Model 5710
DC Power Supply Test System

NH Research

Engineering Characterization & Design Verification Functional Test

Features

- Tektronix MDO-Series Mixed Signal Oscilloscope
- Unlimited voltage, current & timing measurements relative to digital signals.
- Library of design verification test routines reduces program development time
- Configuration flexibility

Applications

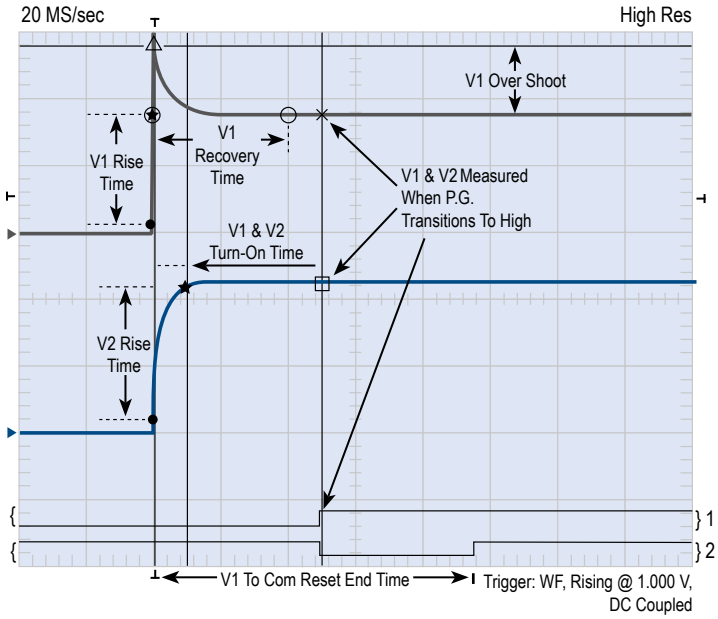
The Model 5710 is designed to yield comprehensive test data on a wide range of AC-DC and DC-DC power supplies with a minimum of programming effort. Such characterization testing is typically done in an engineering design-verification laboratory where the user's own designs or vendor prototypes are evaluated. This type of extensive testing is also often required for high-reliability power supplies used in medical, telecommunication, space and avionic applications.

PowerScope High-Speed Digitizer

The Model 5710 embeds a mixed-signal Tektronix MDO-Series oscilloscope as the system digitizer with three channels each of which can sample up to a 2.5 GSPS rate. The digitizing function is further extended by paring two of the channels with a 16-channel multiplexer thus allowing automated selection and measurement of different measurement points. When more than 17 inputs are required, multiple 15-input extension chassis may be added to the system further increasing the multiplexing capability.

With a full 100 MHz of bandwidth, the primary multiplexing channel as well as the third fixed input channel precisely captures and digitizes fast moving signals. The second multiplexing channel supports 10 MHz bandwidth making it ideal for measuring DC and other slower moving signals. In mixed signal applications, a 16-input digital input captures digital signals along with analog measurements. All of the above measurements are synchronously captured, which provides complex analog-analog or analog-digital timing analysis. Finally, a 10 Mega-sample memory depth easily captures non-repetitive transients as well as digital states even when they occur with a relatively long separation from the trigger event.

***Model 5710** in a 3-bay cabinet*



Unlimited cursors and markers identify the exact point where the measurement is to be taken.

Design Verification Test Routines

To complement the powerful digital measurement system, a special suite of test routines are provided to determine power supply performance characteristics far beyond that available on a basic production tester. For instance, more than 20 different measurements can be extracted from each waveform capture and channel-to-channel measurements are all straight forward to execute. One example of this capability is sweep tests where one parameter, such as efficiency, is plotted across the full range of another parameter like output voltage or power. This test can now be programmed and executed in minutes rather than the hours and days required by previous generation test systems.

