SECTION I
GENERAL INFORMATION

1-1. INTRODUCTION.

1-2. This manual provides operating and maintenance information on the -hp- Model 3480D Digital Voltmeter in combination with the -hp- Model 3484A plug-in multi-function unit which plugs into the 3480D. Neither the 3480D nor the 3484A can be used alone. Other plug-ins have been produced but are no longer in production. In this manual the Model 3480D Digital Voltmeter will be referred to as the 3480D or mainframe. The 3484A multi-function unit will be referred to as the 3484A or plug-in.

1-3. Also listed on the title page of this manual is a microfiche part number. This number can be used to order the 4X6 inch microfilm transparencies of the manual. Each microfiche contains up to 96 photo duplicates of the manual page. The microfiche package also contains the latest Manual Changes Supplement.

1-4. DESCRIPTION.

1-5. The 3480D and the 3484A with *no options* installed comprise a multi-functioned digital voltmeter system with the following features:

a. Four-and-one half digit resolution.

b. 50% overranging on most ranges.

c. A fifth digit (1) to indicate overrange.

d. Automatic display and polarity selection.

e. Manual or automatic selection of dc volts at 100 mV, 1000 mV, 10 V, 100 V or 1000 V range.

f. Manual or automatic ranging.

g. Rack mounting capability.

1-6. *With all options* added, the 3480D and 3484A together have the following additional features.

a. Sample/Hold.

b. Isolated BCD (binary coded decimal) output.

c. Manual, automatic or *remote* selection of:

1. True RMS volts at 100 mV, 1000 mV, 10 V, 100 V or 1000 V ranges.

2. Ohms at 100 ohms, 1000 ohms, 10 kilohms, 100 kilohms, or 10 megohms ranges.

d. Isolated remote control.

1-7. OPTIONS AND ACCESSORIES AVAILABLE.

1-8. Table 1-1 lists all of the options and accessories available with the 3480D and 3484A along with a brief description of each. All options are factory or field installable. Field installation kits are available under the accessory numbers in Table 1-1. Their installation instructions are in Section II of this manual.

1-9. For additional information regarding optional equipment, contact your nearest -hp- Sales and Service Office, listed in the rear of this manual.

1-10. SPECIFICATIONS AND TYPICAL OPERATING DATA.

1-11. Specifications for the Model 3480D and 3484A combination are given in Table 1-2. These specifications are the performance standards against which the instrument is tested. Typical operating data are given in Table 1-3.

1-12. INSTRUMENT AND MANUAL IDENTIFICATION.

1-13. Hewlett-Packard uses a two-section serial number. The first section concerns instrument modifications; the second section numbers the individual instruments. Some serial numbers may have a letter separating the two sections of the number. This letter indicates the country in which the instrument was manufactured: A = U.S.A.; U = United Kingdom; G = Germany.

1-14. MANUAL CHANGES.

1-15. There are two methods of changing information in this manual—revising pages and change supplements.

1-16. Supplements.

1-17. An instrument manufactured after the printing of this manual may have a serial prefix that is not listed on the title page. The unlisted serial prefix indicates that the instrument is different from those documented in this manual. However, the manual is supplied with a yellow Manual Changes supplement for the instrument that contains "change information" that documents the differences.

1-18. In addition to change information, the supplement may contain information for correcting errors in the manual. To keep this manual as current and accurate as possible, Hewlett-Packard recommends that you periodically request the latest Manual Changes supplement. The supplement for this manual is keyed to this manual's print date

and part number, both of which appear on the title page. Complementary copies of the supplement are available from Hewlett-Packard.

1-19. Revised Pages.

1-20. When pages are revised in this manual, the title page will also be revised and will show the latest instrument serial number covered by the revision.

1-21. Backdating.

1-22. This manual has no backdating section, as information required to make the manual current with the latest instruments is integrated into the text and schematics. Extensive changes will occasionally require that two schematics be printed, for example, to cover the original and the revised versions of a given circuit. In all cases, the latest version will be inserted first.

1-23. Changed information in the text is flagged by a ΔN where the N represents the change number for reference. Occasionally there will be a footnote on the page with a corresponding ΔN for explanation. There will also be a corresponding ΔN on the Record of Changes page(s) behind the Title Page. Information which has changed, but is of little or no consequence to the user, is flagged by a Δ (no subscript). If your instrument is different from the latest changes, contact your local hp Sales and Service Office for information on how to bring it up to date.

