

GP/IB

Constant Current Mode

Range — 100 mA to 3.0 A (Foldback characteristic below 4.5 V, maximum short circuit current is <1.5 A).

Overall Accuracy — $\pm(5\% + 20 \text{ mA})$.

Resolution — 100 mA $\pm 30 \text{ mA}$.

Scaled Output — 10 mA = 1 mV $\pm(2\% + 2 \text{ mV})$ available at rear interface (not ground referenced).

Overvoltage Protection — SCR crowbar typically trips at 6 V to 7 V.

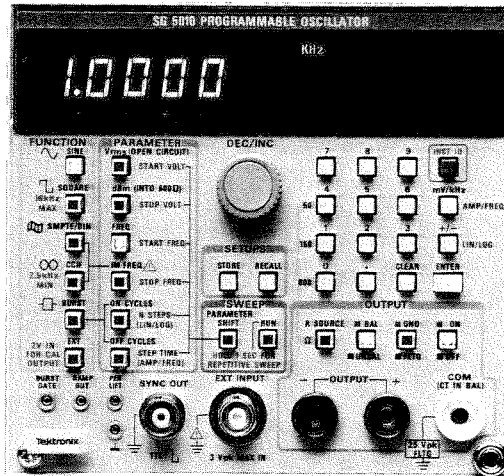
OTHER CHARACTERISTICS

TM 5000 Power Module Compatibility — The PS 5010 is not compatible with TM 500 mainframes.

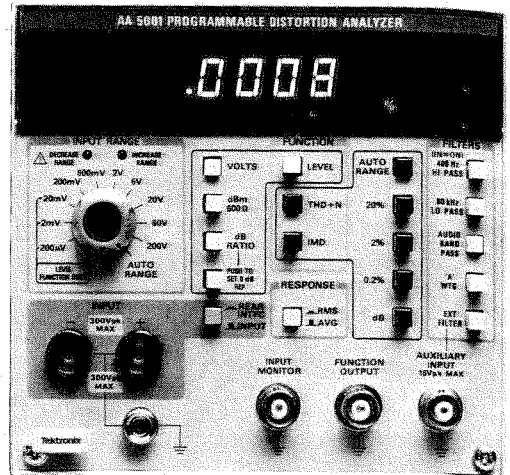
Power Consumption — 250 VA maximum in high power compartment, 200 VA in standard compartment.

IEEE Standard 488-1978 Interface Function Subsets Implemented — Same as PS 5004.

SG 5010



AA 5001



Programmable Audio Test System

ORDERING INFORMATION

PS 5010 Power Supply **\$3,050**

Includes: Instruction manual (070-3391-00); instrument interfacing guide (070-4610-00); reference guide (070-3402-00).

Utility Software

For TM 5000/4041 Order 062-6958-01

\$150

See page 359 for description and ordering information.

SG 5010/AA 5001



The SG 5010 and AA 5001 comply with IEEE Standard 488-1978, and with Tektronix Standard Codes and Formats.

Fast, Accurate, Repeatable Measurements

Easy to Use, Minimizes Training Needs

Automatic Low-Cost Documentation of Test Results

Automated Audio Test System Advantages

Tektronix SG 5010 and AA 5001 programmable instruments in a computer-controlled test system will make critical audio measurements consistently, accurately, and in two to four seconds each. Even complex tests can be made by technically unskilled operators since the procedures are controlled by software in the controller. And, permanent graphic or tabular records of test results can be produced at very low cost.

An SG 5010/AA 5001 based system will automatically perform such industry-standard tests as harmonic distortion to IHF A202, intermodulation distortion to SMPTE TH 22.51, DIN 45403, IEC 268.3, and IHF A202, frequency response to IHF A202, and noise or signal-to-noise ratio to IHF A202 ("A" weighting filter complies with ANSI specification S1.4 and IEC specification 179 for sound level meters). With the Option 02 capability of the AA 5001, noise measurements can be made to CCIR 468-2 and DIN 45405 standards. The SG 5010 also generates the burst signal necessary for dynamic headroom tests per IHF A202.

A basic automated system consists of the SG 5010 Programmable Oscillator, the AA 5001 Programmable Distortion Analyzer, and an IEEE Standard 488 controller such as the Tektronix 4041 System Controller. Frequency counters, signal switchers, interface devices, disc storage, and hard copy units or plotters can be optionally added to the system.