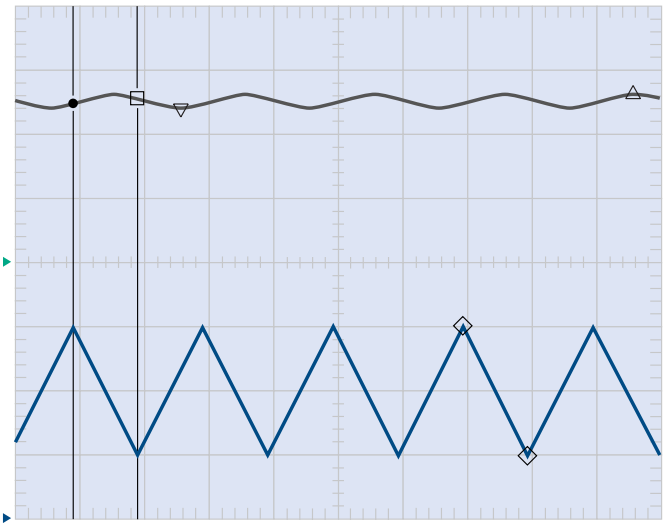
MODEL 5710 EMPOWER TEST CAPABILITY	
General Tests	Output Accuracy Output Adjustment Output Trim RMS Noise/Ripple Operator Data Entry, Test, Visual Acceptance & Instructions Power Fail Signal Power Good Signal P/ S ON Signal Operator Waveform Inspection Multi-Measure Monotonicity Shock/ Shake Test
Regulation Tests	Load Regulation Cross-Load Regulation Voltage Regulation Current Regulation Power Regulation
Protection Tests	Over-Current Ramp Protection High Accuracy Over-Current Slew Protection Over-Voltage Protection (no scope required) Under-Voltage Protection High Accuracy Over-Power Slew Protection Over-Power Protection Short-Circuit Protection (up to 100A) Over-Temperature (via relay control)
Dynamic Tests	Single Load Transient Synchronized Multi-Output Load Transient Worst-Case Dynamic Transient (Frequency & Duty Cycle) Overshoot Undershoot Settle/ Recovery Voltage Settle/ Recovery Time
Timing Tests	Rise-Time Fall Time Turn-On Time Turn-On Sequence (load-to-load timing) Turn-Off Time Turn-Off Sequence (load-to-load timing) Hold-Up Time Transient Recovery Time Overshoot Width Undershoot Width Pulsewidth as Time Pulsewidth as Frequency Multiple-Timing (Unlimited-Cursors)
Control	Single Digital Control BYTE/WORD Digital Control OVP (OverVoltage) Driver OTP (OverTemperature) Driver Start/ Stop/ Pass/ Fail/ Busy/ Ready Controls 8 Measurement Channels Control for Vout & ID Outputs
Output Measurement	Voltage Current Power Digital State DC Positive Peak DC Negative Peak Voltage & Current Waveform Capture and Analysis Frequency Mean RMS AC Coupled RMS DC Coupled Peak Max Peak Min Peak-Peak Peak Absolute Time at Event Timing as Frequency Measurement at Event
Real Time (Manual Control)	Interactive Real-Time Hardware Control Step-by-step Interactive Test Program Break Point for Fixture & UUT Debug

Test Report Examples

Triangular Current Waveform Measurements

Vout Max	4.700 V	5.155 V	5.300 V	Pass
Vout Min	4.700 V	4.747 V	5.300 V	Pass
Iout Max	2.950 A	3.030 A	3.050 A	Pass
Iout Min	950.000 mA	1.016 A	1.050 A	Pass
Vout @ 1st Iout Max	4.700 V	4.851 V	5.300 V	Pass
Vout @ 1st Iout Min	4.700 V	5.062 V	5.300 V	Pass
Iout Frequency	495.000 Hz	497.512 Hz	505.000 Hz	Pass

