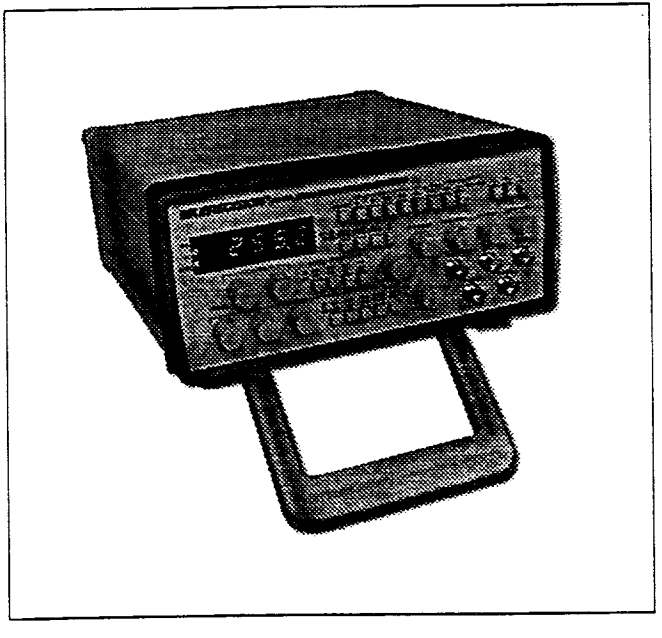
INSTRUCTION MANUAL

Test Equipment Depot
1-800-517-8431

BK PRECISION®

MODEL 4040A



20 MHz SWEEP/FUNCTION GENERATOR

with FREQUENCY COUNTER

BK PRECISION®

TEST INSTRUMENT SAFETY

WARNING

Normal use of test equipment exposes you to a certain amount of danger from electrical shock because testing must sometimes be performed where exposed voltage is present. An electrical shock causing 10 milliamps of current to pass through the heart will stop most human heartbeats. Voltage as low as 35 volts dc or ac rms should be considered dangerous and hazardous since it can produce a lethal current under certain conditions. Higher voltages pose an even greater threat because such voltage can more easily produce a lethal current. Your normal work habits should include all accepted practices to prevent contact with exposed high voltage, and to steer current away from your heart in case of accidental contact with a high voltage. You will significantly reduce the risk factor if you know and observe the following safety precautions:

1. Don't expose high voltage needlessly. Remove housings and covers only when necessary. Turn off equipment while making test connections in high-voltage circuits. Discharge high-voltage capacitors after removing power.
2. If possible, familiarize yourself with the equipment being tested and the location of its high voltage points. However, remember that high voltage may appear at unexpected points in defective equipment.
3. Use an insulated floor material or a large, insulated floor mat to stand on, and an insulated work surface on which to place equipment; and make certain such surfaces are not damp or wet.
4. Use the time proven "one hand in the pocket" technique while handling an instrument probe. Be particularly careful to avoid contacting a nearby metal object that could provide a good ground return path.
5. When testing ac powered equipment, remember that ac line voltage is usually present on some power input circuits such as the on-off switch, fuses, power transformer, etc. any time the equipment is connected to an ac outlet, even if the equipment is turned off.

(continued on inside back cover)

Instruction Manual
for
Model 4040A

20 MHz
SWEEP/FUNCTION
GENERATOR

with FREQUENCY COUNTER

BK PRECISION®

1031 Segovia Circle ▪ Placentia, CA 92870

TABLE OF CONTENTS

	page
TEST INSTRUMENT SAFETY	inside front cover
INTRODUCTION	3
SPECIFICATIONS	4
CONTROLS AND INDICATORS	6
OPERATING INSTRUCTIONS	9
Frequency and Waveform Selection	9
Duty Cycle Control	11
Burst Operation	12
AM Operation	13
FM Operation	14
TTL/CMOS Output	15
Voltage Controlled Frequency Operation	15
Sweep Operation	16
Use of Frequency Counter with External Signals	16
Output Protection Considerations	17
Function Generator Applications Guidebook	17
MAINTENANCE	18
Disassembly and Reassembly	18
Fuse Replacement	18
Line Voltage Selection	18
Instrument Repair Service	19
CUSTOMER SUPPORT	21
WARRANTY SERVICE INSTRUCTIONS	22
LIMITED TWO-YEAR WARRANTY	23

INTRODUCTION

The **B&K Precision Model 4040A** Sweep/Function Generator is a versatile signal source which combines several functions into one unit—waveform generation, pulse generation (through variable symmetry), and frequency sweep. Additionally, the instrument provides the added convenience of a built-in frequency counter. This permits more accurate determination of output frequency than is possible with a simple calibrated dial. Coarse and fine tuning controls permit precision settability of the output frequency. The internal frequency counter can also be used to measure external frequencies.

The five-digit frequency counter displays the generator output frequency or external signals from 5 to 30 MHz.

With this versatility, the unit has a vast number of applications in both analog and digital electronics in the engineering, manufacturing, servicing, educational, and hobbyist fields.

The heart of the function generator is a VCG (voltage-controlled generator) that produces precision sine, square, or triangle waves over the 0.2 Hz to 20 MHz range. This encompasses subaudible, audio, ultrasonic, and RF applications. A continuously variable dc offset allows the output to be injected directly into circuits at the correct bias level.

The sweep generator offers linear or log sweep with variable sweep rate and adjustable sweep time. Front panel controls allow the start and stop frequencies to be set.

Burst operation enables the output to be gated by an internal, adjustable signal or by an externally applied signal.

Variable symmetry of the output waveform converts the instrument to a pulse generator capable of generating rectangular waves or pulses, ramp or sawtooth waves, and slewed sine waves.

