Instruction Manual
for
Model 3040

13 MHz
UNIVERSAL FUNCTION GENERATOR

B+K PRECISION®
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INTRODUCTION

The highly versatile **B & K-Precision** Model 3040 "Universal" Function Generator is actually two generators in one. The main generator operates from 0.1 Hz to 13 MHz. The second generator operates from 0.01 Hz to 10 kHz and serves as a modulation source for the main generator or operates independently. Both generators provide sinewave, triangle wave, or square wave outputs. Both generators have variable duty cycle to change triangle waves to ramps and square waves to pulses. The second generator provides AM or FM modulation of any desired frequency. The second generator can provide a ramp voltage to cause the main generator to operate as a sweep generator. The second generator can generate a square wave or pulse to gate the main generator on and off for gated burst output.

The instrument also contains a 6-digit frequency counter for measuring the generator output frequency or for measuring external signals to 30 MHz. The counter has four selectable gate times for fast updates or high resolution as needed.

Overall, the Model 3040 combines six functions into one unit; waveform generation, pulse generation (through variable symmetry), frequency sweep, FM operation, AM operation, and frequency counter.

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 0.1 Hz to 13 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.

A separate TTL output permits the generation of digital pulses that are preset to the correct level.

The sweep generator offers linear sweep with variable sweep rate and adjustable start frequency and sweep width.

Burst operation enables the output to be gated by either an internal, adjustable signal, or by an externally applied signal. Triggered operation permits a single cycle to be generated synchronously with the trigger.

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

The output can be either amplitude modulated or frequency modulated. Modulation can be either by an internal adjustable modulation signal or by an externally applied signal.

In addition to the above features, an external signal 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; this makes possible complex outputs such as gated pulse trains with external or internal sweep.

SPECIFICATIONS

FREQUENCY CHARACTERISTICS

All specifications apply with frequency dial setting between 1 and 13 times range, and after 30 minutes warm-up.

General

Frequency Range:	0.1 Hz to 13 MHz in 8 ranges.
Tuning Range:	Each ranges provides 100:1 frequency control.
Outputs:	Sine, square, triangle wave, ramp, TTL square wave, pulse, sync. output.
Operating Modes:	Sweep, AM, FM, gated burst, VCG (Voltage Controlled Generator).
Switched DC Offset:	Continuously variable, ± 10 V maximum open circuit (± 5 V into 50 ohm load).
Preset DC Offset:	Less than 0.1 VDC.
Variable Symmetry:	80:20:80 to 1 MHz.

Square Wave

Symmetry:	Greater than 98% from 0.1 Hz to 100 kHz.
Rise/Fall Time:	Less than 18 ns at maximum output (into 50 ohm load).

Sinewave

Distortion:	Less than 0.5% from 10 Hz to 50 kHz. Harmonics greater than 30 dB below fundamental 50 kHz to 13 MHz at maximum amplitude. Harmonics greater than 25 dB from maximum to 20% of maximum amplitude.
Amplitude Flatness:	Less than ±3% (0.3 dB) 10 Hz to 100 kHz.
	Less than ±10% (1.0 dB) 100 kHz to 10 MHz.
	Less than ±20% (2.0 dB) 10 MHz to 13 MHz.

Triangular Wave

Linearity:	Greater than 99% at 100 kHz.

TTL Pulse:

Amplitude:	Greater than 3 V p-p.
Rise/Fall Time:	Less than 25 ns.
Fan Out:	20 TTL Loads.

SYNC Output:

Impedance:	50 Ω ±10%.
Level:	>1 V p-p open circuit.

VCG (Voltage-Controlled Generator)

Input Control:	VCG tunable by 0 to –2 VDC ±20%.
	VCG tuning range is 1000:1.
Linearity:	Less than 0.5% to 1 MHz; less than 5% to 10 MHz.
Input Impedance:	3.5k ohms ±10%.

SWEEP CHARACTERISTICS

Mode:	Linear only.
Sweep Width:	Continuously variable; greater than 1000:1.
Sweep Rate:	0.01 Hz to 10 kHz; 90:10 ramp.
Ramp Output:	0 to 4 V p-p into 5k ohms.

AM MODULATION CHARACTERISTICS

Source:	Internal, external.
Modulation Ratio:	0 to 100%.
INT. Modulation:	0.01 Hz to 10 kHz.
EXT. Modulation:	DC to 1 MHz.
EXT. sensitivity:	Less than 10 V p-p for 100% modulation.
AM DC Offset:	Less than 0.1 VDC.
Carrier Amplitude Flatness:	0 to –3 dB; 100 Hz to 5 MHz.

FM MODULATION CHARACTERISTICS

Source:	Internal, external.
Deviation:	0 to ±5%.
INT. Modulation:	0.01 Hz to 10 kHz.
EXT. Modulation:	DC to 50 kHz.
EXT. sensitivity:	Less than 10 V p-p for 10% modulation.

