

MIL-STD-1665
NOTICE 5
1 May 1984

MILITARY STANDARD
TEST EQUIPMENT FOR THE
STANDARD ELECTRONIC MODULES PROGRAM

TO ALL HOLDERS OF MIL-STD-1665:

1. THE FOLLOWING PAGES OF MIL-STD-1665 ARE NEW OR HAVE BEEN REVISED AND SUPERSEDED THE PAGES LISTED:

NEW PAGE	DATE	SUPERSEDED PAGE	DATE
5	1 May 1984	5	16 January 1984
6	1 May 1984	6	16 January 1984
D08-1	1 May 1984		
D08-2	1 May 1984		
D08-3	1 May 1984		
D08-4	1 May 1984		
EL01-1	1 May 1984	EL01-1	20 January 1978
EL02-1	1 May 1984		
EL03-1	1 May 1984		
EL04-1	1 May 1984		
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PI04-1	1 May 1984		
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PI05-1	1 May 1984		
PI05-2	1 May 1984		
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R07-1	1 May 1984	R07-1	20 January 1978
S03-1	1 May 1984		
S03-2	1 May 1984		
TC01-1	1 May 1984		
Y07-1	1 May 1984		

2. RETAIN THIS NOTICE AND INSERT BEFORE TABLE OF CONTENTS.

3. Holders of MIL-STD-1665 will verify that additions indicated above have been entered. This notice page will be retained as a check sheet. This issuance, together with the appended pages is a separate publication. Each notice is to be retained by stocking points until the Military Standard is completely revised or canceled.

Custodians:

Army - ER
Navy - EC
Air Force - 85

Preparing activity:

Navy - EC

(Project 5963-0029)

Review activities:

Army - AT, AV
Navy - AS, SH
Air Force - 13, 17, 19
DLA - ES

User activities:

Army -
Navy -
Air Force -

Agent:

DLA - ES

FSC 5963

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ITEM D08

OSCILLOSCOPE, MAINFRAME

TYPE OF EQUIPMENT - - - - - Fast storage oscilloscope.

FUNCTION PERFORMED- - - - - Has a high vertical bandwidth, fast storage-writing speed, and four plug-in compartments which form a highly flexible measuring system, dependent on the plug-ins used.

SPECIFICATIONS

Vertical system - - - - - Two lefthand plug-in compartments.
 Modes of operation- - - - - LEFT, ALT, ADD, CHOP, RIGHT.
 Chopped mode rep rate - - - - - 1 MHz \pm 2 percent.
 Bandwidth - - - - - To 400 MHz, dependent on plug-in.
 Difference between compartments - - - - - \pm 1 percent.
 Isolation between compartments
 DC to 150 MHz - - - - - 100:1.
 150 to 400 MHz- - - - - 30:1.
 Delay line- - - - - Permits viewing the triggering signal leading edge.

Horizontal system- - - - - Two righthand compartments.
 Modes of operation- - - - - A, ALT, CHOP, B.
 Chopped mode rep rate - - - - - 200 kHz \pm 20 percent.
 Bandwidth - - - - - DC to 1 MHz.
 Difference between compartments - - - - - \pm 1 percent.
 Fastest calibrated sweep rate - - - - - 1 ns/division.
 Phase shift between vertical and horizontal deflection systems- - - - - 2 percent or less from dc to 35 kHz.

Triggering system
 A and B trigger source modes- - - - - VERT MODE, LEFT VERT, RIGHT VERT.

Calibrator
 Waveshape - - - - - Square wave.
 Polarity- - - - - Positive going, baseline at ground.
 Source impedance- - - - - 450 ohms.
 Output voltage
 Into 100 kilohms or greater - - - - - 40 mV, 0.4 V, 4 V.
 Into 50 ohms- - - - - 4 mV, 40 mV, 0.4 V.
 Output current- - - - - 40 mA.
 Amplitude accuracy (V p-p)- - - - - \pm 1 percent.
 Repetition rate - - - - - 1 kHz \pm 0.25 percent.
 Duty factor - - - - - 50 \pm 2 percent.
 Rise and fall times - - - - - 250 ns into 100 pF.

Signal outputs
 Sawtooth out
 Source- - - - - Either of the horizontal time-base units.
 Polarity (into 1 megohm)- - - - - Positive going, baseline at 0 \pm 1 V.
 Output voltage, rate of rise
 Into 50 ohms- - - - - 50 mV/unit of time selected by time-base unit, time/div switch \pm 15 percent; 100 ns/div maximum.
 Into 1 megohm - - - - - 1 V/unit of time selected by time-base unit, time/div switch \pm 10 percent; 1 μ s/div maximum.
 Output resistance - - - - - \leq 950 ohms.

Gate out
 Source- - - - - Either of the horizontal time-base units.

