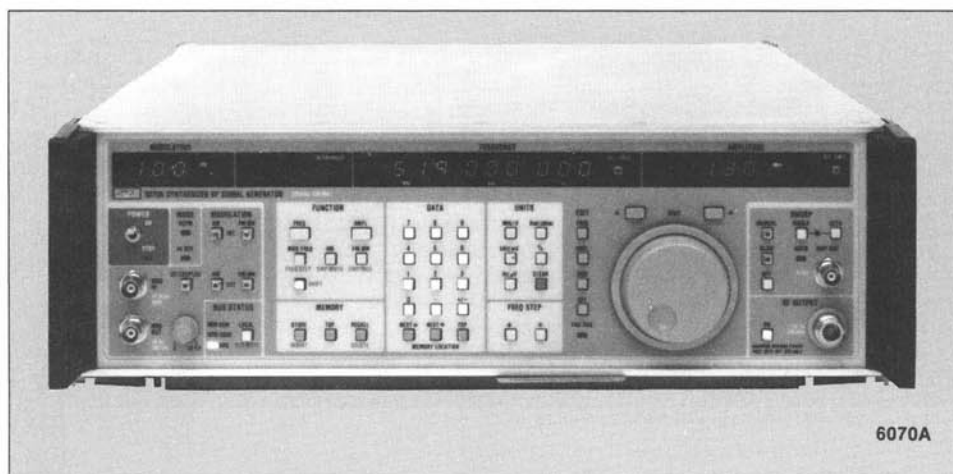


## 6070A & 6071A



### 6070A & 6071A, to 520 MHz or 1040 MHz

Non-harmonic spurious outputs: -90 dBc to -100 dBc to 520 MHz

Precision digital sweep

Front panel memory

AM, FM,  $\phi$ M modulation

Responsive spin knob tuning

Low output VSWR and optional reverse-power protection

Relative amplitude and frequency mode

Design innovations in the 6070A and 6071A combine the precision resolution and settability of a synthesizer with the low-noise performance of the best open-loop signal generators on the market. And these two state-of-the-art instruments were developed to be competitively priced as well as cost effective in other ways.

The 6070A and 6071A are programmable and directly compatible with IEEE Std 488-1978. With them, you may make sophisticated tests and measurements rapidly and with great precision. On VHF and UHF receivers you can measure selectivity, sensitivity, intermodulation distortion, AM rejection, AGC response, audio hum, noise and distortion, and SINAD ratio. Or you can align a discriminator or check IF response using the digital sweep feature.

Spectral purity is excellent. Spurious outputs, those not related harmonically to either the carrier frequency or the power line frequency, are on the order of -90 dBc to -100 dBc to 520 MHz and -84 dBc above 520 MHz. The typical broadband noise floor is a comfortable -150 dBc per Hz, and the single sideband phase-noise is typically -138 dBc per Hz at 20 kHz offset from a 500 MHz carrier. These specifications, by any standard, reflect a truly excellent level of spectral purity.

### AM, FM, $\phi$ M Modulation

Amplitude modulation depth can be set from 0% to 99.9% in 0.1% steps. External dc coupling is provided for leveling, extending bandwidths down to dc, or providing analog control of output amplitude.

Frequency or phase modulation can be set with deviations up to 1 MHz or 100 radians respectively, depending on the rf frequency. Exceptionally wide deviation is made possible by a high deviation mode that is automatically activated when required. External, dc-coupled FM is available for phase locking the instrument to another source. That extends the maximum deviation at low rates, and provides for analog sweeping with an external signal.

Simultaneous AM+FM or AM+ $\phi$ M is available internally or from internal-external combinations. The internal modulation oscillator covers a wide range of frequencies. It can be continually varied from 20 Hz to 200 kHz, with an over-range capability extending it from 1 Hz to 255 kHz in steps of approximately 0.1%.

The modulation oscillator output is available at a front panel connector. This provides you with an audio source separate from the rf output. Typical total harmonic distortion is 0.05%.

### IEEE-488 Interface

No option is required to make the 6070A or 6071A compatible with IEEE Std 488-1978; the capability is built in. And all of the functions that may be controlled from the front panel manually are also controllable remotely in an IEEE-488 system, except for turning power on and off and controlling the modulation signal output level. Status indicators are: Remote, Addressed, and SRQ. Interface functions are: SH1, AH1, T6, L3, SR1, RL1, DC1, DT1, C0, E2.