TRIGGER GATE (BURST) CHARACTERISTICS

Trigger Source:	Internal, external.
Trigger Mode:	Single, multiple.
Start/Stop Phase Range:	+90° , –80°.
Frequency Range:	0.01 Hz to 10 kHz (INT.).
	0.1 Hz to 1 MHz (EXT.).
External Level:	TTL level (Hi: greater than 2.4 V, Lo: less than 0.8 V, Lo: Burst OFF, Hi: Burst ON).
Burst (Carrier) Frequency:	0.1 Hz to 1 MHz.

SPECIFICATIONS

FREQUENCY COUNTER

General Specifications

Display:	6 digit LED (0.3″) with kHz, gate, overflow indicators.
Accuracy:	Time base accuracy ± 1 count.
Time Base:	±10 PPM (23°C ±5°C) after 30 minutes warm up.
Mode:	Internal, external.

INTERNAL

Range:	0.1 Hz to 13 MHz.
Gate Time:	0.01, 0.1, 1, 10 seconds.

EXTERNAL

Range:	5 Hz to 30 MHz.
Resolution:	0.1, 1, 10, 100 Hz, 1kHz.
Sensitivity:	Less than 20 mV rms.
Input Impedance:	1M Ω/100pF.

OUTPUT

Mode:	Sine, square, triangle selectable.
Amplitude:	Continuously variable to 20 V p-p (10 V p-p into 50 ohm load, 0.1 Hz to 10 MHz).
Attenuation:	0 to 80 dB, fixed attenuation steps of 20 dB, 40 dB. Continuously variable 0 to 20 dB. All selected attenuation is cumulative.
Output Impedance:	50 ohms ±10%.

MISCELLANEOUS

Input Jacks:	VCG IN, EXT TRIGGER in, EXT COUNTER in, EXT MODULATION INPUT.
Output Jacks:	MAIN OUTPUT, SYNC OUTPUT, TTL OUT, INT MODULATION OUTPUT.
Input Limit:	VCG IN: 0 to 12 VDC EXT MODULATION INPUT: 12 V p-p EXT TRIGGER in: TTL level.
Operating Evironment:	0°C to 50°C (32°F to 122°F) Ratings are specified at 25°C ±5°C.
Power Source:	100, 120, 220, 240 VAC ±10%, 50/60 Hz.
Weight:	11 lb. (5 kg) without power cord.
Dimensions:	310 x 99 x 380 mm (12.2 x 3.9 x 15 in.).
Accessories Supplied:	(1) BNC to BNC, (2) BNC to alligator cables, power cord, instruction manual, schematic diagram and parts list.

CONTROLS AND INDICATORS

FRONT PANEL

(Refer to Fig. 1.)

1. **POWER Switch**. Turns unit on/off.
2. **FREQUENCY Control.** Rotation determines operating frequency in conjunction with RANGE switches (25).
3. **GATE Switch**. Selects gate period in four ranges, 0.01S, 0.1S, 1S or 10S.
4. **30M - 10M Switch.**
   a. Pushed in: Selects 30 MHz range for counter.
   b. Released: Selects 10 MHz range for counter.
5. 1/10 - 1/1 Switch
   a. Pushed in: Selects 1/10 attenuation for counter input.
   b. Released: Selects 1/1 attenuation for counter input.
6. **EXT COUNTER Input**. Input for external frequency measurement.
7. EXT - INT Switch.
   a. Pushed in: Selects external input for counter.
   b. Released: Selects internal input for counter.
8. AMPLitude Control. Adjusts amplitude of output at MAIN OUTPUT. Range of adjustment is 20 dB, and is cumulative with the selected step attenuation (10).
9. SYNC OUTPUT Jack. Square wave output 180° out of phase with MAIN output.
10. ATTenuation Switches. 20 dB and 40 dB step attenuators operate independently or in combination to provide selection of 0 dB, 20 dB, 40 dB or 60 dB attenuation of output at MAIN OUTPUT jack.
11. MAIN OUTPUT Jack. Output of all main generator signals. 20 V p-p into open circuit or 10 V p-p maximum into 50 ohm load when ATT Switches are set for 0 dB.
12. DC OFFSET Control.
    a. Pulled out: Provides variable dc offset on main output, from –10 to +10 V open circuit, –5 to +5 V into 50 ohm load. Rotation adjusts amount of dc offset.
    b. Pushed in: provides zero dc offset.
13. TRIGGER PHASE Control. Sets starting phase of the output signal in the burst mode. In full counterclockwise, FREE RUN position, disables the burst.
14. DUTY Control.
    a. Pushed in: Provides symmetrical output (50% duty cycle).
    b. Pulled out: Rotation varies the symmetry of output waveform at the MAIN and SYNC OUTPUT.
15. INT OUTPUT/EXT INPUT Jack. Dual-purpose jack functions either as input or output as follows:
    a. If any MODULATION waveform (20) is selected, that waveform is presented as an output at this jack.
    b. If no waveform is selected (all buttons out), this jack becomes the input for an external modulation source.