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A Gate - - - - -	Derived from the A HORIZ time-base unit main gate.
B Gate - - - - -	Derived from the B HORIZ time-base unit main gate.
Delay Gate - - - - -	Derived from the A HORIZ time-base unit delaying gate.
Polarity	
A or B Gate (into 1 megohm)- - - - -	Positive going, baseline at 0 ±1 V.
A Delayed Gate - - - - -	Positive level when A time-base delayed sweep or B sweep is disabled. 0 V within 1 V (into 1 megohm) when sweeps are disabled.
Output voltage	
Into 50 ohms - - - - -	0.5 V ±10 percent.
Into 1 megohm- - - - -	10 V ±10 percent (up to 1 μs/div).
Rise time into 50 ohms - - - - -	20 ns.
Output resistance- - - - -	≈ 950 ohms.
Vertical signal out	
Source - - - - -	Same as A trigger source.
Output voltage	
Into 50 ohms - - - - -	25 mV/div of vertical deflection ±25 percent.
Into 1 megohm- - - - -	0.5 V/div of vertical deflection ±25 percent.
Bandwidth (into 50 ohms) - - - - -	Dependant on vertical plug in used.
DC centering (into 1 megohm) - - - - -	0 ±1V.
Aberrations- - - - -	15 percent maximum p-p within 50 ns of step.
Output resistance- - - - -	≈ 950 ohms.
External Z-Axis input	
Polarity - - - - -	Positive signal blanks the trace.
Sensitivity- - - - -	2 V p-p for full intensity range.
Low-frequency response - - - - -	DC.
Input capacitance- - - - -	50 pF maximum.
Input resistance - - - - -	≈ 470 ohms.
Open-circuit voltage - - - - -	0V.
Maximum input voltage- - - - -	15 V (dc + ac peak).
Maximum repetition rate- - - - -	1 MHz.
CRT display modes- - - - -	Nonstore, bistable, variable persistence, fast bistable, and fast variable persistence (full or reduced scan).
Auto erase - - - - -	Variable from 1 s to 10 s.
Storage, full scan (center 6x8 div at 0.9 cm/div).	
Fast variable persistence	
Writing speed- - - - -	300 div/μs (270 cm/μs).
View time- - - - -	30 s.
Erase time - - - - -	1.4 s.
Fast bistable	
Writing speed- - - - -	50 div/μs (45 cm/μs).
View time- - - - -	30 minutes.
Erase time - - - - -	1.4 s.
Variable persistence	
Writing speed- - - - -	2 div/μs (1.8 cm/μs).
View time- - - - -	30 s.
Erase time - - - - -	0.9 s.

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Bistable	
Writing speed - - - - -	0.03 div/ μ s (0.027 cm/ μ s).
View time - - - - -	30 minutes.
Erase time- - - - -	0.9 s.
Storage, reduced scan (center 8 x 10 div at 0.45 cm/div).	
Fast variable persistence	
Writing speed - - - - -	5,500 div/ μ s (2,500 cm/ μ s).
View time - - - - -	30 s.
Erase time- - - - -	1.4 s.
Fast bistable	
Writing speed - - - - -	776 div/ μ s (350 cm/ μ s).
View time - - - - -	30 minutes.
Erase time- - - - -	1.4 s.
Variable persistence	
Writing speed - - - - -	12 div/ μ s (5.4 cm/ μ s).
View time - - - - -	30 s.
Erase time- - - - -	0.9 s.
Bistable	
Writing speed - - - - -	0.2 div/ μ s (0.09 cm/ μ s).
View time - - - - -	30 minutes.
Erase time- - - - -	0.9 s.
Auto erase view time	
Minimum- - - - -	Less than 1 s.
Maximum- - - - -	Greater than 4 s.
Remote reset input	
Signal required- - - - -	Switching from high level (15 V to 10 V; sink less than 40 μ A) to low level (0.5 V to -15 V; sink less than 10 mA), in less than 1 ms, resets the sweep.
Minimum pulse width- - - - -	10 μ s at 50 percent amplitude points.
Maximum input voltage- - - - -	+ or -15 V (dc plus peak ac).
Remote storage gate input	
Signal required- - - - -	TTL voltage compatible.
Rise time- - - - -	1 μ s.
Fall time- - - - -	1 μ s.
Minimum pulse width- - - - -	50 ns at 50 percent amplitude.
Input resistance - - - - -	Greater than 15 kilohms from -0.6 to 5 V input.
Input capacitance- - - - -	\leq 100 pF.
Open circuit voltage - - - - -	0V.
Maximum input voltage- - - - -	+ or - 15 V (dc plus peak ac).
Remote erase input	
Signal required- - - - -	TTL voltage compatible.
Rise time- - - - -	1 ms maximum.
Fall time- - - - -	10 μ s maximum.
Minimum pulse width- - - - -	1 ms at 50 percent amplitude.
Input resistance - - - - -	Greater than 27 kilohms.
Input capacitance- - - - -	\leq 100 pF.
Open circuit voltage	
Nonstore mode- - - - -	0V.
Store mode - - - - -	5.6 V.
Maximum input voltage- - - - -	+ or -15 V (dc plus peak ac).

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Remote sense input

Signal required- - - - -	TTL voltage compatible.
Rise time- - - - -	1 ms maximum.
Fall time- - - - -	1 ms maximum.
Open circuit voltage - - - - -	2.5 V
Input resistance - - - - -	≈ 10 kilohms.
Input capacitance- - - - -	≈ 100 pF.
Maximum input voltage- - - - -	+ or -15 V (dc + peak ac).
Input power	
Line voltage ranges- - - - -	90-132 V (115 V nominal) or 180-250 V (230 V nominal).
Line frequency - - - - -	48-440 Hz.
Maximum power consumption- - - - -	215 watts.

EQUIPMENT MEETING ALL SPECIFICATIONS

Manufacturer - - - - - Tektronix model 7834.

