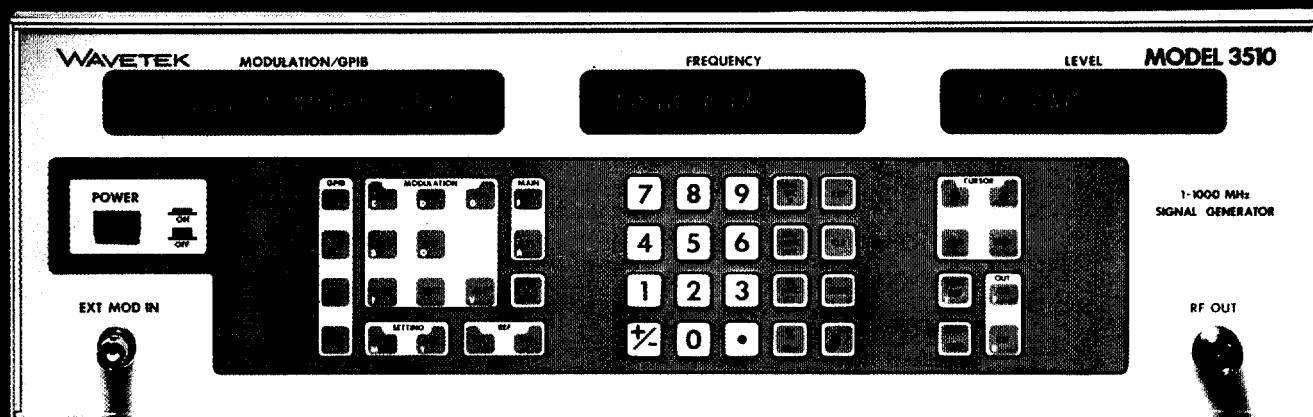


WAVETEK

**Model 3510**

1 GHz  
Programmable  
Signal Generator

1000



# The most versatile programmable signal generator you can buy.

## **Every feature is designed to your needs.**

The Wavetek Model 3510 Programmable Signal Generator offers a unique approach to signal generator control.

From the chassis up, the Model 3510 is designed to be easily adaptable to your application needs. Its frequency range of 1 to 1040 MHz covers a wide spectrum of testing requirements, and the 100 Hz resolution (.001% accuracy) provides the precision you need. Frequency settling time is typically just 40 milliseconds. Other programmable generators might take as long as 2 seconds. If you want more than the standard 0.2 ppm/hr stability, a variety of high-stability external/internal reference options are available. The RF output power can be set in 0.1 dB steps, from -137 dBm to +13 dBm with a flatness of  $\pm 1$  dB. Internal modulation can be set to any frequency between 80 Hz and 10 kHz in 10 Hz increments.

But the most important feature is how easily all this performance can be put into action. Let us show you how.

## **We've redefined programmability.**

High-speed GPIB programmability is standard with the Model 3510. Every control function except the on/off switch is accessible from the bus. Wavetek programming conventions let you send instructions in free format. A non-volatile memory can store up to 32 complete front-panel setups for fast test sequences. With these stored settings, a completely new setup can be output by a single instruction.

The Model 3510 executes GPIB commands very quickly. Successive frequency changes can be executed in 75 msec.

## **Enter a new world of convenience.**

The same free-format entry system used by the GPIB is also available at the front panel. You can make as many setting adjustments as you wish without changing the output because your entries are stored in a "scratch pad" memory. Once you are satisfied with the new setup, just push a single button to implement it. A STATUS key lets you re-examine the current settings while you are making new entries.

There is also a cursor for incrementing selected digits of any parameter. Or you can increment the parameter by any quantity you choose. For instance, when testing receivers with 12.5 kHz channel spacing, the frequency increment step can be set to 12.5 kHz and each channel can be tested in sequence.

Even the 48-key touch panel is designed to make your job simpler. It uses reliable membrane switches and provides an audible signal each time a key is pressed. All settings are given in convenient units on high-visibility, vacuum-fluorescent displays.

## **Permanently store 32 complete front-panel settings.**

The Model 3510 has a large non-volatile memory which holds as many as 32 combinations of frequency, level, and modulation commands, for a total of 96 operational settings. You can recall a complete setup, or just the parameter you want. (For instance, you might leave level and modulation alone, and step through 32 pre-set frequencies.) This is a powerful aid for running complicated test sequences on the bench and for simplifying instrument setup over the bus.

