Phase Matrix, Inc.

Instruments You Can Count On

575B
578B

Phase Matrix, Inc.
EIP 575B and 578B
CW Frequency Counters

Source Locking CW Microwave Frequency Counters with Selective Power Measurement

- Source Locking
  - Frequency Range of 10 MHz to 20/26.5 GHz (110 GHz optional)
  - Resolution to 10 kHz • 200 msec phase-lock time
- Keyboard controlled frequency limit selection
- Power measurement accuracy to ±0.5dB typical
- -30 dBm sensitivity
- 200 Watt (+53 dBm) peak damage protection
- 200msec acquistion time
- 20 Mhz P-P FM tolerance up to a 10 MHz rate

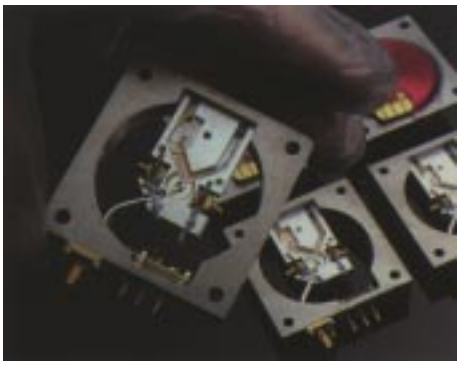
Phase Matrix / EIP 575B and 578B. . . .
Source Locking Microwave Frequency Counters

The Ideal Research Counters

This family of Phase Matrix/EIP microwave frequency counters provides fully automatic source locking of virtually any electronically tunable source to the same accuracy and long term stability as the timebase oscillator in the counter. The ability of the 575B and the 578B to accurately set and stabilize the frequency of a source generator often eliminates the need for an expensive, synthesized signal generator.

The 575B measures CW, FM and AM frequencies from 10 Hz to 20 GHz, and the 578B extends that range up to 26.5 GHz. With simultaneous power measurement capability, and options for a high stability time base, these high performance counters are ideally suited for applications in:

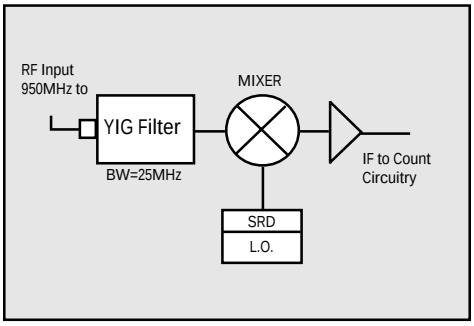
- Production Line testing
- R&D Labs
- ATE



Only Phase Matrix counters offer the unique YIG-preselected heterodyne technique.

Unsurpassed Burnout Protection

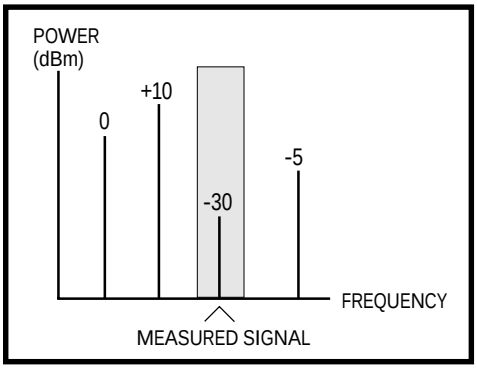
Typically found in high performance spectrum analyzers; only Phase Matrix counters feature a YIG-preselected microwave input, which provides unparralled burnout protection, FM tolerance and frequency selectivity. The YIG preselector works like a tunable bandpass filter, preventing harmonics and other out-of-band spurious signals from interfering with measurement of the desired signal. It also protects the counter from accidental application of high level signals (up to 200 watts peak), reducing downtime and the associated high cost of repairing damaged microwave circuitry.



All Phase Matrix Counters feature the unique YIG Preselected Heterodyne Down-Convertor.

Selective Frequency and Power Measurements

With a single connection, the 575B and 578B can simultaneously measure and display the input signals frequency and power level in the microwave band, eliminating the need for a seperate microwave power meter. Within the 25MHz bandwidth of the YIG-preselector, only the selected signals frequency and power level are measured. Signals to be analyzed are selected by keystroke entry of an individual center frequency, or search a range between a low and high frquency limit. This signal selectivity, combined with 20MHz of FM tolerance at all rates up to 10MHz, allows the 575B and the 578B to make accurate frequency and power level measurements even while the input signal is carrying traffic.



