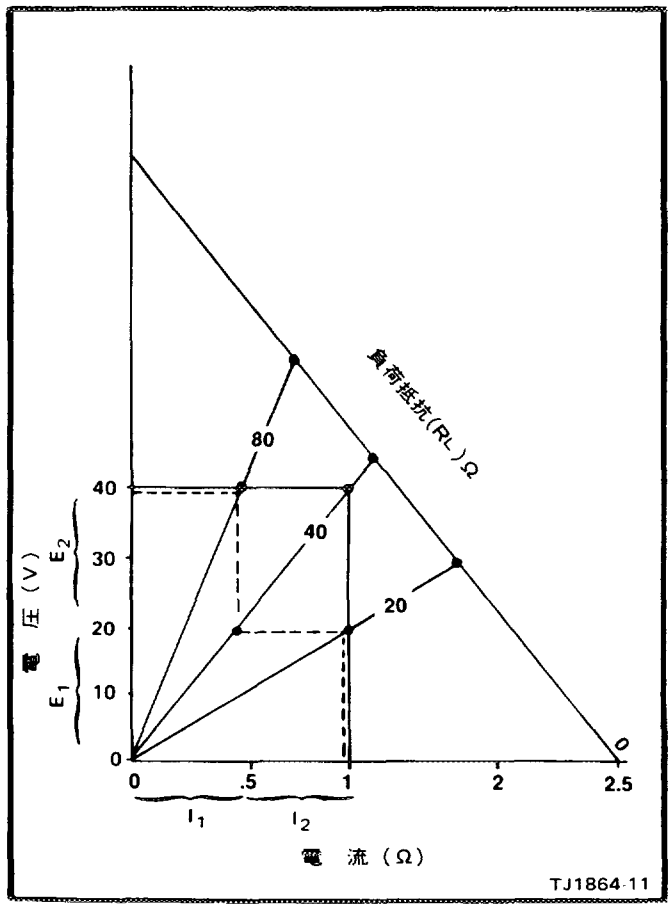
VOLTS DUAL TRACKING コントロールを引き出すと、0から＋および－VOLTS コントロールの両設定値が一定比で変化します。たとえば＋および－VOLTS コントロールが最大出力（約20V）に設定されている場合、VOLTS DUAL TRACKING コントロール（比率1：1）によって、両出力を0から20Vまで変化させることができます。同様にして、一方の電源を10V、他方を20Vに設定した場合は、10V出力で1V変化させると、20V出力では2Vの変化となって現われます。（比率2：1）

VOLTS DUAL TRACKING が押し込まれている時は、このコントロールの設定にかかわらず、出力は＋および－VOLTS コントロールの設定により決まります。したがって各電源の出力をすばやく変化させるには、VOLTS DUAL TRACKING コントロールを押し込むか引っはることによって行えます。

＋および－電源が“結合電源作動”の項で述べたように接続されている時、VOLTS DUAL TRACKING コントロールは0から＋および－VOLTS コントロールの設定値の和を変化させることができます。

ステア・ステップ作動

PS503A型は、負荷制限とコントロールの設定によってステア・ステップ出力特性を得ることができます。たとえば、＋および－出力端子間に可変抵抗（R_L）を接続すると、**1－7図**のように**PS503A型**からステア・ステップ出力が得られます。各電源が最大電圧および電流（40V、1A）に設定されていれば、開回路から負荷が40Ωになるまで、出力電圧は**1－7図**の実線のように一定に保たれます。この交差点においては、出力電圧は負荷に従って減少し、出力電流は1Aに制限されます。したがって負荷抵抗が約40Ω以下の場合は、両電源は、出力電圧が負荷により変化する電流源として動作します。両電源が同じ出力電圧にセットされていれば、各電源は、電力（I^2R）を二分します。もし片方の電源が他方より低い出力電圧に設定されていたならば、電力は出力電圧に比例します。



1-7図　電流電圧および負荷の特性

電源E_2の電流を0.5Aに固定し、負荷を同じレンジで変化させると、負荷が約80Ωになるまで、電源は定電圧源として動作します。この交差点においては0.5Aにセットされた電源（E_2）は電流源となり、その出力電圧は負荷に従って減少します。約40Ω、20Vの点で電源E_2は、電力を供給しなくなり、したがって電源E_1が全電力を負うことになります。負荷が約20Ω以下になると、電源E_1は、最大出力である1Aの定電流源となります。このように、適当な負荷の選択と、コントロールの設定により、4つの特性より任意の1つを選ぶことができます。

第2のステア・ステップ出力は、最初に予備設定しておいてVOLTS DUAL TRACKINGコントロールを押し込むか引き出すかして出力されます。(VOLTS DUAL TRACKINGコントロールの機能の詳細については、"デュアル・トラッキング作動"の項をご覧下さい。)

直列接続駆動

2台以上のPS503A型の出力を1－8図のように接続すると各電源の出力電圧の和に等しい電圧を得ることができます。各電源は個々に希望する出力電圧が得られるように調整しなければなりません。(VOLTS DUAL TRACKINGコントロールですべての電源の出力を変化させるには"デュアル・トラッキング作動"の項をご覧下さい。)

注

PS503A型は、直列接続した時に、負荷が短絡したり電源のひとつが作動しない場合の逆極性から保護するための内部ダイオードが出力部分に付いています

並列接続駆動

注　意

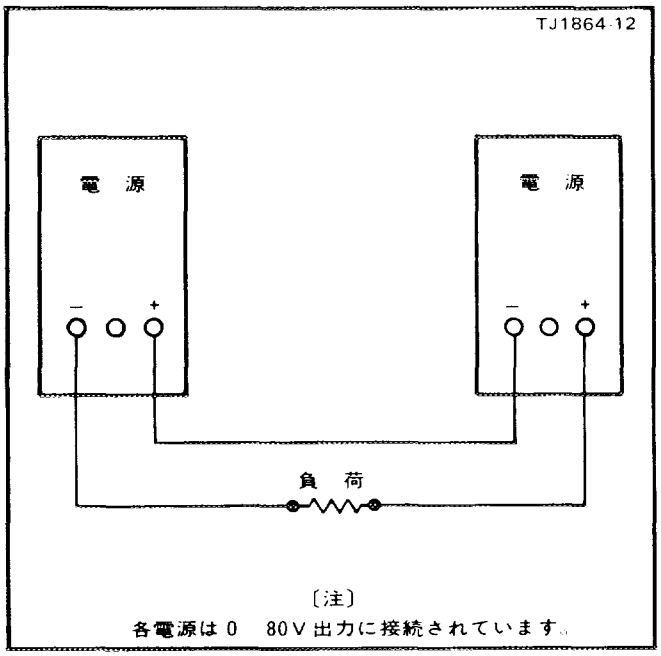
必要な電圧と電流を扱える順方向バイアスのダイオードが電源と負荷との間に挿入されている場合に並列駆動をお奨めできます。これを行わないと電源が損傷する恐れがあります。

2台以上のPS503A型の出力を1－9図のように接続すると、各電源の出力電流の和に等しい電流を得ることができます。各電源は個々に希望する出力電流が得られるように調整しなければなりません。また、0.8A以上の出力を得るにはTM500シリーズの本体（TM504型、TM506型）の高電力プラグイン・ホールで使用する必要があります。（1－9図参照）

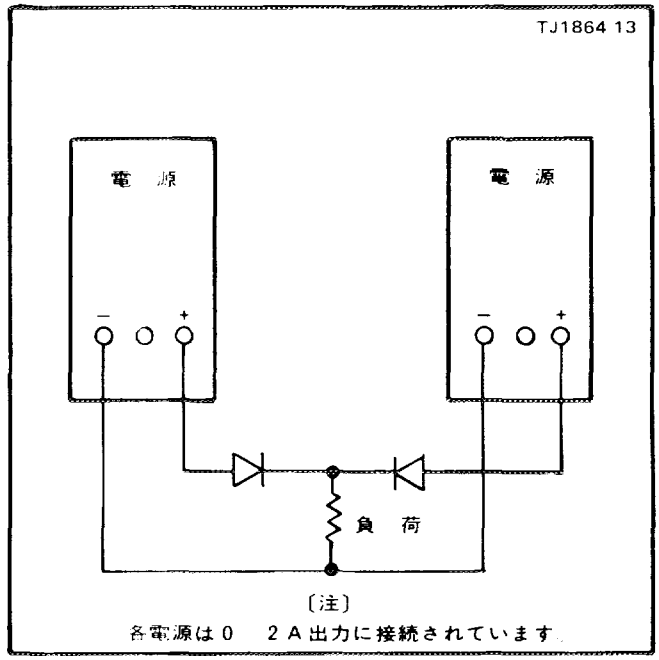
注

＋および－電源は内部で接続されていますので、各電源からの電流の和に等しい出力電流を得るために外部で＋および－電源を並列に接続することはできません

ひとつの電源を希望する電圧に設定したら、他の電源はこれよりわずかに高い電圧にして下さい。希望する電圧に設定した電源は定電圧源となり、一方これよりわずかに高い電圧に設定した電源は、低い電圧に設定した電源まで出力電圧が減少するので、定電流源となります



1-8図　直列接続駆動



1-9図　並列接続駆動

SPECIFICATION AND PERFORMANCE CHECK

SPECIFICATION

Performance Conditions

The electrical characteristics are valid only if the PS 503A has been calibrated at an ambient temperature between +20° C and +30° C and is operating at an ambient temperature between 0° C and +50° C unless otherwise noted.

Items listed in the Performance Requirements column are verified by completing the Performance Check in this manual. Items listed in the Supplemental Information column are not verified in this manual; they are either explanatory notes or performance characteristics for which no limits are specified.

Table 2-1

ELECTRICAL CHARACTERISTICS

Characteristics	Performance Requirements	Supplemental Information
	Plus and Minus 20 V Floating Supplies	
Voltage Outputs		0 V (±100 mV) to at least 20 V dc (20.1, −.1, +.4 V dc) with respect to common terminal, or 0 V to at least 40 V dc across the plus and minus terminals. Outputs either independently variable or both variable at a constant ratio of a common control (Dual Tracking).
Variable Current Limiting	Less than 100 mA to at least 1A when installed in a high-power compartment.	Maximum limit; 1.5 A
	Less than 100 mA to at least 400 mA when installed in a low power compartment.	Maximum limit; 600 mA
Minimum Resolution		50 mV

Table 2-1 (cont)

Characteristics	Performance Requirements	Supplemental Information
Load Regulation	Within 3 mV with a 1 A load change.	Within 1 mV with a 400 mA load change.
Transient Recover		≤20 μs for a constant voltage to recover within 20 mV for a nominal output voltage after a 400 mA change in output current.
Line Regulation	Within 5 mV for a ±10% line voltage change.	
Ripple and Noise (2 Hz to 2 MHz instrument not in current limiting.)	3 mV peak-to-peak or less with a 1 A load.	1 mV peak-to-peak or less with a 400 mA load (noise and ripple increase unpredictably when current is being limited).
Temperature Coefficent		0.025%/° C or less.
Stability		0.1% +5 mV (or less) of drift in 8 hours. Line voltage, load and temperature held constant.
Supply Isolation from Ground		350 V (dc + peak ac).
Dual Tracking Mode Offset Error	If the two supplies are set independently to any given voltage ratio, and if both supplies are then monitored and varied a given amount (by using the VOLTS DUAL TRACKING control), the two supplies will maintain the same voltage ratio as initially set within 50 mV; until one supply reaches either 0 V or 20 V.	
	+5 V Ground Reference Supply	
Output	4.75 V dc to 5.25 V dc with a 5 ohm load.	Measured at a temperature between +20° C and +30° C.
Load Regulation	Within 100 mV with a 1 A load change.	
Line Regulation	Within 50 mV for a ±10% line voltage change.	Measured at a temperature between +20° C and +30° C.
Ripple and Noise (2 Hz to 2 MHz)	5 mV peak-to-peak or less with a 1 A load.	
Long Term Stability		0.5% or less of drift.
Overload Protection		Fixed (automatic) current limiting and over-temperature shutdown.

Table 2-2

ENVIRONMENTAL

Characteristics	Performance Requirements	Supplemental Information
Temperature		
Operating	0° C to +50° C.	
Storage	−40° C to +75° C.	
Altitude		
Operating	To 15,000 feet, maximum operating temperature decreased by 1° C/1000 feet from 5000 to 15,000 feet.	
Storage	To 50,000 feet.	
Vibration		
Operating and Non-Operating	With the instruments complete and operating, vibration frequency swept from 10 to 55 to 10 Hz at 1 minute per sweep. Vibrate 15 minutes in each of the three major axes at 0.015" total displacement. Hold 10 minutes at any major resonance, or if none, at 55 Hz. Total time, 75 minutes.	
Shock		
Operating and Non-Operating	30 g's, 1/2 sine, 11 ms duration, 3 shocks in each direction along 3 major axes, for a total of 18 shocks.	

Table 2-3

PHYSICAL

Characteristic	Information
Overall Dimensions (measured at maximum points)	
Height	4.96 inches 126 mm
Width	2.6 inches 66.8 mm
Length	11.71 inches 297.5 mm
Net Weight (Instrument only)	1 lb 13 oz 821 grams

PERFORMANCE CHECK

Introduction

This procedure checks the electrical characteristics of the PS 503A that appear in the Specification portion of this section. Limits and tolerances given in the Supplemental Information column are provided for user and service information only, and should not be interpreted as requirements for this Performance Check.

The electrical characteristics are valid only if the instrument has been calibrated at an ambient temperature between +20° C and +30° C, and is operated at an ambient temperature between 0° C and +50° C unless otherwise noted.

Limits and tolerances given in this Performance Check are for the instrument under test and do not include test equipment error. Limits and tolerances in this procedure are instrument performance requirements only if stated as such in the Specification portion of this section.

Test Equipment Required

The following test equipment, or equivalent, is required to perform the performance check and adjustment procedure. Test equipment characteristics listed are the minimum required to verify the performance of the equipment under test. Substitute equipment must meet or exceed the stated requirements. All test equipment is assumed to be operating within tolerance.

Special test devices are used where necessary to facilitate the procedure. Most of these are available from Tektronix, Inc. and can be ordered through your local Tektronix Field Office or representative.

Table 2-4

LIST OF TEST EQUIPMENT REQUIREMENTS

Description	Performance Requirements	Application	Example
Oscilloscope	Bandwidth, dc to 2 MHz; minimum deflection factor, 1 mV/div; sweep rate, 10 ms/div to 1 μs/div.	Used throughout procedure to provide display.	Tektronix 5110, 5B10N Oscilloscope System.
Digital voltmeter	Range, zero to 1000 volts; accuracy, within 0.1%.	Voltage measurements.	Tektronix DM 501 Digital Multimeter.[a]
Power Module	Four compartments or more, with one high-power compartment.	All tests.	Tektronix TM 504 or TM 506.
Autotransformer with ac voltmeter	Capable of supplying an output voltage from 90 to 132 volts, ac; 120 W of power at the upper limits.	Regulation and ripple checks	General Radio W10MTR3W Variac Autotransformer.
Coaxial cable	Impedance, 50 Ω; length, 42 inches; connectors, bnc.	Provides signal interconnection.	Tektronix Part No. 012-0057-01.
Patch cord (2 required)	Banana-plug-jack to banana-plug-jack; length, 18 inches.	Provides signal interconnection	Tektronix Part No. 012-0031-00 (black), 012-0039-00 (red).

Table 2-4 (cont)

Description	Performance Requirements	Application	Example
Adapter	Bnc female to dual-banana plugs.	Provides signal interconnection.	Tektronix Part No. 103-0090-00.
Load resistor	20 Ω, 20 W, 5%, (two 10 Ω, 10 W in series).	Load tests.	Tektronix Part No. 308-0175-00
Load resistor	5 Ω, 5 W, 5%.	Load tests.	Tektronix Part No. 308-0179-00.
Resistor (2 required)	4.99 kΩ, 1/2 W, 1% or better.	Dual tracking detector test.	Tektronix Part No. 323-0260-00.
1X passive probe	Compatible with 5A-series amplifiers used in oscilloscope.	Provides signal interconnection.	Tektronix P6028 Probe.

*Requires TM 500-Series Power Module.

Preliminary Procedure

1. Ensure that all test equipment and the PS 503A under test are suitably adapted to the line voltage to be applied. Refer to the installation section of the power module manual.

2. Be certain that the POWER switch on the power module is off and that the OUTPUT pushbutton on the PS 503A is in the out position.

3. Install the PS 503A in the far right (high power) compartment of the power module.

4. Connect the power module to the autotransformer and connect the autotransformer to the line voltage source. Set the autotransformer voltage output control for zero volt output.

5. Set all front-panel controls on the PS 503A fully counterclockwise (ccw). Apply power to the power module and press in the OUTPUT pushbutton on the PS 503A. Push the PS 503A VOLTS DUAL TRACKING control in.

6. Adjust the autotransformer to the nominal line voltage and check that the two VOLTS indicator lights on the PS 503A are on.

7. Set the vertical deflection factor for 1 mV/div and sweep rate for 5 ms/div on the test oscilloscope. Use ac coupling for the vertical amplifier unit during this procedure.

