



ELECTRO-TECHNIC PRODUCTS INC.

4642 N. RAVENSWOOD, CHICAGO, ILLINOIS 60640-4510

TELEPHONE: 1-773-561-2349

FAX: 1-773-561-3130

Model BD-10A /BD-10AS HIGH FREQUENCY GENERATOR PRODUCT NUMBER 11011 / 11031 INSTRUCTIONS



DESCRIPTION. The Model BD-10A and BD-10AS are hand-held units which generate a high voltage at a high frequency. **It is intended for intermittent use, no more than 10 minutes at a time.** It has an output of between 20,000 to 45,000 volts, at a frequency of approximately 500 kHz. When properly adjusted, when the electrode is held within $\frac{1}{4}$ to 1 in. (6 to 25 mm) from a metal object, a spark will jump to the metal. Current output of the spark is about 1 mA.

The Model BD-10AS (illustrated above) has a button on the side, which when pressed turns on the high voltage side of the coil. When it is depressed, the high voltage is turned off. The Model BD-10A does not have this feature.

Both models are a variation of the tesla coil. They have a primary coil which produces an output voltage of about 1200 V at the input line frequency, 50 or 60 Hz. This output voltage is interrupted by a vibrating contact, energized by this coil at twice the line frequency. The output voltage of this primary coil is connected to capacitors, which are then discharged into a high voltage coil.

The capacitance, resistance and inductance of this circuit is designed to oscillate, or ring, at a very high frequency, in this case 500 kHz. The output of this high voltage coil is adjustable by varying the distance of the vibrating contacts, which is user adjustable, by means of a knob on the end of the unit.

Applications include pinhole leak detection, as in the linings of tanks and other similar metal objects, and in plastic welds, where a test metal backing is applied. Other applications include ionizing a gas inside a lamp, neon sign, double-pane insulated window, pharmaceutical vial, or similar glass vessel where a deep vacuum is contained.

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Four models are available for different input voltages:

Model BD-10A, 115 V, 50/60 Hz, with 12101 Electrode Tip.

Model BD-10AV, 230 V, 50/60 Hz, with 12101 Electrode Tip.

Model BD-10AS, 115 V, 50/60 Hz, with Switch and 12101 Electrode Tip.

Model BD-10ASV, 230 V, 50/60 Hz, with Switch and 12101 Electrode Tip.

INSTALLATION. A standard tip electrode, Part No, 12101, illustrated above, but not below is included with each model. To install it, press it into the tip of the generator handle. To remove, grasp its base firmly, and with a gentle rocking motion, pull out from the generator tip. Never insert or remove the electrode while power is on.

Accessory Electrodes for the Model BD-10A/BD-10AS



These electrodes, plus the 12101 Standard Tip, are the only factory approved electrodes for the Model BD-10A/BD-10AS. No other electrodes should be used.

After the electrode is inserted, plug the power line cord into its matching receptacle, providing the proper voltage for the unit, either 115 V or 230 V.

OPERATION.

- 1) Turn the Output Adjustment Knob fully counterclockwise.
- 2) Turn the Output Adjustment Knob clockwise to adjust the voltage for the desired spark length. Hold the tip close to a metal object, to observe and adjust the length of the spark.

- 3) For pinhole detection of thick materials, the spark should be adjusted for near maximum length. For thinner materials, a shorter spark is desired. A one inch spark represents a peak voltage of approximately 50,000 volts. For materials less than 1/8 in. (3 mm), use the Model BD-40E or Model BD-60. For vacuum leak checking, an output near the maximum is usually required to ionize (glow) the gas inside the container.
- 4) Once the unit is adjusted, pass the electrode over the material being tested. The electrode can be passed directly over most materials, however, with thin linings or glass, keep the electrode no more than 1/8 in. above the surface being tested.
- 5) When the electrode passes over a pinhole, crack, or similar type flaw, observe a bright, concentrated spark jumping from the electrode to the metal, or similarly conducting surface below the lining or coating.



Do not use the Voltage Adjustment Knob as an "ON/OFF" switch for the high voltage, as this will prematurely wear this part. Never leave either model connected to the power line unattended. Remove from the power line when not in use. Use of a power strip with ON / OFF Switch is recommended.

If the output level of the Model BD-10A/BD-10AS is required to be verified when this instrument is in use, check the output with a Model 12701 Peak Voltage Calibrator, shown below.



THEORY OF OPERATION. The output of the Model BD10A/AS is adjusted by changing the gap between two contacts, one vibrating due to the magnetic pull and push from a coil, and the other connected to a screw with black knob at the end of the unit. The vibrating contact assembly consists of the contact, spring, and metal plug to which the magnetic field attracts and repels. The other contact assembly is held in place by a flexible spring connected to a shaft and the black control knob. Its position is determined by the adjustment, in or out, of the connecting shaft.

Both contact assemblies must make contact to energize both the magnetic and high voltage coils and capacitor, but must also allow this contact to break when the vibrating contact is pulled away by the attracting force portion of the alternately attracting/repelling magnetic field. This action of making and breaking these two contacts sets up an oscillation in the circuitry, generating the high voltage at a high frequency (of 500 kHz).