The output can be either amplitude modulated or frequency modulated. Modulation can be by a 1 kHz internal, adjustable signal or by an externally applied signal.

In addition to the above features, an external voltage may be used to control operating frequency. This is useful in situations where an externally controlled frequency is desirable.

Many functions can be operated simultaneously, making possible such complex outputs such as gated pulse trains with external or internal sweep.

SPECIFICATIONS

FREQUENCY CHARACTERISTICS

Waveforms:	Sine. Square. Triangle. ± Pulse. ± Ramp
Range:	0.2 Hz to 20 MHZ in 8 ranges
Resolution:	5 digits
Tuning Range:	Coarse: 10:1. Fine: ± 5% of Coarse Setting
Variable Duty Cycle	15:85:15 Continuously Variable
Operating Modes	Normal. Sweep. VCG. AM. FM. Burst
Frequency Stability:	The output will change less than 0.09% over 15 minutes after 1 hour warmup.

OUTPUT CHARACTERISTICS

Impedance:	50Ω ± 10%
Level:	20 V p-p Open-circuit. 10 V p-p into 50Ω to 10 MHz
Amplitude Control:	Variable. 20 dB range typical
Attenuation:	–20 dB ±1 dB
Dc Offset:	Preset: ±0.1 V typical Variable: ±10V open-circuit. ±5V into 50Ω

Sine Wave

Distortion:	0.1 Hz to 100 KHz: ≤3%
Flatness:	±5% (0.45 dB) 10 Hz to 10 MHZ ±20% (2.0 dB) 10 MHZ to 20 MHZ

Square Wave

Symmetry:	≤2% 0.2 Hz to 100 kHz
Rise Time:	≤30 ns (Typical)
Overshoot & Undershoot	≤5%

TRIANGLE WAVE

Linearity:	≥98% to 100 kHz

TTL OUTPUT

Level:	0.8 V to 2.4 V
Rise Time:	≤20 nS
Duty Cycle:	50% typical

CMOS OUTPUT

Max Frequency:	2 MHz
Level:	4 V to 14 V ±0.5V p-p. continuously variable
Rise Time:	≤120 nS

VCG (Voltage Controlled Generator) INPUT

Input Voltage:	0–10 V ± 1V causes a 100:1 frequency change
Impedance:	10 kΩ ±5%

SWEEP OPERATION

Mode:	LIN / LOG
Width:	100:1, Continuously variable
Rate:	20 mS to 2 sec. continuously variable
Sweep Output:	0 to 2 V
Start/Stop Frequencies:	Adjustable

AM MODULATION CHARACTERISTICS

Source:	Internal, External
Modulation Ratio:	0 To 100%
INT. Modulation:	1 kHz
EXT. Modulation:	DC to 500 KHz
EXT. Sensitivity:	Less than 10V p-p for 100% modulation

FM MODULATION CHARACTERISTICS

Source:	Internal, External
Deviation:	0 to 5%
INT. Modulation:	1 kHz
EXT. Modulation:	DC to 500 kHz
EXT. Sensitivity:	Less than 10V p-p for 100% modulation

BURST CHARACTERISTICS

Source:	Internal, External
Burst Width:	Continuously variable from 5% to 90% of internal gating frequency
Repetition Rate:	0.5 Hz to 50 Hz, internal or DC to 500 kHz, external
Burst Frequency:	Determined by the main generator frequency setting. Tone burst is in integral cycles of frequency being gated.

FREQUENCY COUNTER

Accuracy:	Time Base Accuracy ±1 count
Time Base Accuracy:	±10 PPM (23°C ±5°C)
Display:	5 digit LED
External Input:	
Frequency:	5 Hz to 30 MHz
Resolution:	0.1, 1, 10, 100, 1 kHz
Sensitivity:	≤25 mV rms
Impedance:	1 MΩ/100 pF

POWER SOURCE

120/230 VAC ±10%, 50/60 Hz, internal jumper selectable

DIMENSIONS (H x W x D)

10 1/2" x 5 1/2" x 12 3/8" (26.67cm x 13.97cm x 31.43cm)

WEIGHT

5.3 lb. (2.4 kg.)

ACCESSORIES

Output Cable, BNC to Alligator Clips

Instruction Manual

CONTROLS AND INDICATORS

FRONT PANEL (Refer to Fig. 1)

1. **POWER Switch.** Turns power on and off.
2. **DUTY CYCLE Switch.** When engaged, enables operation of DUTY CYCLE control (7).
3. **CMOS LEVEL Switch.** When engaged, changes the TTL signal to CMOS signal at the TTL/CMOS jack, and enables operation of CMOS LEVEL Control (8).
4. **DC OFFSET Switch.** When engaged, enables operation of the DC OFFSET control (11).
5. **–20dB Switch.** When engaged, the signal at the OUTPUT jack is attenuated by 20 dB.
6. **RANGE Switch.** Selects output frequency range. Eight ranges from 2 Hz to 20 MHz. Switch indicates maximum frequency of range and is adjusted with COARSE FREQUENCY control to 0.1 times the maximum. For example, if the 200 kHz range is selected, the output frequency can be adjusted from 20 kHz to 200 kHz.
7. **DUTY CYCLE Control.** Activated by the DUTY CYCLE Switch (2). Rotation from center position adjusts the duty cycle of the main OUTPUT signal and TTL/CMOS signal.
8. **CMOS LEVEL Control.** Rotating this control clockwise increases the amplitude of the CMOS signal at the TTL/CMOS jack.
9. **FUNCTION Switch.** Selects sine, square, or triangle waveform at OUTPUT jack.
10. **OUTPUT LEVEL Control.** Controls the amplitude of the signal at the OUTPUT jack. Output level can be decreased by approximately 20 dB with this control.
11. **DC OFFSET Control.** Activated by the DC OFFSET Switch (4). Clockwise rotation from center changes the DC offset in a positive direction while counterclockwise rotation from center changes the DC offset in a negative direction.
12. **VCG/MOD INPUT Jack.** Controlled by MODULATION OFF/ON Switch (33). When MODULATION OFF is selected, jack is the Voltage Controlled Generator input and permits external control of generator output frequency by a DC voltage input at this jack. A positive voltage will decrease frequency. When MODULATION ON is selected, jack becomes modulation input source.
13. **OUTPUT Jack.** Waveform selected by FUNCTION Switch as well as the superimposed DC OFFSET voltage is available at this jack.
14. **BURST INPUT** Jack. Input for external gating signal for Burst operation.
15. **TTL/CMOS Jack.** TTL or CMOS square wave, depending on the position of the CMOS LEVEL switch (3) is output at this jack This output is independent of the OUTPUT LEVEL and DC OFFSET controls.
16. **EXT. COUNTER INPUT Jack.** Input for external frequency measurements.

