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 SUPERSEDE THE PAGES LISTED:

NEW PAGE	DATE	SUPERSEDED PAGE	DATE
5	1 May 1984	5	16 January 1984
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TC01-1	1 May 1984		
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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.

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Preparing activity:
Navy - EC

(Project 5963-0029)

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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 ±2 percent.
Bandwidth	To 400 MHz, dependent on plug-in.
Difference between compartments	±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.
Horizonal system	Two righthand compartments.
Modes of operation	A, ALT, CHOP, B.
Chopped mode rep rate	200 kHz ±20 percent.
Bandwidth	DC to 1 MHz.
Difference between compartments	±1 percent.
Fastest calibrated sweep rate	1 ns/division.
Phase shift between vertical and horizonal 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)	±1 percent.
Repetition rate	1 kHz ±0.25 percent.
Duty factor	50 ±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 ±1 V.
Output voltage, rate of rise	
Into 50 ohms	50 mV/unit of time selected by time-base unit, time/div switch ±15 percent; 100 ns/div maximum.
Into 1 megohm	1 V/unit of time selected by time-base unit, time/div switch ±10 percent; 1 µs/div maximum.
Output resistance	≈ 950 ohms.
Gate out	
Source	Either of the horizontal time-base units.

ITEM D08 - Continued

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 persistance, fast bistable, and fast variable presistance (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 presistence	
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/µs (0.027 cm/µs).
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/µs (2,500 cm/µs).
View time	30 s.
Erase time	1.4 s.
Fast bistable	
Writing speed	776 div/µs (350 cm/µs).
View time	30 minutes.
Erase time	1.4 s.
Variable persistence	
Writing speed	12 div/µs (5.4 cm/µs).
View time	30 s.
Erase time	0.9 s.
Bistable	
Writing speed	0.2 div/µs (0.09 cm/µs).
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 µA) 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 µs 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 µs.
Fall time	1 µs.
Minimum pulse width	50 ns at 50 percent amplitude.
Input resistance	Greater than 15 kilohms from -0.6 to 5 V input.
Input capacitance	≤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 µs maximum.
Minimum pulse width	1 ms at 50 percent amplitude.
Input resistance	Greater than 27 kilohms.
Input capacitance	≲ 100 pF.
Open circuit voltage	
Nonstore mode	0V.
Store mode	5.6 V.
Maximum input voltage	+ or -15 V (dc plus peak ac).

ITEM D08 - Continued

Remote save 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 comsumption- - - - - - -	215 watts.

EQUIPMENT MEETING ALL SPECIFICATIONS

Manufacturer - - - - - - - - - - - - - -	Tektronix model 7834.

ITEM EL01

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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ITEM 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.

ITEM EL03

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.

ITEM EL04

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 μs/A or 50 μs 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.

ITEM 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.

ITEM 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 OUT 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

Defection factor	
Calibrated range	10 µV/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 µV/div to 10 mV/div	±1 V.
20 µV/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 µV/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 µV/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 µV/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 µV/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 µV/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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Maximum input voltage, ac coupled	±500 V, each input.
Input dc rejection, ac coupled	400,000:1.
Input R and C	1 megohm ±1 percent, 47 pF.
R and C product	±1 percent between all deflections.
Displayed noise	16 µV 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.

ITEM PI04

PLUG-IN UNIT, TIME BASE

TYPE OF EQUIPMENT - - - - - - - - - - - - - - - - -	Horizontal time base plug-in unit.
FUNCTION PERFORMED- - - - - - - - - - - - - - - - -	Provides calibrated sweep rates, continuously varible 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 varible 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 µs/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 µs/div - - - - - - - - - - - -	2 times TIME/DIV setting.
0.5 µs/div to 10 ns/div - - - - - - - - - -	2 µs.
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.

ITEM PI04 - Continued

External trigger input	
Maximum input voltage	250 V (dc plus peak ac).
Input R and C	1 megohm ±5 percent, 20 pF ±10 percent.
Level range (1 kHz sine wave)	
EXT ÷ 1	At least + and -1.5 V.
EXT ÷ 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 7880 when used in conjunction with a Tektronix 7000 series oscilloscope.