8. Connect all test equipment to a suitable line voltage source.

9. Turn on all test equipment and allow at least twenty minutes for the equipment to warm-up and stabilize.

NOTE

During warm-up time, attach banana pins to the leads of the 20 Ω and 5 Ω load resistors so that they can be inserted in the holes of the dual-banana adapter. This allows the load resistors to be connected as close as possible to the output terminals on the PS 503A so contact resistance is kept to a minimum.

Performance Check Procedure

1. Check 0-20 Volt Output Voltage

a. Check that all controls on the PS 503A front panel are fully ccw and that the 400 mA MAX indicator light is off (this light should remain off as long as the PS 503A is installed in the high-power compartment of the power module). Also check that both CURRENT LIMIT indicator lights are off. (For instruments SN B022064-below, these lights may be on; if so, adjust the appropriate CURRENT LIMIT control cw just enough to turn them off).

b. Set the digital voltmeter to the 2 volts dc range. Use patch cords to connect the +20 V floating output terminals of the PS 503A to the digital voltmeter input terminals; connect the red patch cord from the 0 -20V red binding post to the digital voltmeter high input terminal, and the black patch cord from the COMMON (black) binding post to the digital voltmeter low input terminal.

c. Check that the PS 503A + VOLTS controls are fully ccw and check for a meter reading of .0000, within ±100 mV.

d. Set the digital voltmeter to the 200 volts dc range and set the PS 503A + VOLTS controls fully cw.

e. Check—for a meter reading of at least +20.1 volts, but less than +20.4 volts.

f. Adjust the PS 503A - VOLTS controls fully ccw and move the red patch cord from the 0 -20V red binding post to the 0 -20V green binding post on the PS 503A.

g. Repeat parts 1c through 1e, using the PS 503A VOLTS controls to check the -20 V supply.

h. Set the PS 503A VOLTS controls fully ccw and move the red patch cord back to the 0 -20V red binding post on the PS 503A. Check to be certain that all PS 503A front-panel controls are fully ccw.

2. Check Variable Current Limiting

a. Adjust the PS 503A + VOLTS controls for +5.0 V output. Move the red patch cord to the PS 503A 0-20V green binding post and adjust the PS 503A VOLTS controls for -5.0 V output. Move the red patch cord back to the PS 503A 0 -20V red binding post.

b. Disconnect the red patch cord from the digital voltmeter high input terminal and set the digital voltmeter to the 2000 mA dc range. Reconnect the red patch cord to the digital voltmeter high input terminal.

c. Check for a current reading of less than 100 mA for the +20 V supply. The PS 503A + CURRENT LIMIT light should be on.

d. Move the red patch cord from the PS 503A 0 -20V red binding post to the PS 503A 0-20V green binding post.

e. Check for a current reading of less than 100 mA for the -20 V supply. The PS 503A - CURRENT LIMIT light should be on.

f. Rotate the PS 503A - CURRENT LIMIT control fully cw.

g. Check for a current reading of more than 1000 mA, but less than 1500 mA for the -20 V supply.

h. Reconnect the red patch cord to the PS 503A 0 -20V red binding post and rotate the PS 503A + CURRENT LIMIT control fully cw.

i. Check for a current reading of more than 1000 mA, but less than 1500 mA for the +20 V supply.

j. Set all controls on the PS 503A front panel fully ccw and retain the digital voltmeter connections to the PS 503A.

3. Check Load Regulation

a. Disconnect the red patch cord from the digital voltmeter input terminal and set the digital voltmeter to the 20 volts dc range. Reconnect the red patch cord to the digital voltmeter high input terminal; the meter reading should indicate approximately zero volts. Both CURRENT LIMIT lights on the PS 503A front panel should be off and remain off during the load regulation check.

b. Rotate the CURRENT LIMIT control on the PS 503A fully cw.

c. Adjust the PS 503A + VOLTS fine and coarse controls for a meter reading between +19.900 and +19.980 volts. Note and record the exact open-circuit voltage reading before applying the adapter (with load resistor attached) in part d of this step.

d. Insert the leads of the 20 Ω, 5% resistor into the holes of a dual-banana plug adapter and connect the adapter to the patch cord jacks, which remain connected to the PS 503A 0–20V red and the COMMON binding post terminals. Observe correct polarity for the adapter (GND to COMMON).

e. CHECK—that the meter reading does not change more than 3 mV (three counts of the most right-hand digit).

NOTE

If the reading on the digital voltmeter changes by more than 3 mV, another 20 Ω, load resistor having a resistance value closer to 20 Ω should be used, or the voltage output from the PS 503A can be reduced to +19.000 (step 3c).

f. Remove the adapter (with load resistor) from the PS 503A patch cord jacks. Move the red patch cord to the 0 20V green binding post terminal.

g. Adjust the PS 503A – VOLTS fine and coarse controls for a meter reading between –19.900 and –19.980 volts. Note and record the exact open-circuit voltage reading before applying the adapter (with load resistor attached) in part h of this step.

h. Insert the leads of the 20 Ω, 5% resistor into the holes of a dual-banana adapter and connect the adapter to the patch cord jacks, which remain connected to the PS 503A 0–20V green and the COMMON binding post terminals. Observe correct polarity for the adapter (GND to COMMON).

i. Check—that the meter reading does not change more than 3 mV (three counts of the most right-hand digit).

4. Check Line Regulation

a. Note the exact voltage reading displayed on the digital voltmeter with the adapter and load resistor still attached to the PS 503A 0–20V green and COMMON binding post terminals (–19.900 to –19.980 volts).

b. Adjust the autotransformer 10% below and 10% above the nominal line voltage setting.

c. Check—that the voltage reading displayed on the digital voltmeter does not change more than ±5 mV (5 counts) for each 10% line voltage change. Readjust the autotransformer to the nominal line voltage.

d. Remove the adapter (with load resistor) from the patch cord jacks. Move the red patch cord to the 0–20V red binding post terminal. Reconnect the adapter (with load resistor) to the patch cord jacks. Observe correct polarity for the adapter (GND to COMMON).

e. Note the exact voltage reading displayed on the digital voltmeter with the adapter and load resistor still attached to the 0 20V red and COMMON binding post terminals (+19.900 to +19.980 volts).

f. Adjust the autotransformer 10% below and 10% above the nominal line voltage setting.

g. Check—that the voltage reading displayed on the digital voltmeter does not change more than ±5 mV (5 counts) for each 10% line voltage change. Readjust the autotransformer to the nominal line voltage.

5. Check Ripple and Noise

a. Disconnect the patch cords from the PS 503A 0–20V red and COMMON binding post terminals and reconnect the dual-banana adapter (with load resistor) directly to the 0–20V red and COMMON binding post terminals; observe correct polarity of the adapter (GND to COMMON).

b. Connect the output of the adapter to the vertical input of the oscilloscope, using a 42-inch bnc cable. Set the oscilloscope vertical deflection factor for 1 mV/div (calibrated).

c. Slowly adjust the autotransformer output voltage 10% below and then 10% above the nominal line voltage.

d. Check—the signal display on the oscillosocpe for less than 3 mV peak-to-peak (within three vertical divisions) at all points of the specified voltage limits.

e. Readjust the autotransformer to the nominal line voltage.

f. Connect the adapter (with load resistor attached) to the PS 503A 0–20V green and COMMON binding post terminals; observe correct polarity of the adapter (GND to COMMON).

g. Repeat steps 5c through 5e to check the ripple and noise of the PS 503A 20 V supply.

h. Readjust the autotransformer to the nominal line voltage and disconnect all connections from the PS 503A.

6. Check Dual Tracking Mode Offset Error

a. Pull out the PS 503A VOLTS DUAL TRACKING control and set it fully ccw to ensure minimum output voltage while connecting the resistors.

b. Connect the two 4.99 kΩ, 1% resistors in series between the PS 503A 0–20V green and 0–20V red binding post terminals. Do not connect the junction of the two resistors to the COMMON terminal or the chassis.

c. Connect the black patch cord from the digital voltmeter low terminal to the PS 503A COMMON binding post, and the red patch cord from the digital voltmeter high terminal to the PS 503A 0–20V red binding post.

d. Set the PS 503A VOLTS DUAL TRACKING control fully cw and adjust the PS 503A + VOLTS controls for a meter reading of +18 V, ±0.1 volt.

e. Connect the red patch cord to the 0–20V green binding post and adjust the PS 503A VOLTS controls for a meter reading of 18 V, ±0.1 volt.

f. Disconnect the red patch cord from the 0–20V green binding post and connect it to the junction of the two 4.99 kΩ, 1% resistors. Check that the digital voltmeter indicates a dc voltage less than 1 V.

g. Set the digital voltmeter to the 2-volts dc range and adjust either the – VOLTS or VOLTS controls on the PS 503A to obtain a meter reading of 0 V dc (–100 mV).

h. Adjust the PS 503A VOLTS DUAL TRACKING control slowly from cw to ccw.

i. Check—that the meter reading remains within +25 mV of zero volts.

j. Set the PS 503A VOLTS DUAL TRACKING control fully ccw and push the control knob in. Disconnect both patch cords and the two resistors from the binding post terminals.

7. Check +5 Volt Output Voltage

a. Connect the digital voltmeter between the +5V@1A ground referenced red binding post and the ground white binding post.

b. Push in the OUTPUT button and check that the two VOLTS indicator lights are on.

c. Check for a meter reading of +4.75 to +5.25 volts.

d. Connect a 5 Ω, resistor between the +5V@1A ground referenced red binding post and the ground (white) binding post.

e. Check that the meter reading does not change by more than 100 mV.

8. Check +5 Volt Output Voltage Regulation

a. Adjust the autotransformer output voltage from the low limit to the high limit as indicated in Table 2-5.

b. Check that the digital voltmeter reading does not change more than 50 mV for a plus 10% or minus 10% line voltage change.

c. Disconnect the digital voltmeter.

d. Connect the probe of the test oscilloscope between the +5V binding post and the ground (white) binding post.

e. Adjust the autotransformer output voltage from the low limit to the high limit as indicated in Table 2-5.

f. Check the test oscilloscope display for not more than 5 mV peak-to-peak ripple and noise.

g. Return the autotransformer to the nominal line voltage setting.

h. Disconnect the test oscilloscope probe from the binding posts.

i. Press and release the PS 503A OUTPUT button to turn off the power to the PS 503A.

Table 2-5

POWER MODULE UNIVERSAL TRANSFORMER

Line Selector Block Position	Regulating Ranges	
	110-Volts Nominal	220-Volts Nominal
L	90 VAC to 110 VAC	180 VAC to 220 VAC
M	99 VAC to 121 VAC	198 VAC to 242 VAC
H	108 VAC to 132 VAC	216 VAC to 264 VAC
Line Fuse Data	1.6 A slow-blow	0.8 A slow-blow

9. Check Variable Current Limiting

a. Turn the power off to the TM 500 Series Power Module and remove the PS 503A from the high-power compartment and install the PS 503A in the low-power compartment.

b. Turn on the power to the power module and press the PS 503A OUTPUT button in. Set all front panel controls fully ccw and allow approximately three minutes for the equipment to stabilize.

c. Check—that the 400 mA MAX indicator light is on.

d. Adjust the PS 503A + VOLTS and − VOLTS coarse controls to the 4 V position (leave the fine controls fully ccw).

e. Set the digital voltmeter to the 2000 mA position and connect the black patch cord from the digital voltmeter low terminal to the PS 503A COMMON binding post and the red patch cord from the digital voltmeter high terminal to the PS 503A 0−20V red binding post.

f. Set the PS 503A + and − CURRENT LIMIT controls fully cw.

g. Check—that the digital voltmeter indicates a current reading of more than 400 mA, but less than 600 mA. The + CURRENT LIMIT light should be on.

h. Move the red patch cord from the 0−20V red binding post to the 0−20V green binding post.

i. Check—that the digital voltmeter display indicates a current reading of more than 400 mA, but less than 600 mA. The − CURRENT LIMIT light should be on.

j. Set the PS 503A − CURRENT LIMIT control fully ccw.

k. Check—that the digital voltmeter indicates a current reading of less than 100 mA. The − CURRENT LIMIT light should remain on.

l. Move the red patch cord from the 0−20V green binding post to the 0−20V red binding post and set the PS 503A + CURRENT LIMIT control fully ccw.

m. Check—that the digital voltmeter indicates a current reading of less than 100 mA. The + CURRENT LIMIT light should be on.

n. Turn off all power to the power module. Push and release the PS 503A OUTPUT button and set all other front-panel controls fully ccw.

o. This completes the Performance Check Procedure for the PS 503A.

WARNING

THE FOLLOWING SERVICING INSTRUCTIONS ARE FOR USE BY QUALIFIED PERSONNEL ONLY. TO AVOID PERSONAL INJURY, DO NOT PERFORM ANY SERVICING OTHER THAN THAT CONTAINED IN OPERATING INSTRUCTIONS UNLESS YOU ARE QUALIFIED TO DO SO. REFER TO OPERATORS SAFETY SUMMARY AND SERVICE SAFETY SUMMARY PRIOR TO PERFORMING ANY SERVICE.

ADJUSTMENT

Introduction

This adjustment procedure is to be used to restore the PS 503A to original performance specifications. Adjustment need not be performed unless the instrument fails to meet the requirements listed in the Specification section, or the Performance Check cannot be completed satisfactorily.

Services Available

Tektronix, Inc. provides complete instrument repair and adjustment at local Field Service Centers and at the Factory Service Center. Contact your local Tektronix Field Office or representative for further information.

Test Equipment Required

The test equipment listed in Table 2-4 or equivalent, is required for adjustment of the PS 503A. Specifications given for the test equipment are the minimum necessary for accurate adjustment and measurement. All test equipment is assumed to be correctly calibrated and operating within specification.

If other test equipment is substituted, control settings or calibration setup may need to be altered to meet the requirements of the equipment used.

Preparation

a. Remove the left-hand and right-hand side covers of the PS 503A to gain access to the component side of the circuit boards. Pull the rear end of the side cover outward from the side of the instrument (the cover snaps into place).

b. Install the PS 503A into the far right (high power) power module compartment, or if appropriate, connect the PS 503A to the power module by means of the flexible plug-in extender. If a flexible extender is used, current limiting switch S95 must be engaged in the maximum current (HI) position. See Fig. 3-1 for switch location.

c. Set the power module for the line voltage to be applied (see power module manual) and connect it to the autotransformer, then connect the autotransformer to the line voltage source. Be sure that the power switch is off.

d. Install all TM 500-series equipment, including the PS 503A into the power module.

e. Connect all test equipment to a suitable line voltage source.

f. Turn on all test equipment and allow at least twenty minutes for the equipment to warm-up and stabilize.

g. Set the autotransformer to the nominal line voltage setting.

Initial Control Settings

Set the following controls during warm-up time:

PS 503A Dual Power Supply

− VOLTS (coarse and fine)	fully ccw
+ VOLTS (coarse and fine)	fully cww
CURRENT LIMIT	
Plus supply	fully ccw
Minus supply	fully ccw
VOLTS DUAL TRACKING	pushed in and fully ccw

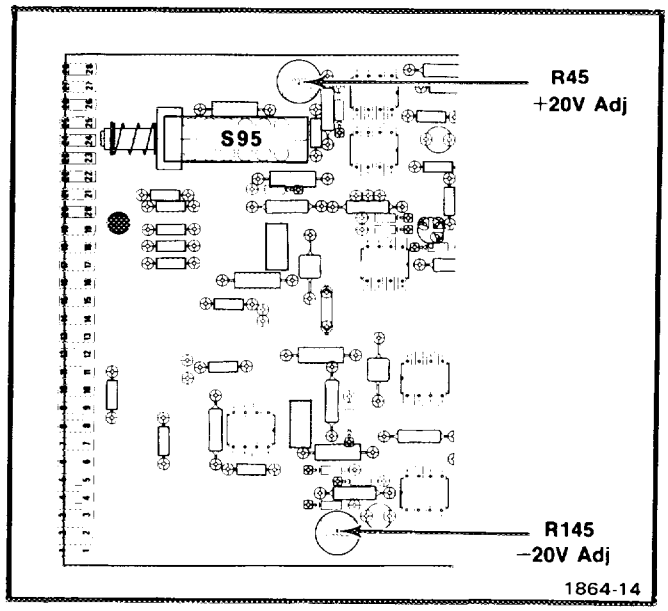


Fig. 3-1. Location of +20 V and −20 V adjustment.

1. Adjust 20 Volt Output Voltages

a. Check—that all controls on the PS 503A front panel are fully ccw and the 400 mA MAX indicator light is off (this light should remain off as long as the PS 503A is installed in the high-power compartment of the power module). Also check that both CURRENT LIMIT indicator lights are off. (For instruments SN B022064-below, these lights may be on; if so, rotate the appropriate CURRENT LIMIT control cw just enough to turn them off).

b. Set the digital voltmeter to the 2 volts dc range and check for a meter reading of zero volts, ±100 mV.

c. Set the digital voltmeter to the 200 volts dc range. Use patch cords to connect the plus 20 V floating output terminals of the PS 503A to the digital voltmeter input terminals; red patch cord from the 0 - 20V red binding post to the digital voltmeter high input terminal, and the black patch cord from the COMMON (black) binding post to the digital voltmeter low input terminal.

d. Turn the PS 503A + VOLTS fine and coarse controls fully cw.

e. Adjust -R45, +20 Adj, for a meter reading of +20.2 volts, ±0.1 volt. See Fig. 3-1 for adjustment location.

f. Adjust the PS 503A + VOLTS fine and coarse controls fully ccw and move the red patch cord from the 0 -20V red binding post to the 0 20V green binding post.

g. Turn the PS 503A - VOLTS fine and coarse controls fully cw.

h. Adjust -R145, −20 Adj, for a meter reading of −20.2 volts, ±0.1 volt. See Fig. 3-1 for adjustment location.

i. Adjust the PS 503A − VOLTS fine and coarse controls fully ccw.

j. This completes the adjustment portion of this procedure. However, to verify satisfactory performance after adjustment, perform the complete Performance Check procedure as specified in Section 2 of this manual.