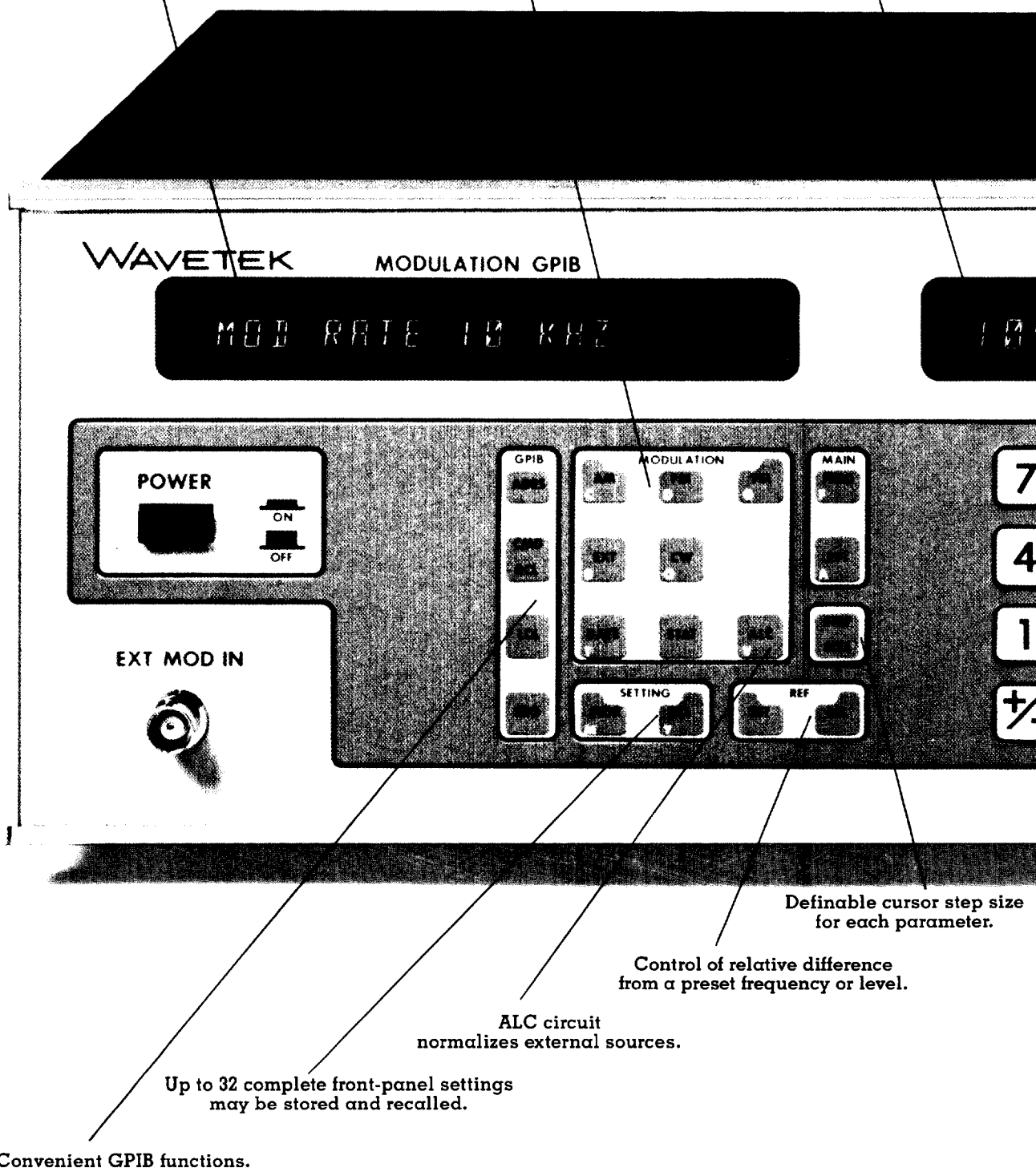
## **Versatile modulation system.**

The 3510 is equipped with an internal audio generator that can supply any modulation frequency between 80 Hz and 10 kHz in 10 Hz increments. Add an external modulation generator and you can create complex or simultaneous modulation such as AM on FM, FM on FM, or AM on AM. ALC is available for normalizing any external modulation source between .1 V and 1 V RMS to assure calibrated modulation levels. Pulse modulation is offered as an option.

Easy to read  
vacuum fluorescent displays.

Internal audio source supplies  
80 Hz to 10 kHz in 10 Hz increments.

Carrier frequency settable  
from 1 MHz to 1040 MHz  
in 100 Hz steps.



