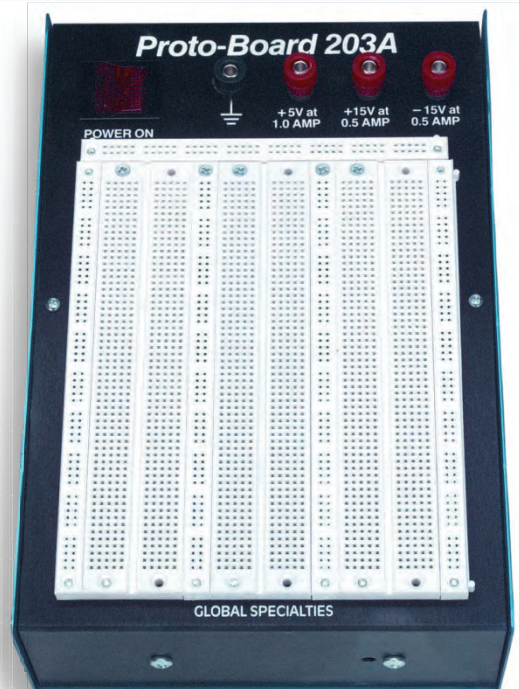


# PB-203A

## Powered Proto-Board Instruction Manual



Revision: 2/2012



## FEATURES & APPLICATIONS

The PB-203A is a durable powered breadboard capable of being used to design a multitude of analog, digital, logic and microcomputer circuits. The PB-203A's on-board power supply eliminates the need for an external supply, adding more versatility to circuit design and experiments, as well as saving valuable bench space by eliminating the need for an external prototyping power supply. Due to its ample sized breadboarding area, the PB-203A is ideally suited for virtually any type of breadboarding circuitry, from TTL, CMOS and ECL, to op-amps, audio, comparators, video amps, microprocessor components, phase locks and more. Use the PB-203A to construct a wide variety of experiments, including but not limited to.

- Opto-Device Circuits
- Clocks
- Multivibrators
- Oscillator Circuits
- Timers
- Function Generator Circuits
- Logic Circuits
- Gates
- Counters
- Flip-Flops
- Analog-to-Digital Converters
- Digital-to-Analog Converters
- Medium Scale Integration Circuits
- Phase Lock Loops
- Operational Amplifiers

## ABOUT GLOBAL SPECIALTIES

Thank you for selecting the Model PB-203A. Since 1973, Global Specialties has been the recognized leader in technical education courses, training equipment and tutorial materials. Our electronics and microcomputer teaching systems have proven to be effective in secondary schools, technical schools, colleges, universities and industrial training departments throughout the world.

We have been leaders in the development of integrated teaching systems and completely packaged courses, which include everything required for effective instruction. Experienced professionals and educators have written comprehensive textbooks, laboratory manuals, and instructor guides in a non-intimidating style specifically for use with our equipment. Each course is designed to make selections appropriate for a variety of educational levels and course goals

The central concept upon which we base our entire product line is education through application. We believe that relevant scientific and technical education is best when it involves permitting students to learn by doing.

Global stands behind its products by offering the industry's best warranties. The PB-203A comes with a full, three-year, parts and labor warranty and can be returned for prompt repair or replacement to our factory in Yorba Linda California.

Low per-student cost, durable and trouble-free hardware and proven tutorial materials combine to make technical and scientific courses from Global Specialties the most effective, economical way to upgrade your lab & curriculum.

Please visit to explore the many options available for the PB-203A, such as pre-formed jumper wire kits, test probes and prototyping accessories.

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## SPECIFICATIONS

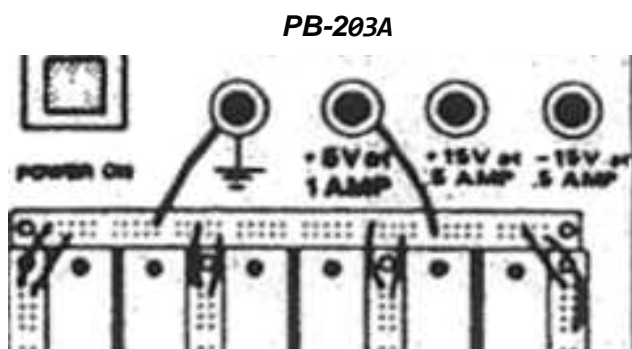
<b>Input Power Source</b>	108 to 130VAC @ 60Hz
<b>Power Supplies</b>	<p><b>Fixed:</b> +5V +/-0.2VDC, 1.0A max, current limited Load Regulation better than 0.8% +/- 0.02%/°C Ripple, &lt;4mVp-p @ 1A</p> <p><b>Fixed:</b> +15VDC Load Regulation better than 1% +/- 0.04%/°C, Ripple less than 10mVp-p @ 0.5A</p> <p><b>Fixed:</b> -15VDC Load Regulation better than 1% +/- 0.04%/°C Ripple less than 10mVp-p @ 0.5A</p>
<b>Binding Posts</b>	<p>(1) Black: Chassis Ground</p> <p>(3) Red: Power Supply Outputs +5VDC, +15VDC &amp; -15VDC</p>
<b>Breadboards</b>	2250 Tie points with (8) 100 pin and (2) 80 pin power rails and accommodates up to 24 (14 pin) IC's
<b>Weight</b>	5lbs, 5oz
<b>Dimensions</b>	9.8" x 6.6" x 3.3"

## OPERATING INSTRUCTIONS

Uncoil the power cord and plug the PB-203A into a 115V AC 60 Hz outlet. Push the power switch on. The power supply bank is now active, providing +5 Volts at 1 Amp for digital circuitry, and +15 and -15 Volt supplies at 0.5 Amp for linear and op-amp circuitry. All supplies are regulated and current limited for maximum performance and safety. The black binding post is common ground to all power supplies.