MAINTENANCE AND INTERFACING INFORMATION

PREVENTIVE MAINTENANCE

There are no special preventive maintenance procedures that apply to the PS 503A. Refer to the power module instruction manual for general preventive maintenance procedures and instructions.

CORRECTIVE MAINTENANCE

Refer to the power module instruction manual for general corrective maintenance procedures and instructions.

TROUBLESHOOTING

Use the Performance Check, Adjustment Procedure, and Circuit Description as aids to locate trouble in the event of equipment failure. The test equipment listed in the Performance Check and Adjustment Procedures will prove useful in troubleshooting the PS 503A.

FUNCTIONS AVAILABLE AT REAR CONNECTOR

Pins are available at the rear connector for routing signals to and from the PS 503A for specialized applications (see Fig. 4-1, Input-Output Assignments for Plug-In Rear Interface Connector). One or more compartments of a multi-plug-in power module can be wired with barriers installed to provide specific functions between compartments. See power module instruction manual for additional information.

FUNCTION PROGRAMMING OF REAR INTERFACE CONNECTOR

Remote Resistance Program

Remove the jumpers from F - F (+Volts supply) and H - H (−Volts supply). Install jumpers between E - E (+Volts supply) and G - G (−Volts supply).

Connect a 10.0 kΩ, 1% resistor between pins 28A and 28B (+Volts supply) and pins 27A and 27B on the interface connector. Install the PS 503A into a TM 500 Series Power Module. Connect a digital voltmeter between the +20-volt and common output terminals and between the −20-volt and common output terminals. Adjust R45, +Adj and R145, −Adj to obtain a 20 V reading for each supply or the supply being programmed. Turn off the PS 503A and remove the 10.0 kΩ, 1% resistor.

NOTE

Do not turn on the PS 503A without a program resistor connected between pins 28A and 28B (+Volts supply) and pins 27A and 27B (−Volts supply) on the interface connector or the over-voltage protection circuit will cause the fuse to blow.

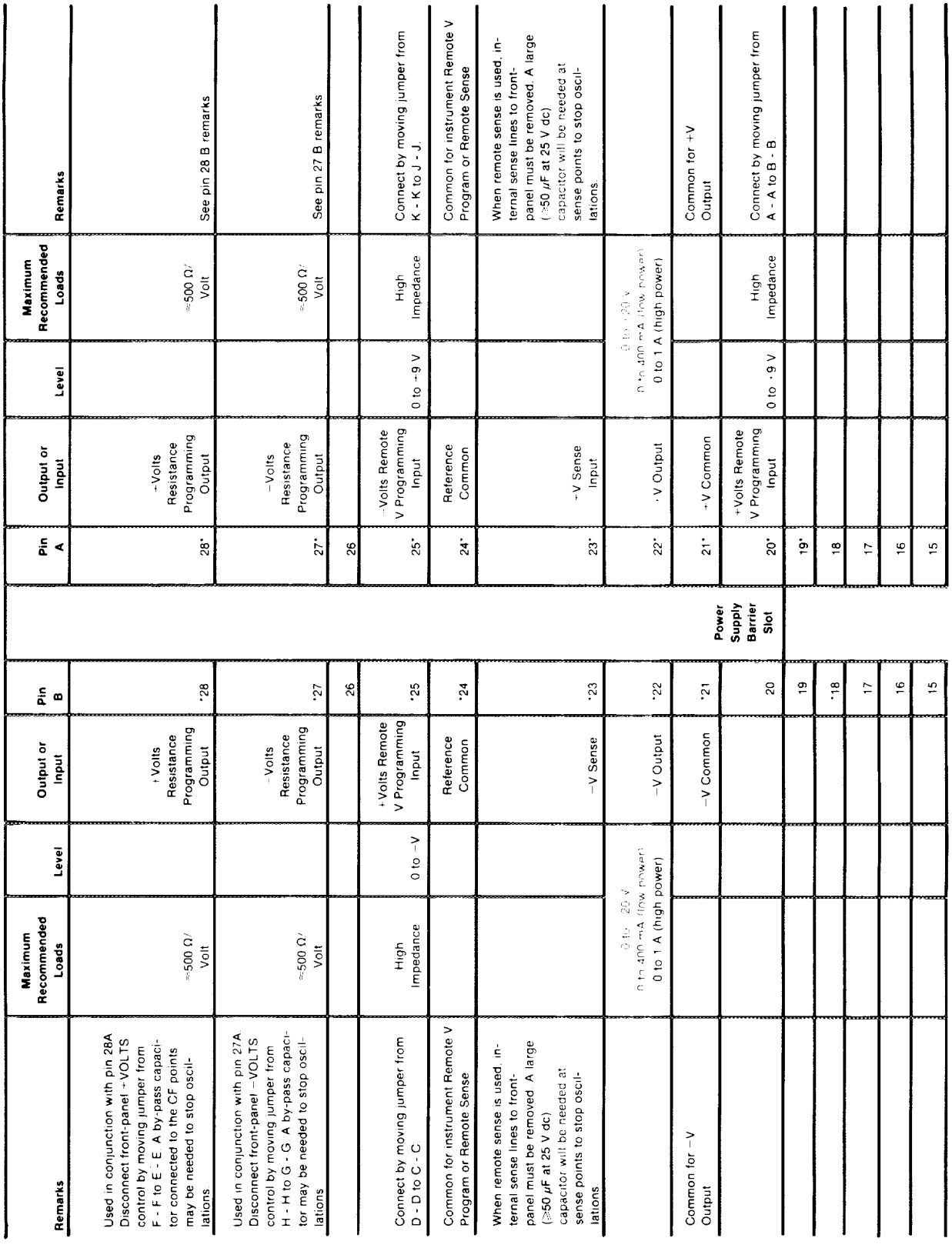
The PS 503A has now been programmed at 500 Ω/volt up to 20 V, i.e., a 1 kΩ change in the program resistor results in a 2 V change in the PS 503A output.

A capacitor connected across the points marked C_F+ or C_F- may be needed to stop oscillations caused by the lead length associated with the program resistor.

Remote Voltage Program

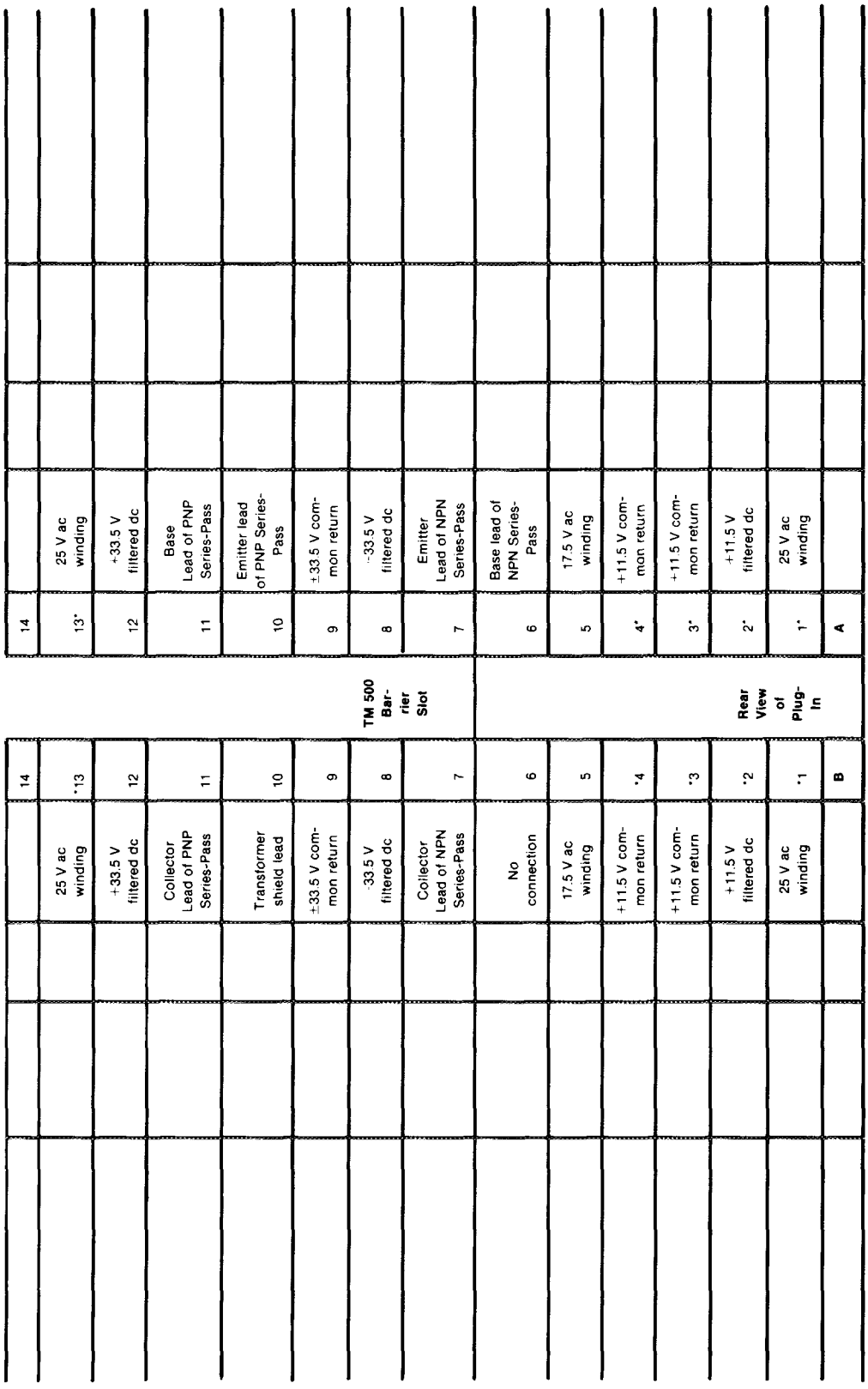
Dual Tracking. Remove the jumper from A - A, then connect a jumper between B - B.

Connect the + lead of the remote voltage to pin 20A and the − lead to pin 24A and 24B on the interface connector. Install the PS 503A into a TM 500 Series Power Module. Connect a digital voltmeter between the +20 V and common output terminals and between the −20 V and common output terminals. Apply 9 V from the remote voltage source to the PS 503A. Adjust R45, +Adj and R145, −Adj to obtain a 20 V reading for each supply.



Remarks	Maximum Recommended Loads	Level	Output or Input	Pin B		Pin A	Output or Input	Level	Maximum Recommended Loads	Remarks
Used in conjunction with pin 28A Disconnect front-panel +VOLTS control by moving jumper from F - F to E - E A by-pass capacitor connected to the CF points may be needed to stop oscillations	≈500 Ω/ Volt		+ Volts Resistance Programming Output	*28		28*	+ Volts Resistance Programming Output		≈500 Ω/ Volt	See pin 28 B remarks
Used in conjunction with pin 27A Disconnect front-panel −VOLTS control by moving jumper from H - H to G - G A by-pass capacitor may be needed to stop oscillations	≈500 Ω/ Volt		− Volts Resistance Programming Output	*27		27*	− Volts Resistance Programming Output		≈500 Ω/ Volt	See pin 27 B remarks
				26		26				
Connect by moving jumper from D - D to C - C	High Impedance	0 to −V	+ Volts Remote V Programming Input	*25		25*	+ Volts Remote V Programming Input	0 to +9 V	High Impedance	Connect by moving jumper from K - K to J - J.
Common for instrument Remote V Program or Remote Sense			Reference Common	*24		24*	Reference Common			Common for instrument Remote V Program or Remote Sense
When remote sense is used, internal sense lines to front-panel must be removed. A large (≥50 μF at 25 V dc) capacitor will be needed at sense points to stop oscillations.			−V Sense	*23		23*	+V Sense Input			When remote sense is used, internal sense lines to front-panel must be removed. A large (≥50 μF at 25 V dc) capacitor will be needed at sense points to stop oscillations.
	0 to 25 V 0 to 400 mA (low power) 0 to 1 A (high power)		−V Output	*22		22*	+V Output	0 to 25 V 0 to 400 mA (low power) 0 to 1 A (high power)		
Common for −V Output			−V Common	*21		21*	+V Common			Common for +V Output
				20	Power Supply Barrier Slot	20*	+ Volts Remote V Programming Input	0 to +9 V	High Impedance	Connect by moving jumper from A - A to B - B
				19		19*				
				*18		18				
				17		17				
				16		16				
				15		15				

Fig. 4-1. Input-Output pin assignments for Rear-Interface connector (Rear View).



Assignments listed for pins 1A-13A and 1B-13B are available in all power modules; however only those pins marked with an asterisk (*) are used by the PS 503A.

Fig. 4-1 (cont). Input-Output pin assignments for Rear-Interface connector (Rear View).

The PS 503A has now been programmed so that a 9 V remote input voltage results in a 20 V output. By removing C34 and applying a waveform that varies between 0 and +9 V, both + and − supply outputs will follow the input remote voltage source. The slew rate and accuracy when operated this way is dependent on the load and the change in the output voltage.

Individual Supplies. Remove the jumper from D - D (+Volts supply) and K - K (−Volts supply). Install jumpers between C - C (+Volts supply) and J - J (−Volts supply).

Connect the + lead of the remote voltage to pin 24A or 24B (+Volts supply) or pin 25A (−Volts supply) and the − lead to pin 25B (+Volts supply) or pin 24A or 24B (−Volts supply) on the interface connector. Install the PS 503A into a TM 500 Series Power Module. Connect a digital voltmeter between the +20 V and common output terminals and between the −20 V and common output terminals. Apply 9 V from the remote voltage source to the PS 503A. Adjust R45, +Adj and R145 −Adj to obtain a 20 V reading for each supply or the supply being programmed.

The PS 503A individual supplies have now been programmed so that a 9 V remote input voltage results in a 20 V output. One or both supplies may now be independently swept from 0 to 20 V. The slew rate depends on the load and the change in output voltage.

Remote Output (Remote Sensing)

+Volts Supply. Remove the + sense wire (blk-red wire) from the post of the red-connector and the + sense common wire (wht-red) from the upper front portion of the circuit board. Insulate the bare end of the wire.

Connect the remote load between pin 21A (+Volts supply common) and pin 22A (+Volts supply output) on the interface connector.

Connect interface connector pins 24A and 24B to pin 21A (+Volts supply common) at the remote load connection.

Connect interface connector pin 23A (+Volts supply sense input) to pin 22A (+Volts supply sense output) at the remote load connection.

Install a 50 μF, 25 V dc (minimum rating) capacitor across the remote load. To stop oscillations caused by lead length an additional capacitor may be needed across the point marked C_F+.

−Volts Supply. Remove the − sense wire (blk-vio wire) from the post of the green connector and the − sense common wire (wht-red) from the lower front portion of the circuit board. Insulate the bare ends of the wires.

Connect the remote load between pin 21B (−Volts supply common) and pin 22B (−Volts supply output) on the interface connector.

Connect interface connector pins 24A and 24B to pin 21B (−Volts supply common) at the remote load connection.

Connect interface connector pin 23B (−Volts supply input) to pin 22B (−Volts supply output) at the remote load connection.

Install a 50 μF, 25 V dc (minimum rating) capacitor across the remote load. To stop oscillations caused by lead length an additional capacitor may be needed across the point marked C_F−.

Combined Supplies. Remove the + sense wire (blk-red wire) from the post of the red-connector and the − sense wire (blk-vio wire) from the post of the green connector. Remove from the charcoal gray connector two of the wires. Insulate the bare ends of the wires.

Connect the remote load between pin 22A (+Volts supply output) or pin 22B (−Volts supply output) on the interface connector.

Connect interface connector pins 24A and 24B to both pin 21A (+Volts supply common) and pin 21B (−Volts supply common) at the remote load connection.

Connect interface connector pin 23A (+Volts supply sense input) to pin 22A (+Volts supply sense output) and pin 23B (−Volts supply input) to pin 22B (−Volts supply output) at the remote load connections.

Install a 50 μF, 25 V dc (minimum rating) capacitor across the remote load. To stop oscillations caused by lead length an additional capacitor may be needed across the points marked C_F+ and C_F−.

Dual Operation of +Volts and −Volts Supplies. Remove the + sense wire (blk-red wire) from the post of the red-connector and the − sense wire (blk-vio wire) from the post of the green connector. Remove from the charcoal

gray connector two of the wires. Insulate the bare ends of the wires.

Connect the remote load between pin 21A (+Volts supply common) and pin 22A (+Volts supply output) and between pin 21B (−Volts supply common) and pin 22B (−Volts supply output) on the interface connector.

