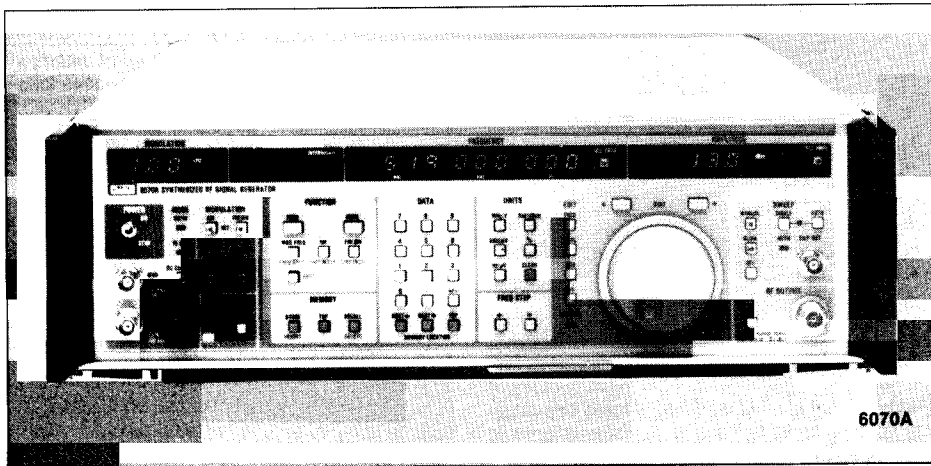


Synthesized Signal Generators

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, ϕ 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, ϕ 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+ ϕ 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 ± 0.2 dB from 200 kHz to 520 MHz, ± 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 squarewave. Input impedance is 50 ohms. External reference is automatically switched in when connected

Reference Output: 10 MHz TTL level

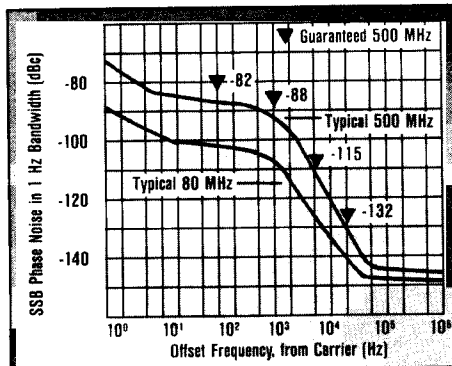
Spectral Purity

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

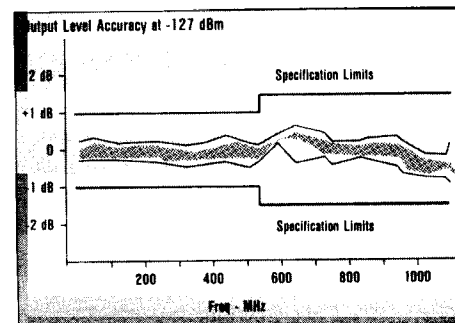
Voltage Level Range: -140 dBm to +19 dBm for frequencies up to 520 MHz. Above 520 MHz (6071A), -140 dBm to +13 dBm

Resolution: 0.1 dB or 1% of voltage

Accuracy (dB)

Output	0.2 to 520 MHz	520 to 1040 MHz
+19 to +13 dBm	± 1.0	N/A
+13 to -127 dBm	± 1.0	± 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	≤ 1 kHz	<90%	+5%, -8%
5 to 520 MHz	≤ 3 kHz	<90%	$\pm 5\%$
520 to 1040 MHz	≤ 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	≤ 1 kHz	<2%	<5%	<7%
5 to 520 MHz	≤ 3 kHz	<1.5%	<3%	<3%
520 to 1040 MHz	≤ 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 Hz	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