The frequency selective operation of the counters allows measurement of any individual signal's frquency and power in a multi-signal environment.

Frequency Extension to 110 GHz

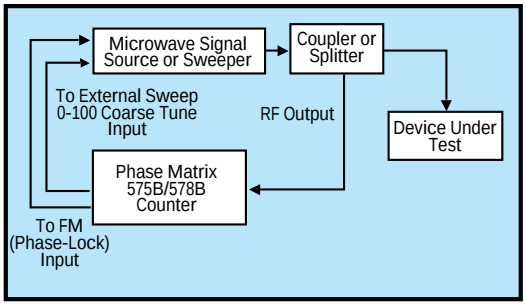
Option 06 provides the ability to extend the frequency range of your 578B, in bands, up to 110 GHz. Remote sensors allow you to reach out to connect to virtually any wave guide system without the complications of the additional plumbing necessary to bring the signal to your counter. A wide selection of sensors provides measurement capability in the wave guide band that you are working in now, and the flexibility to change as your application changes without having to purchase another counter.

Phase Matrix / EIP 575B and 578B. . . .
The Ultimate Reasearch Instrument

New Flexibility For GPIB-based ATE Systems

The Phase Matrix 575B/578B family of counters offers new flexibility and efficiency in controller programming of your source. First, programming steps can be eliminated by letting the counter directly control the sources frequency over its entire frequency range. Second, only a single command string to the counter is needed to set and lock the source. Third, the signal source does not need to have GPIB capability. The counter constantly monitors and corrects the source thereby relieving the controller of the task of checking the frequency and issuing correction commands. The ability to rapidly step and lock the signal source also saves test time as shown by these examples:

Frequency Step	Typical Lock Time
1 MHz	<200 ms
10 MHz	<300 ms
1 GHz	<500 ms



Only three connections are required to coarse tune and then phase-lock an electrically tunable microwave signal source. The ability of the 575B and the 578B to accurately set and stabilize the frequency of a source generator often eliminates the need for an expensive, synthesized signal generator.

Automatic Broad-Band Tuning

Operation of the source and counter combination is straightforward and automatic. Lock frequency is easily entered via the front panel keyboard or via standard GPIB interface. The counter automatically takes it from there, locking the source at the entered frequency.

Frequency Storage and Recall

For repetitive production testing, an operator can store up to nine lock frequencies and rapidly recall them as needed. This also reduces typical lock times for steps over 10 MHz to<300ms.

Frequency Limits

Automatic amplitude discrimination enables the 575B/578B counters to automatically select and measure the input signal with the highest level, and ignore all other harmonics and other spurious signals that are present. "Frequency Limits" extend this signal selection capability by allowing you to select upper and lower limits, The counter will measure the frequency and power level of only the highest level signal within these limits - even if there are higher level signals present at the counters input. This gives you the ability to measure the frequency and power of a low level signal (such as a harmonic) even when a signal of much higher level (the fundamental) is present.

Power Measurement

The 575B/578B family of microwave counters offers the optional ability to simultaneously measure both the frequency and power level through the same input. This often eliminates the need for a separate microwave power meter. With the 25 MHz bandwidth of the YIG tuned preselector, power measurement is made only of the displayed signal, not of its harmonics or other signals present. Thus you can simultaneously measure and display both frequency and power of individual signals in a multisignal environment. Easy keystroke entry of power offsets can be used to measure power deviation from a reference, or to compensate for losses in external hook-ups such as cable and attenuator losses.

SPECIFICATIONS

MODEL 575B and 578B	BAND 1	BAND 2	BAND 3
Frequency Range	10 Hz-100 MHz	10 MHz-1 GHz	1-20 GHz (575B) 1-26.5 GHz (578B)
Sensitivity	25mV rms	-20dBm	-30 dBm 1-12.4 GHz -25 dBm 12.4 GHz-20 GHz -20 dBm 20 GHz-26.5 GHz (578B)
Impedance	1MΩ/20pF	50 Ohms	50 Ohms
Connector	BNC (female)	BNC (female)	Precision Type N-female (575B) APC 3.5-female (578B)
Input Coupling	DC	AC	AC
Maximum Operating Level	120 V rms*	+10 dBm	+10 dBm
Damage Level	150 V rms*	+27 dBm	+45 dBm (30 watts) continuous +53 dBm (200 watts) peak pulsed (<1uS PW, 0.1% duty)
Acquisition Time			
Standard	N/A	<50mS	<200ms
Center Frequency Mode	N/A	N/A	<20ms
Automatic Amplitude Discrimination	N/A	N/A	10 dB
FM Tolerance	Carrier remains in band	Carrier remains in band	20 MHz P-P up to 10MHz rate
Maximum Tracking Speed	Carrier remains in band	>800MHz/sec typical	>800MHz/sec typical
VSWR	N/A	2.5:1 typical	2.5:1 typical
Center Frequency Mode	N/A	N/A	Keyboard controlled. Unit will measure signal within ± 5 MHz of entered frequency. Signals of equal amplitude must be seperated by 40 MHz
Frequency Limits	N/A	N/A	Keyboard controlled. Unit will measure largest signal within set limits. Signals outside desired range must be seperated by ≥200 MHz (typical) from either limit. *Above 1KHz, decreases @ 6dB/octave down to 3.0 V rms