The MP 2902 is a measurement package offering a total solution to your audio measurement requirements. It includes an automatic test program generator which dramatically reduces software development time and allows program development by nonprogrammers. See page 377.

Other Measurement Capabilities

Features and flexibility of the SG 5010 and AA 5001 permit a variety of other measurements to be easily automated. SMPTE-like IMD measurements can be made at a variety of lower frequencies and any value of upper frequency, and at 1:1 amplitude ratios in addition to the standard 4:1 ratio. A

CCIF test with the frequencies selected near the upper band limit of the device under test has been shown to be a very effective and simple-to-implement test for transient or dynamic intermodulation (TIM and DIM). Burst signals of any desired duty cycle can be generated for IHF dynamic headroom measurements and to test compressors and limiters; the between-bursts level can be selected as Off or 20 dB below the burst level. Power measurements are made by a controller computation from a voltage measurement across a known load resistance. SINAD measurements of sensitivity of FM communications receivers are a standard capability of the AA 5001 plus an appropriate RF signal generator. The SG 5010 features an amplifier mode in which an external signal can be converted to the high level, multiple impedance, balanced and floating capability of the SG 5010 output circuitry. Fully program-selectable filters in the AA 5001 allow various choices of bandwidth for distortion measurements and weighting for noise measurements, or rejection of interfering signals. Phase measurements can be added to the system by use of the DC 5009 or DC 5010 Universal Counter Timer.

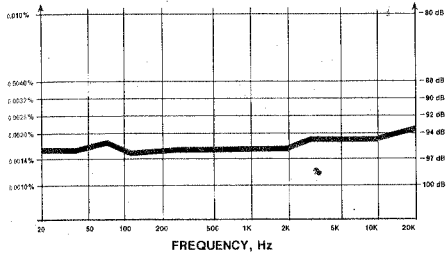
AUDIO TEST SYSTEM

**CHARACTERISTICS (SYSTEM)
HARMONIC DISTORTION FUNCTION**

Measurement Settling Time — Typically ≤ 2.5 s above 100 Hz, increasing by 1 s/octave below 100 Hz.

Residual THD + N — $V_{in} \geq 250$ mV, RMS response, all distortion, noise, and nulling resources combined. 20 Hz to 20 kHz $\leq 0.0032\%$ (-90 dB) with 80 kHz filter. 10 Hz to 100 kHz $\leq 0.01\%$ (-80 dB) no filters.

TYPICAL SYSTEM RESIDUAL THD + NOISE
 $V_{in} \geq 250$ mV with 80 kHz filter, RMS response.



**INTERMODULATION
DISTORTION FUNCTION**

Measurement Settling Time — Typically ≤ 2 s.

Residual IMD — $V_{in} \geq 250$ mV, RMS response.

SMPTE and DIN Tests — $\leq 0.0032\%$ (-90 dB) for 60 Hz and 7 kHz or 250 Hz and 8 kHz, 4:1 ratio.

CCIF Difference Frequency Test — $\leq 0.0018\%$ (-95 dB) with 14 kHz and 15 kHz.

LEVEL FUNCTION

Measurement Settling Time — Typically ≤ 2 s.

Flatness — ± 0.1 dB 20 Hz to 20 kHz.

**CHARACTERISTICS (SG 5010)
AVAILABLE FUNCTIONS**

Sinewave, squarewave, SMPTE/DIN 4:1, SMPTE DIN 1:1, CCIF, Sinewave Burst, IHF Burst (-20 dB or Off between bursts), External Input (Amplifier Mode).

FREQUENCY RANGE AND ACCURACY

Sinewave, Sinewave Burst

SMPTE/DIN: 10 Hz to 163.80 kHz $\pm 0.01\%$.

CCIF Center Frequency: 2.500 kHz to 163.80 kHz $\pm 0.01\%$.

Squarewave: 10 Hz to 16.380 kHz $\pm 0.01\%$.

Resolution in Above Functions

10.00 Hz to 163.80 Hz: 0.01 Hz. 163.9 Hz to 1.6380 kHz: 0.1 Hz. 1.639 kHz to 16.380 kHz: 1.0 Hz. 16.39 kHz to 163.80 kHz: 10.0 Hz.

SMPTE Lower Tone, CCIF Offset From Center Frequency — Selectable From: 40 Hz, 50 Hz, 60 Hz, 80 Hz, 100 Hz, 125 Hz, 250 Hz, 500 Hz, all $\pm 2\%$.