Connect interface connector pins 24A and 24B to both pin 21A (+Volts supply common) and pin 21B (−Volts supply common) at the remote load connection.

Connect interface connector pin 23A (+Volts supply sense input) to pin 22A (+Volts supply sense output) and pin 23B (−Volts supply input) to pin 22B (−Volts supply output) at the remote load connection.

Install a 50 μF, 25 V dc (minimum rating) capacitor across the remote load. To stop oscillations caused by lead length an additional capacitor may be needed across the points marked C_F+ and C_F-.

REPACKAGING FOR SHIPMENT

If the Tektronix instrument is to be shipped to a Tektronix Service Center for service or repair, attach a tag showing: owner (with address) and the name of an indivdual at your firm that can be contacted. Include complete instrument serial number and a description of the service required.

Save and re-use the package in which your instrument was shipped. If the original packaging is unfit for use or not available, repackage the instrument as follows:

Surround the instrument with polyethylene sheeting to protect the finish of the instrument. Obtain a carton of corrugated cardboard of the correct carton strength and having inside dimensions of no less than six inches more than the instrument dimensions. Cushion the instrument by tightly packing three inches of dunnage or urethane foam between carton and instrument, on all sides. Seal carton with shipping tape or industrial stapler.

The carton test strength for your instrument is 200 pounds.

CIRCUIT DESCRIPTION

Introduction

This section of the manual contains a description of the circuitry used in the PS 503A Dual Power Supply. Individual descriptions are separated into the following parts: Dual Tracking, Reference Supply, Automatic Crossover, Constant Voltage/Current Limited Output, Load Regulation, Power Line Regulation, Power Supplies, Over-voltage Protection, and Output Current Selection. Refer to the appropriate diagrams in the Diagrams section of this manual while reading the circuit description.

NOTE

The negative and positive supplies operate identically. The two supplies are internally connected with a common front-panel VOLTS DUAL TRACKING control for varying the output of both supplies at a constant ratio. Therefore, except for Dual Tracking operation, this discussion will cover only the positive supply.

Dual Tracking

When the VOLTS DUAL TRACKING knob is pulled out, S30 disconnects the input to the reference buffers (U35 and U135) from the fixed voltage at the collector of Q30 and connects it to the potentiometer wiper arm of the VOLTS DUAL TRACKING control, R30.

Reference Supply

The reference supply consists of temperature-compensated, constant-current circuit Q30-Q25-VR24. This circuit furnishes constant voltage to voltage-follower buffer U35 and to the current limiting circuitry. Voltage-follower buffer U35 supplies voltage to inverter-follower buffer U135. The U135 buffer then supplies reference voltage to + voltage error amplifier U45. The constant current circuit supplies current to the current-limiting circuitry via Q80.

Automatic Crossover

The positive supply employs two operational amplifiers; U45 and U55. Amplifier U45 controls output voltage, while U55 controls output current. For any value of load resistance, the power supply acts either as a constant-voltage source or a current source—but never both. Automatic crossover is accomplished by combining the outputs from pin 6 of U45 and U55 in a negative-true, "OR" gate configuration (see Fig. 5-1). The amplifier with the lower output voltage at pin 6 causes its associated diode (CR45 or CR48) to conduct, which eventually reverse biases the other diode. A portion of the current available from R87 is then diverted away from the base of Q85 and to the amplifier with the lower output. The remainder of the current drives the base of Q85, which in turn controls the current through the series-pass transistor in the Power Module to the load.

Constant Voltage/Current Limited Output

Output current or voltage varies when an imbalance occurs between the comparison voltage at pin 2 and 3 of either U45 or U55. This imbalance is caused by a change in the load resistance or in the reference voltage selected by CURRENT LIMIT control R70 or by + VOLTS coarse control R50A. Fig. 5-2 illustrates the output characteristics of the power supply with various currents, voltage and loads.

CURRENT LIMIT control R70 establishes the non-inverting reference input to pin 3 of U55, the current-controlling amplifier.

With no load connected to the output terminals, $R = \infty$, $I = 0$ and $E = S_{VL}$, the front-panel voltage limit setting (see Fig. 5-2). When a load is connected to the power supply output terminal, output current increases, which results in an increase in the voltage drop across current-sensing resistor R67. This drop provides the inverting input to pin 2 of U55. If the voltage at pin 2 exceeds the reference voltage at pin 3, then the voltage at pin 6 drops to a level where CR48 turns on and CR45 is reverse biased; thus, control crosses over to U55, the current controlling amplifier. U55 holds the voltage at pin 2 to that set at pin 3 by R70, the CURRENT LIMIT control (S_{CL}). The supply is now in current-limit operation (see Fig. 5-2).

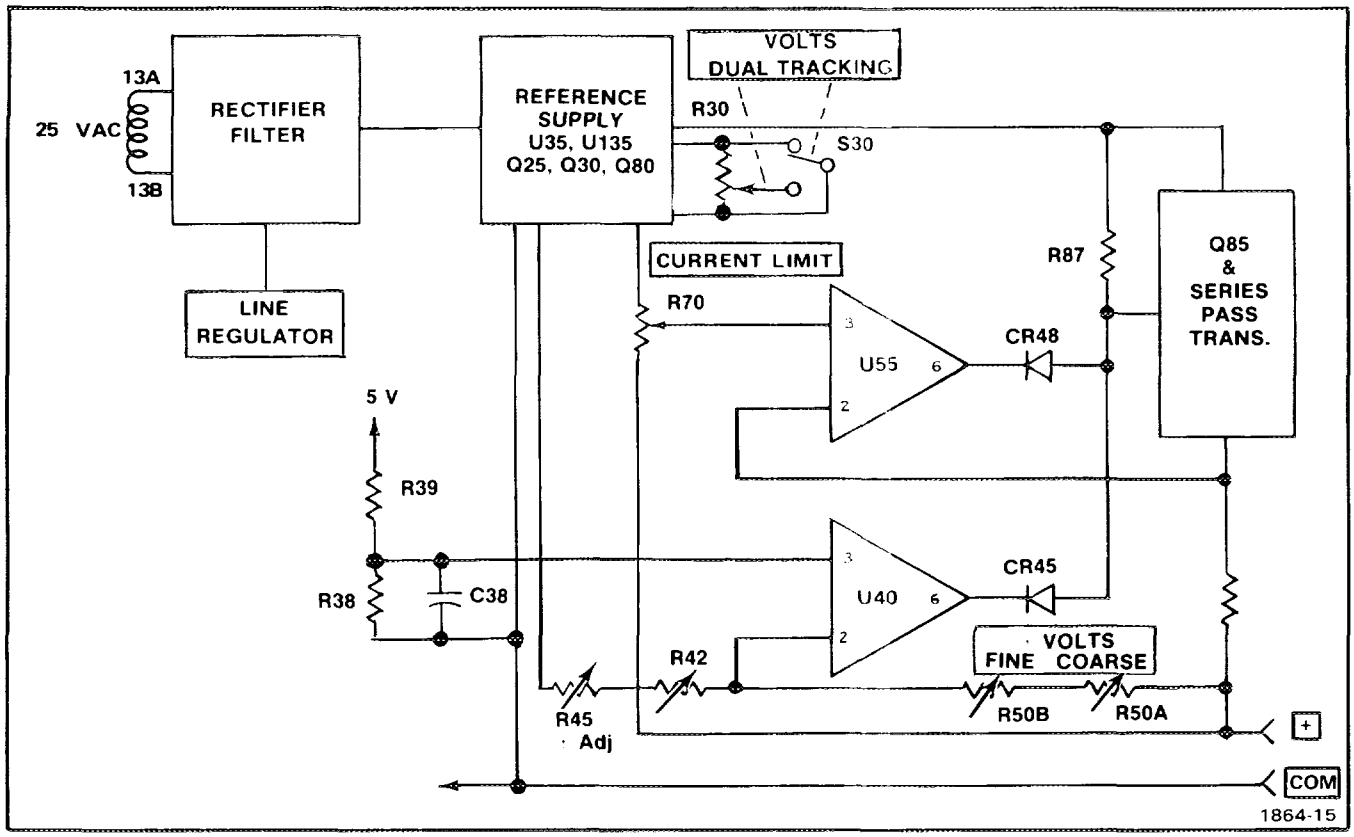


Fig. 5-1. Simplified block diagram of PS 503A.

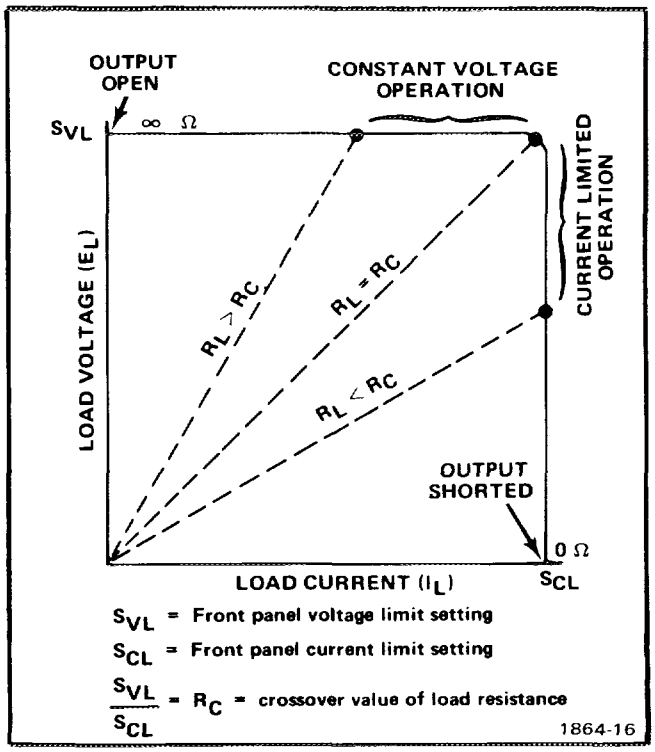


Fig. 5-2. Operating charactertistics with various voltages, current, and loads.

Load Regulation

With no load connected to the output terminals, all of the output current flows through feedback divider R50A-R50B-R42 (approximately 2 mA/V) and back to the minus side of C10. When a load is connected to the output terminals, output current must increase to maintain the output voltage.

An increase in output current cannot occur unless the drive to the base of Q85 and the series-pass transistor (located in power module) is also increased. The increase in the voltage differential between pin 2 and 3 of U45 necessary to drive Q85 and the series-pass transistor (refer to the discussion of constant voltage/current limited operation) is obtained by applying the lower voltage at the + output terminal to the inverting input (pin 2) of U45 causes a more positive output at pin 6 of U45, reducing the conduction of CR45. The current no longer going through CR45 now goes to the base of Q85.

Power Line Regulation

Q15 and associated components make-up a shut-down equalizer circuit. When the TM 500 Series Power Module

power switch is turned off, or power fails, the shut-down equalizer circuit will cause the supply (+ or −) that has the lightest load to reduce its output voltage to prevent spiking of the lightly loaded supply as the filter capacitor is discharged.

Power Supplies

+27 V Integrated Circuit Pre-regulator. Zener diode VR20 and emitter follower Q20 form a voltage regulator to supply U35 and U135.

+5 V Ground-Referenced Supply. The power module supplies +11.5 V through pins 2A and B and 3A and B on the plug-in rear connector to pins 1 and 3 of integrated circuit U1. U1 provides a regulated +5 V output limited at 1 A from pins 2 and 3 to output connectors J1 and J2 on the front panel.

Over-voltage Protection

When the voltage at the PS 503A front-panel + output terminal reaches about 26 volts, over-voltage protection silicon controlled rectifier (scr) Q65 turns on. Q65 turning on shorts the +33 volts supply to the COMMON terminal, causing the power supply to shut down.

NOTE

By changing Zener diode VR64, different over-voltage levels can be obtained.

Output Current Selection

If the PS 503A is operated in any compartment of a TM 500 Series Power Module except the high power compartment of the TM 504 and TM 506 Power Modules, S95 reduces the current limit to 400 mA and turns on 400 mA limit indicator LED.

REPLACEABLE ELECTRICAL PARTS

PARTS ORDERING INFORMATION

Replacement parts are available from or through your local Tektronix, Inc. Field Office or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the following information in your order: Part number, instrument type or number, serial number, and modification number if applicable.

If a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc. Field Office or representative will contact you concerning any change in part number.

Change information, if any, is located at the rear of this manual.

SPECIAL NOTES AND SYMBOLS

X000	Part first added at this serial number
00X	Part removed after this serial number

ITEM NAME

In the Parts List, an Item Name is separated from the description by a colon (:). Because of space limitations, an Item Name may sometimes appear as incomplete. For further Item Name identification, the U.S. Federal Cataloging Handbook H6-1 can be utilized where possible.

ABBREVIATIONS

ACTR	ACTUATOR	PLSTC	PLASTIC
ASSY	ASSEMBLY	QTZ	QUARTZ
CAP	CAPACITOR	RECP	RECEPTACLE
CER	CERAMIC	RES	RESISTOR
CKT	CIRCUIT	RF	RADIO FREQUENCY
COMP	COMPOSITION	SEL	SELECTED
CONN	CONNECTOR	SEMICOND	SEMICONDUCTOR
ELCTLT	ELECTROLYTIC	SENS	SENSITIVE
ELEC	ELECTRICAL	VAR	VARIABLE
INCAND	INCANDESCENT	WW	WIREWOUND
LED	LIGHT EMITTING DIODE	XFMR	TRANSFORMER
NONWIR	NON WIREWOUND	XTAL	CRYSTAL

CROSS INDEX - MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip Code
00213	NYTRONICS COMPONENTS GROUP INC SUBSIDIARY OF NYTRONICS INC	ORANGE ST	DARLINGTON SC 29532
01121	ALLEN-BRADLEY CO	1201 SOUTH 2ND ST	MILWAUKEE WI 53204
01295	TEXAS INSTRUMENTS INC SEMICONDUCTOR GROUP	13500 N CENTRAL EXPRESSWAY P O BOX 225012 M/S 49	DALLAS TX 75265
02735	RCA CORP SOLID STATE DIVISION	ROUTE 202	SOMERVILLE NJ 08876
03508	GENERAL ELECTRIC CO SEMI-CONDUCTOR PRODUCTS DEPT	N GENESEE ST	AUBURN NY 13021
04713	MOTOROLA INC SEMICONDUCTOR GROUP	5005 E MCDOWELL RD	PHOENIX AZ 85008
05397	UNION CARBIDE CORP MATERIALS SYSTEMS DIV	11901 MADISON AVE	CLEVELAND OH 44101
07263	FAIRCHILD CAMERA AND INSTRUMENT CORP SEMICONDUCTOR DIV	464 ELLIS ST	MOUNTAIN VIEW CA 94042
07716	TRW INC TRW ELECTRONICS COMPONENTS TRW IRC FIXED RESISTORS/BURLINGTON	2850 MT PLEASANT AVE	BURLINGTON IA 52601
12697	CLAROSTAT MFG CO INC	LOWER WASHINGTON ST	DOVER NH 03820
12954	MICROSEMI CORP	8700 E THOMAS RD P O BOX 1390	SCOTTSDALE AZ 85252
14552	MICRO/SEMICONDUCTOR CORP	2830 S FAIRVIEW ST	SANTA ANA CA 92704
14936	GENERAL INSTRUMENT CORP DISCRETE SEMI CONDUCTOR DIV	600 W JOHN ST	HICKSVILLE NY 11802
19701	MEPCO/ELECTRA INC A NORTH AMERICAN PHILIPS CO	P O BOX 760	MINERAL WELLS TX 76067
31918	ITT SCHADOW INC	8081 WALLACE RD	EDEN PRAIRIE MN 55343
32997	BOURNS INC TRIMPOT DIV	1200 COLUMBIA AVE	RIVERSIDE CA 92507
54473	MATSUSHITA ELECTRIC CORP OF AMERICA	ONE PANASONIC WAY	SECAUCUS NJ 07094
56289	SPRAGUE ELECTRIC CO	87 MARSHALL ST	NORTH ADAMS MA 01247
57668	ROHM CORP	16931 MILLIKEN AVE	IRVINE CA 92713
58361	GENERAL INSTRUMENT CORP OPTOELECTRONICS DIV	3400 HILLVIEW AVE	PALO ALTO CA 94304
58474	SUPERIOR ELECTRIC CO THE	383 MIDDLE ST	BRISTOL CT 06010
59660	TUSONIX INC	2155 N FORBES BLVD	TUCSON, ARIZONA 85705
59821	CENTRALAB INC SUB NORTH AMERICAN PHILIPS CORP	7158 MERCHANT AVE	EL PASO TX 79915
71400	MCGRAW-EDISON CO BUSSMANN MFG DIV	502 EARTH CITY PLAZA P O BOX 14460	ST LOUIS MO 63178
71744	GENERAL INSTRUMENT CORP LAMP DIV	4433 N RAVENSWOOD AVE	CHICAGO IL 60640
80009	TEKTRONIX INC	4900 S W GRIFFITH DR P O BOX 500	BEAVERTON OR 97077