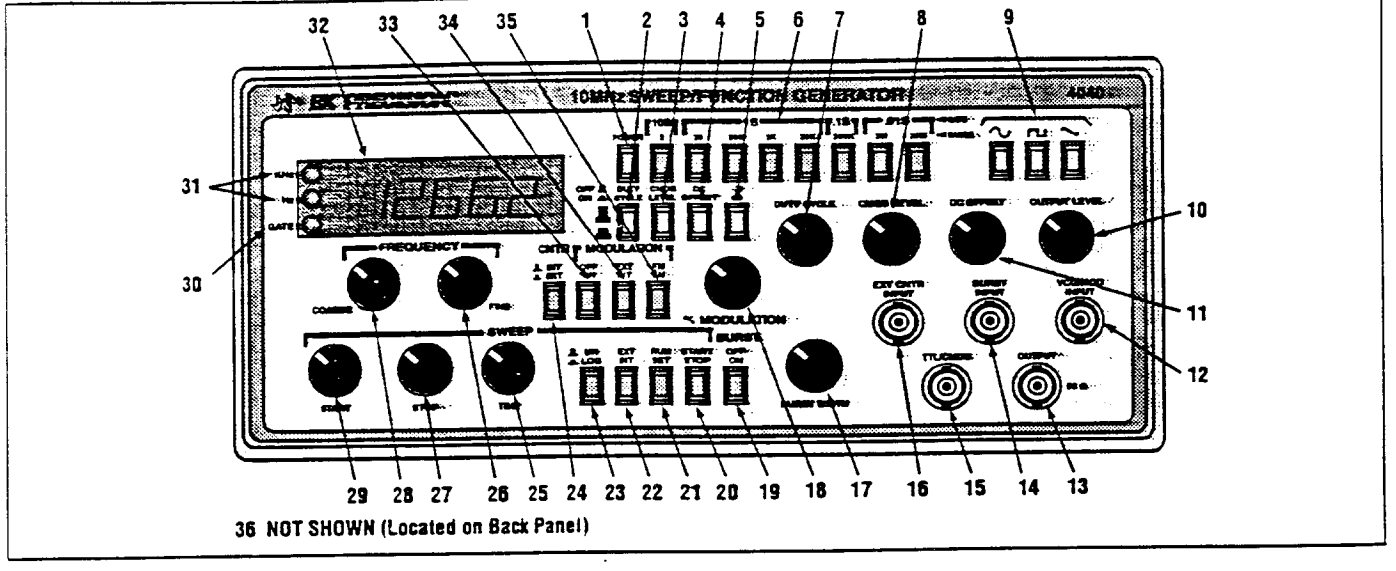


Figure 1. Model 4040A Front Panel.

17. **BURST WIDTH Control**. Adjusts the duty cycle of the internal burst gate.

18. **% MODULATION Control**. Adjusts the percentage of AM or FM modulation.

19. **BURST OFF/ON Switch**. Selects external or internal burst gate. Continuous output is obtained width switch in the OFF position and no external burst gate is applied.

20. **START/STOP Switch.** Enables adjustment of the starting and stopping sweep frequencies. The actual adjustment is performed by the SWEEP START and SWEEP STOP controls (29 and 27). START/STOP selection is enabled only when the SET/RUN switch (21) is set to SET.

21. **RUN/SET Switch.** Selects sweep set or sweep run operation. In the SET position, the starting or ending sweep frequency is continuously present at the output. In the RUN position, the generator sweeps between the low and the high frequencies at a rate set by the SWEEP TIME control.

22. **SWEEP EXT/INT Switch.** When engaged (INT) enables the sweep mode of operation. Sweep rate is controlled by SWEEP TIME control (25) and sweep length is controlled by the SWEEP STOP control (27) and the start frequency is controlled by the SWEEP START control (29). When released (EXT), allows external control of generator output frequency by a DC voltage input at the VCG/MOD INPUT jack (12).

23. **SWEEP LIN/LOG Switch.** When engaged (LOG) selects logarithmic sweep characteristic and when released (LIN) selects a linear sweep characteristic.

24. **CNTR INT/EXT Switch.** Selects the input source for the counter input.

25. **SWEEP TIME Control.** In sweep mode, rotation determines amount of time to sweep from the start frequency to the stop frequency.

26. **FINE FREQUENCY Control.** Vernier adjustment of the output frequency for ease of setting frequency.

27. **SWEEP STOP Control.** Adjusts the ending sweep frequency.

