

Instruction Manual

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Model 4001A and 4003A Sweep Function Generator

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Section 1 - 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. A 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 high voltage. You will significantly reduce the risk factor if you know and observe the following safety precaution.

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 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.
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 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 equipment. Always connect an isolation transformer between the ac outlet and the equipment under test. The B&K Precision Model TR-110 or 1604A Isolation Transformer or Model 1653A or 1655A 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 is 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.

Never work all alone. Someone should be nearby to render aid if necessary. Training in CPR (cardio-pulmonary resuscitation) first aid is highly recommended.

Section 2

Introduction

Models 4001A and 4003A are 4MHz Sweep Function/ Sweep Generator with the added feature of 60MHz digital counter on model 4003A. The function generator generates sinusoidal, triangular, ramp, square and pulse waveforms. The type of function is selectable through a rotary switch.

The frequency is settable from 0.5Hz to 4MHz with the use of the range selector switch and the Frequency Control Knob for variable adjustments with multiplication factor of 0.04 to 4.0 of the selected frequency range.

The Signal amplitude can be adjusted from 0.1 V to 20Vp-p with no load conditions and 0.1V to 10Vpp with a 50 ohm load termination.

The Main Output has the provision of SYNC Output signal (TTL level) when selected.

The sweep generator offers linear or log sweep with variable sweep rate and adjustable sweep width.

(Model 4003A only)

Auto ranging, 5-digit frequency counter is provided with range from 0.2Hz to 60MHz and resolution of 0.001Hz. The counter is utilized for external as well the internal functions.

(Model 4003A only)

In addition to above features, an external voltage signal can be used to control the frequency of the function. With AC input signal, FM Output can be generated.

Section 3

Technical Specifications

3.1 FREQUENCY CHARACTERISTICS

Waveforms	:	Sine, Square, Triangle, Ramp, \pm Pulse.
Range	:	0.5Hz to 4MHz in 6 ranges
Tuning Range	:	Variable Multiplication factor of 0.04 to 4.0 of selected range.
Resolution	:	0.001Hz (model 4003A only).
Operating Modes	:	Normal, Sweep, VCF.
Frequency Stability	:	Output will change less than 0.1% for 15 minutes after switching ON and it will change less than 0.2% for 24 Hours after switching ON.

3.2 OUTPUT CHARACTERISTICS

Impedance	:	50 Ω \pm 2%.
Level	:	Variable control From 0.1Vp-p (No Load). 0.05Vp-p (50 Ω Load). To 20Vp-p (No Load) \pm 1Vp-p. 10Vp-p (50 Ω Load) \pm 0.5Vp-p.
Attenuation	:	-20dB \pm 2%.
DC Offset	:	Variable : \pm 10V open circuit, \pm 5V into 50 Ω .

3.3 SINE WAVE

Distortion	:	Less than 2% (1Hz - 100kHz).
Harmonic Ratio	:	<30dB, 100kHz to 4MHz.
Frequency Response	:	<0.1dB, upto 100kHz. <1dB, 100kHz to 4MHz.

3.4 TRIANGULAR WAVE

Symmetry	:	50% (Positive Half) to 50% (Negative Half). <2%, 1Hz to 100kHz.
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3.5 RAMP WAVE

Frequency Range	:	0.5Hz to 3.5MHz.
Symmetry	:	80% (Rise Wave) to 20% (Fall Wave) <5%, 1Hz to 100kHz.
Rising Wave linearity	:	<2%, 1Hz to 100kHz.

3.6 SQUARE WAVE

Symmetry : 50% (Positive Half) to
50% (Negative Half).
<2%, 1Hz to 100kHz.
Rise Time : <90nS, (20Vp-p, No Load).

3.7 POSITIVE PULSE

Frequency Range : 0.5Hz to 3.5MHz.
Symmetry : 20% to 80%,
<5%, 1Hz to 100kHz.
Rise Time : <90nS, (20Vp-p, No Load).

3.8 NEGATIVE PULSE

Frequency Range : 0.5Hz to 3.5MHz.
Pulse Width : 15% of time period of the Set Frequency.
Symmetry : 80% to 20%, <5%, 1Hz to 100kHz.
Rise Time : <90nS, (20Vp-p, No Load).

3.9 SYNCHRONOUS OUTPUT

Impedance : $50\Omega \pm 2\%$.
Level (TTL) : 3Vp-p fix amplitude.
Level (CMOS) : Adjustable 5V to 15Vp-p.
Rise Time (TTL) : <60nS.
Rise Time (CMOS) : <90nS.

3.10 VCF INPUT (model 4003A only).

Input Level : 0 to 10V.
Input Frequency : DC to 1kHz.