ITEM PI05

PLUG-IN UNIT, TIME BASE

TYPE OF EQUIPMENT - - - - - - - - - - - - - - - -	Dual time base plug-in unit.
FUNCTION PERFORMED- - - - - - - - - - - - - - - -	Provides normal, delayed, intensified, and alternate sweep operations when used in conjunction with a compatible oscilloscope.
SPECIFICATIONS	
Delaying sweep (main sweep) - - - - - - - - - -	NORMAL, ALT (delayed sweep trace), and DLY'D SWEEP.
Calibrated sweep rates- - - - - - - - - - - -	0.2 s/div to 0.5 ns/div in 27 steps in a 1-2-5 sequence.
Continuously varible uncaled sweep rate - - -	Extends sweep rate to at least 0.5s.
Sweep accuracy (over center 8 div)	
0.2 s/div to 20 ns/div- - - - - - - - - - -	2 percent.
10 ns/div to 5 ns/div - - - - - - - - - - -	3 percent.
2 ns/div to 1 ns/div- - - - - - - - - - - -	4 percent.
0.5 ns/div- - - - - - - - - - - - - - - - -	5 percent.
Sweep accuracy (over any 2 div portion within center 8 div)	
0.2 s/div to 10 ns/div- - - - - - - - - - -	5 percent.
5 ns/div to 0.5 ns/div- - - - - - - - - - -	10 percent.
Intensified sweep - - - - - - - - - - - - - - -	ALT (delaying sweep trace).
Calibrated sweep rates- - - - - - - - - - - -	0.2 s/div to 10 ns/div in 23 steps in a 1-2-5 sequence.
Continuously varible uncaled sweep rate - - -	Extends sweep rate to at least 0.5s.
Sweep accuracy (over center 8 div)	
0.2 s/div to 20 ns/div- - - - - - - - - - -	2 percent.
10 ns/div - - - - - - - - - - - - - - - - -	3 percent.
Sweep accuracy (over any 2 div portion within center 8 div)	
0.2 s/div to 10 ns/div- - - - - - - - - - -	5 percent.
Varible time delay	
Delay time range- - - - - - - - - - - - - - -	0 to 9.6s.
Delay time accuracy (0.2 s/div to 1 µs/div) -	±0.75 percent measurement plus 0.5 percent full scale ±5 ns.
(50 ns/div to 10 ns/div)-	±1 percent measurement plus 1 percent full scale ±5 ns.
Delay time jitter - - - - - - - - - - - - - -	10 times the TIME/DIV or DLY TIME switch setting ±0.5 ns.
Main triggering - - - - - - - - - - - - - - - -	Auto, Norm, or single sweep modes.
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.
AC LF REJ coupling	
Triggering frequency range- - - - - - - - -	30 kHz to 20 MHz.
Minimum triggering signal - - - - - - - -	Internal 0.5 div, external 100 mV.
Tiggering frequency range- - - - - - - - - -	20 to 500 MHz.
Minimum triggering signal - - - - - - - -	Internal 1.0 div, external 500 mV.

ITEM PIO5 - 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 - - - - - - - - -	HF SYNC mode.
Triggering frequency range- - - - - - - - - -	100 to 500 MHz.
Minimum triggering signal - - - - - - - - -	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 ÷ 10 - - - - - - - - - - - - -	At least + and -35 V.
R and C, 1 megohm input - - - - - - - - - - -	1 megohm ±5 percent, 20 pF ±10 percent.
Resistance, 50 ohm input- - - - - - - - - - -	50 ohm ±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 tigger 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 ±5 percent, 20 pF ±10 percent.
Resistance, 50 ohm input- - - - - - - - - - -	50 ohms ±7 percent.

EQUIPMENT MEETING ALL SPECIFICATIONS

Manufacturer- - - - - - - - - - - - - - - - - - -	Tektronix model 7B92A when used in conjunction with Tektronix 7800 and 7900 series oscilloscopes.

ITEM 002

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 µs.
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.

ITEM R07

OHMMETER

TYPE OF EQUIPMENT	Ohmmeter.
FUNCTION PERFORMED	Accurate measurement of resistance.
SPECIFICATIONS	
Range	Resistance measurements from 0.1Ω to 10 MΩ with the following ranges: 1.0 kΩ full scale +20 percent over-range. 10.0 kΩ full scale +20 percent over-range. 100.0 kΩ full scale +20 percent over-range. 1,000.0 kΩ full scale +20 percent over-range. 10,000.0 kΩ full scale.
Measurement current	*10/R (full) scale) amperes for all ranges* except the 1 kΩ and 1 MΩ ranges which are 1/R (full scale) amperes.
Accuracy	
1 to 100 kΩ	±(0.05 percent of reading +0.02 percent full scale).
1 MΩ	±(0.10 percent of reading +0.03 percent full scale).
10 MΩ	±(0.20 percent of reading +0.05 percent full scale).
Temperature coefficient	
1 kΩ to 1MΩ	±0.005 percent of reading ±0.0015 percent of full scale/°C.
10 MΩ	+0.005 percent of reading +0.005 percent of full scale/°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 kΩ full scale range.
Manufacturer	Fluke Model 8600A digital multimeter.
Exceptions	Measurement current - 1/R (full scale) amperes for all ranges. Accuracy of 1 kΩ range - ±(0.1 percent of reading +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 μA 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.) ≥ 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.).

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.

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.

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).
Defection factor range	1 mV/div to 200 mV/div in 8 calibrated steps, 1-2-5 sequence, accurate within 3 percent (with an oscilloscope defection 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	
Manufacaturer	Tektronix model P6046.

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