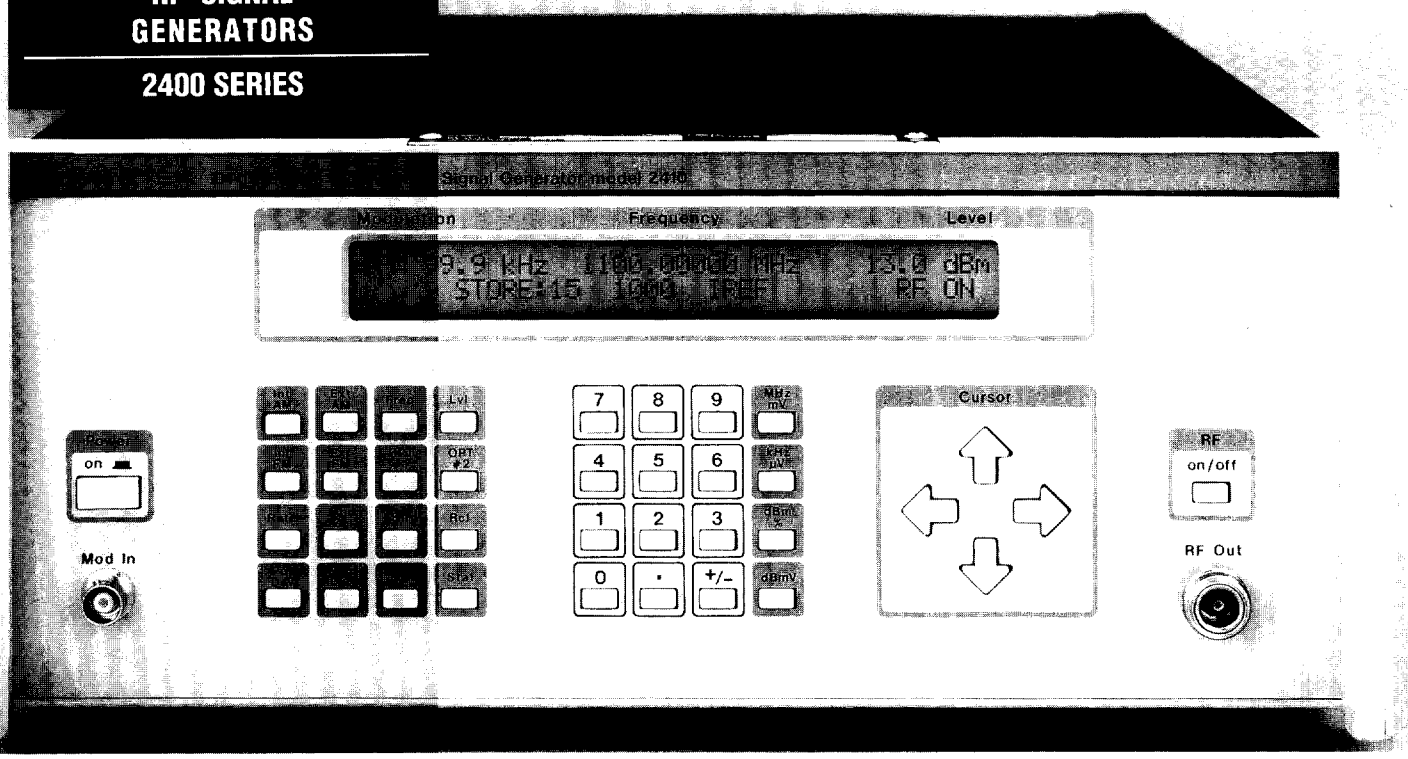
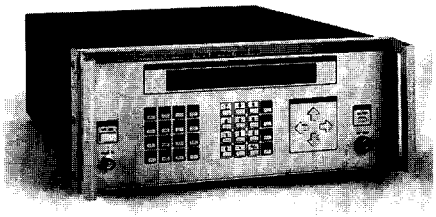


2400 Family, RF Signal Generators

- **Model 2410: 0.01 to 1100 MHz Synthesized Signal Generator**
- **Model 2410R: Ruggedized Model 2410**
- **Model 2405: 0.01 to 550 MHz Synthesized Signal Generator**

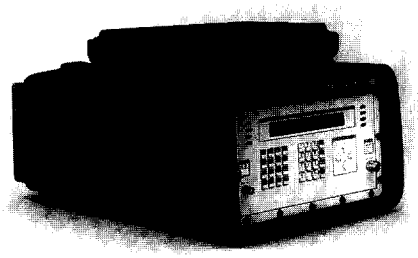
The 2400 family of synthesized signal generators presently consist of three models, the 2405, 2410, and 2410R. This line of instruments is specifically designed to help increase the productivity of ATE and field service applications. The 2400 Series is the most efficient solution for general purpose RF testing.