If the gap between the contacts is too large, no contact will be made, the circuits will not be connected; the unit will not generate the high voltage. If the adjusting shaft is turned clockwise too much, both contacts will be pressed together towards the magnetic coil, but the spring tension on the vibrating contact will be too great for the attracting magnetic field to overcome. Hence, the contacts will not break contact, and the unit will not produce the high voltage.

Once the contact gap is adjusted properly to make and break the connection between contacts, the distance can be adjusted, to a limited range, to vary the output of the voltage, the greater the gap the lower the voltage, and vice versa.

However, the gap distance is also affected by the pull of gravity of the metal plug of the vibrating contact, especially at the lowest output level. If, for example, if the unit is adjusted to resonate while the unit is held horizontally, if then positioned to point downward, the gap distance will increase, breaking the connection between contacts. If the unit is then held vertically upward, the gap distance decreases, making the connection again between the contacts.

For example, if the Model BD-10A/AS was set for an output voltage near the low range of operation, at the horizontal position, it might have an output of 23 kV, but be intermittent, cutting out on occasion, if held with the switch pointing down, and continuous if the switch was held upright. When held pointing down, the unit might no longer generate an output. When held pointing up, the unit might generate a voltage of 27 kV, with a continuous output.

Normally, units should be adjusted to function in the orientation in which it is used, or adjusted to operate at the higher output level, where the orientation issue is not as much a problem.

Alternately, the Model BD-50E is recommended. The vibration contacts are inside a power control unit, and are always horizontal when the power control unit is placed on a horizontal surface. The high voltage coil is held in the black-plastic housing. It can be held in any position without affecting the position of the contact gap. In fact the contact gap is factory set for optimal performance, and the output is changed by a 9-step switch, with positions marked on the power control unit front panel. This also makes the calibration of this unit more positive, and repeatable, then the Model BD-10A/AS.

For voltage ranges below 20 kV, another option is the Model BD-40E. It uses solid-state circuitry, instead of vibrating contacts to adjust the voltage and set up the circuit oscillation, producing the high voltage, 2 kV to 20 kV, at 500 kHz.



SAFETY PRECAUTIONS. It is used in industrial applications for pinhole leak detection, and to ionize a gas inside a lamp, neon sign, vial or similar device to determine whether a good vacuum is being held inside the device. It is also used as a lamp starter, principally in printing industry.

Only factory approved electrodes should be used. No other electrodes should be used with this device.

Never touch or come in contact with the high voltage output of this device, nor with any device it is energizing.

Since its output is 500 kHz, it radiates its energy for a short distance. It may interfere with sensitive electronic devices near by. If a user is wearing a pace maker or similar device, their physician should be contacted prior to using this device. The same should be said for women who are pregnant.

Also, a small amount of ozone gas is generated as a by-product. Use in a well-ventilated area.



Special Notice Regarding CE Marking. The Model BD-10AV/BD-10ASV generates a high voltage corona of approximately 500 kHz. However by the very nature of its design, it will produce electromagnetic interference (EMI) as a result of its operation.

Electric arc welders, for example, are another product that by its very nature and mode of operation produces EMI.

As a result, the Model BD-10AV/BD-10ASV cannot meet the European Union Electromagnetic Compatibility (EMC) Directive 89/336/EEC, and cannot be CE marked.

It does, however, meet EN61010-1:1993 Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use, following the provisions of the Low Voltage Directive 73/23/EEC, as amended by 93/68/EEC

Because of the risk of EMI, a risk assessment should be carried out prior to use of this equipment.

The power output of the Model BD-10 is limited. The effective range of EMI is less than about 1 meter on so in all directions. Metal objects nearby may bend or deflect this radiation. Therefore, there is some risk that it might interfere with electronic equipment 1 meter or so from this apparatus. This might include telephones, computers, cell phones, for example. Operators who wear pacemakers may also wish to consult with a physician prior to using this equipment.

If interference with equipment is detected, move the Model BD-10 further away, or schedule its operation when the affected equipment is not in operation. Consult plant safety personnel regarding its use.

If you should have any further questions, contact Electro-Technic Products, Inc. for additional technical assistance.

REPAIR. There are no user serviceable parts inside the unit. In the event that the unit requires service, send it back to the factory. However, parts are available separately, so an **experienced electronics technician** can make repairs. The following troubleshooting guide is furnished:

Disassembly Instructions:

With the power removed from the unit, remove the electrode tip, and then remove the 10-32 hex nut by using the special 5/16 in. nut driver, P/N 049-0025-1. Then remove the top half (smooth cone portion) of the plastic housing by turning it counterclockwise.

Turn the black adjusting knob counterclockwise and remove it by holding the brass adjusting screw with the special 3/16-in. wrench, P/N 049-0026-1 and turning the knob counterclockwise. Save the plastic and fiber washers. The number of washers may vary from one unit to another.

On each side of the adjusting screw are two metal screws covered by wax. Remove and save the wax, and remove the screws.