28. **COARSE FREQUENCY Control.** Coarse adjustment of the output frequency from 0.1 to 1 times the selected range.

29. **SWEEP START Control.** Adjusts the starting sweep frequency.

30. **GATE LED.** Indicates when the frequency counter display is updated. When the 200K through 20M ranges are selected, the LED will flash 10 times per second (every 0.1 seconds). When the 20 through 20K ranges are selected, the LED will flash once every second and when the 2 range is selected, the LED will flash every 10 seconds. As the LED turns off, the display is updated.

31. **Hz and KHz LED.** Indicates whether the counter is reading in Hz or KHz.

32. **COUNTER DISPLAY.** Displays frequency of internally generated waveform, or external signal when CNTR EXT is selected.

33. **MODULATION ON/OFF Switch.** Enables or disables modulation of the generator.

34. **MODULATION EXT/INT Switch.** Selects whether generator modulation is from the internal 1 KHz source or from a signal applied to the VCG/MOD INPUT jack.

35. **MODULATION FM/AM Switch.** Selects Frequency modulation or Amplitude modulation.

36. **GCV OUTPUT.** (Located on back panel) Generator control voltage output. Voltage is proportional to the generator frequency. When Sweep mode is selected sweep voltage is present at this jack for connection to an oscilloscope.

OPERATING INSTRUCTIONS

The **B&K Precision** Model 4040A Sweep/Function Generator is a versatile instrument, capable of producing a variety of output waveforms over a broad range of frequencies. To gain a working familiarity with the unit, it is recommended that it be connected initially to an oscilloscope, so that the effects of the various controls on the output waveforms can be observed. Use this manual as required for reference until becoming accustomed to the operating procedures.

FREQUENCY AND WAVEFORM SELECTION

1. Initially, verify that the **DUTY CYCLE** (2), **CMOS LEVEL** (3), **DC OFFSET** (4), **-20dB** (5), and **SWEEP EXT/INT** (22), and **AM/FM** (35) switches are in the released position. This will produce a symmetrical waveform unaffected by the sweep generator and other controls.
2. Plug the unit into an appropriate power source and turn it on by depressing the **POWER** switch (1).
3. Select the desired waveform (SINE, SQUARE, or TRIANGLE) by depressing one of the **FUNCTION** switches (9). Phase relationships of the waveforms are shown in Fig. 2.
4. Select the frequency of the waveform by depressing one of the **RANGE** switches (6). The output frequency is displayed, along with the appropriate measurement units, **KHz** or **Hz** (31), on the LED display.
5. Rotate the **COARSE** (28) frequency control to quickly set the output frequency to the approximate desired value. The **FINE** (26) frequency control can then be used to easily set the output to the specific desired value. The frequency selected is available at the **OUTPUT** jack (13). In addition, a digital signal, either TTL or CMOS is available at the **TTL/CMOS** jack (15) (refer to the "TTL/CMOS OUTPUT" section of this manual).

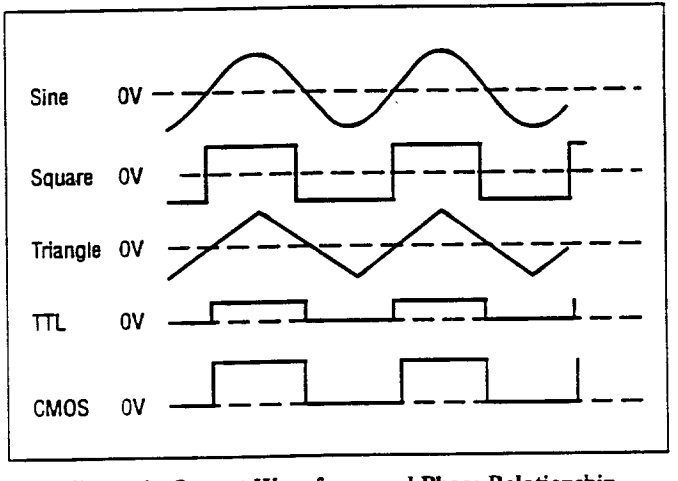


Figure 2. Output Waveform and Phase Relationship

6. Adjust the amplitude of the output as desired using the **OUTPUT LEVEL** control (10). Rotation of this control varies the amplitude from maximum to 20 dB below maximum. An additional attenuation of −20 dB is available by pushing in the **−20dB** switch (5). The attenuation factors can be combined for a total of −40 dB. The maximum signal level is 10 V p-p (into 50Ω).
7. A DC component can be added to the output signal by pushing in the **DC OFFSET** switch (4) to enable operation of the **DC OFFSET** control (11). Rotation of this control adds a positive or negative DC component to the output signal. The DC component introduced is independent of the **OUTPUT LEVEL** control and can be varied by ±10 volts open circuited or ±5 volts into 50Ω. The DC Offset does not affect the **TTL/CMOS** output jack. The effect of DC OFFSET is shown in Fig. 3.

Considerations

1. Counterclockwise rotation of the **COARSE** frequency control decreases the output frequency to approximately one-tenth of the maximum for the range selected (10:1). For example, if the **10 K** range is selected and the **COARSE** frequency control is set to full counterclockwise, the output frequency is approximately **1 kHz**.
2. It is advisable to set the **FINE** frequency control to the approximate center of its rotation before setting the **COARSE** frequency control. This assures that the **FINE** control will not reach its limit while trying to finalize the frequency setting.