### Precision Digital Sweep

Versatile sweep modes let you characterize devices such as wideband amplifiers, narrow-band crystal filters, and other rf components. Repetitive, single, or manual modes are available with either symmetrical or asymmetrical sweeps. Five sweep step intervals between 20 ms and 500 ms may be selected. A coincidental 0 to 10V staircase sweep signal is available at an output connector to drive X-Y recorders or oscilloscopes. Another rear-panel output signal provides Z-axis blanking for oscilloscopes or a pen-lift signal for X-Y recorders.

### Front Panel Program Memory

Up to nine different combinations of front-panel control settings may be stored and later recalled. Up to 50 combinations may be stored in a non-volatile memory using Option -570. This feature reduces errors and saves time in making common measurements.

### Responsive Spin-Knob Tuning

In addition to the simple keystroke operation and layout of the front-panel controls, a high-inertia, magnetically detented, optically coupled knob provides analog convenience when continuous adjustments are required. It may be used to select frequency, amplitude, or modulation. Each complete turn gives you 25 increments or decrements, depending on direction of rotation.

### Low Output VSWR & Optional Reverse-Power Protection

The rf output impedance of the 6070A and 6071A is 50 ohms with a low source VSWR to minimize the effects of signals reflected from loads having a high VSWR. Option -870 protects the output circuits from being damaged when connected to a transceiver that accidentally transmits power.

### Relative Units

A relative-amplitude mode makes it easy to compensate for cable loss, attenuation in the rf output, make linearity tests on detectors and amplifiers, and measure AGC characteristics. Output levels are selectable in 0.1 dB steps, all



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the way from -140 dBm to +19 dBm for frequencies up to 520 MHz (+13 dBm above 520 MHz). Flatness is typically  $\pm 0.2$  dB from 200 kHz to 520 MHz,  $\pm 0.3$  dB to 1040 MHz.

Besides offering 1 Hz resolution up to 520 MHz (2 Hz above 520 MHz), a relative-frequency mode allows you to display specific frequencies above and below a selected center frequency. It makes testing the frequency response of filters and IF strips easy.

### Specifications

#### Technical Specifications

Specifications for frequencies above 520 MHz apply to 6071A only.

#### Frequency

**6070A Ranges:** 0.2 to 519.999 999 MHz

**6071A Ranges:** 0.2 to 1039.999 998 MHz

**6070A Resolution:** 1 Hz

**6071A Resolution:** 1 Hz (<520 MHz), 2 Hz ( $\geq 520$  MHz)

**Accuracy & Stability:** Same as Reference Oscillator

#### Reference Oscillator

**Internal Standard:** 10 MHz quartz oscillator. Aging rate  $\leq \pm 0.5$  ppm/month. Temperature effects:  $\leq \pm 5$  ppm 0 to 50°C instrument ambient (relative to 25°C)

**Option -130:** 10 MHz ovenized oscillator. (See options)

**External:** 1, 2, 2.5, 5, 10 MHz input. Level required is 0.3 to 4.0V pp sinewave or square-wave. Input impedance is 50 ohms. External reference is automatically switched in when connected

**Reference Output:** 10 MHz TTL level

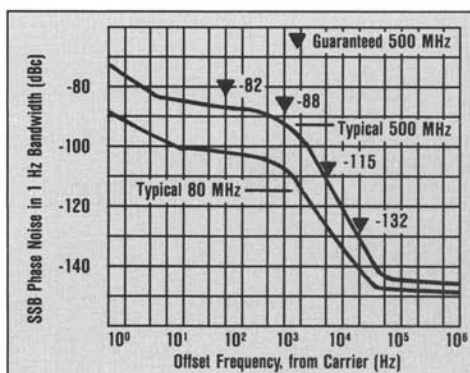
#### Spectral Purity

All specifications are with High Deviation mode off

#### SSB Phase Noise

**SSB Phase Noise for CW and AM Modes (dBc/Hz)**

Carrier Frequency Range	Offset Frequency, from Carrier				
	100 Hz	1 kHz	5 kHz	20 kHz	>3 MHz
0.2 to 62.5 MHz	-75	-85	-106	-123	-129
62.5 to 125 MHz	-94	-100	-125	-140	-144
125 to 250 MHz	-88	-94	-121	-138	-144
250 to 520 MHz	-82	-88	-115	-132	-144
520 to 1040 MHz	-76	-82	-109	-126	-138