1-24. Recording Changes.

1-25. The Record of Changes page following the title page provides a summary of all changes made to the instrument which required changes to the manual. If you change the manual yourself, the Record page provides a convenient place to record the change.

1-26. SAFETY CONSIDERATIONS.

1-27. The 3480D/3484A is a safety class I instrument (provided with a protective earth terminal) which has been designed and tested according to international safety standards IEC348 and Underwriters Laboratories Standard for Safety 478.

1-28. Use of the words Warning and Caution have the following meanings in this manual.

> *Warning* — An operating procedure, practice, etc., which if not strictly complied with could result in *personal injury*.

> *Caution* — An operating procedure, practice, etc., which if not strictly complied with, could result in damage to or destruction of equipment.

1-29. Safety information pertinent to operating, maintaining and servicing the 3480D/3484A is found throughout the manual.

1-30. RECOMMENDED TEST EQUIPMENT.

1-31. A list of all of the test equipment required for performance tests, adjustments, troubleshooting and repair of the 3480D/3484A is found in the Maintenance Section of this manual.

Table 1-1. Options and Accessories

Option	Accessory or Part Number	Used On	Name and Use
001	11186B	3480D	S/H (Sample/Hold) — scanning a changing voltage; digitizing low frequency waveforms, peak readings; transient analysis; response time measurements.
	1251-1757	Opt 001	9 — Pin S/H Connector (supplied with Opt 001) accommodates a cable for remote control of Sample/Hold (Amphenol 126-220).
004	11187C	3480D	*IBCDO (Isolated BCD Output) — provides 8-bit BCD measurement data, print control, voltage references and external trigger connections, all referenced to power line (chassis) ground and isolated from the low input terminal and 3480D circuit common.
	1251-0086	Opt 004	50 — Pin IBCDO connector (supplied with Opt 004) — accommodates a cable for remote control and use of IBCDO (Amphenol 57-30500-376).
	5060-6033	3480D	Extender Boards (two supplied) — for extending 3480D printed circuit boards for testing and adjusting.
908		3480D	Rack Mount Kit (not supplied) — allows 3480D cabinet to be mounted in a standard 19-inch rack. Support must be provided for the rear of the instrument.
	11146A	Opt 004 not 001	Interface Kit (not supplied) — for interfacing IBCDO without S/H to hp 2114/2115/2116 computer.
	11146B	Opt 004 and 001	Interface Kit (not supplied) — for interfacing IBCDO with S/H to hp 2114/2115/2116 computer.
041	11151B	3484A	*Isolated Remote Control — provides remote programming connections which are isolated from 3484A internal circuits and are referenced to power line (chassis) ground. Requires the 3480D to have an isolated 5 volt power supply.
	11149A or 11149-60601	3484A	Remote Programming Cable (not supplied) — 6-foot cable; one end mates to J14 on 3484A rear panel; other hangs loose for connection to a remote programmer.
		11149A	Parts for mating connector on cable 11149.
	1251-2417	11149A	Cannon number DBC26P-F Body.
	1251-0392	11149A	Cannon number DB51212-1 — Boot.
	1251-2384	11149A	Cannon number 030-1952-000 — Contact
	1251-1042	11149A	Cannon number DB-51221-1 — Lock.
	1251-0218	11149A	Cannon number D-53018 — Lock Post (2 required).
042	11152A	3484A	Ohm Converter — allows resistance measurements on one of six manually or automatically selectable ranges: 100 Ω, 1000 Ω, 10 kΩ, 100 kΩ, 1000 kΩ and 10 MΩ.
043	11153A	3484A	*True RMS AC Converter — Allows true RMS measurements on one of five manually or automatically selectable ranges: 100 mV, 100 mV, 10 V, 100 V and 1000 V. Allows 50% overranging and two measurement modes. a. AC Coupled Mode — for ac frequencies from 10 Hz to 10 MHz. b. DC Coupled Mode — for dc or ac on dc frequencies down to 1 Hz.
910	03480-90007	3480D/3484A	Extra Manu.

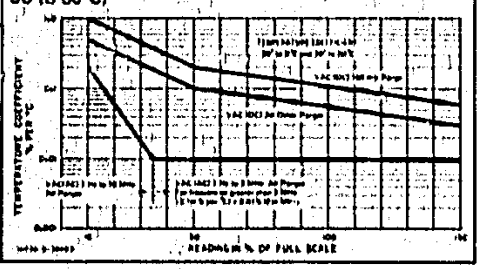
*These options are included in the hp Blue Stripe Exchange program. Any defective boards may be replaced at a nominal charge with rebuilt boards by the hp Field Service Center. Contact your hp Field Service engineer for additional information.