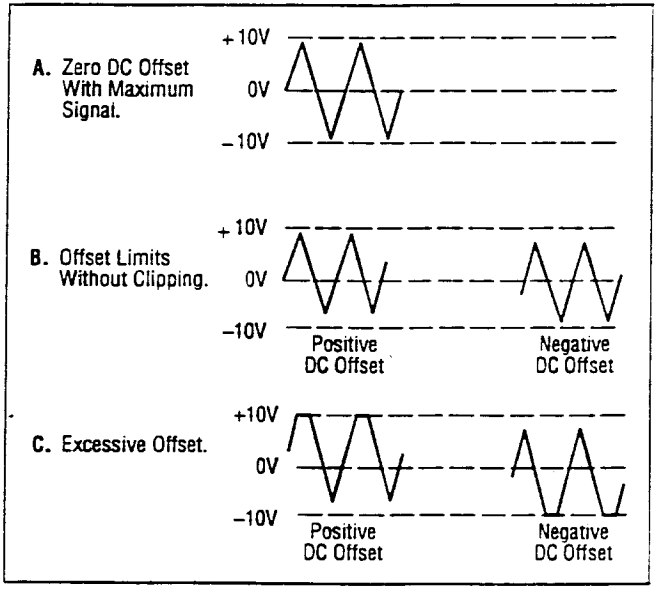


Figure 3. Use of DC OFFSET Control

3. The **FINE** frequency control provides approximately ±5% frequency deviation from the **COARSE** control setting. This provides vernier adjustment to easily set the frequency to a precise value.

4. When the **2 Hz** range is selected, the gate time is 10 seconds and the display is updated once every 10 seconds. The result of a frequency change will not be displayed until 10 seconds later. Adjust the frequency in progressively smaller steps, waiting for the display to update until the desired frequency is obtained.

5. When outputting square waves or when using the TTL output, terminate the cable into 50Ω to minimize ringing. Also, keep cables as short as possible.

6. Remember that the output signal swing of the generator is limited to ±10 volts open circuited or ±5 volts into 50Ω, and applies to the combined peak-to-peak signal and DC offset. Clipping occurs slightly above these levels. Fig. 3 illustrates the various operating conditions encountered when using the DC offset. If the desired output signal is large or if a large DC offset is required, an oscilloscope should be used to make sure that the desired signal is obtained without undesirable clipping.

DUTY CYCLE CONTROL

The **DUTY CYCLE** control can be used to alter the symmetry of the output waveform, to produce waveshapes such as those shown in Fig. 4. For a square wave, symmetry variation amounts to changing the duty cycle (ratio of "high" to "low" time), effectively converting the instrument into a pulse generator. For a triangle wave, the result is a ramp, and with a sine wave, a distorted waveshape called a slewed sine is produced. The Model 4040 provides for symmetry variation from 15% to 85%.

1. Select the waveform desired either SINE, SQUARE or TRIANGLE.

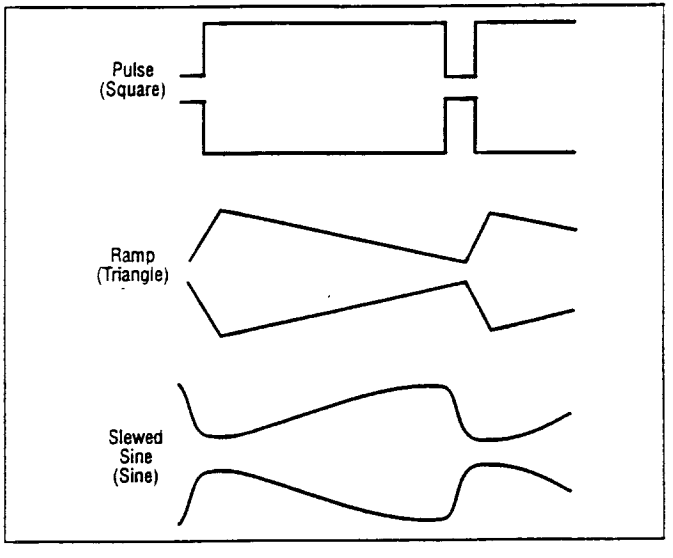


Figure 4. Effects of Symmetry Variation.

2. Engage the **DUTY CYCLE** switch (2) and adjust the **DUTY CYCLE** control (7) for the desired waveshape. Clockwise rotation from center results in an increase in square wave duty cycle, and changes the sine and triangle waves as shown in the top waveform of each pair of Fig. 4. Counter-clockwise rotation results in the bottom waveform in each pair.

3. Varying the duty cycle setting results in a slight change in frequency. Adjust the **COARSE** and **FINE** frequency controls as required.

BURST OPERATION

In gated burst mode of operation, the generator output is switched on and off (gated), either by an internally generated signal or by an externally applied signal. Both the repetition rate and the duty cycle are variable. Fig. 5 illustrates the type of waveform generated and summarizes the control settings used to obtain the desired waveform.

Internal Triggering

1. Select the waveform to be gated by pushing in the appropriate FUNCTION switch. Display the output of the generator on an oscilloscope.
2. Adjust the frequency, amplitude, symmetry, and dc offset of the signal by using the main generator controls.
3. Enable the burst mode by pushing in the **BURST ON** switch.
4. Set the repetition rate of the burst with the **SWEEP TIME** control.
5. Adjust the tone burst duty cycle, or adjust the tone burst width to a specific time period, with the **BURST WIDTH** control.

External Triggering

1. Select the waveform to be gated by pushing in the appropriate **FUNCTION** switch on the front panel.
2. Adjust the frequency, amplitude, symmetry, and dc offset of the signal by using the main generator controls.

