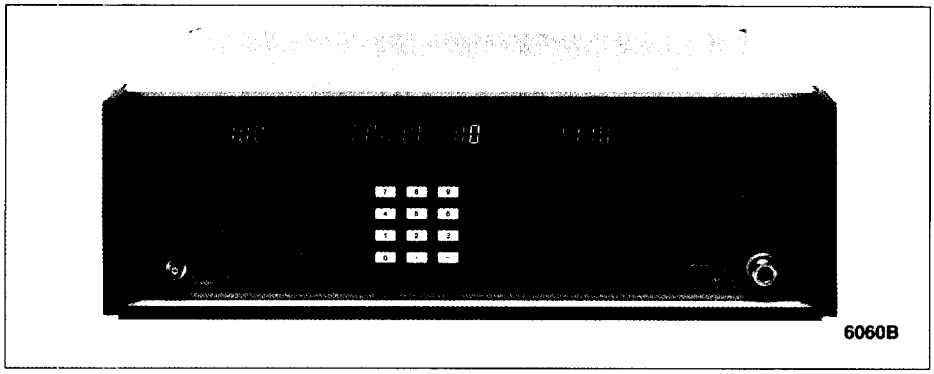
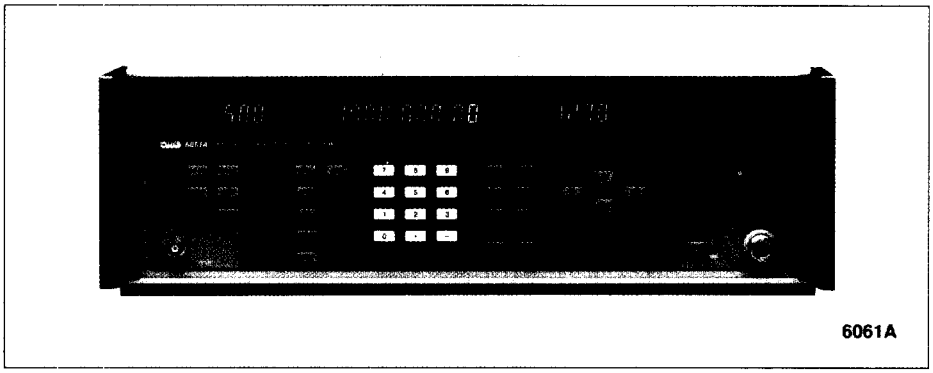
Synthesized RF Signal Generators

6060B, 6061A & 6062A

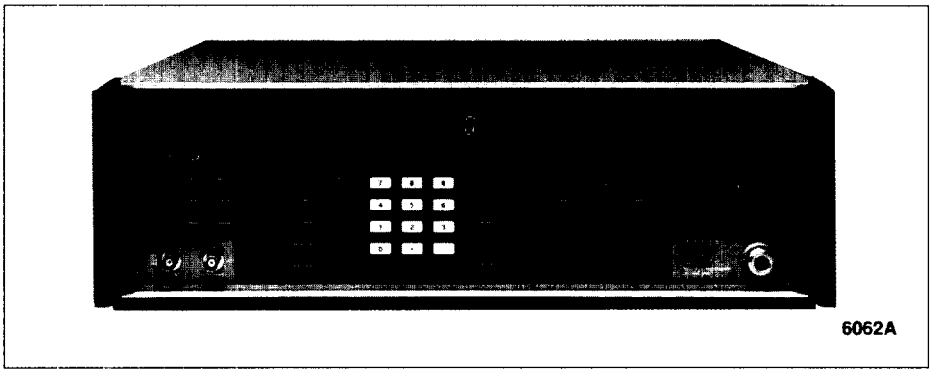
GPIB IEEE-488



6060B



6061A



6062A

6060 Series: Synthesized RF Signal Generators

- .01 to 1050 MHz and 0.1 to 2100 MHz
- ±1 dB amplitude accuracy to 1 GHz and ±1.5 dB accuracy to 2100 MHz (6062A)
- Non-harmonic spurious -60 dBc to 1050 MHz
- GPIB/IEEE-488
- Built-in diagnostics and error code display
- Reverse power protection
- 50 location non-volatile memory
- Relative frequency and amplitude modes
- Bright-digit editing

Economy and Performance

The Fluke 6060 Series is a family of fully programmable, synthesized signal generators covering 10 kHz to 2100 MHz.

