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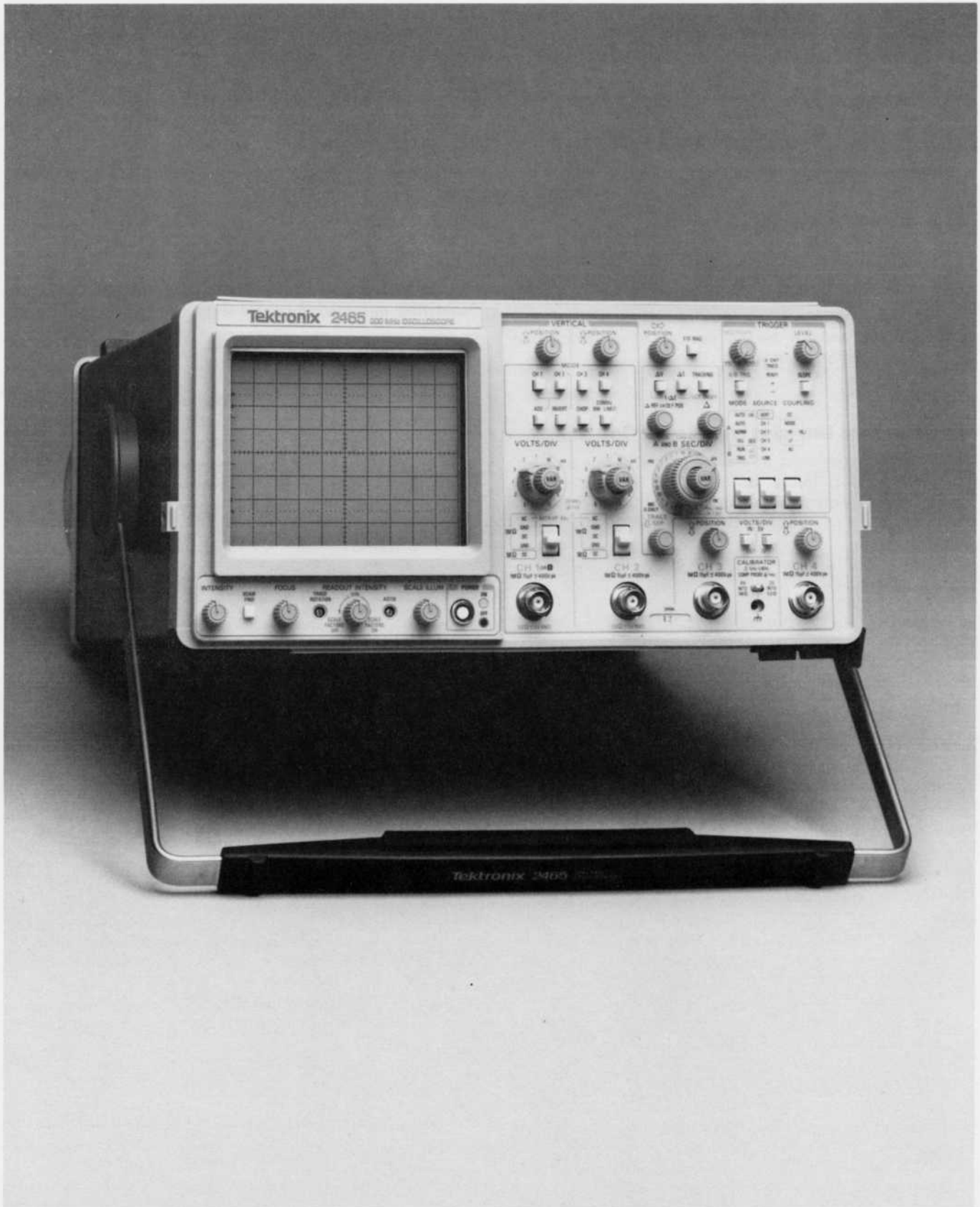
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The 2465 Oscilloscope.