#### Residual FM for CW and FM Modes (Hz rms)

Carrier Range	0.3 to 3 kHz bw	0.05* to 15 kHz bw
0.2 to 62.5 MHz	3.5	5.0
62.5 to 125 MHz	0.3	0.75
125 to 250 MHz	0.85	1.3
250 to 520 MHz	1.7	2.5
520 to 1040 MHz	3.4	5.0

\*Typically the same for 0.02 to 15 kHz bandwidth.

**Residual AM:**  $\leq 0.02\%$  rms (-74 dBc) in a 0.05 to 15 kHz post-detection bandwidth, referred to 100% sinewave modulation. Typically the same in a 0.02 to 15 kHz post-detection bandwidth

#### Spurious Signals (dBc)

Relationship to Output Carrier Frequency ( $f_0$ )	Carrier Frequency Range				
	200 kHz to 62.5 MHz	62.5 MHz to 125 MHz	125 MHz to 250 MHz	250 MHz to 520 MHz	520 MHz to 1040 MHz
Non-Harmonic >10 kHz offset	-90	-100	-96	-90	-84
550 Hz to 10 kHz offset	-70	-82	-76	-70	-64
Power Line, Display, Mechanical <550 Hz offset	-56	-68	-62	-56	-50
Sub-Harmonic $f_0/2$ , $3f_0/2$ , $5f_0/2$ offset	N/A	N/A	N/A	N/A	-35
Harmonic (6070A) $f_0$ , $2f_0$ , $3f_0$ offset, >+13 dBm	-30	-30	-30	-25	N/A
$\leq +13$ dBm	-35	-35	-35	-35	N/A
Harmonic (6071A) $f_0$ , $2f_0$ , $3f_0$ offset, >+13 dBm	-30	-30	-25	-20	N/A
$\leq +13$ dBm	-35	-35	-35	-35	-25

#### Output

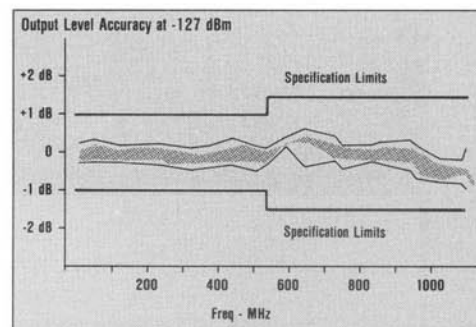
**Voltage Level Range:** -140 dBm to +19 dBm for frequencies up to 520 MHz. Above 520 MHz (6071A), -140 dBm to +13 dBm

**Resolution:** 0.1 dB or 1% of voltage

#### Accuracy (dB)

Output	0.2 to 520 MHz	520 to 1040 MHz
+19 to +13 dBm	$\pm 1.0$	N/A
+13 to -127 dBm	$\pm 1.0$	$\pm 1.5$

20°C  $\pm 5^\circ$ C



Typical amplitude data measured at -127 dBm. 75% of the units measured within the shaded area. The outer lines represent worst-case measurements.

**Output Impedance:** 50 ohms, nominal

#### SWR

Output Level	0.2 to 520 MHz	520 to 1040 MHz
$\geq +7$ dBm	2.0	2.5
$< +7$ dBm	1.5	2.0

#### Amplitude Modulation

**AM Depth:** 0 to 99.9% in 0.1% steps

**AM Accuracy: (Internal or External)**

Carrier Range	Modulation Frequency	AM Depth	Depth Accuracy
0.2 to 5 MHz	$\leq 1$ kHz	$< 90\%$	+5%, -8%
5 to 520 MHz	$\leq 3$ kHz	$< 90\%$	$\pm 5\%$
520 to 1040 MHz	$\leq 3$ kHz	$\leq 70\%$	$\pm 5\%$