The 6060B is an economical solution for most general purpose RF testing needs. The 6061A is equivalent to the 6060B, but has superior noise performance, making it desirable for receiver testing. These generators have output frequency selectable in 10 Hz steps from 10 kHz to 1050 MHz. Non-harmonic spurious products are less than -60 dBc, and harmonics less than -30 dBc. Level is programmable in 0.1 dB steps over the range -147 to +13 dBm, with overrange to +19 dBm. Accuracy is guaranteed ±1 dB in the range -127 dBm to +13 dBm.

The 6062A spans 100 kHz to 2100 MHz in 20 Hz steps (10 Hz steps below 1050 MHz). Specified amplitude accuracy is ±1.5 dB from -127 dBm to +13 dBm. Like its lower frequency family members, it has amplitude and frequency modulation. Also, the 6062A has phase modulation and fast-rise pulse modulation.

High-performance Pulse Modulation in the 6062A

The 6062A's gallium arsenide pulse modulator generates fast, high quality pulses for testing of pulsed communication and navigation circuits. It employs a design that can generate very narrow pulses, limited only by the modulator's 15 nanosecond rise and fall time.

Microprocessor Control

Microprocessor technology gives the 6060 family sophisticated operator functions including:

Keyboard Parameter Entry and Fluke **Bright-digit Editing.**

Increment Step Function, to allow an operator to vary frequency, amplitude, or modulation in specific increments.

Memory Store and Recall, for fifty complete front panel set-ups with internal non-volatile memory.

Relative Amplitude allows compensation for cable loss in test set-ups.

Relative Frequency speeds testing of frequencies relative to a reference, during filter testing or receiver selectivity measurements.

Self-Test Capabilities

Built-in diagnostics and error code displays provide immediate feedback of incorrect operation. Also, the generators perform a series of internal digital and analog tests at power-up and isolate problem areas immediately via a coded display on the front panel. These internal checks may be accessed and initiated at any time from the front panel. Special service and trouble-shooting test routines are contained within the unit to aid in calibration and maintenance.

Options Summary

The GPIB/IEEE-488* interface is optional on the 6060B (Option 488), and is included as standard equipment on the 6061A and 6062A. The generators come with a 10 MHz free-air crystal reference oscillator, or may be fitted with one of two oven oscillator references: the high stability reference (Option -130) with $\pm 5 \times 10^{-10}$/day aging rate, or a medium stability reference (Option -132) with $\pm 1 \times 10^{-7}$/month aging. Other options are rear output (Option -850), and low-rate FM (Option -651).

6060B General Purpose 1 GHz Signal Generator

- 10 kHz to 1050 MHz, 10 Hz resolution
- -127 to +13 dBm output, plus overrange
- 1 dB amplitude accuracy
- 0.1 dB resolution
- Non-harmonic spurious -60 dBc
- IEEE-488 (optional)
- Reverse power protection
- Non-volatile memory
- Relative frequency and amplitude modes

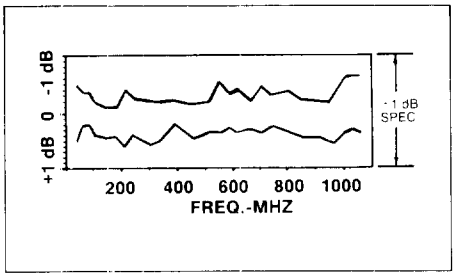
6061A Low-Noise Performance

- All features of the 6060B, plus:
- IEEE-488 included standard
- Lower SSB phase noise: typical -123 dBc/Hz at 20 kHz offset from 500 MHz carrier
- Lower Residual FM: 12 Hz rms at 1000 MHz

6062A 2.1 GHz General Purpose Signal Generator

- Contains all the features of the 6060B and 6061A
- Incorporates the low-noise improvements of the 6061A
- Adds these new features:
- Frequency coverage from 0.1 to 2100 MHz
- Phase modulation
- Fast-rise pulse modulation
- AC/DC-coupled AM
- 400 kHz FM deviation on 1050 to 2100 MHz range
- On-site manual or automated calibration
- IEEE-488 included standard

Typical Level Accuracy vs. Frequency for 6060B, measured at -127 dBm



*The terms GPIB and IEEE-488 may be used interchangeably throughout this catalog.

