PROGRAMMABLE STIMULUS SYSTEM

HFS 9003 • HFS 9009 • HFS 9DG1 • HFS 9DG2
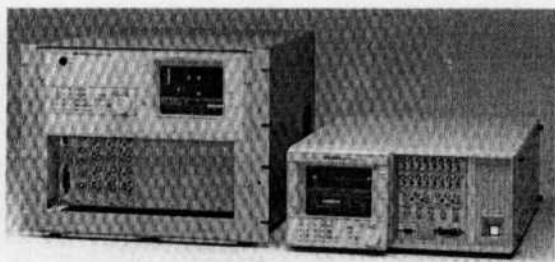
| FEATURES – BENEFITS	APPLICATIONS
HFS 9000 SERIES	Characterize CMOS, ECL, ACL, BiCMOS and GaAs Devices
Complete Stimulus Setup in Just Minutes	Precise Clock Source
Specify Data and Timing on Every Pin	
Up to 630 MHz Repetition Rate	
Fully Digital Implementation	
Multi-channel Architecture – Up to 640 or More Phase-locked Channels	
Independent Edge Placement	
Channel Deskew	
Precision Channel-to-Channel Timing Alignment	
1 ps Timing Resolution	
GPIB (IEEE 488) Programmable	
Modular Construction	
Upgrade Capability	
Maximum Control and Flexibility	
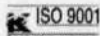
HFS 9000 STIMULUS SYSTEM

When product designs were simple, and time-to-market not so critical, designers could afford the days, or even weeks, necessary to assemble, program, debug and characterize the various elements of a stimulus system and its fixturing. As product design complexity and market pressures have increased, however, designers of high-speed, high-performance circuits simply cannot afford this expenditure in time.

Now there's a solution. With Tektronix HFS 9000 Stimulus Systems we've taken the features of a high-performance pulse generator, made them better and added complete data generation capabilities as well. We've eliminated the need for a switch matrix since we have data and timing on every pin. And the need for a separate power supply is gone, as the HFS 9000 has the ability to produce the DC levels needed to drive logic lines directly. Finally, all these capabilities are present on every pin simultaneously, so you get extremely flexible formatting. Now you can set up a complete stimulus system in minutes, rather than hours or days, and test products more thoroughly throughout the development cycle.

DIGITAL ARCHITECTURE

The HFS 9000 Series products were designed as completely programmable digital instruments rather than being based on traditional mono-stable analog architecture. This allows more capability and flexibility in pulse edge placement without the restrictions that analog instruments commonly impose. Now you can adjust both Delay and Width from 0 to 20 µs over all frequencies.

MODULAR DESIGN

You can build a stimulus system with from 4 to 36 channels in one mainframe, and 640 or more

channels across multiple phase-locked mainframes. Choose from the HFS 9003 mainframe with 3-slot, 12-Channel capability, or the HFS 9009 mainframe with 9-slot, 36-Channel capability. Both systems can include the 4-Channel HFS 9DG1 and HFS 9DG2 Data Time Generator cards in any combination.

All channels are slaved to a common clock, resulting in highly accurate channel-to-channel edge placement. This makes the HFS 9000 ideal for precise characterization and evaluation of synchronous devices having multiple, and possibly interactive, inputs.

FULL CHANNEL DESKEW CAPABILITY

All HFS 9000 channels have independent, wide deskew ranges to allow precise pulse alignment and timing at the device under test (DUT). Deskew compensates for the timing differences caused by cabling and fixturing so your analysis can be focused on the relative timing at the DUT.

1 ps TIMING RESOLUTION

No other system lets you generate whatever combination of signals is required, with data and timing on every pin with 1 ps resolution. Now you can create data buses, clocks, strobes, gated clocks, logic level sources, pseudorandom bits and other stimuli with unequaled accuracy. You can perform setup and hold time margin tests by providing the clock, data, set and reset signals to the DUT. And you can hold inactive signals at programmable high or low logic levels, eliminating the need for external DC voltage sources and microwave switches.

630 MHz REPETITION RATE

Accurate and repeatable AC measurements of prop delay, setup and hold time, and maximum operating frequency (fmax) require fast rep rates and edge speeds. With repetition rates up to 630 MHz, the HFS 9000 is ideal for characterizing the most advanced logic families, and it can be used for testing component compliance with the SONET telecommunications standard. Transition times as fast as 250 ps (20%-80%) enable repeatable and accurate testing of the highest-speed ECL and GaAs digital devices. Variable transition time control from 800 ps to 6 ns is also available with the appropriate output

levels for testing advanced CMOS, BiCMOS and TTL logic families.