3831-01

SPECIFICATION

INTRODUCTION

The TEKTRONIX 2465 Oscilloscope is a portable 300-MHz instrument having a four-channel vertical deflection system. Channel 1 and Channel 2 provide calibrated deflection factors from 2 mV per division to 5 V per division. For each of these channels, input impedance is selectable between two values: either 1 M Ω in parallel with 15 pF, or 50 Ω internal termination. Input-signal coupling with 1-M Ω impedance can be selected as either AC or DC. Channel 3 and Channel 4 have deflection factors of either 0.1 V or 0.5 V per division. Each of these channels has an input impedance of 1 M Ω in parallel with 15 pF, with DC input-signal coupling. Trigger circuits enable stable triggering over the full bandwidth of the vertical system.

The horizontal deflection system provides calibrated sweep speeds from 1.5 s per division to 500 ps per division. Drive for the horizontal deflection system is obtained from a choice of A, B delayed, A alternated with B delayed sweeps, or CH 1 (for the X-Y display mode).

The 2465 incorporates alphanumeric crt readouts of the vertical and horizontal scale factors, the trigger levels, time-difference measurement values, voltage-difference measurement values, and certain auxiliary information.

The 2465 Oscilloscope is shipped with the following standard accessories:

- 2 Probe packages
- 1 Snap-lock accessories pouch
- 1 Zip-lock accessories pouch
- 1 Operators manual
- 1 Service manual
- 1 Operators pocket reference card
- 1 Fuse
- 1 Power cord (installed)
- 1 Blue plastic crt filter (installed)
- 1 Clear plastic crt filter
- 1 Front-panel cover

For part numbers and further information about both standard and optional accessories, refer to either "Options and Accessories" (Section 7) in the Operators manual or the Accessories information at the rear of this manual. Your Tektronix representative or local Tektronix Field Office can also provide accessories information and ordering assistance.

PERFORMANCE CONDITIONS

The following electrical characteristics (Table 1-1) are valid for the 2465 when it has been adjusted at an ambient temperature between +20°C and +30°C, has had a warm-up period of at least 20 minutes, and is operating at an ambient temperature between -15°C and +55°C (unless otherwise noted).

Items listed in the "Performance Requirements" column are verifiable qualitative or quantitative limits that define the measurement capabilities of the instrument.

Environmental characteristics are given in Table 1-2. The 2465 Oscilloscope meets the environmental requirements of MIL-T-28800C for Type III, Class 3, Style C equipment, with the humidity and temperature requirements defined in paragraphs 3.9.2.2, 3.9.2.3, and 3.9.2.4.

Mechanical characteristics of the 2465 are listed in Table 1-3.

VERTICAL

Equipment Required (see Table 4-1)

Power Supply (Item 1)	Dual-Input Coupler (Item 11)
Primary Leveled Sine-Wave Generator (Item 2)	50 Ω BNC Termination (Item 12)
Calibration Generator (Item 3)	Mini Probe Tip-to-BNC Adapter (Item 13)
Secondary Leveled Sine-Wave Generator (Item 4)	BNC Female-to-BNC Female Adapter (Item 14)
P6131 10X Probe (supplied with 2465) (Item 7)	BNC Female-to-Dual Banana Adapter (Item 15)
Precision 50 Ω BNC Cable (Item 9)	2X Attenuator (Item 16)
50 Ω BNC Cable (Item 10)	5X Attenuator (Item 17)
	10X Attenuator (Item 18)

Initial Control Settings.

Control settings not listed do not affect the procedure.

Set:

VERTICAL MODE

CH 1	On (button in)
CH 2, CH 3, CH 4, ADD, and INVERT	Off (buttons out)
CHOP/ALT	ALT (button out)
20 MHz BW LIMIT	Off (button out)

VOLTS/DIV

CH 1 and CH 2	1 V
CH 1 and CH 2 VAR	In detent
CH 3 and CH 4	0.1 V (buttons out)

Input Coupling

CH 1 and CH 2	1 M Ω GND
---------------	------------------

A and B SEC/DIV

	10 ms (knobs locked)
--	----------------------

A and B SEC/DIV VAR

	In detent
--	-----------

X10 MAG

	Off (button out)
--	------------------

Δt and ΔV

	Off (press and release until associated readout is off)
--	---

TRACKING

	Off (button out)
--	------------------

TRACE SEP

	Fully CW
--	----------

TRIGGER

HOLDOFF	Fully CCW
LEVEL	Midrange
SLOPE	+ (plus)
A/B TRIG SELECT	A
MODE	AUTO LVL
SOURCE	VERT
COUPLING	DC

1. Verify CH 1 and CH 2, 50 Ω OVERLOAD Protection.

a. Connect the Power Supply to the CH 1 OR X input connector via a 50 Ω BNC cable and a BNC female-to-dual banana adapter.