- **Bright, easy to read display**
- **Data entry by keypad**
- **RF on/off switch**
- **Independent modularity**
- **IEEE-488 interface standard**
- **50 watt reverse power protection**
- **Extensive diagnostic package**
- **Autocal routine**
- **Calibration data tracking**
- **Ergonomic user interface**

Advanced User Interface
The Wavetek 2400 series are dual microprocessor controlled synthesized signal generators that both increase productivity and decrease learning curves through sophisticated user interfaces. The GPIB programming language is in an English language format utilizing the Wavetek minimum uniqueness format. An extensive set of internal diagnostic features allows isolation of potential trouble spots to the board level without opening the instrument.

Advanced PLL/DDS Hybrid Synthesis
The Wavetek 2400s combine fractional division phase lock loop techniques with direct digital synthesis for a wide variety of frequency step sizes. The 2410s cover the frequency range of 10 kHz to 1100 MHz; the 2405 has a range of 10 kHz



to 550 MHz. All have an RF output range of +13 to -127 dBm, and exhibit an output accuracy of ±1.5 dB. More level calibration points may be added through a GPIB diagnostic feature. Other standard features include very broad peak FM deviation; 16 standard stored settings optionally to 100 settings, wide AM bandwidth of 50 kHz, reverse power protection, and external clock input/output.

Easy Service Construction
Construction of the instrument is based around a fully modular design. Each module can be replaced or upgraded

with no dependent interaction with the surrounding modules. There is no need to return a unit for extensive and expensive upgrade kits.

Enhanced Calibration

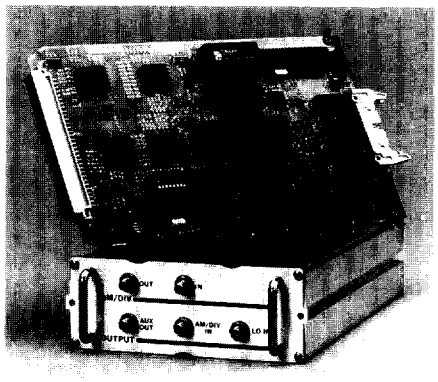
AutoCal of the instrument can be initiated both from the front panel and through the IEEE-488 bus. A state-of-the-art error tracking system allows user read out of the calibration error correction data. This provides statistical process control of the instrument's aging cycle to predict and schedule maintenance.

Long Term Warranty

The Wavetek 2400s have a standard two year warranty. Wavetek is committed to supply their customers with the most reliable instrumentation available.

Models

The models 2405 and 2410 are utilized in a bench or test rack setting, found in engineering, production test, and quality assurance. The model 2410R provides a unique ruggedized case for field use such as flight line radio testing.



SPECIFICATIONS

FREQUENCY
Range
0.01 - 1100 MHz (2410)
0.01 - 550 MHz (2405)
Resolution
8 digits
10 Hz
Frequency Stability (0-50° C)
2.5 ppm standard
0.5 ppm optional
0.1 ppm optional
Frequency Stability (Aging)
<1 ppm/year
Switching Speed
200 ms ±100 Hz of final value in CW, changes <10 kHz in FM, typ. 100 ms
Warm-Up Time
1 hour
External Reference
10 MHz

RF OUTPUT
Impedance
50Ω (SWR 1.5:1 @ output level <-3 dBm
Output Connectors
Type "N"
Output Level Range
-127 to +13 dBm
Output Resolution
0.1 dB
Level Accuracy
±1.5 dB
Flatness
±1 dB
EMI/RFI Leakage
<1.0μ V into a 2 turn 1 inch diameter loop, 1 inch from any surface (@ 550 MHz)
SPECTRAL PURITY
Harmonics
For CW > 10 MHz <-30 dBc
For CW < 10 MHz <-26 dBc
Sub-Harmonics
<25 dBc >550 MHz
Non-Harmonics
Spurious (>5 kHz from carrier)
<-55 dBc
Phase Noise @ 500 MHz
10 kHz offset:
-109 dBc guaranteed
20 kHz offset:
-113 dBc guaranteed
Residual AM, Mod Off
-60 dBc, (50 Hz to 15 kHz Post Det BW)
Residual FM, Mod Off
0.3-3 kHz (0.05-15 kHz) PDBW
<15 Hz <20 Hz (<137.5 MHz)
<8 Hz <12.5 Hz (137.5-275 MHz)
<15 Hz <20 Hz (275-550 MHz)
<30 Hz <40 Hz (550-1100 MHz)
MODULATION
Types
AM, FM
Internal Source
400 Hz, 1 kHz
External Source
400 Hz, 1 kHz
AM Frequency Response (0-50%)
10 Hz to 50 kHz
AM Resolution
0.1%
AM Accuracy, (0-90%)
(0 to 90%) ± (1% Full Scale + 5% of Reading)
AM Range
0-99.9%
AM Distortion
<5% (<90% AM)
<3% (<70% AM)
<1.5% (<30% AM)