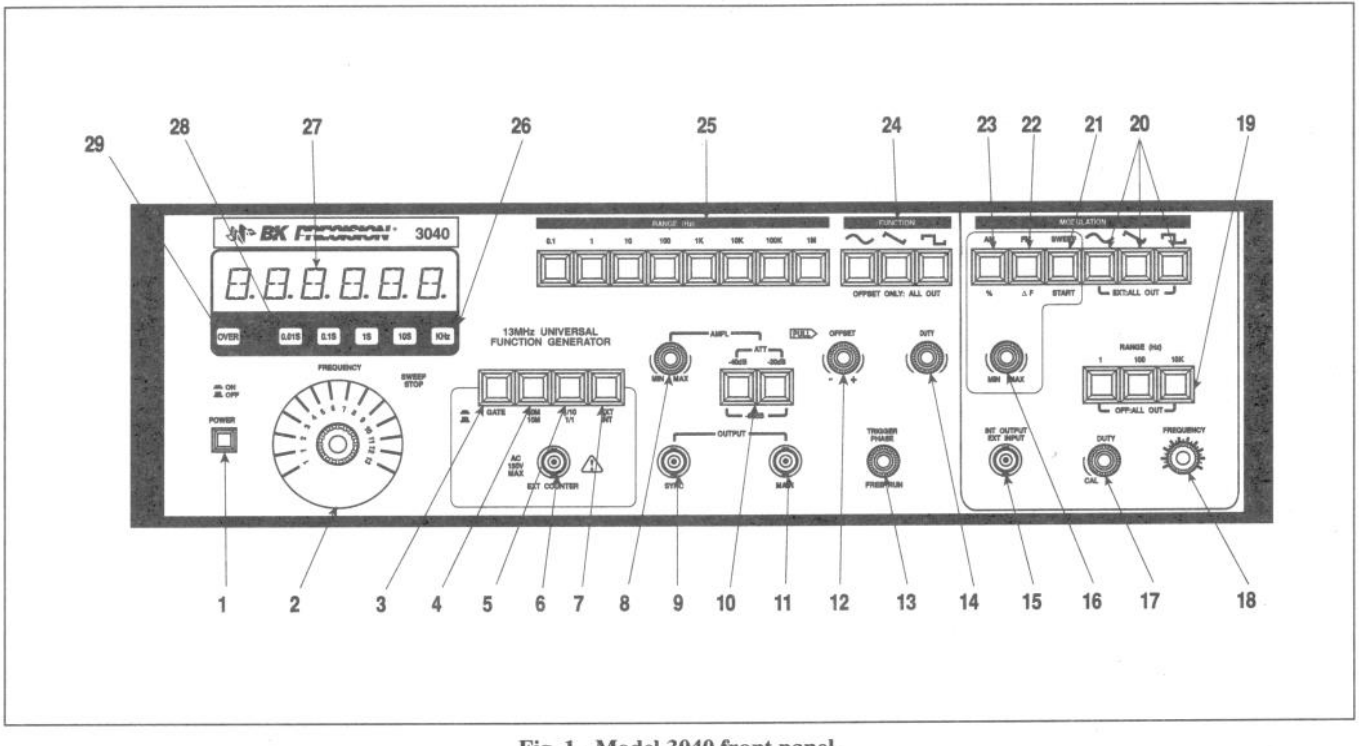

Fig. 1. Model 3040 front panel.

16. MODULATION MIN - MAX CONTROL. Sets the percent of AM modulation, the deviation for FM modulation and the start frequency for sweep.

17. **MODULATION DUTY Control.** Varies the symmetry of the internal modulation waveform. CAL position selects a 90:10 ramp for the sweep and symmetrical (50% duty cycle) for all other functions.

18. MODULATION FREQUENCY. Varies the modulation frequency selected by MODULATION RANGE switches (19).

19. MODULATION RANGE Switches. Three interlocking pushbuttons (1, 100, 10K) select internal modulation frequency range. Internal modulation off when all pushbuttons are out.

20. MODULATION Waveform Switches. Three interlocking pushbuttons select internal modulation waveform, sine wave, triangle wave, or squarewave. When all pushbuttons are out, external modulation can be applied through the EXT INPUT jack (15).

21. SWEEP Switch. Selects sweep modulation mode.

22. FM Switch. Selects FM modulation mode.

23. AM Switch. Selects AM modulation mode.

24. FUNCTION Switch. Interlocking pushbuttons select sinewave, triangle wave, or squarewave for MAIN OUTPUT. When all pushbuttons are out the dc offset level can be set.

25. RANGE Switches. Eight interlocking pushbuttons select operating frequency range. Used in conjunction with FREQUENCY dial (2).

26. kHz Indicator. When lit indicates display is in kHz.

27. Frequency Display. Reads frequency of internal generator or signal applied to EXT COUNTER jack (6). Signal source is selected by EXT-INT switch (7).

28. Gate Time Indicators. Four LED indicators display gate time of frequency counter. Counting is in process while indicator is lit.

29. OVER Indicator. Indicates overrange reading on frequency display (27). Applicable only when counter is measuring an externally applied signal.