#### AM Distortion

Carrier Range	Modulation Frequency	AM Depth		
		0 to 30%	30 to 70%	70 to 90%
0.2 to 5 MHz	$\leq 1$ kHz	$< 2\%$	$< 5\%$	$< 7\%$
5 to 520 MHz	$\leq 3$ kHz	$< 1.5\%$	$< 3\%$	$< 3\%$
520 to 1040 MHz	$\leq 3$ kHz	$< 2\%$	$< 3\%$	$< 5\%$

#### AM Signal Bandwidth (-3 dB)

Current Range	AM Depth	Internal or External AC Coupled	External DC Coupled
0.2 to 5 MHz	$\leq 70\%$	20 Hz-8 kHz	DC-8 kHz
5 to 520 MHz	$\leq 90\%$	20 Hz-50 kHz	DC-50 kHz
520 to 1040 MHz	$\leq 70\%$	20 Hz-50 kHz	DC-50 kHz

**Incidental FM (for 30% AM):** 0.3 x modulation frequency for  $< 520$  MHz; 0.6 x modulation frequency for  $> 520$  MHz



## 6070A & 6071A

### Frequency Modulation

#### Maximum Peak Frequency Deviation (kHz)

Frequency Range	ACFM the lesser of	DCFM the lesser of
0.2 to 62.5 MHz	999 or $f_m \times (520 - f_o)$	499
62.5 to 125 MHz	199 or $f_m \times f_o$	$f_o$ or 99.9
125 to 250 MHz	499 or $f_m \times f_o$	$f_o$ or 199
250 to 520 MHz	999 or $f_m \times f_o$	$f_o$ or 499
520 to 1040 MHz	999 or $f_m \times f_o$	$f_o$ or 999

$f_o$  = Output frequency in megahertz

$f_m$  = Modulation frequency in kilohertz

**FM Deviation Resolution:** 100 Hz for <100 kHz deviation; 1 kHz for ≥100 kHz deviation

**FM Deviation Accuracy:** (Internal or external) ±10% at 400 Hz or 1 kHz modulation rate; ±13% at 0.3 to 50 kHz modulation rate (including flatness)

#### FM Total Harmonic Distortion

Output Frequency Range	DCFM Mode Off and High Deviation:		DCFM Mode On 0.5%+
	Off 0.5%+	On	
0.2 to 62.5 MHz	0.75% per 100 kHz dev		1.2% per 100 kHz dev
62.5 to 125 MHz	3.0% per 100 kHz dev		
125 to 250 MHz	1.5% per 100 kHz dev	1.5%	(600 ÷ $f_o$ ) % per 100 kHz dev
250 to 520 MHz	0.75% per 100 kHz dev		
520 to 1040 MHz	0.375% per 100 kHz dev		

$f_o$  = Output frequency in megahertz

**FM Signal Bandwidth (-3 dB):** 20 Hz to 250 kHz internal or ac coupled external. Dc to 250 kHz dc coupled external

**Center Frequency Accuracy (DCFM Off):** Same as reference oscillator

#### Center Frequency Accuracy (DCFM On)\*

Output Frequency Range	Initial Accuracy	Typical Stability
0.2 to 62.5 MHz	±1 kHz	50 Hz/min
62.5 to 125 MHz	±250 Hz	12.5 Hz/min
125 to 250 MHz	±500 Hz	25 Hz/min
250 to 520 MHz	±1 kHz	50 Hz/min
520 to 1040 MHz	±2 kHz	100 Hz/min

\*Auto-CAL upon initialization

**Incidental AM:** ≤0.5% (-52 dBc) for deviations up to 50 kHz at 1 kHz rate (single sideband) component referred to sinewave modulation

### Phase Modulation

#### Deviation and Distortion

Output Frequency Range	Max Peak Deviation Radians	Total Harmonic Distortion Per Radian of Deviation With High Deviation Mode	
		Off	On
0.2-62.5 MHz	99.9	0.5+(0.75×10 <sup>-5</sup> × $f_m$ )%	
62.5-125 MHz	19.9	0.5+(3.0×10 <sup>-5</sup> × $f_m$ )%	
125-250 MHz	49.9	0.5+(1.5×10 <sup>-5</sup> × $f_m$ )%	1.5%
250-520 MHz	99.9	0.5+(0.75×10 <sup>-5</sup> × $f_m$ )%	
520-1040 MHz	99.9	0.5+(0.375×10 <sup>-6</sup> × $f_m$ )%	