Sine Distortion (Load $\geq 600 \Omega$, THD Including 2nd Through 5th Harmonics) — 20 Hz to 20 kHz: 0.001% (-100 dB). 20 kHz to 50 kHz: 0.0032% (-90 dB). 10 Hz to 20 kHz and 50 kHz to 100 kHz: 0.01% (-80 dB). 100 kHz to 163.8 kHz: 0.032% (-70 dB) any individual harmonic.

SMPTE, DIN or CCIF Distortion — See System Specifications.

Sine Flatness — 20 Hz to 20 kHz: ± 0.05 dB. 10 Hz to 163.8 kHz: ± 0.2 dB.

Squarewave Rise Time — $1.5 \mu\text{s} \pm 10\%$.

Burst Range — 1 cycle to 65535 cycles On. 1 cycle to 65535 cycles Off. Off level either -20 dB or zero. All switching at sinewave zero crossing. Triggered, gated, or free-running burst modes available.

OUTPUT LEVEL RANGE AND ACCURACY

Balanced — Into Open Circuit: $200 \mu\text{V}$ to 21.2 V RMS. Into 600 Ω : -72.45 dBm to +28.05 dBm.*1

Unbalanced — Into Open Circuit: $200 \mu\text{V}$ to 21.2 V RMS. Into 600 Ω : -72.45 dBm to +22.05 dBm.*1

Resolution — 0.05 dB in dBm mode, 0.25% or better in volts mode.

Level Accuracy (Sinewave) — 20 Hz to 20 kHz $\pm 2\%$ (0.2 dB). 10 Hz to 163.8 kHz ± 3 (0.3 dB).

*1 $R_S=50 \Omega$. For $R_S=150 \Omega$, subtract 1.25 dBm; for $R_S=600 \Omega$, subtract 5.35 dBm.

OUTPUT IMPEDANCE AND CONFIGURATION
50 $\Omega \pm 3\%$, 150 $\Omega \pm 2\%$, or 600 $\Omega \pm 1\%$, balanced or unbalanced, floating or grounded.

EXTERNAL INPUT

A floating single-ended input is provided for accessing the variable gain stage and high level output amplifier, enabling the use of custom test signals. Input impedance is 20 k Ω ; a 2 V RMS input (2.83 V peak maximum) provides a calibrated output.

SYNC OUTPUT

A ground referenced TTL-compatible signal is provided that allows stable oscilloscope display of all functions. In sine and squarewave modes the output is at the signal frequency. In the IM modes the sync output is at the lower or offset frequency. In both burst modes the sync signal follows the burst envelope.

SWEEP MODE

Linear or logarithmic sweep of amplitude or frequency in any function. Sweep is composed of discrete steps. The following sweep functions are programmable via GPIB or from the front panel: swept parameter (frequency or amplitude), linear or log sweep, number of steps up to 99, time per step from 0.1 s to 25 s, start frequency or voltage, and stop frequency or voltage. Start and stop frequencies or voltages can be anywhere within the range of the generator, and sweep direction can be upward or downward. Pen lift and ramp outputs are available for interface to an analog plotter.

STORED SETUPS

Ten different complete front panel setups can be stored in the nonvolatile internal memory and recalled from front panel push buttons or via the GPIB. Additionally, the front panel settings at power down are retained and used at power up.

PROGRAMMABILITY

All functions, parameters, and modes can be controlled over the GPIB using simple English-like commands. All settings can be interrogated, with the resulting response usable as a command to return the instrument to that setting (Learn mode). The GPIB address can be displayed and changed from the front panel.

GPIB Interface Function Subsets Implemented — SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0.

**CHARACTERISTICS (AA 5001)
HARMONIC DISTORTION FUNCTION**

Fundamental Frequency Range — 10 Hz to 100 kHz, automatically tuned to input frequency.

Distortion Ranges — Auto (100%), 20%, 2%, 0.2%, and dB (autoranging).

Accuracy — 20 Hz to 20 kHz is ± 1 dB. 10 Hz to 100 kHz is ± 1 , -2 dB. (Accuracy is limited by residual THD + N and filter selection.)

Fundamental Rejection — At least 10 dB below specified residual THD + N or actual signal THD, whichever is greater.

Minimum Input Level — 60 mV (-22 dBm).

LEVEL FUNCTION

Autoranging digital voltmeter displays input signal level in volts, dBm, or dB ratios.

Modes — Volts, dBm (600 Ω), or dB ratio with push-to-set 0 dB reference.