MIL-STD-1665
1 May 1984ITEM ELO1
LOAD, ELECTRONIC

TYPE OF EQUIPMENT - - - - -	Electronic load.
FUNCTION PERFORMED- - - - -	Provides accurate simulation of electrical loads.
SPECIFICATIONS	
Load voltage- - - - -	0 to 50 V.
Load current- - - - -	0 to 60 A.
Power dissipation - - - - -	1 to 1000 W.
Overload rating - - - - -	10 percent.
Self-protection - - - - -	Overvoltage: <60 V. Overcurrent: <65 A. Over power: <1300 W.
Resistance range- - - - -	0 to 1 A/V, 0 to 10 A/V (load current proportional to load voltage).
Constant current ranges - - - - -	0 to 10 A, 0 to 60 A.
Pulse load- - - - -	0 to 50 A.
External modulation - - - - -	0 to 6 V.
Pulse modulation- - - - -	Square wave, frequency adjustable, 500 to 5000 Hz, 0 to full load plus selected steady state load.
Input power - - - - -	105 to 125 V, 47 to 63 Hz.
Voltmeter ranges- - - - -	6 V, 18 V, 60 V full scale.
Ammeter ranges- - - - -	6 A, 18 A, 60 A full scale.
EQUIPMENT MEETING ALL SPECIFICATIONS	
Manufacturer- - - - -	Transistor Devices Model DLP 50-60-1000 Dynaload.
EQUIPMENT MEETING SPECIFICATIONS WITH EXCEPTIONS AS NOTED	
Manufacturer- - - - -	Transistor Devices Model DLP 50-150-3000 Dynaload.
Exceptions- - - - -	Load current: 180 A. Power dissipation: 3000 W. Resistance ranges: 0 to 5 A/V, 0 to 30 A/V. Constant current ranges: 0 to 30 A, 0 to 150 A. Pulse load: 0 to 150 A Overcurrent: <180 A. Overpower: <3500 W. Ammeter ranges: 18 A, 60 A, 180 A full scale.
Manufacturer- - - - -	Transistor Devices Model DLP 50-150-3000A Dynaload.
Exceptions- - - - -	Load current: 0 to 150 A. Power dissipation: 1 to 3000 W. Resistance ranges: 0 to 5 A/V, 0 to 30 A/V. Constant current ranges: 0 to 30 A, 0 to 150 A. Pulse load: 0 to 150 A Overcurrent: <160 A. Overpower: <3500 W. Ammeter ranges: 18 A, 60 A, 180 A full scale.

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ELO1-1

MIL-STD-1665
1 May 1984ITEM EL02
LOAD, ELECTRONIC

TYPE OF EQUIPMENT - - - - -	Electronic load.
FUNCTION PERFORMED- - - - -	Provides accurate simulation of electrical loads.
SPECIFICATIONS	
Load voltage- - - - -	0 to 50 V.
Load current- - - - -	0 to 150 A.
Power dissipation - - - - -	1 to 3000 W.
Overload rating - - - - -	10 percent.
Self-protection - - - - -	Over voltage: <60 V. Over current: <160 A. Over power: <3500 W.
Resistance range- - - - -	0 to 5 A/V, 0 to 30 A/V (load current proportional to load voltage).
Constant current ranges - - - - -	0 to 30 A, 0 to 150 A.
Pulse load- - - - -	0 to 150 A.
External modulation - - - - -	0 to 6 V.
Pulse modulation- - - - -	Square wave, frequency adjustable 500 to 5000 Hz, 0 to full load plus selected steady state load.
Short circuit switch- - - - -	Shorts the input.
Input power - - - - -	105 to 125 V, 47 to 63 Hz.
Voltmeter ranges- - - - -	6 V, 18 V, 60 V full scale.
Ammeter ranges- - - - -	18 A, 60 A, 180 A full scale.
EQUIPMENT MEETING ALL SPECIFICATIONS	
Manufacturer- - - - -	Transistor Devices Model DLP 50-150-3000A Dynaload.
Manufacturer- - - - -	Transistor Devices Model DLP 50-150-3000 Dynaload.

MIL-STD-1665
1 May 1984ITEM ELO3
LOAD, ELECTRONIC

TYPE OF EQUIPMENT - - - - -	Electronic load.
FUNCTION PERFORMED- - - - -	Provides accurate simulation of electrical loads.
SPECIFICATIONS	
Load voltage- - - - -	0 to 130 V.
Load current- - - - -	0 to 15 A.
Power dissipation - - - - -	1 to 750 W.
Overload rating - - - - -	10 percent.
Self-protection - - - - -	Over voltage: <150 V. Over current: <20 A. Over power: <1000 W.
Resistance range- - - - -	0 to 0.5 A/V, 0 to 3 A/V (load current proportional to load voltage).
Constant current ranges - - - - -	0 to 3 A, 0 to 15 A.
Pulse load- - - - -	0 to 15 A.
External modulation - - - - -	0 to 6 V.
Input power - - - - -	105 to 125 V, 47 to 63 Hz.
Voltmeter ranges- - - - -	18 A, 60 A, 180 A full scale.
Ammeter ranges- - - - -	1.8 A, 6 A, 18 A full scale.
EQUIPMENT MEETING ALL SPECIFICATIONS	
Manufacturer- - - - -	Transistor Devices Model DLP 130-15-750 Dynaload.