FM Rate
50 Hz to 100 kHz (3 dB BW)
FM Resolution
100 Hz for FM <100 kHz
1 kHz for FM >100 kHz
FM Accuracy
±5% of indicated setting at 1 kHz or 400 Hz rate excluding residual FM
FM Deviation Range
0.01 MHz <CW <1 MHz: 0 to 10 kHz
1 MHz <CW<3 MHz: 0 to 100 kHz
3 MHz <CW <137.49999 MHz:
0 to 1 MHz
137.49999 MHz <CW <275 MHz:
0 to 500 kHz
CW >275 MHz: 0 to 1 MHz
FM Distortion
Internal Source
<2% harmonic distortion at 1 kHz or 400 Hz rate, FM <100 kHz peak
External Source
<0.5% at 1 kHz or 400 Hz rate, FM <100 kHz peak

FRONT PANEL CONTROL
Type
Push buttons, GPIB

REVERSE POWER PROTECTION
50 watts
GPIB (Standard)
Interface
GPIB IEEE-488-1978, 1987
Functions
T6, L4, SH1, AH1, RL1, DC1, DT1, E2, SR1, TE0, LE0, PP0, C0

FEATURES
16 nonvolatile stored settings standard
Optional 100 stored settings
Front Panel Programming of GPIB address
Power-on Confidence Check
AutoCal®, Frequency and Level Calibration

GENERAL
Dimensions
13.2 cm (5.2 in.) High;
31.8 cm (12.5 in.) Wide;
53.3 cm (21 in.) Deep.
Weight
12.7 kg (28 lb)
Power
100, 115, 215 or 230 VAC ±10%
Environment
MIL-T-28800C
Class 5
95% Humidity, non condensing
Operating Temp. Range
0-50° C

Options for 2400 SERIES

PULSE MODULAR

- **80 dB On/Off Ratio**
- **15 ns Rise/Fall Time**

Wavetek's Pulse Modulation Option (PUL) provides a high quality Gallium Arsenide (GaAs) switch that boasts >80 dB on/off ratio and rise/fall times faster than 15 nanoseconds.

Traditional pulse modulator markets are in commercial aircraft radar, military radar and E.W. countermeasure applications.

Frequency Range (Carrier):
DC to 2200 MHz
RF Output (Max Available):
+10 dBm to -137 dBm
On/Off Ratio:
>80 dB
Pulse Rise Time:
≤15 ns
Pulse Fall Time:
≤15 ns
Maximum Pulse Repetition Rate:
1 MHz
Input Impedance:
50Ω, Pulse on or off
Pulse Input: TTL:
+5 Volts = RF Off (Must not exceed 10 Volts). +0 Volts = RF On Threshold Level = 1.4 Volts
Temperature Range:
0 to +55°C.
(May not be used with options LEX and XP.)

DEVIATION METER

- **Positive Deviation**
- **Negative Deviation**

The FM deviation of an external source can be measured for either positive or negative deviation. The external source is applied to the Mod In port of the 2405 and FM deviation is measured to ± 30 kHz.

Range:
0-500 kHz
Frequency Input:
30-500 MHz
Input Signal Level:
15 mV-5V rms
Polarity:
Selectable positive or negative
Modulation Rate:
100 Hz - 8 kHz
Accuracy:
6% of full scale from 100 Hz - 8 kHz
(Available only on the model 2405.)

75Ω GENERATOR

The 75Ω output impedance option provides comparability with TV and CATV applications.

Impedance:
75Ω
Output Connector:
BNC
Output Level Range:
-127 to + 6 dBm
Available on all models.

LOW FREQUENCY EXTENSION

- **100 Hz to 10 kHz**

The low frequency extension option (LEX) offers a low cost, one instrument, solution in addressing broad frequency applications. This makes the option ideal for EMI/Tempest (emissions) testing in secured communications programs.