Level Ranges — 200 μV full scale to 200 V full scale in ten steps, manual or autoranging.

Accuracy

Frequency	Volts	dBm or dB Ratio
20 Hz to 20 kHz	$\pm 2\%$ ± 1 count	$\pm 0.3 \text{ dB}^{*1}$ +0.5% of reading
10 Hz to 100 kHz	$\pm 4\%$ ± 2 counts	$\pm 0.5 \text{ dB}^{*1}$ +0.5% of reading

*1 $V_{in} \geq 100 \mu\text{V}$, level ranging indicators extinguished. ± 0.2 dB at 1 kHz only. Flatness is ± 0.1 dB, 20 Hz to 20 kHz, and ± 0.3 dB, 10 Hz to 100 kHz.

Bandwidth — ≥ 300 kHz.

Residual Noise —

$\leq 3 \mu\text{V}$ (-108 dBm) with 80 kHz and 400 Hz filters, RMS response.

$\leq 1.5 \mu\text{V}$ (-114 dBm) with "A" weighting filter, RMS response (standard instrument only).

$\leq 5 \mu\text{V}$ (-104 dBm) with CCIR weighting filter, quasi-peak response (Option 02 instrument only).

**INTERMODULATION
DISTORTION FUNCTION**

Fully automatic SMPTE, DIN, and CCIF difference tone measurements. Minimum input level 60 mV (-22 dBm). Accuracy ± 1 dB.

SMPTE and DIN Tests — Lower Frequency Range: 50 Hz to 500 Hz. Upper Frequency Range: Usable from 3 kHz to 163.8 kHz. Level Ratio Range: 1:1 to 4:1 (lower:upper). Residual IMD: See System Specifications.

CCIF Difference Frequency Test — Frequency Range: Usable from 4 kHz to 163.8 kHz. Difference Frequency Range: 80 Hz to 1 kHz. Residual IMD: See System Specifications.

ALL FUNCTIONS

Display — $3\frac{1}{2}$ digits resolution at ≈ 3 readings/s.

Detection — Average or true RMS for waveforms with crest factors ≤ 3 . Option 02 replaces average detector with quasi-peak detector complying with CCIR Recommendation 468-2 and DIN 45405.



To order, call your local Tektronix Sales Office, or call Tek's National Marketing Center, toll free: 1-800-426-2200, Ext 99. In Oregon call collect: (503) 627-9000, Ext. 99

GPIB

AUDIO TEST SYSTEMS

GP/IB

Filters —

400 Hz High Pass: -3 dB at 400 Hz ±5%; 18 dB octave slope, at least 40 dB rejection at 60 Hz.
80 kHz Low Pass: -3 dB at 80 kHz ±5%; 18 dB/octave slope.

Audio Bandpass: -3 dB at 22.4 Hz and 22.4 kHz, both ±5%. Complies with CCIR Recommendation 468-2 and DIN 45405.

"A" Weighting: Meets specifications for Type one sound level meters (ANSI S1.4, IEC Recommendation 179). Option 02 replaces "A" weighting filter with CCIR weighting filter complying with CCIR Recommendation 468-2 and DIN 45405.

Ext: Allows connection of external filters.

Input Type — Balanced (full differential).

Input Impedance — 100 kΩ ±2%, each side to ground.

Maximum Input — 300 V peak, 200 V RMS either side to ground or differentially. Fully protected on all ranges.

Common-Mode Rejection — ≥50 dB at 50 Hz or 60 Hz. Typically ≥40 dB to 300 kHz.

PROGRAMMABILITY

Function (Level or THD or IMD), Level Mode (Volts or dBm), Input Level and Distortion Ranges (Auto-range or default to range selected by front panel switches).

Detector Type (RMS or AVG; or RMS or Q-PK on Option 02).

Filter Selection (400 Hz Hi Pass, 80 kHz Low Pass, 22.4 Hz to 22.4 kHz Band-Pass, "A" Weight (or CCIR WTG on Option 02, Ext Filter).

GP/IB Interface Function Subsets Implemented — SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT0, C0.

FRONT PANEL SIGNALS

Input Monitor — Provides constant amplitude version of signal applied to input. Output Voltage: 1 V RMS ±10% for input signals >50 mV. Source Impedance: 1 kΩ ±5%.

Function Output — Provides a scaled sample of selected function signal. Output Voltage: 1 V RMS ±3% for 1000 count display. Source Impedance: 1 kΩ ±5%.

