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FREQUENCY SYNTHESIZERS

SYNTHESIZERS

FREQUENCY SYNTHESIZERS

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COMPANY PROFILE

Programmed Test Sources, Inc. is a major manufacturer of high performance frequency synthesizers which are designed for stand-alone and OEM uses.

In 1975 we announced our first product, which embodied the goals formulated at the company's inception: a high quality, fast-switching, low-noise synthesizer of modular construction. This approach would make it possible to adapt the instrument effectively to a broad spectrum of uses and do so at a price not available elsewhere.

Today, we offer one of the most complete lines of synthesizers available in the industry. Our models all use our own direct synthesis systems. Their advantages over competitive designs include excellent specifications for phase-noise, switching speed and spurious outputs along with low complexity.

The acceptance of our products has proven the value of our approach. Tens of thousands of PTS synthesizers have been shipped to an international roster of customers. We are proud to have served Analog Devices, Atmel, Boeing, Credence, G.E., Hughes, ITT, JEOL, LTX, Motorola, Philips, Raytheon, Siemens, Teradyne, Toshiba and others. The confidence we have in our products is reflected in our three-year warranty, and by our flat-rate service policy for years four through ten.

In this catalog our instruments are fully specified and priced. In addition to our products, we take pride and care in the services we render. You can count on immediate access to engineering personnel for technical questions, efficient fax, email or phone-quoting, order-taking and processing, on-time delivery and repair service within seven days. Finally, should you have any question about applicability or performance detail, demonstrator models are available for evaluations.

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PTS FREQUENCY SYNTHESIZER SUMMARY CHART

	Frequency Range	Resolution	Switching Time[1]	Phase-Continuous Switching[2]	Phase-Rotation Option	Remote-Control Interface	Page	Notes
PTS 040	.1-40 MHz	optional .1 Hz to 100 KHz	1-20µs	optional	✓	BCD (std) or GPIB (opt)	9	
PTS 120	90-120 MHz	optional .1 Hz to 100 KHz	1-20µs	optional	✓	BCD (std) or GPIB (opt)	10	satellite communications synthesizer
PTS 160	.1-160 MHz	optional .1 Hz to 100 KHz	1-20µs	optional	✓	BCD (std) or GPIB (opt)	11	
PTS 250	1-250 MHz	optional .1 Hz to 100 KHz	1-20µs	optional	✓	BCD (std) or GPIB (opt)	12	
PTS 310	.1-310 MHz	1 Hz	1-20µs	standard	✓	BCD (std) or GPIB (opt)	13	space-saving 3½" cabinet
PTS 500	1-500 MHz	optional .1 Hz to 100 KHz	1-20µs	optional	✓	BCD (std) or GPIB (opt)	14	
PTS 620	1-620 MHz	optional .1 Hz to 100 KHz	1-20µs	optional	✓	BCD (std) or GPIB (opt)	15	
PTS 1600	1-1600 MHz	1 Hz	1-20µs	standard	✓	BCD (std) or GPIB (opt)	16	
PTS 3200	1-3200 MHz	1 Hz	1-20µs	standard	✓	BCD (std) or GPIB (opt)	17	
PTS 6400	1-6400 MHz	1 Hz	1-20µs	standard		BCD (std) or GPIB (opt)	18	
PTS x10	user specified 10 MHz decade	1 Hz	1-5µs	standard	✓	BCD (std) or GPIB (opt)	19	economical; 3½" cabinet
PTS D310	two channels .1-310 MHz	.1 Hz	1-20µs	standard	✓	BCD (std) or GPIB (opt)	20	
PTS D620	two channels 1-620 MHz	.1 Hz/.2 Hz	1-20µs	standard	✓	BCD (std) or GPIB (opt)	21	
PTS SX-51	various, see notes, select-able direct or F 1/10 mode	1 Hz 0.1 Hz	1-20µs	not applicable	not applicable	BCD (std) or GPIB (opt)	22	for PTS 160, 250 310 to obtain super-low phase noise in 1/10 mode

1 Switching Time is dependent on digit (decade) switched; see detailed instrument specifications.
2 For applicable digits, see detailed instrument specifications.

Often outpromised, seldom outperformed.

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TABLE OF CONTENTS

	PAGE
INTRODUCTION	2
PTS QUALITY & RELIABILITY	3
Warranty	3
GLOSSARY	4
FREQUENCY SYNTHESIZERS: Technology Overview	5
GENERAL INFORMATION	7
Remote Control Interfaces	7
Frequency Switching Behavior	8
Frequency Standards	8
SYNTHESIZER SPECIFICATIONS	
PTS 040	9
PTS 120	10
PTS 160	11
PTS 250	12
PTS 310	13
PTS 500	14
PTS 620	15
PTS 1600	16
PTS 3200	17
PTS 6400	18
PTS x10.	19
PTS D310	20
PTS D620	21
PTS 250...SX-51	22
OPTIONS AND ACCESSORIES	23
MECHANICAL SPECIFICATIONS	26
PTS PRODUCT CODE	28
ORDERING INFORMATION	30

INTRODUCTION

PTS frequency synthesizers are precision frequency generators. They transfer the accuracy and stability of a frequency standard operating at 5.0 or 10.0 MHz, either built-in or external, to a selectable output frequency.

Each model is a direct frequency synthesizer capable of providing signals for many uses requiring stable and accurate sine-wave signals with low attendant spurious outputs, low phase noise and fast switching between selected frequencies. Typical applications include communications, spectrum analysis and surveillance, radar and automatic test systems with both narrow and wide-band coverage. Options based on a modular design concept permit a high degree of adaptation to a customer's specific needs.

Up to ten significant figures and resolution to 0.1 Hz are available; custom higher resolution is also available. All output frequencies are coherent with the standard frequency and reflect its stability and accuracy. Any frequency within the instrument's range may be selected by manual dial or by remote control. The output from the levelled system is +3 to +13 dBm (for most models) into 50 ohms and may be adjusted manually by the front panel control or remotely by analog voltage.

PTS synthesizers offer a *choice* of the two most widely-used remote interfaces. Instruments may be equipped with either the BCD-parallel (buffered) or the GPIB (IEEE 488) interface. In addition, PTS now offers the industry's fastest GPIB list-processing capability; this enhanced interface features full IEEE 488.2 and SCPI capability.

The PTS systems of synthesis drastically cut complexity and parts count. The attendant reduction of primary power-input and dissipation (less than 50% of that of competitive designs) is a major factor in the reliability which is further enhanced by a packaging system maximizing mechanical integrity and stability while keeping weight low. For ease of service, most modules are of plug-in design and used in all models.

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PTS QUALITY AND RELIABILITY

Since its founding, PTS has given top priority to reliability. This is reflected in both a management approach which constantly stresses reliability, and the practical implementation of a manufacturing process in which reliability is the key parameter from design to prototype to regular production. This system has ensured our quality for over 25 years.

Complex electronic equipment using modern semiconductor technology can be designed and produced to have very high reliability and long service life if certain ground rules are observed: low power consumption, small internal heat rise and conservative derating of components are all guidelines strictly observed in the design and manufacture of PTS products.

PTS uses only brand-name high quality components. After assembly, all internal modules are subjected to elevated temperature cycling to accelerate infant-mortality component failures, and 100% tested for electrical functionality. All completed instruments are again subjected to elevated temperature testing, 100% tested for electrical functionality, and individually tested to insure conformance to performance specifications.

Constant evaluation and monitoring of service data covering more than 30 years of manufacturing and over 40,000 units in the field demonstrate an actual MTBF of approximately 25,000 hours, and a yearly service rate of 3-4%. In addition, although our equipment is designed for commercial applications, calculations according to MIL 217 show a MTBF of 20,000 to 40,000 hours, depending on options and instrument configuration analyzed. Based on this outstanding record of demonstrated reliability, PTS was one of the first in the industry to offer a three-year warranty. Today, PTS is a key supplier to many blue-chip companies, and has been recognized through quality awards as outstanding in its field.

In addition, with life-cycle cost becoming the accepted criterion in the selection of capital equipment, we now offer complete predictability. Not only can the low 3-4% failure rate be used to project the incidence of required service, but the cost of that service is guaranteed: for years four through ten from shipment we will repair or recalibrate any PTS synthesizer for a flat rate of $450 (PTS 1600, $575; PTS 3200, PTS 6400, $850), if the customer has not attempted repairs and the unit was not subjected to unusual service conditions.

PTS synthesizers carry one or more of these approvals:

WARRANTY

PTS products are warranted for a period of three years from date of shipment against defects in material and workmanship.

Repair or replacement without charge, at PTS's option, will be made at the factory. Equipment must be shipped prepaid after return authorization has been obtained.

PTS is not liable for consequential damages, and no other warranty is expressed or implied.

GLOSSARY

The following is a brief list of terms used in characterizing synthesizer performance in general:

Frequency Range:	The bandwidth over which the output frequency can be varied. Specified in MHz.
Resolution:	The smallest increment by which the output frequency can be changed under local or remote control. Specified in MHz, KHz, Hz, etc.
Accuracy/Stability:	The degree to which the output frequency is invariant with respect to time and temperature. Usually the same as the specification for the frequency standard. Specified in ppm or smaller fractions.
Output Level/ Flatness:	The output power or voltage produced and the maximum deviation over the entire frequency range. Specified in dBm, V, dB.
Phase Noise (Broadband):	The demodulated, integrated phase modulation from 0.5 Hz to 15 KHz produced by noise and discrete close-in sidebands (line or display related) expressed as a ratio to the carrier or absolutely in milli-radians, dBc.
Phase Noise (Spectral Density):	The single-sided plot of the noise modulation, designated "$\mathscr{L}$"; it shows the ratio of the carrier to the noise power in a 1 Hz bandwidth as a function of the offset (modulation frequency) from that carrier. Specified in dBc/Hz.
Residual FM:	The phase noise measured by an FM discriminator and expressed as a frequency deviation (for ready comparison with a normal deviation in a communication system). Various post-detection bandwidths are used and noise very close to the carrier, which is very significant in other applications, is usually not included.
Short-Term Frequency Stability:	This is the extension of the concept of stability versus time, determined by the frequency standard, to time intervals of milliseconds to seconds, where residual contributions of phase disturbance of the synthesizing circuits can affect the overall behavior of the unit. In this case angle-modulation (noise) is measured by a counter. Many consecutive measurements are taken and used to calculate the "Allan variance" which broadly speaking represents the expected standard deviation, sigma, of the value of frequency during the observation interval. Specified in small fractions, e.g. 10^{-11}/sec.
Discrete Spurious Outputs:	Non-harmonic signals which are present within the output bandwidth and may have any offset from the carrier. Specified in dB relative to the carrier amplitude.

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GLOSSARY (continued)

Phase-Continuous Frequency Switching:	The property that at a frequency switching point the amplitude or phase of the signal at both the "old" and the "new" frequency are equal, with no transients or discontinuities. Phase-continuous frequency switching is possible in a DDS because of its ability to maintain an accumulated phase value during a frequency switch, and after the next clock pulse begin generating the output signal at the new frequency from the phase value reached by the old frequency.
Phase-Coherent Frequency Switching:	This term actually does not address the switching behavior of an output signal, but rather defines the signal's steady state phase. Beginning with two in-phase signals at frequency f_1, assume that one undergoes the switching sequence f_1, f_2, f_1. If, after the switching sequence, the two signals are again in phase, phase-coherent switching has occurred. In general, with arbitrary timing the phase transients required for phase coherence preclude phase continuity.
Phase-Zero Set/ Phase Reset:	To reset the phase of an output signal to zero. Phase-zeroing or resettability is possible in a DDS because of its ability to asynchronously zero out the phase accumulator, and then begin generating an output signal from zero phase.
Phase Rotation/ Digital Phase Modulation:	To rotate or shift the phase of an output signal a certain number of degrees or radians. Since the amount of phase rotation is specified by digital data indicating the number of degrees or radians to be shifted, this is also referred to as digital phase modulation.

