Tektronix

TM500 & TM 5000 Series Rear Interface Data Book

070-2088-04

Please check for change information at the rear of this manual.

First Edition: November 1975
Last Revised: November 1985

Scans
By
Artek Media

Artek Media
1042 Plummer Cir. SW
Rochester, MN 55902

www.artekmedia.com

"High resolution scans of obsolete technical manuals"

If your looking for a quality scanned technical manual in PDF format please visit our WEB site at www.artekmedia.com or drop us an email at manuals@artekmedia.com and we will be happy to email you a current list of the manuals we have available.

If you don't see the manual you need on the list drop us a line anyway we may still be able to point you to other sources. If you have an existing manual you would like scanned please write for details, This can often be done very reasonably in consideration for adding your manual to our library.

Typically the scans in our manuals are done as follows;

1) Typed text pages are typically scanned in black and white at 300 dpi.
2) Photo pages are typically scanned in gray scale mode at 600 dpi
3) Schematic diagram pages are typically scanned in black and white at 600 dpi unless the original manual had colored high lighting (as is the case for some 70's vintage Tektronix manuals).

If you purchased this manual from us (typically through our Ebay name of ArtekMedia) thank you very much. If you received this from a well-meaning "friend" for free we would appreciate your treating this much like you would "share ware". By that we mean a donation of at least $5-10 per manual is appreciated in recognition of the time (a manual can take as much as 40 hours to reproduce, book, link etc.), energy and quality of effort that went into preserving this manual. Donations via PayPal go to: manuals@artekmedia.com or can be mailed to us the address above.

Thanks

Dave & Lynn Henderson
Artek Media

Printed in the U.S.A.

Tektronix, Inc., P.O. Box 1000, Wilsonville, OR 97070–1000

TABLE OF CONTENTS

INTRODUCTION

The TEKTRONIX TM 500/TM 5000 line of modular instrumentation offers a new approach to electronic tests and measurements. In the past, monolithic signal sources such as function generators, sine-wave oscillators, pulse generators, ramp generators, and dc power supplies were often interconnected to DMMs, digital counters, and oscilloscopes for accurate electrical set-ups or measurements of frequency, period, pulse width, rise and fall times, ac-dc currents, and voltages. The front-panel interconnections between these monolithic instruments can often become a confusing maze of wires and cables that obscures one's view of displays and interferes with operation of front-panel controls.

In almost all TM 500/TM 5000 plug-in instruments, a duplication of front-panel input and output connections appears on the plug-in's rear connector. Since each plug-in is connected to a common rear-interface board within its mainframe, plug-ins can be interfaced to "talk to" one another by way of inteconnecting wires and cables easily installed by the user (see Fig. 1-1). The number of possible interfacing schemes is only limited by the imagination. For example, the DM 502A DMM rear input terminals can be interconnected to an alongside PS 503A power supply for accurately setting power supply voltages. The DMM is not permanently connected to the power supply because a special INT-EXT front-panel switch can be pressed; thereby returning the DMM to external full-function capability. Another similar example could include interfacing the DC 503A univeral counter-timer's dc trigger level output to the DMM for setting up the counter's channel A and B LEVEL controls. This would allow accurate setting of the counter timer's trigger levels for such measurements as risetime and pulse width. The list can go on and on. However, sooner or later one gets around to asking the questions, "How do I connect these instruments together to form my own instrument package?" This rear interface manual will suggest some ideas on interconnected systems and provide readily-accessible reference data so that you can easily design your own special-purpose test set.

It should be noted that with some plug-in functions, performance specifications will be degraded when using the rear interface.

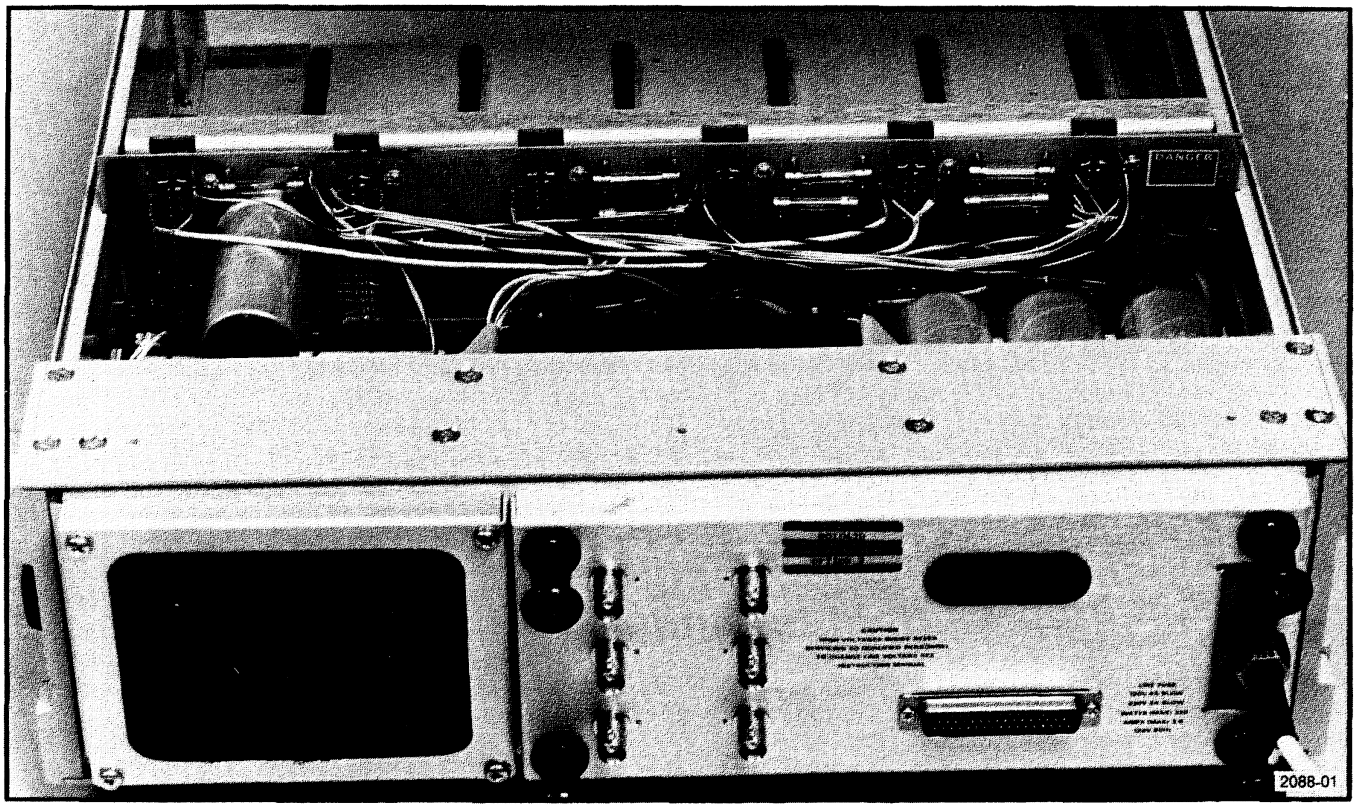


Fig. 1-1. A TM 500 Option 02 mainframe interfaced by the use of special square pin connectors and cables.

REFERENCE INFORMATION

INTERFACE CONNECTIONS

The plug-in rear interconnections are made at the rear of the power mainframes module interace circuit board[1] (see Fig. 2-1). On this board are mounted double edge 28 pin connectors for accepting plug-in modules.

Each 28-pin connector is numbered starting with number 1 near the mainframe bottom and ending with number 28 near the top. However, only contact numbers starting with 14 through 28 are used for signal line data interfacing. Pins 1 through 13 are used for connections from mainframe power to the instruments. In the MODULE DATA section, a rear view of only signal line contacts 14 through 28 is given for user applications. Since each plug-in connector has a double row of contacts, the left column (as viewed from the rear of the mainframe or instrument) is designated as B and the right column as A. The actual interface connection techniques are described in the remaining portions of this section.

INTERFACE COMPATIBILITY

An important feature of the TM 500/TM 5000 Series is the ability to interconnect instruments in a mainframe to each other, or to external equipment, via the "rear interface". Physically, the rear interface consists of (1) the upper 30-edge-card connections at each plug-in compartment, (2) optional connectors on the mainframe rear panel, and (3) any wiring or cabling used to make connections from plug-in to plug-in, or from plug-in to rear connector, and hence to external equipment.

The wiring or cabling portion of most TM 500/TM 5000 interconnecting systems is customer installed. A large number of unique interconnections is possible. Because of the variety of instruments in the TM 500/TM 5000 family, it was decided to make the interface a custom system with no factor-installed bus lines or truly "standard" pin assignments. However, instruments are grouped into families with similar I/O characteristics and an optional keying system that permits physical lockout of plug-ins from other families. Use of the optional keying system (with barrier keys) minimizes the possiblity of introducing the wrong plug-in into a mainframe compartment when the mainframe has been wired for specialized rear interface connections. However, the assignment of family keys does not mean that a system will be fully functional when plug-ins are installed, only that nothing destructive to hardware (internal or external) will occur if the wrong plug-in is installed. In other words, the main compatibility rules are:

1. Instruments having dissimilar input/output characteristics are grouped into different families. If the rear interface is wired to configure a system, it is possible that installing a plug-in of the wrong family may destroy hardware. Install family barrier keys in the mainframe to avoid possible damage to equipment.

2. Although family members have similar input/output characteristics, their basic functions may differ drastically. Only a keying system with a unique key or combination for every individual instrument type would ensure system operation. Therefore, it is only required that family members are neither conducive nor susceptible to hardware failure (destructive) if plugged into a compartment wired for a different member of the same family.

[1]**The TM 515 rear interconnections are made at the front of the interface circuit board.**

FAMILY BARRIER KEYS

A barrier key is a special plastic part designed to be inserted between contact pins located in the power module circuit board edge connector (see Fig. 2-1). Its function is to prevent possible damage to plug-in modules that are electrically incompatible. Incompatability can arise as the result of inserting plug-in modlues into a mainframe that has been TM 5000 plug-ins cannot be used in TM 500 mainframes. They are mechanically prewired for a different set of TM 500/TM 5000 instruments. TM 5000 plug-ins cannot be used in TM 500 power modules. They are mechanically incompatible. Compatible plug-in modules are classified into family categories. The categories and barrier key assignments are listed in with the data for each instrument.

If you require extra barrier keys, order Tektronix Part 214-1593-02 from your local Tektronix Field Office or representative.

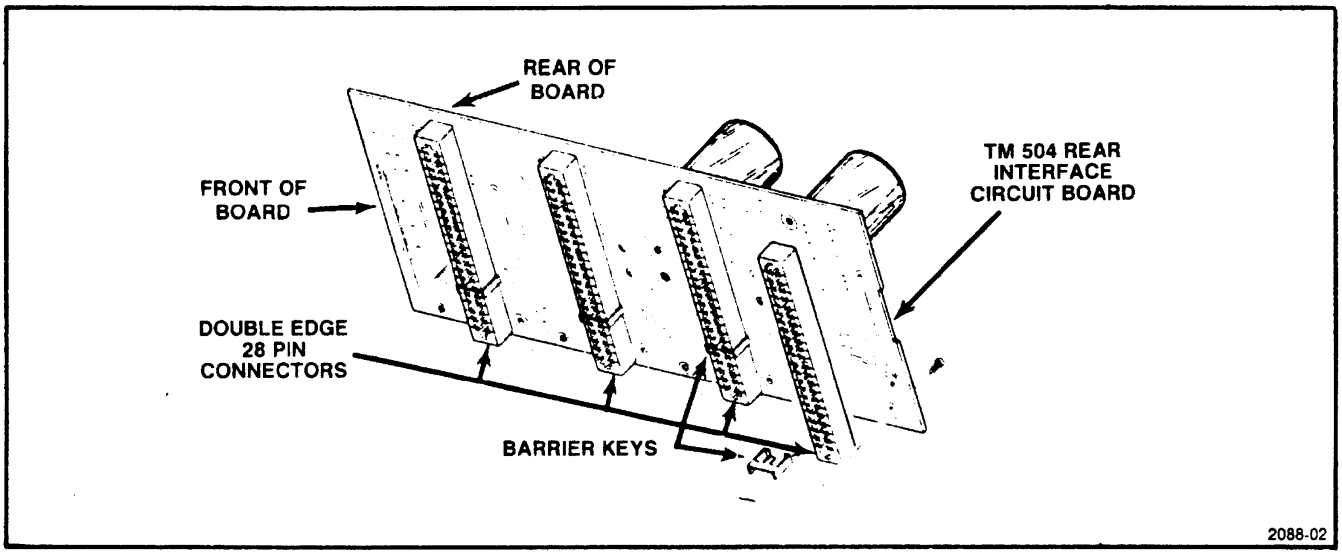


Fig. 2-1. Barrier Keys.

INTERFACING

THE STANDARD MAINFRAME

The standard mainframe purchased without any options comes without square pin connectors. Any interfacing between plug-in compartments can be accomplished by hand soldering interconnecting wires or coaxial cables between pin locations at the rear (front in the TM 515 Traveler mainframe) of the mainframe rear interface circuit board (see Fig. 2-2). A good quality insulated wire varying in sizes according to current-carrying capabilities can be used for low-frequency or dc circuits. Minature 50 Ω coaxial cables should be used in high-frequency signal environments to eliminate potential crosstalk problems.

SPECIAL NOTES ON ORDERING COAXIAL CABLES

- Small 50 Ω coaxial cable by the foot.

  If you require a quantity of small diameter 50 Ω coaxial cable, order Tektronix part number 175-1020-00 by the foot.

- Small 50 Ω coaxial cable with pre-installed special Peltola connectors on each end.

  Some plug-in instruments do not have all inputs or outputs factory-wired to the rear and require special internal connections prior to rear interface use. In special cases of this nature, the required information can be found in the section pertaining to the plug-in of interest. If you require small diameter 50 Ω coaxial cable with special Peltola connectors on each end, measure and order the optimum length from the list of cables in Table 2-1.

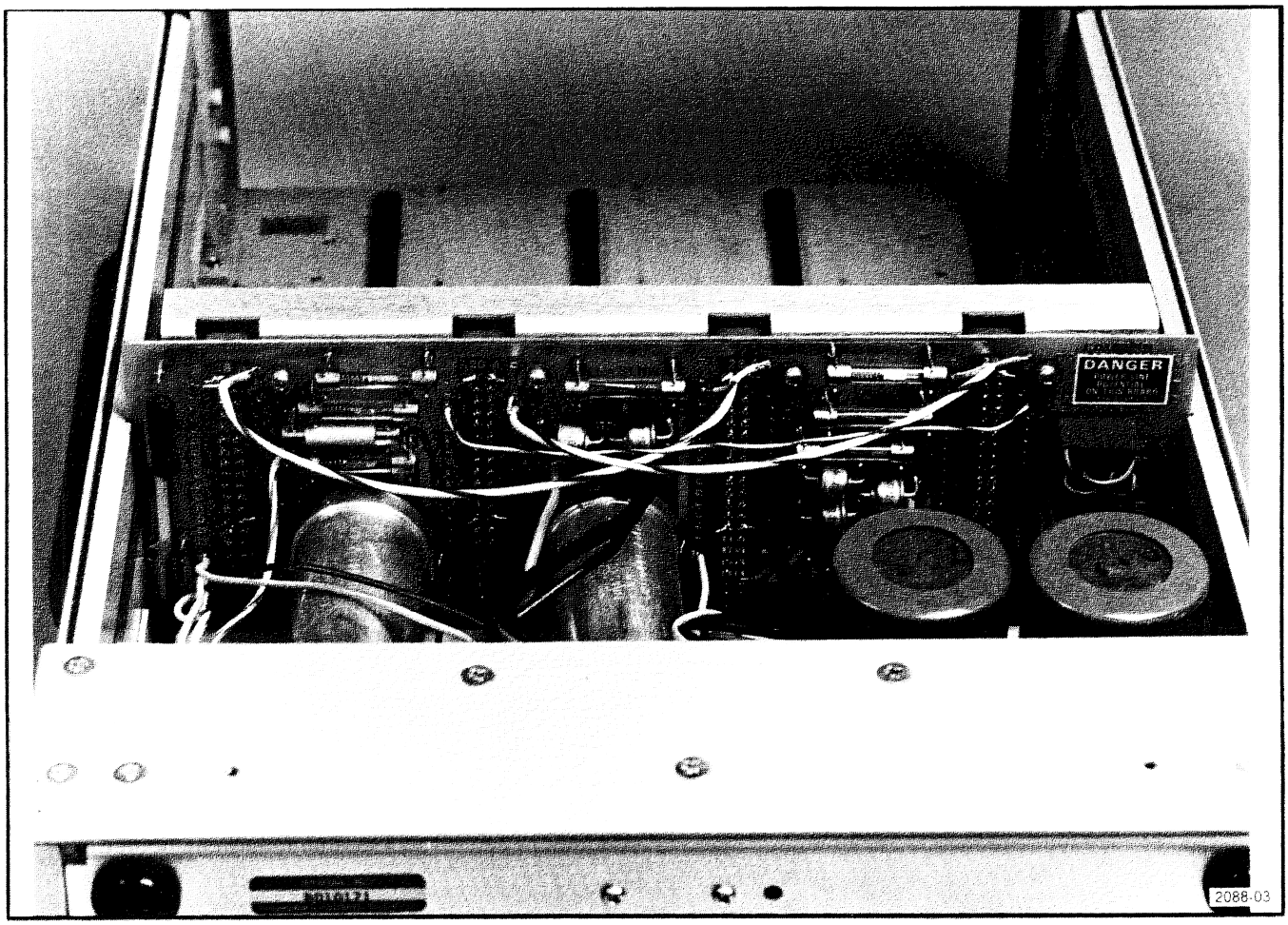


Fig. 2-2. Standard Mainframe soldered interconnections.

Table 2-1

50 Ω COAXIAL CABLES WITH PELTOLA CONNECTORS ON EACH END

Length	Tektronix Part No.
6 inches	175-1824-00
8 inches	175-1825-00
10 inches	175-1826-00
12 inches	175-1827-00
14 inches	175-1828-00
16 inches	175-1829-00
18 inches	175-1830-00

THE OPTION 02 MAINFRAMES

IMPORTANT NOTE

If you intend to interconnect your mainframe as a dedicated system, the standard mainframe may be purchased as a cost-saving measure. However, if you plan to make numerous rear interconnections throughout the mainframe life, you should give serious consideration to purchasing an Option 02 mainframe with pre-installed square-pin connectors. These connectors offer a way to eliminate hand soldering to circuit board runs, thereby extending your instrument life and investment.

The Option 02 mainframes can be purchased in all the standard series except for the TM 515.[1] The Option 02 mainframes are supplied with a rear-panel, male connector, mating cable connector, one bnc connector per plug-in compartment, square pin connectors on the rear interface circuit board, and a special wire kit consisting of standard wires and coazial cables with mating square-pin receptacles. The actual quantity and length of wires and coaxial cables depend on the number of mainframe compartments. The square-pin connectors are intended to provide a way to make numerous interconnections throughout the mainframe life without causing circuit board camage resulting from numerous hand-soldered connections to the interfacxe circuit board (see Fig. 2-3). The remaining components offer several interface alternatives, one of which may be more desireable than another depending upon your actual application.

[1]**The TM 515 Traveler mainframe, Option 05, provides square pins at the interface board and a wire kit for easy internal interconnections. Unlike Option 02 on the other mainframes, however, the TM 515 has no provision for bnc or a 50-pin connector at the rear.**

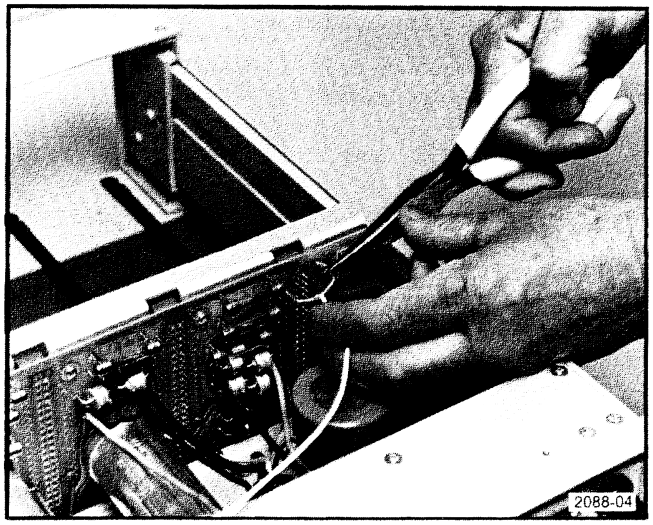


Fig. 2-3. Option 02 Mainframe Interconnections.

EXTERNAL INTERFACING

The rear-panel BNC connectors and the multi-pin connector on the Option 02 mainframes (shown in Fig. 2-4) provide the means of interfacing with equipment external to the TM 500/TM 5000 system. These connectors are not factory-wired, in order to give the system designer as much flexibility as possible. Hence, there are no pin assignments for the rear-panel connectors.

QUICK CHANGE INTERFACING

In cases where the interfacing within the mainframe must be changed frequently, the multi-in connector can also be used to provide a means of quick-change interfacing. To do this, instead of connecting the rear-interface wiring from one plug-in compartment to another, the user would connect all of the rear-interface functions that he expects to use directly to individual pins on the multi-in connector. Then, he would wire up a number of female connectors with jumper wires to provide the connections between plug-ins that he desires. One female connector would be wired up for each system configuration desired. Changing configurations would then be as simple as removing one pre-wired connector and connecting another. Fig. 2-5 shows such a pre-wired female connector in place on the rear of a TM 503 Option 02.

Connections to the multi-pin connector on the mainframe may be easier if the connector is removed from the rear panel, as shown in Fig. 2-6., and remounted after the connections have been made.

One female connector and cover is provided with each Option 02 mainframe. Where additional units are needed, the Tektronix part numbers for the connector and cover are 131-1345-00 and 131-1319-00, respectively (131-0569-00 and 200-0821-00 for the TM 5003).

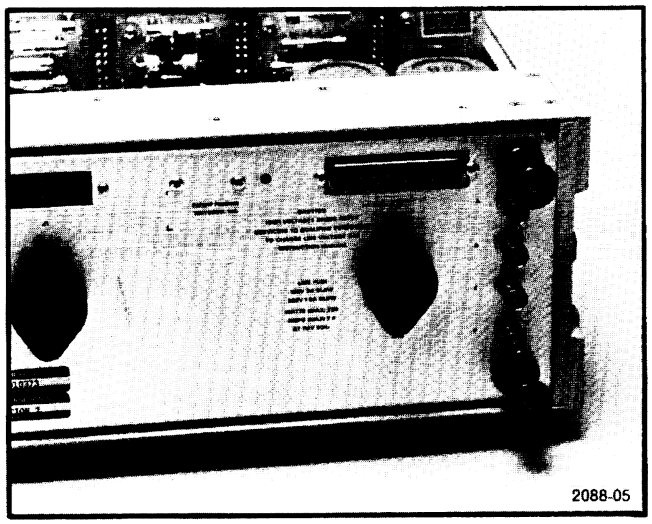


Fig. 2-4. Rear view of TM 504, Option 02.

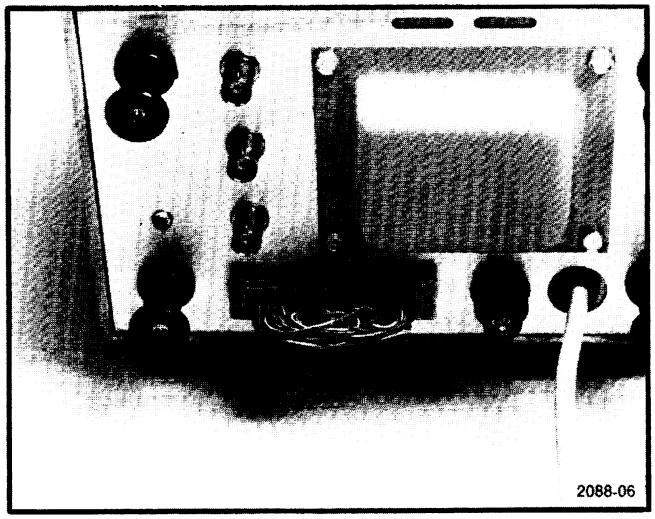


Fig. 2-5. Quick change interfacing connector on TM 503, Option 02.

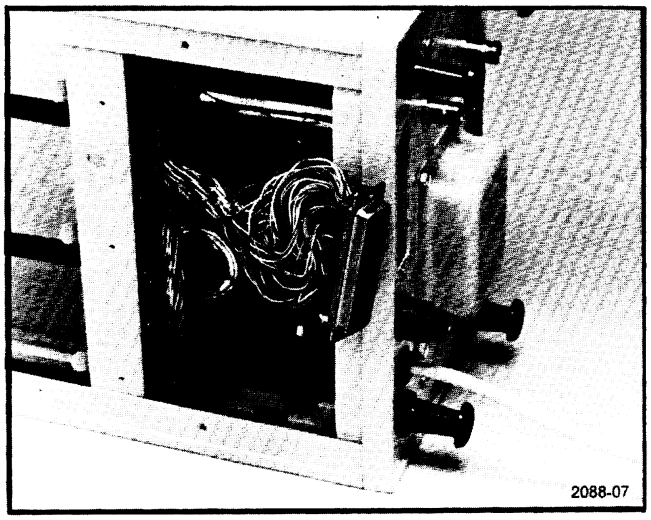


Fig. 2-6. Wiring to multi-pin connector of TM 503, Option 02.

CAUTION

In the event your mainframe is sent to a Tektronix Service Center for service, please notify the service center that the mainframe has been interfaced. This will save money and expedite the return of your instrument. It is advisable to return both power module and plug-in(s) to the service center.

THE OPTION 07 MAINFRAMES (TM 500 ONLY)

The bus wires and barrier keys described below are added to the rear interface connector boards in the following TM 500-Series power modules in order to provide rear interface connections between the DC 508/DC 508A Option 07 Counter (or other Option 07 counters), TR 502 Tracking Generator, and SW 503 Sweep Generator.

Bus Wires

Six-conductor ribbon cable (Tektronix Part Number 175-0829-00) is used to make bus runs between the following points.

TM 503, TM 504, TM 506, TM 515

B14 on J10, J20, and J30
B15 on J10, J20, and J30
B16 on J10, J20, and J30
B17 on J10, J20, and J30
B18 on J10, J20, and J30
A18 on J10, J20, and J30

J10, J20, and J30 are plug-in connectors. See Power Module instruction Manual.

Plastic barrier keys (Tektronix Part Number 214-1593-02) are inserted between pins 21 and 22 on J10 (Counter slot), between pins 23 and 24 on J20 (Sweep Generator slot), and pins 17 and 18 on J30 (Tracking Generator slot).

Once the bus connections are made and barrier keys inserted, the three connectors so changed are system dedicated and the three slots should be used only for system-dedicated plug-in modules.

REAR INTERFACE POWER CONNECTIONS

Pins 1A and 1B through 13A and 13B are common to the rear connectors of all TM 500/TM 5000 instruments. The pin assignments are shown in Fig. 2-7. Not all connections are used by an individual instrument, but the capability is there (see Fig. 2-7). These pins are not shown on the individual rear connectors pictured with each instrument, only the pins from 14A and 14B through 28A and 28B.

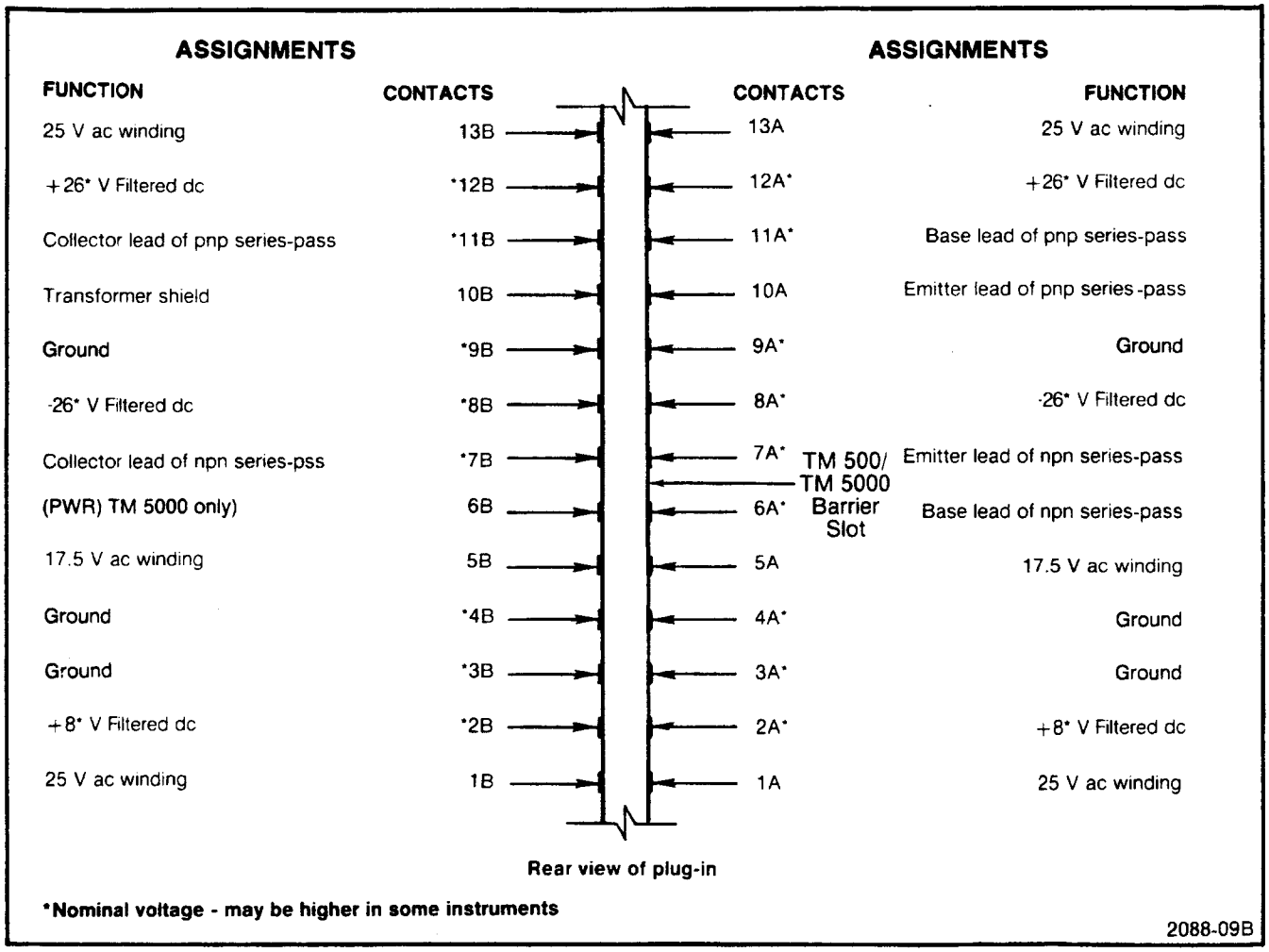


Fig. 2-7. Rear Interface power connections.

TM 500 DOUBLE-WIDE AND SINGLE-WIDE BLANK PLUG-IN KITS

Both blank plug-in kits illustrated in Fig. 3-1 are intended for users who require a way to design their own plug-in in order to complete a working instrumentation system. For the single-wide blank plug-in kit, order Tektronix Part No. 040-0652-02. For the double-wide blank plug-in kit, order Tektronix Part No. 040-0754-05. All basic plug-in parts are funished as shown in Fig. 3-1 along with a set of instructions detailing maximum available power to each plug-in as a load. An additional power supply design booklet "A3186" can be ordered separately from your Tektronix field office or representative.

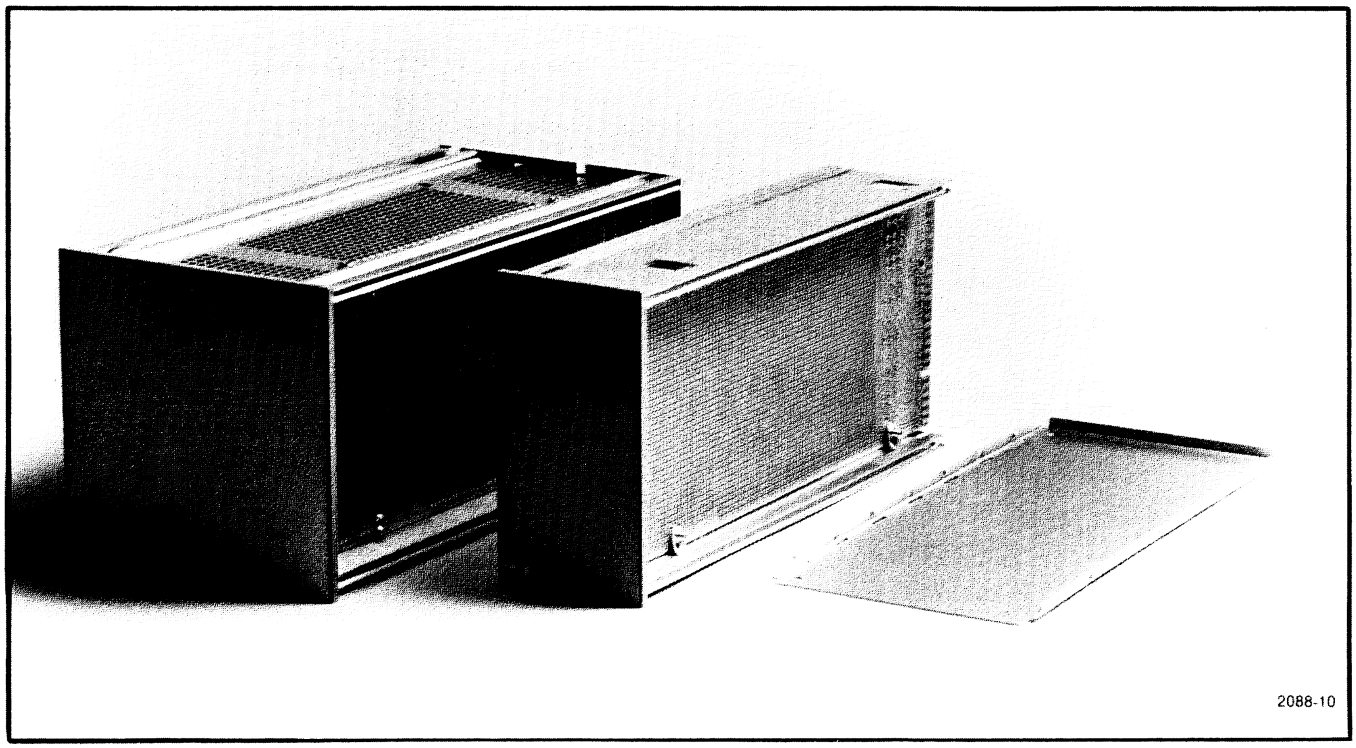


Fig. 3-1. Blank Plug-in kits.

NOTES

APPLICATION EXAMPLES

The following are examples of applications of the rear-interfacing capability provided by the modular design of TM 500/TM 5000. Details of the specific rear-interface functions available with each TM 500/TM 5000 plug-in are given in the following sections of this manual.

DMM READOUT OF COUNTER TRIGGER LEVELS

Any TM 500 DMM can be used to read out the A and B trigger "level out" of the DC 503A Universal Counter. The benefit of this interfacing feature is improved accuracy in making width B and time interval A → B measurements.

This feature uses a DMM and the DC 503A gate lamp to measure the +E peak and the -E peak levels of the pulse train to be counted. The peak-to-peak measurement is then used to determine the correct setting of the level countrols for the measurement of interest.

The actual connections between the DMM and the DC 503A are made as illustrated below:

DMM				DC 503A
28B	←	signal	→	22A
28A	←	ground	→	17A

NETWORK ATTENUATION OR GAIN MEASUREMENT

The dBm or dBV measurement capability of the DM 502A can be used to measure the attenuation or gain of a network under test when driven by an SG 502 Audio Generator. Audio network analysis can be performed on networks such as filters and amplifiers.

Upon completion of interface connections (see below), operation consists of pressing the DM 502A INT button to read network input level. Press back to EXT for network output level. The network gain or loss in dB is obtained by subtracting the input level from the output level.

The actual connections between instruments to be interfaced follow:

SG 502	NETWORK	DM 502A
28A (SIG OUT)	–	28B (HI)
27A (SIG GND)	–	28A (LO)
FRONT PANEL	INPUT (SIG)	–
BNC OUT	INPUT (GND)	–
–	OUTPUT (SIG)	FRONT PANEL (HI)
–	OUTPUT (GND)	FRONT PANEL (LO)

CONTROL AND REGULATION OF PS 503A VOLTAGES

The plus and minus 20 volt supplies of the PS 503A can be remotely controlled by either voltage or resistance through the rear interface. One or both supplies can then be independently and remotely swept between 0 and 20 volts. In addition, regulation of the plus and minus 20 volt supplies can be improved by remote sense connections at the rear of the PS 503A.

GENERATING COMPLEX WAVEFORMS WITH TM 500 INSTRUMENTS

The generation of a variety of differently-shaped signals can be produced by an RG 501 Ramp Generator, two PG 505 Pluse Generators, and an AM 501 Operational Amplifier. An alongside TM 500 Oscilloscope such as the SC 501 or SC 502 can be used with this system to provide a means of determining signal periods, durations, rise and fall times, and delay times as well as peak-to-peak signal amplitudes. For complete detials on the Waveform Generation System, ask your Tektronix salesperson.

INTEGRATION THROUGH V TO F CONVERSION

Measurement transducers are often used to produce a voltage that is proportional to the rate of flow of something like a gas, a liquid, or electrical energy. But, frequently it is more important to know the total number of units that have been measured by the transducer during some time interval like a second or a day, than it is to know the rate at any particular point in time. There particular TM 500 instruments

can be configured together to provide this voltage to frequency conversion. The transducer output is first processed by a signal conditioning AM 501 or AM 502 Operational Amplifier. The resulting output is applied to produce an analog-to-frequency conversion in a function generator such as an FG 501 or FG 502. The output frequency is displayed on an alongside digital counter. For more complete information on this application, ask your Tektronix salesperson for application note No. 75M 2.0.

FUNCTION GENERATOR SWEPT FREQUENCY AND TWO-TONE APPLICATIONS

Although this application was written specifically for the FG 501, the underlying principles apply equally well to the other function generators such as the FG 502 and FG 503. A function generator can be made to change its output frequency as determinded by the instantaneous applied voltage appearing at the VCF input bnc connector. For example, a voltage ramp applied to the VCF input will provide a linear change in output frequency. A square-wave voltage will provide two output tones, the output frequency of which is determinded by the specific levels of the top and bottom portions of the square wave. For example, the two-tone output capability could be used for FSK applications where the FG 501 dial setting is the mark frequency and the positive aplitude is the space frequency. For more complete information on this application, ask your Tektronix salesperson for the application note entitled "FG 501 Swept Frequency Applications."

POWER SUPPLIES DRIVEN BY SIGNAL SOURCES

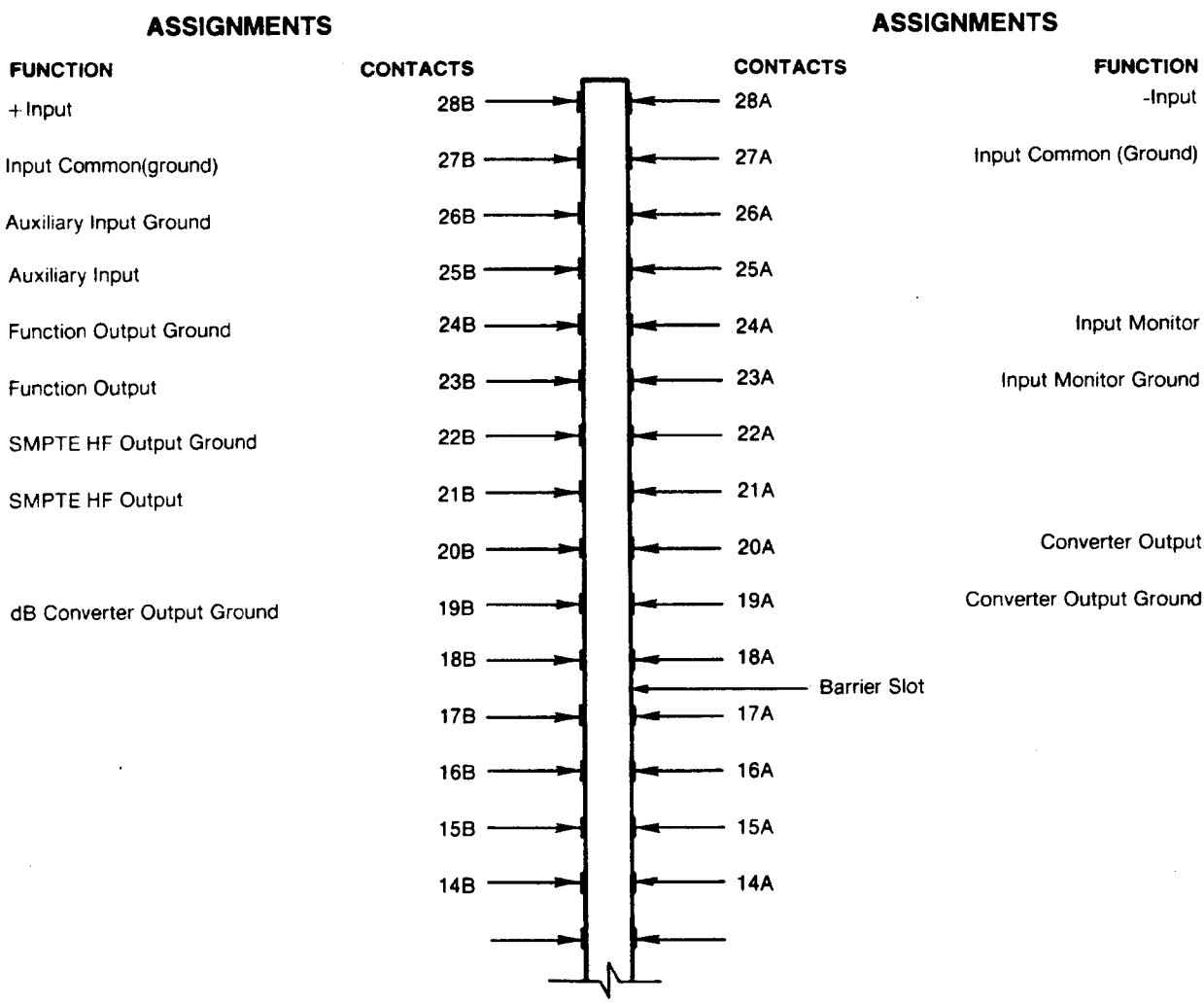
Any of the analog programmable power supplies such as PS 501, PS 503, or PS 503A plug-ins can be driven by an adjacent signal or function generator to provide a low source impedance suitable for delivering higher currents into a low impedance load. Some load examples would include drive relays, lamps, small motors, loudspeakers, etc. The power supply will follow the signal sources output frequency and risetime up to its slew rate limitations.

MICROVOLTMETER

The AM 502 and DM 501 can provide ac and dc microvolt measurements. When the AM 501 is set for a gain of 1000 (dc-coupled) and its rear interface SIGNAL OUT (28A) and SIGNAL OUT GROUND (27A) are connected to the DM 501A's rear HI INPUT (28B) and LO INPUT (28A), respectively, the DM 501A will provide a 2 mV dc or ac full scale digital display on the 2-volt ranges. This measurement application can be used in setting up low audio signal output levels from an adjacent audio signal source such as the SG 502, or SG 505.

SIGNAL PROCESSORS

NOTES



CAUTION

When a Power Module compartment has been selected for the AA 501 and wired for a specialized interface system, a plastic barrier (Tektronix Part Number 214–1593–02) should be installed in a key slot between contacts 17 and 18 on the Power Module.

Do not insert any TM 500 Series plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

2088-11A

Fig. AA 501-1. Rear interface connector assignments.

INTERFACE NOTES

Introduction

Slots exist between pins 17 and 18, and 6 and 7 on the rear interface connector. The slot between pins 6 and 7 identifies the AA 501 as a member of the TM 500 family. Insert a barrier between contact 21 and contact 22 of the power module jack to prevent noncompatible plug-ins from being inserted in slots wired for the AA 501. Consult the power module manual for further information. Signal inputs, outputs, or other specialized connections may be made to the rear interface connectors as shown in the input/output assignments illustration. A description of these connections follows.

+ and − Input Connectors (Contacts 28B and 28A)

These terminals are connected to the input of the AA 501 when the REAR INTFC INPUT button on the front panel is pressed. The front-panel INPUT connectors are disconnected in this mode. The characteristics of these terminals are identical with the front-panel INPUT connectors except the maximum input voltage is limited to 42 V peak or 30 V rms. Due to the possibility of crosstalk at the rear interface, noise and distortion performance may be degraded.

Input Common (Contacts 27B and 27A)

These are the common (ground) connections for the rear interface input.

Auxiliary Input (Contact 25B)

This terminal is connected in parallel with the front-panel AUXILIARY INPUT connector. Maximum input voltage is 15 V peak and limited to 6 V peak for linear operation.

Auxiliary Input Ground (Contact 26B)

Use this connection as a ground return for the auxiliary input.

Function Output (Contact 23B)

This connector is in parallel with the front-panel FUNCTION OUTPUT connector.

Function Output Ground (Contact 24B)

Use this connector for the return circuit for the function output.

Input Monitor (Contact 24A)

This terminal is in parallel with the front-panel INPUT MONITOR connector.

Input Monitor Ground (Contact 23A)

Use this connector as the return circuit for the INPUT MONITOR.

SMPTE HF Output (Contact 21B)

The high-frequency component of a SMPTE test signal is provided at this jack. This signal can be monitored on a spectrum analyzer or oscilloscope. The range is typically from 0.5 V to 3 V. The amplitude varies with the input signal level and the low to high frequency amplitude ratio. The output impedance is 2 kΩ.

SMPTE HF Output Ground (Contact 22B)

Use this connector as the ground return for the SMPTE HF output.

Converter Output (Contact 20A)

This connector provides a dc output from the ac to dc converter. This level correponds to the average or rms output as selected on the front panel. The output level is 1 V, ±5% for a 1000 count display. The source resistance is 500 Ω, ±5%.

Converter Output Ground (Contact 19A)

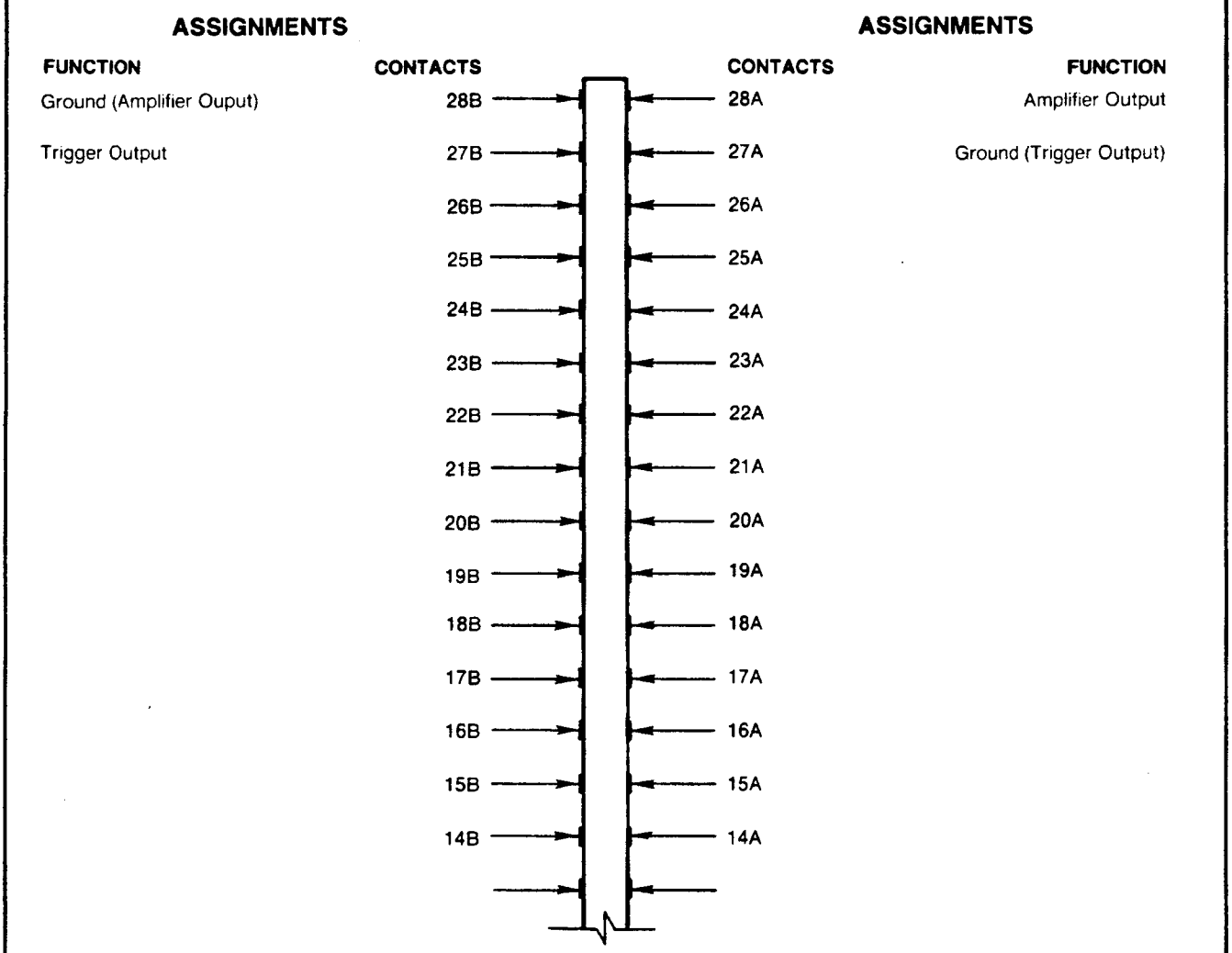
Use this connector as the ground return for the converter output.

dB Converter Output (Contact 19B)

This connector provides a dc output from the logarithmic dB converter. The output voltage is 10 mV, ±5% for each 1 dB on the display. The source resistance is 1 kΩ, ±5%. Changes in input level range or distortion range will cause brief ac transients.

dB Converter Output Ground (Contact 20B)

Use this connector as the ground return for the dB converter output.



CAUTION

When a Power Module compartment has been selected for the AF 501 and wired for a specialized interface system, a plastic barrier (Tektronix Part Number 214-1593-02) should be installed in a key slot between contacts 23 and 24 on the Power Module.

Do not insert any TM 500 Series plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

2088-12A

Fig. AF 501-1. Connector rear view.

INTERFACE NOTES

Amplifier Output (Contact 28A)

Contact 28A is placed in parallel with the front-panel OUTPUT connector when switch S210 (internal Output) is set to Int position. The specifications for contact 28A are the same as those stated for the front-panel connector.

Trigger Output (Contact 27B)

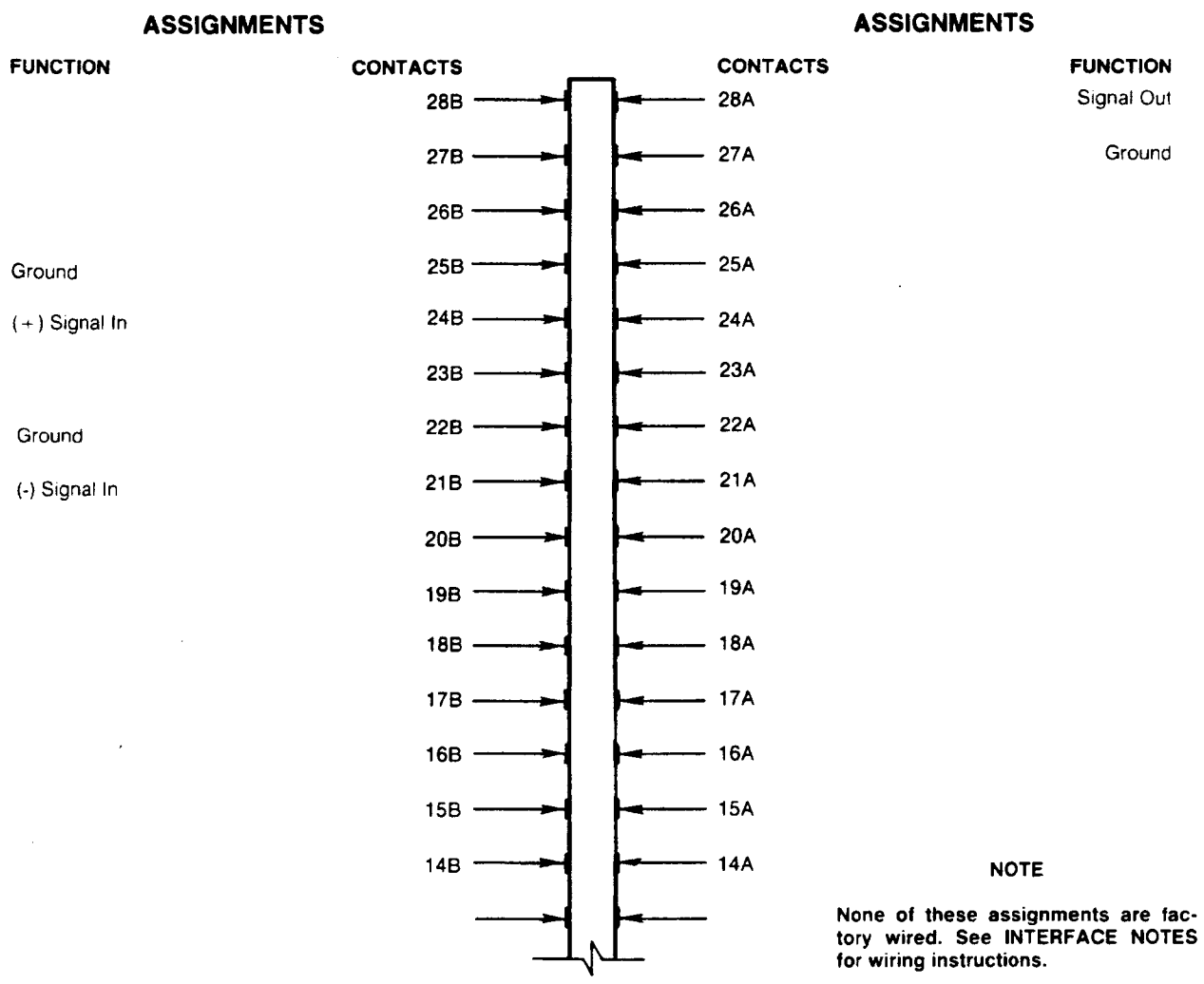
Contact 27B is placed in parallel with the front-panel TRIG OUT connector when switch S310 (internal Trig Out) is set to Int position. The specifications for contact 27B are the same as those stated for the front-panel connector.

Ground (Trigger Output and Amplifier Output) (Contacts 27A and 28B)

Contacts 27A and 28B are both switched to chassis ground. Contact 27A is switched to ground at the same time the Trigger Output is switched to the rear interface by S310, while contact 28B is switched to ground at the same time the Amplifier Output is switched to the rear interface by S210.

Approximate net instrument weight, 1.8 lb.

Maximum power requirement at 120 V, 2 watts.



CAUTION

When a Power Module compartment has been selected for the AM 501 and wired for a specialized interface system, a plastic barrier (Tektronix Part Number 214–1593–02) should be installed in a key slot between contacts 23 and 24 on the Power Module.

Do not insert any TM 500 Series plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

Fig. AM 501-1. Connector rear view.

INTERFACE NOTES

Introduction

None of the rear pin connectors (except power supply connections) are factory wired. Instead, contacts 21A through 28A and 21B through 28B have their own solder pads (holes) to allow the user to hard wire his own input and output connections to the rear interface. The pin assignments listed are suggested in order to ensure compatibility with other TM 500-Series instruments.

Signal Out (Contact 28A) and Ground (Contact 27A)

Contact 28A at the rear connector should be thought of as an output terminal for signals obtained from a specific point in a simple or complex operational amplifier feedback circuit. A specific output terminal is not always the same point that is connected to one of the front-panel output connectors. To connect contact 28A to the specific output terminal, solder #22 or #26 wire (of the proper length) from the solder pad for contact 28A to the desired point in the operational amplifier circuit. This point may be located on the circuit board or at one of the front-panel output connectors, depending on your circuit requirements. If necessary, you can disconnect an undesirable front-panel output connection.

Using #22 or #26 wire, solder the proper length from the solder pad for contact 27A to the large foil area marked GND on the "A" side of the Main circuit board. In some types of operational amplifier circuitry, it may not be desirable to connect contact 27A to GND (chassis); in those cases, contact 27A would be a "floating" connection and the design of external circuitry connected to the rear interface must take this fact under consideration.

Making Signal Input and Ground Connections

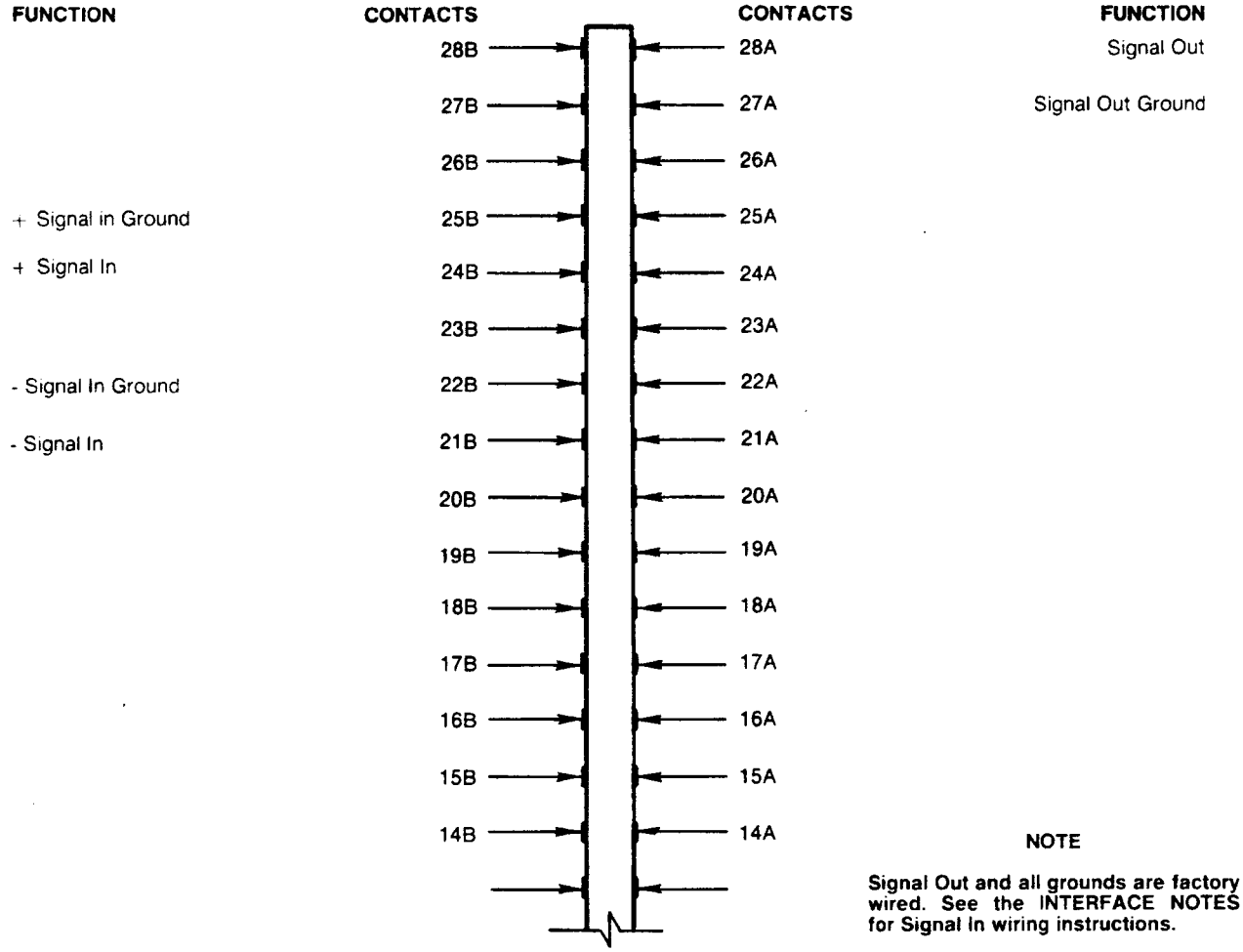
Use #22 or #26 wire to hard wire the − Signal In (inverting input) from the solder pad (hole) for 21B to the input of your circuit. Hard wire contact 22B to the large foil area labeled GND on the "A" side of the Main circuit board. Perform the same operations for the + Signal In (non-inverting input) from contact 24B to the input of your circuit and hard wire the GND connections for contact 25B in the same manner as stated for contact 22B. High-frequency signals may require the use of miniature coaxial cable instead of standard gauge wire.

NOTE

If more than a foot or two of coaxial cable is connected to the rear interface output contact (contact 28A), an isolation resistor equal in value to the coaxial cable impedance should be inserted in series with the center conductor of cable. The purpose of the series resistor is to reduce ringing effects due to loading factors.

Approximate net instrument weight, 1.8 lbs.

Maximum power requirement at 120 V, 11.0 watts.



CAUTION

When a Power Module compartment has been selected for the FG 504 and wired for a specialized interface system, a plastic barrier (Tektronix Part Number 214–1593–02) should be installed in the key slot between contacts 23 and 24 on the Power Module.

Do not insert any TM 500 Series Plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

2088-14

Fig. AM 502-1. Connector rear view.

INTERFACE NOTES

Signal Out (Contact 28A) and Signal Out Ground (Contact 27A)

Contacts 28A and 27A are factory-wired to rear interface contacts. Contact 27A is chassis ground. It is not necessary to disconnect the Signal Out from the front-panel bnc connector to use the output signal on contact 28A.

Signal Input Connections (Contacts 24B, 21B, 25B, and 22B)

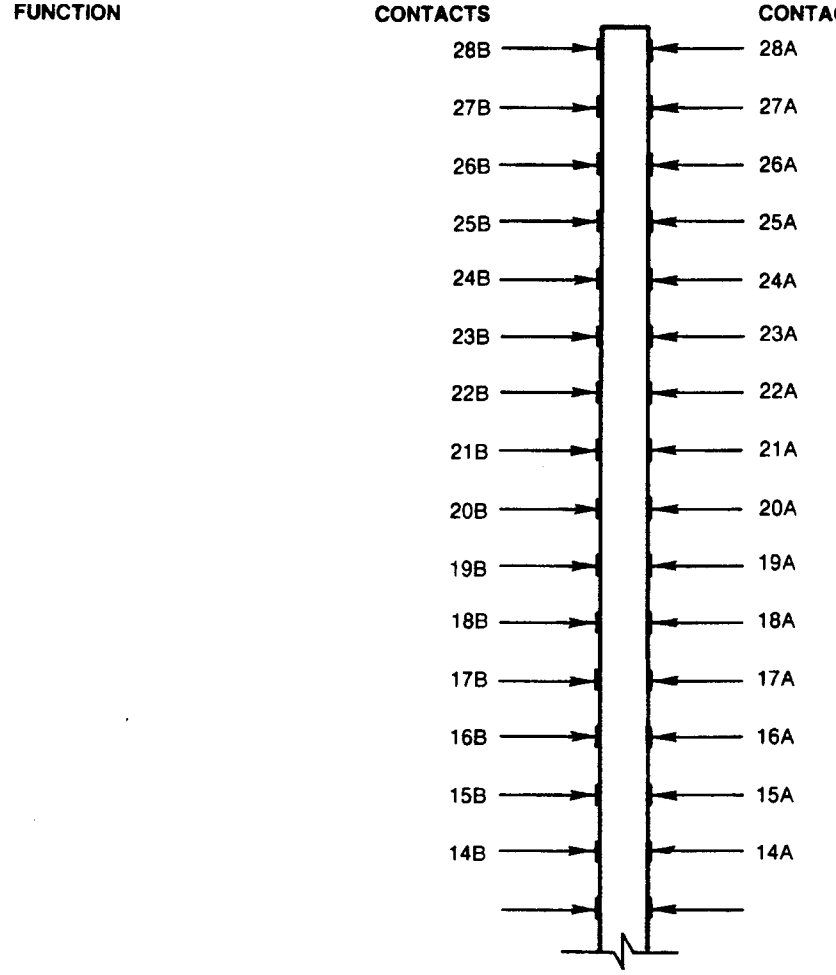
These input connections must be user wired. Use the center conductor of a miniature 50 Ω coaxial cable (about 11 inches long) to hard wire (solder) the + Signal In (contact 24B) and the – Signal In (contact 21B) from the associated solder pads at the rear connector pins to the appropriate + and – front-panel bnc connectors. Solder the associated coaxial cable shields (braids) to the associated solder pads for the chassis ground connections (contact 25B for + Signal In and contact 22B for – Signal In).

NOTE

The addition of coaxial cable connections to the front-panel bnc connector increases the input capacitance.

Approximate net instrument weight, 1.8 lbs.

Maximum power requirement at 120 V, 9.5 watts.



CAUTION

When a Power Module compartment has been selected for the AM 503 and wired for a specialized interface system, a plastic barrier (Tektronix Part Number 214–1593–02) should be installed in a key slot between contacts 23 and 24 on the Power Module.

Do not insert any TM 500 Series plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

2088-15

Fig. AM 503-1. Connector rear view.

INTERFACE NOTES

Signal Output (Contact 28A) and Ground (Contact 27A)

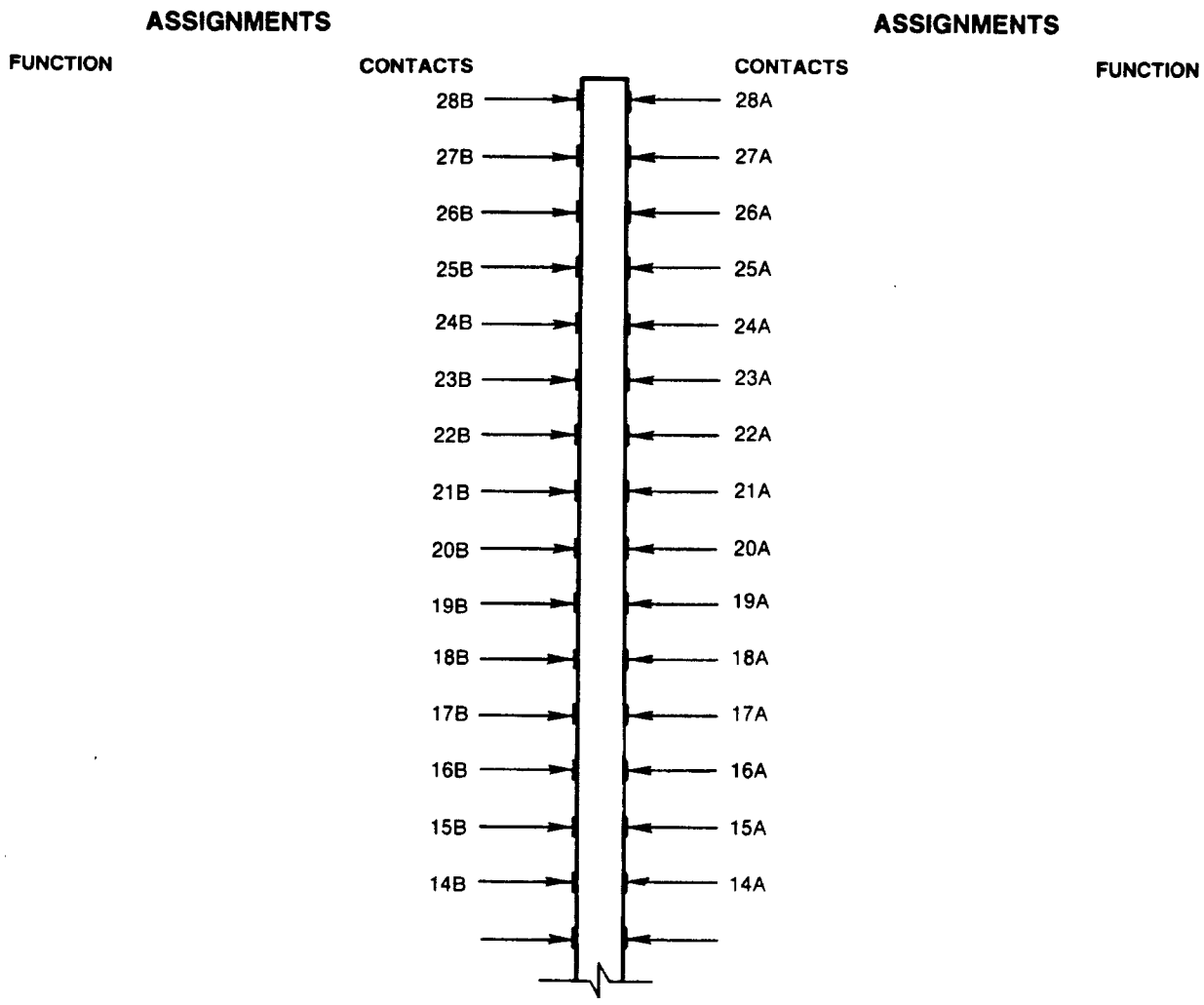
Contacts 28A and 27A are the only pins that are factory wired to the rear interface. To provide the output signal on 28A, it is necessary to disconnect the coaxial lead from the rear of the front panel bnc connector (OUTPUT INTO 50 Ω) and insert it into the coaxial connector, J480. J480 is located close to rear interface contact 28A. No other input/output assignments are allocated for the AM 503 at this time.

Impedance Matching

The output from the AM 503 requires a 50 Ω load. R480 (49.9 Ω) provides this load at the rear interface when the signal output from 28A is connected to a device with an input resistance of 600 Ω, or greater. If the device has an input impedance of 50 Ω, disconnect R480. R480 is located next to J480 (see instruction manual).

Approximate net instrument weight, 2.0 lbs.

Maximum power requirement at 120 V, 17.0 watts.



CAUTION

When a Power Module compartment has been selected for the AM 511 and wired for a specialized interface system, a plastic barrier (Tektronix Part Number 214–1593–02) should be installed in a key slot between contacts 23 and 24 on the Power Module.

Do not insert any TM 500 Series plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

2088-16

Fig. AM 511-1. Connector rear view.

NOTES

DIGITAL COUNTERS

NOTES

GENERAL COUNTER INFORMATION

TTL Voltage Levels

The words "HI" and "LO" refer to TTL voltage levels present on the rear contacts under specific conditions. TTL specifications are as follows: A TTL LO output exists from 0.0 V to 0.4 V. A TTL HI output exists from +2.4 V to +5.0 V. Rear interface inputs will accept TTL LO voltages between 0.0 V and +0.8 V. TTL HI inputs must be between +2.0 V and +5.0 V. Where TTL currents are given, the quantity is a maximum value.

Time-Ladder Diagram

All of the counters use time-slot pulses derived from a Scan Clock signal to select a particular decimal digit that is displayed on a front-panel LED display. The time-ladder diagram in Fig. 6-1 illustrates the basic time relationships between waveforms discussed under the INTERFACE NOTES for each Counter. No one Counter has all of the waveforms available at the rear interface. The waveforms are to be used only as a guide when interpreting the individual data discussed for each Counter.

NOTE

Thorough understanding of the schematic diagrams and the exact internal connections for input/output lines to the rear contacts (found in individual instruction manuals) will be an aid in designing your specialized TM 500 interface system.