b. Using the CH 1 VERTICAL POSITION control, position the trace on the bottom horizontal graticule line.

c. Change the CH 1 Input Coupling switch to 1 M Ω DC.

d. Turn the Power Supply on.

e. Adjust the Power Supply output level until the CH 1 trace rises to 1 division above the center graticule line (+5 V).

f. Change the CH 1 Input Coupling switch to 50 Ω DC.

g. VERIFY—For a period of one minute, the readout display does not indicate any overload condition (50 Ω OVERLOAD).

h. Change the CH 1 VOLTS/DIV control to 5 V and the CH 1 Input Coupling to 1 M Ω DC.

i. Increase the Power Supply output level until the CH 1 trace rises to the center graticule line (+20 V).

DESCRIPTION

DIAGRAM CHANGES (cont)

DIAGRAM 5 DISPLAY SEQUENCER, TRIGGERING, A & B SWEEP (cont)

Add capacitor C941 (47pF) and resistor R947 (162 Ω) as shown here.

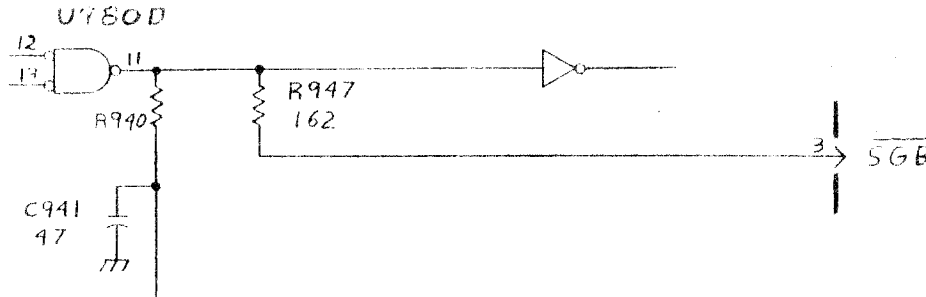


DIAGRAM 6 CHANNEL SWITCH AND OUTPUT AMPLIFIERS

Add resistors R984 (100 Ω) and R983 (100 Ω) as shown here.

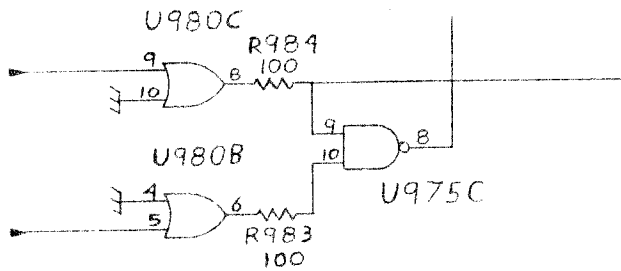
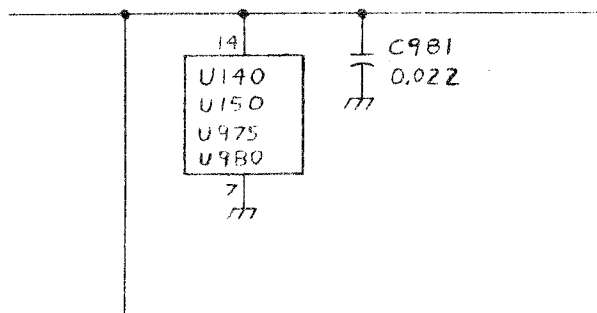


DIAGRAM 11 POWER DISTRIBUTION A

Add capacitor C981 (0.022 μF) as shown.



