-TM 11-6625-2517-14

TECHNICAL MANUAL
No. 11–6625–2517–14

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D. C., *3 April 1972*

OPERATOR'S, ORGANIZATIONAL, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE MANUAL INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST (INCLUDING DEPOT MAINTENANCE REPAIR PARTS AND SPECIAL TOOLS) FOR DUAL TRACE PLUG-IN UNIT TYPE 1A2

Current as of 12 February 1974

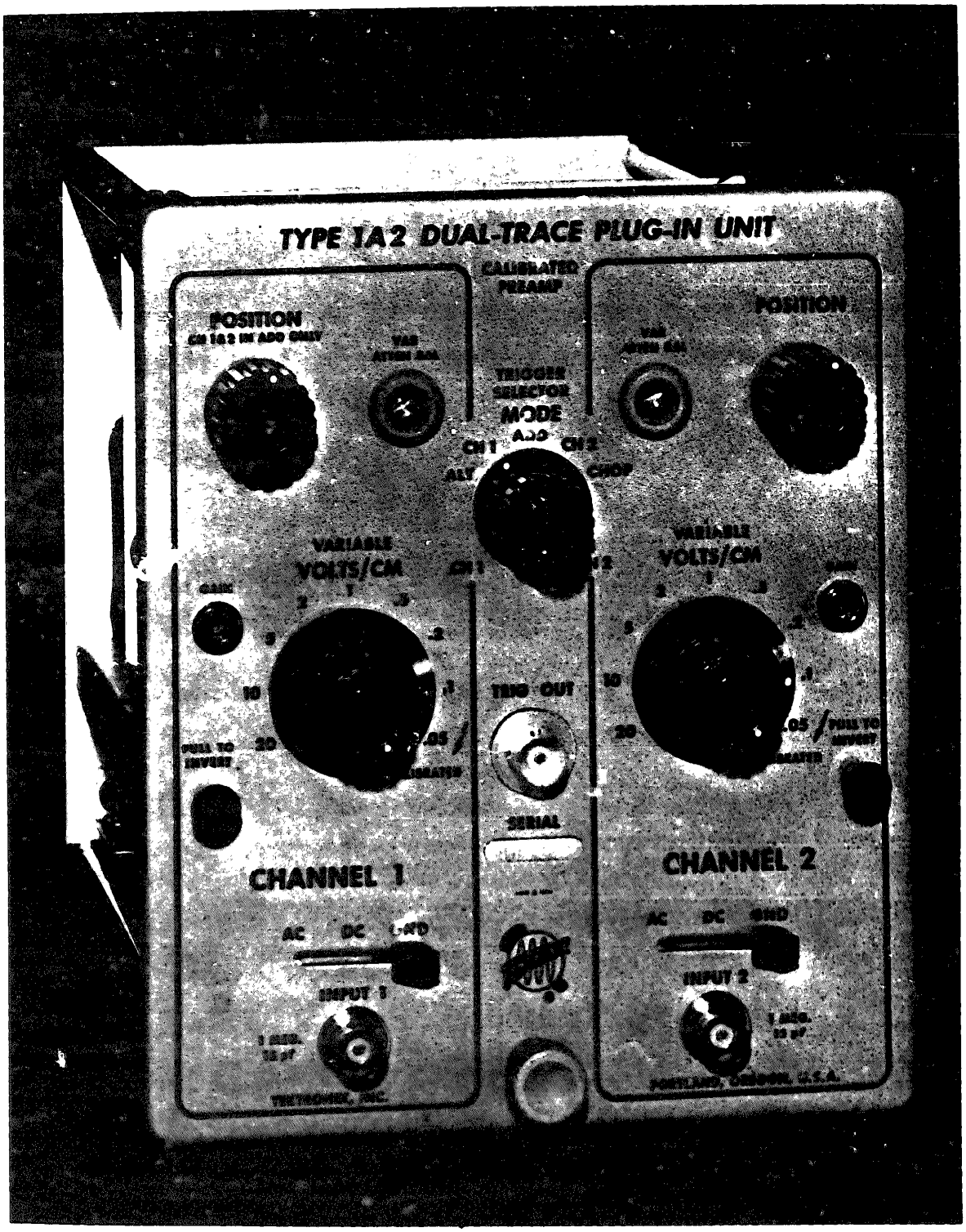

Figure 1-1. Dual Trace Plug-in Unit Type 1A2.

CHAPTER A

INTRODUCTION

A-1. SCOPE.

a. This manual describes Tektronic Type 1A2 Dual-Trace Plug-in Unit and covers its installation, operation, and organizational, direct and general support maintenance.

b. Throughout this manual, where appropriate, references are made to other publications which contain information applicable to the operation and maintenance of the Type 1A2 Dual-Trace Plug-in Unit. A complete listing of applicable reference publications is provided in appendix A.

c. The maintenance allocation chart appears in appendix B, and the repair parts and special tools list (RPSTL) appears in appendix C.

A-2. INDEX OF PUBLICATIONS.

a. DA PAM 310-4. Refer to the latest issue of DA PAM 310-4 todetermine whether there are new editions, changes, or additional publications pertaining to the equipment.

b. DA PAM 310-7, Refer to DA PAM 310-7 to determine whether there are modification work orders (MWO's) pertaining to the equipment.

A-3. FORMS AND RECORDS.

a. Report of Maintenance and Unsatisfactory Equipment, Use equipment forms and records in accordance with instructions in TM 38-750.

b. Report of Packaging and Handling Deficiencies. Fill out and forward DD Form 6 (Report of Packaging and Handling Deficiencies) as prescribed in AR 700-58 (Army)/ NAVSUP PUB 378 (Navy)/AFR 71-4 (Air Force)/ and MCO P4030.29 (Marine Corps).

c. Discrepancy in Shipment Report IDISREP) (SF361). Fill out and forward Discrepancy in Shipment Report (DISREP) (SF361) as prescribed in AR 55-38 (Army)/ NAVSUP PUB 459 (Navy)/ AFM 75-34 (Air Force)/ and MCO P4610.19 (Marine Corps).

d. Reporting of Equipment Manual Improvements. The reporting of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to Publications) and forwarded direct to Commanding General, U. S. Army Electronics Command, ATTN: AMSEL-MA-CT, Fort Monmouth, N. J. 07703.

A-4. ADMINISTRATIVE STORAGE.

For procedure, forms and records, and inspection required during administrative storage of this equipment, refer to TM 740-90-1.

This technical manual is an authentication of the manufacturer' s commercial literature and does not conform with the format and content specified in AR 310-3, Military Publications. This technical manual does, however, contain available information that is essential to the operation and maintenance of the equipment,

CHAPTER 1

CHARACTERISTICS

Introduction

The Type 1A2 Dual-Trace Plug-In Unit contains two identical fast-rise calibrated preamplifier channels. Either channel can be used independently, or electronically switched to produce dual-trace displays. In addition, both channels can be combined at the output, adding or subtracting according to the settings of the polarity switches.

Each channel has its own input coupling, attenuator, gain, polarity and position controls which allows each display to be adjusted independently for optimum viewing.

There are two modes of dual-trace operation: Chopped or Alternate. In the chopped mode, an internal multivibrator switches the channels at a free-running rate of about 220 kHz. In the alternate mode, the oscilloscope time-base generator internally switches the channels at the end of each sweep during the retrace interval.

The Type 1A2 can be used with any of the Tektronix 530-, 540-, or 550-series Oscilloscopes. it can also be used with the 580-series Oscilloscopes in conjunction with the Type 81 or 81A Plug-In Adapter. The Type 1A2 can also be used with other oscilloscopes and devices through the use of the Type 127, 132, or 133 Plug-In Power Supplies.

CALIBRATED PREAMPLIFIER

Characteristic	Performance Requirement	Supplemental Information
Deflection Factor	05 volts/cm to 20 volts/cm in 9 calibrated steps for each channel	Steps in 1-2-5 sequence
Deflection Accuracy	Within ±3% of indicated deflection with VARIABLE control fully clockwise	With gain correct at .05 V/cm
Variable Deflection Factor	Uncalibrated deflection factor at least 2.5 times the VOLTS/CM switch indication. This permits continuous (uncalibrated) adjustment from 0.05 volts/cm to at least 50 volts/cm	
Bandwidth (not more than 3 dB down): Type 1A2 with Tektronix oscilloscope;		
544, 546, or 547	DC to 50 MHz	
581, 581A, 585, 585A	DC to 50 MHz with Type 81A Plug-In Adapter	DC to 33 MHz with Type 81 Plug-in Adapter
541, 541A, 543, 543A, 545, 545A, 545B, or 555	DC to 33 MHz	
551	DC to 27 MHz	
531, 531A, 533, 533A, 535, or 535A	DC to 15 MHz	
536	DC to 11 MHz	
Risetime: Type 1A2 with Tektronix oscilloscopes;		
544, 546, or 547	7 ns	
581, 581A, 585, 585A	7 ns with Type 81A Plug-In Adapter	11 ns with Type 81 Plug-In Adapter
541, 541A, 543, 543A, 545. 545A, 545B, or 555	11 ns	
551	13 ns	
531, 531A, 533, 533A, 535, or 535A	24 ns	
536	32 ns	
Input RC Characteristics		Typically 1 MΩ parallel with approximately 15 pF
Maximum Input Voltage		600 volts combined DC and peak AC; 600 volts peak-to-peak AC
Input Coupling Modes	AC or DC, selected by front-panel switch	GND, disconnects signal and grounds amplifier input

Characteristic	Performance Requirement	Supplemental Information
AC Low-Frequency Response		Typically 3 dB down at 2 Hz direct; 0 2 Hz with 10× probe
Display Modes	Channel 1 only Channel 2 only Dual-trace, alternate between channels. Dual-trace, chopped between channels. Added algebraically	
Chopped Repetition Rate	220 kHz ±20% rate to show successive 2 μs segments of each trace	
Common Mode Rejection Ratio	20 1 for common-mode signals up to 10 cm in amplitude	With optimum GAIN adjustment for both channels
Polarity Inversion	Signal on either Channel 1 or 2 can be inverted	
Output Trigger[1]		Measured at TRIG OUT connector
Output Trigger Voltage	Approximately 0 5 V/cm or gain of 10	VOLTS/CM at .05
Bandwidth	Low-Frequency 3 dB down is about 10 Hz when output of the amplifier is working into 1 MΩ; High-Frequency 3 dB down is amplitude dependent and shown in the graph of Fig. 1-2	
Output Coupling	AC	

[1]Applies only to instruments with a serial number of 716 or higher.

ACCESSORIES

Standard accessories supplied with this instrument will be found in the Mechanical Parts List. For optional accessories, see the current Tektronix, Inc catalog

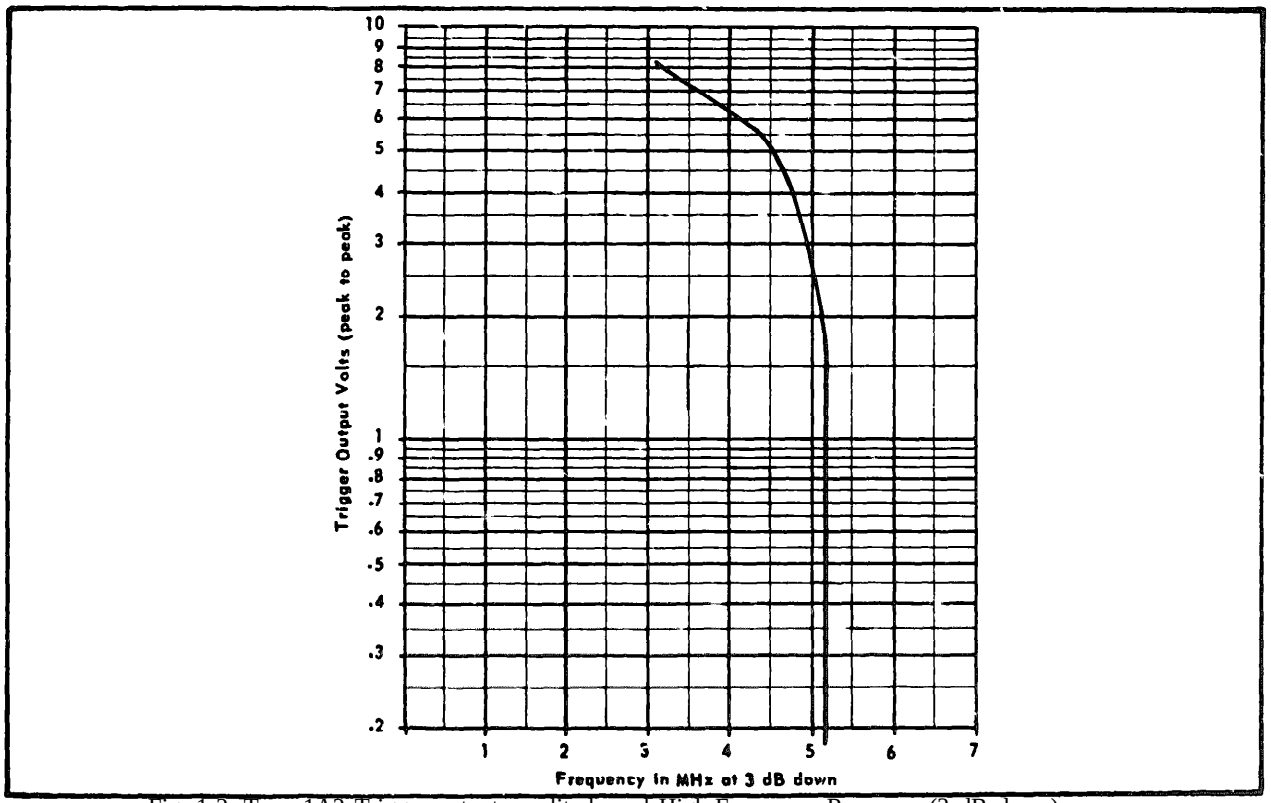

Fig. 1-2. Type 1A2 Trigger output amplitude and High-Frequency Response (3 dB down)

CHAPTER 2

OPERATING INSTRUCTIONS

FUNCTIONS OF FRONT PANEL CONTROLS

The functions of all controls, adjustments and connectors except the MODE and TRIGGER SELECTOR switches are identical for both channels

POSITION	Positions the trace vertically on the CRT Only the Channel 1 POSITION controls position in the ADD mode
PULL TO INVERT	A two-position switch that presents the display in a normal or Inverted polarity with respect to the applied signal
GAIN	A screwdriver adjustment that calibrates the basic deflection factor of the channel
VAR ATTEN BAL	A screwdriver adjustment for setting the amplifier DC levels so the trace does not shift position under no-signal conditions as the VARIABLE VOLTS/CM control is turned
MODE	A five-position switch that sets the mode of operation as follows ALT-Dual-trace alternate mode of operation (triggered electronic switching between channels during the beam retrace Interval) CH 1 -Selects the use of Channel 1 only ADD -Permits adding the outputs of the two channels algebraically CH 2 -Selects the use of Channel 2 only CHOP-Dual-trace chopped mode of operation (free-running electronic switching of channels at about a 220-kHz rate)
VOLTS/CM	Nine-position switch to select the calibrated vertical-deflection factors
VARIABLE	Provides overlapping variable uncalibrated attenuation between the calibrated deflection factors and extends the attenuation range to about 50 V/CM
AC-DC-GND	Three-position switch to provide either AC- or DC-coupled input into the amplifier A third position (GND) connects the amplifier input to ground without grounding the input signal
TRIGGER SELECTOR	Determines whether the Channel 1 or Channel 2 slgnal is applied to the Trigger Amplifier
TRIG OUT	Output signal of the Trigger Amplifier Permlts the use of Channel 1 or 2 as on external trigger source

FIRST TIME OPERATION

The following procedure will help you become familiar with the Type 1A2 operation

1 insert the Type 1A2 into the oscilloscope, tighten the securing rod and turn on the oscilloscope power.

2 Allow about 2 to 3 minutes warm-up time and free run the oscilloscope sweep at 0.5 sec/cm.

3 Set the applicable Type 1A2 front-panel controls for both channels as follows

AC-DC-GND	DC
VOLTS/CM	05
VARIABLE	CALIBRATED
FULL TO INVERT	Pushed in
POSITION	Centered
MODE	CH 1
TRIGGER SELECTOR'	CH 1

4 Position the trace about one centimeter above the graticule centerline with the Channel 1 POSITION control.

5 Place the MODE switch to CH 2 and position the trace one centimeter below the graticule center line with the Channel 2 POSITION control

6 Place the MODE switch to ALT Both Channel 1 and 2 traces should be displayed

7 Set the oscilloscope Time/Cm switch to 50 msec Note that for each sweep cycle one channel is displayed and the other is shut off. Electronic switching from one channel to the other occurs during the retrace Interval

8 Set the MODE switch to CHOP Notice that both traces seem to start simultaneously and continue across the CRT.

9 Set the oscilloscope Time/Cm switch to 5 usec and adjust the oscilloscope trigger controls to obtain a stable display Notice that each trace is composed of many short-duration bits or segments with visible switching transients existing between channels (see Fig. 2-1A).

10 To see the chopped-mode switching action clearly, Increase the sweep rate to 1 usec/cm Notice that Channels 1 and 2 are alternately on and off at about 2 us intervals. (See Fig 2-1B) Chopping rate is determined by the free-running multivibrator switching rate and is about 220 kHz.

11 Blank out the switching transients between channels by setting the CRT Cathode Selector switch (located on the rear panel of most Tektronix oscilloscopes) to the Dual-Trace Chopped Blanking position (see Fig 2-1C)

12 Set the oscilloscope Time/Cm switch to 0.5 msec Using coaxial cables, a T connector connected to Channel 1 and a connector adapter (if needed), apply 0.1 volt from the oscilloscope Amplitude Calibrator to the Channel 1 and 2 input connectors

13 Set the trigger controls for + internal (plug-in) triggering or connect a jumper coaxial cable from the TRIG OUT connector* to the oscilloscope Trigger Input connector and

[1]Applies only to instruments with a serial number of 716 or higher.

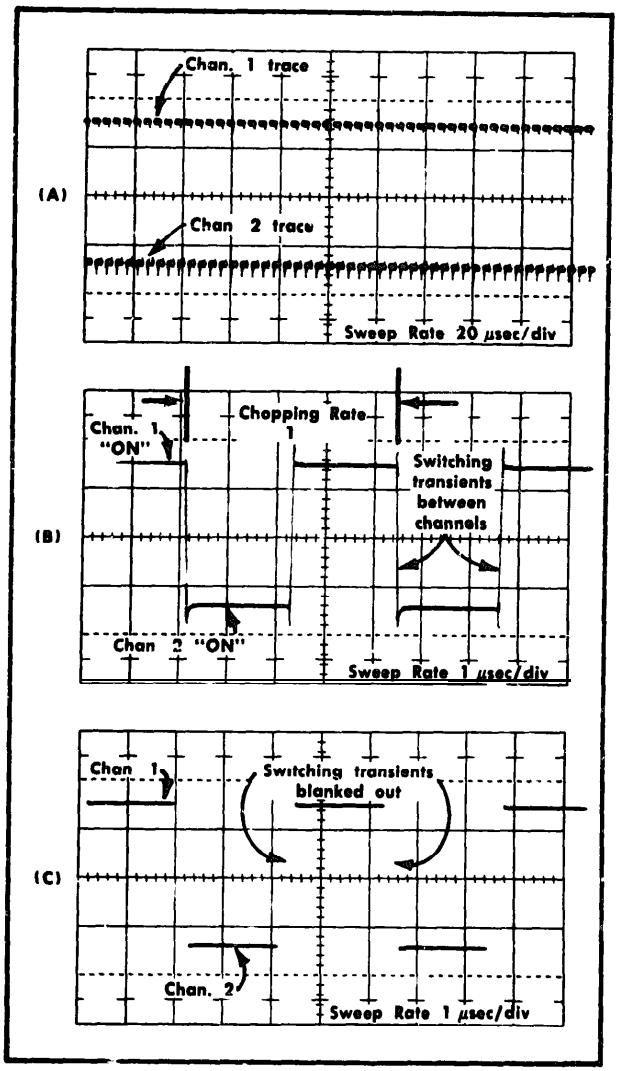

Fig. 2-1. Chopped-mode waveforms (A) trace broken up Into segments, (B) chopped-mode switching action from channel to channel, and (C) switching transients blanked out

set the trigger controls for + external triggering. Both Channel 1 and 2 should display the calibrator waveform Each waveform should be 2 cm in amplitude.

NOTE

If the waveforms are not exactly 2 cm in amplitude, overlook the inaccuracy until completing this operating procedure. Subsequent paragraphs describe how to properly set the gain of the unit.

14. Set the MODE switch to ADD There should be one waveform display 4 cm in amplitude. This is the addition of the Channel 1 and 2 signals (2 cm each) Notice that only the Channel 1 POSITION control will move the display vertically.

15. Pull out the Channel 1 PULL TO INVERT switch and free run the time base The display should be a straight line, indicating the algebraic difference between the two signals Since both signals have equal amplitudes and waveshape, the difference is zero,

NOTE

If the display is not a straight line, this indicates that the gains of the channels are not matched, This may he overlooked until this operating procedure is completed. Subsequent paragraphs, describe how to properly set the gain of such channel.

Before the Type 1A2 is used for accurate measurements, the GAIN and VAR ATTEN BAL for each channel should be adjusted. These adjustments are described in the following paragraphs

Gain Adjustments

The gain adjustments should be checked periodically to assure correct vertical deflectron factors, particularly when the Type 1A2 is used for the first time or is moved from one oscilloscope to another. Use the following procedure to check the gain of each channel:

1. Set the applicable Type 1A2 front-panel controls for both channels as follows-

AC-DC-GND	DC
VOLTS/CM	05
PULL TO INVERT	Pushed in
POSITION	Centered
VARIABLE	CALIBRATED
MODE	CH 1
TRIGGER SELECTOR	CH 1

2 Set the oscilloscope sweep rote and triggering controls for a 0.1 msec/cm free-running sweep

3. Apply a 0.2-volt peak-to-peak signal from the oscilloscope calibrator through a coaxial cable to the Channel 1 Input connector

NOTE

For maximum accuracy use a calibrator signal source which has an amplitude accuracy of better than 3%.

4 The resulting display should be exactly 4 cm in amplitude If not, set the Channel 1 GAIN for the correct waveform amplitude. (Use the Channel 1 POSITION control to align the display with the graticule markings)

5. Set the MODE switch to CH 2 and apply the calibrator signal to the Channel 2 input connector.

6 The display should be exactly 4 cm in amplitude lf not, adjust the Channel 2 GAIN control for the proper display amplitude Use the Channel 2 POSITION control to align the display with the graticule markings

7 Disconnect the calibrator signal

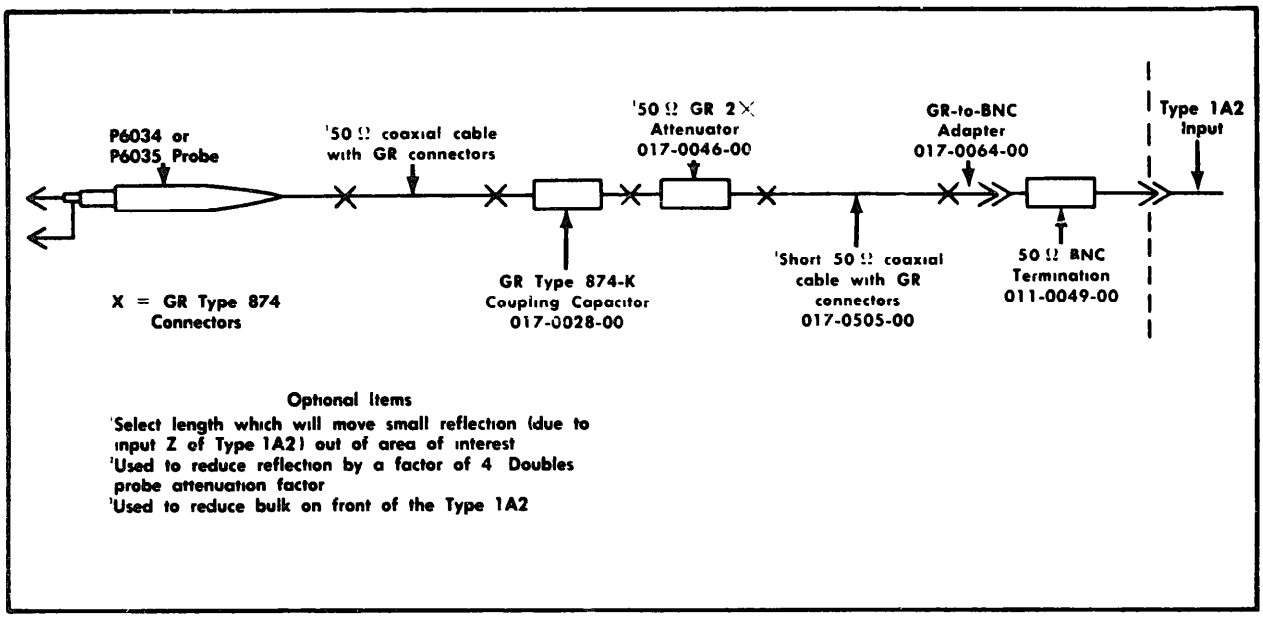

Figure 2-2. Using the P6034 or P6035 Probe with the Type 1A2

Variable Attenuator Balance Adjustments

If the VAR ATTEN BAL control of a channel is not properly set, the position of a no-signal free-running trace will shift vertically as the VARIABLE control is turned If there is a trace shift, set the VAR ATTEN BAL adjustment for each channel as follows

1 Set the Type 1A2 front-panel controls to the same positions as in the Gain Adjustments procedure except the AC-DC-GND switch must be set to GND and the MODE switch to ALT

2. Carefully adjust the Channel 1 VAR ATTEN BAL control to a point where there is no trace shift as the Channel 1 VARIABLE control is turned back and forth through its full range

3. Carefully adjust the Channel 2 VAR ATTEN BAL control to a point where there is no trace shift as the Channel 2 VARIABLE control is turned back and forth through its full range

4. Due to interaction between channels, repeat steps 2 and 3 until there is no further interaction

GENERAL OPERATION

Either of the two channels of the Type 1A2 can be used independently by setting the MODE switch to CH 1 or CH 2 and connecting the signal to be observed to the appropriate input Table 2-1 lists several input systems compatible with the Type 1A2 input Fig 2-2 shows a block diagram of the input when using the system outlined in Method 7 of Table 2-1 Figure 2-3 shows the X and R curves for the Type 1A2

Use of Probes

A conventional passive attenuator probe with a standard 42-inch cable lessens both capacitive and resistive loading, but at the same time reduces sensitivity The attenuation introduced by the probe permits measurement of signal voltages that would overscan the CRT it applied directly to the Type 1A2. However, in applying high-amplitude signal voltages to either the probe or Type 1A2, do not exceed their maximum voltage ratings When making amplitude measurements with an attenuator probe, be sure to multiply the observed amplitude by the probe attenuation factor.

To assure the accuracy of pulse or high-frequency measurements, check the probe compensation To make the adjustment, proceed as follows

1 Set the oscilloscope Amplitude Calibrator for a calibrator output signal of suitable amplitude (at least 2 cm)

2. Place the MODE switch to the appropriate channel setting (CH 1 or CH 2) to be used with the probe

3 Touch the probe tip to the calibrator output connector and adjust the oscilloscope controls to display several cycles of the waveform

4 Adjust the probe compensation for best square-wave response as shown in the right-hand picture of Fig 2-4

NOTE

If a square-wave source other than the oscilloscope calibrator is used for compensating the probe, do not use a repetition rate higher than 5 kHz. At higher repetition rates, the waveform amplitude appears to change as the probe is compensated. Thus, proper compensation is difficult. If the probe remains improperly compensated, measurements will be inaccurate.

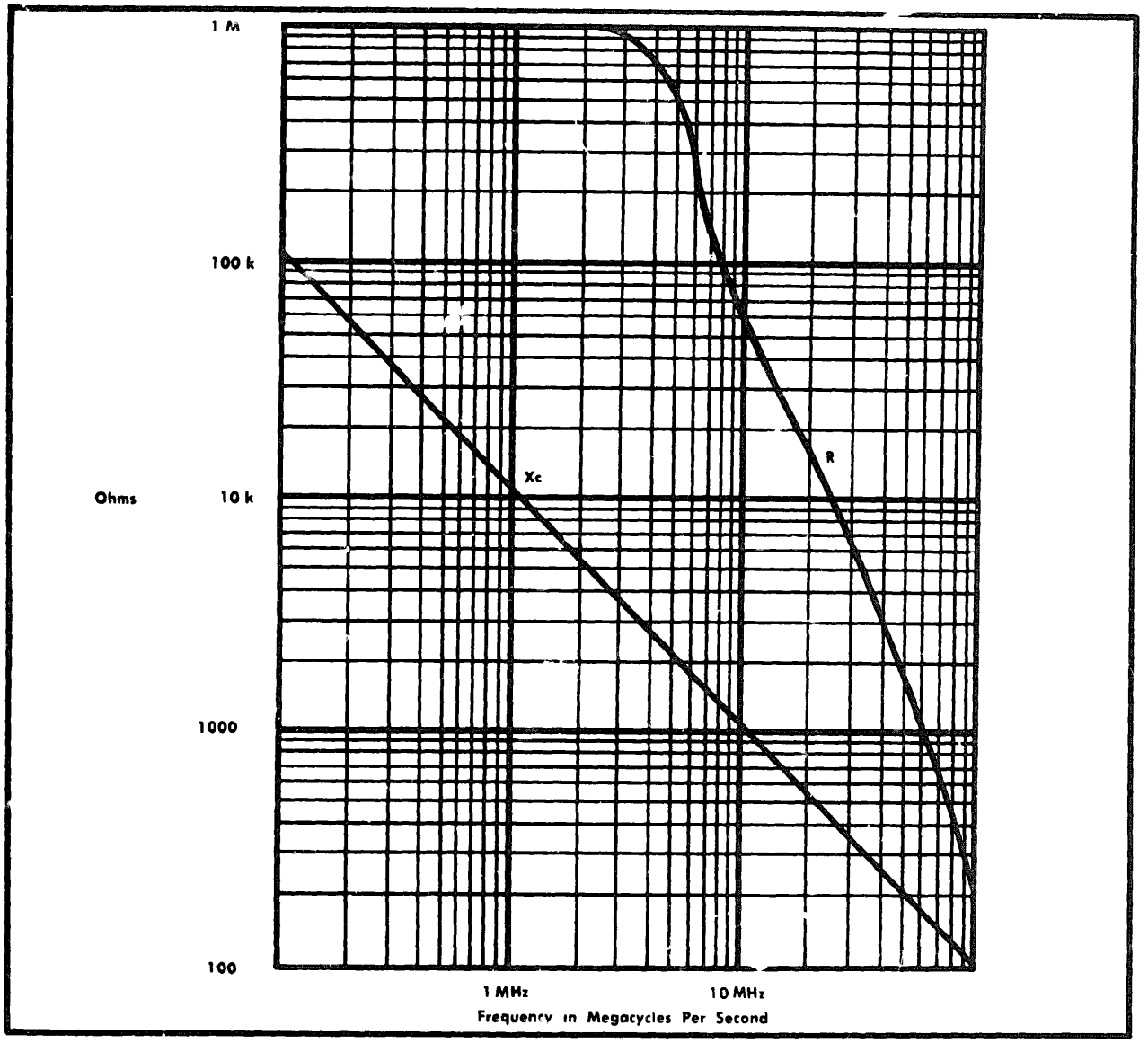

Figure 2-3. Type 1A2 nominal input resistance and capacitive reactance vs frequency at any position of the VOLTS/CM switch.

AC-DC-GND Switch

To display both the DC and AC components of an applied signal, set the AC-DC-GND switch to DC, to display only the AC component of a signal, set the AC-DC-GND switch to AC

In the AC position of the switch, the DC component of the signal is blocked by a capacitor in the input circuit The input time constant of the input circuit is about 0.1 second and the low-frequency response of the unit is down 3 dB at about 2 Hz If a 10X attenuator probe is used with the Type 1A2, the low-frequency response will be extended to about 0.2 Hz with a 100X probe, low-frequency response is about 2 Hz

Placing the AC-DC-GND switch to the GND position grounds the input circuit of the Type 1A2 to provide a DC zero reference When the AC-DC-GND switch is set to GND the switch internally disconnects but does not ground the applied signal at the input connector The GND position of the switch eliminates the need for externally grounding the input of the unit or probe tip to establish the ground reference

VOLTS/CM Switch and VARIABLE Control

The amount of vertical deflection produced by a signal is determined by the signal amplitude, the attenuation factor (if any) of the probe, the setting of the VOLTS/CM switch and the setting of the VARIABLE control Calibrated deflection factors indicated by the settings of the VOLTS/CM switch apply only when the VARIABLE control is set to the CALIBRATED position Errors in display measurements may result

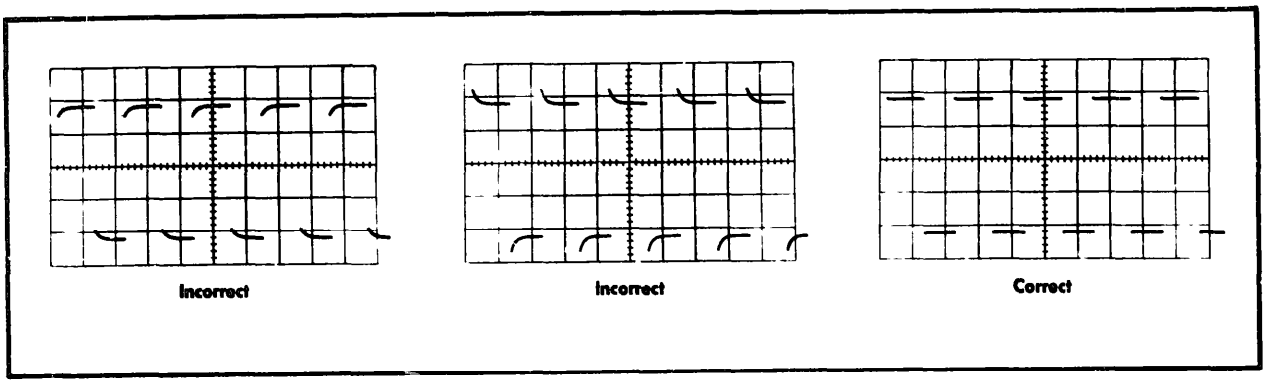

Fig. 2-4. Probe compensation waveform using 1-kHz calibrator signals.

if the setting of this control is moved away from the CALIBRATED position.

The range of the VARIABLE control is at least 2.5 to 1 to provide continuously variable (uncalibrated) vertical deflection factors between all calibrated settings of the VOLTS/CM switch. When the control is turned to its maximum-counterclockwise position and the VOLTS/CM switch is set to 20, the VARIABLE control extends the vertical deflection factor to about 50 volts/cm. By applying the oscilloscope calibrator voltage or any other calibrated voltage source to the Type 1A2, any specific deflection factor can be set within the range of the VARIABLE control

PULL TO INVERT Switch

The PULL TO INVERT switch may be used to invert the displayed waveform, particularly when using the dual-trace feature of the Type 1A2. The PULL TO INVERT switch has two positions With the knob pushed in, the displayed waveform will have the same polarity as the applied signal; that is a positive-going pulse applied to the Type 1A2 will be displayed as a positive-going waveform on the CRT. If a positive voltage is DC coupled to the Type 1A2, the beam will move up

With the switch pulled the displayed waveform will be inverted; that is, a positive-going pulse applied to the Type 1A2 will be inverted or displayed as a negative-going waveform on the CRT. If a positive voltage is DC coupled to the Type 1A2, the beam will move down.

MODE Switch

The MODE switch has five positions: ALT, CH 1, ADD, CH 2, and CHOP. These positions and their purposes are described in subsequent paragraphs. Useful triggering information is included in the description of the ALT and CHOP switch positions.

CH 1, CH 2 - Single Channel Operation

To display a single signal (single-channel operation), apply the signal either to the Channel 1 or Channel 2 Input connector and set the MODE switch to the corresponding position: CH 1 (Channel 1) or CH 2 (Channel 2).

To display a signal in one channel Independently when the same signal or a different signal is applied to the other channel, simply select the signal in the channel to be displayed by setting the MODE switch to the appropriate CH 1 or CH 2 position.

ALT, CHOP - Dual Trace Operation

To display two signals together (dual-trace operation), apply one signal to the INPUT 1 connector and apply the other signal to the INPUT 2 connector.

In general, use the CHOP position (chopped-mode operation) with sweep rates of 50 usec/cm or slower for displaying two non-repetitive signals occurring within the sweep-time Interval set by the oscilloscope Time/Cm switch Non-repetitive signals are those signals which are transient or random. The CHOP position is also useful for displaying low-frequency synchronous signals Synchronous signals are those which have the same repetition rate or are frequency-related by whole number multiple.

NOTE

When using chopped-mode operation, be sure to set the oscilloscope CRT Cathode Selector switch to the Dual-Trace Chopped Blanking position to blank out the undesirable chopped-mode switching transients.

Use the ALT position (alternate-mode operation) when using sweep rates at about 0.5 ms/cm or faster to display high-frequency synchronous and asynchronous signals. Asynchronous signals are those which do not have the same repetition rate or are not frequency related to each other by a whole number multiple. Table 2-2 summarizes the following discussion for dual-trace operation.

Displaying two Non-rep**e**titive or Low-Frequency (**Below 2** kHz Synchronous Signals. To show true time and phase relationship between two non-repetitive or low-frequency synchronous signals, use chopped-mode operation. Transients as short as 0.5 ms can be well delineated or resolved. At 50 us/cm a 0.5 ms duration transient, for example, will contain about 200 on segments in the trace. If a higher sweep rate is used, the number of segments that make up each of the traces will be less and therefore resolution will be poorer

To make the low frequency or non-repetitive display stable, use either Internal triggering on Channel 1 or 2 (from pin 5 of interconnecting plug-see Block Diagram in Section 10) or use the TRIG OUT connector as the external trigger source If there is no Plug-In position on the oscilloscope Trigger Source switch, use the signal available at the TRIG OUT connector of the Type 1A2 by connecting a lumper coaxial cable from the TRIG OUT connector to the oscilloscope Trigger Input connector and setting the Triggering Source switch to Ext.

Type 1A2's below SN716 do not hove the Plug-In triggering capability

NOTE

Use the oscilloscope Plug-In position of the Triggering Source switch in preference to external patching to obtain optimum bandwidth capabilities from the Trigger Output Amplifier.

Do not set the oscilloscope Triggering Source switch to Norm Int or Int (oscilloscope vertical amplifier trigger takeoff signal) because a stable display is difficult and sometimes impossible to obtain During dual-trace chopped-mode operation the Norm Int or Int trigger source is a composite signal consisting of the signals applied to both channels superimposed on, but not synchronized with, the free-running rate of the chopped-mode switching signal. The switching signal has a square waveshape the same as the one shown in Fig 2-1B. Its amplitude is dependent on the distance that the truces are positioned apart and the amount of DC component contained in the applied signals; Its rote is the chopping rate (about 220 kHz).

Since the internal trigger from the oscilloscope vertical amplifier is a composite trigger during chopped mode of operation, and the trigger contains a nonsynchronized chopped-mode switching signal, Internal triggering may occur first on one of the applied signals and then on the chopped-mode switching signal, or vice versa, resulting in an unstable display

TABLE 2-1
Signal Coupling Methods

Method	Advantages	Limitations	Accessories Required	Source Loading See Fig. 2-3 Input R and X_c Curves	Precautions
1. Open test unshielded) leads	Simplicity	Limited frequency response, subject to stray pickup	BNC to Banana Jack adapter (103-0003-00) Two test leads	1 Meg Ω and 15 pF at input, plus test leads	Stray pickup and spurious oscillations
2. Unterminated coaxial cable	Full Sensitivity	Limited frequency response. High capacitance of cable	Coaxial cable with BNC connector(s)	1 Meg Ω and 15 pF plus cable capacitance	High capacitive loading
3. Terminated coaxial cable Termination at Type 1A2 input	Full sensitivity. Full Type 1A2/Oscilloscope bandwidth Relatively flat resistive loading Long cable with uniform response.	Presents R_o (typically 50 Ω) loading at end of coaxial. May need blocking capacitor to prevent DC loading or damage to termination.	Coaxial cable with BNC connectors R_o termination at Type 1A2 input (BNC 50 Ω Termination, 011-0049-00	R_o plus 15 pF at Type 1A2 end of coaxial can cause reflections	Reflection from 15 pF at input DC and AC loading on test point Power limit of termination
4. Same as 3, with coaxial attenuator at termination	Less reflection from 15 pF at termination	Sensitivity is reduced (increased Deflection Factor)	BNC Coaxial attenuators	R_o only	DC and AC loading on test point Power limit of attenuator.
5. Tap into terminated coaxial system (BNC Tee: UG-274/U at Type 1A2 input).	Permits signal to go to normal load DC or AC coupling without coaxial attenuators	15 pF load at tap point	BNC Tee and BNC connectors on signal cables	1 Meg Ω and 15 pF at tap point	Reflections from 15 pF input
6. 10×, 10 MΩ Probe 10×, 10 MΩ Probe 1000×, 100 MΩ Probe	Reduce resistive and capacitive loading, nearly full Type 1A2/Oscilloscope bandwidth.	×0 1 sensitivity ×0 01 sensitivity ×0 001 sensitivity	P6006, P6008 are 10×; P6007, P6009 are 100×, P6015 is 1000×	P6006[2] ≈7 pF, 10 MΩ P6007 Less than 2 pF, 10 MΩ P6008 ≈7 5 pF, 10 MΩ P6009 ≈2 5 pF, 10 MΩ P6015 ≈ 2 7 pF, 100 MΩ.	Check probe frequency compensation Use square-wave frequency less than 5 kHz, preferably 1 kHz.

[2]P6006 Probe has less input capacitance than P6008, but P6008 has wider bandwidth.

TABLE 2-1 (cont)

Method	Advantages	limitations	Accessories Required	Source loading See Fig. 2-3 Input R and Xc Curves	Precautions
7. 500 Ohms and 5 kilohms Probes (Must be terminated in 50 Ohm at Type 1A2 input.)	Reduced capacitive loading to about 0.7 pF Bandwidth that of Type 1A2/ Oscilloscope Probe compensation need not be adjusted, since effect is not apparent when used with the Type 1A2/Oscilloscope	Resistive loading X0.1 or X0.01 sensitivity May need blocking capacitor to prevent DC loading or damage to termination Limited low frequency response when AC coupled: 70 kHz for P6034 7 kHz for P6035	P6034 --10X P4035--100x Items in Fig 2-2	P6034: 500 Ohm, 0.7 pF P6035 5 kilohm, 0.6 pF	DC and AC loading. Voltage rating of probe.
8 Current transformer Terminated in 50 Ohm at Type 1A2 Upper Bandwidth that of Type 1A2/ Oscilloscope	Current xfmr can be permanent part of test circuit Less than 3.2 pF to test circuit chassis. Measures signal current in transistor circuits CT-1 20 amps peak CT-2 100 amps peak	RMS current rating- CT-1 0.5 amps CT-2 2.5 amps Sensitivity: CT-1 5 mV/mA CT-2. 1 mV/mA	CT-1 Coaxial adapter and BNC termination CT-2. Nothing extra. (Perhaps additional coaxial cable for either transformer)	CT 1 Insertron; 1 Ohm paralleled by about 5 uH. Up to 1.5 pF. CT-2. Insertion; 0.04 Ohm paralleled by about 5 uH. Up to 2.2 pF.	Not a quick-connect device. CT-1 low frequency limit about 75 kHz CT-2. low frequency limit about 1.2 kHz, and is 1/5th as sensitive as the CT-l.

TABLE 2-2

Dual-Trace Operation

Applied Signals (One to Channel 1 and other to Channel 2)	Type 1A2 MODE Switch Setting	Oscilloscope Triggering Source Switch Setting	Oscilloscope Trigger Coupling Switch Setting	Displays show true time relationship between signals Other remarks
(a) Two non-repetitive signals or two low-frequency synchronous signals (below 2 kHz) Set the TRIGGER SELECTOR switch to the Channel with the reference signal applied.	CHOP	Plug-In[3] or Ext (connect lumper coaxial cable from TRIG OUT connector to Trigger Input connector on the oscilloscope).	AC or AC Slow or AC Fast or AC LF Reject	Yes Use sweep rates up to 50 usec/cm. Higher sweep rates reduce resolution.
(b) Two asynchronous Signals, any frequency within full bandwidth of the system,	ALT	Norm Int or Int[4]	AC or AC Slow for frequencies below 1 kHz. AC Fast or AC LF Reject for frequencies above 1 kHz.	No
(c) Two synchronous signals. 60 Hz and above	ALT	Plug-In[3] or Ext (connect jumper coaxial cable from TRIG OUT connector to Trigger Input connector on the oscilloscope).	AC or AC Slow or AC Fast or AC LF Reject	Yes Set the TRIGGER SELECTOR switch to the Channel with the reference signal applied
		Norm Int or Int4	AC Fast or AC LF Reject	No

[3]Plug-In position is the Trigger Output Amplifier signal available at pin 5 of the Type 1A2 interconnecting plug to the oscilloscope. If your oscilloscope is not wired to permit use of this trigger source, use the Ext position and the TRIG OUT signal.

[4]Norm Int or Int switch position is the internal trigger takeoff signal from Ho oscilloscope vertical amplifier. In dual-trace operation this trigger is a composite of the applied signal superimposed on the DC positioning levels of the channels as they are switched.

Displaying Two Asynchronous Signals. To obtain a stable display of two asynchronous signals which do not exceed the system bandwidth, use alternate-mode operation and set the oscilloscope Trigger Source switch to Norm Int or Int. Set the oscilloscope Trigger Coupling switch to AC for stable triggering on signals below 1 kHz, set the Trigger

Coupling switch to AC LF Reject or AC Fast for stable triggering and a bright display of signals above 1 kHz. Since the oscilloscope vertical amplifier internal trigger is the trigger source, the applied signals will not be displayed in their true time relationship because triggering occurs on the applied signal in each channel as it switches on

To obtain a stable display in this mode of operation, it is very important to set the oscilloscope Triggering Level control to a point where the time base can trigger on the signal in one channel as it turns on, and on the signal in the other channel when it turns on In addition, both applied signals must be of sufficient amplitude to, meet the Internal trigger signal amplitude requirements of the oscilloscope

If one displayed signal has a smaller amplitude than the other but is of adequate amplitude for internal triggering, then set the Triggering level control to a point that will assure triggering on the smaller amplitude signal To do this, set the Triggering Level control near the zero position

Though it may seem easy to obtain stable triggering on asynchronous signals, there are certain conditions that may promote jitter When using the AC Fast or AC LF Reject triggering mode, jitter most likely occurs when attempting to trigger on high-frequency asynchronous signals that ore vertically positioned apart on the CRT with POSITION controls if jitter occurs, it con be reduced and sometimes eliminated by positioning the displays close together or superimposing them This not only reduces jitter but may also increase the display brightness

If you use the AC or AC Slow triggering mode, stable internal triggering on asynchronous signals above 1 kHz is more difficult to obtain and the jitter will be greater If you are using sweep rates foster than 0.5 ms/cm, the dual-trace display becomes noticeably brighter as the waveforms are vertically positioned together and dimmer when they are positioned apart These effects are normal and are caused by the problem of triggering on the alternate-mode composite trigger waveform The waveform is very similar to the one described for chopped-mode operation

The alternate-mode composite trigger consists of the asynchronous signals applied to the Type 1A2 superimposed on the DC positioning and signal levels of the alternate-mode switching waveform The switching waveform portion of the composite trigger is a low-frequency square wove whose amplitude is governed by the setting of the POSITION controls and DC components (If any) of the applied signals By itself, the switching waveform viewed on a test oscilloscope resembles the waveshape shown in Fig 2-1B when the traces ore positioned two centimeters apart Repetition rate of the switching waveform is one-half the sweep repetition rate

When the alternate-mode composite trigger is internally AC coupled to the oscilloscope trigger input circuit, the trigger circuit may not respond instantly to the signals superimposed on the alternate-mode switching signal The delay is caused by the recovery time of the trigger input circuit as each cycle of the low-frequency switching waveform couples into the input stage of the trigger circuit Since AC coupling is used in all the Trigger Coupling switch positions (AC AC Slow, AC Fast, AC LF Reject) recovery time is dependent on the RC time constant of the trigger input circuit

In conclusion, trigger circuit recovery time is shorter, hence the sweep repetition rate can be higher and the display brighter, if AC Fast or AC LF Reject triggering mode is used In either of these triggering modes, a smaller value coupling capacitor is used in the oscilloscope trigger input circuit as compared to the value used in the AC or AC Slow triggering mode Trigger recovery time ran be shortened and triggering will be more stable if high-frequency waveform displays are vertically positioned closer together or superimposed rather than positioned further apart

Displaying Two Synchronous Signals, 60 Hz and Above. To show true time and phase relationship between two synchronous signals, 60 Hz and above, use alternate mode operation and trigger externally from one of the signals In practice, for displaying signals between 60 Hz and 2 kHz you can choose either alternate- or chopped-mode operation since this is an overlapping area Set the Trigger Coupling switch to the desired AC position (AC, AC Slow, AC Fast or AC LF Reject) Apply the reference signal to the external trigger input and set the oscilloscope Trigger Source switch to the Ext position in high-frequency applications Set the TRIGGER SELECTOR switch to the channel with the reference signal and set the oscilloscope Triggering Source to the Plug-In position If your oscilloscope does not have the Plug-In switch position, apply the signal from the TRIG OUT connector to the oscilloscope Trigger Input connector and set the Triggering Source switch to Ext

When externally triggering the oscilloscope, if one of the signals change, frequency one of the signals will remain stationary while the other signal will appear to free run This phenomenon is useful for determining zero-beat points between the two signals

ADD-Algebraic Addition of Two Signals

In many applications, the desired signal is superimposed on an undesired signal such as line frequency hum, etc Algebraic addition makes it possible in many cases to improve the ratio of desired to undersired signal To do this, connect one input to a source containing both the desired and undesired signal Connect the other input to a source containing only the undersired signal Place the MODE switch to the ADD position Set the PULL TO INVERT switches to opposite settings (depending upon the polarity of the desired signal By carefully adjusting (especially at low frequencies) the VARIABLE control of one of the channels, the undesired displayed signal can be reduced by a factor of at least 20 compared to the amplitude of the desired signal In general the input coupling should be the some on both channels

CHAPTER 3

APPLICATIONS

Introduction

This section of the manual describes procedures and techniques for making basic measurements with the Type 1A2 and the associated Tektronix oscilloscope.