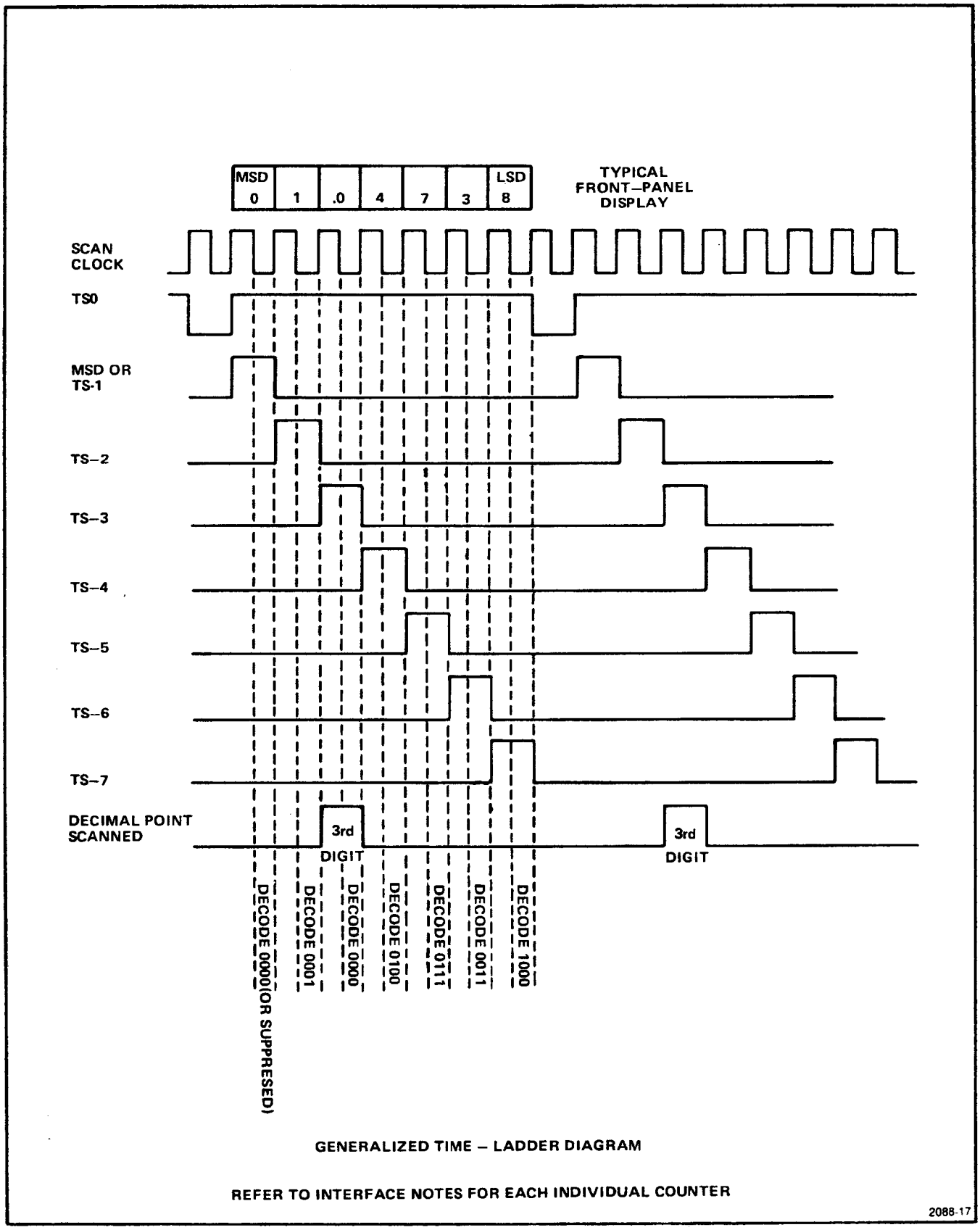
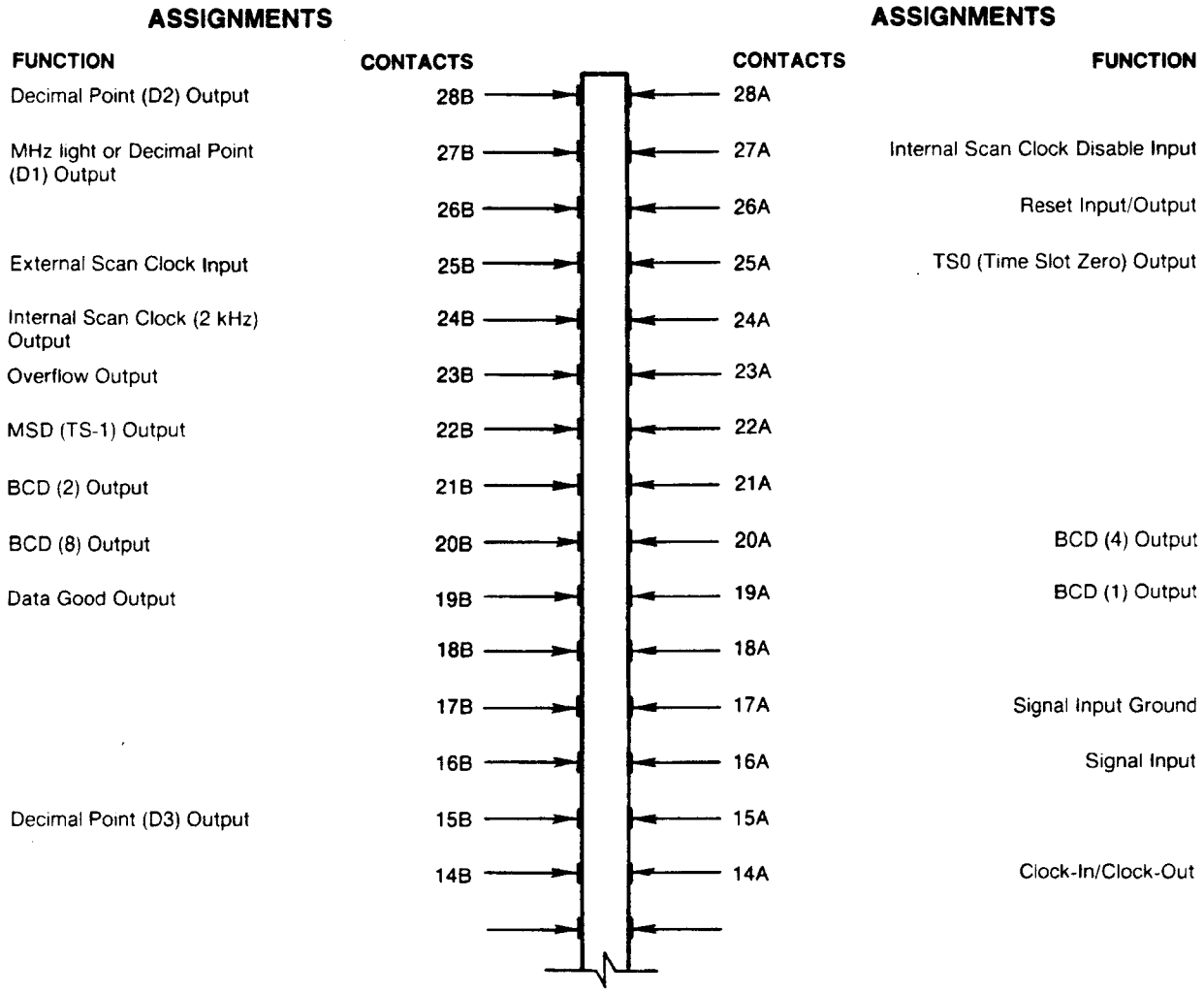


Fig. DC 501-1. Generalized Time-Ladder Diagram.



CAUTION

When a Power Module compartment has been selected for the DC 501 and wired for a specialized interface system, a plastic barrier (Tektronix Part Number 214–1593–02) should be installed in a key slot between contacts 21 and 22 on the Power Module.

Do not insert any TM 500 Series plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

2088-18

Fig. DC 501-2. Connector rear view.

INTERFACE NOTES

BCD Outputs (8, 4, 2, 1 Code)

Contacts 20B, 20A, 21B, and 19A provide bcd data directly to the Power Module interface. The count (front-panel display) is transmitted in a serial-by-decimal digit method, with the decimal digit sequence being from left to right (msd to lsd as observed on the front-panel display). The binary levels for each decimal digit use positive-true logic (HI = 1, LO = 0). Each output data line is capable of driving 6 TTL loads (10 mA).

Decimal Point/Front-Panel Status Outputs

TTL logic levels are transmitted directly to contacts 27B and 28B. The data on contacts 27B and 28B is related to the position of the MEASUREMENT INTERVAL switch and front-panel decimal point location. Decimal points are numbered from left to right on the front-panel display (see Table DC 501-1). All LO levels are caused by a switch contact closure to chassis ground, except for an Option 02 instrument where AUTO gate operation can cause the LO levels to be above chassis ground by approximately 0.4 V.

NOTE

If a direct active-low level output is desired for D3 (.000), it is suggested that a #22 or #26 AWG stranded wire be connected from the switch end of R284 to an unassigned rear contact that is compatible with your external equipment. Rear contact 15B is suggested.

Data Good Output (Contact 19B)

A positive-true Data Good pulse is transmitted directly to rear contact 19B at each updating of the DC 501 storage register. For an instrument with a 1 MHz clock, the pulse duration varies between 0.5 and 1.5 μs; a 5 MHz clock (Option 01) produces a pulse duration that varies between 0-.2 and 1.2 μs. The Data Good output (19B) goes HI immediately after the internal gate time selected by the MEASUREMENT INTERVAL switch position or AUTO gate selection period (Option 02). The storage register is updated on the positive-going edge of the Data Good pulse. Rear contact 19B also goes HI and remains HI as long as the MEASUREMENT INTERVAL switch is in the MANUAL (totalize) position. This output will drive at least 6 TTL loads.

Reset Input/Output (Contact 26A)

This contact is directly wired to the front-panel RESET push button and can be used as either a Reset Input or Reset Output function. Contact 26A is normally at a HI level and goes LO when the RESET button is pushed (for any positions of the MEASUREMENT INTERVAL switch), or between switch detent positions (when changing the MEASUREMENT INTERVAL switch positions). Rear contact 26A does not go LO when the DC 501 clears its own internal circuitry for another count.

To use 26A as a counter Reset Input function, it can be set to a LO by an external switch contact closure to ground or driven LO by an open-collector logic gate capable of sinking 9 TTL current loads (15 mA).

Scan Clock Output, Input, and Disable (Contacts 24B, 25B, and 27A)

These three functions are all wired directly to rear contacts. A 2 kHz (square wave) Internal Scan Clock signal (TTL) is applied to rear contact 24B, providing a continuous output to the rear interface as long as rear contact 27A (Internal Scan Clock Disable) is held HI. The decimal digits are scanned from msd to lsd, with the rising edge of each Scan Clock period selecting the decimal digit to be displayed. The binary levels for a selected digit remain on the bcd output lines for one complete Scan Clock period (500 μs

Table DC 501-1

Decimal Point/Front-Panel Status Outputs

Contact		Display			Measurement
27B	28B	Light On	Decimal Point		Interval
LO	LO	MHz	.0000	(D2)	.01 Sec
LO	HI	MHz	.00000	(D1)	.1 Sec
HI	HI	kHz	.000	(D3)	1 Sec
HI	LO	kHz	.0000	(D2)	10 Sec
HI	HI	GATE	000	(None)	MANUAL (Start)

for Internal Scan Clock). All of the time-slot pulses have a duration equal to a Scan Clock period. Using the Internal Scan Clock signal, it takes approximately 4 ms for a complete display scanning cycle. The ideal time to read (decode) the bcd data is during the negative half of the Scan Clock period. This requires that an external bcd decoder be driven by the falling edges of the Scan Clock signal.

Setting rear contact 27A to a TTL low disables the Internal Scan Clock and allows the application of an External Scan Clock signal to rear contact 25B. The External Scan Clock should be a TTL signal, with a maximum frequency of 1 MHz and a fall time of less than 100 ns (frequency may be less than 2 kHz, if desired). Consequently, the time of a complete display scan and time-slot pulse duration will change accordingly.

One advantage of the External Scan Clock and Internal Scan Clock Disable inputs is to allow the user to design a bcd data capture system that extracts the data at a faster or slower rate than 2 kHz. It is not intended that a high-frequency External Scan Clock be applied continuously to rear contact 25B, although it could be done. A continuous 1 MHz External Scan Clock would allow bcd data capture, but could also cause false front-panel displays. Refer to the time-ladder diagram in Fig. 6-1 for an example of using the External Scan Clock and Internal Scan Clock disable pulse.

Time-Slot Zero (TS0) and MSD (TS-1). (Contacts 25A and 22B)

TS0 on rear 25A is a TTL negative-going pulse that has a duration equal to a Scan Clock period and occurs once per complete display scanning cycle. It is a pulse that predicts that the next bcd output data on contact 20B, 20A, 21B, and 19A will be equivalent to the msd during TS-1. This pulse may be used as a synchronizing pulse for external equipment, used as a latch pulse, or to clear/reset external digital circuitry.

The msd (TS-1) output on rear contact 22B is a TTL positive-going pulse that also has a duration equal to a Scan Clock period and occurs once per complete display scanning cycle. Some users may prefer to use the msd (left-side digit) pulse for synchronizing external equipment, rather than using the TS0 pulse. TS0 and TS-1 are the only time-slot pulses directly wired to rear contacts.

Overflow Indication (Contact 23B)

Rear contact 23B is normally at a LO level. This contact goes HI under two conditions; (1) when the DC 501 is operated in the MANUAL (Totalize) mode and the storage register is full of nines (9999999 display), contact 23B goes HI on the next input count; (2) when making high-resolution frequency measurements by increasing the MEASUREMENT INTERVAL by a factor of 10 or greater (deliberately overflowing the display). Contact 23B is HI any time that the front-panel OVERFLOW light is on.

Signal Input (Contacts 16A and 17A)

Rear contact 16A is directly wired to the front-panel EXT-INT switch. When signals to be counted or measured are applied to contact 16A, the front-panel switch must be in the INT position. Contact 16A is terminated into a 50 Ω load (R101) and miniature 50 Ω RF cable should be used to connect signals to this contact on the Option 02 Power Module interface. Connect the coaxial-cable shield to rear contact 17A for a Signal Input Ground. Input specifications apply when signals are applied to contact 16A. Lifting the ground end of R101 converts the input resistance to 1 MΩ.

Clock-In/Clock-Out (Optional–Contact 14A)

Rear contact 14A can be used for a higher quality in-house Clock Input, or as a 1 MHz clock output, as desired. Connect a miniature 50 Ω RF cable between pin 14 of U209 and rear contact 14A (see Fig. DC 501-1). Pin 14 of U209 operates at TTL levels. Ground both ends of the coaxial-cable shield; one end to rear contact 17A and the other end to pin 7 of U209, U200, or U201. When rear contact 14A is used as a Clock Input for an unmodified digital counter, remove U200 from the circuit board; for an Option 01 instrument, remove U201.

Approximate net instrument weight, 1.8 lbs.

Maximum power requirement at 120 V, 21.5 watts.

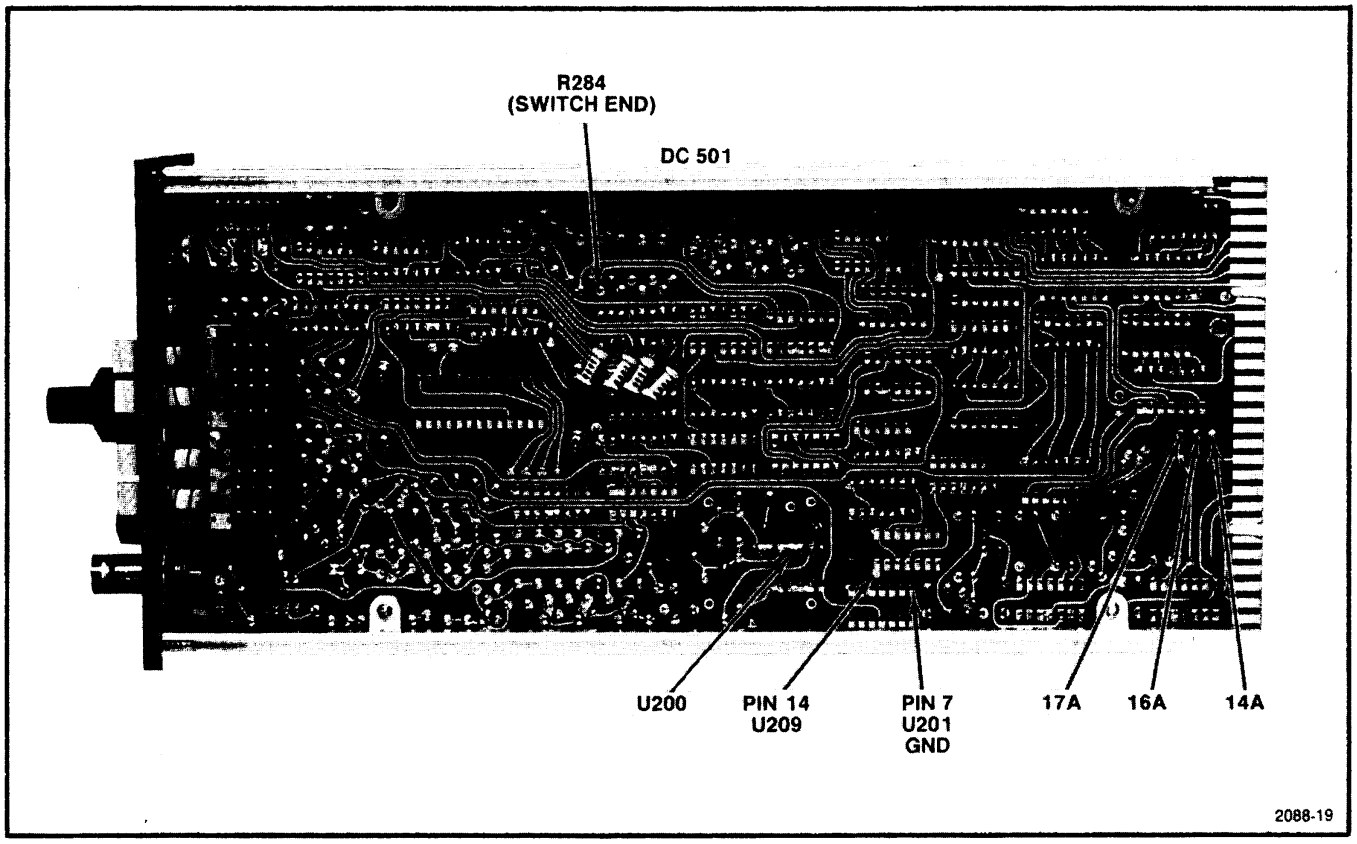
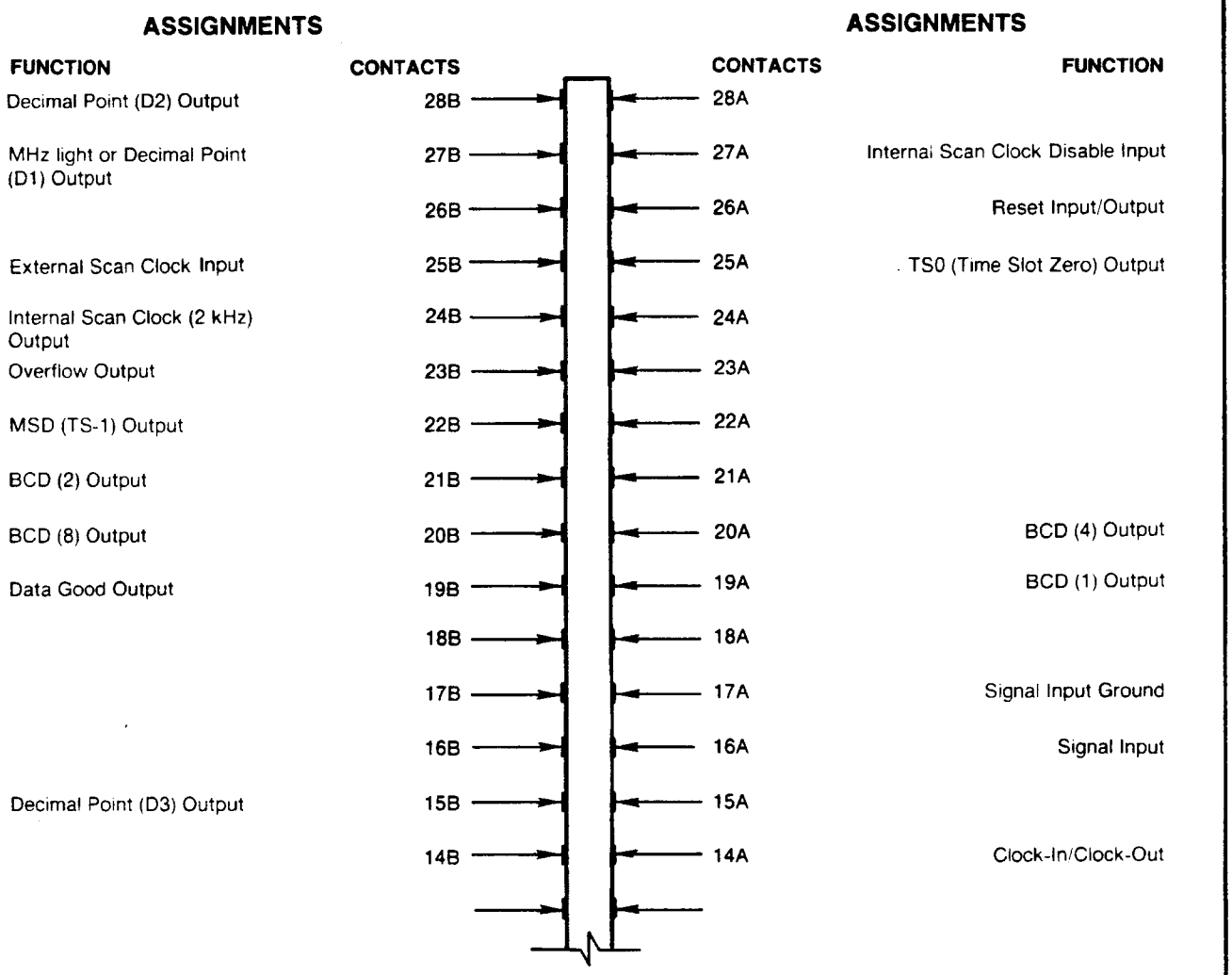


Fig. DC 501-3. Board connection points.



CAUTION

When a Power Module compartment has been selected for the DC 502 and wired for a specialized interface system, a plastic barrier (Tektronix Part Number 214–1593–02) should be installed in a key slot between contacts 21 and 22 on the Power Module.

Do not insert any TM 500 Series plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

2088-20

Fig. DC 502-1. Connector rear view.

INTERFACE NOTES

BCD Outputs (8, 4, 2, 1 Code)

Contacts 20B, 20A, 21B, and 19A provide bcd data directly to the Power Module interface. The count (front-panel display) is transmitted in a serial-by-decimal digit method, with the decimal digit sequence being from left to right (msd to lsd as observed on the front-panel display). The binary levels for each decimal digit are expressed in positive logic (HI = 1, LO = 0). Each output data line is capable of driving 6 TTL loads (10 mA).

Decimal Point/Front-Panel Status Outputs

TTL logic levels are transmitted directly to rear contacts 27B and 28B. The data on these contacts is related to the position of the MEASUREMENT INTERVAL switch and front-panel decimal point location (see Table DC 502-1). Decimal points are numbered from left to right in the display. The following table is applicable to a standard DC 502 or an Option 01 instrument. All LO levels are caused by a switch-contact closure to chassis ground.

NOTE

If a direct active-low level output is desired for D3 (.000), connect a #22 or #26 AWG stranded wire from the switch end of R248 to an unassigned rear contact that is compatible with your external equipment. Rear contact 15B is suggested.

Data Good Output (Contact 19B)

A positive-true Data Good pulse is transmitted directly to rear contact 19B at each updating of the DC 502 storage register. For an instrument with a 1 MHz clock, the pulse duration varies between 0.5 and 1.5 μs; a 5 MHz clock (Option 01) produces a pulse duration that varies between 0.2 and 1.2 μs. The Data Good output goes HI immediately after the internal gate time selected by the MEASUREMENT INTERVAL switch position. The storage register is updated on the positive-going edge of the Data Good pulse. Rear contact 19B also goes HI and remains HI as long as the MEASUREMENT INTERVAL switch is in either of the MAN (Totalize) positions. This output will drive at least 6 TTL loads.

Reset Input/Output (Contact 26A)

This contact is directly wired to the front-panel RESET push button and can be used as either a counter Reset Input or Reset Output function. Contact 26A is normally at a HI level and goes LO when the RESET button is pushed (for any position of the MEASUREMENT INTERVAL switch), or between switch detent positions. Contact 26A does not go LO when the DC 502 clears its own interval circuitry for another count.

To use 26A as a counter Reset Input function, it can be set to a LO level by an external switch contact closure to ground or driven LO by an open-collector logic gate capable of sinking 9 TTL current loads (15 mA).

Table DC 502-1

DECIMAL POINT/FRONT-PANEL STATUS OUTPUTS

Contact			Display		Measurement
27B	28B	Light On	Decimal Point		Interval
Direct Input					
LO	LO	MHz	.0000	(D2)	.01 Sec
LO	HI	MHz	.00000	(D1)	.1 Sec
HI	HI	kHz	.000	(D3)	1 Sec
HI	LO	kHz	.0000	(D2)	10 Sec
HI	HI	Gate	000	(None)	MAN (Start)
Prescale Input					
LO	HI	MHz	.000	(D3)	.01 Sec
LO	LO	MHz	.0000	(D2)	.1 Sec
LO	HI	MHz	.00000	(D1)	1 Sec
HI	HI	kHz	.000	(D3)	10 Sec
HI	HI	Gate	000	(None)	MAN (Start)

Scan Clock Output, Input, and Disable (Contacts 24B, 25B, and 27A)

These three functions are all wired directly to rear contacts. A 2 kHz (square wave) Internal Scan Clock signal (TTL) is applied to rear contact 24B, providing a continuous output to the rear interface as long as rear contact 27A (Internal Scan Clock Disable) is held HI. The decimal digits are scanned from msd to lsd, with the rising edge of each Scan Clock period selecting the decimal digit to be displayed. The binary levels for a selected digit remain on the bcd output lines for one complete Scan Clock period (500 μs for Internal Scan Clock). All of the time-slot pulses have a duration equal to a Scan Clock period. Using the Internal Scan Clock signal, it takes about 4 ms for a complete display scanning cycle. The ideal time to read (decode) the bcd data is during the negative half of a Scan Clock period. This requires that an external bcd decoder be gated by the falling edge of the Scan Clock signal.

Setting near contact 27A to a TTL LO disables the Internal Scan Clock and allows the application of an External Scan Clock signal to rear contact 25B. The External Scan Clock should be a TTL signal with a maximum frequency of 1 MHz and a fall time of less than 100 ns (frequency may be less than 2 kHz, if desired). Consequently, the time of a complete display scan and time-slot pulse duration will change accordingly.

One advantage of the External Scan Clock and Internal Scan Clock Disable inputs is to allow the user to design a bcd data capture system that extracts the data at a faster or slower rate than 2 kHz. It is not intended that a high-frequency External Scan Clock signal be applied continuously to rear contact 25B, although it can be done. A continuous 1 MHz External Scan Clock signal allows bcd data capture, but can also cause false front-panel displays.

Time Slot Zero and MSD (Contacts 25A and 22B)

Time Slot Zero (TS0) on rear contact 25A is a TTL negative-going pulse that has a duration equal to a Scan Clock period and occurs once per complete display cycle. TS0 is a pulse that predicts that the next bcd data to appear on contacts 20B, 20A, 21B, and 19A will be equivalent to the most significant digit during TS-1. This pulse can be used as a synchronizing pulse for external equipment, used as a latch pulse, or a clear/reset pulse for external digital circuitry.

The msd (TS-1) output on rear contact 22B is a TTL positive-going pulse that also has a duration equal to a Scan Clock period and occurs once per complete display scanning cycle. Some users may prefer to use the msd (left-side digit) pulse for synchronizing external equipment, rather than using the TS0 pulse. TS0 and msd (TS-1) are the only time-slot pulses directly wired to the rear contacts.

Overflow Indication (Contact 23B)

Rear contact 23B is normally at a LO level. This contact goes HI under two conditions: (1) when the DC 502 is operated in a MAN (Totalize) mode and the storage registers are full of nines (999999999 display), contact 23B goes HI on the next input count; (2) when making high-resolution frequency measurements by increasing the MEASUREMENT INTERVAL by a factor of 10 or greater. Contact 23B is HI any time that the front-panel OVERFLOW light is on.

Signal Input (Contacts 16A and 17A)

NOTE

It is important to consider VSWR and cross-talk problems at high frequencies. Pay particular attention to lead dress, terminations, and discontinuities along a high-frequency signal path.

Rear contacts 16A and 17A are not directly wired to the input and ground circuits of the DC 502. Contact 16A is reserved for Signal Input and Contact 17A is reserved for Signal Input Ground.

When applying input signals through the rear interface, it is necessary to connect the center conductor (stranded wire) of a miniature 50 Ω coaxial cable from 16A to the DIRECT INPUT solder connection on the B side of the instrument. Connect both ends of the coaxial cable shield, one end to 17A and the other end to a convenient ground on the circuit board near the DIRECT INPUT connection. There is no switching system available to switch between front-panel input and rear interface signals; therefore, if it is not desired to transmit front-panel signals to the rear interface, disconnect the lead to the DIRECT INPUT bnc connector. The coaxial cable can be terminated into a 50 Ω load, if desired. Contact 17A must also be grounded (externally) in an Option 02 Power Module.

Most instruments have solder pad connections for 16A and 17A located on the B side of the circuit board, while earlier instruments require direct connections to 16A and 17A on the A side of the circuit board. Refer to illustration.

Contacts 16A and 17A can also be wired to the PRESCALE INPUT circuit board on the A side of the instrument, if desired. Remove the cable to the PRESCALE INPUT bnc connector in order to maintain a clean 50 Ω environment.

Clock-In/Clock-Out (Optional–Contact 14A)

Rear contact 14A can be used for a higher quality in-house Clock Input, or as a 1 MHz Clock Output, as desired. Connect a miniature 50 Ω coaxial cable between pin 14 of U209 and rear contact 14A. Pin 14 of U209 operates at TTL levels. Ground both ends to the coaxial-cable shield; one end to rear contact 17A and the other end to pin 7 of U209, U200, or U201. When 14A is used as a Clock Input for a standard DC 502, remove U200 from the circuit board; for an Option 01 instrument, remove U201.

Approximate net instrument weight, 1.8 lbs.

Maximum power requirement at 120V, 21.5 watts.

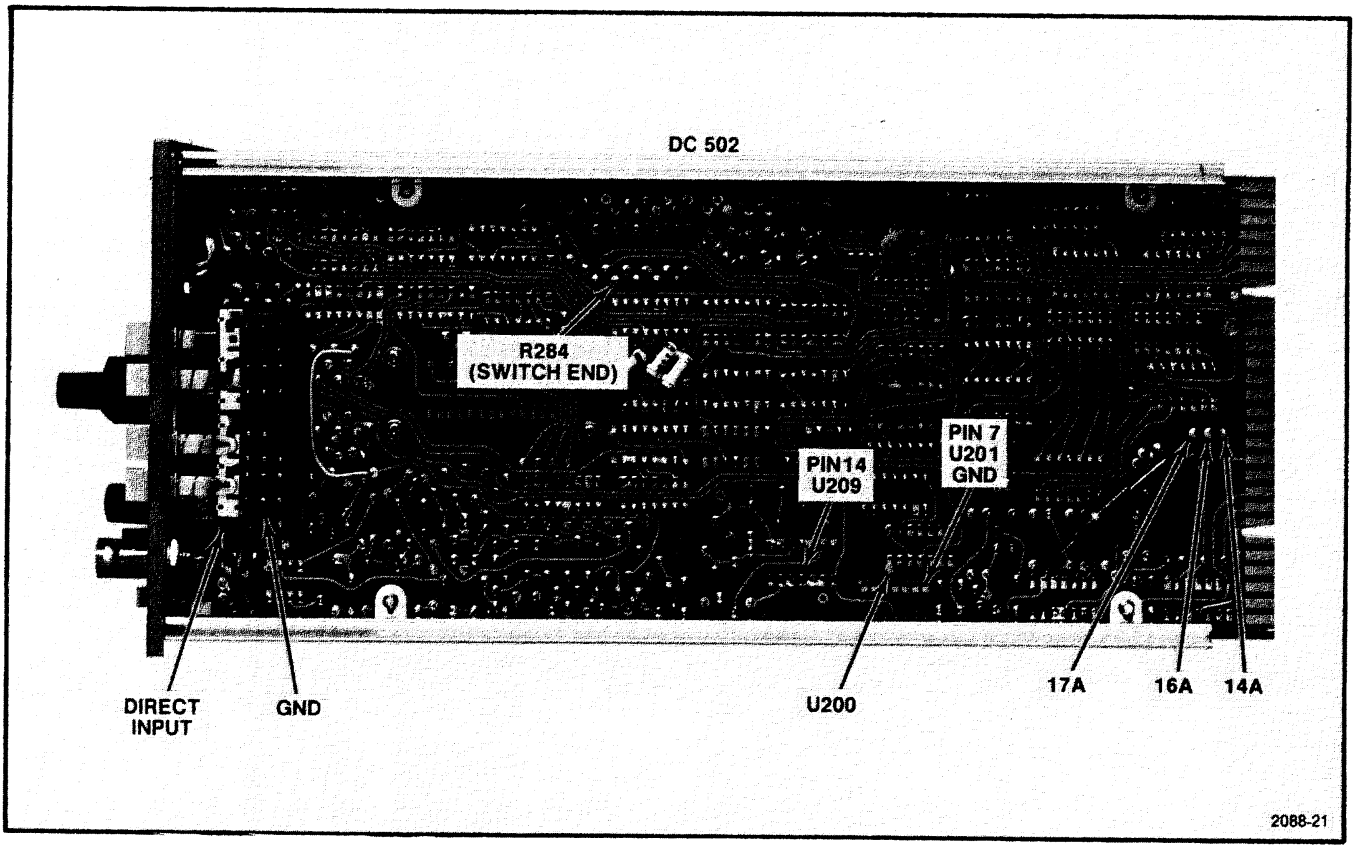
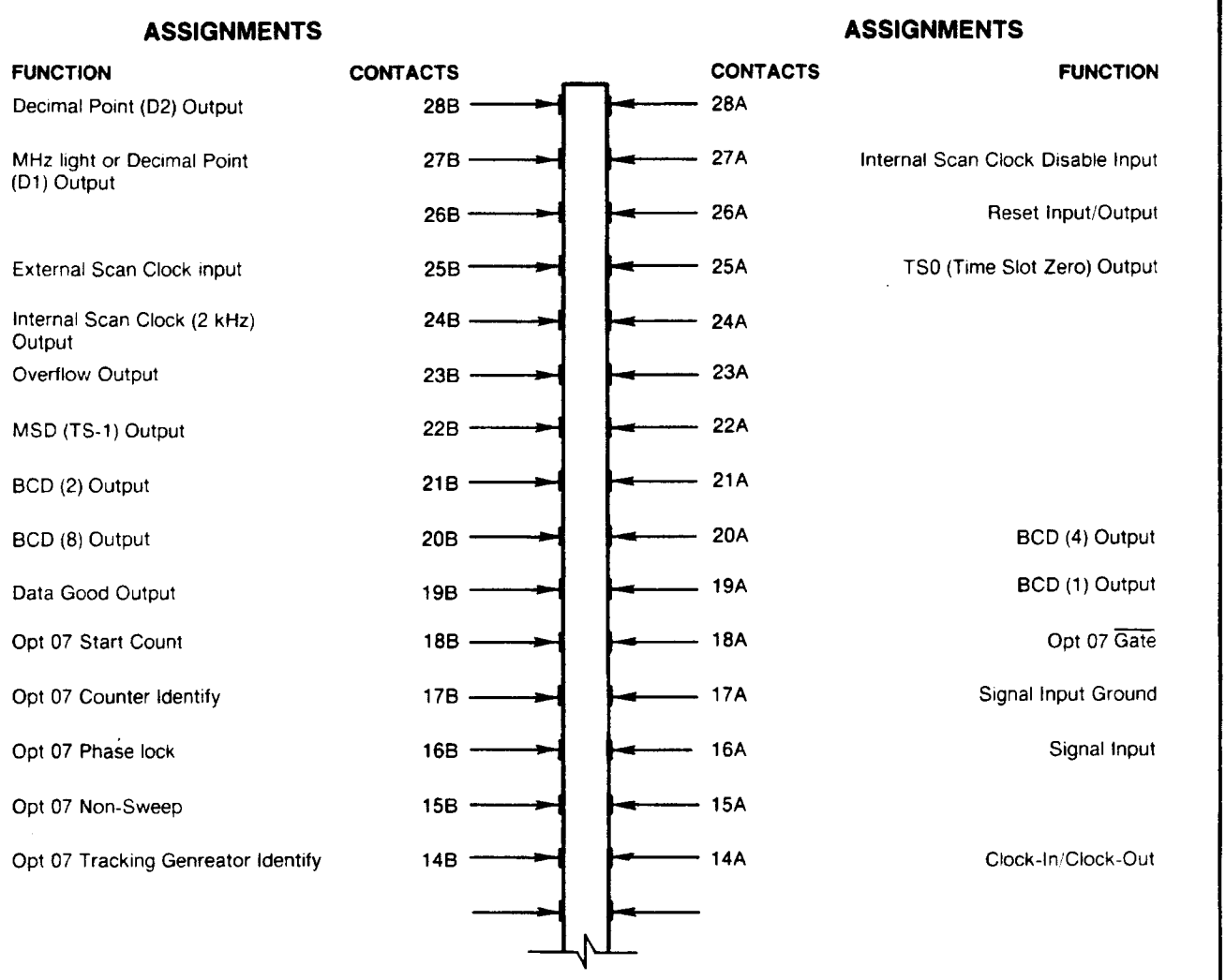


Fig. DC 502-2. Board connection points.



CAUTION

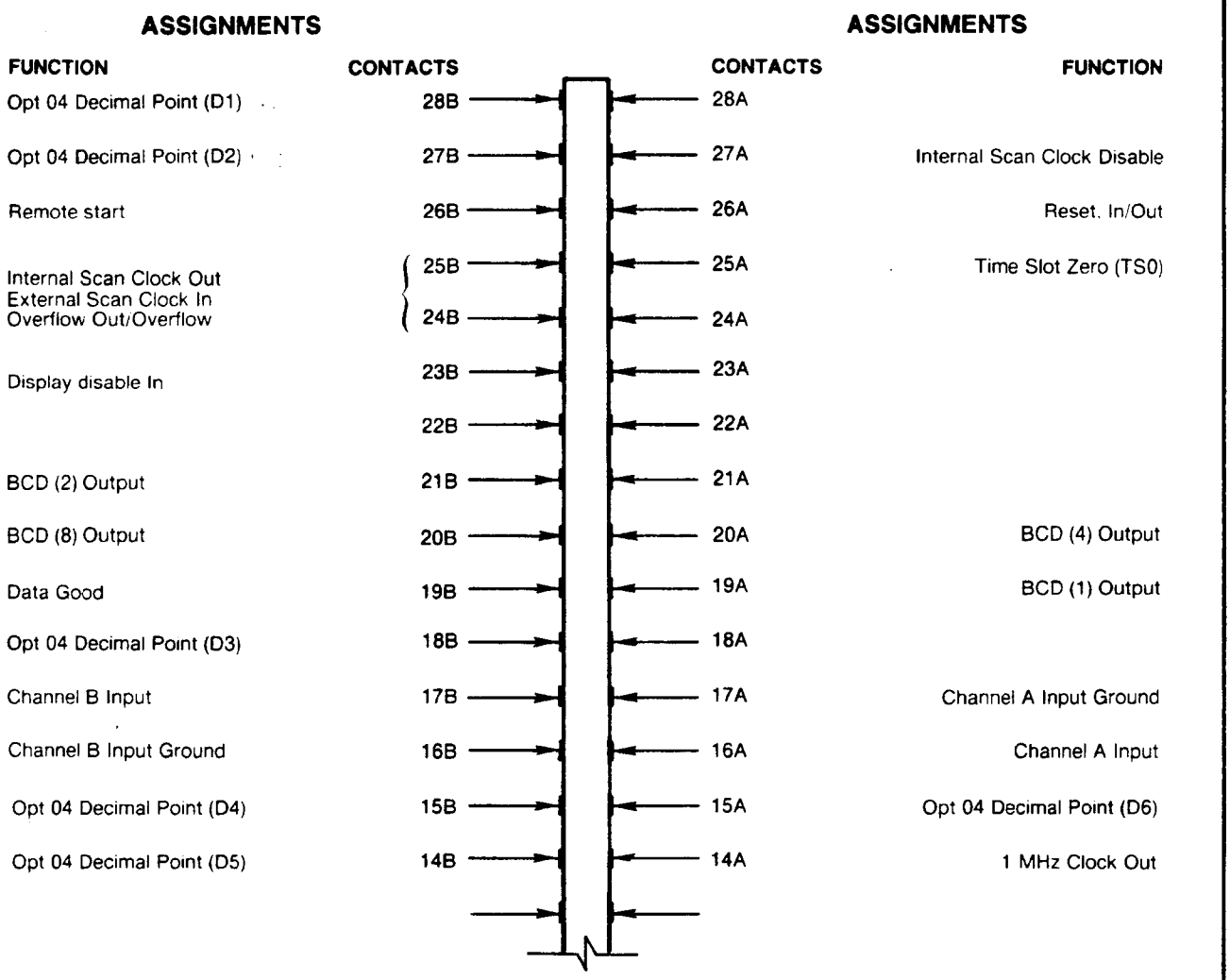
When a Power Module compartment has been selected for the DC 502 and wired for a specialized interface system, a plastic barrier (Tektronix Part Number 214–1593–02) should be installed in a key slot between contacts 21 and 22 on the Power Module.

Do not insert any TM 500 Series plug-in a live Power Module and do not use excessive force when inserting the plug-in.

Fig. DC 502 OPT. 7-1. Connector rear view.

Option 07 (Contacts 18A, 18B, 17B, 16B, 15B, and 14B)

These contacts are factory wired for a DC 502 Option 07 instrument. The DC 502 Option 07 is an Option 01 instrument to which an additional logic circuit board has been added plus some circuit modifications. The DC 502 Option 07 was designed to operate with a spectrum analyzer and a tracking generator to provide an accurate readout of the spectrum analyzer's center frequency. When the DC 502 Option 07 instrument is used with this system it must be installed in a specific compartment of a TM 500-Series Option 07 Power Module. Refer to the instruction manuals for the DC 502 Digital Counter and TR 502 Tracking Generator for more information.



CAUTION

When a Power Module Compart ment has been selected for the DC 503 and wired for a specialized interface system, a plastic barrier (Tektronix Part Number 214–1593–02) should be installed in a key slot between contacts 21 and 22 on the Power Module.

Do not insert ant TM 500 Series Plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

Fig. DC 503-1. Connector rear view.

INTERFACE NOTES

BCD Outputs (8, 4, 2, 1 Code)

Contacts 20B, 20A, 21B, and 19A provide bcd data directly to the Power Module interface. The count (front-panel display) is transmitted in serial-by-decimal digit sequence. The decimal digit sequence is from left to right (msd to lsd as observed on the front-panel readout). The binary levels for each decimal digit use positive-true logic (HI = 1, LO = 0). Each output data line is capable of driving 6 TTL loads (10 mA).

Decimal Point Output Data

There are six decimal points associated with the front-panel display, numbered from left to right in the readout. An active decimal point location is dependent on the positions of two front-panel switches (FUNCTION and N/CLOCK RATE).

Decimal point output data is factory wired to rear contacts only for an Option 04 instrument. A rear contact is at a TTL low level when the associated front-panel decimal point is active.

To obtain decimal point output data for instruments other than Option 04, a unit can be hard-wired by performing the decimal modification section of the instructions included with Product Modification Kit, Tektronix Part No. 040-0713-00.

Data Good Output (Contact 19B)

A positive-true Data Good pulse is transmitted directly to rear contact 19B at each updating of the DC 503 storage register. Pulse duration is from a minimum of 0.2 μs to a maximum of 1.5 μs, dependent on the clock option. The storage register is updated on the positive-going edge of the Data Good pulse. The Data Good pulse goes HI immediately after an internal gate time selected by the FUNCTION or N/CLOCK rate switches (dependent on the operating mode). Contact 19B also goes HI and remains HI as long as the FUNCTION switch is in either the TIME MANUAL or TOTALIZE A positions. This output will drive at least 6 TTL loads.

Reset Input/Output (Contact 26A)

The counter is cleared to zero when a LO is applied to contact 26A. This is accomplished when the front-panel RESET button is pushed, or when the FUNCTION switch is between detent positions. Contact 26A also goes LO momentarily during an automatic power-up reset period. This contact does not go LO when the DC 503 internal circuitry clears itself for another count. To use 26A as a Reset Input function, it can be set to a LO by an external switch contact closure to ground, or driven LO by an open-collector logic gate capable of sinking 15 mA.

Scan Clock Output/Input and Disable (Contacts 24B/25B and 27A)

Contacts 24B/25B are hard-wired together at the rear edge connectors. A 2 kHz (square wave) Internal Scan Clock signal is applied to these two contacts as long as contact 27A (Internal Scan Clock Disble) is held HI. A LO applied to contact 27A allows contacts 24B/25B to be used as an External Scan Clock Input.

The decimal digits are scanned from msd to lsd (as observed on the front-panel display), with the rising edge of each Scan Clock period selecting the decimal digit to be displayed. The binary levels for a selected digit remain on the bcd output lines for one complete Scan Clock period (500 μs for Internal Scan Clock signal). Using the Internal Scan Clock signal, it takes approximately 4 ms for one complete display scanning cycle. The ideal time to read (decode) the bcd data is during the negative portion of the Internal Scan Clock period.

The risetime of an External Scan Clock signal applied directly to 24B/25B should be less than 100 ns. Signal inversion does not occur before toggling a divide by 8 counter circuit. Note that changing a Scan Clock period changes the time-slot duration and the time of one complete display scanning cycle. Maximum External Scan Clock frequency is 1 MHz. Refer to the time-ladder diagram (Fig. 6-1) for waveform relationships between the Internal Scan Clock, TS0 pulse, and Internal Scan Clock Disable pulse. The DC 503 has no TS-1 through TS-7 output to the rear interface.

Time Slot Zero (Contact 25A)

Time Slot Zero (TS0) on rear contact 25A is a TTL negative-going pulse that has a duration equal to a Scan Clock period and occurs once per complete display scanning cycle. TS0 is a pulse which predicts that the next bcd data to appear on the bcd output lines will be equivalent to the most significant digit during TS-1. This pulse can be used as a synchronizing pulse for external equipment.

Overflow and Leading Zero Suppresssion (Contact 23B)

Rear contact 23B goes LO and HI at approximately a 3 Hz rate when the DC 503 is in an overflow condition. A LO

corresponds to "display blanked" and HI corresponds to "display on". Contact 23B can be driven LO externally to blank the front-panel display. When the display is not in an overflow condition, a LO will exist during periods of leading zero suppression.

1 MHz Clock Out/Clock In (Contact 14A)

Rear contact 14A can be used as a 1 MHz Clock Out/Clock In function. Use contact 17A as a reference ground. When contact 14A is used as a more accurate Clock In function, remove U250 from the circuit board (standard instrument), or remove U251 for an Option 01 instrument.

Signal Inputs (Contacts 16A and 17B)

Rear contact 16A is assigned for Channel A input, with 17A its reference ground. Contact 17B is assigned for Channel B input, with 16B its reference ground. When it is desired to apply input signals to these rear interface contacts for counter operation, the appropriate channel must be selected by the front-panel SOURCE switches. The internal signal inputs are terminated into a nominal 50 Ω load impedance to match coaxial-cable connections to the rear interface. For high impedance (1 MΩ) rear inputs, one end of either or both 50 Ω resistors may be lifted. The resistors are physically located at the push-pull input-output switches at the front panel.

Remote Start (Contact 26B)

Grounding this contact terminates the measurement interval gate when operating in the TIME MANUAL or TOTALIZE A functions. The front-panel IN START OUT STOP switch must be in the START position for this contact to function. This contact represents one TTL load and can be switched by an appropriate active device.

Approximate net instrument weight, 2.1 lbs.

Maximum power requirement at 120 V, 21.5 watts.

INTERFACE NOTES

Introduction

A slot exists between pins 21 and 22 on the rear connector. Insert a barrier key in the corresponding position of the power module jack to prevent noncompatible plug-ins from being used in that compartment. Consult the power module manual for further information. Signal outputs for other specialized connections may be made to the rear interface connectors.

Decimal Point Scanned Output (Contact 27B)

This contact goes high and remains high for one scan clock period. This indicates a decimal point to the right of the active digit. This output will drive two TTL loads.

Remote Start (Contact 26B)

This connection duplicates the front-panel START/STOP button. When this connection is low and the DC 503A is in TOTALIZE A or TIME MANUAL modes, the counter counts. When this line goes high, counting stops. The external device pulling this line low must sink 1.6 mA.

Scan Clock Out (Contact 24B)

This connection provides a 2 to 2.5 kHz square wave. A different front-panel digit is displayed on each falling edge of the waveform. The display scans from time slot 1, the most significant digit, to time slot 8, the least significant digit, and then repeats. The corresponding bcd information transfers to the output at each falling edge of the scan clock. Data should be transferred to an external memory on the following positive going edge. This allows for propagation delays and ensures that bcd, time slot and decimal point information have time to settle. This output will drive two TTL loads.

Overflow Out (Contact 23B)

This line goes high when the counter overflows. It is capable of driving two TTL loads.

Channel A Level Out (Contact 22A)

The voltage at this connection follows the channel A front-panel trigger LEVEL control. The source impedance is 1 kΩ and the signal level is between ±3.5 V.

Channel B Level Out (Contact 22B)

The voltage at this connection follows the channel B front-panel trigger LEVEL control. The source impedance is 1 kΩ and the signal level is between ±3.5 V.

Bcd Outputs: Bcd (1), Bcd (2), Bcd (4), and Bcd (8); (Contacts 19A, 21B, 20A, and 20B, respectively)

These connections output the bcd information. The positive pulses are 1 scan clock period in length for each given digit. Each line can drive two TTL loads.

Data Good (Latch) Output (Contact 19B)

This line is high when data is transferring from a count chain into the latches. Do not acquire data through the rear interface connector when this pin is high. This output will drive two TTL loads.

Channel A Input (Contact 16A)

This is the channel A input connection when the front-panel CH A SOURCE switch is in the INT position. This input is terminated in 50 Ω, with a maximum input of 4 V peak to 8 V peak to peak.

Channel A Input Ground (Contact 17A)

This terminal is the ground return for the rear interface channel A input.

Channel B Input (Contact 17B)

This is the channel B input connection when the front-panel CH A SOURCE switch is in the INT position. This input is terminated in 50 Ω, with a maximum input of 4 V peak or 8 V peak to peak.

Channel B Input Ground (Contact 16B)

This terminal is the ground return for the rear interface channel B input.

Reference 10 MHz Out (Contact 15B)

This is the buffered output of the counter time base. This output is capable of driving two TTL loads.

Ground (Clock) (Contact 15A)

This is the ground return for the clock input-output signals (21A, 15B, 14A).

Output or Input	Pin B		Pin A	Output or Input
	28		28	
Decimal Point Scanned Output	27		27	
Remote Start	26		26	$\overline{\text{Reset In/Out}}$
	25		25	Time Slot One (TS1)
Scan Clock Out	24		24	
Overflow Out	23		23	
Channel B Level Out	22	Barrier Slot	22	Channel A Level Out
BCD (2) Output	21		21	TTL Clock Input
BCD (8) Output	20		20	BCD (4) Output
$\overline{\text{Data Good}}$ (Latch) Output	19		19	BCD (1) Output
	18		18	
Channel B Input	17		17	Channel A Input Ground
Channel B Input Ground	16		16	Channel A Input
Reference 10 MHz Out	15		15	Gnd (clock)
	14		14	External 10 MHz Clock Input

(2971-14) 2088-24

Fig. DC 503A-1. Connector rear view.

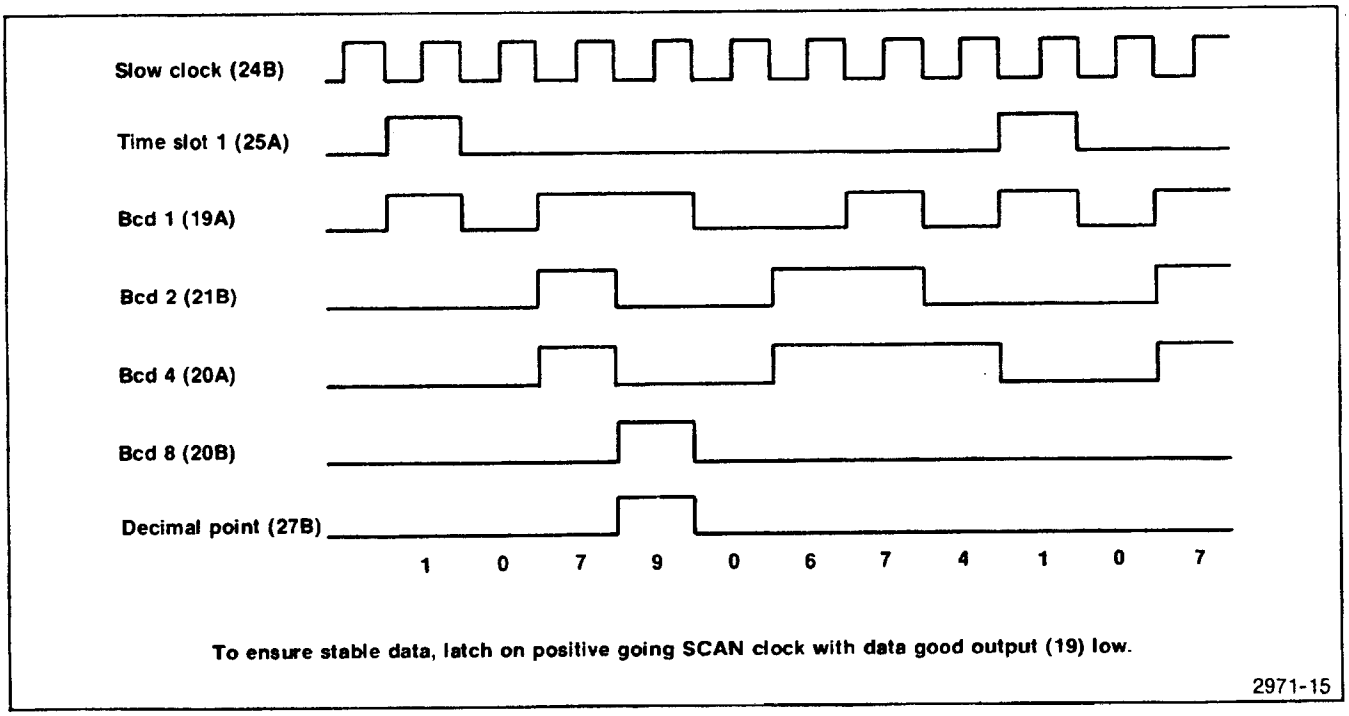


Fig. DC 503A-2. Rear interface timing for a display of 1079.0674.

Reset In/Out (Contact 26A)

This line goes low when the counters are reset. This line also goes low when the front-panel RESET button is pressed. It can be pulsed low through the rear interface connector. The device pulling this line to ground must be capable of sinking 5 mA.

Time Slot 1 (TS1) (Contact 25A)

This line is high during the time the most significant digit is scanned. It goes high on the falling edge of the scan clock and returns low on the next falling edge of the scan clock. This output is capable of driving two TTL loads.

TTL Clock Input (Contact 21A)

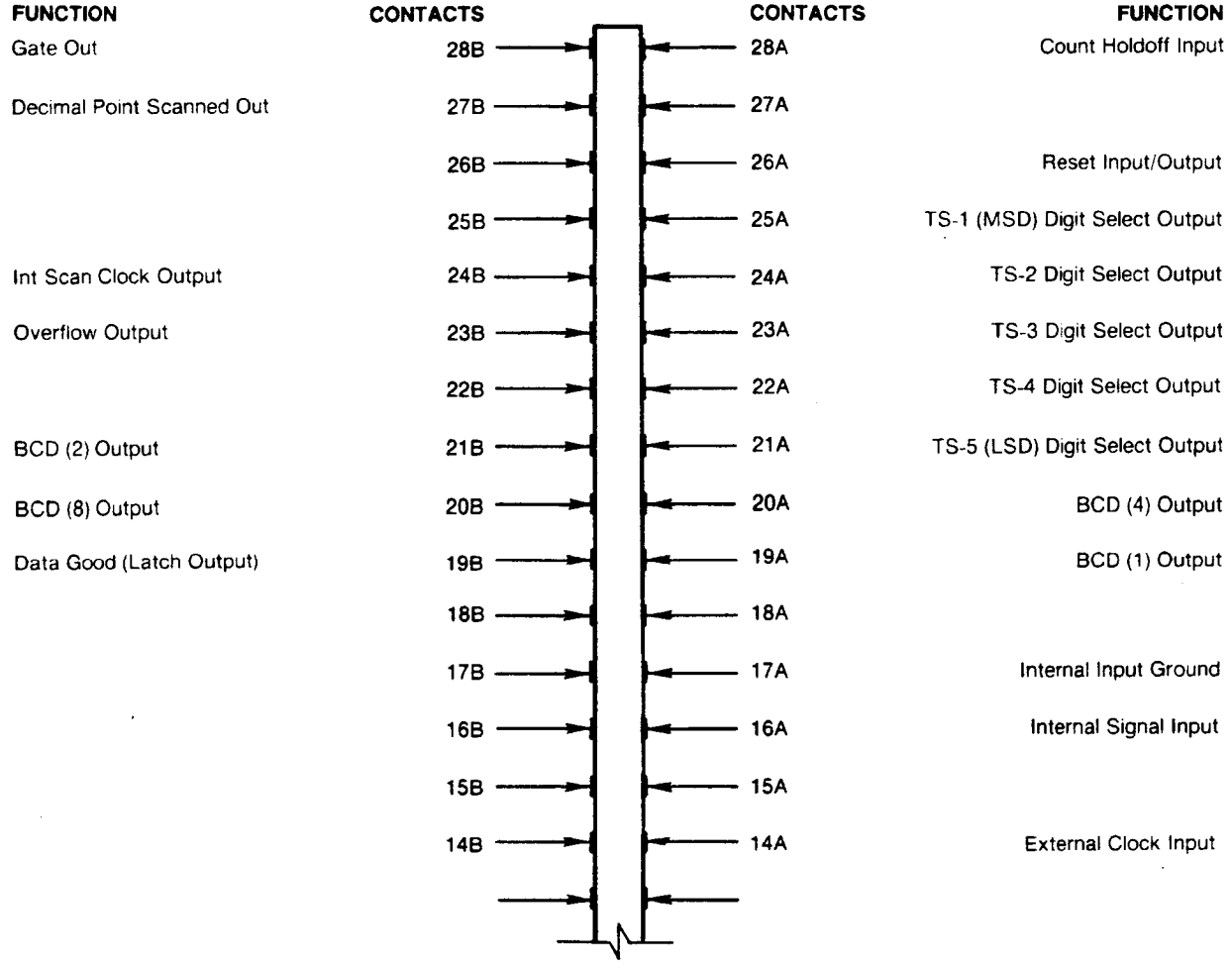
This input is a single low power Schottky TTL load. The circuitry driving this input must source 20 μA for a high input and sink 0.35 mA when driving low. An external time base, meeting the above requirements, can be connected to this terminal. The ground return for this input is pin 15A.

External 10 MHz Clock Input (Contact 14A)

This input is ac coupled with an input impedance of approximately 1 kΩ. Any signal from approximately 500 mV rms to approximately 3 V rms is sufficient. Use contact 15A as ground return for this input.

Approximate net instrument weight, 2.0 lbs.

Maximum power requirement at 120 V, 49 V.



CAUTION

When a Power Module compartment has been selected for the DC 504 and wired for a specialized interface system, a plastic barrier (Tektronix Part Number 214–1593–02) should be installed in a key slot between contacts 21 and 22 on the Power Module.

Do not insert any TM 500 Series plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

2088-25

Fig. DC 504-1. Connector rear view.

INTERFACE NOTES

BCD Output Data (Contacts 20B, 20A, 21B, and 19A)

These contacts provide bcd data (8, 4, 2, 1 code) directly to the Power Module interface. The count (front-panel display) is transmitted in serial-by-decimal digit sequences. The decimal digit sequence is from left to right (msd to lsd as observed on the front-panel display). The binary levels for each decimal digit use positive-true logic (HI = 1, LO = 0). Each output data line is capable of driving 6 TTL loads (10 mA).

Decimal Point Scanned Output (Contact 27B)

Three decimal points are numbered from left to right in the front-panel display. A decimal point to the left of a selected digit is scanned (made active) during its particular time slot. Contact 27B goes HI and remains HI for one Scan Clock period to indicate that a decimal point has been scanned. When the DC 504 is used in the RPM mode (internal switch function), the decimal points are not active and 27B remains at a LO level. This data line will drive 24 TTL loads (38 mA).

Digit Select Outputs (Contacts 25A through 21A)

These output lines provide positive-going time-slot pulses TS-1 (msd) through TS-5 (lsd) to the rear interface. The time-slot pulses scan the front-panel digits from left to right. Each time-slot pulse duration is equal to one Scan Clock period (approximately 0.25 ms). There is no TS0 pulse that occurs before the msd data appears on the bcd output lines. Each Digit Select line will drive 4 TTL loads (6.4 mA).

Scan Clock Output (Contact 24B)

This output line provides a square-wave signal of approximately 4 kHz to the rear interface. A different front-panel digit is selected to be displayed on each rising edge of the Scan Clock waveform. An ideal time to externally read (decode) the bcd output data for a selected digit is on each falling edge of the Scan Clock signal. Refer to the DC 504 instruction manual for waveform relationships. This output data line will drive only 1 TTL load (1.6 mA).

Data Good Output (Contact 19B)

This output line provides a positive Data Good (Latch) pulse to the rear interface. The pulse duration is approximately 10 μs and occurs as each updating of the display storage register. In a Latch Override mode (internal switch function), contact 19B remains HI during a selected measurement interval. This data line will drive 10 TTL loads (16 mA).

Overflow Output (Contact 23B)

Contact 23B is normally at a LO level and goes HI to indicate that the counter is in an overflow condition. Contact 23B is at a HI level any time that the front-panel OVERFLOW light is on. This output data line will drive 8 TTL loads (12.8 mA).

Reset Input/Output (Contact 26A)

The counter is cleared to zero when a LO is applied to 26A. This is accomplished from the front-panel by pushing the RESET button or setting the FUNCTION switch between detents. When used as an output, this line will drive 6 TTL loads (10 mA). Contact 26A also goes LO momentarily during power-up reset, when the counter prepares itself for operation. Contact 26A does not go low when the internal circuitry clears itself for another count.

When contact 26A is used as a Reset Input function, the external circuit must be able to drive 9 TTL loads; a discrete transistor capable of sinking 15 mA can be used.

Gate Out/TOTALIZE Stop (Contact 28B)

Contact 28B has two assignments.

1. It provides a Gate Out signal that is HI during the time that an internal gate is open (while an input signal is gated into the decade counter units). This output line will drive 5 TTL loads (9 mA).

2. When the DC 504 is operated in the TOTALIZE mode, 28B can be pulled LO to inhibit the gate (stop the counting). When used as an input line, the external circuitry must be capable of sinking 5 mA (3 TTL). Open-collector logic or a discrete transistor without a pull-up resistor is recommended to set 28B to a LO.

If contact 28B is pulled LO in any mode other than TOTALIZE, the counting will stop and the front-panel display will go to zero after a time determined by the DISPLAY TIME control. Forcing 28B to a HI causes the internal gate to remain open in all operating modes.

Count Holdoff Input (Contact 28A)

This input line drives the base of a transistor and one input line to a TTL logic gate. The application of a HI level to

28A forces the DC 504 into a hold mode. The counter will hold the latest measurement and will take another count only after the RESET button is pushed, the FUNCTION switch is rotated, or when the Count Holdoff signal to 28A goes LO. Your external circuit to 28A must be able to drive 3 TTL loads (Fan In).

Internal Signal Input (Contact 16A and 17A)

Input signals can be applied through the rear interface via contact 16A, with 17A serving as a ground reference (coaxial-cable shield connection). To select input signals via contact 16A, set the front-panel SOURCE switch to the INT positon. The input signals are dc or ac coupled, dependent upon the selected position of an internal switch. Contact 16A is terminated with a nominal 15 Ω load impedance. R100 can be removed to convert the input impedance to 1 MΩ, if desired.

External Clock Input (Contact 14A and 17A)

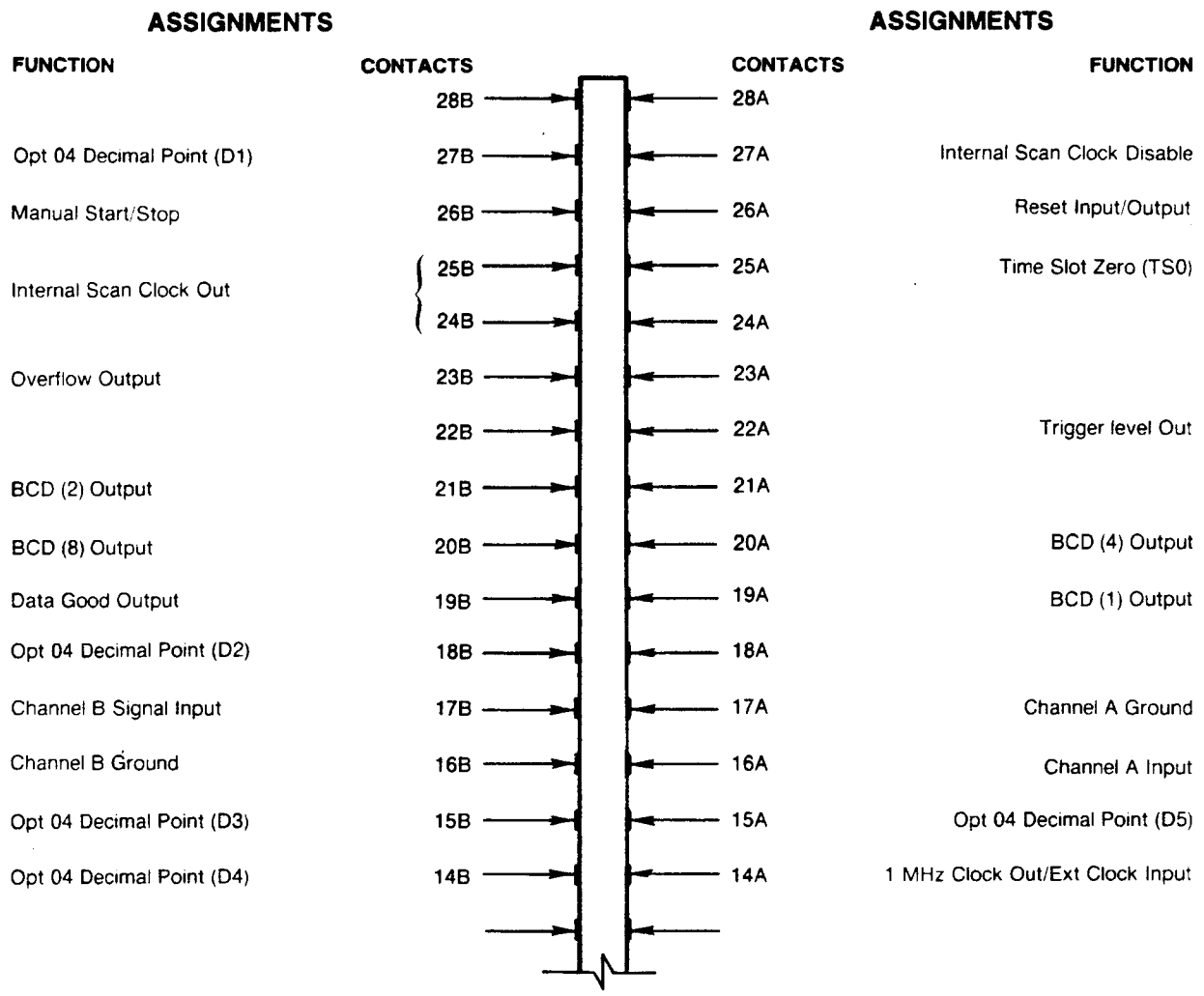
An External Clock signal can be used instead of the internal 1 MHz clock by applying the input to 14A and using 17A to ground a coaxial-cable shield. To use the External Clock signal, set the internally located Int/Ext switch to the EXT position and use a shielded cable to connect between the solder pads marked EO on the circuit board.

The External Clock input is somewhat duty-cycle sensitive. It is recommended that the positive portion of this input signal have a duty cycle of at least 15%, but not more than 70%. Refer to the DC 504 Instruction Manual for more information. At present, there is no direct connection to any rear contact to provide a 1 MHz Clock signal output.

Approximate net instrument weight, 1.4 lbs.

Maximum power requirement at 120 V, 14.1 watts.

NOTES



NOTE:

The DC 505/505A is not compatible with the TM 5000 series power modules.

CAUTION

When a Power Module compartment has been selected for the DC 505 and wired for a specialized interface system, a plastic barrier (Tektronix Part Number 214–1593–02) should be installed in a key slot between contacts 21 and 22 on the Power Module.

Do not insert any TM 500 Series plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

2088-26A

Fig. DC 505/A-1. Connector rear view.

INTERFACE NOTES

BCD Outputs (8, 4, 2, 1 Code)

Contacts 20B, 20A, 21B, and 19A provide bcd data directly to the power module interface. The count (front-panel display) is transmitted in serial-by-decimal digit sequence. The decimal digit sequence is from left to right (msd to lsd and observed on the front-panel readout). The binary levels for each decimal digit use positive-true logic (HI = 1, LO = 0). Each output data line is capable of driving 6 TTL loads (10 mA).

Decimal Point Output Data

There are five decimal points associated with the front-panel display, dependent upon the position of the front-panel controls (see Instruction Manual). An active decimal point location is numbered from left to right in the front-panel readout.

Decimal point output data is factory wired to the rear contacts only for an Option 04 instrument. A rear contact is at a TTL LO level when the associated front-panel decimal point is active.

To obtain decimal point data for instruments other than Option 04, a unit can be user wired by performing the decimal point modification section of the instructions included with Product Modification Kit, Tektronix Part No. 040-0713-00.

Data Good Output (Contact 19B)

A positive-true Data Good pulse is transmitted directly to contact 19B at each updating of the DC 505/DC 505A storage register. Pulse duration is from a minimum of 0.2 μs to a maximum of 1.5 μs, dependent upon the clock option. The storage register is updated on the positive-going edge of the Data Good pulse. Contact 19B goes HI immediately after an internal gate time as selected by the front-panel controls. Contact 19B also goes HI and remains HI as long as the DC 505/DC 505A is operated in the TOTALIZE A mode.

Reset Input/Output (Contact 26A)

The counter is cleared to zero when a LO is applied to contact 26A. This is accomplished when the front-panel RESET button is pushed, or when the FUNCTION switch is between detents. Contact 26A also goes LO momentarily during a power-up reset period. This contact does not go LO when the DC 505/DC 505A internal circuitry clears itself for another count. To use 26A as a Reset Input function, set it to a LO by an external switch closure to ground, or drive it LO by an open-collector logic gate capable of sinking 15 mA.

Int Scan Clock Output/Int Scan Clock Disable (Contacts 24B/25B and 27A)

Contacts 24B/25B are hard wired together at the rear edge connectors. The Int Scan Clock signal (2 kHz square wave) is present on 24B/25B as long as 27A (Int Scan Clock Disable) is held HI (or open). A LO applied to 27A will disable the Int Scan Clock circuit. At present, it is not recommended to apply an External Scan Clock signal to 24B/25B when disabling the Int Scan Clock.

The decimal digits are scanned from msd or lsd (as observed on the front-panel display), with the rising edge of each Scan Clock period selecting the decimal digit to be displayed. The binary levels for a selected digit remain on the bcd output lines for one complete Scan Clock period (500 μs). An ideal time to externally read (decode) the bcd data is during the negative portion of the Internal Scan Clock period.

Time Slot Zero (Contact 25A)

Time Slot Zero (TS0) on rear contact 25A is a TTL negative-going pulse that has a duration equal to a Scan Clock period and occurs once per complete display scanning cycle. TS0 is a pulse that predicts that the next bcd data to appear on the bcd output lines will be equivalent to the most significant digit during TS-1. This pulse can be used as a synchronizing pulse for external equipment.

Overflow and Leading Zero Suppression (Contact 23B)

Rear contact 23B is normally at a HI level and goes LO and HI at about a 3 Hz rate when the DC 505 is in an overflow condition. A LO corresponds to "display on". 23B can be driven LO to completely blank the front-panel display (all digits). When the display is not in an overflow condition, a LO will exist during periods of leading zero suppression.

1 MHz Clock Out/Ext Clock Input (Contact 14A)

An internal switch position determines whether contact 14A provides a 1 MHz Clock Output or is used as a more accurate Ext Clock Input. In either case, coaxial cable should be used for this connection (using contact 17A as a shield ground).

Signal Inputs (Contact 16A-17A and 17B-16B)

Selection of Channel A (16A) or Channel B (17B) signal inputs is controlled by front-panel LEVEL/SOURCE switches. Signals applied through the rear interface are terminated into a nominal 50 Ω load impedance to match coaxial cable

connections. Use contacts 17A and 16B as coaxial-cable shield ground connections. Resistors R210 and R100 can be removed to convert the input impedance to 1 MΩ, if desired.

Manual Start/Stop (Contact 26B)

Contact 26B is normally at a TTL HI level. A TTL LO applied to this contact will open an internal gate to allow counting. Contact 26B should be wired and used in the TOTALIZE A mode *only*. In other modes of operation 26B is *not* locked out, and if a LO is applied for these modes, the result will be a variety of erroneous displays.

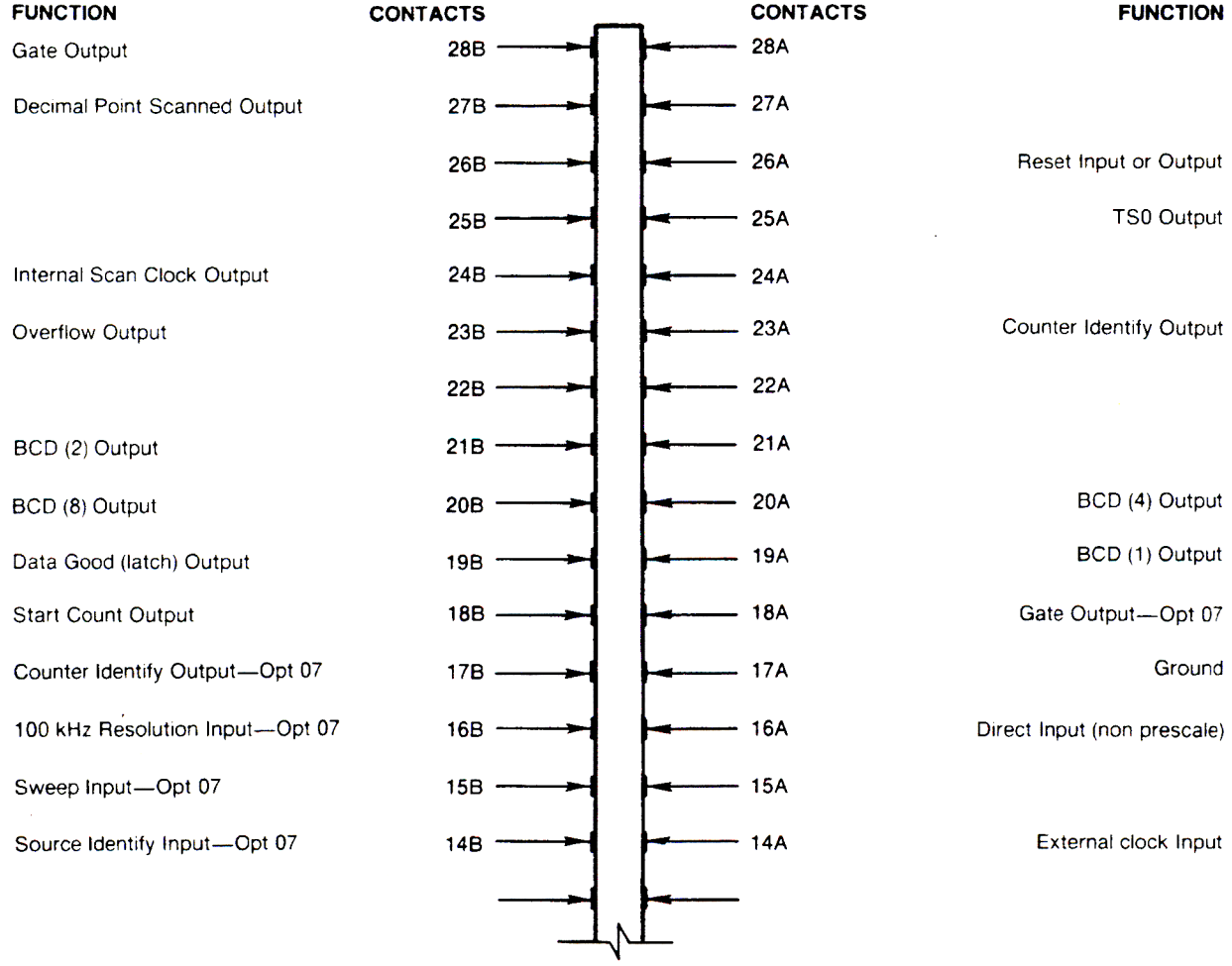
Trigger Level Out (Contact 22A)

This contact has a dc voltage range (−2 V to +2 V) that allows monitoring (with a DVM) the triggering level of signals applied to CH A or CH B. A front-panel switch determines whether the dc output on contact 22A is for CH A or CH B. For the DC 505A, this output is factory wired. For a DC 505 that does not have this feature, you can order and install a Trigger Level Out Modification Kit, Tektronix Part No. 040-0757-02.

