tionsgenerator EXELE - 508

Instruction Manual

SECTION 1

SPECIFICATIONS

AND

VERIFICATION OF SPECIFICATIONS PROCEDURE

SPECIFICATIONS

WAVEFORMS

Sine, triangle, square, ramp, pulse, sync.

MODES OF OPERATION

Run, gate, trigger, pulse, burst, linear sweep, logarithmic sweep, variable symmetry.

DYNAMIC FREQUENCY RANGE

0.0001Hz to 5MHz.

FREQUENCY ACCURACY

±(1% of setting plus 1% of full scale) 0.1Hz to 1MHz.
±(2% of setting plus 2% of full scale) 0.0001Hz to 0.1Hz and 500K range.
Note: does not apply in DIAL or LOG modes.

MAIN OUTPUT

50ohm output impedance
30VP-P into open circuit (Sine, Square, and Triangle)
15VP-P into 50ohms (Sine, Square, and Triangle)
15V peak into open circuit (Pulse and ramp).
7.5V peak into 50ohms (Pulse and ramp).

ATTENUATOR

60dB in 10dB steps plus 20dB continuously variable.
(80dB total).

DC OFFSET

Variable, switched in and out with pushbutton.
+15V to -15V open circuit.
+7.5V to -7.5V into 50ohms.
Note: Protection circuit will automatically clip waveform if DC offset plus signal exceeds maximum peak voltage.

SQUAREWAVE

Rise and fall times: <25nsec.
Overshoot and ringing: <5% of maximum P-P amplitude.

SYMMETRY (TIME)

±(1% + 10nsec). Variable symmetry off.

SINE DISTORTION

<0.5% 1Hz to 100KHz.
No harmonics < 30dB down 100KHz to 5MHz.

SINE FREQUENCY RESPONSE
Within ±0.1dB to 100KHz.
Within ±1dB 100KHz to 5MHz.

TRIANGLE LINEARITY
Within 1% (Best straight line method). 1Hz to 100KHz.

MAIN SYNC OUTPUT
Squarewave, approximately 3V Peak. TTL compatible.

VCF INPUT (VOLTAGE CONTROLLED FREQUENCY)
Approximately 5V input for 100,000:1 logarithmic frequency control (1000:1 linear).
Note: VCF range is limited to 100:1 on the 10Hz range and below.

FREQUENCY STABILITY
Within 0.05% of setting for 10 minutes.
Within 0.25% of setting for 24 hours.

AMPLITUDE STABILITY
Within 0.05% of max P-P amplitude for 10 minutes.
Within 0.25% of max P-P amplitude for 24 hours.

SYMMETRY CONTROL
Continuously variable from 19:1 to 1:19.
The generator frequency is divided by approximately 10 when operating in this mode.

GATE AND TRIGGER
Requirements: Manual or external voltage of approximately 500mV for turn on.
Input: DC coupled, approximately 5K ohm input impedance.

RAMP GENERATOR MODES OF OPERATION
Stop freq, start freq, run, gate, trigger.

RAMP PERIOD RANGE
10 µsec to 100 sec. (1000 sec with option E)

AUX. RAMP OUTPUT
Typically 5V Peak open circuit.
75 ohm output impedance.

RAMP SYNC OUTPUT
Square wave, approximately 3V Peak. TTL compatible.

RAMP GATE AND TRIGGER MODES
Requirements: Manual or external voltage of approximately 500mV for turn on.
Input: DC coupled, approx. 5K ohm input impedance.

V:f OUTPUT (Voltage proportional to frequency)

Approx. 0V to +5V for a 100,000:1 log range.
Can be used to drive complementary analog instruments such as X-Y recorders, oscilloscopes, etc.

POWER REQUIREMENTS

115 VAC ± 10% (Other voltages available).
50Hz to 400Hz.
Approximately 20 watts.

PHYSICAL CHARACTERISTICS

31.8cm wide by 8.9cm high by 34.3cm deep.

NOTE

Unless otherwise specified, specifications apply 10% to maximum output voltage terminated into 50 ohms and do not apply at frequency settings less than 1.0 times the Range-Hz switch. Specifications are valid at 25° C ± 5° C after a 30 minute warmup.

Verification of Specifications

To verify the Model 508 specifications you will need the following equipment:

Oscilloscope: DC to 50 MHz, 20 mV/cm with differential comparator.

Counter/Timer: 0.1 μsec time base.

DVM: 0.01% accuracy.

Harmonic Distortion Analyzer: < 0.1% residual distortion.

Spectrum Analyzer: 100 KHz to 100 MHz.

Before verifying the specifications, turn on the instrument and allow it to warm up for 60 minutes.