No attempt has been made to describe specific applications, since familiarity with the unit enables the operator to apply these techniques to a wide variety of applications

AC Component Voltage Measurements

To measure the AC component of a waveform, the AC-DC-GND switch of the channel you intend to use should be set to the AC position In this position, only the AC components of the input signal are displayed on the CRT [However, when the AC component of the input signal is very low in frequency, use the DC position of the switch)

To make a peak-to-peak voltage measurement of the AC component of a waveform, perform the following steps (Channel 1 is used (as the example).

1 Set the Channel 1 VOLTS/CM switch so that the voltage to be applied to the input connector is no more than about four to six times the setting

2 Apply the signal to the INPUT 1 connector, preferably through a coaxial cable or an attenuator probe.

3 Set the MODE switch to CH 1

4 Set the triggering controls to obtain a stable display and set the sweep rate to display several cycles of the waveform

5 Use the Channel 1 POSITION control to vertically position the waveform to a point on the CRT where the waveform amplitude can be easily determined For example, position the waveform so that the negative peaks coincide with one of the lower graticule lines and one of the positive peaks lies near the graticule vertical centerline (see Fig 3-1)

6 Measure the vertical deflection in centimeters from peak to peak on the waveform Make sure the VARIABLE control is set to the CALIBRATED position

NOTE

in measuring signal amplitudes, the width of the trace may be an appreciable part of the overall measurement. To make the measurement as accurate as possible, measure from one side of the trace (particularly when measuring low-amplitude signals). Notice in Fig. 3-1 that both points (a) and (b) correspond to the bottom side of the trace. The measurement would be just as accurate if points (a) and (b) corresponded to the top side or center of the trace

7 Multiply the peak-to-peak distance measured in step 6 by the setting of the Channel 1 VOLTS/CM switch and the attenuation factor, if any, of the probe

As an example of this method, assume that the peak-to-peak vertical deflection is 4.6 cm using 10X probe with the VOLTS/CM switch set to 0.5 Substituting these values in the following formula

Volts Peak to peak	=	Vertical deflection in cm	×	VOLTS/CM switch setting	×	Probe atten factor

Then:

Volts peak to peak = 4 6 × 0 5 × 10 = 23 volts

Instantaneous Voltage Measurements

To measure the DC level at a given point on a waveform proceed as follows

1. Set the Channel 1 VOLTS/CM switch so that the voltage to be applied to the input connector is not more than about SIX times the switch setting

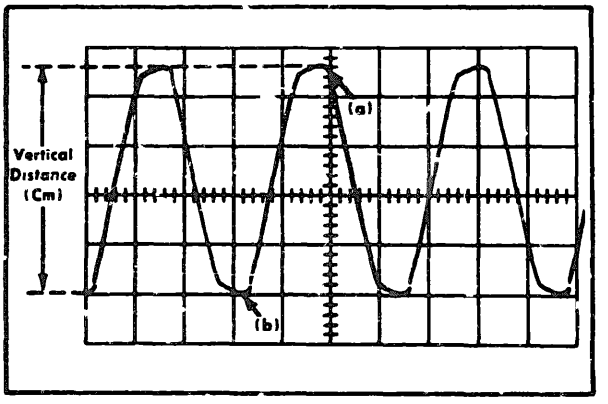

Figure 3-1. Measuring the peak-to-peak voltage of a waveform.

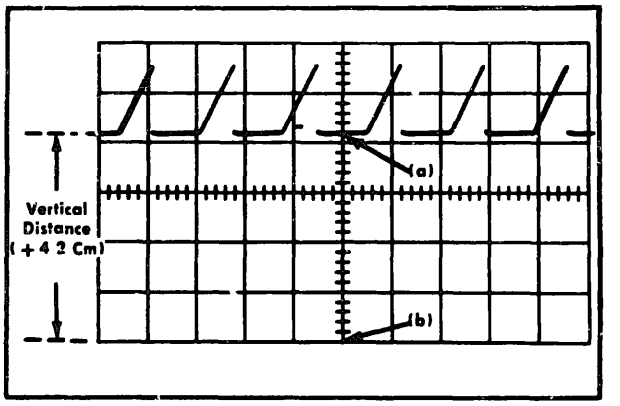

Fig. 3-2. Measuring instantaneous voltage with respect to some reference.

2 Set the oscilloscope triggering and time-base controls so that the time base free runs at the desired rate

3. Set the Channel 1 AC-DC-GND switch to GND and position the trace (with the Channel 1 POSITION control) to one of the horizontal graticule lines such as point (b) in Fig 3-2 This line will be used as a ground (or zero) reference line In any case, the reference line chosen will depend upon the polarity and DC level of the signal to be measured Do not move the Channel 1 POSITION control after the reference line has been established

4 Set the Channel 1 AC-DC-GND switch to DC

NOTE

Any shift in the position of the trace when the AC-DC-GND switch is moved from GND to DC, or vice versa, indicates grid current in the appropriate input Nuvistor (V133 or V233). Maximum trace shift due to grid current is ±2 mm. If the trace shifts more than this amount, replace the faulty Nuvistor.

5. Apply the signal, preferably through a coaxial cable or an attenuator probe, to the Channel 1 Input connector

6. Set the triggering controls of the time base for a stable display

7. Measure the vertical distance in centimeters from the ground (zero) reference line established in step 3 to the pair. on the waveform that you wish to measure, such as between (a) and (b) in Fig 3-2 If the PULL TO INVERT switch is pushed in and the point on the waveform is above the reference line, the polarity is indicated to be positive (+) If the point is below the line, the polarity is negative (-) If the PULL TO INVERT switch is pulled out, the indicated polarities will be reversed.

8. Multiply the measured distance by the setting of the VOLTS/CM switch and the attenuator factor, if any, of the probe This is the Instantaneous DC level of the point measured For example, assume the vertical deflectron is 4.2 cm above the reference line (see Fig. 3-2) using a 10X attenuator probe with the PULL TO INVERT switch pushed in and the VOLTS/CM switch set to 2. Substitute these values in the following formula.

Instantaneous Voltage (with respect to a ground reference) = Vertical Deflection in cm and polarity × VOLTS/CM switch setting × Probe atten factor

Then·

Instantaneous Voltage (with respect to a ground reference) = +4 2 × 2 × 10 = +84 olts

9. To re-establish the (zero) reference line without disconnecting the applied signal, set the AC-DC-GND switch to GND. To establish a reference other than zero, set the AC-DC-GND switch to DC, touch the signal probe to the desired reference voltage and position the free-running sweep along one of the horizontal graticule lines.

Voltage Comparison Measurements

In some applications you may want to establish a set of deflection factors other than those indicated by the VOLTS/CM switch This is useful for comparing signals which are exact multiples of a given voltage amplitude The following procedure describes how to determine deflectron factors for Channel 1 The same basic procedure can be used for Channel 2 To establish a set of deflection factors based upon some specific reference amplitudes, proceed as follows

1 Apply a known-amplitude reference signal to the Channel 1 Input connector and, with the Channel 1 VOLTS/CM switch and VARIABLE control, adjust the amplitude of the display for an exact number of graticule divisions Do not move the VARIABLE control after obtaining the desired deflectton

2 Divide the amplitude of the reference signal (in volts by the product of the deflectron in centimeters (established in step 1) and the VOLTS/CM switch setting The result is the Deflection Convers.on Factor

$$\text{Deflection Conversion Factor} = \frac{\text{Reference signal amplitude in volts}}{\text{(Defle 'ion in cm)} \times \text{(VOLTS/CM switch setting)}}$$

3 To calculate the True Deflectton Factor at any setting of the Channel 1 VOLTS/CM switch, multiply the VOLTS/CM switch setting by the Deflection Conversion Factor obtained in step 2

True Deflection Factor = (VOLTS/CM switch setting) × (Deflection Conversion Factor)

The True Deflectron Factor obtained for any setting of the Channel 1 VOLTS/CM switch applies to Channel 1 only, and only if the VARIABLE control is not moved from the positron to which it was set in step 1

For example, assume the amplitude of the reference signal applied to Channel 1 is 30 volts, the VOLTS/CM switch is set to 5 and the VARIABLE control is adjusted to decrease the amplitude of the display to exactly 4 cm Then substitute the preceding values in the Deflectron Conversion Factor and True Deflectron Factor formulas

$$\text{Deflection Conversion Factor} = \frac{30}{(4) \times (5)} = 1\,5$$

$$\text{True Deflection Factor} = (5) \times (1\,5) = 7\,5 \text{ volts/cm}$$

4 To determine the peak-to-peak amplitude of a signal to be compared, disconnect the reference signal and apply the signal to Channel 1

5 Set the Channel 1 VOLTS/CM switch to a setting that will provide enough deflection so that a measurement can be made

6 Measure the vertical distance in centimeters and determine the amplitude by using the following formula

Signal Amplitude = Deflection Conversion Factor × Deflection in cm × VOLTS/CM switch setting

For example, assume the signal to be compared caused a vertical deflectron of 4.5 cm at a VOLTS/CM switch setting of 10 and the VARIABLE VOLTS/CM control was not moved

from the setting used in the previous example. Then, substitute these values and a Deflection Conversion Factor of 1.5 in the Signal Amplitude formula:

$$\text{Signal Amplitude (in volts)} = (1.5) \times (4.5) \times (10) = 67.5 \text{ volts}$$

Time-Difference Measurements

The calibrated sweep rate of the oscilloscope and the dual-trace feature of the Type 1A2 allows measurement of the time difference between events Measure time difference as follows:

1. Set the AC-DC-GND swatches to identical settings; either AC or DC depending on the type of coupling desired.

2 Push in the PULL TO INVERT switches

3 Place the MODE switch to either CHOP or ALT, as desired. In general, the CHOP position is more suitable for low-frequency signals and the ALT position is more suitable for high-frequency signals

4. Connect a trigger signal to the oscilloscope Trigger Input connector. This trigger signal must bear a fixed time relationship to the signals to be displayed.

5 Set the VOLTS/CM switches so that the expected voltages applied to the input connectors will provide suitable vertical deflection on the CRT

6. Apply the signals to the input connectors. Use coaxial cables or probes having equal delay.

7. Set the oscilloscope Trigger Source switch to externally trigger on the signal.

8. Set the oscilloscope time-base controls for a calibrated sweep rate which will allow accurate measurement of the distance between the two waveforms.

9. Measure the horizontal distance between the points on the two waveforms.

10. Multiply the distance measured for each channel by the setting of the oscilloscope Time/Cm switch to obtain the apparent time interval.

11 To obtain the actual time Interval, divide the apparent time Interval by the amount of sweep magnification, if any, or by 1 if no sweep magnification is used. The formula is as follows:

$$\text{Time Delay} = \frac{\text{(Time/Cm switch setting)} \times \text{(Distance in cm)}}{\text{Sweep Magnification}}$$

For example, assume that the Time/Cm switch setting is 2 usec, the Magnifier is set for 5X magnification, and there is a horizontal distance of 3 cm (as shown in Fig 3-3) between the leading edge of the reference waveform and the leading edge of the waveform displayed by Channel 2. Then substitute these values in the preceding formula:

$$\text{Time Delay} = \frac{(2\ \mu\text{sec}) \times (3\ \text{cm})}{5} = 1.2\ \mu\text{sec}$$

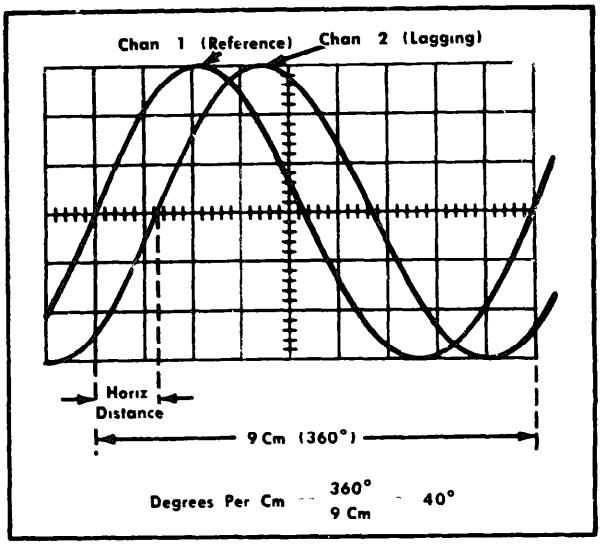

Fig. 3-3 Measuring phase shift between two sine waves

Phase Measurements

Phase comparison of two signals of the same frequency can be made using the dual-trace feature of the Type 1A2 To make the comparison, proceed as follows

1. Follow the procedure outlined in the first seven steps under Time-Difference Measurements

2. Set the oscilloscope sweep rate to obtain a display of less than 1 cycle of the waveform

3. Adjust the VARIABLE control for each channel so the waveform amplitudes are equal and fill the graticule area vertically. Reset the VOLTS/CM switches, if necessary, to

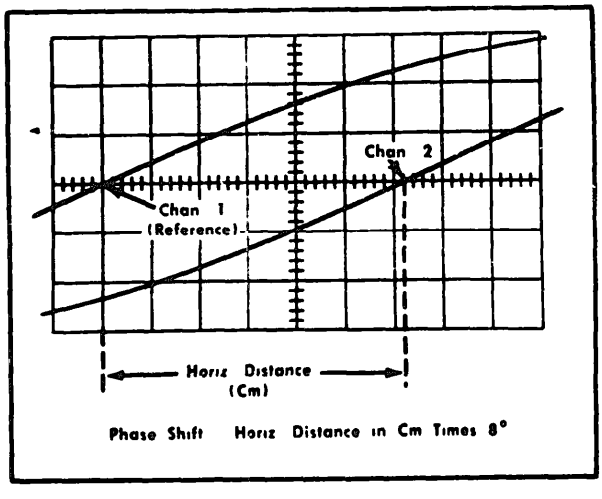

Fig. 3-4. Computing the phase shift when the oscilloscope swoop rate is Increased 5X

obtain equal-amplitude waveform displays (Equal amplitudes are used to make comparisons easier)

4 Use the POSITION controls to center the waveforms vertically, that is, an equal distance each side of the graticule centerline

5 Turn the oscilloscope Variable Time/Cm control counterclockwise until 1 cycle of the reference signal occupies 9 cm horizontally Use the Trigger Slope and Triggering Level controls to trigger on the reference waveform at any point you desire Each cm on the graticule now represents 40° of 1 cycle (see Fig 3-3)

6 Measure the horizontal distance, in cm, between corresponding points on the waveforms Note the distance and whether the Channel 2 waveform is leading or lagging (see Fig 3-3)

7 Multiply the distance by 40°/cm to obtain the amount of phase difference

For more precise measurements, Increase the previous sweep rate but do not change the setting of the oscilloscope Variable Time/Cm control However, you must consider this increase in your calculations

For example, if you Increase the sweep rate by a factor of 5, and then measure the distance between waveforms, each cm will represent 8° (40° - 5) of a cycle. Thus, phase difference up to 80° can be measured more accurately. When preparing to make the measurement, horizontally position the waveforms to points where the graticule markings aid in determining the exact distance Fig 3-4 for example, shows how the phase difference of the Channel 2 waveform can be computed using this method

CHAPTER 4

CIRCUIT DESCRIPTION

Introduction

The Type 1A2 contains two channel input amplifiers, a common output amplifier, a switching circuit for dual-trace operation and a trigger output amplifier (Instruments with serial number below 715 do not have a trigger output amplifier)

Channel Input Amplifiers

Serial Numbers 11000 and above utilize Field Effect Transistor circuits in the input amplifiers to reduce drift, and improve reliability and overload handling capability Input amplifiers for those instruments with serial numbers below 11000 consist of Nuvistor cathode follower circuits. The applied signal from the INPUT connector passes through the AC-DC-GND switch to the attenuation network The AC position of the AC-DC-GND switch AC couples the signal to the amplifier; the DC position directly couples the signal to the amplifier and the GND position opens the circuit to the input signal and grounds the input of the amplifier

The applied signal from the INPUT connector passes through the AC-DC-GND switch to the attenuation network. The AC position of the AC-DC-GND switch AC couples the signal to the amplifier; the DC position directly couples the signal to the amplifier and the GND position opens the circuit to the input signal and grounds the input of the amplifier

The deflection factor of the plug-in unit is changed with attenuators (VOLTS/CM switch) connected in the input circurt Each attenuator is frequency compensated for equal attenuation of low and high frequencies. The input capacitance of each attenuator is standardized so that input capacitance is the some regardless of the settings of the VOLTS/CM switch.

For SN 11000 and up; From the Attenuator network, the incoming channel 1 signal passes to the gate of Field Effect Transistor Q132. Q132 is connected as a source follower, Q133 acts as a Gm multiplier, the combination exceeds the performance that could be obtained with a single much more expensive FET or Transistor The gate of Q132 and D117 withstand positive and negative overload excursions up to 600 V For Channel 2, Q232, Q233 and 0217 perform a like function. Q132 and Q232 are selected for matched characteristics. Below SN 11000 the incoming signal passes to the grid of the input Nuvistor V133 (or V233 in Channel 2). The Nuvistor is connected as a cathode follower and has a voltage gain of about 0 9 The neon bulb B118, between the grid and cathode of the Nuvistor, keeps the grid-to-cathode voltage within safe limits while the tube is warming up. D134 (D234 in Channel 2) protects against excessive plate current in the event of a large positive voltage swing on the grid of the tube. D397 prevents current variations in the supply due to positioning controls in common mode operation. C397 prevents the plate voltage following the grid signal at frequencies above 50 kHz Diodes D137 and D138 protect the transistor stage by limiting the output swing of the Nuvistor. In Instruments with serial numbers below 715, D397 and C397 are not present, D134 is connected to the + 100-V supply.

From the attenuator network, the incoming signal passes to the grid of the input Nuvistar V133 (or V233 in Channel 2). The Nuvistor is connected as a cathode follower and has a voltage gain of about C9. The neon bulb B118, between the grid and cathode of the Nuvistor, keeps the grid-to-cathode voltage within safe limits while the tube is warming up. D134 (D234 in Channel 2) protects against excessive plate current in the event of a large positive voltage swing on the grid of the tube. D397 prevents current variations in the supply due to positioning controls in common mode operation. C397 prevents the plate voltage following the grid signal at frequencies above 50 kHz. Diodes D137 and 0138 protect the transistor stage by limiting the output voltage swing of the Nuvistor. In instruments with serial numbers below 715, D397 and C397 are not present; D134 is connected to the +100-V supply.

The remaining stage of the Channel Input Amplifier is an emitter coupled paraphase amplifier This stage converts the single-ended input signal to push-pull Gain of the stage is controlled by R142 and R161 in the common emitter circuit. These variable resistors vary emitter degeneration. Maximum gain occurs with minimum resistonce between the two emitters. The VAR ATTEN BAL control sets the level on the base of the undriven transistor so that no current flows between emitters under no-signal conditions. This insures that there is no ground reference shift of the trace when the VARIABLE control is turned.

Resistors R140 and R160, in the collector circuits of Q143 and Q163, provide thermal stability by forcing the transistors to operate in a balanced power mode. This means that dissipation of the transistors remains balanced with varying signals.

The PULL TO INVERT switches reverse the displayed polarity of the signal. With the switches pushed in, a positive voltage change at the INPUT connector deflects the electron beam of the oscilloscope upward. With the switches pulled out, a positive voltage change at the INPUT connector deflects the electron beam downward.

The POSITION controls vary the current on each side of the push-pull circuit for positioning control. In the ADD position of the MODE switch, note that the Channel 2 POSITION control is out of the circuit and only the Channel 1 POSITION control can position the display.

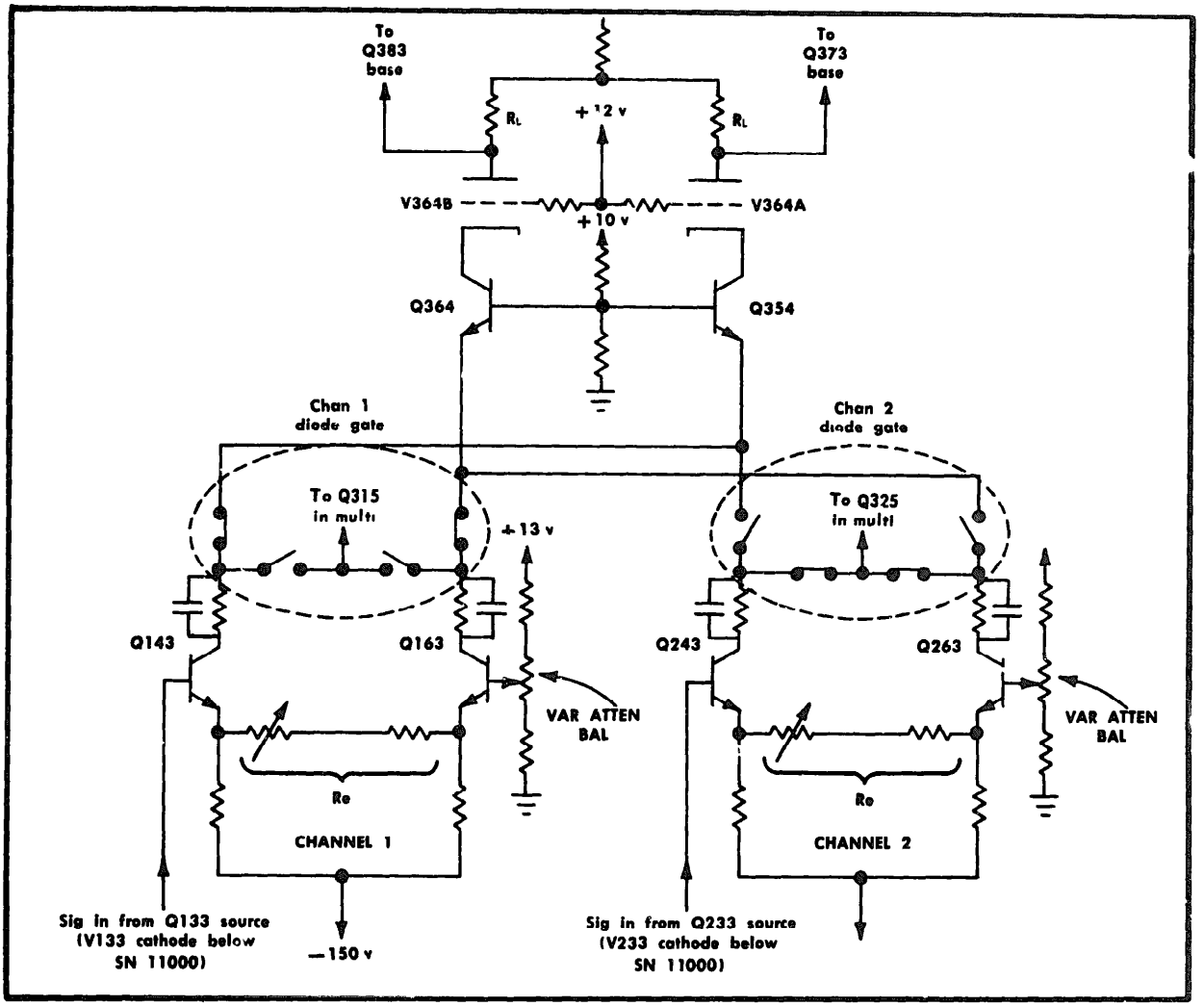

Fig. 4-1 Simplified schematic to illustrate the relationship of the Channel Input Amplifiers to the diode gates and the Output Amplifier Resistances of R_L and R_E determine overall gain of the plug-in unit

Fig 4-1 shows a simplified schematic diagram of the relationship of the last stage of each Channel Amplifier to the diode gates and the first stage of the Output Amplifier.

Diode Gates

The state of the diode gates determine which Channel Input Amplifier signal passes through to the Output Amplifier. The diode gates are controlled by the switching circuit In the ADD position of the MODE switch, both diode gates allow both Channel Input Amplifier signals to pass on to the Output Amplifier In all other positions of the MODE switch, the diode gates are never on at the same time

The diode gates permit the signal current to pass when D301-D304 (D306-D309 in Channel 2) are forward biased and D302-D303 (D307-D308 in Channel 2) are back biased The diode gates block the signal when the diodes are in the opposite state. For simplicity, the schematic of Fig 4-1 represents the diode gates as switches

Output Amplifier

The first stage of the Output Amplifier is a hybrid push-pull cascade amplifier The Channel Input Amplifiers current-drive the emitters of Q354 and Q364 Toroids, T301 and T310, are parasitic oscillation suppressors The voltage swing on the emitters is relatively small, due to the low input impedance

The cathodes of V364 are current-driven by Q354 and Q364 V364 elevates the DC level of the stage to the correct voltage necessary for the vertical amplifier of the oscilloscope The OUTPUT DC LEVEL adjustment is provided so that this voltage level can be accurately set

The final stage of the Output Amplifier is an emitter follower circuit The emitter follower stage Isolates the preceding stage from the vertical amplifier of the oscilloscope The high-frequency compensation network consisting of C377-R377 and C379-R379 standardizes the response of the instrument

Switching Circuit

The switching circuit consists of a bistable multivibrator (Q315-Q325) and a trigger circuit (Q340) Both circuits are arranged in various configurations by the MODE switch SW350A The operation of the switching circuit and its effect on the diode gates at the different settings of the MODE switch is described in the following paragraphs See the schematic diagrams at the rear of this manual for the appropriate waveforms and voltages

ALT. In the ALT position of the MODE switch, the switching circuit must switch to the opposite channel at the end of each sweep of a time-base circuit The command pulse (called the Alt Trace Sync Pulse) for this purpose arrives at the base of Q340 from pin 8 of the interconnecting plug through diode D332 In this mode, Q340 is connected as a triggered Blocking-Oscillator The output trigger pulse is transformer-coupled to the steering diodes D317-D327 of the bistable multivibrator (Q315-Q325) Depending on the state of the multivibrator, one of the steering diodes is forward biased by the trigger pulse This steering diode passes the trigger signal to the appropriate side of the multivibrator and causes it to switch to the opposite state The change of state of the multivibrator reverses the condition of both diode gates Note that when Q325 conducts, diodes D307-D308 are forward biased, D306-D309 are back biased, and the Channel 2 diode gate does not permit the signal to pass to the Output Amplifier When Q315 conducts, diodes D302-D303 are forward biased, D301-D304 are back biased, and the Channel 1 signal is then blocked from the Output Amplifier

When the plug-in unit is used with an oscilloscope that has alternate sweep switching, an Alternate Sweep Slave Pulse is coupled into pin 7 of the interconnecting plug The slave pulse Insures that the multivibrator (Q315-Q325) turns on Channel 1 during the Time Base A sweep of the oscilloscope This, in turn, allows the Channel 1 signal to be displayed on the Tune Base A sweep of the oscilloscope and the Channel 2 signal to be displayed on the Main Time Base (B) sweep See Fig 4-2 for the relationship of the slaving pulse to the oscilloscope sweep voltages Note that this capability occurs only in the ALT setting of the MODE switch

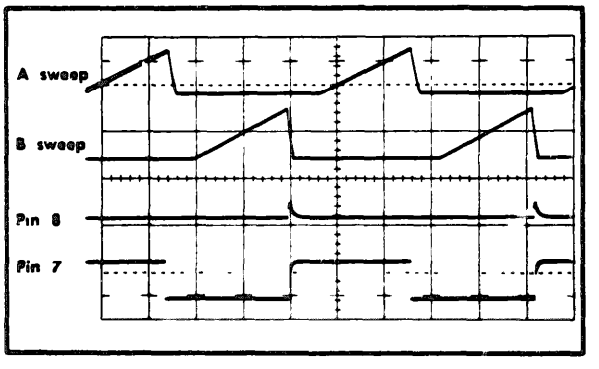

Fig. 4-2. The time relationship between the alternate-sweep slave pulse, alternate-trace sync pulse and the alternate sweeps of a Type 547 Oscilloscope.

CH 1. This position of the MODE switch allows only the Channel 1 signal to pass to the output amplifier. This is accomplished by reverse biasing the base of Q315 from the +225-volt supply through R311 and R314. The base of Q325 is forward biased by connecting it to ground through R324

With Q325 conducting, a more positive voltage is developed at the junction of R327-R328 than at the emitters of Q354 and Q364. This positive voltage forces D307-D308 into conduction and back biases D306-D309 With D306-D309 back biased, the Channel 2 signal is blocked from the Output Amplifier.

With Q315 turned off, the junction of R317-R318 is sufficiently more negative than the emitters of Q354-Q364 to reverse bias D302-D303 Therefore, with D302-D303 not conducting, D301-D304 are forward biased and allow the Channel 1 signal to pass to the Output Amplifier Fig 4-1 shows the condition of the diode gates, in simplified form, when the MODE switch is set to CH 1

ADD. This position of the MODE switch permits the output of both channels to pass to the Output Amplifier at the same time The resultant display is an algebraic addition of the two inputs. To allow both diode gates to pass the signal at the same time, both Q315 and Q325 must be turned off To do this, the MODE switch removes the voltages from the emitters and bases of Q315 and Q325 This places the junctions of D302-D303 and D307-D308 sufficiently below Q354-Q364 emitters so the diodes are back biased

NOTE

R323 is switched in is a dummy load resistor that maintains the proper current drain on the + 10-volt source.

With the two channels working into the Output Amplifier simultaneously, twice the amount of current is passed through the diode gates Thus, additional current is supplied through R352 by the MODE switch to maintain the same output DC level.

CH 2. In this position of the MODE switch, only the Channel 2 signal passes to the Output Amplifier. This is done by reversing the state of the switching multivibrator from the condition of the CH 1 position That is, Q325 is turned off and Q315 is turned on This blocks the Channel 1 signal and permits the Channel 2 diode gate to pass the signal to the Output Amplifier.

CHOP. In this positron of the MODE switch, the triggering circuit (Q340) is arranged as an astable (free running) blocking oscillator. Frequency of the blocking oscillator is about 220 kHz The output pulse of the blocking oscillator is coupled to the switching multivibrator through C340 to the steering diodes. The only difference in the operation of the circuits from the ALT mode of operation is that the blocking oscillator (Q340) free runs and doesn't rely on a triggering signal from the time base circuitry of the oscilloscope. The result is that the switching multivibrator rapidly switches back and forth between channels during the sweep of the time base A blanking signal is coupled from the collector of Q340 to pin 16 of the interconnecting plug This blanking signal blanks the electron beam of the oscilloscope while the switching multivibrator switches between channels

Filament Supplies

Filament current for V364 is supplied from pins 13 and 14 of the interconnecting plug This voltage is approximately 6.3 volts at line frequency Below SN 11000 filament voltage for the input Nuvistors is regulated by the supply in the oscilloscope The DC filament voltage eliminates any line frequency ripple that might otherwise be Introduced into the cathodes of V133 and V233 Also, the constant filament voltage eliminates bias shift when there is any change in the line voltage.

Trigger Output Amplifier

Q414 and Q424 with the associated circuitry are feedback amplifiers for the signal arriving from R136 or R236 in the cathode of the input Nuvistor Variable resistor R415 simulates the input base impedence of Q414 so the input cathode follower of the channel not selected for trigger amplification has the same loading to ground as when it is selected for trigger amplification Voltage gain for the stage is about 2 to 25 for Q414 and about 5 for Q424 The signal is AC coupled from the collector of Q414 to the base of Q424 to minimize the effect of DC drift, and from the collector of Q424 to both the TRIG OUT connector and pm 5 of the interconnecting plug to the oscilloscope

The trigger at pm 5 is available for use as an Internal trigger source However, to make use of thus trigger the associated oscilloscope must be capable of selecting it with a Triggering Source switch If the trigger cannot be selected internally, external triggering must be used The trigger has the same polarity as the signal applied at the Input connector Output DC level is approximately zero volts

Power Distribution Circuits

SN 11000 and up The negative 3 V source for D117 and D217 is obtained from the -150 volt supply at pin 9 of P11 and is clamped by D397. An adjustable +10 volt supply, a +12 volt supply, and a +13 volt supply are derived from the +75 V source at pin 15 of P11 A second +10 volt supply for the drains of Q132 and Q232 comes from a Zener clamped network originating at the +225 V terminal at pin 11 of P11

For serial numbers below 11000, the -3 V supply and the second +10 V supply (from +225) were not present The other + 10 volt supply along with the + 12 V, + 13 V and a +75 V supply all came from the pin 15 +75 volt source at P11 through a somewhat different divider network

CHAPTER 5

MAINTENANCE

SCOPE OF MAINTENANCE

The maintenance duties assigned to the operator of the Type 1A2 are listed below together with a reference to the appropriate maintenance table and the paragraph covering the specific maintenance functions. The duties assigned do not require tools or test equipment other than those issued with the equipment.

1. Operator's daily preventive maintenance checks and services (table 5-1)

2. Operator' s weekly preventive maintenance checks and services (table 5-2)

3. Cleaning

The maintenance duties assigned to the organizational maintenance repairmen of the equipment are listed below, together with a reference to the paragraphs covering the specific functions. The duties assigned do not require tools or test equipment other than those issued with the equipment.

1. Organizational monthly preventive maintenance checks and services (table 5-3)

2. Rustproofing and painting

PREVENTIVE MAINTENANCE

Preventive maintenance is the systematic care,, servicing, and inspection of equipment to prevent the occurrence of trouble, reduce downtime, and assure that the equipment is serviceable.

1. Systematic Care. The procedures given in paragraph on cleaning and tables 5-1 through 5-3 cover routine systematic care and cleaning essential to proper upkeep and operation of the equipment.

2. Preventive Maintenance Checks and Services. The preventive maintenance checks and services charts (table 5-1 and table 5-2) outline functions to be performed at specific intervals. These checks and services are designed to maintain Army equipment in a combat-serviceable condition; that is, in good general (physical) condition and in good operating condition. To assist operators in maintaining combat serviceability, the charts indicate what to check, how to check, and the normal conditions; the References column lists the paragraphs that contain detailed repair or replacement procedures. If the defect cannot be remedied by the operator, a higher category of maintenance or repair is required. Records and reports of these checks and services must be made in accordance with instructions given in TM 38-750.

PREVENTIVE MAINTENANCE CHECKS AND SERVICES PERIODS

Preventive maintenance checks and services of the Type 1A2 are required daily, weekly and monthly.

Table 5-1 specifies the checks and services that must be accomplished daily, or under the special conditions listed below:

1. Before the equipment is taken on a mission.

2. When the equipment is initially installed.

3. When the equipment is reinstalled after removal for any reason.

4. At least once a week, if the equipment is maintained in standby condition.

Tables 5-1 and 5-3 specify additional checks and services that must be performed weekly and monthly, Perform the maintenance functions indicated in the monthly preventive maintenance checks and services chart (table 5-3) once each month. A month is defined as approximately 30 calendar days or 8-hour per-day operation. If the equipment is operated 16 hours a day, the monthly preventive maintenance checks and services should be performed at 15-day intervals. Adjustment of the maintenance interval must be made to compensate for any unusual operating conditions. Equipment maintained in a standby (ready for immediate operation) condition must have monthly preventive maintenance checks and services. Equipment in limited storage (requires service before operation) does not require monthly preventive maintenance.

Table 5-1. Operator' s Daily Preventive Maintenance Checks and Services

Sequence No.	Item to be inspected	Procedure	References
1	Type 1A2 Dual Trace Plug-in Unit	Check equipment for completeness and general condition.	Appendix B
2	Exterior surfaces	Clean exterior surfaces of equipment.	Chapter 5, paragraph on equipment cleaning.
3	External receptacles	Inspect external receptacles for breakage and for firm seating.	
4	Meter glass	Inspect front panel glass window for damaged housing, broken glass, physical damage, dust, or moisture.	
5	Knobs, controls, and switches	During operation (item 6), check knobs, controls, and switches for proper mechanical action. Action must be positive, without backlash, binding, or scraping.	
6	Operation	During operation, be alert for any abnormal indications.	

Table 5-2. Operator's Weekly Preventive Maintenance Checks and Services

Sequence No.	Item to be inspected	Procedure	References
1	Cables	Inspect external cables for cuts, cracked or gouged jackets, fraying, or kinks.	
2	Hardware	Inspect all exterior hardware for looseness and damage, The spectrum analyzer cover, carrying handle, hinges, and all bolts and screws must be tight and not damaged.	
3	Preservation	Inspect equipment to determine that it is free of bare spots, rust, and corrosion. If these conditions exist, refer to a higher category maintenance for repair.	Chapter 5, cleaning, rustproofing and painting paragraphs.

Table 5-3. Organizational Monthly Preventive Maintenance Checks and Services

Sequence No,	Item to be inspected	Procedure	References
1	Publications	Check to see that publications are complete, serviceable, and current.	DA Pam 310-4
2	Modification work orders	Check to see that all URGENT MWO's have been applied and that all NORMAL MWO's have been scheduled.	DA Pam 310-7
3	Completeness	Check equipment for completeness and general condition.	Appendix B

Table 5-3. Organizational Monthly Preventive Maintenance Checks and Services (Cont)

Sequence No.	Item to be inspected	Procedure	References
4	Cleanliness	Clean exterior surfaces of equipment	Chapter 5, Paragraph on equipment cleaning
5	Preservation	Inspect equipment to determine that it is free of bare spots, rust, and corrosion.	Chapter 5, Cleaning and rustproofing and painting paragraphs.
6	External receptacles	Inspect external receptacles for breakage and for firm seating.	
7	Meter glass	Inspect front panel glass window for damaged housing, broken glass, physical damage, dust, or moisture.	
8	Cables	Inspect external cables for cuts, cracked, or gouged jackets, fraying, or kinks.	
9	Hardware	Inspect all exterior hardware for looseness and damage. The Dual Trace Plug-in Unit cover and all bolts and screws must be tight and not damaged.	
10	Operation	During operation, be alert for any abnormal indications.	

CLEANING

Inspect the exterior of the Type 1A2. The exterior surface must be free of dust, dirt, grease: and fungus.

1. Remove dust and loose dirt with a clean, soft cloth.

WARNING

Prolonged breathing of cleaning compound is dangerous; provide adequate ventilation, Cleaning compound is flammable; do not use near a flame. Avoid contact with the skin; wash off any that spills on the hands,

2. Remove grease, fungus, and ground-in dirt from the cases; use a cloth dampened (not wet) with Cleaning Compound (Federal Stock No. 7930-395-9542),

3. Remove dust or dirt from plugs and jacks with a brush.

4. Clean the front panel control knobs; use a soft, clean cloth. If necessary, dampen the cloth with water; mild soap may be used for more effective cleaning.

RUSTPROOFING

1. Rustproofing. When the finish on the Type 1A2 has become badly scarred or damaged, rust and corrosion can be prevented by touching up the bare surfaces. Use No. 000 sandpaper to clean the surface down to the bare metal. Obtain a bright, smooth finish.

2. Painting. Remove rust and corrosion from metal surfaces by lightly sanding them with fine sandpaper. Brush two thin coats of paint on the bare metal to protect it from further corrosion. Refer to the applicable cleaning and refinishing practices specified in TB SIG 364.

LUBRICATION INSTRUCTIONS

1. Gasoline should not be used as a cleaning fluid for any purpose, When the equipment is overhauled or repairs are made, clean the parts with cleaning compound.

2. Do not use excessive amounts of Lubricating Oil, Instrument (OAI) (FSN 9150-664-6518) and do not allow connections to become greasy.

3. Be sure that lubricants and points to be lubricated are free from sand, grit, or dirt. Use cleaning compound to clean all parts. Before lubrication, clean all surfaces to be lubricated; use a lint-free cloth dampened with cleaning compound, Keep cleaning compound off surrounding parts.

4. Lubrication intervals designated are for daily 8-hour periods of operation. For longer periods of operation, intervals should be shortened.

PREVENTIVE MAINTENANCE

Cleaning the Interior

To clean the interior of the Type 1A2, blow off the accumulated dust using low-velocity compressed (10 psi) air. High-velocity air stream could damage components.

Visual Inspection

Many potential or existing troubles can be detected by a visual inspectton of the unit. For this reason, a complete visual check should be performed periodically or every time the unit is inoperative, needs repair or needs recalibration. Visible defects may include loose or broken connections, frayed coax-shield (that could cause a short), damaged connectors, improperly seated tubes or semiconductors arid scorched or burned parts.

The remedy for these troubles is readily apparent except in the case of heat-damaged parts. Damage to parts due to heat is often the result of other less apparent troubles in the unit. It is essential that the cause of overheating be determined and corrected before replacing the damaged parts.

Checking Tubes and Semiconductors

Periodic tester checks on the tubes and semiconductors used in the Type 1A2 are not recommended. Static tube and semiconductor testers in many cases indicate a defect when a component is operating satisfactorily in a circuit, or fail to indicate defects which affect circuit performance.

The true test of tube or semiconductor usability is whether or not the component works properly in the circuit. If it is working correctly, it should not be replaced.

Calibration

The Type 1A2 should provide many hours of trouble-free operation. However, to insure the reliability of measurements, check the calibration of the unit after each 500 hours of operation (or every six months if the unit is used intermittently). A complete step-by-step procedure for calibrating the unit and checking its operation is given in the Calibration section of this manual.

CORRECTIVE MAINTENANCE

Soldering Precautions

A. Soldering to Ceramic Terminal Strips

Solder used on the ceramic terminal strips should contain about 3% silver. ordinary tin lead solder can be used but not repeatedly. If ordinary tin lead solder is used repeatedly or, if excessive heat is applied, the ceramic-to-solder bond can be broken. For this reason, we recommend solder with about a 3% silver content and a 40- to 75-watt soldering iron with a 1/8 inch wide chisel tip for installing or removing connections on the strips.

Silver-bearing solder is usually available locally but if it is not it can be purchased from Tektronix in one pound rolls: order by Tektronix part number 251-0514-00.

B. Soldering to metal terminals.

In soldering to metal terminals (such as interconnecting plug pins, switch terminals, potentiometers, etc.), ordinary 60/40 solder and a 40- to 75-watt soldering iron with 1/8 inch wide chisel tip can be used. The chisel tip must be properly tinned.

The procedure for soldering is as follows:

1. Apply only enough heat to melt the solder and remove the connection.

2. When resoldering the lead, apply enough heat to make the solder flow freely.

3. If the lead extends beyond the solder joint, clip the excess close to the solder joint

Replacing Tubes and Transistors

Do not replace tubes and transistors unless they actually cause trouble. During routine maintenance, it may be necessary to remove tubes or transistors from their sockets. It is important that these components be returned to the same sockets.

Unnecessary replacement or switching of tubes or transiston will often necessitate recalibration of the instrument. if any components do require replacement, it is recommended that they be replaced by previously checked, high quality components. The best check of tubes and transistors is to place them in the circuit and then check for proper operation.

CAUTION

Turn off the oscilloscope power when replacing tubes or transistors to prevent thorn from being damaged. Be sure the voltages and loads on the transistors are normal before making the substitution.

After completing the check, if you have replaced any tubes or transistors in the amplifier stages, check the gain and transient response of the Type 1A2 before using the unit for waveform measurements.

Removing and Replacing Switches

Single wafers or mechanical parts on rotary switches are not normally replaced. If the switch is defective, the entire

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switch should be replaced The VOLTS/CM and MODE switches can be ordered through your Tektronix Field Engineering Office either unwired or wired, as desired Refer to the Parts List to find the unwired and wired switch part numbers

CAUTION

When disconnecting or connecting leads to a wafer-type switch, do not let solder flow around and beyond the rivet on the switch terminal. Excessive solder can destroy the spring tension of the contact

Special Parts

In addition to the standard electrical components mentioned in the previous paragraph, special parts are also used in the assembly of the Type 1A2 These parts are manufactured or selected by Tektronix to satisfy particular requirements or are manufactured specially for Tektronix by other companies in accordance with Tektronix specifications These parts and most mechanical parts should be ordered from your Tektronix Field Engineer or Field Office as they are normally difficult or impossible to obtain from other sources.

TROUBLESHOOTING

Front-Panel Controls

Before troubleshooting, double check the front-panel controls of the plug-in unit and oscilloscope for proper settings In addition, check the front-panel screwdriver-adjustable controls to determine if their settings are proper This is important since symptoms caused by incorrect control settings are not described in this section of the manual Next, determine whether the trouble is in the oscilloscope or the Type 1A2

Type 1A2 or Oscilloscope

When following a troubleshooting procedure, it is assumed that the oscilloscope used with the Type 1A2 is operating normally Since this is not always the case, check the operation of the oscilloscope before attempting to troubleshoot the Type 1A2

Troubles occurring in the oscilloscope can usually be detected by substituting another plug-in unit for the Type 1A2-preferably another Type 1A2 which is working normally. Then, such troubles as loss of alternate sync pulses or improper chopped blanking can be readily isolated to either the Type 1A2 or the oscilloscope. If a substitute unit is not available, multi-trace troubles will have to be Isolated by using signal tracing methods

NOTE

Be sure proper line voltage is applied to the oscilloscope used with the Type 1A2. For proper oscilloscope low-voltage power supply regulation, the AC line voltage should contain no more than 3% to 5% sine-wave distortion.

If the Type 1A2 is definitely at fault and not the associated oscilloscope, make a careful operational check of the Type 1A2 Carefully note the effect that each front-panel control has on the symptom By analyzing such effects, you can sometimes isolate a trouble to either a defective control or circuits containing the trouble In addition, the normal or abnormal operation of each control should indicate checks to make

The remainder of this section deals with detailed troubleshooting A step-by-step method of checking and adjusting the Type 1A2 is given in the Calibration section The calibration procedure can be used to check the operational standards of the Type 1A2 Any deficiency that shows up while performing the steps can lead you to the area at fault and the possible causes

CIRCUIT TROUBLESHOOTING

Diagrams

Circuit diagrams are contained in the pullout pages of section 10 The circuit diagrams contain component circuit numbers, voltages and waveforms Conditions under which the voltages and waveforms were taken are also indicated on the diagrams

Coding of Switch Wafers

Switch wafers shown on the circuit diagrams are coded to indicate the physical location of the wafer on the actual switch The number portion of the code refers to the wafer number on the switch assembly Wafers are numbered from the first wafer located behind the detent section of the switch to the last wafer. The letters F and R indicate whether the front or the rear of the wafer is used to perform the particular switching function. For example, 2R of a VOLTS/CM switch is the second wafer when counting back from the detent section, and R is the rear side of the wafer

(Next printed page is 5-3.)

Cable Color Coding

All wiring in the Type 1A2 is color coded to facilitate circuit tracing. The power-supply wires originating at the oscilloscope interconnecting plug are identified by the following code; the widest stripe identifies the first color in the code.

Supply Voltage	Cable Color Code
+225 V	Red/red/dark-brown on white
+100 V	Dark-brown/black/dark-brown on white
+75 V	Purple/green/black on white
+150 V	Dark-brown/green/dark-brown on tan
+13 V	Green on white
+12 V	Black/orange on white
+10 V	Black/blue on white

lest Equipment

Following is a list of suggested equipment useful in trouble-shooting the Type 1A2

1 Transistor tester to dynamically test transistors and diodes used in the Type 1A2 Tektronix Type 575 Transistor-Curve Tracer recommended

2 VOM or VTVM for precision and general purpose use Can also be used to check transistors and diodes if used with care. Not recommended as a substitute for a good transistor and diode tester The VOM DC sensitivity should be at least 20,000 ohms per volt, DC voltage accuracy for either the VOM or VTVM should be within 3%

CAUTION

Be sure the test prods are well insulated (except for the very tip) to prevent accidental shorts when reaching a test point. If you use the VOM or VTVM as an ohmmeter to measure resistances when semiconductors are in the circuit, know and use ranges (usually RX 1 K and higher) that deliver a current of less than 2 mA at full deflection.

3. Milliammeter to determine full-scale current delivered by the VOM or VTVM on ohmmeter ranges used for semiconductor testing, range 0 to 2 mA

4. Test oscilloscope to signal trace the switching circuits, a wide-bandwidth oscilloscope (DC to 10 MHz or better) with calibrated vertical deflection factors down to 0.1 V/cm without a 10X probe (1 V/cm with a 10X probe). To low-frequency signal trace and check DC levels in each amplifier stage, a low-bandwidth oscilloscope (DC to about 300 kHz or better) with calibrated vertical deflectson factors down to 50 mV/cm without a 10X probe (500 mV/cm with a 10X probe). An Ext Trig Input connector on the test oscilloscope is desirable The wide-bandwidth oscilloscope can be used if the vertical deflection factor is 50 mV/cm without a 10X probe, the low-bandwidth oscilloscope can be used to signal trace the switching circuits if the bandwidth limitation is considered.