Approximate net instrument weight, 2.3 lbs.

Maximum power requirements at 120 V, 32.6 watts.

NOTES



CAUTION

When a Power Module compartment has been selected for the DC 508 and wired for a specialized interface system, a plastic barrier (Tektronix Part Number 214–1593–02) should be installed in the key slot between contacts 21 and 22 on the Power Module.

Do not insert any TM 500 Series plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

2088-27

Fig. DC 508/A-1. Connector rear view.

INTERFACE NOTES

Time Slot Zero Output (Contact 25A)

This line provides a reference time indication for proper demultiplexing of the display bcd information. This pulse is negative-going and equal in width to one scan-clock period. The negative-going leading edge is time coincident with the rising edge of the scan-clock line. The next rising edge of the scan-clock line places the first (msd) digit of bcd information on the four bcd output lines. This connection will drive five TTL loads (8 mA).

BCD Output Data (Contact 20B, 20A, 21B, and 19A)

These contacts provide bcd data (8, 4, 2, 1, code) directly to the rear interface. The count (front-panel display) is transmitted in serial-by-decimal digit sequences. The decimal digit sequence is from left to right (msd to lsd) as observed on the front-panel display. The binary levels are positive-true logic. Each output data line is capable of driving five TTL loads (8 mA). During time slot zero (TS0), all four bcd lines are high.

Decimal Point Scanned Output (Contact 27B)

A decimal point to the left of a selected digit is scanned (made active) during its particular time slot. Contact 27B goes high and remains high for one scan-clock period, indicating that a decimal point is scanned. This data line will drive nine TTL loads (15 mA).

Scan Clock Output (Contact 24B)

This output line provides approximately 5 kHz squarewave signal at the rear interface. A different front-panel digit is displayed on each rising edge of the scan-clock waveform. The display scans from time slot zero (TS0) to the most significant digit, and then through the digits in sequence, to the least significant digit on succeeding scan clock cycles.

The corresponding bcd information is transferred to the output on each scan-clock positive-going edge. To allow for propagation delays, the data should be transferred to external memory on the following negative-going edge of the scan clock signal. This output line will drive two TTL loads (3.2 mA).

Data Good Output (Contact 19B)

This output line provides a low data good (latch) pulse. The pulse duration is determined by the measurement interval plus the display time and occurs after each updating of the display storage latches. The accumulated count is transferred to the latches when this line is high and is actually latched on the falling edge. To avoid errors, data should not be acquired until after the falling edge. This data line will drive one TTL load (1.6 mA).

Overflow Output (Contact 23B)

Contact 23B is normally at a low level and goes high to indicate that the counter is in an overflow condition. Contact 23B is at a high level any time that the front-panel OVERFLOW light is on. This output data line will drive two TTL loads (3.2 mA).

Reset Input-Output (Contact 26A)

The counter is cleared to zero when a low is applied to 26A. This is accomplished from the front panel by pushing the RESET button or moving the RESOLUTION control between detents. When used as an output, this line will drive two TTL loads (3.1 mA). Contact 26A also goes low momentarily during power-up reset, when the counter prepares itself for operation. This contact does not go low when the internal circuitry clears itself for another count. This output will drive two TTL loads (3.2 mA).

When contact 26A is used as a reset input function, the external circuit must be able to drive 15 TTL loads; a discrete transistor capable of 24 mA can be used.

Gate Out (Contact 28B)

This contact provides a gate out signal that is high during the time that the internal gate is open (while an input signal is gated into the decade counter units). This output line will drive five TTL loads (8 mA).

Internal Signal Input (Contacts 16A and 17A)

Direct input signals (non prescaled) can be applied through the rear interface via contact 16A, with 17A serving as a ground reference (coaxial-cable shield connection). To select direct input signals via contact 16A, depress the front-panel SOURCE switch to the INT position. The input signals are ac coupled. Contact 16A is terminated in a nominal 50 Ω load impedance. Connections should be made using a 50 Ω coaxial cable with leads as short as possible for maximum bandwidth operation.

External Clock Input (Contacts 14A and 17A)

An external clock signal can be used instead of the basic internal 10 MHz clock by applying the input to 14A and

using 17A to ground a coaxial-cable shield. To use the external clock signal, set the internal jumper to the EXT position. The internal frequency selection jumper must be properly placed for 1, 5, or 10 MHz depending on the choice of external clock frequency. The input signal should be a TTL level signal capable of driving an ac coupled 1 kΩ load.

Start Count Input (Contact 18B)

For instruments without Option 07, this line initiates the DC 508 measurement cycle by an external trigger signal. When the SOURCE switch is pressed and a signal is present at the rear interface (pins 16A and 17A), a measurement may be started on command by asserting a high level on contact 18B. A single measurement is made if 18B is pulled low before the gate and display times have elapsed. If 18B is held high, the counter makes continuous readings. The load is one TTL (1.6 mA).

In Option 07 equipped instruments, a high on contact 18B starts the measurement cycle and directly initiates the low level on contact 18A (Gate Output).

Counter Identify Output (Contact 23A)

This line goes low when the SOURCE switch is pressed (internal), for instruments without Option 07. This indicates that the instrument is in the count-on-command mode as explained in the Start Count Input description. This output provides 16 mA, equivalent to 10 TTL loads. Contact 23A is disconnected in Option 07 equipped instruments.

Counter Identify Output-Option 07 (Contact 27B)

When this contact is low and the instrument is equipped with Option 07, the counter operates continuously; when high, the instrument counts only when contact 18B (Start Count) goes high. Output capability is 1.6 mA, equivalent to one TTL load. This contact is not wired in instruments without Option 07.

Source Identify Input-Option 07 (Contact 14B)

When this contact is low, all Option 07 functions are enabled; when this contact is high, the counter operates normally. This input requires 4.8 mA, equivalent to three TTL loads. This contact is not wired in instruments without Option 07.

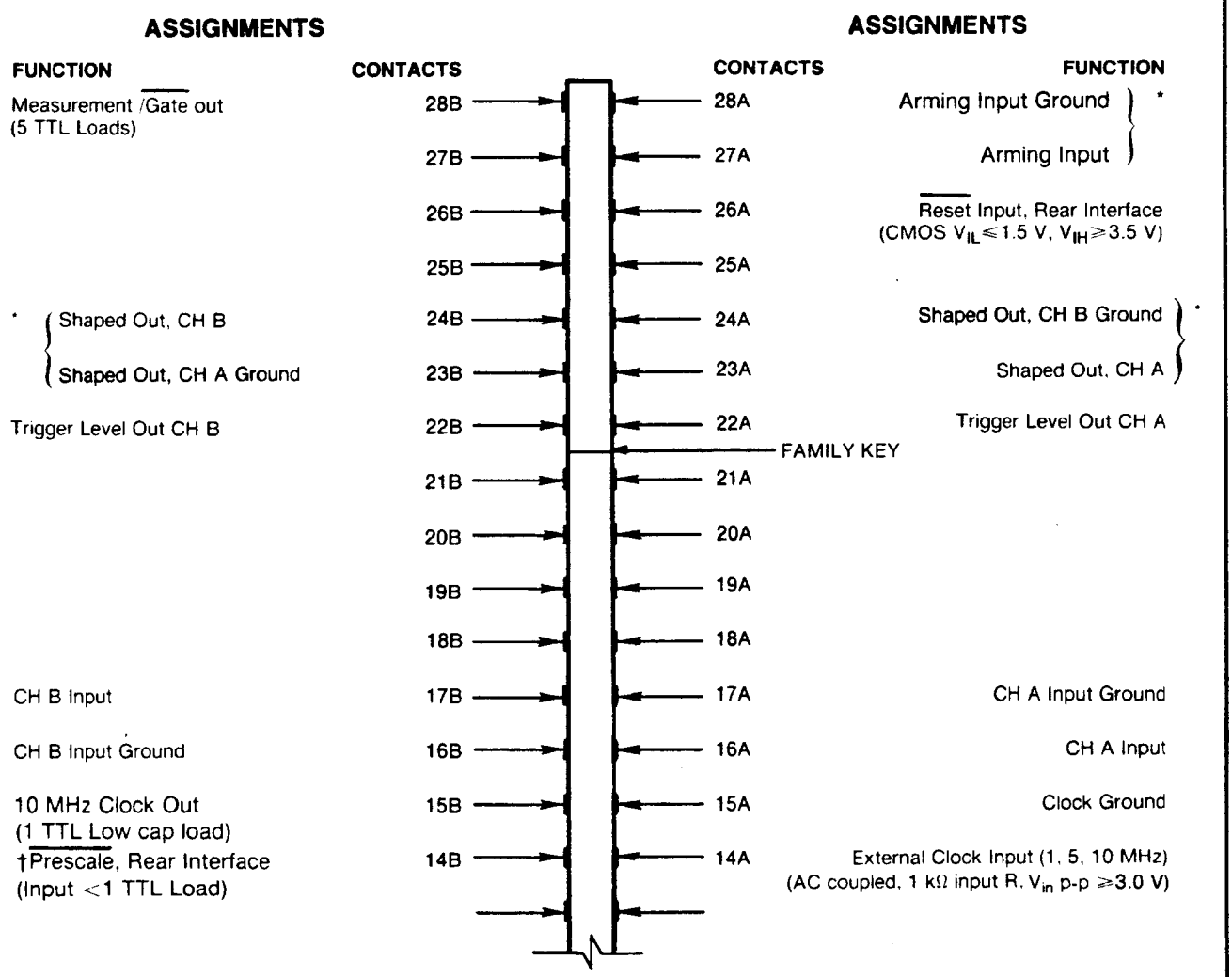
Gate Output-Option 07 (Contact 18A)

This contact goes low during the measurement interval in instruments equipped with Option 07. Output capability is 15 mA, equivalent to nine TTL loads. There is no connection to this contact in instruments without Option 07.

Approximate net instrument weight, 2.5 lbs.

Maximum power requirement at 120 V, 17.0 watts.

NOTES



***These signals when re-routed to the rear interface, are not available at the front panel.**

†When the prescale line is held low the counter automatically adjusts the displayed answer for use with a divide-by-16 prescaler in FUNCTIONS, FREQUENCY, PERIOD, RATIO, and TOTALIZE modes.

CAUTION

When a Power Module compartment has been selected for the DC 509 and wired for a specialized interface system, a plastic barrier (Tektronix Part Number 214–1593–02) should be installed in the key slot between contacts 21 and 22 on the Power Module.

Do not insert any TM 500 Series plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

2088-28A

Fig. DC 509-1. Connector rear view.

INTERFACE NOTES

Introduction

A slot between pins 21 and 22 on the rear connector identifies this instrument as a member of the TM 500 counter family. Insert a barrier in the corresponding position of the power module jack to prevent non-compatible plug-ins from being used in that compartment. Consult the power module manual for further information.

Display

The display contains eight seven-segment LEDs and six annunciators. The decimal point is automatically positioned. Display count overflow is indicated by a flashing display.

External Clock Input (Contact 14A)

This input allows an external 1, 5, or 10 MHz frequency standard to be used in place of the internal timebase. The input is ac coupled and has a 1 kΩ input resistance. The peak-to-peak input voltage required is ≥3 V.

Refer to Fig. DC 509-1 for the 1, 5, and 10 MHz outputs.

$\overline{\text{Prescale}}$ (Contact 14B)

When this available line is held low, the counter automatically adjusts the displayed answer for use with a divide-by-16 prescaler in FUNCTIONS, FREQUENCY, PERIOD, RATIO, and TOTALIZE modes (≤1 TTL load).

10 MHz Clock Out Ground (Contact 15A)

This terminal is the ground return for the clock input-output signals.

10 MHz Clock Out (Contact 15B)

This available output line will drive one TTL load. This line is not intended to drive large capacitance loads and cable length should be kept to a minimum.

CH A Input (Contact 16A)

This is the channel A input connection when the front-panel CH A SOURCE switch is in the INT position. This input is terminated in 50 Ω with a maximum input of 3.6 V peak (10 V rms, sinewave).

CH B Input Ground (Contact 16B)

This terminal is the ground return for the rear interface channel B input.

CH A Input Ground (Contact 17A)

This terminal is the ground return for the rear interface channel A input.

CH B Input (Contact 17B)

This is the channel B input connection when the front-panel CH B SOURCE switch is in the INT position. This input is terminated in 50 Ω with a maximum input of 3.6 V peak (10 V rms, sinewave).

Trigger Level Out CH A (Contact 22A)

The voltage at this connection follows the channel A front-panel trigger LEVEL control. The signal level is approximately ±3.5 V.

Trigger Level Out CH B (Contact 22B)

The voltage at this connection follows the channel B front-panel trigger LEVEL control. The signal level is approximately ±3.2 V.

Shaped Out, CH A (Contact 23A)

This terminal provides a replica of the internal signals being used for the measurement, and is used as an aid to proper triggering on complex waveforms. This signal, when routed to the rear interface, is not available at the front panel.

Refer to Fig. DC 509-1 for this output signal.

Shaped Out, CH A Ground (Contact 23B)

This terminal is the ground return for the rear interface shaped out channel A signal.

Shaped Out, CH B Ground (Contact 24A)

This terminal is the ground return for the rear interface shaped out channel B signal.

Shaped Out, CH B (Contact 24B)

This terminal provides a replica of the external signals being used for the measurement, and is used as an aid to proper triggering on complex waveforms. This signal, when routed to the rear interface, is not available at the front panel.

Refer to Fig. DC 509-1 for this output signal.

$\overline{\text{Reset}}$ Input (Contact 26A)

When this line is set low, the current measurement process is aborted for all selected functions and causes all digits in the display to read 8.8.8.8.8.8.8.8. All six annuciators are also illuminated. When this line is set high, a new measurement process is initiated for the selected FUNCTION and operating conditions. (CMOS $V_{IL} \leq 1.5$ V and $V_{IH} \geq 3.5$ V with a minimum pulse width of ≈ 10 ms).

Arming Input (Contact 27A)

This terminal is normally at a TTL high level. When pulled to a TTL low state with a TTL signal or transistor collector, the counter is prevented from making a measurement until the input goes to a TTL high state. When this input is routed to the rear interface, it is not available at the front panel.

Refer to Fig. DC 509-1 for this input signal. ($V_H \geq 2.4$ V, $V_L \leq 0.4$ V $\approx$ 2 TTL loads).

Arming Input Ground (Contact 28A)

This terminal is the ground return for the rear interface arming input signal.

Measurement $\overline{\text{Gate}}$ Out (Contact 28B)

This line is in the high state during the current measurement process and is capable of driving five TTL loads. The gate duration is dependent on the input signal frequency and the AVERAGES selected.

Maximum power requirement at 120 V is 56 VA.

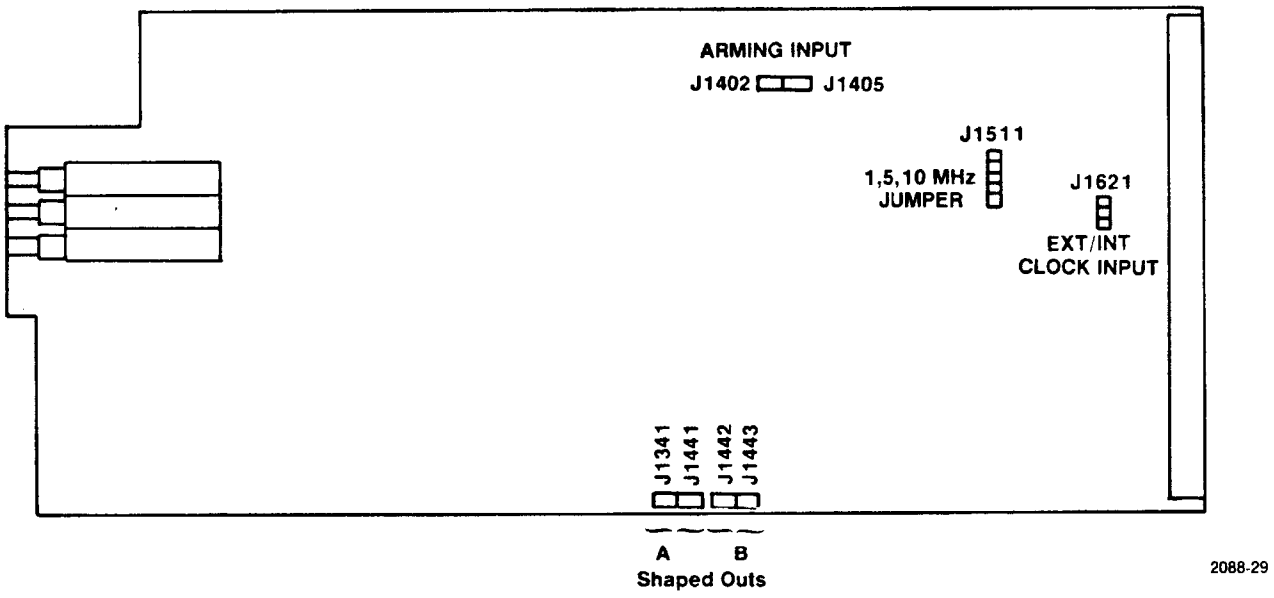
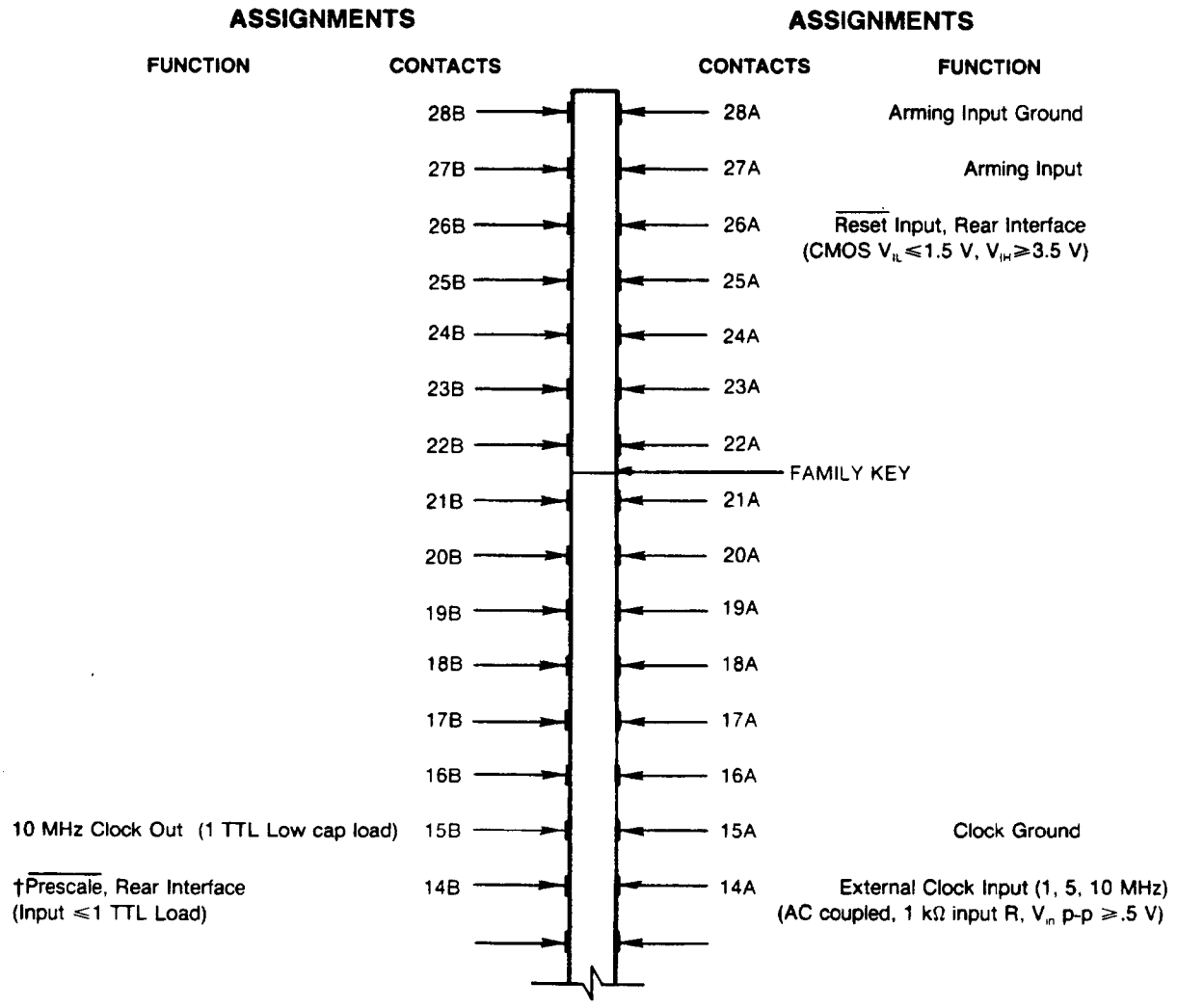


Fig. DC 509-2. Board Interface Jack Locations.

NOTES



†When the prescale line is held low the counter automatically adjusts the displayed answer for use with a divide-by-16 prescaler in FUNCTIONS, FREQUENCY, PERIOD, RATIO, and TOTALIZE modes.

CAUTION

When two Power Module compartments have been selected for the DC 510 and wired for a specialized interface system, a plastic barrier (Tektronix Part Number 214-1593-02) should be installed in the key slot between contacts 21 and 22 in each selected compartment of the Power Module.

Do not insert any TM 500 Series plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

2088-96

Fig. DC 510-1. Connector rear view.

INTERFACE NOTES

Introduction

A slot between pins 21 and 22 on the rear connector identifies this instrument as a member of the TM 500 counter family. Insert a barrier in the corresponding position of the power module jack to prevent noncompatible plug-ins from being used in that compartment. Consult the power module manual for further information.

Functions Available at Right Rear Interface Connector (P1600)

External Clock Input (Contact 14A)

This input allows an external 1, 5, or 10 MHz frequency standard to be used in place of the internal timebase. The input is ac coupled and has a 1 kΩ input resistance. The peak-to-peak input voltage required is ≥0.5 V.

$\overline{\text{Prescale}}$ (Contact 14B)

When this available line is held low, the counter automatically adjusts the displayed answer for use with a divide-by-16 prescaler in FREQ A, PERIOD A, RATIO B/A, and TOTALIZE A modes (≤1 TTL load).

10 MHz Clock Out Ground (Contact 15A)

This terminal is the ground return for the clock input-output signals.

10MHz Clock Out (Contact 15B)

This available output line will drive one TTL load. This line is not intended to drive large capacitance loads and cable length should be kept to a minimum.

$\overline{\text{Reset}}$ Input (Contact 26A)

When this line is set low, the current measurement process is aborted for all selected functions and causes all digits in the display to read 8.8.8.8.8.8.8.8. All eight annunciators (and pushbuttons) are also illuminated. When this line is set high, a new measurement process is initiated for the selected FUNCTION and operating conditions. (CMOS V_{IL} ≤1.5 V and V_{IH} ≥3.5 V with a minimum pulse width of approximately 10 ms.) When not used, the line is in the high state.

Arming Input (Contact 27A)

This terminal is normally at a TTL high level. When pulled to a TTL low state with a TTL signal or transistor collector, the counter is prevented from making a measurement until the input goes to a TTL high state. When this input is routed to the rear interface it is dc coupled to the front panel arm signal. (V_H ≥2.4 V, V_L ≤0.4 V approximately 2 TTL loads).

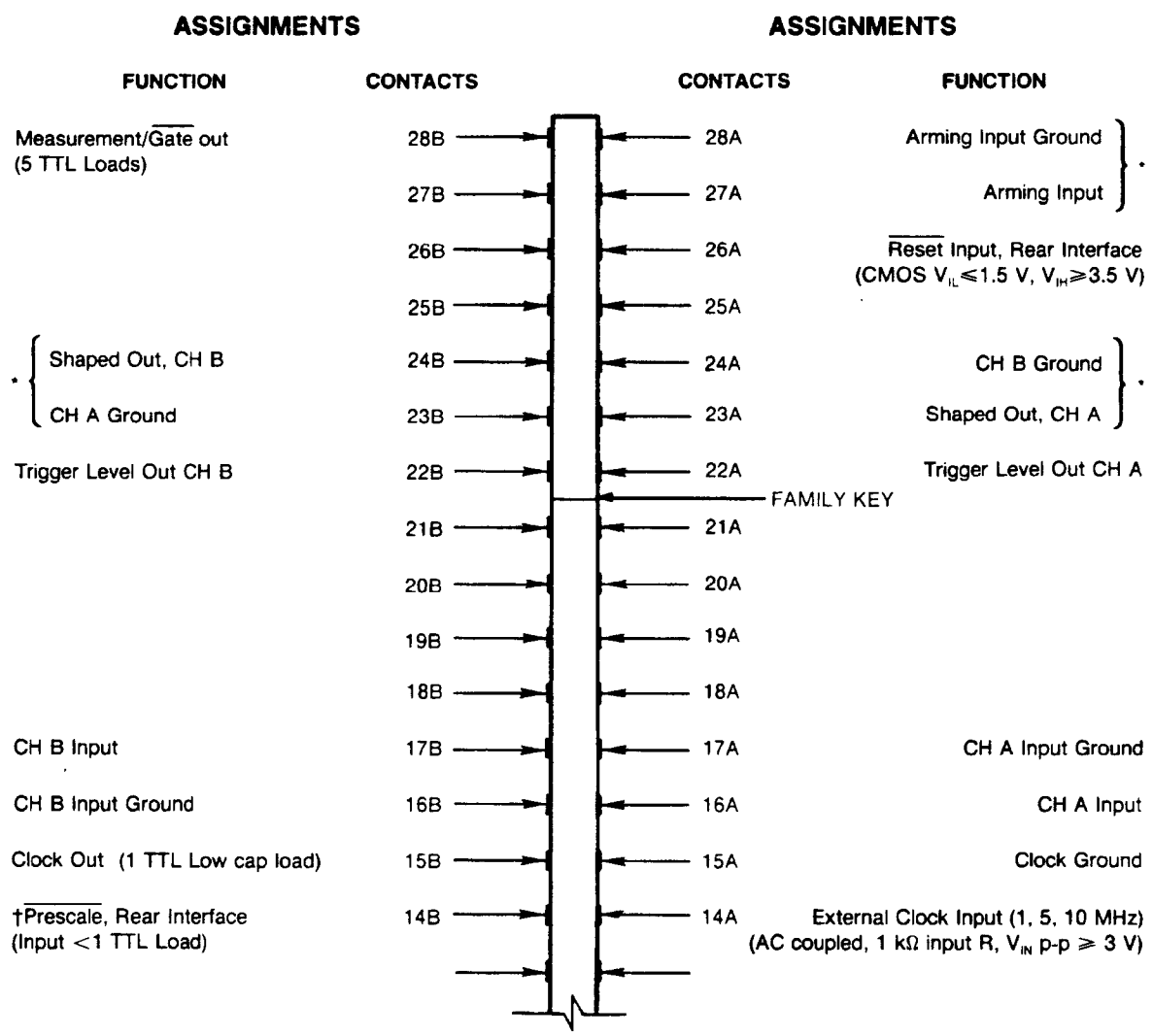
Arming Input Ground (Contact 28A)

This terminal is the ground return for the rear interface arming input signal.

Functions Available at Left Rear Interface Connector (P1820)

There are no rear interface functions available.

Approximate net instrument weight, 3.6 lbs.
Maximum power requirement at 120 V, 82 VA.



***These signals when re-routed to the rear interface, are not available at the front panel.**

†When the prescale line is held low the counter automatically adjusts the displayed answer for use with a divide-by-16 prescaler in FUNCTIONS, FREQUENCY, PERIOD, RATIO, and TOTALIZE modes.

CAUTION

When a Power Module compartment has been selected for the DC 5009 and wired for a specialized interface system, a plastic barrier (Tektronix Part Number 214-1593-02) should be installed in the key slot between contacts 21 and 22 on the Power Module.

Do not insert any TM 5000 Series plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

2088-97

Fig. DC 5009-1. Connector rear view.

INTERFACE NOTES

Introduction

A slot between pins 21 and 22 on the rear connector identifies this instrument as a member of the TM 5000 counter family. Insert a barrier in the corresponding position of the power module jack to prevent noncompatible plug-ins from being used in that compartment. Consult the power module manual for further information.

Functions Available at Rear Connector (P1625)

External Clock Input (Contact 14A)

This input allows an external 1, 5, or 10 MHz frequency standard to be used in place of the internal timebase. The input is ac coupled and has a 1 kΩ input resistance. The peak-to-peak input voltage required is ≥3 V.

Prescale (Contact 14B)

When this available line is held low, the counter automatically adjusts the displayed answer for use with a divide-by-16 prescaler in FREQUENCY A, PERIOD A, RATIO B/A, and TOTALIZE A modes (≤1 TTL load).

Clock Out Ground (Contact 15 A)

This terminal is the ground return for the clock input-output signals.

Clock Out (Contact 15B)

This available output line will drive one TTL load. This line is not intended to drive large capacitance loads and cable length should be kept to a minimum.

CH A Input (Contact 16A)

This is the Channel A input connection when the front panel CHANNEL A SOURCE switch is in the INT position. This input is terminated in 50 Ω with a maximum input of 3.6 V peak (10 V rms, sinewave).

CH B Input Ground (Contact 16B)

This terminal is the ground return for the rear interface Channel B input.

CH A Input Ground (Contact 17A)

This terminal is the ground return for the rear interface Channel A input.

CH B Input (Contact 17B)

This is the Channel B input connection when the front panel CHANNEL B SOURCE switch is in the INT position. This input is terminated in 50 Ω with a maximum input of 3.6 V peak (10 V rms, sinewave).

Trigger Level Out CH A (Contact 22A)

The voltage at this connection follows the Channel A front panel trigger LEVEL control. The signal level is approximately ±3.2 V.

Trigger Level Out CH B (Contact 22B)

The voltage at this connection follows the Channel B front panel trigger LEVEL control. The signal level is approximately ±3.2 V.

Shaped Out, CH A (Contact 23A)

This terminal provides a replica of the internal signals being used for the measurement; used as an aid to proper triggering on complex waveforms. This signal, when routed to the rear interface, is not available at the front panel.

Shaped Out, CH A Ground (Contact 23B)

This terminal is the ground return for the rear interface shaped out Channel A signal.

Shaped Out, CH B Ground (Contact 24A)

This terminal is the ground return for the rear interface shaped out Channel B signal.

Shaped Out, CH B (Contact 24B)

This terminal provides a replica of the internal signals being used for the measurement; used as an aid to proper triggering on complex waveforms. This signal, when routed to the rear interface, is not available at the front panel.

$\overline{\text{Reset}}$ Input (Contact 26A)

When this line is set low, the current measurement process is aborted for all selected functions and causes all digits in the display to read 8.8.8.8.8.8.8.8. All six annunciators are also illuminated. When this line is set high, a new measurement process is initiated for the selected FUNCTION and operating conditions. (CMOS $V_{IL} \leq 1.5$ V and $V_{IH} \geq 3.5$ V with a minimum pulse width of approximately 10 ms.)

Arming Input (Contact 27A)

This terminal is normally at a TTL high level. When pulled to a TTL low state with a TTL signal or transistor collector, the counter is prevented from making a measurement until the input goes to a TTL high state. When this input is routed to the rear interface it is not available at the front panel. ($V_H \geq 2.4$ V, $V_L \leq 0.4$ V approximately 2 TTL loads).

Arming Input Ground (Contact 28A)

This terminal is the ground return for the rear interface arming input signal.

Measurement $\overline{\text{Gate}}$ Out (Contact 28B)

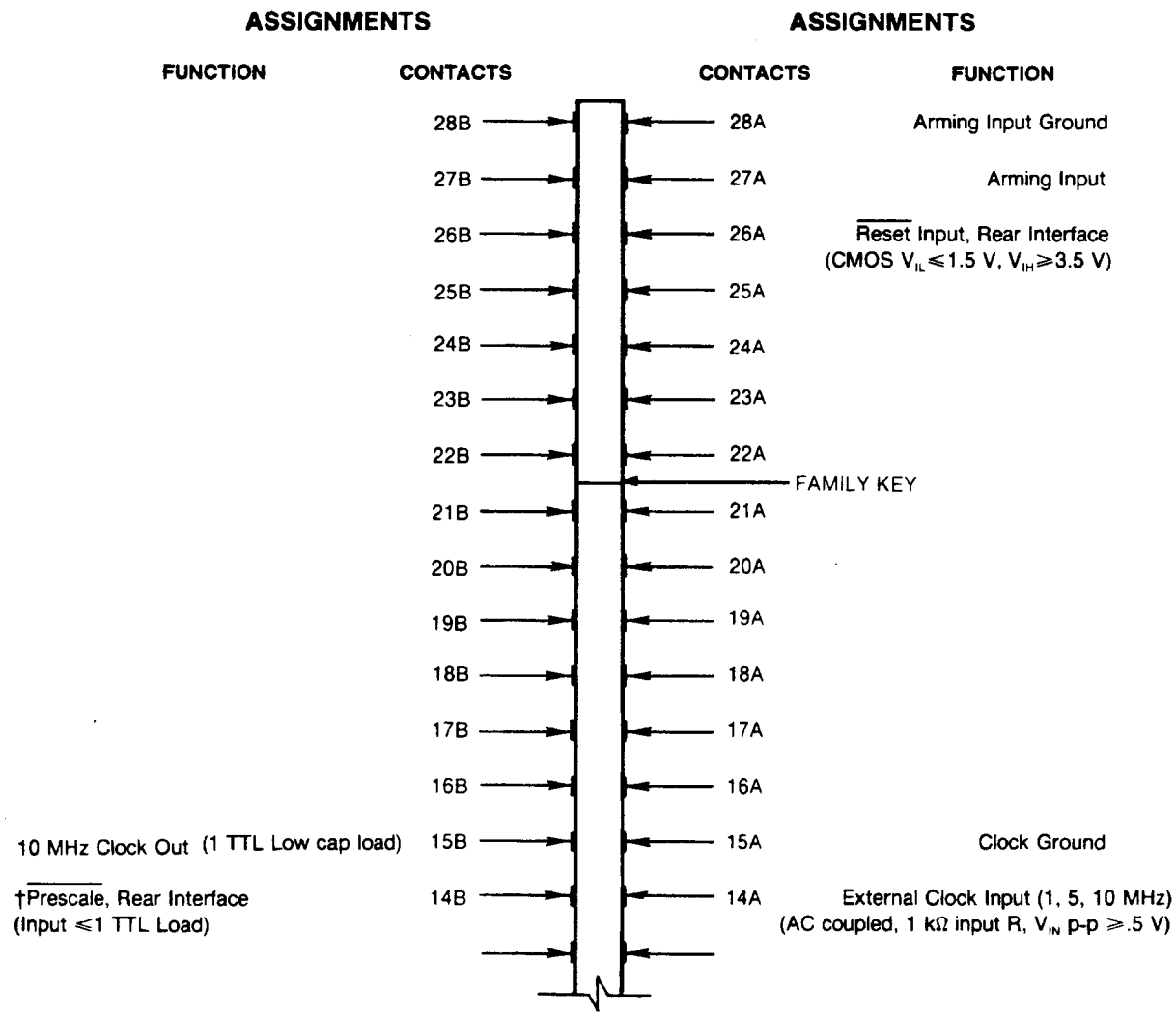
This line is in the low state during the current measurement process and is capable of driving three LS TTL loads (1.2 mA, I_{OL}). The gate duration is dependent on the input signal frequency and the AVERAGES selected.

GPIB Rear Interface Connector (P1001)

This connector does not contain any signals that would be connected between plug-ins.

Approximate net instrument weight, 2.6 lbs.
Maximum power requirement at 120 V, 53 VA.

NOTES



†When the prescale line is held low the counter automatically adjusts the displayed answer for use with a divide-by-16 prescaler in FREQ A, PERIOD A, RATIO B/A, and TOTALIZE A modes.

CAUTION

When two Power Module compartments have been selected for the DC 5010 and wired for a specialized interface system, plastic barriers (Tektronix Part Number 214-1593-02) should be installed in the key slot between contacts 21 and 22 in each selected compartment of the Power Module.

Do not insert any TM 5000 Series plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

Fig. DC 5010-1. Connector rear view.

INTERFACE NOTES

Introduction

A slot between pins 21 and 22 on the rear connector identifies this instrument as a member of the TM 5000 counter family. Insert a barrier in the corresponding position of the power module jack to prevent noncompatible plug-ins from being used in that compartment. Consult the power module manual for further information.

Functions Available at Right Rear Interface Connector (P1600)

External Clock Input (Contact 14A)

This input allows an external 1, 5, or 10 MHz frequency standard to be used in place of the internal timebase. The input is ac coupled and has a 1 kΩ input resistance. The peak-to-peak input voltage required is ≥0.5 V.

$\overline{\text{Prescale}}$ (Contact 14B)

When this available line is held low, the counter automatically adjusts the displayed answer for use with a divide-by-16 prescaler in FREQ A, PERIOD A, RATIO B/A, and TOTALIZE A modes (≤1 TTL load).

10 MHz Clock Out Ground (Contact 15A)

This terminal is the ground return for the clock input-output signals.

10 MHz Clock Out (Contact 15B)

This available output line will drive one TTL load. This line is not intended to drive large capacitance loads and cable length should be kept to a minimum.

$\overline{\text{Reset}}$ Input (Contact 26A)

When this line is set low, the current measurement process is aborted for all selected functions and causes all digits in the display to read 8.8.8.8.8.8.8.8. All eight annunciators (and pushbuttons) are also illuminated. When this line is set high, a new measurement process is initiated for the selected FUNCTION and operating conditions. (CMOS V_{IL} ≤1.5 V and V_{IH} ≥3.5 V with a minimum pulse width of approximately 10 ms.) When not used, the line is in the high state.

Arming Input (Contact 27A)

This terminal is normally at a TTL high level. When pulled to a TTL low state with a TTL signal or transistor collector, the counter is prevented from making a measurement until the input goes to a TTL high state. When this input is routed to the rear interface it is dc coupled to the front panel arm signal. (V_H ≥2.4 V, V_L ≤0.4 V approximately 2 TTL loads).

Arming Input Ground (Contact 28A)

This terminal is the ground return for the rear interface arming input signal.

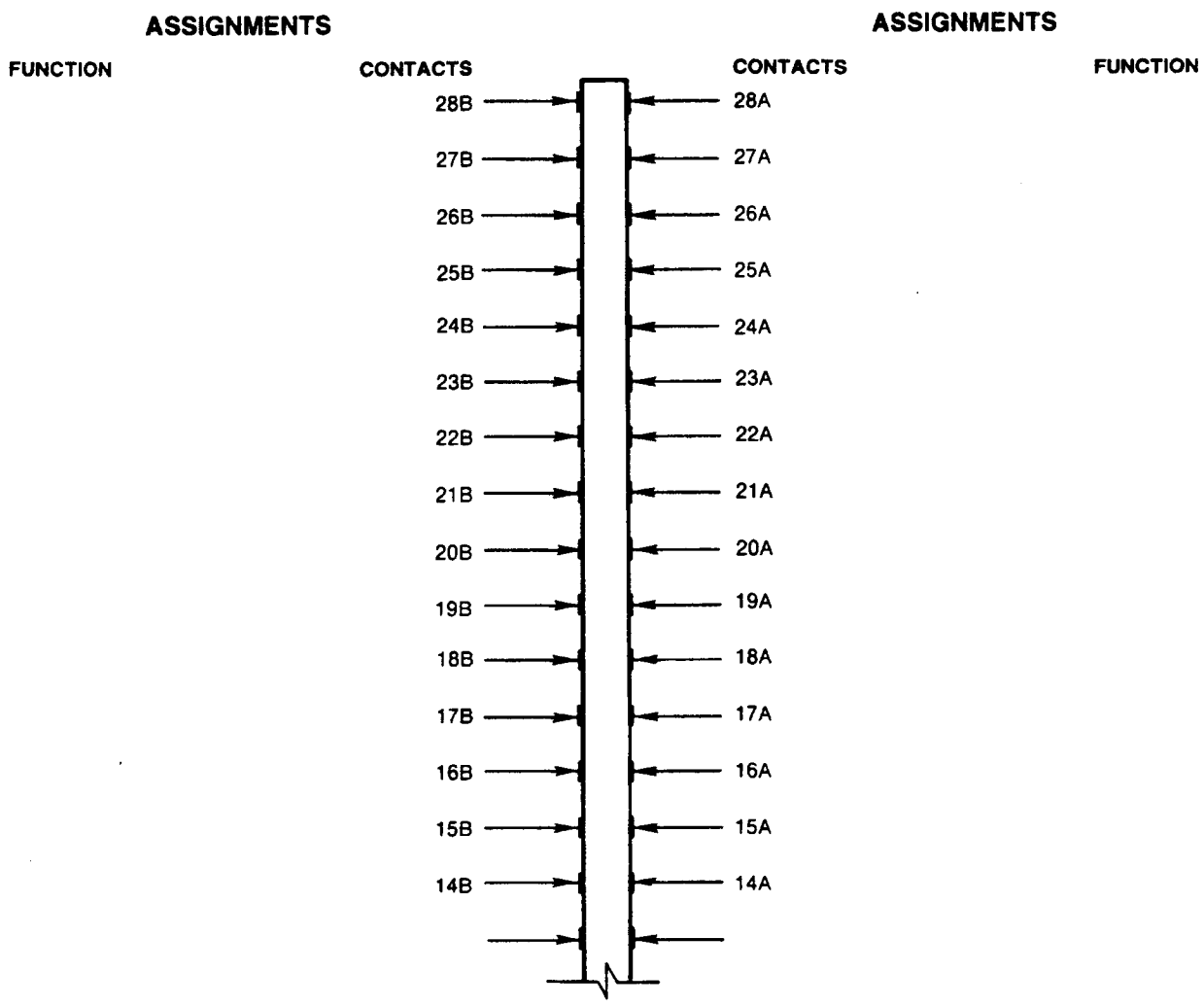
Functions Available at Left Rear Interface Connector (P1820)

This connector does not contain any signals that would be connected between plug-ins.

Approximate net instrument weight, 3.7 lbs.
Maximum power requirement at 120 V, 93 VA.

DIGITAL DELAY UNITS

NOTES



CAUTION

When a Power Module compartment had been selected for the DD 501 and wired for a specialized interface system, (Option 07) a plastic barrier (Tektronix Part Number 214–1593–02) should be installed in a key slot between contacts 21 and 22 on the Power Module.

Do not insert any TM 500 Series plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

2088-30

Fig. DD 501-1. Connector rear view.

INTERFACE NOTES

DLY'D TRIG OUT (Suggestion)

At the present time, no pin assignments are available for the DD 501. If the user desires the DLY'D TRIG OUT signal connected to the rear interface, the coaxial cable should be disconnected from the rear of the front-panel bnc connector and a new 50 Ω coaxial cable routed to contact 27B (signal out) and 28B (coaxial-cable shield ground). Note that the DLY'D TRIG OUT signal must be terminated into a 50 Ω load in order to maintain the risetime and falltime characteristics of the signal.

EVENTS INPUT (Suggestion)

The EVENTS INPUT can be applied through the rear interface by using contact 24B (signal input) with contact 25B used as ground. Route a new cable from the rear interface to the bnc connector (EVENTS INPUT) on the front panel.

START INPUT (Suggestion)

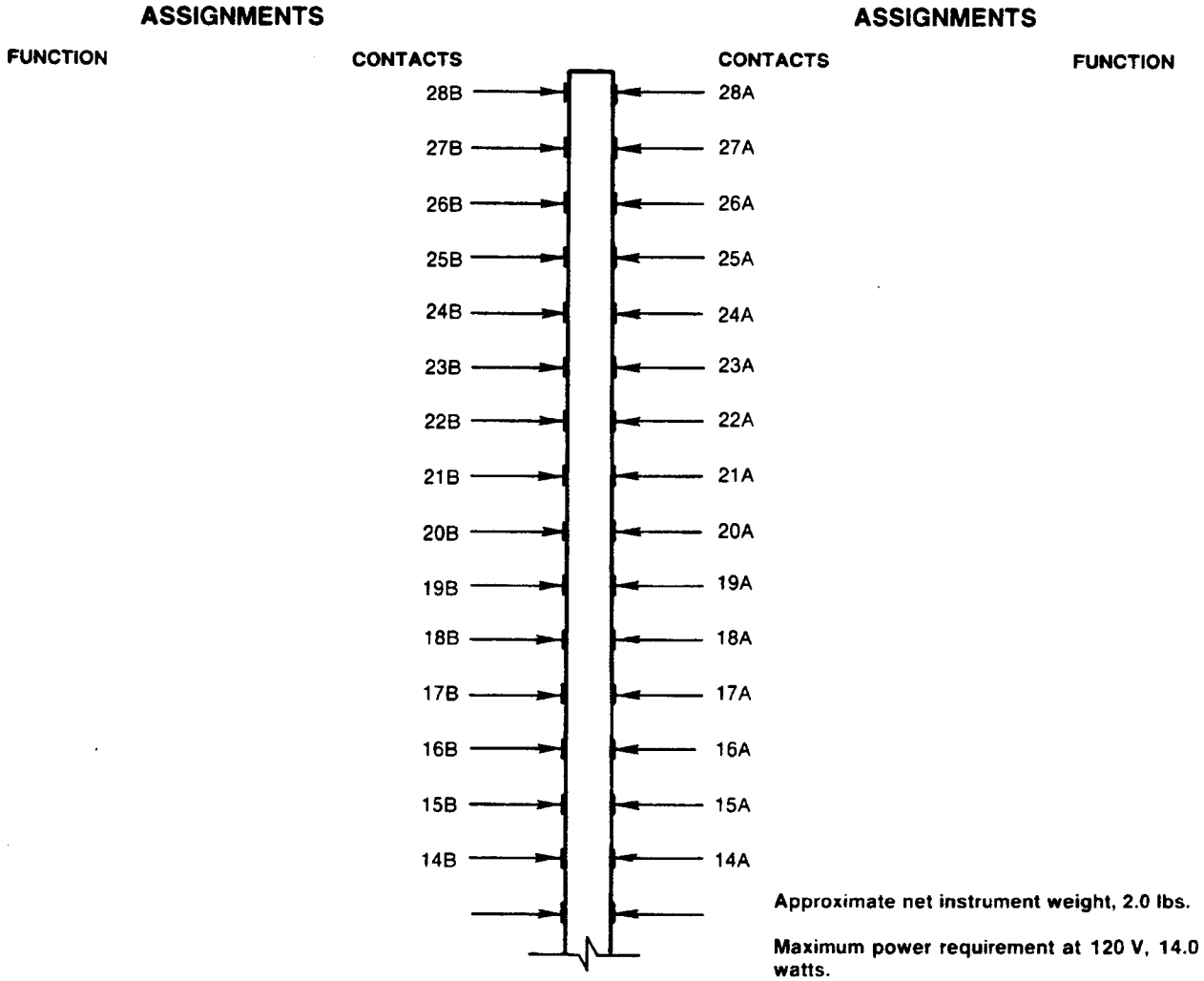
The START INPUT can be applied through the rear interface by using contact 21B (signal input) with contact 22B used as ground. Route a new cable from the rear interface to the bnc connector (START INPUT) on the front panel.

NOTE

Wiring the rear interface and front-panel connectors in parallel increases the input capacitance. The EVENTS INPUT and START INPUT have compensation adjustments that may alter the calibration procedure.

Approximate net instrument weight, 1.5 lbs.

Maximum power requirement at 120 V, 16 watts.



CAUTION

When a Power Module compartment has been selected for the DL 502 and wired for a specialized interface system, a plastic barrier (Tektronix Part Number 214-1593-02) should be installed in a key slot between contacts 24 and 25 on the Power Module.

Do not insert any TM 500 Series plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

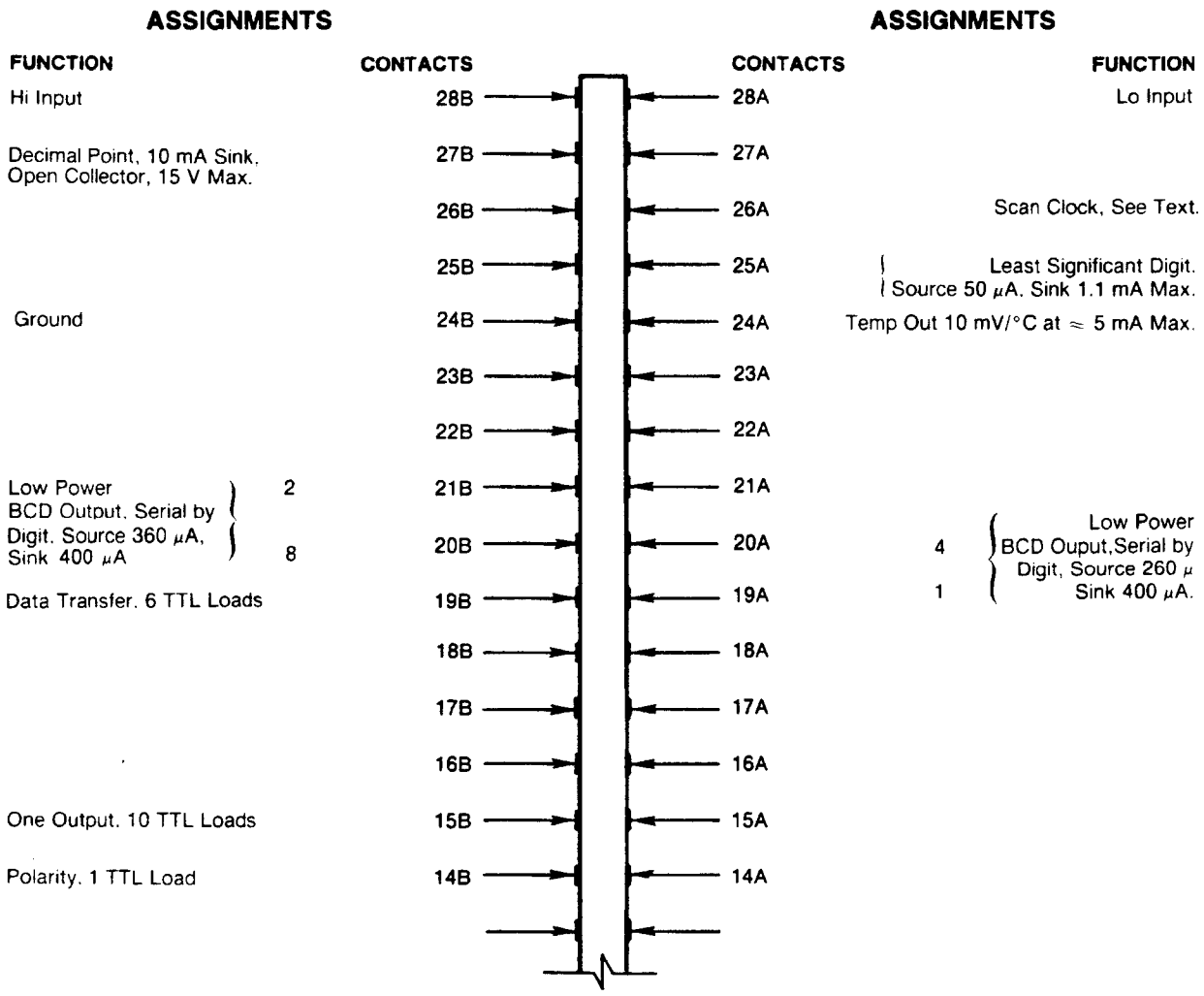
2088-31

Fig. DL 502-1. Connector rear view.

NOTES

DIGITAL MULTIMETERS

NOTES



CAUTION

When a Power Module compartment had been selected for the DM 501's (before serial number B072150) and wired for a specialized interface system, a plastic barrier (Tektronix Part Number 214–1593–02) should be installed in a key slot between contacts 22 and 23 on the Power Module.

Do not insert any TM 500 Series plug-in in a live power Module and do not use excessive force when inserting the plug-in.

2088-32

Fig. DM 501-1. Connector rear view.

INTERFACE NOTES

Introduction

Display logic, temperature readout simultaneous with the front-panel output and external input, are available at the rear-interface connector.

Display Details

The display is sequentially scanned starting with the least significant digit (lsd) and ending with the second most significant digit. The most significant digit (msd) and polarity signs are not scanned in time sequence (see Fig. DM 501-1). They are determined when the count is transferred to the latches and are not updated until the next data transfer. All digits display numbers from 0 through 9 with the exception of the most significant digit. This digit displays either a 1 or 0. The plus or minus sign is also included within this digit module. All digits except the most significant digit have similar segments connected together. These segments are driven from a bcd to seven-segment decoder driver. The bcd data is available at the rear-interface connector.

Buffering Output Terminals

The assignments diagram lists the loads each rear interface output terminal is capable of driving. Buffers may be required depending on the load requirements. A 74L04 low power TTL chip with six inverters per chip may suffice. For a non-inverted output, use a CMOS buffer such as a CD4050. If buffering is required on only one output line, use a transistor such as the 2N2222A.

Hi and Lo Input (Contacts 28B and 28A)

When the front-panel INPUT switch is pushed in, the HI and LO inputs are transferred from the front panel to the rear-interface connections. These contacts are floating. Maximum voltage on either input should not exceed 350 V measured from ground.

Decimal Point (Contact 27B)

Connect a 5.1 kΩ resistor from this contact to +5 V. This terminal connects directly to the collector of Q340. This terminal is high when the displayed digit requires a decimal point to its left.

Scan Clock (Contact 26A)

This is a 4 kHz signal used to step the display through the digit sequence as described earlier (see Fig. DM 501-2). Buffer this output with a non-loading device (CMOS).

Least Signficant Digit (Contact 25A)

This terminal goes high when the data on the bcd lines applies to the least significant digit.

BCD Output Lines (Contacts 19A, 20A, 20B, 21B)

These lines present the data in bit parallel, character serial fashion.

Data Transfer (Contact 19B)

This line goes high when the count accumulated in the cascaded counters transfers to the five 4-bit latches. The first lsd pulse (high) after Data Transfer goes low may be used to start the display sequence.

One Output (Contact 15B)

This line goes low when the 1 in the msd module is illuminated.

Polarity (Contact 14B)

This connection is low when the vertical bars in the polarity sign are illuminated.

Temperature Readout (Contacts 24A and 24B Ground)

These connections are in parallel with the front-panel TEMP OUT terminals. The voltage available is 10 mV/degree.

Approximate net instrument weight, 1.8 lbs.

Maximum power requirement at 120 V, 14.0 lbs.

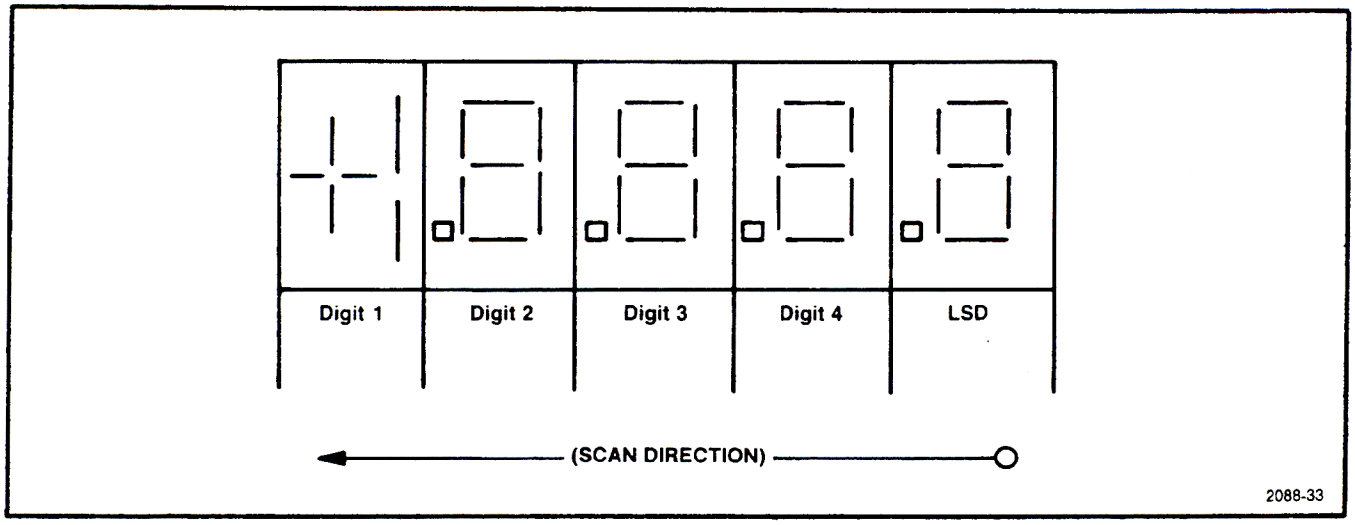


Fig. DM 501-2. Digit scan direction.

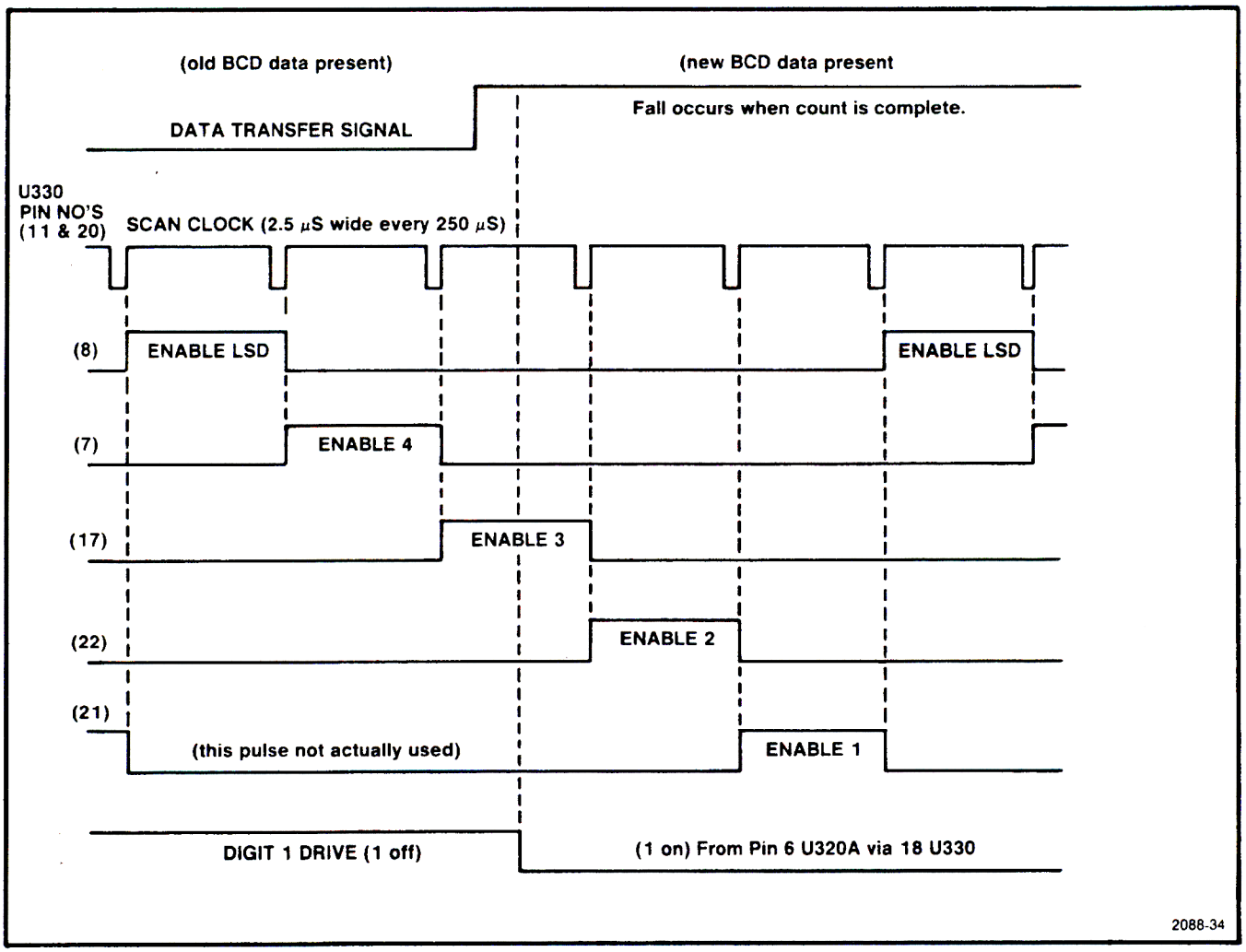


Fig. DM 501-3. Digit scan waveforms.

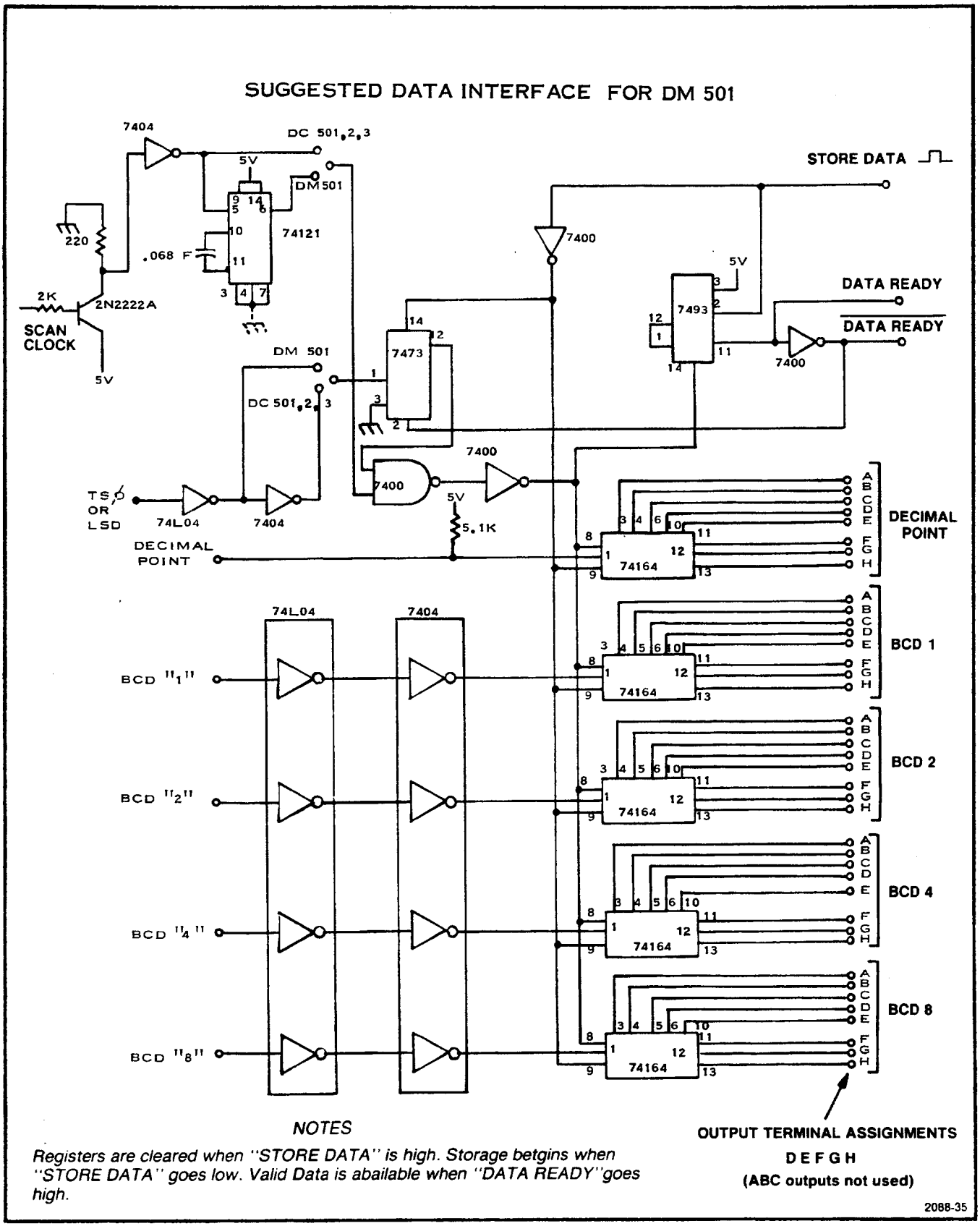


Fig. DM 501-4. Data interface.

Remarks	Maximum Recommended Loads	Active Level	Output or Input	Pin B		Pin A	Output Input	Active Level	Maximum Recommended Loads	Remarks
			HIGH Input	*28		28*	LOW input			
				27		27				
				26		26				
				25		25				
				24		24				
				23		23				
				22		22				
				21		21				
				20		20				
				19	DM barrier slot	19				
				18		18				
				17		17				
				16		16				
				15		15				
				14		14				

2088-36

Fig. DM 501A-1. Connector rear view.

INTERFACE NOTES

Introduction

Rear interface input can be selected by a front-panel push button for dc voltage (200 mV, 2 V, 20 V, 200 V, and 1000 V), true rms ac voltage (200 mV, 2 V, 20 V, 200 V, and 500 V), and dB (-40 dB, -20 dB, 0 dB, +20 dB, and +40 dB) or resistance measurements (200 Ω, 2 kΩ, 20 kΩ, 200 kΩ, 2000 kΩ, and 20 MΩ).

Display Details

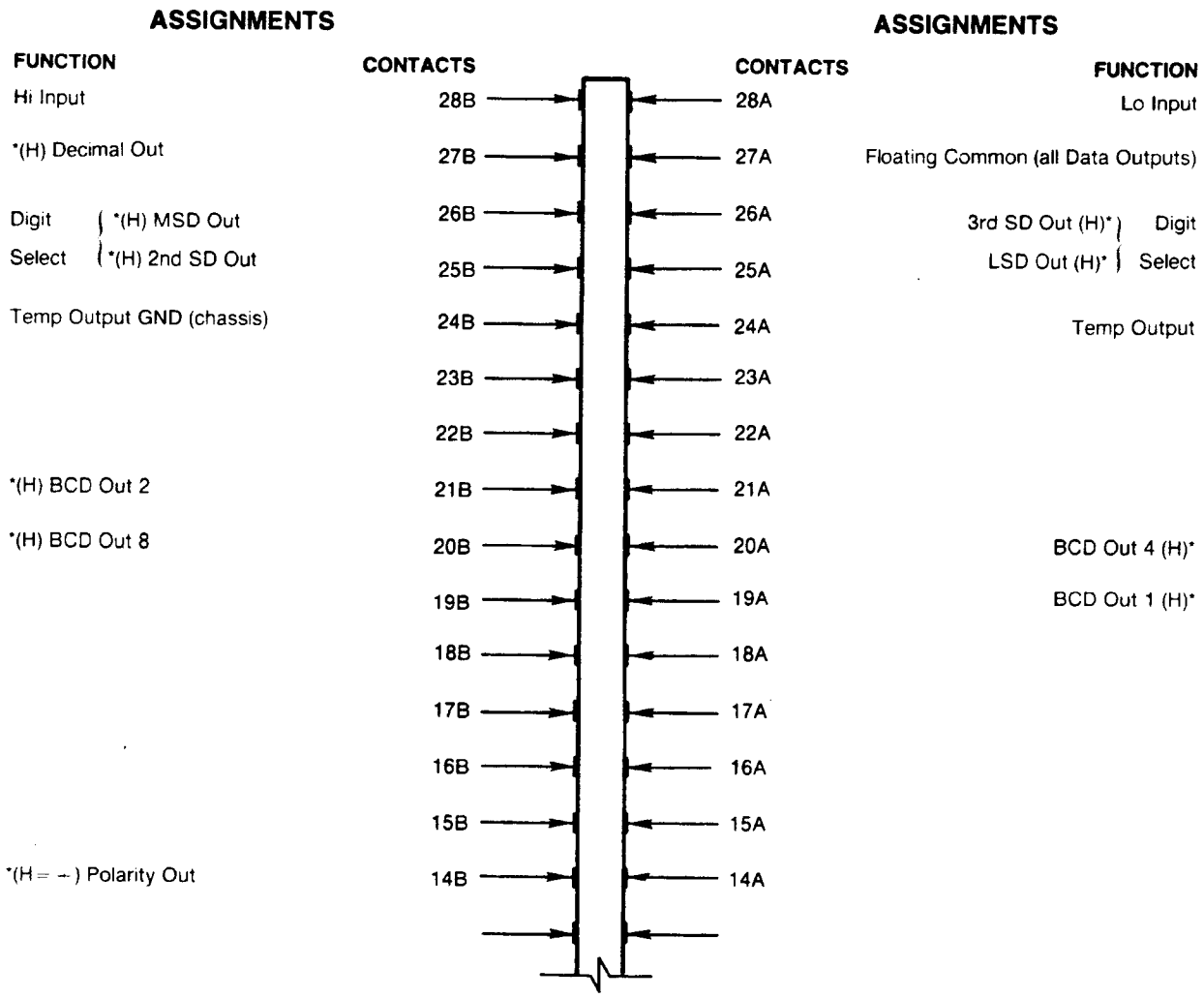
The LED indicators provide a 4 1/2 digit, 0.4 in. high display. The decimal point is automatically positioned by the range push buttons. Polarity signs for dc volts, dc amperes, and dB are also displayed. Overrange is indicated by a blinking display.

Lo Input (Contact 28A), HI Input (Contact 28B)

When the front-panel INPUT switch is depressed, the HI (contact 28B) and LO (contact 28A) inputs are transferred from the front panel to the rear interface connections. Maximum voltage on either input should not exceed 200 V peak measured from ground.

Approximate net instrument weight, 2.5 lbs.

Maximum power requirement at 120 V, 9.0 watts.



**Optional—see Interface notes. These outputs must be buffered before using them to drive external inputs. Letter in ( ) indicates active level.*

CAUTION

When a Power Module compartment had been selected for the DM 502 and wired for a specialized interface system, a plastic barrier (Tektronix Part Number 214–1593–02) should be installed in a key slot between contacts 22 and 23 on the Power Module. Earlier productions for the DM 502's (before serial number B024510) have the key slot between contacts 22 and 23 on the Power Module.

Do not insert any TM 500 Series Plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

Fig. DM 502-1. Connector rear view.

INTERFACE NOTES

Introduction

The Hi Input (contact 28B), Lo Input (contact 28A), Temp Output (contact 24A), and Temp Output Gnd (contact 24B–chassis ground) are the only DM 502 input/output functions that are factory wired to the rear-interface contacts. If it is desired to transmit digital data through the power module interface, the connections to the rear-interface contacts must be user wired. Suggested instructions for obtaining digital data from the DM 502 are included in these Interface Notes.

Hi Input and Lo Input (Contacts 28B and 28A)

Measurement signals, except temperature (TEMP PROBE), can be applied directly through the rear interface Hi (28B) and Lo (28A) circuit board contacts. Comparisons can be made between front panel and rear interface measurement sources by using the EXT-INT push button switch on the front panel of the DM 502.

When using the rear interface Hi and Lo contacts, the maximum deviation from earth ground (dc plus peak ac) should not exceed 350 V, or +50 dBm in the dB mode. The impedance between the Hi and Lo contacts is dependent on the position of the front-panel range/function switch (type of measurement being made). For further details related to input impedance and input limitations refer to the Electrical specifications section of the DM 502 instruction manual.

Temp Output and Temp Output Gnd (Contacts 24A and 24B)

These contacts can be used to monitor a dc voltage proportional to temperature measurements when using a P6430 probe connected to the front-panel TEMP PROBE input connector. The output impedance at contact 24A is quite low and a 10,000 to 20,000 Ω/V meter can be driven directly from this point. Sensitivity (for a properly calibrated system) is 10 mV/°C or 10 mV/°F. In normal operation, °C or °F mode is selected by a front-panel switch and the dc voltage measured on contact 24A (2 volts maximum) is directly related to the temperature value displayed on the DM 502 front panel.

If it is desired to monitor the dc voltage (at 24A) related to temperature while using the front-panel range/function control to perform other measurement functions, the user can modify the internal circuitry (refer to Fig. DM 502-1).

1. For monitoring in the °C mode, disconnect either end of R285.
2. For monitoring in the °F mode, connect a jumper wire between the center terminal of potentiometer R268 (°F) and the solder pad as shown.

The DM 502 Option 02 instrument does not have the temperature measurement or monitoring capability and contact 24A for an Option 02 instrument is grounded to the chassis.