FREQUENCY ACCURACY:

Main Generator:

1. Initialize the controls:

RANGE-Hz	1K
START FREQ	10.0
FREQ VERNIER	CAL
MODE	RUN
FUNCTION	TRIANGLE
RAMP MODE	GATE
VAR SYM SWITCH	OUT (OFF)

2. Connect the counter/timer input to the 508 sync out with co-ax.

3. Using the chart below, set the Model 508 frequency controls and observe frequency or periods as indicated.

508 SETTINGS		COUNTER READING		
RANGE-Hz	START FREQ	MIN	MAX	COMMENTS
1K	10.0	9.80 KHz	10.20 KHz	
10K	10.0	98.0 KHz	102.0 KHz	
100K	10.0	960 KHz	1040 KHz	
500K	10.0	4.80 MHz	5.20 MHz	
500K	5.0	2.35 MHz	2.65 MHz	
500K	1.0	390 KHz	610 KHz	
100K	1.0	89 KHz	111 KHz	
10K	1.0	8.90 KHz	11.1 KHz	
1K	1.0	890 Hz	1110 Hz	
		or 1110 µsec	890 µsec	
100	1.0	11.10 msec	8.90 msec	
10	1.0	111.0 msec	89.0 msec	Capacitance Multi
1	1.0	1110 msec	890 msec	" "
.1	1.0	11.1 sec	8.90 sec	" "
.01	1.0	122 sec	78.0 sec	" "
.001	1.0	1220 sec	780 sec	" "
.0001	1.0	12200 sec	7800 sec	" "
.0001	10.0	1040 sec	960 sec	" "
.001	10.0	104.0 sec	96.0 sec	" "
.01	10.0	10.40 sec	9.60 sec	" "
.1	10.0	1.020 sec	.980 sec	" "
1	10.0	102.0 msec	98.0 msec	" "
10	10.0	10.20 msec	9.80 msec	" "
100	10.0	1020 µsec	980 µsec	" "

Ramp Generator:

1. Initialize the controls:

RAMP MODE	RUN
MODE (Main Mode)	GATE
RAMP TIME	10 μsec
VARIABLE	CAL (CW)

2. Connect the Counter/Timer input to the 508 rear panel Ramp Sync output with the co-ax.

3. Set the Counter/Timer to measure the time interval between a positive slope and the next negative slope.

4. Set the 508 RAMP TIME to each position and observe the approximate time intervals indicated. Generally, the time interval observed will be within 5%.

TIME SYMMETRY:

1. Initialize the controls:

RANGE-HZ	500K
START FREQ	10.0
FREQ VERNIER	CAL
MODE	RUN
RAMP MODE	GATE
FUNCTION	SQUARE
VAR SYM Switch	OUT (OFF)

2. Connect the Counter/Timer input to the 508 main OUTPUT (front panel) with 50 Ω coax. Insert a 50 Ω termination at the counter input.

3. Using the chart below, set the 508 frequency controls and observe that the difference between the time interval A to B and the time interval B to A is less than the maximum indicated.

508 SETTINGS		(A to B) - (B to A)
RANGE-Hz	START FREQ	Maximum Difference
500K	10.0	12 nsec
100K	10.0	20 nsec
10K	10.0	110 nsec
1K	10.0	1010 nsec
100	10.0	10 µsec
10	10.0	100 µsec
1	10.0	1.0 msec
.1	10.0	10 msec
.01	10.0	100 msec
.001	10.0	1 sec
.0001	10.0	10 sec
.01	1.0	100 sec
.1	1.0	10 sec
.01	1.0	1.0 sec
.1	1.0	100 msec
1	1.0	10 msec
10	1.0	1.0 msec
100	1.0	100 µsec
1K	1.0	10 µsec
10K	1.0	1010 nsec
100K	1.0	110 nsec
500K	1.0	30 nsec

FREQUENCY STABILITY

Connect the counter/timer input to the 508 front panel OUTPUT with co-ax. Terminate the co-ax with 50 Ω at the counter/timer input. Observe frequency changes less than 0.05% for 10 minutes.

SYNC OUTPUTS

1. With the main MODE switch in RUN, connect a co-ax cable between the front panel SYNC OUT and the oscilloscope input. Observe a 0 to +5V (approximately; must be > +3V peak) pulse.

2. With the RAMP MODE switch in RUN, connect a co-ax cable between the rear panel RAMP SYNC OUT and the oscilloscope input. Observe a 0 to +5V (approximately; must be > +3V peak) pulse.

MAIN OUTPUT

1. Initialize the controls:

RANGE-Hz	1K
START FREQ	10.0
MODE	RUN
AMPLITUDE	max CW
ATTENUATOR	OFF (all 3 switches out)
RAMP MODE	GATE
FUNCTION	TRIANGLE
VAR SYM	OFF (switch out)
OFFSET	OFF (switch out)
START PHASE	Centered

2. Connect the 508 OUTPUT to the oscilloscope input and observe a triangle waveform of 30V P-P or more.

3. Add a 50 Ω termination at the oscilloscope input and observe a triangle waveform of 15V P-P or more. (The actual voltage will depend on the accuracy of the 50 Ω termination.)