5 Flexible cable plug-m extension to permit operation of the Type 1A2 out of the plug-in compartment so that all sides of the unit are accessible for servicing

NOTE

The plug-in extension must be used with care since, under certain conditions, it can cause the instrument to oscillate and/or have poor high-frequency response.

6. Adapter for use, if the test oscilloscope Ext Trig (item 4) connector is a UHF type of connector, in a low-frequency signal-tracing setup to check phase relationship of the calibrator signal at output of each amplifier stage in the Type 1A2 (Signal tracing setup includes items 4 through 8.) Tektronix Part No 103-0015-00 recommended

7 BNC T connector to use in a low-frequency signal-tracing setup for connecting to the two BNC coaxial cables (Item 8) and to the Cal Out connector on the oscilloscope used with the Type 1A2 Tektronix Part No. 103-0030-00 recommended

8 Coaxial Cables (two required) for use in low-frequency signal-tracing setup to apply the calibrator signal to the Type 1A2 and to the test oscilloscope Ext Trig Input connector, equipped with BNC plug connectors on each end. Tektronix Part No 012-0057-00 recommended.

9 Miscellaneous Replacement tubes, transistors and diodes.

In-Circuit Diode Checks

In-circuit checks of diodes can be made quite easily by using a voltmeter to find out if the diode is functioning properly in the circuit Measure the voltage on each side of the diode during its quiescent state as given on the schematics, then determine whether the difference between voltages is normal or not

If you are in doubt whether a diode is defective, unsolder one end and check the forward-to-back resistance ratio If the ohmmeter check proves unsatisfactory, replace the diode

NOTE

As a general rule, do not use the R X 1 and R X 10 ohmmeter ranges. Use the higher ranges where the current is limited to less than 2 mA. You can quickly check the current by inserting a milliammeter between the ohmmeter leads, and then noting the current for each range you intend to use. Internal voltage of the ohmmeter should not exceed 22 V.

Isolating DC imbalance

For free-running traces to appear within the usable viewing area of the CRT screen, the DC voltage as measured between pins 1 and 3 of the interconnecting plug to the oscilloscope must be less than ±0.3 volt A voltage difference which exceeds ±0.3 volt between these two points may position the trace more than ±3 cm from the oscilloscope vertical-amplifier electrical center, thus positioning the trace above or below the range of visibility.

To find the oscilloscope vertical-amplifier electrical center, short pins 1 and 3 together momentarily and note the position of the trace The position of the trace is the electrical center When shorting the pins, use care to avoid shorting to other pins or to ground

TABLE 5-1

Trouble Isolation Procedure

Symptoms	Checks to Make	
	Some Possible Causes	Probable Circuit Area At Fault
1 No trace or waveform display, either channel Trace deflected off the CRT	Defective output amplifier tube or transistor (V364, Q354, Q364) Open filament in one of the tubes Defective interconnecting plug. Check these nominal voltages in the Type 1A2 +225V, +100V, +75V, +13V, +12V, +10V, and -150 V If any of these voltages are Incorrect, find the trouble before going to the third column	Check for DC Imbalance in the Output Amplifier second stage
2 Trace but no waveform display, either channel	Open filament in V364	Check Output Amplifier
3 No Channel 1 trace or waveform display	Open series diode D301 or D304, Q132 or Q133 (V133 below SN 11000 (defective Check that the Switching Multivibrator stage is working properly be cut off and Q325 should be conducting D302 or D303 shorted Q143 or Q163 defective SW160 defective +13-volt source low	Check for DC Imbalance in Channel 1
4 No Channel 2 trace or waveform display	Open series diode D306 or D309, Q232 or Q233 (V233 below SN 11000) defective Check that the Switching Multivibrator stage is working properly Q325 should be cut off and Q315 should be conducting D307 or D308 shorted Q243 or Q263 defective SW260 defective +13-volt source low	Check for DC Imbalance in Channel 2
5 Channel 1 trace but no waveform display	Short or open circuit between Channel 1 input connector and gate of Q132 (V133 grid, below SN 11000)	Signal trace Channel 1 to locate faulty circuit
6 Channel 2 trace but no waveform display	Short or open circuit between Channel 2 input connector and gate of Q232 (V233 grid, below SN 11000)	Signal trace Channel 2 to locate faulty circuit
7 No chopped or alternate mode of operation One channel is on all the time	Q325 defective Q315 defective	Troubleshoot Switching Multivibrator stage Q325/Q315
8 No alternate mode of operation Chopped mode is normal	D332 defective Defective SW350	Check Blocking Oscillator Q340 stage
9 No chopped mode of operation Alternate mode is normal	Defective contact on the MODE switch in the CHOP position Q340 defective (open)	Troubleshoot Q340 stage
10 No signal or insufficient amplitude signal at TRIG OUT connector	Q414 or Q424 defective	Check Trigger Output Amplifier stage.

The DC voltages at pins 1 and 3 of the interconnecting plug depend on the DC balance of all amplifier stages in both channels Since all the amplifier stages are DC coupled, any excessive Imbalance between input and output can unbalance the output and cause the trace to deflect out of the viewing area.

If the voltage limits are exceeded in one stage, the limits will be exceeded in the following stages (looking toward the output) and the trace will deflect off the screen. For example, if the voltage difference between the emitters of Q354 and Q364 in the Output Amplifier stage reads ±0.04 volt, the voltage between the emitters of (Q373 and Q383 in the Output Amplifier stage will read more than ±0.3 volt, and cause the trace to be deflected off the CRT.

One quick method for isolating DC imbalance either to one of the channels or to the Output Amplifier stage is to turn one channel on at a time to see if the trace for the channel can be normally postponed on the CRT. If the trace for one channel cannot be postponed onto the CRT, then the DC imbalance originates in that channel

If none of the traces appear on the CRT, then the trouble is probably in the Output Amplifier stage Also, consider the possibility that the trouble might be one of the diode switches (D301, D302, D303, or D304 in Channel 1; D306, D307, D308, or D309 in Channel 2) or in the Switching Multivibrator stage Q315/Q325

Troubleshooting Table

Table 5-1 is a list of typical symptoms, their possible causes and the probable circuit at fault The list is based on deliberate troubles placed in various areas of the Type 1A2 Since It is impossible to list every kind of symptom that might happen, those that are Included here may give you a clue to the most likely area to check

To locate the exact cause of a trouble when it is not listed in the table, use the conventtonal method of trouble-shooting, i.e. signal tracing, voltage and resistance checks, and parts substitution To reduce the parts substitution method of troubleshooting to a minimum, however, use the other methods of troubleshooting first In addition, use the information provided on the schematics and in other portions of this manual as an aid to isolating the trouble

CHAPTER 6

PERFORMANCE CHECK

Introduction

This performance check procedure is provided to check the operation of the Type 1A2 without removing the instrument from the oscilloscope plug-in compartment. This procedure may be used for upcoming inspection, instrument familiarization, reliability testing, calibration verification, etc.

Recommended Equipment

The following equipment is recommended for a complete performance check Specifications given are the minimum necessary to perform this procedure All equipment is assumed to be calibrated and operating within the original specifications If equipment is substituted, it must meet or exceed the specifications of the recommended equipment.

For the most accurate and convenient performance check, special calibration fixtures are used in this procedure. These calibration fixtures are available from Tektronix, Inc. Order by part number through your local Tektronix Field Office or representative.

1 Test oscilloscope Bandwidth DC to 50 MHz. Tektronix Type 544, 546, or 547 recommended

2 Standard amplitude calibrator. Amplitude accuracy, within 0.25%, signal amplitude, 20 millivolts to 100 volts; output signal, 1 kHz Tektronix calibration fixture 067-0502-00 recommended

NOTE

The Standard Amplitude Calibrator must be used to check and/or set the deflection factor of the Type 1A2 to can accuracy of ±3%. If an accuracy of ±6% is sufficient, use the calibrator of the oscilloscope instead of item 2.

3. Square-wave generator Frequency, 1 kHz and 120 kHz, risetime, 13 ns and 1 ns maximum, output amplitude, about 8 volts into 50 ohms Tektronix Type 106 Square-Wave Generator recommended

4. Termination. Impedance, 50 ohms, accuracy, ±3%; connection, BNC. Tektronix Part No 011-0049-00

5. Constant amplitude signal generator. Frequency, 50 kHz to at least 50 MHz Tektronix Constant Amplitude Signal Generator Type 191 recommended.

6. Input RC normalizer Time constant, 1 megohm X 15 pF; attenuation, 2X, connectors, BNC Tektronix Part No 067-0537-00

7. Cable (two) Impedance, 50 ohm, length, 18 inch, connectors, BNC Tektronix Part No 012-0076-00

8. Dual input coupler Matched signal transfer to each input Tektronix Part No 067-0525-00

9 Patch cord BNC to banana plug, length 18 inches.

10. Adapter Connectors, GR to BNC jack Tektronix Part No. 017-0063-00

PERFORMANCE CHECK PROCEDURE

General

In the following procedure, test equipment connections or control settings should not be changed except as noted If only a partial check is desired, refer to the preceding step(s) for setup information.

The following procedure uses the equipment listed under Recommended Equipment. If substitute equipment is used, control settings or setup must be altered to meet the requirements of the equipment used

Names of front and rear-panel controls on the Type 1A2 are written in all upper-case letters

Preliminary Procedure

Insert the Type 1A2 into the Test oscilloscope. Connect the power cord of the oscilloscope to the proper operating voltage and turn on the power switch Allow a 15-minute warm-up time before preceeding with the performance check to allow the unit to stabilize Preset the front panel controls as follows:

Test Oscilloscope

Horizontal Display	B (546, 547) Normal (×1) (544)
Sweep Magnifier	×1 off (546, 547)
Single Sweep Switch	Normal
Triggering Level	Fully clockwise and pushed in
Triggering Source	Norm Int
Triggering Coupling	AC
Triggering Slope	+
Triggering Mode	Auto Stability
Time/CM	20 μs
Variable (Time/CM)	Calibrated
Horizontal Position	Trace starts at left graticule line
Amplitude Calibrator	Off

Type 1A2

MODE	CH 1
TRIGGER SELECTOR	CH 1
Both channels	
POSITION	At or near midrange
VOLTS/CM	05
VARIABLE	CALIBRATED
AC-DC-GND	GND
PULL TO INVERT	Pushed in

1. Check Variable Attenuator Balance

a. Requirement-Minimum vertical trace movement as the VARIABLE control is rotated

b. Rotate the Channel 1 VARIABLE control in both directions

c. If vertical trace movement occurs, adjust the Channel 1 VAR ATTEN BAL for minimum vertical trace movement

d. Check-Minimum vertical trace movement as the VARIABLE control is rotated

e. Change the MODE switch to CH 2

f. Rotate the Channel 2 VARIABLE control in both directions

g. If vertical trace movement occurs, adjust the Channel 2 VAR ATTEN BAL for minimum vertical trace movement

h. Check-Minimum vertical trace movement as the VARIABLE control is rotated

i. Set both VARIABLE controls in the CALIBRATED position

2. Check Position Control Range

a. Requirement-POSITION control moves trace off the graticule area in both directions, clockwise rotation moves the trace upward and counterclockwise rotation moves the trace downward

b. Rotate the Channel 2 POSITION control fully clockwise and counterclockwise.

c. Check-Rotation moves trace off the graticule area, upward with clockwise rotation and downward with counterclockwise rotation

d. Position the trace at the graticule centerline

e. Change the MODE switch to CH 1.

f. Rotate the Channel 1 POSITION control fully clockwise and counterclockwise

g. Check-Rotation moves trace off the graticule area, upward with clockwise rotation and downward with counterclockwise rotation

h. Position the trace at the center graticule line

3. Check Normal to Invert Trace Shift

a. Requirement--Maximum trace shift ±1 cm

b. Pull out the Channel 1 PULL TO INVERT switch

c. Check--Trace shift is no more than ±1 cm

d. Change the MODE switch to CH 2

e. Pull out the Channel 2 PULL TO INVERT switch.

f. Check--Trace shift m ithan ± ±1 cm

g. Push in both PU' SWT switches

4. Check CH 1 to ADD Trace Shift

a. Requirement-Maximum trace shaft ±2 cm, Channel POSITION controls trace movement

b. Set the MODE switch to CH 1 and center the trace vertically, then change the MODE switch to ADD

c. Check-Trace shift is no more than ±2 cm

d. Rotate the Channel 2 POSITION control

e. Check-Trace does not move

f. Rotate the Channel 1 POSITION control.

g. Check-Trace is moved by the Channel 1 POSITlON control.

h. Set the MODE switch to CH 2 and center the trace with the Channel 2 POSITION control

i. Set the MODE switch to CH 1 and center the trace with the CH 1 POSITION control

5. Check Gate Current (SN 1100 & up) or Check Grid Current (Below SN 11000)

a. Requirement -Maximum shift (grid current) from AC to GND is 4 mm, microphones should not exceed 1 cm peak to peak

b Change the Channel 1 AC-DC-GND switch to AC and back to GND

c. Check-Maximum trace shift due to gate or grid current is 4 mm.

d. Tap the left side of the oscilloscope highly near the Type 1A2 front panel and watch for excessive microphonics

e. Check-Microphonics should not exceed 1 cm peak to peak

f. Set the MODE switch to CH 2

g. Change the Channel 2 AC-DC-GND switch to AC and back to GND

h. Check-Maximum trace shift due to grid current is 4 mm

i. Tap the left side of the oscilloscope lightly near the Type 1A2 front panel and watch for excessive microphonics

j. Check-Microphonics should not exceed 1 cm peak to peak

6. Check Alternate Mode Operation and Slave Pulse

a. Requirement-Alternate operation at all sweep rates, Channel 1 must run with the A Sweep, when the Test oscilloscope has provision for alternate slave operation

b Set the MODE switch to ALT

c Position the Channel 1 trace 1 cm above the graticule center line and the Channel 2 trace 1 cm below the graticule center line

d Set the oscilloscope Time/CM switch to various sweep rates

e Check-Alternate traces at all sweep rates

f. Set the oscilloscope Horizontal Display switch to A Alt B, and A Time/CM switch to 20 mSEC and the B Time/CM switch to 5 mSEC

g. Operate the Channel 1 position control, and by noting which channel moves vertically, differentiate between the traces of Channel 1 and Channel 2

h. Check-Channel 1 trace is 20 mSEC/CM, Channel 2 trace at 5 mSEC/CM

7. Check Chopped Mode Operation

a. Requirement-Chopped waveform must be 220 kHz ±20% flat top distortion must be no more than 2 mm, chopped transients (rising and falling portions) must be blanked in Chopped Blanking

b. Set the Horizontal Display switch to B and the B Time/CM switch to 1 uSEC

c. Set the MODE switch to CHOP and adjust the B Triggering Level control for a stable display Position the Channel 1 trace 1 cm above the graticule center line

d. Measure the time of one cycle

e. Check-Time duration of one cycle is approximately 4.5 us ±9 us for a frequency of 220 kHz ±20%. See Fig 6-1A

f. Set the CRT Cathode Selector (located at the rear of the oscilloscope) to Chopped Blanking

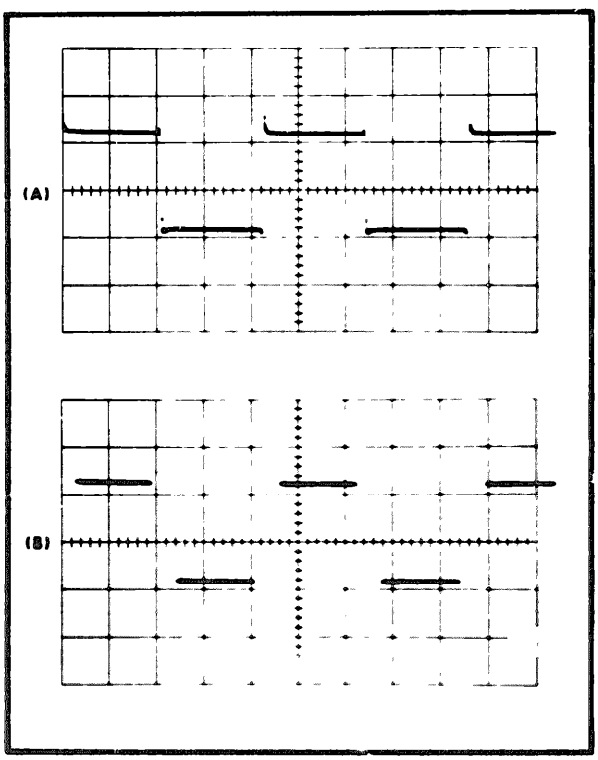

Figure 6-1. (A) Unblanked chopped-mode waveform, and (B) blanked waveform. Sweep rate is 1 usec/div.

g. Check-Horizontal flat top distortion must be no more than 2 mm, vertical switching transients must be blanked. See Fig. 6-1B.

h. Return the CRT Cathode Selector switch to External CRT Cathode and set the B Time/CM switch to .05 mSEC/CM

8. Check Gain

a. Requirement-Gain adjusted to the deflection sensitivity of the oscilloscope at the .05 VOLTS/CM position; adjustable without being at the extreme ends of its range.

b. Connect the Dual Input Coupler to both INPUT connectors and apply a 0.2 volt signal from the Standard Amplitude Calibrator to the Dual Input Coupler through a 50 ohm coaxial cable.

c. Set the MODE switch to CH 1 and both AC-DC-GND switches to DC Center the display

d. Rotate the Channel 1 GAIN control fully clockwise, then fully counterclockwise, and note the amplitude range. The control must vary the amplitude of the display through the calibrated 4 cm amplitude. (4.2 to 3.8 cm.)

e. Set the GAIN adjustment for exactly 4 cm of display amplitude.

f. Set the MODE switch to CH 2.

g Repeat the above procedure for Channel 2.

9. Check Input Switch DC to AC Shift

a. Requirement-Waveform shifts downward so center graticule line is approximately through the center of the waveform.

b Position the bottom of the waveform to the center graticule line

c. Set the Channel 2 AC-DC-GND to AC and check the amount of waveform shift.

d Check-Waveform shift is approximately 2 cm downward Amount of shift depends on symmetry of calibration signal and amount of gate or grid current

e. Set the MODE switch to CH 1 and repeat the above procedure for Channel 1

10. Check Added Algebraic and Common Mode Rejection

a Requirement—Added accuracy must be within ±3%; common mode rejection must be 20 to 1 or greater.

b. Set the Standard Amplitude Calibrator output to .1 volt.

c Set the MODE switch to ADD.

d Check—Display amplitude is 4 cm ±3% (±1.2 mm).

e Pull the Channel 1 PULL TO INVERT switch and change the Standard Amplitude Calibrator output to .5 volt.

f Check—Amplitude of the display must not be more than 5 mm, a common mode rejection ratio of 20 to 1

g. Push in the Channel 1 PULL TO INVERT switch and pull the Channel 2 PULL TO INVERT switch

h. Check-Display amplitude not more than 5 mm, the common mode rejection ratio is 20 to 1 or greater

i. Set the Standard Amplitude Calibrator output to 2 volt, the MODE switch to CH 1, the Channel 2 AC-DC-GND switch to GND Push in the Channel 2 PULL TO INVERT switch.

11. Check Volts/CM Accuracy and Variable Ratio

a. Requirement-Volts/CM accuracy is ±3% at all settings; Variable control ratio must be 2.5 to 1 or greater

b. Check-Amount of vertical deflection and the % error with the Instrument controls set according to Table 6-1

TABLE 6-1

Attenuator Accuracy Check

Type 1A2 VOLTS/CM	Standard Amplitude Calibrator In Volts	Display Amplitude In Centimeters	Allowable Error In Millimeters
05	2	4	00[1]
.1	.5	5	1 5
.2	1	5	1.5
.5	2	4	1 2
1	5	5	1.5
2	10	5	1.5
5	20	4	1.2
10	50	5	1 5
20	100	5	1.5

[1]Adjusted during step 8.

NOTE

The bottom of the output square-wave signal from the Standard Amplitude Calibrator is at ground potential. Since the AC-DC-GND switch is set to DC, the bottom of the square-wave signal will remain fixed. Therefore, it is possible to set the bottom of the square-wave signal one centimeter below the bottom graticule line and still make accurate measurements. It is necessary to do this o a signal five centimeters high may be measured on instruments having only four centimeter high graticules. To establish the new base line for the calibrator signal, display a four centimeter square-wave signal. With the Type 1A2 POSITION control align the top of the square-wave with the third graticule line up from the bottom of the graticule.

c. Rotate the VARIABLE control fully counterclockwise and check the amount of vertical deflection.

d. Check-Amplitude of vertical deflection must be 2 cm or less with a 5 cm amplitude signal for a VARIABLE ratio of 2.5 to 1 or greater

e. Return the Standard Amplitude Calibrator output signal to 2 volts

f Set the MODE switch to CH 2, the Channel 2 AC-DC-GND switch to DC, and the Channel 1 AC-DC-GND switch to GND

g Repeat the above check procedures for the Channel 2 VOLTS/CM attenuator and VARIABLE control

h. Remove the Standard Amplitude Calibrator signal and the Dual Input Connector

i. Return both VARIABLE controls to the CALIBRATED position, both VOLTS/CM switches to 0.5 and the Channel 1 AC-DC-GND switch to DC

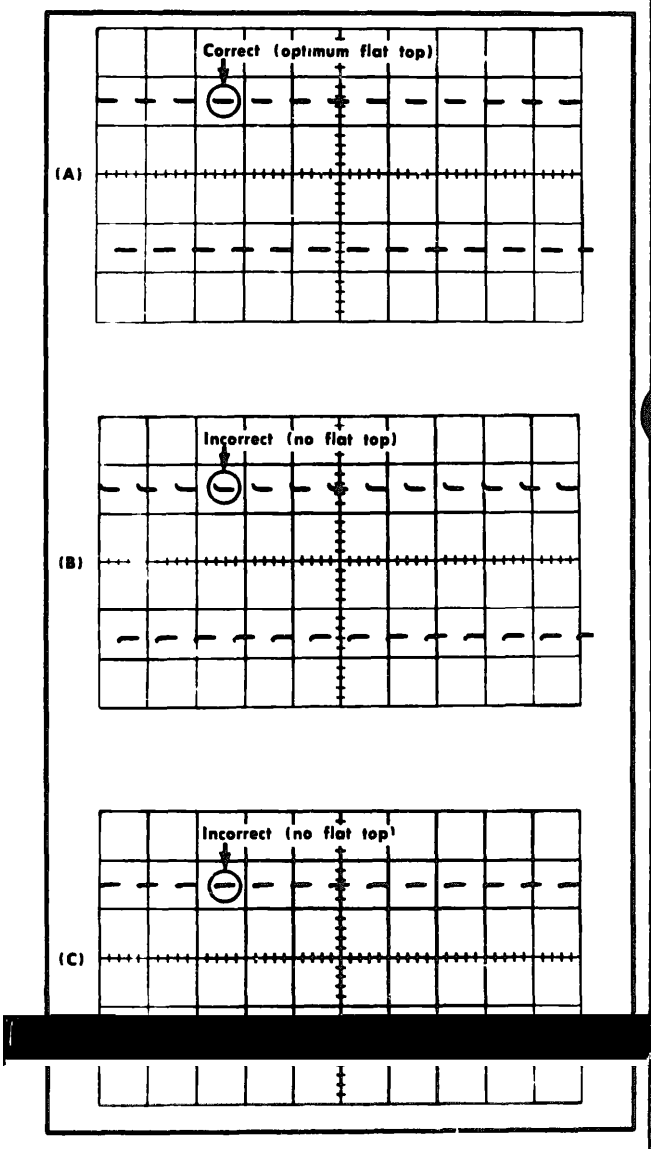

Fig. 6-2 (A) Typical CRT display shoeing correct VOLTS/CM switch compensation, (B) and (C) incorrect compensation.

12. Check Input and Attenuator Compensation

a. Requirement- -Top of waveform deviation must be less than ±3%

b. Set the oscilloscope Time/CM switch to 5 mSEC

c Apply a 1 kHz signal from the Type 106 Square-Wave Generator through a GR to BNC adapter, a 50 ohm coaxial cable, a 50 ohm termination and a 15 pF input RC Normalizer to the INPUT 2 connector

d. Adjust the output of the Square-Wave Generator for an approximate 4 cm amplitude, center the display and adjust the oscilloscope Triggering Level control for a stable display.

e. Check-Compensation of the waveform for level flat top, overshoot and undershoot at all VOLTS/CM switch settings, for deviation less than ±3% (1.2 mm), see Fig 6-2 Adjust the output of the generator to maintain about 4 cm of display amplitude It will be necessary to remove the 50 ohm termination at VOLTS/CM settings higher than 1 volt.

WARNING

To avoid a signal shock hazard, reduce the generator output to minimum when changing signal connections.

f. Set the MODE switch to CH 1

g. Remove the Input RC Normalizer from the INPUT 2 connector and connect it to the INPUT 1 connector (Replace the 50 ohm termination)

h. Repeat the above procedure to check the Channel 1 attenuator compensation

i. Remove the Square-Wave Generator signal and the 15 pF Input RC Standardizer

f. Set both VOLTS/CM switches to 0.5 and AC-DC-GND switches to AC

13. Check High Frequency Compensation

a Requirement-Waveform must be flat topped with no more than 3% peak-to-peak rolloff, spiking and/or ringing, no more than 6% peak to-peak aberration in ADD The risetime is dependent on the oscilloscope/Type 1A2 combination See the Characteristics section

b. Connect the fast rise + output of the Square-Wave Generator through a GR to BNC adapter, a 50 ohm coaxial cable, a 50 ohm termination to the INPUT 1 connector

c. Set the frequency to approximately 120 kHz and adjust the amplitude for a 4 cm display

d Set the Time/CM switch to 1 uSEC and adjust the Triggering level control for a stable display.

a. Check-Waveform is flat topped with no more than 3% (1 2 mm) peak-to-peak rolloff, spiking and/or ringing. (See Fig. 6-3A)

f. Set the MODE switch to ADD

g. Check—Wavefrom is flat topped with no more than 6% (2.4 mm) peak-to-peak aberration.

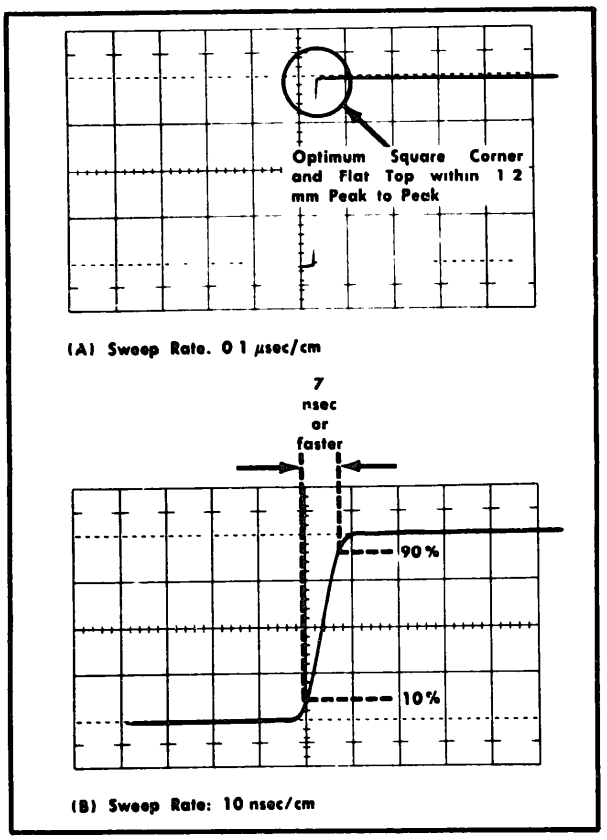

Fig. 6-3. High-Frequency waveform displays at different sweep rates.

h. Check risetime by setting the Magnifier to X10 and measuring the rising portion of waveform between the 10% and 90% points Risetime should be 7 ns or less with Types 544, 546 or 547 oscilloscopes (see Fig. 6-3B).

i. Remove the 50 ohm termination from the INPUT 1 connector and reconnect it to the INPUT 2 connector.

j. Turn the Magnifier to X1 and repeat the above check procedure to check the flat top of the Channel 2 waveform

k. Remove the signal and turn the Triggering Level control fully clockwise; set the MODE switch to CH 1.

14. Check Bandwidth

a. Requirement-Bandwidth is dependent on the oscilloscope/Type 1A2 combination See the Characteristics section

b. Connect the Constant Amplitude Signal Generator to the INPUT 1 connector through a GR to BNC adapter, 50 ohm coaxial cable and a 50 ohm termination.

c. Adjust the output of the Constant Amplitude Signal Generator for 4 cm of 50 kHz signal.

d Increase the frequency until there is exactly 2.8 cm of deflectron. See Fig. 6-4.

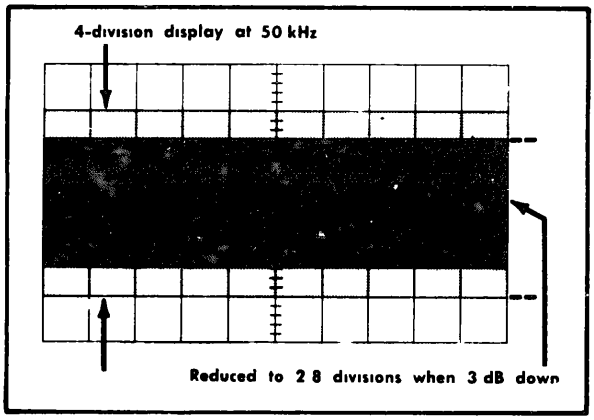

Fig 6-4. Typical CRT display when checking frequency response

e. Check-This is the 3 dB down point and should be no lower in frequency than the Characteristics section shows (50 MHz or higher with Types 544, 546 or 547 Oscilloscopes)

f. Change the MODE switch to ADD and repeat the above check procedure

g. Remove the signal from the INPUT 1 connector and apply it to the INPUT 2 connector, set the MODE switch to CH 2 and repeat the check procedure to determine the frequency response of Channel 2

h. Remove the signal and set the MODE switch to CH 1

i. Set the Time/CM switch to 1 mSEC

15. Check High Frequency Common Mode Rejection

a. Requirement-Common mode rejection must be 20 to 1 or greater

b. Set both VOLTS/CM switchcs to 2 volts

c. Connect the Constant Amplitude Signal Generator to both INPUT connectors through a GR to BNC adapter, a 50 ohm coaxial cable, a 50 ohm termination and a Dual Input Coupler

d. Adjust the output amplitude of the Constant Amplitude Signal Generator for 2.5 cm of 50 kHz signal

e. Change the frequency to 50MHz (with Types 544, 546 or 547 Oscilloscope)

f. Set both VOLTS/CM switches to 0.5, the MODE switch to ADD and pull the Channel 2 PULL TO INVERT switch

g. Check-Displayed amplitude must be 5 cm or less, a 20 to 1 rejection ratio If displayed amplitude is greater, pull the Channel 1 PULL TO INVERT switch and push in the Channel 2 PULL TO INVERT switch One of the combinations must result in a displayed amplitude of 5 cm or less

h Remove the Dual Input Coupler, push in both PULL TO INVERT switches and set the MODE switch to CH 1

16. Check AC Coupled Low Frequency Response

a. Requirement-Response 3 dB down at 2 Hz or less

b. Set both AC-DC-GND switches to AC, both VOLTS/CM switches to 2 volts and the Time/CM switch to 1 SEC, reducing the Intensity to normal brilliance to avoid burning the CRT

c. Connect a patch cord from the + Gate B connector to the INPUT 1 connector The display obtained should be a falling RC curve

d. Adjust the Channel 1 VARIABLE control for a display amplitude of 4 cm

e. Position the display to the center of the graticule area and measure the time it takes the waveform to fall from 4 cm to 1.5 cm See Fig 6-5

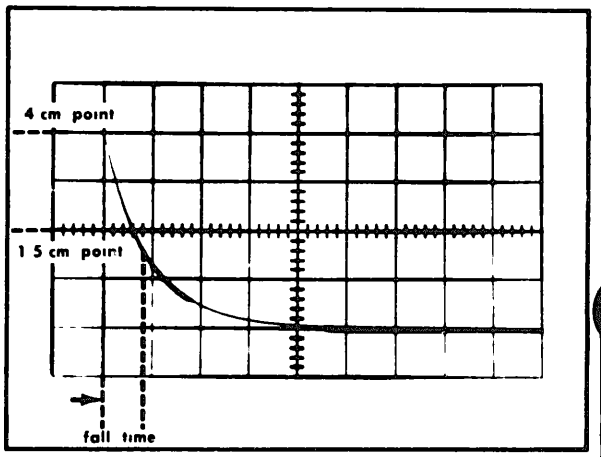

Fig 6-5 Measuring AC coupled low-frequency response using an RC curve

f. Check-Time should be more than 0.08 s (8 mm) which indicates a frequency of less than 2 Hz

g. Change the patch cord to the INPUT 2 connector and set the MODE switch to CH 2

h. Repeat the check procedure to check the Channel 2 low frequency response

i. Remove the patch cord and set the Time/CM switch to 1 mSEC

TRIGGER OUTPUT CHECKS[2]

17. Check Trigger Balance

a. Requirement-Trace must shift no more than ±2 mm when the TRIGGER SELECTOR is switched from CH 1 to CH 2

b. Set the MODE switch to ALT and readjust the VAR ATTEN BAL if necessary (step 1)

[2]Applies only to instruments with a serial number of 716 or higher

c. Position both traces to the center of the graticule area, 4 mm apart

d. Change the TRIGGER SELECTOR switch between CH 1 and CH 2

e. Check-Trace must shift no more than ±2 mm.

18. Check Trigger Out Gain

a. Requirement-Tagger gain must be at least 10.

b. Set the TRIGGER SELECTOR switch to CH 1

c. Connect a 50 ohm coaxial cable from the TRIG OUT connector to the INPUT 2 connector

d. Connect a 50 ohm coaxial cable from the Calibrator to the INPUT 1 connector and set the Calibrator for a 50 mV signal.

e. Set the Channel 2 VOLTS/CM switch to 5 and compare the Channel 2 display amplitude against the Channel 1 display amplitude.

f. Check-Channel 2 amplitude must be at least equal to or greater than the Channel 1 amplitude (10X).

g Disconnect the Calibrator signal.

19. Check Trigger Bandwidth

a. Requirement-Must be no more than 3 dB down at 5 MHz with a 5 V peak-to-peak reference signal amplitude

b. Set the MODE switch to CH 2 and the TRIGGER SELECTOR switch to CH 1

c. Set the Channel 2 VOLTS/CM switch to 0.1 volt.

d. Apply a 50 kHz reference signal from the Constant Amplitude Signal Generator to the INPUT 1 connector through a 50 ohm coaxial cable and 50 ohm termination.

e. Set the Constant Amplitude Signal Generator output control for a signal amplitude of 5 cm

f. Change the Constant Amplitude Signal Generator frequency to 5 MHz

g. Check-Signal amplitude must be at least 3 cm or greater.

h. Disconnect the Constant Amplitude Signal Generator coaxial cable and the coaxial cable from the TRIG OUT connector to the INPUT 2 connector

This completes the performance check procedure for the Type 1A2 Dual-Trace Plug-In Unit If the Instrument has met all performance requirements given in this procedure, it is correctly calibrated and within the specified tolerances.

CALIBRATION

Introduction

The Type 1A2 should be calibrated after each 500 hours of operation or every six months if used intermittently Also, if tubes, transistors, or other electrical components are changed, calibration of the instrument should be checked.

The instructions that follow ore arranged in a specific sequence for a complete calibration. Any of the steps may be performed out of sequence except the adjustment of the OUTPUT DC LEVEL, the +10 VOLTS and the high-frequency compensation steps That is the OUTPUT DC LEVEL and +10 VOLTS should be set prior to the high-frequency compensation Also, neither of these steps should be performed alone without at least a check of the other

EQUIPMENT REQUIRED

(see Fig. 7-1)

General

The following equipment, or its equivalent, is required for complete calibration of the Type 1A2 Specifications given are the minimum necessary for accurate calibration of this instrument. All test equipment is assumed to be correctly calibrated and operating within the original specifications. If equipment is substituted, it must meet or exceed the specifications of the recommended equipment

Special Test Equipment

For the quickest and most accurate calibration, special calibration fixtures are used where necessary All calibration fixtures listed under Equipment Required can be obtained from Tektronix, Inc Order by part number through your local Tektronix Field Office or representative.

Equipment Required

1. Test oscilloscope for use with the Type 1A2 Type 544, 546 or 547 recommended.

2. Standard amplitude calibrator. Amplitude accuracy, **within 0.25%; signal amplitude,** 20 millivolts to 100 volts; **output signal. 1 kHz Tektronix calibration** fixture 067-0502-00 **recommended.**

NOTE

The standard amplitude calibrator must be used to check and/or set the deflection factor of the Type 1A2 to an accuracy of ±3%. If an accuracy of ±6% is sufficient, use the calibrator of the oscilloscope instead of item 2.

3. Square-wave generator Frequency 1, 10 and 120 kHz **risetime,** 13 ns and 1 ns maximum; output amplitude, about 8 volts into 50 ohms. Tektronix Type 106 Square-Wave Generator recommended.

4. Constant amplitude signal generator. Frequency, 50 kHz to at least 50 MHz Tektronix Constant Amplitude Signal Generator Type 191 recommended

5. Termination. Impedance, 50 ohms, accuracy, ±3%, connectors, BNC Tektronix Part No. 011-0049-00

6. Input RC Normalizer Time constant, 1 megohm X 15 pF, attenuation, 2X; connectors, BNC. Tektronix Part No. 067-0537-00.

7. Cable (two) Impedance, 50 ohm, length, 18 inch, connectors, BNC Tektronix Part No 012-0076-00.

8. Dual input coupler Matched signal transfer to each input Tektronix Part No 067-0525-00

9. Adapter Connectors, GR to BNC tack Tektronix Part No 017-0063-00

10. Precision DC voltmeter Accuracy, within ±0.05%, meter resolution, 50 uV; range, 10 to 100 volts A John Fluke Differential Voltmeter, Model 801B recommended

11. Adjustment tools (See Fig 7-2)

	Description	Tektronix Part No
a	Screwdriver, 3" shaft, 1/8" wide tip.	003-0192-00
b	Insulated screwdriver, 1½" shaft, non-metallic.	003-0000-00
c	Tuning tool	
	Handle	003-0307-00
	Insert with a wire pin	003-0308-00
	Calibration tool tip	003-0334-00

CALIBRATION RECORD AND INDEX

This Abridged Calibration Procedure is provided to aid in checking the operation of the Type 1A2 It may be used as a calibrating guide by the experienced calibrator, or it may be used as a calibration record Since the step numbers and titles used here correspond to those used in the complete Calibration Procedure, the following procedure serves as an index to locate a step in the complete Calibration Procedure Characteristics are those listed in the Characteristics section of the Instruction Manual

Type 1A2 Serial No. _____

Calibration Date _____

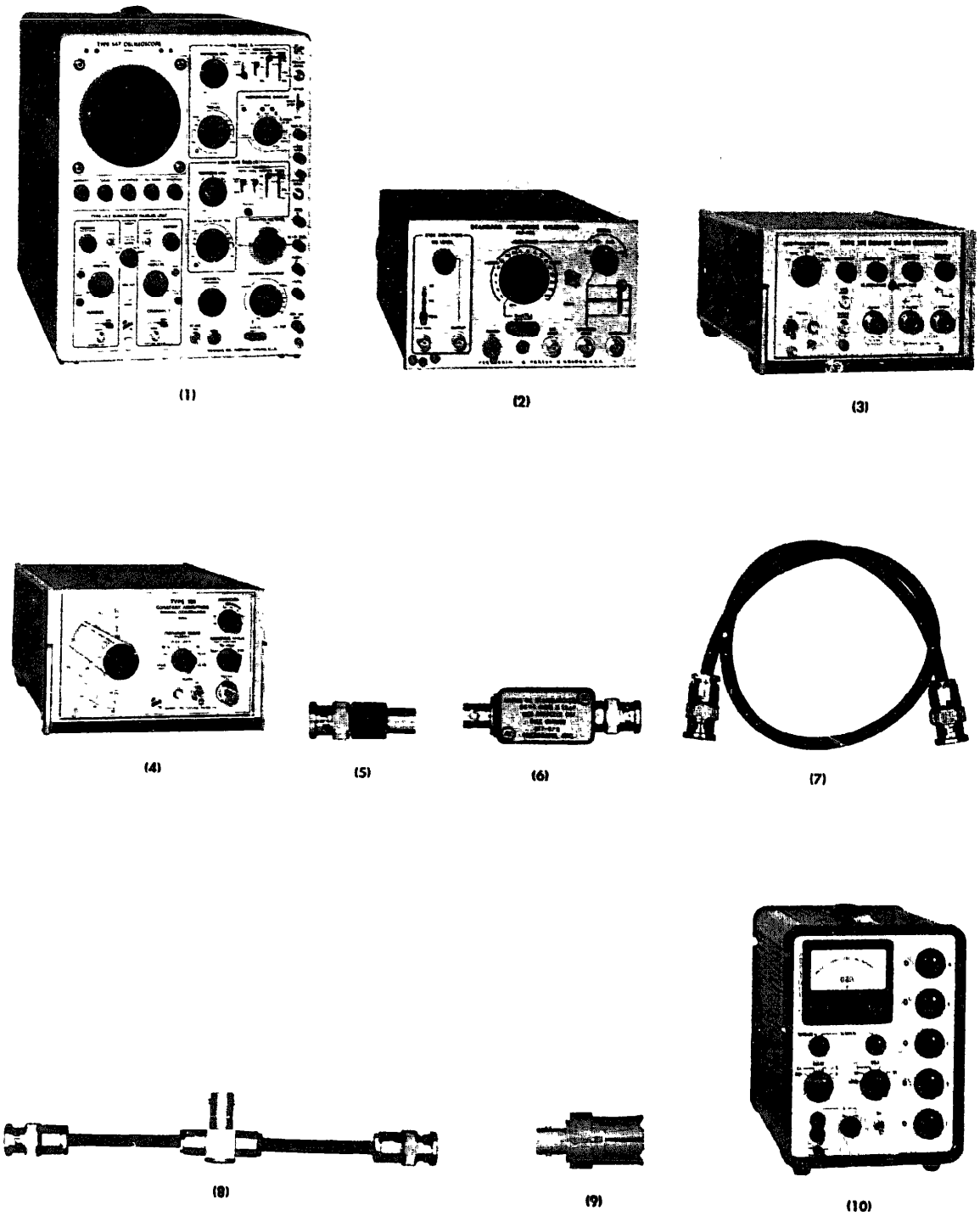

Fig 7-1. Equipment required for calibrating.

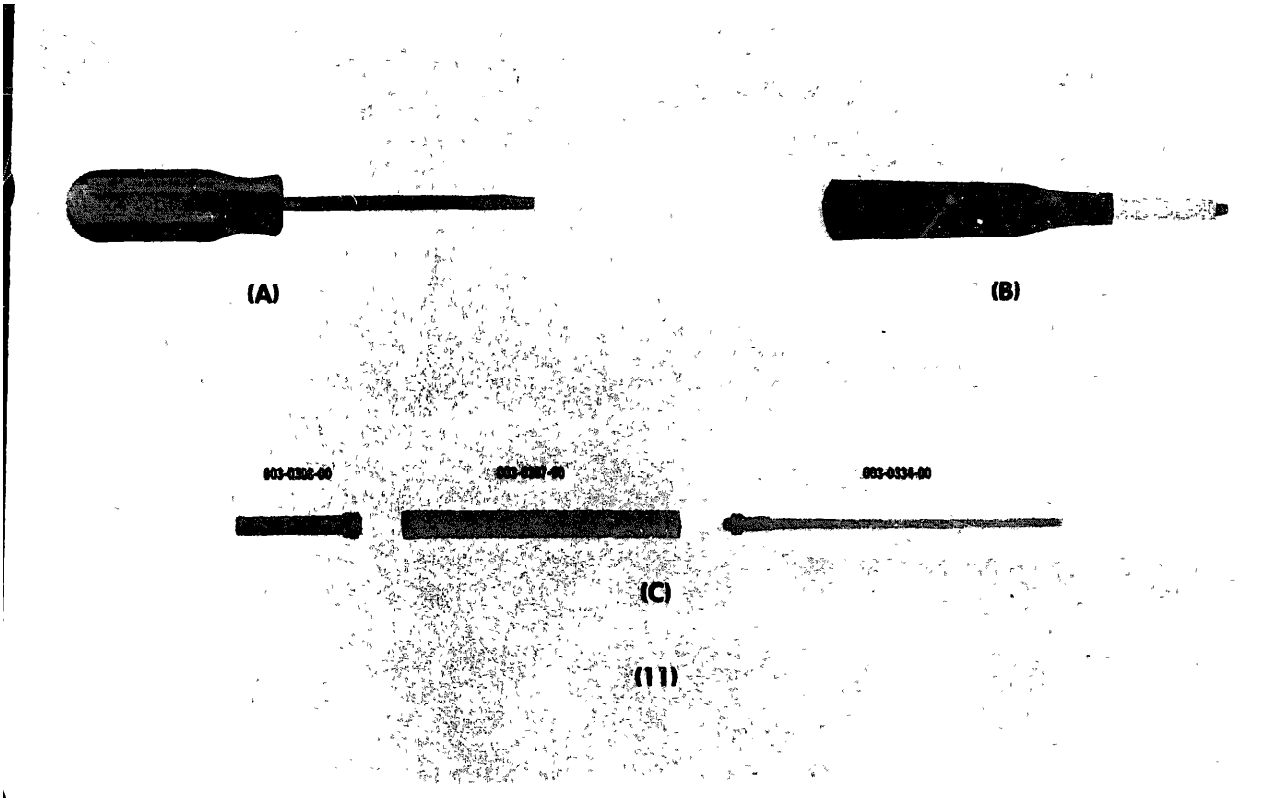

Fig 7-2. Adjusting tools required for calibrating the Type 1A2.

1. Adjust Variable Attenuator Balance (page 7-5)
   Traces should not shift as either VARIABLE control is rotated
2. Adjust R415[1] (page 7-6)
   Maximum trace shift of ±2 mm as TRIGGER SELECTOR switch is changed from CH 1 to CH 2
3. Adjust Output DC Level (page 7-6)
   Meter reading 67.5% of the measured +100-volt supply
4. Adjust +10 Volts (page 7-6)
   Meter reading of +10 volts
5. Adjust Channel 2 Gain (page 7-7)
   Correct vertical deflection indicated by VOLTS/CM switch
6. Check Channel 2 Variable Control (page 7-7)
   VARIABLE control range at least 2.5 to 1
7. Adjust Channel 1 Gain (page 7-8)
   Correct vertical deflection indicated by VOLTS/CM switch
8. Check Channel 1 Variable control (page 7-8)
   VARIABLE control range at least 2.5 to 1
9. Check for Microphonics (Both Channels) (page 7-8)
   Microphonics should not exceed 1 cm peak to peak
10. Check Channel 1 Gate or Grid Current (page 7-8)
    Maximum trace shift is ±4 mm
11. Check Channel 2 Gate or Grid Current (page 7-8)
    Maximum trace shift is ±4 mm
12. Check Channel 2 Normal-Invert Balance (page 7-8)
    Maximum trace shift is ±1 cm
13. Check Channel 1 Normal-Invert Balance (page 7-8)
    Maximum trace shift is ±1 cm
14. Check Chopped-Mode Operation (page 7-9)
    Repetition rate is 220 kHz ±20%
15. Check Alternate-Mode Operation (page 7-9)
    Two traces on the CRT Trace alternation at all sweep rates
16. Check Add Mode Operation (page 7-9)
    Correct addition and subtraction of signals
17. Check Volts/CM Attenuation Ratios (Both Channels) (page 7-10)
    Vertical deflection within ±3% of VOLTS/CM switch indication
18. Check Trigger Out Gain (page 7-11)
    Gain at least 10

[1] Applies only to instruments with serial numbers of 716 or higher

19. Adjust Input and Attenuator Compensation (Both Channels (page 7-12)

Optimum square-wave response in all VOLTS/CM switch positions

20. Adjust High-Frequency Compensation (page 7-15)

Optimum square-wave response at high frequency.

21. Check Frequency Response (page 7-17)

No more than 3 dB down at 50 MHz with Types 544, 546 or 547 Oscilloscopes

22. Check Trigger Bandwidth* (page 7-18)

No more than 3 dB down at 5 MHz with .5 volt reference signal.

23. Check Hugh-Frequency Common Mode Rejection (page 7-18)

Ratio at least 20-1 at 50 MHz with Types 544, 546 or 547 Oscilloscopes.

CALIBRATION PROCEDURE

General

In the following calibration procedure, a test equipment setup is shown for each major setup change. Complete control settings are listed beneath the picture. If only a partial calibration is preformed, start with the nearest setup preceding the desired portion.

*Applies only to instruments with serial numbers of 716 or higher.

NOTE

When performing a complete recalibration, best performance will be provided if each adjustment is made to the exact setting, even if the Check is within the allowable tolerance.

The following procedure uses the equipment listed under Equipment Required If substitute equipment is used, control settings or setup must be altered to meet the requirements of the equipment used.

Preliminary Procedure

a. Lay the oscilloscope on its right side for access to the bottom side of the Type 1A2.

b. Remove the left side and bottom panels from the oscilloscope to expose the left and bottom sides of the vertical plug-in compartment.

c Install the Type 1A2 in the oscilloscope vertical plug-in compartment.

d. Connect the power cord of the oscilloscope to the design-center operating voltage for which it is wired.

e. Turn on the oscilloscope and allow 15 minutes for warm up and stabilization.

f. Turn on all test equipment.