WAVETEK

MODULATION GPIB

MOD RATE 10 KHZ

100

POWER

ON

OFF

EXT MOD IN

GPIB

MODULATION

MAIN

7

4

1

+/-

SETTING

REF

Definable cursor step size  
for each parameter.

Control of relative difference  
from a preset frequency or level.

ALC circuit  
normalizes external sources.

Up to 32 complete front-panel settings  
may be stored and recalled.

Convenient GPIB functions.

RF output level from  
-137 dBm to +13 dBm in 1 dB steps.

Cursor available for analog-like  
control of parameters.

Units of measure are  
selectable for user convenience.

FREQUENCY

LEVEL

MODEL 3510

0 MHz

13 dBm

CURSOR

OUT

1-1000 MHz  
SIGNAL GENERATOR

RF OUT

RF output electronically  
switchable on or off.  
50W reverse power protection.

# Model 3510 is ideal for production testing.

Whether you are running automated tests over the GPIB or have a complicated series of measurements to make on a bench, Model 3510 is designed to make your operation more efficient.

As a GPIB instrument, it offers total free-format programmability, including all control functions except on/off. Also, the internal non-volatile memory is available to the controller, allowing up to 32 front-panel setups to be downloaded to the 3510 in advance and stepped through with just a single command for each output change. The Model 3510 also responds as much as 50 times faster than some other programmable generators. Typical frequency settling time is just 40 milliseconds.

For manually controlled testing, the non-volatile memory lets the operator store 32 commonly used setups that can then be called up in any order or stepped through sequentially.

The mechanical design of the Model 3510 also takes the production environment into consideration. It employs high-reliability sealed membrane switches and has rugged modular construction. The use of surface-mounted components reduces the likelihood of instrument damage from shock and vibration.



Model 3510 (shown with Wavetek's Model 6000 Controller) provides the sophistication and affordability you need for both large and small ATE systems.

## Model 3510 on the GPIB: Fast. Friendly. Flexible.

### Fully GPIB Compatible

The Model 3510 conforms to all IEEE-488, 1978 standards. (See Specifications for Model 3510 bus functions.)

### Friendly Programming

The GPIB command strings are as simple to construct as the front panel is to operate because the same format is used for both. The GPIB programming codes are even printed on their respective front-panel function keys.

### Talker-Listener

Via the GPIB, the Model 3510 can report the current setting of any output parameter to the controller. Routines may be written that initially "learn" test sequences from a manually operated front panel. Complete front-panel setups may be written into, or read from, the generator's non-volatile memory.

### Error Messages

Error conditions, such as an unlocked phase-locked loop or tripped reverse power protection, generate service requests to alert the controller. The general class of error is returned as a status byte when the instrument is polled, and the actual error condition may be read over the bus if desired.

### Programmable GET Response

The Model 3510 can respond in one of five different ways to a controller-initiated Group Execute Trigger (GET). The GET may be used to execute previously entered front-panel settings, or to step through stored front-panel setups in rapid succession.

# Specifications

## FREQUENCY

### Range

1 MHz to 1040 MHz

### Resolution

100 Hz

### Accuracy

±.001% in all modes with ALC on;  
±(.001% + 10 kHz) in all modes with  
ALC off.

### Stability

(After 2 hr warmup)  
1 to 520.9999 MHz: .2 ppm/hr with  
ALC on, 500 Hz/10 min with ALC off.  
521 to 1000 MHz: .4 ppm/hr with ALC  
on, 1 kHz/10 min with ALC off.

### Switching Speed

Typically <200 msec  
(<40 msec for steps > 1 MHz)

## RF OUTPUT

### Impedance

50 Ohms (SWR less than 1.3 at RF  
levels less than .1 VRMS).

### Output Connector

Type N

### Power Level Range

1 to 1000 MHz: +13 to -137 dBm  
(1 volt to .0316  $\mu$ VRMS).

### RF Level Control

Adjustable in 0.1 dB steps in dBm  
mode. Three significant digits in  
voltage mode.

### Total Level Accuracy (1 to 1000 MHz)

+13 to -36.9 dBm: ±1.3 dB below  
-36.9 dBm: ±(1.3 dB + .1 dB/10 dB  
decrease).

### Accuracy Breakdown (1 to 1000 MHz)

Flatness (+13 to -6.9 dBm): ±1 dB  
Step Attenuator: ±0.3 dB or 1% of  
attenuation, whichever is greater.