FULLY PROGRAMMABLE

Programmability is important in developing automated, repeatable tests in R&D, incoming inspection and production of high-speed components. Therefore, the HFS 9000 offers full implementation of the IEEE 488.2 standard and utilizes Tektronix Codes and Formats. GPIB/RS-232 ports provide for remote, fully programmable control. Coupled with a high-speed acquisition system, such as the TDS694D DSO, 11801B Digital Sampling Oscilloscope, or the most advanced logic analysis system on the market – the Tektronix TLA700, a fully automated test system can be developed with unequaled accuracy and repeatability.

PHASE LOCK MODE

Phase lock-in allows the internal time base to be phase-locked to an external frequency source. This "supercharger" capability can be used to augment the speed performance of automated component test systems by creating synchronized signals as fast as 630 MHz.

CONFIGURATION OPTIONS

Card-modular design lets you adapt to any logic family from within the same mainframe. Choose the HFS 9DG1 Data Time Generator card for 630 MHz bandwidth and ≤250 ps fixed rise time. The 9DG1 provides four channels of stimulus. This card is ideal for ECL and GaAs device characterization.

Or, choose the HFS 9DG2 Data Time Generator card for up to 315 MHz bandwidth and variable transition times from 800 ps to 6 ns. The 9DG2 provides four channels of stimulus. This card is ideal for simulating TTL, CMOS and BiCMOS logic signals.

Combine these cards in any combination for testing a broad range of components or systems with mixed logic families.

APPLICATIONS

From verifying critical parameters to full characterization, from developing manufacturing test vectors on the bench to phase-locked at-speed testing in conjunction with production test systems, the HFS 9000 Data Time Generator simplifies the process while adding

unmatched capabilities. You can, for example, create complex stimuli that are impossible with other systems. Download test vectors and timing parameters to the HFS 9000 to set up worst-case conditions and to stimulate each pin in isolation. Vary voltage levels, pulse widths and timing relationships independently for each channel. Mix high-speed and variable transition time modules to fit your logic family and obtain channel counts unavailable in any other discrete instrument.

The Data Time Generator also provides a new dimension of assistance in characterizing pattern sensitivity. It provides the data stream while also creating the varying signal levels, timing relationships or signal characteristics required to detect pattern sensitivity across worst-case operating conditions.

Capabilities like these allow you to perform full characterizations on the first run, lowering your development costs and reducing your time to market.

CHARACTERISTICS

Level Resolution – 0.01 V.
HIGH Level Accuracy – ±2% of level ±50 mV.
LOW Level Accuracy – ±2% of HIGH level ±2% of amplitude ±50 mV.
Output Aberrations (200ps after 50% pt.) – Overshoot: +15% +20 mV. Undershoot: –10% –20 mV.

TIME BASE PERFORMANCE
Frequency Range – 50 kHz to 630 MHz.
Frequency Resolution – ≤0.1% of programmed value.
Frequency Accuracy – ±1% of programmed value.
RMS Jitter – 15 ps ±0.05% of interval.
PHASE LOCK IN Frequency Range – 6 MHz to 630 MHz.
PHASE LOCK IN Amplitude Range – 0.8 V to 1.0 $V_{p\text{-}p}$.
Output Frequency Range – any 2^n multiple or submultiple of PHASE LOCK IN frequency. Must remain inside the allowed frequency range for installed cards.
FRAME SYNC IN – Initiates a burst when using PHASE LOCK IN external frequency reference.

OUTPUT EDGE PLACEMENT PERFORMANCE

Channel Deskew Range – Minus 60 ns to 2.0 μs.
Channel Deskew Resolution – 1 ps.
DELAY Adjust Range – 0 to 20 μs.
DELAY Adjust Resolution – 1 ps.
DELAY Accuracy – 1% ±50 ps.
WIDTH Adjust Range – 0 to 65,536 x one period.
WIDTH Adjust Resolution – 1 ps.
WIDTH Accuracy – HFS 9DG1: 1% of width ±50 ps; HFS 9DG2: 1% of width +50 ps −250 ps.

