

# Programmable Frequency Synthesizers

- Frequency Range: DC to 3 MHz
- Resolution: Constant 0.001 Hz
- Direct Digital Synthesis: No Range Multipliers, Mixing or Phase Lock Loops
- Ultra-Fast Switching: 1.5  $\mu$ s
- True Phase and Amplitude Continuity

## Versatility

Models 5100 and 5110 Programmable Frequency Synthesizers provide spectrally pure output frequencies in 0.001 Hz steps from DC to 3 MHz. Model 5100 may be programmed locally and remotely; Model 5110 is intended for remote-only applications.

## Synthesis Technique

A patented\* direct digital synthesis technique is used to generate the output frequency directly from an internal crystal reference, which may be phase locked to an external 1 MHz standard, if desired.

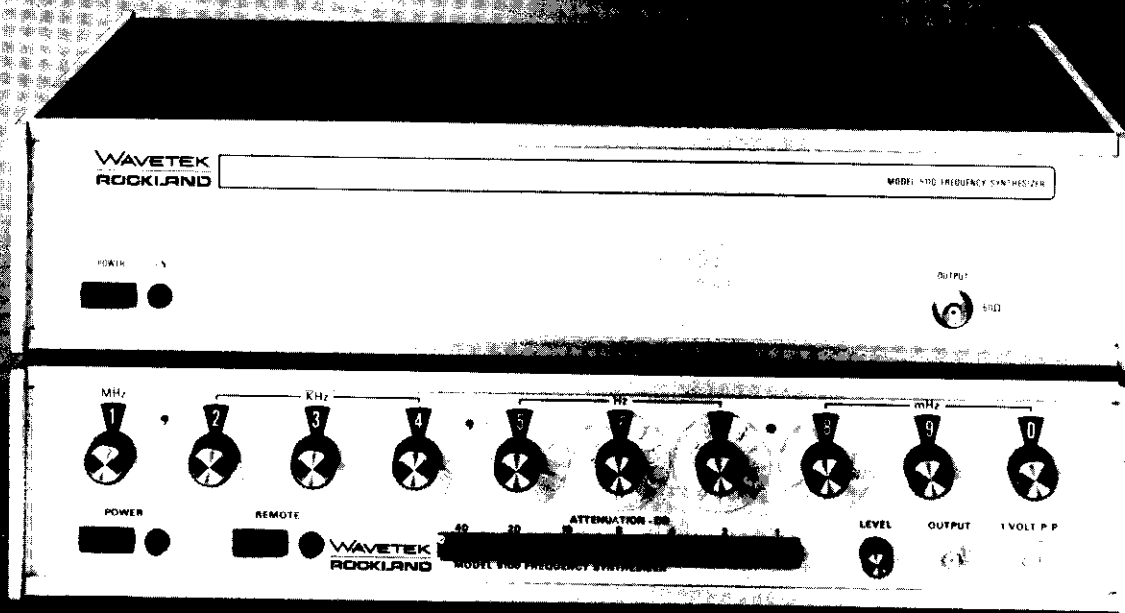
\*U.S. Patent 3,735,269

## Design

In addition to excellent short term stability, digital synthesis also provides other improvements in performance. Digital operation means inherent programmability and very fast switching. In binary word format, Models 5100 and 5110 synthesizers maintain *amplitude and phase continuity in switching between any two frequencies* (i.e., no switching transient) with a programming delay of only 1.5  $\mu$ s before switching. Thus, linear frequency sweeping or frequency hopping (including FSK signaling) are easily programmed with the 5100 and 5110.

## Features

Excellent spectral purity is also possible with digital synthesis since output distortion is determined entirely by the number of bits per sample and the linearity of the D/A converter. Another feature of digital synthesis is the ability to precisely control the phase of output frequency. In the Models 5100 and 5110 the phase may be asynchronously reset to zero at any time for as long as desired (or as little as 125 ns). Hence, for example, sinusoidal bursts are easily produced with each burst beginning at exactly zero phase.



# MODELS 5100/5110

# FREQUENCY SYNTHESIZERS

## FREQUENCY

### Range

DC to 2,000,000.000 Hz.  
DC to 3,000,000.00 Hz with Option 13.

### Resolution

Constant 0.001 Hz.

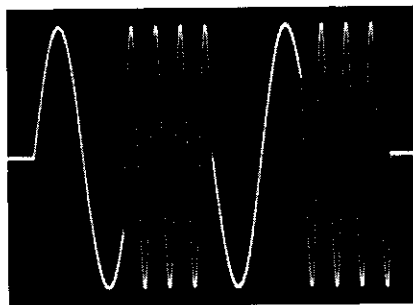
### Control

**Local:** Ten 10-position rotary switches.  
**Remote:** 31 bits in binary or 37 bits in BCD format.  
**Optional:** GPIB. Model 1488A-12.

## SWITCHING CHARACTERISTICS

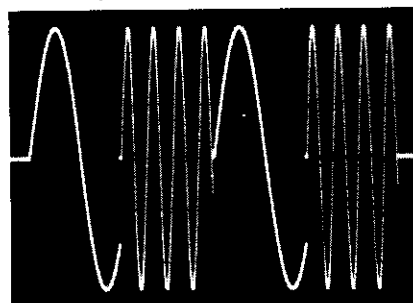
### Programming Delay

1.5  $\mu$ s for binary word with phase and amplitude continuity. 20  $\mu$ s for BCD word with output reset to zero phase during delay.