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A1	670-3291-00	B010100	B022064	CIRCUIT BD ASSY:MAIN	80009	670-3291-00
A1	670-3291-01	B022065	B026129	CIRCUIT BD ASSY:MAIN	80009	670-3291-01
A1	670-3291-02	B026130	B038916	CIRCUIT BD ASSY:MAIN	80009	670-3291-02
A1	670-3291-03	B038917	B039889	CIRCUIT BD ASSY:MAIN	80009	670-3291-03
A1	670-3291-04	B039890		CIRCUIT BD ASSY:MAIN	80009	670-3291-04
A1	670-3291-00	B010100	B022064	CIRCUIT BD ASSY:MAIN	80009	670-3291-00
A1	670-3291-01	B022065	B026129	CIRCUIT BD ASSY:MAIN	80009	670-3291-01
A1	670-3291-02	B026130	B038916	CIRCUIT BD ASSY:MAIN	80009	670-3291-02
A1	670-3291-03	B038917	B039889	CIRCUIT BD ASSY:MAIN	80009	670-3291-03
A1	670-3291-04	B039890		CIRCUIT BD ASSY:MAIN	80009	670-3291-04
A1C2	283-0081-00			CAP,FXD,CER DI:0.1UF,+80-20%,25V	59821	200U69E104Z
A1C3	290-0525-00	B010100	B026129	CAP,FXD,ELCTLT:4.7UF,20%,50V	05397	T368B475M050AS
A1C3	290-0522-00	B026130		CAP,FXD,ELCTLT:1UF,20%,50V	05397	T368A105M050AZ
A1C4	290-0745-00	B026130		CAP,FXD,ELCTLT:22UF,+50-10%,25V	54473	ECE-A25V22L
A1C10	290-0320-00			CAP,FXD,ELCTLT:4500UF,+100-10%,40V	56289	D45528
A1C19	283-0003-00			CAP,FXD,CER DI:0.01UF,+80-20%,150V	59821	D103Z40Z5UJDCEX
A1C20	290-0525-00	B010100	B039889	CAP,FXD,ELCTLT:4.7UF,20%,50V	05397	T368B475M050AS
A1C20	290-0779-00	B039890		CAP,FXD,ELCTLT:10 UF +50% -10%,50VDC	56289	5020237
A1C34	290-0525-00	B010100	B039889	CAP,FXD,ELCTLT:4.7UF,20%,50V	05397	T368B475M050AS
A1C34	290-0779-00	B039890		CAP,FXD,ELCTLT:10 UF +50% -10%,50VDC	56289	5020237
A1C38	290-0525-00	B010100	B039889	CAP,FXD,ELCTLT:4.7UF,20%,50V	05397	T368B475M050AS
A1C38	290-0779-00	B039890		CAP,FXD,ELCTLT:10 UF +50% -10%,50VDC	56289	5020237
A1C55	283-0060-00	B038917	B039889	CAP,FXD,CER DI:100PF,5%,200V	59660	855-535U2J101J
A1C56	283-0144-00	B039890		CAP,FXD,CER DI:33PF,2%,500V	59660	801-547P2G330G
A1C60	290-0117-00			CAP,FXD,ELCTLT:50UF,+75-10%,50V	56289	3005066050009
A1C64	290-0525-00	B010100	B039889	CAP,FXD,ELCTLT:4.7UF,20%,50V	05397	T368B475M050AS
A1C64	290-0779-00	B039890		CAP,FXD,ELCTLT:10 UF +50% -10%,50VDC	56289	5020237
A1C85	283-0003-00			CAP,FXD,CER DI:0.01UF,+80-20%,150V	59821	D103Z40Z5UJDCEX
A1C110	290-0320-00			CAP,FXD,ELCTLT:4500UF,+100-10%,40V	56289	D45528
A1C119	283-0003-00			CAP,FXD,CER DI:0.01UF,+80-20%,150V	59821	D103Z40Z5UJDCEX
A1C120	290-0525-00	B010100	B039889	CAP,FXD,ELCTLT:4.7UF,20%,50V	05397	T368B475M050AS
A1C120	290-0779-00	B039890		CAP,FXD,ELCTLT:10 UF +50% -10%,50VDC	56289	5020237
A1C138	290-0525-00	B010100	B039889	CAP,FXD,ELCTLT:4.7UF,20%,50V	05397	T368B475M050AS
A1C138	290-0779-00	B039890		CAP,FXD,ELCTLT:10 UF +50% -10%,50VDC	56289	5020237
A1C145	283-0115-00	B038917		CAP,FXD,CER DI:47PF,5%,200V	59821	200T60K470J
A1C155	283-0060-00	B038917	B039889	CAP,FXD,CER DI:100PF,5%,200V	59660	855-535U2J101J
A1C156	283-0144-00	B039890		CAP,FXD,CER DI:33PF,2%,500V	59660	801-547P2G330G
A1C160	290-0117-00			CAP,FXD,ELCTLT:50UF,+75-10%,50V	56289	3005066050009
A1C167	290-0525-00	B010100	B039889	CAP,FXD,ELCTLT:4.7UF,20%,50V	05397	T368B475M050AS
A1C167	290-0779-00	B039890		CAP,FXD,ELCTLT:10 UF +50% -10%,50VDC	56289	5020237
A1CR10	152-0462-00			SEMICOND DVC,DI:RECT,SI,200V,2.5A	14936	KBU4D
A1CR24	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR35	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR45	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR46	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR48	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR55	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR60	152-0040-00			SEMICOND DVC,DI:RECT,SI,600V,1A,DO-41	80009	152-0040-00
A1CR66	152-0040-00	B022065		SEMICOND DVC,DI:RECT,SI,600V,1A,DO-41	80009	152-0040-00
A1CR78	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR110	152-0462-00			SEMICOND DVC,DI:RECT,SI,200V,2.5A	14936	KBU4D
A1CR135	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR145	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR146	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR148	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR155	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR160	152-0040-00			SEMICOND DVC,DI:RECT,SI,600V,1A,DO-41	80009	152-0040-00
A1CR167	152-0040-00	B022065		SEMICOND DVC,DI:RECT,SI,600V,1A,DO-41	80009	152-0040-00

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A1CR185	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1DS50	150-0109-00			LAMP,INCAND:18V,0.026A,#CM7220,WIRE LD	71744	CM7220
A1DS150	150-0109-00			LAMP,INCAND:18V,0.026A,#CM7220,WIRE LD	71744	CM7220
A1F10	159-0016-00			FUSE,CARTRIDGE:3AG,1.5,250V,FAST BLOW	71400	AGC-CN-1 1/2
A1F110	159-0016-00			FUSE,CARTRIDGE:3AG,1.5,250V,FAST BLOW	71400	AGC-CN-1 1/2
A1J1	129-0064-01			POST,BDG,ELEC:RED,5-WAY MINIATURE	58474	A207799-G2
A1J2	129-0064-02			POST,BDG,ELEC:WHITE,5-WAY,MINIATURE	58474	207784-G5
A1J3	129-0064-00			POST,BDG,ELEC:CHARCOAL,5-WAY MINIATURE	58474	A207799-G7
A1J60	129-0064-01			POST,BDG,ELEC:RED,5-WAY MINIATURE	58474	A207799-G2
A1J160	129-0064-03			POST,BDG,ELEC:GREEN,5-WAY MINIATURE	58474	BP21GN
A1Q15	151-0302-00			TRANSISTOR:NPN,SI,TO-18	04713	ST899
A1Q20	151-0136-00			TRANSISTOR:NPN,SI,TO-5	02735	35495
A1Q25	151-0347-00			TRANSISTOR:NPN,SI,TO-92	04713	SPS7951
A1Q30	151-0342-00			TRANSISTOR:PNP,SI,TO-92	07263	S035928
A1Q65	151-0506-00			SCR:SI,RO-44	03508	C10682X283
A1Q80	151-0350-00			TRANSISTOR:PNP,SI,TO-92	04713	SPS6700
A1Q85	151-0365-00			TRANSISTOR:NPN,SI,X-51C	03508	X42CR182
A1Q115	151-0301-00			TRANSISTOR:PNP,SI,TO-18	04713	ST898
A1Q120	151-0208-00			TRANSISTOR:PNP,SI,TO-5	02735	65349
A1Q165	151-0342-00	B010100	B022064	TRANSISTOR:PNP,SI,TO-92	07263	S035928
A1Q170	151-0506-00			SCR:SI,RO-44	03508	C10682X283
A1Q185	151-0350-00			TRANSISTOR:PNP,SI,TO-92	04713	SPS6700
A1Q190	151-0347-00			TRANSISTOR:NPN,SI,TO-92	04713	SPS7951
A1Q195	151-0364-00			TRANSISTOR:PNP,SI,X-51C	03508	X43CR181
A1R3	301-0241-00			RES,FXD,FILM:240 OHM,5%,0.5W	01121	EB2415
A1R14	321-0303-00			RES,FXD,FILM:14.0K OHM,1%,0.125W,TC=T0	07716	CEA0 14001F
A1R15	321-0297-00			RES,FXD,FILM:12.1K OHM,1%,0.125W,TC=T0	07716	CEA012101F
A1R17	305-0751-00			RES,FXD,CMPSN:750 OHM,5%,2W	01121	HB7515
A1R20	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
A1R24	301-0152-00			RES,FXD,FILM:1.5K OHM,5%,0.5W	19701	5053CX1K500J
A1R26	321-0170-00			RES,FXD,FILM:576 OHM,1%,0.125W,TC=T0	07716	CEA0576R0F
A1R28	321-0108-00			RES,FXD,FILM:130 OHM 1%,0.125W,TC=T0	07716	CEA013000F
A1R29	321-0192-00			RES,FXD,FILM:976 OHM,1%,0.125W,TC=T0	19701	5033ED976R0F
A1R34	315-0302-00			RES,FXD,FILM:3K OHM,5%,0.25W	57668	NTR25J-E03K0
A1R36	321-0254-00			RES,FXD,FILM:4.32K OHM,1%,0.125W,TC=T0	07716	CEA043200F
A1R38	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
A1R39	315-0474-00			RES,FXD,FILM:470K OHM,5%,0.25W	19701	5043CX470K0J82U
A1R42	321-0240-00	B010100	B022064	RES,FXD,FILM:3.09K OHM,1%,0.125W,TC=T0	07716	CEA030900F
A1R42	321-0250-00	B022065		RES,FXD,FILM:3.92K OHM,1%,0.125W,TC=T0	07716	CEA039200F
A1R45	311-1560-00	B010100	B022064	RES,VAR,NONWW:TRMR,5K OHM,0.5W	32997	3352T-1-502
A1R45	311-1561-00	B022065		RES,VAR,NONWW:TRMR,2.5K OHM,0.5W	32997	3352T-0Y7-252
A1R48	303-0122-00			RES,FXD,CMPSN:1.2K OHM,5%,1W	01121	GB1225
A1R55	301-0511-00			RES,FXD,FILM:510 OHM,5%,0.5W	19701	5053CX510R0J
A1R64	315-0471-00			RES,FXD,FILM:470 OHM,5%,0.25W	57668	NTR25J-E470E
A1R65	307-0051-00	B010100	B022064	RES,FXD,CMPSN:2.7 OHM,5%,0.5W	01121	EB27G5
A1R66	315-0102-00	B022065		RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
A1R67	308-0245-00			RES,FXD,WW:0.6 OHM,5%,2W	00213	310S .6-5
A1R72	321-0195-00			RES,FXD,FILM:1.05K OHM,1%,0.125W,TC=T0	07716	CEA010500F
A1R73	315-0681-00	B022065		RES,FXD,FILM:680 OHM,5%,0.25W	57668	NTR25J-E680E
A1R74	321-0173-00			RES,FXD,FILM:619 OHM,1%,0.125W,TC=T0	07716	CEA0619R0F
A1R78	315-0273-00			RES,FXD,FILM:27K OHM,5%,0.25W	57668	NTR25J-E27K0
A1R80	321-0216-00	B010100	B022064	RES,FXD,FILM:1.74K OHM,1%,0.125W,TC=T0	07716	CEA017400F
A1R80	321-0213-00	B022065		RES,FXD,FILM:1.62K OHM,1%,0.125W,TC=T0	07716	CEA016200F
A1R85	301-0822-00			RES,FXD,FILM:8.2K OHM,5%,0.5W	19701	5053CX8K200J
A1R87	301-0302-00			RES,FXD,FILM:3K OHM,5%,0.5W	19701	5053CX3K000J
A1R88	315-0510-00	B038917		RES,FXD,FILM:51 OHM,5%,0.25W	19701	5043CX51R0J
A1R90	315-0131-00			RES,FXD,FILM:130 OHM,5%,0.25W	19701	5043CX130R0J
A1R95	301-0302-00			RES,FXD,FILM:3K OHM,5%,0.5W	19701	5053CX3K000J
A1R114	321-0303-00			RES,FXD,FILM:14.0K OHM,1%,0.125W,TC=T0	07716	CEA0 14001F

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Serial/Assembly No. Decont	Name & Description	Mfr. Code	Mfr. Part No.
A1R115	321-0297-00			RES,FXD,FILM:12.1K OHM,1%,0.125M,TC=T0	07716	CEA012101F
A1R117	305-0751-00			RES,FXD,CMPSN:750 OHM,5%,2M	01121	HB7515
A1R120	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25M	57668	NTR25JE01K0
A1R134	315-0152-00			RES,FXD,FILM:1.5K OHM,5%,0.25M	57668	NTR25J-E01K5
A1R136	321-0254-00			RES,FXD,FILM:4.32K OHM,1%,0.125M,TC=T0	07716	CEAD43200F
A1R138	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25M	57668	NTR25JE01K0
A1R139	315-0474-00			RES,FXD,FILM:470K OHM,5%,0.25M	19701	5043CX470K0J82U
A1R142	321-0240-00	B010100	B022064	RES,FXD,FILM:3.09K OHM,1%,0.125M,TC=T0	07716	CEAD30900F
A1R142	321-0250-00	B022065		RES,FXD,FILM:3.92K OHM,1%,0.125M,TC=T0	07716	CEAD39200F
A1R145	311-1560-00	B010100	B022064	RES,VAR,NONWW:TRMR,5K OHM,0.5M	32997	3352T-1-502
A1R145	311-1561-00	B022065		RES,VAR,NONWW:TRMR,2.5K OHM,0.5M	32997	3352T-0Y7-252
A1R148	303-0122-00			RES,FXD,CMPSN:1.2K OHM,5%,1M	01121	GB1225
A1R155	301-0511-00			RES,FXD,FILM:510 OHM,5%,0.5M	19701	5053CX510R0J
A1R164	315-0471-00	B010100	B022064	RES,FXD,FILM:470 OHM,5%,0.25M	57668	NTR25J-E470E
A1R165	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25M	57668	NTR25JE01K0
A1R167	315-0471-00			RES,FXD,FILM:470 OHM,5%,0.25M	57668	NTR25J-E470E
A1R170	307-0051-00	B010100	B022064	RES,FXD,CMPSN:2.7 OHM,5%,0.5M	01121	EB27G5
A1R174	308-0245-00			RES,FXD,WW:0.6 OHM,5%,2M	00213	310S .6-5
A1R176	321-0173-00			RES,FXD,FILM:619 OHM,1%,0.125M,TC=T0	07716	CEAD619R0F
A1R178	321-0185-00			RES,FXD,FILM:1.05K OHM,1%,0.125M,TC=T0	07716	CEAD10500F
A1R182	315-0681-00	B022065		RES,FXD,FILM:680 OHM,5%,0.25M	57668	NTR25J-E680E
A1R185	321-0282-00	B010100	B022064	RES,FXD,FILM:8.45K OHM,1%,0.125M,TC=T0	07716	CFAD84500F
A1R185	321-0287-00	B022065		RES,FXD,FILM:9.53K OHM,1%,0.125M,TC=T0	19701	5033ED9K530F
A1R187	321-0224-00			RES,FXD,FILM:2.10K OHM,1%,0.125M,TC=T0	07716	CEAD21000F
A1R190	321-0213-00			RES,FXD,FILM:1.62K OHM,1%,0.125M,TC=T0	07716	CEAD16200F
A1R192	301-0302-00			RES,FXD,FILM:3K OHM,5%,0.5M	19701	5053CX3K000J
A1R194	301-0822-00			RES,FXD,FILM:8.2K OHM,5%,0.5M	19701	5053CX8K200J
A1R196	315-0131-00	B010100	B038916	RES,FXD,FILM:130 OHM,5%,0.25M	19701	5043CX130R0J
A1R196	315-0750-00	B038917		RES,FXD,FILM:75 OHM,5%,0.25M	57668	NTR25J-E75E0
A1S1	260-1332-00			SWITCH,PUSH:4PDT,PUSH-PUSH	31918	ORDER BY DESCR
A1S95	260-1310-01			SWITCH,PUSH:4PDT MOMENTARY,NON-SHORTING	31918	ORDER BY DESCR
A1U1	156-0277-00			MICROCKT,LINEAR:VOLTAGE REGULATOR	04713	LM340T-5.0
A1U35	156-0067-00			MICROCKT,LINEAR:OPNL AMPL,SEL	04713	MC1741CP1
A1U45	156-0067-00			MICROCKT,LINEAR:OPNL AMPL,SEL	04713	MC1741CP1
A1U55	156-0067-00	B010100	B039889	MICROCKT,LINEAR:OPNL AMPL,SEL	04713	MC1741CP1
A1U55	156-0105-00	B039890		MICROCKT,LINEAR:OPNL AMPL	01295	LM301AP
A1U135	156-0067-00			MICROCKT,LINEAR:OPNL AMPL,SEL	04713	MC1741CP1
A1U145	156-0067-00			MICROCKT,LINEAR:OPNL AMPL,SEL	04713	MC1741CP1
A1U155	156-0067-00	B010100	B039889	MICROCKT,LINEAR:OPNL AMPL,SEL	04713	MC1741CP1
A1U155	156-0105-00	B039890		MICROCKT,LINEAR:OPNL AMPL	01295	LM301AP
A1VR17	152-0195-00	B010100	B022064	SEMICOND DVC,DI:ZEN,SI,5.1V,5%,0.4M,DO-7	04713	SZ11755RL
A1VR17	152-0280-00	B022065		SEMICOND DVC,DI:ZEN,SI,6.2V,5%,0.4M,DO-7	04713	1N753A
A1VR20	152-0147-00			SEMICOND DVC,DI:ZEN,SI,27V,5%,0.4M,DO-7	04713	SZ50622KRL
A1VR24	152-0306-00			SEMICOND DVC,DI:ZEN,SI,9.1V,5%,0.4M,DO-7	12954	1N8608
A1VR30	152-0212-00			SEMICOND DVC,DI:ZEN,SI,9V,5%,0.5M,DO-7	04713	SZ50646RL
A1VR84	152-0285-00			SEMICOND DVC,DI:ZEN,SI,24V,5%,0.4M	14552	TD3810986
A1VR117	152-0195-00	B010100	B022064	SEMICOND DVC,DI:ZEN,SI,5.1V,5%,0.4M,DO-7	04713	SZ11755RL
A1VR117	152-0280-00	B022065		SEMICOND DVC,DI:ZEN,SI,6.2V,5%,0.4M,DO-7	04713	1N753A
A1VR120	152-0147-00			SEMICOND DVC,DI:ZEN,SI,27V,5%,0.4M,DO-7	04713	SZ50622KRL
A1VR164	152-0285-00			SEMICOND DVC,DI:ZEN,SI,24V,5%,0.4M	14552	TD3810986
DS48	150-1001-00			LT EMITTING DIO:RED,660NM,100MA MAX	58361	MV5024
DS95	150-1001-00			LT EMITTING DIO:RED,660NM,100MA MAX	58361	MV5024
DS148	150-1001-00			LT EMITTING DIO:RED,660NM,100MA MAX	58361	MV5024
R30	311-1310-00			RES,VAR,NONWW:PNL,20K OHM,1M,4PST SWITCH (PART OF S30)	01121	10M854
R50	311-1759-00			RES,VAR,NONWW:PNL,1K X 10K OHM,20%,0.5M	01121	18M445
R70	311-1524-00	B010100	B010319	RES,VAR,NONWW:PNL,20K OHM,0.5M	01121	73J1G040L203U