Table 1-2. 3480D/3484A Specifications (Includes Options 041 and 043).

Item	Specifications		
	DC Volts	Ohms Option 042	True RMS Option 043
Full Range Display	± 100.00 mV ± 1000.0 mV ± 10,000 V ± 100.00 V ± 1000.0 V	100.00 Ω 1000.0 Ω 10,000 kΩ 1000.0 kΩ 10,000 MΩ	100.00 mV 1000.0 mV 10,000 V 100.00 V 1000.0 V
Overranging	50% on lower four ranges	50% on all ranges	50% on all ranges

Range Selection: manual, automatic, or (with option 041) remote

Auto Ranging: Upranges at 140% of range
Downranges at 10% of range

Item		A	TC	H for DC Volts (worst case)
ACCURACY for 90 days at < 95% relative humidity compute measured value by formula below MV = R ± (A + TC (N) + N% S) where MV = measured value R = reading A = accuracy deviation in volts or ohms at 20 to 30°C. TC = Temperature coefficient: added accuracy deviation in volts or ohms per °C of temperature deviation from 20 to 0 or from 30 to 50°C N = number of °C deviation for TC H = added accuracy deviation only if using Sample Hold and ΔV/ΔT < 8% S/μsec (only for DC Volts) S = Range or scale V_m = peak voltage of sine input f = frequency of sine input for f < .1 fo fo = frequency parameter for a given range If S = / Then fo = 100 mV / 12 kHz 1 V or 10 V / 38 kHz 100 V or 1000 V / 8.5 kHz	DC VOLTS	100 mV range: 0.1% R + 20X10^{-6} + (.03% S if Sample Hold is used) Other ranges: 0.1% R + .01% S (accuracy good only if ΔV/ΔT ΔV/ΔT < 10% S/sec)	100 mV range Filter out: .001% R + 5X10^{-7} Filter A or B: .001% R + 1.5X10^{-6} Other ranges: .001% R + .0005% S	for range: $H = \frac{100\,\Delta V}{\Delta T\ 2\pi S f_o}$ For readings taken when sine crosses Zero $H = \frac{100\,V_m f}{S\,f_o}$
	OHMS	100 Ω range: .02% R+.05 10 MΩ range: .1% R+1000 Other ranges: .01% R+.01% S	1000 Ω range: .0035% R+5 10 MΩ range: .0035% R+50 Other ranges:* .0015% R+.0005% S	for readings taken when sine is at peak $H = \frac{100\,V_m f^2}{S\,f_o^2}$ (see Sample/Hold specs for more information)
	TRUE RMS VOLTS (AC)	For 60% S < R < 150% S compute from graph B For R < 60% S compute from graph C	Use graph A for True RMS GRAPH A: True RMS Temperature Coefficient (for temperatures from 20 to 0°C and from 30 to 50°C) 	
	TRUE RMS VOLTS (DC)	X% R + Y% R (X = dc component and Y = ac component) For 60% S < R < 150% S X = 1, Y = Value from graph C For R < 60% S X and Y = Values from graph C		

*NOTE

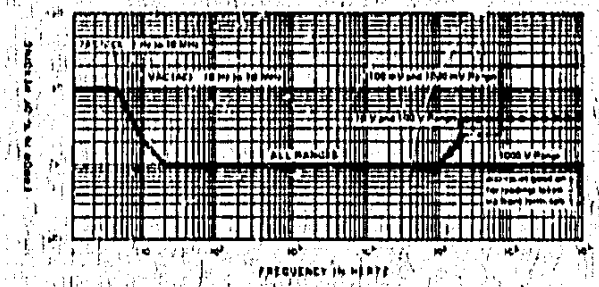
When measuring low resistance on the 100 ohm range, accuracy is affected 3 counts or more by resistance of internal wiring and test leads. To remove this effect, subtract reading with leads shorted from measurement reading. Do not adjust front panel Zero control.

Table 1-2. 3480D/3484A Specifications (Cont'd).