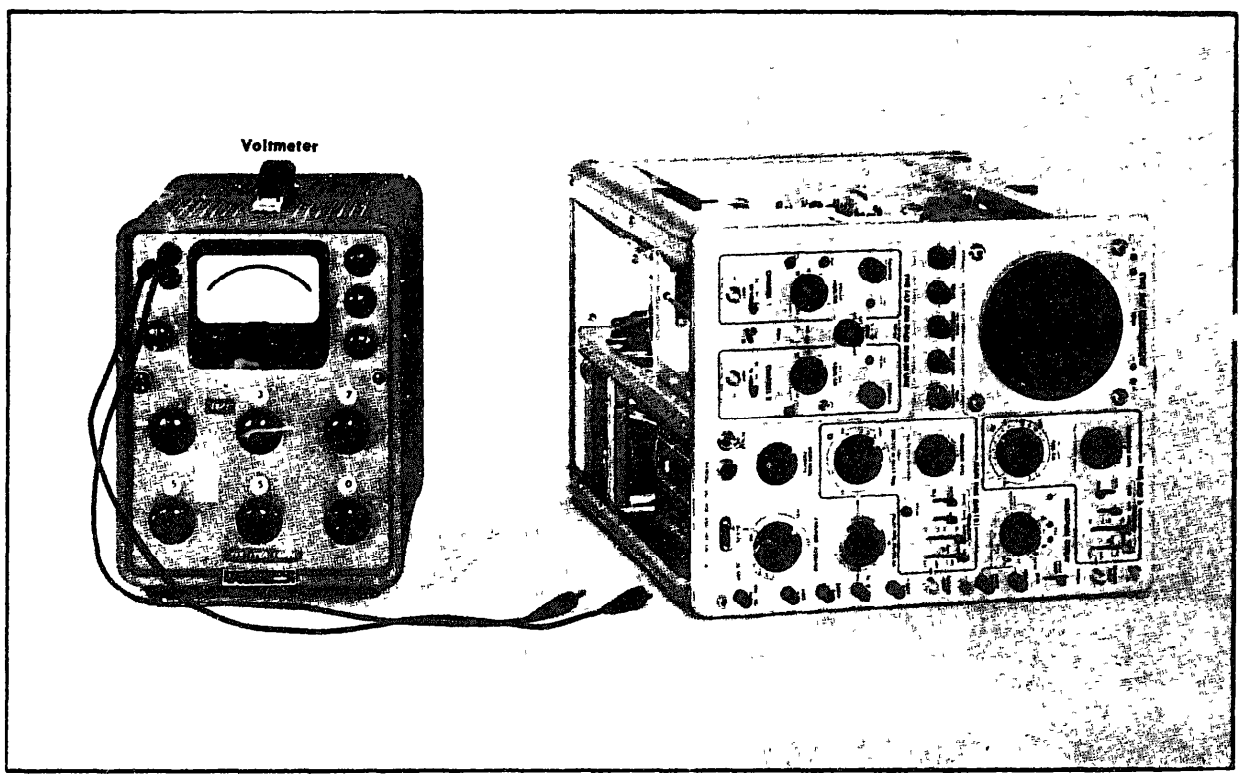

Fig 7-3 Initial equipment setup for steps 1 through 4

Control Settings

Test Oscilloscope

Horizontal Display	B (546, 547) Normal (×1) (544)
Sweep Magnifier	×1 off (546, 547)
Single Sweep Switch	Normal
Triggering Level	Fully clockwise and pushed in
Triggering Source	Norm Int
Triggering Coupling	AC
Triggering Slope	+
Triggering Mode	Auto
Time/CM	5 mSEC
Variable (Time/CM)	Calibrated
Horizontal Position	Centered
Vernier (Horizontal Position)	Centered
CRT Cathode Selector	CRT Cathode
Amplitude Calibrator	Off

Type 1A2

MODE	ALT
TRIGGER SELECTOR	CH 1

[5]Applies only to instruments with serial numbers of 716 or higher

Both Channels	
POSITION	Centered
VOLTS/CM	05
VARIABLE	CALIBRATED
PULL TO INVERT	Pushed in
AC-DC-GND	GND

1. Adjust Variable Attenuator Balance

a. Equipment setup is shown in Fig 7-3

b. Position traces near center of CRT

c. Check-Traces should not shift as either VARIABLE control is rotated

d. Adjust-Channel 1 VAR ATTEN BAL adjustment for no trace shift as the Channel 1 VARIABLE control is rotated and the Channel 2 VAR ATTEN BAL adjustment for no trace shift as the Channel 2 VARIABLE control is rotated

c. Interaction of the VAR ATTEN BAL adjustments makes it necessary to repeat the adjustments until there is no further Interaction

f. Set both VARIABLE controls in the CALIBRATED position

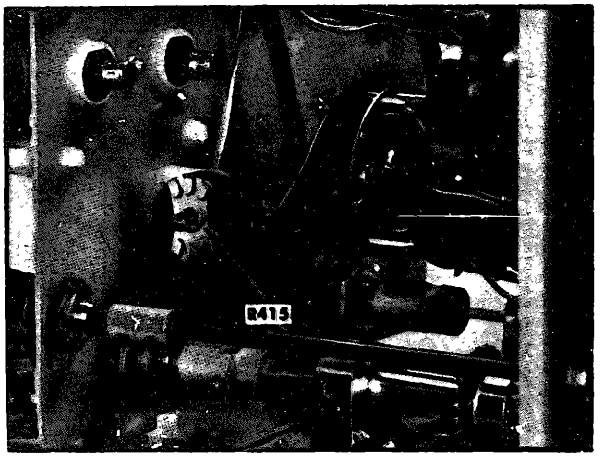

Fig 7-4 Location of R415

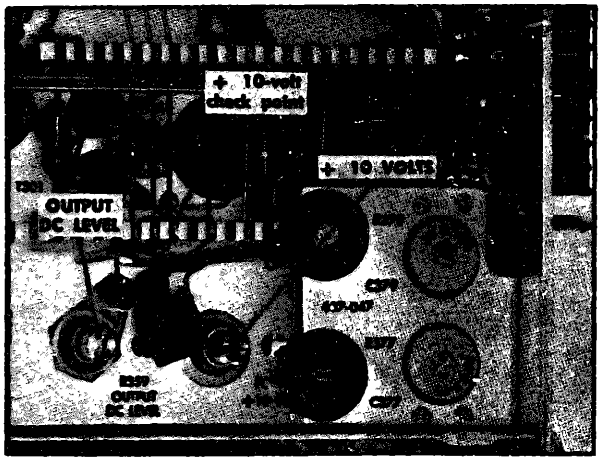

Fig 7-5 Location of Output DC Level and +10 Volts adjustments and +10 volt test point

2. Adjust Trigger Balance R415

a. Equipment setup remains as in step 1

b. Position the Channel 1 trace 1 cm above the graticule center line and the Channel 2 trace 1 cm below the graticule center line with the POSITION controls

c. Check-Maximum trace shift of ±2 mm as the TRIGGER SELECTOR switch is changed back and forth between CH 1 and CH 2

d. Adjust-R415 for minimum trace shift as the TRIGGER SELECTOR switch is changed back and forth between CH 1 and CH 2 See Fig 7-4 for location

3. Adjust Output DC Level

a. Equipment setup is shown in Fig 7-3

b. Measure the +100 volt supply of the oscilloscope with the DC voltmeter

NOTE

Do not connect the voltmeter to the +100 volts available at pin 10 of the Interconnecting plug. This voltage is on the output side of a decoupling network and will typically be a few volts less than the required +100 volts The +100-volt supply leads in the oscilloscope are color coded with black and brown stripes on a white wire.

Applies only to instruments with serial number 716 or higher

c. Calculate 67.5% of the measured +100-volt supply

d. Connect the DC voltmeter between ground and either pin 1 or 3 (+67.5 volts) of the interconnecting plug in the Type 1A2

e. Check-Meter reading 67.5% of the measured +100-volt supply

f. Adjust-OUTPUT DC LEVEL of the Type 1A2 for a meter reading of exactly 67.5% of the measured +100-volt supply See Fig 7-5 for location

g. Remove the voltmeter connections

4. Adjust +10 Volts (R396)

a. Equipment setup is shown in Fig 7-3

b. Connect the DC voltmeter between the +10-volt test point and ground See Fig 7-5 for location

c. Check-Meter reading of +10 volts

d. Adjust -- +10 VOLTS for a meter reading of exactly 10 volts

e. Remove the voltmeter connections

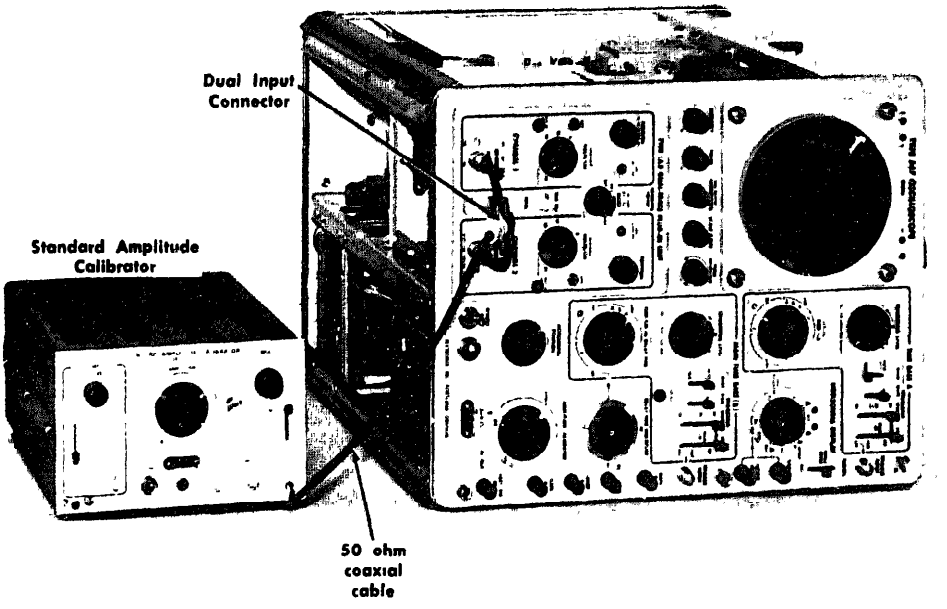

Fig 7-6 Initial equipment setup for steps 5 through 16.

Control Settings

Test Oscilloscope

Horizontal Display	B (546, 547) Normal (1) (544)
Sweep Magnifier	×1 off (546, 547)
S le Sweep Switch	Normal
Ti ggering Level	Fully clockwise and pushed in
Triggering Source	Norm Int
Triggering Coupling	AC
Triggering Slope	+
Triggering Mode	Auto
Time/CM	5 mSEC
Variable (Time/CM)	Calibrated
Horizontal Position	Centered
Vernier (Horizontal Position)	Centered
CRT Cathode Selector	CRT Cathode
Amplitude Calibrator	Off

Type 1A2

MODE	CH 2
TRIGGER SELECTOR	CH 2
Both Channels	
POSITION	Centered
VOLTS/CM	05
VARIABLE	CALIBRATED
PULL TO INVERT	Pushed in
AC-DC-GND	GND

5. Adjust Channel 2 Gain

a. Equipment setup is shown in Fig 7-6

b. Apply a 0.2 volt calibrator signal from the Standard Amplitude Calibrator to both INPUT 1 and INPUT 2 con nectors through a 50 ohm coaxial cable and the Dual Input Coupler (See the note after item 2 in Equipment Required)

c. Set the Channel 2 AC-DC-GND switch to AC

d. Check--Display amplitude should be 4 cm

e. Adjust---Channel 2 GAIN adjustment for a display amplitude of 4 cm

NOTE

Use the Channel 2 POSITION control to position the display for convenient measuring

6. Check Channel 2 Variable Control

a. Equipment setup is as given in step 5

b. Set the Channel 2 VOLTS/CM switch to the 2 posi tion and change the input signal to 1 volt

c. Turn the Channel 2 VARIABLE control fully counter clockwise

d. Check Displayed amplitude should be 2 cm or less

NOTE

If turning the VARIABLE control causes erratic jumping of the trace, the control is defective.

e. Return the Channel 2 VARIABLE control to the CALIBRATED position

1. Adjust Channel 1 Gain

a. Equipment setup is as given in step 6.

b. Set the input signal to 2 volt.

c. Set the MODE switch to ADD, the Channel 1 AC-DC-GND switch to AC and the Channel 2 VOLTS/CM switch to 0.5 Pull out the Channel 2 PULL TO INVERT switch.

NOTE

Use the Channel 1 POSITION control to position the trace to a convenient point on the screen.

d. Check-Signal canceled on the CRT.

e. Adjust-Channel 1 GAIN adjustment to cancel signal on the CRT Be sure both VARIABLE controls are set to the CALIBRATED position.

8. Check Channel 1 Variable Control

a. Equipment setup is as given in step 7.

b. Set the MODE switch to CH 1, the Channel 1 VOLTS/CM switch to .2 and the Channel 2 AC-DC-GND switch to GND.

c. Set the input signal to 1 volt.

d. Turn the Channel 1 VARIABLE control fully counterclockwise.

e. Check-Displayed amplitude should be 2 cm or less.

NOTE

If turning the VARIABLE control causes erratic jumping of the trace, the control is defective.

f. Disconnect the Dual Input Coupler, return the Channel 1 VARIABLE control to the CALIBRATED position and set the channel 1 VOLTS/CM switch to 05.

9. Check for Microphonics (Both Channels)

a. Equipment setup remains as in step 8.

b. Set both AC-DC-GND switches to GND and adjust the Channel 1 POSITION control so the trace is positioned to the graticule center.

c. Tap the left side of the oscilloscope lightly near the Type 1A2 front panel and watch for excessive microphonics

d. Check—Amplitude of microphonics should not exceed 1 cm peak to peak.

NOTE

Below SN 11000, if microphonics are excessive, turn off the oscilloscope power and replace V133. Turn on the oscilloscope and allow sufficient warm-up time (about 15 minutes) for the new tube. Get the trace on the CRT by adjusting the Channel 1 VAR ATTEN BAL control. Check for microphonics. If they are not excessive, repeat steps 1 and 7.

e. Set the MODE switch to CH 2.

f. Adjust the Channel 2 POSITION control so the trace is positioned to graticule center.

g. Repeat step 9b In this case, if microphonics are excessive, turn off the oscilloscope power and replace V233 in instruments below SN 11000 Turn on the power and allow about 15 minutes warm-up time Get the trace on the CRT by adjusting the Channel 2 VAR ATTEN BAL control Check for microphonics If they are not excessive, repeat steps and 5.

10. Check Channel 1 Gate Current (SN 11000 & up) or Grid Current (Below SN 11000)

a. Equipment setup remains as in step 9.

b. Set the MODE switch to CH 1, the Channel 1 AC-DC-GND switch to DC and note the position of the trace.

c Set the Channel 1 AC-DC-GND switch to GND.

d Check-Maximum trace shift is ±4mm.

11. Check Channel 2 Gate Current (SN 11000 & up) or Grid Current (Below SN 11000)

a. Equipment setup is the same as in step 10.

b. Set the MODE switch to CH 2, the Channel 2 AC-DC-GND switch to DC and note the position of the trace.

c. Set the Channel 2 AC-DC-GND switch to GND.

d. Check-Maximum trace shift is ±4 mm.

12. Check Channel 2 Normal-Invert Balance

a. Equipment setup is unchanged from step 11.

b. Note position of the trace.

c. Pull out the Channel 2 PULL TO INVERT switch and note trace shift.

d. Chock-Maximum trace shift is ±1 cm.

e. Push in the Channel 2 PULL TO INVERT switch.

13. Check Channel 1 Normal-Invert Balance

a. Equipment setup remains unchanged.

b. Set the MODE switch to CH 1.

c. Note position of the trace.

d. Pull out the Channel 1 PULL TO INVERT switch and note trace shift.

e. Check-Maximum trace shift is ±1 cm.

f. Push in the Channel 1 PULL TO INVERT switch

14. Check Chopped-Mode Operation

a. Equipment setup remains as in step 13.

b. Set the MODE switch to CHOP. Two free-running traces should be displayed.

c. Using both POSITION controls, position the Channel 1 trace 1 cm above the center graticule line and the Channel 2 trace 1 cm below the center graticule line.

d. Set the oscilloscope Time/CM switch to 0.5 uSEC and adjust the Triggering Level control to obtain a stable display

e. Horizontally position the display so the display starts at the left side of the graticule.

f. Check-Repetition rote of the displayed waveform should be approximately 220 kHz, within a tolerance of ± 20%. This is equal to a time duration of 4.5 us per cycle with a tolerance of ±0.9 us See Fig. 7-7A.

g. Set the oscilloscope CRT Cathode Selector switch to the Chopped Blanking position Note that the switching portion (vertical lines) of the trace from one channel to the other blanks out (becomes dim). This indicates that the Type 1A2 blanking pulses are blanking the beam during the switching time internal between channels. See Fig. 7-78.

h. Set the oscilloscope Time/CM switch to .1 mSEC and turn the Triggering Level control fully clockwise.

i. At normal intensity and with the FOCUS and Astigmatism controls properly set, check the width (thickness) of the traces. Normal trace width is about 1 mm or less.

j. Return the oscilloscope CRT Cathode Selector switch to CRT Cathode position.

15. Check Alternate-Mode Operation

a. The equipment setup remains unchanged.

b. Set the MODE switch to the ALT position.

c. Check-Two traces on the CRT.

d. Set the oscilloscope Time/CM switch to various sweep rates and check that the traces run alternately across the face of the CRT.

e. Set the Time/CM switch to .5 mSEC

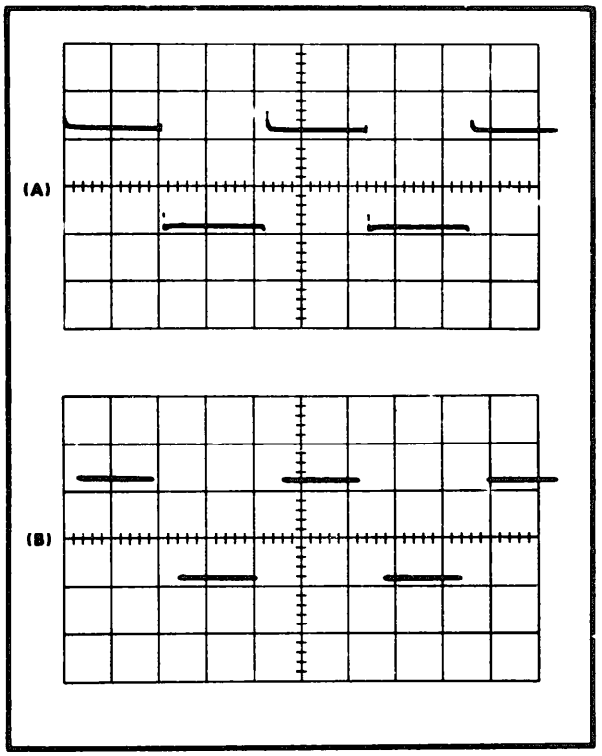

Fig. 7-7. (A) Unblanking chopping-mode waveform, and (B) blanked waveform. Sweep rate is 1 usec/div

16. Check Add Mode Operation

a. Equipment setup remains as in step 15.

b. Apply a 0.1 volt peak-to-peak signal from the Standard Amplitude Calibrator to both INPUT 1 and INPUT 2 connectors through a 50 ohm coaxial cable and the Dual Input Connector.

c. Set the MODE switch to ADD, both AC-DC-GND switches to AC and adjust the Triggering Level control for a stable display.

d. Check-Display waveform is 4cm in amplitude.

e. Pull out the Channel 1 PULL TO INVERT switch.

f. Set the input signal to 1 volt.

g. Check-The two signals should cancel each other out within 1 cm.

h. Disconnect the Duel Input Connector and push in the Channel 1 PULL TO INVERT switch.

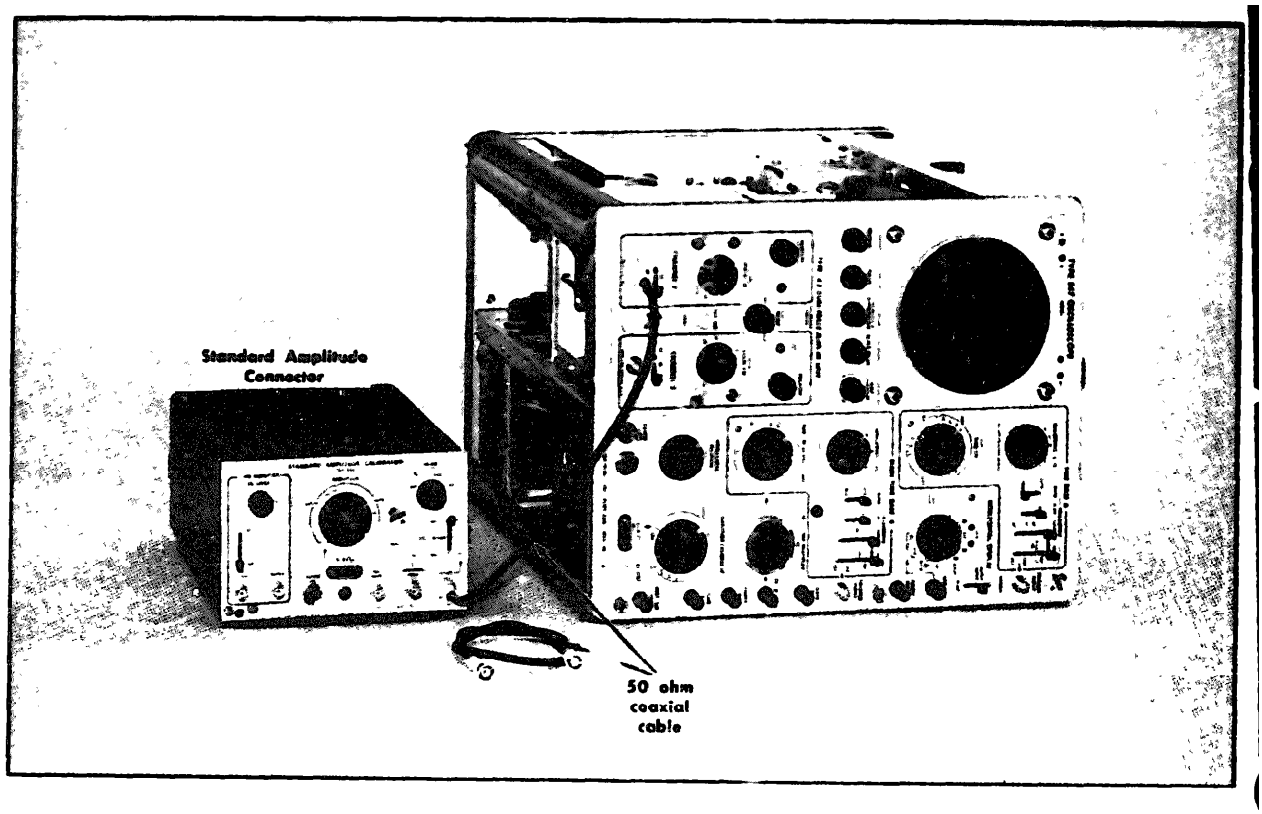

Fig 7-8 Initial equipment setup for steps 17 and 18

Control Settings

Test Oscilloscope

Horizontal Display	B (546, 547) Normal (1) (544)
Sweep Magnifier	·1 off (546, 547)
Single Sweep Switch	Normal
Triggering Level	Fully clockwise and pushed in
Triggering Source	Norm Int
Triggering Coupling	AC
Triggering Slope	+
Triggering Mode	Auto
Time/CM	5 mSEC
Variable (Time/CM)	Calibrated
Horizontal Position	Centered
Vernier (Horizontal Position)	Centered
CRT Cathode Selector	CRT Cathode
Amplitude Calibrator	Off

Type 1A2

MODE	CH 1
TRIGGER SELECTOR	CH 1
Both Channels	
POSITION	Centered
VOLTS/CM	05
VARIABLE	CALIBRATED
PULL TO INVERT	Pushed in
AC DC GND	GND

17. Check Volts/CM Attenuation Ratios (Both Channels)

a. Equipment setup is shown in Fig 7.8

b. Apply a 2 volt signal from the Standard Amplitude Calibrator to the INPUT 1 connector through a 50 ohm coaxial cable

c. Set the Channel 1 AC DC GND switch to DC and the MODE switch to CH 1

d. Adjust the oscilloscope Triggering Level control to obtain a stable display

e. Check Proper deflection at each Channel 1 VOLTS/CM switch position using Table 7 1 as a guide, the allowable error is 3 .

f. Set the input signal to 2 volt and apply the signal to to the INPUT 2 connector

g. Set the Channel 2 AC DC GND switch to DC and the MODE switch to CH 2

TABLE 7-1

Attenuator Accuracy Check

Type 1A2 VOLTS/CM	Standard Amplitude Calibrator In Volts	Display Amplitude In Centimeters	Allowable Error In Millimeters
.05	.2	4	0.0[5]
.1	.5	5	1.5
.2	1	5	1.5
.5	2	4	1.2
1	5	5	1.5
2	10	5	1.5
5	20	4	1.2
10	50	5	1.5
20	100	5	1.5

[5] Was adjusted during step 5 and 7.

h. Check-Proper deflection at each Channel 2 VOLTS/CM switch position using Table 7-1 as a guide; allowable error is ±3%.

18. Check Trigger Out Gain

a. Equipment setup is given in step 17.

Appliers only to instruments with serial number 716 or higher.

b. Apply a .02 volt signal from the Standard Amplitude Calibrator to the INPUT 1 connector through a 50 ohm coaxial cable and connect another 50 ohm coaxial cable from the TRIG OUT connector to the INPUT 2 connector.

c. Set both VOLTS/CM switches to .05, the MODE switch to CH 2, the TRIGGER SELECTOR to CH 1 and both AC-DC-GND switches to AC.

d. Center the display with the Channel 2 POSITION control.

e. Check-Display amplitude is at least 4cm.

f. Connect the input signal to the INPUT 2 connector and the TRIG OUT signal to the INPUT 1 connector.

g. Set the MODE switch to CH 1 and the TRIGGER SELECTOR switch to CH 2.

h. Center the display with the Channel 1 POSITION control.

i. Check-Display amplitude is at least 4 cm.

j. Disconnect the coaxial cable from the TRIG OUT connector to the INPUT 2 connector and disconnect the input signal.

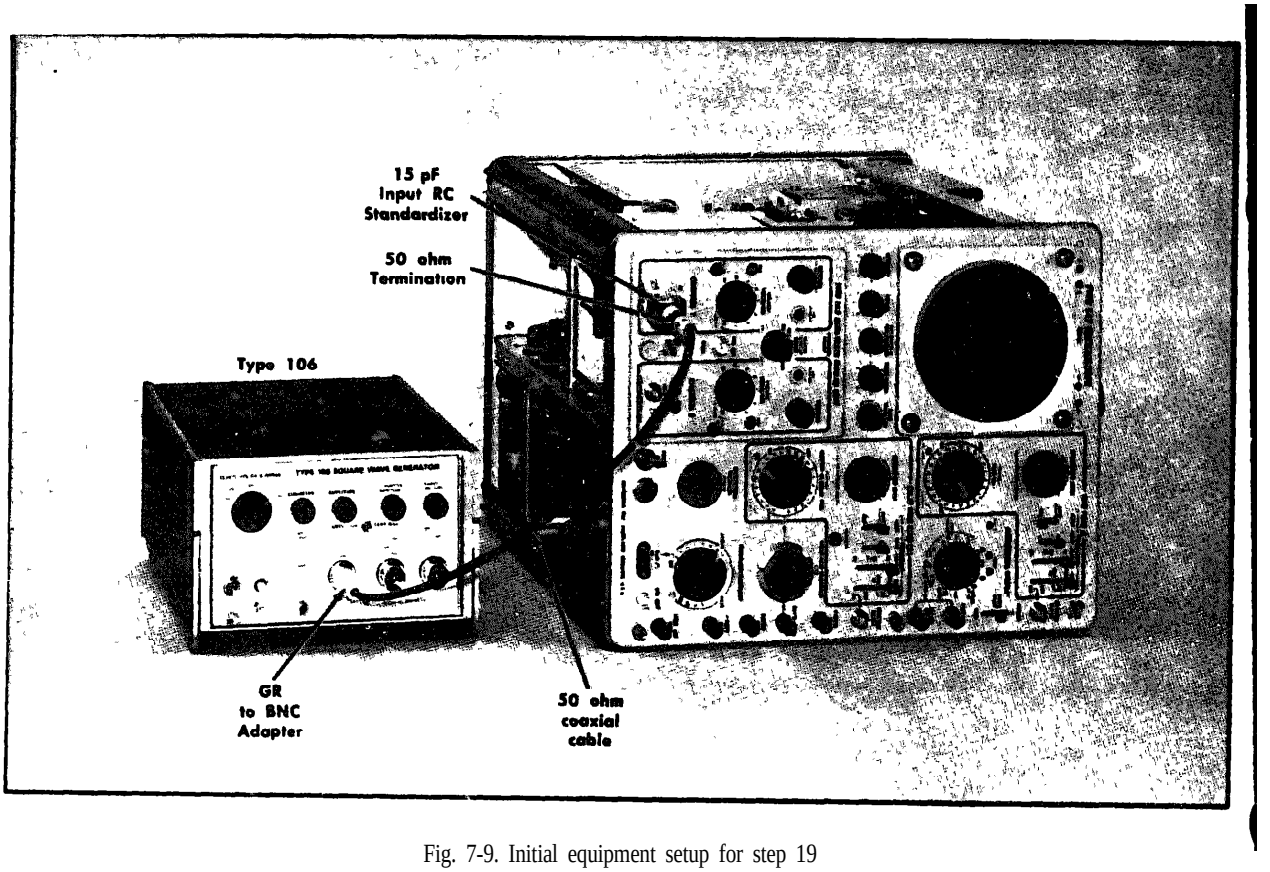

Fig. 7-9. Initial equipment setup for step 19

Control settings

Test Oscilloscope

Horizontal Display	B (546, 547) Normal (×1) (544)
Sweep Magnifier	×1 off (546, 547)
Single Sweep Switch	Normal
Triggering Level	Fully clockwise and pushed in
Triggering Source	Norm Int
Triggering Coupling	AC
Triggering Slope	+
Triggering Mode	Auto
Time/CM	5 mSEC
Variable (Time/CM)	Calibrated
Horizontal Position	Centered
Vernier (Horizontal Position)	Centered
CRT Cathode Selector	CRT Cathode
Amplitude Calibrator	Off

Type 1A2

MODE	CH 1
TRIGGER SELECTOR	CH 1
Both Channels	
POSITION	Centered
VOLTS/CM	05
VARIABLE	CALIBRATED
PULL TO INVERT	Pushed in
AC-DC-GND	GND

19. Adjust Input and Attenuator Compensations (Both Channels)

This step describes how to properly adjust the input shunt capacitance of each channel so the input time constant is the same for each position of the VOLTS/CM switch Thus, an attenuator probe, when compensated to match one setting of the VOLTS/CM switch, will work into the same time constant when using the other VOLTS/CM switch positions Normalizing the input capacitance virtually eliminates the need for recompensating the probe each time a different switch position is used

This procedure also describes a method for compensating the input attenuators so AC attenuation is equal to DC attenuation Since there is some interaction between both sets of adjustments (input capacitance and attenuator compensation) faster, more accurate results are obtained by combining both sets of adjustments in this one procedure

a. Equipment setup is shown in Fig 7-9

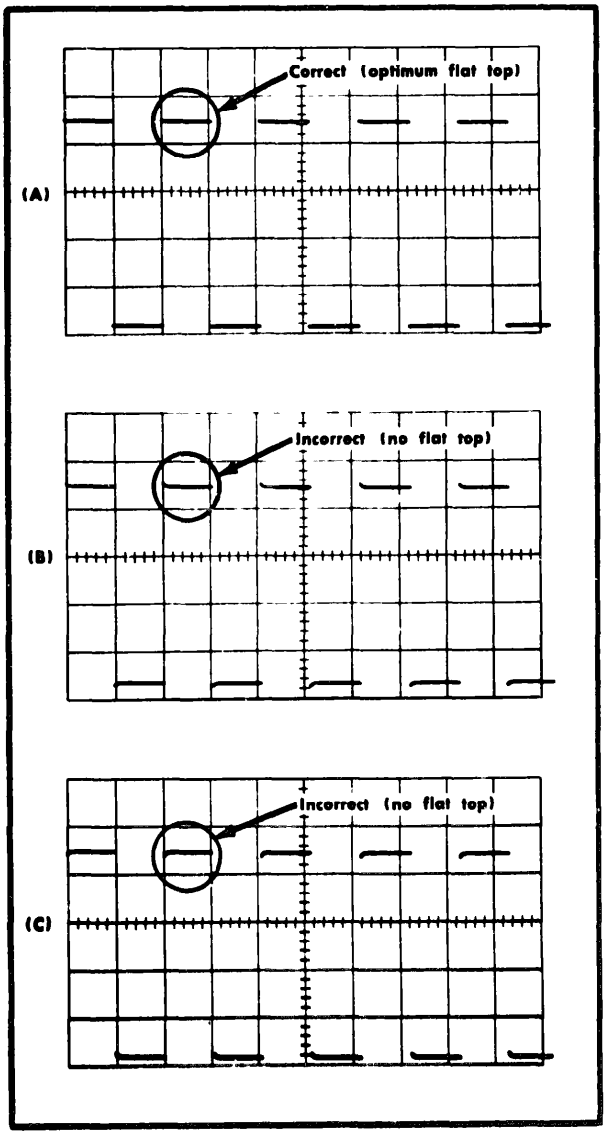

Fig. 7-10. Normalizing the Input time constant and shunt compensation attenuator adjustments of the Type 1A2. Square-wavw repesition rate is 1 kHz and sweep rate is 0.5 mSEC/CM.

b. Apply a 1 kHz signal from the Type 106 Square-Wave Generator high amplitude output through a GR to BNC adapter, a 50 ohm coaxial cable, 50 ohm termination and a 15 pF Input RC Normalizet to the INPUT 1 connector.

c. Adjust the output of the Square-Wave Generator for an approximate 4 cm amplitude display. Center the display with the Channel 1 POSITION control and adjust the oscilloscope Triggering Level control for a stable display.

d. Check—Waveform display should be flat topped as shown in Fig. 7-10.

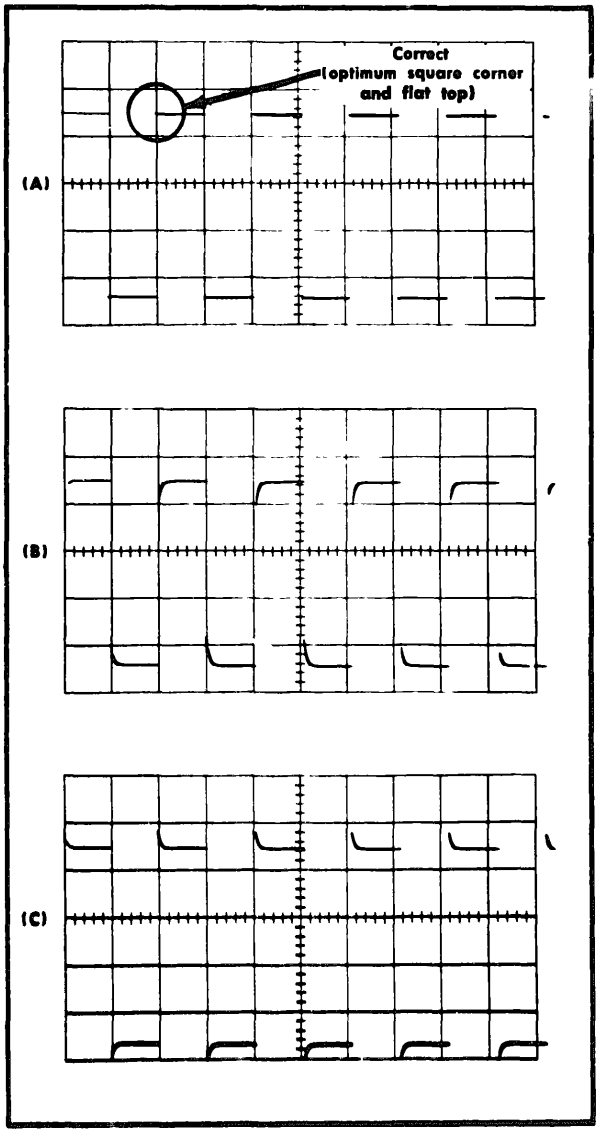

Fig. 7-11. Waveform (A) shows desired results obtained when the series frequency compensating adjustment is correct. Waveforms (B) and (C) show misadjustment. Incorrect adjustment of the shunt compensations will not be seen. Square-wave repetition rate is 10 kHz and sweep rate is 50 uSEC.

e. Adjust—C104 for best square-wave response as shown in Fig. 7-10A if the waveform is not optimum and looks something like that of Fig. 7-10B or Fig. 7-10C.

f. Check—Waveform for optimum flat top at each VOLTS/CM switch setting. Adjust the output of the generator to maintain about 4 cm of display amplitude. It will be necessary to remove the 50 ohm termination at VOLTS/CM switch settings higher than 1 volt.

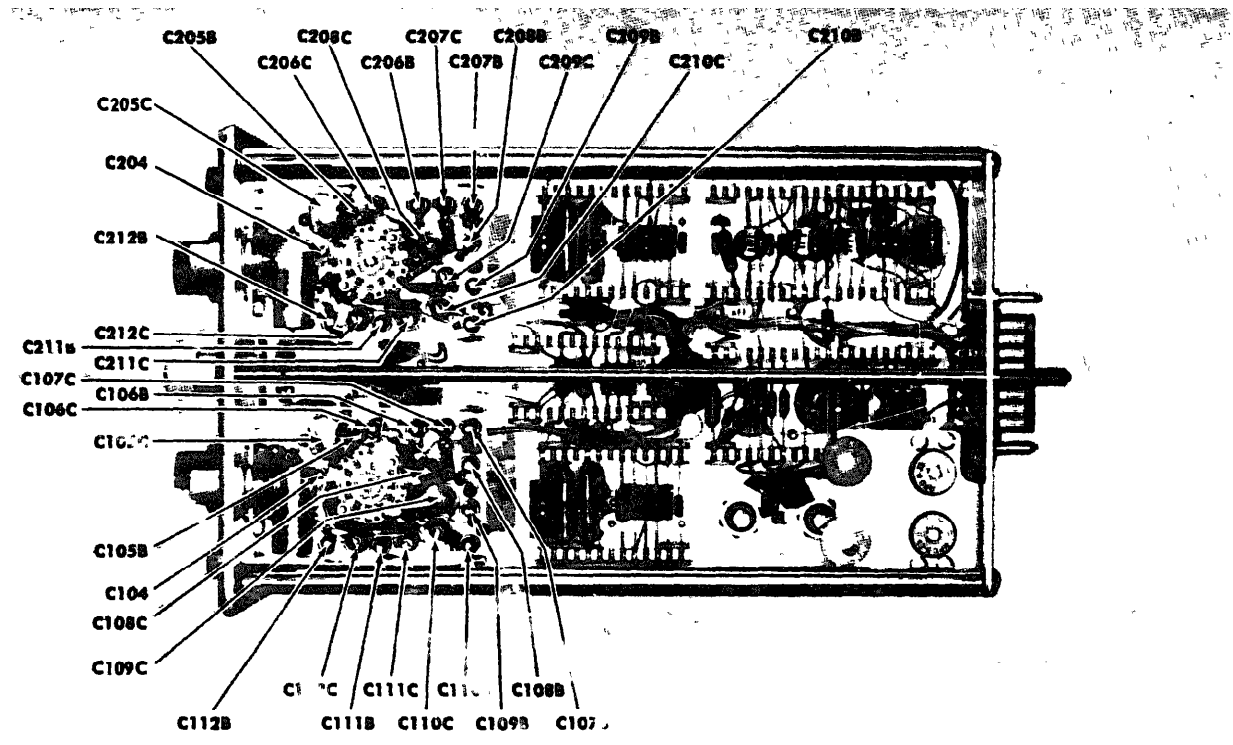

Fig 7-12 Location of input and attenuator compensation adjustments

WARNING

To avoid a signal shock hazard, reduce the gen erator output to minimum when changing signal connections

g. Adjust-input Shunt Capacitor for Optimum fiat top at each VOLTS/CM switch setting using Table 7-2 See Fig 7-12 for the location of adjustments

h Remove the 15 pF Input RC Normalizer and replace the 50 ohm termination

i. Change the Square Wave Generator frequency to 10 kHz, the Time/Cm switch to 50 uSEC the VOLTS/CM switch to 1 and adjust the output for a display amplitude of 4 cm

j. Adjust-Frequency Compensating Capacitor for optimum square corner and flat top at each VOLTS/CM switch setting using Table 7-2 See Fig 7-11A for waveform and Fig 7-12 for location of adjustments It will not be possible to maintain the 4 cm amplitude at the 5 10 and 20 VOLTS/CM switch positions)

Replace the 15 pF Input RC Normalizer and repeat step 19f

Change the MODE and TRIGGER SELECTOR switches to CH 2 and apply the Square Wave Generator signal to the INPUT 2 connector

m. Perform steps 19d through k adjusting the Channel 2 capacitors using Table 7-2 Location of adjustments is shown in Fig 7-12.

n Disconnect the Input RC Normalizer and coaxial cable

TABLE 7-2

Input Time Constant Standardization and Frequency Compensation

VOLTS/CM Switch Setting	Channel 1 Input Shunt Capacitor	Channel 1 Frequency Compensating Capacitor	Channel 2 Input Shunt Capacitor	Channel 2 Frequency Compensating Capacitor
05	C104	None	C204	None
1	C105B	C105C	C205B	C205C
2	C106B	C106C	C206B	C206C
5	C107B	C107C	C207B	C207C
1	C108B	C108C	C208B	C208C
2	C109B	C109C	C209B	C209C
5	C110B	C110C	C210B	C210C
10	C111B	C111C	C211B	C211C
20	C112B	C112C	C212B	C212C

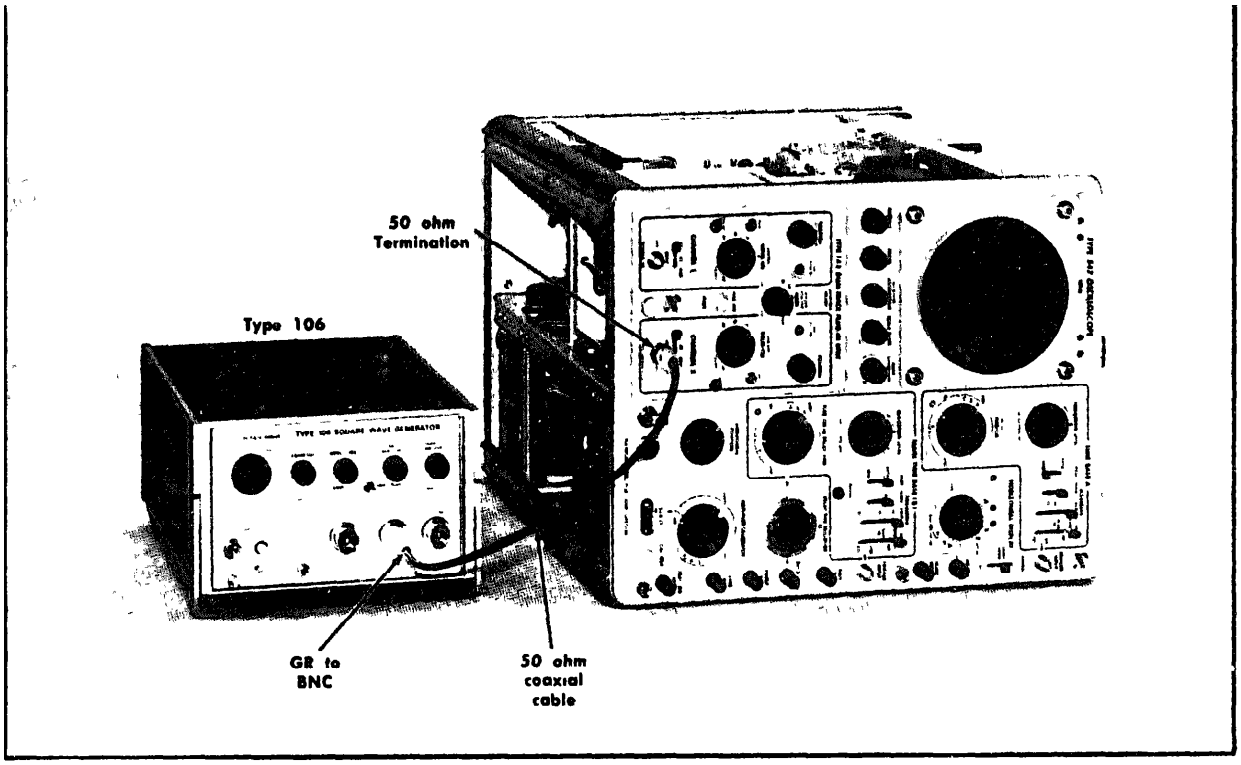

Fig 7-13 Initial equipment setup for step 20

Control Settings

Test Oscilloscope

Horizontal Display	B (546, 547) Normal (1) (544)
Sweep Magnifier	×1 off (546, 547)
Single Sweep Switch	Normal
Triggering Level	Fully clockwise and pushed in
Triggering Source	Norm Int
Triggering Coupling	AC
Triggering Slope	+
Triggering Mode	Auto
Time/CM	1 μSEC
Variable (Time/CM)	Calibrated
Horizontal Position	Centered
Vernier (Horizontal Position)	Centered
CRT Cathode Selector	CRT Cathode
Amplitude Calibrator	Off

Type 1A2

MODE	CH 2
TRIGGER SELECTOR	CH 2

Both Channels

POSITION	Centered
VOLTS/CM	05
VARIABLE	CALIBRATED
PULL TO INVERT	Pushed in
AC DC GND	AC

20. Adjust High-Frequency Compensation

a. Equipment setup is shown in Fig 7-13

b. Apply an approximate 120 kHz signal from the Fast Rise + output of the Type 106 Square Wove Generator to the INPUT 2 connector through a GR to BNC adapter, 50 ohm coaxial cable and a 50 ohm termination

c. Set both AC-DC-GND switches to AC and the Time/CM switch to 0.1 uSEC

d. Adjust the amplitude control for a display amplitude of 4 cm and the Triggering level control for a stable display

e. Position the rising position of the display near the graticule center

f. Check Waveform is flat topped with no more than 3% (1.2mm) peak to peak rolloff spiking and/or ringing

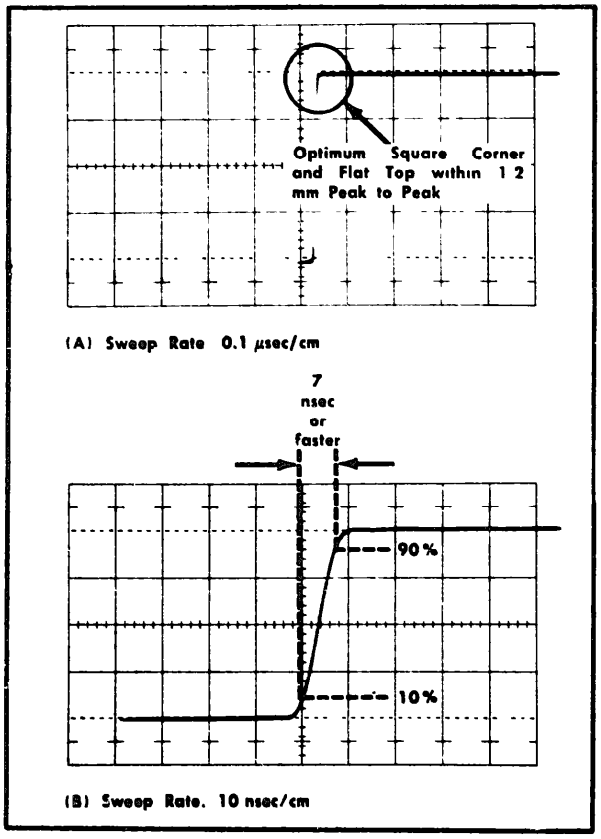

Fig 7-14 Typical CRT display showing (A) high-frequency adjustment and (B) measuring risetime.

g. Adjust-R379, C379, R377 and C377 for the sharpest leading corner and a level top. See Fig. 7-14A and Fig. 7-15 for location,

h. Change the Time/CM switch to 2 usec/cm and again check the waveform, readjusting R377 and C377 if necessary.

i. Disconnect the 50 ohm termination from the INPUT 2 connector and connect it to the INPUT 1 connector,

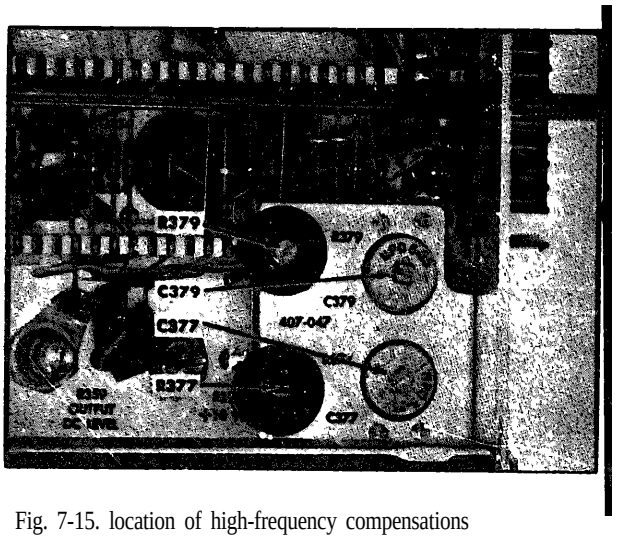

Fig. 7-15. location of high-frequency compensations

Change the MODE and TRIGGER SELECTOR switches to CH 1

k. Check-Waveform for optimum front corner

l. Change the Time/CM switch to 1 uSEC and the Magnifier to X10

m. Center the waveform and measure the rising portion of the waveform between the 10% and 90% points.