$f_m$  = Modulation frequency in hertz

**φM Resolution:** 0.01 radian for <10 radians, 0.1 radian for ≥10 radians

**φM Deviation Accuracy:** (Internal or external) ±10% at 400 Hz or 1 kHz modulation rate; ±13% at 0.3 to 3 kHz modulation rate (including flatness)

**φM Signal Bandwidth (-3 dB):** 0.02 to 12 kHz internal or ac coupled external. Dc to 12 kHz external dc coupled

**Incidental AM:** ≤0.5% (-52 dBc) for deviations up to 50 radians at a 1 kHz rate (single sideband component referred to sinewave modulation)

#### Modulation Signal Source

**Modes:** AM, FM, φM, AM + FM, AM + φM

**Range:** 0.02 kHz to 200 kHz

**Frequency Accuracy:** ±3% for 20°C to 30°C ambient temperature range. Add 0.1% per degree C outside that range

**Total Harmonic Distortion:** <0.15% from 0.2 kHz to 100 kHz; <0.2% below 0.2 kHz and above 100 kHz

**Output Level:** 0V to 2V peak to peak into 600Ω

**Output Impedance:** 600Ω, nominal via front panel BNC connector

#### External Modulation Input

**Level:** 1V peak for specified AM, FM, or φM accuracy

**Impedance:** 600Ω, nominal

**Coupling:** AC or DC

#### Switching Time

**Frequency:** <85 ms from last controller command (<35 ms for most small changes) until frequency has settled to within 100 Hz of final value. Applies to frequency changes only

**Level:** <50 ms from last controller command. Applies to level changes only

#### Frequency Sweep

**Sweep Modes:** Auto, Single, Manual

**Sweep Functions:** Symmetrical sweep, asymmetrical sweep, sweep speed

**Data Entry:** Sweep width, sweep increment

**Sweep Speed:** Approximately 20 ms, 50 ms, 100 ms, 200 ms, 500 ms, per increment

**Sweep Output:** 0 to +10V, up to 1000-point stepped ramp. Available at front panel BNC connector

**Penlift/Z Axis Blanking:** TTL output level at rear panel BNC connector. High during sweep retrace and when sweep is off

### Memory

**Memory Functions:** Store, recall, insert above, delete, top

**Locations:** 9 standard, volatile; Option-570 50 non-volatile. Front panel set-ups can be stored in each location and later re-called

### Remote Programming

**Interface:** IEEE-488

**Functions Controlled:** All front-panel controls except line power switch and modulation output amplitude (MOD OUT)

**Status Indicators:** Remote, Addressed, SRQ

**Interface Functions:** SH1, AH1, T6, L3, SR1, RL1, DC1, DT1, C0, E2

### Option Specifications

#### 10 MHz Ovenized Oscillator (-130)

Aging rate <±5 × 10<sup>-10</sup> per day after a 21-day warmup. Temperature effects: <±2 × 10<sup>-10</sup>/°C

#### Non-Volatile Memory (-570)

50 locations; operational features same as standard features. Data is stored with built in battery when power is off

#### Rear RF Output (-830)

Type N RF output connector available on rear panel

#### Auxiliary RF Output (-831)

Greater than -18 dBm, available at rear panel BNC. Impedance, 50 ohms

#### Reverse Power Protection (-870)

Up to 50 watts from a 50 ohm source over 0.2 to 1040 MHz. Will withstand up to 50V dc

#### Pulse Modulation (-950)

Adds pulse modulation to 6070A only. Fast 25 rise/fall times with on/off ratio of 40 to 60 dB depending of carrier frequency

### General Specifications

**EMI:** Meets MIL-STD 461A RE02 and CE03, and MIL-I-6181D Sections 4.3.1 and 4.3.2 for both narrowband and broadband tests. RF leakage: less than 3 μV is induced into a two-turn, 1 inch diameter loop 1 inch away from any surface and measured into a 50Ω receiver

**Temperature:** 0°C to 50°C, operating; -40°C to +75°C, non-operating

**Relative Humidity:** ≤95% to 25°C; ≤75% to 50°C

**Altitude:** ≤10,000 feet