MIL-STD-1665
1 May 1984ITEM ELO4
LOAD, ELECTRONIC

TYPE OF EQUIPMENT - - - - -	Electronic load.
FUNCTION PERFORMED- - - - -	Provides accurate simulation of electrical loads.
SPECIFICATIONS	
Load voltage- - - - -	1.8 to 55 V dc.
Load current- - - - -	0 to 150 A.
Power dissipation - - - - -	750 W maximum.
Overload rating - - - - -	>750 W.
Self-protection - - - - -	Over voltage shutdown. Over temperature shutdown. Reversed polarity.
Operating modes - - - - -	Constant current. Constant resistance.
Current ripple- - - - -	≥ 0.1 A p-p.
Dynamic loading	
Frequency - - - - -	1 kHz or two times input line frequency.
Duty cycle- - - - -	50
Response time - - - - -	1 μ s/A or 50 μ s whichever is the greater.
Remote programming- - - - -	0 to 10 V is equal to 0 to 150 A.
Accuracy- - - - -	1 percent.
Input impedance - - - - -	100 kilohm.
Operating temperature - - - - -	0°C to 40°C.
Input power - - - - -	105 to 125 V, 47 to 63 Hz.
Voltmeter range - - - - -	0 to 60 V, full scale.
Ammeter ranges- - - - -	0 to 10 A, 0 to 50 A, 0 to 100 A, and 0 to 200 A, full scale.
EQUIPMENT MEETING ALL SPECIFICATIONS	
Manufacturer- - - - -	Acdc Electronics Model 750B.

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1 May 1984ITEM P10
POWER SUPPLY, DC

TYPE OF EQUIPMENT - - - - -	DC power supply.
FUNCTION PERFORMED- - - - -	A constant voltage/constant current dc power source. Which will furnish full rated output voltage at the maximum rated output current or can be continuously adjusted throughout most of the output range.
SPECIFICATIONS	
Input- - - - -	208/230/380/400/460 V ac ± 10 percent three phase, 57 to 63 Hz, 50 A per phase at 230 V ac.
Output - - - - -	0 to 600 V at 0 to 15 A or 0 to 500 V at 0 to 20 A or 0 to 400 V at 0 to 25 A.
Load regulation	
Constant voltage - - - - -	Less than 0.05 percent plus 100 mV for a load current change equal to the current rating of the supply.
Constant current - - - - -	Less than 0.1 percent plus 35 mA for a load voltage change equal to the voltage rating of the supply.
Line regulation	
Constant voltage - - - - -	Less than 0.05 percent plus 100 mV for any changes within the input rating.
Constant current - - - - -	Less than 0.1 percent plus 35 mA for any change within the input rating.
Ripple and noise	
Constant voltage - - - - -	Less than 600 mV rms, 5 V p-p (dc to 200 MHz).
Operating temperature- - - - -	0°C to 50°C.
Temperature coefficient	
Constant voltage - - - - -	Less than 0.03 percent plus 20 mV change in output per °C change in ambient.
Constant current - - - - -	Less than 0.06 percent plus 60 mA change in output per °C change in ambient.
Stability	
Constant voltage - - - - -	Less than 0.15 percent plus 80 mV drift per 8 hours.
Constant current - - - - -	Less than 0.3 percent plus 250 mA drift per 8 hours.

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Transient recovery time

Constant voltage - - - - - Less than 50 ms/100 ms for output voltage recovery to within 12 V/5 V of the nominal output voltage following a load change from full load to half load or vice versa.

Resolution

Constant voltage - - - - - 60 mV is the minimum output voltage change obtainable with the front panel controls.

Constant current - - - - - 25 mA is the minimum output current change obtainable with the front panel controls.

Remote resistance programming

Constant voltage - - - - - 300 ohms/volt, Accuracy equals ± 2 percent.

Constant current - - - - - 40 ohms/amp, Accuracy equals ± 2 percent.

EQUIPMENT MEETING ALL SPECIFICATIONS

Manufacturer - - - - - Hewlett Packard Model 6483C.

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1 May 1984ITEM P101
PLUG-IN UNIT, AMPLIFIER

TYPE OF EQUIPMENT - - - - -	Dual trace amplifier plug-in unit.
FUNCTION PERFORMED- - - - -	A dual trace wide bandwidth amplifier, vertical plug-in, used in conjunction with a compatible oscilloscope.
SPECIFICATIONS	
Deflection factor	
Calibrated range- - - - -	5 mV/div to 5 V/div; ten steps in a 1-2-5 sequence.
Accuracy - - - - -	±2 percent with gain adjusted at 10 mV/div.
Gain	
BW full/20 MHz gain match - - - - -	20 MHz gain within 1 percent full gain.
Frequency response	
Upper bandwidth - - - - -	Depends upon oscilloscope used.
Lower bandwidth (ac coupled)- - - - -	10 Hz or less.
20 MHz bandwidth- - - - -	20 ±3 MHz.
Rise time - - - - -	21 ns or less.
Maximum input voltage	
DC coupled- - - - -	250 V (dc + peak ac).
AC coupled- - - - -	500 V (dc + peak ac).
Channel isolation - - - - -	50:1 display ratio up to 200 MHz.
Input R and C	
Resistance- - - - -	1 megohm ±2 percent.
Capacitance - - - - -	20 pF approximately.
Delay time between channels - - - - -	200 ns or less.
Trigger source selection- - - - -	Channel 1 only. Follows DISPLAY MODE selection channel 2 only.
Display modes - - - - -	Channel 1 trace only. Dual-trace, alternate between channels. Added algebraically. Dual-trace, chopped between channels. Channel 2 trace only.
EQUIPMENT MEETING ALL SPECIFICATIONS	
Manufacturer- - - - -	Tektronix model 7A26 when used in conjunction with a Tektronix 7000 series oscilloscope.