DESCRIPTION

PG 38

EFFECTIVE SERIAL NUMBER: B040000

REPLACEABLE ELECTRICAL PARTS LIST CHANGES

ADD:

A15 388-8684-01 CIRCUIT BOARD: POT INTERCONNECT

CHANGE TO:

A1 670-7276-15 CKT BOARD ASSY: MAIN

A1 670-7276-16 CKT BOARD ASSY: MAIN
(WITH OPTION 06)

A1C106	281-0775-00	CAP,FXD,CER DI: 0.1UF,20%,50V
A1C108	281-0775-00	CAP,FXD,CER DI: 0.1UF,20%,50V
A1C113	281-0909-00	CAP,FXD,CER DI: 0.022UF,20%,50V
A1C117	281-0775-00	CAP,FXD,CER DI: 0.1UF,20%,50V
A1C119	281-0909-00	CAP,FXD,CER DI: 0.022UF,20%,50V
A1C125	281-0775-00	CAP,FXD,CER DI: 0.1UF,20%,50V
A1C175	281-0775-00	CAP,FXD,CER DI: 0.1UF,20%,50V
A1C180	281-0775-00	CAP,FXD,CER DI: 0.1UF,20%,50V
A1C181	281-0775-00	CAP,FXD,CER DI: 0.1UF,20%,50V
A1C203	281-0773-00	CAP,FXD,CER DI: 0.01UF,10%,100V
A1C210	281-0909-00	CAP,FXD,CER DI: 0.022UF,20%,50V
A1C217	281-0775-00	CAP,FXD,CER DI: 0.1UF,20%,50V
A1C219	281-0775-00	CAP,FXD,CER DI: 0.1UF,20%,50V
A1C220	281-0775-00	CAP,FXD,CER DI: 0.1UF,20%,50V
A1C301	281-0775-00	CAP,FXD,CER DI: 0.1UF,20%,50V
A1C469	281-0763-00	CAP,FXD,CER DI: 47PF,10%,100V
A1C500	281-0909-00	CAP,FXD,CER DI: 0.022UF,20%,50V
A1C501	281-0909-00	CAP,FXD,CER DI: 0.022UF,20%,50V
A1C528	281-0775-00	CAP,FXD,CER DI: 0.1UF,20%,50V
A1C804	281-0759-00	CAP,FXD,CER DI: 22PF,10%,100V
A1C822	281-0775-00	CAP,FXD,CER DI: 0.1UF,20%,50V
A1C980	281-0909-00	CAP,FXD,CER DI: 0.022UF,20%,50V
A1L219	108-1251-00	COIL,RF: 2.7UH,10%
A1L403	108-0420-00	COIL,RF: 35NH,15% (NOMINAL VALUE)
A1R120	307-0106-00	RES,FXD,CMPSN: 4.7 OHM,5%,0.25W
A1R134	311-2174-01	RES,VAR,NONWW: 5K OHM,20%,0.5W,LINEAR
A1R220	307-0106-00	RES,FXD,CMPSN: 4.7 OHM,5%,0.25W
A1R361	315-0223-00	RES,FXD,CMPSN: 22K OHM,5%,0.25W
A1R403	311-0609-00	RES,VAR,NONWW: TRMR,2K OHM,0.5W
A1R417	311-2234-00	RES,VAR,NONWW: TRMR,5K OHM,20%,0.5W
A1R601	307-0106-00	RES,FXD,CMPSN: 4.7 OHM,5%,0.25W
A1R602	307-0106-00	RES,FXD,CMPSN: 4.7 OHM,5%,0.25W
A1R608	307-0106-00	RES,FXD,CMPSN: 4.7 OHM,5%,0.25W
A1R618	311-2234-00	RES,VAR,NONWW: TRMR,5K OHM,20%,0.5W
A1R638	311-2234-00	RES,VAR,NONWW: TRMR,5K OHM,20%,0.5W
A1R639	311-2230-00	RES,VAR,NONWW: TRMR,500 OHM,20%,0.5W
A1R801	311-2230-00	RES,VAR,NONWW: TRMR,500 OHM,20%,0.5W
A1R802	311-2234-00	RES,VAR,NONWW: TRMR,5K OHM,20%,0.5W
A1R850	311-2234-00	RES,VAR,NONWW: TRMR,5K OHM,20%,0.5W
A1R860	311-2234-00	RES,VAR,NONWW: TRMR,5K OHM,20%,0.5W

