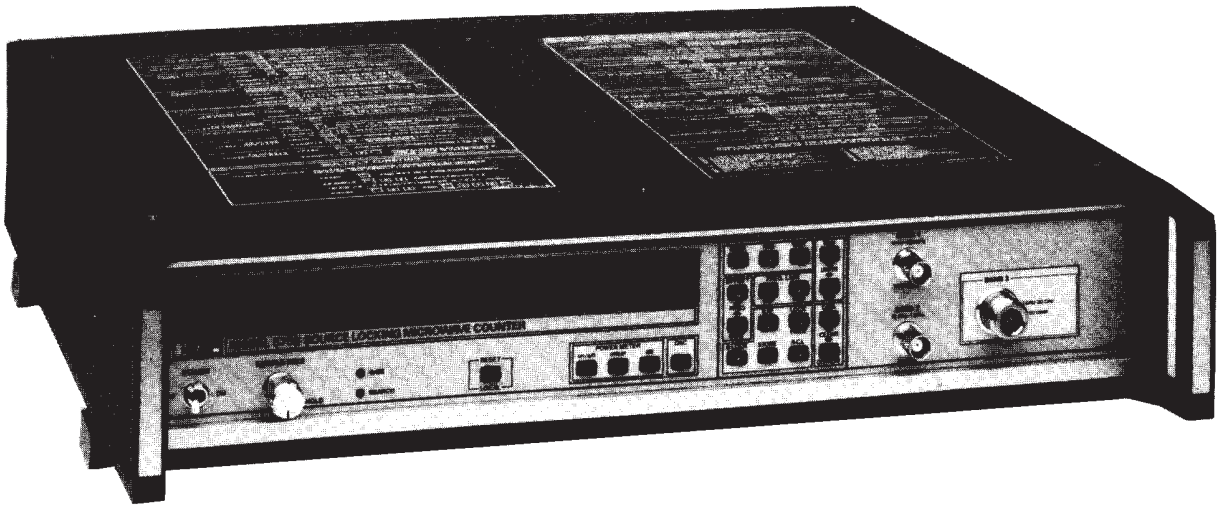
Section 1
General Information



DESCRIPTION

The Model 575B and Model 578B Source Locking Counters are multi-function microprocessor based devices. These counters are not only able to perform frequency and (optionally) power measurement, but can tune and phase lock an external signal source over a wide range of frequencies. The basic frequency range of the 575B is 10 Hz to 20 GHz, while the 578B extends to 26.5 GHz.

When the 578B is equipped with Frequency Extension Capability (Option 06) and used with external accessories such as the Model 590 and a Remote Sensor, the counter is capable of operationg up to 110 GHz.

Frequency counting is divided into 4 bands. Band 1 is a high impedance input (1 M ohm/20 pF) and covers 10 Hz to 100 MHz with a sensitivity of 25 mV RMS. Band 2 is a 50 ohm input operating from 10 MHz to 1 GHz with a minimum sensitivity of -20 dBm. Band 3 is also a 50 ohm input and covers the range of 1 GHz to 20 GHz using the 575B, and 1 GHz to 26.5 GHz using the 578B, with sensitivity to -30 dBm. The 578B has optional frequency coverage that is designated as Band 4, and is subdivided into 5 frequency ranges, each with a typical sensitivity of -25 dBm.

Band 41	26.5 - 40 GHz
Band 42	40 - 60 GHz
Band 43	60 - 90 GHz
Band 44	90 - 110 GHz
Band 42, 43	50 - 75 GHz

An optional power measurement capability (Option 02) is available to supplement Band 3. With this option the counter can simultaneously display frequency to 100 kHz resolution, and power to .1 dB resolution. Typical accuracy of power measurement is 0.5 dB (at 25° C). Range is from sensitivity up to +10 dBm.

The other major feature of the 57XB counters is the ability to tune and phase lock virtually any frequency source that is capable of being electronically tuned. Two output ports are provided, one for coarse tune and one for phase lock. With these outputs a source can be locked from 10 MHz up to the maximum operating frequency of the counter. Frequencies can be selected to a resolution of 10 kHz and maintain the long term accuracy and stability of the internal time base crystal oscillator.

Using the keyboard (or IEEE 488-1978 bus control) the 57XB counters provide not only the major counter functions but a variety of other capabilities such as frequency offsets, power offsets, and a frequency multiple function. Optional capabilities can also include a digital to analog converter (DAC) and three high stability oven oscillators.