ITEM P102

PLUG-IN UNIT, DIFFERENTIAL COMPARATOR

TYPE OF EQUIPMENT - - - - -	Differential amplifier comparator plug-in.
FUNCTION PERFORMED- - - - -	A dc coupled differential comparator, which may also be used as a differential input preamplifier or conventional preamplifier. This is a plug-in unit and must be used in conjunction with a compatible oscilloscope.
SPECIFICATIONS	
Deflection factor	
Calibrated range- - - - -	1 mV/div to 5V/div, 12 steps in a 1-2-5 sequence.
Gain ratio accuracy - - - - -	±1.5 percent of GAIN adjusted at 1 mV/div.
Common mode signal ranges	
1 mV/div to 50 mV/div - - - - -	10 and -10 V.
10 mV/div to 0.5V/div - - - - -	100 and -100 V.
0.1 V/div to 5V/div - - - - -	500 and -500 V.
Frequency response	
Upper bandwidth - - - - -	Up to 105 MHz, dependent on oscilloscope and probe.
Lower bandwidth (ac coupled)- - - - -	10 Hz.
5 MHz bandwidth - - - - -	DC to 5 MHz within 500 KHz.
Common mode rejection ratio	
1 mV/div to 50 mV/div, x10 Vc in	
DC to 100 kHz - - - - -	20,000:1, 20Vp-p or less test signal.
100 kHz to 1 MHz- - - - -	10,000:1, 10Vp-p or less test signal.
1 to 10 MHz - - - - -	500:1, 1Vp-p or less test signal.
10 to 20 MHz- - - - -	200:1, 1Vp-p or less test signal.
10 mV/div to 50 mV/div, X10 Vc out, and 0.1 mV/div to 5V/div, X10 Vc in or out.	
DC to 10 kHz- - - - -	2000:1.
AC coupled at 60 Hz - - - - -	500:1.
Input R and C - - - - -	1 megohm ±0.15 percent, 20 pF approximately.
R and C product - - - - -	±1 percent between all deflection factors.
Maximum gate current- - - - -	0.2 nA.
Amplifier crosstalk - - - - -	1 percent or less.
Displayed noise - - - - -	400 μA.
Comparison voltage range- - - - -	0 to ±10 V.
Accuracy- - - - -	± (0.1% of setting +3 mV).
Electrical zero - - - - -	0.5 mV or less.
Vc OUI resistance - - - - -	2 to 5.5 kilohms.
Operating temperature - - - - -	0°C to +50°C.
EQUIPMENT MEETING ALL SPECIFICATIONS	
Manufacturer- - - - -	Tektronix model 7A13 when used in conjunction with a Tektronix 7000 series oscilloscopes.

ITEM P103
PLUG-IN UNIT, DIFFERENTIAL AMPLIFIER

TYPE OF EQUIPMENT - - - - -	Differential amplifier plug-in.
FUNCTION PERFORMED- - - - -	A dc coupled differential amplifier for low amplitude, low frequency measurements. This is a plug-in unit to be used in conjunction with a compatible oscilloscope.
SPECIFICATIONS	
Deflection factor	
Calibrated range- - - - -	10 μ V/div to 10 V/div, 19 steps in a 1-2-5 sequence.
Gain ratio accuracy - - - - -	± 2 percent of GAIN adjusted at 1 mV/div.
Differential signal range (DC OFFSET not used)	
10 μ V/div to 10 mV/div- - - - -	± 1 V.
20 μ V/div to 0.1 V/div- - - - -	± 10 V.
0.2 V/div to 1 V/div- - - - -	± 100 V.
2 V/div to 10 V/div - - - - -	± 1000 V.
DC offset (course range from electrical zero)	
10 μ V/div to 10 mV/div- - - - -	± 1 V.
20 mV/div to 0.1 V/div- - - - -	± 10 V.
0.2 V/div to 1 V/div- - - - -	± 100 V.
2 V/div to 10 V/div - - - - -	± 1000 V.
Frequency response	
Overall (dc-coupled)- - - - -	DC to within 10% of 1 MHz at -3dB.
Lower bandwidth (ac-coupled)- - - - -	2 Hz.
Bandwidth limiting	
High frequency -3 dB point- - - - -	100 Hz to 1 MHz, 9 steps in a 1-3 sequence.
Accuracy- - - - -	± 10 percent.
Low frequency -3 dB point - - - - -	0.1 Hz to 10 kHz, 6 steps in a 1-10 sequence.
Accuracy- - - - -	± 12 percent.
Common mode signal	
10 μ V/div to 10 mV/div- - - - -	10 and -10 V.
20 mV/div to 0.1 V/div- - - - -	100 and -100 V.
0.2 V/div to 10 V/div - - - - -	500 and -500 V.
Common mode rejection ratio	
DC coupled	
10 μ V/div to 10 mV/div, 10 Hz to 100 kHz - -	100,000:1.
20 mV/div to 10 V/div, 10 Hz to 1 kHz- - -	1000:1.
AC coupled	
10 μ V/div to 10 mV/div, 12 kHz to 100 kHz- -	20,000:1.
20 mV/div to 10 V/div at 60 Hz - - - - -	700:1.
20 mV/div to 10 V/div at 1 kHz - - - - -	900:1.
Maximum input voltage, dc coupled	
10 μ V/div to 10 mV/div - - - - -	± 15 V.
20 mV/div to 0.1 V/div - - - - -	± 200 V.
0.2 V/div to 10 V/div- - - - -	± 500 V.

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ITEM P103 - Continued

Maximum input voltage, ac coupled - - - - -	*500 V, each input.
Input dc rejection, ac coupled- - - - -	400,000:1.
Input R and C - - - - -	1 megohm \pm 1 percent, 47 pF.
R and C product - - - - -	\pm 1 percent between all deflections.
Displayed noise - - - - -	16 μ V or 0.1 div, whichever is greater.
Isolation between inputs- - - - -	200:1, dc to 1 MHz.