GRAPHS FOR TRUE RMS ACCURACIES, Cont'd

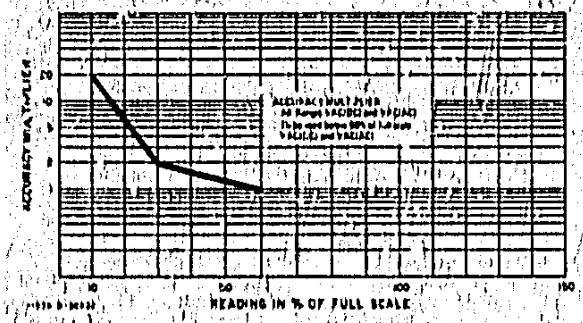
Graphs B and C specify True RMS accuracy deviations for 90 days at 20° to 30°C < 95% Relative Humidity. See Graph A for additional accuracy deviation at other temperatures.

GRAPH B: For the ac component only of readings between 60% and 150% of RANGE:



TRUE RMS ACCURACY MULTIPLIER > 60% Range

GRAPH C: For the dc and the ac components of Readings below 60% of Range



TRUE RMS ACCURACY MULTIPLIER < 60% Range

NOTES

1. Accuracies apply only if input is within input limits.
2. For VAC (DC): to measure the ac component only from 1 Hz to 10 MHz, eliminate dc by using a 10 μF coupling capacitor (instrument reading = $\sqrt{(dc)^2 + (ac\ rms)^2}$).
3. The fact that the 3480D/3484A measures signals accurately down to 1 Hz and up to 1000 volts does not imply that it is factory tested with a 1 Hz, 1000 V signal source.

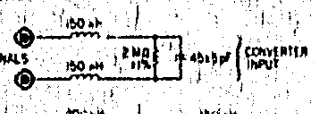
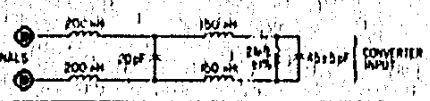
Item	3484A Filter Selection: Filter Out	Filter A	Filter B
Normal Mode Rejection at 50 Hz:	0 dB	> 27 dB	> 77 dB
Normal Mode Rejection at > 60 Hz:	0 dB	> 30 dB	> 80 dB
EFFECTIVE COMMON MODE REJECTION, DC to 60 Hz (the ratio of the peak common-mode voltage to the resultant error in reading with 1 kΩ unbalance in either lead).	> 80 dB (1 kΩ in either lead)		
INPUT IMPEDANCE DC VOLTS: 100 V and 1000 V ranges	10 MΩ ± 1%		
all other ranges	> 1000 MΩ		
TRUE RMS CONVERTER: front terminals:			
rear terminals:			

Table 1-3. 3480D/3484A Typical Operating Data.

OPERATING TEMPERATURE: 0 to 55°C
STORAGE TEMPERATURE: −40 to +75°C

INPUT POWER REQUIREMENTS: (includes all options and normal environment)
Voltage: 115 V or 230 V ± 10%
Frequency: 48 to 440 Hz
Max Power: 60 VA

WARM UP TIME: 1 hour

WEIGHTS:
3480D alone, no options—5.71 kg (12 lb. 2 oz.)
3484A alone, no options—1.97 kg (4 lb. 6 oz.)
3480D/3484A with all options—8.91 kg (19 lb. 10 oz.)
3480D Shipping Weight—8.1 kg (18 lb.)
3484A Shipping Weight—4 kg (8 lb. 14 oz.)

FUNCTION SELECTION: Manual or (with Option 041) remote

MAXIMUM READING RATE:
Manual (initiated via front panel pushbutton): 1 to 25 per sec
Remote (initiated via remote triggering): 0 to 1000 per sec

MINIMUM TIME PER READING: 1 ms

INPUT TERMINALS: High, Low and Guard on both front and rear panels, switch-selectable front front panel.

SHUNT CAPACITANCE:
Front Terminal High-to-Low (Filter Out): < 50 pF
Rear Terminals High-to-Low (Filter Out): < 80 pF
Guard to Low: < 4000 pF
Guard to Chassis: < 1200 pF

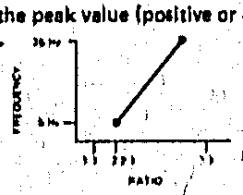
OHMS (OPTION 042) INPUT CHARACTERISTIC:
Output Voltage Across Unknown Impedance: 1 V at full scale (all ranges)
Output Current Through Unknown Impedance: $\frac{1}{R}$ Amperes (Where R = Range in Ohms)

PEAK-TO-PEAK NOISE (UNFILTERED): < 40 μV
(approximates a Gaussian distribution where the standard deviation (rms value) = 10 μV).