Specifications

Technical Specifications

Frequency
Range: .01 to 1050 MHz (6060B and 6061A); .1 to 2100 MHz (6062A)
Resolution: 10 Hz to 1050 MHz, 20 Hz from 1050 to 2100 MHz (6062A only)
Switching Speed: <100 ms to be within 100 Hz of final frequency
Accuracy & Stability: Same as Reference Oscillator

Reference Oscillator

Internal Reference Oscillator Characteristics

Characteristic	Standard, Free-Air Crystal	-132 Option, Medium Stability Oven	-130Option, High Stability Oven
Frequency	10 MHz	10 MHz	10 MHz
Temperature	$<\pm 5 \times 10^{-6}$ total, 0-50°C	$<\pm 1 \times 10^{-7}$ total, 0-50°C	$<\pm 2 \times 10^{-10}$ /°C 0-50°C
Aging Rate	$<\pm 5 \times 10^{-7}$ /mo	$<\pm 1 \times 10^{-7}$ /mo	$<\pm 5 \times 10^{-10}$ day $<\pm 1.5 \times 10^{-8}$ /mo
Warm-up (typical)	1 hr to within 1 ppm of final frequency	20 min to within $<\pm 3 \times 10^{-8}$ of final frequency	30 min to within $<\pm 1 \times 10^{-8}$ of final frequency

Reference Output

Frequency: 10 MHz, sinewave
Level: 0 dBm min into 50 Ωs
Source Impedance: 50 Ωs nominal

External Reference

Input Frequency: 1, 2, 2.5, 5, 10 MHz
Input Level: .3 to 4V pk-pk, sinewave or square-wave
Input Impedance: 50 Ωs nominal

Spectral Purity

Harmonics:

Amplitude	6060B and 6061A	6062A
+13 to +16 dBm	N/A	-25 dBc
>+13 dBm	-30 dBc (freq. >100 kHz)	-30 dBc (freq. >1 MHz)
	-26 dBc (10-100 kHz)	-25 dBc (0.1-1 MHz)

Subharmonics:

Carrier Frequency	6060B and 6061A	6062A
Below 1050 MHz	None	None
1050 to 2100 MHz	N/A	-45 dBc

Non-Harmonic Spurious:

Output Frequency	6060B and 6061A	6062A
10 kHz to 100 kHz	-55 dBc	N/A
.1 to 1050 MHz	-60 dBc	-60 dBc
1050 to 2100 MHz	N/A	-54 dBc

For offsets >10 kHz from carrier, cw mode

Residual FM (Hz rms) in 0.3 to 3 kHz BW:

Frequency Range	6060B	6061A		6062A	
	(Spec)	(Spec)	(typ.)	(Spec)	(typ.)
Below 245 MHz	20	12	8	12	8
245 to 512 MHz	10	6	4	6	4
512 to 1050 MHz	20	12	8	12	8
1050 to 2100 MHz	N/A	N/A	N/A	24	16

** Residual FM specifications for 6060B apply for temperature 25°C ±5°C. 6061A and 6062A specifications apply for full 0° to 50°C range.*

Residual FM (Hz rms) in .05 to 15 kHz BW:

Frequency Range	6060B	6061A		6062A	
	(Spec)	(Spec)	(typ.)	(Spec)	(typ.)
Below 245 MHz	44	18	12	18	12
245 to 512 MHz	22	9	6	9	6
512 to 1050 MHz	44	18	12	18	12
1050 to 2100 MHz	N/A	N/A	N/A	36	24

Residual FM (Hz rms) CCITT:

Frequency Range	6060B	6061A		6062A	
		(Spec)	(typ.)	(Spec)	(typ.)
Below 245 MHz	Not Specified	10	7	10	7
245 to 512 MHz		5	3.5	5	3.5
512 to 1050 MHz		10	7	10	7
1050 to 2100 MHz		N/A	N/A	20	14

Residual AM in .05 to 15 kHz BW: <0.1% rms (-60 dBc)

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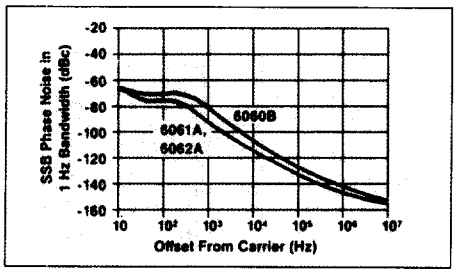
Typical SSB Phase Noise @ 500 MHz (with internal reference)