EQUIPMENT MEETING ALL SPECIFICATIONS

Manufacturer- - - - -	Tektronix model 7A22 when used in conjunction with a Tektronix 7000 series oscilloscope.
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ITEM P104
PLUG-IN UNIT, TIME BASE

TYPE OF EQUIPMENT - - - - - Horizontal time base plug-in unit.

FUNCTION PERFORMED- - - - - Provides calibrated sweep rates, continuously variable sweep rates between calibrated steps, used as an independent time base, or as a delayed sweep unit with a companion delaying time base unit. This is a plug-in unit and must be used in conjunction with a compatible oscilloscope.

SPECIFICATIONS

Sweep generator

Calibrated sweep rates- - - - - 5 s/div to 10 ns/div in 27 steps.

Continuously variable uncalibrated sweep rate- 2.5 times the calibrated sweep rate setting.

Sweep accuracy (over center 8 div)

5 s/div to 1 s/div- - - - - 4 percent.

0.5 s/div to 0.1 μ s/div - - - - - 1.5 percent.

50 ns/div to 10 ns/div- - - - - 2.5 percent.

Sweep length- - - - - At least 10.2 divisions.

Trigger holdoff time (minimum setting)

5 s/div to 1 μ s/div - - - - - 2 times TIME/DIV setting.

0.5 μ s/div to 10 ns/div - - - - - 2 μ s.

Triggering- - - - - Auto, Norm, and single sweep modes.

AC coupling

Triggering frequency range- - - - - 30 Hz to 50 MHz.

Minimum triggering signal - - - - - Internal 0.3 div, external 50 mV.

Triggering frequency range- - - - - 50 to 400 MHz.

Minimum triggering signal - - - - - Internal 1.5 div, external 250 mV.

AC LF REJ coupling

Triggering frequency range- - - - - 30 kHz to 50 MHz.

Minimum triggering signal - - - - - Internal 0.3 div, external 50 mV.

Triggering frequency range- - - - - 50 to 400 MHz.

Minimum triggering signal - - - - - Internal 1.5 div, external 250 mV.

AC HF REJ coupling

Triggering frequency range- - - - - 30 Hz to 50 kHz.

Minimum triggering signal - - - - - Internal 0.3 div, external 50 mV.

Dc coupling

Triggering frequency range- - - - - DC to 50 MHz.

Minimum triggering signal - - - - - Internal 0.3 div, external 50 mV.

Triggering frequency range- - - - - 50 to 400 MHz.

Minimum triggering signal - - - - - Internal 1.5 div, external 250 mV.

Internal trigger jitter - - - - - 0.1 ns at 400 MHz.

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ITEM P104 - Continued

External trigger input	
Maximum input voltage - - - - -	250 V (dc plus peak ac).
Input R and C - - - - -	1 megohm \pm 5 percent, 20 pF \pm 10 percent.
Level range (1 kHz sine wave)	
EXT \times 1 - - - - -	At least + and -1.5 V.
EXT \times 10- - - - -	At least + and -15 V.
Triggering- - - - -	P-P Auto mode.
AC or DC coupling	
Triggering frequency range- - - - -	200 Hz to 50 MHz.
Minimum triggering signal - - - - -	Internal 0.5 div, external 135 mV.
Triggering frequency range- - - - -	50 to 400 MHz.
Minimum triggering signal - - - - -	Internal 1.5 div, external 375 mV.
Low Frequency response	
Triggering frequency range- - - - -	At least 50 Hz.
Minimum triggering signal - - - - -	Internal 2 div, external 500 mV.
EQUIPMENT MEETING ALL SPECIFICATIONS	
Manufacturer- - - - -	Tektronix model 7B80 when used in conjunction with a Tektronix 7000 series oscilloscope.

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ITEM PI05 - Continued

AC HF REJ coupling	
Triggering frequency range- - - - -	30 Hz to 50 kHz.
Minimum triggering signal - - - - -	Internal 0.5 div, external 100 mV.
DC coupling	
Triggering frequency range- - - - -	DC to 20 MHz.
Minimum triggering signal - - - - -	Internal 0.5 div, external 100 mV.
Triggering frequency range- - - - -	20 to 500 MHz.
Minimum triggering signal - - - - -	Internal 1.0 div, external 500 mV.
AC, AC LF REJ, or DC coupling - - - - -	
Triggering frequency range- - - - -	HF SYNC mode.
Minimum triggering signal - - - - -	100 to 500 MHz.
	Internal 0.5 div, external 100 mV.
External trigger input	
Maximum input voltage, 1 megohm input - - - - -	250 V (dc + peak ac).
Maximum input voltage, 50 ohm input - - - - -	1 watt average (7 V rms).
Level range, EXT- - - - -	At least + and -3.5 V.
Level range, EXT \div 10 - - - - -	At least + and -35 V.
R and C, 1 megohm input - - - - -	1 megohm \pm 5 percent, 20 pF \pm 10 percent.
Resistance, 50 ohm input- - - - -	50 ohm \pm 7 percent.
Trigger jitter (internal or external) - - - - -	50 ps at 400 MHz.
Delay triggering	
AC coupling	
Triggering frequency range- - - - -	30 Hz to 20 MHz.
Minimum triggering signal - - - - -	Internal 0.5 div, external 100 mV.
Triggering frequency range- - - - -	20 to 500 MHz.
Minimum triggering signal - - - - -	Internal 1.0 div, external 500 mV.
DC coupling	
Triggering frequency range- - - - -	DC to 20 MHz.
Minimum triggering signal - - - - -	Internal 0.5 div, external 100 mV.
Triggering frequency range- - - - -	20 to 500 MHz.
Minimum triggering signal - - - - -	Internal 1.0 div, external 500 mV.
External trigger input	
Maximum input voltage, 1 megohm input - - - - -	250 V (dc + peak ac).
Maximum input voltage, 50 ohm input - - - - -	1 watt average (7 V rms).
Level range, EXT- - - - -	At least + and -3.5 V.
R and C, 1 megohm input - - - - -	1 megohm \pm 5 percent, 20 pF \pm 10 percent.
Resistance, 50 ohm input- - - - -	50 ohms \pm 7 percent.
EQUIPMENT MEETING ALL SPECIFICATIONS	
Manufacturer- - - - -	Tektronix model 7B92A when used in conjunction with Tektronix 7800 and 7900 series oscilloscopes.