Digital Data Output (Optional Contacts)

The DM 502 front-panel readout is a 3 1/2 digit display using four seven-segment LED's. The most significant digit (msd) is at the extreme left with the least significant digit (lsd) at the extreme right of the display. The digits are numbered 1, 2, 3, 4 (from right to left) with the lsd being digit 1 and the msd being digit 4.

The internal circuitry for the DM 502 does not scan the digits in a 1, 2, 3, 4 sequence. The scan sequence is digit 1 (lsd), digit 3, digit 2, and then digit 4 (msd) for one complete scan of all the digits.

In order to obtain digital data through the rear interface, the optional contacts must be user wired to specific data points on the DM 502 circuit board. Refer to Fig. DM 502-2 for the specific data point locations and the solder pad connections for the rear-interface contacts.

CAUTION

All digital data outputs and the LO input terminals (front and rear) of the DM 502 are referenced to a floating ground (contact 27A) when wired according to Fig. DM 502-2. If the data outputs are wired to a peripheral instrument with a chassis ground reference, the DM 502 circuitry must also be referenced to chassis ground. If the DM 502 circuitry is left floating as little as 0.2 V away from chassis ground, the result is a possible loss of data and just a few volts more than this can result in damage to the DM 502 and the peripheral instrument. The DM 502 floating ground can be referenced to chassis ground by connecting a jumper between the LO and chassis ground terminals on the front panel.

If the DM 502 is user wired according to Fig. DM 502-2, the digital data outputs (signal lines) must be buffered to prevent excessive loading on the DM 502 data lines. A typi-

cal transistor buffer circuit is illustrated in Fig. DM 502-2. Note that the digit scan sequence (1-3-2-4) remains the same as the front-panel scan sequence. When using the transistor type of buffer circuit, the bcd and Digit Select output logic level format is changed from active high true to active low true. The output logic level format for the Transfer signal line (contact 19B) is true in the low state and this signal line might require a buffer circuit of opposite polarity than the circuit suggested in Fig. DM 502-2. It is suggested that the transistor buffer circuits drive additional inverter circuits to retain the same logic level format as the DM 502.

It is not recommended that TTL devices be connected directly to the digital data lines at the rear interface. As a result, external interface alternatives should include low-curent load devices such as CMOS, or the isolation circuitry similar to that showin in Fig. DM 502-3.

NOTES

When any DM 502 interface system has been completed, it might be necessary to perform Step 3 of the Internal Adjustment Procedure in the DM 502 Instruction Manual in order to Adjust Integrator Zero.

The isolation circuitry shown in Fig. DM 502-3 peforms two major functions. It allows digital data to be transmitted through the rear interface when the DM 502 is floated above ground (chassis) reference, within specified limitations, and changes the digit scan sequence from 1-3-2-4 to a 1-2-3-4 sequence. This circuit could be built on an auxiliary board mounted on the cam switch. If this is done, connect the specific data points to the input of the isolators and the output terminals to the designated rear-interface contacts. The output signal lines are TTL compatible. All of the IC's

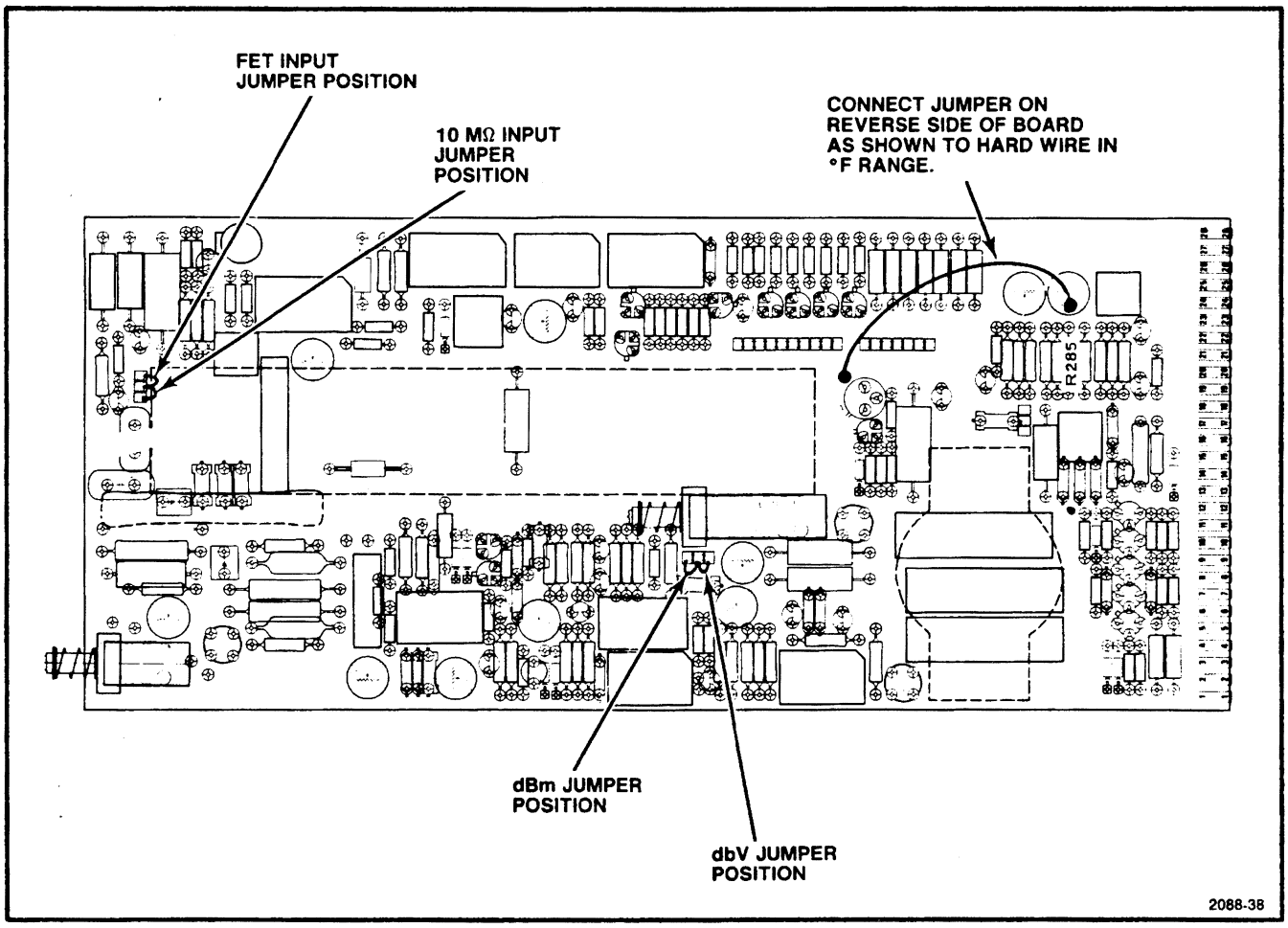


Fig. DM 502-2. Board Jumper Locations.

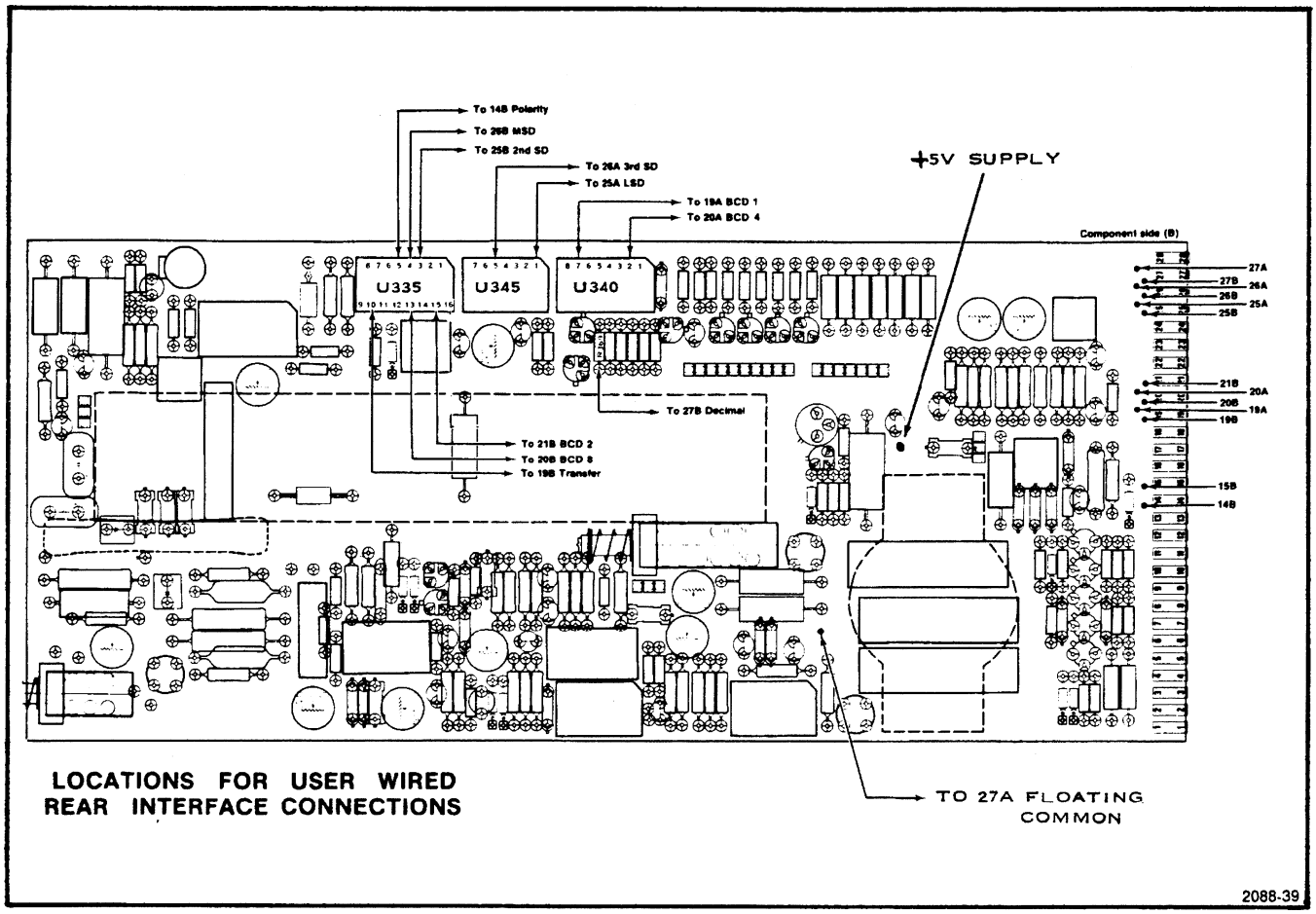


Fig. DM 502-3. Interface connection points.

should be CMOS devices so that the outputs of the isolators are not loaded. The circuit requires two quad-nand-gates, one hex-inverter, one J-K flip-flop, four CA3083 transistor packages, and ten optical isolators. When connecting the CA3083 transistors, be certain that the transistor packages are not mixed between the isolator and driver circuits and that the substrate for each package is tied to its individual signal ground reference.

A time-ladder diagram for the circuit illustrated in Fig. DM502-3 is shown in Fig. DM 502-4. Note that the DM 502 Digit Select pulses are approximately 0.4 ms duration with the DM 502 scan period (1-3-2-4 sequence) being approximately 1.56 ms. The J-K flip-flop changes the digit scan sequence by enabling one pair of the nand gates for digits 1 and 2 for one DM 502 scan period and then enabling the other pair of nand gates for digits 3 and 4 during the next DM 502 scan period. The J-K flip-flop is clocked by the negative-going edge of the msd pulse. As a result, the complete period for the 1-2-3-4 digit select sequence is increased to about 3.12 ms.

The DM 502 internal circuitry has the ability to count to approximately 3100, even though the numeral for digit 4 (msd) on the front panel is limited to the numeral 1. The DM 502 front-panel display starts blinking at the count of 2000, and the numerals 2 or 3 will not appear on the DM 502 display. By applying a logic low level to the two nand gates for binary bits 4 and 8 during the msd time slot, the interface circuitry has the ability to provide valid counts up to 3000, even though the display may be blinking.

Approximate net instrument weight, 2.0 lbs.

Maximum power requirement at 120 V, 14.0 watts.

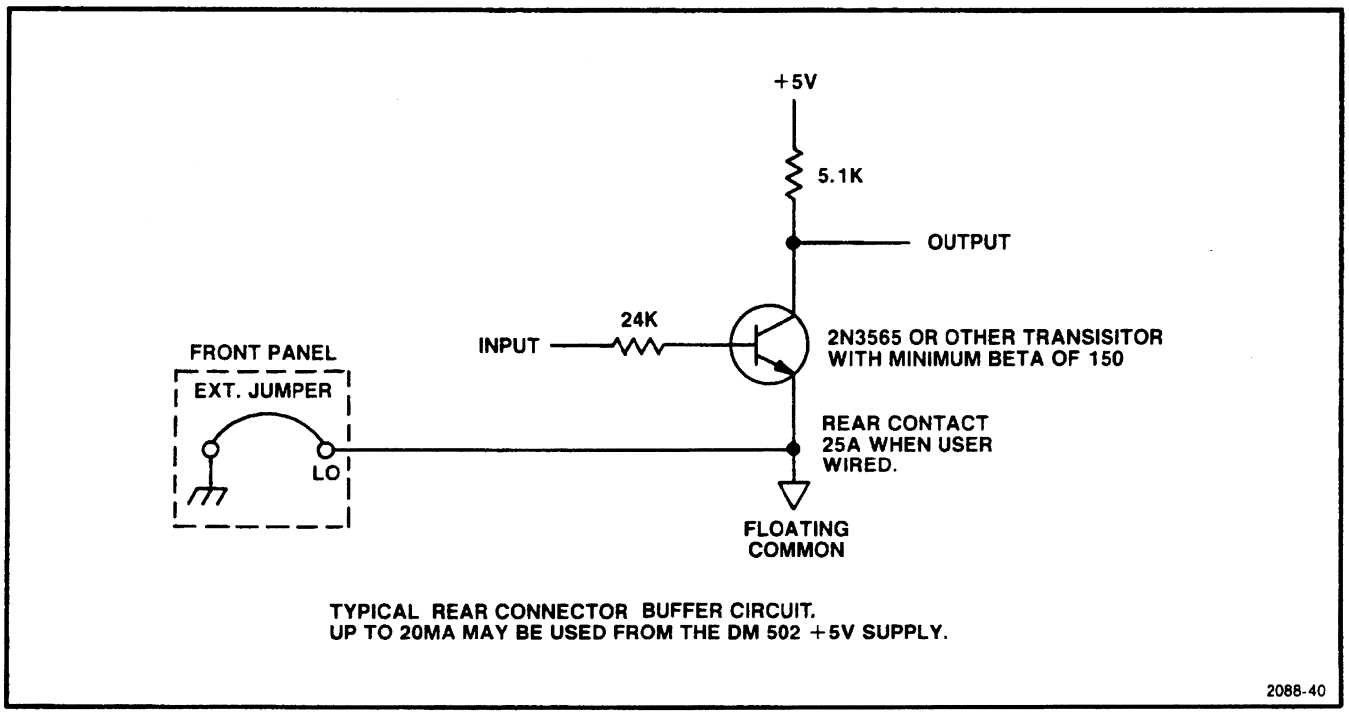


Fig. DM 502-4. Rear connector buffer.

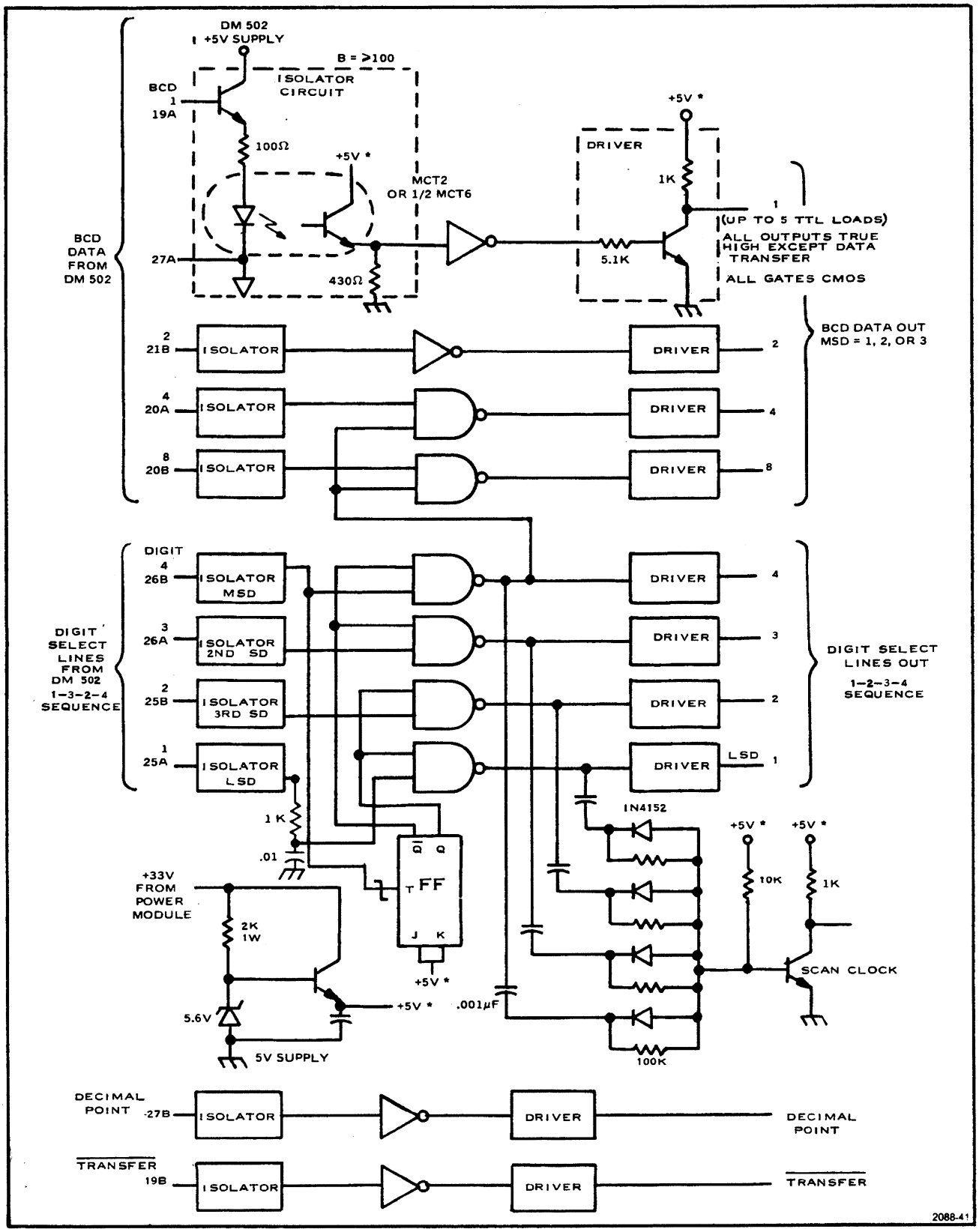


Fig. DM 502-5. Isolation circuitry.

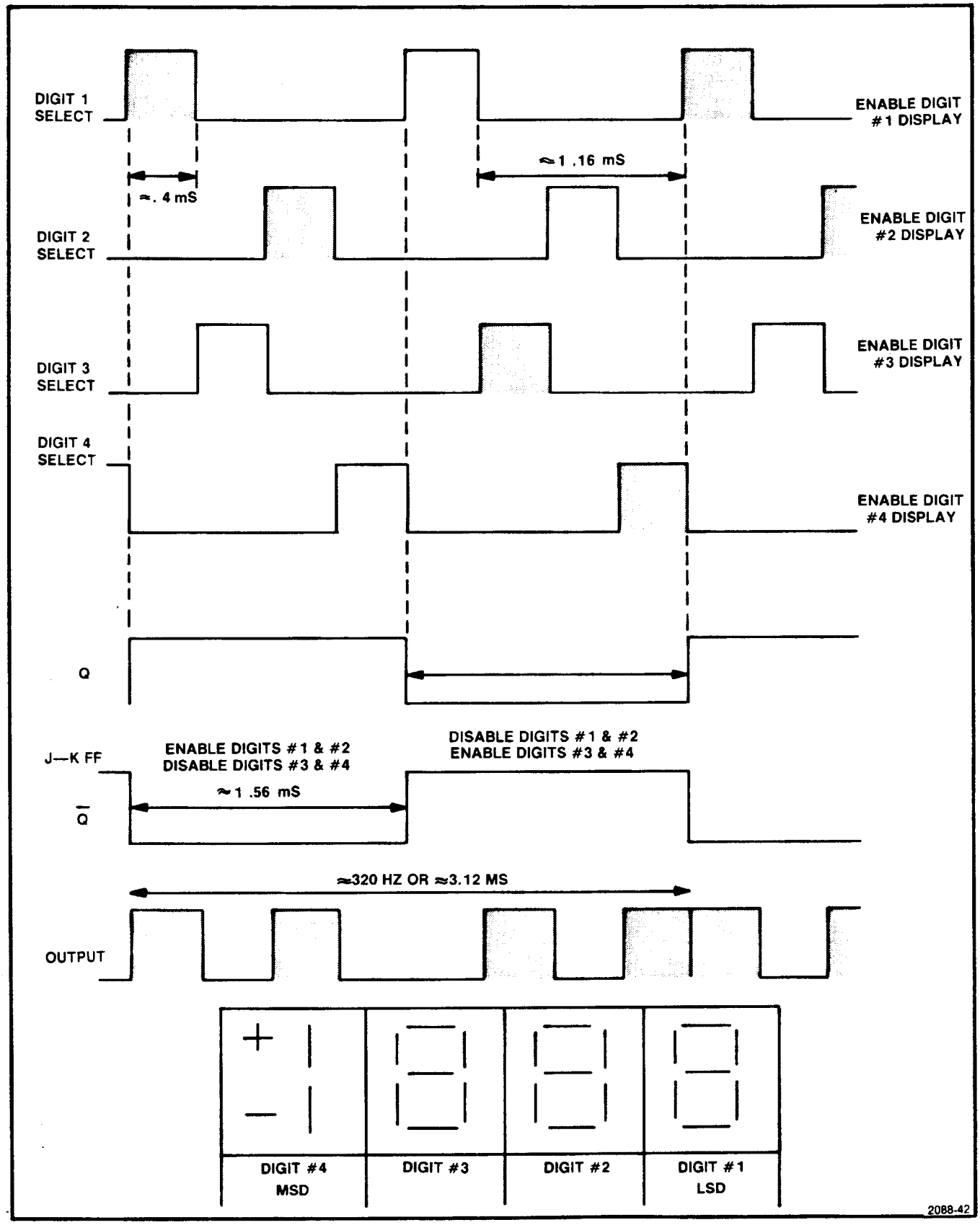


Fig. DM 502-6. Digit select waveforms.

NOTES

Remarks	Maximum Recommended Loads	Active Level	Output or Input	Pin B		Pin A	Output Input	Active Level	Maximum Recommended Loads	Remarks
			HIGH Input	*28		28*	LOW input			
				27		27				
				26		26				
				25		25				
				24		24				
				23		23				
				22		22				
				21		21				
				20		20				
				19	DM barrier slot	19				
				18		18				
				17		17				
				16		16				
				15		15				
				14		14				

2088-36

Fig. DM 502A-1. Connector rear view.

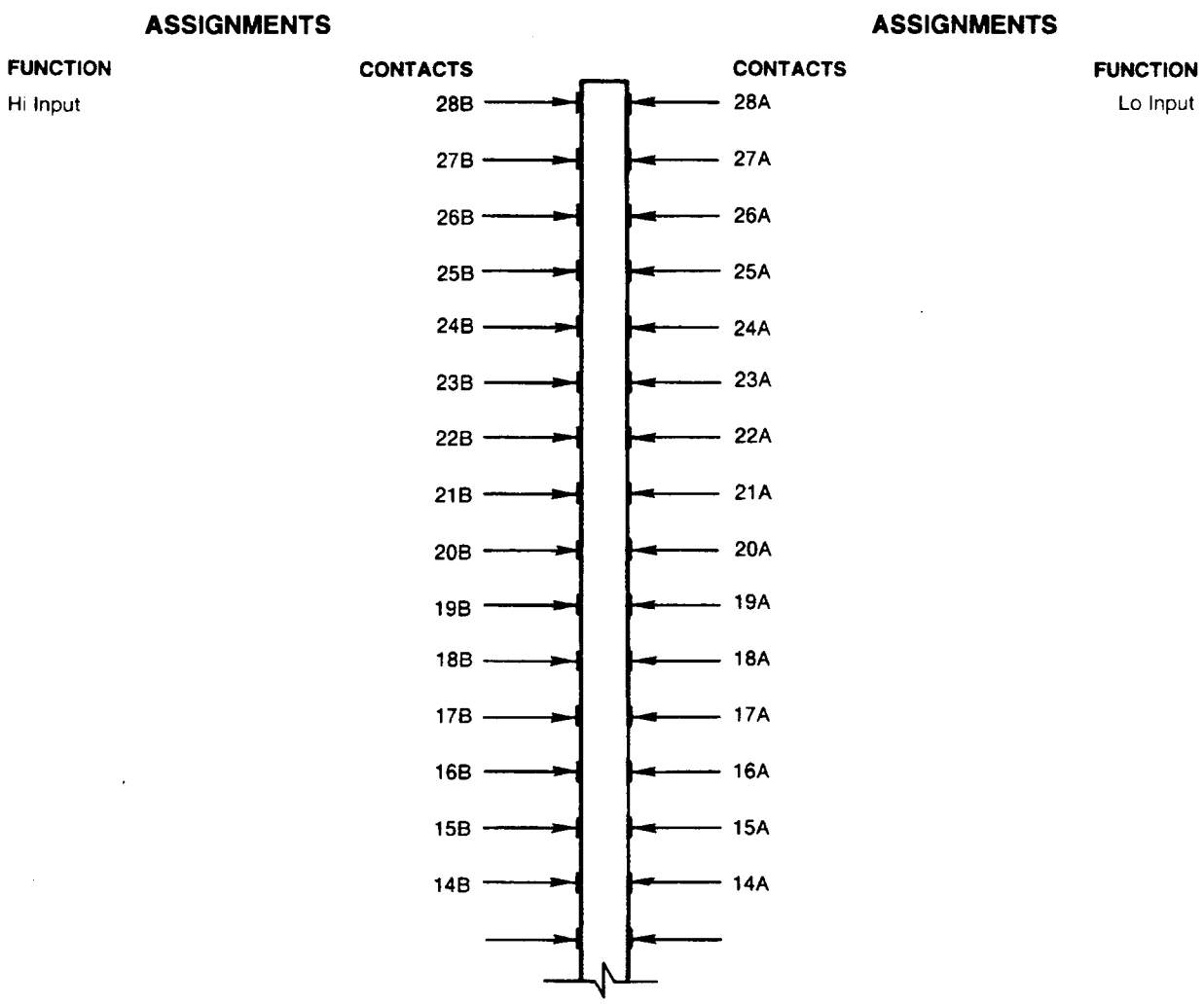
INTERFACE NOTES

High and Low Input (Contacts 28B and 28A)

Measurement signals, except temperature and current, can be applied directly through the rear interface circuit board contacts. Comparisons can be made between front-panel and rear-interface measurement sources by using the EXT INT push button located on the front panel. Do not exceed the maximum specified input voltage listed in the Specification section of the instrument manual. Note that some functions, when applied at the rear interface inputs, are derated. This information is also noted in the Specification section.

Approximate net instrument weight, 2.5 lbs.

Maximum power requirement at 120 V, 9 watts.



CAUTION

When a Power Module compartment has been selected for the DM 505 and wired for a specialized interface system, a plastic barrier (Tektronix Part Number 214–1593–02) should be installed in the key slot between contacts 17 and 18 on the Power Module.

Do not insert any TM 500 Series Plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

2088-44

Fig. DM 505-1. Connector rear view.

INTERFACE NOTES

Introduction

The HI Input (contact 28B) and LO Input (contact 28A) are the only DM 505 input functions that are available at the rear-interface contacts. These contacts are factory wired.

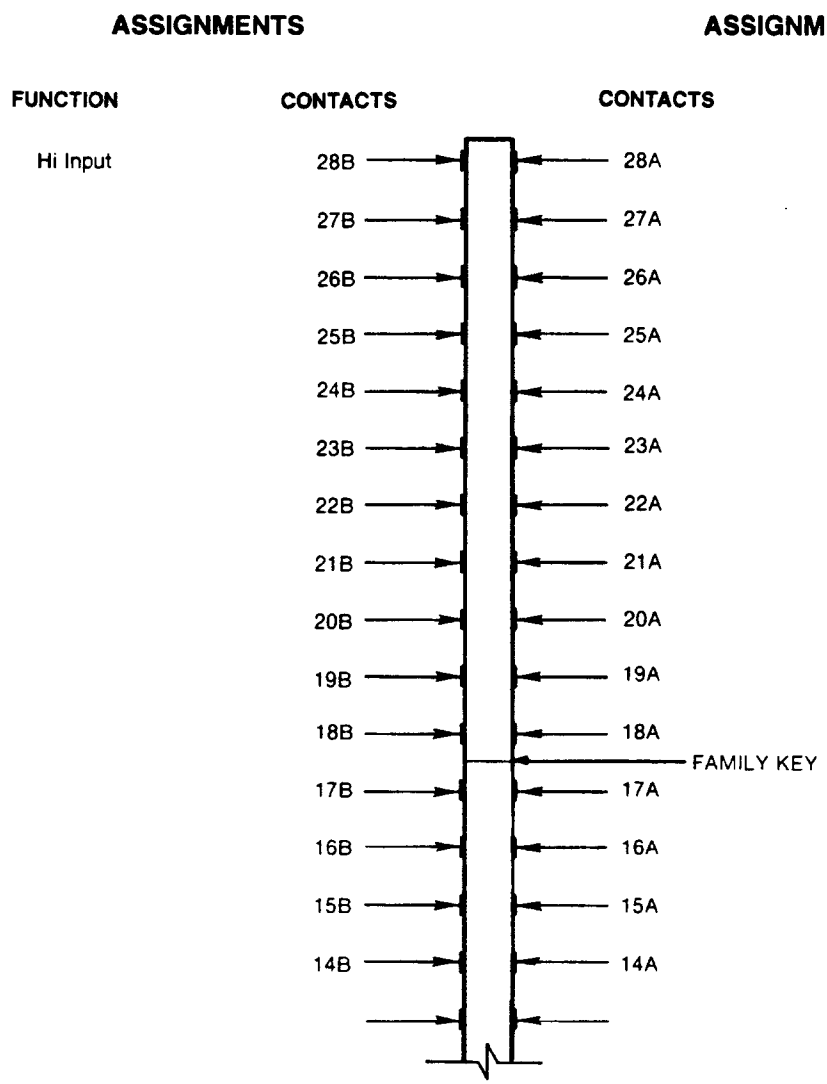
HI Input and LO Input (Contacts 28B and 28A)

Resistance, ac voltages, and dc voltages can be applied directly through the rear interface HI (28B) and LO (28A) circuit board contacts. These contacts are floating. Comparisons can be made between front-panel and rear-interface measurement sources by using the EXT-INT INPUT push button on the DM 505 front panel. When using the rear interface HI and LO contacts, the maximum voltage applied to either rear-interface contact should not exceed 200 V peak measured from chassis ground.

Approximate net instrument weight, 2.2 lbs.

Maximum power requirement at 120 V, 8.0 watts.

ADC Board



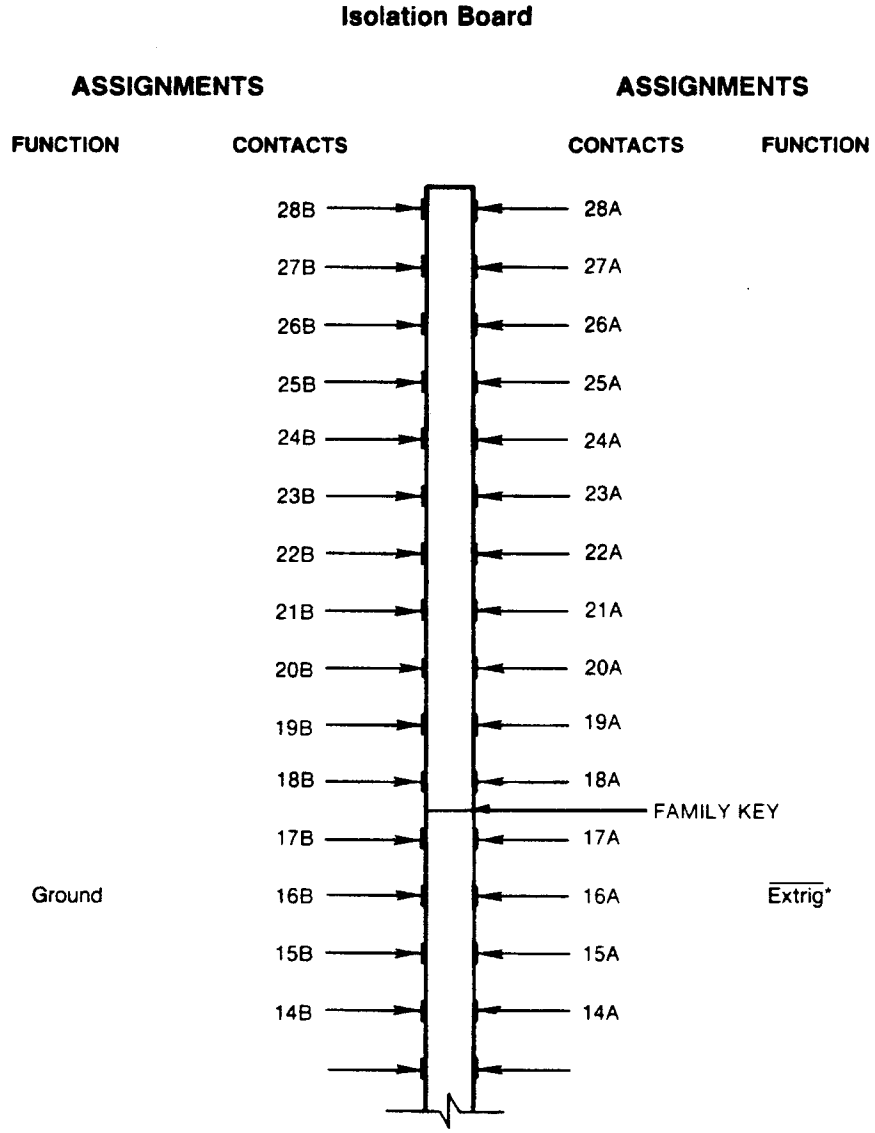
CAUTION

When two Power Module compartments have been selected for the DM 5010 and wired for a specialized interface system, plastic barriers (Tektronix Part Number 214-1593-02) should be installed in the key slot between contacts 18 and 17 in each selected compartment of the Power Module.

Do not insert any TM 5000 Series plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

2088-98

Fig. DM 5010-1. Right rear (ADC Board) interface connector rear view.



***Requires installation of internal jumper.**

CAUTION

When two Power Module compartments have been selected for the DM 5010 and wired for a specialized interface system, plastic barriers (Tektronix Part Number 214-1593-02) should be installed in the key slot between contacts 18 and 17 in each selected compartment of the Power Module.

Do not insert any TM 5000 Series plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

2088-99

Fig. DM 5010-2. Middle rear (Isolation Board) interface connector rear view.

INTERFACE NOTES

Functions Available at Right Rear Interface Connector

Hi and Lo Input (Contacts 28B and 28A respectively)

Measurement signals can be applied directly through the rear interface. Comparisons can be made between front panel and rear interface measurement sources by using the REAR INPUT button on the instrument front panel. The internal Guard is connected to the rear Lo Input when using the rear interface inputs.

For information about maximum input voltages, input impedance, and front panel rear interface switching precautions, refer to the DM 5010 instruction manual.

Functions Available at Middle Rear Interface Connector

$\overline{\text{Extrig}}$ and Ground (Contacts 16A and 16B respectively)

Readings may be triggered via the rear interface. Use of this feature requires installation of an internal jumper located on the CPU Board. For access to the jumper, remove the instrument left side cover. Connect pins 2 and 3 of J1721 using its Extrigger jumper, P1721. Refer to Fig. DM 5010-3. Replace the side cover. Installation of this jumper enables the EXTRIG function in addition to the RUN and TRIGGERED functions. To use the EXTRIG trigger activate the TRIGGERED button to disable the instruments free-running trigger. The EXTRIG requires a negative-going TTL compatible signal to initiate the internal trigger. To cause a single trigger, the EXTRIG line must be held low between 0.5 and 10 μsec. If held low longer, the instrument triggers multiple measurements.

Functions Available at Left Rear Interface Connector

This connector does not contain any signals that would be connected between plug-ins.

Approximate net instrument weight, 4.5 lbs.
Maximum power requirements at 120 V, 50 VA

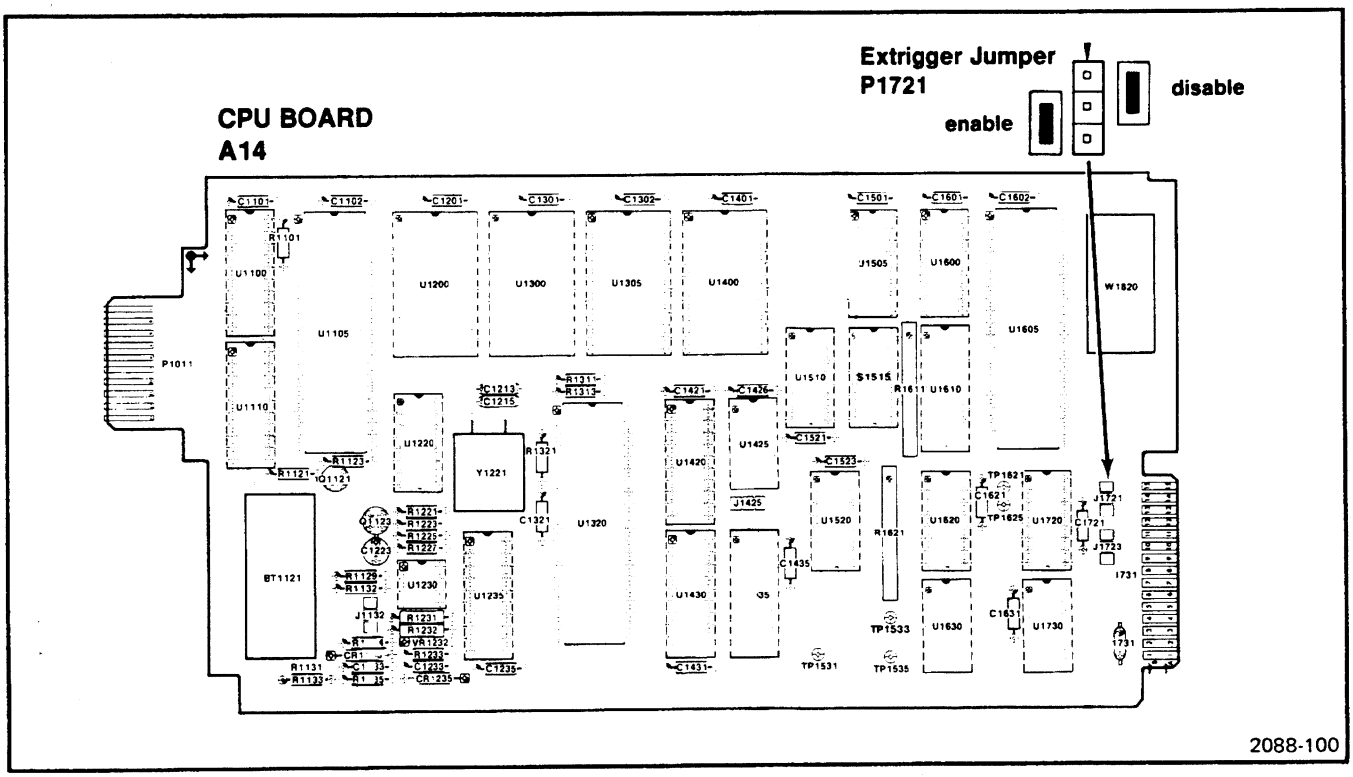
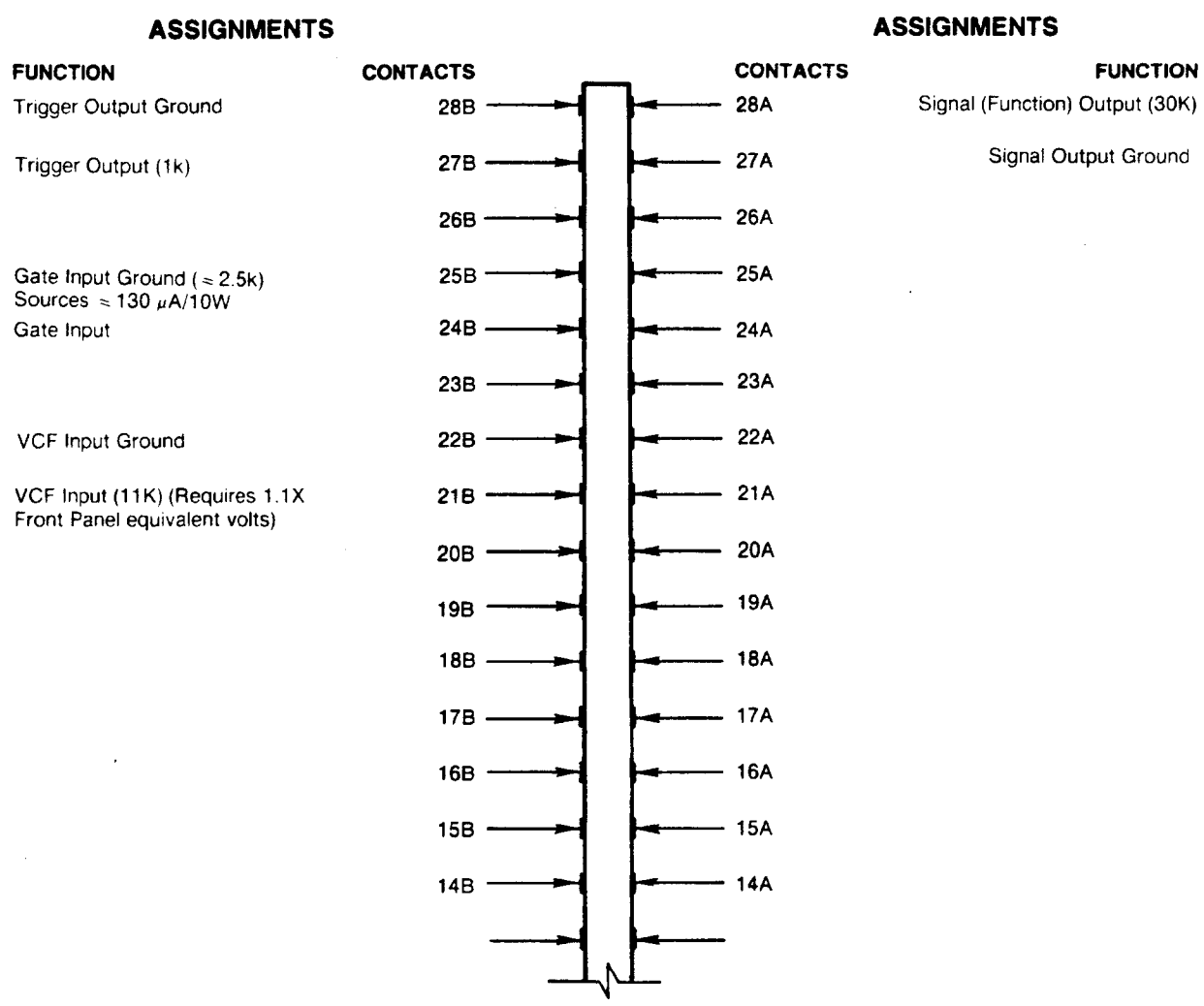


Fig. DM 5010-3. Extrigger jumper location.

NOTES

FUNCTION GENERATORS

NOTES



CAUTION

When a Power Module compartment has been selected for the FG 501 and wired for a specialized interface system, a plastic barrier (Tektronix Part Number 214–1593–02) should be installed in the key slot between contacts 23 and 24 on the Power Module.

Do not insert any TM 500 Series Plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

2088-45

Fig. FG 501-1. Connector rear view.

INTERFACE NOTES

Introduction

In order to maintain waveform fidelity, all input-output connections to the power module interface should be done using coaxial cable, paying particular attention to cable lay-out to reduce cross talk to a minimum.

Signal (Function) Output (Contacts 28A and 27A)

All waveforms (including dc offset) available at the front-panel OUTPUT connector are transmitted to the rear interface via contact 28A. Source impedance from 28A is nominally 30 kΩ (to provide external equipment isolation). Normal load impedance should be 300 kΩ, or greater. To convert contact 28A to a low impedance source, R299 can be replaced with a 47 Ω, 1 W resistor. When this is done, the use of the front-panel OUTPUT connector and contact 28A at the same time can cause some waveform distortion. The absolute signal amplitude across the load is dependent on the voltage divider ratio of the FG 501 source and load impedance. Open-circuit output amplitudes are 15 V peak to peak with ±3 V dc offset. In some cases, high-frequency compensation may be necessary. Ground the coaxial-cable shield to contact 27A.

Trigger Output (Contacts 27B and 28B)

Trigger signals from rear contact 27B are derived from a 1 kΩ source impedance with the absolute output amplitude being load dependent. Open-circuit output amplitude is approximately 5 V peak to peak. The trigger waveform is rectangular; the period and duty cycle is dependent upon the selected frequency and type of waveform selected by the FUNCTION switch. The trigger signal is the best output to drive a counter, because its waveshape and amplitude do not change with front-panel control settings. Use contact 28B to ground a coaxial-cable shield.

Gate Input (Contacts 24B and 25B)

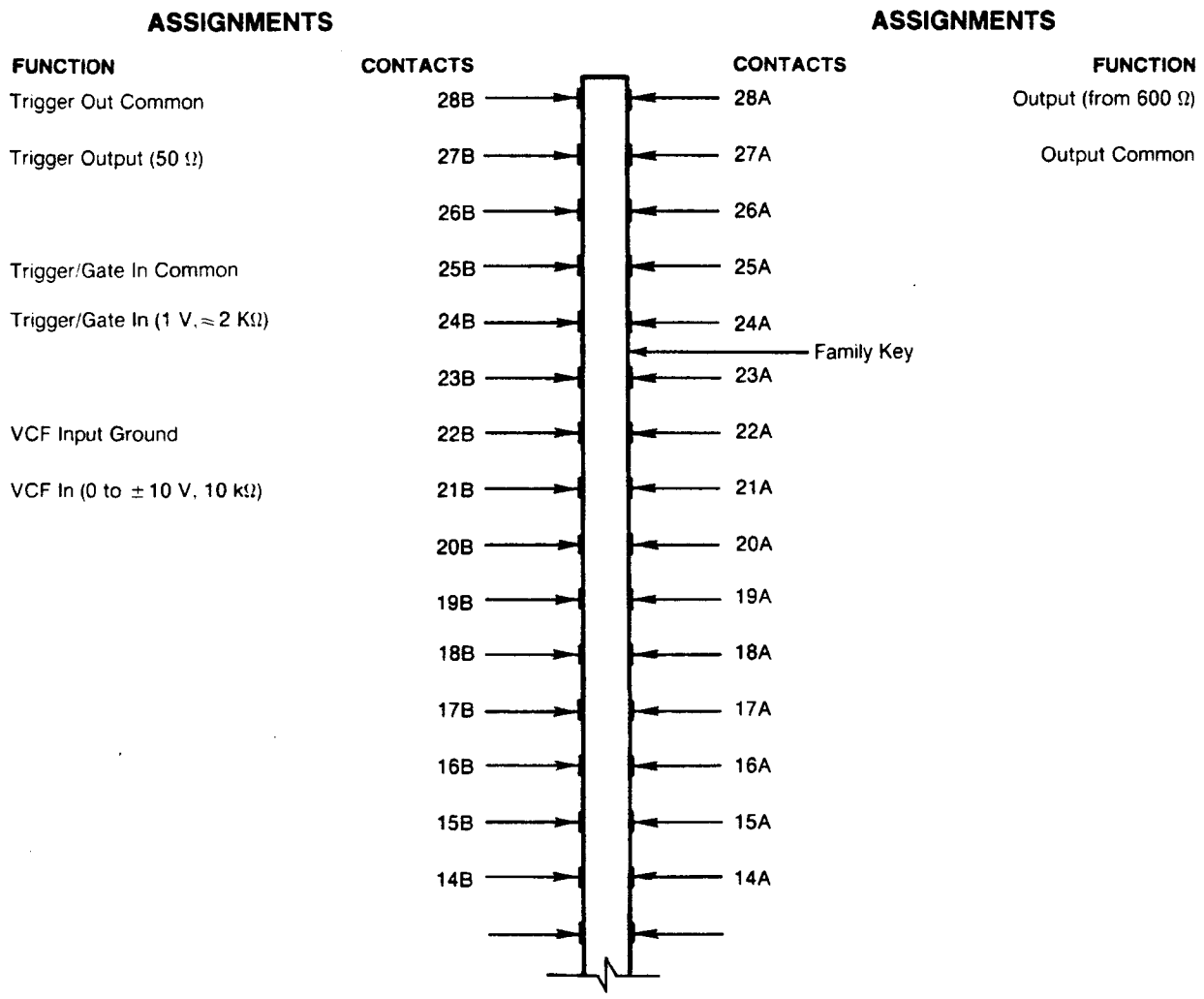
The Gate Input signal to contact 24B should be at least +2 V and not more than +15 V. Refer to the FG 501 Instruction Manual for operation and applications related to Gated (Burst) Output, Variable Phase, Tone-Burst Generation, or Stepped-Frequency Multiplication. Use contact 25B to ground a coaxial-cable shield. Input impedance for contact 24B is approximately 2 kΩ.

VCF Input (Contacts 21B and 22B)

An input signal (0 V to ±11 V maximum–usually a linear ramp) applied to contact 21B can be used to operate the FG 501 in a Voltage-Controlled Frequency mode. Refer to the FG 501 Instruction Manual. A positive-going signal sweeps the selected frequency upwards, while a negative-going signal sweeps the selected frequency downwards. Input impedance for contact 21B is approximately 11 kΩ. Use contact 22B to ground a coaxial-cable shield.

Approximate net instrument weight, 1.8 lbs.

Maximum power requirement at 120 V, 19.0 watts.



CAUTION

Then a Power Module compartment has been selected for the FG 501A and wired for a specialized interface system, a plastic barrier (Tektronix Part Number 214–1593–02) should be installed in the key slot between contacts 23 and 24 on the Power Module.

Do not insert any TM 500 Series plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

2088-46

Fig. FG 501A-1. Connector rear view.

INTERFACE NOTES

Output (From 600 Ω) (Contact 28A)

This terminal is not connected to the front-panel OUTPUT connector. Connections must be made using a length of 50 Ω miniature coaxial cable. Refer to Fig. FG 501A-1 for location of solder points. This procedure is most easily accomplished on the back side of the board where the solder points are marked OUT and GND for each end of the cable. Access to the back of the Main board is gained by removing the right side cover.

Output Ground (Contact 27A)

This is the return connection for the output and sweep out.

Trigger Output (50 Ω) (Contact 27B)

This terminal is connected via an internal jumper to the front-panel trigger output connector. See Fig. FG 501-1 for the location of this jumper.

Trigger Out Ground (Contact 28B)

This is the return connection for the trigger output.

Trig/Gate in (Contact 24B)

This terminal is connected to the trigger amplifier through a 1 kΩ resistor. The output signal is 1 V with an impedance of ≤10 kΩ.

Trig/Gate in Ground (Contact 25B)

This is the return conection for the Trig/Gate In.

VCF in (Contact 21B)

This terminal is connected through a 10 kΩ resistor via an internal jumper to the virtual ground summing node of operational amplifier U1540A (contact 2). See Fig. FG 501-1 for the location of this jumper.

VCF Input Ground (Contact 22B)

This connection is the ground return for the VCF In.

Approximate net instrument weight, 1.9 lbs.

Maximum power requirement at 120 V, 12.0 watts.

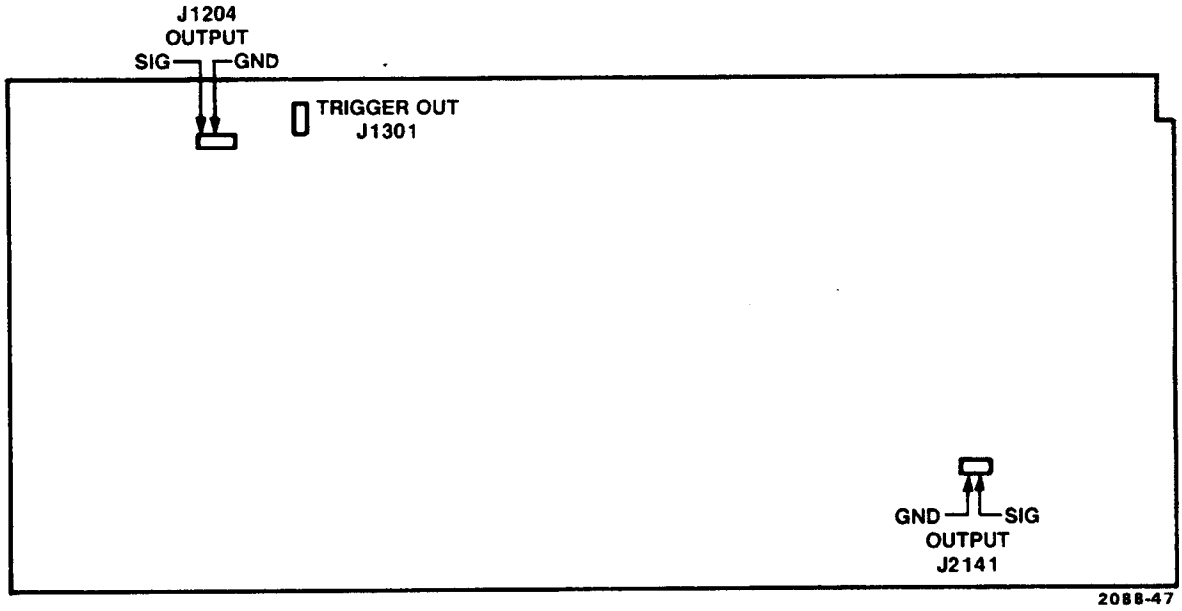
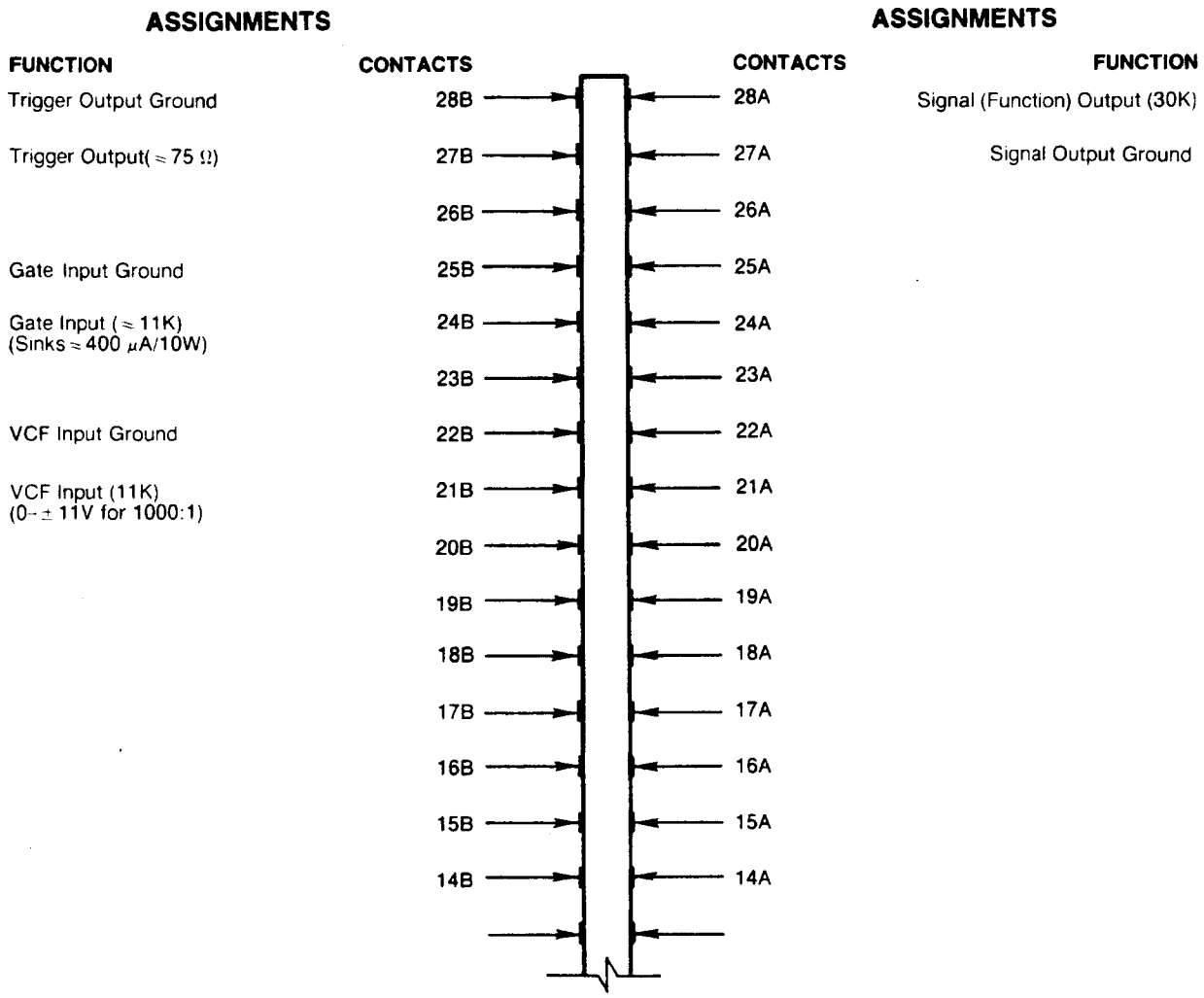


Fig. FG 501A-2. Main Board connection points.



CAUTION

When a Power Module compartment has been selected for the FG 502 and wired for a specialized interface system, a plastic barrier (Tektronix Part Number 214–1593–02) should be installed in the key slot between contacts 23 and 24 on the Power Module.

Do not insert any TM 500 Series Plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

2088-48

Fig. FG 502-1. Connector rear view.

INTERFACE NOTES

Introduction

In order to maintain waveform fidelity, all input-output connections to the power module interface should be done using coaxial cable, paying particular attention to cable lay-out to reduce cross talk to a minimum.

Signal (Function) Output (Contacts 28A and 27A)

All waveforms (including dc offset) available at the front-panel OUTPUT connector are transmitted to the rear interface via contact 28A. Source impedance from 28A is nominally 30 kΩ, (to provide external equipment isolation). Normal load impedance should be 300 kΩ, or greater. To convert contact 28A to a low impedance source, R560 can be replaced with a 47 Ω, 1 W resistor. When this is done, the use of the front-panel OUTPUT connector and contact 28A at the same time can cause some waveform distortion. The absolute signal amplitude across the load is dependent on the voltage divider ratio of the FG 502 source and load impedances. Open-circuit output amplitudes are 10 V peak to peak with ±5 V dc offset. In some cases, high-frequency compensation may be necessary. Ground a coaxial-cable shield to contact 27A.

Trigger Output (Contacts 27B and 28B)

Trigger signals from rear contact 27B are derived from a ≈75 Ω source impedance with the absolute output amplitude being load dependent. Open-circuit output amplitude is approximately 5 V peak to peak. The trigger waveform is rectangular; the period and duty cycle is dependent upon the selected frequency and type of waveform selected by the FUNCTION switch. The trigger signal is the best output to drive a counter or edge-triggered devices, because its waveshape and amplitude do not change with front-panel control settings. Use contact 28B to ground a coaxial-cable shield.

Gate Input (Contacts 24B and 25B)

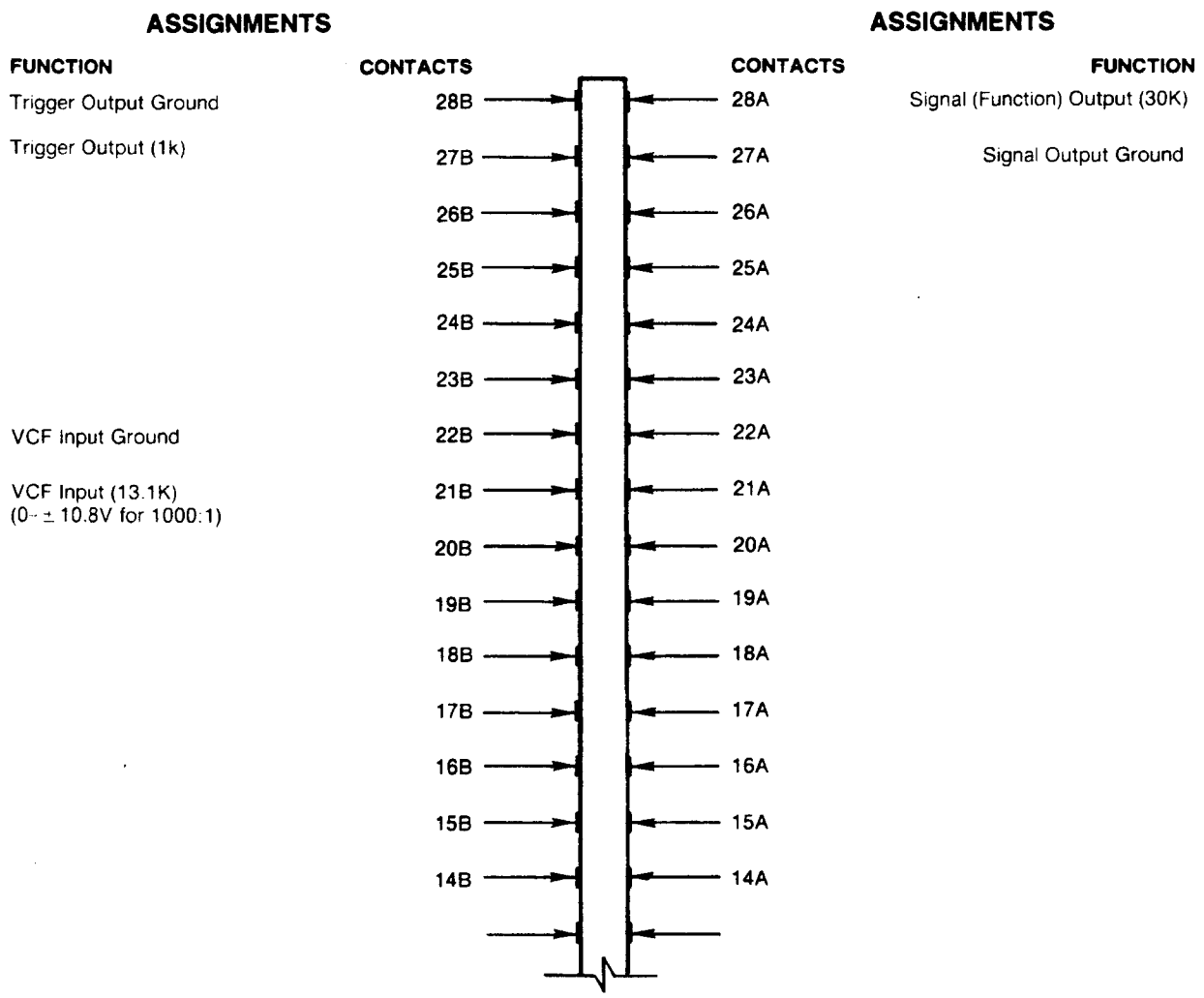
The Gate Input signal to contact 24B should be 0 V to +2 V or greater and not to exceed +15 V. Refer to the FG 502 Instruction Manual for operation and applications related to Gated Output, Tone-Burst Generation, or Stepped-Frequency Multiplication. Use contact 25B to ground a coaxial-cable shield. Input impedance for contact 24B is approximately 11 kΩ.

VCF Input (Contacts 21B and 22B)

An input signal (0 V to ±11 V maximum–usually a linear ramp) applied to contact 21B can be used to operate the FG 502 in a Voltage-Controlled Frequency mode. Refer to the FG 502 Instruction Manual. A positive-going signal sweeps the selected frequency upwards, while a negative-going signal sweeps the selected frequency downwards. Input impedance for contact 21B is approximately 11 kΩ. Use contact 22B to ground a coaxial-cable shield.

Approximate net instrument weight, 1.8 lbs.

Maximum power requirement at 120 V, 20.0 watts.



CAUTION

When a Power Module compartment has been selected for the FG 503 and wired for a specialized interface system, a plastic barrier (Tektronix Part Number 214-1593-02) should be installed in the key slot between contacts 23 and 24 on the Power Module.

Do not insert any TM 500 Series Plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

2088-49

Fig. FG 503-1. Connector rear view.

INTERFACE NOTES

Introduction

In order to maintain waveform fidelity, all input-output connections to the power module interface should be done using coaxial cable, paying particular attention to cable lay-out to reduce cross talk to a minimum.

Signal (Function) Output (Contacts 28A and 27A)

All waveforms (including dc offset) available at the front-panel OUTPUT connector are transmitted to the rear interface via contact 28A. Source impedance from 28A is nominally 30 kΩ (to provide external equipment isolation). Normal load impedance should be 300 kΩ, or greater. If it is desired to convert contact 28A to a low impedance source, R412 can be replaced with a 47 Ω, 1 W resistor. When this is done, the use of the front-panel OUTPUT connector and contact 28A at the same time can cause some waveform distortion. The absolute signal amplitude across the load is dependent on the voltage divider ratio of the FG 503 source and load impedances. Open-circuit output amplitudes are 20 V peak to peak with ±5 V dc offset. In some cases, high-frequency compensation may be necessary. Ground a coaxial-cable shield to contact 27A.

Trigger Output (Contacts 27B and 28B)

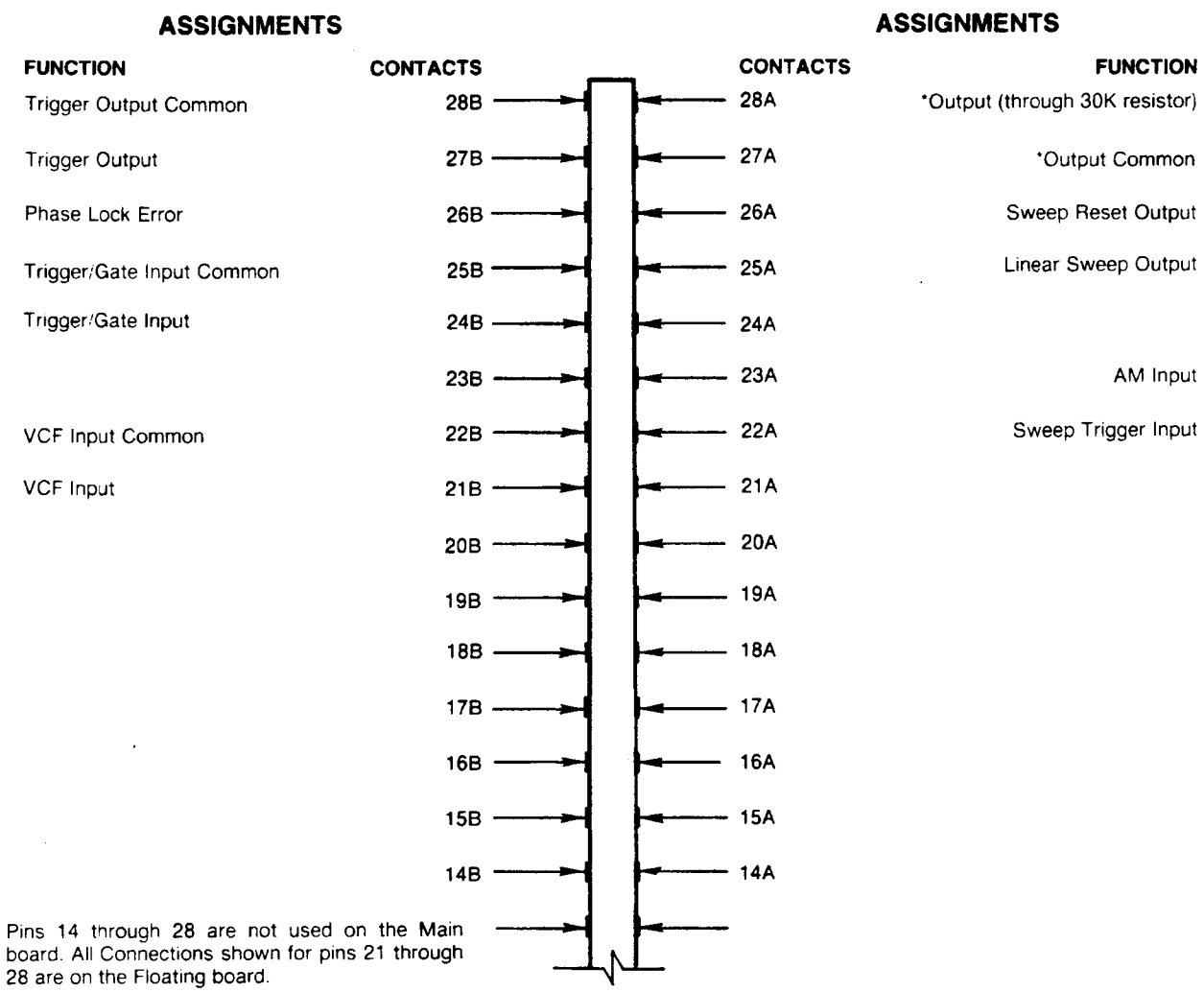
Trigger signals from rear contact 27B are derived from a 1 kΩ source impedance with the absolute output amplitude being load dependent. Open-circuit output amplitude is approximately 5 V peak to peak. The trigger waveform is rectangular with the period and duty cycle dependent upon the selected frequency and type of waveform selected by the FUNCTION switch. The trigger signal should be used to drive a counter or edge-triggered devices, because its waveshape and amplitude does not change with front-panel control settings. Use contact 28B to ground a coaxial-cable shield.

VCF Input (Contacts 21B and 22B)

An input signal (0 V to ±10.8 V maximum–usually a linear ramp) applied to contact 21B can be used to operate the FG 503 in a Voltage-Controlled Frequency mode. Refer to the FG 503 Instruction Manual. A positive-going signal sweeps the selected frequency upwards, while a negative-going signal sweeps the selected frequency downwards. Input impedance for contact 21B is approximately 13.1 kΩ. Use contact 22B to ground a coaxial-cable shield.

Approximate net instrument weight, 1.4 lbs.

Maximum power requirement at 120 V, 13.5 watts.



**Later models have output from pins 27A and 28A on the Main board.*

CAUTION

When a Power Module compartment has been selected for the FG 504 and wired for a specialized interface system, a plastic barrier (Tektronix Part Number 214-1593-02) should be installed in the key slot between contacts 23 and 24 on the Power Module.

Do not insert any TM 500 Series Plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

Fig. FG 504-1. Connector rear view.

INTERFACE NOTES

Output, Main Board (Contact 28A)

This terminal is connected to the front-panel OUTPUT connector through a 30 kΩ resistor. The common terminal for this output is contact 27A.

Sweep Reset Output (Contact 26A)

A positive-going pulse from approximately −13 V to +9 V occurs at this connection at the time the sweep resets. This output is designed to drive at least 10 kΩ. The pulse can be used to raise the pen on a chart recorder when doing sweep frequency tests on filters or other devices or as end-of-sweep trigger for an external device. Connect the return line to chassis ground.

Linear Sweep Output (Contact 25A)

This terminal is connected to the output of the sweep generator through a 1 kΩ resistor. The waveform at this terminal is identical with the waveform at the front-panel LIN SWEEP OUTPUT terminal except in the STOP FREQ mode. In the STOP FREQ mode this rear connection continues to output the linear sweep ramp while the front-panel connection outputs a dc voltage equivalent to the peak ramp voltage. To make the output at the rear terminal the same as the LIN SWEEP OUTPUT terminal, remove the lower end of R1525 from the Function board. Connect an eight-inch wire from the lower end of R1525 to the lower end of R1520 also located on the Function board. The exact location of these resistors can be found from the Parts Location Grid. Use chassis ground as the return circuit.

AM Input (Contact 23A)

This input has the same input characteristics as the AM INPUT connection on the front panel. Use chassis ground for the circuit return.

Sweep Trigger Input (Contact 22A)

This terminal is connected to the front-panel SWEEP TRIG INPUT connector through a 1.5 kΩ resistor. Use chassis ground for the return circuit.

Trigger Output (Contact 27B)

This connection is made through a 510 Ω resistor to the front-panel TRIG OUTPUT connector. Use contact 27B for the return circuit.

Phase Lock Error Voltage Output (Contact 26B)

The signal at this terminal is the output of the phase locked loop filter. An output of 0 V indicates the reference frequency is the same as the free-run frequency. A voltage of +10 V open circuit indicates a generator output frequency of about 10 dial divisions higher than the free run frequency and −10 V open circuit indicates a generator frequency about 10 dial divisions lower than the free-run frequency. The output impedance is 1 kΩ. Use the chassis ground as the return circuit.

Trigger/Gate Input (Contact 24B)

This connection has the same dc input characteristics as the front-panel TRIGGER INPUT contact. Use the chassis ground as the return circuit.

VCF Input (Contact 21B)

This connection has the same input characteristics as the front-panel VCF INPUT connector. Use contact 22B as the return circuit.

Approximate net instrument weight, 3.9 lbs.

Maximum power requirements at 120 V, 48 watts.