OVERLOAD RECOVERY TIME:
DC VOLTS: ≤1 sec
OHMS: ≤3 sec
TRUE RMS: ≤60 sec

CREST FACTOR (TRUE RMS ONLY) AT FULL SCALE:

Definition: The ratio of the peak value (positive or negative) of a signal to its rms value.



MINIMUM INPUT AMPLIFIER BANDWIDTH:

Range	Bandwidth
100 mV	12 kHz
1000 mV	35 kHz
10 V	35 kHz
100 V	500 kHz
1000 V	500 kHz

RESPONSE TIME:
Time from application of a full scale step input to completion of a valid reading, with no interim programming or range changes:

DC VOLTS: To within 1 count of final reading
Filter Out: 1 msec
Filter A: 200 msec
Filter B: 1 sec

*TRUE RMS VOLTS
VAC (DC): 15 sec to within 10 counts of final reading
VAC (AC):
For Step Input from 10 to 100% of range: 1 sec to within 10 counts of final reading
For Step Input from 100 to 10% of range: 1 sec to within 20 counts of final reading

**OHMS: To within 1 count of final reading
10 MΩ, Filter A: 2 sec
1000 kΩ, Filter A: 200 msec
All Other Ranges, Filter Out: 1 msec

AUTORANGING TIME (approximate, per range change)
*TRUE RMS
VAC (AC): 1 sec
VAC (DC): 3 sec

DC VOLTS AND OHMS**
FILTER OUT: 3 to 4 msec
FILTER A: 200 to 260 msec
FILTER B: 1 to 1.1 sec

*Filter selection has no effect on filtering or response time for true rms measurements, but is used to reduce noise and improve response time.

**See text for data on using filters for making resistance measurements.

3484A FILTERS (used to reduce noise and improve response time):

RESPONSE TIME (to within 1 count of final reading):
Filter Out: 200 msec
Filter A: 1 sec
Filter B: 1 msec

AUTORANGING TIME (approximate, for DC and OHMS only):
Filter Out: 3 to 4 msec
Filter A: 200 to 260 msec
Filter B: 1 to 1.1 sec

DRIFT FROM ZERO:
VOLTAGE DRIFT (at constant temperature): < 10 μV/week
VOLTAGE-TEMPERATURE DRIFT COEFFICIENT (0 to 55°C): < ± 1 μV/°C
CURRENT DRIFT (20 to 30°C): < ± 10 pA
CURRENT-TEMPERATURE DRIFT COEFFICIENT (0 to 55°C): < ± 1 pA/°C

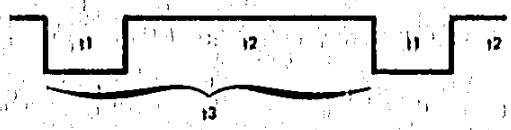
Table 1-3. 3480D/3484A Typical Operating Data (Cont'd).

	DC VOLTS			OHMS (Option 042)	TRUE RMS (Option 043)	
	Guard To Chassis	Guard To Low	High To Low			
MAXIMUM STEP CHANGE IN INPUT VOLTAGE (Exceeding these limits can result in error, wrong flag and false triggering.):	100 V peak	20 V peak	300 V peak	not applicable	not applicable	
MAXIMUM INPUT VOLTAGE:	± 500 V peak	± 200 V peak	± 1200 V peak	± 75 V peak	dc + ac = 1500 V peak	
					VAC(AC)	VAC(DC)
					10 V dc max on 100 mV range 100 V dc max on other ranges	1000 V rms max on all ranges

REMOTE TRIGGERING

NOTES

1. *May be used only with Option 001 (Sample/Hold) or Option 004 (Isolated BCD Output).*
2. *Allowed only when Sample Rat. Control is set to HOLD or Interface HOLD input is grounded.*
3. *Triggering may be applied via one of three connectors: BCD, RC or S/H (see below).*
4. *For additional data see Sample/Hold.*



Option Used	Where To Apply Low Trigger	To Enable Triggering Set Sample Rate Control to Hold	Minimum Trigger Width (t_1*)	Minimum Time Trigger Must Be High Before Low (t_2*)	Minimum Trigger Period (t_3*)
004–BCD	J13 pin 46	Ground J13 pin 47	≥ 50 µsec	≥ 50 µsec	1 msec
041–RC	J14 pin 19	Ground J14 pin 17	≥ 50 µsec	≥ 50 µsec	1 msec
001–S/H	J15 pin A or B	Set Sample Rate Control to HOLD;	≥ 1 µsec	≥ 50 µsec	1 msec

*Remote Triggering Timing Relationships

ISOLATED REMOTE CONTROL (OPTION 041) operates only if Option 001 or 004, S/H or BCD, is installed because it needs the 5 V supply they provide.