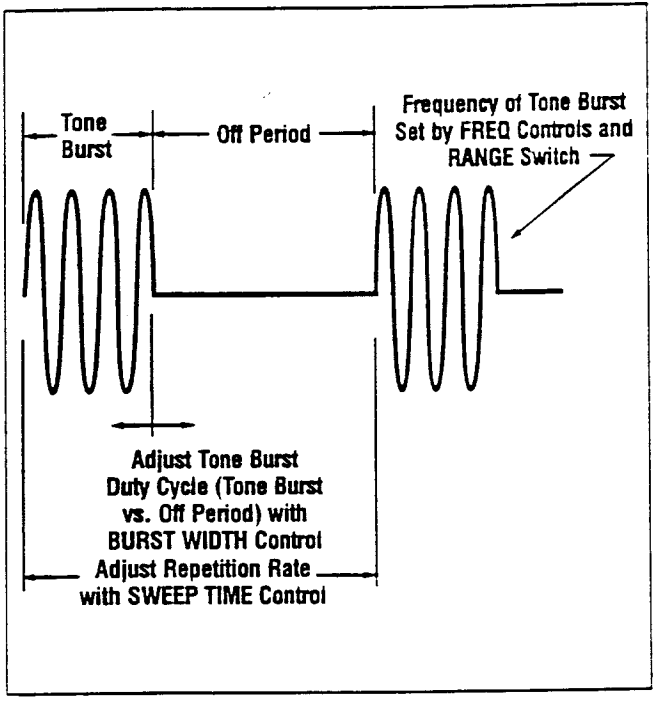


Figure 5. Tone burst generator output waveform.

3. With **BURST ON/OFF** switch in OFF position, apply a TTL gating signal of the proper width to the front panel **BURST INPUT** jack.

Considerations

1. Make sure the tone burst and *entire* off period is viewed when setting the repetition rate. The visible portion of the off period could be incorrectly interpreted as the entire off period. To avoid this error, use a low sweep speed on the oscilloscope, adjusted to view the tone burst, off period, *and the beginning of a second tone burst.*
2. The **BURST WIDTH** control does not interact with the **SWEEP TIME** control and will not affect the repetition rate. However, both controls affect the tone burst width. Since the BURST WIDTH control adjusts the duty cycle (percentage of repetition rate cycle in which tone burst is produced), any subsequent adjustment of the **SWEEP TIME** control affects the tone burst width, as well as the off period. When setting the tone burst width to a specific time period, adjust the **SWEEP TIME** control first, then the **BURST WIDTH** control.
3. The tone burst output signal is always in full cycles or half cycles. Note that as the **BURST WIDTH** control is adjusted slowly, the tone burst is increased or decreased on half cycle increments. This allows synchronization of the waveform for oscilloscope viewing and eliminates transients and frequency components not harmonically related to the frequency being gated. This feature is applicable to internal or external tone burst operation.

AM OPERATION

The output of Model 4040A can be amplitude-modulated, either by the internal 1 kHz signal, or by an external signal applied to the **VCG/MOD INPUT** jack.

Internal

1. Set the carrier frequency using the main **FREQUENCY** controls and **RANGE** switches.
2. Engage the **MODULATION ON** and **AM MODULATION** switches.
3. Engage the **INT MODULATION** switch.
4. Set the percent of modulation by rotating the **% MODULATION** control. Modulation can be set in excess of 100%.

Fig. 6 shows the appearance of a carrier modulated by a sine wave, and the quantities A and B which are used in measuring percentage of modulation. The formula is:

$$\text{Percent modulation} = 2B/A \times 100$$

Where A = unmodulated carrier level
B = modulation depth

External

1. Set the carrier frequency using the main **FREQUENCY** controls and **RANGE** switches.
2. Engage the **MODULATION ON** and **AM MODULATION** switches.

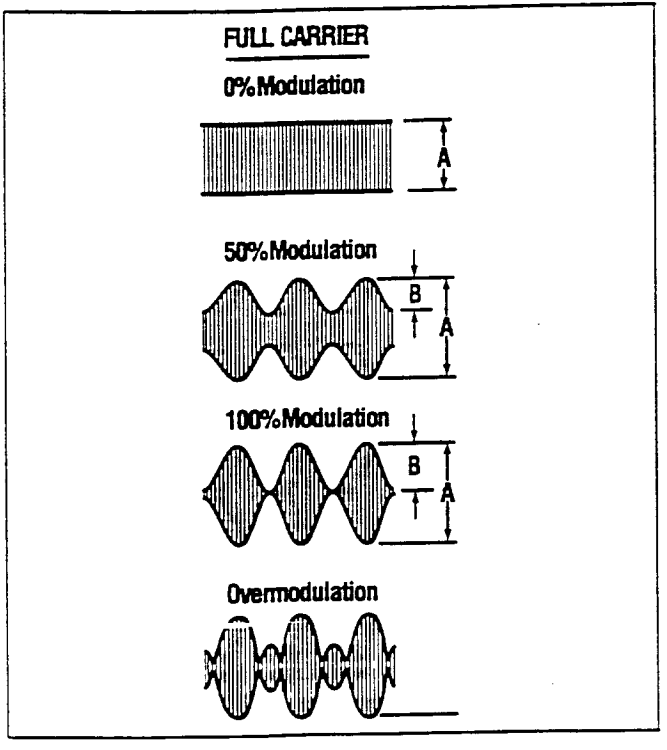


Figure 6. Examples of AM modulation

3. Place the **EXT MODULATION** switch in the released position.
4. Connect a suitable modulating signal to the **VCG/MOD INPUT** jack on the front panel.
5. Adjust the modulation level as described previously.

FM OPERATION

The output of the Model 4040 can be frequency-modulated. either by the internal 1 kHz internal signal or by an external signal applied to the front panel **VCG/MOD INPUT** jack.