The LEX, in conjunction with the 2405 or 2410 synthesized signal generators provide a frequency range form 100 Hz to 550 MHz (2405) or 1100 MHz (2410).

Frequency:
Range:
100 Hz to 200 kHz
Resolution:
10 Hz
Accuracy:
0.5 PPM Std. 0.1 PPM Optional
Output
Impedance:
50Ω
Flatness:
± 1.2 dB
Level:
-137 to +10 dBm
Resolution:
0.1 dB
Spectral Purity
Harmonics:
≤30 dBc
Spurious:
<50 dBc
Option Compatibility:
Can be used with any other option available, except pulse modulation and XP (extended power).

VARIABLE MODULATION SOURCE

Signal sources have traditionally supplied 400 Hz and 1 kHz internal modulation frequencies. Continued advancement in two way and secure communications shows numerous applications for other modulation sources such as, 150 Hz tone coded squelch in two way radio systems.

The variable modulation source option (VAR) uses direct digital synthesis which allows a continuously variable modulation source form 1 Hz to 100 kHz with 1 Hz resolution.

Internal pulse modulation is a product of the VAR option, and the duty cycle can be controlled from 10% to 90% in 1% increments.

VAR is available in either the 2405 (550 MHz) or the 2410 (1100 MHz) synthesized signal generators.

Frequency
Range:
1 Hz to 100 kHz
Resolution:
1 Hz
Accuracy:
0.5 PPM Std. 0.1 PPM Optional
Output
Impedance:
600Ω
Level:
1.0 VVP
Sine Distortion:
Less than 1%
Internal Pulse Modulation
Duty Cycle:
10% to 90%
Resolution:
1%
Rep Rate:
1 Hz to 10 kHz
Accuracy:
± 2.5%
Rear Panel Output:
5 volt TTL for monitor
Option Compatibility:
Can be used with any other option available.

STORED SETTINGS

Additional memory added to provide 100 complete front panel stored settings. All 100 are stored in nonvolatile RAM. The standard unit offers 20 settings.

Available on all models.

PHASE MODULATION
•External Phase Modulation
•Front Panel or GPIB control
An external phase modulation signal at a 20 Hz to 50 kHz rate, 1 Vp-p is applied to the 'Mod In' port, for easy implementation of a phase modulated RF output.

REMOTE KEYPAD
A remote, hand held cursor pad is provided for incrementing/decrementing front panel settings. Applications include remotely executing stored settings without the need for GPIB programming.

Peak Phase Modulation:
19.99 rad (3-137.49999 MHz)
9.99 rad (137.5-274.9999 MHz)
19.99 rad (275-1100 MHz)
3 dB Band Width:
20 Hz-50 kHz
Accuracy:
± 6%

Availability Option Matrix

Option	Description	Signal Generators 2405	2410	2410R
VAR	Variable Modulation (1 Hz to 100 kHz)	•	•	•
XP	Extended Power Output to 23 dBm	•	•	
PUL	Pulse Modulation	•	•	
RHM	Phase Modulation	•	•	•
R01	0.5 PPM Reference	•	•	•
R02	0.1 PPM Reference	•	•	•
LEX	Low Frequency Extension to 100 Hz	•	•	
DEV	RM Deviation Meter	•		
RPC	Rear Panel Connectors	•	•	
K0317	Rack Mount Without Slides	•	•	
STR	100 Stored Settings	•	•	•
RK	Remote Key Pad	•	•	•
75Ω	75Ω Output Impedance	•	•	•

Option Compatibility Matrix

Option	VAR	LEX	XP	PUL	DEV	PHM	R01	R02	RPC	K0317	STR	RK	75Ω
VAR	•	•	•	•	•	•	•	•	•	•	•	•	•
LEX	•		•			•	•	•	•	•	•	•	•
XP	•	•				•	•	•	•	•	•	•	•
PUL	•					•	•	•	•	•	•	•	•
DEV							•	•	•	•	•	•	•
PHM	•	•	•	•			•	•	•	•	•	•	•
R01	•	•	•	•	•	•			•	•	•	•	•
R02	•	•	•	•	•	•			•	•	•	•	•
RPC	•	•	•	•	•	•	•	•	•	•	•	•	•
K0317	•	•	•	•	•	•	•	•	•	•	•	•	•
STR	•	•	•	•	•	•	•	•	•	•	•	•	•
RK	•	•	•	•	•	•	•	•	•	•	•	•	•
75Ω	•	•	•	•	•	•	•	•	•	•	•	•	•

• *Denotes Compatibility*