n. Check-Risetime should be 7 ns or less, using a Type 544, 546 or 547 Oscilloscope See Fig. 7-14B.

o. Change the MODE switch to ADD, center the waveform and measure the risetime.

p. Check-Ritetime should be 7 ns or less using a Type 544, 546 or 547 Oscilloscope.

q. Turn the Magnifier to X 1 (Off),

r. Check-Waveform is flat topped with no more than 6% (2.4 mm) peak-to-peak aberrations,

s. Disconnect the input signal,

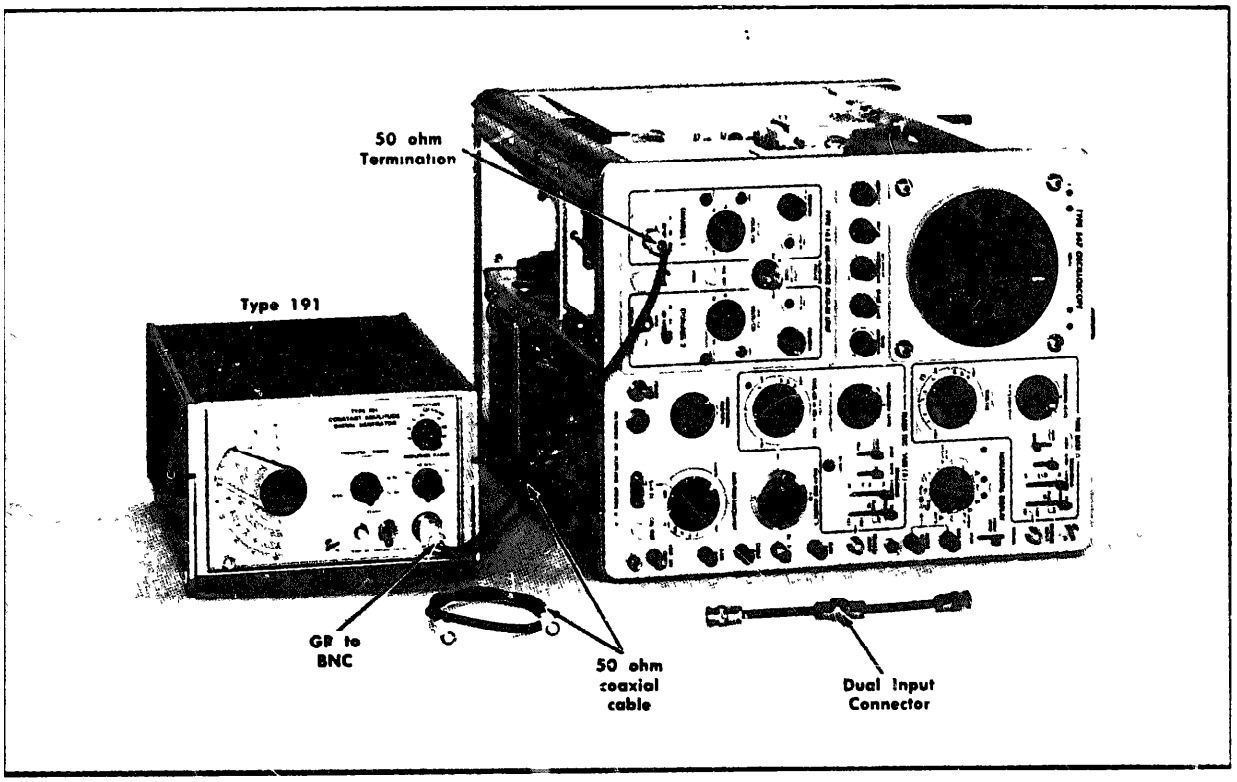

Fig 7-16. Initial equipment setup for steps 21 through 23

Control Settings

Test Oscilloscope

Horizontal Display	B (546, 547) Normal (1) (544)
Sweep Magnifier	1 off (546, 547)
Single Sweep Switch	Normal
Triggering Level	Fully clockwise and pushed in
Triggering Source	Norm Int
Triggering Coupling	AC
Triggering Slope	+
Triggering Mode	Auto
Time/CM	1 μSEC
Variable (Time/CM)	Calibrated
Horizontal Position	Centered
Vernier (Horizontal Position)	Centered
CRT Cathode Selector	CRT Cathode
Amplitude Calibrator	Off

Type 1A2

MODE	CH 1
TRIGGER SELECTOR	CH 1

Both Channels

POSITION	Centered
VOLTS/CM	05
VARIABLE	CALIBRATED
PULL TO INVERT	Pushed in
AC DC GND	GND

21. Check Bandwidth

a. Equipment setup is shown in Fig 7-16

b. Connect the Constant Amplitude Signal Generator to the INPUT 1 connector through a GR to BNC adapter, and 50 ohm coaxial cable and a 50 ohm termination

c. Adjust the output of the Constant Amplitude Signal Generator for 4 cm of 50 kHz signal amplitude

d. Increase the frequency until there is exactly 2.8 cm of deflection See Fig 7-17

e. Check-This is the 3 dB down point and should be no lower in frequency than the Characteristics section of the manual shows (50 MHz or higher with Types 544, 546 or 547 Oscilloscopes)

f. Change the MODE switch to ADD and repeat the above check procedure

g. Remove the signal from the INPUT 1 connector and apply it to the INPUT 2 connector

h. Set the MODE switch to CH 2 and repeat the check procedure to determine the bandwidth of Channel 2

22. Check Trigger Bandwidth

a. Equipment setup is given in step 21

b. With the signal from the Constant Amplitude Signal Generator applied to Channel 2, set the TRIGGER SELECTOR switch to CH 2 and connect the TRIG OUT connector to the INPUT 1 connector through a 50 ohm coaxial cable

c. the MODE switch to CH 1 and the Channel 1 VOLTS/CM switch to 1

d. Adjust the Constant Amplitude Signal Generator output for a 5 cm display amplitude at 50 kHz

e. Increase the frequency until 3.5 cm of display amplitude is obtained

f. Check-Frequency should be 5 MHz or greater

g. Remove the input signal and the coaxial cable between the TRIG OUT connector and the INPUT 1 connector

23. Cheek High-Frequency Common Mode Rejection

a. Equipment setup is given in step 22

b. Set both VOLTS/CM switches to 2 volts

c. Connect the Constant Amplitude Signal Generator to both INPUT connectors through a GR to BNC adapter, a 50 ohm coaxial cable, a 50 ohm termination and a Dual input Connector

d. Adjust the output amplitude of the Constant AmpIitude Signal Generator for 2.5 cm of 50 kHz signal

e. Change the frequency to 50 MHz (with Types 544, 546 or 547 Oscilloscopes)

Applies only to instruments with serial numbers 716 or higher

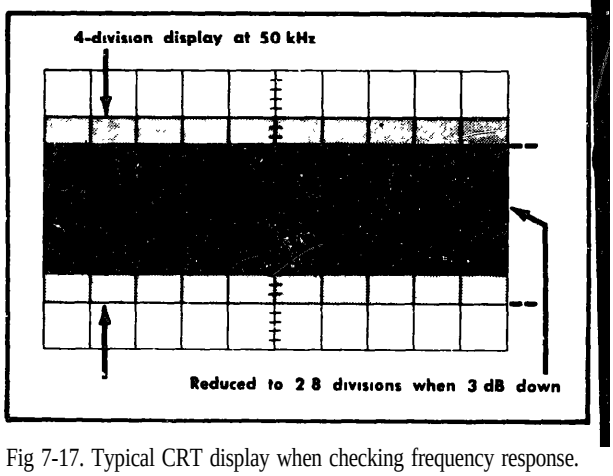

Fig 7-17. Typical CRT display when checking frequency response.

f. Set the MODE switch to ADD, both VOLTS/CM switches to 05 and pull the Channel 2 PULL TO INVERT Switch

g. Check-Displayed amplitude must be 5 cm or less, a 20 to 1 rejection ratio If displayed amplitude is greater, pull the Channel 1 PULL TO INVERT switch One of the combinations must result in a displayed amplitude of 5 cm or less

h Remove the Dual Input Connector, push in both PULL TO INVERT switches and set the MODE switch to CH 1.

This completes the calibration of the Type 1A2. Disconnect all test equipment and replace the side and bottom covers of the oscilloscope If the Instrument has been completely calibrated to the tolerances given in this procedure, it will perform to the limits given in the Characteristics section of the Instruction Manual

APPENDIX A

REFERENCES

The following publications contain information applicable to the operation and maintenance of the Type 1A2 Dual trace Plug-in Unit.

DA PAM 310-4	Index of Technical Manuals, Bulletins, Supply Manuals (types 7, 8, and 9), Supply Bulletins, and Lubrication Orders.
DA PAM 310-7	U.S. Army Equipment Index of Modifications Work Orders.
SB 38-100	Preservation, Packaging, and Packing Materials, Supplies, and Equipment Used by the Army.
TB SIG 222	Solder and Soldering.
TB 746-10	Field Instructions for Painting and Preserving Electronics Command Equipment.
TM 36-750	The Army Maintenance Management Systems (TAMMS)
TM 740-90-1	Administrative storage of Equipment.

APPENDIX B

MAINTENANCE ALLOCATION

Section I. INTRODUCTION

B-1. General

This appendix provides a summary of the maintenance operations covered in the equipment literature. It authorizes categories of maintenance for specific maintenance functions on repairable items and components and the tools and equipment required to perform each function. This appendix may be used as an aid in planning maintenance operations.

B-2. Maintenance Functions

Maintenance functions will be limited to and defined as follows:

a. INSPECT. To determine serviceability of an item by comparing its physical, mechanical, and electrical characteristics with established standards.

b. TEST. To verify serviceability and to detect incipient electrical or mechanical failure by use of special equipment such as gages, meters, etc. This is accomplished with external test equipment and doe; not include operation of the equipment and operator type tests using internal meters or indicating devices.

c. SERVICE. Not applicable.

d. ADJUST. To rectify to the extent necessary to bring into proper operating range.

e. ALIGN. To adjust two or more components or assemblies of an electrical or mechanical system so that their functions are properly synchronized. This does not include setting the frequency control knob of radio receivers or transmitters to the desired frequency.

f. CALIBRATE. Not applicable.

g. INSTALL. Not applicable.

h. REPLACE. To replace unserviceable items with serviceable like items.

i. REPAIR. To restore an item to serviceable condition through correction of a specific failure or unserviceable condition. This function includes, but is not limited to welding, grinding, riveting, straightening, and replacement of parts other than the trial and error replacement of running spare type items such as fuses, lamps, or electron tubes.

1. OVERHAUL. Not applicable.

k. REBUILD. Not applicable.

1. SYMBOLS. The uppercase letter placed in the appropriate column indicates the lowest level at which that particular maintenance function is to be performed.

B-3. Explanation of Format

Column 1. group number. Column 1 lists group numbers, the purpose of which is to identify components, assemblies, subassemblies and modules with the next higher assembly.

b. Column 2, functional group. Column 2 lists the noun names of components) assemblies, subassemblies and modules on which maintenance is authorized.

c. Column 3. maintenance functions. Column 3 lists the maintenance category at which performance of the specific maintenance function is authorized. Authorization to perform a function at any category also includes authorization to perform that function at higher categories. The codes used represent the various maintenance categories as follows:

Code	Maintenance Category
C	Operator/Crew
O	Organizational Maintenance
F	Direct Support Maintenance
H	General Support Maintenance
D	Depot Maintenance

d. Column 4, tools and test equipment. Column 4 specifies, by code, those tools and test equipment required to perform the designated function. The numbers appearing in this column refer to specific tools and test equip ment which are identified in Table I.

e. Column 5, Remarks. Self-explanatory.

B-4. Explanation of Format of Table I, Tool and Test Equipment Requirements

The columns in Table I, Tool and Test Equipment Requirements are as follows:

a. Tools and Equipment. The numbers in this column coincide with the numbers used in the tools and equipment column of the Maintenance Allocation Chart. The numbers indicate the applicable tool for the maintenance function.

b. Maintenance Category. The codes in this column indicate the maintenance category normally allocated the facility.

c. Nomenclature. This column lists tools, test, and maintenance equipment required to perform the maintenance functions.

d. Federal Stock Number. This column lists the Federal stock number of the specific tool or test equipment.

e. Tool Number. Not used.

SECTION II. MAINTENANCE ALLOCATION CHART (DUAL-TRACE PREAMPLIFIER, TEKTRONIX TYPE 1A2)

MAINTENANCE ALLOCATION CHART

GROUP NUMBER	COMPONENT ASSEMBLY NOMENCLATURE	MAINTENANCE FUNCTIONS										TOOLS AND EQUIPMENT	REMARKS
		INSPECT	TEST	SERVICE	ADJUST	ALIGN	CALIBRATE	INSTALL	REPLACE	REPAIR	OVERHAUL	REBUILD	
1	DUAL-TRACE PREAMPLIFIER; TEKTRONIX TYPE 1A2	O	H		H					H			1 thru 10 1,3 thru 14 14	

TABLE I. TOOL AND TEST EQUIPMENT REQUIREMENTS (DUAL-TRACE PREAMPLIFIER; TEKTRONIX 1A2

TOOL AND TEST EQUIPMENT REQUIREMENTS					
TOOLS AND EQUIPMENT	MAINTENANCE CATEGORY	NOMENCLATURE RECOMMENDED IN MANUAL	NOMENCLATURE MILITARY EQUIVALENT	FEDERAL STOCK NUMBER	TOOL NUMBER
		DUAL-TRACE PREAMPLIFIER; TEKTRONIX 1A2 (CONT'D)			
1	H	MULTIMETER	MULTIMETER, ME-26D/U	6625-913-9781	
2	H	TRANSISTOR TESTOR, SIERRA 219B	TEST SET, TRANSISTOR, TS-1836/U	6625-168-0954	
3	H	OSCILLOSCOPE, TEK. 535A	OSCILLOSCOPE, AN/USM-182A	6625-133-1196	
4	H	OSCILLOSCOPE, TEK. 544	OSCILLOSCOPE, AN/USM-281A	6625-228-2201	
5	H	CABLE PLUG-IN EXTENSION, TEK. 012-0038-01			
6	H	X10 PROBE P6006, TEK. 010-0160-00			
7	H	DUAL INPUT COUPLER, TEK. 067-0525-00			
8	H	STANDARD AMPLITUDE CALIBRATOR, TEK. 067-0502-00			
9	H	RC NORMALIZER, TEK. 067-0537-00			
10	H	SQUARE WAVE GENERATOR, TEK. 106	GENERATOR, SIGNAL SG-299C/U	6625-624-3516	
11	H	TUNING TOOL HANDLE, TEK. 003-0307-00			
12	H	TUNING TOOL INSERT WITH WIRE PIN, TEK. 003-0308-00			
13	H	TUNING TOOL CALIBRATION TOOL TIP, TEL. 003-0334-00			
14	H	TOOL KIT, TK-100/G	TOOL KIT, ELECTRONIC EQUIPMENT TK-100/G	5180-605-0079	

APPENDIX C

ORGANIZATIONAL, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE REPAIR PARTS AND SPECIAL TOOLS LIST (INCLUDING DEPOT MAINTENANCE REPAIR PARTS AND SPECIAL TOOLS)

Section I. INTRODUCTION

C-1. Scope

This appendix lists repair parts required for the performance of organizational, direct support, general support, and depot maintenance of the Dual Trace Plug-In Unit, Type 1A2.

NOTE

No special tools, test, and support equipment required.

C-2. General

This repair parts list is divided into the following sections:

a. Organizational Maintenance Repair Parts List Section II. A list of repair parts authorized for the performance of maintenance at the organizational level.

b. Repair Parts for Direct Support, General Support, and Depot Maintenance - Section III. A list of repair parts authorized for the performance of maintenance at the direct support, general support, and depot level.

c. *Federal* Stock Number Cross Reference—Section IV. A list of Federal stock numbers in ascending numerical sequence, and item sequence number.

d. Manufacturer Part Number Cross Reference—Section V. **A list of reference numbers (manufacturer part number) appearing in ascending numericalpha and/or alphanumeric sequence, cross-referenced to the Federal manufacturer code, figure number, reference designator, and item sequence number.**

e. Reference Designator Cross Reference—Section VI. **A list of reference designators cross-referenced to item sequence number.**

C-3. Explanation of Columns

The following provides an explanation in the tabular lists:

a. Source, Maintenance and Recoverability Codes (SMR) and Item Sequence Number (ISN) Column. The first line in this column lists the applicable SMR codes for the part. Listed in ascending order directly below the SMR code is the item sequence number assigned to the repair part.

(1) Source code indicates the selection status and source for the listed item. Source codes are:

Code	Explanation
P	Repair parts which are stocked in or supplied from the GSA/DSA, or Army supply system and authorized for use at indicated maintenance categories.
P2	Repair parts which are procured and stocked for insurance purposes because the combat or military essentiality of the end item dictates that a minimum quantity be available in the supply system.
P9	Assigned to items which are NSA design controlled: unique repair parts, special tools, test, measuring and diagnostic equipment, which are stocked and supplied by the Army COMSEC logistic system, and which are not subject to the provisions of AR 380–41.
P10	Assigned to items which are NSA design controlled: special tools, test, measuring and diagnostic equipment for COMSEC support, which are accountable under the provisions of AR 380–41, and which are stocked and supplied by the Army COMSEC logistic system.
M	Repair parts which are not procured or stocked, but are to be manufactured at indicated maintenance levels.
A	Assemblies which are not procured or stocked as such, but are made up of two

Code	Explanation
	or more units. Such component units carry individual stock numbers and descriptions, are procured and stocked separately, and can be assembled to form the required assembly at indicated maintenance categories.
X	Parts and assemblies which are not procured or stocked and the mortality of which normally is below that of the applicable end item or component. The failure of such part or assembly should result in retirement of the end item from the supply system.
X1	Repair parts which are not procured or stocked. The requirement for such items will be filled by use of the next higher assembly or component.
X2	Repair parts which are not stocked. The indicated maintenance category requiring such repair parts will attempt to obtain same through cannibalization. Where such repair parts are not obtainable through cannibalization, requirements will be requisitioned, with accompanying justification, through normal supply channels.
G	Major assemblies that are procured with PEMA funds for initial issue only as exchange assemblies at DSU and GSU level. These assemblies will not be stocked above DS and GS level or re turned to depot supply level.

(2) Maintenance code indicates the lowest **category of maintenance authorized to install the listed item. The maintenance level codes are:**

Code	*Explanation*
C	**Operator/Crew**
O	**Organizational maintenance**
F	**Direct support maintenance**
H	**General support maintenance**
D	**Depot maintenance**

(3) Recoverability code indicates whether unserviceable items should be returned for recovery or salvage. Items not coded are expendable.

Code	*Explanation*
R	**Repair parts and assemblies that are economically repairable at DSU and GSU activities and are normally furnished by supply on an exchange basis.**
S	**Repair parts and assemblies which are economically repairable at DSU and GSU activities and which normally are furnished by supply on an exchange basis. When items are determined by GSU to be uneconomically repairable, they will be evacuated to a depot for evaluation and analysis before final disposition.**
T	High dollar value recoverable repair parts which are subject to special handling and are issued on an exchange basis. Such repair parts normally are repaired or overhauled at depot maintenance activities.
U	Repair parts specifically selected for salvage by reclamation units because of precious metal content, critical materials, or high dollar value reusable castings or castings.

b. Federal Stock Number. Indicates the Federal stock number assigned to the item and will be used for requisitioning purposes.

c. Indent Code. This column indicates the breakdown of each given part or assembly. Components, assemblies, and subassemblies are listed in topdown order. That is, the assemblies which are part of a component are listed immediately below that component, and the subassemblies which are part of an assembly are listed immediately below that assembly. An asterisk indicates attaching hardware.

d. Description. Indicates the Federal item name and any additional description of the item required. A part number or other reference number is followed by the applicable five-digit **Federal supply code for m**anufacturers in **parentheses. For subsequent** appearances of **the same item, the words "same as" followed by the item sequence number assigned to the item when it first appeared in the list will follow the item name, e.g., "RESISTOR, FIXED, COMPOSITION: SAME AS CVGK."**

e. Usable on Code. **Not used.**

f. Unit of Measure (U/M). **A two-character alphabetic abbreviation indicating the amount or quantity of the item upon which the allowances are based, e.g., ft., ea., pr., etc.**

quantity of the item used in the 1A2. Subsequent appearances of the same item in the same assembly are indicated by the letters "REF".

h. Allowances (15-Day Organizational Maintenance, 30-Day DS/GS Maintenance, 1 Year Per Equipment (Contingency), and Depot Maintenance). **Items authorized for requisition**

as required are identified by an asterisk in the allowance column.

i. Illustrations.

(1) Figure number. Indicates the figure number of the illustration in which the item is shown.

(2) Reference designator or item number. Indicates the reference designator used to identify the item in the illustration.

C-4. Location of Repair Parts

a. This appendix contains three cross-reference indexes (sec., IV, V, and VI) to be used to locate a repair part when either the Federal stock number, reference number (manufacturer's part number), figure number, or reference designator is known. The first column in each cress-reference index is prepared, as applicable, in numerical or alphanumerical sequence. The last column of each cross-reference index lists the item sequence number assigned to the part.

b. Refer to the appropriate cross-reference index (para. C-2c, d, e) and note the index number in the last column; then refer to the repair parts list to locate the item sequence number which is listed in ascending order in column 1 of the repair parts list.

C-5. Federal Supply Code for Manufacturers

The Federal supply code for manufacturer (FSCM) is used as an element in item identification to designate manufacturer, distributor, or government agency, etc. Refer to SB 708-42 for identification of FSCM's.

(Next printed page is C-5.)

SECTION II. ORGANIZATIONAL MAINTENANCE REPAIR PARTS LIST

(1) SOURCE CODE / MAINT CODE / REC CODE (SMR)	(2) FEDERAL STOCK NUMBER	(2a) IDENT CODE	(3b) DESCRIPTION REF NUMBER (MFR PART NO.)	MFR CODE	(3c) USE ON CODE	(4) UNIT OF MEASURE	(5) QTY INCL IN UNIT	(6) 15 DAY ORGANIZATIONAL MAINT ALW (a) 1 5	(b) 6 20	(c) 21 50	(d) 51 100	(7) ILLUSTRATIONS (a) FIGURE NUMBER	(b) REF / ITEM NUMBER
PAOZZ			**GROUP 0001 CHASSIS**										
GOS CUA8	6625-133-4631	A	DUAL TRACE 1A2	(80009)		EA	1						
PAO CUDP	5960-880-0457	B	ELECTRON TUBE 6DJ8	(81349)		EA	1	*	*	*	*		V364
PAO CUET	5355-948-9963	B	KNOB GRAY, 0.591 IN. L X 0.780 IN. OD 366-0113-00	(80009)		EA	2	*	*	*	*		MP3
PAO CUEV	5355-923-5660	B	KNOB CHARCOAL, 0.750 IN. L X 0.875 IN. DIA 366-0175-00	(80009)		EA	1	*	*	*	*		MP4
PAO CUEX	5355-948-9963	B	KNOB SAME AS CUET 366-0113-00	(80009)		EA	REF	*	*	*	*		MP5
PAO CUEZ	5355-849-7445	B	KNOB CHARCOAL, 0.585 IN. L X 1.225 IN. OD 366-0142-00	(80009)		EA	2	*	*	*	*		MP6
PAO CUF8	5355-685-5580	B	KNOB RED, 0.400 IN. L X 0.694 IN. OD 366-0031-00	(80009)		EA	2	*	*	*	*		MP7
PAO CUFD	5355-064-0133	B	KNOB RED, 0.500 IN. OD X 0.625 IN. L 366-0189-00	(80009)		EA	1	*	*	*	*		MP8
PAO CUFF	5355-849-7445	B	KNOB SAME AS CUEZ 366-0142-00	(80009)		EA	REF	*	*	*	*		MP9
PAO CUFH	5355-685-5580	B	KNOB SAME AS CUF8 366-0031-00	(80009)		EA	REF	*	*	*	*		MP10
PAO CUFK	5355-865-3889	B	KNOB,SECURING AL ROD, KNURLED, 0.563 IN. OD X 0.625 IN. L 366-0125-00	(80009)		EA	1	*	*	*	*		MP11
PAO CUFM	5355-422-2330	B	LEVER,KNOB CHARCOAL, 0.210 IN. H X 0.375 IN. L 366-0215-01	(80009)		EA	2	*	*	*	*		MP13
PAO CUFN	5388-422-2330	B	LEVER,KNOB SAME AS CUFM 366-0215-01	(80009)		EA	REF	*	*	*	*		MP14

SECTION III. REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE

(1) SOURCE CODE / MAINT CODE / REC CODF ISN	(2) FEDERAL STOCK NUMBER	(3a) INDENT CODE	(3b) DESCRIPTION REF NUMBER (MFR PART NO)	MFR CODE	(3c) USE ON CODE	(4) UNIT OF MEASURE	(5) QTY INCL IN UNIT	30 DAY MAINT ALW (6) DS 1 20	DS 21 50	DS 51 100	(7) GS 1 20	GS 21 50	GS 51 100	(8) 1 YR ALW PER 100 EQUIP CONTGCY PL	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS a) FIGURE NUMBER	(b) REF / ITEM NUMBER
G O S CUAB	6625-133-4631	A	DUAL TRACE			EA	1										
			1A2	(80009)													
P H CUAC	5930-406-8715	B	BALL BEARING			EA	2				*	*	*	*	*		MP33
			214-0274-00	(80009)													
P H CUAD	5930-406-8715	B	BALL BEARING SAME AS CUAC 214-0274-00	(80009)		EA	REF				*	*	*	*	*		MP34
X2 H CUAE		B	BRACKET			EA	1										MP25
			407-0156-00	(80009)													
X2 H CUAF		*	POST,BINDING			EA	2										H2
			129-0150-00	(80009)													
P H CUAG	5305-059-7877	*	SCREW,MACHINE			EA	2				*	*	*	*	*		H2
			MS35208-16	(96906)													
P H CUAH	5305-054-6650	*	SCREW,MACHINE CRES, 6-32 X 1/4 LG MS51957-26	(96906)		EA	10				*	*	*	*	*		H2
P H CUAJ	5305-054-6650	*	SCREW,MACHINE SAME AS CUAH MS51957-26	(96906)		EA	REF				*	*	*	*	*		H2
X2 H CUAK		B	BRACKET,CAPACITOR			EA	1										MP31
			406-0635-00	(80009)													
P H CUAL	5305-058-2099	*	SCREW,TAPPING,THREAD FORMING CRES, PNH, TYPE B, 4-24 X 0.250 IN. LG MS24622-8	(96906)		EA	4				*	*	*	*	*		H2
X2 H CUAM		B	BRACKET,FRAME			EA	1										MP49
			407-0047-00	(80009)													
P H CUAN	5305-054-5647	*	SCREW,MACHINE CRES, 4-40 X 1/4 IN. LG MS51957-13	(96906)		EA	4				*	*	*	*	*		H2

SECTION III. REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE

(1) SOURCE CODE / MAINT CODE / REC CODE ISN	(2) FEDERAL STOCK NUMBER	(3a) INDEX CODE	(3b) DESCRIPTION REF NUMBER (MFR PART NO.) MFR CODE	(3c) USE ON CODE	(4) UNIT OF MEASURE	(5) QTY INCL IN UNIT	(6) 30 DAY MAINT ALW DS 1 20	DS 21 50	DS 51 100	(7) GS 1 20	GS 21 50	GS 51 100	(8) 1 YR ALW PER 100 EQUIP CONTGCY PL	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIGURE NUMBER	(b) REF / ITEM NUMBER
X2 H CUAP		B	BRACKET,SWITCH 407-0046-00 (80009)		EA	1										MP37
P H CUAQ	5305-054-6652	*	SCREW,MACHINE CRES, 6-32 X 5/16 LG MS51957-27 (96906)		EA	5				*	*	*	*	*		H1
X2 H CUAR		*	WASHER,SHOULDER 210-0975-00 (80009)		EA	2										H1
P H CUAS	5305-061-2332	*	SCREW,TAPPING,THREAD FORMING MS24622-2 (96906)		EA	6				*	*	*	*	*		H2
X2 H CUAT		B	BRACKET,SWITCH 407-0032-00 (80009)		EA	1										MP51
P H CUAU	5305-054-6652	*	SCREW,MACHINE SAME AS CUAQ MS51957-27 (96906)		EA	REF				*	*	*	*	*		H1
X2 H CUAV		*	WASHER,SHOULDER SAME AS CUAR 210-0975-00 (80009)		EA	REF										H1
P H CUAW	4730-082-5833	B	BUSHING,MACHINE THREAD 358-0054-00 (80009)		EA	2				*	*	*	*	*		MP15
P H CUAX	4730-082-5833	B	BUSHING,MACHINE THREAD SAME AS CUAW 358-0054-00 (80009)		EA	REF				*	*	*	*	*		MP16
P H CUAY	5325-071-6256	*	GROMMET,PLASTIC 348-0031-00 (80009)		EA	3				*	*	*	*	*		H1
P H CUAZ	5310-400-5503	*	NUT,PLAIN,HEXAGON CRES, 1/4-28 THD, 7/16 AF X 3/16 IN. THK MS35650-3254 (96906)		EA	2				*	*	*		*		H1
M H CUBA		B	CABLE ASSEMBLY,SPECIAL PURPOSE 179-0986-00 (80009)		EA	1										W1
P H CUBB	5910-726-8952	B	CAPACITOR,FIXED,CERAMIC DI 6800 PF, P80M20 PCT, 500 VDCW 281-0614-00 (80009)		EA	2				*	*	*	*	*		C117

(1) SOURCE CODE / MAINT CODE / REC CODE ISN	(2) FEDERAL STOCK NUMBER	(3a) INDENT CODE	(3b) DESCRIPTION REF NUMBER (MFR PART NO.)	MFR CODE	(3c) USE ON CODE	(4) UNIT OF MEASURE	(5) QTY INCL IN UNIT	30 DAY MAINT ALW (6) DS 1 20	(6) DS 21 50	(6) DS 51 100	(7) GS 1 20	(7) GS 21 50	(7) GS 51 100	(8) 1 YR ALW PER 100 EQUIP CONTGCY PL	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIGURE NUMBER	(10) ILLUSTRATIONS (b) REF / ITEM NUMBER
P H CUBC	5910-726-8952	B	CAPACITOR,FIXED,CERAMIC DI SAME AS CUBB 281-0614-00	(80009)		EA	REF				*	*	*	*	*		C217
P H CUBD	5910-792-0065	B	CAPACITOR,FIXED,CERAMIC DI 150 PF 281-0524-00	(80009)		EA	2				*	*	*	*	*		C315
P H CUBE	5910-792-0065	B	CAPACITOR,FIXED,CERAMIC DI SAME AS CUBD 281-0524-00	(80009)		EA	REF				*	*	*	*	*		C325
P H CUBF	5910-682-3247	B	CAPACITOR,FIXED,CERAMIC DI 47 PF 281-0518-00	(80009)		EA	1				*	*	*	*	*		C326
P H CUBG	5910-801-1005	B	CAPACITOR,FIXED,CERAMIC DI 10000 PF, 20 PCT, 150 VDCW 283-0003-00	(80009)		EA	1				*	*	*	*	*		C333
P H CUBH	5910-071-7360	B	CAPACITOR,FIXED,CERAMIC DI 10000 PF, 20 PCT, 250 VDCW 283-0079-00	(80009)		EA	2				*	*	*	*	*		C334
P H CUBJ	5910-071-7360	B	CAPACITOR,FIXED,CERAMIC DI SAME AS CUBH 283-0079-00	(80009)		EA	REF				*	*	*	*	*		C343
P H CUBK	5910-713-2011	B	CAPACITOR,FIXED,CERAMIC DI 100 PF 281-0523-00	(80009)		EA	1				*	*	*	*	*		C340
P H CUBL	5910-879-6851	B	CAPACITOR,FIXED,CERAMIC DI 150 PF, 5 PCT, 200 VDCW 283-0054-00	(80009)		EA	1				*	*	*	*	*		C344
P H CUBM	5910-954-9055	B	CAPACITOR,FIXED,CERAMIC DI 200000 PF, 20 PCT, 25 VDCW 283-0026-00	(80009)		EA	3				*	*	*	*	*		C346
P H CUBN	5910-954-9055	B	CAPACITOR,FIXED,CERAMIC DI SAME AS CUBM 283-0026-00	(80009)		EA	REF				*	*	*	*	*		C395
P H CUBP	5910-954-9055	B	CAPACITOR,FIXED,CERAMIC DI SAME AS CUBM 283-0026-00	(80009)		EA	REF				*	*	*	*	*		C396
P H CUBQ	5910-943-0153	B	CAPACITOR,FIXED,CERAMIC DI 100000 PF, P80M20 PCT, 200 VDCW 283-0057-00	(80009)		EA	2				*	*	*	*	*		C354

(1) SOURCE CODE / MAINT C ODE / RIC CODE ISN	(2) FEDERAL STOCK NUMBER	(3a) INDENT	(3b) DESCRIPTION REF NUMBER (MFR PART NO.) MFR CODE	(3c) USE ON CODE	(4) UNIT OF MEASURE	(5) QTY INCL IN UNIT	30 DAY MAINT ALW (6) DS 1 20	(6) DS 21 50	(6) DS 51 100	(7) GS 1 20	(7) GS 21 50	(7) GS 51-100	(8) 1 YR ALW PER 100 EQUIP CONTGCY PL	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIGURE NUMBER	(10) ILLUSTRATIONS (b) REF / ITEM NUMBER
P H CUBR	5910-943-0153	B	CAPACITOR,FIXED,CERAMIC DI SAME AS CUBQ 283-0057-00 (80009)		EA	REF				*	*	*	*	*		C424
P H CUBS	5910-577-1315	B	CAPACITOR,FIXED,CERAMIC DI 10 PF, 10 PCT, 500 VDCW 281-0504-00 (80009)		EA	1				*	*	*	*	*		C380
P H CUBT	5910-827-1211	B	CAPACITOR,FIXED,ELECTROLYTIC 25000000 PF, P75M10 PCT, 25 VDCW 300256G025C84 (56289)		EA	1				*	*	*	*	*		C421
P H CUBU	5910-401-6601	B	CAPACITOR,FIXED,PLASTIC DI 100000 PF, P5M15 PCT, 600 VDCW 285-0751-00 (80009)		EA	2				*	*	*	*	*		C101
P H CUBV	5910-401-6601	B	CAPACITOR,FIXED,PLASTIC DI SAME AS CUBU 285-0751-00 (80009)		EA	REF				*	*	*	*	*		C201
P H CUBW	5910-018-1241	B	CAPACITOR,FIXED,CERAMIC DI 10 PF, 1 PF, 200 VDCW 281-0613-00 (80009)		EA	2				*	*	*	*	*		C103
P H CUBX	5910-018-1241	B	CAPACITOR,FIXED,CERAMIC DI SAME AS CUBW 281-0613-00 (80009)		EA	REF				*	*	*	*	*		C203
P H CUBY		B	CAPACITOR,FIXED,CERAMIC DI 1000 PF, 20 PCT, 1000 VDCW 831-000Z5U0102M (72982)		EA	9				*	*	*	*	*		C140
P H CUBZ		B	CAPACITOR,FIXED,CERAMIC DI SAME AS CUBY 831-000Z5U0102M (72982)		EA	REF				*	*	*	*	*		C159
P H CUCA		B	CAPACITOR,FIXED,CERAMIC DI SAME AS CUBY 831-000Z5U0102M (72982)		EA	REF				*	*	*	*	*		C160
P H CUCB		B	CAPACITOR,FIXED,CERAMIC DI SAME AS CUBY 831-000Z5U0102M (72982)		EA	REF				*	*	*	*	*		C240
P H CUCC		B	CAPACITOR,FIXED,CERAMIC DI SAME AS CUBY 831-000Z5U0102M (72982)		EA	REF				*	*	*	*	*		C259
P H CUCD		B	CAPACITOR,FIXED,CERAMIC DI SAME AS CUBY 831-000Z5U0102M (72982)		EA	REF				*	*	*	*	*		C260

SECTION III. REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE

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P H CUCE		B	CAPACITOR,FIXED,CERAMIC DI SAME AS CUBY 831-000Z5U0102M (72982)		EA	REF				*	*	*	*	*		C335
P H CUCF		B	CAPACITOR,FIXED,CERAMIC DI SAME AS CUBY 831-000Z5U0102M (72982)		EA	REF				*	*	*	*	*		C391
P H CUCG		B	CAPACITOR,FIXED,CERAMIC DI SAME AS CUBY 831-000Z5U0102M (72982)		EA	REF				*	*	*	*	*		C397
P H CUCH		B	CAPACITOR,VARIAB E,CERAMIC DI 5-25 PF, 350 VDCW 557-076A5-25 (72982)		EA	2				*	*	*	*	*	7-15	C377
P H CUCJ		B	CAPACITOR,VARIABLE,CERAMIC DI SAME AS CUCH 557-076A5-25 (72982)		EA	REF				*	*	*	*	*	7-15	C379
P H CUCK	5305-058-2099	*	SCREW,TAPPING,THREAD FORMING SAME AS CUAL MS24622-8 (96906)		EA	REF				*	*	*	*	*		H1
X2 H CUCL		B	CAP,ELECTRICAL 200-0536-00 (80009)		EA	1										MP44
X1 H CUCM		B	CHASSIS,ELECTRICAL EQUIPMENT 441-0567-00 (80009)		EA	1										MP32
P H CUCN	5310-934-9761	*	NUT,PLAIN,HEXAGON CRES, 6-32 MS35649-264 (96906)		EA	2				*	*	*	*	*		H2
P H CUCP	5305-059-4550	*	SCREW,MACHINE CS, CAD PL STL, 4-40 X 0.312 IN. LG MS35190-235 (96906)		EA	4				*	*	*	*	*		H4
P H CUCQ	5305-054-6650	*	SCREW,MACHINE SAME AS CUAH MS51957-26 (96906)		EA	REF				*	*	*	*	*		H2
P H CUCR	5310-616-3555	*	WASHER,LOCK CRES,0.141 ID X 0.275 OD X 0.017 IN.THK MS35333-71 (96906)		EA	2				*	*	*	*	*		H2
P H CUCS	5935-201-8476	B	CONNECTOR,PLUG,ELEC 26-159-16 (02660)		EA	1				*	*	*	*	*		J301

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P H CUCT	5310-934-9748	*	NUT,PLAIN,HEXAGON CRES, 4-40 MS35649-244 (96906)		EA	2				*	*	*	*	*		H2
P H CUCU	5305-054-5647	*	SCREW,MACHINE SAME AS CUAN MS51957-13 (96906)		EA	REF				*	*	*	*	*		H2
P H CUCV	5940-847-3138	*	TERMINAL,LUG 2104-04-00-2520N (78189)		EA	4				*	*	*	*	*		H1
P H CUCW	5310-550-3715	*	WASHER,LOCK CRES,0.115 ID X 0.255 OD X 0.015 IN.THK MS35333-70 (96906)		EA	1				*	*	*	*	*		H1
P H CUCX		B	CONNECTOR,RECEPTACLE,ELEC 131-0955-01 (80009)		EA	2				*	*	*	*	*		J101
P H CUCY		B	CONNECTOR,RECEPTACLE,ELEC SAME AS CUCX 131-0955-01 (80009)		EA	REF				*	*	*	*	*		J201
P H CUCZ	5935-122-3705	B	CONNECTOR,RECEPTACLE,ELEC 9732-1 (95712)		EA	1				*	*	*	*	*		J401
X2 H CUDA		B	COUPLING,SHAFT,FLEXIBLE 376-0051-00 (80009)		EA	2										MP21
X2 H CUDB		B	COUPLING,SHAFT,FLEXIBLE SAME AS CUDA 376-0051-00 (80009)		EA	REF										MP22
P H CUDC	5985-023-2363	*	COUPLING,RING 376-0049-00 (80009)		EA	2				*	*	*	*	*		H1
P H CUDD	5340-064-0015	*	RING,COUPLING 354-0251-00 (80009)		EA	6				*	*	*	*	*		H2
P H CUDE	5305-773-2697	*	SETSCREW CRS, 4-40 X 3/16 IN. LG MS18064-5 (96906)		EA	8				*	*	*	*	*		H2
X2 H CUDF		B	COUPLING,SHAFT,FLEXIBLE 376-0054-00 (80009)		EA	2										A1

SECTION III. REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE

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X2 H CUDG		*	COUPLING,RING			EA	2										H1
			376-0046-00	(80009)													
P H CUDH	5340-064-0015	*	RING,COUPLING SAME AS CUDD			EA	REF				*	*	*	*	*		H1
			354-0251-00	(80009)													
P H CUDJ	5340-064-0014	*	RING,COUPLING			EA	2				*	*	*	*	*		H1
			354-0261-00	(80009)													
P H CUDK	5305-470-8766	*	SETSCREW			EA	4				*	*	*	*	*		H2
			MS18066-5	(96906)													
P H CUDL	5305-934-8499	*	SETSCREW			EA	2				*	*	*	*	*		H1
			MS18063-16	(96906)													
P H CUDM	5305-773-2697	*	SETSCREW SAME AS CUDE			EA	REF				*	*	*	*	*		H2
			MS18064-5	(96906)													
X2 H CUDN		B	COUPLING,SHAFT,FLEXIBLE SAME AS CUDF			EA	REF										A2
			376-0054-00	(80009)													
P O CUDP	5960-880-0457	B	ELECTRON TUBE			EA	1	*	*	*	*	*	*	*	*		V364
			6DJ8	(81349)													
X2 H CUDQ		B	EXTENSION,SHAFT			EA	2										MP19
			384-0313-00	(80009)													
X2 H CUDR		B	EXTENSION,SHAFT SAME AS CUDQ			EA	REF										MP20
			384-0313-00	(80009)													
P H CUDS	5315-466-0471	B	EXTENSION,SHAFT			EA	2				*	*	*	*	*		MP23
			384-0276-00	(80009)													
P H CUDT	5315-466-0471	B	EXTENSION,SHAFT SAME AS CUDS			EA	REF				*	*	*	*	*		MP24
			384-0276-00	(80009)													
P H CUDU	5325-071-6256	B	GROMMET,PLASTIC SAME AS CUAY			EA	REF				*	*	*	*	*		MP30
			348-0031-00	(80009)													

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P H CUDV	5325-413-0201	B	GROMMET,PLASTIC 348-0064-00 (80009)		EA	1				*	*	*	*	*		MP41
P H CUDW	5950-779-8418	B	HOLDER,COIL 352-0017-00 (80009)		EA	2				*	*	*	*	*		MP28
P H CUDX	5950-779-8418	B	HOLDER,COIL SAME AS CUDW 352-0017-00 (80009)		EA	REF				*	*	*	*	*		MP29
P H CUDY	5365-816-0002	*	SPACER,SLEEVE 361-0007-00 (80009)		EA	3				*	*	*	*	*		H1
X2 H CUDZ		B	HOLDER,COIL 352-0065-00 (80009)		EA	1										MP42
P H CUEA	5961-020-9131	B	HOLDER,TRANSISTOR SOCKET 354-0234-00 (80009)		EA	17				*	*	*	*	*		MP26
P H CUEB	5961-020-9131	B	HOLDER,TRANSISTOR SOCKET SAME AS CUEA 354-0234-00 (80009)		EA	REF				*	*	*	*	*		MP27
P H CUEC	5961-020-9131	B	HOLDER,TRANSISTOR SOCKET SAME AS CUEA 354-0234-00 (80009)		EA	REF				*	*	*	*	*		MP65
P H CUED	5961-020-9131	B	HOLDER,TRANSISTOR SOCKET SAME AS CUEA 354-0234-00 (80009)		EA	REF				*	*	*	*	*		MP66
P H CUEE	5961-020-9131	B	HOLDER,TRANSISTOR SOCKET SAME AS CUEA 354-0234-00 (80009)		EA	REF				*	*	*	*	*		MP67
P H CUEF	5961-020-9131	B	HOLDER,TRANSISTOR SOCKET SAME AS CUEA 354-0234-00 (80009)		EA	REF				*	*	*	*	*		MP68
P H CUEG	5961-020-9131	B	HOLDER,TRANSISTOR SOCKET SAME AS CUEA 354-0234-00 (80009)		EA	REF				*	*	*	*	*		MP69
P H CUEH	5961-020-9131	B	HOLDER,TRANSISTOR SOCKET SAME AS CUEA 354-0234-00 (80009)		EA	REF				*	*	*	*	*		MP70

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P H CUEJ	5961-020-9131	B	HOLDER,TRANSISTOR SOCKET SAME AS CUEA 354-0234-00 (80009)		EA	REF				*	*	*	*	*		MP71
P H CUEK	5961-020-9131	B	HOLDER,TRANSISTOR SOCKET SAME AS CUEA 354-0234-00 (80009)		EA	REF				*	*	*	*	*		MP72
P H CUEL	5961-020-9131	B	HOLDER,TRANSISTOR SOCKET SAME AS CUEA 354-0234-00 (80009)		EA	REF				*	*	*	*	*		MP73
P H CUEM	5961-020-9131	B	HOLDER,TRANSISTOR SOCKET SAME AS CUEA 354-0234-00 (80009)		EA	REF				*	*	*	*	*		MP74
P H CUEN	5961-020-9131	B	HOLDER,TRANSISTOR SOCKET SAME AS CUEA 354-0234-00 (80009)		EA	REF				*	*	*	*	*		MP75
P H CUEP	5961-020-9131	B	HOLDER,TRANSISTOR SOCKET SAME AS CUEA 354-0234-00 (80009)		EA	REF				*	*	*	*	*		MP76
P H CUEQ	5961-020-9131	B	HOLDER,TRANSISTOR SOCKET SAME AS CUEA 354-0234-00 (80009)		EA	REF				*	*	*	*	*		MP77
P H CUER	5961-020-9131	[illegible]	354-0234-00 (30009)													
P H CUES	5961-020-9131	B	HOLDER,TRANSISTOR SOCKET SAME AS CUEA 354-0234-00 (80009)		EA	REF				*	*	*	*	*		MP79
P O CUET	5355-948-9963	B	KNOB GRAY, 0.591 IN. L X 0.780 IN. OD 366-0113-00 (80009)		EA	2	*	*	*	*	*	*	*	*		MP3
X2 H CUEU		*	SETSCREW MS18066-6 (96906)		EA	8										H1
P O CUEV	5355-923-5660	B	KNOB CHARCOAL, 0.750 IN. L X 0.875 IN. DIA 366-0175-00 (80009)		EA	1	*	*	*	*	*	*	*	*		MP4
X2 H CUEW		*	SETSCREW SAME AS CUEU MS18066-6 (96906)		EA	REF										H1

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P O CUEX	5355-948-9963	B	KNOB SAME AS CUET 366-0113-00 (80009)		EA	REF	*	*	*	*	*	*	*	*		MP5
X2 H CUEY		*	SETSCREW SAME AS CUEU MS18066-6 (96906)		EA	REF										H.
P O CUEZ	5355-849-7445	B	KNOB CHARCOAL, 0.585 IN. L X 1.225 IN. OD 366-0142-00 (80009)		EA	2	*	*	*	*	*	*	*	*		MP6
X2 H CUFA		*	SETSCREW SAME AS CUEU MS18066-6 (96906)		EA	REF										H1
P O CUFB	5355-685-5580	B	KNOB RED, 0.400 IN. L X 0.694 IN. OD 366-0031-00 (80009)		EA	2	*	*	*	*	*	*	*	*		MP7
X2 H CUFC		*	SETSCREW SAME AS CUEU MS18066-6 (96906)		EA	REF										H1
P O CUFD	5355-064-0133	B	KNOB RED, 0.500 IN. OD X 0.625 IN. L 366-0189-00 (80009)		EA	1	*	*	*	*	*	*	*	*		MP8
P H CUFE	5305-969-4350	*	SETSCREW MS18066-2 (96906)		EA	11				*	*	*	*	*		H1
P O CUFF	5355-849-7445	B	KNOB SAME AS CUEZ 366-0142-00 (80009)		EA	REF	*	*	*	*	*	*	*	*		MP9
X2 H CUFG		*	SETSCREW SAME AS CUEU MS18066-6 (96906)		EA	REF										H1
P O CUFH	5355-685-5580	B	KNOB SAME AS CUFB 366-0031-00 (80009)		EA	REF	*	*	*	*	*	*	*	*		MP10
X2 H CUFJ		*	SETSCREW SAME AS CUEU MS18066-6 (96906)		EA	REF										H1
P O CUFK	5355-865-3889	B	KNOB,SECURING AL ROD, KNURLED, 0.563 IN. OD X 0.625 IN. L 366-0125-00 (80009)		EA	1	*	*	*	*	*	*	*	*		MP11