Amplitude Range: 6060B and 6061A: -127 to +13 dBm (+13 dBm peak on AM), with overrange to +19 dBm and underrange to -147 dBm. 6062A: -137 to +16 dBm (+16 dBm peak on AM) to 1050 MHz, to +13 dBm (+13 dBm peak on AM) above 1050 MHz. Overrange to +17 dBm and underrange to -147 dBm
Resolution: 0.1 dB
Annunciators: 6060B and 6061A: dB, dBm, V, mV, µV; 6062A: dB, dBm, V, mV, µV, dB µV, dB mv
Amplitude Accuracy: 25°C ±5°C
6060B and 6061A

Amplitude Range	10 kHz to 400 kHz	400 kHz to 1050 MHz
+13 to -100 dBm	±2 dB	±1 dB
-100 to -127 dBm	±3 dB	±1 dB

6062A

Amplitude Range	1 MHz to 1050 MHz	1050 kHz to 2100 MHz
+16 to -127 dBm	±1.0 dB	N/A
+13 to -127 dBm	±1.0 dBm	±1.5 dB

Amplitude Accuracy: 0°C to 50°C
6060B and 6061A

Amplitude Range	400 kHz to 1050 MHz
+13 to -127 dBm	±1.5 dB

6062A

Amplitude Range	100 kHz to 1 MHz	1 to 1050 MHz	1050 to 2100 MHz
+16 to +13 dBm	±2 dB	±1.5 dB	N/A
+13 to -127 dBm	±2 dB	±1.5 dB	±1.5 dB

Output Impedance: 150 Ωs, nominal
Output VSWR:
<1.5:1 for amplitude <+1 dBm
<2.0:1 for amplitude >+1 dBm

Reverse Power Protection: 6060B and 6061A: 50W RF from a 50Ω source, 10 kHz to 1050 MHz. Will withstand up to 50V dc. 6062A: 25W RF from a 50Ω source; up to 30V dc
Trip/Reset: Flashing RF OFF annunciator indicates when Reverse Power Protection circuit is tripped. Pushing RF ON/OFF button will reset generator. The 6062A is protected when the instrument is off; the 6060B and 6061A are not.
Leakage:

	6060B	6061A	6062A
RF Leakage at Carrier Frequency	1 µ V	0.5 µ V	1 µ V

Supplemental Characteristics

Amplitude Switching Speed: <100 ms typical (within 0.1 dB of selected value)
Level Flatness: ±0.5 dB (6060B and 6061A)
Amplitude Modulation
AM Depth: 0 to 99% in 1% steps
AM Accuracy: (6060B and 6061A)
±(2% + 4% of setting)
AM Accuracy: (6062A)
±(3% + 5% of setting), 0.1 to 1 MHz, to +16 dBm pk
±(2% + 4% of setting), 1 to 1050 MHz, to +16 dBm pk
±(2% + 4% of setting), 1050 to 2100 MHz, to +13 dBm pk

AM Distortion: 6060B and 6061A

AM Depth	10 kHz to 1050 MHz
0 to 30% AM	<1.5% THD
30 to 70% AM	<3% THD
70 to 90% AM	<5% THD

AM Distortion: 6062A

AM Depth	100 kHz to 1 MHz	1 MHz to 1050 MHz	1050 MHz to 2100 MHz
0 to 30% AM	<3% THD	<1.5% THD	<3% THD
30 to 70% AM	<5% THD	<3% THD	<3% THD
70 to 99% AM	<7% THD	<5% THD	<5% THD

Incidental FM:
<.3 f_m at internal rates and <30% AM to 1050 MHz
<.6 f_m above 1050 MHz (6062A)
Rates
Internal Rates: 1400 Hz and 1 kHz (see Modulation Source for specifications)
External BW: 1(3 dB)

	6060B & 6061A	6062A
AC-coupled	.02 to 30 kHz	.02 to 50 kHz
DC-coupled	N/A	DC to 50 kHz

Frequency Modulation
Deviation Ranges: 100 to 999 Hz, 1 to 9.99 kHz, 10 to 99.9 kHz, 100 to 400 kHz (6062A only)

Maximum Deviation: The following table applies for modulating frequencies of 200 Hz and above