3.11 SWEEP OPERATION

Operating Mode : Linear/ LOG.
Sweep Rate : 5 sec to 25ms.
Width : 1:1 to 1:100.

3.12 SWEEP SYNCHRONOUS OUTPUT

Output waveform : Linear/ LOG ramp wave.
Amplitude : 10Vp-p (No Load), 5Vp-p (1k Ω Load).

3.13 FREQUENCY COUNTER (model 4003A only).

Display : 5 digit, Auto range.
Display Unit : Hz/ kHz auto range.
Resolution : 0.01Hz (max.).
Accuracy : <0.02% \pm 1 digit.
Temp coefficient : <10PPM / $^{\circ}$ C.

3.14 EXTERNAL COUNTER (model 4003A only).

Max. Input Voltage : <150mV rms.
Input Frequency : 0.1Hz to 60MHz.
Coupling : HF - for more than 100 kHz.
 LF - With 100 kHz filter for less than 100 kHz.
Sensitivity : <30mV rms (1MHz).

3.15 POWER SOURCE : 115V AC \pm 10 %, 50/60Hz, fuse 600mA or
230V AC \pm 10 %, 50/60Hz, fuse 300mA.

3.16 OPERATING ENVIRONMENT

Temperature : 0 to 40 $^{\circ}$ C.
Humidity : 10% to 80%

3.17 STORAGE

Temperature : - 20 $^{\circ}$ C to 70 $^{\circ}$ C.
Humidity : 0% to 90%.

3.18 DIMENSIONS : WxHxD 11 x 3.6 x 11.9" (275 x 90 x 300 mm.)

3.19 WEIGHT : 5.5 lbs. (2.5 Kg.)

3.20 ACCESSORY : Power Cord, User's Manual.

Section 4

Controls & Indicators

4.1 FRONT PANEL (Refer Fig. 1A & 1B)

1. POWER SWITCH

Push the switch "ON" will light the LED of the digits (14) to indicate power "ON".

2. FREQUENCY CONTROL KNOB

Used to adjust the required frequency for selected range with the multiplication factor of 0.04 to 4.0.

3. SYNC OUTPUT

The TTL level square signal Output synchronous with frequency of Main Output.

4. SWEEP OUTPUT

Sweep signal is available regardless of position of SWEEP ON switch provided with Sweep Rate Knob.

5. MAIN OUTPUT

Function Output signal provides normal mode or sweep mode output depending on mode selected. The maximum Output impedance is 50Ω.

6. AMPLITUDE KNOB

The amplitude of signal can be adjusted from 0.1Vp-p to 20Vp-p at No Load. Pull the Knob to attenuate the signal 10 times.

7. DC OFFSET

This Knob can apply a DC Offset to Main Signal. Turn the Knob clockwise for Positive Offset and anti-clockwise for Negative Offset.

8. SWEEP RATE

This Knob is used to adjust the sweep rate from 5 seconds to 25 milliseconds. Also if this Knob is pulled, then Sweep mode operation will be ON.

9. SWEEP WIDTH

This Knob is used to adjust the Sweep Width. When the knob is in "Push" condition, a Linear Sweep Output will be available and When Knob is in "Pull" condition, then LOG Sweep Output will be available.

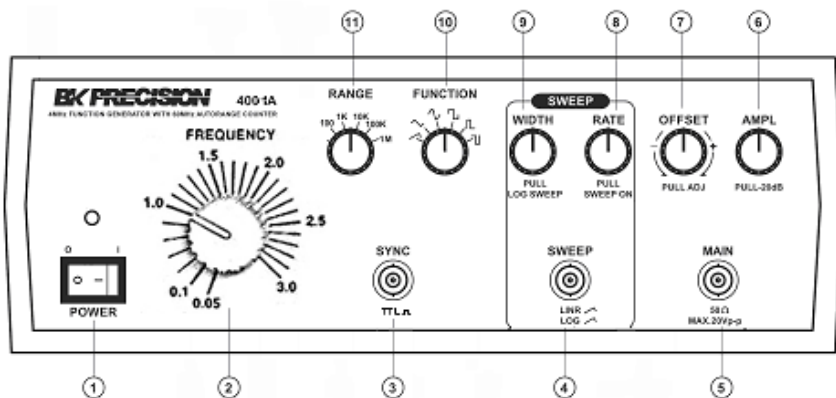


Fig. 1A Front Panel Controls (4001A)