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X2 H CUFL		*	SETSCREW SAME AS CUEU MS18066-6 (96906)		EA	REF										H1
P O CUFM	5355-422-2330	B	LEVER,KNOB CHARCOAL, 0.210 IN. H X 0.375 IN. L 366-0215-01 (80009)		EA	2	*	*	*	*	*	*	*	*		MP13
P O CUFN	5355-422-2330	B	LEVER,KNOB SAME AS CUFM 366-0215-01 (80009)		EA	REF	*	*	*	*	*	*	*	*		MP14
X2 H CUFP		B	PANEL,BLANK 333-0906-00 (80009)		EA	1										MP1
X2 H CUFQ		B	PANEL,BLANK 387-0952-00 (80009)		EA	1										MP2
X2 H CUFR		B	PANEL,BLANK 387-0951-00 (80009)		EA	1										MP50
P H CUFS	6625-708-7199	B	PIN,STRAIGHT,THREADED 384-0510-00 (80009)		EA	1				*	*	*	*	*		MP12
P H CUFT		B	RESISTOR,FIXED,WIRE WOUND 1300 OHM, 5 PCT, 10W VP10F1301J (12697)		EA	1				*	*	*	*	*		R393
P H CUFU	5340-649-8429	*	INSERT,SCREW THREAD 210-0478-00 (80009)		EA	3				*	*	*	*	*		H1
P H CUFV	5305-054-6660	*	SCREW,MACHINE CRES, NO.6-32 THD X 1-1/2 IN.LG MS51957-36 (96906)		EA	3				*	*	*	*	*		H1
P H CUFW	5305-054-6652	*	SCREW,MACHINE SAME AS CUAQ MS51957-27 (96906)		EA	REF				*	*	*	*	*		H1
P H CUFY	5340-649-8429	*	INSERT,SCREW THREAD SAME AS CUFU 210-0478-00 (80009)		EA	REF				*	*	*	*	*		H1
P H CUFZ	5305-054-6660	*	SCREW,MACHINE SAME AS CUFV MS51957-36 (96906)		EA	REF				*	*	*	*	*		H1

SECTION III. REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE

(1) SOURCE CODE / MAINT CODE / REC CODE ISN	(2) FEDERAL STOCK NUMBER	(3a) INDENT CODE	(3b) DESCRIPTION REF NUMBER (MFR PART NO.)	MFR CODE	(3c) USE ON CODE	(4) UNIT OF MEASURE	(5) QTY INCL IN UNIT	30 DAY MAINT ALW (6) DS 1 20	(6) DS 21 50	(6) DS 51 100	(7) GS 1 20	(7) GS 21 50	(7) GS 51 100	(8) 1 YR ALW PER 100 EQUIP CONTGCY FL	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIGURE NUMBER	(10) ILLUSTRATIONS (b) REF / ITEM NUMBER
P H CUGA	5305-054-6652	*	SCREW,MACHINE SAME AS CUAQ MS51957-27	(96906)		EA	REF				*	*	*	*	*		H1
P H CUGB		B	RESISTOR,FIXED,WIRE WOUND 6500 OHM, 5 PCT, 10W VP10F6501J	(12697)		EA	1				*	*	*	*	*		R351
P H CUGC	5340-649-8429	*	INSERT,SCREW THREAD SAME AS CUFU 210-0478-00	(80009)		EA	REF				*	*	*	*	*		H1
P H CUGD	5305-054-6660	*	SCREW,MACHINE SAME AS CUFV MS51957-36	(96906)		EA	REF				*	*	*	*	*		H1
P H CUGE	5305-054-6652	*	SCREW,MACHINE SAME AS CUAQ MS51957-27	(96906)		EA	REF				*	*	*	*	*		H1
P H CUGF	5905-197-0221	B	RESISTOR,FIXED,COMPOSITION 27 OHM, 5 PCT, 1/8W RCR05G270JS	(81349)		EA	2				*	*	*	*	*		R114
P H CUGG	5905-197-0221	B	RESISTOR,FIXED,COMPOSITION SAME AS CUGF RCR05G270JS	(81349)		EA	REF				*	*	*	*	*		R214
P H CUGH	5905-106-1317	B	RESISTOR,FIXED,FILM 1000000 OHM, 1/2 PCT, 1/4W MF6CD1004D	(19701)		EA	6				*	*	*	*	*		R115
P H CUGJ	5905-106-1317	B	RESISTOR,FIXED,FILM SAME AS CUGH MF6CD1004D	(19701)		EA	REF				*	*	*	*	*		R215
P H CUGK	5905-761-5758	B	RESISTOR,FIXED,COMPOSITION 470 OHM, 5 PCT, 1/8W RCR05G471JS	(81349)		EA	2				*	*	*	*	*		R117
P H CUGL	5905-761-5758	B	RESISTOR,FIXED,COMPOSITION SAME AS CUGK RCR05G471JS	(81349)		EA	REF				*	*	*	*	*		R217
P H CUGM	5905-400-4482	B	RESISTOR,FIXED,COMPOSITION 33000 OHM,5 PCT,1W RCR32G333JS	(81349)		EA	5				*	*	*	*	*		R133
P H CUGN	5905-400-4482	B	RESISTOR,FIXED,COMPOSITION SAME AS CUGM RCR32G333JS	(81349)		EA	REF				*	*	*	*	*		R134

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P H CUGP	5905-400-4482	B	RESISTOR,FIXED,COMPOSITION SAME AS CUGM RCR32G333JS	(81349)		EA	REF				*	*	*	*	*		R233
P H CUGQ	5905-400-4482	B	RESISTOR,FIXED,COMPOSITION SAME AS CUGM RCR32G333JS	(81349)		EA	REF				*	*	*	*	*		R234
P H CUGR	5905-111-4727	B	RESISTOR,FIXED,COMPOSITION 2700 OHM, 5 PCT, 1/4W RCR07G272JS	(81349)		EA	2				*	*	*	*	*		R136
P H CUGS	5905-111-4727	B	RESISTOR,FIXED,COMPOSITION SAME AS CUGR RCR07G272JS	(81349)		EA	REF				*	*	*	*	*		R236
P H CUGT	5905-121-9932	B	RESISTOR,FIXED,COMPOSITION 390 OHM, 5 PCT, 1/4W RCR07G391JS	(81349)		EA	2				*	*	*	*	*		R140
P H CUGU	5905-121-9932	B	RESISTOR,FIXED,COMPOSITION SAME AS CUGT RCR07G391JS	(81349)		EA	REF				*	*	*	*	*		R240
P H CUGV	5905-126-6692	B	RESISTOR,FIXED,COMPOSITION 62 OHM, 5 PCT, 1/4W RCR07G620JS	(81349)		EA	2				*	*	*	*	*		R141
P H CUGW	5905-126-6692	B	[illegible] RCR07G620JS	(81349)		EA	REF				*	*	*	*	*		R241
P H CUGX	5905-879-6335	B	RESISTOR,FIXED,WIRE WOUND 20000 OHM, 5 PCT, 5W 243E2035	(56289)		EA	4				*	*	*	*	*		R143
P H CUGY	5905-879-6335	B	RESISTOR,FIXED,WIRE WOUND SAME AS CUGX 243E2035	(56289)		EA	REF				*	*	*	*	*		R163
P H CUGZ	5905-879-6335	B	RESISTOR,FIXED,WIRE WOUND SAME AS CUGX 243E2035	(56289)		EA	REF				*	*	*	*	*		R243
P H CUHA	5905-879-6335	B	RESISTOR,FIXED,WIRE WOUND SAME AS CUGX 243E2035	(56289)		EA	REF				*	*	*	*	*		R263
P H CUHB	5905-119-8811	B	RESISTOR,FIXED,COMPOSITION 150 OHM, 5 PCT, 1/4W RCR07G151JS	(81349)		EA	2				*	*	*	*	*		R144

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P H CUHC	5905-119-8811	B	RESISTOR,FIXED,COMPOSITION SAME AS CUHB RCR07G151JS	(81349)		EA	REF				*	*	*	*	*		R244
P H CUHD	5905-111-4742	B	RESISTOR,FIXED,COMPOSITION 390 OHM, 5 PCT, 1/2W RCR20G391JS	(81349)		EA	2				*	*	*	*	*		R151
P H CUHE	5905-111-4742	B	RESISTOR,FIXED,COMPOSITION SAME AS CUHD RCR20G391JS	(81349)		EA	REF				*	*	*	*	*		R251
P H CUHF	5905-121-9863	B	RESISTOR,FIXED,COMPOSITION 5.6 OHM, 5 PCT, 1/4W RCR07G5R6JS	(81349)		EA	2				*	*	*	*	*		R152
P H CUHG	5905-121-9863	B	RESISTOR,FIXED,COMPOSITION SAME AS CUHF RCR07G5R6JS	(81349)		EA	REF				*	*	*	*	*		R252
P H CUHH	5905-120-9154	B	RESISTOR,FIXED,COMPOSITION 470 OHM, 5 PCT, 1/4W RCR07G471JS	(81349)		EA	4				*	*	*	*	*		R153
P H CUHJ	5905-120-9154	B	RESISTOR,FIXED,COMPOSITION SAME AS CUHH RCR07G471JS	(81349)		EA	REF				*	*	*	*	*		R160
P H CUHK	5905-120-9154	B	RESISTOR,FIXED,COMPOSITION SAME AS CUHH RCR07G471JS	(81349)		EA	REF				*	*	*	*	*		R253
P H CUHL	5905-120-9154	B	RESISTOR,FIXED,COMPOSITION SAME AS CUHH RCR07G471JS	(81349)		EA	REF				*	*	*	*	*		R260
P H CUHM	5905-104-8368	B	RESISTOR,FIXED,COMPOSITION 47 OHM, 5 PCT, 1/4W RCR07G470JS	(81349)		EA	4				*	*	*	*	*		R159
P H CUHN	5905-104-8368	B	RESISTOR,FIXED,COMPOSITION SAME AS CUHM RCR07G470JS	(81349)		EA	REF				*	*	*	*	*		R259
P H CUHP	5905-104-8368	B	RESISTOR,FIXED,COMPOSITION SAME AS CUHM RCR07G470JS	(81349)		EA	REF				*	*	*	*	*		R355
P H CUHQ	5905-104-8368	B	RESISTOR,FIXED,COMPOSITION SAME AS CUHM RCR07G470JS	(81349)		EA	REF				*	*	*	*	*		R365

(1) SOURCE CODE / MAINT CAT CODE / REC CODE ISN	(2) FEDERAL STOCK NUMBER	(3a) INDENT CODE	(3b) DESCRIPTION REF NUMBER (MFR PART NO)	MFR CODE	(3c) USE ON CODE	(4) UNIT OF MEASURE	(5) QTY INCL IN UNIT	30 DAY MAINT ALW (6) DS 1 20	(6) DS 21 50	(6) DS 51 100	(7) GS 1 20	(7) GS 21 50	(7) GS 51 100	(8) 1 YR ALW PER 100 EQUIP CONTGCY PL	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIGURE NUMBER	(b) REF / ITEM NUMBER
P H CUHR	5905-935-8539	B	RESISTOR,FIXED,COMPOSITION 2000 OHM, 5 PCT, 1/2W RCR20G202JS	(81349)		EA	4				*	*	*	*	*		R165
P H CUHS	5905-935-8539	B	RESISTOR,FIXED,COMPOSITION SAME AS CUHR RCR20G202JS	(81349)		EA	REF				*	*	*	*	*		R169
P H CUHT	5905-935-8539	B	RESISTOR,FIXED,COMPOSITION SAME AS CUHR RCR20G202JS	(81349)		EA	REF				*	*	*	*	*		R265
P H CUHU	5905-935-8539	B	RESISTOR,FIXED,COMPOSITION SAME AS CUHR RCR20G202JS	(81349)		EA	REF				*	*	*	*	*		R269
P H CUHV	5905-255-3701	B	RESISTOR,FIXED,COMPOSITION 56 OHM, 5 PCT, 1/8W RCR05G560JS	(81349)		EA	14				*	*	*	*	*		R203
P H CUHW	5905-106-9348	B	RESISTOR,FIXED,COMPOSITION 150000 OHM, 5 PCT, 1/2W RCR20G154JS	(81349)		EA	3				*	*	*	*	*		R311
P H CUHX	5905-106-9348	B	RESISTOR,FIXED,COMPOSITION SAME AS CUHW RCR20G154JS	(81349)		EA	REF				*	*	*	*	*		R321
P H CUHY	5905-141-0591	B	RESISTOR,FIXED,COMPOSITION 10000 OHM, 5 PCT, 1/2W RCR20G103JS	(81349)		EA	3				*	*	*	*	*		R314
P H CUHZ	5905-879-7815	B	RESISTOR,FIXED,FILM 1400 OHM, 1 PCT, 1/8W MF5CD1401F	(19701)		EA	2				*	*	*	*	*		R315
P H CUJA	5905-879-7815	B	RESISTOR,FIXED,FILM SAME AS CUHZ MF5CD1401F	(19701)		EA	REF				*	*	*	*	*		R325
P H CUJB	5905-950-0203	B	RESISTOR,FIXED,FILM 64.9 OHM, 1 PCT, 1/8W RN55D64R9F	(81349)		EA	2				*	*	*	*	*		R317
P H CUJC	5905-950-0203	B	RESISTOR,FIXED,FILM SAME AS CUJB RN55D64R9F	(81349)		EA	REF				*	*	*	*	*		R327
P H CUJD	5905-078-1549	B	RESISTOR,FIXED,FILM 301 OHM, 1 PCT, 1/8W MF5C03010F	(19701)		EA	2				*	*	*	*	*		R318

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P H CUJE	5905-078-1549	B	RESISTOR,FIXED,FILM SAME AS CUJD MF5CD3010F (19701)		EA	REF				*	*	*	*	*		R328
P H CUJF		B	RESISTOR,FIXED,FILM 332 OHM, 1 PCT, 1/2W CECTO-3320F (07716)		EA	1				*	*	*	*	*		R323
P H CUJG	5905-141-0591	B	RESISTOR,FIXED,COMPOSITION SAME AS CUHY RCR20G103JS (81349)		EA	REF				*	*	*	*	*		R324
P H CUJH		B	RESISTOR,FIXED,FILM 237 OHM, 1 PCT, 1/8W MF5CD2370F (19701)		EA	1				*	*	*	*	*		R329
P H CUJJ	5905-104-8348	B	RESISTOR,FIXED,COMPOSITION 3300 OHM, 5 PCT, 1/2W RCR20G332JS (81349)		EA	1				*	*	*	*	*		R332
P H CUJK	5905-106-9348	B	RESISTOR,FIXED,COMPOSITION SAME AS CUHW RCR20G154JS (81349)		EA	REF				*	*	*	*	*		R333
P H CUJL	5905-141-0591	B	RESISTOR,FIXED,COMPOSITION SAME AS CUHY RCR20G103JS (81349)		EA	REF				*	*	*	*	*		R334
P H CUJM	5905-141-1130	B	RESISTOR,FIXED,COMPOSITION 2700 OHM, 5 PCT, 1/2W RCR20G272JS (81349)		01	1				*	*	*	*	*		R335
P H CUJN	5905-108-6922	B	RESISTOR,FIXED,COMPOSITION 150 OHM, 5 PCT, 1/2W RCR20G151JS (81349)		EA	1				*	*	*	*	*		R340
P H CUJP	5905-11-4734	B	RESISTOR,FIXED,COMPOSITION 47 OHM, 5 PCT, 1/2W RCR20G470JS (81349)		EA	1				*	*	*	*	*		R342
P H CUJQ	5905-151-4633	B	RESISTOR,FIXED,COMPOSITION 24000 OHM, 5 PCT, 2W RCR42G243JS (81349)		EA	1				*	*	*	*	*		R343
P H CUJR	5905-111-4858	B	RESISTOR,FIXED,COMPOSITION 470 OHM, 5 PCT, 1/2W RCR20G471JS (81349)		EA	1				*	*	*	*	*		R344
P H CUJS	5905-106-9344	B	RESISTOR,FIXED,COMPOSITION 100 OHM, 5 PCT, 1/2W RCR20G101JS (81349)		EA	1				*	*	*	*	*		R346

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P H CUJT	5905-102-6001	B	RESISTOR,FIXED,FILM 2260 OHM, 1 PCT, 1/8W MF5CD2261F (19701)		EA	1				*	*	*	*	*		R348
P H CUJU	5905-408-8267	B	RESISTOR,FIXED,FILM 1620 OHM, 1 PCT, 1/8W MF5CD1621F (19701)		EA	1				*	*	*	*	*		R349
P H CUJV		B	RESISTOR,FIXED,WIRE WOUND 5000 OHM, 1 PCT, 3W RS2BU5001F (91637)		EA	1				*	*	*	*	*		R352
P H CUJW	5905-922-9920	B	RESISTOR,FIXED,FILM 2000 OHM, 1 PCT, 1/8W MF5CD2001F (19701)		EA	2				*	*	*	*	*		R353
P H CUJX	5905-922-9920	B	RESISTOR,FIXED,FILM SAME AS CUJW MF5CD2001F (19701)		EA	REF				*	*	*	*	*		R363
P H CUJY	5905-897-0599	B	RESISTOR,FIXED,FILM 121 OHM, 1 PCT, 1/8W MF5CD1210F (19701)		EA	2				*	*	*	*	*		R354
P H CUJZ	5905-897-0599	B	RESISTOR,FIXED,FILM SAME AS CUJY MF5CD1210F (19701)		EA	REF				*	*	*	*	*		R364
P H CUKA	5905-116-8566	B	RESISTOR,FIXED,COMPOSITION 68 OHM, 5 PCT, 1/2W RCR20G680JS (81349)		EA	1				*	*	*	*	*		R356
P H CUKB	5905-235-3534	B	RESISTOR,FIXED,COMPOSITION 680 OHM, 5 PCT, 1W RCR32G681JS (81349)		EA	1				*	*	*	*	*		R357
P H CUKC	5905-118-7913	B	RESISTOR,FIXED,FILM 226 OHM, 1 PCT, 1/8W MF5CD2260F (19701)		EA	1				*	*	*	*	*		R361
P H CUKD	5905-772-2736	B	RESISTOR,FIXED,FILM 909 OHM, 1 PCT, 1/8W MF5CD9090F (19701)		EA	1				*	*	*	*	*		R362
P H CUKE	5905-116-8570	B	RESISTOR,FIXED,COMPOSITION 9100 OHM, 5 PCT, 1/2W RCR20G912JS (81349)		EA	2				*	*	*	*	*		R373
P H CUKF	5905-116-8570	B	RESISTOR,FIXED,COMPOSITION SAME AS CUKE RCR20G912JS (81349)		EA	REF				*	*	*	*	*		R383

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P H CUKG	5905-106-1249	B	RESISTOR,FIXED,COMPOSITION 51 OHM, 5 PCT, 1/8W RCR07G510JS (81349)		EA	2				*	*	*	*	*		R375
P H CUKH	5905-106-1249	B	RESISTOR,FIXED,COMPOSITION SAME AS CUKG RCR07G510JS (81349)		EA	REF				*	*	*	*	*		R385
P H CUKJ	5905-104-8352	B	RESISTOR,FIXED,COMPOSITION 15000 OHM, 5 PCT, 1W RCR32G153JS (81349)		EA	1				*	*	*	*	*		R390
P H CUKK		B	RESISTOR,FIXED,WIRE WOUND 3000 OHM, 5 PCT, 5W 246E3025 (56289)		EA	1				*	*	*	*	*		R391
P H CUKL	5905-841-7755	B	RESISTOR,FIXED,WIRE WOUND 4000 OHM, 5 PCT, 7W 244E4025 (56289)		EA	1				*	*	*	*	*		R392
P H CUKM	5905-247-8733	B	RESISTOR,FIXED,COMPOSITION 5600 OHM, 5 PCT, 1W RCR32G562JS (81349)		EA	2				*	*	*	*	*		R394
P H CUKN	5905-400-4482	B	RESISTOR,FIXED,COMPOSITION SAME AS CUGM RCR32G333JS (81349)		EA	REF				*	*	*	*	*		R397
P H CUKP	5905-114-5489	B	RESISTOR,FIXED,COMPOSITION 82000 OHM, 5 PCT, 1/2W RCR20G823JS (81349)		EA	1				*	*	*	*	*		R411
P H CUKQ	5905-228-5506	B	RESISTOR,FIXED,COMPOSITION 6200 OHM, 5 PCT, 1/4W RCR07G622JS (81349)		EA	1				*	*	*	*	*		R412
P H CUKR	5905-104-5757	B	RESISTOR,FIXED,COMPOSITION 27000 OHM, 5 PCT, 1W RCR32G273JS (81349)		EA	1				*	*	*	*	*		R413
P H CUKS	5905-247-8718	B	RESISTOR,FIXED,COMPOSITION 24000 OHM, 5 PCT, 1W RCR32G243JS (81349)		EA	1				*	*	*	*	*		R414
P H CUKT		B	RESISTOR,FIXED,WIRE WOUND 12500 OHM, 1 PCT, 4W RS2U1252F (91637)		EA	1				*	*	*	*	*		R420
P H CUKU	5905-116-2394	B	RESISTOR,FIXED,COMPOSITION 510 OHM, 5 PCT, 1/4W RCR07G511JS (81349)		EA	1				*	*	*	*	*		R421

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P H CUKV	5905-141-0743	B	RESISTOR,FIXED,COMPOSITION 3900 OHM, 5 PCT, 1/4W RCR07G392JS	(81349)		EA	1				*	*	*	*	*		R422
P H CUKW	5905-484-0277	B	RESISTOR,FIXED,COMPOSITION 30000 OHM, 5 PCT, 1W RCR32G303JS	(81349)		EA	1				*	*	*	*	*		R423
P H CUKX	5905-247-8733	B	RESISTOR,FIXED,COMPOSITION SAME AS CUKM RCR32G562JS	(81349)		EA	REF				*	*	*	*	*		R424
P H CUKY	5905-104-5756	B	RESISTOR,FIXED,COMPOSITION 1000000 OHM, 5 PCT, 1/2W RCR20G105JS	(81349)		EA	1				*	*	*	*	*		R425
P H CUKZ	5905-255-3701	B	RESISTOR,FIXED,COMPOSITION SAME AS CUHV RCR05G560JS	(81349)		EA	REF				*	*	*	*	*		R103
P H CULA	5905-813-5968	B	RESISTOR,VARIABLE 100 OHM 311-0169-00	(80009)		EA	2				*	*	*	*	*		R142
P H CULB	5905-813-5968	B	RESISTOR,VARIABLE SAME AS CULA 311-0169-00	(80009)		EA	REF				*	*	*	*	*		R242
X2 H CULC		*	NUT,PLAIN,HEXAGON 76010	(73734)		EA	2				*	*	*	*	*		H1
P H CULD	5310-087-5103	*	WASHER,LOCK 30-301	(73734)		EA	2				*	*	*	*	*		H1
X2 H CULE		*	WASHER,SHOULDER 104201	(73734)		EA	4				*	*	*	*	*		H2
P H CULF	5310-984-3503	*	WASHER,SPRING TENSION PH BRZ,.492 IN.OD,.32IN.ID,.007 IN.THK 210-0914-00	(80009)		EA	2				*	*	*	*	*		H1
P H CULG	5905-122-8618	B	RESISTOR,VARIABLE 250 OHM, 10 PCT, 1/4W 311-0592 00	(80009)		EA	2				*	*	*	*	*		R161
P H CULH	5905-122-8618	B	RESISTOR,VARIABLE SAME AS CULG 311-0592-00	(80009)		EA	REF				*	*	*	*	*		R261

SECTION III. REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE

(1) SOURCE CODE / MAINT CODE / REC CODE ISN	(2) FEDERAL STOCK NUMBER	(3a) INDENT CODE	(3b) DESCRIPTION REF NUMBER (MFR PART NO.) / MFR CODE	(3c) USE ON CODE	(4) UNIT OF MEASURE	(5) QTY INCL IN UNIT	30 DAY MAINT ALW (6) DS 1 20	DS 21 50	DS 51 100	(7) GS 1 20	GS 21 50	GS 51 100	(8) 1 YR ALW PER 100 EQUIP CONTGCY PL	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIGURE NUMBER	(b) REF / ITEM NUMBER
X2 H CULJ		*	NUT, PLAIN, HEXAGON 76025 (73734)		EA	7										H1
P H CULK	5310-184-8628	*	WASHER, FLAT MS13795-816 (96906)		EA	2				*	*	*	*	*		H1
X2 H CULL		*	WASHER, LOCK 30-350 (73734)		EA	5										H1
X2 H CULM		*	WASHER, SHOULDER 104204 (73734)		EA	4										H2
P H CULN	5905-722-9159	B	RESISTOR, VARIABLE 10000 OHM, 20 PCT, 0.2W 311-0017-00 (80009)		EA	1				*	*	*	*	*	7-15	R377
X2 H CULP		*	NUT, PLAIN, HEXAGON 67021 (73734)		EA	4										H1
P H CULQ		B	RESISTOR, VARIABLE 1000 OHM, 20 PCT, 0.2W 311-0131-00 (80009)		EA	1				*	*	*	*	*	-	R379
X2 H CULR		*	NUT, PLAIN, HEXAGON SAME AS CULP 67021 (73734)		EA	REF										H1
P H CULS		B	RESISTOR, VARIABLE 200 OHM, 0.5W 311-0178-00 (80009)		EA	1				*	*	*	*	*	7-5	R396
X2 H CULT		*	NUT, PLAIN, HEXAGON SAME AS CULJ 76025 (73734)		EA	REF										H1
P H CULU	5310-167-0837	*	WASHER, FLAT AN960-516L (88044)		EA	6				*	*	*	*	*		H1
P H CULV		B	RESISTOR, VARIABLE 1000 OHM, 10 PCT, 1/2W, 2 SECT. 311-0471-00 (80009)		EA	2				*	*	*	*	*		R167
P H CULW		B	RESISTOR, VARIABLE SAME AS CULV 311-0471-00 (80009)		EA	REF				*	*	*	*	*		R267

SECTION III. REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE

(1) SOURCE CODE / MAINT CODE / REC CODE / ISN	(2) FEDERAL STOCK NUMBER	(3a) INT/NT CODE	(3b) DESCRIPTION / REF NUMBER (MFR PART NO.) / MFR CODE	(3c) USE ON CODE	(4) UNIT OF MEASURE	(5) QTY INCL IN UNIT	30 DAY MAINT ALW (6) DS 1 20	DS 21 50	DS 51 100	(7) GS 1 20	GS 21 50	GS 51 100	(8) 1 YR ALW PER 100 EQUIP CONTGCY PL	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIGURE NUMBER	(b) REF / ITEM NUMBER
X2 H CULX		*	NUT,PLAIN,HEXAGON SAME AS CULJ 76025 (73734)		EA	REF										H1
P H CULY	5310-167-0837	*	WASHER,FLAT SAME AS CULU AN960-616L (88044)		EA	REF				*	*	*	*	*		H1
X2 H CULZ		*	WASHER,LOCK SAME AS CULL 30-350 (73734)		EA	REF										h1
P H CUMA		B	RESISTOR,VARIABLE 100 OHM, 10 PCT, 1W 311-0947-00 (80009)		EA	2				*	*	*	*	*		R150
P H CUMB		B	RESISTOR,VARIABLE SAME AS CUMA 311-0947-00 (80009)		EA	REF				*	*	*	*	*		R250
P H CUMC	4730-984-9363	*	BUSHING,MACHINE THREAD 358-0010-00 (80009)		EA	2				*	*	*	*	*		H1
P H CUMD	5310-878-2193	*	NUT,PLAIN,HEXAGON 3145-0265 (73743)		EA	4				*	*	*	*	*		H2
P H CUME	5905-228-6436	B	RESISTOR,VARIABLE 500 OHM, 0.5W 311-0362-00 (80009)		EA	1				*	*	*	*	*	7-5	R359
X2 H CUMF		*	NUT,PLAIN,HEXAGON SAME AS CULJ 76025 (73734)		EA	REF										H1
P H CUMG	5905-917-9333	B	RESISTC ARIABLE 150 OHM, 20 PCT, 0.2W 311-0129-00 (80009)		EA	1				*	*	*	*	*	7-4	R415
X2 H CUMH		*	NUT,PLAIN,HEXAGON SAME AS CULP 67021 (73734)		EA	REF										H2
X2 H CUMJ		B	ROD ASSEMBLY,SWITCH EXTENSION 384-0310-00 (80009)		EA	2										MP17
X2 H CUMK		B	ROD ASSEMBLY,SWITCH EXTENSION SAME AS CUMJ 384-0310-00 (80009)		EA	REF										MP18

SECTION III. REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE

(1) SOURCE CODE / MAINT CODE / REC CODE ISN	(2) FEDERAL STOCK NUMBER	(3a) INDENT CODE	(3b) DESCRIPTION REF NUMBER (MFR PART NO.)	MFR CODE	(3c) USE ON CODE	(4) UNIT OF MEASURE	(5) QTY INCL IN UNIT	30 DAY MAINT ALW (6) DS 1 20	DS 21 50	DS 51 100	(7) GS 1 20	GS 21 50	GS 51 100	(8) 1 YR ALW PER 100 EQUIP CONTGCY PL	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIGURE NUMBER	(b) REF / ITEM NUMBER
X2 H CUML		B	ROD,SPACING 384-0631-00	(80009)		EA	4										MP52
X2 H CUMM		B	ROD,SPACING SAME AS CUML 384-0631-00	(80009)		EA	REF										MP53
X2 H CUMN		B	ROD,SPACING SAME AS CUML 384-0631-00	(80009)		EA	REF										MP54
X2 H CUMP		B	ROD,SPACING SAME AS CUML 384-0631-00	(80009)		EA	REF										MP55
P H CUMQ	5305-054-6670	*	SCREW,MACHINE CRES, 8-32 X 1/2 IN. LG MS51957-45	(96906)		EA	4				*	*	*	*	*		H1
P H CUMR	5961-858-5686	B	SEMICONDUCTOR DEVICE,DIODE CD12676	(07910)		EA	2				*	*	*	*	*		D117
P H CUMS	5961-858-5686	B	SEMICONDUCTOR DEVICE,DIODE SAME AS CUMR CD12676	(07910)		EA	REF				*	*	*	*	*		D217
P H CUMT	5961-105-7681	B	SEMICONDUCTOR DEVICE,DIODE CD8220	(07910)		EA	8				*	*	*	*	*		D301
P H CUMU	5961-105-7681	B	SEMICONDUCTOR DEVICE,DIODE SAME AS CUMT CD8220	(07910)		EA	REF				*	*	*	*	*		D302
P H CUMV	5961-105-7681	B	SEMICONDUCTOR DEVICE,DIODE SAME AS CUMT CD8220	(07910)		EA	REF				*	*	*	*	*		D303
P H CUMW	5961-105-7681	B	SEMICONDUCTOR DEVICE,DIODE SAME AS CUMT CD8220	(07910)		EA	REF				*	*	*	*	*		D304
P H CUMX	5961-105-7681	B	SEMICONDUCTOR DEVICE,DIODE SAME AS CUMT CD8220	(07910)		EA	REF				*	*	*	*	*		D306
P H CUMY	5961-105-7681	B	SEMICONDUCTOR DEVICE,DIODE SAME AS CUMT CD8220	(07910)		EA	REF				*	*	*	*	*		D307

(1) SOURCE CODE / MAINT CODE / REC CODE ISN	(2) FEDERAL STOCK NUMBER	(3a) INDENT CODE	(3b) DESCRIPTION REF NUMBER (MFR PART NO.)	MFR CODE	(3c) USE ON CODE	(4) UNIT OF MEASURE	(5) QTY INCL IN UNIT	30 DAY MAINT ALW (6) DS 1 20	DS 21 50	DS 51 100	(7) GS 1 20	GS 21 50	GS 51 100	(8) 1 YR ALW PER 100 EQUIP CONTGCY PL	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIGURE NUMBER	(b) REF / ITEM NUMBER
P H CUMZ	5961-105-7681	B	SEMICONDUCTOR DEVICE,DIODE SAME AS CUMT CD8220	(07910)		EA	REF				*	*	*	*	*		D308
P H CUNA	5961-105-7681	B	SEMICONDUCTOR DEVICE,DIODE SAME AS CUMT CD8220	(07910)		EA	REF				*	*	*	*	*		D309
P H CUNB	5961-936-7604	B	SEMICONDUCTOR DEVICE,DIODE SILICON 152-C185-00	(80009)		EA	3				*	*	*	*	*		D317
P H CUNC	5961-936-7604	B	SEMICONDUCTOR DEVICE,DIODE SAME AS CUNB 152-0185-00	(80009)		EA	REF				*	*	*	*	*		D327
P H CUND	5961-936-7604	B	SEMICONDUCTOR DEVICE,DIODE SAME AS CUNB 152-0185-00	(80009)		EA	REF				*	*	*	*	*		D340
P H CUNE	5961-053-5445	B	SEMICONDUCTOR DEVICE,DIODE 1N961B	(80131)		EA	1				*	*	*	*	*		D391
P H CUNF		B	SEMICONDUCTOR DEVICE,DIODE 1N963B	(81349)		EA	1				*	*	*	*	*		D395
P H CUNG		B	SEMICONDUCTOR DEVICE,DIODE 1N4372A	(81349)		EA	1				*	*	*	*	*		D397
P H CUNH	5961-908-7598	B	SEMICONDUCTOR DEVICE,DIODE 152-0075-00	(80009)		EA	1				*	*	*	*	*		D416
P H CUNJ	5961-752-6165	B	SEMICONDUCTOR DEVICE,DIODE 75V ZENER VOLTAGE, 5 PCT 1N982B	(81349)		EA	1				*	*	*	*	*		D420
P H CUNK	5961-617-5668	B	SEMICONDUCTOR DEVICE,DIODE T12G	(03877)		EA	1				*	*	*	*	*		D332
X2 H CUNL		B	SHIELD,FRONT 337-0674-00	(80009)		EA	1										MP48
P H CUNM	5310-063-7415	*	NUT,ASSEMBLED WASHER 511-041800-00	(78189)		EA	9				*	*	*	*	*		H1

SECTION III. REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE

(1) SOURCE CODE / MAINT CODE / REC CODE ISN	(2) FEDERAL STOCK NUMBER	(3a) INDENT CODE	(3b) DESCRIPTION REF NUMBER (MFR PART NO) / MFR CODE	(3c) USE ON CODE	(4) UNIT OF MEASURE	(5) QTY INCL IL UNIT	30 DAY MAINT ALW (6) DS 1 20	(6) DS 21 50	(6) DS 51 100	(7) GS 1 20	(7) GS 21 50	(7) GS 51 100	(8) 1 YR ALW PER 100 EQUIP	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIGURE NUMBER	(b) REF / ITEM NUMBER
P H CUNN	5305-901-2591	*	SCREW,MACHINE CAD PL, NO. 4 PHILLIPS RECESSED 213-0044-00 (80009)		EA	10				*	*	*	*	*		H1
P H CUNP		B	SOCKET,ELECTRON TUBE 05-0901-03 (91662)		EA	1				*	*	*	*	*		XBV364
P H CUNQ	5305-901-2591	*	SCREW,MACHINE SAME AS CUNN 213-0044-00 (80009)		EA	REF				*	*	*	*	*		H2
P H CUNR	5935-918-0469	B	SOCKET,SEMICONDUCTOR DEVICE 3 PIN 136-0181-00 (80009)		EA	17				*	*	*	*	*		XQ132
P H CUNS	5935-918-0469	B	SOCKET,SEMICONDUCTOR DEVICE SAME AS CUNR 136-0181-00 (80009)		EA	REF				*	*	*	*	*		XQ133
P H CUNSA	5935-918-0469	B	SOCKET,SEMICONDUCTOR DEVICE SAME AS CUNR 136-0181-00 (80009)		EA	REF				*	*	*	*	*		XQ143
P H CUNU	5935-918-0469	B	SOCKET,SEMICONDUCTOR DEVICE SAME AS CUNR 136-0181-00 (80009)		EA	REF				*	*	*	*	*		XQ163
P H CUNV	5935-918-0469	B	SOCKET,SEMICONDUCTOR DEVICE SAME AS CUNR 136-0181-00 (80009)		EA	REF				*	*	*	*	*		XQ232
P H CUNW	5935-918-0469	B	SOCKET,SEMICONDUCTOR DEVICE SAME AS CUNR 136-0181-00 (80009)		EA	REF				*	*	*	*	*		XQ233
P H CUNX	5935-918-0469	B	SOCKET,SEMICONDUCTOR DEVICE SAME AS CUNR 136-0181-00 (80009)		EA	REF				*	*	*	*	*		XQ243
P H CUNY	5935-918-0469	B	SOCKET,SEMICONDUCTOR DEVICE SAME AS CUNR 136-0181-00 (80009)		EA	REF				*	*	*	*	*		XQ263
P H CUNZ	5935-918-0469	B	SOCKET,SEMICONDUCTOR DEVICE SAME AS CUNR 136-0181-00 (80009)		EA	REF				*	*	*	*	*		XQ315
P H CUPA	5935-918-0469	B	SOCKET,SEMICONDUCTOR DEVICE SAME AS CUNR 136-0181-00 (80009)		EA	REF				*	*	*	*	*		XQ325

(1) SMR CODE / ISN	(2) FEDERAL STOCK NUMBER	(3a) INDENT CODE	(3b) DESCRIPTION / REF NUMBER (MFR PART NO.)	MFR CODE	(3c) USE ON CODE	(4) UNIT OF MEASURE	(5) QTY INCL IN UNIT	30 DAY MAINT ALW (6) DS 1 20	DS 21 50	DS 51 100	(7) GS 1 20	GS 21 50	GS 51 100	(8) 1 YR ALW PER 100 EQUIP CONTGCY PL	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIGURE NUMBER	(b) REF / ITEM NUMBER
P H CUPB	5905-918-0469	B	SOCKET,SEMICONDUCTOR DEVICE SAME AS CUNR 136-0181-00	(80009)		EA	REF				*	*	*	*	*		XQ340
P H CUPC	5935-918-0469	B	SOCKET,SEMICONDUCTOR DEVICE SAME AS CUNR 136-0181-00	(80009)		EA	REF				*	*	*	*	*		XQ354
P H CUPD	5935-918-0469	B	SOCKET,SEMICONDUCTOR DEVICE SAME AS CUNR 136-0181-00	(80009)		EA	REF				*	*	*	*	*		XQ364
P H CUPE	5935-918-0469	B	SOCKET,SEMICONDUCTOR DEVICE SAME AS CUNR 136-0181-00	(80009)		EA	REF				*	*	*	*	*		XQ373
P H CUPF	5935-918-0469	B	SOCKET,SEMICONDUCTOR DEVICE SAME AS CUNR 136-0181-00	(80009)		EA	REF				*	*	*	*	*		XQ383
P H CUPG	5935-918-0469	B	SOCKET,SEMICONDUCTOR DEVICE SAME AS CUNR 136-0181-00	(80009)		EA	REF				*	*	*	*	*		XQ414
P H CUPH	5935-918-0469	B	SOCKET,SEMICONDUCTOR DEVICE SAME AS CUNR 136-0181-00	(80009)		EA	REF				*	*	*	*	*		XQ424
P H CUPJ	5365-816-0002	B	SPACER,SLEEVE SAME AS CUDY 361-0007-00	(80009)		EA	REF				*	*	*	*	*		MP43
X2 H CUPK		B	SPRING,FLAT 214-0483-00	(80009)		EA	2										MP35
X2 H CUPL		B	SPRING,FLAT SAME AS CUPK 214-0483-00	(80009)		EA	REF										MP36
P H CUPM	5305-058-2097	*	SCREW,TAPPING,THREAD FORMING MS24622-4	(96906)		EA	4				*	*	*	*	*		H2
X2 H CUPN		*	SPACER,DETENT SPRING 361-0080-00	(80009)		EA	2										H1
A H S CUPP		B	SWITCH ASSEMBLY 262-0694-02	(80009)		FA	2										SW101/SW105

SECTION III. REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE

(1) SOURCE CODE / MAINT CODE / REC CODE ISN	(2) FEDERAL STOCK NUMBER	(3a) INDENT CODE	(3b) DESCRIPTION REF NUMBER (MFR PART NO) / MFR CODE	(3c) USE ON CODE	(4) UNIT OF MEASURE	(5) QTY INCL IN UNIT	30 DAY MAINT ALW (6) DS 1 20	DS 21 50	DS 51 100	(7) GS 1 20	GS 21 50	GS 51 100	(8) 1 YR ALW PER 100 EQUIP CONTGCY PL	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIGURE NUMBER	(b) REF / ITEM NUMBER
A H S CUPQ		B	SWITCH ASSEMBLY SAME AS CUPP 262-0694-02 (80009)		EA	REF										SW201/SW205
X2 H CUPR		*	BUSHING,MACHINE THREAD 358-0249-00 (80009)		EA	2										H1
P H CUPS	5310-167-0837	*	WASHER,FLAT SAME AS CULU AN960-616L (88044)		EA	REF				*	*	*	*	*		H1
X2 H CUPT		C	BEARING,SLEEVE 358-0242-00 (80009)		EA	2										SW201/SW205MP7
P H CUPU	5910-900-1085	C	CAPACITOR ASSEMBLY FXD 50 PF, 250 VDCW, VAR 0.25-1.5 PF, 600 VDC 281-0083-00 (80009)		EA	8				*	*	*	*	*	7-12	C109C
P H CUPV	5910-900-1085	C	CAPACITOR ASSEMBLY SAME AS CUPU 281-0083-00 (80009)		EA	REF				*	*	*	*	*		C109E
P H CUPW	5910-900-1085	C	CAPACITOR ASSEMBLY SAME AS CUPU 281-0083-00 (80009)		EA	REF				*	*	*	*	*	7-12	C209C
P H CUPWA	5910-900-1085	C	CAPACITOR ASSEMBLY SAME AS CUPU 281-0083-00 (80009)		EA	REF				*	*	*	*	*		C209E
P H CUPX	5910-450-8546	C	CAPACITOR ASSEMBLY FXD 100 PF, 10 PCT, VAR 0.25-1.5 PF, 600VDCW 281-0113-00 (80009)		EA	8				*	*	*	*	*	7-12	C110C
P H CUPY	5910-450-8546	C	CAPACITOR ASSEMBLY SAME AS CUPX 281-0113-00 (80009)		EA	REF				*	*	*	*	*		C110E
P H CUPZ	5910-450-8546	C	CAPACITOR ASSEMBLY SAME AS CUPX 281-0113-00 (80009)		EA	REF				*	*	*	*	*	7-12	C210C
P H CUQA	5910-450-8546	C	CAPACITOR ASSEMBLY SAME AS CUPX 281-0113-00 (80009)		EA	REF				*	*	*	*	*		C210E

(1) SOURCE CODE / MAINT CODE / REC CODE ISN	(2) FEDERAL STOCK NUMBER	(3a) INDENT CODE	(3b) DESCRIPTION REF NUMBER (MFR PART NO) / MFR CODE	(3c) USE ON CODE	(4) UNIT OF MEASURE	(5) QTY INCL IN UNT	30 DAY MAINT ALW (6) DS 1 20	DS 21 50	DS 51 100	(7) GS 1 20	GS 21 50	GS 51 100	(8) 1 YR ALW PER 100 EQUIP CONTGCY PL	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIGURE NUMBER	(b) REF / ITEM NUMBER
P H CUQB	5910-900-1089	C	CAPACITOR ASSEMBLY FXD 200 PF, 250V, VAR 0.25-1.5 PF, 600 VDCW 281-0085-00 (80009		EA	8				*	*	*	*	*	7-12	C111C
P H CUQC	5910-900-1089	C	CAPACITOR ASSEMBLY SAME AS CUQB 281-0085-00 (80009)		EA	REF				*	*	*	*	*		C111E
P H CUQD	5910-900-1089	C	CAPACITOR ASSEMBLY SAME AS CUQB 281-0085-00 (80009)		EA	REF				*	*	*	*	*	7-12	C211C
P H CUQE	5910-900-1089	C	CAPACITOR ASSEMBLY SAME AS CUQB 281-0085-00 (80009)		EA	REF				*	*	*	*	*		C211E
P H CUQF	5910-900-1097	C	CAPACITOR ASSEMBLY FXD 500 PF, 500V, VAR 0.25-1.5 PF, 600 VDCW 281-0086-00 (80009)		EA	8				*	*	*	*	*	7-12	C112C
P H CUQG	5910-900-1097	C	CAPACITOR ASSEMBLY SAME AS CUQF 281-0086-00 (80009)		EA	REF				*	*	*	*	*		C112E
P H CUQH	5910-900-1097	C	CAPACITOR ASSEMBLY SAME AS CUQF 281-0086-00 (80009)		EA	REF				*	*	*	*	*	7-12	C212C
P H CUQJ	5910-900-1097	C	CAPACITOR ASSEMBLY SAME AS CUQF 281-0086-00 (80009)		EA	REF				*	*	*	*	*		C212E
P H CUQK	5910-794-3269	C	CAPACITOR,FIXED,CERAMIC DI 0.68 PF 281-0537-00 (80009)		EA	4				*	*	*	*	*		C105A
P H CUQL	5910-794-3269	C	CAPACITOR,FIXED,CERAMIC DI SAME AS CUQK 281-0537-00 (80009)		EA	REF				*	*	*	*	*		C205A
P H CUQM	5910-828-1455	C	CAPACITOR,FIXED,CERAMIC DI 1 PF, 20 PCT, 500 VDCW 281-0538-00 (80009)		EA	4				*	*	*	*	*		C106D
P H CUQN	5910-828-1455	C	CAPACITOR,FIXED,CERAMIC DI SAME AS CUQM 281-0538-00 (80009)		EA	REF				*	*	*	*	*		C206D

(1) SOURCE CODE / MAINT CODE / REC CODE — ISN	(2) FEDERAL STOCK NUMBER	(3a) INDENT CODE	(3b) DESCRIPTION — REF NUMBER (MFR PART NO.) / MFR CODE	(3c) USE ON CODE	(4) UNIT OF MEASURE	(5) QTY INCL IN UNIT	30 DAY MAINT ALW (6) DS 1-20	(6) DS 21-50	(6) DS 51-100	(7) GS 1-20	(7) GS 21-50	(7) GS 51-100	(8) 1 YR ALW PER 100 EQUIP (CONTOCK PL)	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIGURE NUMBER	(10) ILLUSTRATIONS (b) REF / ITEM NUMBER
P H CUQP	5910-950-9073	C	CAPACITOR,FIXED,CERAMIC DI 3.3 PF, PORM .25 PF, 500 VDCW 301-000C0J0339C (72982)		EA	8				*	*	*	*	*		C108A
P H CUQQ	5910-950-9073	C	CAPACITOR,FIXED,CERAMIC DI SAME AS CUQP 301-000C0J0339C (72982)		EA	REF				*	*	*	*	*		C112A
P H CUQR	5910-950-9073	C	CAPACITOR,FIXED,CERAMIC DI SAME AS CUQP 301-000C0J0339C (72982)		EA	REF				*	*	*	*	*		C208A
P H CUQS	5910-950-9073	C	CAPACITOR,FIXED,CERAMIC DI SAME AS CUQP 301-000C0J0339C (72982)		EA	REF				*	*	*	*	*		C212A
P H CUQT	5910-226-0475	C	CAPACITOR,FIXED,CERAMIC DI 2.7 PF, 0.25 PF, 500 VDCW 301-000C0J0279C (72982)		EA	16				*	*	*	*	*		C107A
P H CUQU	5910-226-0475	C	CAPACITOR,FIXED,CERAMIC DI SAME AS CUQT 301-000C0J0279C (72982)		EA	REF				*	*	*	*	*		C109A
P H CUQV	5910-226-0475	C	CAPACITOR,FIXED,CERAMIC DI SAME AS CUQT 301-000C0J0279C (72982)		EA	REF				*	*	*	*	*		C110A
P H CUQW	5910-226-0475	C	CAPACITOR,FIXED,CERAMIC DI SAME AS CUQT 301-000C0J0279C (72982)		EA	REF				*	*	*	*	*		C111A
P H CUQX	5910-226-0475	C	CAPACITOR,FIXED,CERAMIC DI SAME AS CUQT 301-000C0J0279C (72982)		EA	REF				*	*	*	*	*		C207A
P H CUQY	5910-226-0475	C	CAPACITOR,FIXED,CERAMIC DI SAME AS CUQT 301-000C0J0279C (72982)		EA	REF				*	*	*	*	*		C209A
P H CUQZ	5910-226-0475	C	CAPACITOR,FIXED,CERAMIC DI SAME AS CUQT 301-000C0J0279C (72982)		EA	REF				*	*	*	*	*		C210A
P H CURA	5910-226-0475	C	CAPACITOR,FIXED,CERAMIC DI SAME AS CUQT 301-000C0J0279C (72982)		EA	REF				*	*	*	*	*		C211A
P H CURB		C	CAPACITOR,VARIABLE,AIR 1.8-13 PF, 325 VDCW 545-000 (72982)		EA	4				*	*	*	*	*	7-12	C105C