Internal

1. Set the carrier frequency using the main **FREQUENCY** controls and **RANGE** switches.
2. Engage the **MODULATION ON** switch and release the **MODULATION FM/AM** switch.
3. Engage the **INT MODULATION** switch.
4. The amount of deviation can be varied by rotating the % **MODULATION** control.

External

1. Set the carrier frequency using the main **FREQUENCY** controls and **RANGE** switches.
2. Engage the **MODULATION ON** switch and release the **MODULATION FM/AM** switch.
3. Place the **EXT MODULATION** switch in the released position.

4. Connect a suitable modulation signal to the **VCG/MOD INPUT** jack on the front panel.
5. Adjust the amplitude and frequency of the external signal as required. Typically, a signal less than 10V p-p will provide 10% modulation of the carrier.

TTL/CMOS OUTPUT

The **TTL/CMOS** output jack provides a fast rise time square wave output. Either a fixed TTL or a variable CMOS output level is available. The output is positive with respect to ground and can be used as an external sync pulse for oscilloscopes or as a variable frequency signal source for exercising logic circuits. Because of the fast rise time of this output, cable length should be minimized to limit ringing and overshoot.

1. Select the desired frequency range and adjust the frequency controls as required. The **OUTPUT LEVEL** and **DC OFFSET** controls have no effect on the signal at the TTL/CMOS jack.
2. When the **CMOS LEVEL** switch (3) is released, a TTL signal is output at the **TTL/CMOS** jack. Select a CMOS signal by engaging the **CMOS LEVEL** switch and adjust the level of the signal by rotating the **CMOS LEVEL** control (8).

VOLTAGE CONTROLLED FREQUENCY OPERATION

The **Model 4040A** can be operated as a voltage-controlled generator by using an external control voltage applied to the **VCG/MOD INPUT** jack (12). The externally applied voltage will vary the frequency which is preselected by the range switches and the frequency controls. Applying approximately +10 V with the **COARSE** control at full clockwise decreases the output frequency by about 100 times (a 100:1 ratio).

1. Select the desired frequency range and waveform.
2. Set the starting frequency with the **COARSE** control. Apply a positive DC voltage to the **VCG/MOD INPUT** jack (12) to decrease the frequency. A voltage from 0 to +10 V will cause the frequency to decrease by a factor of 100 if the **COARSE** frequency control is set at maximum CW rotation. For example, if the starting frequency is 100 kHz, applying +10 V will change the output frequency to 1 kHz.
3. To operate the function generator as a sweep generator, apply a positive-going ramp signal to the **VCG/MOD** input jack. As the ramp voltage increases, the frequency decreases. The rate of sweep can be adjusted by varying the frequency of the ramp signal.
4. Specific frequencies can be selected by applying a fixed dc voltage to the **VCG/MOD INPUT** jack or the frequencies can be stepped by applying a stepped dc voltage.
5. Do not apply more than ±15 volts (dc or dc + ac peak) to the **VCG/MOD INPUT** jack. Inputs of more than 15 volts will not cause any further shift in the frequency and could cause damage to the generator.

SWEEP OPERATION

1. Select LINEAR sweep by leaving the **SWEEP LIN/LOG** switch (23) in the released position or select LOG sweep by engaging the **SWEEP LIN/LOG** switch.
2. Rotate **COARSE FREQUENCY** Control to minimum (CCW).
3. Engage the **RUN/SET** switch to adjust the start and stop sweep frequencies.
4. With the **START/STOP** switch set to START (released position), adjust the starting frequency of the sweep by adjusting the **START** control and observing the counter.
5. Engage the **START/STOP** switch to the STOP position and adjust the stop sweep frequency by adjusting the **STOP** control.
6. Release the **RUN/SET** switch for sweep operation. The sweep rate can be adjusted with the **SWEEP TIME** control. Clockwise rotation increases the sweep rate.

If the output of the circuit to be tested is connected to the vertical scope input, and the GCV output to the horizontal, setting the scope to X-Y mode produces the amplitude vs. frequency plot. However, note that switching to LOG sweep still produces a linear display on the scope. This is because the horizontal sweeping signal, the internal log ramp, also becomes logarithmic when the sweep does. To view a true logarithmic graph, put the scope back in time base operation and use the Sweep output solely as a scope trigger. Use the scope's linear time base as a horizontal deflection source.

USE OF FREQUENCY COUNTER WITH EXTERNAL SIGNALS

The frequency counter display in the Model 4040 is normally used to monitor the internally generated output. However, it can also be used as a stand-alone frequency counter up to 30 MHz.

1. Set the **CNTR INT/EXT** switch to EXT.
2. Apply the signal to be measured to the **EXT CNTR INPUT** jack on the front panel.
3. Obtain the desired display resolution by selecting the appropriate gate period using the GATE pushbutton switch. The resolution obtained with each of the four gate settings is as follows, given an input signal of exactly 2 KHz.

Gate Setting	Reading	Indicator
0.01S	2.0	KHz
0.1S	2.00	KHz
1S	2000	Hz
10S	2000.0	Hz

OUTPUT PROTECTION CONSIDERATIONS

Use care when connecting the function generator output to a signal injection point. Excessive voltage at the point of signal injection of the function generator can causes internal damage. Under normal operation, the generator output should never be connected to an external voltage other than low dc values that can be matched with the **DC OFFSET** control. The Model 4040 is overload protected so that shorting the output, even continuously, will not cause damage. A fuse has been added in series with the **OUTPUT** jack to help protect the instrument from damage by connection to excessive external voltage.