4. Change the FUNCTION to SINE and observe a 15V P-P sinewave.

5. Change the FUNCTION to SQUARE and observe a 15V P-P squarewave.

6. Change the FUNCTION to +PULSE and observe a +7.5V peak pulse.

7. Change the FUNCTION to -PULSE and observe a -7.5V peak pulse.

8. Change FUNCTION to RAMP, RAMP MODE to RUN, and observe a +7.5V peak ramp.

MAIN OUTPUT (Continued)

9. Rotate the AMPLITUDE CCW and observe > 20dB attenuation. (At least 10X voltage reduction). Return AMPLITUDE to the fully CW position.

10. Set the ATTENUATOR for 10dB, 20dB, 30dB, 50dB, and 60dB and observe corresponding attenuation. (Each 10dB is approximately 3+ X voltage change, 20dB is 10X voltage change). Return ATTENUATOR switches to OFF (Out).

GATE AND TRIGGER MODES

1. Set:

RANGE-Hz	1K
START FREQ	10.0
MODE	GATE
START PHASE	Centered
FUNCTION	SINE
RAMP MODE	GATE
RAMP TIME	10 msec
VARIABLE	CW

2. Monitor OUTPUT with oscilloscope.

3. Apply a 100 Hz signal at TRIG IN, increase signal and observe that the main generator runs at approximately +500mV of trigger signal. Remove trigger signal.

4. Depress MANUAL pushbutton and observe generator runs while pushbutton is depressed.

5. Change:
   MODE TRIGGER

   Apply a signal at TRIG IN. Increase signal and observe that the main generator produces one complete cycle each time the trigger input rises to approximately +500mV. Remove trigger signal.

6. Depress MANUAL pushbutton and observe one complete cycle.

7. Change:

MODE	PULSE
RAMP MODE	RUN
STOP FREQ/BURST WIDTH	5.0

GATE AND TRIGGER MODES (Continued)

Observe a single cycle each 10 msec. Vary the START PHASE control and observe varying start and stop phase on the waveform. (Generator will free run when START PHASE is set too close to positive peak.)

8. Change:

MODE	BURST

Observe a burst group starting each 10 msec.

9. Vary the STOP FREQ/BURST WIDTH controls and observe that the burst width varies from 0 to approximately 9 msec.

SINE WAVE DISTORTION

1. Set:

MODE	RUN
RANGE-Hz	1K
START FREQ	10.0
AMPLITUDE	FULLY CW
FUNCTION	SINE
RAMP MODE	GATE
VAR SYM	OFF (OUT)
OFFSET	OFF (OUT)

2. Connect distortion analyzer to OUTPUT with a 50 Ω termination at the analyzer. Measure sine distortion of $< 0.5\%$, typically 0.3%.

3. Set RANGE-Hz to 10K and measure sine distortion $< 0.5\%$.

4. Set RANGE-Hz to 500K. Connect spectrum analyzer to OUTPUT and measure harmonic content. Observe no harmonics $<$ 30dB down.

SINE FREQUENCY RESPONSE

1. Set RANGE-Hz to 1K.

2. Connect oscilloscope to OUTPUT terminated into 50Ω.

3. Observe sine wave amplitude.

4. Set Range to 10K. Observe sine amplitude change $<$ 0.1dB.

5. Set Range to 500K. Observe sine amplitude change $<$ 1dB.

SQUARE WAVEFORM

1. Set:

MODE	RUN
RANGE	100K
START FREQ	10.0
FUNCTION	SQUARE
AMPLITUDE	CW
RAMP MODE	GATE

2. Connect OUTPUT through a 50 Ω coaxial cable terminated into 50 Ω at the oscilloscope input.

3. Observe risetime and falltime of square < 25 ns at main output.

4. Observe overshoot and ringing < 5% of P-P amplitude.

DC OFFSET

1. Set Range to 1K, AMPLITUDE CCW.

2. Despress DC offset pushbutton.

3. Rotate DC offset and observe DC level shift ± 7.5V into 50 Ω.

4. Remove terminator and observe DC level shift ± 15V open circuit.

NOTE: DC offset plus signal cannot exceed maximum voltage output or clipping will occur.