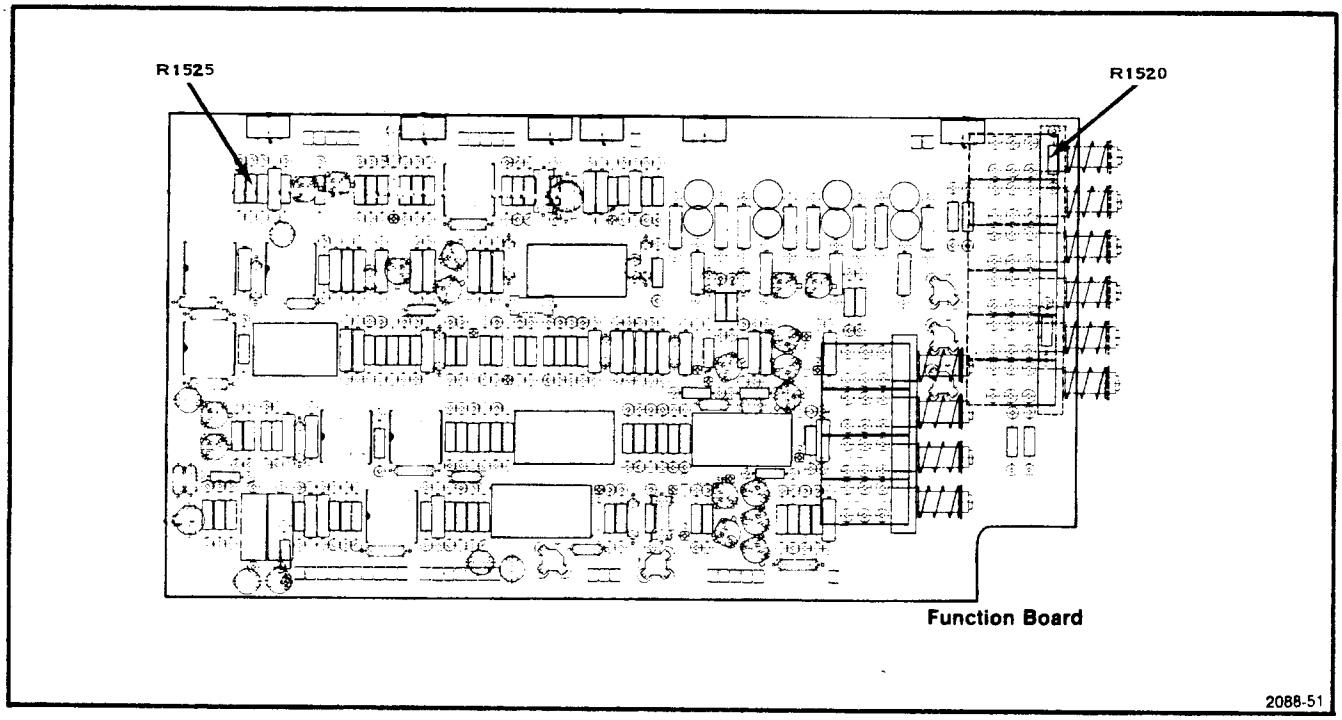
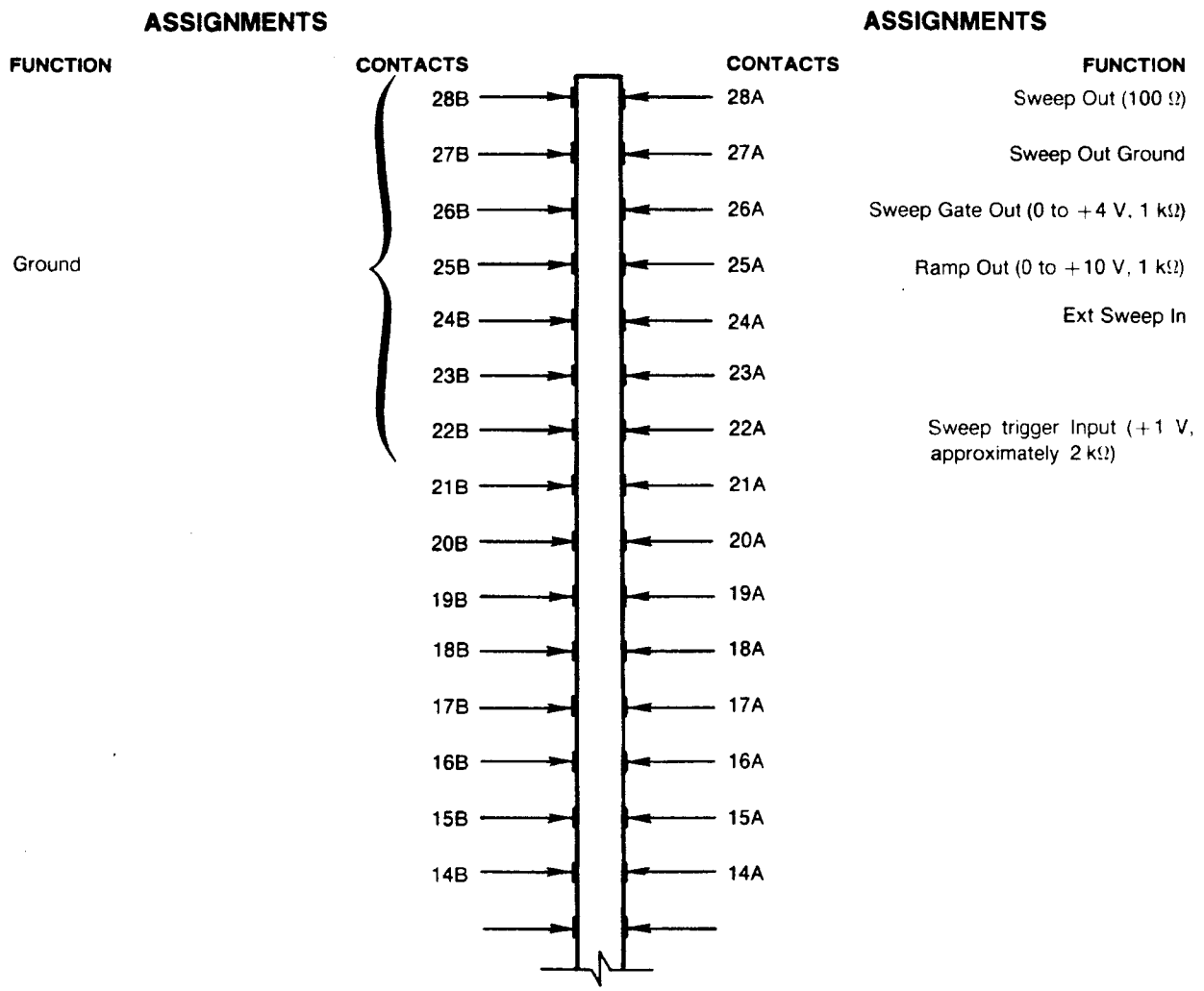


Fig. FG 504-2. Component locations.

NOTES



CAUTION

Then a Power Module compartment has been selected for the FG 507 and wired for a specialized interface system, a plastic barrier (Tektronix Part Number 214-1593-02) should be installed in the key slot between contacts 23 and 24 on the Power Module.

Do not insert any TM 500 Series plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

2088-53

Fig. FG 507-1. Main Board connection locations.

INTERFACE NOTES

MAIN BOARD

Output (From 600 Ω) (Contact 28A)

This terminal is not connected to the front-panel OUTPUT connector. Connection must be made using a length of 50 Ω miniature coaxial cable. Refer to Fig. FG 507-1 for location of solder points. This procedure is most easily accomplished on the back of the Main board where the solder points are marked OUT and GND for each end of the cable. Access to the back of the Main board is gained by removing the top and bottom covers.

Output Ground (Contact 27A)

This is the return connection for the output and sweep out.

Trigger Output (50 Ω) (Contact 27B)

This terminal is connected via an internal jumper to the front-panel trigger output connector. See Fig. FG 507-1 for the location of this jumper.

Trigger Out Ground (Contact 28B)

This is the return connection for the trigger output.

Trig/Gate In (Contact 24B)

This terminal is connected to the trigger amplifier through a 1 kΩ resistor. The output signal is 1 V with an impedance of ≤10 kΩ.

Trig/Gate In Ground (Contact 25B)

This is the return connection for the Trig/Gate In.

VCF In (Contact 21B)

This terminal is connected through a 10 kΩ resistor via an internal jumper to the virtual ground summing node of operational amplifier U1540A (pin 2). See Fig. FG 507-1 for the location of this jumper.

VCF Input Ground (Contact 22B)

This connection is the ground return for the VCF In.

SWEEP BOARD

Sweep Out (Contact 28A)

This terminal connects through 100 Ω to the output of the sweep generator. Sufficient current is available to drive the input of an operational amplifier or similar device.

Sweep Out Ground (Contact 27A)

This is the return connection for the sweep out.

Sweep Gate Out (Contact 26A)

This connection provides a 0 to +4 V waveform. The output impedance is 1 kΩ. This waveform is similar to the front-panel GATE OUTPUT waveform. The common terminal is any convenient connection from contacts 22B through 28B.

Ramp Out (Contact 25A)

This connection provides a 0 to +10 V ramp waveform. It is functionally identical to the front-panel RAMP OUTPUT. This contact is isolated from the front-panel connector by 1 kΩ. The common terminal is any convenient connection from 22B through 28B.

Extenal Sweep Input (Contact 24A)

This terminal is connected, through a 10 kΩ resistor, to the +X input of the Multiplier (U1730). With the SWEEP DURATION switch in the OFF position, an externally-generated ramp applied to this terminal can be used to sweep the generator. The common connection is any convenient contact from 22B through 28B.

Sweep Trigger Input (Contact 22A)

This contact is functionally equivalent to the front panel SWP TRIG IN connection. A waveform of approximately +1 V into 2 kΩ is required. The common connector is any convenient contact from 22B through 28B.

Common Grounds (Contacts 22B through 28B)

These are the common ground terminals for the Sweep Gate Out, Ramp Out, Ext Sweep Input and Sweep Trigger Input.

Approximate net instrument weight, 3.25 lbs.

Maximum power requirement at 120 V, 17 watts.

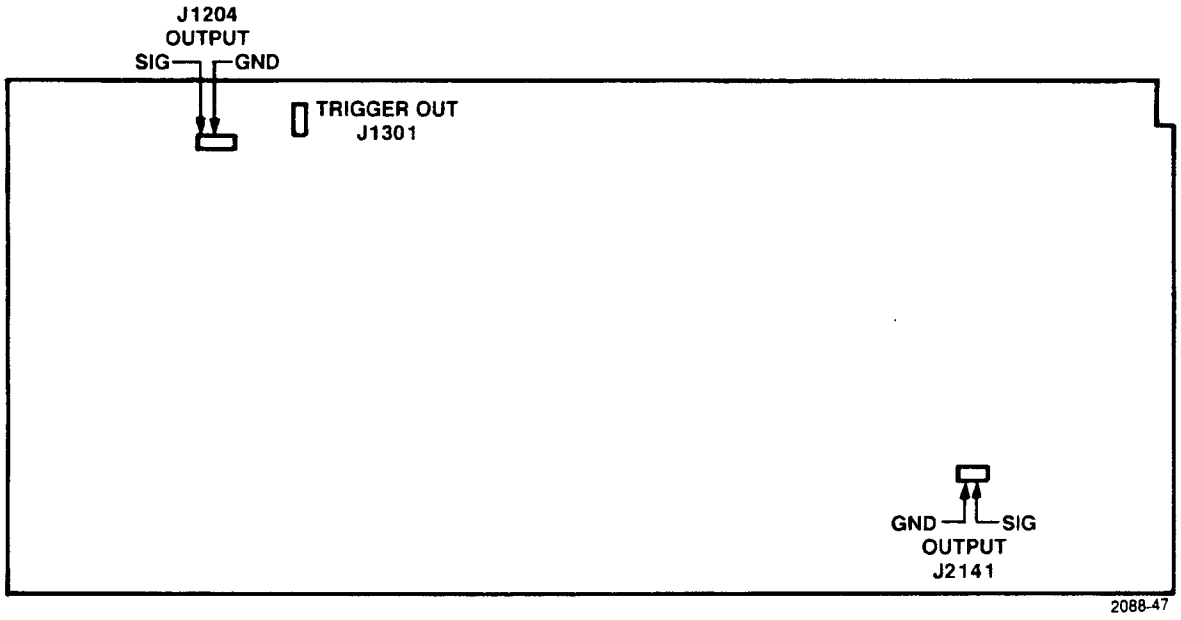
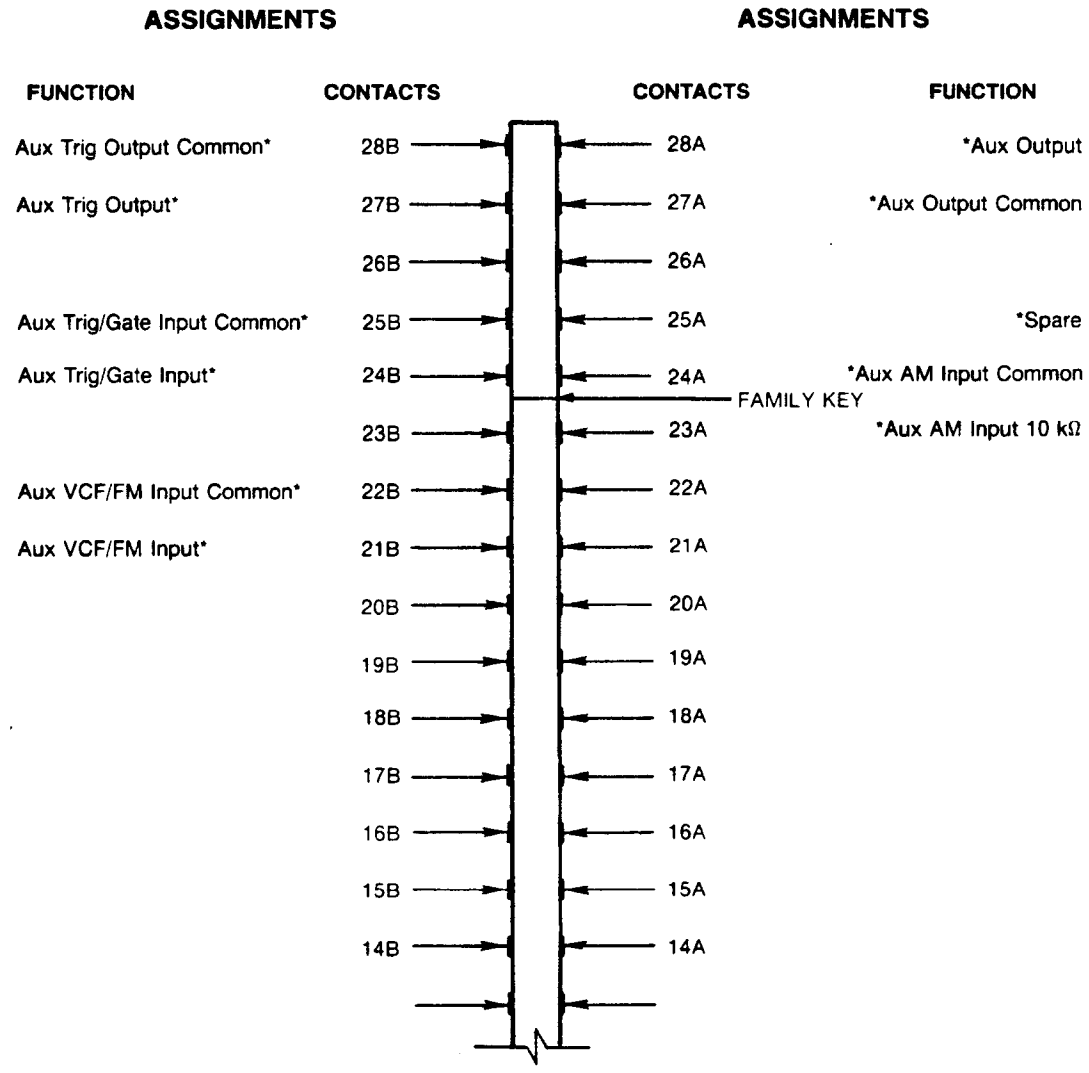


Fig. FG 507-2. Connector rear view.

NOTES



***Not factory wired–see Interface Notes**

CAUTION

When two Power Module compartments have been selected for the FG 5010 and wired for a specialized interface system, plastic barriers (Tektronix Part Number 214-1593-02) should be installed in the key slot between contacts 23 and 24 in each selected compartment of the Power Module.

Do not insert any TM 5000 Series plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

2088-101

Fig. FG 5010-1. Right rear (Sine Shaper board) interface connector rear view.

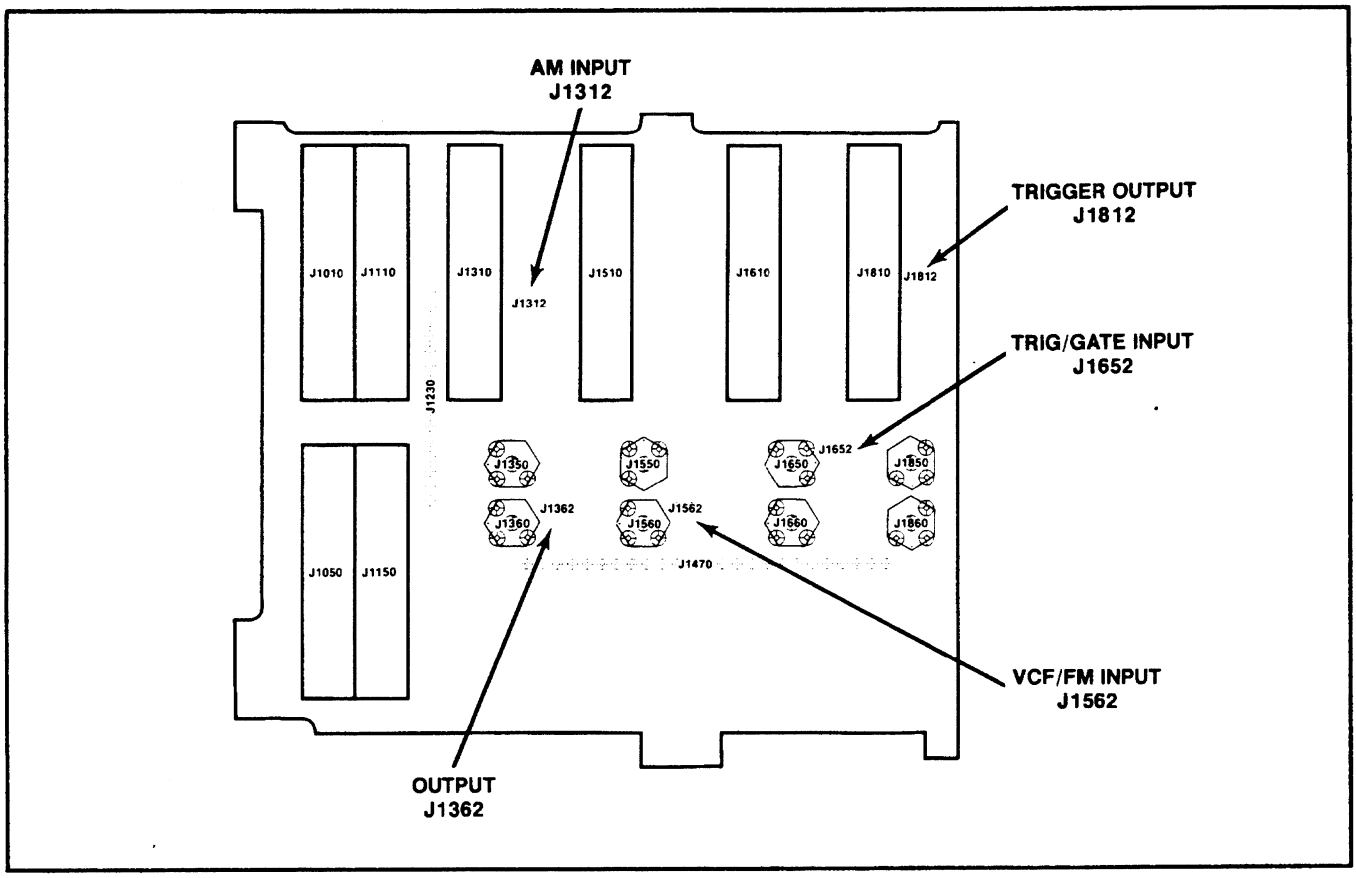


Fig. FG 5010-2. Interconnect board.

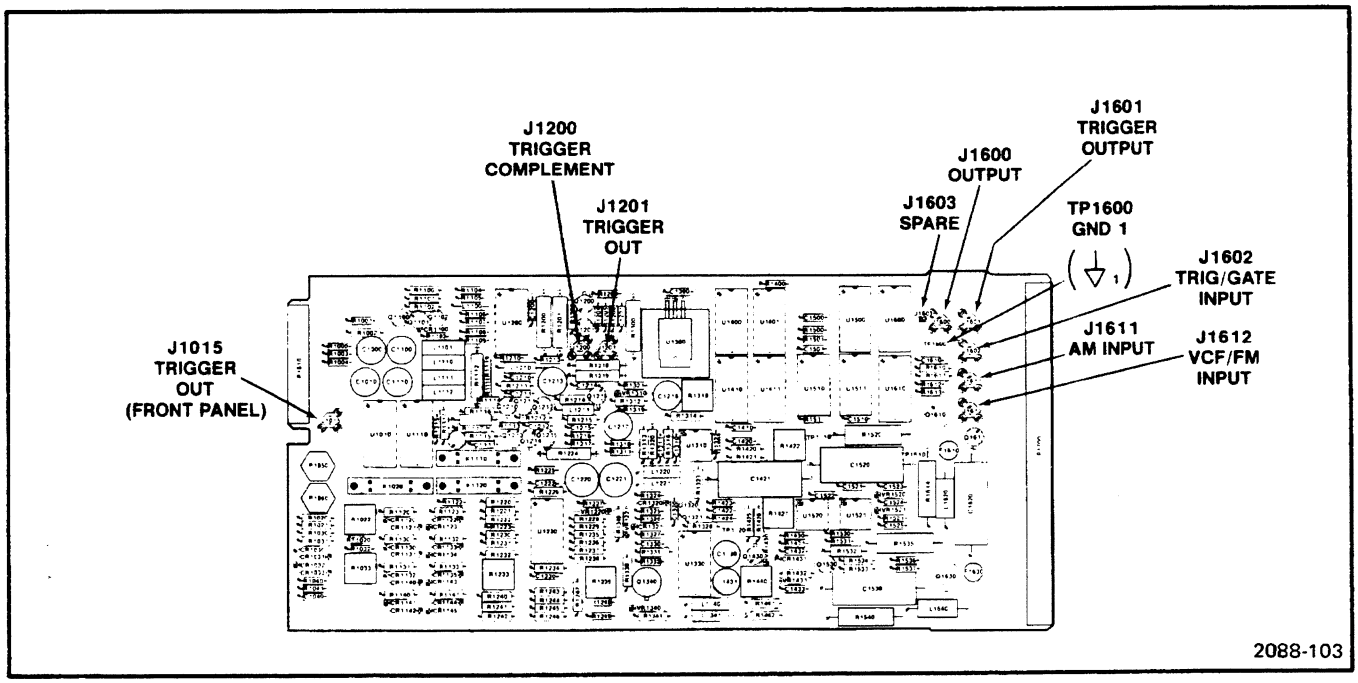


Fig. FG 5010-3. Sine Shaper board.

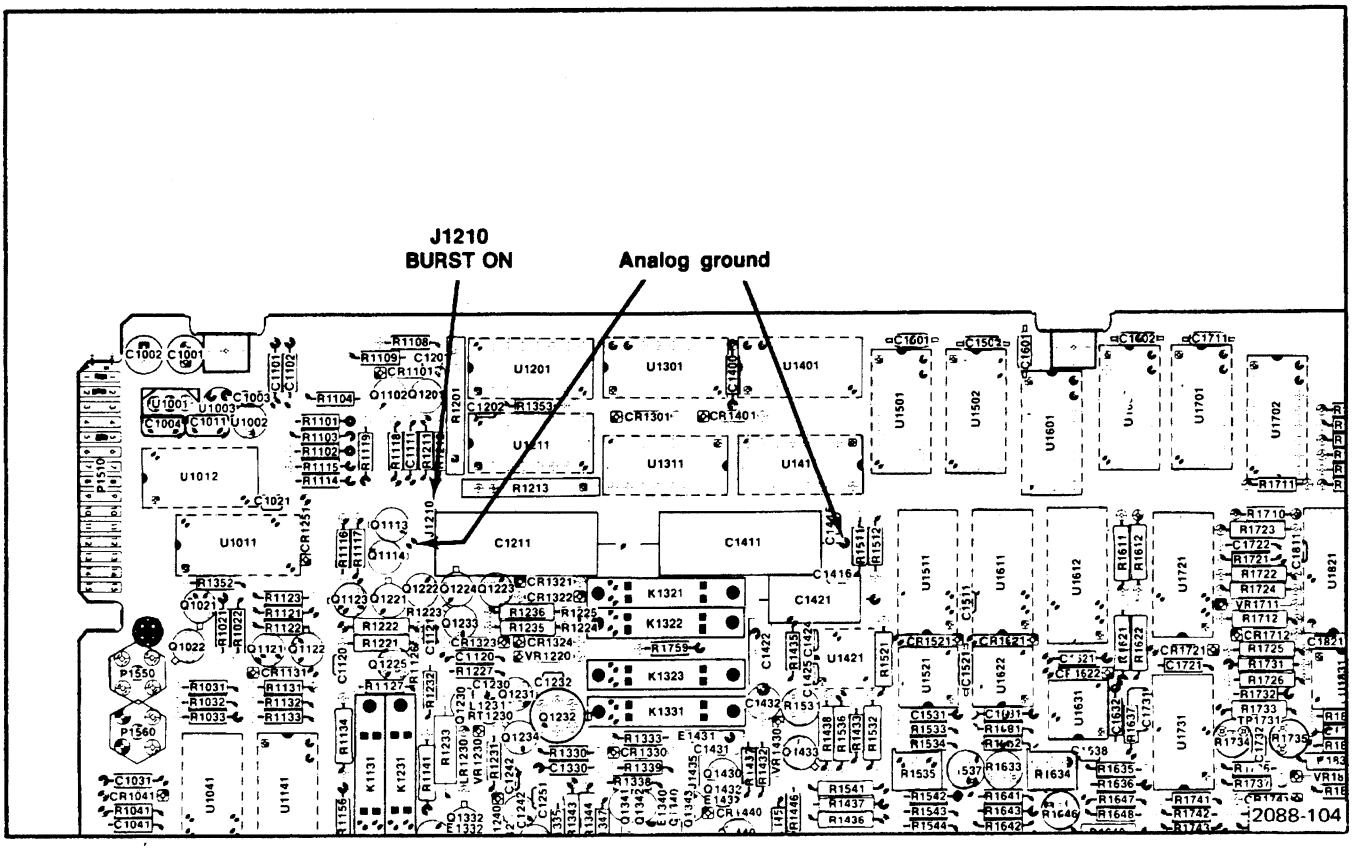


Fig. FG 5010-4. Loop 1 board.

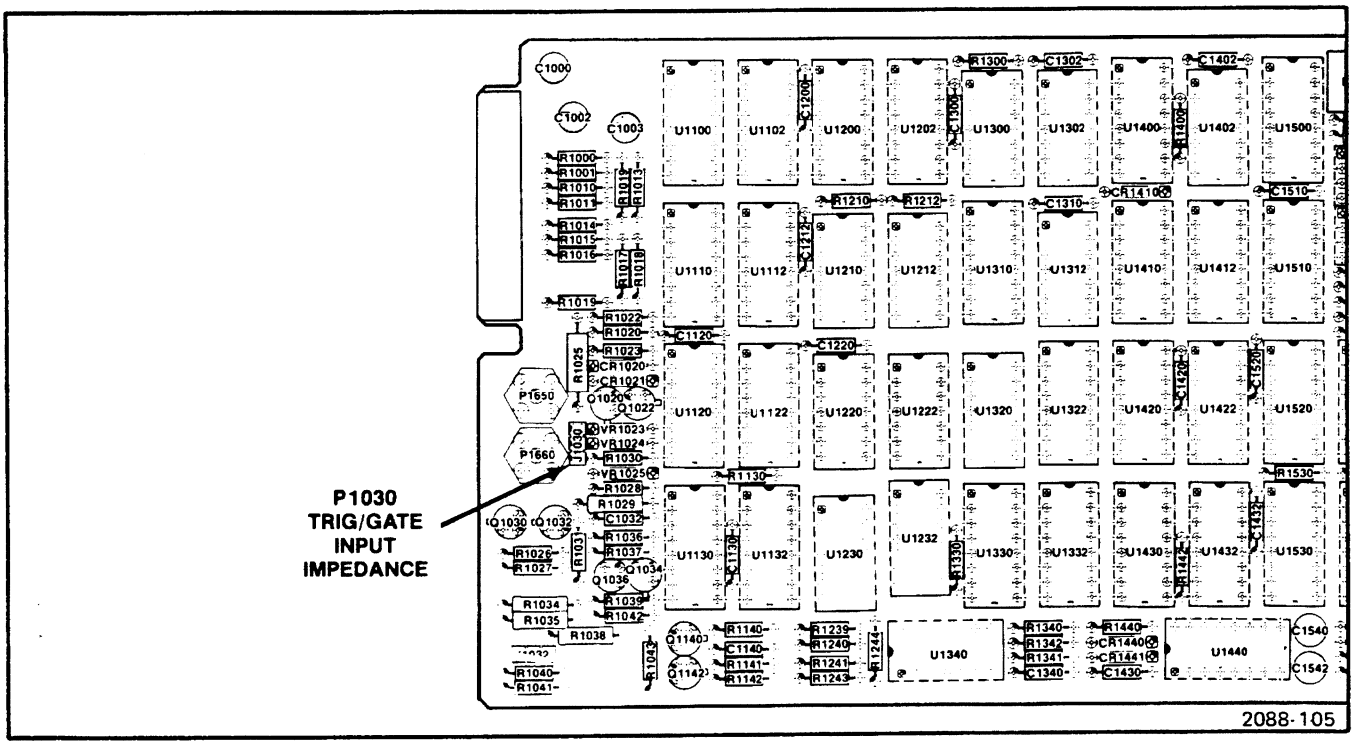


Fig. FG 5010-5. Loop 2 board.

INTERFACE NOTES

Introduction

Slots exist between pins 23 and 24 on the Sine Shaper board and the Output Amplifier board. The slot identifies the FG 5010 as a member of the function generator family. Insert a barrier between pins 23 and 24 on each power module jack to prevent noncompatible plug-ins from being inserted in compartments wired for the FG 5010. This protects the plug-in if specialized connections are made to that compartment. Consult the power module manual for further information. Signal inputs, outputs, or other specialized connections may be made to the rear interface connectors as shown in the input-output assignments illustration (Fig. FG 5010-1). These connections are not factory wired. A wire kit, Tektronix Part No. 020-0701-00, provides the wires for making the necessary connections.

Making Connections

Disassemble the instrument (refer to the Maintenance section in the FG 5010 Instruction manual) to gain access to the front of the Interconnect board. Disconnect the cables from the front panel bnc connectors to the Interconnect board. See Figs. FG 5010-2 and FG 5010-3 for the location of signal inputs and outputs on the Interconnect and Sine Shaper boards. The cable connecting J1812, on the Interconnect board, to the front panel TRIG OUTPUT connector may be left connected. Either the trigger output or trigger complement output may be routed to the front panel through J1015 on the Sine Shaper board. The other output may be routed to the rear interface output.

Normally all cable routing for the rear interface connections will be from the front of the Interconnect board, passing beneath the bottom edge of the Interconnect board, then over the right side of the Sine Shaper board to the connectors.

Use of the rear interface inputs and outputs causes some degradation in signal performance.

A lead is provided to bring out to the rear interface a signal that remains high during the time the loop clamp is disabled. For N BURST, this time is roughly equivalent (depending on frequency) to the length of the burst, less the last half of the last cycle. To connect this lead, remove the shield on the Loop 1 board located over J1210 as shown in Fig. FG 5010-4. Run a wire from J1210 lead through the hole in the shield near J1210, forward across the edge connectors on the Interconnect board, and back along the outside of the Sine Shaper board to the single pin Spare connector as shown in Fig. FG 5010-3.

After all connections are made, reinstall the boards.

A description of the functions available at the right rear interface connector follows:

Aux Output and Aux Output Common (Contacts 28A and 27A respectively)

This is the rear interface output and return connections. It is not factory connected. Disconnect the front panel OUTPUT connector cable going to the Interconnect board. Connect a cable (part of wire kit 020-0701-00) from the Interconnect board output connector to J1600 Output connector on the Sine Shaper board, see Fig. FG 5010-3.

Aux Trig Output and Aux Trig Output Common (Contacts 27B and 28B respectively)

This is the rear interface trigger output and return. It is not factory connected. The signal is +2 V from 50 Ω. This signal can be either the trigger output or trigger complement output (180° phase difference) depending on the cable connection. Both signals can be used simultaneously; one signal at the rear interface and the other at the front panel. Connect a cable (part of wire kit 020-0701-00) from the desired trigger signal (either Trig or Trig Comp) connector on the Sine Shaper board to the J1601 Trig Comp Out connector on the Sine Shaper board, see Fig. FG 5010-3.

Spare (Contact 25A)

This contact connects to a square pin on the sine shaper board. See Fig. FG 5010-3 for location of this pin. This pin may be used for a burst-timed signal output as previously described under Making Connections. Return circuit for this signal is chassis ground.

Aux Trig/Gate Input and Aux Trig/Gate In Common (Contacts 24B and 25B respectively)

This signal is not factory wired. A jumper (P1030) to select the input impedance for this connection is located on the Loop 2 board. See Fig. FG 5010-5 for jumper (P1030) location. Input impedance is either 50 Ω or 1 MΩ. Maximum input is +5 V.

Disconnect the front panel TRIG/GATE IN connector cable going to the Interconnect board. Connect a cable (part of wire kit 020-0701-00) from the Interconnect board trig/gate in connector to J1602 Trig/Gate Input connector on the Sine Shaper board, see Fig. FG 5010-3.

Aux AM Input and Aux AM Input Common (Contacts 23A and 24A respectively)

This connection is not factory wired. The input impedance is 10 kΩ. A 2.5 V input equals 100% modulation. Maximum input is +5 V peak.

To connect the AM INPUT signal to the rear interface, disconnect the front panel AM INPUT connector cable going to the Interconnect board. Connect a cable (part of wire kit 020-0701-00) from the Interconnect board AM input connector to J1611 AM Input connector on the Sine Shaper board, see Fig. FG 5010-3.

Aux VCF/FM Input and Aux VCF/FM In Common (Contacts 21B and 22B respectively)

This connection is not factory wired. A 0 to +10 V change gives at least a 1000:1 frequency change.

To connect the VCF/FM INPUT signal to the rear interface, disconnect the front panel VCF/FM INPUT connector cable going to the Interconnect board. Connect a cable (part of wire kit 020-0701-00) from the Interconnect board VCF/FM input connector to J1612 VCF/FM Input connector on the Sine Shaper board, see Fig. FG 5010-3.

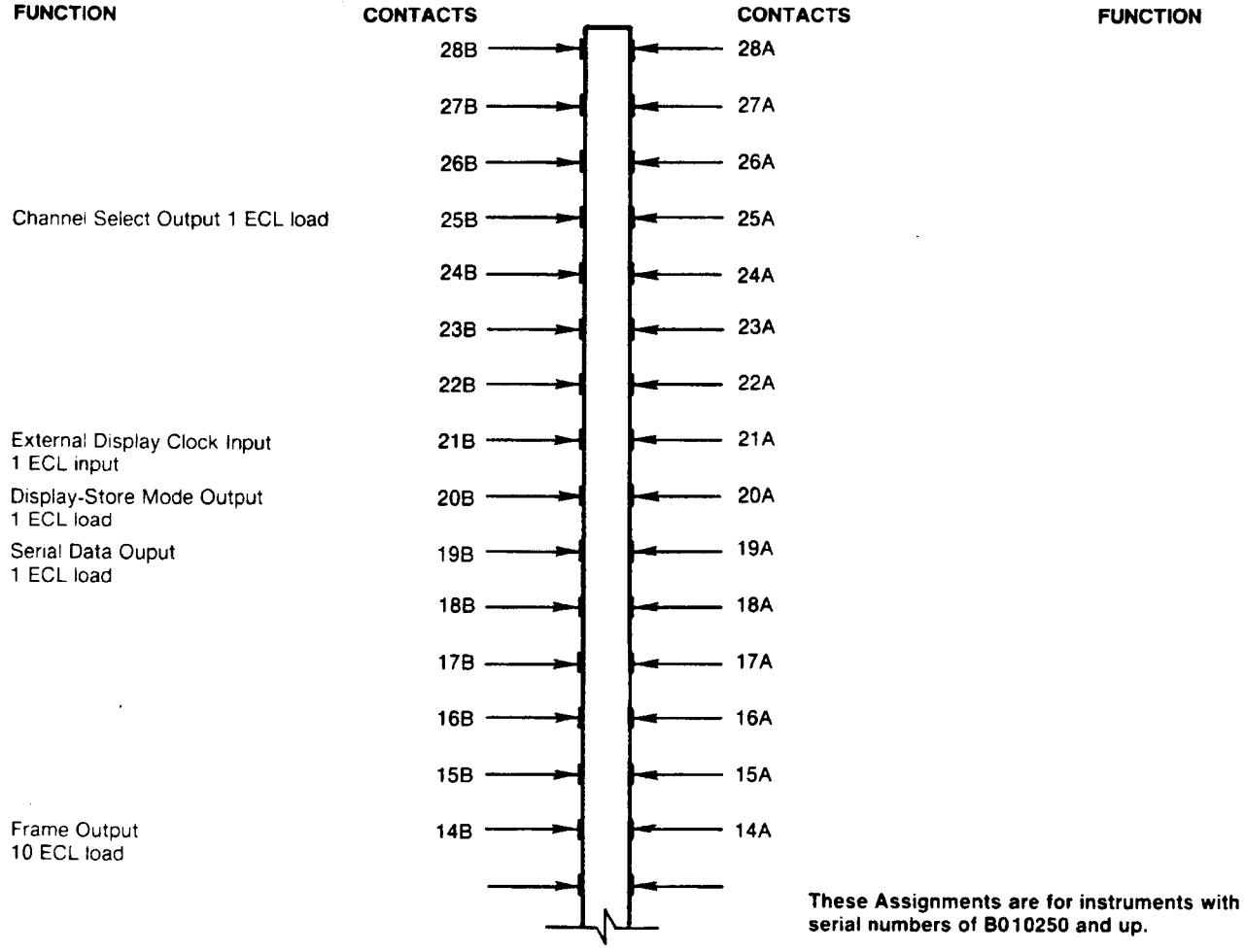
The middle and left rear interface connectors do not contain any signals that would be connected between plug-ins.

Approximate net instrument weight, 6.2 lbs.
Maximum power requirements at 120 V, 195 VA.

NOTES

LOGIC ANALYZERS

NOTES



CAUTION

When a Power Module compartment has been selected for the LA 501 and wired for a specialized interface system, a plastic barrier (Tektronix Part Number 214–1593–02) should be installed in the key slot between contacts 24 and 25 on the Power Module.

Do not insert any TM 500 Series Plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

2088-54

Fig. LA 501-1. Connector rear view.

INTERFACE NOTES

Introduction

To maintain waveform fidelity, make connections to the power module interface with coaxial cable. Carefully place the cable to keep cross talk to a minimum.

Frame Output (Contact 14B)

The output at contact 14B represents the scanning status of the serial data output. Channel 3 is the last channel scanned in the serial data output. The output is an ECL low pulse, which occurs once each 16 flag pulses (or every 4096 bits of data serially scanned–see J120-14 for flag output). The leading edge of the low pulse is the start of a channel 3 serial scan and the trailing edge is the end of the channel 3 scan.

Serial Data Output (Contact 19B)

Contact 19B is the output of the memory that has been converted from parallel data to serial data form (negative-voltage ECL). See Table LA 501-1 for channel output sequence.

Display-Store Mode Output (Contact 20B)

This output contact 20B indicates the status of the display-store mode. The output is negative-voltage ECL. In the display mode, the output level is low and in the store mode it is high. (The output is actually the internal display clock inhibit signal).

Ext Display Clock Input (Contact 21B)

Contact 21B is an external input used as a display clock in the display mode. Using this input involves internal switch (S835) selection. This input accepts negative-voltage ECL.

Channel Select Output (Contact 25B)

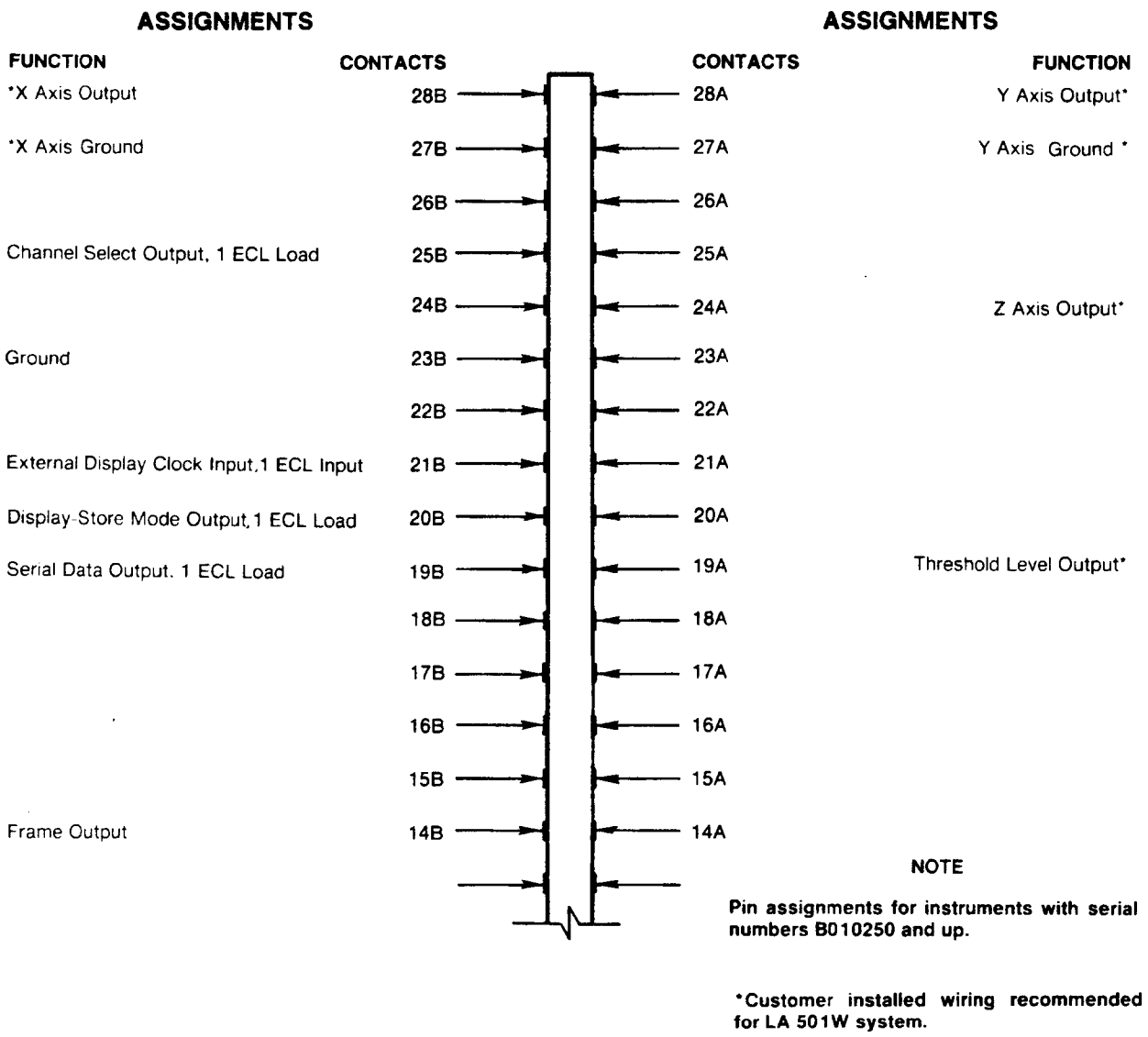
The output at contact 25B indicates the scanning status of a channel that has been selected for positioning. The output is negative-voltage ECL. This line provides a low pulse each time a channel selected for positioning is scanned in serial data format. When the next channel is selected for scanning, the output returns high.

Approximate net instrument weight, 3.8 lbs.

Maximum power requirement at 120 V, 32 watts.

Table LA501-1
SERIAL DATA OUTPUT SEQUENCE

FORMAT		
4 CH	8 CH	16 CH
CHANNEL DISPLAYED		
0	4	12
1	5	13
2	6	14
3	7	15
0	0	8
1	1	9
2	2	10
3	3	11
0	4	4
1	5	5
2	6	6
3	7	7
0	0	0
1	1	1
2	2	2
3	3	3



NOTE:

The LA 501 is not compatible with the TM 5000 series power modules.

CAUTION

The LA 501W is a logic analyzer system, using the WR 501 Word Recognizer and the LA 501 Logic Analyzer. The units are mechanically locked together. When using this system, insert a plastic barrier (Tektronix Part Number 214–1593–02) between contacts 24 and 25 on the Power Module compartment associated with the WR 501. The LA 501 unit has no designated key slot and there are no rear interface input/output pin assignments for the WR 501.

Do not insert any TM 500 Series plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

2088-55A

Fig. LA 501 W-1. Connector rear view.

INTERFACE NOTES

RASTER DISPLAY OUTPUTS

Introduction

These instructions provide aditional information concerning the LA 501. The user can custom wire the X-axis, Y-axis, and the input Threshold Levels to the rear interface. Refer to the LA 501 Interface Notes for the input-output information concerning the factory wired pin assignments. When the LA 501W is user wired for these additional output functions and a TM 500-Series oscilloscope is modified to accept an X, Y, or Z input, a simultaneous multi-channel raster can be displayed on the associated crt.

Threshold Level (Contact 19A)

Install a jumper between pin 8 of the red harmonica (P2 on the A2 Memory circuit board) and contact 19A. A DVM input through the rear interface can then be used to monitor the TTL, ECL, and VAR Threshold levels.

Z-Axis Output (Contact 24A) and Ground (Contact 23B)

Use approximately 12 inches of miniature coaxial cable to connect contact 24A (center conductor) and contact 23B (ground) to the front-panel bnc connector labeled Z BLANK OUT. Z-axis output is designed to drive a load $\geq$10 kΩ.

Set SW720 (internal switch on the LA 501) to the required Z-axis blanking polarity; switch in the up position for positive blanking, down for negative blanking (depends on monitor oscilloscope requirements).

X-axis Output (Contact 28B) and Ground (Contact 27B)

Use approximately 12 inches of miniature coaxial cable to connect contact 28B (center conductor) and 27B (ground) to the front-panel bnc connector labeled X HORIZ OUT. X-axis output is designed to drive a load $\geq$10 kΩ.

Y-axis Output (Contact 28A) and Ground (Contact 27A)

Use approximately 12 inches of miniature coaxial cable to connect contact 28A (center conductor) and 27A (ground) to the front-panel bnc connector labeled Y VERT OUT. Y-axis output is designed to drive a load $\geq$10 kΩ.

NOTES

Wiring the miniature coaxial cable to the front-panel bnc connectors increases the input capacitance.

GENERAL OPERATING HINTS

The following procedure is offered as a guide to use in obtaining a crt raster display when operating a LA 501W system that has been interfaced with an oscilloscope (monitor) in a TM 500-Series mainframe.

1. On the LA 501—center both POS controls and turn both MAG controls fully counterclockwise.

2. Set the dual-channel oscilloscope for X-Y operation from CH1 and CH2 and center the crt beam at graticule center (0,0) with the oscilloscope controls.

3. If the load presented to the X-axis (horizontal) signal from the LA 501 (contact 28B) is 1 MΩ, set the associated oscilloscope Channel for 50 mV/division. If the load is 50 Ω, set the deflection factor for 20 mV/division.

4. If the load presented to the Y-axis (vertical) signal from the LA 501 (contact 28A) is 1 MΩ, set the associated oscilloscope Channel for 50 mV/division. If the load is 50 Ω, set the deflection factor for 50 mV/division.

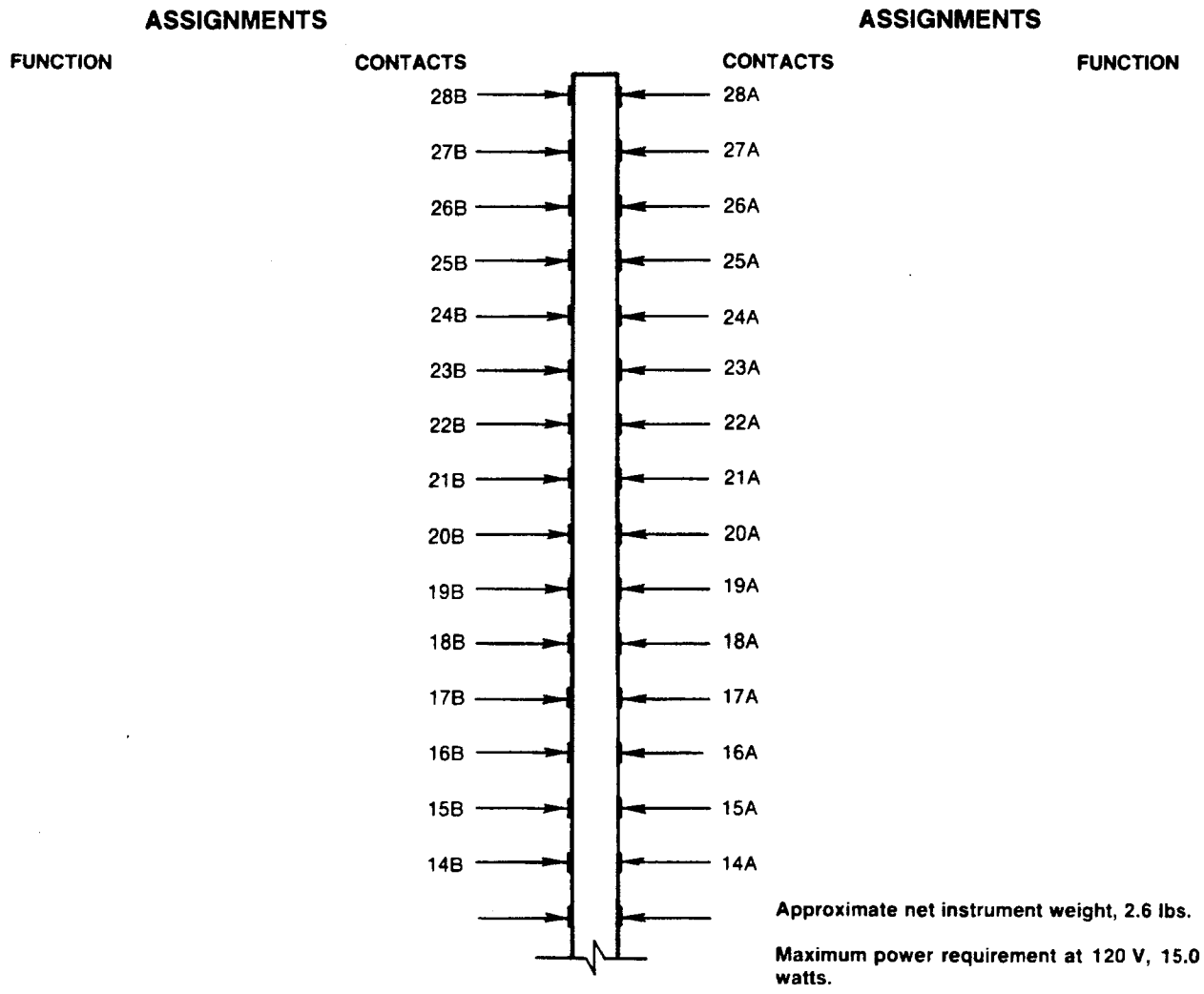
5. Set the oscilloscope controls, or internal switches, to accept the desired X, Y, or Z signals from the rear interface.

NOTE

If the oscilloscope or monitor is used in a real-time mode, the LA 501W must be triggered and the cursor turned off.

Approximate net instrument weight, 6.4 lbs. (LA 501 and WR 501)

Maximum power requirement at 120 V, 47 watts.



CAUTION

There are no rear interface input/output pin assignments for the WR 501. The WR 501 can be interconnected (electrically and mechanically) with the LA 501, either at the factory or by referring to Modification Kit Number 040–0806–01. When these two instruments are interconnected, the system is known as the LA 501W Logic Analyzer. When the WR 501 is used as a stand alone instrument, a compartment can be dedicated by inserting a family barrier key (Tektronix Part Number 214–1593–02) between contacts 24 and 25 on the Power Module.

Do not insert any TM 500 Series plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

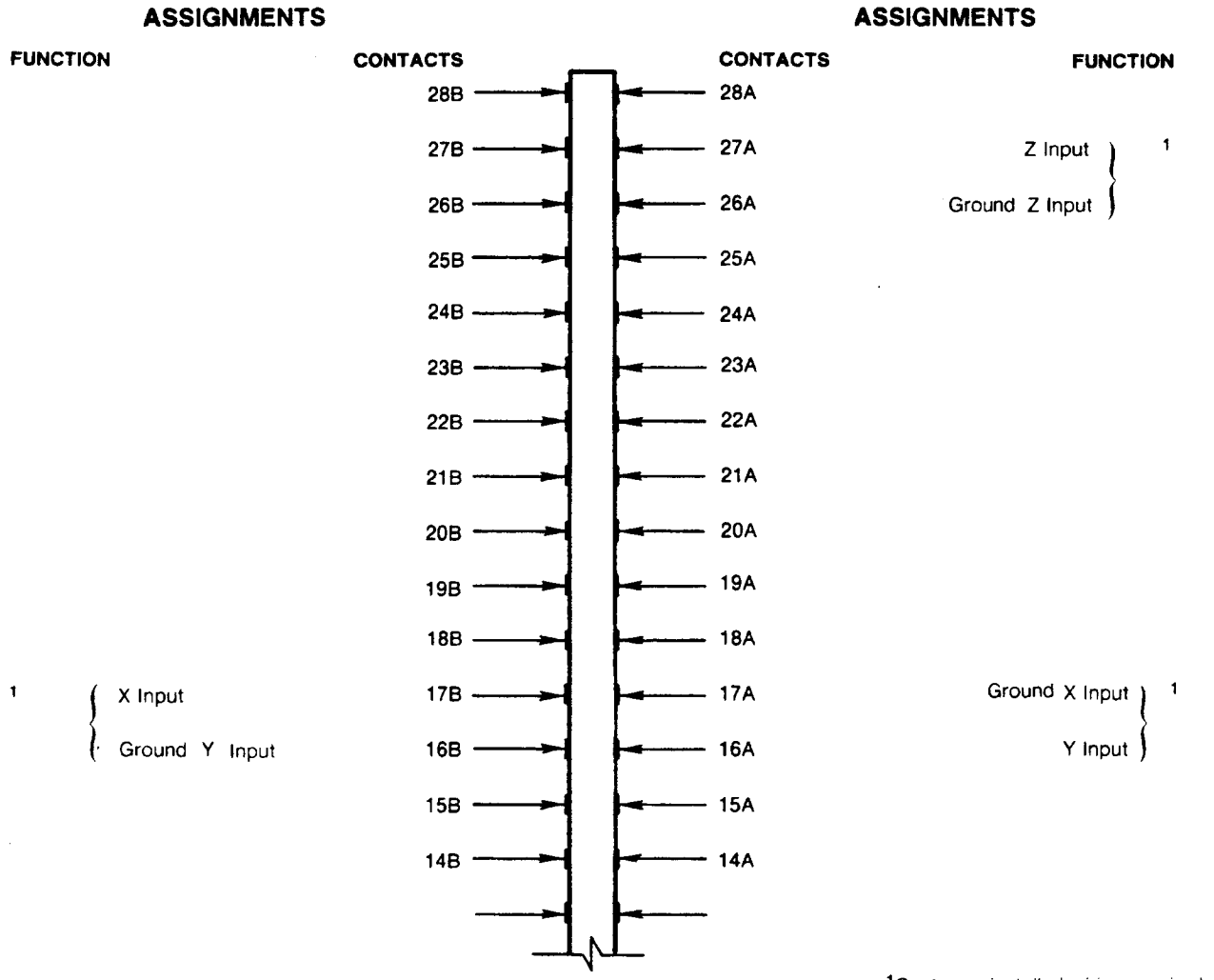
2088-56

Fig. WR 501-1. Connector rear view.

NOTES

MONITORS

NOTES



CAUTION

When a Power Module compartment has been selected for the MR 501 and wired for a specialized interface system, a plastic barrier (Tektronix Part Number 214–1593–02) should be installed in the key slot between contacts 21 and 22 on the Power Module.

Do not insert any TM 500 Series Plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

2088-57

Fig. MR 501-1. Connector rear view.

INTERFACE NOTES

Z Input (Contact 27A)

The Z-axis input signal can be applied to contact 27A by unsoldering the coaxial cable from the Z front-panel input connector and soldering it to contact 27A. A +5 V signal turns the crt beam on from a zero volt, off condition. The input resistance is 10 kΩ.

X Input (Contact 17B)

To apply the horizontal (X) input signal to contact 17B, disconnect the resistor from the X front-panel input connector and solder the center conductor of a length of miniature coaxial cable to the disconnected end of the resistor. Solder the unconnected end of the X input cable to contact 17B (center conductor) and 17A (ground). The input resistance is 1 MΩ.

Y Input (Contact 16A)

To apply the vertical (Y) input signal to contact 16A, disconnect the resistor from the Y front-panel input connector and solder the center conductor of a length of miniature coaxial cable to the disconnected end of the resistor. Solder the unconnected end of the Y input cable to contact 16A (center conductor) and 16B (ground). The input resistance is 1 MΩ.

Z Input Ground, X Input Ground, and Y Input Ground (Contacts 26A, 17A, and 16B)

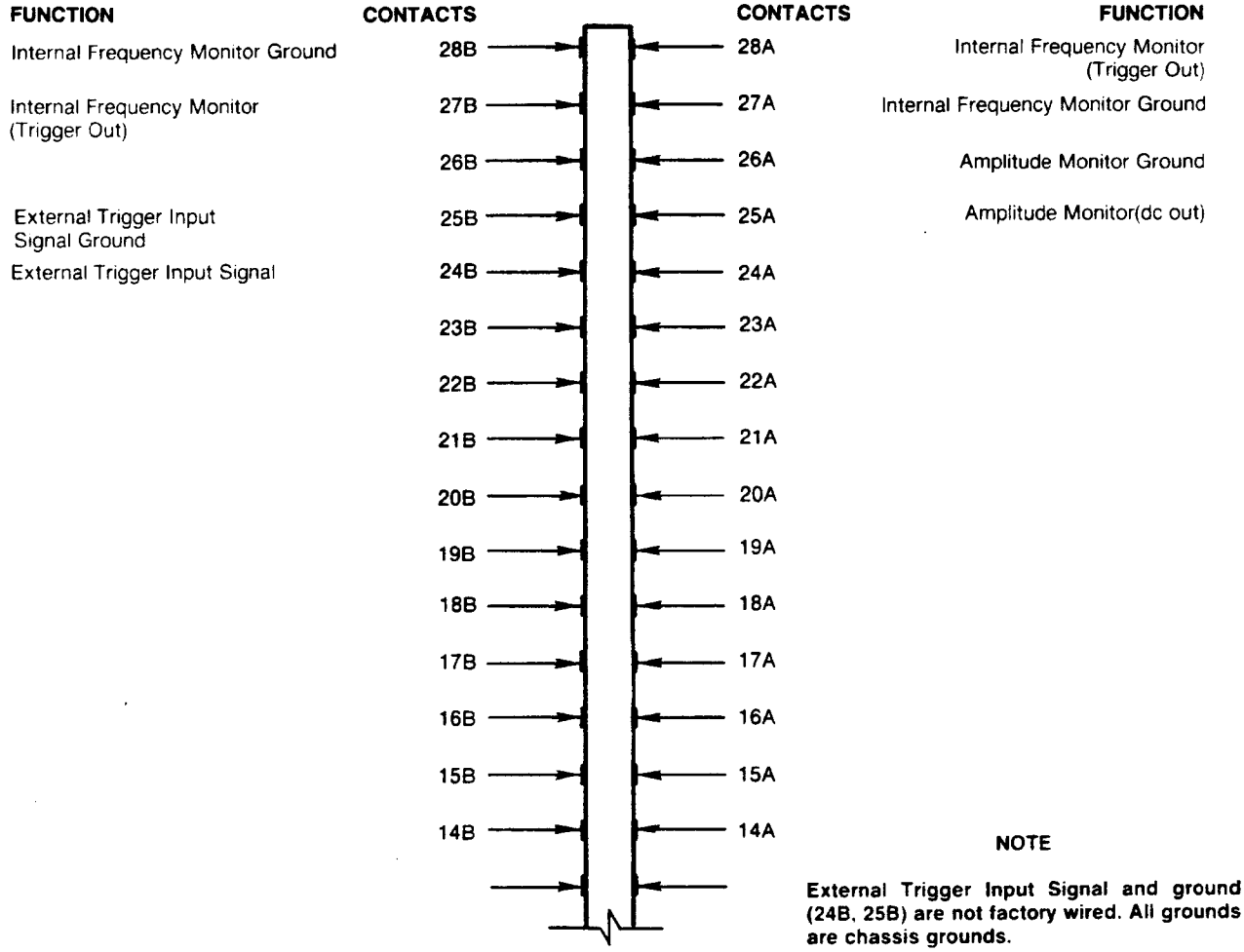
Contacts 26A, 17A, and 16B are electrically tied to the instrument chassis. Certain contacts are recommended for specific use for connection convenience.

Approximate net instrument weight, 2.1 lbs.

Maximum power requirement at 120 V, 12.0 watts.

PULSE GENERATORS

NOTES



CAUTION

When a Power Module compartment has been selected for the PG 501 and wired for a specialized interface system, a plastic barrier (Tektronix Part Number 214–1593–02) should be installed in the key slot between contacts 23 and 24 on the Power Module.

Do not insert any TM 500 Series Plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

Fig. PG 501-1. Connector rear view.

INTERFACE NOTES

Internal Frequency Monitor (Trigger Out) (Contacts 28A and 27B)

Contacts 28A and 27B are connected together on the circuit board. These contacts provide a square wave pre-trigger with transition times occurring approximately 10 ns before the output pulse. This trigger is the complement of the front-panel TRIG OUT signal. The open circuit output voltage varies between 0 V and 1 V and is in phase with the negative pulse output from a source impedance of 27 Ω. Changing R55 to 51 Ω increases the maximum output voltage to 2 V. Only period adjustments affect this square wave. These contacts may be shorted to ground without causing damage. Use contacts 27A/28B or both as ground returns.

Amplitude Monitor (dc out) (Contact 25A)

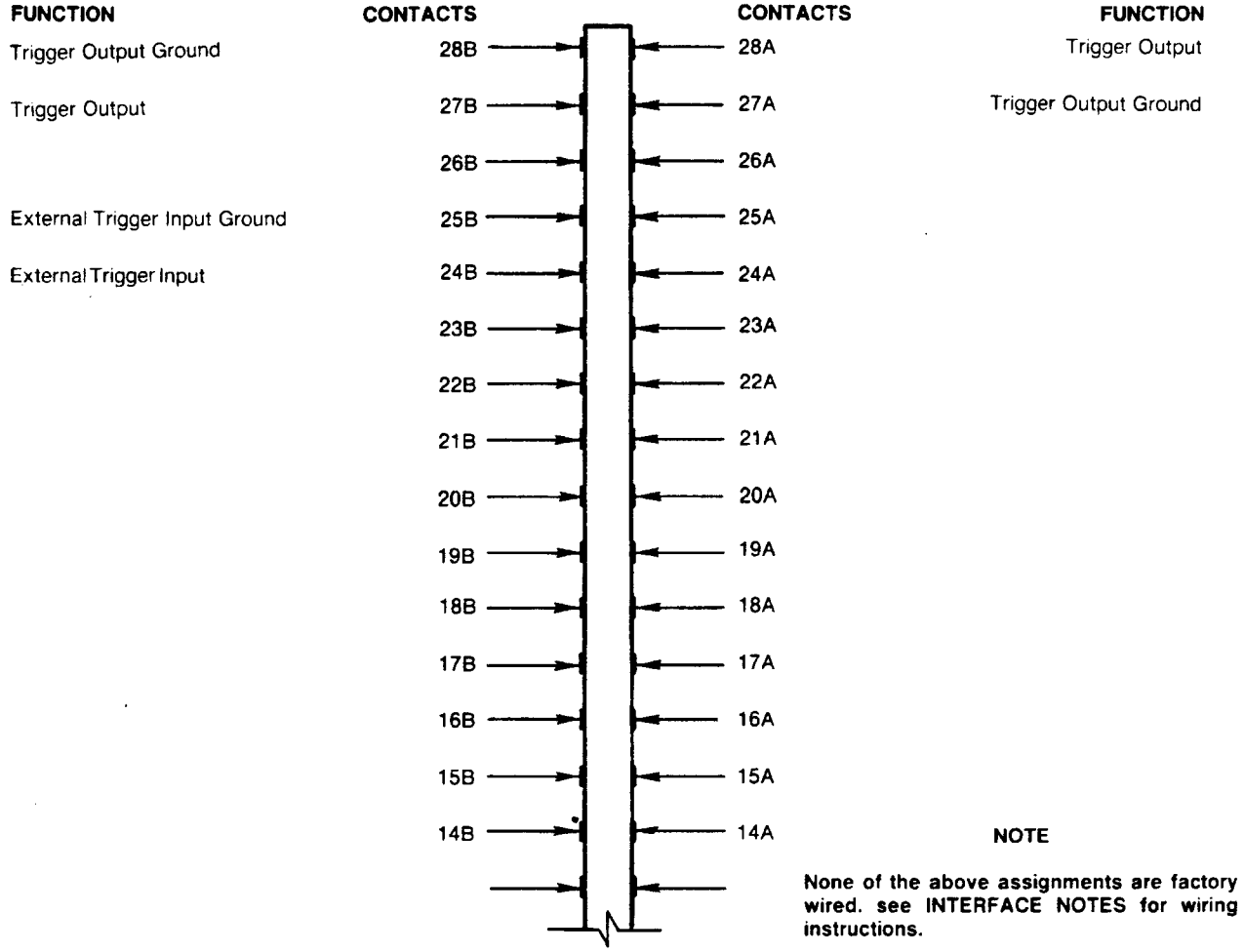
This output, contact 25A, may be used to accurately set the plus or minus output amplitude. The polarity of the voltage at this contact is selected by the Amplitude Monitor slide switch located in the center of the A board. Connect a high impedance voltmeter to this contact. Use contact 26A as ground. Set the PULSE DURATION control to the LOCKED ON position. Now adjust the selected OUTPUT AMPLITUDE (VOLTS) control for the desired amplitude. The source resistance for this contact is 27 kΩ.

External Trigger Input Signal (Contact 24B)

Contact 24B and its ground, 25B, are assigned to External Trigger Input Signal. These assignments are not factory wired. They provide the same feature as the front-panel TRIG/DURATION IN connection. To use these connections, disconnect the coaxial cable from the front-panel TRIG/DURATION IN bnc connector and reconnect the center conductor to 24B and the shield to 25B. Set the PERIOD selector to the EXT TRIG position and the PULSE DURATION control to the desired duration time or to the EXT DURATION position. In the latter position, the TRIG/DURATION signal controls both the frequency and duration of the output. When the PULSE DURATION control is not in the EXT DURATION Position and the PERIOD control is in EXT TRIG position, the external TRIG/DURATION IN signal triggers the output pulse, and the duration is determined by the PULSE DURATION control settings.

Approximate net instrument weight, 1.5 lbs.

Maximum power requirement at 120 V, 26 watts.



CAUTION

When a Power Module compartment has been selected for the PG 502 and wired for a specialized interface system, a plastic barrier (Tektronix Part Number 214–1593–02) should be installed in the key slot between contacts 23 and 24 on the Power Module.

Do not insert any TM 500 Series Plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

Fig. PG 502-1. Connector rear view.

INTERFACE NOTES

Trigger Output Signal (Contacts 28A and 27B)

Contacts 28A and 27B are connected together on the circuit board as are ground contacts 27A and 28B. To obtain a +TRIG OUT signal at the rear interface connectors, pull the coaxial cable from the front-panel +TRIG OUT connector and the Timing circuit board. Replace this cable with a miniature 50 Ω coaxial cable approximately ten inches long. Insert one end of the cable in the connector on the Timing board (do not solder), and the other end to the connector on the Output board (near the assigned rear interface connectors). If a coaxial cable with prepared end adapters is available, simply plug the ends of the cable into the connectors. The amplitude of this pulse is at least 1 V into 50 Ω. There is a fixed delay of approximately 10 ns between the leading edges of the trigger pulse and the output pulse. Be certain that coaxial cable shields are grounded.

Complementary Trigger Output Signal

To obtain a complementary (opposite polarity) trigger signal, connect a 50 Ω coaxial cable from the holes marked Internal Trig Out on the Timing Board. The center conductor of the coaxial cable connects to the hole marked + and the shield to the hole marked Gnd. Connect the other end of this cable to the connector on the A side of the Output board near connectors 28 and 27. This provides outputs on the same connectors as the Trigger Output Signal described above. These connections do not interfere with the + TRIG OUT signal. A one-half volt signal into 50 Ω is available at these connections.

Trigger/Duration Input

Connections for this input can also be transferred to the rear interface connector. Disconnect the cable from the front-panel +TRIG/DURATION INPUT and the connector labeled Trig In on the Timing board. Pull the cable to remove the ends from the connections. Now connect a piece of 50 Ω coaxial cable approximately ten inches in length from the Trig In connections on the Timing board to the holes connected to contact 25B (ground) and 24B (center conductor). Solder the cable in the rear connector holes and insert the other end in the connector on the Timing board, or obtain a cable with the proper adapters.

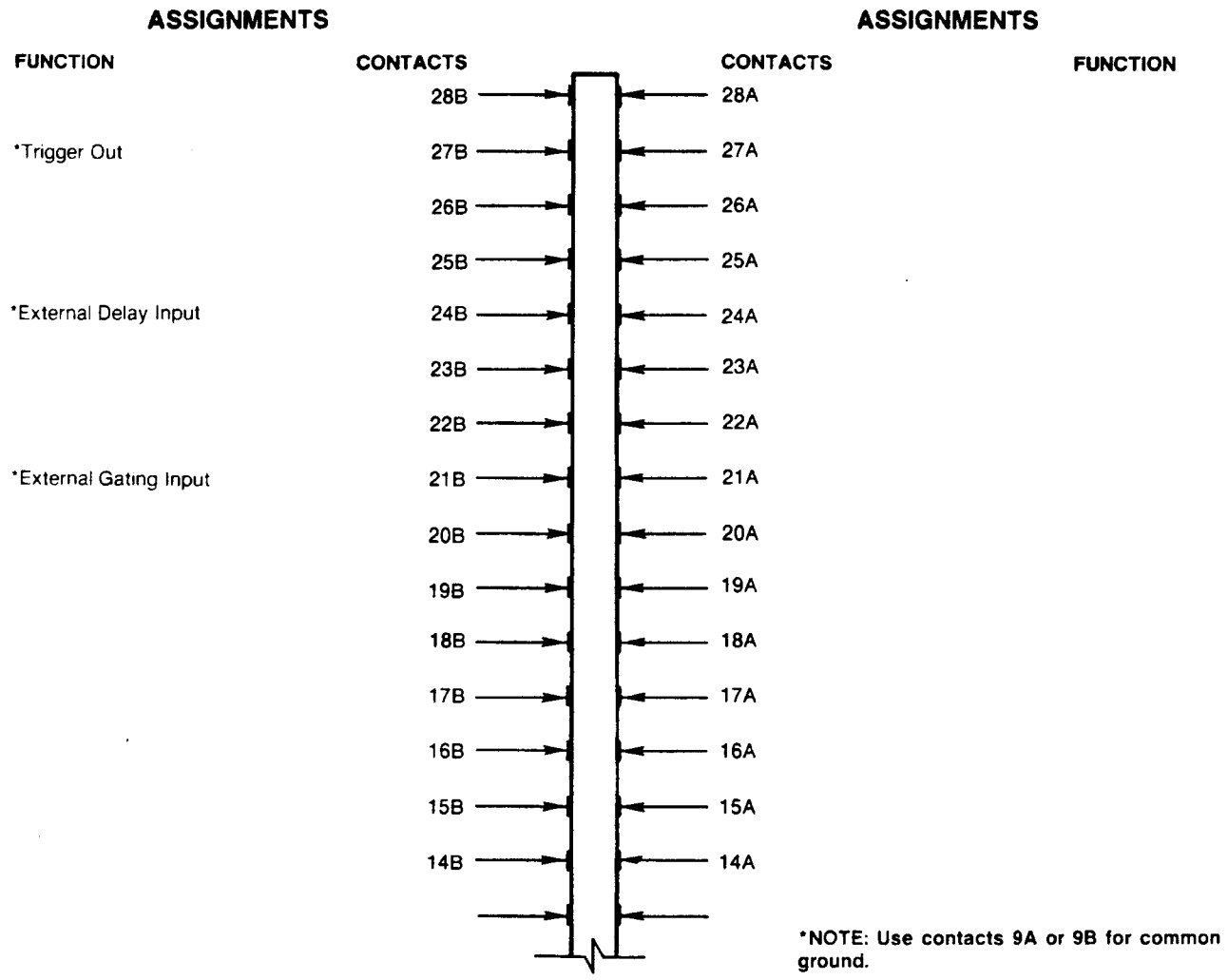
Set the PERIOD selector to the EXT TRIG position and the PULSE DURATION control to the desired duration time or to the EXT DURATION position. In the latter position, the +TRIG/DURATION INPUT signal controls both the frequency and duration of the output. When the PULSE DURATION control is not in the EXT DURATION position and the PERIOD control is in the EXT TRIG position, the external +TRIG/DURATION INPUT signal triggers the output pulse. The duration of the output pulse is determined by the PULSE DURATION control setting.