	Maximum Peak Deviation	
Output Frequency	6060B and 6061A	6062A
Below 245 MHz	100 kHz	200 kHz
245 to 512 MHz	100 kHz	100 kHz
512 to 1050 MHz	100 kHz	200 kHz
1050 to 2100 MHz	N/A	400 kHz

Maximum Deviation for Low Modulating Frequencies: At low audio frequencies, maximum FM deviation is modulation-index limited. Use the following formulas to compute maximum allowable deviation

	6060B and 6061A	6062A
Below 24 MHz	dev. = $2f_m(f_o+800)$	dev. = $2f_m(f_o+800)$
245 to 1050 MHz	dev. = $2f_mf_o$	
245 to 2100 MHz		dev. = $2f_mf_o$

f_o= RF frequency in MHz
f_m= modulation frequency in Hz
dev.= max peak deviation in Hz
Example: If f_o = 300 MHz and f_m = 50 Hz, the maximum allowable deviation is 30 kHz. i.e., (2)(50)(300) = 30,000 Hz or 30 kHz
FM Deviation Accuracy: ±7% for rates of 0.3 to 20 kHz for carrier frequency greater than 400 kHz, FM deviation >100 Hz
AF Bandwidth: .02 to 100 kHz (3 dB)
Distortion: Less than 1% THD for .3 to 20 kHz rates, FM deviation >100 Hz (effects of Residual FM excluded)
Incidental AM: Less than 1% AM at 1 kHz rate and less than 50 kHz deviation
Internal Rates: 400 Hz and 1 kHz (see Modulation Source for specifications)
External BW: (3 dB) 20 Hz to 100 kHz

Phase Modulation (6062A only)

Deviation Ranges: .01-.099 rad, .100-.999 rad, 1.00-9.99 rad, and 10.0-40.0 rad
Maximum Phase Deviation:

	Peak Deviation
Below 245 MHz	20 radians
245 to 512 MHz	10 radians
512 to 1050 MHz	20 radians
1050 to 2100 MHz	40 radians

Accuracy: ±7% for rates of 0.3 to 10 kHz and greater than .01 rad deviation
Distortion: Less than 1% THD at 1 kHz rate and >.01 rad deviation
Bandwidth: 20 Hz to 10 kHz (3 dB)
Incidental AM: 1Less than 1% AM at 1 kHz rate and less than 40 rad deviation

Pulse Modulation (6062A only)

ON/OFF Ratio: 80 dB minimum
Rise and Fall Times: 15 nanoseconds maximum
Level Error: For pulse width ≥50 nsec, power in pulse within ±0.5 dB of CW level
Duty Cycle: 0-100%
Rep Rate: DC-16 MHz
Internal Modulation: 400 Hz, 1000 Hz rates, 50% duty cycle
Pulse Modulator Input (External): Nominal 50Ω impedance with internal pull-up. Can be driven directly by TTL

Input Voltage	Modulator State*
<0.9 Volts	RF OFF
>1.1 Volts	RF ON
Open Circuit	RF ON

**EXT PULSE enabled*

Modulation Source

Internal: 400 Hz or 1 kHz, ±3% for 20-30°C; add ±0.1%/°C outside this range
External: 1 volt peak causes indicated modulation index. Internal and External modulation sources may be enabled simultaneously, and combine linearly
Input Impedance: 600 Ωs nominal (560 Ωs nominal when EXT AM and EXT FM enabled simultaneously)
External Modulation Annunciators: EXT HI/EXT LO indicator when 1V peak, ±2% is applied at MOD IN connector .02 to 100 kHz BW

Memory

Type: Non-volatile. Data is stored 2 years (typical) with power off
Size: 50 complete front panel settings
Features: 1Store, recall, sequence

Option Specifications

Option -130: High Stability Crystal Oscillator
Option -132: Medium Stability Crystal Oscillator
See data under Reference Oscillator section.
Option -488: IEEE-488 Compatible Interface (standard on 6061A and 6062A). For field installation order -489K (Kit)
Interface: IEEE-488-1978
Functions Controlled: All front panel controls except line power switch
Data Output: Instrument status, stored memory contents, instrument settled, instrument ID, option complement, uncal/reject entry status, operating time
Indicators: Remote, Addressed, SRQ
Interface Functions: SH1, AH1, T5, TE0, L3, LE0, SR1, LR1, PP0, DC1, DT1, C0, E1
Option -651: Low Rate AC-coupled FM
Maximum Deviation: 9.99 kHz
Bandwidth (3 dB): 0.5 Hz to 100 kHz (typical)
Droop: 15% typical on 7 Hz squarewave
Maximum DC Input: ±10 mV
Note: See also 6060B/AK for enhanced low-rate FM capability.
Option -830: Rear Only RF output and modulation inputs. Type N RF output connector on rear panel