Slide the rear plastic housing back and expose the internal parts of the unit. During this operation, for the Model BD-10AS, pull the black plastic button up to avoid interference while the housing is being removed.

Troubleshooting:

Observe the adjusting screw for worn threads. Replace if this is observed. Note that on Model BD-10A (unit without switch), some customers incorrectly use the adjusting knob as an "ON/OFF" switch. This practice prematurely wears out the threads. Customers must be warned not to do this, but do use a power strip or similar device to turn the unit on and off.

Next observe the contacts. They must be aligned to each other's center as much as possible, and must be corrosion and burn-spot free. If corrosion or burn spots are observed, clean with a fine file, or replace. Make sure the bottom contact has enough room on the bottom, so that when the top spring is pushed against it, the bottom contact does not get pushed into the molded spool core.

Use a multimeter to check the power cord for any broken wires. Replace if it is found that the customer has used tape to cover frayed insulation.

Check the magnet coil for broken wire leads. Use an ohmmeter to measure the resistance of the magnet coil. If the coil resistance is zero (open), replace it.

Check the yellow capacitor using an ohmmeter. Check for broken leads. If power is applied to the unit, and it makes a knocking sound (from the armature bottom spring making contact with the spool core), but there is no output, the capacitor is bad. Replace it if any of these conditions are present.

Use an ohmmeter to check the resonator coil. If no resistance, check for broken lead wires, or replace the resonator coil. If the unit is powered, and arcing is observed inside the resonator coil, replace it. If the unit works Okay, but has a weak output, the resonator coil is defective. Replace the resonator coil if any of these conditions are present.

The Model BD-10AS has a microswitch to turn power on and off to the resonator. Check the switch for broken wire leads. If leads are Okay, test the switch for continuity with a multimeter. Replace if bad.

If the unit is working, but the output is reduced, check the resonator coil, the capacitor, and the contacts.

Assembly Instructions:

For the Model BD-10AS, make sure the microswitch aligns with the pushbutton.

Install the plastic housing, 10-32 nut, and screws to the proper position.

To avoid a potential shock hazard, cover the screws with wax as before.

Install the adjusting knob on the adjusting screw. Turn the knob clockwise until the unit turns on. Turn the knob clockwise until it shuts off. Back up the knob until the unit turns on again. Remove power from the unit and install the plastic or fiber washers into the space between the plastic housing and the adjusting knob. Tighten the knob securely.

The unit should sound smooth when turned on. If the adjusting knob is turned too far into the unit, a loud vibration will be heard, the output will be high. If left in this position, the internal parts will begin to burn up. Back off the knob to the position which has a smooth sound.

If the contacts were replaced, the number of adjusting washers may vary with what was used before contact replacement. If the contacts were not replaced, the same number of adjusting washers can be used.

REPAIR PARTS. The following are repair parts for the BD-10 models. Contact Electro-Technic for price and availability. These parts can be ordered on-line from our e-commerce section of our web site.

Part Number	Description
12101	Electrode Tip
002-0005-1	Nut, 10-32, Hex, for Electrode Socket
011-0008-1	Magnet Coil, Model BD-10A, 115 V
011-0009-1	Magnet Coil, Model BD-10AV, 230 V
011-0010-1	Magnet Coil, Model BD-10AS, 115 V
011-0011-1	Magnet Coil, Model BD-10ASV, 230 V
011-0018-1	Magnet Coil, w/Capacitor & Spool Head
011-0024-1	Resonator Coil
021-0003-1	Capacitor, 0.1 uF, 1000 V
029-0012-1	Micro-Type Switch, BD-10AS Models
035-0001-1	Bridge w/Posts, Ratchet Spring, Adjusting Screw (Top Assembly)
035-0003-1	Top Spring Rivet Contact Assembly
035-0007-1	Armature Assembly
035-0011-1	Adjusting Screw Assembly
040-0030-1	Bridge Yoke & Bushing
044-0003-1	Top Housing, Cone, Models BD-10A, BD-10AS
044-0004-1	Bottom Housing, Model BD-10A
044-0005-1	Adjusting Knob
044-0017-1	Cord Clamp
044-0018-1	Bottom Housing, Model BD-10AS
044-0027-1	Molded Switch Base, BD-10AS Models
044-0028-1	Molded Button, BD-10AS Models
044-3007-1	Molded Spool Core, BD-10A Models
044-3031-1	Molded Spool Core, BD-10AS Models
045-0003-1	Electrode Socket
049-0025-1	Nut Driver, 5/16 in.
049-0026-1	Wrench, Small, 3/16 in.
050-0037-1	Tungsten Screw Contact
051-0001-1	Teflon-Type Spacer, Electrode Tip
060-0002-1	Line Cord Set, 3 Conductor, 115 V
060-000X-1	Line Cord Set, 3 Conductor, 230 V, Specify Type
070-0004-1	Carton, Packing, with Inserts
083-0001-1	Housing, Bakelite, Complete, BD-10A Models
083-0011-1	Housing, Bakelite, Complete, BD-10AS Models