FREQUENCY SYNTHESIZERS: Technology Overview

Synthesizers have become indispensable in many of today's advanced measurement and production systems, as well as in stand-alone uses. Typical applications range from ATE and NMR medical imaging to satellite earth station oscillators, from magnetic storage media testing to crystal production, from mode-locking of lasers to ECM. Precision timing, radar simulations, Doppler systems, all make use of synthesizers.

Frequency synthesizers are basically variable radio-frequency generators which are very accurately and quickly settable and possess high stability. Within a specified frequency range they can be programmed either manually or remotely to practically any output frequency. This output frequency is as accurate and as stable as a built-in frequency standard, usually a crystal oscillator, or as accurate and stable as an external precision standard which may be connected to the synthesizer in lieu of its own standard. Where very high stabilities are desired, atomic or molecular standards are often used.

Most commercial frequency synthesizers use a decimal read-out or indicator system. The least-significant step or digit determines resolution, how closely the synthesizer can be set to any arbitrary frequency. Resolution ranges from megahertzs to microhertzs, depending on use; some synthesizers offer a choice of resolution to match capability (and price) to users' need. (Although read-out or indication of setting is normally decimal, remote control frequency setting may use other coding.)

FREQUENCY SYNTHESIZERS: Technology Overview (continued)

The ideal of a pure frequency, a single spectral line, is not attained in practical synthesizers. All produce unwanted frequencies, called spurious outputs, and they also have, like any oscillator, harmonics. While harmonics are at least one octave removed and thus not often troublesome, the suppression of other unwanted frequencies is a major challenge of synthesizer design; units differ widely in this respect, and this is of major impact regarding cost. The same is true of the very close-in noise around the carrier that constitutes unwanted phase-modulation. These perturbations are variously called broadband phase noise, spectral density distribution of phase noise, residual FM, and short term fractional frequency deviation.

Today's synthesizers use three technologies, singly or in combination, to generate an output frequency from a reference standard: direct analog, indirect and direct digital.

Direct analog synthesis makes use of a limited number of auxiliary or standard frequencies which are derived from the reference. The output band is covered solely by arithmetic operations on these auxiliary frequencies, using fixed-tuned filters, RF switches, mixers, multipliers and dividers. The "mix-and-divide" direct synthesis approach permits the use of many identical modules, producing arbitrarily fine resolution and low spurious output.

Indirect synthesis uses phase-locked loops to produce an output frequency. This approach may take various forms: divide-by-n for one or more digits, fractional-n with multi-digit capability, and mix-and-divide with loops embedded. In each case, the loop is governed by some derivative of the frequency standard. Again, the mix-and-divide approach permits the use of many identical modules.

Direct digital synthesis makes use of digital technology. Using adder circuitry, phase is accumulated at a rate dependent on the frequency selected. Phase value is then used to address a PROM, which stores discrete values of the sine function. A D/A converts the digital output of the PROM to a sine wave which is low-pass filtered to remove the clock frequency, aliases and D/A glitches. The theoretical maximum output frequency obtainable is one-half the clock frequency, although practical filtering considerations limit the output frequency to less than 45% of the clock.

PTS synthesizers use direct analog and direct digital technologies. Indirect schemes, although cost-effective for multi-digit high resolution, are not used because the switching speed demanded for PTS synthesizers (μseconds) is not attainable. The most significant digits down to 1 MHz are produced by direct analog synthesis. When switching speed and signal purity are considered, there is no better approach. Direct digital synthesis is faster switching, but at this time the technology does not provide the low level of spurious outputs demanded by sophisticated applications at VHF/UHF frequencies.

For the digits from 100 KHz down to 0.1 Hz, PTS offers a choice of repetitive mix-and-divide modules or direct digital synthesis. The direct analog technology permits a close match to customer resolution requirements, while direct digital synthesis provides fast, phase-continuous switching and allows digital phase modulation.

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GENERAL INFORMATION (PTS SYNTHESIZERS)

REMOTE CONTROL INTERFACES

For remote-control or computer-controlled applications, all PTS synthesizers are equipped with either a standard parallel BCD interface, or optional GPIB-compatible interfaces. (Lower-cost remote-only units are available which include no manual control capability.) With both interfaces, output signal frequency, output signal level, and remote/local mode control are programmable.

Parallel BCD Interface

The parallel BCD interface employs a 50-pin Amphenol 57-40500-compatible connector on the equipment, and requires an Amphenol 57-30500-compatible connector for control.

In the standard parallel BCD interface, output signal frequency programming and remote/local mode control programming use TTL-level negative true logic. Output signal level programming uses a DC control voltage.

The programming format for frequency control is parallel, 4 bit BCD coding for each digit (decade). All frequency programming connects to, and can be driven by, industry-standard 74HCT-type ICs. By default, all frequency control lines are internally pulled to a high (false) state; to program a specific frequency the appropriate pins must be brought to the low (true) state.

Data latches are included which provide storage when a “latched” or “buffered” mode of operation is required. By default, all Latch Enable (LE) pins are internally pulled to a high (false) state, disabling the latches. To store remote frequency programming input, the LE pins are brought to the low state. To operate in a “transparent” (i.e., non-latched) mode, the LE pins may be left unconnected. A separate LE line is provided for each digit pair (8 bits) so that operation with serial frequency programming data bytes is possible.

The output signal level is programmed via a DC control voltage. The RMS RF output voltage is one-half (0.5) the DC analog voltage present on the output-level control pin (0.63 to 2.0 VDC, corresponding to 0.315 to 1.0 Vrms output into 50 ohms).

GPIB Interface

The GPIB interface employs an IEEE-488 24-pin female connector on the equipment, and requires an IEEE-488 24-pin male connector for control.

PTS offers two versions of the GPIB interface:

-a fast-switching legacy version which is IEEE 488.1(1987)-compliant. It allows the synthesizer to act as a basic listener device (no talk capabilities), and provides control of the two device-dependent functions output signal frequency and level. Output signal frequency can be programmed in 30 µseconds or less to the instrument’s full resolution; signal level is programmed from +4 dBm to +13 dBm in 1 dB steps.

-a fully IEEE 488.2/SCPI-compliant interface. It allows complete control over all instrument functions and status. Switching speeds are 5 - 10 mseconds, or less than 250 µseconds in the LIST mode of operation.

The PTS GPIB can be controlled via special-purpose GPIB controllers. Alternatively, a number of manufacturers provide low-cost board-level products for microcomputers which implement the IEEE-488 interface. The PTS GPIB remote-control interface is compatible with such products.

FREQUENCY SWITCHING BEHAVIOR

In all PTS synthesizers, the most significant digits down to 1 MHz (all produced by direct analog technology) have phase-coherent frequency switching.

For applications requiring high-speed, phase-continuous frequency switching, PTS offers the Direct Digital Synthesis Table Look Up (DDS-TLU or DDS) option. With this option, the standard direct analog low-resolution subsection of an instrument is replaced with a direct digital subsection capable of generating the required low-resolution frequency increments. The DDS can provide phase-continuous frequency switching, and less than 1 µs switching time (with 2 µs delay). The following versions are available:

•Version H — DDS option replaces the 100 KHz through 0.1 Hz subsection. Phase continuity can be maintained during frequency switches involving the 100 KHz through 0.1 Hz digits. Spurious outputs are – 60 to – 70 dBc.

•Version K — DDS option replaces the 10 KHz through 0.1 Hz subsection. Phase continuity can be maintained during frequency switches involving the 10 KHz through 0.1 Hz digits. Spurious outputs are – 65 to – 75 dBc.

The DDS option is available for PTS models 040, 120, 160, 250, 500 and 620. (DDS high speed, phase-continuous switching is standard in the PTS model 310, 1600, 3200, 6400, x10, D310 and D620.) Note that the spurious specifications for the versions differ, reflecting the tradeoff between bandwidth coverage and spurious output; consult instrument specifications for details.

In instruments using the analog mix-and-divide technology for steps from 100 KHz down to 0.1 Hz, frequency switches have limited, though arbitrary, phase discontinuities. In principle, a frequency switch using the 100 KHz digit may have at most a 180° phase jump, a frequency switch using the 10 KHz digit at most an 18° phase jump, 1 KHz at most 1.8°, 100 Hz at most 0.18°, 10 Hz at most .018°, 1 Hz at most .0018°, and 0.1 Hz at most .00018°. For all practical purposes, frequency switches of 100 Hz or less may be considered phase-continuous in these instruments.

FREQUENCY STANDARDS

The output frequency of a PTS synthesizer reflects directly the accuracy of the controlling frequency standard, either internal or external. PTS offers a choice of two internal standards, a high-stability oven-controlled crystal oscillator (OCXO) or a moderate-stability temperature-compensated crystal oscillator (TCXO).

All quartz crystal oscillators are secondary standards which require a primary reference for calibration. PTS oscillators are set to within 1×10^{-7} of nominal at the time of delivery from the factory. Thereafter, these oscillators are subject to the time-drift and temperature-drift given in the specifications. Both PTS oscillators include field-adjustment capability for up to five years of aging.

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PTS 040

FREQUENCY SYNTHESIZERS

SPECIFICATIONS

Frequency

Range:	0.100 000 0 MHz to 39.999 999 9 MHz
Resolution:	0.1 Hz to 100 KHz, optional in decades
Accuracy	same as frequency standard
Control:	manual by 10-position dial; remote by TTL-level parallel entry BCD or GPIB (optional)

Switching Time (to within 0.1 radian at new frequency)

10 MHz digit:	20 µseconds
1 MHz - 0.1 Hz digit:	5 µseconds

Output

Level:	+3 to +13 dBm (1V max, 50 Ω), metered in dBm and volts (rms)
Flatness:	±0.4 dB
Impedance:	50 Ω
Control:	manual by front panel control; remote by analog voltage

Spurious Outputs

	(at full power output, +13 dBm)
Discrete:	-75 dBc
Harmonics:	-35 dBc at full output (– 40 dBc at lower level)
Phase Noise:	-75 dBc (0.5 Hz to 15 KHz) including effects of internal standard
ℒ(1Hz):	100 Hz/ -125 dBc, 1 KHz/ -135 dBc, 10 KHz/ -135 dBc, 100 KHz/ -137 dBc
Noise Floor:	-138 dBc/Hz

Frequency Standard

	OCXO	or	TCXO
Internal:	3 x 10^{-9}/day		1 x 10^{-8}/day
	±1 x 10^{-8}/0 - 50ºC		±1 x 10^{-6}/0 - 50ºC
	1 x 10^{-6}/year		2 x 10^{-6}/year

External:	10 MHz, 0.4-2.0 Vrms into 300 Ω; 5 MHz, 0.5-2.0 Vrms into 300 Ω
Aux. Output:	10.000 MHz, 0.4 Vrms into 50 Ω (Note: internal or external standard required for operation)

General

Operating Ambient:	0 - 55ºC, 95% R.H.
Power:	105 - 125V, 50 - 400 Hz, 40W (100, 220, 240V optional)
Dimensions:	19 x 5.25 x 18 inches (relay rack or bench cabinet)
Weight:	35 lbs

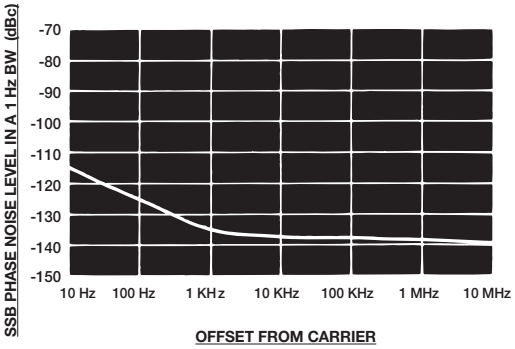
For units equipped with a **DDS-TLU option**, specifications are modified as follows:

DDS Option	**H**	**K**
Phase-Continuous Switching Range	100 KHz thru 0.1 Hz digits (~1 MHz bandwidth)	10 KHz thru 0.1 Hz digits (~100 KHz bandwidth)
Frequency Resolution	0.1 Hz	0.1 Hz
Optional Phase Rotation	0-360° in .36° steps	N/A
Switching Time	(within phase-continuous range) <1µs transient, 2µs delay	
Spurious Outputs Discrete:	-65 dBc	-75 dBc
Phase Noise:	-65 dBc	-70 dBc

PTS 040 FREQUENCY SYNTHESIZER

- 0.1 MHz to 40 MHz
- + 3 to + 13 dBm output
- choice of resolution
- very low phase noise
- fast switching, 5 - 20µs
- fully programmable, BCD or GPIB
- modular flexibility, remote-only versions
- low power consumption, high reliability
- 7 decades of DDS resolution available with phase continuous switching

NOTE:
PTS 040 shown for illustration in "R" and "M" cabinets.
Consult pages 28, 29 for full cabinet style listing.
Consult page 26 for cabinet mechanical specifications.