REAR PANEL

30. TRIGGER EXT-INT Switch. Selects either internal trigger or external trigger applied through EXT jack (35).
31. AC Power Connector.
32. **Fuse.** Inside compartment. See "Maintenance" section of this manual.
33. Line Voltage Selector. Inside compartment. See "Maintenance" section of this manual.
34. TRIGGER SINGLE-MULTIPLE Switch. Selects single cycle or multiple cycles in burst mode.
35. EXT TRIGGER Jack. Trigger input for external burst control.
36. V.C.G. IN Jack. Input for external control of generator frequency.
37. TTL OUT Jack. Provides a TTL-level square wave coincident with the main output, unaffected by changes in dc offset or amplitude.

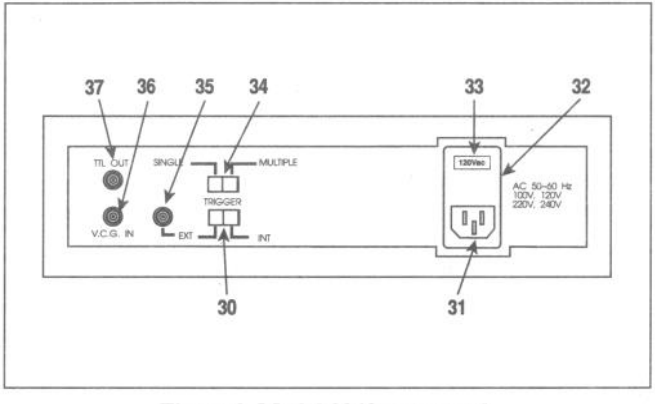

Figure 2. Model 3040 rear panel.

OPERATING INSTRUCTIONS

The B & K-Precision Model 3040 Universal 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.

CONTINUOUS RUN OPERATION

1. Plug the unit into an appropriate power source and turn it on by depressing the POWER switch.

2. Initially set all pushbutton switches to the out position and push in OFFSET and DUTY rotational knobs. Rotate all knobs to the full counterclockwise position. These adjustments initialize the output as a symmetrical waveform, unaffected by the sweep generator and other controls.

3. Select the desired waveform (square, triangle, sine) by depressing the appropriate FUNCTION switch.

4. The SYNC output jack provides a square wave coincident with the main output. This output is 1 V p-p open circuit. The SYNC output is not affected by the OFFSET control but will vary in width when the DUTY control is pulled out and rotated.

5. Select the desired frequency range by depressing the appropriate RANGE switch. For each setting, rotating the FREQUENCY control produces a range of frequencies from about 0.1 to 13 times the RANGE settings. For example, full rotation on the 1 kHz RANGE produces frequencies from approximately 100 Hz to 13 kHz.

NOTE

When using higher output frequencies or the square wave output, terminate the cable into 50 ohms to minimize overshoot and ringing. Also keep cables as short as possible.

6. The output frequency is shown on the counter display in kHz. The kHz indicator lights as a reminder.

NOTE

The GATE switch selects the gate time for the counter. Whenever one of the four gate time indicators is lit, a frequency measurement is in process. When the 10S indicator is lit, the display takes ten seconds to update.

7. Adjust the amplitude of the output as desired using the AMPLitude control. Rotation of this control varies the amplitude from maximum to 20 dB below maximum. An additional attenuation of 20 dB, 40 dB or 60 dB is available by depressing the 20 dB and/or the 40dB ATTenuator pushbuttons. These attenuation factors can be combined up to a total possible of 80 dB.

8. A dc component can be added to the output signal by pulling out the OFFSET control. The dc component introduced is independent of the AMPLitude setting but not the ATTenuation settings. With no attenuation, the dc offset can be varied by ± 10 volts open circuit or ±5 volts into 50 ohms. The dc offset does not affect the output at the SYNC or TTL output jacks.

NOTE

Remember that the output signal swing of the generator is limited to ±10 volts open circuit or ±5 volts into 50 ohms. This applies to the combined 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 combination is obtained without undesirable clipping.

9. A 1 V p-p square wave with constant amplitude and zero dc offset is available at the front panel SYNC OUTPUT jack. This signal, coincident with the main output, is suitable for external triggering of scopes and other equipment.

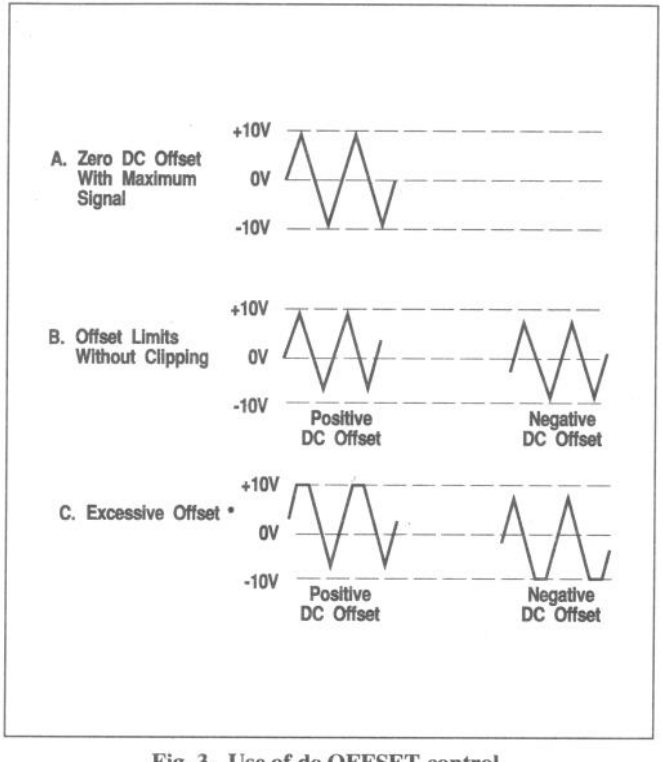

Fig. 3. Use of dc OFFSET control.