50 KS/sec



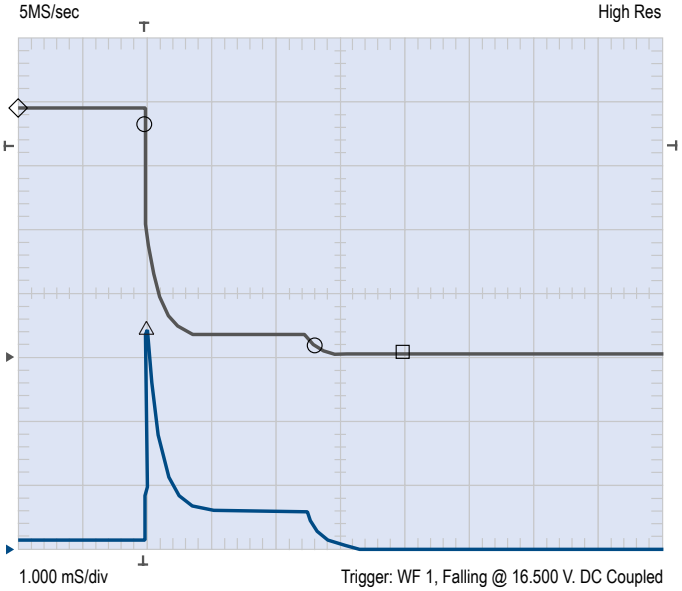
1.000 mS/div Trigger: System Trigger

Wf1, (Current): 1 A/div, 0.0A @ -4 Div. Wf2, (Voltage): 2 V/div, 0.0V @ 0 Div.
Vout Max: Max = △ WF2: Voltage @ 9.560 mS, 5.155 V
Vout Min: Min = ▽ WF2: Voltage @ 2.560 mS, 4.747 V
Iout Max: Max = ◇ WF1: Current @ 6.940 mS 3.030 A
Iout Min: Min = ◇ WF1: Current @ 7.940 mS 1.016 A
Vout @ 1st Iout Max: Min = • WF1: Current @ 900.000 uS, 4.851 V
Vout @ 1st Iout Min: Max = □ WF1: Current @1.900 mS, 5.062 V

Short-Circuit Test

UUT Short-Circuit Response Time	0.000 S	2.592 mS	4.000 mS	Pass
Max Short-Circuit Current	3.340 A	69.034 A	75.000 A	Pass
Vout Before Short-Circuit	18.525 V	19.348 V	20.475 V	Pass
Vout 4mS After Short Circuit	0.000 V	100.637 mV	1.000 V	Pass

5MS/sec High Res



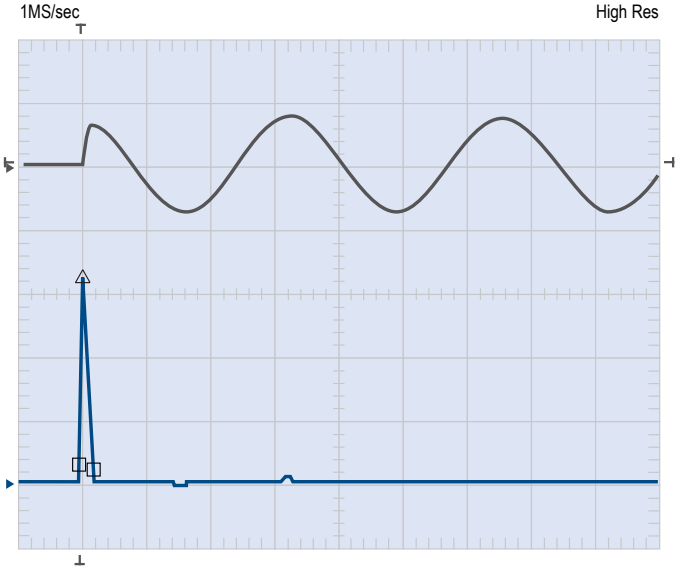
1.000 mS/div Trigger: WF 1, Falling @ 16.500 V. DC Coupled

Wf1, Chn 001, 5V/div. Wf2, Chn 002, 20 A/div.
UUT Short-Circuit Response Time: Start = ○ WF1: Chn 001 @ 1.996 mS. 18.412 V:
Stop = ○ WF1: Chn 001 @ 4.589 mS. 0.971 V
Max Short-Circuit Current: Max = △ WF2: Chn 002 @ 2.020 mS, 69.034 A
Vout Before Short-Circuit: Mean = ◇ WF1: Chn 001 @ 0.000 S, 19.348 V
Vout 4mS After Short-Circuit: Event = □ WF1: Chn 001 @ 6.000 mS, 100.637 mV

Inrush Waveform Measurement

Inrush Current	40.000 A	65.071 A	76.000 A	Pass
Inrush Current Width	500.000 uS	741.000 uS	2.000 mS	Pass
Vin	262.000 V	263.682 V	266.000 V	Pass
Vin Frequency	59.000 Hz	60.588 Hz	61.000 Hz	Pass