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POWER SOURCE, AC

TYPE OF EQUIPMENT - - - - -	3 phase AC power source.
FUNCTION PERFORMED- - - - -	A variable frequency, variable voltage, single or three phase, ac power source.
SPECIFICATIONS	
Waveform- - - - -	Sinewave.
Output voltages - - - - -	0 to 130 V ac and 0 to 260 V ac.
Output currents - - - - -	10 Amps per leg at 0 to 130 V ac. 5 Amps per leg at 0 to 260 V ac.
Output peak current - - - - -	20 Amps per leg at crest of sinewave for driving peak type loads such as dc power supplies.
Fixed frequencies - - - - -	50, 60, and 400 Hz.
Accuracy- - - - -	+0.25 percent.
Stability - - - - -	+0.1 percent.
Variable frequencies- - - - -	47 to 500 Hz.
Accuracy- - - - -	+2 percent.
Stability - - - - -	+0.1 percent.
Power factor- - - - -	+70 percent full power output.
Efficiency- - - - -	65 percent at maximum undistorted output.
Total output power- - - - -	4 kVA.
Output distortion - - - - -	0.75 percent maximum.
Output modulation - - - - -	0.25 percent maximum.
Line regulation - - - - -	0.1 percent maximum.
Load regulation - - - - -	2 percent.
DC offset - - - - -	10 mV dc maximum.
Response time - - - - -	50 μ s.
Isolation - - - - -	Floating output, any output may be grounded.
Output protection - - - - -	Electronic current limiting with auto-reset.
Temperature range - - - - -	0°C to -55°C.
Input voltage - - - - -	120/208 V ac, 3 phase, 60 Hz, 6 kVA.
EQUIPMENT MEETING ALL SPECIFICATIONS	
Manufacturer- - - - -	Pacific Power Source Model 330 JBT.

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ITEM R07

OHMMETER

TYPE OF EQUIPMENT - - - - - Ohmmeter.

FUNCTION PERFORMED- - - - - Accurate measurement of resistance.

SPECIFICATIONS

Range - - - - - Resistance measurements from 0.1 Ω to 10 M Ω
with the following ranges:

1.0 k Ω full scale \pm 20 percent over-range.
 10.0 k Ω full scale \pm 20 percent over-range.
 100.0 k Ω full scale \pm 20 percent over-range.
 1,000.0 k Ω full scale \pm 20 percent over-range.
 10,000.0 k Ω full scale.

Measurement current - - - - - 10/R (full scale) amperes for all ranges
except the 1 k Ω and 1 M Ω ranges which are 1/R
(full scale) amperes.

Accuracy

1 to 100 k Ω - - - - - \pm (0.05 percent of reading \pm 0.02 percent full
scale).1 M Ω - - - - - \pm (0.10 percent of reading \pm 0.03 percent full
scale).10 M Ω - - - - - \pm (0.20 percent of reading \pm 0.05 percent full
scale).

Temperature coefficient

1 k Ω to 1M Ω - - - - - \pm 0.005 percent of reading \pm 0.0015 percent of
full scale/ $^{\circ}$ C.10 M Ω - - - - - \pm 0.005 percent of reading \pm 0.005 percent of
full scale/ $^{\circ}$ C.

EQUIPMENT MEETING ALL SPECIFICATIONS

Manufacturer- - - - - Fairchild Model 7000 Digital multimeter with
option 03 plug-in board.EQUIPMENT MEETING SPECIFICATIONS
WITH EXCEPTIONS AS NOTED

Manufacturer- - - - - Fairchild Model 7100A digital voltmeter.
 Exception - - - - - Does not have 1.0 k Ω full scale range.
 Manufacturer- - - - - Fluke Model 8600A digital multimeter.
 Exceptions- - - - - Measurement current - 1/R (full scale)
 amperes for all ranges. Accuracy of 1 k Ω
 range - \pm (0.1 percent of reading \pm 0.005
 percent of range).