### Leakage: <1 $\mu$ V into a two-turn, 1 inch diameter loop held 1 inch from any surface.

## SPECTRAL PURITY

### Harmonic Output

1 MHz to 10 MHz: <-26 dBc  
10 MHz to 1 GHz: <-30 dBc

### Sub-Harmonics

1 to 520.9999 MHz: none detectable  
521 to 1000 MHz: <-30 dBc

### Non Harmonics:

Fundamental	Spurious Level
1 to 3 MHz	<-60 dBc in 1 to 3 MHz band
3.0001 to 250 MHz	<-65 dBc in 3 to 250 MHz band
3.0001 to 350 MHz	<-55 dBc in 3 to 350 MHz band
3.0001 to 1000 MHz	<-35 dBc in 3 to 1000 MHz band
3.0001 to 1000 MHz	<-30 dBc in 3 to 2000 MHz band

## Phase Noise

1 to 520.9999 MHz: <-93 dBc typical  
(offset 20 kHz from carrier with 1 Hz  
bandwidth)  
1 to 520.9999 MHz: <-120 dBc typical  
(offset 500 kHz from carrier with 1 Hz  
bandwidth)  
521 to 1000 MHz: <-87 dBc typical  
(offset 20 kHz from carrier with 1 Hz  
bandwidth)  
521 to 1000 MHz: <-114 dBc typical  
(offset 500 kHz from carrier with 1 Hz  
bandwidth).

## Residual AM

<-65 dBc in a 50 Hz to 15 kHz post-  
detection bandwidth.

## Residual FM

In 50 Hz to 15 kHz post detection  
bandwidth: 1 to 520.9999 MHz:  
<200 Hz (typically <100 Hz) 521 to  
1000 MHz: <400 Hz (typically  
<200 Hz).

## MODULATION

### Internal Frequency Source

Internal modulation source settable  
in 10 Hz increments between 80 Hz  
and 10 kHz (accuracy ±5% of  
reading).

### External Frequency Source

(AM)  
DC to 30 kHz (3 dB bandwidth) with  
ALC off; 100 Hz to 30 kHz with  
ALC on.

(FM)  
DC to 60 kHz (1 dB bandwidth) with  
ALC off; 100 Hz to 60 kHz with  
ALC on

Input level required to provide  
calibrated display:  
(ALC on): 0.1V to 1V p-p into 600  
ohms;  
(ALC off): 10V p-p into 600 ohms.

### Modulation Depth Resolution

.1%

### Modulation Depth Indicator Accuracy

0 to 90%: ±6% of reading

### Range

0 to 100%

### Distortion

Measured at 1 kHz:  
0 to 30% AM: <1.5%  
30 to 70% AM: <3%  
70 to 90% AM: <5%

### Deviation Resolution

100 Hz for deviations <10 kHz,  
1 kHz for deviations ≥10 kHz

### Deviation Indicator Accuracy

±5% of reading

### Range

0 to 100 kHz deviation

### Distortion

Measured at 1 kHz:  
10 to 100 kHz deviation: <2%  
3 to 10 kHz deviation: <4%

## READOUT

Alpha-numeric vacuum-fluorescent  
display.

## FRONT PANEL CONTROL

Soft touch membrane switches

## REVERSE POWER PROTECTION

Trip Time <2msec  
RF Trip Level ~.7W  
RF 50W  
DC Blocking Voltage 50V

## REMOTE PROGRAMMING

### Interface: GPIB

Conforms to IEEE-488, Standard.  
Controls all functions.

**Function:** Listens and talks, gives error  
status and instrument status. SH1,  
AH1, T6, TE0, L4, LE0, SR1, RL1, PP0,  
DC1, DT1, C0, E2.

## GENERAL

### Dimensions

43.2 cm (17 in) wide x 14.6 cm (5¾ in)  
high x 40.6 cm (16 in) deep.

### Weight

14.5 kg (32 lbs)

### Power

90 to 110, 110 to 130, 180 to 220, or 220  
to 240 VAC; 50 to 400 Hz;  
approximately 75 watts.

## OPTIONS

05 External Reference	\$240
05A High-Stability Reference	\$325
06 High-Stability Reference	\$685

### Pulse Modulation

Available February 1984.

## ORDER INFORMATION

(FOB Beech Grove, Indiana)

**Model 3510 Programmable Signal  
Generator \$6195**

Terms: Net 30 days.

Prices apply only to domestic U.S. customers.  
Specifications subject to change.

**For more information call Toll Free  
800-428-4424 and ask for Ext. 3510.  
In Indiana call (317) 788-5960.**

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