Pulse Fidelity

It is important to remember that when using the rear interface connectors, some pulse degratation may occur due to increased cable lengths or additional capacitance introduced by the rear interface connections, etc.

Approximate net instrument weight, 1.8 lbs.

Maximum power requirement at 120 V, 20 watts.



CAUTION

When a Power Module compartment has been selected for the PG 505 and wired for a specialized interface system, a plastic barrier (Tektronix Part Number 214-1593-02) should be installed in the key slot between contacts 23 and 24 on the Power Module.

Do not insert any TM 500 Series Plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

2088-60

Fig. PG 505-1. Connector rear view.

INTERFACE NOTES

Trigger Out (Contact 27B)

Contact 27B is in parallel with the front-panel TRIG OUT connector.

External Delay Input (Contact 24B)

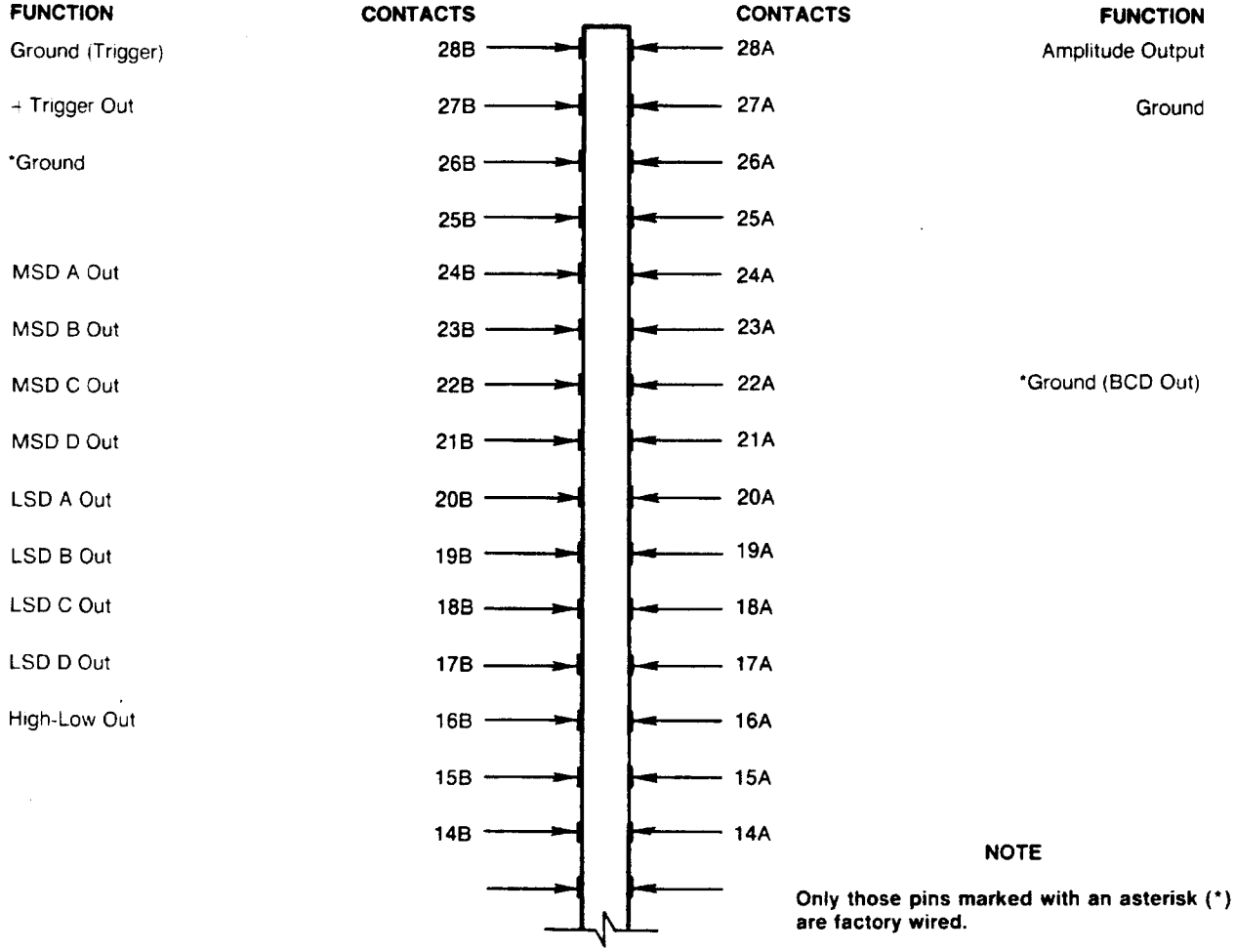
Interface contact 24B is connected in parallel with the INPUT front-panel connector.

External Gating Input (Contact 21B)

Contact 21B is used to gate off the free-running period generator. Apply a 5 V positive-going pulse whose duration is the same as the off time desired. Gating the pulse generator may cause some time distortion to the first and last pulse string.

Approximate net instrument weight, 2.0 lb.

Maximum power requirement at 120 V, 15.5 watts.



CAUTION

When specialized rear interface wiring has been added to a Power Module compartment, the PG 506 may not be fully compatible with all other members for the signal source family. Trigger output (27B and 28B) and main output (28A and 27A) are compatible, as is the ground on 26B. The ground on 22A is not compatible with certain instruments, nor is the bcd information on 17B through 24B and the HIGH-LOW output on 16B. A plastic barrier (Tektronix Part Number 214–1593–02) should be installed in the key slot between contacts 23 and 24 on the power module. However, before inserting any other TM 500 signal source in a compartment with PG 506 interface wiring, check the diagrams in this book for pin-by-pin compatibility. Likewise, do not insert a PG 506 into a slot with rear interface wiring for any other signal source family connection without making the same compatibility check.

Do not insert any TM 500 Series plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

NOTE

The pin assignments shown above for customer-installed connections inside the PG 506 are different in some respects than those shown earlier in PG 506 manuals.

2088-61

Fig. PG 506-1. Connector rear view.

INTERFACE NOTES

Amplitude Output (Contact 28A)

To obtain the AMPL OUTPUT signal at the rear interface connectors, disconnect the coaxial cable from the Main board (located in the lower left hand corner of the B side). Replace this cable with a miniature 50 Ω coaxial cable (Tektronix Part No. 175-1827-00). Remove the coaxial connector from the other end, and solder the cable to the rear interface connector as follows:

Shield to 27A (3rd hole down from top on the B side), and Center conductor to 28A (4th hole down on the B side).

See Fig. PG 506-1 for pictorial interface connection detail.

NOTES

Connecting front-panel signals to the rear interface will degrate their performance slightly.

Trigger Output (Contact 27B)

To connect TRIG OUT to the rear interface, disconnect the coaxial 50 Ω lead to the front panel at the DVM board end (located in the upper right-hand corner as viewed from the rear). Replace this cable with a miniature 50 Ω coaxial cable (Tektronix Part No. 175-1826-00). Remove the coaxial connector from the other end, and solder the cable to the rear interface connector as follows:

Shield to 28B (2nd hole down from top on the A side), and Center Conductor to 27B (5th hole down on the A side).

See Fig. PG 506-1 for pictorial interface connection detail.

NOTE

Ground connctions to 26B and 22A are the only rear interface signal connections that are factory wired.

MSD & LSD Outputs

To obtain readout information at the interface, use flat ribbon-wire to connect this digital information to the through-plated holes as shown in Fig. PG 506-1 and according to the following list:

MSD A to 24B MSD B to 23B MSC C to 22B MSD D to 21B LSD A to 20B LSD B to 19B	6 lead flat ribbon-wire
LSD C to 18B LSD D to 17B Hi-Lo to 16B	3 lead flat ribbon-wire

NOTE

Each of the MSD and LSD outputs is only capable of driving one TTL load. The active level of each output is high.

For the Hi-Lo Output, output is low when the HIGH display light on the front panel is on.

Approximate net instrument weight, 2.3 lbs.

Maximum power requirement at 120 V, 18.6 watts.

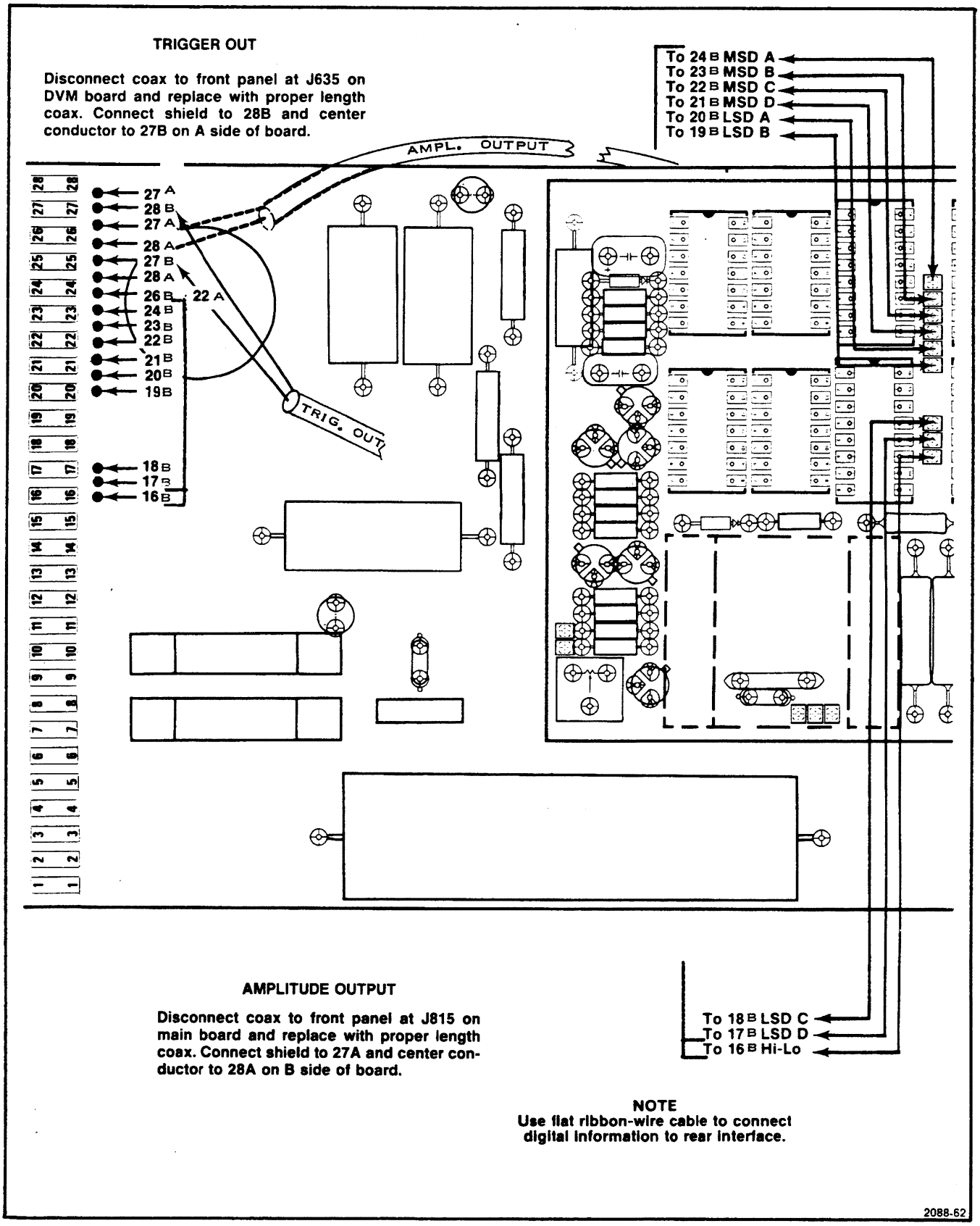
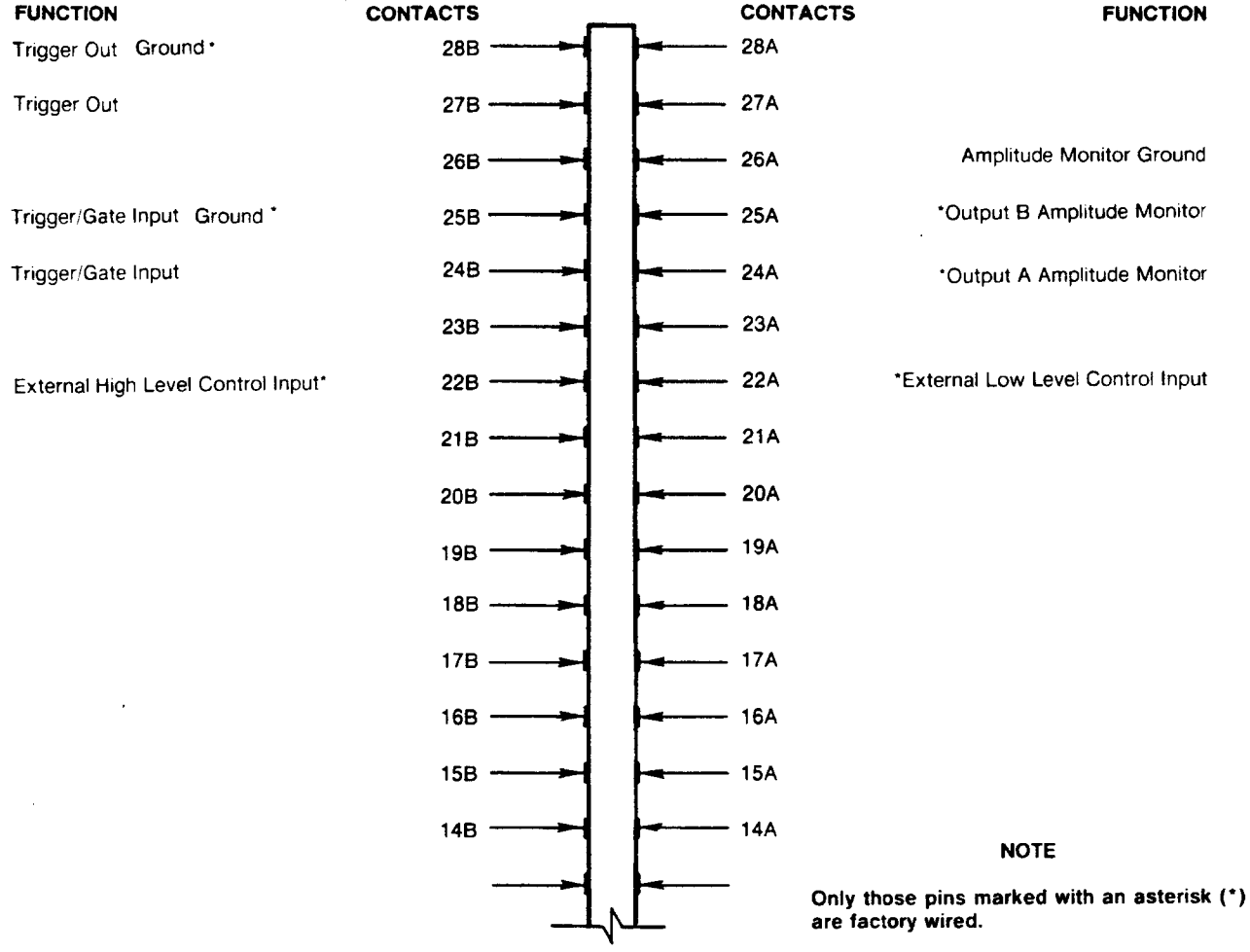


Fig. PG 506-2. Interface connection locations.



CAUTION

When a Power Module compartment has been selected for the PG 507 and wired for a specialized interface system, a plastic barrier (Tektronix Part Number 214–1593–02) should be installed in the key slot between contacts 23 and 24 on the Power Module.

Do not insert any TM 500 Series Plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

2088-63

Fig. PG 507-1. Connector rear view.

INTERFACE NOTES

Introduction

See the accompanying chart for rear interface connector assignments. For other functions not detailed here, the small auxiliary board (A15) has numerous connectors available. Use the connections to make custom inputs or outputs to the PG 507 through the power module.

Amplitude Monitor (Contacts 24A and 25A)

These contacts, on the Output B board (A14) are connected to the OUTPUT terminals through 27 kΩ resistors and ground (26A). To use this function, place the PERIOD control in the EXT TRIG OR MAN position and connect an accurate voltmeter to 24A or 25A (ground 26A). Now adjust the TRIG/GATE LEVEL control clockwise for the high steady state output voltage and counterclockwise for the low steady state output voltage. In this manner, the output pulse amplitude levels may be precisely monitored and set.

Trigger/Gate Input (Contact 24B)

These assignments provide rear-interface input for a trigger/gate signal in place of front-panel input. The signal lead (24B) must be user installed, but the ground (25B) is factory wired. To make the proper connections, remove the cable extending from the TRIG/GATE IN connector to the Input board (A11) by pulling the cable end from the socket. Install a twelve-inch cable with the proper connectors (Tektronix Part Number 175-1827-00), from the connector on the Input board (A11) labeled Trig/Gate In to the connector labeled Trig In on the Output B board (A14). Refer to Fig. PG 507-1.

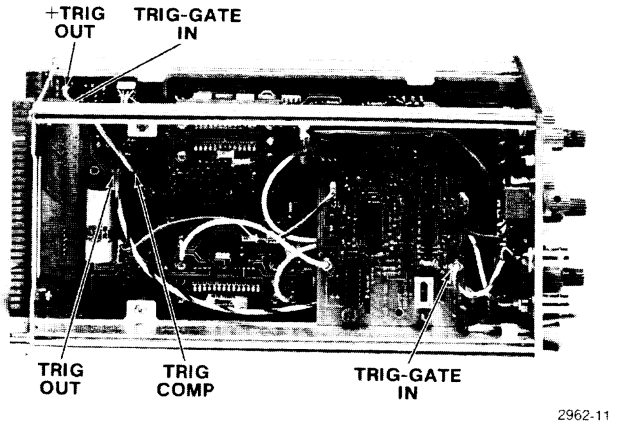


Fig. PG 507-2. External output control circuitry.

Trigger Out (Contact 27B)

The signal lead (27B) and ground connection (28B) are factory wired. The signal available at pin 27B is the complement of the front-panel + TRIG OUT. To route the front-panel + TRIG OUT signal to the rear interface connector and the rear complement signal to the front-panel + TRIG OUT connector, interchange the cable connections to the Trig Out and Trig Comp (TC) coaxial connectors on the Timing board (A12). Refer to Fig. PG 507-1.

External Control Voltage Adjustment (Contacts 22A and 22B)

The output pulse high and low levels can be controlled externally through pins 22B and 22A at the rear interface connector. Refer to Fig. PG 507-2 before making these adjustments.

To make the internal adjustments for this feature, follow these steps.

High Level Control Voltage Adjustment

1. Set the front-panel controls as follows.

PRESET - VAR	in
PERIOD	EXT TRIG or MAN
DURATION	EXT DUR
COMPLEMENT-NORM	both out

2. Using an insulated screwdriver, center the internal Ext Hi (R1013) and the front-panel preset HIGH LEVEL controls.

3. Supply a voltage equal to the lowest external input control voltage desired (−15 V to +15 V) to contact 22B

4. Adjust the front-panel preset HIGH LEVEL control for an output voltage equal to the minimum desired output voltage. It may be necessary to adjust the front-panel preset LOW LEVEL control since the high level output voltage is clamped by the low level output voltage.

5. Now supply a voltage to equal the highest external control voltage.

6. Adjust the Ext Hi (R1013) for the maximum desired output voltage. It may be necessary to adjust the front-panel preset LOW LEVEL control to obtain the desired output. The Ext Hi and the preset HIGH LEVEL controls interact. It may be necessary to repeat steps 3 through 6 until the desired results are obtained.

Low Level Control Voltage Adjustment

7. Push the COMPLEMENT-NORM switch.

8. Center the Ext Lo (R1023) and the front-panel preset LOW LEVEL controls.

9. Supply a voltage at contact 22A of the rear interface equal to the lowest control voltage desired (−15 V to +15 V).

10. Adjust the preset LOW LEVEL control for an output voltage equal to the lowest output voltage desired.

11. Supply a voltage to the highest desired external voltage.

12. Adjust the Ext Lo potentiometer (R1023) for the highest output voltage desired. As the Ext Lo and preset LOW LEVEL controls interact, readjustment may be necessary. Do not readjust the preset HIGH LEVEL or Ext Hi potentiometers. When adjustments are complete, the output voltages vary linearly and independently with the external control voltages.

Approximate net instrument weight, 3.5 lbs.

Maximum power requirement at 120 V, 28 watts.

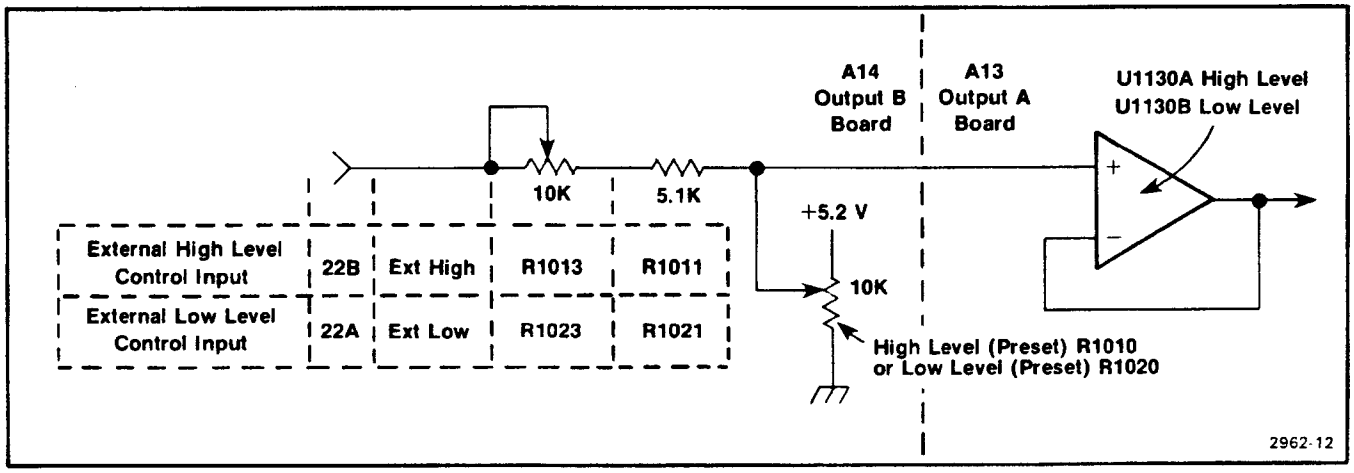
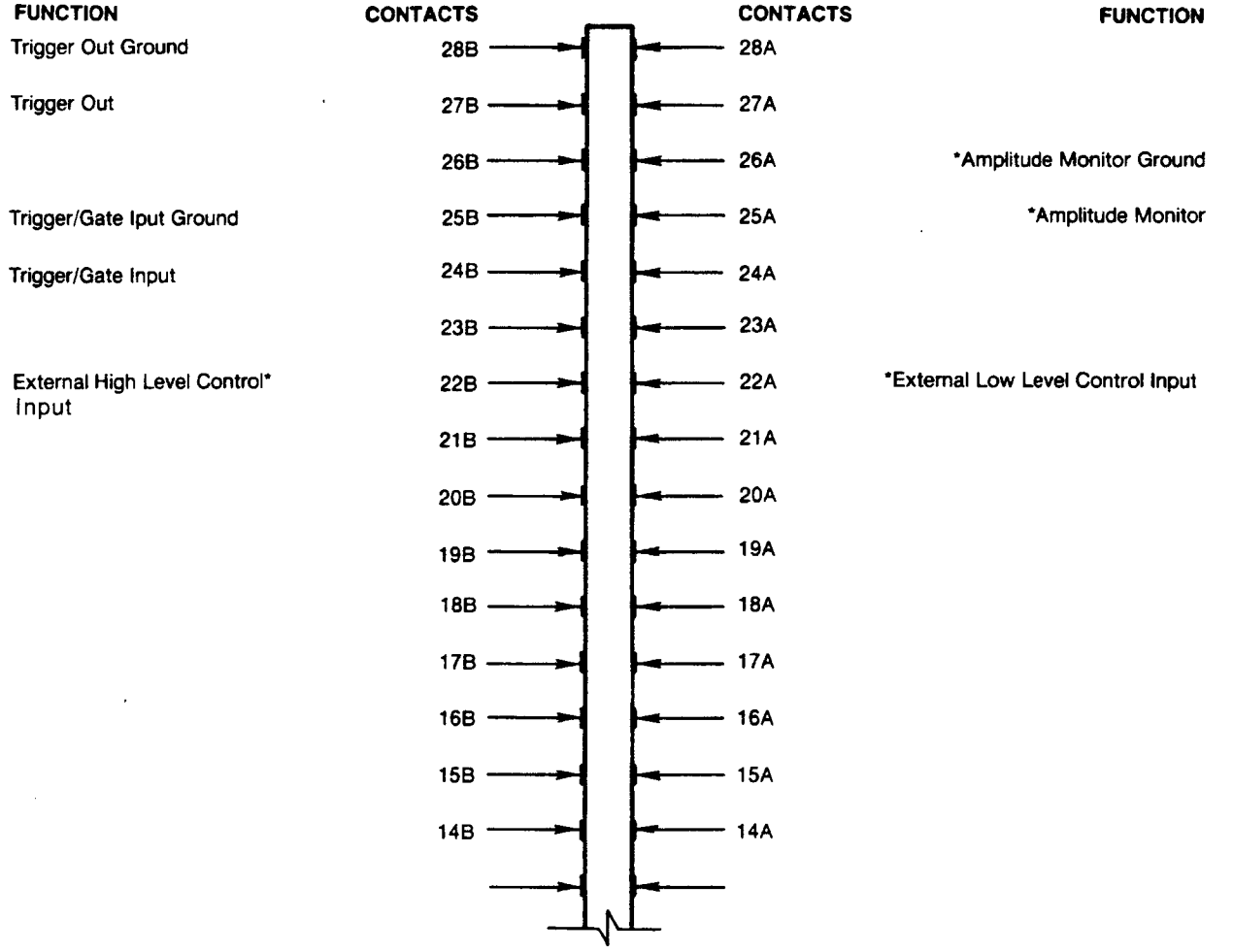


Fig. PG 507-3. Trigger/Complement cable connections.



NOTE

Only those pins marked with an asterisk (*) are factory wired.

CAUTION

When a Power Module compartment has been selected for the PG 508 and wired for a specialized interface system, a plastic barrier (Tektronix Part Number 214–1593–02) should be installed in the key slot between contacts 23 and 24 on the Power Module.

Do not insert any TM 500 Series plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

2088-95

Fig. PG 508-1. Connector rear view.

INTERFACE NOTES

Introduction

See the accompanying chart for rear interface connector assignments. For other functions not detailed here, the small auxiliary board (A15) has numerous connectors available. Use the connections to make custom inputs or outputs to the PG 508 through the power module.

Amplitude Monitor (Contact 25A)

Contact 25A is connected to the OUTPUT terminal through a 27 kΩ resistor and ground (26A). To use this function, place the PERIOD control in the EXT TRIG OR MAN position and connect an accurate voltmeter to these terminals. Now adjust the TRIG/GATE LEVEL control clockwise for the high steady state output voltage and counterclockwise for the low steady state output voltage. In this manner, the output pulse amplitude levels may be precisely monitored and set.

External Level Control Inputs (Contacts 22A and 22B)

The high and low level output voltages can be controlled externally through pins 22B and 22A at the rear interface connector. Fig. PG 508-1 shows the equivalent circuit. Connections must be made from pad K to pad L and pad M to pad N located as shown on Fig. PG 508-2. Use ordinary hook-up wire of the proper length. Solder the wire to the pads. Note the location of the Ext Hi and Ext Lo potentiometers on the output board.

To use this feature, set the front-panel controls as follows:

1. Press the PRESET button (PRESET), place the PERIOD switch in the EXT TRIG OR MAN position, the DURATION in EXT DUR, and the NORM COMPLEMENT switch in the NORM position (out).

2. Use a screwdriver to center the Ext Hi and the preset HIGH LEVEL controls.

3. Supply a voltage to the external high input (pin 22B on the rear interface connector) equal to the highest external input voltage desired (maximum 20 V).

4. Adjust the Ext Hi potentiometer (on the circuit board) for an OUTPUT voltage equal to the maximum desired output voltage. It may be necessary to adjust the preset LOW LEVEL control as the OUTPUT voltage is limited to 20 V peak to peak open circuit. The high level OUTPUT voltage is clamped by the low level OUTPUT voltage if this range is exceeded.

5. Apply a voltage equal to the lowest external control voltage desired to the same rear interface connector (pin 22B).

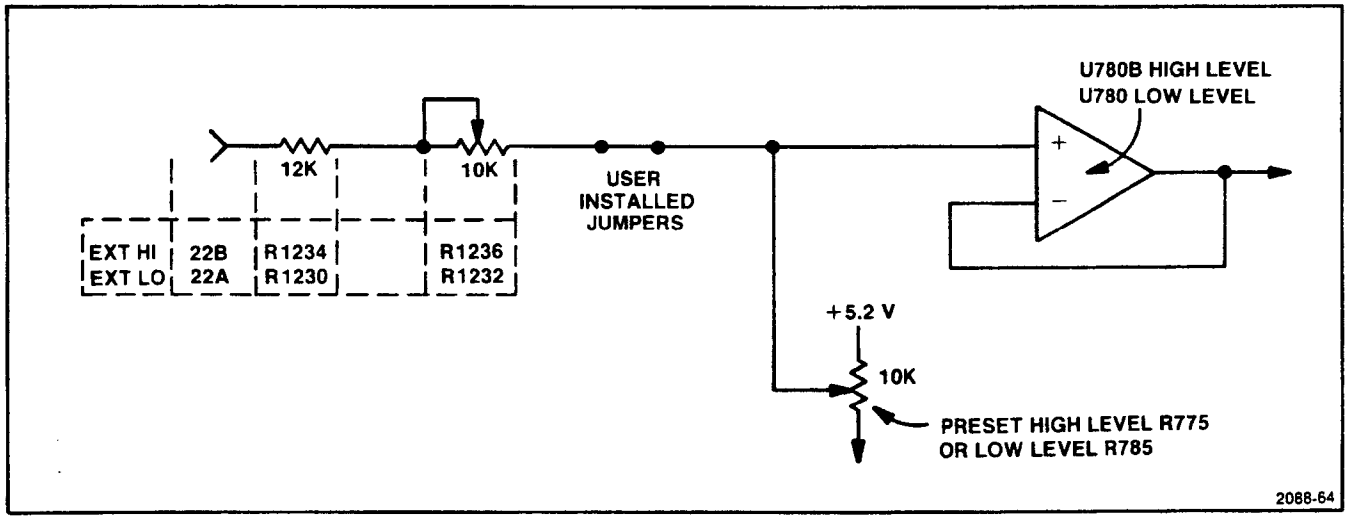


Fig. PG 508-2. External output control circuitry.

6. Adjust the front-panel preset HIGH LEVEL until the lowest desired output voltage is obtained. It may be necessary to adjust the preset LOW LEVEL control to obtain the desired output. The high level OUTPUT voltage cannot go below the low level OUTPUT voltage due to the level control voltage clamps. The Ext Hi and the preset HIGH LEVEL controls interact. It may be necessary to repeat the above procedure several times until the desired results are obtained.

7. Push the NORM COMPLEMENT switch (COMPLEMENT).

8. Center the Ext. Lo and preset LOW LEVEL potentiometers.

9. Supply a voltage to pin 22A of the rear interface connector equal to the highest external control voltage desired.

10. Adjust the Ext Lo potentiometer (on the circuit board) for an OUTPUT voltage equal to the highest OUTPUT voltage desired. Change this voltage to the lowest desired external control voltage.

11. Adjust the front-panel preset LOW LEVEL control for the lowest OUTPUT voltage desired. As these adjustments interact, readjust the preset LOW LEVEL and the Ext Lo potentiometers for the desired results. Do not readjust the preset HIGH LEVEL or the Ext Hi potentiometers. The OUTPUT voltages now vary linearly and independently with the external control voltages.

Trig/Gate Input (Contact 24B)

These assignments provide rear interface input capabilities for the front-panel TRIG/GATE IN input. The signal lead (24B) must be user installed, but the ground (25B) is factory wired. To make the proper connections, remove the cable extending from the TRIG/GATE IN connector to the input board by pulling the end from the socket on the board. Install a twelve inch cable with the proper connectors, Tektronix Part Number 175-1827-00, from the connector on the input circuit board labeled Trig/Gate In to the other connector on the output board labeled Trig/Gate In as shown in Fig. PG 508-3.

Trigger Out (Contact 27B)

The signal lead (27B) and ground connection (28B) are factory wired. The signal available at contact 27B is the complement (180° out of phase) of the front-panel OUTPUT. To obtain the + TRIG OUT signal at the rear interface connector and the complement at the front-panel change the position of both coaxial cables, with respect to the Trig Out and Trig Comp jacks on the rear of the circuit board, as shown in the illustration. The normal trigger input may be used simultaneously with the complement without disturbing the operation of either.

Approximate net instrument weight, 3.6 lbs.

Maximum power requirement at 120 V, 45.0 watts.

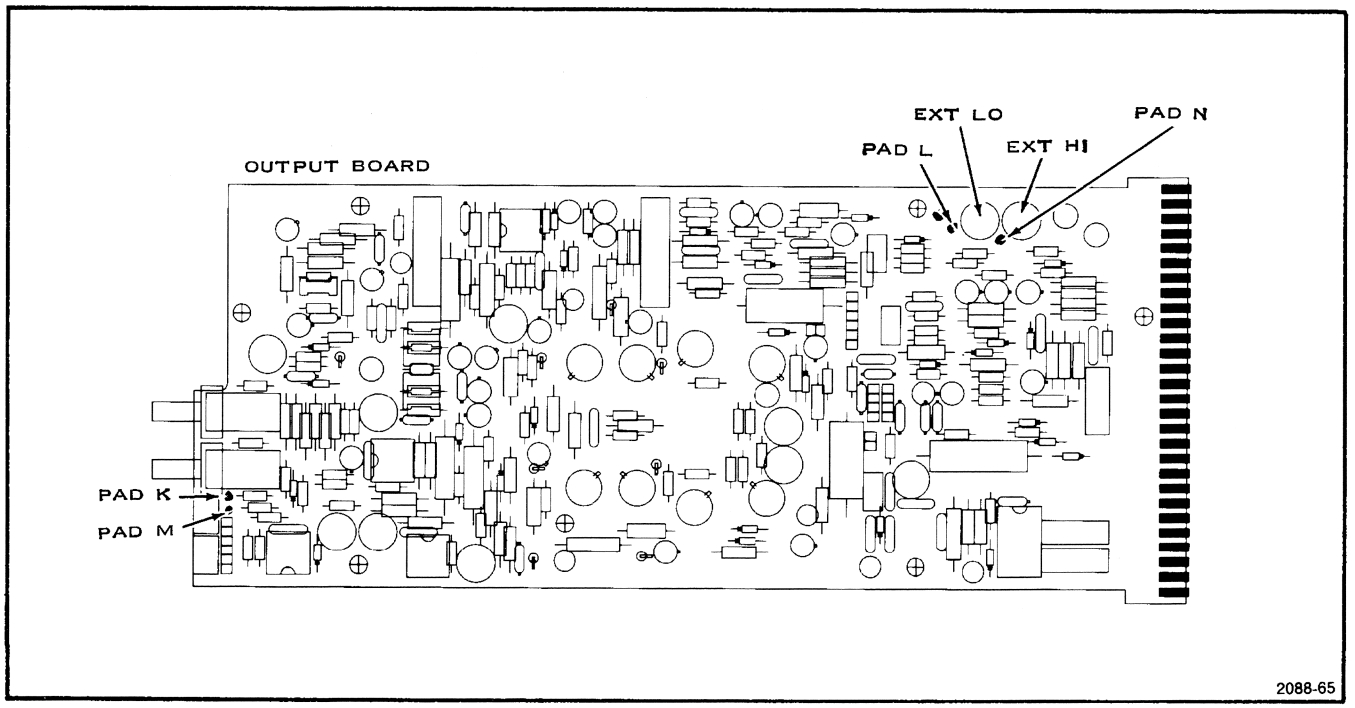


Fig. PG 508-3. Board connection locations.

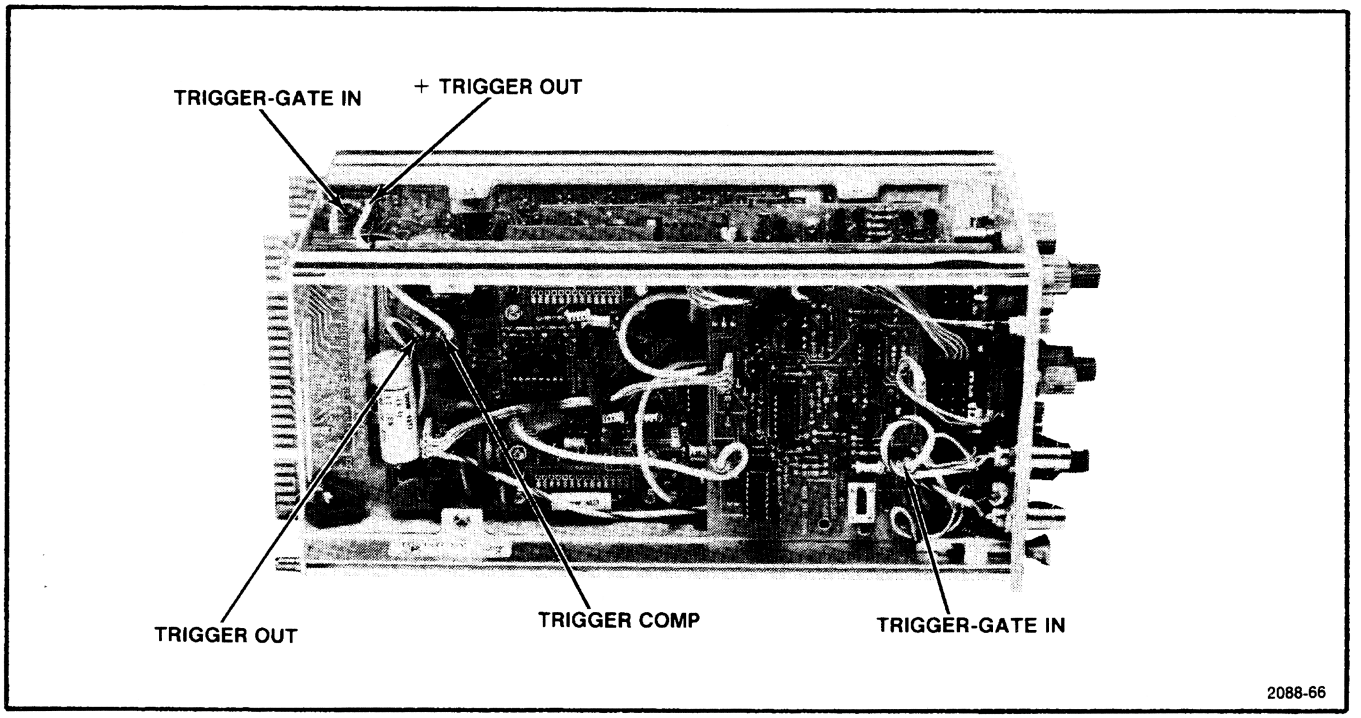
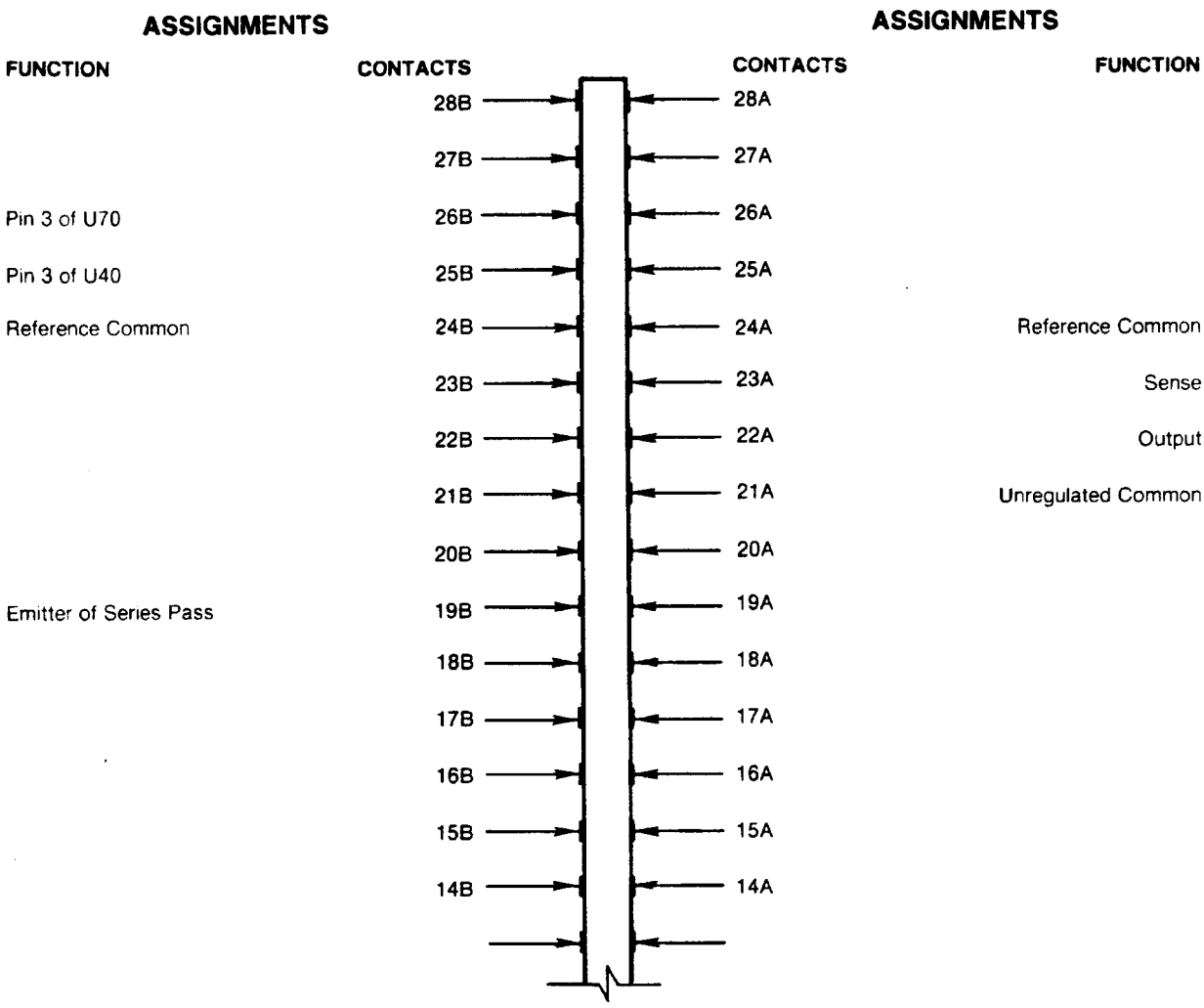


Fig. PG 508-4. Trigger/Complement cable connections.

POWER SUPPLIES

NOTES



CAUTION

When a Power Module compartment has been selected for the PS 501,PS 501-1 or PS 501-2 and wired for a specialized interface system, a plastic barrier (Tektronix Part Number 214–1593–02) should be installed in the key slot between contacts 19 and 20 on the Power Module.

Do not insert any TM 500 Series Plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

2088-67

Fig. PS 501-1. Connector rear view.

INTERFACE NOTES

Introduction

Remote programming, powering, and sensing of some load under the power module Option 02 capabilities may be desirable. Thorough understanding of the schematic diagram and the exact internal connections for Input/Output lines to the rear contacts will be an aid in designing the specialized TM 500 interface system.

Model Deviations

PS 501-1 has several part values different from those used in the other two models of this instrument. The output voltage between J50 and J52 is a constant gain factor greater than the voltage applied to Pin 3 of U40 with respect to J52. The gain factor for the PS 501-1 is theoretically 2.22, while the theoretical gain factor for the other two versions of this instrument is 3.23. Also, there are parts tolerances within the calibration range of these instruments that can cause further deviations in this gain factor.

To measure the gain factor of your individual instrument, adjust it for exactly 20 V out (between J50 & J52). Measure the voltage at contact 25B with respect to reference ground on 24A/24B. (This will give you the voltage applied to Pin 3 of U40.) Now, divide 20 V by the voltage measured between 25A and 24A/24B. This answer is the gain factor of your individual unit. This factor times whatever appropriate + voltage you apply to contact 25B with respect to 24A/24B, will be the output voltage of your unit. Be sure to disconnect the wiper arm of R42A, (see Fig. PS 501-1 for the suggested point for opening this circuit) before applying the external voltage to contact 25B.

If the output voltage is taken from contact 22A with respect to reference common (24A/24B), remote sense at contact 23A should also be connected to the load, and the sensing lead to J50 should be opened up at point P (see Fig. PS 501-2 for the suggested point for opening this circuit). Sensing of the load voltage at the load gives the best regulation. You will note that reaching point P with a soldering iron is best achieved on the contact 24B side of the circuit board.

Reference Common (both Contacts 24A and 24B in preference to Contact 21A or possibly Contact 21B)

Contacts 24A and 24B are the common return for the + voltage offered by this supply. It can be ground referenced, elevated, or left open. It is suggested that elevation of this point does not exceed a +300 V with respect to ground.

Sense (Contact 23A)

This is a reasonably high impedance input (close to 1.6 kΩ), even when current limiting takes place. When remote load voltage sensing is connected to this point, be sure to open the front-panel voltage sensing circuit at point P (see Fig. PS 501-2). Sensing of the voltage at the load gives the best regulation.

+ Output (Contact 22A)

This is the low impedance source of the voltage developed by this unit as dictated by the gain of the individual unit times the + voltage applied to Pin 3 of U40 with respect to reference common. This is done by adjusting R42A or (after opening the wiper arm of R42A, see Fig. PS 501-2) applying an appropriate + voltage to 25B with respect to reference common. Maximum current available here cannot exceed 500 mA; however, current limiting at levels below this can be achieved by setting R65 (the Current Limit front-panel control).

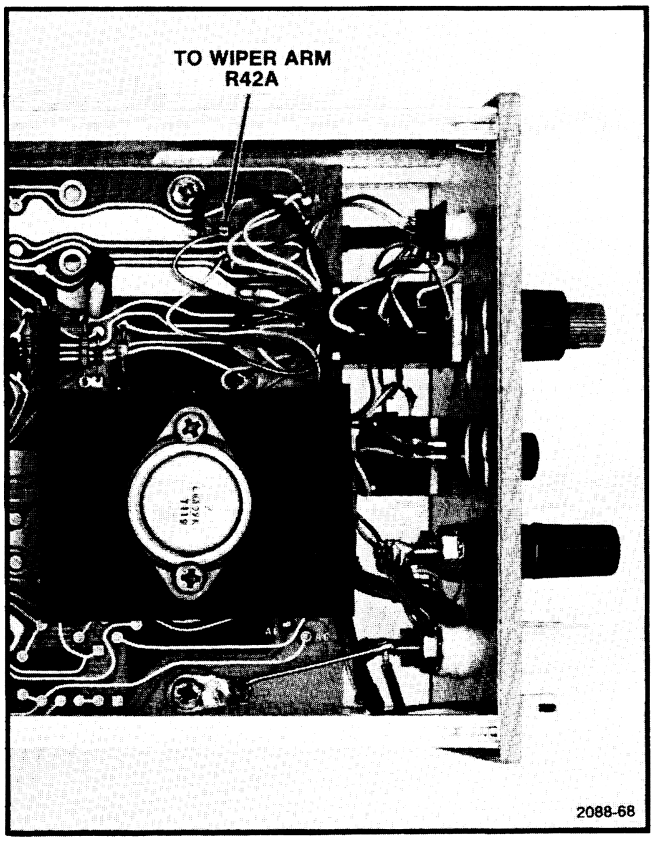


Fig. PS 501-2. Disconnect lead going to this pad to open wiper arm circuit of R42A.

Unregulated Common (Contact 21A)

This is part of the common lead circuitry (along with 24A/24B) but there is a slight resistance to this lead due to the long board runs associated with it (approximately 2 mΩ).

Pin 3 of U40 (Contact 25B)

This input has a 10 kΩ resistance to Pin 3 of U40. Pin 3 of U40 is also a high impedance input, so voltages applied to 25B will show up accurately at Pin 3. External programming of the output voltage of this unit can be achieved by applying an appropriate positive to this input after making sure the wiper arm of R42A has been opened up, see Fig. PS 501-1. The output voltage of this unit will be this unit's gain factor times the voltage applied to this point. (For gain factor, see Model Deviations.) Do not program this unit to develop an output voltage between 22A and 24A greater than 20 volts (also, 22A should be + with respect to 24A).

Pin 3 of U70 (Contact 26B)

This is an external current limiting control point. If it is left open (no connection made to it) current limiting takes place as controlled by the front panel CURRENT LIMIT adjustment. If 26B is connected to 19B, the current limiting feature is completely disabled. If fixed at 0.6 V below reference common, this supply is shut down and will not operate.

NOTE

The +5 volts with a maximum 1 A current capability is not available at the rear interface connector.

Approximate net instrument weight, 1.6 lbs.

Maximum power requirement at 120 V, 42.5 watts.

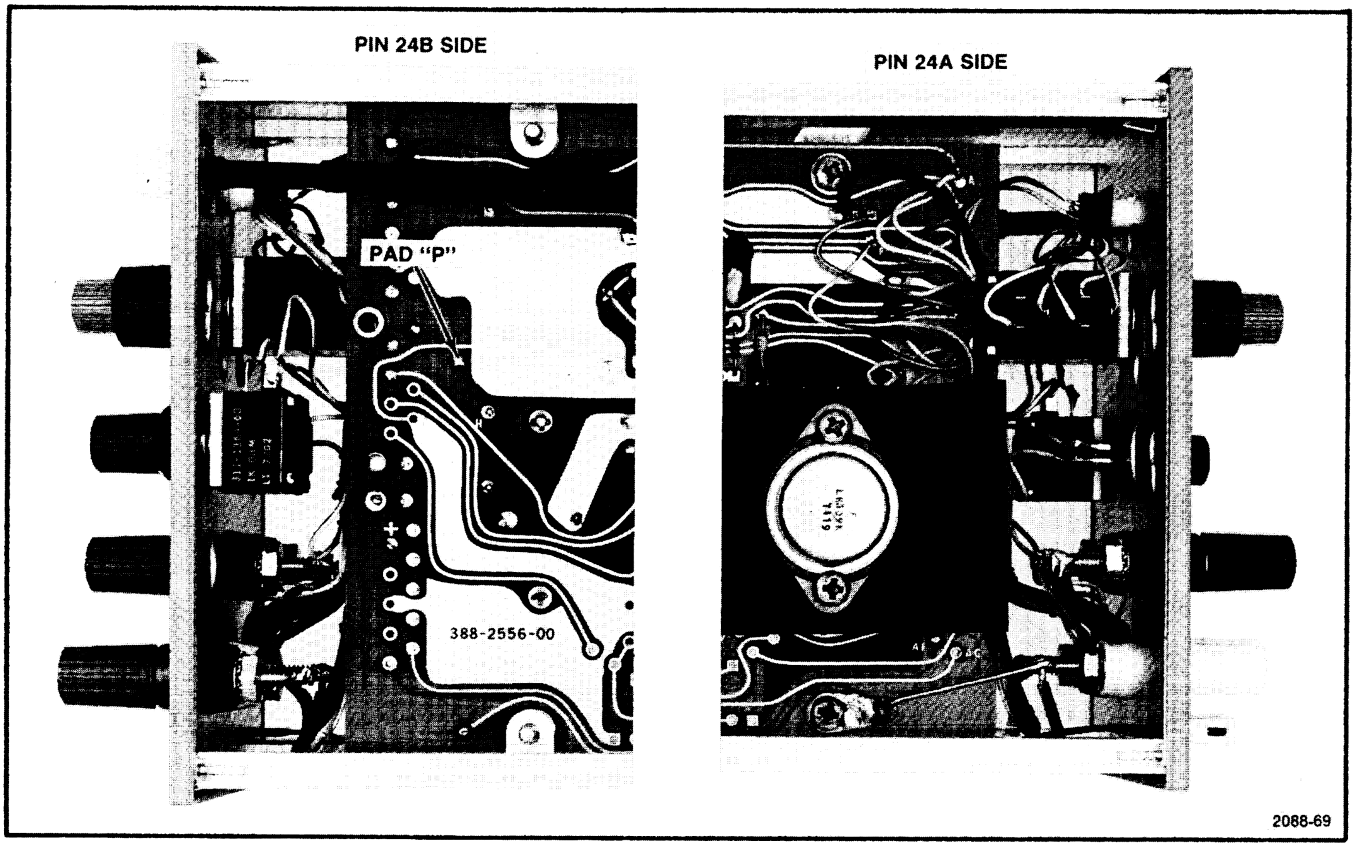
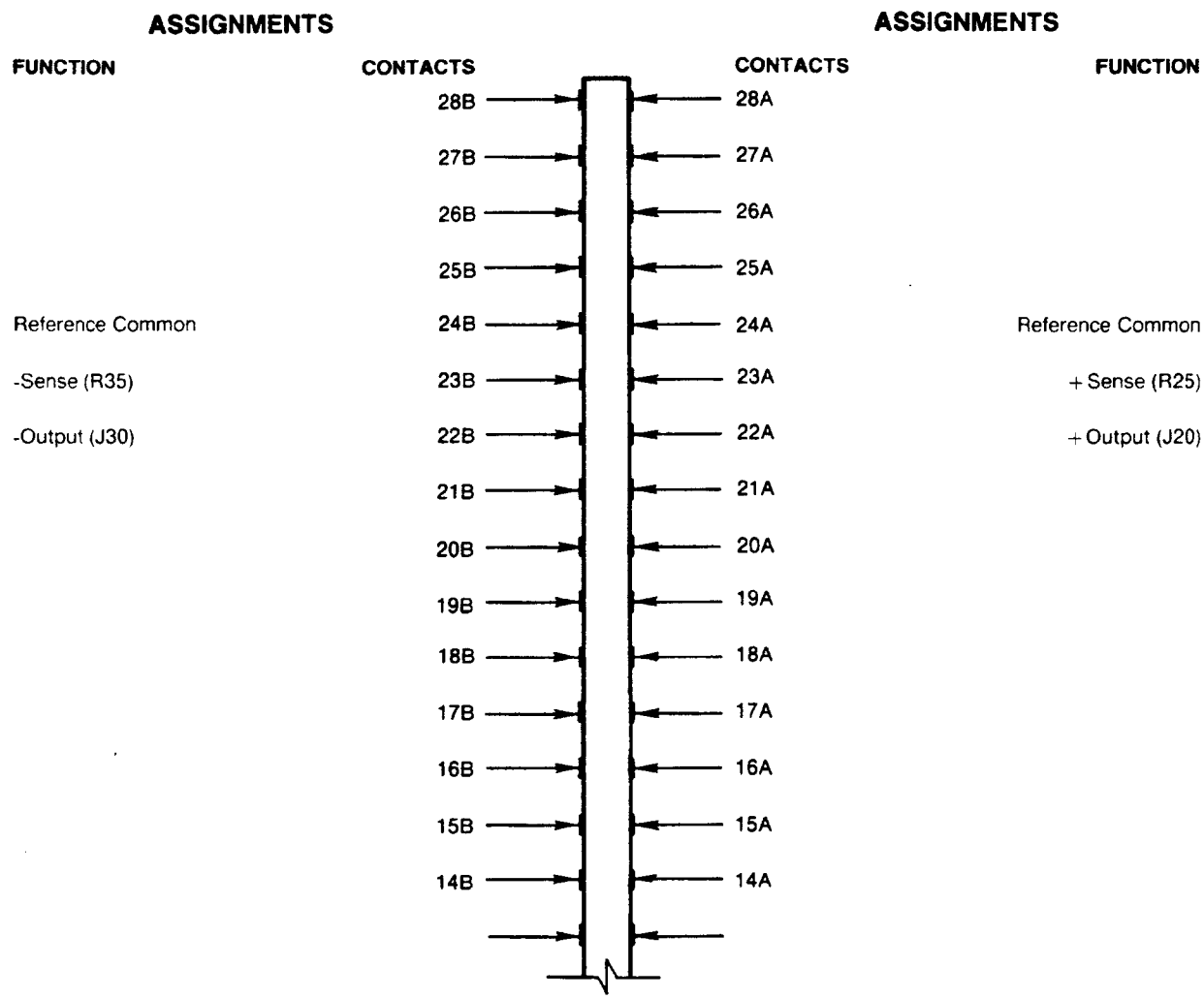


Fig. PS 501-3. Unsolder lead to pad "p" to open sense lead from J50.

NOTES



CAUTION

When a Power Module compartment has been selected for the PS 502 and wired for a specialized interface system, a plastic barrier (Tektronix Part Number 214–1593–02) should be installed in the key slot between contacts 19 and 20 on the Power Module.

Do not insert any TM 500 Series Plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

Fig. PS 502-1. Connector rear view.

INTERFACE NOTES

Introduction

Remote sensing and remote powering of some load under the Power Module Option 02 capabilities for this instrument may be desirable. Thorough understanding of the schematic diagram and the exact internal connections for Input/Output lines to the rear contacts will be an aid in designing the specialized TM 500 interface system. Figure PS 502-1 is designed to help you in this respect.

Actual Wiring vs. Schematic

The Sense lead should be connected as close to the load as possible to guarantee that the PS 502 lives up to its regulation specifications. Fig. PS 502-1 points out the actual difference between wiring detail and the schematic diagram. Two leads actually connect to J20 and two more to J30 on the front panel. If Sensing Input is made at contact 23A and/or 23B on the interface board, then the Sense connection to J20 and/or J30 must be disconnected to prevent it from being active as well. The output voltage leads that are wire connected to the front panel jacks are well labeled on the A (contact 28A) side of the etched circuit board. So, it will be the second lead soldered to the output jacks that is the Sense lead to disconnect.

Reference Common (Both Contacts 24A and 24B)

This is the common return for both the + and − voltages offered by this supply. It can be ground referenced for equal and opposite tracking supplies, or it can be allowed to float with the negative supply tied to ground, thus giving a single +20 to +40 V variable supply. Or, the positive supply can also be grounded, thus giving a −20 to −40 V variable supply. The 25 Vac windings from which this unit operates have no ground reference of their own.

+Sense (R25) and −Sense (R35) (Contacts 23A and 23B, respectively)

These are normally high impedance inputs until current limiting starts to take effect. Then, they turn to low impedance inputs, shutting down the supplies and taking the overload currents to the point where diode steering shunts these higher levels of current around the control circuitry.

+Output and −Output (Both Contacts 22A and 22B, respectively)

These are the low impedance sources of the two voltages resistance programmed into this unit with respect to the Reference Common connections mentioned above. These voltages will be well regulated up to a maximum load curent of 400 mA. Loads that will demand more than 400 mA from these two voltage sources will result in power supply shut down and current limiting.

NOTE

The +5 volts with a maximum 1A current capability is not available at the rear interface connection.

Approximate net instrument weight, 2.0 lbs.

Maximum power requirement at 120 V, 66 watts.

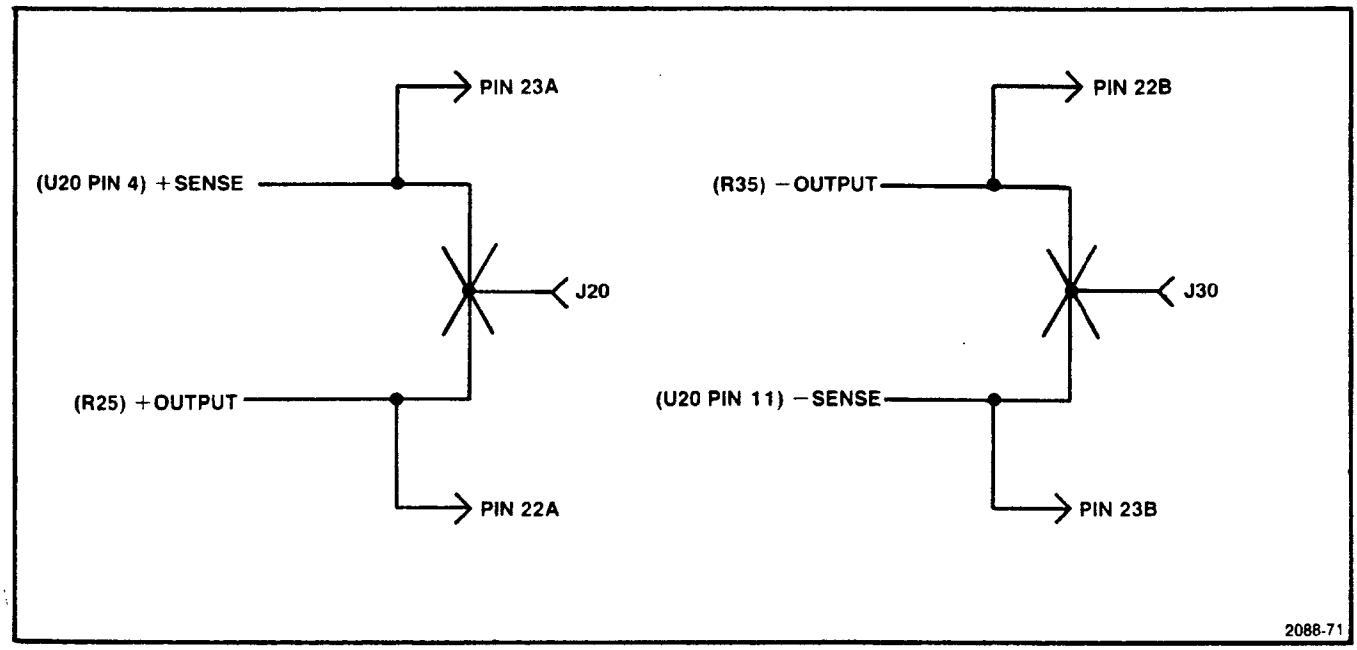
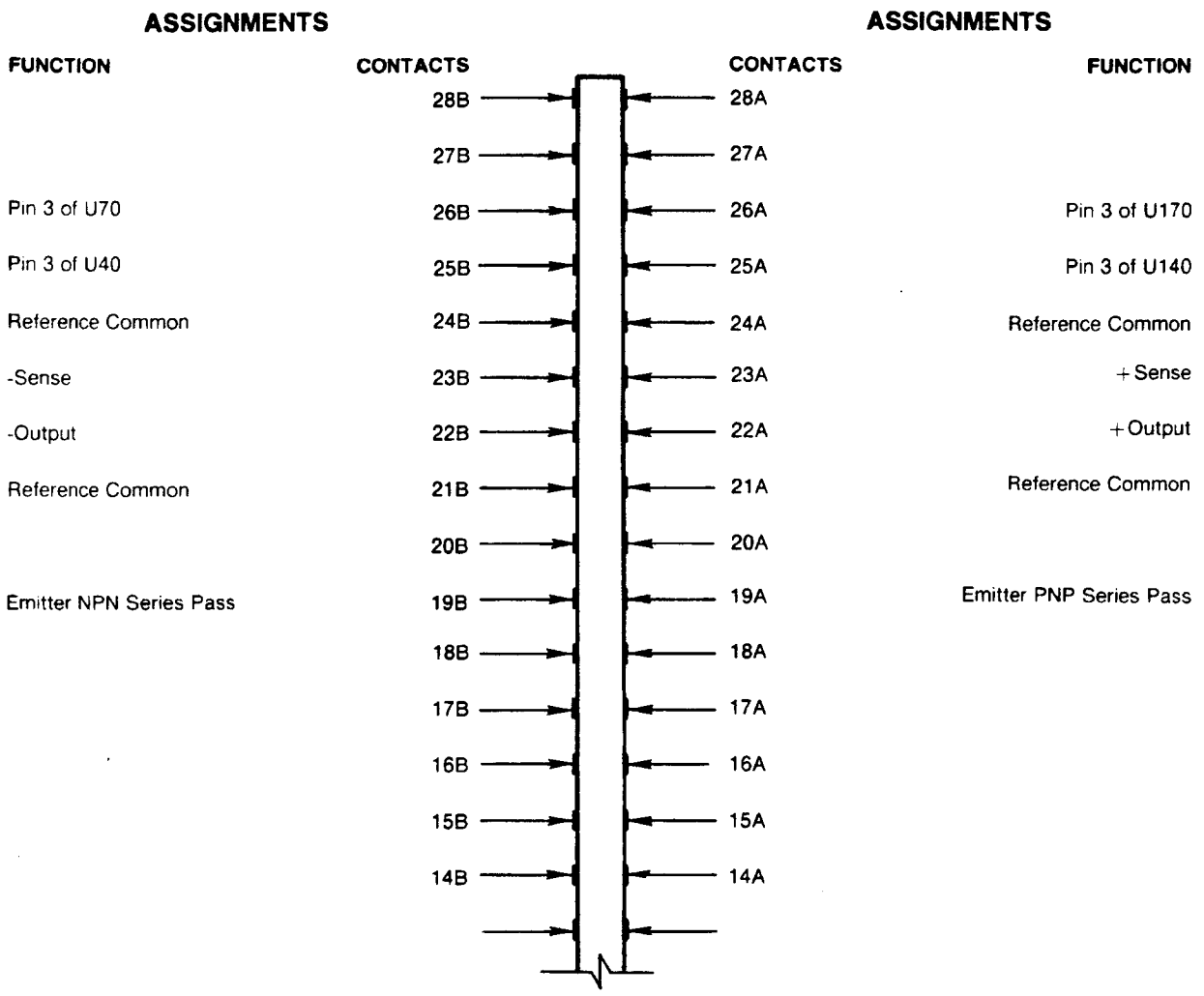


Fig. PS 502-2. Rear interface wiring details.

NOTES



CAUTION

When a Power Module compartment has been selected for the PS 503 and wired for a specialized interface system, a plastic barrier (Tektronix Part Number 214-1593-02) should be installed in the key slot between contacts 19 and 20 on the Power Module.

Do not insert any TM 500 Series Plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

2088-72

Fig. PS 503-1. Connector rear view.

INTERFACE NOTES

Introduction

Remote programming, powering, and sensing of some load under the power module Option 02 capabilities of this line of instruments may be desirable. Thorough understanding of the schematic diagram and the exact internal connections for Input/Output lines to the rear contacts will be an aid in designing the specialized TM 500 interface system.

Detail Circuit Considerations

The PS 503 is a dual zero to twenty volt source of power. One side is a positive supply while the other is a negative supply. The circuitry of the positive supply is almost identical with that for the PS 501, while the circuitry for the negative half of this unit is a pnp version of the npn positive half. The control circuitry of the positive supply operates from −5.1 V and +30.5 V. The two supplies can be operated independently of each other, or ganged to operate in a Dual Tracking fashion. They share the common return circuitry, thus they are either both ground referenced, both floating, or both elevated to the same common level of reference voltage.

The output voltage between J50 and J100 (the + supply) and J150 and J100 (the − supply) is directly set by a gain factor between the Pin 3 inputs of U40 and U140 and the outputs. This gain factor should be approximately 3.23. However, there are parts tolerances within the calibration range of this instrument that can cause further deviations side to side. It will pay you to measure this gain factor for both the + supply and − supply of your specific instrument. To do this, adjust both inputs to an exact +20 V and −20 V. Next, measure the voltage on the interface output 25B with respect to 24B (for the + input voltage) and on 25A with respect to 24A (for the −input voltage). The voltage on 25B divided into 20 will be the gain factor for the positive side, while the voltage measured on 25A divided into 20 V will be the gain factor for the negative side. There is a good possibility they will be slightly different. Do not attempt to make them exactly the same, for the calibration of your unit may be changed as a result.

If external voltages are used to program the output of the PS 503, the wiper arms to R32 and R132 must be disconnected. For the most convenient place to do this, see Fig. PS 503-1.

If the output voltages of either or both halves of the PS 503 are taken from the interface connections, remember to disconnect the Sense connection from the front-panel outlet. See Fig. PS 503-1 for the most convenient place to unsolder this lead. (For proper regulation, voltage sensing must be as close to the actual load as possible.)

Reference common

Both 24A and 24B as well as 21A and 21B are the common return for both the + voltage and − voltage offered by this supply. It can be ground referenced, elevated, or left open. It is suggested that elevation of this point does not exceed a + or −300 V with respect to ground. These common return leads cannot be separated relative to the + and − supplies due to crossed-over interconnections on the etched circuit board, so the two supplies cannot be elevated to two different voltage levels.

Sense (Contacts 23A and 23B)

These are reasonably high impedance inputs (close to 1.6 kΩ), even when current limiting takes place. When remote Load Voltage Sensing is connected to this point, be sure to open the front-panel voltage sensing circuit at point P and AG (see Fig. PS 503-1). Sensing of the voltage at the load gives the best regulation.

+ Output (Contact 22A) and − Output (Contact 22B)

These are the low impedance sources of the voltages developed by this unit as dictated by the gain of the two supplies times their respective input voltages to Pin 3 of both U40 and U140. These output voltages are achieved by either adjusting R32 and R132 (or R30A and R30B in Dual Tracking Mode of operation), or (after opening the wiper arms to R32 and R132, see Fig. PS 503-1) applying a programming voltage to 25B and 25A via the power module interface board. Maximum current available from either supply will not exceed 500 mA. However, current limiting at levels below this can be achieved by setting R69 (for the + supply) and R169 (for the − supply). These two adjustments are front-panel controls.

Pin 3 of U40 (Contact 25B) and Pin 3 of U140 (Contact 25A)

Each of these two inputs has a 10 kΩ resistor between it and Pin 3 of its respective IC. These Pin 3 inputs to the ICs are high impedance inputs, so voltages applied to 25A and 25B will show up accurately at the ICs. External programming of the outputs of this unit can be achieved by applying an appropriate voltage to each of these two points, but remember to make sure the wiper arms to R32 and R132 are disconnected (see Fig. PS 503-1). Do not program either of these two outputs for voltages in excess of 20 V with respect to reference common.

Pin 3 of U70 (Contact 26B) and Pin 3 of U70 (Contact 26A)

Rear interface connection point 26B is an external current limiting control point for the positive supply. If 26B is left open (no connection made to it), current limiting takes place as controlled by the front-panel CURRENT LIMIT adjustment. If it is connected to 19B, the current limiting feature is completely disabled. If fixed at 0.6 V below REFERENCE COMMON, this supply is shut down and will not operate.

Rear interface connection point 26A is an external current limiting control point for the negative supply. If 26A is left open (no connection made to it), current limiting takes place as controlled by the front-panel CURRENT LIMIT adjustment. If 26A is connected to 19A, the current limiting feature is completely disabled. If it is fixed at 0.6 V above reference common, this supply is shut down and will not operate.

NOTE

The +5 volts with a maximum 1 A current capability is not available at the rear interface connector.

Voltage Regulation For Remote Load Critical

Under extremely critical voltage regulation requirements for remotely connected loads to the interface board, it may be desirable to interconnect all four commons (i.e., 21A, 21B, 24A, and 24B) at the interface board and disconnect the four leads that go to J100 at the front panel. Bear in mind that leads from 22A and 22B to their respective loads and back to the four commons should be kept as short as practical. It is further suggested that when using a PS 503 rear interface for remote sensing, it is good practice to connect a filter capacitor across the load (approximately 100 μF). This is to prevent oscillations and spurious signals from occurring.

Output Current Monitoring

If output current monitoring is desirable, connect a voltmeter between rear I/O contacts 19B and 22A (for + supply current) or between contacts 19A and 22B (for − supply current). The current limiting outputs are developed between these contacts and the internal 2 Ω resistors will drop 1 V per 500 mA of load current.

Approximate net instrument weight, 1.9 lbs.

Maximum power requirement at 120 V, 71 watts.