Auxiliary Input — Provides input to detector circuit when Ext Filter button is depressed. Sensitivity: 1 V RMS ±3% = 1000 count display. Impedance: 100 kΩ ±5%, ac coupled.

REAR INTERFACE SIGNALS

Duplicates of all front panel inputs and outputs are provided to allow external filter connections or oscilloscope monitoring within same mainframe without exposed cables. Detector outputs with specified scale factors also available to drive analog chart recorders, storage oscilloscopes, or similar devices.

ORDERING INFORMATION

SG 5010 Programmable Oscillator \$4,195

Includes: Instruction manual (070-4331-00); instrument interface guide (070-4790-00); reference guide (070-4330-00).

AA 5001 Programmable Distortion Analyzer \$3,450

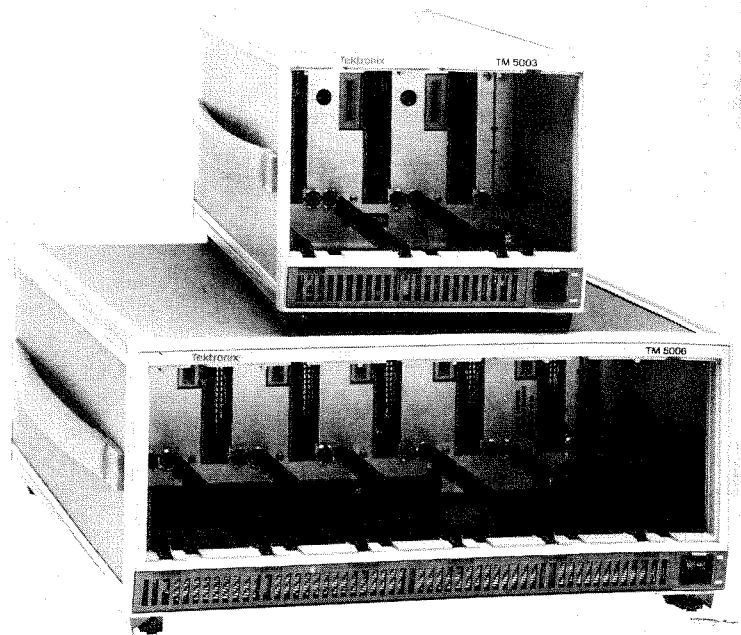
Includes: Instruction manual (070-4598-01); instrument interface guide (070-4788-00); reference guide (070-4597-00).

Option 02 — (AA 5001 only) CCIR/DIN. +\$410

Audio Test Program Generator Software — Order S45F902 \$1,995

Utility Software For TM 5000/4041. Order 062-6958-01 \$150

See page 359 for description and ordering information.



TM 5003 and TM 5006 mainframes shown above.

TM 5003/TM 5006 Power Module Mainframes



The TM 5003 and TM 5006 comply with IEEE Standard 488-1978.

The TM 5000 mainframes extend the convenience of the TM 500 concept into the programmable instrument/IEEE Standard 488 area. The TM 5003 accepts up to three instruments at one time; the TM 5006 accepts up to six instruments at one time. These two TM 5000 mainframes were designed specifically for use with the Tektronix TM 5000 line of programmable, IEEE Standard 488 compatible test and measurement instruments, but all of the TM 500 manual plug-in instruments will also operate in these same mainframes allowing manual and programmable instruments to be mounted together in adjacent slots. This capability permits unique compact combinations of test instruments to be assembled for specific test applications.

Any of the mainframes may be operated with less than a full complement of plug-in instruments installed. TM 5000 instruments cannot be operated in TM 500 mainframes.

Benchtop or Portability

The two benchtop mainframes are the TM 5003 and the TM 5006. The TM 5003 is the most compact, accommodating three single-wide plug-ins. The TM 5006 includes a high power compartment at the right-hand end to supply higher current levels to instruments that provide higher performance or higher output levels. Both the TM 5003 and TM 5006 incorporate a quiet fan for optimum cooling; have feet, tilt-bails, handles, and front panel power switches. Both operate from 110 V ac or 220 V ac.

All benchtop models have carry handles for portable applications.

Rackmount

The TM 5006 Option 10 is electrically identical to the standard TM 5006 and features a slide assembly and handles, plus a higher-power fan than the bench version to accommodate the higher ambient temperatures often found in enclosed racks and consoles. Kits are available to rackmount a TM 5003 with a 4041 System Controller.

TM 5000 MAINFRAMES