SPECIFICATIONS

GENERAL	
RESOLUTION	Front panel keyboard input select .1 Hz to 1 GHz * 0.1 Hz resolution Band 1 only. No frequency offset or multiplier in 0.1 Hz resolution.
MEASUREMENT TIME	1 msec for 1 kHz resolution 1 sec for 1 Hz resolution
DISPLAY	12 digit LED sectionalized
ACCURACY	± 1 count ± time base errors
TEST	Front panel selected diagnostics
SAMPLE RATE	Controls time between measurements variable from 100 msec typ. to 10 sec. Switchable Hold position holds display indefinitely.
RESET	Resets display to zero and initiates new reading
OFFSETS	Keyboard control of frequency offsets (standard) and power offsets (standard with power measurement Option 02). Displayed frequency (power) is offset by entering value to 1 Hz resolution (0.1 dB power).
OPERATION TEMP.	0° C to 50° C
POWER	100/120/220/240/VAC ± 10% (selectable) 50 to 60 Hz, 60 VA typical
WEIGHT, NET	~ 26 lb (11.8 kg)
WEIGHT, SHIPPING	~ 32 lb (14.5 kg)
DIMENSIONS (HWD)	3.5'' x 16.75'' x 14.0'' (89 mm x 425 mm x 356 mm)
ACCESSORIES FURNISHED	Power Cord and Manual

SPECIFICATIONS, continued

BAND 1	
RANGE	10 Hz to 100 MHz
SENSITIVITY	25 mV rms
IMPEDANCE	1 M ohm/20 pF
CONNECTOR	BNC (female)
MAX. INPUT LEVEL	120 V rms *
DAMAGE LEVEL	150 V rms *
	* (Above 1 kHz max. input will decrease at 6 dB/octave down to 3.0 V rms.)

BAND 2	
RANGE	10 MHz to 1 GHz
SENSITIVITY	-20 dBm
DYNAMIC RANGE	30 dB
IMPEDANCE	50 ohms Nominal
CONNECTOR	BNC (female)
MAX. INPUT LEVEL	+10 dBm
DAMAGE LEVEL	+27 dBm
ACQUISITION TIME	<50 msec

BAND 3		
RANGE	1 GHz to 20 GHz (26.5 GHz for model 578B)	
SENSITIVITY	-30 dBm: 1 GHz to 12.4 GHz: -25 dBm: 12.4 GHz to 20 GHz: -20 dBm: 20 GHz to 26.5 GHz:	
DYNAMIC RANGE	1 GHz to 12.4 GHz, 40 dB 12.4 GHz to 20 GHz, 35 dB	20 GHz to 26.5 GHz, 30 dB
IMPEDANCE	50 ohms Nominal	
CONNECTOR	Model 575B: Model 578B:	Precision Type N (female) DMS (female)
MAX. INPUT LEVEL	+10 dBm	
DAMAGE LEVEL	5 Watts, (+37 dBm)	
ACQUISITION TIME	< 200 msec Independent of frequency	
AUTO AMPLITUDE DISCRIMINATION	(Automatic amplitude discrimination of two frequencies) 10 dB	
FM MODULATION	20 MHz p-p up to 10 MHz rate	
VSWR	< 2.5: 1 typical	
FREQUENCY LIMIT	Keyboard control of desired limits (standard). Counter will measure largest signal within programmed limits. Signal outside operating band must be separated by at least 100 MHz from either limit. For signal more than 10 dB above desired signal, separation is typically 200 MHz.	

TIME BASE	
FREQUENCY	10 MHz TCXO
AGING RATE	$<\|1 \times 10^{-7}\|$ per month, $\|1 \times 10\| \|1 \times 10^{-6}\|$ per year
SHORT TERM	$<\|1 \times 10^{-9}\|$ rms for one second averaging time
TEMPERATURE	$<\|1 \times 10^{-6}\|$ 0° to 50° C when set at 25° C
LINE VARIATION	$<\|1 \times 10^{-7}\| \pm$ 10% change.
WARM UP TIME	NONE
OUTPUT FREQUENCY	10 MHz, square-wave, 1 V p-p minimum into 50 ohms.
EXT. TIME BASE	Requires 10 MHz, 1 V p-p minimum into 300 ohms
PHASE NOISE	-95 dBc/Hz at 10 Hz from carrier