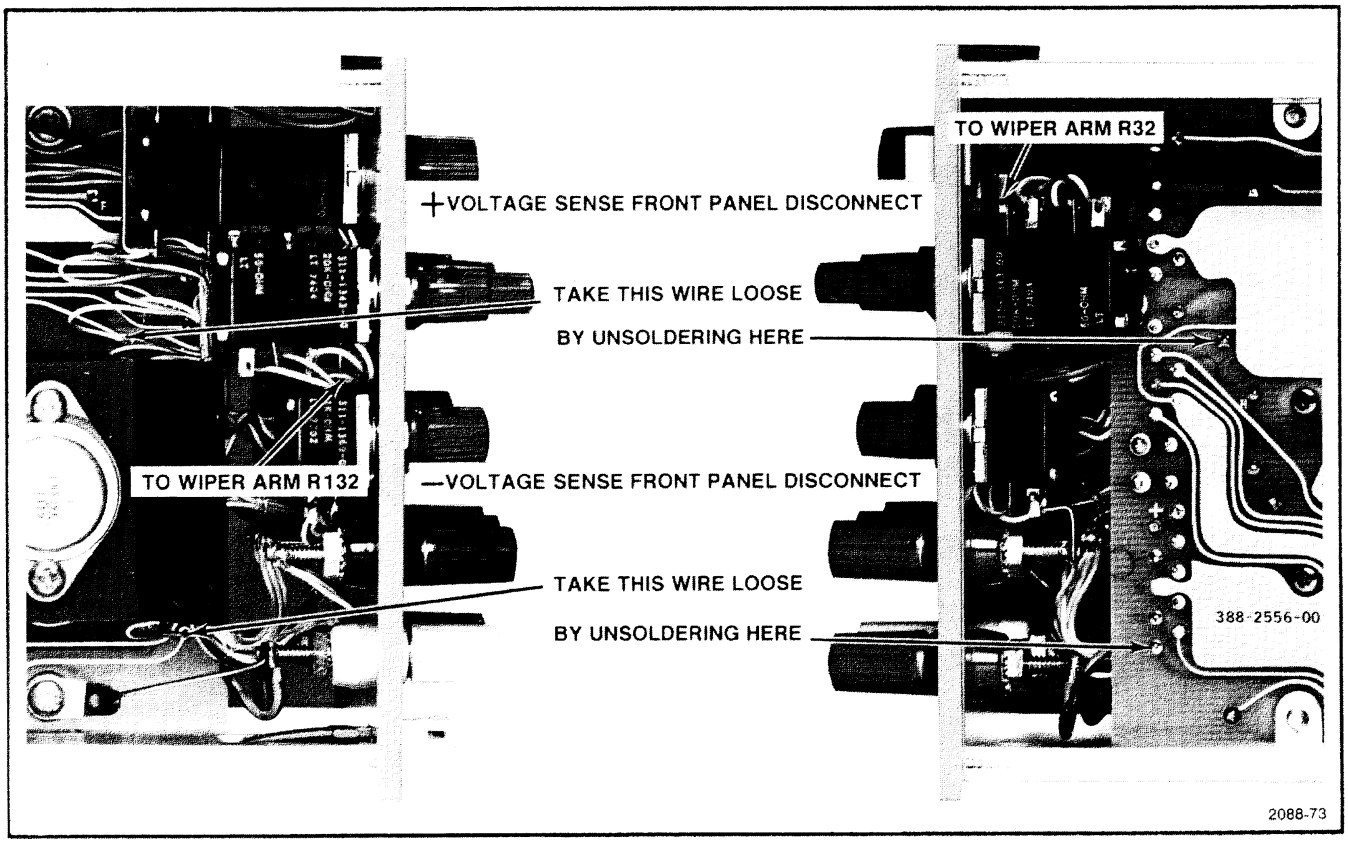
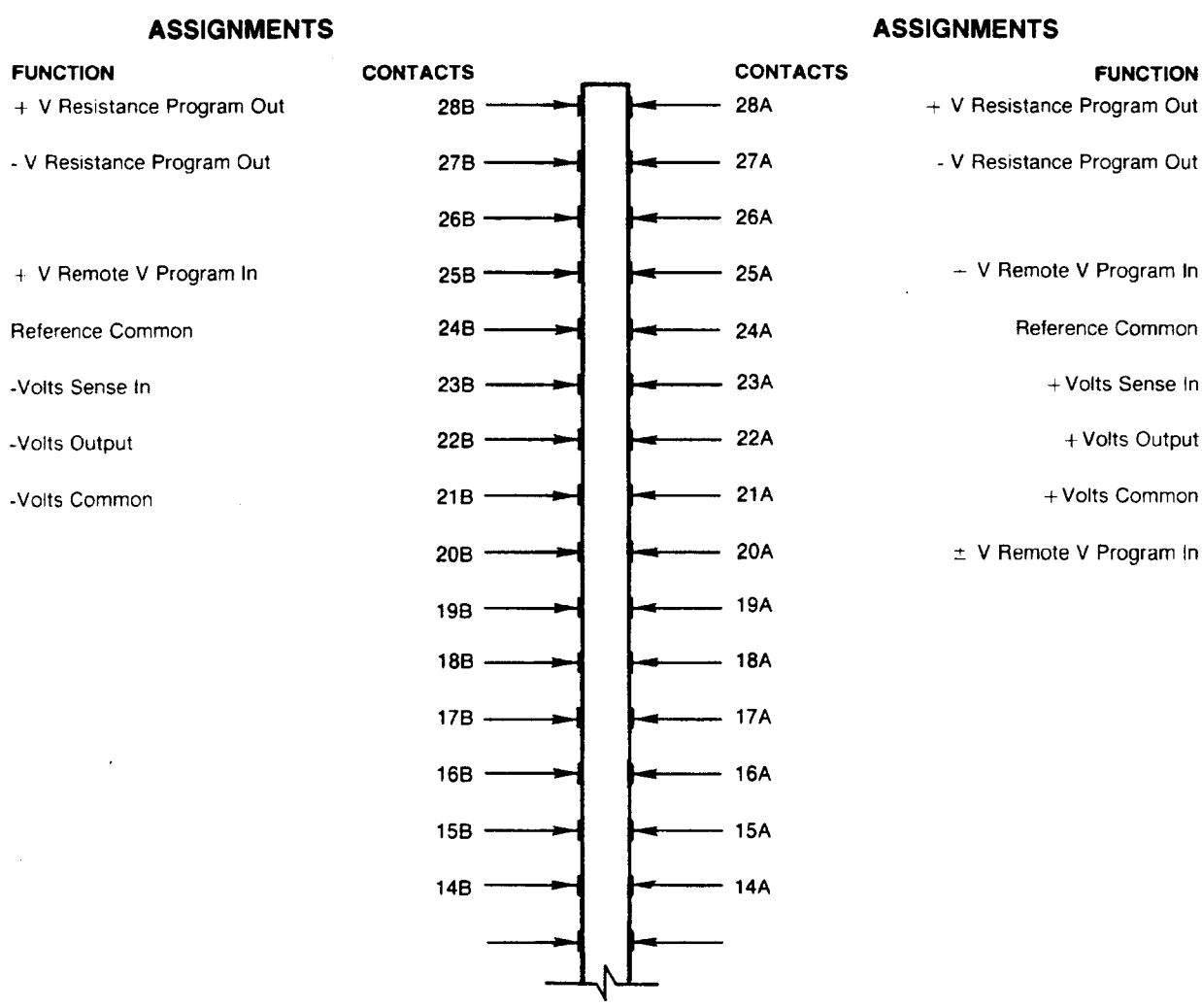


Fig. PS 503-2. Remote sensing connection points.

NOTES



CAUTION

When a Power Module compartment has been selected for the PS 503A and wired for a specialized interface system, a plastic barrier (Tektronix Part Number 214–1593–02) should be installed in the key slot between contacts 19 and 20 on the Power Module.

Do not insert any TM 500 Series Plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

2088-74

Fig. PS 503A-1. Connector rear view.

INTERFACE NOTES

CONNECTOR INFORMATION

+ Volts Resistance Programming Output (Contacts 28A and 28B)

These two contacts are used to remotely resistance program the + voltage output of the PS 503A. Refer to the Function Programming Information. After these pins have been programmed, the load is approximately 500 Ω/volt of output.

− Volts Resistance Programming Output (Contacts 27A and 27B)

These two contacts are used to remotely resistance program the − voltage output of the PS 503A. Refer to the Function Programming Information. After these pins have been programmed, the load is approximately 500 Ω/volt of output.

+ Volts Remote Voltage Programming Input (Contact 25B)

By connecting a 0 to −9 V remote variable voltage source between contact 25B and contacts 24A or 24B, the +20 V output may be varied from 0 to 20 V. Refer to the Function Programming Information. The load presented to the remote voltage source is approximately 5 kΩ.

− Volts Remote Voltage Programming Input (Contact 25A)

By connecting a 0 to 9 V remote variable voltage source between contact 25A and contacts 24A or 24B, the −20 V output may be varied from 0 to 20 V. Refer to the Function Programming Information. The load presented to the remote voltage source is approximately 5 kΩ.

Reference Common (Contacts 24A and 24B)

Contacts 24A and 24B are used as the common return for the + Volts Remote Voltage Programming, − Volts Remote Voltage Programming, + Volts Supply Sense Input and − Volts Supply Sense Input. See Function Programming Information.

− Volts Supply Sense Input (Contact 23B)

Contact 23B is used to place the load sensing at the remote load connection. Internal connected sense lead must be disconnected before the interface connections can be used. A large capacitor (≥50 μF at 25 Vdc) will be needed at the sense point to stop oscillations.

+ Volts Supply Sense Input (Contact 23A)

Contact 23A is used to place the load sensing at the remote load connection. Internal connected sense lead must be disconnected before the interface connections can be used. A large capacitor (≥50 μF at 25 Vdc) will be needed at the sense point to stop oscillations.

− Volts Supply Output (Contact 22B)

This output is in parallel with the front-panel −VOLTS (green) connector. 0 to −20 V at either 0 to 400 mA (plug-in in low power TM 500-Series Power Module compartment) or 0 to 1 A (plug-in in high power TM 500-Series Power Module compartment).

+ Volts Supply Output (Contact 22A)

This output is in parallel with the front-panel +VOLTS (red) connector. 0 to +20 V at either 0 to 400 mA (plug-in in low power TM 500-Series Power Module compartment) or 0 to 1A (plug-in in high power TM 500-Series Power Module compartment).

− Volts Common (Contact 21B)

Common return for the −Volts Supply Output.

+ Volts Common (Contact 21A)

Common return for the +Volts Supply Output.

± Volts Remote Voltage Programming Input (Contact 20A)

By connecting a 0 to 9 V remote variable voltage source between contact 20A and contacts 24A or 24B, the +20 V and −20 V outputs may be varied from 0 to 20 V. Refer to the Function Programming Information. The load presented to the remote voltage source is greater than 5 kΩ.

FUNCTION PROGRAMMING INFORMATION

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 contacts 28A and 28B (+ Volts supply) and contacts 27A and 27B (– 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. Adjust R45, +Adj and R145, –Adj to obtain a 20 V reading for each supply or the supply being programmed. Turn off PS 503A and remove the 10.0 kΩ, 1% resistor.

NOTE

Do not turn on the PS 503A without a program resistor connected between contacts 28A and 28B (+Volts supply) and contacts 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 contact 20A and the –lead to contacts 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.

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 Supply. Remove the jumpers from D-D (+ Volts supply) and K-K (– Volts supply). Install jumpers between C-C (+ Volts supply) and J-J (– Volts supply).

The PS 503 plus and minus supplies can be externally programmed from the plus and minus terminals of a remote voltage source as follows.

PROGRAM + SUPPLY REMOTE	PS 503A
+	24A and 24B
–	25B

PROGRAM – SUPPLY REMOTE	PS 503A
+	25A
–	24A and 24B

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 503. 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 wires.

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

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

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

Install a 50 μF, 25 Vdc (minimum rating) capacitor across the remote load. To stop oscillations caused by lead length, an additonal 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 contact 21B (−Volts supply common) and contact 22B (−Volts supply output) on the interface connector.

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

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

Install a 50 μF, 25 Vdc (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 two of the wires from the charcoal gray connector. Insulate the bare ends of the wires.

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

Connect interface connector contacts 24A and 24B to both contact 21A (+Volts supply common) and contact 21B (−Volts supply common).

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

Install a 50 μF, 25 Vdc (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 two of the wires from the charcoal gray connector. Insulate the bare ends of the wires.

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

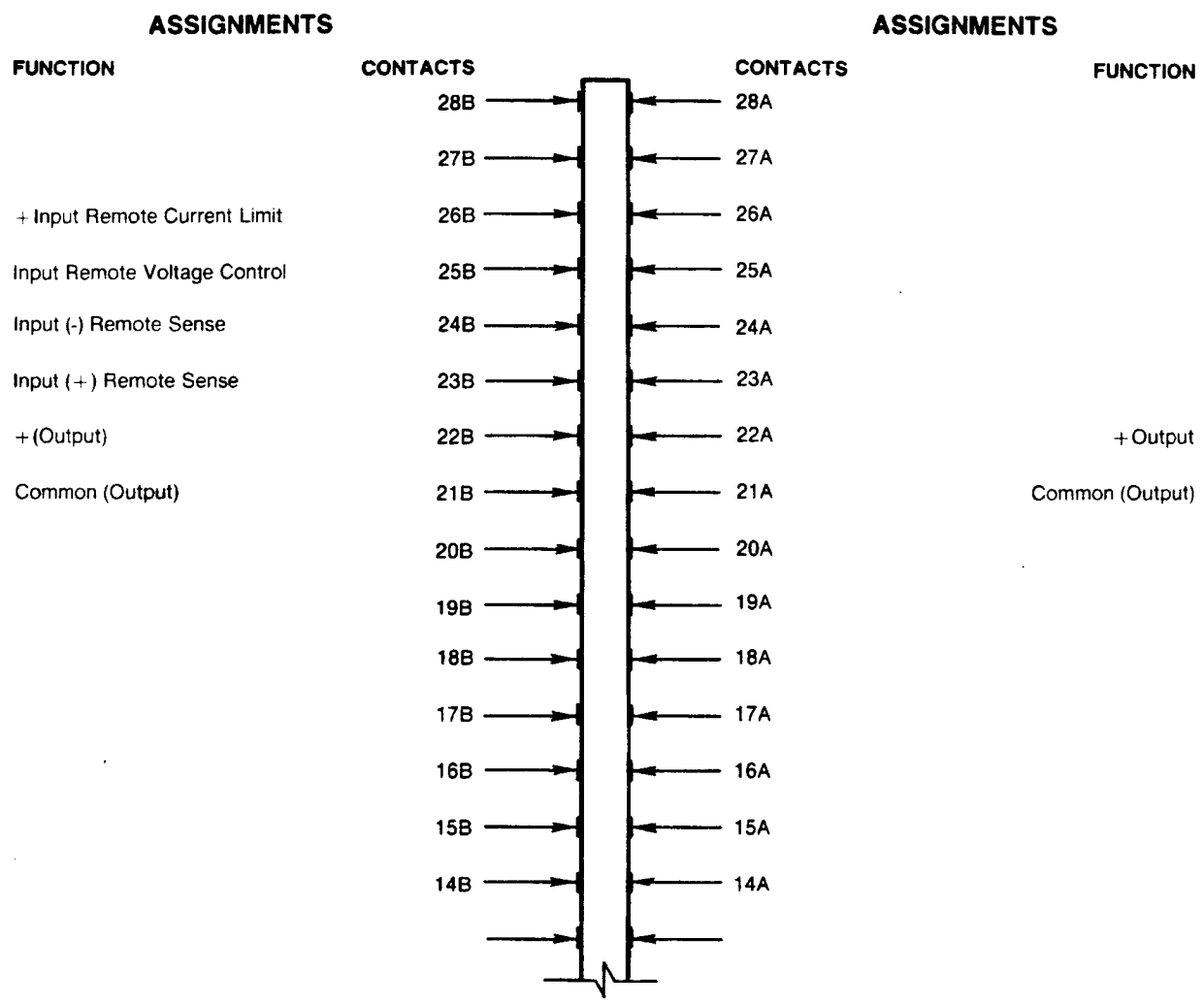
Connect interface connector contact 24A and 24B to both contact 21A (+Volts supply common) and 21B (−Volts supply common) at the remote load connection.

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

Install a 50 μF, 25 Vdc (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-.

Approximate net instrument weight, 1.9 lbs.

Maximum power requirement at 120 V, 72.0 watts.



CAUTION

Then a Power Module compartment has been selected for the PS 505 and wired for a specialized interface system, a plastic barrier (Tektronix Part Number 214–1593–02) should be installed in the key slot between contacts 19 and 20 on the Power Module.

Do not insert any TM 500 Series plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

2088-75

Fig. PS 505-1. Connector rear view.

INTERFACE NOTES

NOTE

The following descriptions apply to the PS 505 only if it is installed in the right-hand (high power) compartment of a TM 504 or TM 506 Power Module.

+ Input Remote Current Limit (Contact 26B)

Applying 0 to 0.4 V between contacts 26B (positive) and 23B (negative) selects a current limit from 0 to at least 4A, respectively. To use the remote current limit function, the front-panel CURRENT LIMIT control must be set to its midrange position or wiper connection removed. Parallel capacitors may be needed across the input to stop oscillation. The input resistance is approximately 5 kΩ.

Input Remote Voltage Control (Contact 25B)

Connecting +3 V to +5.5 V between contacts 25B (positive) and 21B (negative) selects an output voltage from +3 V to +5.5 V, respectively. The front-panel VOLTS control must be set to 4.25 V before using the remote voltage control function or wiper connection removed. The input resistance for contact 25B is 5 kΩ.

Input (−) Remote Sense (Contact 24B) and Input (+) Remote Sense (Contact 23B)

Contacts 24B and 23B are used to place the load sensing at the remote load connections. Remove, from the circuit board, the wires going from the − and + terminals to the − and + solder pads. Insulate the bare end of the wires.

Connect the remote load between contacts 22A-22B (+ Output) and contacts 21A-21B (Common-Output) on the interface connector. Connect contact 24B (− Sense) to contacts 21A-21B and contact 23B (+ Sense) to contacts 22A-22B at the remove load connections.

+ Output (Contacts 22A and 22B)

Contacts 22A and 22B are in parallel with the front-panel + Output terminal.

Common (Output) (Contacts 21A and 21B) and Input (−) Remote Sense (Contact 24B)

Contacts 24B (Input–Remote Sense) and 21A-21B (Common–Output) are floating grounds and are not normally tied to chassis ground because of ground loop problems. Refer to the Operating Instructions section of the PS 505 manual.

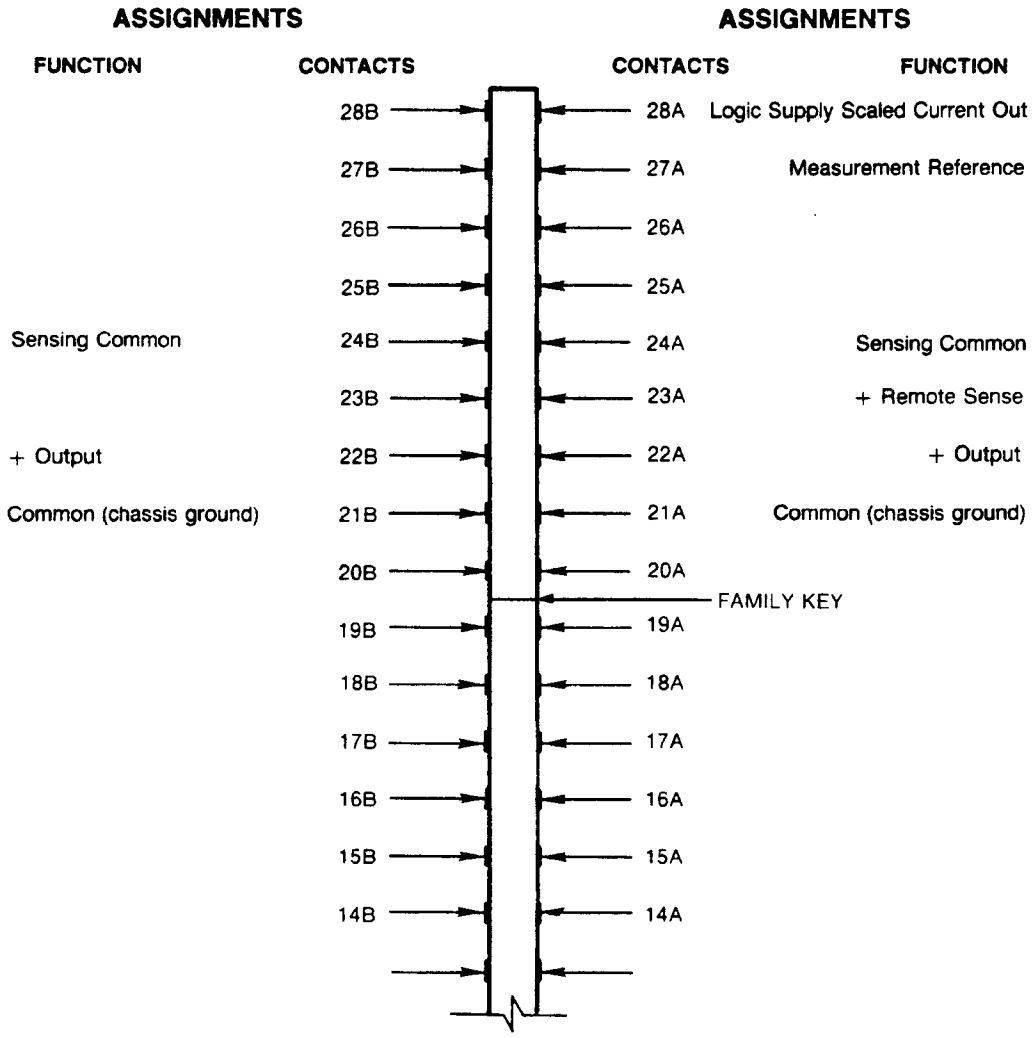
NOTE

If the PS 505 is operated in a compartment other than the right-hand (high power) compartment of a TM 504 or TM 506, the output current drawn from the PS 505 must be limited to 1.0 amperes maximum. However, the negative output terminal should be grounded at the front panel, since there is a possible ground path of uncertain characteristics through the rear connector when the PS 505 is operated in any place other than in the right-hand compartment.

Approximate net instrument weight, 1.1 lbs.

Maximum power requirement at 120 V, 45.9 watts.

Logic Supply Filter Board



CAUTION

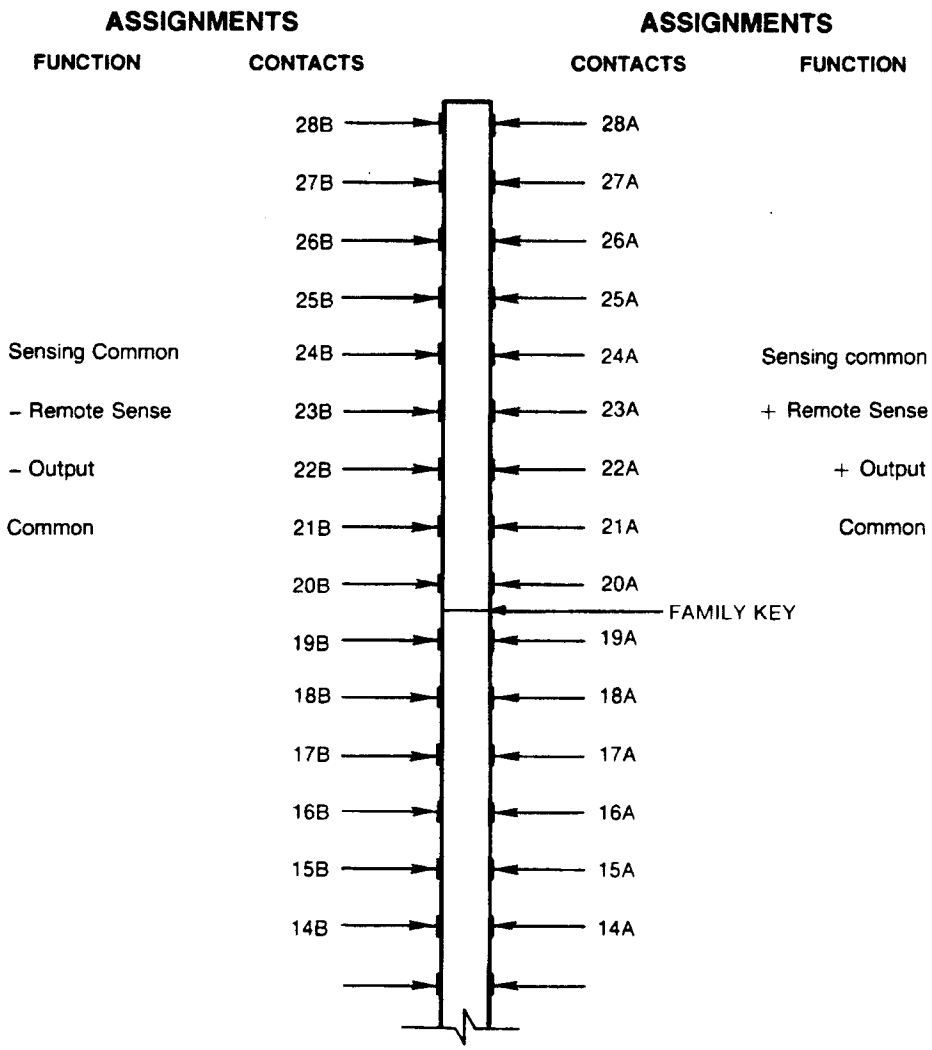
When two Power Module compartments have been selected for the PS 5010 and wired for a specialized interface system, a plastic barrier (Tektronix Part Number 214-1593-02) should be installed in the key slot between contacts 19 and 20 in each selected compartment of the Power Module.

Do not insert any TM 5000 Series plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

2088-106

Fig. PS 5010-1. Right rear (Logic Supply Filter Board) interface connector rear view.

Floating Supply Board



CAUTION

When two Power Module compartments have been selected for the PS 5010 and wired for a specialized interface system, a plastic barrier (Tektronix Part Number 214-1593-02) should be installed in the key slot between contacts 19 and 20 in each selected compartment of the Power Module.

Do not insert any TM 5000 Series plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

2088-107

Fig. PS 5010-2. Middle rear (Floating Supply Board) interface connector rear view.

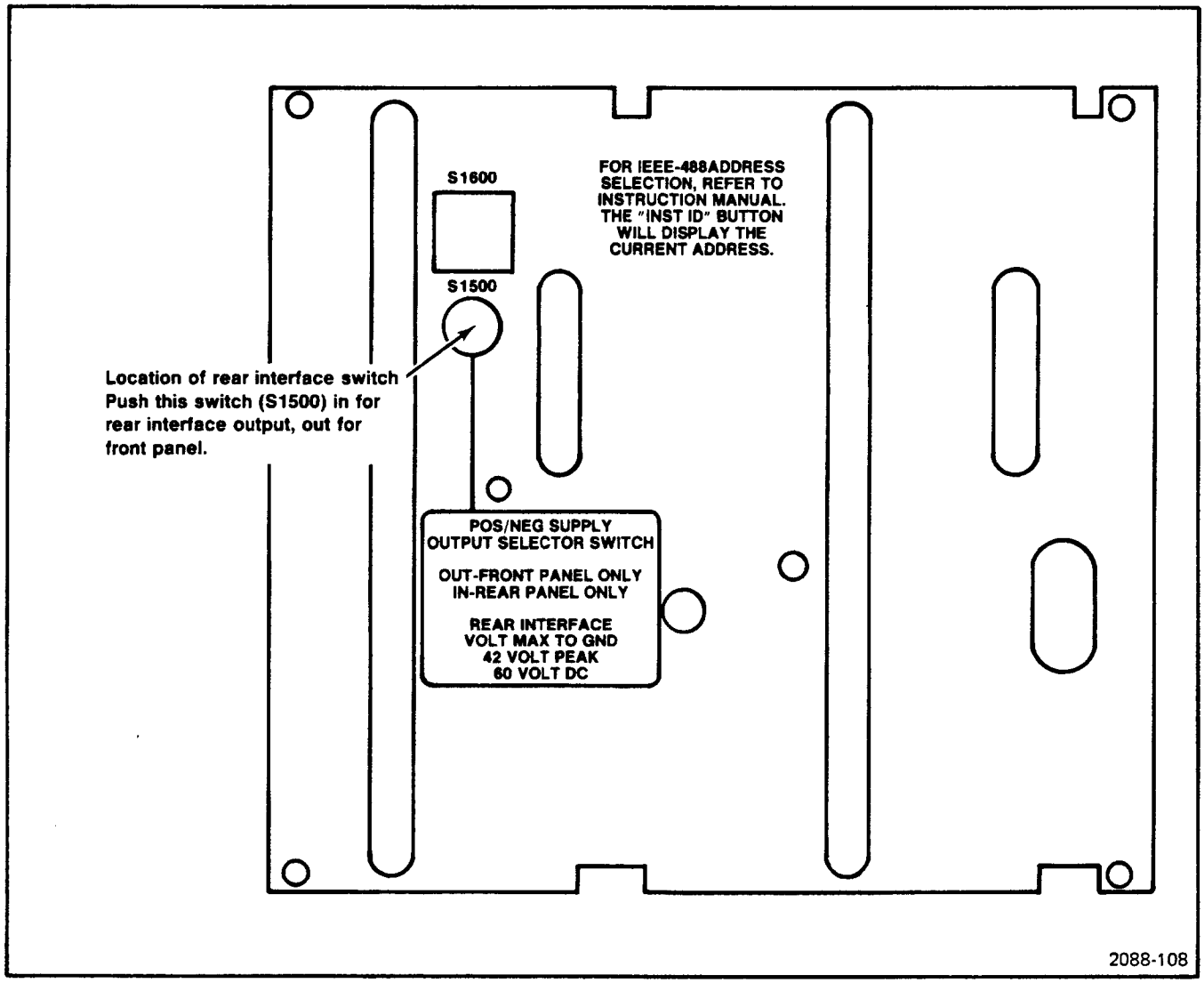


Fig. PS 5010-3. Location of rear interface switch (S1500) on rear of plug-in.

INTERFACE NOTES

Introduction

A slot between pins 19 and 20 identifies this instrument as a member of the TM 5000 power supply family. Insert a barrier in the corresponding position of the power module jack to prevent noncompatible plug-ins from being used in that compartment. This protects the plug-in if specialized connections are made to that compartment. Consult the power module manual for further information. Signal inputs, outputs and other specialized connections may be made to the rear interface connectors as shown in the input/output assignments illustrations. The location and operation of the rear interface switch is shown in Fig. PS 5010-3.

WARNING

Maximum allowable voltage on any rear interface pin is 42 V peak ac or 60 Vdc with respect to chassis (earth) ground.

Functions Available at Right Rear Interface Connector

Logic Supply Scaled Current Out (Contact 28A)

This connector provides a voltage in relationship to the current supplied by the logic supply. See the specification section of the PS 5010 manual for the specified voltage. This output is not ground referenced. Use pin 27A as the return.

Measurement Reference (Contact 27A)

This connection serves as the return for the logic supply scaled current out. This connection is not connected to chassis ground.

+ Remote Sense and Sensing Common (Contacts 23A, 24A and 24B)

These connections function only when using the rear interface output. These sense lines are diode clamped to the respective outputs to prevent uncontrolled regulator response if the sense lines are misconnected. See the heading Remote Sense in the Operating Instructions of the PS 5010 manual for more information.

+ Output (Contacts 22A and 22B)

These connections are the + logic supply output.

Common (Contacts 21A and 21B)

These connections provide the return path for the + logic supply output voltage. They are connected to chassis ground.

Functions Available at Middle Rear Interface Connector

+ and – Remote Sense and Sensing Common (Contacts 23A, 23B, 24A and 24B)

These connections function only in the rear interface mode. The sense lines are diode clamped to the respective outputs to prevent uncontrolled regulator response if the sense lines are misconnected. See the heading Remote Sense in the Operating Instructions of the PS 5010 manual for more information.

+ Output (Contact 22A)

This is the positive supply output for the rear interface.

– Output (Contact 22B)

This is the negative supply output for the rear interface.

Common (Contacts 21A and 21B)

These are the return connections for the + and – floating supply outputs.

NOTE

Remote sense must be used with the rear interface floating supply outputs. Overvoltage damage to delicate loads may result from operating the PS 5010 with S1600 pushed in (rear interface output) and the sense lines open.

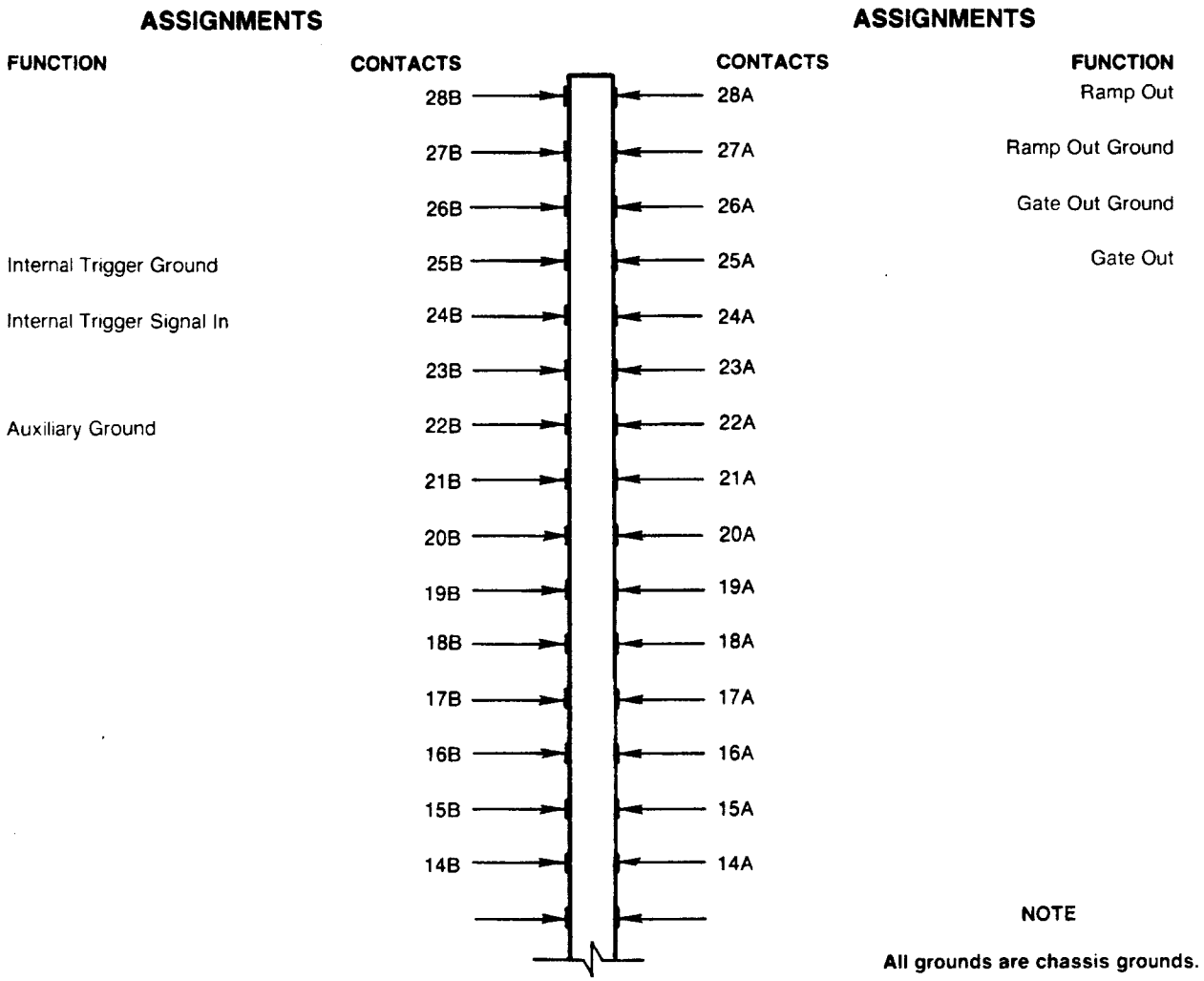
Functions Available at Left Rear Interface Connector

This connector does not contain any signals that would be connected between plug-ins.

Approximate net instrument weight, 6 lbs.
Maximum power requirement at 120 V, 250 VA.

RAMP GENERATORS

NOTES



CAUTION

When a Power Module compartment has been selected for the RG 501 and wired for a specialized interface system, a plastic barrier (Tektronix Part Number 214–1593–02) should be installed in the key slot between contacts 23 and 24 on the Power Module.

Do not insert any TM 500 Series Plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

2088-76

Fig. RG 501-1. Connector rear view.

INTERFACE NOTES

Ramp Out (Contact 28A) and Ramp Out Ground (Contact 27A)

Contact 28A is connected in parallel (factory wired) with the front-panel RAMP OUT bnc connector. Ramp polarity is selected by a front-panel POLARITY switch. When properly calibrated, the ramp baselines start at ground level. The output amplitude is variable (by front-panel RAMP AMPLITUDE control) from 50 mV or less, to at least 10 V (peak to peak). The output circuit is designed to drive a load resistance of 3000 or greater. Maximum load capacity is 300 pF. Use contact 27A as a ground return for the Ramp Out signal.

Gate Out (Contact 25A) and Gate Out Ground (Contact 26A)

Contact 25A is factory wired in parallel with the front-panel GATE OUT bnc connector. Use contact 26A as a ground return. The Gate Out pulse is coincident with the Ramp Out signal. The Gate Out pulse is TTL compatible with the lower level within 100 mV of zero and the upper level at 3 V, within 0.6 V. The loading circuits should be designed to limit the rise and fall times to 100 ns or less. Source resistance is 160 Ω, within 5%.

Internal Trigger In (Contacts 24B and 25B)

When triggering signals are applied to contact 24B, push the front-panel button labeled INT. This connects contact 24B to the internal triggering circuitry, disconnects the front-panel triggering EXT IN connector, and deactivates the LINE triggering feature. Pushing the INT button does not deactivate the AUTO triggering functions. Triggering sensitivity is at least 200 mV (peak to peak) with a response from dc to at least 100 kHz. The input impedance is 10 kΩ (minimum) to 20 kΩ (maximum). Maximum safe input voltage is 50 V dc plus peak ac. Use contact 25B as a ground return.

Ground (Contact 22B)

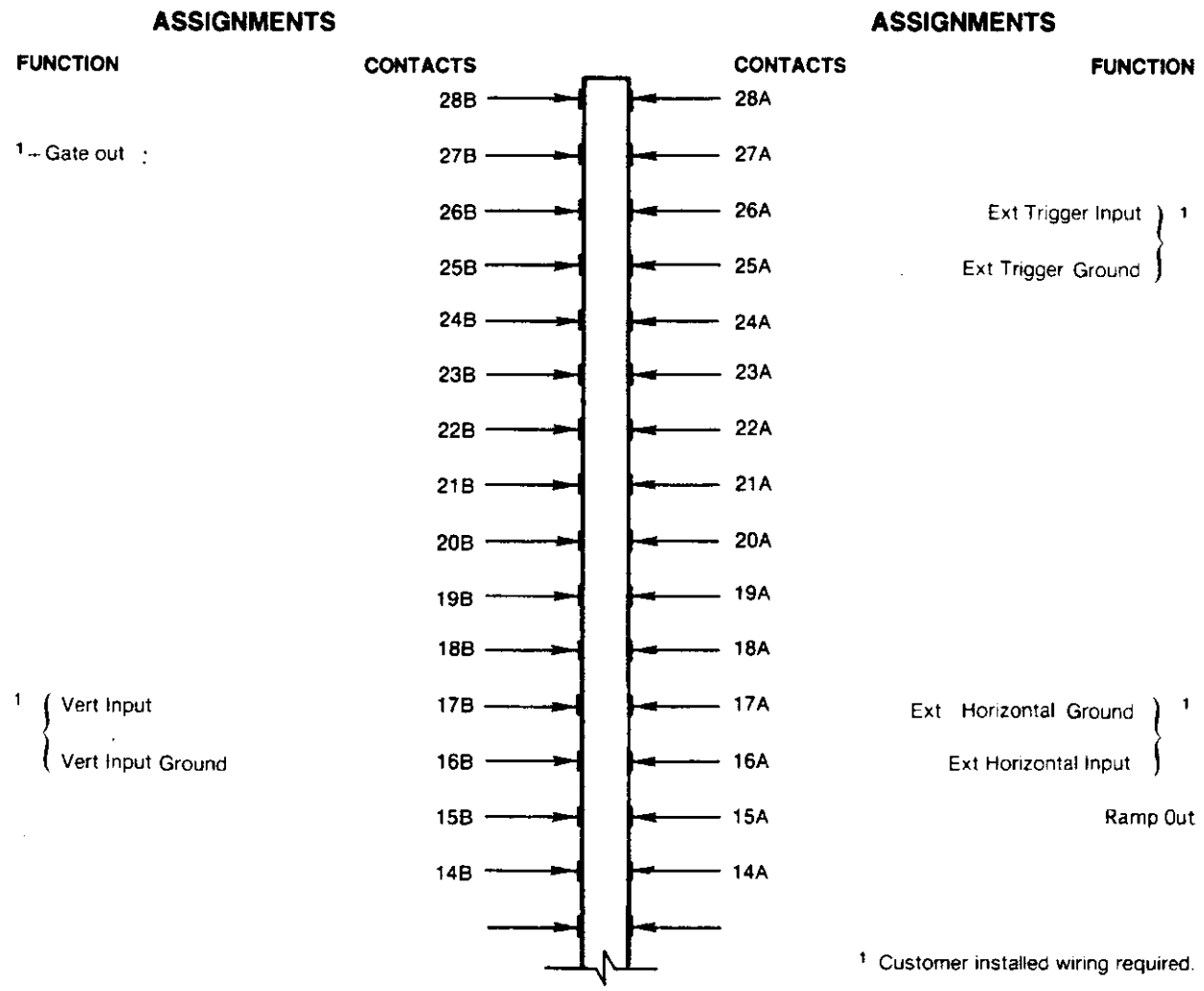
Use contact 22B as an auxiliary ground return to the RG 501 chassis.

Approximate net instrument weight, 1.3 lbs.

Maximum power requirement at 120 V, 7.0 watts.

OSCILLOSCOPES

NOTES



CAUTION

When a Power Module compartment has been selected for the SC 501 and wired for a specialized interface system, a plastic barrier (Tektronix Part Number 214–1593–02) should be installed in the key slot between contacts 23 and 24 on the Power Module.

Do not insert any TM 500 Series Plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

Fig. SC 501-1. Connector rear view.

INTERFACE NOTES

Ramp Out (Contact 15A)

The Ramp Out signal is factory wired (dc coupled) to the rear interface through contact 15A. The output impedance is approximately 470 Ω (R251). When the SC 501 is properly calibrated and operated in a Y–T mode (internal switch selection), the Ramp Out signal starts at about 0 V and goes positive to at least +10 V (open circuit). Absolute amplitude is load dependent. The Ramp Out duration is dependent on the sweep rate selected (approximately equal to sweep rate × 10 divisions). Time between ramps is dependent on sweep retrace time, sweep hold-off periods, and triggering frequency. Slope (Volts/second) is adjustable by the sweep VARIABLE control. ×5 Sweep Magnification factor does not apply to the Ramp Out signal.

For the Y–T mode, contact 15A remains at a quiescent level of 0 V as long as no sweep is generated. When the internal switch is set to the X–Y position, the quiescent level on contact 15A shifts to approximately +5 V.

+ Gate Out (Contact 27B)

A + Gate Out signal at the junction of R320 (2.2 kΩ) and the collector of Q320 can be user-wired via the center conductor of a coaxial cable to contact 27B. Coaxial-cable ground can be any convenient location. The + Gate Out signal is a rectangular pulse whose duration is approximately equal to the crt unblanking interval. Open-circuit output amplitude swings from approximately +0.2 V to +8 V. Absolute amplitude is load dependent.

Vert Input (Contacts 17B and 16B)

To apply vertical input signals from the rear interface, connect the center conductor of a miniature coaxial cable to the 200 Ω resistor (R100) attached to the input bnc connector. Connect the other end of the coaxial cable with the center conductor to contact 17B and shield to contact 16B (ground). The addition of coaxial cables to input circuits affects the input impedance.

Ext Trig (Contacts 27A and 26A)

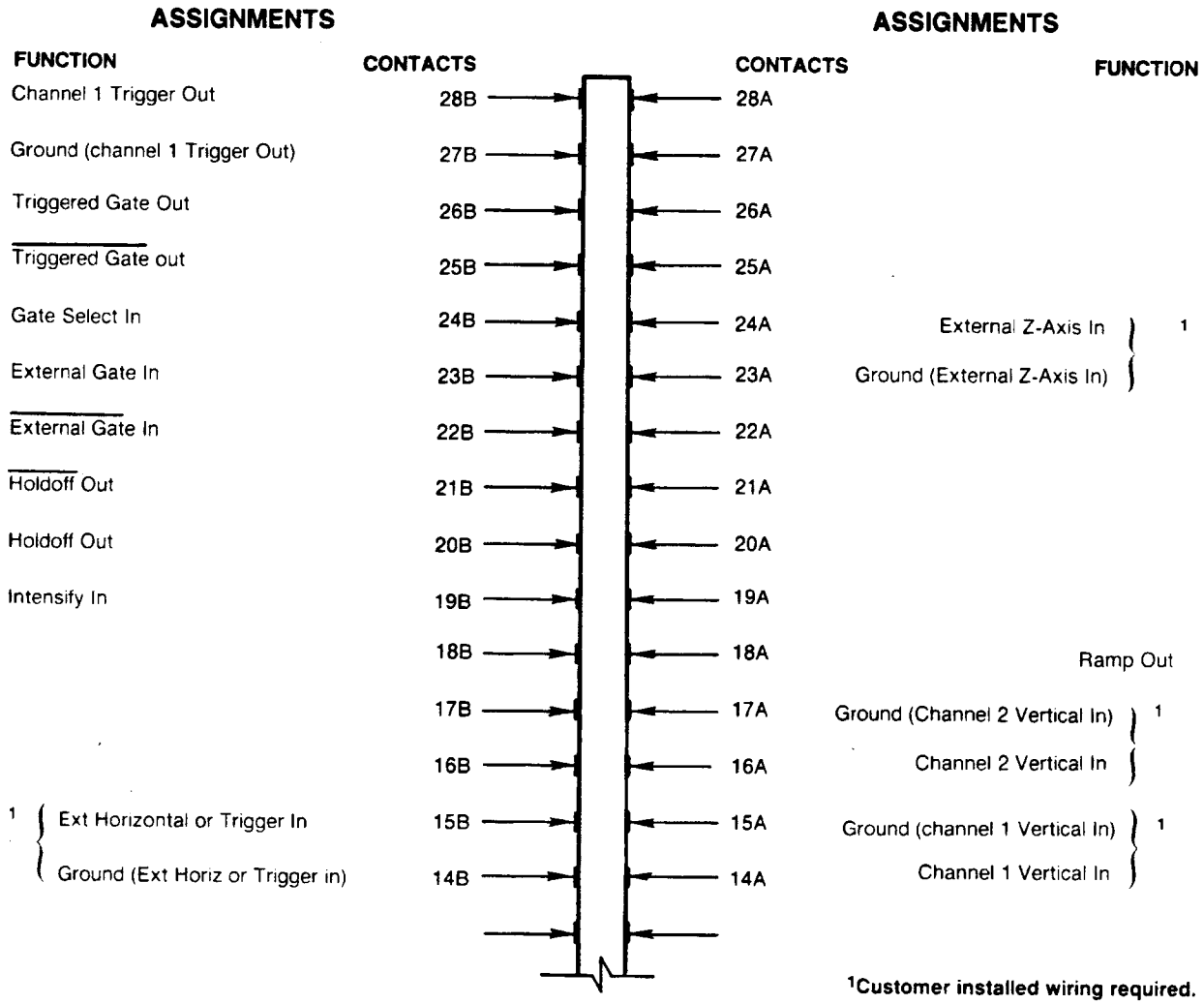
For an Ext Trig signal, connect the center conductor of a miniature coaxial cable to the EXT TRIG pin jack at the front panel. Connect the other end of the coaxial cable with the center conductor to contact 27A and shield to 26A (ground). Set the trigger source switch to the EXT position to trigger the sweep for contact 27A at the rear interface. Input resistance is approximately 22 kΩ.

Ext Horiz (Contacts 16A and 17A)

To apply external horizontal signals from the rear interface, connect the center conductor of a miniature coaxial cable to the EXT HORIZ pin jack at the front panel. Connect the other end of the coaxial cable with the center conductor to contact 16A and shield to contact 17A (ground). Input resistance is approximately 115 kΩ. Set the internal switch to the X–Y position.

Approximate net instrument weight, 2.1 lbs.

Maximum power required at 120 V, 16.5 watts.



CAUTION

When a Power Module compartment has been selected for the SC 502 and wired for a specialized interface system, a plastic barrier (Tektronix Part Number 214–1593–02) should be installed in the key slot between contacts 25 and 26 on the Power Module.

Do not insert any TM 500 Series Plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

2088-78

Fig. SC 502-1. Connector rear view.

INTERFACE NOTES

External Z-Axis In (contact 24A)

An external Z-axis input signal can be applied to contact 24A (center coaxial conductor) and 23A (ground) to turn the crt beam on or off. This is accomplished by connecting a coaxial cable from the auxiliary Z-axis amplifier solder pads (see Fig. SC 502-1) to contacts 24A (center conductor) and 23A (ground). A +5 V signal will unblank the crt beam; a −5 V signal will blank the crt beam. The input resistance is 1 kΩ.

Ramp Out (Contact 18A)

Interface contact 18A supplies a 0 to 6.4 V positive-going ramp that is coincident with the sweep. The load connected to contact 18A must have an input resistance greater than 100 kΩ.

Channel 2 Vertical In (Contact 16A)

A vertical input signal can be connected to the input of the channel 2 vertical amplifier via interface contact 16A. To do this, it is necessary to disconnect, at the circuit board, the coaxial cable going from the front-panel input connector to the circuit board. Connect the appropriate coaxial cable (available through your local Tektronix Field Office) from the channel 2 vertical input circuit board connector to contacts 16A (center coaxial conductor) and 17A (ground). The input resistance is 1 MΩ and the input capacitance is approximately 87 pF. (Use a sixteen-inch cable, Tektronix Part No. 175-1829-00, with one end modified).

Channel 1 Trigger Out (Contact 28B)

Contact 28B furnishes a portion of the channel 1 vertical signal that is also supplied to the trigger circuitry. The signal amplitude is 50 mV/div of crt display amplitude riding a 0 Vdc level. The output resistance is approximately 100 Ω; however, it is recommended that any load connected to contact 28B exceed 10 kΩ.

Triggered Gate Out (Contact 26B) and $\overline{\text{Triggered Gate Out}}$ (Contact 25B)

The signal at contact 26B is a positive-going waveform while the contact 25B signal is negative-going. Both signals are coincident with the gate waveform for sweep generator control. Contacts 26B and 25B signals are designed to drive a 100 Ω side-to-side terminated line with an ECL receiver. The ECL line driver is run between +5 V and ground, and has its outputs to contacts 26B and 25B protected with 47 Ω resistors.

Gate Select In (Contact 24B)

Grounding contact 24B, through 1 kΩ or less of resistance, blocks the gate waveform from the trigger generator and allows an external gate via contacts 23B and 22B to control the sweep generator.

External Gate In (Contact 23B) and $\overline{\text{External Gate}}$ In (Contact 22B)

The input signal to contacts 23B and 22B must drive a 100 Ω side-to-side terminated line with an ECL receiver. The signal at contact 22B must be a negative-going waveform while the positive-going signal is applied to contact 23B. The ECL receiver is run between +5 V and ground.

Holdoff Out (Contact 20B) and $\overline{\text{Holdoff Out}}$ (Contact 21B)

The signal at contact 20B is a positive-going waveform while contact 21B is negative-going. Both signals are coincident with the holdoff signal from the sweep generator. Contacts 21B and 20B signals are designed to drive a 100 Ω side-to-side terminated line with an ECL receiver. The ECL line driver is run between +5 V and ground, and has its outputs to contacts 21B and 20B protected with 47 Ω resistors.

Intensify In (Contact 19B)

The input signal to contact 19B must be the equivalent of an output from an ECL integrated circuit that is run between +5 V and ground. A negative-going signal on contact 19B increases the display intensity. The input resistance of contact 19B is approximately 1 kΩ.

Channel 1 Vertical In (Contact 14A)

A vertical input signal can be connected to the input of the channel 1 vertical amplifier via interface contact 14A. To do this, it is necessary to disconnect, at the circuit board, the coaxial cable going from the front-panel input connector to the circuit board. Connect the appropriate coaxial cable (available through your local Tektronix Field Office) from the channel 1 vertical input circuit board connector to contacts 14A (center coaxial conductor) and 15A (ground). Use a sixteen-inch cable (Tektronix Part No. 175-1829-00 with one end modified.) The input resistance is 1 MΩ and the input capacitance is approximately 87 pF.

External Horizontal or Trigger In (Contact 15B)

An external horizontal or external trigger input signal can be connected to the input of the trigger pickoff circuitry via interface contact 15B. This is accomplished by disconnecting, at the circuit board, the coaxial cable going from the front-panel EXT TRIG/AMPL connector to the circuit board. Connect the appropriate coaxial cable (available through your local Tektronix Field Office) from the trigger pickoff input circuit board connector to contacts 15B (center coaxial conductor) and 14B (ground). The input resistance is approximately 1 MΩ and the input capacitance is approximately 47 pF.

Ground (External Z-Axis In, Channel 2 Vertical In, Channel 1 Trigger Out, Channel 1 Vertical In, and External Horizontal or Trigger In) (Contacts 23A, 17A, 27B, 15A, 14B, respectively)

Contact 27B is electrically tied to the instrument chassis. Contacts 23A, 17A, 15A, and 14B are floating. Certain contacts are recommended for specific use for connection convenience.

Approximate net instrument weight, 5.6 lbs.

Maximum power requirement at 120 V, 24.9 watts.

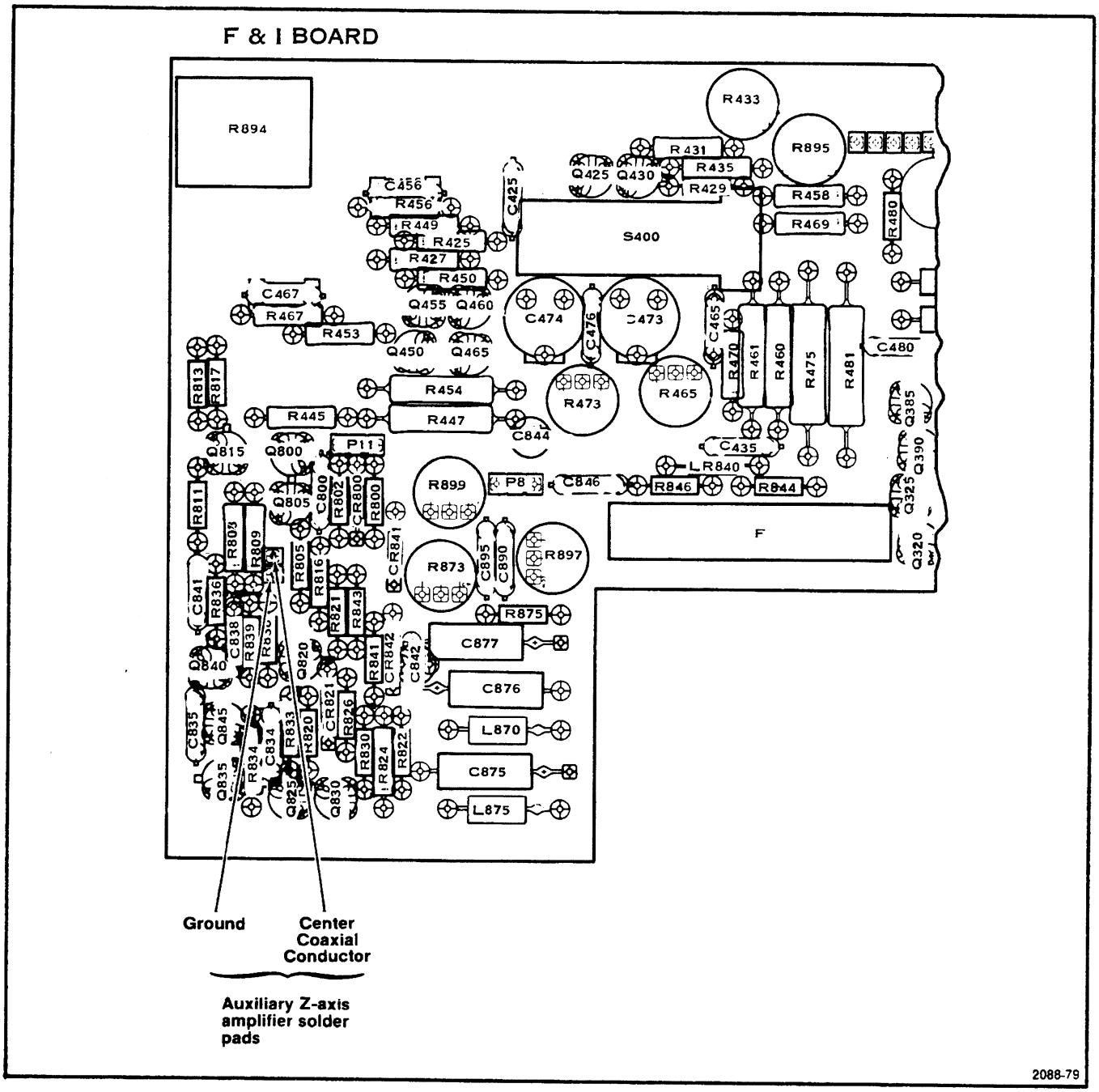
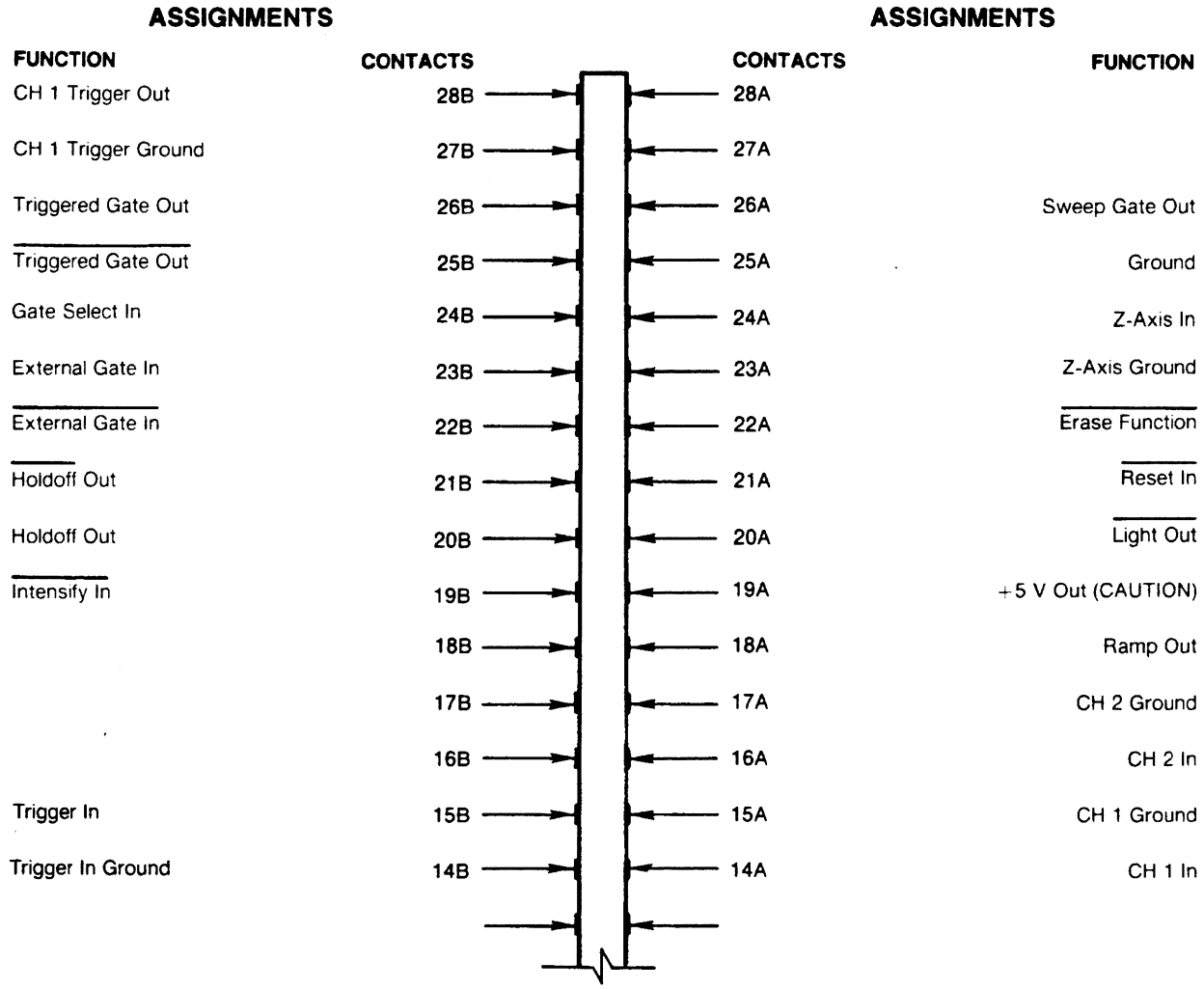


Fig. SC 502-2. External Z-Axis input points.



CAUTION

When a Power Module compartment has been selected for the SC 503 and wired for a specialized interface system, a plastic barrier (Tektronix Part Number 214–1593–02) should be installed in the key slot between contacts 25 and 26 on the Power Module.

Do not insert any TM 500 Series Plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

2088-80A

Fig. SC 503-1. Connector rear view.

INTERFACE NOTES

CH1 Trigger Out (Contact 28B) and Ground (Contact 27B)

Analog output is on contact 28B. Source resistance is less than 50 Ω. Sensitivity is typically 50 mV/div, and bandwidth is typically 4 MHz at the rear interface.

Triggered Gate Out (Contacts 26B and 25B)

These contacts provide an ECL-balanced output operating between +5 V and ground. A logical high state on contact 26B indicates a holdoff condition, and the sweep cannot be triggered or gated on. This output is designed to drive a 100 Ω side-to-side terminated line with an ECL line receiver. The outputs are protected with 47 Ω resistors.

Gate Select In (Contact 24B)

Grounding contact 24B through 1 kΩ (or less) selects the External Gate as the sweep controlling signal. Open circuit causes normal operation.

External Gate In (Contacts 23B and 22B)

These contacts accept an ECL-balanced input operating between +5 V and ground. Input resistance is 100 Ω (side-to-side). A transition to a high logical state on contact 23B causes the sweep to start, run once, and reset, if contact 24B (Gate Select) is grounded. A transition from a high to a low state will truncate the sweep if it is running. ECL input is protected with a diode clamp.

Holdoff Out (Contacts 21B and 20B)

These contacts provide an ECL-balanced output operating between +5 V and ground, designed to drive a 100 Ω side-to-side terminated line with an ECL receiver. The outputs are protected with 47 Ω resistors. A high logical state on contact 20B (low level on contact 21B) indicates a sweep-holdoff period.

Intensify In (Contact 19B)

The input signal to contact 19B must be the equivalent of a single output from an ECL driver operating between +5 V and ground. Input resistance is approximately 1 kΩ. A logical low state intensifies the trace. An open circuit defaults to a logical high state.

Trigger In (Contact 15B) and Ground (Contact 14B)

Contact 15B is selected when the SOURCE switch on the front panel is in the INT (interface) position. Input resistance is nominally 50 Ω when selected and 25 Ω when another source is selected. Input resistance (when selected) can be user-modified by changing the value of R3041 to 1 MΩ. Parallel capacitance is approximately 60 pF. Maximum input voltage is 2.5 V rms, 40 V peak ac.

Sweep Gate Out (Contact 26A) and Ground (Contact 25A)

Contact 26A is approximately +5 V level during sweep time, approximately 0 V otherwise. Source impedance is 1 kΩ.

Z-Axis In (Contact 24A) and Ground (Contact 23A)

Analog input is summed with the front-panel INTENSITY control. When the INTENSITY control is fully counterclockwise, +5 V will turn the crt beam on. When the INTENSITY control is fully clockwise, −5 V will turn the crt beam off. Nominal input resistance is 1.5 kΩ.

Erase Function (Contact 22A)

This contact accepts a remote switch closure to ground, and performs the same function as the ERASE PUSH function on the front panel; +5 V, open circuit.

Reset In (Contact 21A)

Grounding contact 21A through 1 kΩ (or less) causes single sweep reset.

Light Out (Contact 20A)

The output is less than +1 V through 1 kΩ when the READY/TRIG'D light is on, +5 V through high impedance otherwise. Loading by more than 1 mA when output is in the high voltage state may cause erroneous READY/TRIG'D light operation.

+5 V Out (Contact 19A)

CAUTION

Power supply output. Maximum current capability is 15 mA; may be used with discretion.

Ramp Out (Contact 18A)

This contact is the analog output of positive–going sweep (ramp), typically 0 V to +10 V. Output resistance is approximately 500 Ω (not recommended at sweep rates faster than 1 μs/division).

CH 2 Vertical In (Contact 16A) and Ground (Contact 17A)

Contact 16A is selected as the source for the CH 2 vertical signal when the front-panel CH 2 coupling switch is in the INT DC position. Input resistance is nominally 50 Ω; may be user-modified by changing the value of R2051 to 1 MΩ. Parallel capacitance is approximately 100 pF. Maximum input voltage is 5 V rms, 40 V peak ac. Displayed noise may exceed 1 mV, peak to peak.

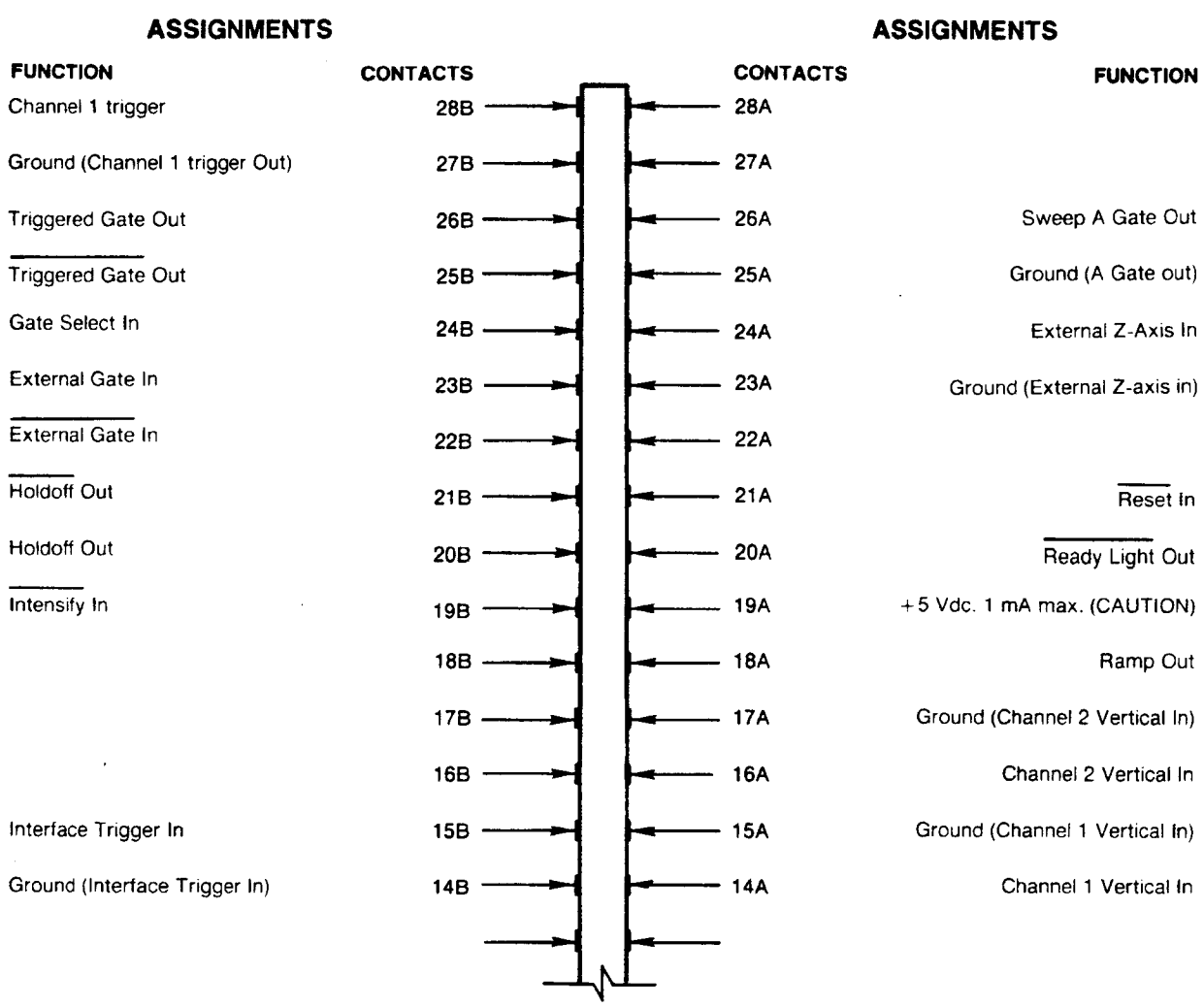
Ch 1 Vertical In (Contact 14A) and Ground (Contact 15A)

Contact 14A is selected as the source for the CH 1 vertical signal when the front-panel CH 1 coupling switch is in the INT DC position. Input resistance is nominally 50 Ω; may be user-modified by changing the value of R2031 to 1 MΩ. Parallel capacitance is approximately 100 pF. Maximum input voltage is 5 V rms, 40 V peak ac. Displayed noise may exceed 1 mV, peak to peak.

Approximate net instrument weight, 5.5 lbs.

Maximum power requirement at 120 V, 27 watts.

NOTES



CAUTION

When a Power Module compartment has been selected for the SC 504 and wired for a specialized interface system, a plastic barrier (Tektronix Part Number 214–1593–02) should be installed in the key slot between contacts 25 and 26 on the Power Module.

Do not insert any TM 500 Series Plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

Fig. SC 504-1. Connector rear view.

INTERFACE NOTES

External Z-Axis In (Contact 24A) and Ground (Contact 23A)

Input resistance is approximately 1.5 kΩ. A +5 V signal will unblank the crt beam (turns it on), and −5 V blanks the crt beam (turns it off). The input signal to contact 24A should be applied through a small coaxial cable, using 23A as shield ground.

Ramp Out (Contact 18A)

A 0 V to +10 V positive-going ramp, coincident with and having the same time interval as the sweep, is available on contact 18A. Load resistance must be greater than 100 kΩ. Output resistance is approximately 500 Ω. Use a small coaxial cable for this signal.

Channel 1 Trigger Out (Contact 28B) and Ground (Contact 27B)

Analog output is available on contact 28B. The signal amplitude at the rear interface is at least 50 mV/div of crt display, referenced to 0 V when driving a 50 Ω load. Use a small coaxial cable for this signal.

Channel 2 Vertical In (Contact 16A) and Ground (Contact 17A)

Input resistance for contact 16A is approximately 50 Ω. This input signal is selected when the Ch 2 source coupling switch is in the INT DC position. Maximum input voltage is 5 V rms, 40 V peak ac. Use a small coaxial cable for this signal.

Channel 1 Vertical In (Contact 14A) and Ground (Contact 15A)

Input resistance is approximately 50 Ω. This input signal is selected when the CH 1 source coupling switch is in the INT DC position. Maximum input voltage is 5 V rms, 40 V peak ac. Use a small coaxial cable with contact 15A as shield ground.

NOTE

XY operation from the rear interface can be performed by applying signals to CH 1 (Y) and CH 2 (X) contacts and setting the front-panel selector switch to XY mode.

Interface Trigger In (Contact 15B) and Ground (Contact 14B)

A trigger signal can be applied to the internal trigger pickoff circuit through rear interface contact 15B. Input resistance is 50 Ω. Set the triggering SOURCE switch to the INT position to use the rear interface trigger signal. Use a small coaxial cable for this signal. When this signal is not selected, the input impedance is 25 Ω.

Trigger Gate Out (Contact 26B) and $\overline{\text{Trigger Gate Out}}$ (Contact 25B)

The signal on contact 26B is a positive-going waveform, while the signal on contact 25B is negative-going. Both signals are coincident with the trigger gate waveform and can be used for sweep generator control. The signals on the contacts are designed to drive a 100 Ω, side-to-side, terminated line with an ECL receiver. The ECL line driver operates between +5 V and ground and its outputs, to contacts 25B and 26B, are protected with 47 Ω resistors.

Ext Gate Select In (Contact 24B)

Grounding contact 24B through 1 kΩ (or less) blocks the gate waveform from the internal trigger generator and allows an external gate, via contacts 23B and 22B, to control the sweep generator.

Extenal Gate In (Contact 23B) and $\overline{\text{External Gate In}}$ (Contact 22B)

When applied, the input signal to contacts 23B and 22B drives a 100 Ω terminated line with an ECL receiver. The signal at contact 22B must be negative-going and the signal applied to contact 23B must be positive-going. These signals must be time-coincident with each other. The ECL receiver operates between +5 V and ground.

Holdoff Out (Contact 20B) and $\overline{\text{Holdoff Out}}$ (Contact 21B)

The signal on contact 20B is positive-going, and the signal on contact 21B is negative-going. Both signals are time coincident with the internal holdoff signal from the sweep generator. These signals are designed to drive a 100 Ω, side-to-side, terminated line with an ECL receiver. The ECL line driver operates between +5 V and ground and its outputs, to contacts 21B and 20B, are protected with 47 Ω resistors.

Intensify In (Contact 19B)

An ECL POS input. Input resistance 1.5 kΩ. A low level signal ($\leq +3.4$ V) intensifies the trace. A high level signal ($\geq +4.0$ V) reduces the trace intensity. The internal ECL circuit operates between +5 V and ground.

Sweep A Gate Out (Contact 26A) and Ground (Contact 25A)

The output signal is positive (approximately +5 V) during sweep time, and negative (approximately 0.5 V) otherwise. The output impedance is 1 kΩ.

Reset In (Contact 21A)

Applying an external ground to contact 21A will reset the sweep generator circuits when it is operating in a single-sweep mode.

Ready Light Out (Contact 20A)

When the sweep generator is reset by applying an external ground to contact 21A, a low-true arming signal is asserted on contact 20A. This output can be used at the user's discretion.

+5 V (Contact 19A)

CAUTION

Can be used for remote ready light voltage source, or at user's discretion. Maximum available current is 15 mA.

CAUTION

When interfacing a system, be certain that this contact is not connected to other rear interface pins where the application of +5 V dc will damage internal components.