10. A TTL-level square wave, coincident with the main output, is available at the rear panel TTL OUTput jack. This output is independent of amplitude and offset of the main output.

VARIABLE SYMMETRY OPERATION

The DUTY 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 triangular wave, the result is a ramp, and with a sine wave, a distorted waveshape called a slewed sine is produced. The model 3040 provides for symmetry variations from about 4:1 to 1:4; that is the duty cycle of a square wave can be varied from about 80% to about 20%.

1. With the DUTY control pushed in, symmetry is 1:1.
2. With the DUTY control pulled out, a 1:1 symmetry is obtained near mid- rotation. Clockwise rotation results in an increase in square wave duty cycle, and changes in triangle and sine waves as shown in the top waveform of each pair in Fig. 4. Counterclockwise rotation results in a decrease in square wave duty cycle, and changes in triangle and sine waves as shown in the bottom waveform of each pair.

NOTE

Varying the DUTY setting also results in a change in output frequency.

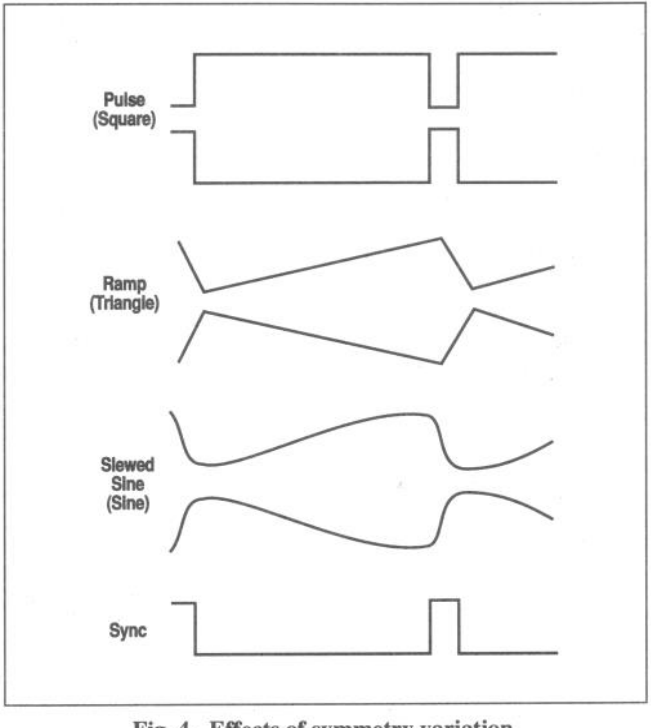

Fig. 4. Effects of symmetry variation.

GATED BURST OPERATION

In gated burst operation, the generator output is switched on and off (gated), either by an internally generated signal or by an externally applied signal. On the Model 3040, the burst output can be set to provide either a single pulse or multiple pulse output.

Internal Triggering

1. Set the rear panel EXT-INT TRIGGER switch to the INT position.
2. Select single pulse or multiple pulse output with the rear panel SINGLE-MULTIPLE switch.
3. Select the waveform of the gated signal by pushing in the appropriate FUNCTION switch on the front panel.
4. Adjust the frequency, amplitude, symmetry, and dc offset of the gated signal by using the main generator controls as in continuous run operation.
5. Enable the burst mode by rotating the TRIGGER PHASE control clockwise; set it to midrange initially.
6. Select the waveform of the gating signal with the MODULATION waveform switches. The square wave is most commonly used as a gating signal, but the sine and triangle may also be used. If they are, the output is gated on the positive-going slope of the gating waveform.
7. Set the repetition rate of the burst with the MODULATION RANGE switches and MODULATION FREQUENCY control.
8. Adjust the phase, or starting point, of the burst, by rotating the TRIGGER PHASE control. Phase can be set from –80° to +90°. The stop point will be at the same phase point as the start; see Fig. 5.