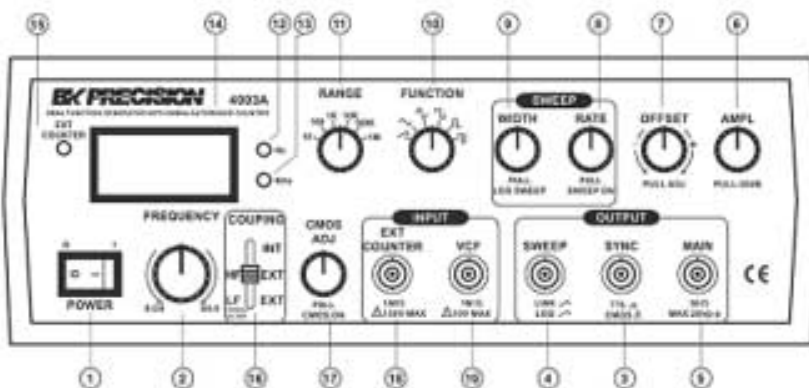


Fig. 1B Front Panel Controls (4003A)

10. FUNCTION SELECTOR SWITCH

A rotary Switch for waveform selection.

11. FREQUENCY RANGE SELECTOR SWITCH

A rotary Switch to select the range from 10Hz to 1MHz in 6 steps.

(Refer Fig. 1B)

12. Hz LED

Green LED will light when the Main Output frequency is in Hz.

13. kHz LED

Red LED will light when the Main Output frequency is in kHz.

14. 5 DIGIT DISPLAY

Indicates frequency of Main Output or the frequency of signal connected to External Input.

15. EXT COUNTER LED

LED becomes ON when External frequency counting is selected by Coupling Switch.

16. COUPLING SWITCH

It is three way switch to select Internal / External High Frequency / External Low Frequency mode.

17. CMOS ADJUST KNOB

For adjusting the CMOS level of SYNC Output while in CMOS mode. Pull the Knob for CMOS ON.

18. EXTERNAL INPUT BNC

Connector for counting external signal frequency.

19. VCF INPUT BNC

For connecting external DC or AC signal from 0 to 10V to achieve voltage controlled frequency output.

4.2 REAR PANEL DESCRIPTION

On the rear side of instrument Main's Input socket is provided. The socket has fuse plug, which is used for fuse replacement and input line voltage selection. The selection of Input line voltage (110/230V AC) depends on how we insert the fuse plug. Refer to Arrow marks on fuse plug and the mark on the panel.

For cooling purpose 40mm Fan is provided on rear panel.

Section 5

Operating Instructions

Before applying power to unit, make sure that input voltage setting is correct and the ventilation holes are not blocked. Ensure that Ventilation Fan is working well.

It is necessary to inspect the generated signal with an oscilloscope before connecting it to any electronic circuit. Hence use of oscilloscope is mentioned in the procedure.

Turn On the instrument with Power ON switch provided on the front panel. The display shows the reading as per present settings.

5.1 FUNCTION GENERATOR OUTPUT

1. Select the type of waveform required by rotary switch of FUNCTION.
2. Select the Range of frequency by rotary switch of RANGE.
3. Connect Main Output signal to Channel 1 of oscilloscope and Sync Output signal to Channel 2 of oscilloscope. Set the trigger source of oscilloscope at Channel 2.
4. Set the frequency of the signal by adjustment knob. The display shows the frequency reading of signal.
5. Adjust the amplitude of the signal Amplitude knob. Pull the knob if the signal is to be attenuated 10 times.
6. Set the DC Offset of signal by OFFSET knob to required level (-10V to +10V).
7. Check the impedance of the load before connecting (50W max.).

5.2 SWEEP GENERATOR OUTPUT

1. Connect Main Output to Channel 1 of oscilloscope and SWEEP Output to Channel 2.
2. Channel 2 displays linear saw-tooth waveform. SWEEP Output is available regardless of "SWEEP ON" switch. If WIDTH knob is pulled then LOG sweep will be available.
3. Adjust the Sweep Rate with Rate Knob. (Adjustable from 5S to 10ms).
4. Adjust the starting frequency as explained in Function generation.
5. PULL the Rate Switch to make SWEEP mode ON.
6. Channel 1 will display Sweep wave.
5. Adjust the sweep width with WIDTH knob. (1:1 to 1:100).

5.3 FREQUENCY COUNTER

1. Check the COUPLING switch position. The HF position is used for frequencies more than 100kHz. And LF position is used for the frequencies less than 100kHz.
2. The EXT COUNTER LED will be ON for when COUPLING switch is selected for counting mode.
3. Connect the signal to EXT COUNTER BNC.
4. Display will show the frequency and Hz / kHz LED's will light depending on the frequency.

5.4 VOLTAGE CONTROLLED FREQUENCY OPERATION

The Model 4003A can be operated as a voltage controlled generator by using an external control voltage applied to the VCF input.

1. Select the desired frequency range and waveform.
2. Set the starting frequency with the variable control. Apply a positive DC voltage to the VCF input to decrease the frequency. A voltage from 0 to +10V will cause the frequency to decrease by a factor of 100. For example, if the starting frequency is 100kHz, applying +10V will change the output frequency to 1kHz.