Table 5-4
Diagnostic and Exerciser Routines

Routine Type	Test Number	Routine Name	Error Code	Error Code Meaning
Buffer Board Test	F1	EAROM Test	X8 1X	Bad read after write. Bad checksum.
GPIB Test	11	GPIB Board		
		RAM	01	Error in RAM or associated circuitry.
		GPIB Controller	02	Malfunction of U4818, decoder U7408, or buffer U4701.
		Power Latch	03	Failure in latch U4801, gate U4735D, Q4745, or buffer U4701.
		Output Latches	04	Malfunction of latch U4625, gate U4730, buffer U4701, a GPIB STATUS indicator, or latch U4626.
		Input Multiplexer	05	Malfunction of DAC amplifier U4641B, input multiplexer U4525 or comparator U4631.
		Switched Supply	06	Malfunction of switch Q4725 or Q4743.
		Output Multiplexer	07	Malfunction of the output multiplexer, associated holding capacitors, or buffers.
		Wait State Generator	08	Malfunction of U4831B, U4706B, U4801, or U4838A.
Buffer Board Exerciser	F1 F2	Option Identification Page Selection	None None	
Exerciser	02	EAROM Examine	None	
GPIB Exerciser	11	Address Selection	None	
GPIB Exerciser	12	Terminator and Talk/Listen Mode Selection	None	

An X in the Error Code column indicates a don't care condition.

GPIB BOARD (GP TEST 11). Circuitry on the GPIB board is checked for proper operation, and error conditions are reported.

Test checks: Circuitry listed in Table 5-4 under GPIB Test 11.

Exerciser Routines

Operation of Exerciser routines is the same as for the standard instrument. The Exerciser routines allow the operator to set and examine various bytes of control data used in determining option function.

OPTION IDENTIFICATION (BU EXER F1). This routine displays the option designator for all installed options across the top line of the crt readout. Option designators are listed in Table 5-5.

**Table 5-5
Option Designators**

Option	Option Designator
Buffer Board	BU
GPIB	GP
TV	TV
DMM	DM
Counter/Timer/Trigger	CT
Word Recognizer	CT

PAGE SELECTION (BU EXER F2). This routine continuously selects and deselects each of the option page registers.

EAROM EXAMINE (EXER 02). This is the standard instrument EAROM Examine routine. The Buffer board memory contents are displayed when Buffer board location 64 (hex) to Buffer board location C7 (hex) are accessed.

ADDRESS SELECTION (GP EXER 11). Used to select the instrument's GPIB address. Its use is explained in Section 2 of this manual.

TERMINATOR AND TALK/LISTEN MODE SELECTION (GP EXER 12). Used to select both the instrument's end-of-message terminator and the Talk/Listen mode of the instrument's GPIB interface. Use of this routine is described in Section 2 of this manual.

EXTENDER CABLE USE

Extender Cable Kit

An extender cable kit, which can be ordered from Tektronix, Inc. (Tektronix Part Number 020-1075-00), is needed when troubleshooting an instrument containing options. The kit is used when troubleshooting the standard instrument by itself or when connecting a removed option assembly to the standard instrument for troubleshooting purposes.

All the cables contained in the kit are listed in Table 5-6. In addition to the cables, the kit contains 12 zero-ohm jumpers (Tektronix Part Number 131-0993-00). The procedures that follow and the "Troubleshooting Procedures" in the "Diagrams" section of this manual reference the cables by number as shown in column one. See Figure 5-1 for a pictorial representation of each cable to aid in cable identification.

**Table 5-6
Extender Cables**

Cable Number	Tektronix Part Number	Option Usage
1	175-7183-00	All
2	175-7184-00	All
3	175-9178-00	All
4	175-9181-00	All
5	175-7215-00	GPIB
6	175-9179-00	GPIB
7	175-9182-00	GPIB
8	175-9175-00	TV
9	175-9180-00	TV
10	175-9183-00	TV
11	175-9174-00	TV,C/T/T
12	175-7932-00	C/T/T
13	175-9176-00	C/T/T
14	175-9177-00	C/T/T