PTS 120

FREQUENCY SYNTHESIZERS

SPECIFICATIONS

Frequency		
	Range:	90.000 000 0 MHz to 119.999 999 9 MHz
	Resolution:	0.1 Hz to 100 KHz, optional in decades
	Accuracy	same as frequency standard
	Control:	manual by 10-position dial; remote by TTL-level parallel entry BCD or GPIB (optional)
Switching Time	(to within 0.1 radian at new frequency)	
	100 MHz - 10 MHz digit:	20 µseconds
	1 MHz - 0.1 Hz digit:	5 µseconds
Output	Level:	+3 to +10 dBm (.7V max, 50 Ω), metered in dBm and volts (rms)
	Flatness:	±0.5 dB
	Impedance:	50 Ω
	Control:	manual by front panel control; remote by analog voltage
Spurious Outputs		(at full power output, +10 dBm)
	Discrete:	-75 dBc within ±30 MHz of carrier,-55 dBc outside; line related, -80 dBc
	Harmonics:	-55 dBc
	Phase Noise:	-75 dBc (0.5 Hz to 15 KHz) including effects of internal standard
	$\mathscr{L}$(1Hz):	10 Hz/ -105 dBc, 100 Hz/ -118 dBc, 1KHz/-128 dBc, 10 KHz/-132 dBc, 100 KHz/ -132 dBc
	Noise Floor:	-135 dBc/Hz

Frequency Standard	Internal:	OCXO	or	TCXO
		3×10^{-9}/day		1×10^{-8}/day
		±1 x 10^{-8}/0 - 50ºC		±1 x 10^{-6}/0 - 50ºC
		1×10^{-6}/year		2×10^{-6}/year
	External:	10 MHz, 0.4-2.0 Vrms into 300 Ω; 5 MHz, 0.5-2.0 Vrms into 300 Ω		
	Aux. Output:	10.000 MHz, 0.4 Vrms into 50 Ω (Note: internal or external standard required for operation)		

General	Operating Ambient:	0 - 55ºC, 95% R.H.
	Power:	105 - 125V, 50 - 400 Hz, 40W (100, 220, 240V optional)
	Dimensions:	19 x 5.25 x 18 inches (relay rack or bench cabinet)
	Weight:	35 lbs

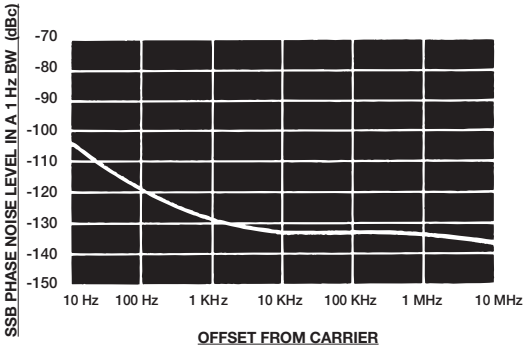
For units equipped with a **DDS-TLU option**, specifications are modified as follows:

DDS Option	**H**	**K**
Phase-Continuous Switching Range	100 KHz thru 0.1 Hz digits (~1 MHz bandwidth)	10 KHz thru 0.1 Hz digits (~100 KHz bandwidth)
Frequency Resolution	0.1 Hz	0.1 Hz
Optional Phase Rotation	0-360° in .36° steps	N/A
Switching Time	(within phase-continuous range) <1µs transient, 2µs delay	
Spurious Outputs Discrete:(±30 MHz of f_{out})	-65 dBc	-75 dBc
Phase Noise:	-65 dBc	-70 dBc

PTS 120 FREQUENCY SYNTHESIZER

- 90 - 120 MHz
- + 3 to + 10 dBm output
- choice of resolution
- very low phase noise
- fast switching, 5 - 20µs
- fully programmable, BCD or GPIB
- modular flexibility, remote-only versions
- low power consumption, high reliability
- 7 decades of DDS resolution available with phase continuous switching

NOTE:
PTS 120 shown for illustration in "M" cabinet.
Consult pages 28, 29 for full cabinet style listing.
Consult page 26 for cabinet mechanical specifications.



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PTS 160

FREQUENCY SYNTHESIZERS

SPECIFICATIONS

Frequency

Range:	0.100 000 0 MHz to 159.999 999 9 MHz
Resolution:	0.1 Hz to 100 KHz, optional in decades
Accuracy	same as frequency standard
Control:	manual by 10-position dial; remote by TTL-level parallel entry BCD or GPIB (optional)

Switching Time (to within 0.1 radian at new frequency)

100 MHz - 10 MHz digit:	20 µseconds
1 MHz - 0.1 Hz digit:	5 µseconds

Output	Level:	+3 to +13 dBm (1V max, 50 Ω), metered in dBm and volts (rms)
	Flatness:	±0.5 dB
	Impedance:	50 Ω
	Control:	manual by front panel control; remote by analog voltage
Spurious		(at full power output, +13 dBm)
Outputs	Discrete:	-75 dBc
	Harmonics:	-35 dBc at full output (– 40 dBc at lower level)
	Phase Noise:	-63 dBc (0.5 Hz to 15 KHz) including effects of internal standard
	$\mathscr{L}$(1Hz):	100 Hz/ -105 dBc, 1 KHz/ -115 dBc, 10 KHz/ -123 dBc, 100 KHz/ -127 dBc
	Noise Floor:	-135 dBc/Hz

Frequency Standard	Internal:	OCXO	or	TCXO
		3×10^{-9}/day		1×10^{-8}/day
		±1 x 10^{-8}/0 - 50ºC		±1 x 10^{-6}/0 - 50ºC
		1×10^{-6}/year		2×10^{-6}/year
	External:	10 MHz, 0.4-2.0 Vrms into 300 Ω; 5 MHz, 0.5-2.0 Vrms into 300 Ω		
	Aux. Output:	10.000 MHz, 0.4 Vrms into 50 Ω (Note: internal or external standard required for operation)		

General	Operating Ambient:	0 - 55ºC, 95% R.H.
	Power:	105 - 125V, 50 - 400 Hz, 40W (100, 220, 240V optional)
	Dimensions:	19 x 5.25 x 18 inches (relay rack or bench cabinet)
	Weight:	35 lbs

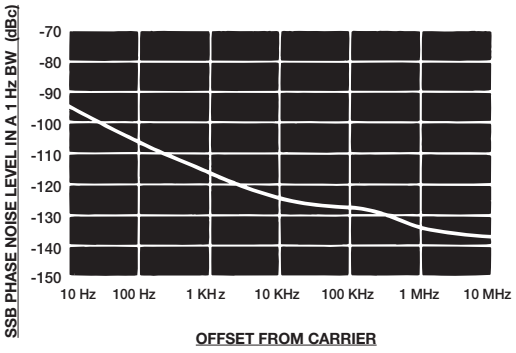
For units equipped with a **DDS-TLU option**, specifications are modified as follows:

DDS Option	**H**	**K**
Phase-Continuous Switching Range	100 KHz thru 0.1 Hz digits (~1 MHz bandwidth)	10 KHz thru 0.1 Hz digits (~100 KHz bandwidth)
Frequency Resolution	0.1 Hz	0.1 Hz
Optional Phase Rotation	0-360° in .36° steps	N/A
Switching Time	(within phase-continuous range) <1µs transient, 2µs delay	
Spurious Outputs Discrete:	-65 dBc	-75 dBc
Phase Noise:	-63 dBc	-63 dBc

PTS 160 FREQUENCY SYNTHESIZER

- 0.1 MHz to 160 MHz
- + 3 to + 13 dBm output
- choice of resolution
- very low phase noise
- fast switching, 5 - 20µs
- fully programmable, BCD or GPIB
- modular flexibility, remote-only versions
- low power consumption, high reliability
- 7 decades of DDS resolution available with phase continuous switching

NOTE:
PTS 160 shown for illustration in “B” cabinet.
Consult pages 28, 29 for full cabinet style listing.
Consult page 26 for cabinet mechanical specifications.



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PTS 250

FREQUENCY SYNTHESIZERS

SPECIFICATIONS

Frequency

Range:	1.000 000 0 MHz to 249.999 999 9 MHz
Resolution:	0.1 Hz to 100 KHz ,optional in decades
Accuracy	same as frequency standard
Control:	manual by 10-position dial; remote by TTL-level parallel entry BCD or GPIB (optional)

Switching Time (to within 0.1 radian at new frequency)

100 MHz - 10 MHz digit:	20 µseconds
1 MHz - 0.1 Hz digit:	5 µseconds

Output	Level:	+3 to +13 dBm (1V max, 50 Ω), metered in dBm and volts (rms)
	Flatness:	±0.5 dB
	Impedance:	50 Ω
	Control:	manual by front panel control; remote by analog voltage
Spurious		(at full power output, +13 dBm)
Outputs	Discrete:	-70 dBc
	Harmonics:	-30 dBc at full output (– 40 dBc at lower level)
	Phase Noise:	-63 dBc (0.5 Hz to 15 KHz) including effects of internal standard
	$\mathscr{L}$(1Hz):	100 Hz/ -105 dBc, 1 KHz/ -115 dBc, 10 KHz/ -123 dBc, 100 KHz/ -127 dBc
	Noise Floor:	-135 dBc/Hz

Frequency Standard	Internal:	OCXO	or	TCXO
		3×10^{-9}/day		1×10^{-8}/day
		±1 x 10^{-8}/0 - 50ºC		±1 x 10^{-6}/0 - 50ºC
		1×10^{-6}/year		2×10^{-6}/year
	External:	10 MHz, 0.4-2.0 Vrms into 300 Ω; 5 MHz, 0.5-2.0 Vrms into 300 Ω		
	Aux. Output:	10.000 MHz, 0.4 Vrms into 50 Ω (Note: internal or external standard required for operation)		

General	Operating Ambient:	0 - 55ºC, 95% R.H.
	Power:	105 - 125V, 50 - 400 Hz, 45W (100, 220, 240V optional)
	Dimensions:	19 x 5.25 x 18 inches (relay rack or bench cabinet)
	Weight:	35 lbs

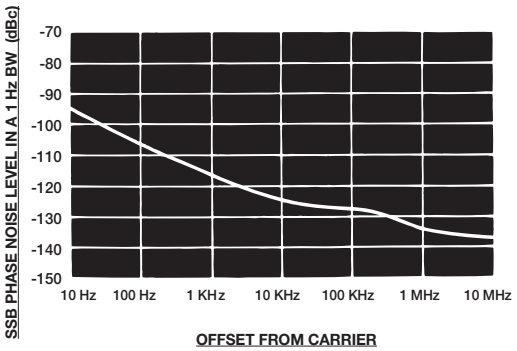
For units equipped with a **DDS-TLU option**, specifications are modified as follows:

DDS Option	**H**	**K**
Phase-Continuous Switching Range	100 KHz thru 0.1 Hz digits (~1 MHz bandwidth)	10 KHz thru 0.1 Hz digits (~100 KHz bandwidth)
Frequency Resolution	0.1 Hz	0.1 Hz
Optional Phase Rotation	0-360° in .36° steps	N/A
Switching Time	(within phase-continuous range) <1µs transient, 2µs delay	
Spurious Outputs Discrete:	-65 dBc	-70 dBc
Phase Noise:	-63 dBc	-63 dBc

PTS 250 FREQUENCY SYNTHESIZER

- 1 MHz to 250 MHz
- + 3 to + 13 dBm output
- choice of resolution
- very low phase noise
- fast switching, 5 - 20µs
- fully programmable, BCD or GPIB
- modular flexibility, remote-only versions
- low power consumption, high reliability
- 7 decades of DDS resolution available with phase continuous switching

NOTE:
PTS 250 shown for illustration in “R, X-6” cabinet.
Consult pages 28, 29 for full cabinet style listing.
Consult page 26 for cabinet mechanical specifications.