Isolation Characteristics: All control lines are referenced to earth ground (instrument chassis). Instrument will make floating measurements and maintain all Normal and Common Mode Rejection specifications when control lines are programmed.

Program Storage: Allows entry and storage of the selected program (except Encode) eliminating the need for sustained "Low" states on the selected control lines. Program is automatically protected from inadvertent change. Remote control line logic states are entered only when a "Low" state is applied to the Program Accept line. Program Flag (output line) verifies receipt of program.

TTL Logic Levels on Control Lines of Remote Control Connector J14:
INPUTS: Low ("0"): 0 to .5 V (2 mA max) or contact closure via < 250 Ω to ground
INPUTS: High ("1"): 2.4 to 5 V or removal of contact closure to ground
OUTPUTS: High ("1"): 5 V; 6 kΩ source resistance
OUTPUTS: Low ("0"): 0 to .5 V; 12 mA current sink (output High and Low will differ by at least 4 V if output load ≥ 100 kΩ.

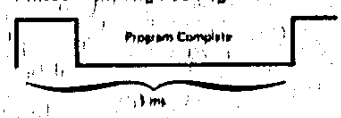
DELAY: selected one of 2 ways, otherwise there is NO internal delay.
a. Jumper inside 3484A.
b. Option H04—Low Logic Level on J14 pin 5

USE: causes a delay between application of external trigger and reading period; delays are controlled by RC Time Constant (are approximate) and Filter Selection.

Function	Typical Delay Time	Response Time
VDC		
Filter Out	3.3 to 3.5 msec	1 msec
Filter A	210 to 260 msec	200 msec
Filter B	1 to 1.1 sec	1 sec
VAC (AC)		
VAC(DC)	3.0 to 3.2 sec*	15 sec*
OHMS		
10 MΩ, Filter A	3.3 to 3.5 msec	1 msec
1000 kΩ, Filter A	210 to 260 msec	200 msec
Other Ranges Filter Out	2 to 2.1 sec	2 sec

*Application: Trigger must occur to start the measurement, then the delay occurs, then the reading is made available. However, the controller must wait additional time (12 to 13 seconds) to allow for the long response time on VAC (DC).

Table 1-3. 3480D/3484A Typical Operating Data (Cont'd).

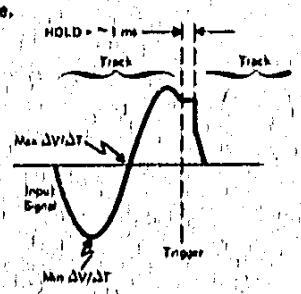
Item			Data
REMOTE CONTROL CONNECTOR—J14			
Pin	Function	Signal (Low True) and Use	
1	Input	Select VAC (AC) function	
2	Input	Select VAC (DC) function	
3	Input	Select OHMS function	
4	Input	Select Range 1000 kΩ	
5	Input	Select DELAY (Option H04) enables delay—see below	
6	Input	Select Range 100 V or 100 kΩ	
7	Input	Select Range 10 V or 10 kΩ	
8	Input	Select Range 1000 mV or 1000 Ω	
9	Input	Select Range 100 mV or 100 Ω	
10–13	None		
14	Input	PROGRAM ACCEPT—causes select lines to be entered and executed	High ≥ 50 µsec, then Low ≥ 150 µsec (must be low ≥ 1msec before Encode)
15	Input	Select Filter B	
16	Input	Select Filter A	
17	Input	INTERFACE HOLD (INHIBIT)—allows remote triggering	Continuous Low
18	Not used		
19	Input	ENCODE (EXTERNAL TRIGGER) initiates measurement period for any option	High ≥ 50 µsec, then Low ≥ 50 µsec (minimum time between commands 1 msec)
20	Output	PROGRAM FLAG—indicates when selected function, range and filter have been executed. Not to be used as an input to return Program Accept Line to High State	Low until program is executed High upon execution (Program Accept) Low when programming completed ≥ 1 msec from High to High 

NOTE: *If no Range, Function or Filter lines are selected VDC, 1000 V or 10 MΩ), Filter Out is selected.*

SAMPLE/HOLD (OPTION 001)

Hold mode: mode when the input voltage is frozen or held to be digitized as a dc voltage (rather than a changing voltage). The hold mode lasts approximately 1 ms and is automatically terminated after digitizing is complete. The hold mode begins 110 ns ± 20 ns after a trigger is given at the Sample/Hold External Trigger Input, when operating in the Non-Delay Mode only.