AMPLITUDE STABILITY

1. Set AMPLITUDE CW, DC offset to OFF (Out) function to TRIANGLE.

2. Connect OUTPUT to the oscilloscope input through a 50Ω coaxial cable terminated into 50Ω.

3. Set oscilloscope sensitivity to 20mV/cm.

4. Using the differential comparator, measure accurately the positive and negative peaks of the triangle and record.

5. Wait 10 minutes and measure positive and negative peaks again. Observe amplitude change <10mV.

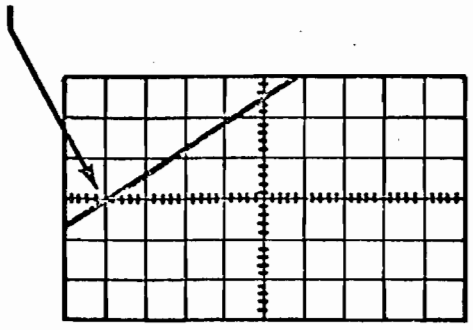
TRIANGLE LINEARITY

1. Connect the output to the oscilloscope through a 50Ω coaxial cable terminated into 50 Ω.

2. Adjust oscilloscope to obtain one-half cycle of triangle across full horizontal grid on oscilloscope CRT.

3. Set oscilloscope sensitivity at 20mV/cm.

4. Adjust comparison voltage until the slope of the triangle waveform intersects the mid-scale horizontal grid line at the second major mark as shown below:



5. Record reference voltage using DVM accurate to 1mV.

6. Adjust comparison voltage until slope of triangle intersects next major horizontal grid mark.

7. Record accurately the new reference voltage.

8. Repeat to obtain as many points as desired.

9. Calculate linearity and observe linearity is 99% or better.

NOTE: Horizontal time base accuracy of oscilloscope and accuracy of DVM are important to obtain meaningful data.

RAMP TRIGGER AND GATE

1. Set:

MODE	GATE
START PHASE	Centered
RAMP MODE	GATE
FUNCTION	RAMP
RAMP TIME	1 msec
VARIABLE	CW

2. Monitor OUTPUT with oscilloscope.

3. Apply a 100 Hz square wave signal to the rear panel RAMP TRIG IN and observe that the ramp runs when the trigger signal exceeds approximately + 500mV. Remove trigger signal.

4. Depress the RAMP MAN pushbutton and observe that the Ramp Generator runs while pushbutton is depressed.

5. Change:

RAMP MODE	TRIG

Apply a 100 Hz signal to the rear panel RAMP TRIG IN and observe that the Ramp Generator produces one complete ramp each time the trigger input rises to approximately + 500mV. Remove trigger signal.

6. Depress the RAMP MAN pushbutton and observe that the Ramp Generator produces one complete ramp each time it is depressed.

SWEEP MODES

1. Initialize the controls:

RANGE-Hz	500K
START FREQ INNER DIAL	LOG
START FREQ OUTER DIAL	10
STOP FREQ INNER DIAL	LOG
STOP FREQ OUTER DIAL	10
FREQ VERNIER	CAL
MODE	SWEEP
FUNCTION	TRIANGLE
RAMP MODE	START FREQ
RAMP TIME	10 sec
VAR SYM SWITCH	OUT (OFF)

SWEEP MODES (Continued)

2. Connect the counter/timer input to the 508 front panel SYNC OUT. Observe a frequency of 5 MHz ± 4%. Note that a 4% change in frequency is a dial rotation of only 1 degree when in the LOG mode. Rotate the START FREQ outer dial to 0.0001, observe a frequency of 50 Hz and return to a setting of 10.

3. Rotate the STOP FREQ outer dial to 0.0001 observing no change in frequency and then return it to a setting of 10.

4. Change the RAMP MODE to STOP FREQ and observe a frequency of 5 MHz ± 4%. Rotate the STOP FREQ outer dial to 0.0001 and observe a frequency of 50 Hz and return to a setting of 10.

5. Rotate the START FREQ outer dial to 0.0001 observing a change in frequency of less than 2%.

6. Connect the oscilloscope to the front panel OUTPUT.

7. Change the RAMP MODE to RUN and observe on the oscilloscope a frequency sweep starting at 50 Hz and ending at 5 MHz.

8. Change the START FREQ outer dial to 10 and the STOP FREQ outer dial to 0.0001 and observe a frequency sweep starting at 5 MHz and ending at 50 Hz.

VARIABLE SYMMETRY

1. Set:

RANGE-Hz	1K
STOP FREQ	10.0
AMPLITUDE	FULLY CW
MODE	RUN
FUNCTION	TRIANGLE
RAMP MODE	GATE
OFFSET SWITCH	OUT (OFF)
VAR SYM	OUT (OFF)
SYMMETRY	Centered

2. Connect OUTPUT to the oscilloscope vertical input and observe a symmetrical triangle waveform.

3. Depress VAR SYM and observe the frequency divided by 10. (The symmetry may change)

4. Vary the SYMMETRY control to fully CCW and then fully CW, observing a symmetry change from 1:19 to 19:1. (At the extreme ends of rotation, the frequency may change)