5.5 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 from the download section of the B&K Precision website www.bkprecision.com

Section 6

Maintenance

6.1 PREVENTIVE MAINTENANCE

Please follow the following preventive steps to ensure the proper operation of your instrument.

- Never place heavy objects on the instrument.
- Never place a hot soldering iron on or near the instrument.
- Never insert wires, pins or other metal object into ventilation fan.
- Never move or pull the instrument with power cord or output lead. Especially never move instrument when power cord or output lead is connected.

- Do not obstruct the ventilation holes in the rear panel. As this will increase the internal temperature.
- Do not operate the instrument with the cover removed unless you are a qualified service technician.
- Clean and check the calibration of the instrument on a regular basis to keep the instrument looking nice and working well.
- Remove any dirt, dust and grime whenever they become noticeable on the Outside cover with a soft cloth moistened with a mild cleaning solution.

6.2 SERVICE INFORMATION

Some of the common problems that may occur and the remedy to put back the instrument in a working condition as fast as possible are given below.

When the unit is not turning on.

Check if the power ON/OFF switch is turned ON. If not, then check the power cord. Please make sure that the power cord is properly connected to the unit. Please also check the main switch. And ensure that the AC supply at your site is the same as the one mentioned at the rear chassis of the unit. For further help call the service personnel.

6.3 FUSE REPLACEMENT

If the fuse blows, the LED will not light and the instrument will not operate. Replace only with the correct value fuse. The fuse is located on the rear panel adjacent to the power cord receptacle.

1. Remove the fuse holder assembly as follows:
2. Unplug the power cord from rear of the instrument.
3. Insert a small screwdriver in fuse holder slot (located between fuse holder and receptacle).

When reinstalling fuse holder, be sure that the fuse is installed so that the correct line voltage is selected.

6.4 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.

Section 7

Customer Support

B&K Precision offers courteous, professional technical support before and after the sale of their test instruments. The following services are typical of those available from our toll-free telephone number.

1-800-462-9832

- Technical advice on the use of your instrument.
- Technical advice on special applications of your instrument.
- Technical advice on selecting the test instrument for a given task.
- Information on optional accessories for your instrument.
- Information on instrument repair and re-calibration services.
- Replacement parts ordering.
- Availability on service publications.
- Information on other B&K Precision instruments.
- Information on other B&K Precision Catalog.

The name of your nearest B&K Precision Distributor.

Call toll free 800-462-9832
Monday through Thursday 8:00 A.M. to 5:00 P.M.
Friday 8:00 A.M. to 12:00 P.M.
Pacific Standard Time
(Pacific Daylight Time Summer)



Limited One-Year Warranty

B&K Precision Corp. warrants to the original purchaser that its product and the component parts thereof, will be free from defects in workmanship and materials for a period of one year from the date of purchase.

B&K Precision Corp. will, without charge, repair or replace, at its' option, defective product or component parts. Returned product must be accompanied by proof of the purchase date in the form a sales receipt.

To obtain warranty coverage in the U.S.A., this product must be registered by completing and mailing the enclosed warranty card to B&K Precision Corp., 22820 Savi Ranch Parkway, Yorba Linda, CA 92887 within fifteen (15) days from proof of purchase.

Exclusions: This warranty does not apply in the event of misuse or abuse of the product or as a result of unauthorized alternations or repairs. It is void if the serial number is alternated, defaced or removed.

B&K Precision Corp. shall not be liable for any consequential damages, including without limitation damages resulting from loss of use. Some states do not allow limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

This warranty gives you specific rights and you may have other rights, which vary from state-to-state.

Model Number: _____

Date Purchased: _____

22820 Savi Ranch Parkway
Yorba Linda, CA 92887
www.bkprecision.com



Service Information

Warranty Service: Please return the product in the original packaging with proof of purchase to the below address. Clearly state in writing the performance problem and return any leads, connectors and accessories that you are using with the device.

Non-Warranty Service: Return the product in the original packaging to the below address. Clearly state in writing the performance problem and return any leads, connectors and accessories that you are using with the device. Customers not on open account must include payment in the form of a money order or credit card. For the most current repair charges contact the factory before shipping the product.

Return all merchandise to B&K Precision Corp. with pre-paid shipping. The flat-rate repair charge includes return shipping to locations in North America. For overnight shipments and non-North America shipping fees contact B&K Precision Corp..

B&K Precision Corp.
22820 Savi Ranch Parkway
Yorba Linda, CA 92887

Email: service@bkprecision.com

Include with the instrument your complete return shipping address, contact name, phone number and description of problem.

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