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PTS 310

FREQUENCY SYNTHESIZERS

SPECIFICATIONS

Frequency

	Range:	0.100 000 0 MHz to 309.999 999 9 MHz
	Resolution:	1 Hz
	Accuracy	same as frequency standard
	Control:	manual by 10-position dial; remote by TTL-level parallel entry BCD or GPIB (optional)

Switching Time (to within 0.1 radian at new frequency)

	100 MHz - 10 MHz digit:	20 µseconds
	1 MHz digit:	5 µseconds
	100 KHz - 1 Hz digit:	<1µs transient, 2µs delay, phase continuous

Output	Level:	+3 to +13 dBm (1V max, 50 Ω)	
	Flatness:	±0.5 dB	
	Impedance:	50 Ω	
	Control:	manual by front panel control; remote by analog voltage	
Spurious Outputs		(at full power output, +13 dBm)	
		Type 1	**Type 2**
	Discrete:	-65 dBc	-60 dBc
	Harmonics:	-30 dBc	-30 dBc
	Phase Noise:	-68 dBc (0.5 Hz to 15 KHz) including effects of internal standard	-63 dBc
	$\mathscr{L}$(1Hz):	100 Hz/ -105 dBc, 1 KHz/ -115 dBc, 10 KHz/ -123 dBc, 100 KHz/ -127 dBc	
	Noise Floor:	-135 dBc/Hz	-135 dBc/Hz
	Optional Phase Rotation:	0°, 90°, 180°, 270° in 90° steps	0 - 360° in .225° steps

Frequency Standard	Internal:	OCXO	or	TCXO
		3×10^{-9}/day		1×10^{-8}/day
		$\pm 1 \times 10^{-8}$/0 - 50ºC		$\pm 1 \times 10^{-6}$/0 - 50ºC
		1×10^{-6}/year		2×10^{-6}/year

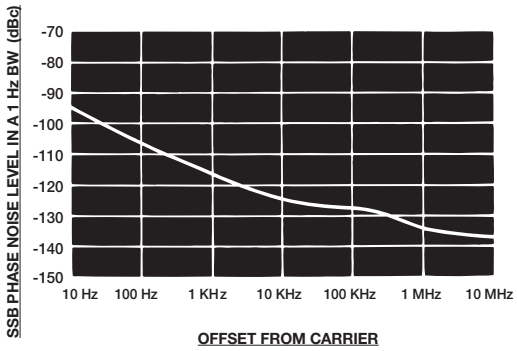
	External:	10 MHz, 0.4-2.0 Vrms into 50 Ω; 5 MHz, 0.5-2.0 Vrms into 50 Ω
	Aux. Output:	10.000 MHz, 0.4 Vrms into 50 Ω
		(Note: internal or external standard required for operation)

General	Operating Ambient:	0 - 55ºC, 95% R.H.
	Power:	105 - 125V, 50 - 400 Hz, 40W (100, 220, 240V optional)
	Dimensions:	19 x 3.5 x 17.5 inches (relay rack or bench cabinet)
	Weight:	20 lbs

PTS 310 FREQUENCY SYNTHESIZER

- 0.1 MHz to 310 MHz
- new standard in performance/price, with choice of spurious suppression
- DDS standard with phase-continuous switching
- flexible phase rotation options
- +3 to +13 dBm output
- 1 Hz resolution
- fully programmable, BCD or GPIB with remote-only versions available.
- space-saving 3.5” cabinet

NOTE:
PTS 310 shown for illustration in “M and V” cabinets.
Consult pages 28, 29 for full cabinet style listing.
Consult page 27 for cabinet mechanical specifications.



PTS 500

FREQUENCY SYNTHESIZERS

SPECIFICATIONS

Frequency

Range:	1.000 000 0 MHz to 499.999 999 9 MHz
Resolution:	0.1 Hz to 100 KHz, optional in decades
Accuracy	same as frequency standard
Control:	manual by 10-position dial; remote by TTL-level parallel entry BCD or GPIB (optional)

Switching Time (to within 0.1 radian at new frequency)

100 MHz - 10 MHz digit:	20 µseconds
1 MHz - 0.1 Hz digit:	5 µseconds

Output	Level:	+3 to +13 dBm (1V max, 50 Ω), metered in dBm and volts (rms)
	Flatness:	±0.5 dB
	Impedance:	50 Ω
	Control:	manual by front panel control; remote by analog voltage
Spurious Outputs		(at full power output, +13 dBm)
	Discrete:	-70 dBc (-55 dBc, 1/2 & 3/2 f_{out} above 250 MHz)
	Harmonics:	-30 dBc at full output (– 40 dBc at lower level)
	Phase Noise:	-63 dBc (0.5 Hz to 15 KHz) including effects of internal standard
	$\mathscr{L}$(1Hz):	100 Hz/ -100 dBc, 1 KHz/ -110 dBc, 10 KHz/ -120 dBc, 100 KHz/ -125 dBc
	Noise Floor:	-135 dBc/Hz

Frequency Standard	Internal:	OCXO	or	TCXO
		3×10^{-9}/day		1×10^{-8}/day
		$\pm 1 \times 10^{-8}$/0 - 50ºC		$\pm 1 \times 10^{-6}$/0 - 50ºC
		1×10^{-6}/year		2×10^{-6}/year

	External:	10 MHz, 0.4-2.0 Vrms into 300 Ω; 5 MHz, 0.5-2.0 Vrms into 300 Ω
	Aux. Output:	10.000 MHz, 0.4 Vrms into 50 Ω
		(Note: internal or external standard required for operation)

General	Operating Ambient:	0 - 55ºC, 95% R.H.
	Power:	105 - 125V, 50 - 400 Hz, 50W (100, 220, 240V optional)
	Dimensions:	19 x 5.25 x 18 inches (relay rack or bench cabinet)
	Weight:	35 lbs

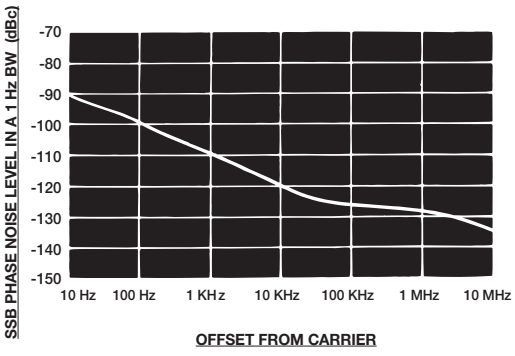
For units equipped with a **DDS-TLU option**, specifications are modified as follows:

DDS Option	**H**	**K**
Phase-Continuous Switching Range	100 KHz thru 0.1 Hz digits (~1 MHz bandwidth)	10 KHz thru 0.1 Hz digits (~100 KHz bandwidth)
Frequency Resolution	0.1 Hz (0.2 Hz, 250-500 MHz)	0.1 Hz (0.2 Hz, 250-500 MHz)
Optional Phase Rotation	0-360° in .36° steps (in .72° steps, 250-500 MHz)	N/A
Switching Time	(within phase-continuous range) <1µs transient, 2µs delay	
Spurious Outputs Discrete:	-60 dBc	-70 dBc
Phase Noise:	-63 dBc	-63dBc

PTS 500 FREQUENCY SYNTHESIZER

- 1 MHz to 500 MHz
- + 3 to + 13 dBm output
- choice of resolution
- very low phase noise
- fast switching, 5 - 20µs
- fully programmable, BCD or GPIB
- modular flexibility, remote-only versions
- 7 decades of DDS resolution available with phase continuous switching

NOTE:
PTS 500 shown for illustration in "M and V" cabinets.
Consult pages 28, 29 for full cabinet style listing.
Consult page 26 for cabinet mechanical specifications.



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PTS 620

FREQUENCY SYNTHESIZERS

SPECIFICATIONS

Frequency

Range:	1.000 000 0 MHz to 619.999 999 9 MHz
Resolution:	0.1 Hz to 100 KHz, optional in decades
Accuracy	same as frequency standard
Control:	manual by 10-position dial; remote by TTL-level parallel entry BCD or GPIB (optional)

Switching Time (to within 0.1 radian at new frequency)

100 MHz - 10 MHz digit:	20 µseconds
1 MHz - 0.1 Hz digit:	5 µseconds

Output	Level:	+3 to +13 dBm (1V max, 50 Ω), metered in dBm and volts (rms)
	Flatness:	±0.5 dB
	Impedance:	50 Ω
	Control:	manual by front panel control; remote by analog voltage
Spurious		(at full power output, +13 dBm)
Outputs	Discrete:	-70 dBc (-55 dBc, 1/2 & 3/2 f_{out} above 310 MHz)
	Harmonics:	-30 dBc at full output (– 40 dBc at lower level)
	Phase Noise:	-63 dBc (0.5 Hz to 15 KHz) including effects of internal standard
	$\mathscr{L}$(1Hz):	100 Hz/ -100 dBc, 1 KHz/ -110 dBc, 10 KHz/ -120 dBc, 100 KHz/ -125 dBc
	Noise Floor:	-135 dBc/Hz

Frequency Standard	Internal:	OCXO	or	TCXO
		3 x 10^{-9}/day		1 x 10^{-8}/day
		±1 x 10^{-8}/0 - 50ºC		±1 x 10^{-6}/0 - 50ºC
		1 x 10^{-6}/year		2 x 10^{-6}/year
	External:	10 MHz, 0.4-2.0 Vrms into 300 Ω; 5 MHz, 0.5-2.0 Vrms into 300 Ω		
	Aux. Output:	10.000 MHz, 0.4 Vrms into 50 Ω (Note: internal or external standard required for operation)		

General	Operating Ambient:	0 - 55ºC, 95% R.H.
	Power:	105 - 125V, 50 - 400 Hz, 50W (100, 220, 240V optional)
	Dimensions:	19 x 5.25 x 18 inches (relay rack or bench cabinet)
	Weight:	35 lbs

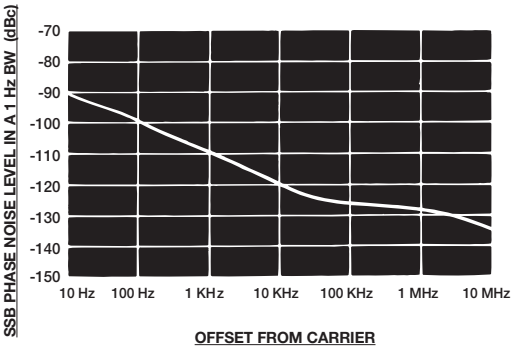
For units equipped with a **DDS-TLU option**, specifications are modified as follows:

DDS Option	**H**	**K**
Phase-Continuous Switching Range	100 KHz thru 0.1 Hz digits (~1 MHz bandwidth)	10 KHz thru 0.1 Hz digits (~100 KHz bandwidth)
Frequency Resolution	0.1 Hz (0.2 Hz, 310-620 MHz)	0.1 Hz (0.2 Hz, 310-620 MHz)
Optional Phase Rotation	0-360° in .36° steps (in .72° steps, 310-620 MHz)	N/A
Switching Time	(within phase-continuous range) <1µs transient, 2µs delay	
Spurious Outputs Discrete:	-60 dBc	-70 dBc
Phase Noise:	-63 dBc	-63 dBc

PTS 620 FREQUENCY SYNTHESIZER

- 1 MHz to 620 MHz
- + 3 to + 13 dBm output
- choice of resolution
- very low phase noise
- fast switching, 5 - 20µs
- fully programmable, BCD or GPIB
- modular flexibility, remote-only versions
- 7 decades of DDS resolution available with phase continuous switching

NOTE:
PTS 620 shown for illustration in "M" cabinet.
Consult pages 28, 29 for full cabinet style listing.
Consult page 26 for cabinet mechanical specifications.