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
R70	311-1197-00	B010320	B051459	RES,VAR,NONWW:PNL,20K OHM,1M	12697	381-CM39696
R70	311-2073-00	B051460		RES,VAR,NONWW:20K OHM,10%,0.5M	01121	MA1G036S203UZ
R150	311-1758-00			RES,VAR,NONWW:PNL,1K X 10K OHM,20%,0.5M	01121	10M445
R180	311-1524-00	B010100	B010319	RES,VAR,NONWW:PNL,20K OHM,0.5M	01121	73J1G040L203U
R180	311-1197-00	B010320	B051459	RES,VAR,NONWW:PNL,20K OHM,1M	12697	381-CM39696
R180	311-2073-00	B051460		RES,VAR,NONWW:20K OHM,10%,0.5M	01121	MA1G036S203UZ
S30	311-1310-00			RES,VAR,NONWW:PNL,20K OHM,1M,4PST SWITCH (PART OF R30)	01121	10M654

OPTIONS

(No options are available at this time)

REPLACEABLE MECHANICAL PARTS

PARTS ORDERING INFORMATION

Replacement parts are available from or through your local Tektronix, Inc. Field Office or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the following information in your order: Part number, instrument type or number, serial number, and modification number if applicable.

If a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc. Field Office or representative will contact you concerning any change in part number.

Change information, if any, is located at the rear of this manual.

SPECIAL NOTES AND SYMBOLS

X000	Part first added at this serial number
00X	Part removed after this serial number

FIGURE AND INDEX NUMBERS

Items in this section are referenced by figure and index numbers to the illustrations.

INDENTATION SYSTEM

This mechanical parts list is indented to indicate item relationships. Following is an example of the indentation system used in the description column.

```
1 2 3 4 5                    Name & Description

Assembly and or Component
Attaching parts for Assembly and or Component
    - - - * - - -
  Detail Part of Assembly and or Component
  Attaching parts for Detail Part
    - - - * - - -
    Parts of Detail Part
    Attaching parts for Parts of Detail Part
    - - - * - - -
```

Attaching Parts always appear in the same indentation as the item it mounts, while the detail parts are indented to the right. Indented items are part of, and included with, the next higher indentation. The separation symbol - - - * - - - indicates the end of attaching parts.

Attaching parts must be purchased separately, unless otherwise specified.

ITEM NAME

In the Parts List, an Item Name is separated from the description by a colon (:). Because of space limitations, an Item Name may sometimes appear as incomplete. For further Item Name identification, the U.S. Federal Cataloging Handbook H6-1 can be utilized where possible.

ABBREVIATIONS

"	INCH
*	NUMBER SIZE
ACTR	ACTUATOR
ADPTR	ADAPTER
ALIGN	ALIGNMENT
AL	ALUMINUM
ASSEM	ASSEMBLED
ASSY	ASSEMBLY
ATTEN	ATTENUATOR
AWG	AMERICAN WIRE GAGE
BD	BOARD
BRKT	BRACKET
BRS	BRASS
BRZ	BRONZE
BSHG	BUSHING
CAB	CABINET
CAP	CAPACITOR
CER	CERAMIC
CHAS	CHASSIS
CKT	CIRCUIT
COMP	COMPOSITION
CONN	CONNECTOR
COV	COVER
CPLG	COUPLING
CRT	CATHODE RAY TUBE
DEG	DEGREE
DWR	DRAWER
ELCTRN	ELECTRON
ELEC	ELECTRICAL
ELCTLT	ELECTROLYTIC
ELEM	ELEMENT
EPL	ELECTRICAL PARTS LIST
EQPT	EQUIPMENT
EXT	EXTERNAL
FIL	FILLISTER HEAD
FLEX	FLEXIBLE
FLH	FLAT HEAD
FLTR	FILTER
FR	FRAME or FRONT
FSTNR	FASTENER
FT	FOOT
FXD	FIXED
GSKT	GASKET
HDL	HANDLE
HEX	HEXAGON
HEX HD	HEXAGONAL HEAD
HEX SOC	HEXAGONAL SOCKET
HLCPS	HELICAL COMPRESSION
HLEXT	HELICAL EXTENSION
HV	HIGH VOLTAGE
IC	INTEGRATED CIRCUIT
ID	INSIDE DIAMETER
IDENT	IDENTIFICATION
IMPLR	IMPELLER
IN	INCH
INCAND	INCANDESCENT
INSUL	INSULATOR
INTL	INTERNAL
LPHLDR	LAMPHOLDER
MACH	MACHINE
MECH	MECHANICAL
MTG	MOUNTING
NIP	NIPPLE
NON WIRE	NOT WIRE WOUND
OBD	ORDER BY DESCRIPTION
OD	OUTSIDE DIAMETER
OVH	OVAL HEAD
PH BRZ	PHOSPHOR BRONZE
PL	PLAIN or PLATE
PLSTC	PLASTIC
PN	PART NUMBER
PNH	PAN HEAD
PWR	POWER
RCPT	RECEPTACLE
RES	RESISTOR
RGD	RIGID
RLF	RELIEF
RTNR	RETAINER
SCH	SOCKET HEAD
SCOPE	OSCILLOSCOPE
SCR	SCREW
SE	SINGLE END
SECT	SECTION
SEMICOND	SEMICONDUCTOR
SHLD	SHIELD
SHLDR	SHOULDERED
SKT	SOCKET
SL	SLIDE
SLFLKG	SELF-LOCKING
SLVG	SLEEVING
SPR	SPRING
SQ	SQUARE
SST	STAINLESS STEEL
STL	STEEL
SW	SWITCH
T	TUBE
TERM	TERMINAL
THD	THREAD
THK	THICK
TNSN	TENSION
TPG	TAPPING
TRH	TRUSS HEAD
V	VOLTAGE
VAR	VARIABLE
W/	WITH
WSHR	WASHER
XFMR	TRANSFORMER
XSTR	TRANSISTOR

CROSS INDEX - MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip Code
01536	TEXTRON INC CAMCAR DIV SEMS PRODUCTS UNIT	1818 CHRISTINA ST	ROCKFORD IL 61108
09922	BURNDY CORP	RICHARDS AVE	NORWALK CT 06852
12327	FREEWAY CORP	9301 ALLEN DR	CLEVELAND OH 44125
22526	DU PONT E I DE NEMOURS AND CO INC DU PONT CONNECTOR SYSTEMS	30 HUNTER LANE	CAMP HILL PA 17011
24546	CORNING GLASS WORKS	550 HIGH ST	BRADFORD PA 16701
27238	BRISTOL INDUSTRIES	630 E LAMBERT RD P O BOX 630	BREA CA 92621
45722	USM CORP., PARKER-KALON FASTENER DIV		CAMPBELLSVILLE, KY 42718
58474	SUPERIOR ELECTRIC CO THE	383 MIDDLE ST	BRISTOL CT 06010
71159	BRISTOL SOCKET SCREW CO		WATERBURY CT
73743	FISCHER SPECIAL MFG CO	446 MORGAN ST	CINCINNATI OH 45206
78189	ILLINOIS TOOL WORKS INC SHAKEPROOF DIVISION	ST CHARLES ROAD	ELGIN IL 60120
80009	TEKTRONIX INC	4900 S W GRIFFITH DR P O BOX 500	BEAVERTON OR 97077
83385	MICRODOT MANUFACTURING INC GREER-CENTRAL DIV	3221 W BIG BEAVER RD	TROY MI 48098
83486	ELCO INDUSTRIES INC	1101 SAMUELSON RD	ROCKFORD IL 61101
86928	SEASTROM MFG CO INC	701 SONORA AVE	GLENDALE CA 91201
93907	TEXTRON INC CAMCAR DIV	600 18TH AVE	ROCKFORD IL 61101
TK0435	LEWIS SCREW CO	4114 S PEORIA	CHICAGO IL 60609

Replaceable Mechanical Parts - PS 503A

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Serial/Assembly No. Deconl	Qty	12345	Name & Description	Mfr. Code	Mfr. Part No.
1-	105-0718-00	B025430	B029879	1		BAR,LATCH RLSE:	80009	105-0718-00
	105-0718-01	B029880	B051459	1		BAR,LATCH RLSE:	80009	105-0718-01
-42	386-2232-01	B010100	B051459	1		SUBPANEL,FRONT:	80009	386-2232-01
						(ATTACHING PARTS)		
-43	213-0229-00	B010100	B030599	4		SCREW,TPG,TF:6-20 X 0.375,TYPE B,FLH,STL	93907	ORDER BY DESCR
	213-0123-00	B030600	B051459	4		SCREW,TPG,TF:6-32 X 0.375,SPCL TYPE,FLH 100 DEG,STL	93907	234-21940-026
						(END ATTACHING PARTS)		
-44	337-1638-01			1		SHIELD,ELEC:REAR SUBPANEL	80009	337-1638-01
-45	384-1101-00			1		EXTENSION SHAFT:4.14 L X 0.187 SQ,PLASTIC	80009	384-1101-00
-46	- ---- -----			1		MICROCIRCUIT,LI:(SEE A1U1 REPL)		
						(ATTACHING PARTS)		
-47	210-0406-00			1		NUT,PLAIN,HEX:4-40 X 0.188,BRS CD PL	73743	12161-50
-48	211-0038-00			1		SCREW,MACHINE:4-40 X 0.312,FLH,100 DEG,STL	TK0435	ORDER BY DESCR
						(END ATTACHING PARTS)		

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Serial/Assembly No. Deconf	Qty	12345	Name & Description	Mfr. Code	Mfr. Part No.
2-1	366-0494-00	B051460		3		KNOB:GRAY WITH SETSCREW	80009	366-0494-00
	213-0246-00	B051460		3		.SETSCREW:5-40 X 0.094,STL	71159	ORDER BY DESCR
-2	366-1077-01	B051460		2		KNOB:GY,0.127 ID X 0.5 OD X 0.531 H	80009	366-1077-01
	213-0246-00	B051460		2		.SETSCREW:5-40 X 0.094,STL	71159	ORDER BY DESCR
-3	366-1559-00	B051460		1		PUSH BUTTON:SIL GY,0.18 SQ X 0.43	80009	366-1559-00
-4	366-1851-01	B051460		1		KNOB,LATCH:IVORY GY,0.625 X 0.25 X 1.09	80009	366-1851-01
-5	333-3044-00	B051460		1		PANEL,FRONT:	80009	333-3044-00
-6	337-3036-00	B051460		1		SHIELD,ELEC:FRONT SUBPANEL	80009	337-3036-00
-7	214-3406-00	B051460		1		SPRING,FLAT:1.48 L X 0.125 W,CU BE	80009	214-3406-00
-8	426-0725-24	B051460		1		FR SECT,PLUG-IN:TOP	80009	426-0725-24
						(ATTACHING PARTS)		
-9	211-0101-00	B051460		2		SCREW,MACHINE:4-40 X 0.25,FLH,100 DG,STL	TK0435	ORDER BY DESCR
						(END ATTACHING PARTS)		
-10	386-4866-00	B051460		1		SUPPORT,FRAME:REAR,AL	80009	386-4866-00
						(ATTACHING PARTS)		
-11	213-0793-00	B051460		2		SCREW,TPG,TF:6-32 X 0.4375,TAPTITE,FILH	83486	239-006-406043
-12	386-3657-01	B051460		2		SUPPORT,PLUG-IN:	93907	ORDER BY DESCR
						(END ATTACHING PARTS)		
-13	337-3039-00	B051460		2		SHIELD,ELEC:SIDE	80009	337-3039-00
-14	214-3364-00	B051460		2		FASTENER,LATCH:ACETAL,SIL GRAY	80009	214-3364-00
-15	105-0932-00	B051460		2		LATCH,PANEL:SIDE	80009	105-0932-00
-16	105-0865-00	B051460		1		BAR,LATCH RLSE:	80009	105-0865-00
-17	105-0866-00	B051460		1		LATCH,RETAINING:SAFETY	80009	105-0866-00
-18	214-3143-00	B051460		1		SPRING,HLEXT:0.125 OD X 0.545 L,XLOOP	80009	214-3143-00
-19	426-0724-05	B051460		1		FR SECT,PLUG-IN:BOTTOM	80009	426-0724-05
						(ATTACHING PARTS)		
-20	211-0025-00	B051460		1		SCREW,MACHINE:4-40 X 0.375,FLH,100 DEG,STL	TK0435	ORDER BY DESCR
	211-0101-00	B051460		1		SCREW,MACHINE:4-40 X 0.25,FLH,100 DG,STL	TK0435	ORDER BY DESCR
						(END ATTACHING PARTS)		
						STANDARD ACCESSORIES		
	070-1834-01			1		MANUAL,TECH:INSTRUCTION	80009	070-1834-01

DIAGRAMS AND CIRCUIT BOARD ILLUSTRATIONS

Symbols and Reference Designators

Electrical components shown on the diagrams are in the following units unless noted otherwise:

Capacitors = Values one or greater are in picofarads (pF).
Values less than one are in microfarads (μF).
Resistors = Ohms (Ω).

Graphic symbols and class designation letters are based on ANSI Standard Y32.2-1975.

Logic symbology is based on ANSI Y32.14-1973 in terms of positive logic. Logic symbols depict the logic function performed and may differ from the manufacturer's data.