Track mode: mode where the Sample/Hold amplifier tracks or follows the input voltage.



MAXIMUM ΔV/ΔT (RAMP) which input amplifier can track: 8% of range per µsec.

Operation of Sample/Hold (S/H) requires that the Sample Rate Control be set to Hold and the Filter Control be set to Out.

ACQUISITION TIME: the time for the 3484A input amplifier to respond to a full-scale step input to within ± .01%:

DCV Range	Acquisition Time
100 mV	100 µs
other ranges	70 µs

APERTURE TIME: the time from the application of a command to Sample/Hold to when the signal is actually held: 110 ± 20 ns

Table 1-3. 3480D/3484A Typical Operating Data (Cont'd).

SAMPLE/HOLD CONNECTOR: J15

Pin	Function	Signal Name (Overscore=Low True)		
A	Input	External $\overline{\text{SAMPLE HOLD TRIGGER}}$		≥ 1 µsec after ≥ 20 µs high initiates Hold and one measurement
B	Input	External $\overline{\text{SAMPLE HOLD TRIGGER}}$		
C		GUARD		
D	Output	*Analog Output High	Proportional to Input Signal—used for scope monitoring input signal	Full Scale = 1 V ± 2%
E	Output	*Analog Output Low		Source Resistance (referenced to Low)=1 kΩ ± 2%
F		GUARD		
H	Input	$\overline{\text{DELAY}}$ Remote Program		
J	Input	S/H Remote Program		
K		Chassis Ground		

LOGIC LEVELS:
High = +2.4 to +5 V or open circuit
Low = 0 to +5 V or contact closure through < 250 Ω to ground.

*Grounding Analog Output also grounds front panel low terminal, thus prohibiting floating measurements.

Max frequency of sine inputs on all ranges and related accuracies if samples are taken at peak and zero crossing. Peak inputs are assumed to be 150% of range except 1 kV range which is 1200 V.

Range	Accuracy To Add to DC Volts Accuracy Spec*	Ramp of Sine (At Zero-Crossing) Or Sawtooth Input Ramp=ΔV/ΔT = Volts Per Second	Maximum Frequency of Input Sinewave If Sample Is Taken At: Zero Crossing Hz	Peak Hz
100 mV	.03% (Delay On)	.75	.8	98
	.1%	7.5	8	310
	1%	75	80	980
1 V	.01%	24	2.5	310
	.1%	240	25	980
	1%	2400	250	3100
10 V	.01%	240	2.5	310
	.1%	2400	25	980
	1%	24 K	250	3100
100 V	.01%	530	.6	69
	.1%	5300	6	220
	1%	53 K	60	690
1000 V	.01%	5300	.6	69
	.1%	53 K	6	220
	1%	530 K	60	690

*See DC Voltage spec for FORMULAE USED TO COMPUTE ACCURACIES FOR DIFFERENT FREQUENCIES; use formulae instead of this table for accuracy computations. This table is primarily to show maximum sine frequencies for sampling inputs on all ranges.

Table 1-3. 3480D/3484A Typical Operating Data (Cont'd).

DELAY Time: the time between applying a remote trigger (see below) while Sample Rate Control is in Hold or Interface Hold is low and holding the input signal (entering Hold mode).

SELECTED By: Rear panel delay switch or remote programming of continuous low on J15 pin H.