BAND 4 (option 06, 578B only)

Frequency Range	26.5 GHz - 110 GHz
Sensitivity	-25 dBm typical
Connector	Depends on remote sensor
Maximum Operating Level	+5 dBm
Damage Level	+10 dBm
Acquisition Time	<1 second typical
Amplitude Discrimination	10 dB

SPECIFICATIONS

Power Measurement

	Frequency Range	1-20 GHz (575B) 1-26.5 GHz (578B)
	Accuracy	±1.2 dB typical (0˚ to 50˚C, input padded by 3 dB) ±0.5 dB typical (25˚C, input padded by 3 dB)
	Resolution	Power: ±0.1 dB Frequency: 100 kHz to 1 GHz (selectable) via GPIB 1 Hz to 1 GHz (selectable) via GPIB
	Minimum Level	Equal to counter sensitivity
	Display	Simultaneous frequency and power reading
	Offset Range	-99.9 dB to +99.9 dB
	Offset Resolution	0.1 dB
	Offset Input	Keyboard or optional GPIB
	Measurement Time	1 Gate Time + 50ms + Freq Measurement Time
	Measurement Window	25 MHz nominal

Time Base: Standard TCXO

Crystal Frequency	10 MHz	
Stability	Aging Rate	$<1x10^{-7}$/month, $<1x10^{-6}$/year
	Short Term	$<1x10^{-9}$ rms for one sec. averaging time
	Temperture	$<1x10^{-6}$, 0˚ to 50˚C
	Line Variation	$<1x10^{-7}$, ±10% line voltage
Output Frequency	10 MHz square wave, 1V P-P min into 50Ω	
External Time Base	Requires 10 MHz, 1VP-P min into 300Ω	

GPIB (IEEE-488/1978) Programmabilty

GPIB	Functions, special functions and diagnostics are programmable. Address settable from the front panel. Compatible IEEE STD-488. SH1, AH1, T5, L3, SR1, RL1, DC1 and DT1 implimented.

General

Warranty	1 year Standard (Extendable to 3 years)
Frequency Resolution	Selectable 0.1 Hz to 10 MHz in band 1, 1 Hz to 1 GHz in bands 2 and 3.
Display	12-digit LED sectionalized to read GHz, MHz, kHz, Hz or GHz, MHz, kHz, dBm.
Frequency Accuracy	± 1 count ± time base error.
Test	Front panel selected service diagnostics and user information.
Sample Rate	Varies time between measurements, from 0 sec to 10 sec. HOLD freezes display indefinitely.
Reset	Resets display to zero and initiates new acquisition.
Frequency Offset	Displayed frequency is offset by the entered value to 1 Hz resolution.
Frequency Multiply	Displayed frequency is multiplied by an entered integer from 1 to 99 and displayed to 1 kHz resolution. OFFSET is added or subtracted to obtain y = mx ±b result.
Computer Interface	GPIB (IEEE 488/1978)
Certifications	CE Certified for EMI/RFI to EN50011 and EN50082-1 Certified for Safety to IEC 1010-1 (1990)
Operating Temperature	0˚ to 50˚C.
Power	100/120/140/200/220/240/VAC ±10%, 50 to 400 Hz; 60 VA typical.
Net Weight	~ 26 lbs. (11.8 kg).
Shipping Weight	~ 32 lbs. (14.5 kg).
Dimensions	3.5" H x 16.75" W x 14.0" D (89 mm H x 425 mm W x 356 mm D).
Standard Accessories	Power cord, Operating manual.