SECTION III. REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE

(1) SOURCE CODE / MAINT CAT CODE / RPSC CODE ISN	(2) FEDERAL STOCK NUMBER	(3a) INDENT CODE	(3b) DESCRIPTION REF NUMBER (MFR PART NO.) MFR CODE	(3c) USE ON CODE	(4) UNIT OF MEASURE	(5) QTY INCL IN UNIT	(6) 30 DAY MAINT ALW DS 1 20	DS 21 50	DS 51 100	(7) GS 1 20	GS 21 50	GS 51 100	(8) 1 YR ALW PER 100 EQUIP CONTGCY PL	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIGURE NUMBER	(b) REF / ITEM NUMBER
P H CURC		C	CAPACITOR,VARIABLE,AIR SAME AS CURB 545-000 (72982)		EA	REF				*	*	*	*	*	7-12	C205C
P H CURD	5910-950-3924	C	CAPACITOR,VARIABLE,PLASTIC DIE 0.7 TO 3 PF 281-0027-00 (80009)		EA	4				*	*	*	*	*	7-12	C106C
P H CURE	5910-950-3924	C	CAPAC TOR,VARIABLE,PLASTIC DIE SAME AS CURD 281-002 -00 (80009)		EA	REF				*	*	*	*	*	7-12	C206C
P H CURF	5910-794-3617	C	CAPACITOR,VARIABLE,PLASTIC DIE 0.7 TO 3 PF, 350 VDCW 281-0037-00 (80009)		EA	32				*	*	*	*	*	7-12	C106B
P H CURG	5910-794-3617	C	CAPACITOR,VARIABLE,PLASTIC DIE SAME AS CURF 281-0037-00 (80009)		EA	REF				*	*	*	*	*	7-12	C107B
P H CURH	5910-794-3617	C	CAPACITOR,VARIABLE,PLASTIC DIE SAME AS CURF 281-0037-00 (80009)		EA	REF				*	*	*	*	*	7-12	C107C
P H CURJ	5910-794-3617	C	CAPACITOR,VARIABLE,PLASTIC DIE SAME AS CURF 281-0037-00 (80009)		EA	REF				*	*	*	*	*	7-12	C108B
P H CURK	5910-794-3617	C	CAPACITOR,VARIABLE,PLASTIC DIE SAME AS CURF 281-0037-00 (80009)		EA	REF				*	*	*	*	*	7-12	C109B
P H CURL	5910-794-3617	C	CAPACITOR,VARIABLE,PLASTIC DIE SAME AS CURF 281-0037-00 (80009)		EA	REF				*	*	*	*	*	7-12	C110B
P H CURM	5910-794-3617	C	CAPACITOR,VARIABLE,PLASTIC DIE SAME AS CURF 281-0037-00 (80009)		EA	REF				*	*	*	*	*	7-12	C111B
P H CURN	5910-794-3617	C	CAPACITOR,VARIABLE,PLASTIC DIE SAME AS CURF 281-0037-00 (80009)		EA	REF				*	*	*	*	*	7-12	C112B
P H CURP	5910-794-3617	C	CAPACITOR,VARIABLE,PLASTIC DIE SAME AS CURF 281-0037-00 (80009)		EA	REF				*	*	*	*	*	7-12	C206B
P H CURQ	5910-794-3617	C	CAPACITOR,VARIABLE,PLASTIC DIE SAME AS CURF 281-0037-00 (80009)		EA	REF				*	*	*	*	*	7-12	C207B

SECTION III. REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE

(1) SOURCE CODE / MAINT CODE / REC CODE ISN	(2) FEDERAL STOCK NUMBER	(3a) INDENT CODE	(3b) DESCRIPTION REF NUMBER (MFR PART NO.) MFR CODE	(3c) USE ON CODE	(4) UNIT OF MEASURE	(5) QTY INCL IN UNIT	30 DAY MAINT ALW (6) DS 1 20	(6) DS 21 50	(6) DS 51 100	(7) GS 1 20	(7) GS 21 50	(7) GS 51 100	(8) 1 YR ALW PER 100 EQUIP CONTGCY PL	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIGURE NUMBER	(10) ILLUSTRATIONS (b) REF / ITEM NUMBER
P H CURR	5910-794-3617	C	CAPACITOR,VARIABLE,PLASTIC DIE SAME AS CURF 281-0037-00 (80009)		EA	REF				*	*	*	*	*	7-12	C207C
P H CURS	5910-794-3617	C	CAPACITOR,VARIABLE,PLASTIC DIE SAME AS CURF 281-0037-00 (80009)		EA	REF				*	*	*	*	*	7-12	C208B
P H CURT	5910-794-3617	C	CAPACITOR,VARIABLE,PLASTIC DIE SAME AS CURF 281-0037-00 (80009)		EA	REF				*	*	*	*	*	7-12	C209B
P H CURU	5910-794-3617	C	CAPACITOR,VARIABLE,PLASTIC DIE SAME AS CURF 281-0037-00 (80009)		EA	REF				*	*	*	*	*	7-12	C210B
P H CURV	5910-794-3617	C	CAPACITOR,VARIABLE,PLASTIC DIE SAME AS CURF 281-0037-00 (80009)		EA	REF				*	*	*	*	*	7-12	C211B
P H CURW	5910-794-3617	C	CAPACITOR,VARIABLE,PLASTIC DIE SAME AS CURF 281-0037-00 (80009)		EA	REF				*	*	*	*	*	7-12	C212B
P H CURX	5910-932-7015	C	CAPACITOR,VARIABLE,CERAMIC DI 0.25-1.5 PF, 10 PCT, 250 VDCW 281-0082-00 (80009)		EA	8				*	*	*	*	*	7-12	C108C
P H CURY	5910-932-7015	C	CAPACITOR,VARIABLE,CERAMIC DI SAME AS CURX 281-0082-00 (80009)		EA	REF				*	*	*	*	*		C108E
P H CURZ	5910-932-7015	C	CAPACITOR,VARIABLE,CERAMIC DI SAME AS CURX 281-0082-00 (80009)		EA	REF				*	*	*	*	*	7-12	C208C
P H CUSA	5910-932-7015	C	CAPACITOR,VARIABLE,CERAMIC DI SAME AS CURX 281-0082-00 (80009)		EA	REF				*	*	*	*	*		C208E
P H CUSB	5910-932-9453	C	CAPACITOR,VARIABLE,PLASTIC DIE 0.25-1.5 PF, 600 VDCW 281-0064-00 (80009)		EA	8				*	*	*	*	*	7-12	SW201/SW205C10
P H CUSC	5910-932-9453	C	CAPACITOR,VARIABLE,PLASTIC DIE SAME AS CUSB 281-0064-00 (80009)		EA	REF				*	*	*	*	*	7-12	C105B
P H CUSD	5910-932-9453	C	CAPACITOR,VARIABLE,PLASTIC DIE SAME AS CUSB 281-0064-00 (80009)		EA	REF				*	*	*	*	*	7-12	SW201/SW205C20

SECTION III. REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE

(1) SOURCE CODE / MAINT CODE / RECOV CODE — ISN	(2) FEDERAL STOCK NUMBER	(3a) INDENT CODE	(3b) DESCRIPTION — REF NUMBER (MFR PART NO.) / MFR CODE	(3c) USE ON CODE	(4) UNIT OF MEASURE	(5) QTY INCL IN UNIT	30 DAY MAINT ALW (6) DS 1 20	(6) DS 21 50	(6) DS 51 100	(7) GS 1 20	(7) GS 21 50	(7) GS 51 100	(8) 1 YR ALW PER 100 EQUIP CONUS	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIGURE NUMBER	(10) ILLUSTRATIONS (b) REF / ITEM NUMBER
P H CUSE	5910-932-9453	C	CAPACITOR,VARIABLE,PLASTIC DIE SAME AS CUSB 281-0064-00 (80009)		EA	REF				*	*	*	*	*	7-12	C205B
P H CUSF	5950-932-7105	C	COIL,RADIO FREQUENCY 8 TURNS, 0.1 UH, 10 PCT 109-0268-00 (80009)		EA	8				*	*	*	*	*		LR105A
P H CUSG	5950-932-7105	C	COIL,RADIO FREQUENCY SAME AS CUSF 108-0268-00 (80009)		EA	REF				*	*	*	*	*		LR106A
P H CUSH	5950-932-7105	C	COIL,RADIO FREQUENCY SAME AS CUSF 108-0268-00 (80009)		EA	REF				*	*	*	*	*		LR205A
P H CUSJ	5950-932-7105	C	COIL,RADIO FREQUENCY SAME AS CUSF 108-0268-00 (80009)		EA	REF				*	*	*	*	*		LR206A
P H CUSK	5950-913-2213	C	COIL,RADIO FREQUENCY 0.17 MH, 10 PCT 108-0286-00 (80009)		EA	4				*	*	*	*	*		LR107A
P H CUSL	5950-913-2213	C	COIL,RADIO FREQUENCY SAME AS CUSK 108-0286-00 (80009)		EA	REF				*	*	*	*	*		LR207A
P H ISM	6625-492-5564	C	FRAME,ATTENUATOR SWITCH 426-0201-00 (80009)		EA	2										SW201/SW205MP3
P H CUSN	5305-969-4350	*	SETSCREW SAME AS CUFE MS18066-2 (96906)		EA	REF				*	*	*	*	*		H1
P H CUSP	3020-134-9321	C	GEAR,BEVEL 214-0272-00 (80009)		EA	4				*	*	*	*	*		SW201/SW205MP4
P H CUSQ	3020-134-9321	C	GEAR,BEVEL SAME AS CUSP 214-0272-00 (80009)		EA	REF				*	*	*	*	*		SW201/SW205MP5
P H CUSR	5305-969-4350	*	SETSCREW SAME AS CUFE MS18066-2 (96906)		EA	REF				*	*	*	*	*		H2
P H CUSS	5905-123-9972	C	RESISTOR,FIXED,FILM 500000 OHM, 1/2 PCT, 1/4W MF6CD*003D (19701)		EA	4				*	*	*	*	*		R105C

(1) SOURCE, MAINT, REC CODE ISN	(2) FEDERAL STOCK NUMBER	(3a) INDENT CODE	(3b) DESCRIPTION REF NUMBER (MFR PART NO.) MFR CODE	(3c) USE ON CODE	(4) UNIT OF MEASURE	(5) QTY INCL IN L T	(6) 30 DAY MAINT ALW DS 1 20	DS 21 50	DS 51 100	(7) GS 1 20	GS 21 50	GS 51 100	(8) 1 YR ALW PER 100 EQUIP CONTGCY PL	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIGURE NUMBER	(b) REF / ITEM NUMBER
P H CUST	5905-123-9972	C	RESISTOR,FIXED,FILM SAME AS CUSS MF6CD5003D (19701)		EA	REF				*	*	*	*	*		R205C
P H CUSU	5905-106-1317	C	RESISTOR,FIXED,FILM SAME AS CUGH MF6CD1004D (19701)		EA	REF				*	*	*	*	*		R105E
P H CUSV	5905-106-1317	C	RESISTOR,FIXED,FILM SAME AS CUGH MF6CD1004D (19701)		EA	REF				*	*	*	*	*		R205E
P H CUSW	5905-106-1318	C	RESISTOR,FIXED,FILM 750000 OHM, 1/2 PCT, 1/4W MF6CD7503D (19701)		EA	4				*	*	*	*	*		R106C
P H CUSX	5905-106-1318	C	RESISTOR,FIXED,FILM SAME AS CUSW MF6CD7503D (19701)		EA	REF				*	*	*	*	*		R206C
P H CUSY	5905-107-0642	C	RESISTOR,FIXED,FILM 333000 OHM, 1/2 PCT, 1/8W MF5CD3333D (19701)		EA	4				*	*	*	*	*		R106E
P H CUSZ	5905-107-0642	C	RESISTOR,FIXED,FILM SAME AS CUSY MF5CD3333D (19701)		EA	REF				*	*	*	*	*		R206E
P H CUTA	5905-104-5826	C	RESISTOR,FIXED,FILM 900000 OHM, 1/2 PCT, 1/4W MF6CD9003D (19701)		EA	4				*	*	*	*	*		R107C
P H CUTB	5905-104-5826	C	RESISTOR,FIXED,FILM SAME AS CUTA MF6CD9003D (19701)		EA	REF				*	*	*	*	*		R207C
P H CUTC	5905-107-2533	C	RESISTOR,FIXED,FILM 111000 OHM, 1/2 PCT, 1/8W MF5CD1113D (19701)		EA	4				*	*	*	*	*		R107E
P H CUTD	5905-107-2533	C	RESISTOR,FIXED,FILM SAME AS CUTC MF5CD1113D (19701)		EA	REF				*	*	*	*	*		R207E
P H CUTE	5905-458-9291	C	RESISTOR,FIXED,FILM 950000 OHM, 1/2 PCT, 1/4W MF6CD9503D (19701)		EA	4				*	*	*	*	*		R108C
P H CUTF	5905-458-9291	C	RESISTOR,FIXED,FILM SAME AS CUTE MF6CD9503D (19701)		EA	REF				*	*	*	*	*		R208C

(1) SOURCE CODE / MAINT CODE / REC CODE ISN	(2) FEDERAL STOCK NUMBER	(3a) INDENT CODE	(3b) DESCRIPTION REF NUMBER (MFR PART NO.)	MFR CODE	(3c) USE ON CODE	(4) UNIT OF MEASURE	(5) QTY INCL IN UNIT	30 DAY MAINT ALW (6) DS 1 20	DS 21 50	DS 51 100	(7) GS 1 20	GS 21 50	GS 51 100	(8) 1 YR ALW PER 100 EQUIP CONTGCY PL	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIGURE NUMBER	(b) REF / ITEM NUMBER
P H CUTG		C	RESISTOR,FIXED,FILM 52600 OHM, 1/2 PCT, 1/8W MF5CD5262D	(19701)		EA	4				*	*	*	*	*		R108E
P H CUTH		C	RESISTOR,FIXED,FILM SAME AS CUTG MF5CD5262D	(19701)		EA	REF				*	*	*	*	*		R208E
P H CUTJ		C	RESISTOR,FIXED,FILM 975000 OHM, 1/2 PCT, 1/4W MF6CD9753D	(19701)		EA	4				*	*	*	*	*		R109C
P H CUTK		C	RESISTOR,FIXED,FILM SAME AS CUTJ MF6CD9753D	(19701)		EA	REF				*	*	*	*	*		R209C
P H CUTL		C	RESISTOR,FIXED,FILM 25600 OHM, 1/2 PCT, 1/8W MF5CD2562D	(19701)		EA	4				*	*	*	*	*		R109E
P H CUTM		C	RESISTOR,FIXED,FILM SAME AS CUTL MF5CD2562D	(19701)		EA	REF				*	*	*	*	*		R209E
P H CUTN		C	RESISTOR,FIXED,FILM 990000 OHM, 1/2 PCT, 1/4W MF6CD9903D	(19701)		EA	4				*	*	*	*	*		R110C
P H CUTP		C	RESISTOR,FIXED,FILM SAME AS CUTN MF6CD9903D	(19701)		EA	REF				*	*	*	*	*		R210C
P H CUTQ	5905-105-9709	C	RESISTOR,FIXED,FILM 10100 OHM, 1/2 PCT, 1/8W MF5CD1012D	(19701)		EA	4				*	*	*	*	*		R110E
P H CUTR	5905-105-9709	C	RESISTOR,FIXED,FILM SAME AS CUTQ MF5CD1012D	(19701)		EA	REF				*	*	*	*	*		R210E
P H CUTS	5905-470-0369	C	RESISTOR,FIXED,COMPOSITION 150 OHM, 5 PCT, 1/8W RCR05G151JS	(81349)		EA	4				*	*	*	*	*		R110G
P H CUTT	5905-470-0369	C	RESISTOR,FIXED,COMPOSITION SAME AS CUTS RCR05G151JS	(81349)		EA	REF				*	*	*	*	*		R210G
P H CUTU	5905-124-4899	C	RESISTOR,FIXED,FILM 995000 OHM, 1/2 PCT, 1/4W MF6CD9953D	(19701)		EA	4				*	*	*	*	*		R111C

SECTION III. REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE

(1) SOURCE CODE / MAINT CODE / REC CODE ISN	(2) FEDERAL STOCK NUMBER	(3a) INDENT CODE	(3b) DESCRIPTION REF NUMBER (MFR PART NO.)	MFR. CODE	(3c) USE ON CODE	(4) UNIT OF MEASURE	(5) QTY INCL IN UNIT	30 DAY MAINT ALW (6) DS 1 20	DS 21 50	DS 51 100	(7) GS 1 20	GS 21 50	GS 51 100	(8) 1 YR ALW PER 100 EQUIP CONTGCY PL	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIGURE NUMBER	(b) REF / ITEM NUMBER
P H CUTV	5905-124-4899	C	RESISTOR,FIXED,FILM SAME AS CUTU MF6CD9953D	(19701)		EA	REF				*	*	*	*	*		R211C
P H CUTW	5905-407-0087	C	RESISTOR,FIXED,COMPOSITION 43 OHM, 5 PCT, 1/8W RCR05G430JS	(81349)		EA	4				*	*	*	*	*		R111D
P H CUTX	5905-407-0087	C	RESISTOR,FIXED,COMPOSITION SAME AS CUTW RCR05G430JS	(81349)		EA	REF				*	*	*	*	*		R211D
P H CUTY		C	RESISTOR,FIXED,FILM 5030 OHM, 1/2 PCT, 1/8W MF5CD5031D	(19701)		EA	4				*	*	*	*	*		R111E
P H CUTZ		C	RESISTOR,FIXED,FILM SAME AS CUTY MF5CD5031D	(19701)		EA	REF				*	*	*	*	*		R211E
P H CUUA	5905-466-1416	C	RESISTOR,FIXED,COMPOSITION 200 OHM, 5 PCT, 1/8W RCR05G201JS	(81349)		EA	4				*	*	*	*	*		R111G
P H CUUB	5905-466-1416	C	RESISTOR,FIXED,COMPOSITION SAME AS CUUA RCR05G201JS	(81349)		EA	REF				*	*	*	*	*		R211G
P H CUUC		C	RESISTOR,FIXED,FILM 99800 OHM, 1/4 PCT, 1/4W MF6CD9982C	(19701)		EA	4				*	*	*	*	*		R112C
P H CUUD		C	RESISTOR,FIXED,FILM SAME AS CUUC MF6CD9982C	(19701)		EA	REF				*	*	*	*	*		R212C
P H CUUE		C	RESISTOR,FIXED,FILM 2510 OHM, 1/2 PCT, 1/8W MF5CD2511D	(19701)		EA	4				*	*	*	*	*		R112E
P H CUUF		C	RESISTOR,FIXED,FILM SAME AS CUUE MF5CD2511D	(19701)		EA	REF				*	*	*	*	*		R212E
P H CUUG	5905-180-8301	C	RESISTOR-FIXED,COMPOSITION 100 OHM, 5 PCT, 1/8W RCR05G101JS	(81349)		EA	4				*	*	*	*	*		R112G
P H CUUH	5905-180-8301	C	RESISTOR,FIXED,COMPOSITION SAME AS CUUG RCR05G101JS	(81349)		EA	REF				*	*	*	*	*		R212G

(1) SOURCE CODE / MAINT CODE / REC CODE ISN	(2) FEDERAL STOCK NUMBER	(3a) INDENT CODE	(3b) DESCRIPTION REF NUMBER (MFR PART NO) / MFR CODE	(3c) USE ON CODE	(4) UNIT OF MEASURE	(5) QTY INCL IN UNIT	30 DAY MAINT ALW (6) DS 1 20	DS 21 50	DS 51 100	(7) GS 1 20	GS 21 50	GS 51 100	(8) 1 YR ALW PER 100 EQUIP CONTGCY PL	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIGURE NUMBER	(b) REF / ITEM NUMBER
P H CUUJ	5905-255-3701	C	RESISTOR,FIXED,COMPOSITION SAME AS CUHV RCR05G560JS (81349)		EA	REF				*	*	*	*	*		SW201/SW205R10
P H CUUK	5905-255-3701	C	RESISTOR,FIXED,COMPOSITION SAME AS CUHV RCR05G560JS (81349)		EA	REF				*	*	*	*	*		R109G
P H CUUL	5905-255-3701	C	RESISTOR,FIXED,COMPOSITION SAME AS CUHV RCR05G560JS (81349)		EA	REF				*	*	*	*	*		R112A
P H CUUM	5905-255-3701	C	RESISTOR,FIXED,COMPOSITION SAME AS CUHV RCR05G560JS (81349)		EA	REF				*	*	*	*	*		SW201/SW205R204
P H CUUN	5905-255-3701	C	RESISTOR,FIXED,COMPOSITION SAME AS CUHV RCR05G560JS (81349)		EA	REF				*	*	*	*	*		R20?G
P H CUUP	5905-255-3701	C	RESISTOR,FIXED,COMPOSITION SAME AS CUHV RCR05G560JS (81349)		EA	REF				*	*	*	*	*		R212A
X2 H CUUQ		C	RING,RETAINING 5100-25SMD (79136)		EA	2										SW201/SW205MP2
X2 H CUUR		C	ROD,SLEEVE 384-0311-00 (80009)		EA	2										SW201/SW205MP6
X2 H CUUS		C	SHIELD,RESISTOR 337-0673-00 (80009)		EA	2										SW201/SW205MP1
P H CUUT	5305-054-6650	*	SCREW,MACHINE SAME AS CUAH MS51957-26 (96906)		EA	REF				*	*	*	*	*		H2
P H CUUU	5930-900-1192	C	SWITCH,LEVER 1 SECT., 3 POS, 30 DEG ANGLE OF THROW 260-0621-00 (80009)		EA	4				*	*	*	*	*		SW101
P H CUUV	5930-900-1192	C	SWITCH,LEVER SAME AS CUUU 260-0621-00 (80009)		EA	REF				*	*	*	*	*		SW201
P H CUUW	5310-063-7415	*	NUT,ASSEMBLED WASHER SAME AS CUNM 511-041800-00 (78189)		EA	REF				*	*	*	*	*		H2

SECTION III. REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE

(1) SOURCE CODE / MAINT CODE / REC CODE / ISN	(2) FEDERAL STOCK NUMBER	(3a) INDENT CODE	(3b) DESCRIPTION / REF NUMBER (MFR PART NO.) / MFR CODE	(3c) USE ON CODE	(4) UNIT OF MEASURE	(5) QTY INCL IN UNIT	30 DAY MAINT ALW (6) DS 1 20	(6) DS 21 50	(6) DS 51 100	(7) GS 1 20	(7) GS 21 50	(7) GS 51-100	(8) 1 YR ALW PER 100 EQUIP CONTGCY PL	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIGURE NUMBER	(10) ILLUSTRATIONS (b) REF / ITEM NUMBER
P H CUUX	5305-993-0191	*	SCREW,MACHINE		EA	8				*	*	*	*	*		H2
			MS35208-11 (96906)													
P H CUUY	5930-122-3646	C	SWITCH,ROTARY		EA	4				*	*	*	*	*		SW105
			260-0673-02 (80009)													
P H CUUZ	5930-122-3646	C	SWITCH,ROTARY SAME AS CUUY 260-0673-02 (80009)		EA	REF				*	*	*	*	*		SW205
P H CUVA	5930-122-3647	B	SWITCH,ROTARY		EA	1				*	*	*	*	*		SW350A/SW350B
			260-0691-00 (80009)													
X2 H CUVB		*	NUT,PLAIN,HEXAGON SAME AS CULJ 76025 (73734)		EA	REF										H1
P H CUVC	5310-167-0837	*	WASHER,FLAT SAME AS CULU AN960-616L (88044)		EA	REF				*	*	*	*	*		H1
X2 H CUVD		*	WASHER,LOCK SAME AS CULL 30-350 (73734)		EA	REF										H1
P H CUVE		B	SWITCH,SLIDE DPDT, MAKE-BREAK, 0.5A 125V AC/DC CONTACT 260-0583-00 (80009)		EA	2				*	*	*	*	o		SW160
P H CUVF		B	SWITCH,SLIDE SAME AS CUVE 260-0583-00 (80009)		EA	REF				*	*	*	*	*		SW260
P H CUVG	5305-061-2332	*	SCREW,TAPPING,THREAD FORMING SAME AS CUAS MS24622-2 (96906)		EA	REF				*	*	*	*	*		H2
P H CUVH	5940-937-0884	B	TERMINAL STRIP,CERAMIC		EA	8				*	*	*	*	*		MP58
			124-0147-00 (80009)													
P H CUVJ	5940-937-0884	B	TERMINAL STRIP,CERAMIC SAME AS CUVH 124-0147-00 (80009)		EA	REF				*	*	*	*	*		MP59
P H CUVK	5365-816-0003	*	SPACER,SLEEVE		EA	4				*	*	*	*	*		H2
			361-0008-00 (80009)													

SECTION III. REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE

(1) SOURCE CODE / MAINT CODE / REC CODE ISN	(2) FEDERAL STOCK NUMBER	(3a) INDENT CODE	(3b) DESCRIPTION REF NUMBER (MFR PART NO)	MFR CODE	(3c) USE ON CODE	(4) UNIT OF MEASURE	(5) QTY INCL IN UNIT	30 DAY MAINT ALW (6) DS 1 20	DS 21 50	DS 51 100	(7) GS 1 20	GS 21 50	GS 51 100	(8) 1 YR ALW PER 100 EQUIP CONTGCY PL	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIGURE NUMBER	(b) REF / ITEM NUMBER
P H CUVL	6625-982-0133	*	TERMINAL STUD			EA	24				*	*	*	*	*		H2
			355-0046-00	(80009)													
P H CUVN	5940-937-0884	B	TERMINAL STRIP,CERAMIC SAME AS CUVH			EA	REF				*	*	*	*	*		MP56
			124-0147-00	(80009)													
P H CUVN	5940-937-0884	B	TERMINAL STRIP,CERAMIC SAME AS CUVH			EA	REF				*	*	*	*	*		MP60
			124-0147-00	(80009)													
P H CUVP	5940-937-0884	B	TERMINAL STRIP,CERAMIC SAME AS CUVH			EA	REF				*	*	*	*	*		MP61
			124-0147-00	(80009)													
P H CUVQ	5940-937-0884	B	TERMINAL STRIP,CERAMIC SAME AS CUVH			EA	REF				*	*	*	*	*		MP62
			124-0147-00	(80009)													
P H CUVR	5940-937-0884	B	TERMINAL STRIP,CERAMIC SAME AS CUVH			EA	REF				*	*	*	*	*		MP63
			124-0147-00	(80009)													
P H CUVS	5940-937-0884	B	TERMINAL STRIP,CERAMIC SAME AS CUVH			EA	REF				*	*	*	*	*		MP64
			124-0147-00	(80009)													
P H CUVT	5365-792-2001	*	SPACER,SLEEVE			EA	20				*	*	*	*	*		H2
			361-0009-00	(80009)													
P H CUVU	6625-982-0133	*	TERMINAL STUD SAME AS CUVL			EA	REF				*	*	*	*	*		H2
			355-0046-00	(80009)													
P H CUVV	5940-937-0882	B	TERMINAL STRIP,CERAMIC			EA	4				*	*	*	*	*		MP45
			124-0145-00	(80009)													
P H CUVW	5940-937-0882	B	TERMINAL STRIP,CERAMIC SAME AS CUVV			EA	REF				*	*	*	*	*		MP46
			124-0145-00	(80009)													
P H CUVX	5940-937-0882	B	TERMINAL STRIP,CERAMIC SAME AS CUVV			EA	REF				*	*	*	*	*		MP47
			124-0145-00	(80009)													
P H CUVY	5940-937-0882	B	TERMINAL STRIP,CERAMIC SAME AS CUVV			EA	REF				*	*	*	*	*		MP57
			124-0145-00	(80009)													

SECTION III. REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE

(1) SOURCE CODE / MAINT CODE / REC CODE ISN	(2) FEDERAL STOCK NUMBER	(3a) INDENT CODE	(3b) DESCRIPTION REF NUMBER (MFR PART NO) / MFR CODE	(3c) USE ON CODE	(4) UNIT OF MEASURE	(5) QTY INCL IN UNIT	30 DAY MAINT ALW (6) DS 1 20	DS 21 50	DS 51 100	(7) GS 1 20	GS 21 50	GS 51 100	(8) 1 YR ALW PER 100 EQUIP CONTGCY PL	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIGURE NUMBER	(b) REF / ITEM NUMBER
P H CUVZ	5365-792-2001	*	SPACER,SLEEVE SAME AS CUVT 361-0009-00 (80009)		EA	REF				*	*	*	*	*		H2
P H CUWA	6625-982-0133	*	TERMINAL STUD SAME AS CUVL 355-0046-00 (80009)		EA	REF				*	*	*	*	*		H2
P H CUWB	5940-577-7143	B	TERMINAL STUD 013-1001 (98291)		EA	3				*	*	*	*	*		MP38
P H CJWC	5940-577-7143	B	TERMINAL STJD SAME AS CUWB 013-1001 (98291)		EA	REF				*	*	*	*	*		MP39
P H CUWD	5940-577-7143	B	TERMINAL STUD SAME AS CUWB 013-1001 (98291)		EA	REF				*	*	*	*	*		MP40
X2 H CUWE		B	TERMINAL,LUG 2157-06-01-2520N (78189)		EA	4										E1
X2 H CUWF		B	TERMINAL,LUG SAME AS CUWE 2157-06-01-2520N (78189)		EA	REF										E2
P H CUWG	5305-901-2591	*	SCREW,MACHINE SAME AS CUNN 213-0044-00 (80009)		EA	REF				*	*	*	*	*		H1
P H CUWH	5940-847-3138	B	TERMINAL,LUG SAME AS CUCV 2104-04-00-2520N (78189)		EA	REF				*	*	*	*	*		E3
P H CUWJ	5940-847-3138	B	TERMINAL,LUG SAME AS CUCV 2104-04-00-2520N (78189)		EA	REF				*	*	*	*	*		E4
P H CUWK	5940-847-3138	B	TERMINAL,LUG SAME AS CUCV 2104-04-00-2520N (78189)		EA	REF				*	*	*	*	*		E5
P H CUWL	5305-901-2591	*	SCREW,MACHINE SAME AS CUNN 213-0044-00 (80009)		EA	REF				*	*	*	*	*		H1
X2 H CUWM		B	TERMINAL,LUG SAME AS CUWE 2157-06-01-2520N (78189)		EA	REF										E6

SECTION III. REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE

(1) SOURCE CODE / MAINT CODE / REC CODE ISN	(2) FEDERAL STOCK NUMBER	(3a) INCENT CODE	(3b) DESCRIPTION REF NUMBER (MFR PART NO.)	MFR CODE	(3c) USE ON CODE	(4) UNIT OF MEASURE	(5) QTY INCL IN UNIT	30 DAY MAINT ALW (6) DS 1 20	(6) DS 21 50	(6) DS 51 100	(7) GS 1 20	(7) GS 21 50	(7) GS 51 100	(8) 1 YR ALW PER 100 EQUIP CONTGCY PL	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIGURE NUMBER	(b) REF / ITEM NUMBER
X2 H CUWN		B	TERMINAL,LUG SAME AS CUWE 2157-06-01-2520N	(78189)		EA	REF										E7
P H CUWP	5305-901-2591	*	SCREW,MACHINE SAME AS CUNN 213-0044-00	(80009)		EA	REF				*	*	*	*	*		H1
P H CUWQ	5940-156-7344	B	TERMINAL,LUG BRZ, NO. 6 2104-06-00-2520N	(78189)		EA	1				*	*	*	*	*		E8
P H CUWR	5940-159-1265	B	TERMINAL,LUG 2103-06-00-2520N	(78189)		EA	1				*	*	*	*	*		E9
P H CUWS	5940-812-7301	B	TERMINAL,LUG 210-0207-00	(80009)		EA	1				*	*	*	*	*		E12
P H CUWT	5940-814-1982	B	TERMINAL,LUG 210-0255-00	(80009)		EA	2				*	*	*	*	*		E10
P H CUWU	5940-814-1982	B	TERMINAL,LUG SAME AS CUWT 210-0255-00	(80009)		EA	REF				*	*	*	*	*		E11
P H CUWV	5950-122-3644	B	TRANSFORMER,TOROID 120-0346-00	(80009)		EA	2				*	*	*	*	*	7-5	T301
P H CUWW	5950-122-3644	B	TRANSFORMER,TOROID SAME AS CUWV 120-0346-00	(80009)		EA	REF				*	*	*	*	*		T310
P H CUWX	5950-122-3643	B	TRANSFORMER,TOROID 120-0343-00	(80009)		EA	1				*	*	*	*	*		T340
P H CUWY	5961-350-8299	B	TRANSISTOR 151-1042-00	(80009)		EA	2				*	*	*	*	*		Q132
P H CUW?	5961-350-8299	B	TRANSISTOR SAME AS CUWY 151-1042-00	(80009)		EA	REF				*	*	*	*	*		Q232
P H CUXA	5961-104-5726	B	TRANSISTOR 2N3605	(80131)		EA	2				*	*	*	*	*		Q13

SECTION III. REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE

(1) SOURCE CODE / MAINT CODE / REC CODE ISN	(2) FEDERAL STOCK NUMBER	(3a) INDENT CODE	(3b) DESCRIPTION REF NUMBER (MFR PART NO)	MFR CODE	(3c) USE ON CODE	(4) UNIT OF MEASURE	(5) QTY INCL IN UNIT	30 DAY MAINT ALW (6) DS 1 20	DS 21 50	DS 51 100	(7) GS 1 20	GS 21 50	GS 51 100	(8) 1 YR ALW PER 100 EQUIP CONTGCY PL	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIGURE NUMBER	(b) REF / ITEM NUMBER
P H CUXB	5961-104-5726	B	TRANSISTOR SAME AS CUXA 2N3605	(80131)		EA	REF				*	*	*	*	*		Q233
P H CUXC	5961-425-3404	B	TRANSISTOR 151-0225-00	(80009)		EA	4				*	*	*	*	*		Q143
P H CUXD	5961-425-3404	B	TRANSISTOR SAME AS CUXC 151-0225-00	(80009)		EA	REF				*	*	*	*	*		Q163
P H CUXE	5961-425-3404	B	TRANSISTOR SAME AS CUXC 151-0225-00	(80009)		EA	REF				*	*	*	*	*		Q243
P H CUXF	5961-425-3404	B	TRANSISTOR SAME AS CUXC 151-0225-00	(80009)		EA	REF				*	*	*	*	*		Q263
P H CUXG	5961-780-8368	B	TRANSISTOR 2N4258	(80131)		EA	2				*	*	*	*	*		Q315
P H CUXH	5961-401-6209	B	TRANSISTOR SAME AS CUXG 2N4258	(80131)		EA	REF										Q325
P H CUXJ	5961-404-6720	B	TRANSISTOR 151-0223-00	(80009)		EA	5				*	*	*	*	*		Q340
P H CUXK	5961-404-6720	B	TRANSISTOR SAME AS CUXJ 151-0223-00	(80009)		EA	REF				*	*	*	*	*	7-15	Q354
P H CUXL	5961-404-6720	B	TRANSISTOR SAME AS CUXJ 151-0223-00	(80009)		EA	REF				*	*	*	*	*	7-15	Q364
P H CUXM	5961-404-6720	B	TRANSISTOR SAME AS CUXJ 151-0223-00	(80009)		EA	REF				*	*	*	*	*		Q373
P H CUXN	5961-404-6720	B	TRANSISTOR SAME AS CUXJ 151-0223-00	(80009)		EA	REF				*	*	*	*	*		Q383
P H CUXP	5961-892-8706	B	TRANSISTOR 151-0190-00	(80009)		EA	2				*	*	*	*	*	7-4	Q414

SECTION III. REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE

(1) SOURCE CODE / MAINT CODE / REC CODE — ISN	(2) FEDERAL STOCK NUMBER	(3b) INDENT CODE	(3a) DESCRIPTION — REF NUMBER (MFR PART NO.) / MFR CODE	(3c) USE ON CODE	(4) UNIT OF MEASURE	(5) QTY INCL. IN UNIT	(6) 30 DAY MAINT ALW DS 1 20	DS 21 50	DS 51 100	(7) GS 1 20	GS 21 50	GS 51 100	(8) 1 YR ALW PER 100 EQUIP CONTGCY PL	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIGURE NUMBER	(b) REF / ITEM NUMBER
P H CUXQ	5961-892-8706	B	TRANSISTOR SAME AS CUXP 151-0190-00 (80009)		EA	REF				*	*	*	*	*	7-4	Q424
X2 H CUXR		*	WASHER, FLAT 103203 (73734)		EA	1										H1

SECTION IV. FEDERAL STOCK NUMBER CROSS REFERENCE

FEDERAL STOCK NO.	FIGURE NUMBER	REFERENCE DESIGNATOR	ISN
3020-134-9321		SW201/SW205MP4	CUSP
3020-134-9321		SW201/SW205MP5	CUSQ
4730-082-5833		MP15	CUAW
4730-082-5833		MP16	CUAX
4730-984-9363		H1	CUMC
5305-054-5647		H2	CUAN
5305-054-5647		H2	CUCU
5305-054-6650		H2	CUAH
5305-054-6659		H2	CUAJ
5305-054-6650		H2	CUCQ
5305-054-6650		H2	CUUT
5305-054-6652		H1	CUAQ
5305-054-6652		H1	CUAU
5305-054-6652		H1	CUFW
5305-054-6652		H1	CUGA
5305-054-6652		H1	CUGE
5305-054-6660		H1	CUFV
5305-054-6660		H1	CUFZ
5305-054-6660		H1	CUGD
5305-054-6670		H1	CUMQ
5305-058-2097		H2	CUPM
5305-058-2099		H1	CUCK
5305-058-2099		H2	CUAL
5305-059-4550		H4	CUCP
5305-059-7877		H2	CUAG
5305-061-2332		H2	CUAS
5305-061-2332		H2	CUVG
5305-470-8766		H2	CUDK
5305-773-2697		H2	CUDE
5305-773-2697		H2	CUDM
5305-834-8499		H1	CUDL
5305-901-2591		H1	CUNN
5305-901-2531		H1	CUWG
5305-901-2591		H1	CUWL
5305-901-2591		H1	CUWP
5305-901-2591		H2	CUNQ
5305-969-4350		H1	CUFE
5305-969-4350		H1	CUSN
5305-969-4350		H2	CUSR
5305-993-0191		H2	CUUX
5310-063-7415		H1	CUNM
5310-063-7415		H2	CUUW
5310-087-5103		H1	CULD
5310-167-0837		H1	CULU
5310-167-0837		H1	CULY
5310-167-0837		H1	CUPS
5310-167-0837		H1	CUVC
5310-184-8628		H1	CULK
5310-400-5503		H1	CUAZ
5310-550-3715		H1	CUCW
5310-616-3555		H2	CUCR
5310-878-2193		H2	CUMD
5310-934-9748		H2	CUCT
5330-934-9761		H2	CUCN
5310-984-3503		H1	CULF
5315-466-0471		MP23	CUDS
5315-466-0471		MP24	CUDT
5325-071-6256		H1	CUAY
5325-071-6256		MP30	CUDU
5325-413-0201		MP41	CUDV
5340-064-0014		H1	CUDJ
5340-064-0015		H1	CUDH
5340-064-0015		H2	CUDD
5340-649-8429		H1	CUFU
5340-649-8429		H1	CUFY
5340-649-8429		H1	CUGC
5355-064-0133		MP8	CUFD
5355-422-2330		MP13	CUFM
5355-422-2330		MP14	CUFN
5355-685-5580		MP7	CUFB
5355-685-5580		MP10	CUFH
5355-849-7445		MP6	CUEZ
5355-849-7445		MP9	CUFF
5355-865-3889		MP11	CUFK
5355-923-5660		MP4	CUEV
5355-948-9963		MP3	CUET
5355-948-9963		MP5	CUEX
5365-792-2001		H2	CUVT
5365-792-2001		H2	CUVZ
5365-816-0002		H1	CUDY
5365-816-0002		MP43	CUPJ
5365-816-0003		H2	CUVK
5905-078-1549		R318	CUJD
5905-078-1549		R328	CUJE
5905-102-6001		R348	CUJT
5905-104-5756		R425	CUKY
5905-104-5757		R413	CUKR
5905-104-5826		R107C	CUTA
5905-104-5826		R207C	CUTB
5905-104-8348		R332	CUJJ
5905-104-8352		R390	CUKJ
5905-104-8368		R159	CUHM
5905-104-8368		R259	CUHN
5905-104-8368		R355	CUHP
5905-104-8368		R365	CUHQ
5905-105-9709		R110E	CUTQ
5905-105-9709		R210E	CUTR
5904-106-1249		R375	CUKG
5905-106-1249		R385	CUKH
5905-106-1317		R105E	CUSU

SECTION IV. FEDERAL STOCK NUMBER CROSS REFERENCE

FEDERAL STOCK NO.	FIGURE NUMBER	REFERENCE DESIGNATOR	ISN
5905-106-1317		R115	CUGH
5905-106-1317		R205E	CUSV
5905-106-1317		R215	CUGJ
5905-106-1318		R106C	CUSW
5905-106-1318		R206C	CUSX
5905-106-9344		R346	CUJS
5905-106-9348		R311	CUHW
5905-106-9348		R321	CUHX
5905-106-9348		R333	CUJK
5905-107-0642		R106E	CUSY
5905-107-0642		R206E	CUSZ
5905-107-2533		R107E	CUTC
5905-107-2933		R207E	CUTD
5905-108-6922		R340	CUJN
5905-111-4727		R136	CUGR
5905-111-4727		R236	CUGS
5905-111-4734		R342	CUJP
5905-111-4742		R151	CUHD
5905-111-4742		R251	CUHE
5905-111-4858		R344	CUJR
5905-114-5489		R411	CUKP
5905-116-2394		R421	CUKU
5905-116-8566		R356	CUKA
5905-116-8510		R373	CUKE
5905-116-8570		R383	CUKF
5905-118-7913		R361	CUKC
5905-119-8811		R144	CUHB
5905-119-8811		R244	CUHC
5905-120-9154		R153	CUHH
5905-120-9154		R160	CUHJ
5905-120-9154		R253	CUHK
5905-120-9154		R260	CUHL
5905-121-9863		R152	CUHF
5905-121-9863		R252	CUHG
5905-121-9932		R140	CUGT
5905-121-9932		R240	CUGU
5905-122-8618		R161	CULG
5905-122-8618		R261	CULH
5905-123-9972		R105C	CUSS
5905-123-9972		R205C	CUST
5905-124-4899		R111C	CUTU
5905-124-4899		R211C	CUTV
5905-126-6692		R141	CUGV
5905-126-6692		R241	CUGW
5905-141-0591		R314	CUHY
5905-141-0591		R324	CUJG
5905-141-0591		R334	CUJL
5905-141-0743		R422	CUKV
5905-141-1130		R335	CUJM
5905-151-4633		R343	CUJQ
5905-180-8301		R112G	CUUG
5905-160-8301		R212G	CUUH
5905-197-0221		R114	CUGF
5905-197-0221		R214	CUGG
5905-228-5506		R412	CUKQ
5905-228-6436	7-5	R359	CUME
5905-235-3534		R357	CUKB
5905-247-8718		R414	CUKS
5905-247-8733		R394	CUKM
5905-247-8733		R424	CUKX
5905-255-3701		R103	CUKZ
5905-255-3701		R109G	CUUK
59OS-255-3701		R112A	CUUL
5905-255-3701		R203	CUHV
5905-255-3701		R209G	CUUN
5905-255-3701		R212A	CUUP
59OS-255-3701		SW201/SW205R104	CUUJ
5905-255-3701		SW201/SW205R204	CUUM
5905-400-4482		R133	CUGM
5905-400-4482		R134	CUGN
5905-400-4482		R233	CUGP
5905-400-4482		R234	CUGQ
5905-400-4412		R397	CUKN
5905-407-0087		R111D	CUTW
5905-407-0087		R211D	CUTX
5905-408-8267		R349	CUJU
5905-458-9291		R108C	CUTE
5905-458-9291		R208C	CUTF
5905-466-1416		R111G	CUUA
5905-466-1416		R211G	CUUB
5905-470-0369		R110G	CUTS
5905-470-0369		R210G	CUTT
5905-484-0277		R423	CUKW
5905-722-9159	7-15	R377	CULN
5905-761-5758		R117	CUGK
5905-761-5758		R217	CUGL
5905-772-2738		R362	CUKD
59OS-813-5968		R142	CULA
5905-813-5968		R242	CULB
5905-841-7755		R392	CUKL
5905-879-6335		R143	CUGX
5905-879-6335		R163	CUGY
5905-879-6335		R243	CUGZ
5905-879-6335		R263	CUHA
5905-879-7815		R315	CUHZ
5905-879-7815		R325	CUJA
5905-897-0593		R354	CUJY
5905-897-0599		R364	CUJZ
5905-917-9333	7-4	R415	CUMG
5905-922-9920		R353	CUJW

SECTION IV. FEDERAL STOCK NUMBER CROSS REFERENCE

FEDERAL STOCK NO.	FIGURE NUMBER	REFERENCE DESIGNATOR	ISN
5905-922-9920		R363	CUJX
5905-935-8538		R165	CUHR
5905-935-8539		R169	CUHS
5905-935-8539		R265	CUHT
5905-935-8539		R269	CUHU
5905-950-0203		R317	CUJB
5905-950-0203		R327	CUJC
5910-018-1241		C103	CUBW
5910-018-1241		C203	CUBX
5910-071-7360		C334	CUBH
5910-071-7360		C343	CUBJ
5910-226-0475		C107A	CUQT
5910-226-0475		C109A	CUQU
5910-226-0475		C110A	CUQV
5910-226-0475		C111A	CUQW
5910-226-0475		C207A	CUQX
5910-226-0475		C209A	CUQY
5910-226-0475		C210A	CUQZ
5910-226-0475		C211A	CURA
5910-401-6601		C101	CUBU
5910-401-6601		C201	CUBV
5910-450-8546	7-12	C110C	CUPX
5910-450-8546		C110E	CUPY
5910-450-8546	7-12	C210C	CUPZ
5910-450-8546		C210E	CUQA
5910-577-1315		C380	CUBS
5910-682-3247		C326	CUBF
5910-713-2011		C340	CUBK
5910-726-8952		C117	CUBB
5910-726-8952		C217	CUBC
5910-792-0065		C315	CUBD
5910-792-0065		C325	CUBE
5910-794-3269		C105A	CUQK
5910-794-3269		C205A	CUQL
5910-794-3617	7-12	C106B	CURF
5910-794-3617	7-12	C107B	CURG
5910-794-3617	7-12	C107C	CURH
5910-794-3617	7-12	C108B	CURJ
5910-794-3617	7-12	C109B	CURK
5910-794-3617	7-12	C110B	CURL
5910-794-3617	7-12	C111B	CURM
5910-794-3617	7-12	C112B	CURN
5910-794-3617	7-12	C206B	CURP
5910-794-3617	7-12	C207B	CURQ
5910-794-3617	7-12	C207C	CURR
5910-794-3617	7-12	C208B	CURS
5910-794-3617	7-12	C209B	CURT
5910-794-3617	7-12	C210B	CURU
5910-796-3617	7-12	C211B	CURV
5920-794-3617	7-12	C212B	CURW
5910-801-1005		C333	CUBG
5910-827-1211		C421	CUBT
5910-828-1455		C106D	CUQM
5910-828-1455		C206D	CUQN
5910-879-6851		C344	CUBL
5910-900-1085	7-12	C109C	CUPU
5910-900-1085		C109E	CUPV
5910-900-1085	7-12	C209C	CUPW
5910-900-1085		C209E	CUPWA
5910-900-1089	7-12	C111C	CUQB
5910-900-1089		C111E	CUQC
5910-900-1089	7-12	C211C	CUQD
5910-900-1089		C211E	CUQE
5910-900-1097	7-12	C112C	CUQF
5910-900-1097		C112E	CUQG
5910-900-1097	7-12	C212C	CUQH
5910-900-1097		C212E	CUQJ
5910-932-7015	7-12	C108C	CURX
5910-932-7015		C108E	CURY
5910-932-7015	7-12	C208C	CURZ
5910-932-7015		C208E	CUSA
5910-932-9453	7-12	C105B	CUSC
5910-932-9453	7-12	C205B	CUSE
5910-932-9453	7-12	SW201/SW205C104	CUSB
5910-932-9453	7-12	SW201/SW205C204	CUSD
5910-932-9453		C354	CUBQ
5910-943-0153		C424	CUBR
5910-950-3924	7-12	C106C	CURD
5910-950-3924	7-12	C206C	CURE
5910-950-9073		C108A	CUQP
5910-950-9073		C112A	CUQQ
5910-950-9073		C208A	CUQR
5910-950-9073		C212A	CUQS
5910-954-9055		C346	CUBM
5910-954-9055		C395	CUBN
5910-954-9055		C396	CUBP
5930-122-3646		SW105	CUUY
5930-122-3646		SW205	CUUZ
5930-122-3647		SW350A/SW350B	CUVA
5930-406-8715		MP33	CUAC
5930-406-8715		MP34	CUAD
5930-900-1192		SW101	CUUU
5930-900-1192		SW201	CUUV
5935-122-3705		J401	CUCZ
5935-201-8476		J301	CUCS
5935-918-0469		XQ132	CUNR
5935-918-0469		XQ133	CUNS
5935-918-0469		XQ143	CUNSA
5935-918-0469		XQ163	CUNU
5935-918-0469		XQ232	CUNV