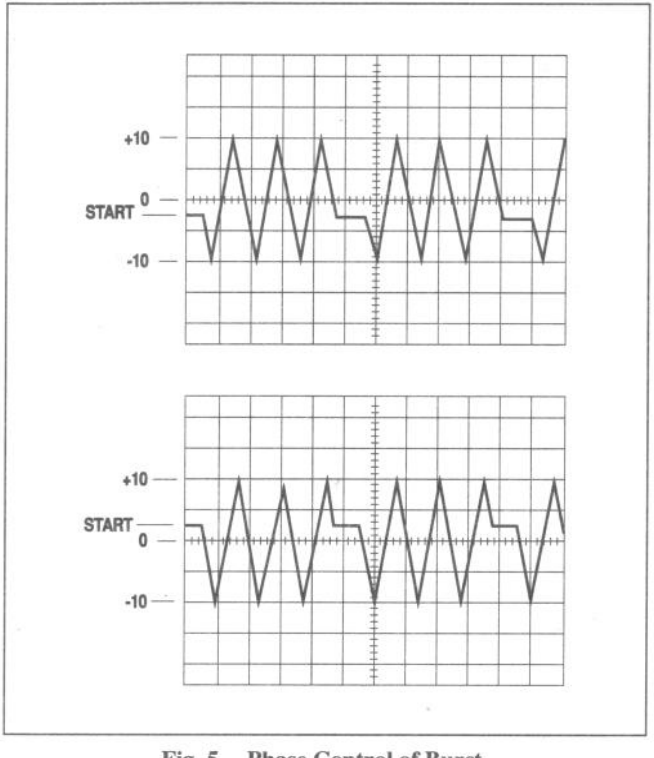

Fig. 5. Phase Control of Burst.

9. The gating signal is available at the INT OUTPUT jack, for connection to an oscilloscope or counter.

External Triggering

1. Set the rear panel EXT-INT TRIGGER switch to the EXT position.
2. Connect the external TTL gating source to the rear panel EXT jack.
3. Select single pulse or multiple pulse output with the rear panel SINGLE-MULTIPLE switch.
4. Select the waveform of the gated signal by pushing in the appropriate FUNCTION switch on the front panel.
5. Adjust the frequency, amplitude, symmetry, and dc offset of the gated signal by using the main generator controls as in continuous run operation.
6. Enable the burst mode by rotating the TRIGGER PHASE control clockwise. Also use this control to adjust the phase of the burst.

SWEEP OPERATION

1. Set up equipment as for continuous run operation.
2. Set the sweep stop frequency using the RANGE switches and the FREQUENCY control.
3. Push in the SWEEP START switch and adjust the SWEEP START frequency using the MODULATION MIN-MAX control.
4. Set the sweep rate by pushing in one of the MODULATION RANGE switches and rotating the MODULATION FREQUENCY control for the desired sweep repetition rate.
5. With the MODULATION DUTY control in the CAL (full counterclockwise) position the sweep rate is a 90:10 ramp. Rotating the control clockwise varies the symmetry of this ramp from 90:10 to 10:90. Note: This also changes the frequency of the ramp (the repetition rate).
6. The INT OUTPUT jack on the front panel provides a 0 to –10 volt output of the sweep ramp. This waveform can be used as the horizontal deflection signal for an oscilloscope, to give X-Y display of signal amplitude vs. frequency. This is commonly done when testing frequency response of audio equipment, or bandwidth of other amplifiers or equipment.

If the output of the unit under test is connected to the vertical scope input and the INT OUTPUT to the horizontal, setting the scope to X-Y mode produces the amplitude vs. frequency plot mentioned above.

AM OPERATION

The output of the Model 3040 can be amplitude-modulated, either by an internal variable frequency signal, or by an external signal applied to the EXT INPUT jack.

Internal

1. Set up as for continuous run operation.
2. Set carrier frequency using the main FREQUENCY control and RANGE switches.
3. Push in AM MODULATION switch.
4. Push in the MODULATION waveform switch for the type of modulation signal desired (sine wave, square wave, sawtooth).

5. Set the modulation frequency by pushing in the appropriate MODULATION RANGE switch and rotating the MODULATION FREQUENCY control.
6. Adjust the symmetry of the modulation signal by rotating the MODULATION DUTY control. Set to CAL position (full counterclockwise) for a symmetrical modulation signal. Note: Rotation affects modulation frequency.
7. Set the percent of modulation by rotating the MODULATION MIN-MAX 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:

$$\text{Percent of Modulation} = \frac{2B}{A} \times 100$$

Where A = unmodulated carrier level
B = modulation depth.

8. The internal modulation signal is available at the INT OUTPUT jack on the front panel as a 4V p-p signal. This is useful as an oscilloscope trigger for viewing the modulated waveform.

External

1. Set up as for continuous run operation.
2. Set carrier frequency using the main FREQUENCY control and RANGE switches.
3. Push in AM MODULATION switch.
4. Release all MODULATION waveform switches (sine wave, square wave, sawtooth) to select external modulation.