S/H Delay Use:
On (105 µs)—STEP INPUTS only — see diagram
Off (110 ns)—Continuous Waveforms or ramps *only*

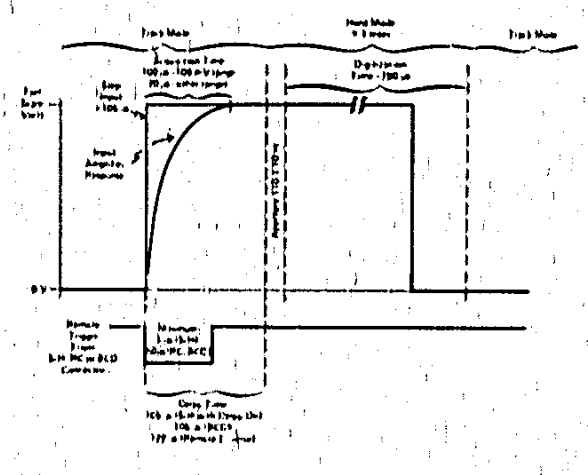
Remote Trigger Low		Interface Hold Low	S/H Delay On	S/H Delay Off	Minimum Trigger Width	Minimum Time Trigger Must Be High Before Going Low	Minimum Trigger Period
BCD	J13 pin 7,6	Pin 17	105 µs	105 µs	≥ 50 µs	≥ 50 µs	1 ms
Remote Control	J14 pin 19	Pin 47	122 µs	122 µs	≥ 50 µs	≥ 50 µs	1 ms
Sample Hold	J15 pin A or B	Sample Rate = Hold	105 µs	110 ns	≥ 1 µs	≥ 20 µs	1 ms

Delays are ± 10 units

USE OF SAMPLE/HOLD

FOR STEP INPUTS

1. Always use Delayed Trigger.
2. Make trigger coincide with step input leading edge.
3. Use triggers no more often than once per millisecond.
4. Apply triggers via any or all of these connectors:
   a. Sample—Hold
   b. Isolated BCD
   c. Isolated Remote Control
5. Input must be stable at end of delay to obtain an accurate reading.



FOR CONTINUOUS WAVE OR RAMP INPUTS:

1. Always use Sample Hold Trigger with NO Delay (110 ns)
2. Most accurate readings of a sine input are achieved at the peak; least accurate at zero-crossing.
3. For a given accuracy, higher frequencies can be measured at the peak than at the zero-crossing point.
4. Maximum $\Delta V/\Delta T$ Trackable: 8% of range per µsec.

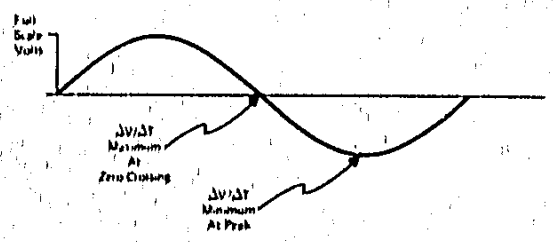


Table 1-3. 3480D/3484A Typical Operating Data (Cont'd).

ISOLATED BCD OUTPUT (Option 004):

TTL LOGIC LEVELS on Connector:
High ("1") + 5 V
Low ("0") 0 to .5 V

All digital signals are isolated and referenced to chassis ground.

BCD CONNECTOR: J13

Pins	Function	Name	
1,2,26,27	Output	BCD Column 1 (Lines F,G,H,I)	
3,4,28,29	Output	BCD Column 2 (Bits 1,2,3,4) 1st digit	
5,6,30,31	Output	BCD Column 3 2nd digit	
7,8,32,33	Output	BCD Column 4 3rd digit	
9,10,34,35	Output	BCD Column 5 4th digit	
11(12,36,37)*	Output	BCD Column 6(overrange) 6th digit	
13,14,38,(39)*	Output	BCD Column 7 (Lines A,B,C)	
15,16,40,(41)*	Output	BCD Column 1 (Lines D,E,Sample/Hold Command)	
17,18(42,43)*	Output	BCD Column 9 (POLARITY, OVERLOAD)	Polarity Low = +; high = −
22	Output	Printer hold off (INHIBIT) high disables front panel sampling during print cycle	high = +5 to +15 V
*(24),25	Output	Low, High reference	High + 5 V ± 10%, 6.8 kΩ source resistance
46	Output	ENCODE (EXTERNAL TRIGGER) Initiates measurement period	Low 0 V, 0 Ω source resistance High ≥ 50 μsec then Low ≥ 50 μsec
47	Input	INTERFACE HOLD (INHIBIT)—disables internal sampling and Sample Rate Control; allows triggering	Continuous Low
48	Output	FLAG (PRINT COMMAND)	High to Low transition at end of measurement = print command

*All numbers in parenthesis are connected to chassis (ground); this includes Low reference.