BAND 4
Used with 578B/06 Counter and 590 Frequency Extension Kit

OPTION	91	92	93	94	95	96
SELECT BAND	41	42	43	44	42 or 43	41 or 42
Waveguide Band	Ka	U	E	W	V	Q
Range	26.5–40 GHz	40–60 GHz	60–90 GHz	90–110 GHz	50–75 GHz	33–50 GHz
Sensitivity (typ)	–25dBm (–20 dBm min)	–25 dBm	–25 dBm	–25 dBm	–25 dBm	–25 dBm
Waveguide Size	WR–28	WR–19	WR–12	WR–10	WR–15	WR–22
Waveguide Flange	UG–599/U	UG–383/U	UG–387/U	UG–387/U	UG–385/U	UG–383/U
Max. Input (typ)	+5 dBm	+5 dBm	+5 dBm	+5 dBm	+5 dBm	+5 dBm
Damage Level	+10 dBm	+10 dBm	+10 dBm	+10 dBm	+10 dBm	+10 dBm
Aquisition Time (typ)	<1 sec	<1 sec	<1 sec	<1 sec	<1 sec	<1 sec

EXAMPLE: If desired measurement is 60 – 90 GHz, the required equipment is:

Model 578B with Option 06 – Extended Frequency and
Model 590 – Extended Frequency Cable Kit with Option 93 – Remote Sensor

SOURCE LOCK	
FREQUENCY RANGE	10 MHz – Max. capability of counter.
RESOLUTION	10 kHz for phase lock freq. $\geq$ 50 MHz 2.5 kHz for < 50 MHz
ACCURACY	equal to counter's Time Base
LONG TERM STABILITY	Equal to counter's Time Base
MIN. PHASE LOCK SIGNAL LEVEL	Equal to counter's sensitivity
POLARITY	User select, 10 kHz, 2 kHz, or 500 Hz, or automatically selects widest bandwidth capable of locking.
LOCK TIME (TYP)	
COARSE TUNE	50 m sec + 1 counter acquisition time for source bandwidth greater than 100 Hz, Limited by source tuning speed below 100 Hz.
PHASE LOCK	200 m sec.
RECALLING STORED DATA	1 counter acquisition + 100 m sec. limited by source tunig speed.
OUTPUT DRIVE (MAX)	
COARSE TUNE OUTPUT	+ 10 V into 5 K ohm min.
PHASE LOCK OUTPUT	$\pm$ 10 V into 5 K ohm min for source gain constant < 64 MHz/V. $\pm$ 75 MA into 10 ohm max for source gain constant < 3.2 MHz/MA. $\pm$ .6 V into 5 K ohm min for source gain constant $\geq$ 64 MHz/V. $\pm$ 4.5 MA into 10 ohm max for source gain constant $\geq$ 3.2 MHz/MA.
CAPTURE RANGE	
COARSE TUNE	Entire range of selected counter band limited by maximum output drive.
PHASE LOCK	Source gain constant X maximum output drive.

