

Table 1-2 Specifications

Frequency Characteristics

Waveforms: Sine, square, pulse, triangle, ramp.
Range: 0.001 Hz to 50.00 MHz (0.001 Hz to 19.99 MHz for 20 and 80% duty cycle/symmetry).
Accuracy, Stability and Resolution:

	Norm	Trig, Gate, Burst	
		f < 1 kHz	f ≥ 1 kHz
Accuracy	0.001%*	0.001%*	5%
Stability over 1 hour	± 1x10 ⁻⁶ *	± 1x10 ⁻⁶ *	± 5x10 ⁻⁴ **
Stability over 24 hours	± 1x10 ⁻⁶ *	± 1x10 ⁻⁶ *	± 1x10 ⁻³ **
Resolution (digits)	4	4	3

* Accuracy and stability can be improved by phase locking to an external frequency reference.
 ** After 15 minutes.

Jitter: ≤ 0.2% at 20/80% duty cycle/symmetry
 ≤ 0.1% (≥ 1 kHz)
 ≤ 0.02% (0.1 Hz – 999 Hz), further improvement at lower frequencies.

Output Characteristics

(50 Ω Source terminated by 50 Ω load unless stated otherwise)
Range: amplitude and offset independently variable within ± 10 V.
Source Impedance: selectable 50 Ω ± 1% or 1 kΩ ± 10%, in parallel with 50 pF.
Amplitude: 10.0 mV_{pp} to 10.0 V_{pp},
 2.00 V_{pp} to 20.0 V_{pp} (1 k Ω into 50 Ω).

Accuracy:	Sine	Square	Triangle (50%)	Ramp (20%, 80%)	Pulse (20%, 80%)
< 1 kHz	± 2%	± 2%	± 2%	± 2%	± 2%
1 kHz – 5 MHz	± 2%	± 2%	± 2%	± 5%	± 2%
5 MHz – 20 MHz	± 5%	± 5%	± 10%	± 10%	± 5%
20 MHz – 50 MHz	± 5%	± 5%	± 5% to -20%	-	-

Resolution: 3 digits.
Offset: 0 to ± 5.00 V,
 0 to ± 10.0 V (1 kΩ into 50 Ω).
 Accuracy: ± (1% programmed value + 1% signal V_{pp} + 20 mV).
Resolution: 2 digits (10 to 99 mV), 3 digits (≥ 100 mV).
Baseline Drift (Trig, Gate and Burst modes): ≤ 5% of peak amplitude.

Sine Characteristics (Norm mode):
Harmonic Components: Up to 5 MHz, THD < 1% of fundamental. Above 5 MHz, all harmonics at least 30 dB below fundamental.
Spurious: all non-harmonically related outputs at least 40 dB below fundamental.

Triangle/Ramp Characteristics
Symmetry: 20, 50, 80% selectable.
Linearity: (10% to 90%): ± 1% (up to 5 MHz), ± 5% (above 5 MHz). cont'd.

Square/Pulse Characteristics:

Duty cycle: 20, 50, 80% selectable.
Transition times (10% to 90%): < 5 ns,
 < 7 ns (1 kΩ into 50 Ω).
Preshoot/Overshoot/Ringing: ± 5%,
 ±10% (1 kΩ into 50 Ω).

Operating Modes

Norm: continuous waveform is generated, phase locked to an internal 10 MHz crystal reference.

VCO: external voltage (100 kHz max) from 10 mV to 10 V linearly sweeps 3 decades up to top of decade in which the 8165A frequency is set. Four bands limited to less than 3 decades:

100 mV – 10 V for 100 kHz – 10 MHz
 and 10 Hz – 1 kHz,
 10 mV – 2 V for 100 kHz – 20 MHz,
 50 mV – 5 V for 500 kHz – 50 MHz.

Trig: pos. ext input pulse ≥ 10 ns wide generates one output cycle. Upper level ≥ +250 mV, lower level ≤ 0V.

Gate: oscillator enabled when ext input ≥ +250 mV, disabled when ≤ 0 V. First and last output cycles are always complete.

Burst: a preprogrammed number of output cycles is generated. Min. time between bursts 50 ns. Burst length 0 to 9999 cycles. Min. trigger pulse width 10 ns, upper level ≥ + 250 mV, lower level ≤ 0 V.

FM: 0 to ± 1 V modulates 0 to ± 1% deviation.

Modulating Frequency: 100 Hz to 20 kHz (Norm mode), dc to 20 kHz (Gate mode with carrier frequency ≥ 1 kHz).

Input Impedance: 10 kΩ typical.

AM (Option 002 only): 0 to 2.5 V_{pp} modulates 0 to 100% modulation depth.

Modulating Frequency: dc to 10 MHz (-3 dB).

Input Impedance: 10 kΩ typical.

Pulse Modulation: transition times < 50 ns.

Envelope Distortion (dc to 250 kHz mod. freq.):

Carrier	Modulation	Distortion
≤ 1 MHz	0 to 90%	< 1%
> 1 MHz	0 to 30%	< 3%

Carrier Frequency Deviation: < 0.01%, 0 to 30% modulation.

Sweep (Option 002 only): provides logarithmic up/down sweep up to 3 decades between limits set on the 8165A. As in VCO mode, 4 bands limited to less than 3 decades. Min frequency 1 mHz.