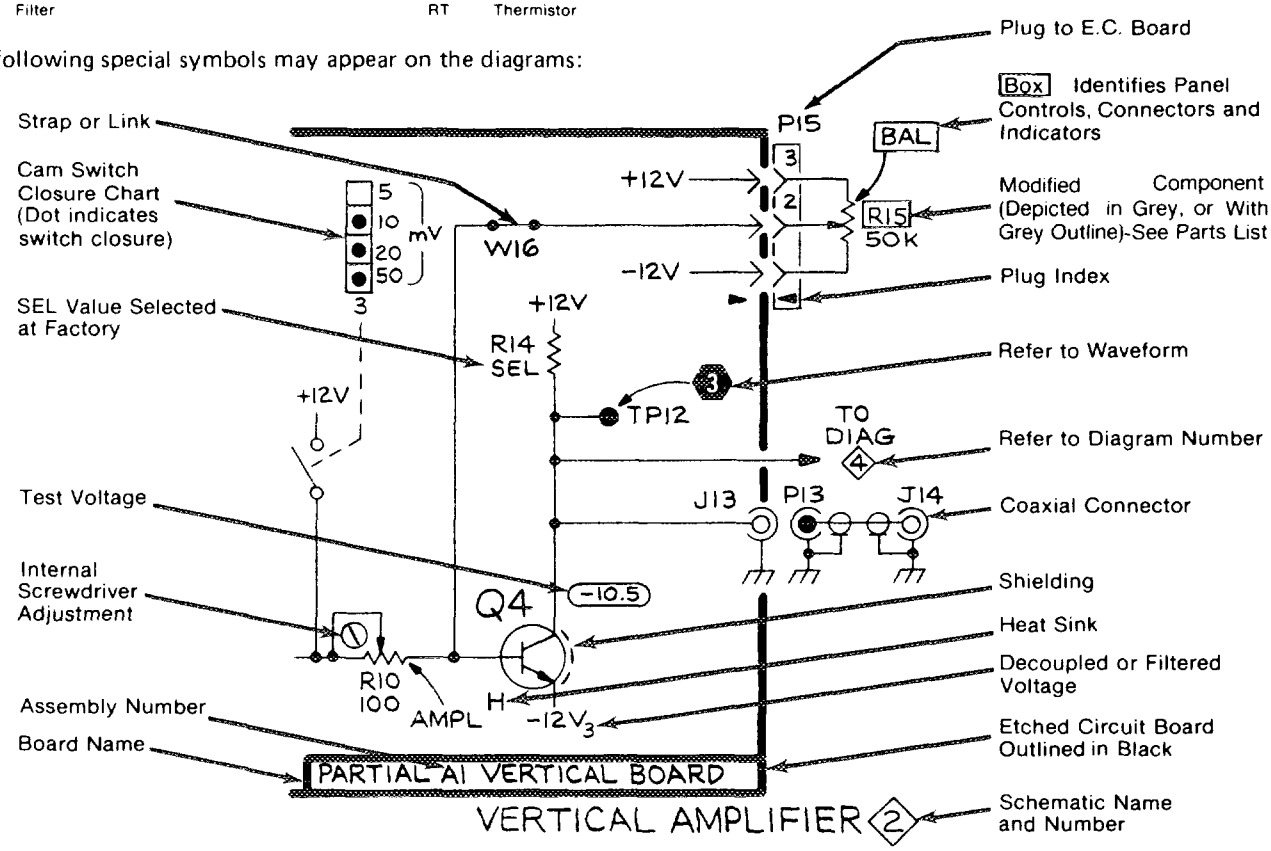
Abbreviations are based on ANSI Y1.1-1972.
Other ANSI standards that are used in the preparation of diagrams by Tektronix, Inc. are:

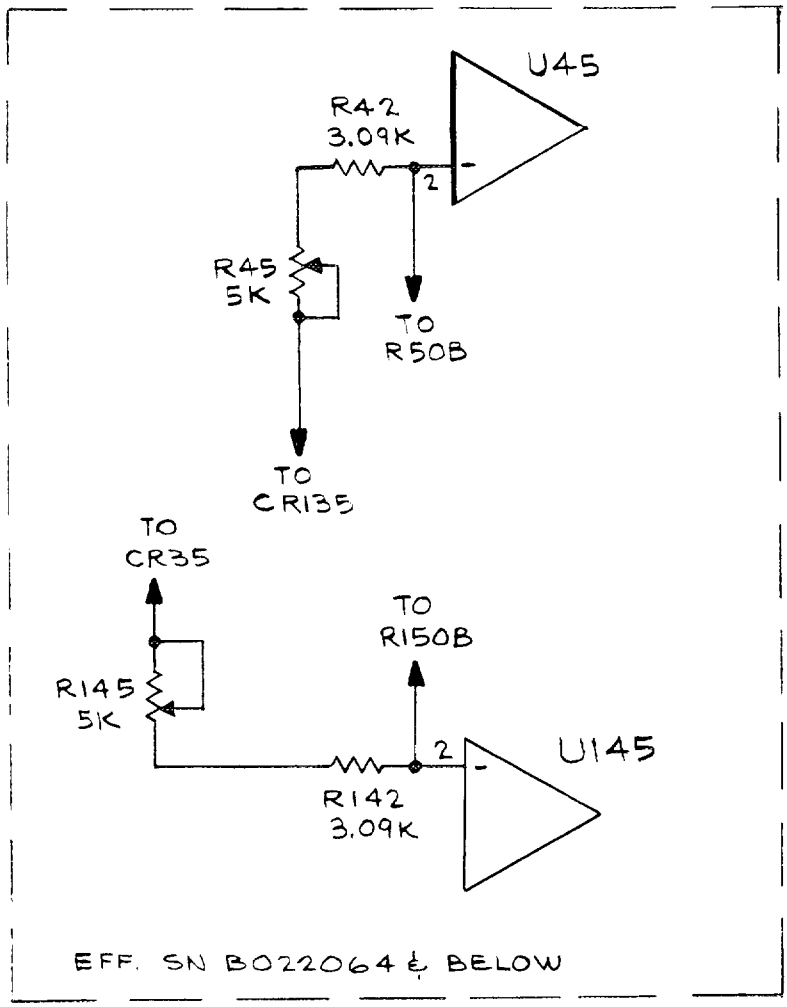
Y14.15, 1966	Drafting Practices.
Y14.2, 1973	Line Conventions and Lettering.
Y10.5, 1968	Letter Symbols for Quantities Used in Electrical Science and Electrical Engineering.

The following prefix letters are used as reference designators to identify components or assemblies on the diagrams.

A	Assembly, separable or repairable (circuit board, etc)	H	Heat dissipating device (heat sink, heat radiator, etc)	S	Switch or contactor
AT	Attenuator, fixed or variable	HR	Heater	T	Transformer
B	Motor	HY	Hybrid circuit	TC	Thermocouple
BT	Battery	J	Connector, stationary portion	TP	Test point
C	Capacitor, fixed or variable	K	Relay	U	Assembly, inseparable or non-repairable (integrated circuit, etc.)
CB	Circuit breaker	L	Inductor, fixed or variable	V	Electron tube
CR	Diode, signal or rectifier	M	Meter	VR	Voltage regulator (zener diode, etc.)
DL	Delay line	P	Connector, movable portion	W	Wirestrap or cable
DS	Indicating device (lamp)	Q	Transistor or silicon-controlled rectifier	Y	Crystal
E	Spark Gap, Ferrite bead	R	Resistor, fixed or variable	Z	Phase shifter
F	Fuse	RT	Thermistor		
FL	Filter				

The following special symbols may appear on the diagrams:




U45
R42
3.09K
2
R45
5K
TO
R50B
TO
CR135
TO
CR35
TO
R150B
R145
5K
2
U145
R142
3.09K
EFF. SN B022064 & BELOW

PS 503A

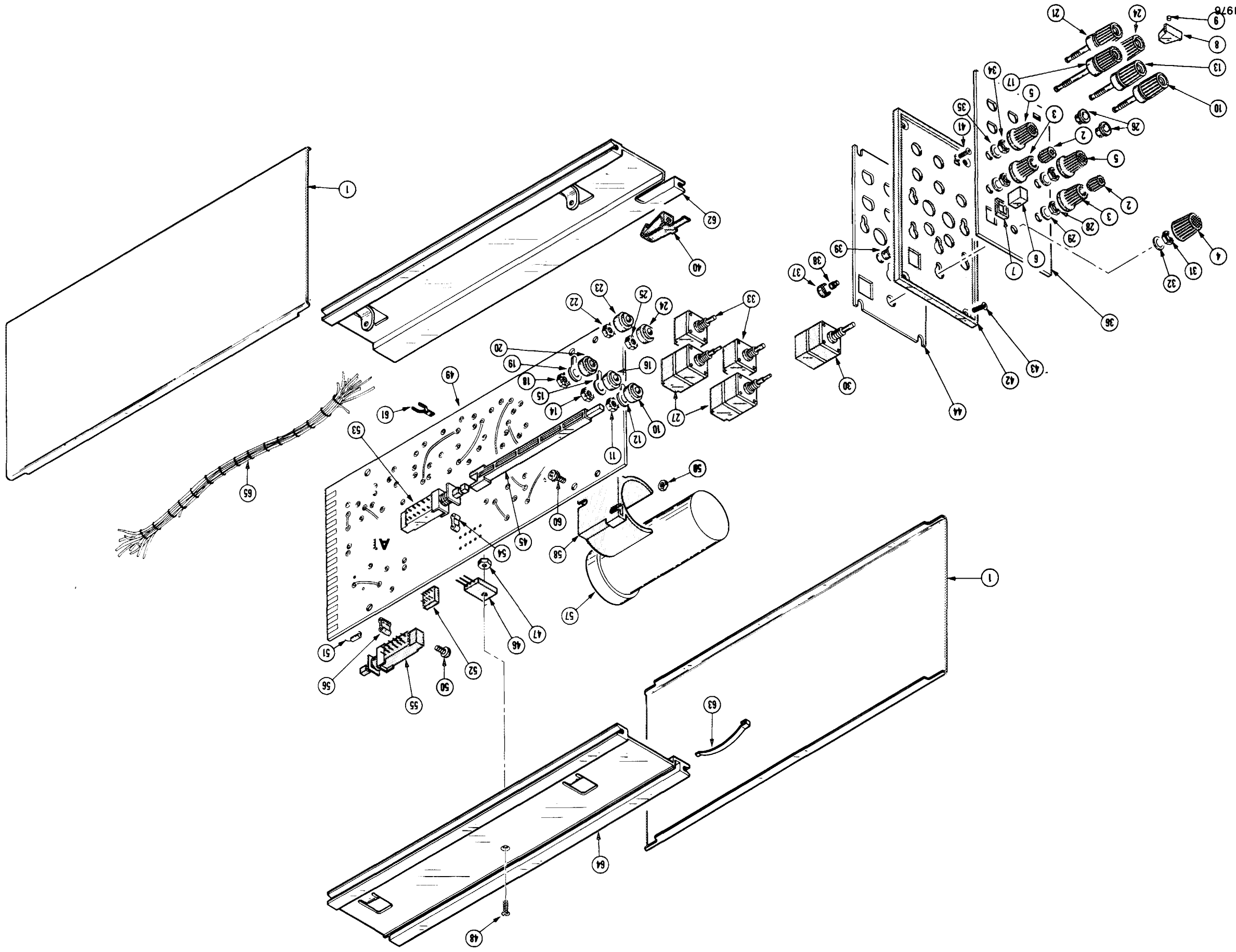
VOLTAGE CONDITIONS

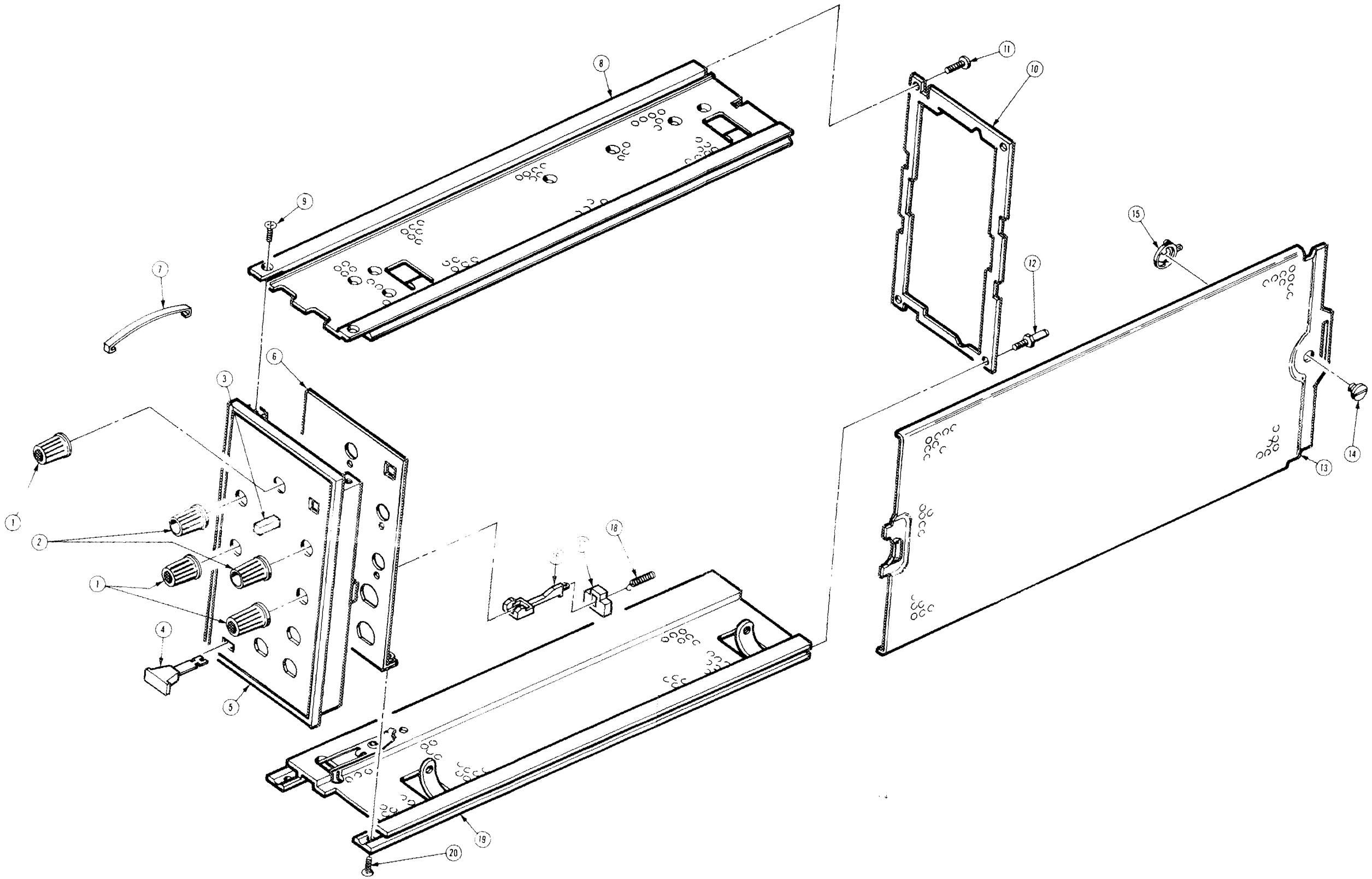
WARNING

Dangerous potentials exist at several points throughout this instrument. When the instrument is operated with the covers removed, do not touch exposed connections or components. Some transistors have voltages present on their cases. Disconnect the power source before replacing parts.

The voltages shown on diagram 1 were taken with the PS 503A front panel controls (knob type) fully counterclockwise. The OUTPUT button was in the ON position. No external load was connected to the binding post output terminals.

Voltage Conditions. The voltages shown on the diagram were obtained using a digital multimeter with a 10 mΩ input impedance (TEKTRONIX DM 501 Digital Multimeter or TEKTRONIX 7D13 Digital Multimeter used with readout equipped, 7000-series oscilloscope).