General Specifications

Operating Temperature: 0°C to 50°C
Storage Temperature: -40°C to 75°C
Humidity (operating): 0-95% up to 30°C, 0-75% 30°C to 40°C, 0-45% 40°C to 50°C
Altitude (operating): ≤10,000 ft
Power: 100, 120, 220, 240V ac ±10%, 47-63 Hz, (for 400 Hz consult the factory) <180 VA, (<15VA standby with opt -130
Weight: <16 kg (35 lb)
Size: 13.3 cm H x 43.2 cm W x 55.3 cm D (5.25 in x 17 in x 21.8 in)
EMI: Meets MIL-STD 461B RE02, CE03, FCC Part 15(j), Class B

Rear Panel Connectors and Controls

Standard:
10 MHz OUT: Connector to monitor internal 10 MHz reference
REF INT/EXT: Control to enable REF IN connector and disable internal reference
REF IN: Connector to input external reference (see Reference Oscillator)
Option:
MOD IN, RF OUT: Present only if -830 is installed
PULSE IN (6062A): Present only if -830 is installed
IEEE-488 Connector: Standard on 6061A and 6062A, optional on 6060B

Ordering Information

Models

January 1989 prices

6060B 1 GHz Signal Generator $5225
6061A 1 GHz Signal Generator 5895
6062A 2 GHz Signal Generator 11,295

Options (for above Models)*

-130 High Stability Reference 1250
-132 Mid Stability Reference 400
-488 IEEE-488 Interface (6060B only) ... 395
-488K IEEE-488 Interface (6060B only) 415
-651 Low-rate AC-FM 395
-830 Rear Output and Modulation Input 125

**See chart page 244 for compatibility*

Accessories (Also see page 485)

Y6001 Rack Mount Kit, inc 24" slides $295
Y9100 Attenuator, 50Ω, 6 dB, BNC 55
Y9101 Attenuator, 50Ω, 14 dB, BNC 55
Y9102 Attenuator, 50Ω, 20 dB, BNC 55
Y9103 50Ω Feed-through Termination, BNC 35
Y9111 3 ft (0.91m) 50Ω Cable, BNC to BNC 20
Y9112 6 ft (1.83m) 50Ω Cable, BNC to BNC 20
Y9301 Min-Loss Pad, 50Ω to 75Ω 75
Y9307 Adapter, N to BNC, 75Ω 25
Y9308 Adapter, N to BNC, 50Ω 20
Y9315 Coaxial Cable, N male to N male, 6 ft 75
Y9316 Cap, Non-shorting, BNC 10
Y9317 50Ω Termination, N 95

PM 21XX Modular GPIB Switching System ..... see page 380
PM 2122 50Ω coaxial switch ..... see page 382
PM 2240 TestTeam Software .... see page 374

Service & Support

Warranty

One-year product warranty. See page 470 for further information on warranty terms and conditions.

Extended Warranty

SC1-6060B Repair (w/calibration) 422
SC1-6060B Repair (cal w/in or out data) 497
SC1-6060B Repair. (cal w/in and out data) 572
SC2-6060B Cal (1 yr recommended) 369
SC2-6060B Cal (1 yr w/in or out data) ... 444
SC2-6060B Cal (1 yr w/in and out data) 519
SC1-6061A Repair (w/calibration) 430
SC1-6061A Repair (cal w/in or out data) 505
SC1-6061A Repair (cal w/in and out data) 580
SC2-6061A Cal (1 yr recommended) 396
SC2-6061A Cal (1 yr w/in or out data) ... 471
SC2-6061A Cal (1 yr w/in and out data) 546
SC1-6062A Repair (w/calibration) 443
SC1-6062A Repair (cal w/in or out data) 518
SC1-6062A Repair (cal w/in and out data) 593
SC2-6062A Cal (1 yr recommended) 432
SC2-6062A Cal (1 yr w/in or out data) ... 507
SC2-6062A Cal (1 yr w/in and out data) 582