Sweep-rate: 0.01, 0.1, 1, 10, 100, 1000 seconds per decade selectable.

Trigger: one up-down sweep per trigger pulse (upper level ≥ +250 mV, lower level ≤ 0 V, width ≥ 10 ns).

Accuracy: sweep start frequency ± (15% + 0.5% of max. stop frequency), sweep stop frequency ± 15%.

Resolution: 2 digits.

Table 1-2 Specifications (continued)

Auxiliary outputs and inputs

Ext. Input: external signals used in VCO, Trig, Gate, Burst and (Option 001) Sweep ext. trig.
Signal range in VCO: 10 mV to 10 V for 3-decade sweep.
Signal thresholds in Trig, Gate, Burst, Sweep ext trig: +250 mV (upper), 0 V (lower).
Max. input: ± 20 V,
Input impedance: 10 kΩ typical.

Sync. output: one trigger pulse per main output cycle.
Amplitude: 3 V_{pp} into open circuit (1.5 V_{pp} into 50 Ω).

Ext. 10 MHz ref.: external 10 MHz, TTL, system clock.
 Rear panel switch selects ext or int clock as instrument reference.

Mod Inp: FM and (Option 002 only) AM input.
Signal range in FM: 0 to ± 1 V for 0 to ± 1% deviation.
Signal range in AM: 0 to 2.5 V_{pp} for 0 to 100% modulation depth.
Max. input: ± 20 V.
Input impedance: 10 kΩ typical.

Sweep out (Option 002, only): triangular sweep voltage, 0 to 2.99 V amplitude for 3 decades (1 V/decade).

HP-IB capability and microprocessor

Code	Interface Function	Code	Interface Function
SH 1	Source Handshake	SR 1	Service Request
AH 1	Acceptor Handshake	RL 1	Remote/Local
T 6	Talker (basic talker, serial poll, unaddress to talk if addressed to listen)	PP 0	No Parallel Poll
L 4	Listener (Basic listener, unaddress to listen if addressed to talk)	DC 0	No Device Clear
		DT 1	Device Trigger
		C 0	No Controller
		E 1	Three-state Bus Drivers

Accuracy: See Frequency and Output Characteristics

Settling times:

Frequency: < 20 ms to ± 5% of programmed value. In Norm mode, and in Trig, Gate, Burst at frequencies < 1 kHz : < 70 ms to ± 2% of programmed value, < 300 ms to final value.
Other Functions: 20 ms. The following range changes can take up to 200 ms:
 Change of duty cycle.
 Selection to or from Sweep/VCO.
 Changing up to/down from the following decades:
 Frequency 1 kHz, 10 kHz, 100 kHz, 1 MHz, 20 MHz.
 Amplitude 100 mV, 1 V
 Offset 1 V.

Number of bytes sent/received

Listener: up to 65 bytes (89 in Option 002) for one complete set of operating parameters.
Talker-Learn Mode: 8 lines. Each line up to 16 bytes plus CR LF. Total: 144 bytes max.
Talker-Error Message: 1 byte.

Byte Rate:

Function Time (typical values): set up as talker/listener 1.1 ms, receiving time per character 0.1 ms, processing per parameter 3.0 ms, entry time per digit 2.0 ms, check time per parameter entry 5–10 ms, waveform/duty cycle/modulation 1.0 ms, input mode 6.5 ms, output modes 9.0 ms, recall 25 ms, store 380 ms.

Memory: 10 addressable locations plus one for existing operating state.

Capacity: each location can store a complete set of operating parameters and modes.

Access time: 20 ms each location.

Storage time: internal battery provides memory retention for approx. 4 weeks at room temperature. Battery recharges when 8165A is switched on.

General

Power Requirements: 100 V, 120 V, 220 V or 240 V; +5 V to -10%, 48 to 66 Hz, 200 VA max.

Environmental: operates to specifications from 0 to 50°C, and with relative humidity to 95% at 40°C.
Storage: -20 to +70°C.

Weight: net 12 kg (26.5 lbs.). Shipping 16 kg (35.3 lbs.).

Dimensions: 426 mm wide, 145 mm high, 450 mm deep (16.8 x 5.7 x 17.7 inches).

Accessories Available: The following cables for interconnecting HP-IB instruments to the bus are available:

10631A	1 m (3.28 ft)	10631C	4 m (13.1 ft)
10631B	2 m (6.56 ft)	10631D	0.5 m (1.64 ft)

The following adapters for connecting to the DUT are available:

15104A	Adder/Splitter
15450A	Adapter for terminating at DUT
15451A	TTL-CMOS Translator. CMOS level originates from DUT thus protecting it.

OPTIONS

Option 002: Sweep and Amplitude Modulation

Option 907: Front Handle Kit, p.n. 5061-0089

Option 908: Rack Mounting Kit, p.o. 5061-0077

Option 909: Combined Front Handle and Rack Mounting Kit, p.n. 5061-0083

Option 910: extra Operating and Service Manual

Specifications describe the instrument's warranted performance. Supplement characteristics - identified by the word "typical" - are intended to provide information useful in applying the instrument by giving typical, but non-warranted, performance parameters.

Data subject to change