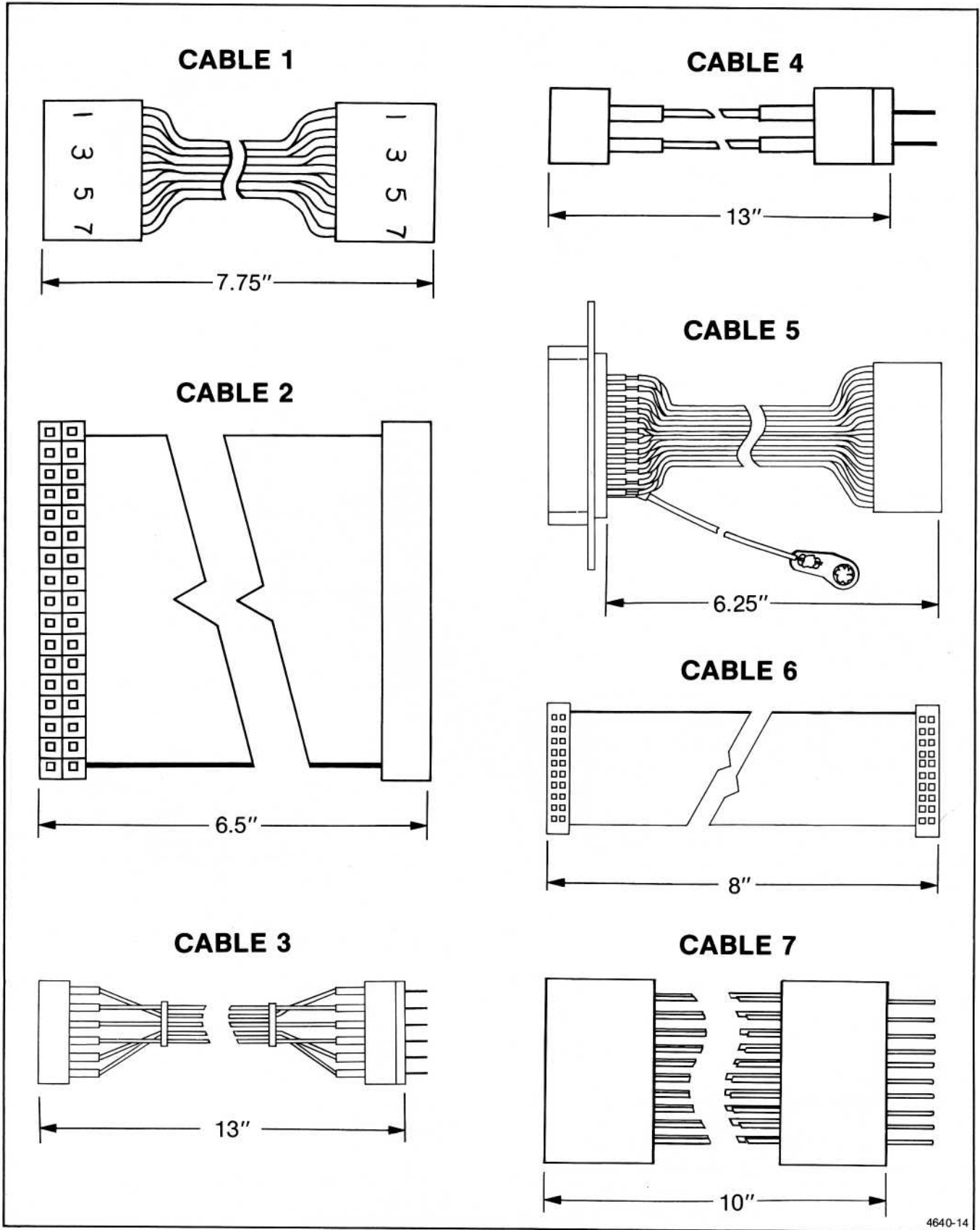
Instrument Troubleshooting Without Options

When it is desired to troubleshoot the standard instrument with the option assembly removed, perform the following steps to complete the signal paths required for operation of the standard instrument circuitry. Note that all the steps will not necessarily be performed, depending on which options were included in the instrument.

NOTE

In the following steps, P100, P101, and P102 are all located on the Main board in the standard instrument.