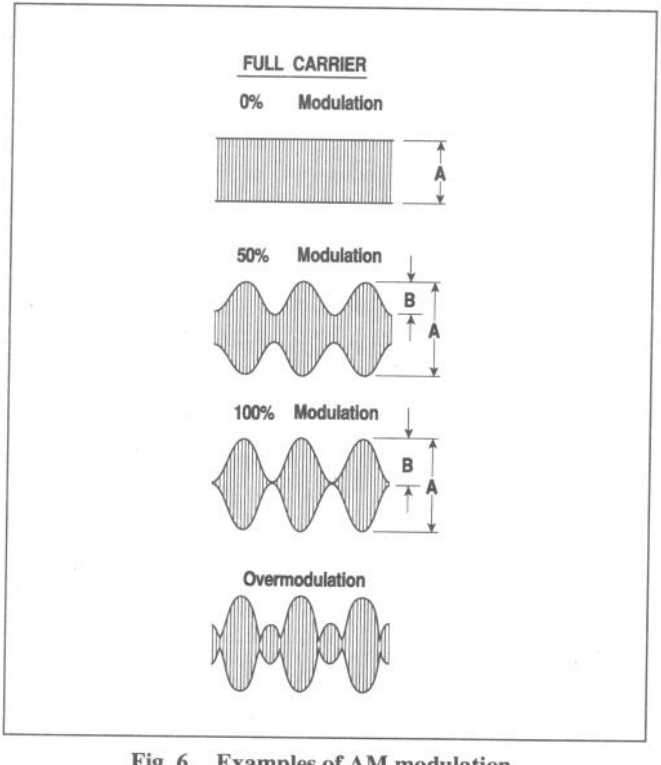

Fig. 6. Examples of AM modulation.

5. Connect a suitable modulating signal to the MODULATION EXT INPUT jack on the front panel.
6. Adjust the amplitude and frequency of the external signal as required. Typically a signal less than 10V p-p will provide 100% modulation. Degree of modulation can also be adjusted by rotating the MODULATION MIN-MAX control.

FM OPERATION

The output of the Model 3040 can be frequency-modulated, either by an adjustable frequency internal signal or by an external signal applied to the front panel EXT INPUT jack.

Internal

1. Set up as for continuous run operation.
2. Set the main FREQUENCY control and RANGE switches.
3. Push in FM MODULATION switch.
4. Push in the MODULATION waveform switch for the type of modulation signal desired (sine wave, square wave, sawtooth).
5. Set the modulation frequency by pushing in the appropriate MODULATION RANGE switch and rotating the MODULATION FREQUENCY control.
6. Adjust the symmetry of the modulation signal by rotating the MODULATION DUTY control. Set to CAL position (full counterclockwise) for a symmetrical modulation signal. Note: Rotation affects modulation frequency.
7. The amount of deviation can be varied by rotating the MODULATION MIN-MAX control.
8. The internal modulation signal is available at the INT OUTPUT jack on the front panel as a 4V p-p signal.

External

1. Set up as for continuous run operation.
2. Set carrier frequency using the main FREQUENCY control and RANGE switches.
3. Push in FM MODULATION switch.
4. Release all MODULATION waveform switches (sine wave, square wave, sawtooth) to select external modulation.
5. Connect a suitable modulating signal to the MODULATION EXT INPUT jack on the front panel.
6. 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. Degree of modulation can also be adjusted by rotating the MODULATION MIN-MAX control.

EXTERNAL FREQUENCY CONTROL

The internal VCG (voltage-controlled generator) circuit of the Model 3040 has as its inputs a number of front panel controls. In each case, the particular control involved presents a variable voltage to the VCG. The sum of these various control voltages is processed by the VCG to produce a certain output frequency.

The VCG INput jack on the rear panel provides direct access for an external control voltage which is in turn summed with all other control inputs to the generator. This allows external frequency control, making possible three modes of operation.

1. Control by a fixed dc voltage, producing a specific output frequency.
2. Control by an ac voltage, resulting in FM modulation.
3. Control by a ramp or other type waveform, providing externally controlled sweep operation.

Control by Fixed DC voltage

1. Set up as for continuous run operation, setting operating frequency using the front panel controls.
2. Connect an external voltage to the VCG INput jack on the rear panel.
3. Since this voltage input is combined with those of the front panel, an input of 0 volts dc has no effect on the output frequency.
4. As the voltage is deviated around zero in the positive or negative direction, the output frequency increases and decreases accordingly.

Frequency control by external dc voltage is useful in programmed frequency selection. A set of two or more specific frequencies may be programmed by using multiple dc voltage values which may be selected by a switch or electronic switching circuits. This type of operation would be desirable in production testing where signals at several specific frequencies are required for various tests. To maintain the original accuracy each time the operation is repeated, the FREQUENCY control must be accurately set to the same position; setting it to the high frequency end of its rotation is advisable—this gives the external voltage the greatest range of control.

NOTE

Higher positive voltages at the VCG INput jack result in higher output frequencies.

A dc voltage from 0 volts to -2 volts applied to the VCG INput jack is sufficient to vary the frequency of the main generator over three decades. A simple power supply is shown in fig. 7.

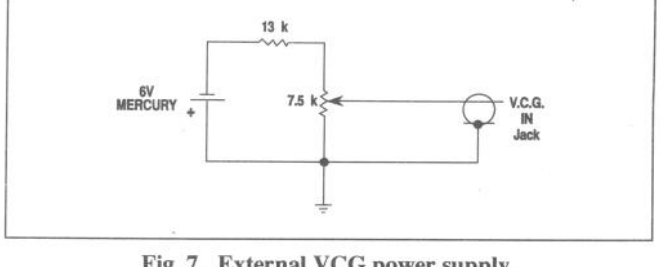

Fig. 7. External VCG power supply.

Control by AC voltage—FM Modulation.