1MS/sec High Res



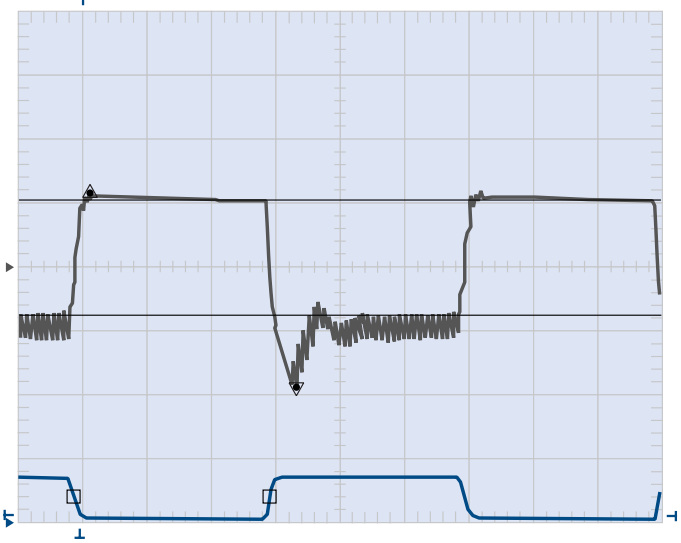
5.000 mS/div Trigger: WF 3. Rising @ 30.012 V. DC Coupled

Wf1, Chn 003, 20A/div. Wf3, Fixed, 500 V/div.
Inrush Current: Max = △ WF1: Chn 005 @ 5.201 mS. 65.071 A
Inrush Current Width: Start = □ WF1: Chn 003 @ 4.925 mS. 6.762 A: Stop = □
WF1: Chn 003 @ 5.666 mS. 5.505 A

Dynamic Test

Vout Max	0.000 V	239.784 mV	500.000 mV	Pass
Vout High	0.000 V	209.241 mV	500.000 mV	Pass
Vout Min	0.000 V	-371.088 mV	-500.000 mV	Pass
Vout Low	0.000 V	-151.174 mV	-500.000 mV	Pass
Vout Overshoot	0.000 V	31.410 mV	500.000 mV	Pass
Vout Undershoot	0.000 V	145.136 mV	500.000 mV	Pass
Iout Pulse Width	585.000 uS	603.800 uS	615.000 uS	Pass
Iout Frequency	1.650 KHz	1.656 KHz	1.690 KHz	Pass

5 MS/sec High Res



200.000 uS/div Trigger: WF2, Falling @ 500.000 mA DC Coupled

Wf1, Chn 001, 200 mV/div, AC. Wf2, Chn 002, 5 A/div.
Vout Max: Max = △ WF1: Chn 001 @ 222.400 uS, 239.784 mV
Vout High: High = WF1: Chn 001 @ 0.000 S, 209.241 mV
Vout Min: Min = ▽ WF1: Chn 001 @ 866.800 uS, -371.088 mV
Vout Low: Low = WF1: Chn 001 @ 0.000 S, -151.174 mV
Vout Overshoot: Max = • WF1: Chn 001 @ 222.400 uS, 239.784 mV
Vout Undershoot Min = • WF1: Chn 001 @ 866.800 uS, -371.088 mV
Iout Pulse Width: Start = □ WF2: Chn 002 @ 184.000 uS, 1.840 A; Stop = □ WF2: Chn 002 @ 787.800 uS, 1.848 A

Model 5710 Power Supply Test System Specifications

SYSTEM CONTROL	
Rack Server CPU	≥ 3.3GHz Intel processor
Memory	4 GB
Hard Drive	≥ 500GB
Monitor	17" Flat Panel
Accessories	Mouse & Keyboard

SOFTWARE	
Operating System	Windows 10
Test Executive	emPower - An integrated environment for creating, debugging, running and collecting data for power supply functional test. Includes a test routine library, report generator and interactive instrument panels. Fully network compatible
Custom Test Program Languages	To extend the user-modifiable test routine library written in Visual Basic, test programs can also be written in any language supporting MS Active X control interface, including LabVIEW and LabWindows CVI

PHYSICAL	
Connectors	Terminal blocks or Hypertronics
Cabinet Dimensions HWD	72 x 28 x 35in 1829 x 712 x 889mm
Cabinet Weight	~750 lbs/cabinet
Operating Temp.	0 -35° C full power
Input Power	All US and Intl. standards available