PTS 1600

FREQUENCY SYNTHESIZERS

SPECIFICATIONS

Frequency

Range:	1.000 000 MHz to 1599.999 999 MHz
Resolution:	1 Hz
Accuracy	same as frequency standard
Control:	manual by keyboard and LCD; remote by TTL-level parallel entry BCD or GPIB (optional)

Switching Time (to within 0.1 radian at new frequency)

1 GHz - 10 MHz digit:	20 µseconds
1 MHz digit:	5 µseconds
100 KHz - 1 Hz digit:	1 µsecond transient, 2 µsecond delay

Phase-Continuous Switching Range: 100 KHz through 1 Hz digits (~1 MHz bandwidth)

Output

Level:	+3 to +13 dBm (1V max, 50 Ω)
Flatness:	±0.7 dB
Impedance:	50 Ω
Control:	manual by front panel control; remote by analog voltage
Connector:	SMA female

Spurious Outputs (at full power output, +13 dBm)

Discrete:	-60 dBc
Harmonics:	-30 dBc
Phase Noise:	-60 dBc (0.5 Hz to 15 KHz) including effects of internal standard
$\mathscr{L}$(1Hz):	100 Hz/ -105 dBc, 1 KHz/ -114 dBc, 10 KHz/ -122 dBc, 100 KHz/ -124 dBc
Noise Floor:	-142 dBc/Hz

Frequency Standard

Internal:	OCXO	or	TCXO
	3 x 10^{-9}/day		1 x 10^{-8}/day
	±1 x 10^{-8}/0 - 50ºC		±1 x 10^{-6}/0 - 50ºC
	1 x 10^{-6}/year		2 x 10^{-6}/year

External: 10 MHz, 0.4-2.0 Vrms into 300 Ω;
5 MHz, 0.5-2.0 Vrms into 300 Ω } BNC Connector
Aux. Output: 10.000 MHz, 0.4 Vrms into 50 Ω
(Note: internal or external standard required for operation)

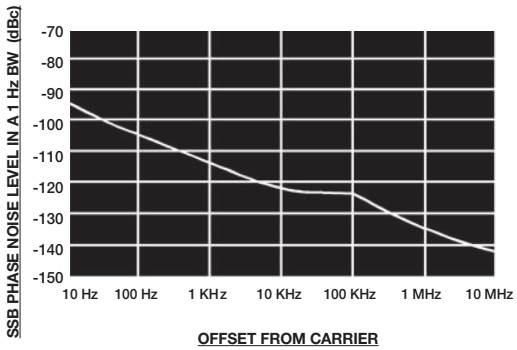
General

Operating Ambient:	10 - 45ºC, 95% R.H.
Power:	105 - 125V, 50 - 400 Hz, 70W (100, 220, 240V optional)
Dimensions:	19 x 5.25 x 18 inches (relay rack or bench cabinet)
Weight:	40 lbs
Optional Phase Rotation:	0 - 360° in .36° steps

PTS 1600 FREQUENCY SYNTHESIZER

- 1 MHz to 1600 MHz
- + 3 to + 13 dBm output
- 1 Hz resolution with DDS
- low phase noise
- fast switching, 3 - 20µs
- fully remote control programmable, BCD or GPIB
- modular flexibility, remote-only versions

NOTE:
PTS 1600 shown for illustration in "D" cabinet.
Consult pages 28, 29 for full cabinet style listing.
Consult page 26 for cabinet mechanical specifications.



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PTS 3200

FREQUENCY SYNTHESIZERS

SPECIFICATIONS

Frequency

Range:	1.000 000 MHz to 3199.999 999 MHz
Resolution:	1 Hz
Accuracy	same as frequency standard
Control:	manual by keyboard and LCD; remote by TTL-level parallel entry BCD or GPIB (optional)

Switching Time (to within 0.1 radian at new frequency)

1 GHz - 10 MHz digit:	20 µseconds
1 MHz digit:	5 µseconds
100 KHz - 1 Hz digit:	1 µsecond transient, 2 µsecond delay

Phase-Continuous Switching Range: 100 KHz through 1 Hz digits (~1 MHz bandwidth)

Output

Level:	+3 to +13 dBm (1V max, 50 Ω)
Flatness:	±0.7 dB
Impedance:	50 Ω
Control:	manual by front panel control; remote by analog voltage
Connector:	SMA female

Spurious Outputs (at full power output, +13 dBm)

Discrete:	-60 dBc 1 - 1600 MHz -55 dBc 1600 - 3200 MHz
Harmonics:	-30 dBc (-35 dBc at lower power level)
Phase Noise:	-60 dBc (0.5 Hz to 15 KHz) including effects of internal standard
ℒ(1Hz):	100 Hz/-99 dBc, 1 KHz/ -108 dBc, 10 KHz/ -116 dBc, 100 KHz/ -118 dBc
Noise Floor:	-130 dBc/Hz

Frequency Standard

Internal:	OCXO	or	TCXO
	3×10^{-9}/day		1×10^{-8}/day
	±1 x 10^{-8}/0 - 50ºC		±1 x 10^{-6}/0 - 50ºC
	1×10^{-6}/year		2×10^{-6}/year

External: 10 MHz, 0.4-2.0 Vrms into 300 Ω; 5 MHz, 0.5-2.0 Vrms into 300 Ω } BNC Connector

Aux. Output: 10.000 MHz, 0.4 Vrms into 50 Ω

(Note: internal or external standard required for operation)

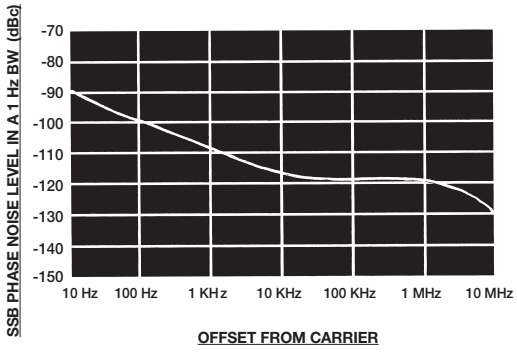
General

Operating Ambient:	10 - 45ºC, 95% R.H.
Power:	105 - 125V, 50 - 400 Hz, 70W (100, 220, 240V optional)
Dimensions:	19 x 5.25 x 18 inches (relay rack or bench cabinet)
Weight:	40 lbs
Optional Phase Rotation:	0 - 360° in .36° steps (in .72° steps,1600 - 3200 MHz)

PTS 3200 FREQUENCY SYNTHESIZER

- 1 MHz to 3200 MHz
- + 3 to + 13 dBm output
- 1 Hz resolution with DDS phase-continuous switching
- low phase noise
- fast switching, 3 - 20µs
- fully remote control programmable, BCD or GPIB
- modular flexibility, remote-only versions
- low power consumption, high reliability

NOTE:
PTS 3200 shown for illustration in "D" and "R" cabinets.
Consult pages 28, 29 for full cabinet style listing.
Consult page 26 for cabinet mechanical specifications.



PTS 6400

FREQUENCY SYNTHESIZERS

SPECIFICATIONS

Frequency

Range:	1.000 000 MHz to 6399.999 999 MHz
Resolution:	1 Hz
Accuracy	same as frequency standard
Control:	manual by keyboard and LCD; remote by TTL-level parallel entry BCD or GPIB (optional)

Switching Time (to within 0.1 radian at new frequency)

1 GHz - 10 MHz digit:	20 µseconds
1 MHz digit:	5 µseconds
100 KHz - 1 Hz digit:	1 µsecond transient, 2 µsecond delay

Phase-Continuous Switching Range: 100 KHz through 1 Hz digits (~1 MHz bandwidth)

Output

Level:	-3 to +7 dBm (500mV max., 50Ω)
Flatness:	±1.0 dB
Impedance:	50 Ω
Control:	manual by front panel control; remote by analog voltage
Connector:	SMA female

Spurious Outputs (at full power output, +7 dBm)

Discrete:	-60 dBc 1 -3200 MHz
	-55 dBc 3200 -6400 MHz
Subharmonics:	-45 dBc 1600 -6400 MHz
Harmonics:	-30 dBc
Phase Noise:	-60 dBc (0.5 Hz to 15 KHz) including effects of internal standard
ℒ(1Hz):	
1600 - 3200 MHz:	100 Hz/ -99dBc, 1 KHz/-108 dBc, 10 KHz/-116 dBc, 100 KHz/-118 dBc
Noise Floor:	
1600 - 3200 MHz:	-136 dBc/Hz
ℒ(1Hz) & Noise Floor:	
1 -1600 MHz:	improved by 6 dB
3200 - 6400 MHz:	degraded by 6 dB

Frequency Standard

	OCXO	or	TCXO
Internal:	3 x 10^{-9}/day		1 x 10^{-8}/day
	±1 x 10^{-8}/0 - 50ºC		±1 x 10^{-6}/0 - 50ºC
	1 x 10^{-6}/year		2 x 10^{-6}/year

External:	10 MHz, 0.4-2.0 Vrms into 300 Ω; 5 MHz, 0.5-2.0 Vrms into 300 Ω } BNC Connector
Aux. Output:	10.000 MHz, 0.4 Vrms into 50 Ω

(Note: internal or external standard required for operation)

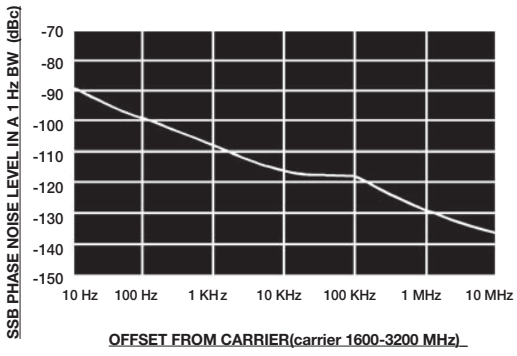
General

Operating Ambient:	10 - 45ºC, 95% R.H.
Power:	105 - 125V, 50 - 400 Hz, 70W (100, 220, 240V optional)
Dimensions:	19 x 5.25 x 18 inches (relay rack or bench cabinet)
Weight:	40 lbs

PTS 6400 FREQUENCY SYNTHESIZER

- 1 MHz to 6400 MHz
- -3 to +7 dBm output
- 1 Hz resolution with DDS phase-continuous switching.
- low phase noise
- fast switching, 3 - 20µs
- fully remote control programmable, BCD or GPIB
- modular flexibility, remote-only versions
- low power consumption, high reliability

NOTE:
PTS 6400 shown for illustration in "D" cabinet.
Consult pages 28, 29 for full cabinet style listing.
Consult page 26 for cabinet mechanical specifications.



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PTS x10

FREQUENCY SYNTHESIZERS

SPECIFICATIONS

Frequency

	Range:	specified 10 MHz decade, 0.1-100 MHz (0.1-10, 10-20,...90-100 MHz)
	Resolution:	1 Hz (optional, 0.1 Hz under remote-control only)
	Accuracy	same as frequency standard
	Control:	manual by 10-position dial; remote by TTL-level parallel entry BCD or GPIB (optional)

Switching Time (to within 0.1 radian at new frequency)

1 MHz digit non-phase-continuous:	5 µseconds
phase-continuous:	<1 µsecond transient, 1 µsecond delay
100 KHz - 1 Hz digits:	<1µsecond transient, 1µsecond delay, phase-continuous

Output	Level:	+3 to +13 dBm (1V max, 50 Ω)
	Flatness:	±0.25 dB
	Impedance:	50 Ω
	Control:	manual by front panel control; remote by analog voltage
Spurious Outputs		(at full power output, +13 dBm)
	Discrete:	-60 dBc
	Harmonics:	-35 dBc
	Phase Noise:	-70 dBc (0.5 Hz to 15 KHz) including effects of internal standard
	$\mathscr{L}$(1Hz):	10 Hz/-110 dBc, 100 Hz/-122 dBc, 1 KHz/ -132 dBc, 10 KHz/ -133 dBc, 100 KHz/ -134 dBc
	Noise Floor:	-135 dBc/Hz

Frequency Standard	Internal:	OCXO	or	TCXO
		3×10^{-9}/day		1×10^{-8}/day
		±1 x 10^{-8}/0 - 50ºC		±1 x 10^{-6}/0 - 50ºC
		1 x 10^{-6}/year		2 x 10^{-6}/year

	External:	10 MHz, 0.4-2.0 Vrms into 50 Ω; 5 MHz, 0.5-2.0 Vrms into 50 Ω
	Aux. Output:	10.000 MHz, 0.4 Vrms into 50 Ω
		(Note: internal or external standard required for operation)

General	Operating Ambient:	10 - 55ºC, 95% R.H.
	Power:	105 - 125V, 50 - 400 Hz, 30W (100, 220, 240V optional)
	Dimensions:	19 x 3.5 x 17.5 inches (relay rack or bench cabinet)
	Weight:	18 lbs
	Optional Phase Rotation:	0 - 360° in .225° steps

PHASE-CONTINUOUS SWITCHING

The PTS x10 sets new standards by offering users a 2 MHz bandwidth of ultra-low phase noise and low spurious phase-continuous switching range. Furthermore, the 2 MHz bandwidth can be switch-selected to span either ***even*** or ***odd*** MHz steps, guaranteeing phase-continuous coverage in the neighborhood of ***any*** selected output frequency.