1. If the instrument contained the GPIB Option, use cable 7 to connect front-panel connector P4256 and Control board connector P651.



4640-14

Figure 5-1. Option extender cables.

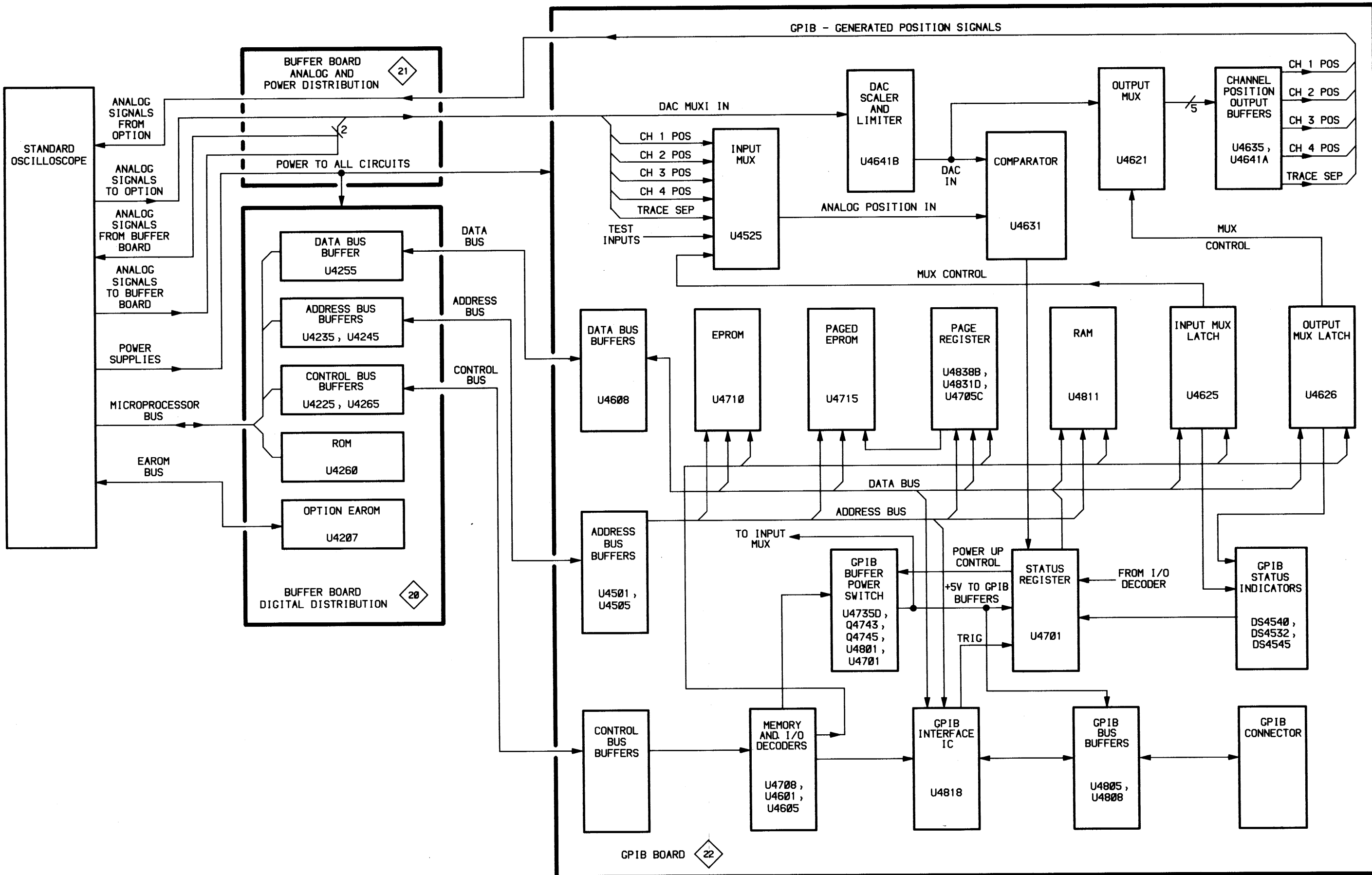


Figure 7-5. Detailed block diagram.