MEASUREMENTS

Basic Digital Measurement Capability	Range	Resolution	Accuracy
Channels	2		
Resolution	16 Bit		
Sample Rate	100KS/Sec		
DC Volts	2, 20, 200, 500	0.003% FS	0.01% + 0.01% FS
AC Volts RMS	14, 140 350VRMS	0.004% FS	0.1% R + 0.065% FS
DC Volts Peak	20, 200, 500V	0.012% FS	1% R + 0.02% FS
RMS Noise	70mV, 350 mV, 3.5V	0.012% FS	1% R + 0.14 % FS
10 Hz - 1 MHz			
Pk-to-Pk Noise	100mV, 500mV, 5V	0.02% FS	1.0% R + 1.0% FS
5 KHz - 100 MHz			
Frequency [1]	10Hz to 5MHz	1/100ns	0.016% R @ ≤ 500Hz
Timing	0 to 7 minutes	100ns	0.02% R + 200nsec
Waveform Capture	DC to 100 MHz	0.003%	1% FS
Phase Angle [1]	0° to 360°	1°	0.5° @ 50/60Hz
THD (2 - 64th) [1]	0 to 100%	0.01%	1% R

High-Frequency Measurement Digitizer	
Scope Family	Tektronix MDO Series
Channels	3 Analog + 16 Digital
Resolution	8-Bit
Sample Rate	2.5GS/sec Maximum
Memory Depth	10 Mega-samples
Channel 1	
Connection	Multiplexer Output 1
Bandwidth	100Mhz
Channel 2	
Connection	Multiplexer Output 2
Bandwidth	10Mhz
Channel 3	
Connection	Fixed Input
Bandwidth	100Mhz
Channel 4	
Connection	System Trigger

I/O Module (Expandable to 8)	
Multiplexer	
Input Channels	16, differential
Output Channels	2, differential
Bandwidth (-3db)	
Output 1	100MHz
Output 2	10MHz
Max Voltage	± 500V
Max Current	100mA
General Purpose Relays	
Quantity	8 DPDT
Contact Rating	5A, 30VDC or 120/240VAC
Relay Drivers	
Quantity	16
Rating	48V @ 500mA
Digital Drivers	
Quantity	16
Rating	100mA, 70VDC, 0.5W
Digital Receivers	
Quantity	8
Input Voltage	± 10V
Accuracy	1%

[1] Measurement derived by *em*power using digitized measurement data.

Configuration Flexibility

A wide variety of source and load instruments as well as third-party, bulk DC sources are available to configure the 5710 system in a single or multiple cabinet form depending on instruments selected. Check with factory for driver availability.

TYPE	AC/DC SOURCES			MODULAR DC SOURCES	MODULAR DC LOADS		FULL CHASSIS OR CABINET LOADS	
Model Number	***5427***	***9420-4***	***9420 (4 Power Sizes)***	***6100 (4 Voltage Models)***	***4312 (3 Power Models)***	***4350 (3 Power Models)***	***4700 (8 Power Sizes)***	***4760 (8 Power Sizes)***
AC Mode								
Voltage	150V/300VRMS	175/350VRMS	175/350VRMS					
Phase	1ø	1ø	1, 2, & 3ø					
Power	2.7kVA	4kW	12, 24, 36, 48kW					
Current	9 & 18ARMS	30ARMS	30, 60, 90, 120A/ø					
Peak Current	90A	90A	90, 180, 270, 360A/ø					
Frequency	40 - 500Hz	30 - 880Hz	30 - 880Hz					
DC Mode								
Voltage	212,424VDC	200/400VDC	200/400VDC	20, 40, 80, 450VDC	120VDC	500VDC	120VDC	600VDC
Power	2kW	4kW	12, 24, 36, 48kW	450W	150, 300, 600W	150, 300, 600W	1, 2, 3, 6, 12, 18, 24, 36kW	1, 2, 3, 6, 12, 18, 24, 36kW
Current	18, 9A	30A	90, 180, 240, 360ADC	60, 30, 15, 8ADC	40, 80, 150A	30, 60, 120A	200 - 7200A	50 - 1800A
Chassis Capability				to 6 sources	to 16 of the 150W loads	to 16 of the 150W loads		

* Request model data sheets for complete specifications.

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