Example:

Consider the **PTS x10** configured to cover the 40-50 MHz decade.

With switch-selected **even** coverage, phase-continuous spans are: 40-41.999999, 42-43.$\dot{9}$, 44-45.$\dot{9}$, 46-47.$\dot{9}$, 48-49.$\dot{9}$

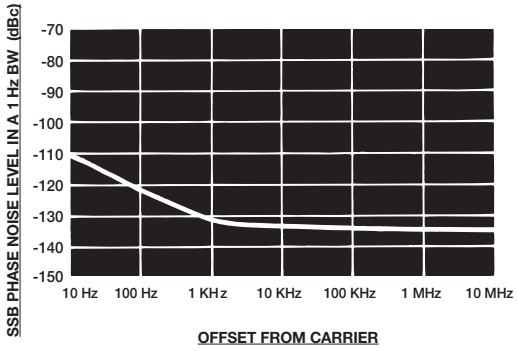
With switch-selected **odd** coverage, phase-continuous spans are: 39-40.999999, 41-42.$\dot{9}$, 43-44.$\dot{9}$, 45-46.$\dot{9}$, 47-48.$\dot{9}$

PTS x10 FREQUENCY SYNTHESIZER

- 10 MHz bandwidth, configured to cover any specified decade 0.1 - 100 MHz (0.1-10, 10-20,...80-90, 90-100)
- 1 Hz resolution with DDS phase-continuous switching
- fully programmable, BCD or GPIB, with remote-only versions available.

The PTS x10 transfers the accuracy and stability of a frequency standard (built-in or external) to any output frequency within the configured 10 MHz decade specified by the user at the time of order (e.g., 20-30 MHz, 30-40 MHz, etc.). Additional optional field-installable replacement modules allow easy and rapid reconfiguration to another selected decade.

NOTE:
PTS x10 shown for illustration in "M" and "R" cabinets.
Consult pages 28, 29 for full cabinet style listing.
Consult page 27 for cabinet mechanical specifications



PTS D310

FREQUENCY SYNTHESIZERS

SPECIFICATIONS (apply to both independently programmable output channels)

Number of channels		2 fully independent output channels
Frequency		
	Range:	0.100 000 0 to 309.999 999 9 MHz
	Resolution:	0.1 Hz
	Accuracy	same as frequency standard
	Control:	remote by TTL-level parallel-entry BCD or GPIB (optional)
Switching Time	(to within 0.1 radian at new frequency)	
	100 MHz - 10 MHz digit:	20 µseconds
	1 MHz digit:	5 µseconds
	100 KHz - 0.1 Hz digit:	1 µsecond transient, 2 µsecond delay
Phase-Continuous Switching Range:		100 KHz through 0.1 Hz digits (~1 MHz bandwidth)
Output	Level:	+3 to +13 dBm (1V max, 50 Ω)
	Flatness:	±0.5 dB
	Impedance:	50 Ω
	Control:	preset and remote by analog voltage
Spurious Outputs		(at full power output, +13 dBm)
	Discrete:	-70 dBc
	Harmonics:	-30 dBc at full power output,(-40 dBc at lower level)
	Phase Noise:	-63 dBc (0.5 Hz to 15 KHz) including effects of internal standard
	$\mathscr{L}$(1Hz):	100 Hz/-105 dBc, 1 KHz/ -115 dBc, 10 KHz/ -123 dBc, 100 KHz/ -127 dBc
	Noise Floor:	-135 dBc/Hz

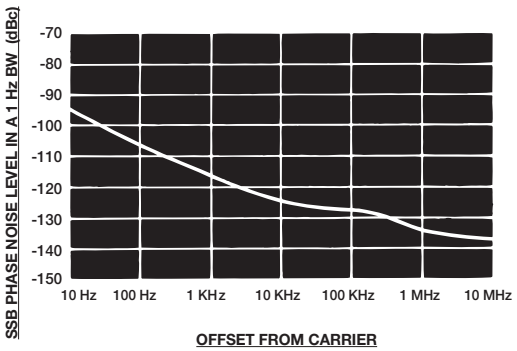
Frequency Standard	Internal:	OCXO	or	TCXO
		3×10^{-9}/day		1×10^{-8}/day
		±1 x 10^{-8}/0 - 50ºC		±1 x 10^{-6}/0 - 50ºC
		1×10^{-6}/year		2×10^{-6}/year
	External:	10 MHz, 0.4-2.0 Vrms into 300 Ω; 5 MHz, 0.5-2.0 Vrms into 300 Ω		
	Aux. Output:	10.000 MHz, 0.4 Vrms into 50 Ω		
		(Note: internal or external standard required for operation)		

General	Operating Ambient:	0 - 50°C, 95% R.H.
	Power:	110 - 125V, 50 - 400 Hz, 75W (100, 220, 240V optional)
	Dimensions:	19 x 5.25 x 18 inches (relay rack or bench cabinet)
	Weight:	40 lbs
	Optional Phase Rotation:	0 - 360° in .225° steps

PTS D310 FREQUENCY SYNTHESIZER

- two fully independent channels, each covering 0.1-310 MHz
- + 3 to + 13 dBm output
- low phase noise
- fast switching, 3 - 20µs
- fully programmable, BCD or GPIB
- DDS standard with phase-continuous switching
- low power consumption, high reliability

NOTE:
PTS D310 shown for illustration in "R" cabinet.
Consult pages 28, 29 for full cabinet style listing.
Consult page 26 for cabinet mechanical specifications.



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PTS D620

FREQUENCY SYNTHESIZERS

SPECIFICATIONS (apply to both independently programmable output channels)

Number of channels		2 fully independent output channels
Frequency		
	Range:	1.000 000 0 to 619.999 999 8 MHz
	Resolution:	0.1 Hz, 1-310 MHz; 0.2 Hz, 310-620 MHz
	Accuracy	same as frequency standard
	Control:	remote by TTL-level parallel-entry BCD or GPIB (optional)
Switching Time	(to within 0.1 radian at new frequency)	
	100 MHz -10 MHz digit:	20 µseconds
	1 MHz digit:	5 µseconds
	100 KHz - 0.1 Hz digit:	1 µsecond transient, 2 µsecond delay
Phase-Continuous Switching Range:		100 KHz through 0.1 Hz digits (~1 MHz bandwidth)
Output	Level:	+3 to +13 dBm (1V max, 50 Ω)
	Flatness:	±0.5 dB
	Impedance:	50 Ω
	Control:	preset and remote by analog voltage
Spurious Outputs		(at full power output, +13 dBm)
	Discrete:	-70 dBc 1-310 MHz -65 dBc 310-620 MHz (-55 dBc, 1/2 & 3/2 f_{out})
	Harmonics:	-30 dBc at full power output,(-40 dBc at lower level)
	Phase Noise:	-63 dBc (0.5 Hz to 15 KHz) including effects of internal standard
	$\mathscr{L}$(1Hz):	100 Hz/-100 dBc, 1 KHz/ -110 dBc, 10 KHz/ -120 dBc, 100 KHz/ -125 dBc
	Noise Floor:	-135 dBc/Hz

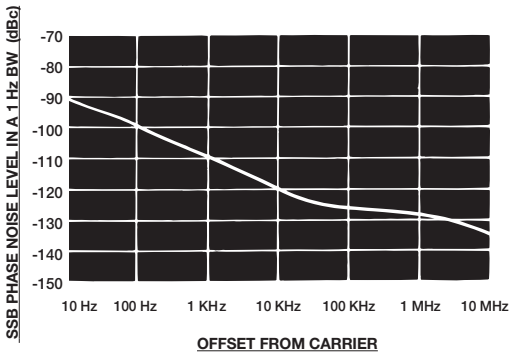
Frequency Standard	Internal:	OCXO	or	TCXO
		3 x 10^{-9}/day		1 x 10^{-8}/day
		±1 x 10^{-8}/0 - 50ºC		±1 x 10^{-6}/0 - 50ºC
		1 x 10^{-6}/year		2 x 10^{-6}/year
	External:	10 MHz, 0.4-2.0 Vrms into 300 Ω; 5 MHz, 0.5-2.0 Vrms into 300 Ω		
	Aux. Output:	10.000 MHz, 0.4 Vrms into 50 Ω		
		(Note: internal or external standard required for operation)		

General	Operating Ambient:	0 - 50°C, 95% R.H.
	Power:	110 - 125V, 50 - 400 Hz, 80W (100, 220, 240V optional)
	Dimensions:	19 x 5.25 x 18 inches (relay rack or bench cabinet)
	Weight:	40 lbs
	Optional Phase Rotation:	0 - 360° in .225° steps (in .450° steps, 310 - 620 MHz)

PTS D620 FREQUENCY SYNTHESIZER

- two fully independent channels, each covering 1-620 MHz
- + 3 to + 13 dBm output
- low phase noise
- fast switching, 3 - 20µs
- fully programmable, BCD or GPIB
- DDS standard with phase-continuous switching
- low power consumption, high reliability

NOTE:
PTS D620 shown for illustration in "R" cabinet.
Consult pages 28, 29 for full cabinet style listing.
Consult page 26 for cabinet mechanical specifications.



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PTS 250..SX-51 DUAL RANGE LOW-NOISE FREQUENCY SYNTHESIZER

(CONSULT FACTORY FOR PTS 160..SX-51 and PTS 310..SX-51 SPECIFICATIONS)

KEY SPECIFICATIONS

Standard Range

Frequency	Range	1.000 000 MHz to 249.999 999 MHz
	Wave Form:	sine wave
	Resolution	1 Hz to 100 KHz, optional in decades
Spurious		(at full power output, +13 dBm)
Outputs	Discrete:	-70 dBc
	Harmonics:	-30 dBc
	Phase Noise:	-63 dBc (0.5 Hz to 15 KHz, including effects of internal standard)
	L (1 Hz):	100 Hz/-105 dBc, 1 KHz/-115 dBc, 10 KHz/-123 dBc, 100 KHz/-127 dBc
	Noise Floor:	-135 dBc/Hz

Ultra-Low Noise Range

Frequency	Range:	1.000 000 0 MHz to 24.999 999 9 MHz
	Wave Form:	approximate square wave with 25 MHz low-pass filtering (harmonics: 2nd, -35 dBc, 3rd, -9 dBc, 4th, -35 dBc, 5th, -15 dBc or lower as a function of output frequency)
	Resolution:	0.1 Hz to 10 KHz, optional in decades
Spurious		(at full power output, +13 dBm)
Outputs	Discrete:	-75 dBc
	Harmonics:	-35 dBc even-order
	Phase Noise:	-73 dBc (0.5 Hz to 15 KHz, including effects of internal standard)
	L (1 Hz):	10 Hz/-120 dBc, 100 Hz/-135 dBc, 1 KHz/-140 dBc, 10 KHz/-142 dBc, 100 KHz/-145 dBc
	Noise Floor:	-147 dBc/Hz

GENERAL SPECIFICATIONS - Apply to both ranges

Frequency	Accuracy:	same as frequency standard
	Control:	manual by 10-position dials; remote by TTL-level parallel entry BCD-encoded negative true logic or GPIB (optional)
Switching		(to within 0.1 radian at new frequency)
Time	100 MHz - 10 MHz digits:	20 µseconds
	1 MHz - 0.1 Hz digits:	5 µseconds
Output	Level:	+3 to +13 dBm (1V max., 50 Ω), metered in dBm and volts (rms)
	Flatness:	±1.0 dB
	Impedance:	50 Ω
	Control:	manual by front panel control; remote by analog voltage

Frequency	Internal:	OCXO	or	TCXO
Standard		3×10^{-9}/day		1×10^{-8}/day
		±1 x 10^{-8}/0 - 50ºC		±1 x 10^{-6}/0 - 50ºC
		1×10^{-6}/year		2×10^{-6}/year
	External:	10 MHz, 0.4-2.0 Vrms into 300 Ω; 5 MHz, 0.5-2.0 Vrms into 300 Ω		
	Aux. Output:	10.000 MHz, 0.4 Vrms into 50 Ω (Note: internal or external standard required for operation)		

General	Operating Ambient:	0 55°C, 95% relative humidity, altitude 0 - 2,000m.
	Power:	120VAC ± 10%, 50 - 60 Hz, 45W (100V, 220-230V, 240V optional)
	IEC Installation category:	I I
	IEC Pollution degree:	2
	Dimensions:	19 x 5.25 x 18 inches maximum (rack or bench cabinet)
	Weight:	35 lbs.