Binary Programming Mode.  
(Note Amplitude and Phase Continuity is Maintained.)

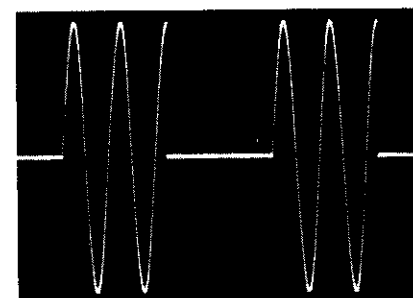
20  $\mu$ s minimum for 4 BCD or binary bytes with output reset to zero phase during programming.



BCD Programming Mode.  
(Note Return to Zero Phase Between Steps.)

### Update Rate

625 ns for binary word.  
18  $\mu$ s for BCD word and byte modes.



Sinusoidal Bursts with ZERO PHASE Line.

### Zero Phase Reset

800 ns to and from ZERO phase (output asynchronously set to ZERO phase).

## MAIN OUTPUTS (FRONT AND REAR PANEL BNC'S)

### Fixed Output

Model 5100: 1Vp-p no load, 0.5 Vp-p into 50 $\Omega$ .  
Model 5110: 1Vrms, 0.5 Vrms into 50 $\Omega$ .  
Option 04: 10 Vp-p output replaces 1V fixed output (Model 5110 only).

### Variable Output (Model 5100 only)

5 Vp-p into 50 $\Omega$  (max).  
10 Vp-p into open circuit (max).

### Auxiliary Output

1 or 8 MHz square wave reference at TTL levels capable of driving 30 TTL loads.

### Level Control

Model 5100 only: 0 to 85 dB attenuation in 1 dB steps plus 0 to 10 dB continuous control.  
Option 02 (5100/5110): Remote program control (7 bits) of 85 dB attenuation in 1 dB steps from 0 to 85 dB.

## SPECTRAL PURITY

### Spurious Components

**Standard:** -70 dB to 100 kHz; -60 dB to 500 kHz; -50 dB to 2 MHz.  
**Option 13:** -45 dB, 500 kHz to 2 MHz; -40 dB to 3 MHz.

### Harmonic Components (at 1 Vrms)

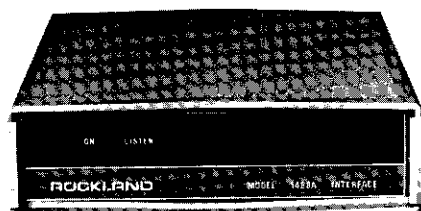
**Standard:** -55 dB to 100 kHz; -50 dB to 500 kHz; -45 dB to 2 MHz.  
**Option 13:** -40 dB, 500 kHz to 3 MHz.

### Phase Noise

30 kHz band excluding 1 Hz centered on carrier.  
**Standard:** -50 dB to 2 MHz.  
**Option 13:** -40 dB 2 MHz to 3 MHz.

### Attenuator Response to 60 dB

$\pm 0.5$  dB to 500 kHz.



Model 1488A

### Optional GPIB

Model 1488A-12 provides following IEEE 488-78 functions: AH1, L1 (listen only) DT1. Programs frequency and amplitude (with option 02) as well as all ZERO PHASE modes.

## CRYSTAL REFERENCES

### Internal

8 MHz Temperature Compesantes Crystal Reference: Standard on

Model 5100; Option 06 for Model 5110).

Temperature Stability:  $\pm 1 \times 10^{-6}$  from 0°C to +50°C.

Aging Rate:  $\pm 5 \times 10^{-6}$ /year.

Option 01 - High Stability (Oven Controlled).

Temperature Stability:  $\pm 1 \times 10^{-8}$  from 0°C to 50°C.

Aging Rate:  $\pm 2 \times 10^{-9}$ /day.

### External

External reference requires a TTL level input (1 TTL load) that is Schmitt-trigger conditioned.

1 MHz Reference: Phase locks to internal reference.

8 MHz Reference: Replaces internal crystal reference. Required for units without internal crystal reference (Model 5110 without options 01/06)).

## GENERAL

### Environment

Operating Temperature: 0°C to +50°C.

Storage Temperature: -20°C to +70°C.

### Dimensions

Model 5100: 43.2 cm (17 in.) wide; 8.9 cm (3 1/2 in.) high; 33 cm (13 in.) deep. Rack Adapters provided.  
Model 5110: 48.3 cm (19 in.) wide; 8.9 cm (3 1/2 in.) high; 33 cm (13 in.) deep. Rack Adapters provided.

### Weight

9.6 kg (21 lb) net; 11.4 kg (25 lb) shipping.

### Power Requirements

115/230V  $\pm 10\%$ , 50 to 60 Hz, 65 watts.

## OPTIONS

**Option 01** **\$895**

High Stability Crystal Reference.

**Option 02** **\$495**

Remote Programmable Attenuator.

**Option 04** **\$75**

10 Vp-p Output (Model 5110).

**Option 06** **\$225**

Temperature Compensated Crystal Reference.

**Option 13** **\$450**

3 MHz Frequency Range.

**Option 20** **\$450**

Auxiliary TTL Output.

## FACTORY/FOB

Rockleigh, NJ

## PRICE

**Model 5100** **\$3750**

**Model 5110** **\$3125**

**Model 1488A-12** **\$895**