SPECIFICATIONS

Source Locking Specifications

	Frequency Range		10 MHz-20 GHz (575B), 10 MHz-26.5 GHz (578B)
	Resolution		10 kHz (2.5 kHz <50 MHz)
	Accuracy		Equal to counters timebase
	Long Term Stability		Equal to counters timebase
	Polarity		Automatically selected
	Bandwidth		User selectable, 10 kHz, 2kHz, 500Hz, or counter automatically selects the widest bandwidth capable of locking.
Lock Time (typical)	Coarse Tune		50 msec + 1 counter acquisition time period for source bandwidths greater than 100 Hz; limited by source tuning speed below 100 Hz.
	Phase-Lock		200 ms
	Recall Stored Data		100 ms + 1 counter acquisition period (limited by source tuning speed.)
Output Drive (maximum)	Coarse Tune		0 to +10V into 5K ohms min.
	Phase-Lock		±10V into 5K ohms min. for source gain constant <64 MHz/V. ±75mA into 10K ohms max. for source gain constant <3.2 MHz/mA. ±0.6V into 5K ohms min. for source gain constant >64 MHz/V. ±4.5mA into 10K ohms max. for source gain constant >3.2 MHz/mA.
Capture Range	Coarse Tune		Entire range of selected counter band, limited by the maximum output drive.
	Phase-Lock		Source gain constant multiplied by maximum output drive.
Output Connector			Rear Panel BNC, female Rear Panel BNC, female
Phase Lock Spectrum	Noise Floor vs. Input Frequency The noise floor extends from the carrier to approximately the loop bandwidth. Beyond this, the noise floor decreases 12 dB/bandwidth octave. The noise floor is the greater of: 1) -70dBc/Hz or 2) (20log F) -65 dBc/Hz where F= Input frequency in GHz.		
Required Source Characteristics	External Sweep	Bandwidth	5Hz minimum
	Coarse Tune Input	Tuning Sensitivity	10 MHz/V minimum 10 GHz/V maximum
	FM (Phase-Lock) Input	Bandwidth	2 kHz minimum
		Tuning Sensitivity:	
		Voltage Driven Input	±2 MHz/V min ±1 GHz/V max
		Current Driven Input	±0.1 MHz/mA min ±50 MHz/mA max

Specifications and ordering
information subject to change without notice.

SPECIFICATIONS

OPTION 01 Digital to Analog Converter

Option 01 will convert any three consecutively displayed digits to an analog voltage output. A display of 000 produces 0 volts output; 999 produces 0.999 volts full scale. Output is updated after every display update.

OPTION 02 Power Measurement

Option 02 measures power of signals applied to the Band 3 input. Power and frequency are simultaneously displayed to 0.1 dB and 100kHz resolution, respectively. Option 02 also allows power offsets from -99.99 to +99.99 dB (0.1 dB resolution) to be input from the keyboard or via GPIB.

OPTION 05 High Stability Ovenized Timebase

Stability	Aging Rate	$<5x10^{-10}$/day, (After 24 hour warm up).
	Short Term	$<1x10^{-10}$ rms for one sec. averaging time
	Temperture	$<3x10^{-8}$, 0˚ to 50˚C
	Line Variation	$<2x10^{-10}$, ±10% line voltage
	Retrace	$<5x10^{-9}$ of final value 10 minutes after counter is turned on at 25˚C

Frequency Extention Accessories

590 Frequency extention cable kit
091 26.5-40 GHz remote sensor, waveguide
092 40-60 GHz remote sensor, waveguide
093 60-90 GHz remote sensor, waveguide
094 90-110 GHz remote sensor, waveguide
095 50-75 GHz remote sensor, waveguide
096 33-50 GHz remote sensor, waveguide
097 26.5-50 GHz remote sensor, coax

Note: All remote sensors require cable kit 590 and extended frequency Option 06

ORDERING INFORMATION

MODEL 575B 10 Hz - 20 GHz Source Locking Microwave Frequency Counter
MODEL 578B 10 Hz - 26.5 GHz Source Locking Microwave Frequency Counter

Options	01	Digital to Analog Converter
	02	Power Measurement
	05	High Stability Ovenized Time Base
	06	Frequency Extension
	09	Rear Panel Signal Input
	10	24” Chasis Slides
	14	2 Year Warranty Extension (3 years total)
	15	MIL-STD 45662 (ANSI Z540-1:94)
Accessories	010	Transit Case
	020	Rack Mount Kit
	031	Extra Operating Manual (one supplied at no cost)
	032	Maintenance and Service Manual (includes operation information)
	040	Service Kit

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Source Locking CW Microwave Frequency Counters with Selective Power Measurement

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