Damage of this type usually occurs by accidentally connecting the output of the function generator to a voltage in the equipment under test. The following protective measures are strongly recommended:

The user should understand the equipment under test well enough to identify valid signal injection points (e.g., the base of a transistor, a logic input of a gate, etc.). The voltage at valid signal injection points is rarely high enough to damage the instrument.

If in doubt about the safety of a signal injection point, measure the voltage present at the intended point of signal injection before connecting the function generator output to that point.

When applying the main output of the function generator to a circuit point containing a dc level, adjust the DC OFFSET control so that the dc level at the main output matches the circuit voltage.

Connect the **TTL** output only to TTL-level circuits. Connect the **CMOS** output only to CMOS circuits. Measure the Vcc of the circuit under test and adjust the **CMOS LEVEL** control as instructed in the manual.

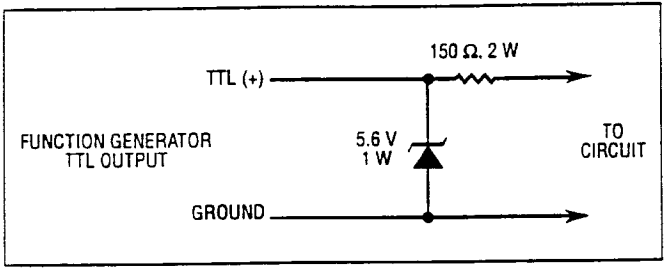


Figure 7. Circuit for Protection of TTL Output.

When the function generator is used by students or other inexperienced users, the circuit shown in Fig. 7 could be added into your TTL output probe or test clip set. It will protect the TTL output of the generator against external voltages up to ± 20 volts.

FUNCTION GENERATOR APPLICATIONS GUIDEBOOK

B+K Precision offers a "Guidebook to Function Generators" which describes numerous applications for this instrument, including hook-up details. It also includes a glossary of function generator terminology and an explanation of function generator circuit operation. It may be obtained free of charge by filling out and mailing the postage paid card enclosed with the Model 4040.

MAINTENANCE

WARNING

The following instructions are for use by qualified service personnel only. To avoid electrical shock, do not perform servicing other than contained in the operating instructions unless you are qualified to do so.

Remember that ac line voltage is present on line voltage input circuits any time the instrument is plugged into an ac outlet, even if turned off. Always unplug the function generator before performing service procedures.

DISASSEMBLY AND REASSEMBLY

In order to gain access to the fuses and the line voltage selector, the bottom half of the case must be removed. Disassembly and reassembly procedures are as follows:

Disassembly

1. Unplug the function generator and turn the unit upside down.
2. Remove the four screws from the bottom of the case.
3. Lift the bottom cover off.

Reassembly

1. With the instrument upside down, line up the slots in the bottom case half with the front panel and the back panel.
2. Carefully push the bottom case half down onto the top half.
3. Replace the four screws.

FUSE REPLACEMENT

1. To replace a fuse, disassemble the case as previously described.
2. To replace the Line fuse, locate the fuse holder. It is located at the rear of the circuit board, to the right of the power transformer. The fuse should not normally open unless a problem has developed with the unit. Try to determine and correct the cause of the blown fuse, then replace only with the correct value fuse (refer to fuse label near fuse holder).
3. To replace the Output fuse, locate the fuse holder. It is located on the output amplifier PC board mounted to the front panel. Replace only with the correct value fuse 0.2A slow blow fuse.
4. Reassemble case as previously described.

LINE VOLTAGE SELECTION

1. Disassemble the case as previously described.
2. Locate the line voltage selection connector. It is located on the PC board behind the power transformer.

3. Unplug the connector by pulling straight up.
4. Push the connector onto the desired voltage selection pin. Be sure that the correct fuse is installed in the fuse holder (refer to fuse label near fuse holder).
5. Reassemble case as previously described.

INSTRUMENT REPAIR SERVICE

Because of the specialized skills and test equipment required for instrument repair and calibration, many customers prefer to rely upon **B+K PRECISION** for this service. We maintain a network of **B+K PRECISION** authorized service agencies for this purpose. To use this service, even if the instrument is no longer under warranty, follow the instructions given in the WARRANTY SERVICE INSTRUCTIONS portion of this manual. There is a nominal charge for instruments out of warranty.

(continued from inside front cover)

6. Some equipment with a two-wire ac power cord, including some with polarized power plugs, is the "hot chassis" type. This includes most recent television receivers and audio equipment. A plastic or wooden cabinet insulates the chassis to protect the customer. When the cabinet is removed for servicing, a serious shock hazard exists if the chassis is touched. Not only does this present a dangerous shock hazard, but damage to test instruments or the equipment under test may result from connecting the ground lead of most test instruments to a "hot chassis". To test "hot chassis" equipment, always connect an isolation transformer between the ac outlet and the equipment under test. The **B+K Precision** Model TR-110 or 1604 Isolation Transformer, or Model 1653 or 1655 AC Power Supply is suitable for most applications. To be on the safe side, treat all two-wire ac equipment as "hot-chassis" unless you are sure it has an isolated chassis or an earth ground chassis.
7. On test instruments or any equipment with a 3-wire ac power plug, use only a 3-wire outlet. This is a safety feature to keep the housing or other exposed elements at earth ground.
8. **B+K Precision** products are not authorized for use in any application involving direct contact between our product and the human body, or for use as a critical component in a life support device or system. Here, "direct contact" refers to any connection from or to our equipment via any cabling or switching means. A "critical component" is any component of a life support device or system whose failure to perform can be reasonably expected to cause failure of that device or system, or to affect its safety or effectiveness.
9. Never work alone. Someone should be nearby to render aid if necessary. Training in CPR (cardio-pulmonary resuscitation) first aid is highly recommended.