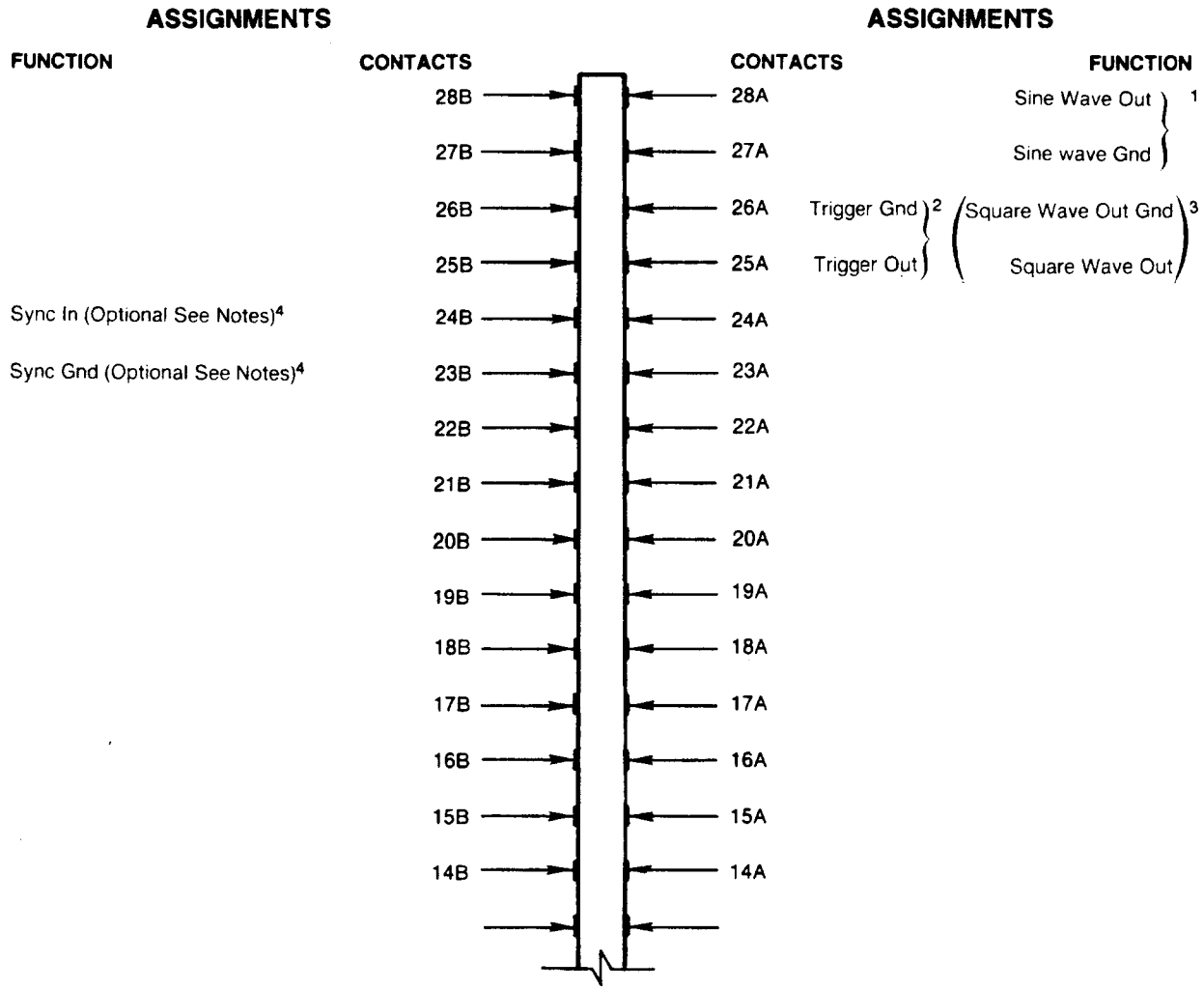
Approximate net instrument weight, 6.0 lbs.

Maximum power requirement at 120 V, 26.0 watts.

NOTES

SINE-WAVE GENERATORS

NOTES



1. Customer installed wiring from SN B010100-B059999. Factory installed wiring from SN B060600-up.
2. Pins 26A and 25A furnish a Trig Out signal from SN B070751-up.
3. From SN B010100 to B069999, pins 26A and 25A furnished a square-wave output signal.
4. The pin assignments shown for sync input in this interface book and the SG 502 instrument manual are 25B sync in (signal input) and 24B sync in (signal ground). Since these connections are not factory-wired, the actual pin assignment can be arbitrary. Other instructions of this same family, such as pulse generators with an external trigger input, use 25B as ground and 24B as the high input. If it is important to maintain compability with these instruments, it is suggested that you interchange the assignments for pins 25B and 24B in the diagram and text notes in the SG 502. If compatibility is not important, the assignments shown are satisfactory.

CAUTION

When a Power Module compartment has been selected for the SG 502 and wired for a specialized interface system, a plastic barrier (Tektronix Part Number 214-1593-02) should be installed in the key slot between contacts 23 and 24 on the Power Module.

Do not insert any TM 500 Series Plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

2088-82

Fig. SG 502-1. Connector rear view.

INTERFACE NOTES

Introduction

For external use, via the interface board connectors of this instrument, you will find a duplication of the sine wave (as available on the front panel) and a special signal for triggering purposes taken from the oscillator amplifier of this unit. User wiring can also supply an extra sync input for controlling the oscillator frequency.

Detail Circuit Considerations

The operator planning to use the interface connections should understand how this instrument operates. The sine wave signal available at the interface board is a duplicate of that same signal from the bnc connector on the front panel. A piece of coaxial cable is hard wired at the factory from the back side of the bnc connector to the interface connections in the rear. This may not be evident at first from some of the early manual schematics. These schematics did not show an actual connection between the sine wave bnc connector and the leads that went to the interface connections; however, the hard wiring is there.

In the case of the SG 502, there is also a signal taken from the oscillator to the interface board, which can be used for triggering purposes. This signal is not available on the front panel.

These connections are shown in the rear interface assignments illustration.

Since it might be desirable for the user to insert a controlling sine wave signal at the rear interface rather than through the front panel connector, the following suggestion is offered. A piece of coaxial cable of appropriate impedance (dependent upon the source of the signal) can be connected to the input circuitry of C10-R10 as shown in Fig. SG 502-1. This coaxial cable should then be fed through the access hole in the shielding surrounding the output circuitry back to the two most convenient connections (i.e., contacts 24B & 25B) at the interface. These two interconnecting points are provided with through-hole-plated solder pads, and it's quite easy to make signal connection to 25B and ground connection to 24B from the opposite side of the board as shown in the illustration. See Note 4 on the rear interface assignments illustration.

Sine Wave Out (Contact 28A) and Sine Wave Gnd (Contact 27A)

Between these two points, there is a 600 Ω impedance regardless of the Step Attenuation used (as selected on the front panel). Considerations as to the loading of this source of signal are pointed out in section 1 of the Instruction manual. It should be remembered that the interface load will be in parallel with whatever load is present on the front-panel bnc connector.

Trig Gnd (Contact 26A) and Trig Out (Contact 25A)–SN B070751

This is a fairly low impedance source of signal of approximately 1 kΩ. Loads less than approximately 600 Ω may require an emitter-follower buffer circuit.

Square Wave Out Gnd (Contact 26A) and Square Wave Out (Contact 25A)–SN B010100-B069999

A 600 Ω impedance exists between these two points. Loading considerations for this signal source are pointed out in section 1 of the Instruction Manual. It should be remembered that the interface load will be in parallel with any load presented to the front-panel bnc connector.

Sync In (Contact 25B) and Sync Ground (Contact 24B)

(See Note 4 on the rear interface assignments illustration.) A high impedance exists between these two points. If the impedance of the signal source matches the coaxial cable installed here, terminate this line at the C10/R10 end for signal purity. There is adequate room to install your terminating resistor between the input end of C10 and the ground mounting point for the shield plate pointed out in Fig. SG 502-1. For the signal voltage requirements here, see section 1 of the Instruction Manual.

Approximate net instrument weight, 2.0 lbs.

Maximum power requirement, 5.5 watts.

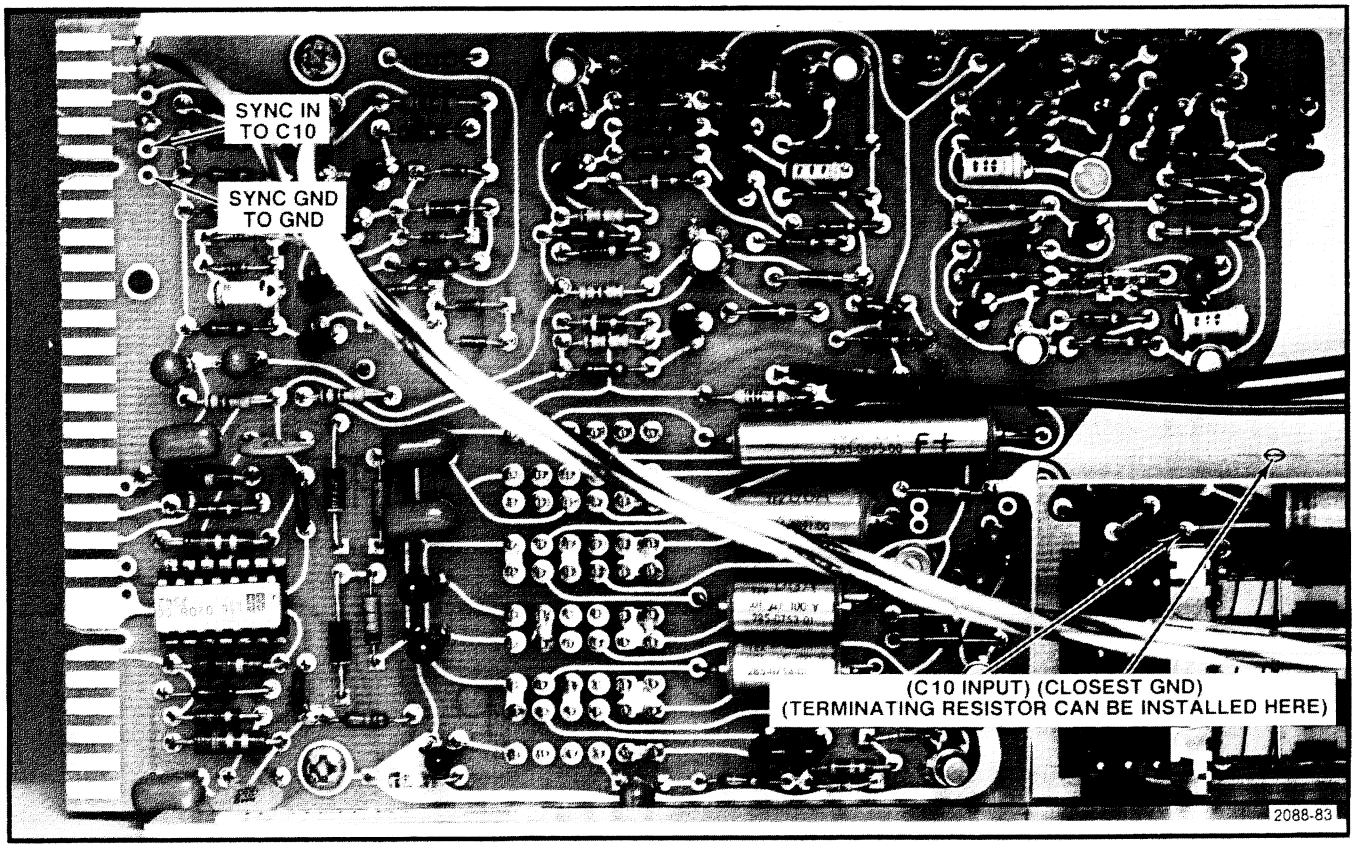


Fig. SG 502-2. Board connection points.

NOTES

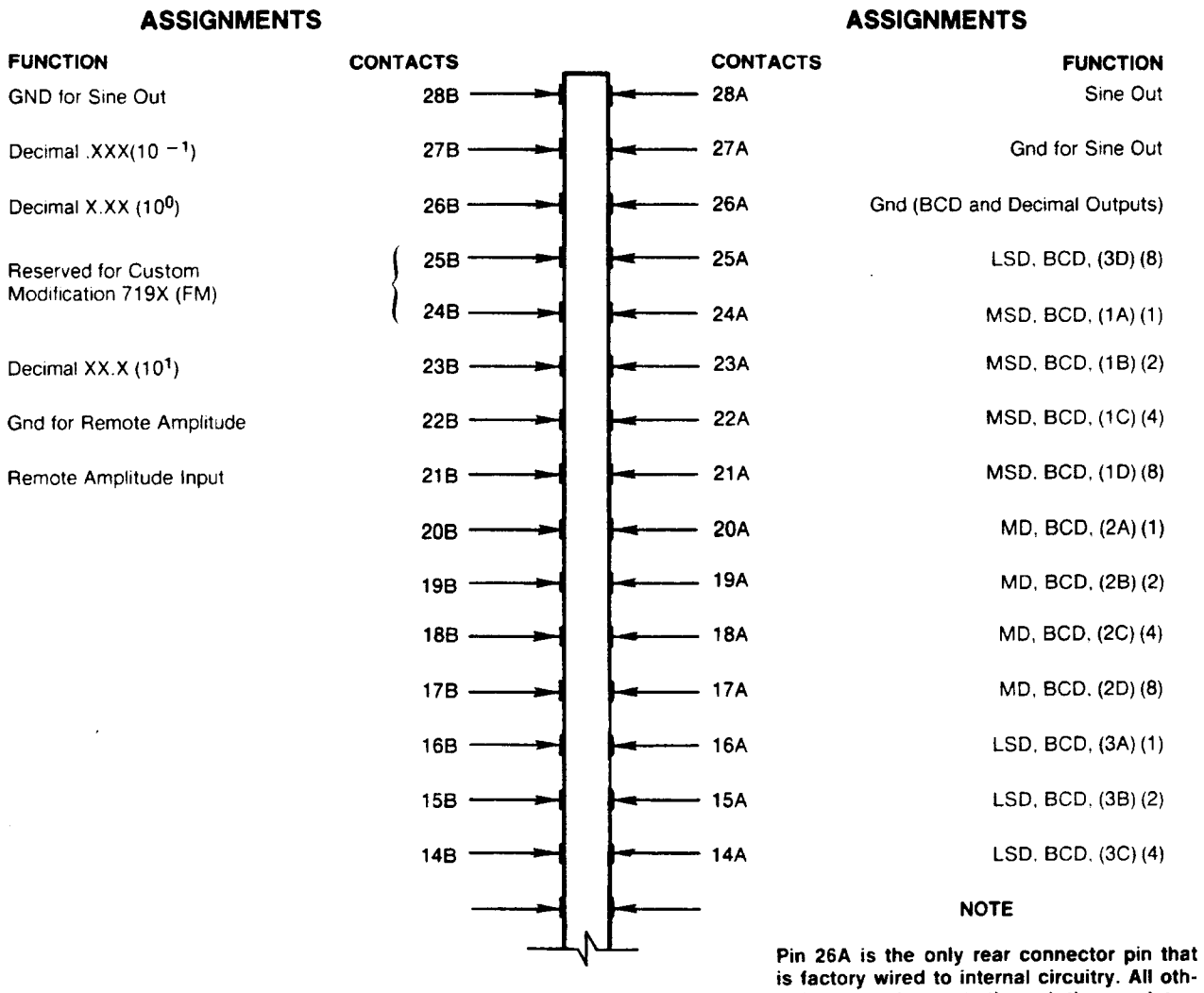


Fig. SG 503-1. Connector rear view.

INTERFACE NOTES

Introduction

Contact 26A is the only rear connector pin (from 14 through 28) that is factory wired to internal circuitry. All other inputs and outputs through the rear interface must be user wired when it is desired to interface the SG 503 in a specialized Option 02 Power Module system.

SINE OUT (Contact 28A) and GND for SINE OUT (Contacts 27A and 28B)

NOTE

Flatness specifications for the SG 503 are invalid when the output signal has been transferred from the front panel to the rear interface, because the insertion loss between the output and the 50 Ω load will be different from that of the precision coaxial cable (Tektronix Part No. 012-0482-00) provided with the instrument.

To transfer the output signal from the front panel to the rear interface, perform the following steps.

1. Remove the short blue cable (with ferrite bead) between the bnc output connector and the Attenuator-Output Buffer Circuit Board (located on the B side of the instrument). When this short blue cable is removed, be certain that it is stored in a known location and not misplaced or lost. This cable is mandatory for repairing or recalibrating the instrument.

2. Locate the four holes near contacts 27 and 28 on the B side of the Main Circuit Board. Install a pin connector socket (Tektronix Part 136-0252-01) in the center hole labeled SINE OUT, and solder it in place from the A side of the board so that connection is made to contact 28A. Install a 3-prong, coaxial-cable receptacle (Tektronix Part No. 131-1003-00) in the remaining three holes and solder it in place from the A side of the board so that ground connections are made to contacts 27A and 28B.

3. Install a 9.4 inch, miniature coaxial cable (blue), with connectors on each end (Tektronix Part No. 175-1554-00), from the output connector on the Attenuator-Output Buffer Circuit Board to the newly installed receptacle for SINE OUT. Dress the blue coaxial cable underneath the lower rear corner of the Attenuator-Output Buffer Circuit Board. Be certain that the center conductor of the blue coaxial cable mates with the center socket pins at each end.

4. Place a tag to the left of the OUTPUT connector on the front panel, labeled: OUTPUT AT REAR CONNECTOR CONTACT 28A.

NOTE

To prevent ground loop currents, GND for SINE OUT (contacts 27A and 28B) should not be tied to any other grounds at the rear interface.

REMOTE Amplitude Controls (Contacts 21B and 22B)

To transfer the OUTPUT AMPLITUDE control from the front panel to the rear interface, perform the following steps:

1. On the A side of the Main Circuit board, immediately behind the front panel, locate the unused holes labeled REMOTE. Install a pin connector socket (Tektronix Part No. 136-0252-01) in the center hole, and a 3-prong, coaxial-cable receptacle (Tektronix Part No. 131-1003-00) in the remaining holes, and solder in place from the B side of the instrument.

2. Locate the unused holes labeled REMOTE near rear connector pins 21 and 22 (A side, Main Circuit Board). Install a pin connector socket (Tektronix Part No. 136-0252-01) in the center hole, and a 3-prong, coaxial-cable receptacle (Tektronix Part No. 131-1003-00) in the remaining three holes, and solder in place from the B side of the instrument. Be certain that the center pin socket is connected to pin 21B and that the 3-prong receptacle is providing a ground connection to contact 22B.

3. On the B side of the Main Circuit Board, locate W260 (Terminal Link). This link looks like a solid white dummy resistor and is located immediately behind the front panel. Unsolder both ends of W260 and, without bending the leads, move it horizontally to the two unused holes about one-fourth inch closer to the front panel. Resolder W260 (from the B side) into the new holes.

4. On the B side of the Main Circuit board add (solder) a 51 kΩ, 1/4 W, 5% resistor (Tektronix Part No. 315-0513-00) between the circuit board run connected to contact 21B and the unused hole labeled GND.

5. Install a 12.4 inch miniature coaxial cable (white), with connectors on each end (Tektronix Part No. 175-

1555-00), between the two newly installed REMOTE receptacles, making sure that the center conductor mates with the center pin sockets at each end. Dress the white coaxial cable between the Coil Circuit Board and the bottom side rail. Do not dress the white coaxial cable along the top side rail. In some instruments, this operation may require loosening screws for the Main Circuit Board and side mount bracket (used as a heat sink); if so, remember to retighten all loosened screws.

6. Check with an ohmmeter to verify that a complete circuit (zero resistance) exists between contact 21B and pin 4 of P230. Plug P230 is the flat blue plug attached to the Attenuator-Output Buffer Circuit Board on the B side of the instrument. Pin 4 is connected to a yellow coded wire. Refer to schematic number 1 in the SG 503 Instruction Manual.

7. Place a tag above the OUTPUT AMPLITUDE control on the front panel, labeled: OUTPUT AMPLITUDE REMOTE CONTROLLED AT REAR CONNECTOR CONTACT 21B.

NOTE

A dc voltage of approximately −1 V to −11 V applied to contact 21B (after modification) will control the output amplitude over the range from 0.5 V to 5.5 V (peak to peak). GND for REMOTE (contact 22B) should not be tied to any other ground at the rear interface.

BCD Outputs (Contacts 14A through 26A)

The SG 503 can be user wired to provide this type of output data to the rear interface. Each decimal digit displayed on the front panel has its own 4-bit bcd data available from the counters in the form of unused holes (solder pads) on the A side of the Main Circuit Board (between the upper two rows of IC's). Each set of four holes are labeled 1A through 1D for the most significant digit (msd), 2A through 2D for the middle digit (md), and 3A through 3D for the least significant digit (lsd). The rear connector pins (14A through 25A) are also labeled in a one-to-one correspondence with 1A through 3D. It is only necessary to use flat ribbon-wire cable (Tektronix Part No. 175-0827-00) of the proper length to interconnect the counter bcd outputs to the proper solder pads (holes) for the rear connector pins. Solder all connections from the B side of the instrument.

The bcd output data uses positive logic and is TTL compatible. The 4-bit data lines have a fanout of 8. External decoding circuitry depends on the desired application. Contact 26A provides an internal ground for the bcd output data.

Decimal Data Output (Contacts 27B, 26B, and 23B)

To transfer Decimal Data to the rear interface, perform the following steps.

1. On the A side of the Main Circuit Board, just below U480, locate three unused holes (solder pads) labeled 10^{-1}, 10^{1}, and 10^{0}.

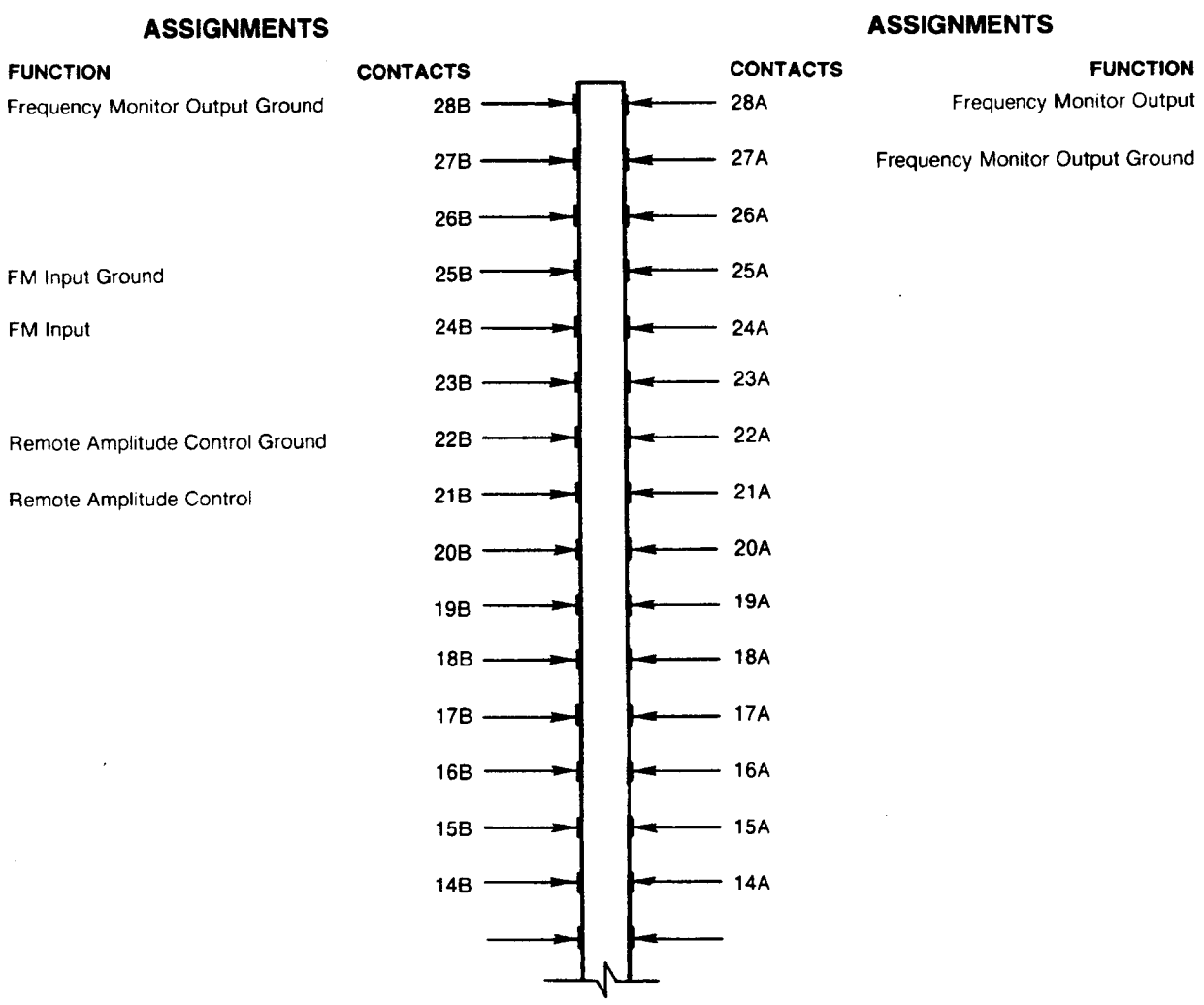
2. Use flat ribbon-wire cable (Tektronix Part No. 175-0827-00) to interconnect these pads in a one-to-one correspondence with rear connector solder pads labeled 10^{-1}, 10^{1}, and 10^{0} (Just to the left of CR680 and close to rear connector contacts 25 and 26). Solder the wire connections on the B side of the Main Circuit Board.

Each Decimal Data line will drive only one TTL gate without external buffering. A Decimal Data line goes to an active-high state when the corresponding front-panel decimal point is turned on by the auto-ranging circuitry.

Approximate net instrument weight, 2.0 lbs.

Maximum power requirement, 21.0 watts.

NOTES



CAUTION

When a Power Module compartment has been selected for the SG 504 and wired for a specialized interface system, a plastic barrier (Tektronix Part Number 214–1593–02) should be installed in the key slot between contacts 23 and 24 on the Power Module.

Do not insert any TM 500 Series Plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

2088-85

Fig. SG 504-1. Connector rear view.

INTERFACE NOTES

Frequency Monitor Output (Contact 28A)

To use this feature, through the rear interface connector, remove the coaxial plug from the rear of the FREQUENCY MONITOR OUT connector by pulling. Re-connect the free end of the cable to the connector marked Freq Mon as shown on the Adjustment Location Illustration of Fig. SG 504-1.

FM Input (Contact 24B)

To use this feature, remove the coaxial plug from the rear of the FM INPUT connector by pulling. Re-connect the free end of the cable to the connector marked Ext Fm as shown on the Adjustment Location Illustration of Fig. SG 504-1.

Remote Amplitude Control (Contact 21B)

This feature allows external amplitude control of the output signal through the rear interface connector. To use this feature, remove the upper end of the jumper marked W265 from the circuit board, located as shown on the Adjustment Location Illustration of Fig. SG 504-1. Connect a wire from the vacant hole on the circuit board to the top hole of the double hole pair marked Remote on the rear of the circuit board. Finally, install a 51 kΩ, 1/4 W, 5% resistor from the bottom hole of the pair to the hole below the word Remote.

The voltage range at contact 21B for full amplitude control of the output signal is −1 V to −11 V maximum. While −1 V provides minimum output amplitude, −11 V provides maximum output amplitude. Do not exceed −11 V.

Approximate net instrument weight, 2.6 lbs.

Maximum power requirement at 120 V, 12 watts.

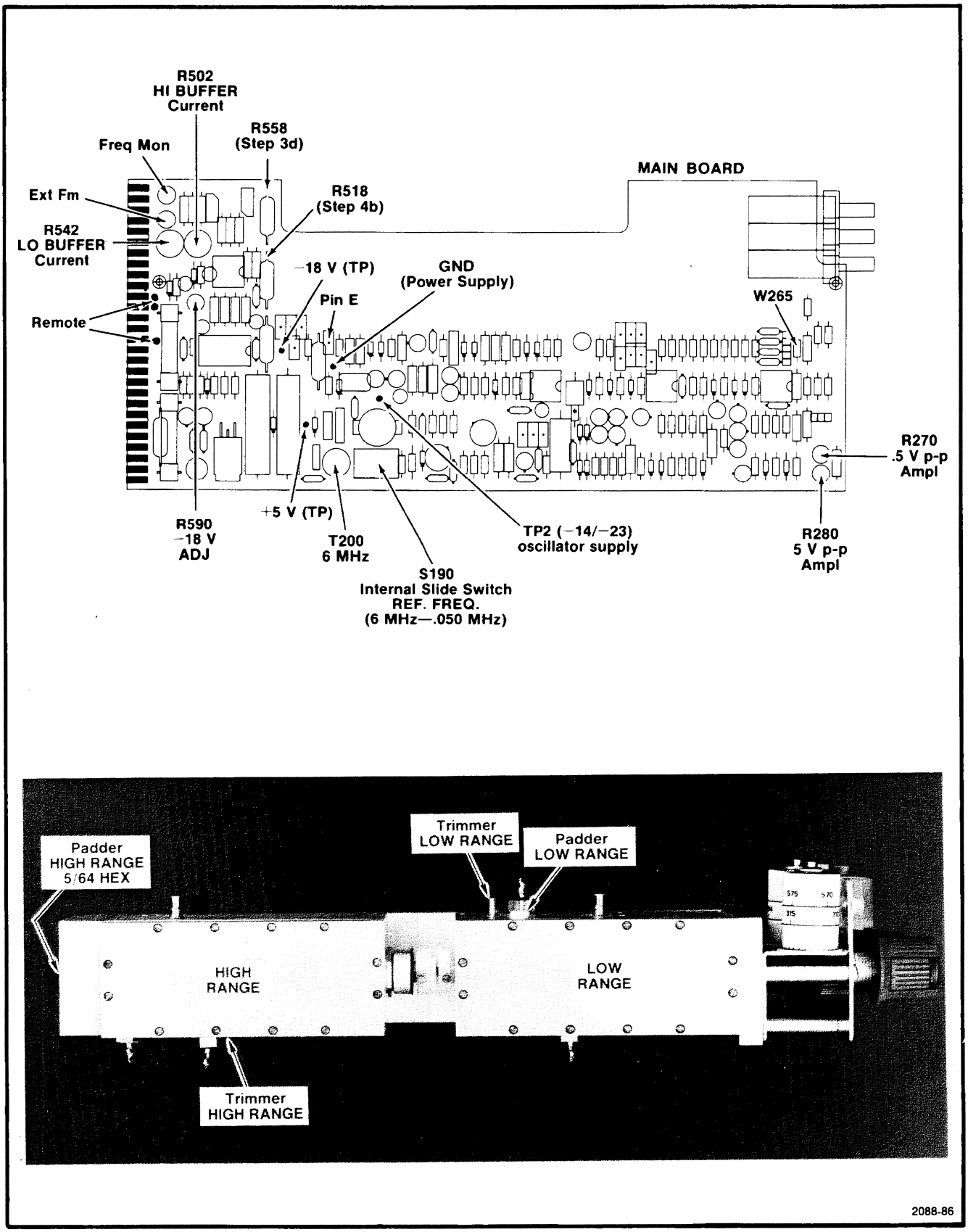
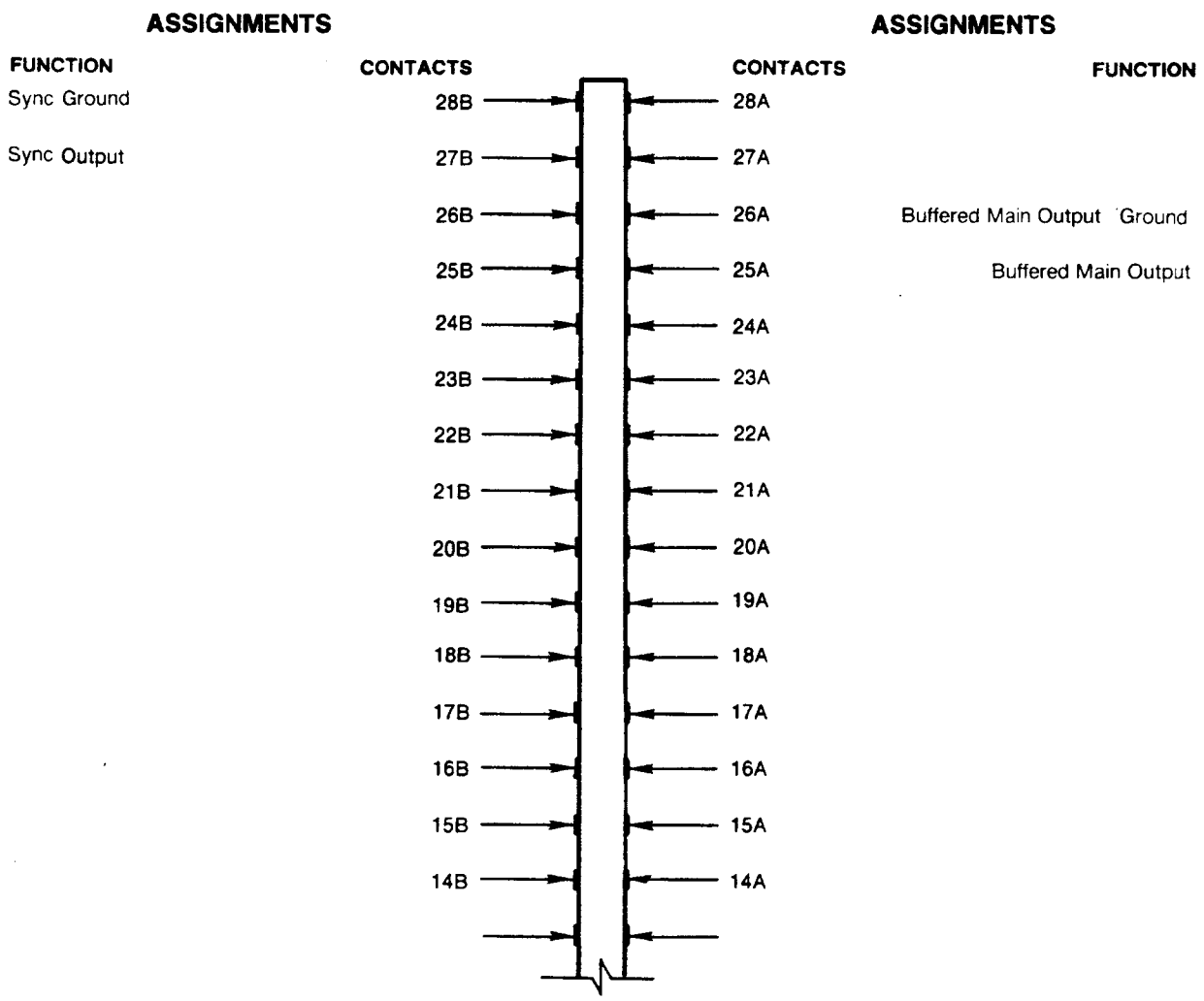


Fig. SG 504-2. Board and oscillator connection locations.

NOTES



CAUTION

When a Power Module compartment has been selected for the SG 505 and wired for a specialized interface system, a plastic barrier (Tektronix Part Number 214-1593-02) should be installed in the key slot between contacts 23 and 24 on the Power Module.

Do not insert any TM 500 Series Plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

2088-87

Fig. SG 505-1. Connector rear view.

INTERFACE NOTES

Introduction

The Sync Output (contact 27B) and Sync Ground (contact 28B), and the Buffered Main Output (contact 25A) and Buffered Main Output Ground (contact 26A) are the only SG 505 functions available at the rear-interface contacts. These contacts are factory wired.

Sync Output (Contact 27B) and Sync Ground (Contact 28B)

This signal is identical to the signal available at the front-panel SYNC OUT connector. The frequency for both the front-panel and rear interface sync signals is the same frequency selected by the FREQUENCY Hz dial for the main output signal. Amplitude of the rear interface sync signal is $\approx$200 mV and the output impedance is $\approx$50 Ω, always chassis-ground referenced.

Buffered Main Output (Contact 25A) and Buffered Main Output Ground (Contact 26A)

These contacts provide a unity gain buffered version of the front-panel main output signal; output impedance is $\approx$600 Ω. To prevent front-panel OUTPUT signal distortion, the rear interface load impedance must be $\geq$1 kΩ. This output is useful as an ac signal level reference for gain measurements. THD is typically $\leq$0.03%.

CAUTION

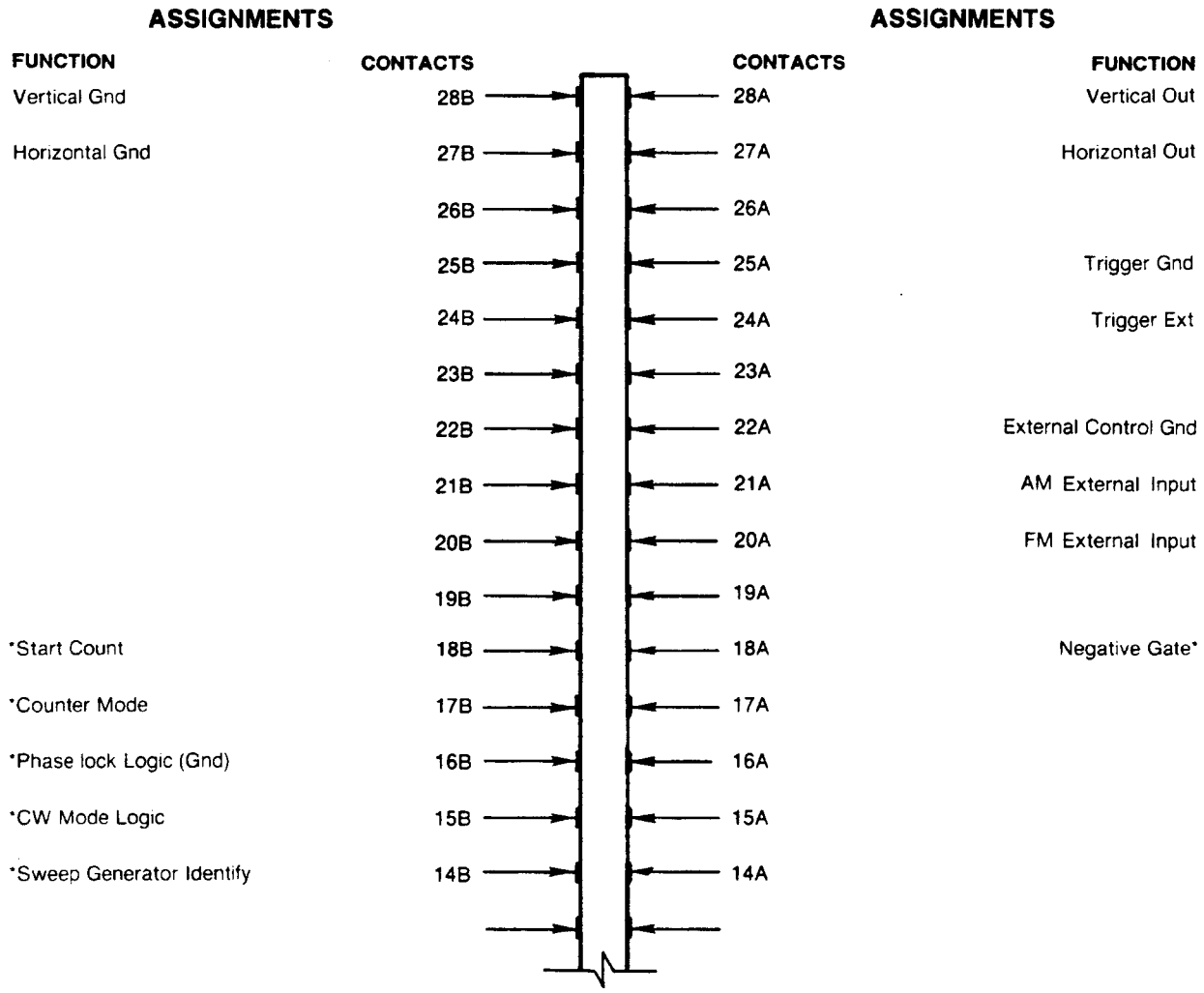
To prevent possible instrument damage, do not float the rear interface output in excess of $\pm$30 V peak.

Approximate net instrument weight, 2.49 lbs.

Maximum power requirement at 120 V, 6 watts.

SWEEP GENERATOR

NOTES



NOTE

Only those pins marked with an asterisk (*) are factory wired.

CAUTION

When a Power Module compartment has been selected for the SW 503 and wired for a specialized interface system, a plastic barrier (Tektronix Part Number 214–1593–02) should be installed in the key slot between contacts 23 and 24 on the Power Module.

Do not insert any TM 500 Series Plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

2088-88

Fig. SW 503-1. Connector rear view.

INTERFACE NOTES

Dot Marker Interface

Contacts 14B through 18B and 18A are factory wired to interface with the DC 502 Option 07. The dot marker scheme utilizes six interconnecting lines between the sweeper and counter. All lines use standard TTL (0 and +5 V) voltages. Four of the lines (14B, 15B, 16B and 17B) are control lines to preset counter functions and identify that the counter and sweeper are plugged into the power module. The remaining two lines (18B and 18A) trigger the counter to start count and signal the end of count. (See Fig. SW 503-1)

Other counters could be modified by the user to work with the dot marker scheme. Only two of the lines are required, the start count (18B) to trigger the counter, and the negative gate (18A) from the counter to resume the sweep. In addition, contact 16B would have to be grounded on the sweep generator.

Vert Output (Y) (Contact 28A)

The vertical output signal can be applied to contact 28A by connecting a jumper wire from the front-panel VERT connector. Vertical output voltage will vary depending upon the type of detector used, but will typically be less than +5 V.

Horiz Out (X) (Contact 27A)

The horizontal output signal can be applied to contact 27A by connecting a jumper wire from the front-panel HORIZ connector. Output voltage will be 500 mV (50 mV/DIV). If desired, an output voltage of 10 V is available from the same point by lifting one end of the 1 kΩ resistor connected to the front-panel HORIZ output connector.

Trig (EXT) Input (Contact 24A)

The external trigger can be enabled from the rear interface by connecting a jumper wire from the front-panel TRIG jack to contact 24A. A positive-going pulse of +4 V to +10 V is required to remotely trigger the instrument.

AM (EXT) Input (Contact 21A)

The external AM input can be enabled from the rear interface by connecting a jumper wire from the front-panel AMPL jack to contact 21A. The identical functions will be available through the rear interface as through the front-panel connections.

FM (EXT) (Contact 20A)

The external FM input can be enabled from the rear interface by connecting a jumper wire from the front-panel FREQ jack to contact 20A. The identical functions will be available through the rear interface as through the front-panel connections.

Ground (For Vert, Horiz, Trig, AM, and FM) (Contacts 28B, 27B, 25A, and 22A, respectively)

Eyelets are provided for gnd connections adjacent to all rear interface connectors. The contacts (22A, 25A, 27B, and 28B) should be tied to contact 16B if they are to be used.

Approximate net instrument weight, 3.3 lbs.

Maximum power requirement at 120 V, 11.0 watts.

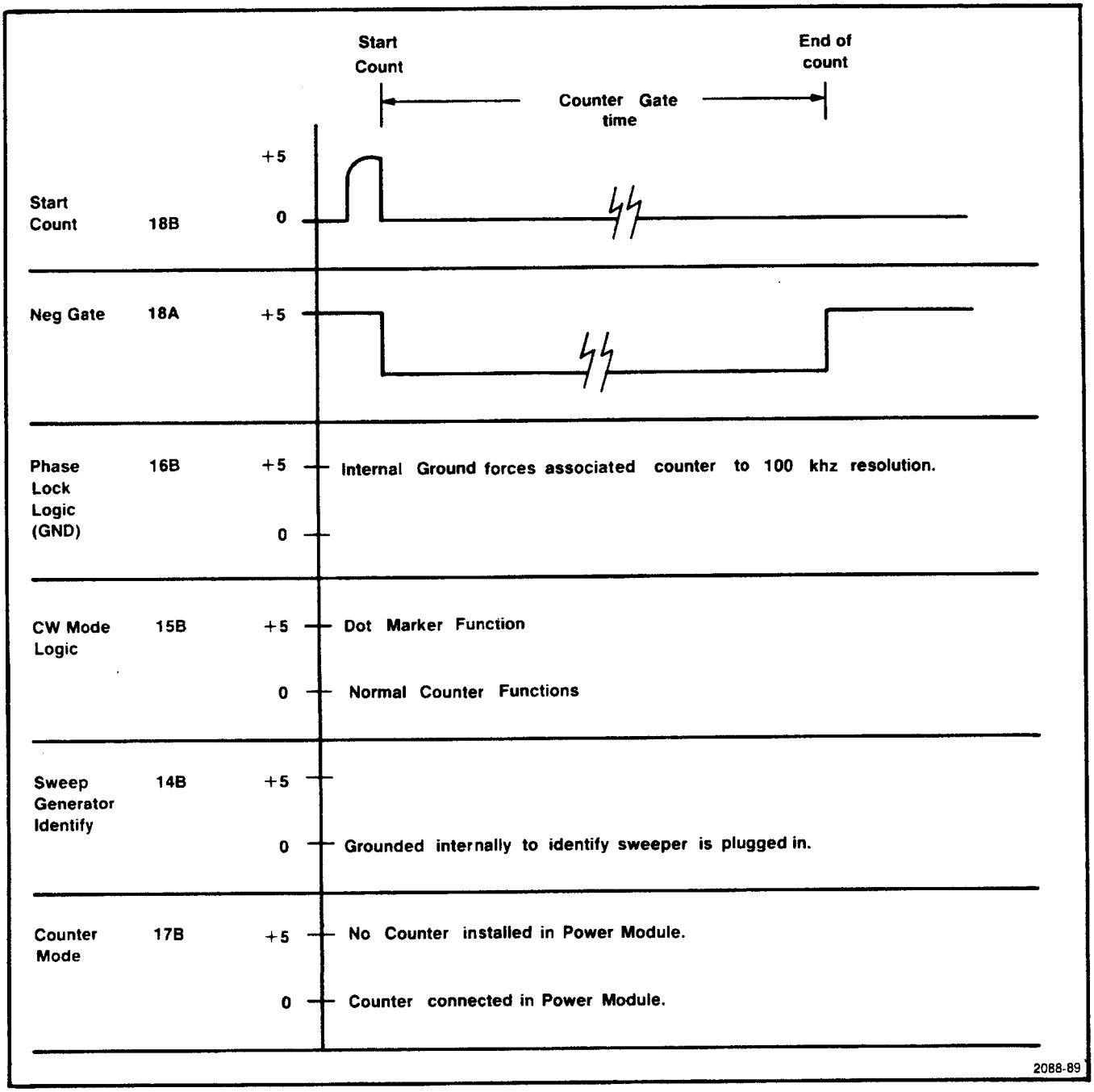
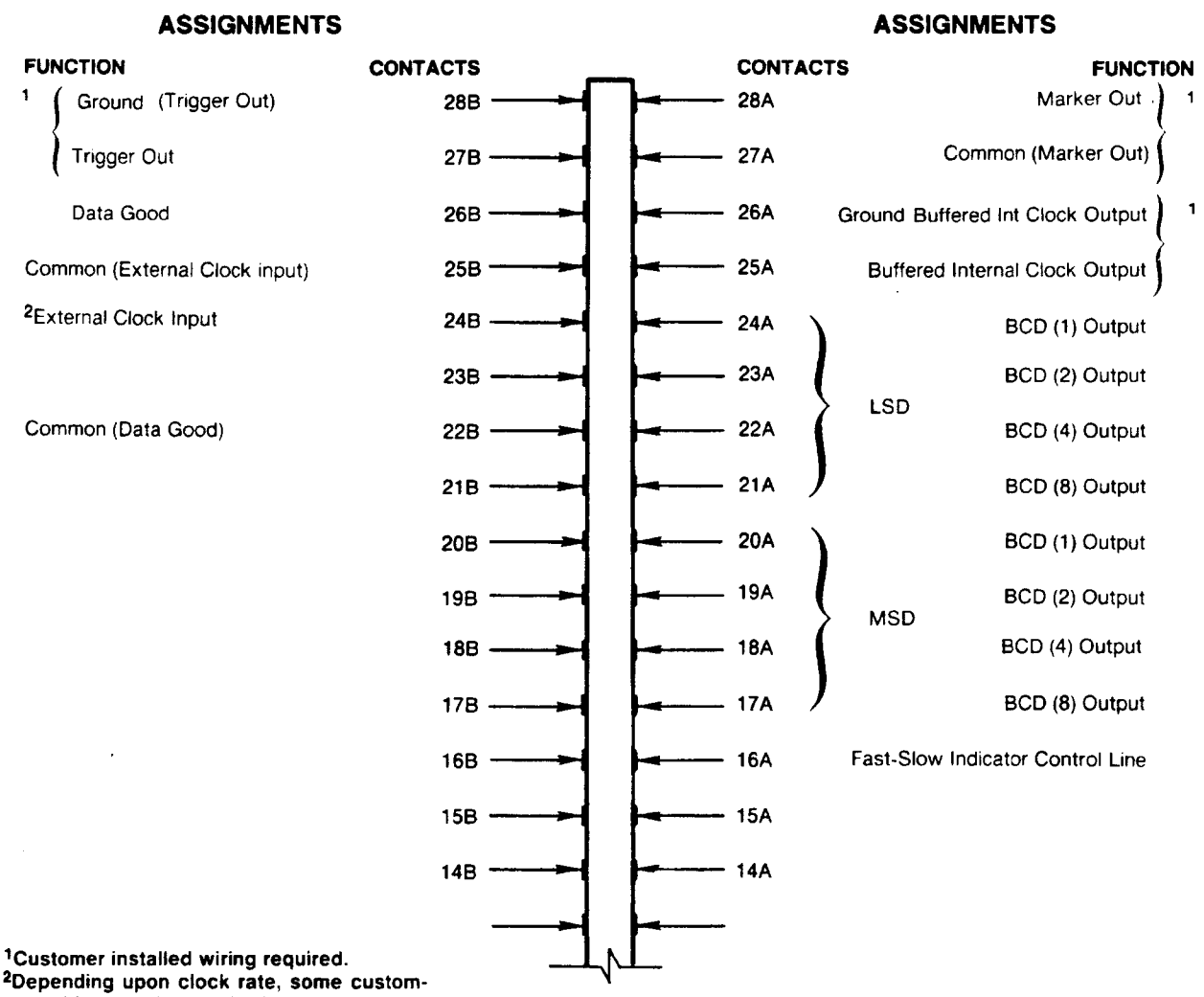


Fig. SW 503-2. Rear interface waveforms.

NOTES

TIME-MARK GENERATORS

NOTES



[1]Customer installed wiring required.
[2]Depending upon clock rate, some customer rewiring may be required.

CAUTION

When a Power Module compartment has been selected for the TG 501 and wired for a specialized interface system, a plastic barrier (Tektronix Part Number 214–1593–02) should be installed in the key slot between contacts 23 and 24 on the Power Module.

Do not insert any TM 500 Series Plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

LSD—Least significant digit; MSD — Most significant digit.

2088-90

Fig. TG 501-1. Connector rear view.

INTERFACE NOTES

Marker Out (Contact 28A)

Marker output pulses (5 s to 2 ns) can be supplied to contact 28A by disconnecting the coaxial cable going to the MARKER OUT front-panel connector. Connect the cable to the connector at the rear of the plug-in that is connected to contact 28A, coiling the excessive cable length so that the coiled loop is near the rear of the TG 501. The output of contact 28A must be terminated into 50 Ω to maintain the waveshape of the time markers.

NOTE

The quality of the output signal may not meet specifications due to variables introduced by using the rear interface.

Buffered Internal Clock Output (Contact 25A)

Interface contact 25A supplies the internal 1 MHz clock pulses of the TG 501 for external use. To connect the internal 1 MHz clock pulses via a buffer to contact 25A, jumper J2 (see Fig. TG 501-1) must be installed. This output will drive at least 2 TTL loads (8 mA).

BCD Outputs (LSD - 8, 4, 2, 1; and MSD - 8, 4, 2, 1 Code)

Contacts 24A, 23A, 22A, 21A, 20A, 19A, 18A, and 17A provide bcd data directly to the power module interface. Each digit of the error count is transmitted in a serial-by-digit method. The binary levels for each digit use positive-true logic (HI=1, LO=0). Each output data line is capable of driving two TTL loads (3.2 mA). Caution must be exercised in connecting external loads to the bcd data lines, since they are neither buffered nor protected.

Fast-Slow Indicator Control Line (Contact 16A)

The output level on rear contact 16A is high (approximately 5 V) when the Slow indicator is lit and is low (approximately 0 V) when the FAST indicator is lit. This output line will drive two TTL loads (3.2 mA). Caution must be exercised in connecting external loads to this line, since it is neither buffered nor protected.

Trigger Out (Contact 27B)

Trigger output pulses can be supplied to contact 27B by disconnecting, at the circuit board, the coaxial cable going from the circuit board to the + TRIGGER OUT front-panel connector. Connect another 50 Ω coaxial cable (having characteristics similar to RG174U) from the circuit board trigger output and shield solder pads (from which the coaxial cable was just removed to contacts 27B (center conductor) and 28B (shield). The output of contact 27B must be terminated into 50 Ω to maintain the waveshape of the trigger pulses.

Data Good (Contact 26B)

A positive-true pulse is transmitted directly to rear contact 26B at each updating of the counters. The Data Good pulse goes high and stays high for approximately 8 ms coinciding with the LED display time. This output will drive at least two TTL loads (3.2 mA). Caution must be exercised in connecting external loads to this line since it is neither buffered nor protected.

External Clock Input (Contact 24B)

A 1 MHz, 5 MHz, or 10 MHz external clock can be substituted for the internal clock. Interface contact 24B is used for the external clock input with the associated ground on contact 25B.

To use an external 5 or 10 MHz clock, U50 (see Instruction Manual diagrams) must be installed on the back of the Main Circuit Board (see Fig. TG 501-1) and the necessary jumpers added (see Fig. TG 501-1 and Table TG 501-1) to divide down the input to meet the 1 MHz internal requirement. For a 1 MHz external clock, U50 is not required, but jumpers must be added.

Standard clock. Remove U100 and disconnect pin 3 of U350 (see Instruction Manual diagrams) before using the external clock. To disconnect pin 3, remove U350 and bend pin 3 out. Then insert U350 back into its socket.

Option 01 clock. Remove jumper J3 (see Fig. TG 501-1) if using a 5 MHz or 10 MHz external clock. If a 1 MHz external clock is to be used, remove jumpers J3, J4, and J7, refer to Fig. TG 501-1.

If the external clock source is a TTL output, remove R52 (see Instruction Manual diagrams).

Table TG 501-1

External Clock Frequency	Install Jumper(s) (See Fig. TG 501-1 for Location)	Remarks
1 MHz	J1 and J5	
5 MHz	J1, J4, and J7	Install U50
10 MHz	J1, J4, and J6	Install U50

Ground (Marker Out, Buffered Internal Clock Output, Trigger Out, External Clock Input, and Data Good)

Contacts 27A, 26A, 28B, 25B, and 22B are electrically tied to the instrument chassis. Certain contacts are recommended for specific use for connection convenience.

Approximate net instrument weight, 2.0 lbs.

Maximum power requirement at 120 V, 29.5 watts.

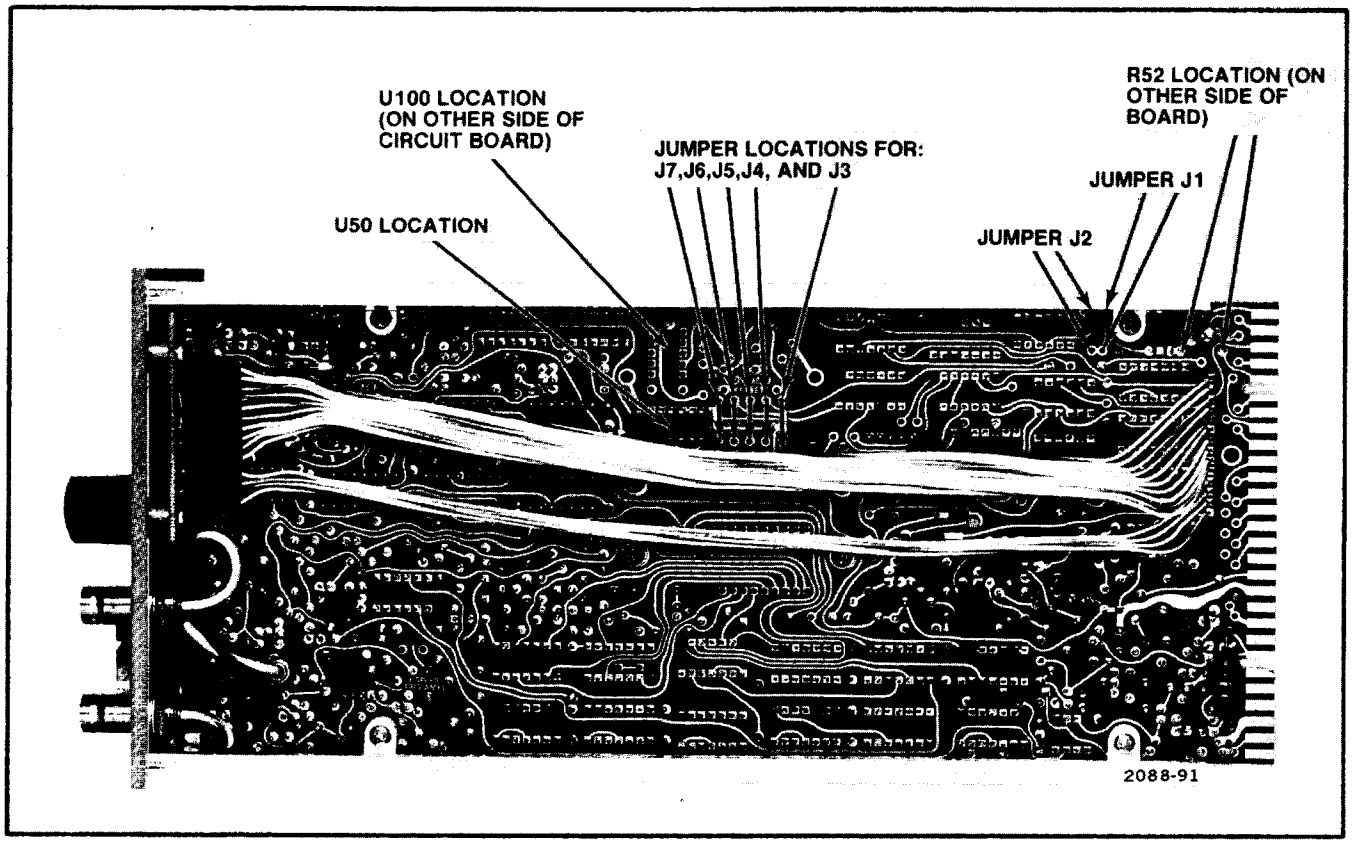
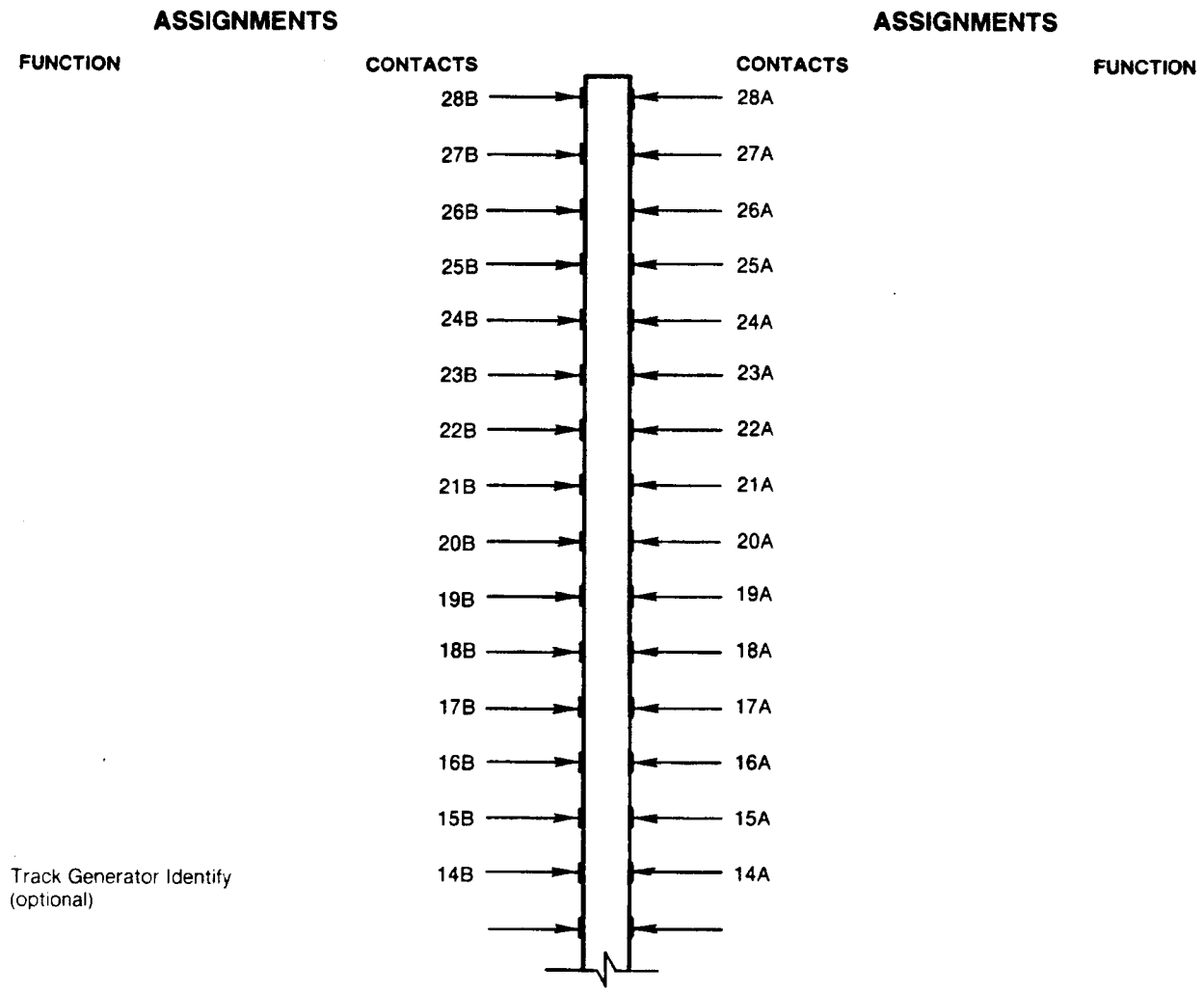


Fig. TG 501-1. Board connection locations.

NOTES

TRACKING GENERATORS

NOTES



CAUTION

When a Power Module compartment has been selected for the TR 501 and wired for a specialized interface system, a plastic barrier (Tektronix Part Number 214–1593–02) should be installed in a key slot between contact 17 and 18 on the Power Module.

Do not insert any TM 500 Series plug-in a live Power Module and do not use excessive force when inserting the plug-in.

2088-92

Fig. TR 501-1. Connector rear view.

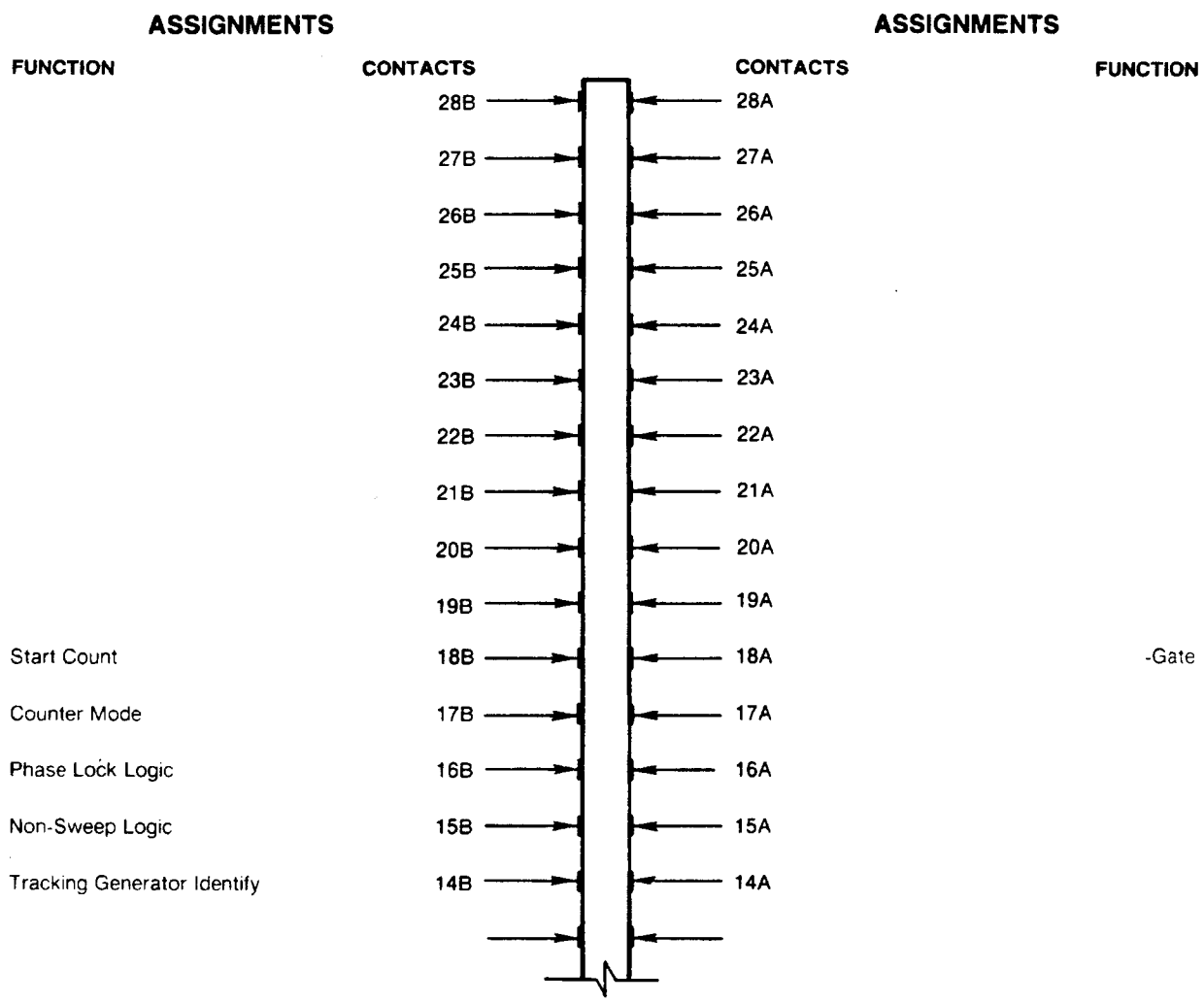
INTERFACE NOTES

Track Generator Identify (14B)

This connection is grounded. Use it to identify that a TR 501 is in the particular compartment.

Approximate net instrument weight, 7.1 lbs.

Maximum power requirement at 120 V, 11.0 watts.



CAUTION

When a Power Module compartment has been selected for the TG 502 and wired for a specialized interface system, a plastic barrier (Tektronix Part Number 214–1593–02) should be installed in the key slot between contacts 17 and 18 on the Power Module.

Do not insert any TM 500 Series Plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

2088-93

Fig. TR 502-1. Connector rear view.

INTERFACE NOTES

Introduction

The rear interface connections on the TR 502 are designed for use with a TM 500-Series Option 07 Power Module and DC 502 Option 07 Counter, or other counters with Option 07 availble.

The TR 502 Tracking Generator is a 100 kHz to 1.8 GHz swept signal source used in conjunction with a spectrum analyzer. When used with a compatible counter, the center frequency of the sweep may be counted.

Tracking Generator Identify (Contact 14B)

This contact is grounded. In the system, it identifies the TR 502 to the counter.

Counter Mode (Contact 17B)

This connection is a TTL input. A low at this connection identifies a counter compatible with the sweep stop scheme of frequency measurement.

Non-sweep Logic (Contact 15B)

This TTL signal originates in the spectrum analyzer. A low at this connection indicates that the analyzer is in a non-sweep mode and for the counter to count continuously. A high at this connection identifies the sweep stop mode of counting. The counter will count on command.

Start Count (Contact 18B)

This signal is a TTL output from the TR 502. A 1 μs pulse on this line tells the counter to count the signal at its front panel.

– Gate (Contact 18A)

After the compatible counter receives the start count pulse, the counter responds with a TTL compatible low on this line. This pulse lasts for the duration of the count. The TR 502 holds the sweep at center while the count is made. When the count is completed, this connection returns to the high state and the frequency sweep continues.

Phase Lock Logic (Contact 16B)

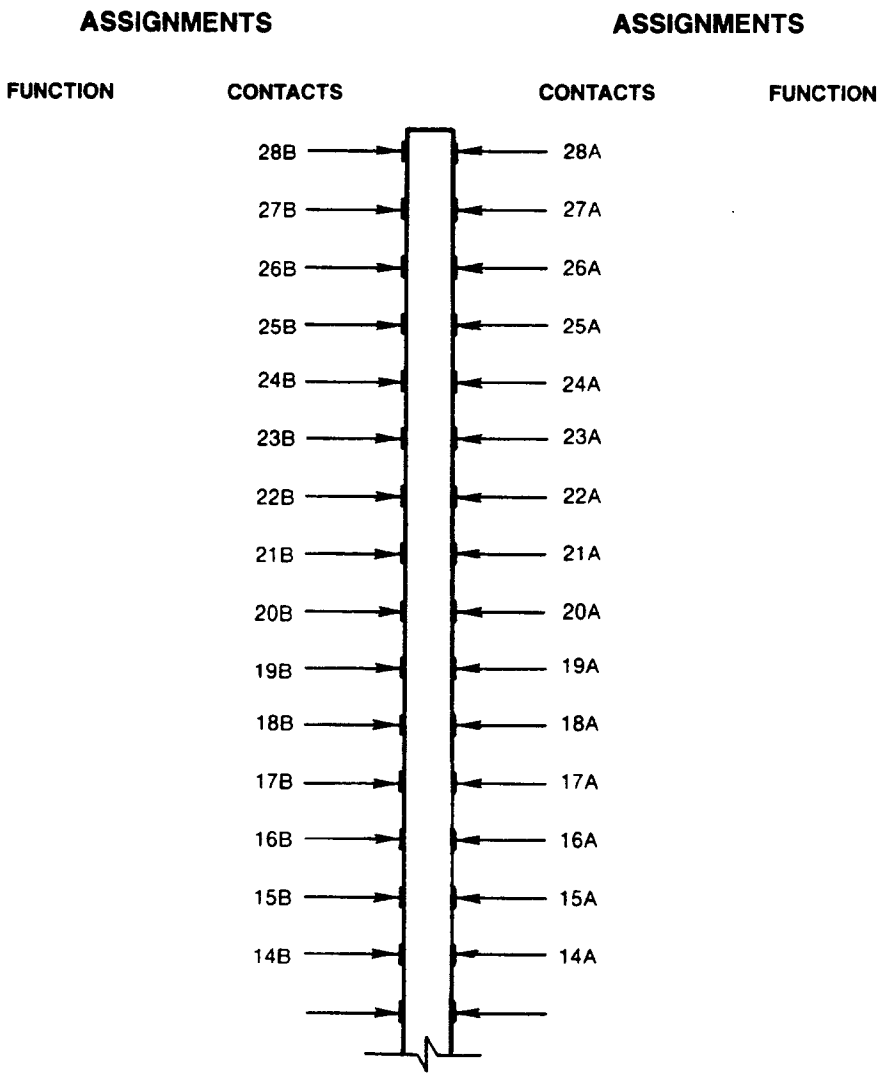
A low on this TTL line, originating in the spectrum analyzer, indicates that the local oscillator in the TR 502 is not phase locked. Frequency is read within 100 kHz. When this line is high, the local oscillator in the TR 502 is phase locked to the local oscillator in the spectrum analyzer. Counts are now accurate within 10 Hz.

Approximate net instrument weight, 7.3 lbs.

Maximum power requirement at 120 V, 10.0 watts.

PROGRAMMABLE INTERFACE

NOTES



CAUTION

Do not insert any TM 5000 Series plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

NOTE

Approximate net instrument weight, MI 5010–2.75 lbs; MX 5010–2.25 lbs.
Maximum power requirements at 120 V, MI 5010–82 VA.

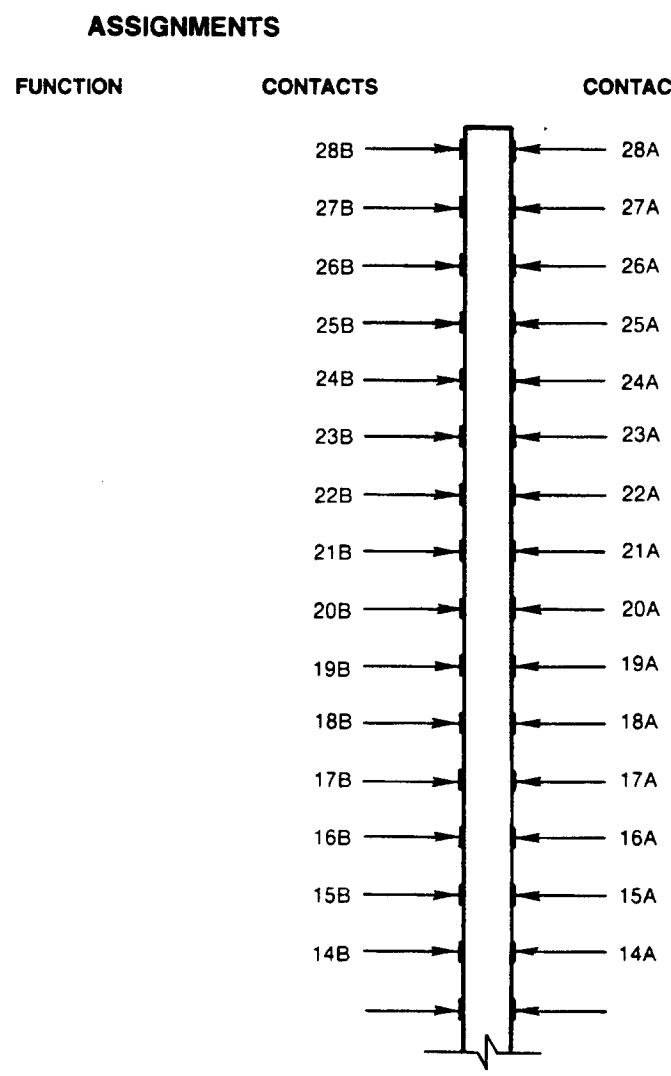
2088-109

Fig. MI 5010/MX 5010-1. Connector rear view.

NOTES

PROGRAMMABLE SCANNER

NOTES



CAUTION

Do not insert any TM 5000 Series plug-in in a live Power Module and do not use excessive force when inserting the plug-in.

NOTE

Approximate net instrument weight, 3.25 lbs.
Maximum power requirement at 120 V, 43 VA.

2088-110

Fig. SI 5010-1. Connector rear view.