OUTPUT PERFORMANCE

	HFS 9DG1	HFS 9DG2
Outputs	4 differential	4 single-ended
Maximum HIGH level	+5.00 V	+5.50 V
Minimum LOW level	-2.50 V	-2.00 V
Max p-p amplitude	3.00 V	5.50 V
Min p-p amplitude	0.01 V (10 mV)	0.01 V (10 mV)
Output transition time (20% to 80%)	≤250 p (≤1 V$_{p-p}$)	variable (800 ps to 6 ns)

TRIGGER INPUT PERFORMANCE
Input Resistance – 50 Ω.
Input Voltage Range – ±5 V maximum.

Programmable Threshold Range – 4.70 V to +4.70 V.
Programmable Threshold Resolution – 100 mV.
Programmable Threshold Accuracy – ±100 mV ±5% of level.
Minimum Input Pulse Width – 1 ns.
Input Rise/Fall Time Requirement – ≤10 ns.
Sensitivity – ≤500 mV.

POWER REQUIREMENTS
Line Voltage Ranges – 90 V AC to 130 V AC RMS, and 180 V AC to 250 V AC RMS; range switched automatically for HFS 9003 (factory configured for HFS 9009).
Line Frequency – 48 Hz to 63 Hz.

POWER CONSUMPTION –

	HFS 9003	HFS 9009
Maximum	540 W	900 W
Typical	400 W	750 W

ENVIRONMENTAL
Temperature – Operating: 0° to +50°C (HFS 9003); 0° to +40°C (HFS 9009). Non-operating: −40° to +75°C.
Humidity – 10°C to +30°C up to 95% relative humidity. 30°C to 40°C up to 75% relative humidity.
Altitude, Shock non-operating, Bench Handling – C Meets MIL-T-28800 Type III, Class 5.

PHYSICAL CHARACTERISTICS

HFS 9003	Cabinet	
Dimensions	**mm**	**in.**
Width	414	16.3
Height	178	7
Depth	629	24.75
Weight*¹;	**kg**	**lbs.**
Net	20.5	45
Shipping	27.3	60

*¹ Maximum configuration.

HFS 9009	Cabinet	
Dimensions	**mm**	**in.**
Width	426	16.75
Height	356	14
Depth	610	24
Weight	**kg**	**lbs.**
Net	36.8	81
Shipping	45.5	100

HFS 9DG1, HFS 9DG2	Cabinet	
Dimensions	**mm**	**in.**
Width	51	2
Height	267	10.5
Depth	356	14
Weight	**kg**	**lbs.**
Shipping	1.36	3

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

HFS 9003
3-Slot Mainframe.

Includes: Traceable Calibration Certificate; User Reference Manual; Service Reference Manual; Power Cord; RS-232 Pigtail; SMA-BNC Adapter; Zip-Lock Pouch; Two Replacement Fuses; and One 50 Ω SMA Coaxial Cable.

Opt. 1R – Rackmount.
Opt. D1 – Calibration Data Report

HFS 9009
9-Slot Mainframe.

Includes: Traceable Calibration Certificate; User Reference Manual; Service Reference Manual; Power Cord; RS-232 Pigtail; SMA-BNC Adapter; Zip-Lock Pouch; Two Replacement Fuses; and One 50 Ω SMA Coaxial Cable.

Opt. D1 – Calibration Data Report.

ACCESSORIES
See page 495 for Cables, Adapters, and Terminators.

HFS 9DG1
Four differential data time outputs per card with ≤250 ps transition time, 630 MHz.
Includes: Installation Instructions and Two Clock Cables.

HFS 9DG2
Four single-ended data time outputs per card with 800 ps to 6 ns variable transition time.
Includes: Installation Instructions and Two Clock Cables.

S85HFS1
BitWriter® Software.

INTERNATIONAL POWER PLUGS
Opt. A1 – Universal Euro 220 V, 50 Hz.
Opt. A2 – United Kingdom 240 V, 50 Hz.
Opt. A3 – Australian 240 V, 50 Hz.
Opt. A4 – North American 240 V, 60 Hz
Opt. A5 – Switzerland 220 V, 50 Hz
See page 619 for description.

MEASUREMENT SERVICE OPTIONS
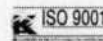**Opt. C3** – Three years of Calibration Services.
Opt. D1 – Cal Data Report.
Opt. D3 – Test Data (requires Opt. C3).
Opt. R3 – Repair warranty extended to cover three years.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1916, inside the U.S. call: 1-800-426-2200.

NOT AVAILABLE IN EUROPE.

ISO 9001

Tektronix measurement products are manufactured in ISO registered facilities.

GPIB

Product(s) complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.