This mode of operation is discussed in the previous section on "FM Operation". However, any signal applied to the VCG INput jack will vary the generator's output frequency. Therefore, an ac signal applied there will still result in FM modulation, even in continuous run mode, with all modulation switches off. This method of FM varies from the one previously discussed in two important aspects:

1. The previous method permits adjustment of the amount of modulation at the front panel of the Model 3040, via the MODULATION MIN-MAX control.

2. This method produces a larger frequency deviation than is possible through the front panel jack.

Control by Ramp Voltage

1. Set up as for continuous run operation.

2. Set the main FREQUENCY control to its highest setting. This is not absolutely necessary but enables the external voltage to completely control the frequency range. An input range of 0 to –2 VDC is sufficient to provide a 1000:1 frequency range.

3. Apply a ramp or other waveform to the VCG INput jack. The amplitude of the external sweep signal now determines the sweep width, and its frequency determines the sweep rate. Note that the RANGE setting on the Model 3040 still affects the range of frequencies swept.

NOTE

Use of an external ramp voltage enables frequency sweeps in either direction.

COMBINATION OF MODES

The Model 3040 may be operated in many of its modes simultaneously. Following is a partial list of operating modes that may be combined, if desired. In any mode, sine, square, or triangle wave output may be used, and variable symmetry may be employed.

Continuous/External VCG
Continuous/AM
Continuous/External VCG/AM
Burst/Sweep
Burst/AM
Burst/External VCG
Sweep/External VCG
Burst/Sweep/External VCG

USE OF FREQUENCY COUNTER WITH EXTERNAL SIGNALS

The frequency counter display in the Model 3040 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 counter EXT-INT switch to EXT. This disconnects the internal generator output from the counter and enables the EXT COUNTER input jack on the front panel.

2. Apply a signal to be measured to the EXT COUNTER input jack.

3. Set counter as a 10 MHz or 30 MHz counter as follows:

   a. Push in the 30M-10M pushbutton to set counter to 30 MHz.

   b. Release the 30M-10M pushbutton to set counter to 10 MHz.

4. Set attenuation of input signal to 1/1 or 1/10 as follows:

   a. Push in the 1/10-1/1 pushbutton to set attenuation of input signal to 1/10.

   b. Release the 1/10-1/1 pushbutton to set attenuation of input signal to 1/1.

5. Obtain 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	2.000	kHz
10S	2.0000	kHz

6. Any input frequency greater than the selected range will cause the OVER indicator to light.

OUTPUT PROTECTION CONSIDERATIONS

Use care when connecting any function generator output to a signal injection point. Excessive voltage at the point of signal injection can be reflected into the function generator circuitry causing internal damage. Damage of this type usually occurs by accidentally connecting the output of the function generator across a voltage in the equipment under test. To be completely safe, adherence to the following protective measures is strongly recommended:

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

2. If in doubt about the safety of a signal injection point, measure in-circuit voltage present at the point of signal injection with a multimeter before connecting a function generator output to the circuit, ascertaining whether it is safe to connect the generator to the circuit.

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 an time the instrument is plugged into an ac outlet, even if turned off. Alway unplug the function generator before performing service procedures.

FUSE REPLACEMENT

The fuse is located in a receptacle as shown in figure 9.

1. Disconnect the power cord.
2. Using a flat-blade screwdriver, open the cover over the fuse receptacle.
3. 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. Use a 1A, 250 V fast-blow fuse (Maxtec part no. 196-303-1-000) for 110/120 V operation, or a 0.5 A, 250 V fast-blow fuse (Maxtec part no. 196-303-0-500) for 220/240 V operation.

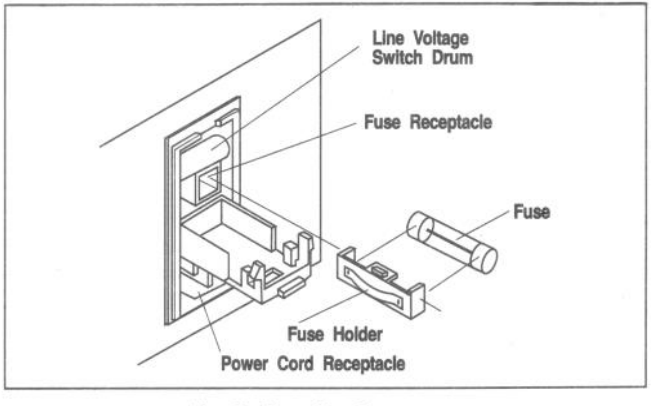

Fig. 9. Fuse Replacement.

LINE VOLTAGE SELECTION

The line voltage switches are operated by cams on a drum located as shown in figure 9.

1. Disconnect the power cord.
2. Using a flat-blade screwdriver, open the cover over the line voltage switch drum.

NOTE

Drum must be positioned so that correct line voltage is displayed through slot in cover.

3. Lift drum out of instrument and rotate to desired position; then reinsert drum.
4. Close cover completely.
5. Check that correct operating voltage is displayed.
6. Install correct value fuse as listed in previous paragraph.
7. Reconnect power cord.

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.