SPECIFICATIONS, continued

OUTPUT CONNECTOR

COARSE TUNE	Rear panel BNC, female
PHASE LOCK	Rear panel BNC, female

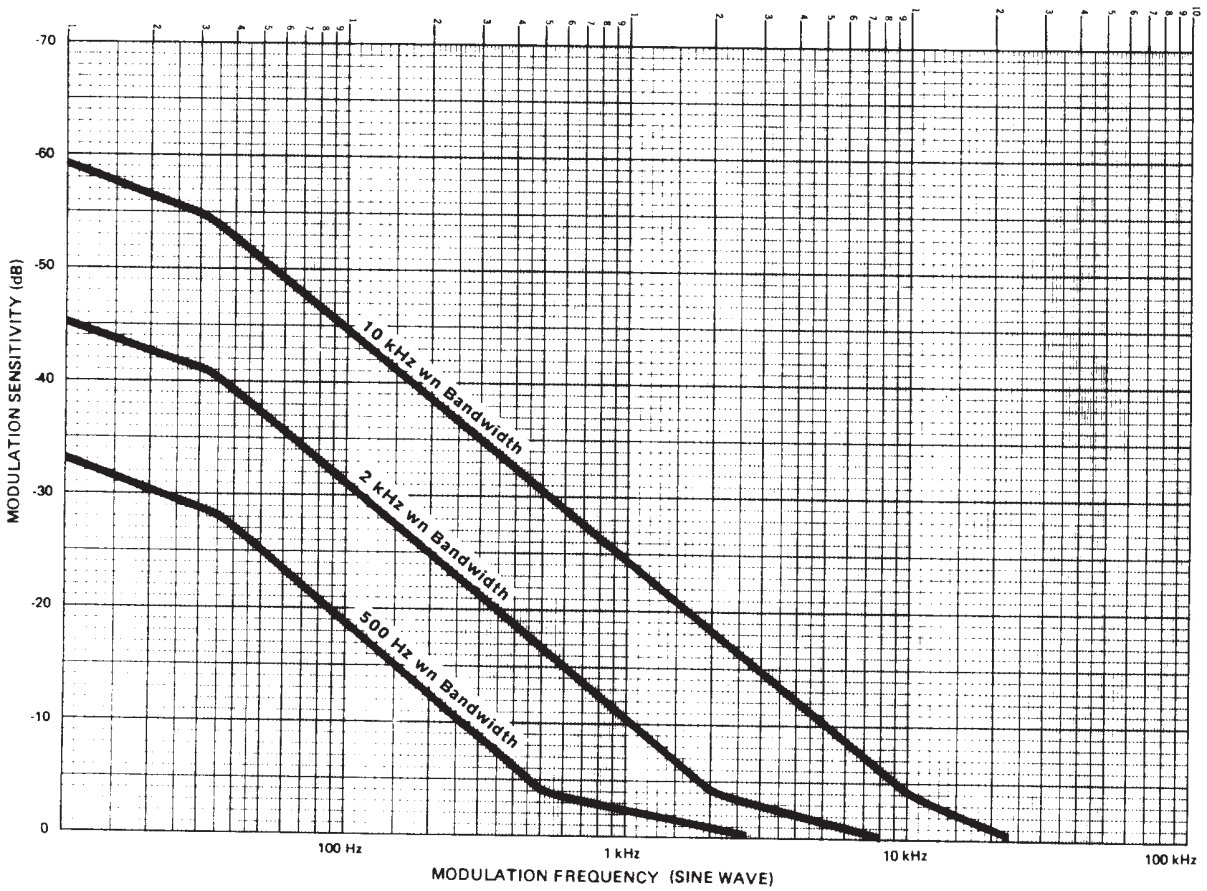
PHASE LOCKED SPECTRUM

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. NOISE FLOOR = -70 dBC / Hz
2. NOISE FLOOR = (20 log F -65) dBC / Hz
   where F = Input frequency in GHz

NOISE REDUCTION vs MODULATION FREQUENCY :