ITEM S03

WATTMETER, TRUE RMS

TYPE OF EQUIPMENT - - - - -	True rms volt-amp wattmeter.
FUNCTION PERFORMED- - - - -	Single phase true rms measurements of voltage, current, and power.
SPECIFICATIONS	
Voltage - - - - -	1.6 to 1000 V (3 ranges).
Frequency range - - - - -	Dc to 300 kHz.
Accuracy	
dc to 30 Hz - - - - -	±(0.6 percent full scale plus 0.4 percent reading).
30 Hz to 100 kHz- - - - -	±(0.4 percent full scale plus 0.2 percent reading).
100 to 300 kHz- - - - -	±(0.6 percent full scale plus 0.6 percent reading).
Input impedance	
20, 200 and 1000 V ranges - - -	5 megohms/6 pF.
Current - - - - -	400 μ A to 7.5 A (4 ranges).
Frequency range - - - - -	DC to 300 kHz (except 5A scale specified to 200 kHz only).
Accuracy	
dc to 30 Hz - - - - -	±(0.6 percent full scale plus 0.4 percent reading).
30 Hz to 100 kHz- - - - -	±(0.4 percent full scale plus 0.2 percent reading).
100 to 300 kHz (except- - - - - 5A range specified to 200 kHz only).	±(0.6 percent full scale plus 0.6 percent reading).
Input impedance	
5 mA range- - - - -	20 ohms.
50 mA range- - - - -	2 ohms.
500 mA range- - - - -	0.33 ohm.
5 A range - - - - -	0.28 ohm.
Power - - - - -	10 mW to 5000 watts (12 ranges plus the power X10 scale).
Accuracy	
(1) Power factor = Power/input volts x input amps (V.A.) \geq 50 percent.	
(a) Input V.A./I range X V range = < 1.5.	
dc to 30 Hz - - - - -	±(0.6 percent full scale plus 0.4 percent V.A.).
30 Hz to 50 kHz - - - - -	±(0.4 percent full scale plus 0.2 percent V.A.).
50 to 100 kHz - - - - -	±(0.6 percent full scale plus 0.6 percent V.A.).
(b) Input V.A./I range x V range = 1.5 to 2.5.	
dc to 30 Hz - - - - -	±(1.0 percent V.A.).
30 Hz to 50 kHz - - - - -	±(0.6 percent V.A.).
50 to 100 kHz - - - - -	±(1.0 percent V.A.).
(2) Power factor = Power/input volts x input amps (V.A.) = < 50 percent.	
(a) Input V.A./I range x V range = < 1.5.	
30 Hz to 25 kHz - - - - -	±(0.4 percent full scale plus 0.2 percent V.A.).
25 to 50 kHz- - - - -	±(0.5 percent full scale plus 0.5 percent V.A.).
50 to 100 kHz - - - - -	±(0.7 percent full scale plus 0.8 percent V.A.).

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ITEM S03 - Continued

(b) Input V.A./I range x V range = 1.5 to 2.5.

30 Hz to 25 kHz - - - - -	±(0.6 percent V.A.).
25 to 50 kHz - - - - -	±(1.0 percent V.A.).
50 to 100 kHz - - - - -	±(1.5 percent V.A.).

Power Factor

Frequency range - - - - -	30 Hz to 25 kHz.
Accuracy - - - - -	±3 percent full scale.

EQUIPMENT MEETING ALL SPECIFICATIONS

Manufacturer - - - - -	Clarke-hess model 255.
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ITEM TC01

THERMOCOUPLE WITH INDICATOR

TYPE OF EQUIPMENT - - - - -	Thermocouple with digital indicator.
FUNCTION PERFORMED- - - - -	Measures difference in temperatures.
SPECIFICATIONS	
Thermocouple type - - - - -	Copper-constantan.
Measurement range - - - - -	-200°C to +400°C.
Resolution- - - - -	±1°C.
Accuracy- - - - -	±1°C.
Stability with temperature	
Cold junction - - - - -	0.5 degrees/degree.
Instrument zero - - - - -	1 μV/°C.
Instrument span - - - - -	0.01 percent of reading/°C.
Stability with time	
Instrument zero - - - - -	No measureable zero drift.
Instrument span - - - - -	2°C/year.
Repeatability - - - - -	±1 digit.
Measurement time- - - - -	1.5 s maximum.
Common mode noise rejection - - - - -	120 dB from 58 to 62 Hz.
Normal mode noise rejection - - - - -	60 dB from 58 to 62 Hz.
Ambient operating temperature - - - - -	0°C to 50°C.
Ambient humidity- - - - -	0 to 70 percent (0°C to 50°C).
Power requirements- - - - -	100 to 125 V ac/190 to 250 V ac, 48 to 62 Hz.
EQUIPMENT MEETING ALL SPECIFICATIONS	
Manufacturer- - - - -	Doric model 400A with copper constantan type thermocouple.

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ITEM Y07

PROBE, FET DIFFERENTIAL

TYPE OF EQUIPMENT - - - - -	Fet differential probe.
FUNCTION PERFORMED- - - - -	High common-mode rejection ratios are provided at high frequencies by performing the common-mode rejection within the probe body, minimizing the measurement errors caused by difference in probes, cable lengths, and input attenuators.
Common-mode rejection ratio - - - - -	With deflection factors of 1 mV/div to 20 mV/div. 10,000:1 minimum at 50 kHz. 5,000:1 minimum at 1 MHz. 1,000:1 minimum at 50 MHz.
Common-mode linear dynamic range- - - - -	±5 V, ±50 V with 10X attenuator.
Bandwidth - - - - -	DC to 100 MHz (-3dB).
Deflection factor range- - - - -	1 mV/div to 200 mV/div in 8 calibrated steps, 1-2-5 sequence, accurate within 3 percent (with an oscilloscope deflection of 10 mV/div).
Input RC- - - - -	1 megohm paralleled by 10 pF of less.
Input coupling- - - - -	AC or DC.
Low frequency response, ac-coupled- - - - -	-3 dB at 20 Hz, 2 Hz with 10X attenuator.
Displayed noise - - - - -	280 μV or less.
Maximum input voltage - - - - -	±25 V (dc + peak ac), 250 V with 10X attenuator.
Output impedance- - - - -	50 ohm.
Amplifier power requirements- - - - -	10 W maximum, 48 to 400 Hz, 105 to 125 V.
EQUIPMENT MEETING ALL SPECIFICATIONS	
Manufacturer - - - - -	Tektronix model P6046.

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