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OPTIONS AND ACCESSORIES

PTS prefers to concentrate on a standard product line which best serves our customers' needs and allows us to provide high-quality products. However, we do offer a number of options and accessories, described below. These options can be combined in a virtually limitless manner, resulting in a product not custom-built but still closely matching the customer's specifications, at a cost which is affordable. Alternatively, custom designs may be considered on a case-by-case basis.

GPIB Remote Control Interfaces

Option G
Option G(2)

GPIB-compatible remote control interface, replaces the standard parallel BCD interface. PTS 310, x10 GPIB includes phase rotation setting function.

Option G: IEEE 488.1 - 1987 compliant; allows the synthesizer to act as a basic listener device (no talk capabilities) and provides control of the two device-dependent functions output signal frequency and level. Output signal frequency can be programmed in 30 µseconds or less to the instrument's full resolution; signal level is programmed from +4 dBm to +13 dBm in 1 dB steps.

Option G(2): IEEE 488.2/SCPI compliant; allows complete control over all instrument functions and status. Switching speeds are 5 - 10 mseconds, or less than 250 µseconds in the LIST mode of operation.

Control: IEEE-488 connector
Available for: Option G: all models Option G(2): all models *except* PTS x10 and PTS 310

Phase Rotation/Digital Phase Modulation

Option Y

Phase rotation of the main instrument output signal over the range 0º - 360º.

Phase Rotation Range: 0º – 360º
Resolution: 0.36° or 0.225° for "undoubled" range depending on model. Consult factory.
Switching Time: 2 µs

Control: 15-pin D-type connector, TTL-level parallel entry BCD-encoded negative true logic with latching capability. Optionally controllable by GPIB.
Available for: PTS 040, 120, 160, 250, 500, 620, (when equipped with option H)
PTS 310 type 2, x10, 1600, 3200
PTS D310, D620
(Note: PTS 310, Type 1, 0°, 90°, 180°, 270° in 90° steps)

DDS Load Strobe

Option X-26

For applications requiring asynchronously-timed phase-continuous switching. Used to control loading of frequency programming data for phase-continuous switching range.

Control: 1-pin BNC connector, TTL-level positive true logic
Available for: PTS 040, 120, 160, 250, 500, 620
PTS 1600, 3200, 6400 (equipped with option J)
PTS 310, x10
PTS D310, D620

Rack Mounting Slides

Standard 19" rack mount slides, for use on models with rack-mounting cabinet style.

Option X-14
Option X-59

Available for: all models

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OPTIONS AND ACCESSORIES

Auxiliary Fixed Frequency Outputs

Extra 10 MHz Outputs — Option E

Replaces the normal single 10 MHz output with 3 passively decoupled outputs which deliver 0 dBm into 50 Ω and have maximum interaction (short circuit) of 1.5 dB.

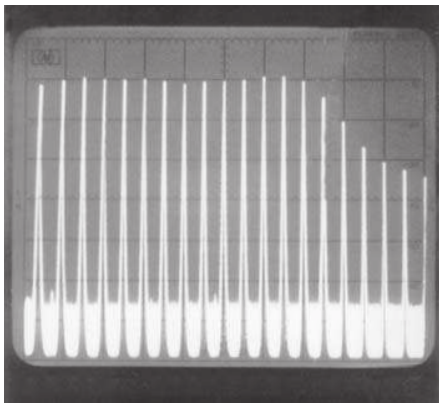
Available for: all models

Dual 10 MHz Square-Wave Outputs — Option M

Two 10 MHz square wave outputs, 1Vpp into 50 Ω, 2 Vpp open circuit.

Available for: all models

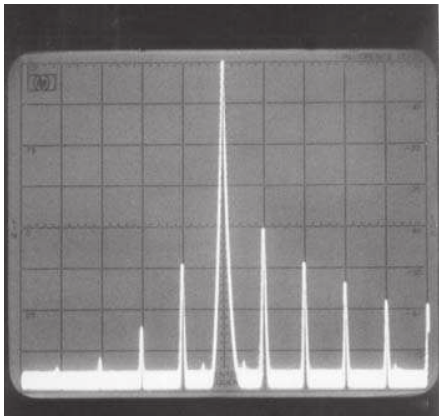
Comb (Picket Fence) Output — Option C



Pulse containing all 10 MHz multiples from 10 MHz to 140 MHz at a level of –5 dBm each. This option uses active isolation to protect internal signal purity.

Available for: PTS 040, 120, 160, 250, 500, 620, 1600, 3200, 6400

Filtered Comb or Internal Auxiliary Frequency — Option F (specify frequency)



Single, coherent n x 10 MHz frequency from 20 MHz to 140 MHz at a level of 0 dBm, with typical 10 MHz side-band suppression of 30 to 40 dBc,

or

(PTS 310 & x10 only) single n x 10 MHz frequency from 20 to 160 MHz with typical 10 MHz sideband suppression of 60 dBc or two n x 10 MHz frequencies with typical 10 MHz sideband suppression of 30 dBc

or

single coherent internal auxiliary frequency (consult factory for specific auxiliary frequencies available).

Available for: all models

This option uses active isolation to protect internal signal purity.

Filtered Comb & Dual 10 MHz Square-Wave Output Combination — Option FM (specify frequency)

Combines single filtered comb output (30 dBc 10 MHz sideband suppression) and dual 10 MHz square-wave outputs. See above for complete description of these options.

Available for: PTS 310, x10

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OPTIONS AND ACCESSORIES

Solid State Programmable Step Attenuator — Option A, A-1

Remote-control only (Option A) or manual and remote-control (Option A-1) attenuator providing 90 dB of total attenuation in 10 dB steps.

Attenuation Range:	90 dB in 10 dB steps
Frequency Range:	1-1000 MHz
Return Loss:	12 dB (VSWR 1.7) to 500 MHz 10 dB to 1000 MHz
Insertion Loss: (0 dB setting)	0 dB*
Output Level Flatness: (0 dB setting)	± 0.75 dB*
Accuracy of Attenuation 10 to 90 dB: (referenced to 0 dB setting)	± 1.0 dB at 500 MHz ± 1.5 dB at 1000 MHz
Accuracy, Incremental Step-to-Step:	± 1.0 dB typical to 1000 MHz
Harmonic Distortion: (where different from instrument spec.)	– 30 dBc
Switching Time:	5 µs (delay and rise time)

*The insertion loss will be "absorbed" by the instrument; frequency response of synthesizer plus attenuator will be ± 0.75 dB at the 0 dB attenuation setting.

Control: manual by 10-position front panel dial (available some models only, see model details below)
remote by TTL-level parallel-entry BCD, or GPIB on instruments equipped with GPIB interface (see Notes 1 and 2, below)

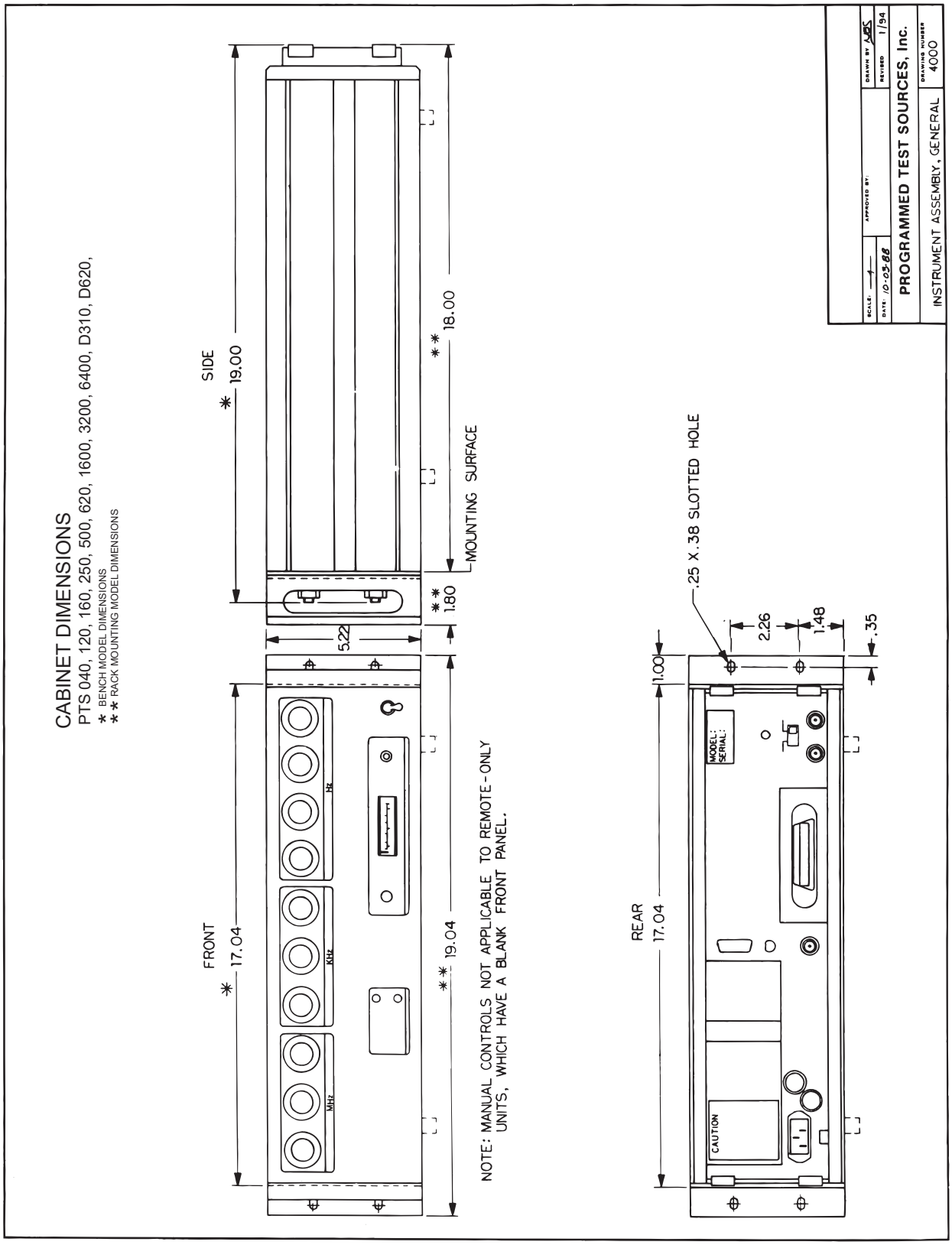
Available for: PTS 040, 120, 160, 250, 500, 620 (manual and remote-control or remote-control only)
PTS 310, x10 (remote-control only)

Note 1: On models PTS 040, 120, 160, 250, 500, and 620, attenuator TTL-level parallel-entry BCD remote control is through a 9-pin D-type connector, control logic **integrated** with the standard parallel remote control interface.
On models PTS 310, x10, attenuator TTL-level parallel-entry BCD remote control is through a 15-pin D-type connector, control logic **separate** from the standard parallel remote control interface.