SECTION IV. FEDERAL STOCK NUMBER CROSS REFERENCE

FEDERAL STOCK NO.	FIGURE NUMBER	REFERENCE DESIGNATOR	ISN
5935-918-0469		XQ233	CUNW
5935-918-0469		XQ243	CUNX
5935-918-0469		XQ263	CUNY
5935-918-0469		XQ315	CUNZ
5935-918-0469		XQ325	CUPA
5935-918-0469		XQ340	CUPB
5935-918-0469		XQ354	CUPC
5935-918-0469		XQ364	CUPD
5935-918-0469		XQ373	CUPE
5935-918-0469		XQ383	CUPF
5935-918-0469		XQ414	CUPG
5935-918-0469		XQ424	CUPH
5940-156-7344		E8	CUWQ
5940-159-1265		E9	CUWR
5940-577-7143		MP38	CUWB
5940-577-7143		MP39	CUWC
5940-577-7143		MP40	CUWD
5940-812-7301		E12	CUWS
5940-814-1982		E10	CUWT
5940-814-1982		E11	CUWU
5940-847-3138		E3	CUWH
5940-847-3138		E4	CUWJ
5940-847-3138		E5	CUWK
5940-847-3138		H1	CUCV
5940-937-0882		MP45	CUVV
5940-937-0882		MP46	CUVW
5940-937-0882		MP47	CUVX
5940-937-0882		MP57	CUVY
5940-937-0884		MP56	CUVM
5940-937-0884		MP58	CUVH
5940-937-0884		MP59	CUVJ
5940-937-0884		MP60	CUVN
5940-937-0884		MP61	CUVP
5940-937-0884		MP62	CUVQ
5940-937-0884		MP63	CUVR
5940-937-0884		MP64	CUVS
5950-122-3643		T340	CUWX
5950-122-3644	7-5	T301	CUWV
5950-122-3644		T310	CUWW
5950-779-8418		MP28	CUDW
5950-779-8418		MP29	CUDX
5950-913-2213		LR107A	CUSK
5950-913-2213		LR207A	CUSL
5950-932-7105		LR105A	CUSF
5950-932-7105		LR106A	CUSG
5950-932-7105		LR205A	CUSH
5950-932-7105		LR206A	CUSJ
5960-880-0457		V364	CUDP
5961-020-9131		MP26	CUEA
5961-020-9131		MP27	CUEB
5961-020-9131		MP65	CUEC
5961-020-9131		MP66	CUED
5961-020-9131		MP67	CUEE
5961-020-9131		MP68	CUEF
5961-020-9131		MP69	CUEG
5961-020-9131		MP70	CUEH
5961-020-9131		MP71	CUEJ
5961-020-9131		MP72	CUEK
5961-020-9131		MP73	CUEL
5961-020-9131		MP74	CUEM
5961-020-9131		MP75	CUEN
5961-020-9131		MP76	CUEP
5961-020-9131		MP77	CUEQ
5961-020-9131		MP78	CUER
5961-020-9131		MP79	CUES
5961-053-5445		D391	CUNE
5961-104-5726		Q133	CUXA
5961-104-5726		Q233	CUXB
5961-105-7681		D301	CUMT
5961-105-7681		D302	CUMU
5961-105-7681		D303	CUMV
5961-105-7681		D304	CUMW
5961-105-7681		D306	CUMX
5961-105-7681		D307	CUMY
5961-105-7681		D308	CUMZ
5961-105-7681		D309	CUNA
5961-401-6209		Q325	CUXH
5961-404-6720		Q340	CUXJ
5961-404-6720	7-15	Q354	CUXK
5961-404-6720	7-15	Q364	CUXL
5961-404-6720		Q373	CUXM
5961-404-6720		Q383	CUXN
5961-425-3404		Q143	CUXC
5961-425-3404		Q163	CUXD
5961-425-3404		Q243	CUXE
5961-425-3404		Q263	CUXF
5961-617-5668		D332	CUNK
5961-752-6165		D420	CUNJ
5961-780-8368		Q315	CUXG
5961-858-5686		D117	CUMR
5961-858-5686		D217	CUMS
5961-892-8706	7-4	Q414	CUXP
5961-892-8706	7-4	Q424	CUXQ
5961-908-7593		D416	CUNH
5961-936-7604		D317	CUNB
5961-936-7604		D327	CUNC
5961-936-7604		D340	CUND
5985-023-2363		H1	CUDC
6625-133-4631			CUAB
6625-492-5564		SW201/SW205MP3	CUSM

SECTION IV. FEDERAL STOCK NUMBER CROSS REFERENCE

FEDERAL STOCK NO.	FIGURE NUMBER	REFERENCE DESIGNATOR	ISN	FEDERAL STOCK NO.	FIGURE NUMBER	REFERENCE DESIGNATOR	ISN
6625-708-7199		MP12	CUFS				
6625-982-0133		H2	CUVL				
6625-982-0133		H2	CUVU				
6625-982-0133		H2	CUWA				

SECTION V. MANUFACTURER PART NUMBER CROSS REFERENCE

MANUFACTURER PART NUMBER	FED MFR CODE	FIGURE NUMBER	REFERENCE DESIGNATOR	ISN
CECTO-3320F	07716		R323	CUJF
ME5CD2370F	19701		R329	CUJH
ME5CD2511D	19701		R112E	CUUE
ME5CD2511D	19701		R212E	CUUF
ME5CD2562D	19701		R109E	CUTL
ME5CD2562D	19701		R209E	CUTM
ME5CD5031D	19701		R111E	CUTY
ME5CD5031D	19701		R211E	CUTZ
ME5CD5262D	19701		R108E	CUTG
ME5CD5262D	19701		R208E	CUTH
ME6CD9753D	19701		R109C	CUTJ
ME6CD9753D	19701		R209C	CUTK
ME6CD9903D	19701		R110C	CUTN
ME6CD9903D	19701		R210C	CUTP
ME6CD9982C	19701		R112C	CUUC
ME6CD9982C	19701		R212C	CUUD
MS18066-6	96906		H1	CUEU
MS18066-6	96906		H1	CUEW
MS18066-6	96906		H1	CUEY
MS18066-6	96906		H1	CUFA
MS18066-6	96906		H1	CUFC
MS18066-6	96906		H1	CUFG
MS18066-6	96906		H1	CUFJ
MS18066-6	96906		H1	CUFL
RS2BU5001F	91637		R352	CUJV
RS2U1252F	91637		R420	CUKT
VP10E1301J	12697		R393	CUFT
VP10F6501J	12697		R351	CUGB
05-0901-03	91662		XBV364	CUNP
1N4372A	81349		D397	CUNG
1N963B	81349		D395	CUNF
103203	73734		H1	CUXR
104201	73734		H2	CULE
104204	73734		H2	CULM
129-0150-00	80009		H2	CUAF
131-0955-01	80009		J101	CUCX
131-0955-01	80009		J201	CUCY
151-1042-00	80009		Q132	CUWY
151-1042-00	80009		Q232	CUWZ
179-0986-00	80009		W1	CUBA
200-0536-00	80009		MP44	CUCL
210-0975-00	80009		H1	CUAR
210-0975-00	80009		H1	CUAV
214-0483-00	80009		MP35	CUPK
214-0483-00	80009		MP36	CUPL
2157-06-01-2520N	78189		E1	CUWE
2157-06-01-2520N	78189		E2	CUWF
2157-06-01-2520N	78189		E6	CUWM
2157-06-01-2520N	78189		E7	CUWN
246E3025	56289		R391	CUKK

MANUFACTURER PART NUMBER	FED MFR CODE	FIGURE NUMBER	REFERENCE DESIGNATOR	ISN
260-0583-00	80009		SW160	CUVE
260-0583-00	80009		SW260	CUVF
262-0694-02	80009		SW101/SW105	CUPP
262-0694-02	80009		SW201/SW205	CUPQ
30-350	73734		H1	CULL
30-350	73734		H1	CULZ
30-350	73734		H1	CUVD
311-0131-00	80009	7-15	R379	CULQ
311-0178-00	80009	7-5	R396	CULS
311-0471-00	80009		R167	CULV
311-0471-00	80009		R267	CULW
311-0947-00	80009		R150	CUMA
311-0947-00	80009		R250	CUMB
333-0906-00	80009		MP1	CUFP
337-0673-00	80009		SW201/SW205MP1	CUUS
337-0674-00	80009		MP48	CUNL
352-0065-00	80009		MP42	CUDZ
358-0242-00	80009		SW201/SW205MP7	CUPT
358-0249-00	80009		H1	CUPR
361-0080-00	80009		H1	CUPN
376-0046-00	80009		H1	CUDG
376-0051-00	80009		MP21	CUDA
376-0051-00	80009		MP22	CUDB
376-0054-00	80009		A1	CUDF
376-0054-00	80009		A2	CUDN
384-0310-00	80009		MP17	CUMJ
384-0310-00	80009		MP18	CUMK
384-0311-00	80009		SW201/SW205MP6	CUUR
384-0313-00	80009		MP19	CUDQ
384-0313-00	80009		MP20	CUDR
384-0631-00	80009		MP52	CUML
384-0631-00	80009		MP53	CUMM
384-0631-00	80009		MP54	CUMN
384-0631-00	80009		MP55	CUMP
387-0951-00	80009		MP50	CUFR
387-0952-00	80009		MP2	CUFQ
406-0635-00	80009		MP31	CUAK
407-0032-00	80009		MP51	CUAT
407-0046-00	80009		MP37	CUAP
407-0047-00	80009		MP49	CUAM
407-0156-00	80009		MP25	CUAE
441-0567-00	80009		MP32	CUCM
5100-25SMD	79136		SW201/SW205MP2	CUUQ
545-000	72982	7-12	C105C	CURB
545-000	72982	7-12	C205C	CURC
557-076A5-25	72982	7-15	C377	CUCH
557-076A5-25	72982	7-15	C379	CUCJ
67021	73734		H1	CULP
67021	73734		H1	CULR
67021	73734		H2	CUMH

SECTION V. MANUFACTURER PART NUMBER CROSS REFERENCE

MANUFACTURER PART NUMBER	FED MFR CODE	FIGURE NUMBER	REFERENCE DESIGNATOR	ISN
76010	73734		H1	CULC
76025	73734		H1	CULJ
76025	73734		H1	CULT
76025	73734		H1	CULX
76025	73734		H1	CUMF
76025	73734		H1	CUVB
831-000Z5UO102M	72982		C140	CUBY
831-000Z5UO102M	72982		C159	CUBZ
831-000Z5UO102M	72982		C160	CUCA
831-000Z5U0102M	72982		C240	CUCB
831-000Z5U0102M	72982		C259	CUCC
831-000Z5U0102M	72982		C260	CUCD
831-000Z5U0102M	72982		C335	CUCE
831-OOOZ5U0102M	72982		C391	CUCF
831-000Z5U0102M	72982		C397	CUCG

REFERENCE DESIGNATOR	ITEM SEQUENCE NO.
A1	CUDF
A2	CUDN
C101	CUBU
C103	CUBW
C105A	CUQK
C105B	CUSC
C105C	CURB
C106B	CURF
C106C	CURD
C106D	CUQM
C107A	CUQT
C107B	CURG
C107C	CURH
C108A	CUQP
C108B	CURJ
C108C	CURX
C108E	CURY
C109A	CUQU
C109B	CURK
C109C	CUPU
C109E	CUPV
C110A	CUQV
C110B	CURL
C110C	CUPX
C110E	CUPY
C111A	CUQW
C111B	CURM
C111C	CUQB
C111E	CUQC
C112A	CUQQ
C112B	CURN
C112C	CUQF
C112E	CUQG
C117	CUBB
C140	CUBY
C159	CUBZ
C160	CUCA
C201	CUBV
C203	CUBX
C205A	CUQL
C205B	CUSE
C205C	CURC
C206B	CURP
C206C	CURE
C206D	CUQN
C207A	CUQX
C207B	CURQ
C207C	CURR
C208A	CUQR
C208B	CURS
C208C	CURZ
C208E	CUSA
C209A	CUQY
C209B	CURT
C209C	CUPW
C209E	CUPWA
C210A	CUQZ
C210B	CURU
C210C	CUPZ
C210E	CUQA
C211A	CURA
C211B	CURV
C211C	CUQD
C211E	CUQE
C212A	CUQS
C212B	CURW
C212C	CUQH
C212E	CUQJ
C217	CUBC
C240	CUC8
C259	CUCC
C260	CUCD
C315	CUBD
C325	CUBE
C326	CUBF
C333	CUBG
C334	CUBH
C335	CUCE
C340	CUBK
C343	CUBJ
C344	CUBL
C346	CUBM
C354	CUBQ
C377	CUCH
C379	CUCJ
C380	CUBS
C391	CUCF
C395	CUBN
C396	CUBP
C397	CUCG
C421	CUBT
C424	CUBR
D117	CUMP
D217	CUMS
D301	CUMT
D302	CUMU
D303	CUMV
D304	CUMW
D306	CUMX
D307	CUMY

REFERENCE DESIGNATOR	ITEM SEQUENCE NO.
D308	CUMZ
D309	CUNA
D317	CUNB
D327	CUNC
D332	CUNK
D340	CUND
D391	CUNE
D395	CUNF
D397	CUNG
D416	CUNH
D420	CUNJ
E1	CUWE
E2	CUWF
E3	CUWH
E4	CUWJ
E5	CUWK
E6	CUWM
E7	CUWN
E8	CUWQ
E9	CUWR
E10	CUWT
E11	CUWU
E12	CUWS
J101	CUCX
J201	CUCY
J301	CUCS
J401	CUCZ
LR105A	CUSF
LR106A	CUSG
LR107A	CUSK
LR2054	CUSH
LR206A	CUSJ
LR207A	CUSL
MP1	CUFP
MP2	CUFQ
MP3	CUET
MP4	CUEV
MP5	CUEX
MP6	CUEZ
MP7	CUFB
MP8	CUFD
MP9	CUFF
MP10	CUFH
MP11	CUFK
MP12	CUFS
MP13	CUFM
MP14	CUFN
MP15	CUAW
MP16	CUAX
MP17	CUMJ
MP18	CUMK
MP19	CUDQ
MP20	CUDR
MP21	CUDA
MP22	CUDB
MP23	CUDS
MP24	CUDT
MP25	CUAE
MP26	CUEA
MP27	CUEB
MP28	CUDW
MP29	CUDX
MP30	CUDU
MP31	CUAK
MP32	CUCM
MP33	CUAC
MP34	CUAD
MP35	CUPK
MP36	CUPL
MP37	CUAP
MP38	CUWB
MP39	CUWC
MP40	CUWD
MP41	CUDV
MP42	CUDZ
MP43	CUPJ
MP44	CUCL
MP45	CUVV
MP46	CUVW
MP47	CUVX
MP48	CUNL
MP49	CUAM
MP50	CUFR
MP51	CUAT
MP52	CUML
MP53	CUMM
MP54	CUMN
MP55	CUMP
MP56	CUVM
MP57	CUVY
MP58	CUVH
MP59	CUVJ
MP60	CUVN
MP61	CUVP
MP62	CUVQ
MP63	CUVR
MP64	CUVS
MP65	CUEC
MP66	CUED
MP67	CUEE

REFERENCE DESIGNATOR	ITEM SEQUENCE NO.
MP68	CUEF
MP69	CUEG
MP70	CUEH
MP71	CUEJ
MP72	CUEK
MP73	CUEL
MP74	CUEM
MP75	CUEN
MP76	CUEP
MP77	CUEQ
MP78	CUER
MP79	CUES
Q132	CUHY
Q133	CUXA
Q143	CUXC
Q163	CUXD
Q232	CUWZ
Q233	CUXB
Q243	CUXE
Q263	CUXF
Q315	CUXG
Q325	CUXH
Q340	CUXJ
Q354	CUXK
Q364	CUXL
Q373	CUXM
Q383	CUXN
Q414	CUXP
Q424	CUXQ
R103	CUKZ
R105C	CUSS
R105E	CUSU
R106C	CUSW
R106E	CUSY
R107C	CUTA
R107E	CUTC
R108C	CUTE
R108E	CUTG
R109C	CUTJ
R109E	CUTL
R109G	CUUK
R110C	CUTN
R110E	CUTQ
R110G	CUTS
R111C	CUTU
R111D	CUTW
R111E	CUTY
R111G	CUUA
R112A	CUUL
R112C	CUUC
R112E	CUUE
R112G	CUUG
R114	CUGF
R115	CUGH
R117	CUGK
R133	CUGM
R134	CUGN
R136	CUGR
R140	CUGT
R141	CUGV
R142	CULA
R143	CUGX
R144	CUHB
R150	CUMA
R151	CUMD
R152	CUHF
R153	CUHH
R159	CUHM
R160	CUHJ
R161	CULG
R163	CUGY
R165	CUHR
R167	CULV
R169	CUHS
R203	CUHV
R205C	CUST
R205G	CUSV
R206C	CUSX
R206F	CUSZ
R207C	CUTB
R207E	CUTD
R208C	CUTF
R208E	CUTH
R209C	CUTK
R209E	CUTM
R209G	CUUN
R210C	CUTP
R210E	CUTR
R210G	CUTT
R211C	CUTV
R211D	CUTX
R211E	CUTZ
R211G	CUUB
R212A	CUUP
R212C	CUUD
R212E	CUUF
R212G	CUUH
R214	CUGG
R215	CUGJ
R217	CUGL

SECTION VI. REFERENCE DESIGNATOR CROSS REFERENCE

REFERENCE DESIGNATOR	ITEM SEQUENCE NO.
R233	CUGP
R234	CUGQ
R236	CUGS
R240	CUGU
R241	CUGW
R242	CULB
R243	CUGZ
R244	CUHC
R250	CUMB
R251	CUHE
R252	CUHG
R253	CUHK
R259	CUHN
R260	CUHL
R261	CULH
R263	CUHA
R265	CUHT
R267	CULW
R269	CUHU
R311	CUHW
R314	CUHY
R315	CUHZ
R317	CUJB
R318	CUJD
R321	CUHX
R323	CUJF
R324	CUJG
R325	CUJA
R327	CUJC
R328	CUJE
R329	CUJH
R332	CUJJ
R333	CUJK
R334	CUJL
R335	CUJM
R340	CUJN
R342	CUJP
R343	CUJQ
R344	CUJR
R346	CUJS
R348	CUJT
R349	CUJU
R351	CUGB
R352	CUJV
R353	CUJW
R354	CUJY
R355	CUHP
R356	CUKA
R357	CUKB
R359	CUME
R361	CUKC
R362	CUKD
R363	CUJX
R364	CUJZ
R365	CUHQ
R373	CUKE
R375	CUKG
R377	CULN
R379	CULQ
R383	CUKF
R385	CUKH
R390	CUKJ
R391	CUKK
R392	CUKL
R393	CUFT
R394	CUKM
R396	CULS
R397	CUKN
R411	CUKP
R412	CUKQ
R413	CUKR
R414	CUKS
R415	CUMG
R420	CUKT
R421	CUKU
R422	CUKV
R423	CUKW
R424	CUKX
R425	CUKY
SW101	CUUU
SW105	CUUY
SW160	CUVE
SW201	CUUV
SW205	CUUZ
SW260	CUVF
SW350A/SW350B	CUYA
SW101/SW105	CUPP
SW201/SW205	CUPQ
SW201/SW205C104	CUSB
SW201/SW205C204	CUSD
SW201/SW205MP1	CUUS
SW201/SW205MP2	CUUQ
SW201/SW205MP3	CUSM
SW201/SW205MP4	CUSP
SW201/SW205MP5	CUSQ
SW201/SW205MP6	CUUR
SW201/SW205MP7	CUPT
SW201/SW205R104	CUUJ
SW201/SW205R204	CUUM
T301	CUWV

REFERENCE DESIGNATOR	ITEM SEQUENCE NO.	REFERENCE DESIGNATOR	ITEM SEQUENCE NO.
T310	CUWW		
T340	CUWX		
V364	CUDP		
W1	CUBA		
XBV364	CUNP		
XQ132	CUNR		
XQ133	CUNS		
XQ143	CUNSA		
XQ163	CUNU		
XQ223	CUNV		
XQ233	CUNW		
XQ243	CUNX		
XQ263	CUNY		
XQ315	CUNZ		
XQ325	CUPA		
XQ340	CUPB		
XQ354	CUPC		
XQ364	CUPD		
XQ373	CUPE		
XQ383	CUPF		
XQ414	CUPG		
XQ424	CUPH		

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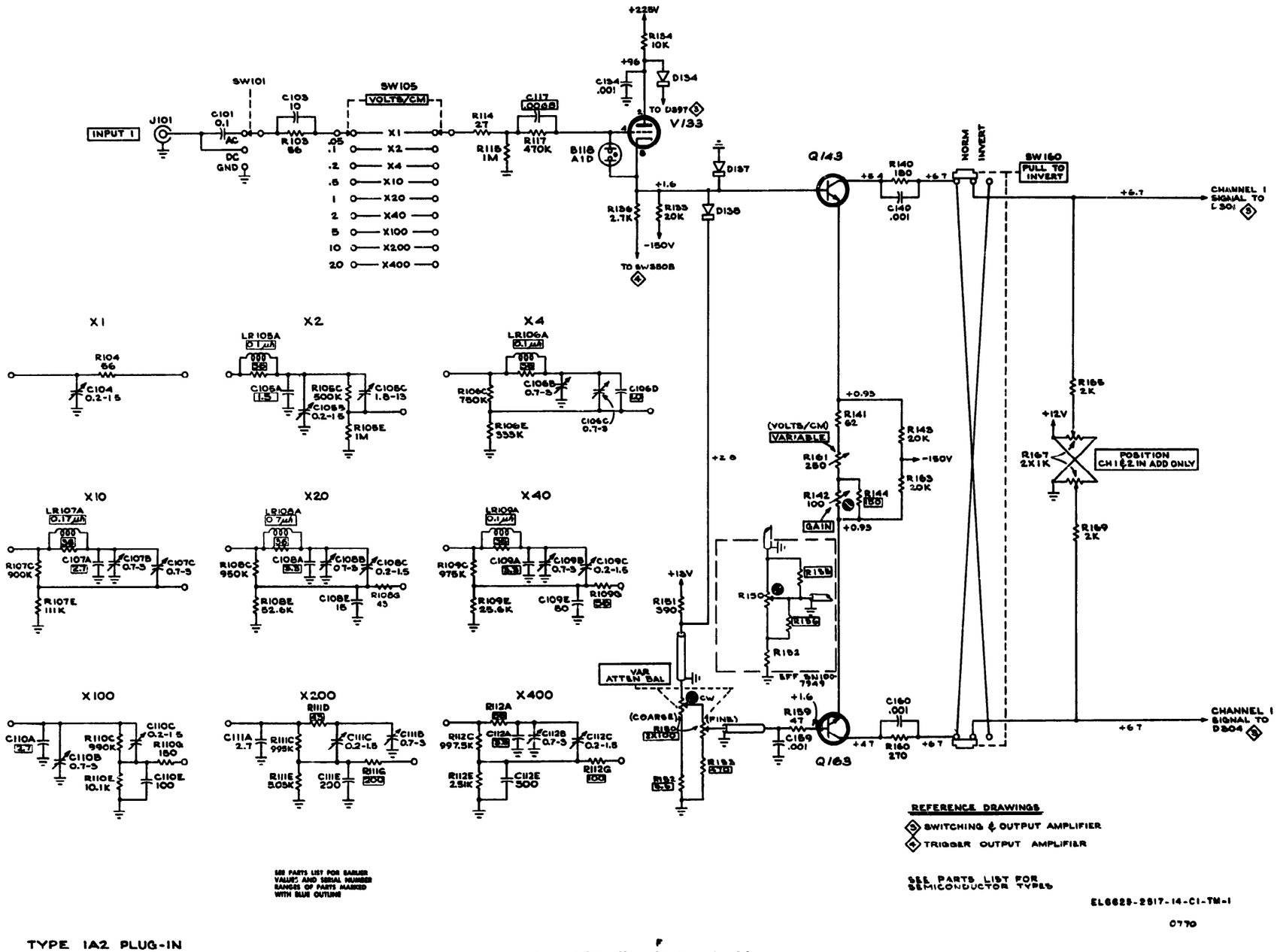

Figure FO-1. Channel 1, Input Amplifier
SN-100-10.999

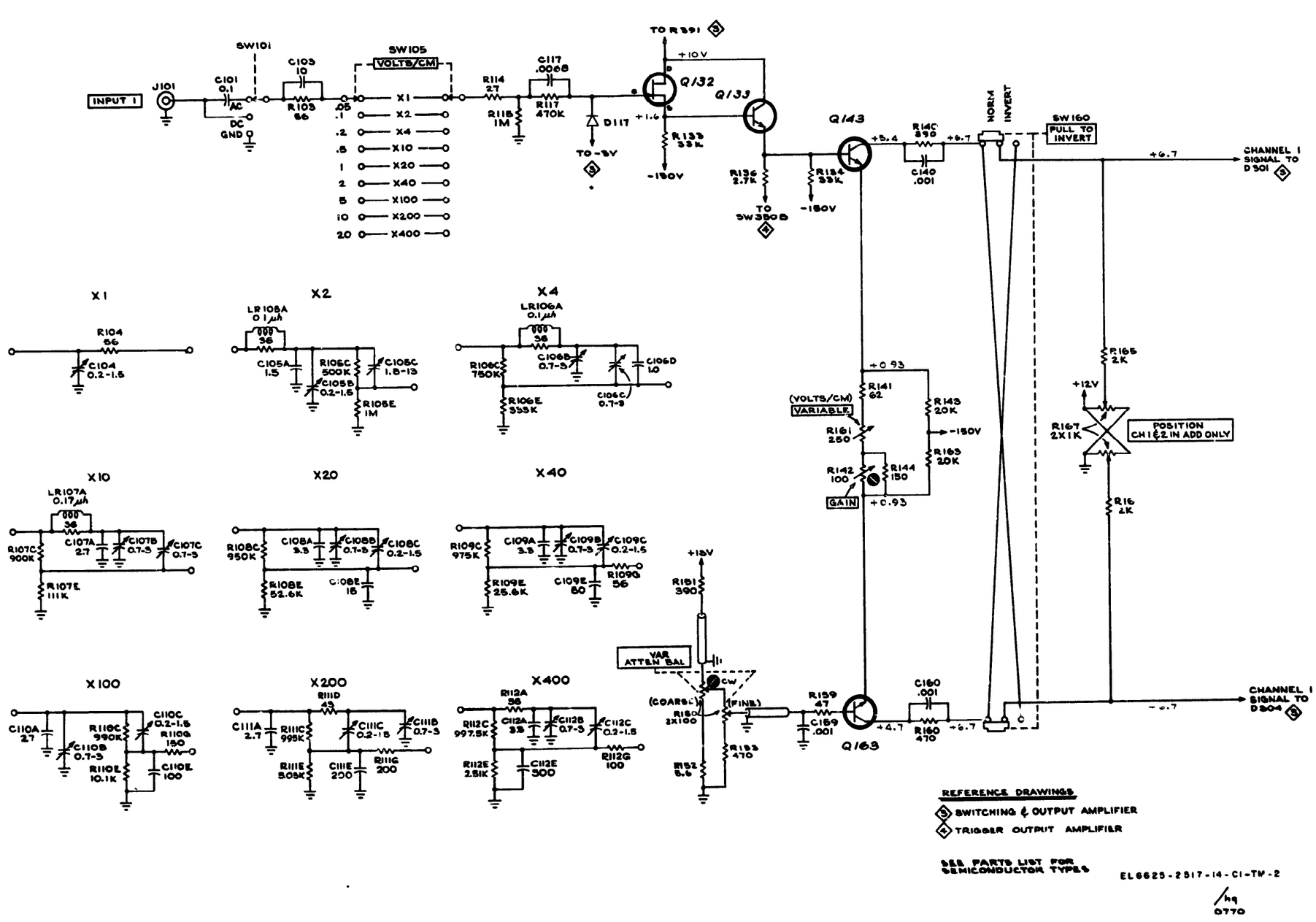

Figure FO-2. Channel 1, Input Amplifier
SN 11,000-UP

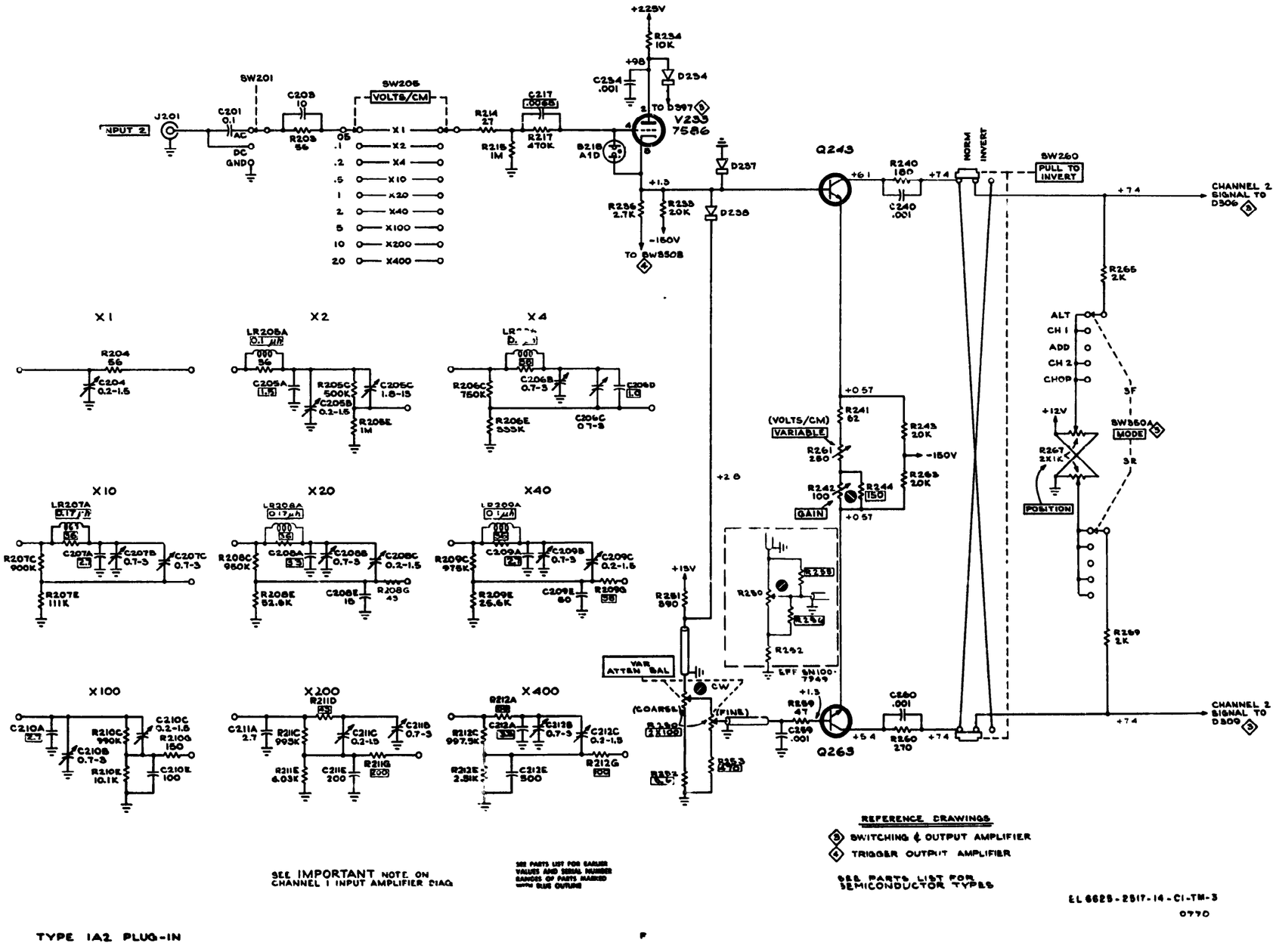

Figure FO-3. Channel 2, Input Amplifier
SN 100-10.999

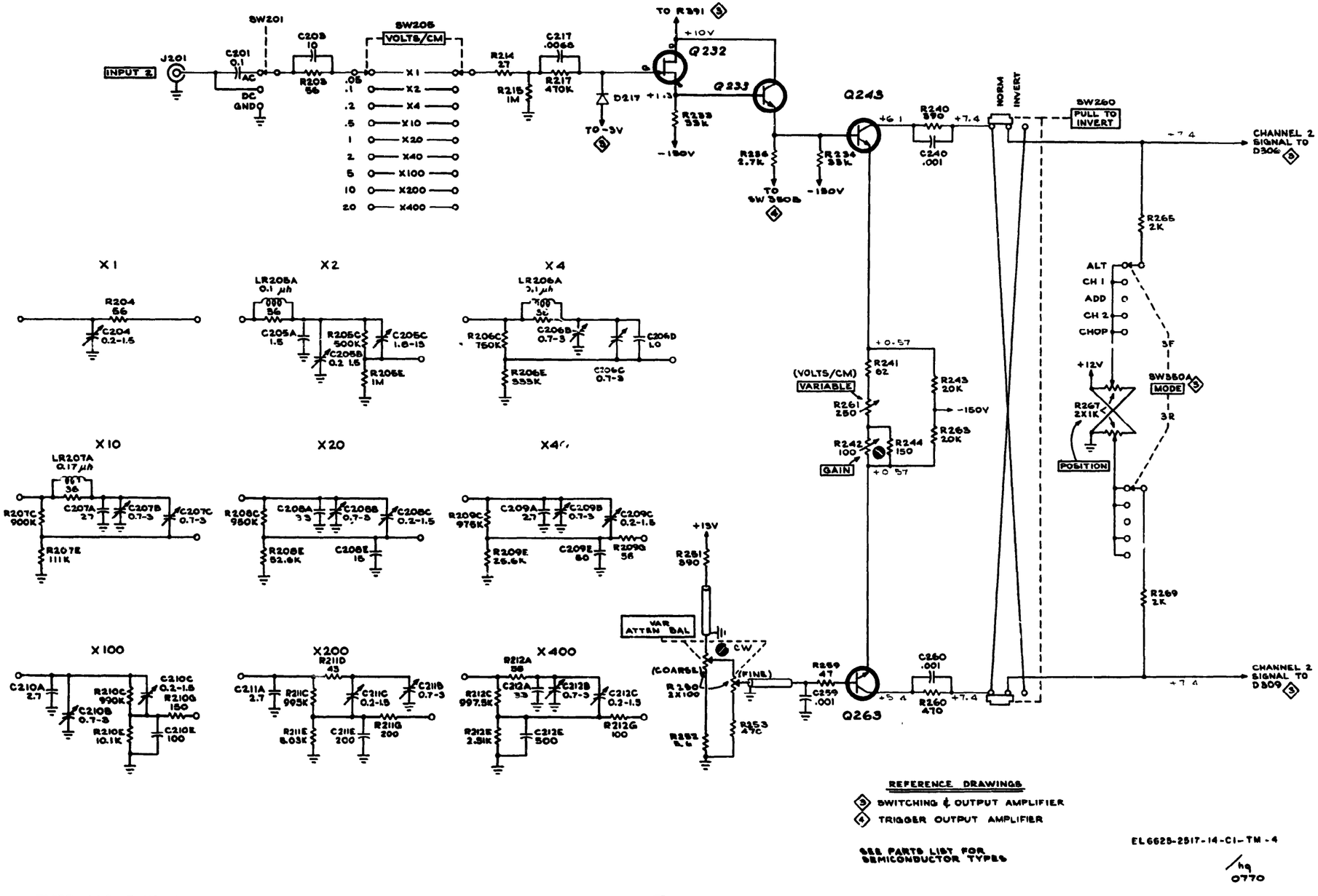

Figure FO-4. Channel 2. Input Amplifier
SN 11,000-UP

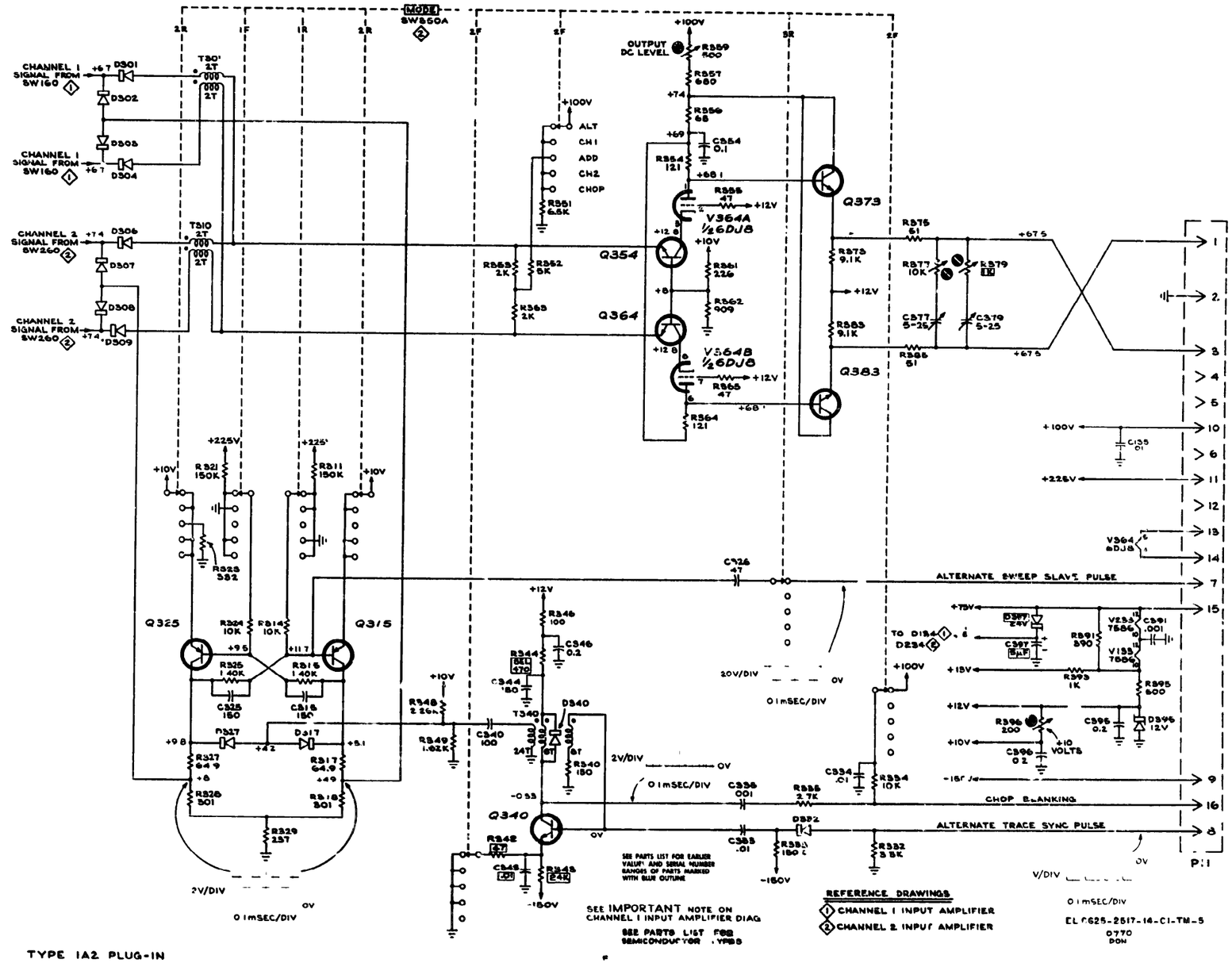

Figure FO-5. Switching and Output Amplifier SN 100-10.999

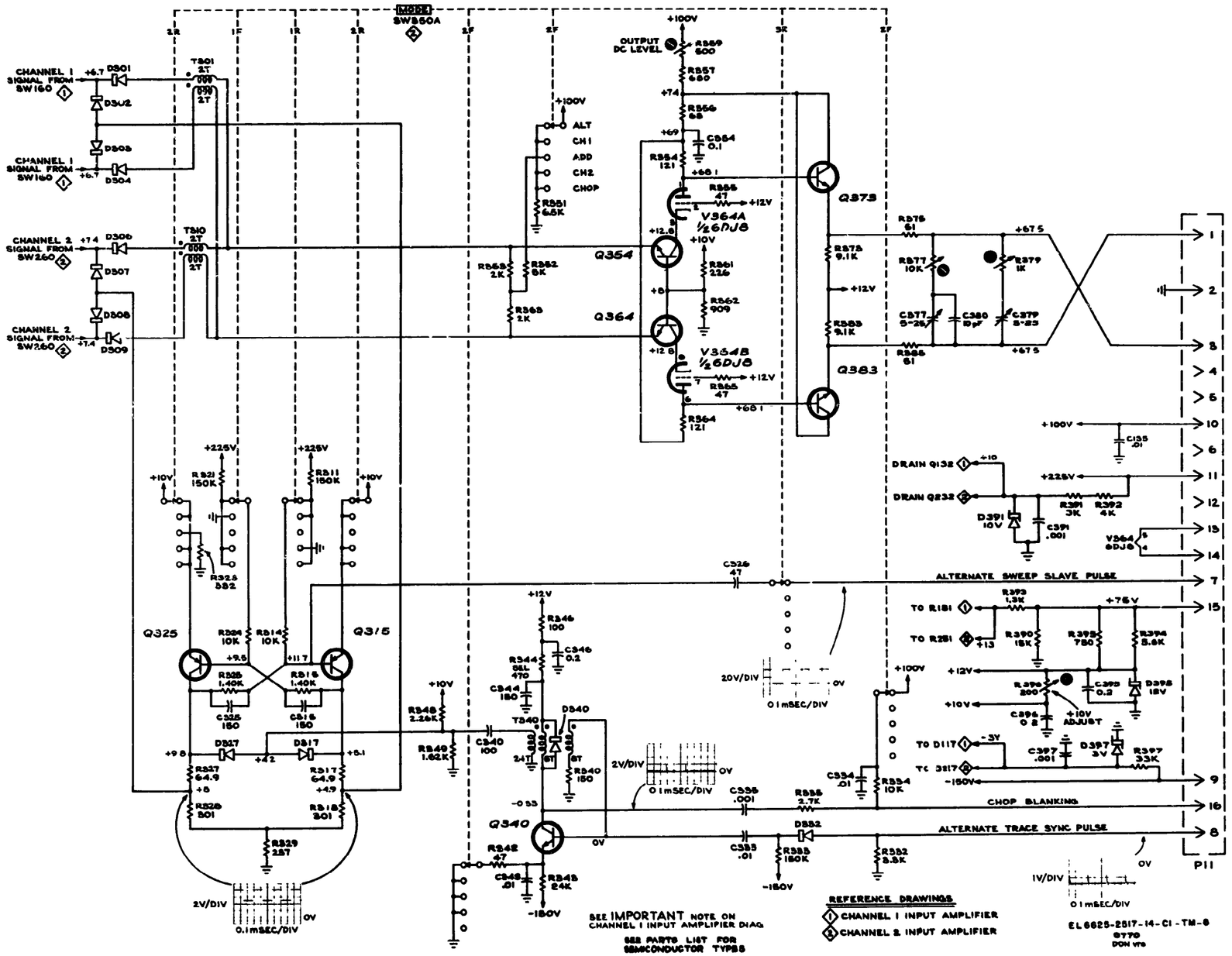

Figure FO-6. Switching and Output Amplifier SN 11,000-UP

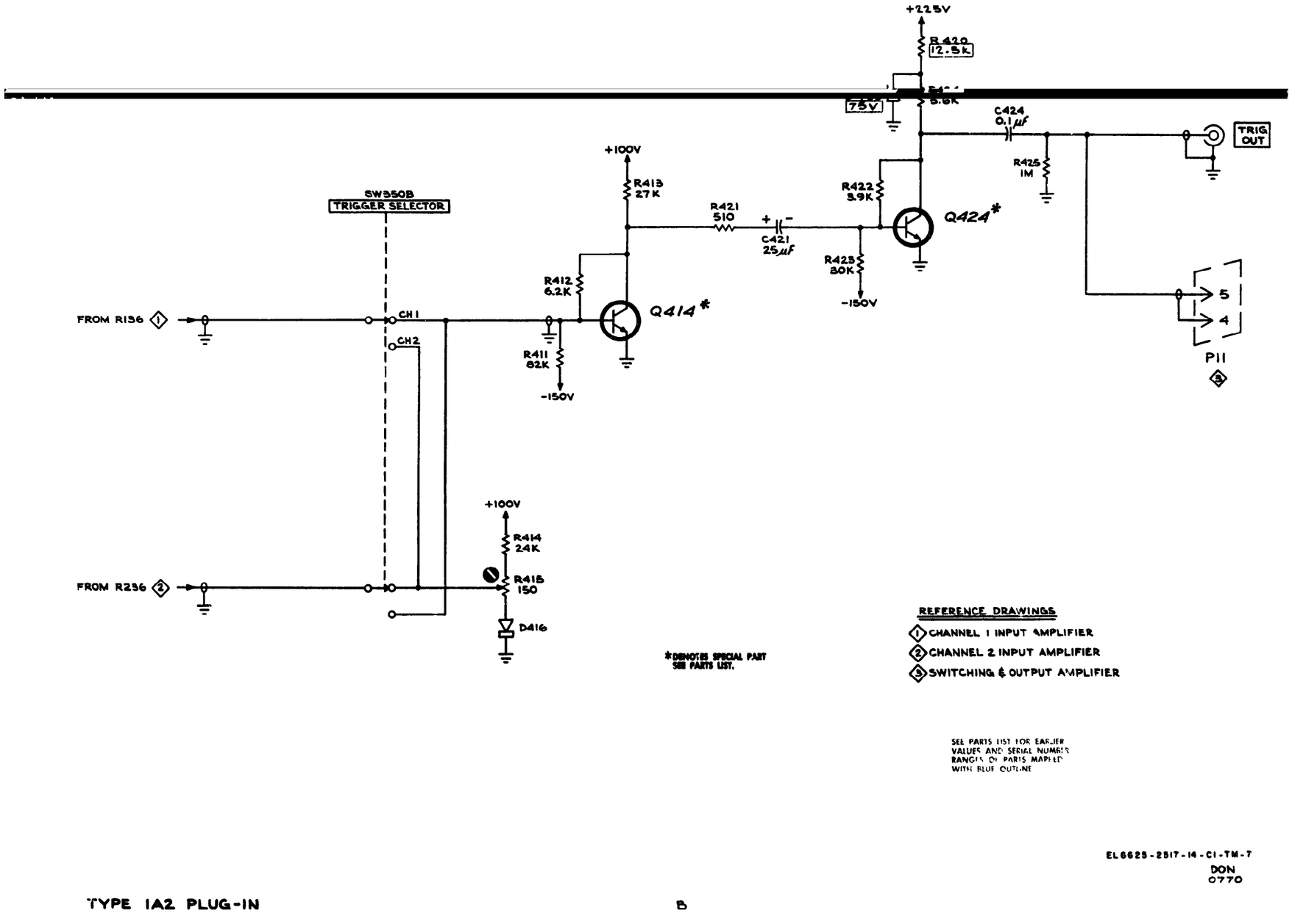

Figure FO-7. Trigger Output Amplifier

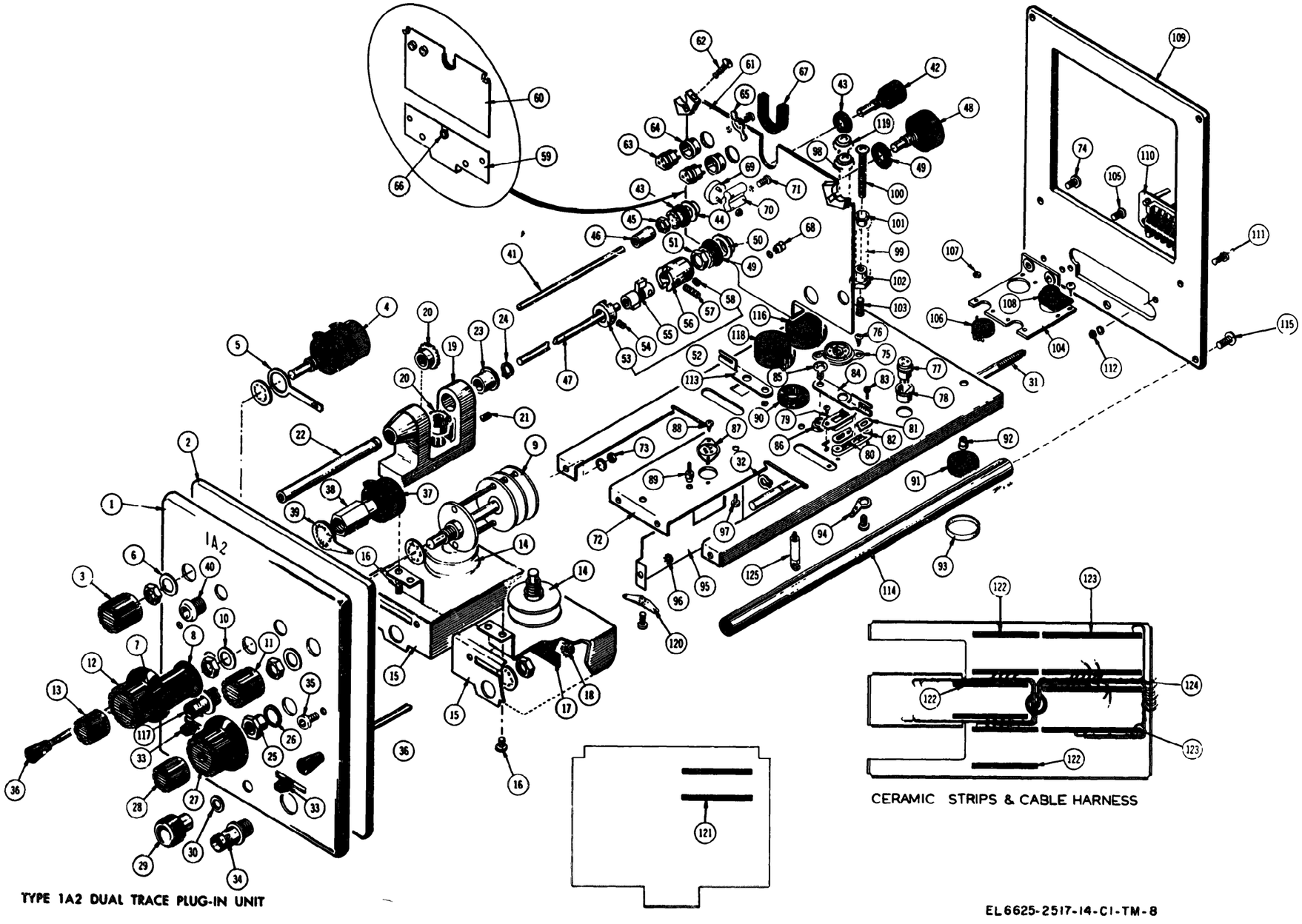

Figure FO-8. Exploded view.