A1

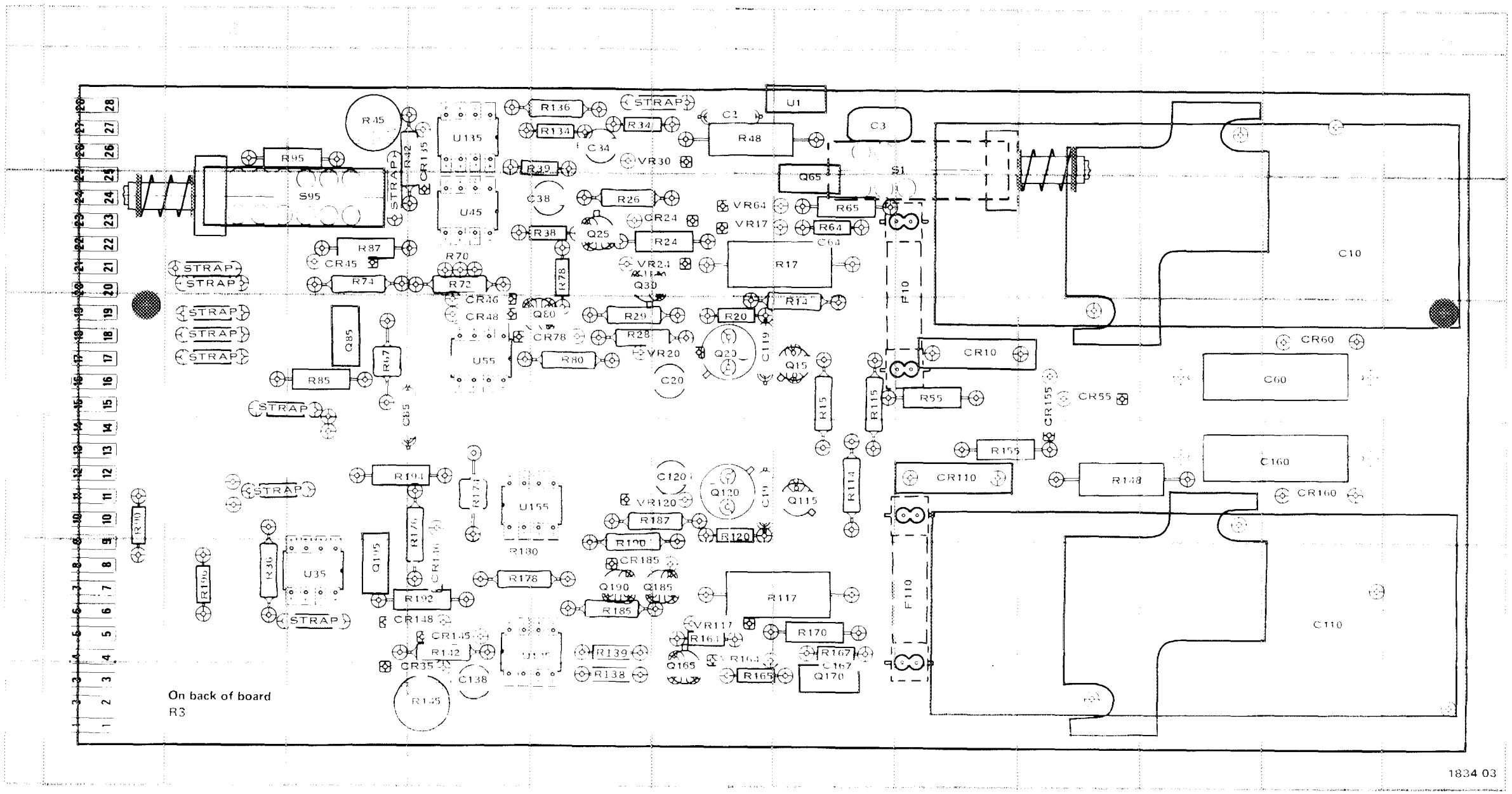


ADD SEP 1983

PS 503A

1834-02
REV DEC 1981

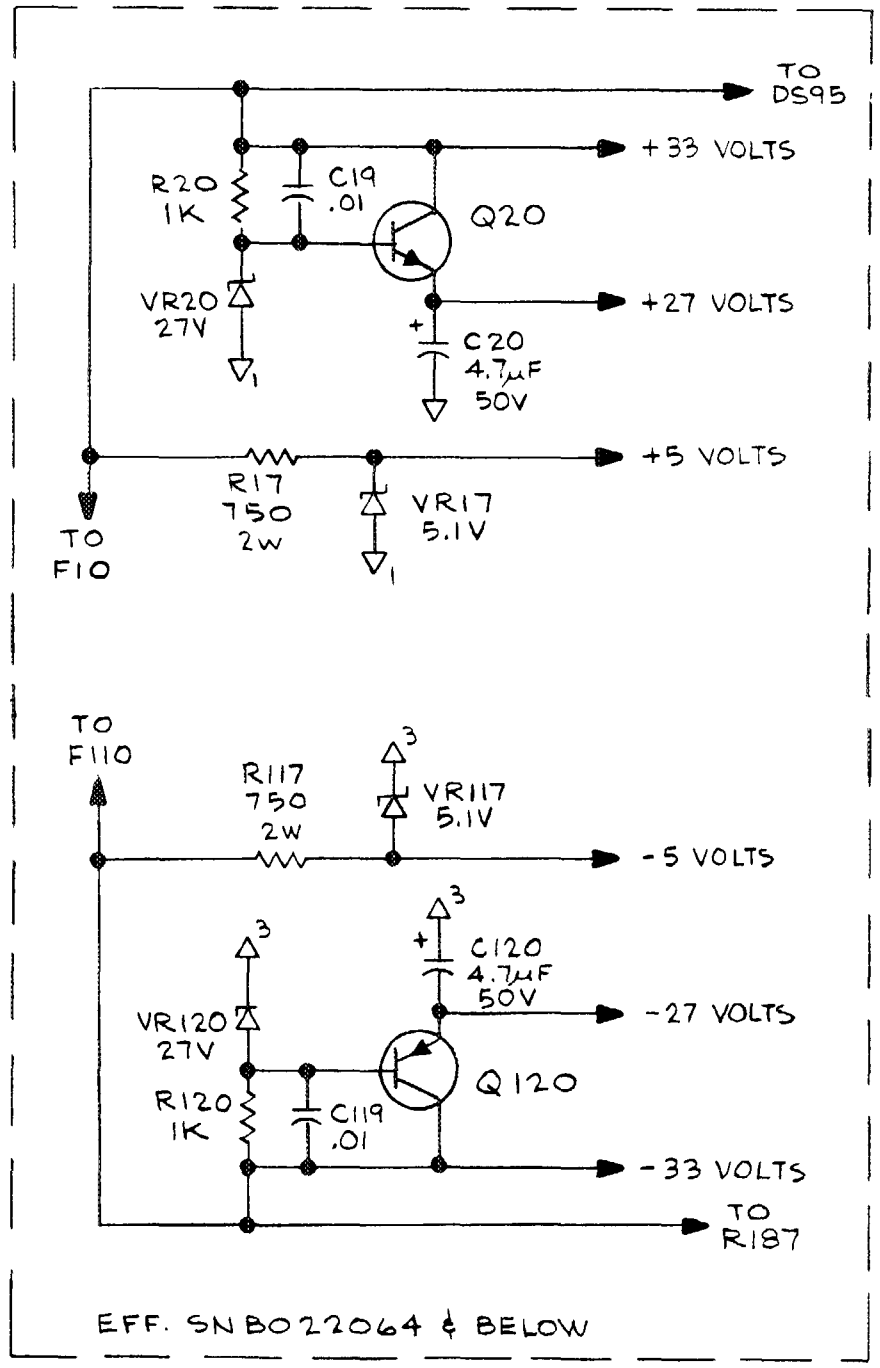
Power Supply ⓘ
(SN B022065 & ABOVE)

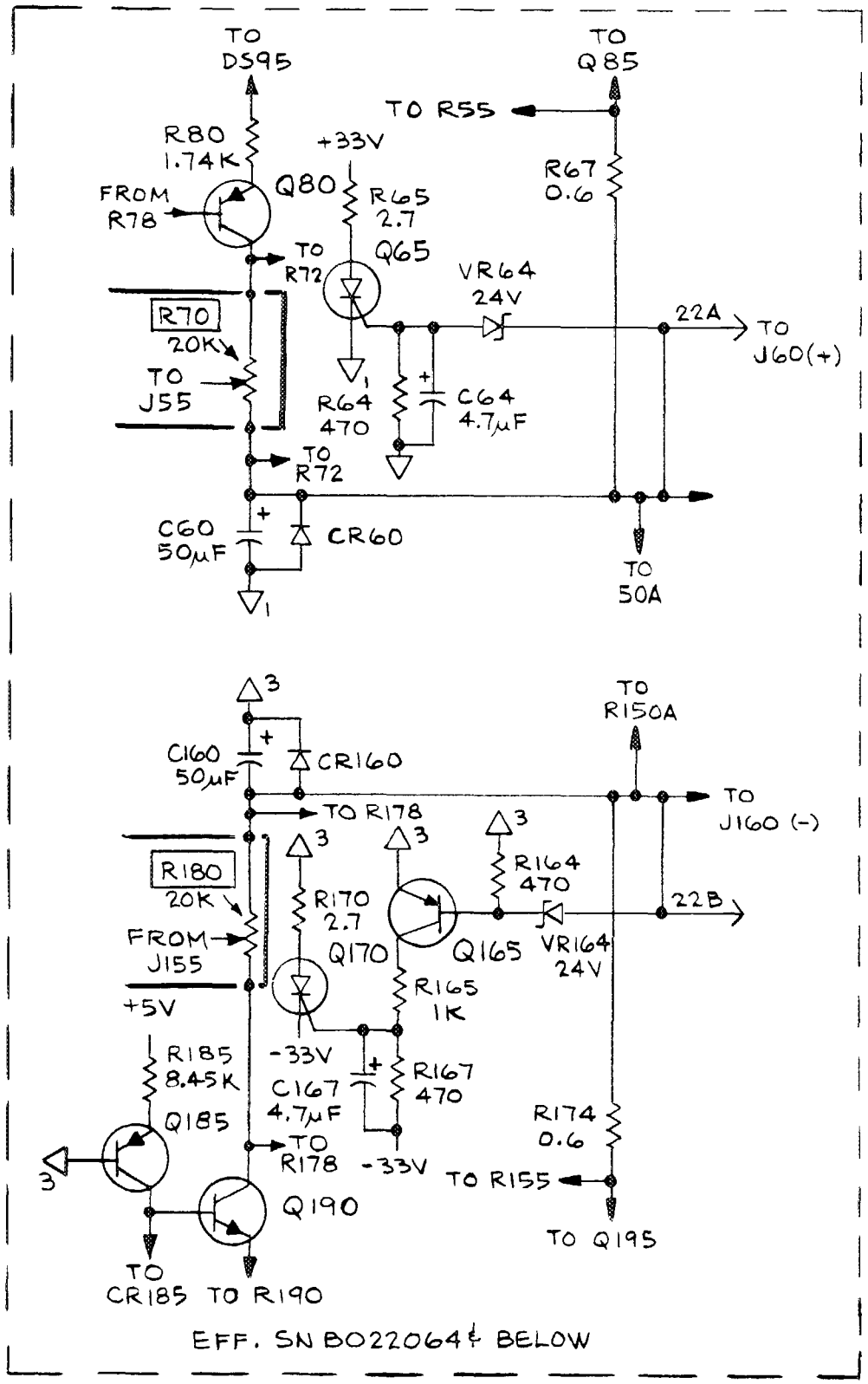


A1 MAIN CIRCUIT BOARD (SN BO22064–below)

CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC
C2	F1	C119	F3	CR48	D3	CR185	E5	Q85	C3	R17	G2	R45	C1	R85	C3	R139	E5	R178	D5	U1	G1	VR30	F1
C3	G1	C120	F4	CR55	I3			Q115	G4	R20	F3	R48	F1	R87	C2	R142	D5	R180	D5	U35	C5	VR64	F2
C10	K2	C138	D6	CR60	K3	F10	H2	Q120	F4	R24	F2	R55	H3	R90	A4	R145	D6	R185	E5	U45	D2	VR117	F5
C19	F4	C160	K4	CR78	E3	F110	H5	Q165	F6	R26	E2	R64	G2	R95	C1	R148	I4	R187	F4	U55	D3	VR120	F4
C20	F3	C167	G5	CR110	H4			Q170	G6	R28	E3	R65	G2	R114	G4	R155	H4	R190	E5	U135	D1	VR164	F5
C34	E1			CR135	D1	Q15	G3	Q185	F5	R29	E3	R67	C3	R115	G3	R164	F5	R192	D5	U145	E5		
C38	E2	CR10	H3	CR145	D5	Q20	F3	Q190	E5	R34	E1	R70	D2	R117	G5	R165	F6	R194	D4	U155	E4		
C60	K3	CR24	F2	CR146	D5	Q25	E2	Q195	C5	R36	B5	R72	D2	R120	F4	R167	G5	R196	B5				
C64	G2	CR35	D6	CR148	D5	Q30	E2			R38	E2	R74	C2	R134	E1	R170	G5			VR17	F2		
C85	D4	CR45	C2	CR155	I3	Q65	G2	R14	G3	R39	E1	R78	E2	R136	E1	R174	D4	S1	H2	VR20	F3		
C110	K5	CR46	D3	CR160	K4	Q80	E3	R15	G3	R42	D1	R80	E3	R138	E6	R176	C2	S95	C2	VR24	E2		

REV B DEC 1979





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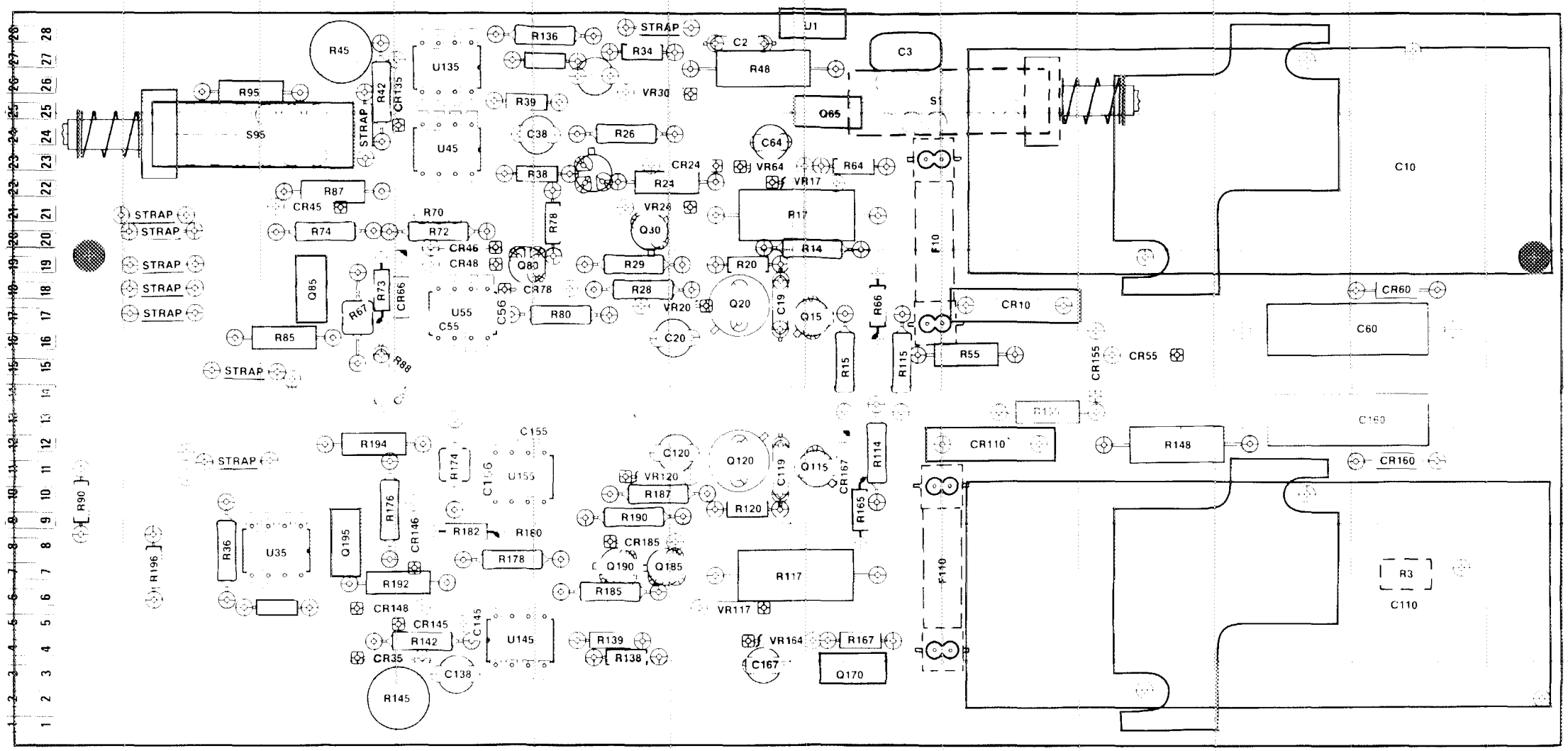
PARTIAL POWER SUPPLY



1834-01B

A1 MAIN CIRCUIT BOARD (SN BO22065–above)

*See Parts List for serial number ranges.

†Located on back of board.

CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC
C2	F1	C119	F4	CR55	I3	CR185	E5	Q115	G4	R24	E2	R45	C1	R85	C3	R138	E5	R182	D5	U1	F1	VR64	F2
C3	G1	C120	E4	CR60	K3			Q120	F4	R26	E2	R55	H3	R87	C2	R139	E5	R185	E5	U35	C5	VR117	F5
C10	K2	C138	D6	CR66	C3	F10	G2	Q170	G6	R28	E3	R64	G2	R88	D3	R142	D5	R187	E4	U45	D2	VR120	E4
C19	F3	C145†	D5	CR78	D3	F110	G5	Q185	E5	R29	E3	R66	G3	R90	A4	R145	C6	R190	E4	U55	D3	VR164	F5
C20	E3	C155†*	E4	CR110	H4			Q190	E5	R34	E1	R67	C3	R95	B1	R148	I4	R192	C5	U135	D1		
C34	E1	C156*	D4	CR135	C1	Q15	F3	Q195	C5	R35	C5	R70	D2	R114	G4	R165	G4	R194	C4	U145	D5		
C38	D2	C160	K4	CR145	D5	Q20	F3	R3	K5	R36	B5	R72	D2	R115	G3	R167	G5	R196	B5	U155	D4		
C55†*	D3	C167	F5	CR146	D5	Q30	E2	R14	F2	R38	D2	R73	C3	R117	F5	R174	D4						
C56*	D3	CR10	H4	CR148	C5	Q65	G1	R15	G3	R39	D1	R74	C2	R120	F4	R176	C4			VR20	E3		
C60	K3	CR24	F2	CR155	I3	Q80	D3	R17	F2	R48	F1	R78	E2	R134	E1	R178	D5	S1	G1	VR30	E1		
C64	F2	CR35	C5	CR160	K4	Q85	C3	R20	F3	R42	C1	R80	E3	R135	C1	R180	D5	S95	B1	VR24	E2		
C85	D4	CR45	C2	CR167	G4									R136	E1								
C110	K5	CR46	D2																				
		CR48	D3																				

REV MAY 1985