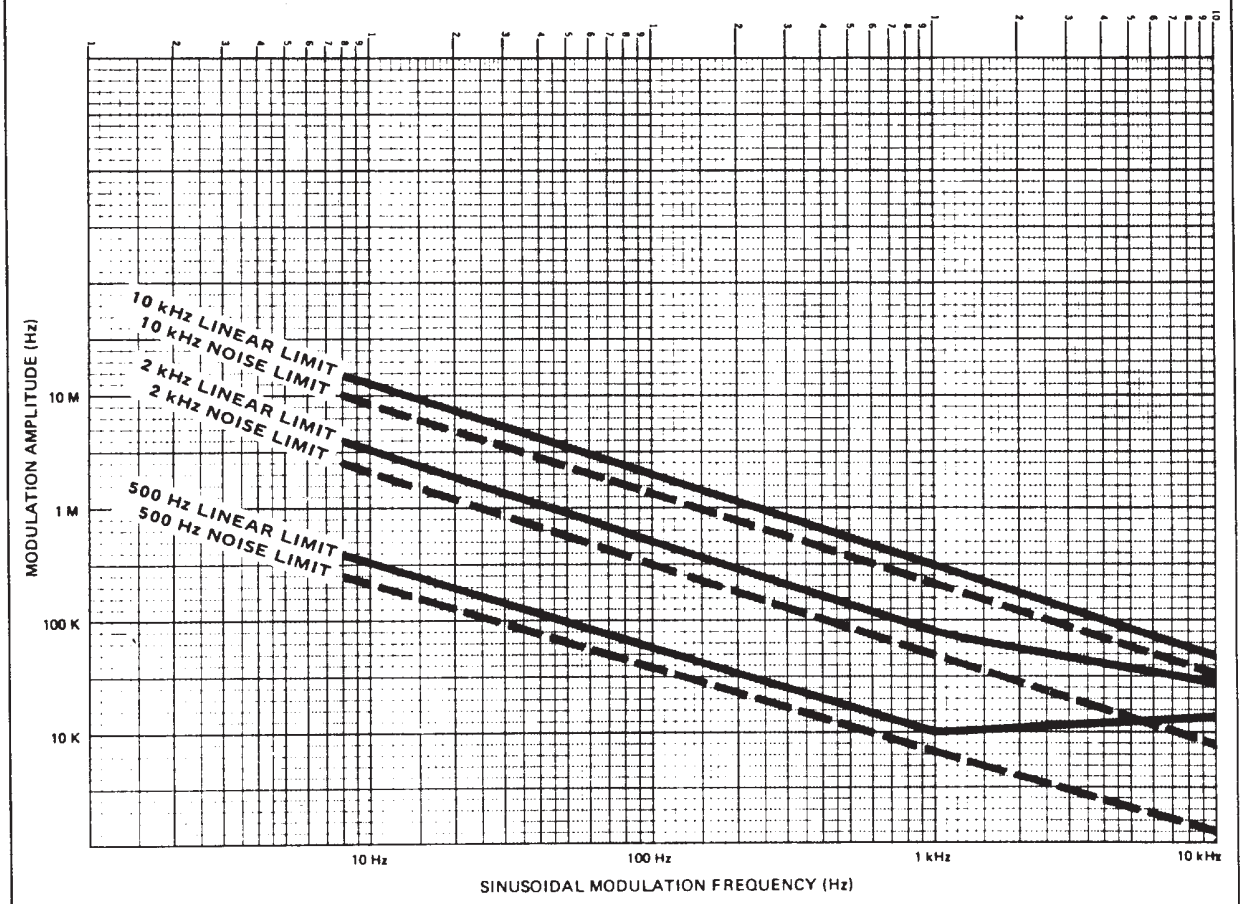


SPECIFICATIONS, continued

SOURCE CHARACTERISTICS (required)	
COARSE TUNE INPUT :	
BANDWIDTH	5 Hz minimum
TUNING SENSITIVITY	10 MHz / V minimum 10 GHz / V maximum
PHASE LOCK (FM) INPUT :	
BANDWIDTH	2 kHz minimum
TUNING SENSITIVITY :	
VOLTAGE DRIVEN INPUT	± 2 MHz / V minimum ± 1000 MHz / V maximum
CURRENT DRIVEN INPUT	± 0.1 MHz / mA minimum ± 50 MHz / mA maximum

MAXIMUM FM

The counter will still frequency stabilize if maximum FM is exceeded, but accuracy and long term stability will not equal the counter's time base.



SPECIFICATIONS, continued

OPTIONS

01 D TO A CONVERTER
DAC will convert any three consecutively displayed digits into an analog voltage output on rear panel.

02 POWER METER
1 to 18/26.5 GHz will measure sine wave amplitude to 0.1 dBm resolution from sensitivity to -20 dBm: 0.2 dBm resolution from -10 dBm to overload and display simultaneously with frequency. Power offset to 0.1 dB resolution, selectable from front panel; will not degrade performance of the counter.

NOTE
Power Meter and Source Locking cannot be active at the same time.

TIME BASE OSCILLATOR OPTIONS:

	03	04	05
AGING RATE/24 HOURS (After 72 hour warm-up)	$<\lvert 5 \times 10^{-9} \rvert$	$<\lvert 1 \times 10^{-9} \rvert$	$<\lvert 5 \times 10^{-10} \rvert$
SHORT TERM STABILITY (1 second average)	$< 1 \times 10^{-10}$ rms	$< 1 \times 10^{-10}$ rms	$< 1 \times 10^{-10}$ rms
0° to +50°C TEMPERATURE STABILITY	$<\lvert 6 \times 10^{-8} \rvert$	$<\lvert 3 \times 10^{-8} \rvert$	$<\lvert 3 \times 10^{-8} \rvert$
± 10% LINE VOLTAGE CHANGE	$<\lvert 5 \times 10^{-10} \rvert$	$<\lvert 2 \times 10^{-10} \rvert$	$<\lvert 2 \times 10^{-10} \rvert$

06 EXTENDED FREQUENCY CAPABILITY – 578B
Use in conjunction with model 590 Frequency Extension Cable kit and a remote sensor.

09 REAR INPUT

10 CHASSIS SLIDES