Note 2: On instruments equipped with GPIB, attenuator remote control will produce 99 steps of 1 dB each.

MECHANICAL SPECIFICATIONS

All PTS synthesizer cabinets use substantial extrusion-reinforced frames for stability and long-term serviceability.



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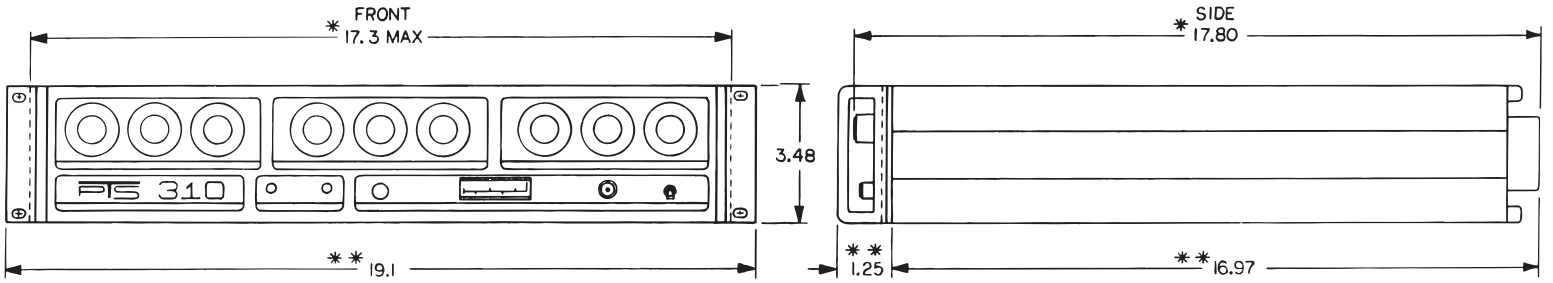
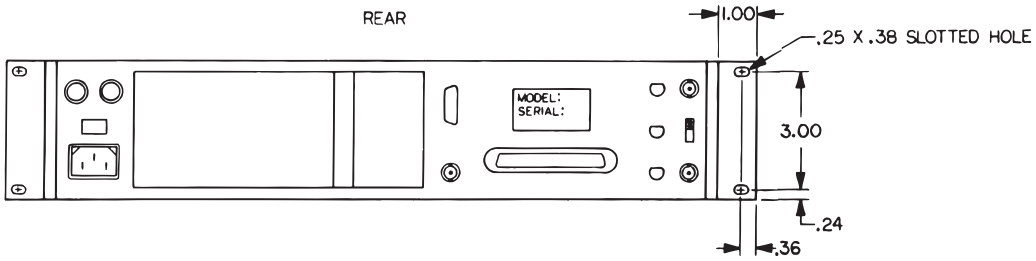
CABINET DIMENSIONS

PTS 310, x10

* BENCH MODEL DIMENSIONS
** RACK MOUNTING MODEL DIMENSIONS



NOTE: MANUAL CONTROLS NOT APPLICABLE TO REMOTE ONLY UNITS, WHICH HAVE A BLANK FRONT PANEL.



SCALE:	APPROVED BY:	DRAWN BY WBS
DATE 8-29-88		REVISED 5-29-91
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INSTRUMENT ASSEMBLY, PTS 310		DRAWING NUMBER 4001

The Drafboard, Inc.

PTS PRODUCT CODE

The PTS product code is an alpha-numeric part number designed to fully specify your PTS synthesizer. Each product code contains the specification for frequency range, packaging option, resolution, frequency standard, line voltage and any miscellaneous options.

Example

PTS Code: 160M7O1C

Specifies: 0.1-160 MHz frequency range, manual controls, remote BCD control, front output, rack cabinet, 0.1 Hz resolution, OCXO frequency standard, 120V power supply and comb (picket fence) output.

160

FREQUENCY RANGE

040	0.1-40 MHz
120	90-120 MHz
160	0.1-160 MHz
250	1-250 MHz
310	0.1-310 MHz
500	1-500 MHz
620	1-620 MHz
1600	1-1600 MHz
3200	1-3200 MHz
6400	1- 6400 MHz
x10	(user specified)
D310	0.1-310 MHz
D620	1-620 MHz

M

CABINET, CONTROLS, OUTPUT LOCATIONS

19" Rack Mounting	M	Manual & Remote Controls, Front Output
	S	Manual & Remote Controls, Rear Output
	D*	Keyboard/LCD & Remote Controls, Front Output
	R	Remote Control Only, Rear Output
Bench Cabinet	B	Manual & Remote Controls, Front Output
	U	Manual & Remote Controls, Rear Output
	V	Remote Control Only, Rear Output

*available on PTS 1600, 3200, 6400 only

7

RESOLUTION / PTS 310 TYPE / PTS x 10 FREQ. RANGE

Code	PTS 040/120/160/250/500/620/1600/3200/6400	PTS 310	PTS x10
0	_____	_____	0.1-10 MHz
1	100 KHz Resolution	Type 1	10-20 MHz
2	10 KHz Resolution	Type 2	20-30 MHz
3	1 KHz Resolution	_____	30-40 MHz
4	100 Hz Resolution	_____	40-50 MHz
5	10 Hz Resolution	_____	50-60 MHz
6	1 Hz Resolution	_____	60-70 MHz
7	0.1 Hz Resolution	_____	70-80 MHz
H*	DDS with 0.1 Hz Resolution	_____	
J**	DDS with 1 Hz Resolution	_____	
K	DDS with 0.1 Hz Resolution	_____	
8	_____	_____	80-90 MHz
9	_____	_____	90-100 MHz

*standard resolution on PTS D310, D620

standard resolution on PTS 1600, 3200, 6400; ***not available on other models*

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O

TYPE OF FREQUENCY STANDARD

O . . . . OCXO
3 x 10^{-9}/day
±1 x 10^{-8}/0-50ºC
1 x 10^{-6}/year

T . . . . TCXO
1 x 10^{-8}/day
±1 x 10^{-6}/0-50ºC
2 x 10^{-6}/year

N . . . . NONE

1

AC LINE VOLTAGE

1 . . . . . 120 V
2 . . . . . 120/220 V
3 . . . . . 120/240 V
5 . . . . . 120/100 V

C

MISCELLANEOUS OPTIONS

A . . . . Programmable Step Attenuator (remote-control only)
(not available on PTS 1600, 3200, 6400, D310, D620)

A-1 . . Programmable Step Attenuator (manual and remote controls)
(not available on PTS 310, 1600, 3200, 6400, x10, D310, D620)

C . . . . Comb (Picket Fence) Output
(not available on PTS 310, x10, D310, D620)

E . . . . Extra 10 MHz Outputs

F . . . . Filtered Comb or Internal Auxiliary Frequency

FM. . . Filtered Comb & Dual 10 MHz Square-Wave Output Combination
(available on PTS 310, x10 only)

G . . . . GPIB Remote Control Interface (IEEE 488.1-1987 compliant)

G(2) . . GPIB Remote Control Interface (IEEE 488.2 SCPI compliant)
(not available on PTS 310, x10)

M . . . Dual 10 MHz Square-Wave Outputs

Y . . . . Phase Rotation / Digital Phase Modulation
(not available on PTS 6400)

X-6 . . Rack Cabinet with Rack Handles Removed

X-26 . DDS Load Strobe

SX-51 Dual Range Low Noise Frequency Synthesizer
(available on PTS 160, 250, 310 only)

Consult **Options and Accessories** section for complete specifications and availability.

IMPORTANT: FOR MISCELLANEOUS OPTIONS

Option:	Precludes:
*C	E, F or M
E	C or M
F	C or M
M	C, E or F

*If unit is equipped with manual controls and front output, this option available with “E” option.

ORDERING INFORMATION

The following describes how to construct the product code which will specify your synthesizer.

I. The product code begins with the model (frequency range) you are ordering:

040 (0.1-40 MHz)	310 (0.1-310 MHz)	D620 (2 @ 1-620 MHz)
120 (90-120 MHz)	D310 (2 @ 0.1-310 MHz)	1600 (1-1600 MHz)
160 (0.1-160 MHz)	500 (1-500 MHz)	3200 (1-3200 MHz)
250 (1-250 MHz)	620 (1-620 MHz)	6400 (1-6400 MHz)
		x10 (user-specified 10 MHz decade)

II. After the model number, use one letter to indicate type of controls, output location and cabinet choice:

*M:	Manual & Remote Controls	Front Output	Rack Cabinet
*S:	Manual & Remote Controls	Rear Output	Rack Cabinet
**D:	Keyboard/LCD & Remote Controls	Front Output	Rack Cabinet
R:	Remote Control Only	Rear Output	Rack Cabinet
*B:	Manual & Remote Controls	Front Output	Bench Cabinet
*U:	Manual & Remote Controls	Rear Output	Bench Cabinet
V:	Remote Control Only	Rear Output	Bench Cabinet

*not available on PTS 1600, 3200, 6400, D310, D620
**available on PTS 1600, 3200, 6400 only
note: rack cabinet instruments available without rack handles; specify X-6 option

III. Following this, use an alpha-numeric code to indicate either the resolution for models 040, 120, 160, 250, 500, 620, 1600, 3200, 6400, D310 & D620 **or** the type number of the PTS 310 **or** the frequency range of the PTS x10:

Code	PTS 040/120/160/250/500/620/1000/3200/D310/D620	PTS 310	PTS x10
0	_____	_____	0.1-10 MHz
1	100 KHz resolution	Type 1	10-20 MHz
2	10 KHz resolution	Type 2	20-30 MHz
3	1 KHz resolution	_____	30-40 MHz
4	100 Hz resolution	_____	40-50 MHz
5	10 Hz resolution	_____	50-60 MHz
6	1 Hz resolution	_____	60-70 MHz
7	0.1 Hz resolution	_____	70-80 MHz
*H	DDS with 0.1 Hz resolution	_____	
**J	DDS with 1 Hz resolution	_____	
K	DDS with 0.1 Hz resolution	_____	
8	_____	_____	80-90 MHz
9	_____	_____	90-100 MHz

*standard on PTS D310 & D620
standard on PTS 1600, 3200 & 6400 *(not available on other models)***

IV. Next, use a letter to indicate the frequency standard:

O: OCXO (3 x 10^{-9}/day) (±1 x 10^{-8}/0-50°C) (1 x 10^{-6}/year)
T: TCXO (1 x 10^{-8}/day) (±1 x 10^{-6}/0-50°C) (2 x 10^{-6}/year)
N: none required (external drive required)

V. Next, use a single digit to indicate the power supply: (all are 50-400 Hz, AC)

1: 120 V 2: 120/220 V 3: 120/240 V 5: 120/100 V

VI. Lastly, use a letter or letters to indicate any miscellaneous options (use letter O if no miscellaneous options are required):

A: Programmable Step Attenuator (remote control only; order A-1 for manual & remote controls)
C: Comb (Picket Fence) Output
E: Extra 10 MHz Outputs
F: Filtered Comb or Internal Auxiliary Frequency
FM: Filtered Comb & Dual 10 MHz Square-Wave Output Combination
G or G(2): GPIB Interface
M: Dual 10 MHz Square Wave Outputs
Y: Phase Rotation
X-6: Rack cabinet with rack handles removed
X-14: Rack Mounting Slides (5.25 inch instruments)
X-59: Rack Mounting Slides (3.50 inch instruments)
X-26: DDS Load Strobe
SX-51: Dual Range Low Noise Frequency Synthesizer

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DATE: September, 2004

A customer writes:

I just wanted to drop you a line to let you know how pleased we are with your synthesizers. We are especially pleased with their ***dependability.***

...since 1988 in 24/365 operation...it has failed once.

Congratulations and my thanks to you and all your employees for producing such fine products.

Complete letter on file at PTS. Comments were unsolicited.

PTS
FREQUENCY SYNTHESIZERS

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