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 \geq 100 kHz deviation

FM Deviation Accuracy: (Internal or external) $\pm 10\%$ at 400 Hz or 1 kHz modulation rate; $\pm 13\%$ 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		1.5% ($600 \div f_o$) % per 100 kHz dev
125 to 250 MHz	1.5% 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: $\leq 0.5\%$ (-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	$0.5 + (0.75 \times 10^{-5} \times f_m)\%$	
62.5-125 MHz	19.9	$0.5 + (3.0 \times 10^{-5} \times f_m)\%$	
125-250 MHz	49.9	$0.5 + (1.5 \times 10^{-5} \times f_m)\%$	1.5
250-520 MHz	99.9	$0.5 + (0.75 \times 10^{-5} \times f_m)\%$	%
520-1040 MHz	99.9	$0.5 + (0.375 \times 10^{-5} \times f_m)\%$	%

f_m = Modulation frequency in hertz

ϕ M Resolution: 0.01 radian for <10 radians, 0.1 radian for \geq 10 radians

ϕ M Deviation Accuracy: (Internal or external) $\pm 10\%$ at 400 Hz or 1 kHz modulation rate; $\pm 13\%$ at 0.3 to 3 kHz modulation rate (including flatness)

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

Incidental AM: $\leq 0.5\%$ (-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, ϕ M, AM + FM, AM + ϕ M

Range: 0.02 kHz to 200 kHz

Frequency Accuracy: $\pm 3\%$ 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 600 Ω

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

External Modulation Input

Level: 1V peak for specified AM, FM, or ϕ M accuracy

Impedance: 600 Ω , 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 $\leq \pm 5 \times 10^{-10}$ per day after a 21-day warmup. Temperature effects: $\leq \pm 2 \times 10^{-10}/^\circ\text{C}$

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 μ V is induced into a two-turn, 1 inch diameter loop 1 inch away from any surface and measured into a 50 Ω receiver

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

Relative Humidity: $\leq 95\%$ to 25°C; $\leq 75\%$ to 50°C

Altitude: $\leq 10,000$ feet

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Power: 100, 120, 200, 240V ac $\pm 10\%$ 47 to 63 Hz; 125 watts typical. For 400 Hz operation consult your Fluke representative

Size: 13.3 cm H x 43.2 cm W x 54.6 cm D from front panel to rear handle (5.25 in H x 17.0 in W x 21.5 in D)

Weight: 27.7 kg (61 lb)

Safety: CSA 556B certified

Included: Operator's manual, service manual, power cord, serialized and dated calibration certificate

Ordering Information

Models

January 1988 prices

6070A Synthesized Sig Gen (0.2-520 MHz)	\$18,900
6071A Synthesized Sig Gen (0.2-1040 MHz)	19,900

Options (for 6070A & 6071A)

-130 Ovenized Reference Oscillator ..	1200
-570 Non-Volatile Memory	550
-830 Rear RF Output	125
-831 Auxiliary RF Output	175
-870 Reverse Power Protection	280
-950 Pulse Modulation (6070A only) ..	4925

Accessories (Also see page 468)

Y6001 Rack Mount Kit inc 24" slides	275
Y9100 Attenuator, 50 Ohm, 6 dB, BNC	55
Y9101 Attenuator, 50 Ohm, 14 dB, BNC	55
Y9102 Attenuator, 50 Ohm, 20 dB, BNC	55
Y9103 50 Ohm Feedthru Termination, BNC	35
Y9111 3 ft (0.91m) 50 Ω Cable, BNC to BNC	20
Y9112 6 ft (1.83m) 50 Ω Cable, BNC to BNC	20
Y9308 Adapter, N to BNC, 50 Ω	20
Y9315 Coaxial Cable, N male to N male left	65
Y9316 Cap, Non-shorting, BNC	10
Y9317 50 Ω Termination, N	95

Service & Support

Warranty

One-year product warranty. See page 453 for further information on warranty terms and conditions.

Extended Warranty

SC1-6070A Repair (w/calibration)	598
SC1-6070A Repair (cal w/in or out data) ..	673
SC1-6070A Repair (cal w/in and out data) ..	748
SC2-6070A Cal (1 yr recommended)	546
SC2-6070A Cal (1 yr w/in or out data) ...	621
SC2-6070A Cal (1 yr w/in and out data) ..	696
SC1-6071A Repair (w/calibration)	667
SC1-6071A Repair (cal w/in or out data) ..	742
SC1-6071A Repair (cal w/in and out data) ..	817
SC2-6071A Cal (1 yr recommended)	446
SC2-6071A Cal (1 yr w/in or out data) ...	621
SC2-6071A Cal (1 yr w/in and out data) ..	696