### POWER DISTRIBUTION AND JUMPER WIRES

Ten distribution buses (solderless breadboard strips) are provided on each PB-203A. They include two horizontal buses with 40 contacts (80 total tie points) each and eight vertical buses with 50 contacts each (400 total tie points). One possible power distribution scheme for a single power supply is shown in Figure 1.



**FIGURE 1. Power Distribution**

The jumper wires should be #22 gauge solid hook-up wire. Global suggests that the insulation on the jumper wires be stripped 1/2" to 3/8" from each end to ensure easy insertion into the solderless breadboards. After you've built up a few circuits, you'll have a good collection of pre-stripped jumper wires. Pre-formed wires in various sizes are also available from Global Specialties (please visit web site for available options and accessories).

### COMPONENT INSERTION

ICs are mounted by lining up the leads with the contact holes on each side of the center of the solderless breadboard, then pressing gently at the center of the IC until it clicks into position. Withdrawing the IC can be tricky. You should use a thin-bladed screwdriver, IC puller. Slide the end of the screwdriver blade under one end of the IC and lift gently. Repeat on the other side, then remove the IC from the socket. By following this procedure, you will not bend the delicate leads of the IC.

T0-5 case ICs can be inserted by pre-forming the leads with a set of long nose pliers, so the leads resemble a DIP pack.

Transistors can be inserted bridging the center of the breadboard or with leads-in-line on one side of the socket.

Diodes, resistors, and capacitors may be inserted in the same manner as jumper wires.

## BROKEN WIRES

Sometimes a wire will break off at the surface of a breadboard contact hole. Two ways of solving this problem are as follows:

1. Push the broken wire into the socket. This will not affect the operation of the contact.
2.
  - a) Remove the 4 screws on the bottom of the case
  - b) Remove the 2 flathead screws located on the black top surface of the PB-203A.
  - c) The top and bottom case halves can now come apart.
  - d) Remove the screws holding the sockets to the top cover.
  - e) Unsnap the sockets. Remove the vinyl label from the socket containing the broken wire (a heat gun or hair dryer may be required to remove label).
  - f) Remove the terminal by inserting a round, stiff .025 pin into one of the unblocked holes. (A small paper clip, bent open, will also work.)
  - g) Force the terminal completely out of the socket.
  - h) Remove the broken wire, then replace the terminal. Be sure to press down firmly.
  - i) Replace the vinyl label, snap the sockets together, and remount them on the cover.

*NOTE: DO NOT TIGHTEN SCREWS TOO MUCH OR YOU MAY STRIP THE THREADS IN THE PLASTIC BODY.*



## POWER SUPPLIES

Each power supply of the PB-203A is regulated using a 7805 or a 7815 voltage regulator. This circuit provides the plus and minus 15 Volt rail voltages, as well as the 5V supply available for use in breadboard experiments. Figure 2 shows the circuit diagram of the PB-203A.

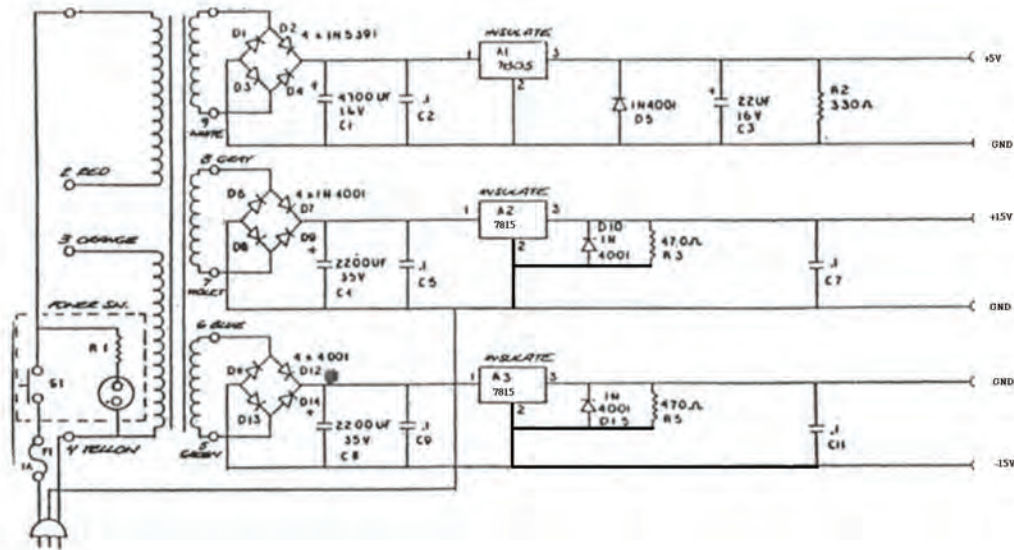


FIGURE 2. Schematic Diagram

## USING THE PB-203A

The PB-203A is ideally suited for virtually any type of bread-boarding circuitry, from TTL, CMOS and ECL, to op-amps, audio, comparators, video amps, microprocessor components, phase locks and more. In order to get the most out of your breadboarding experience, the following guidelines and tips should be observed.

**Ground Loops:** A ground loop is a Voltage drop on a ground bus, caused by a power stage output ground, when entering the ground bus some distance away from the power supply ground binding post. Although this Voltage drop may only be in the millivolts or microvolts, it's part of the output load. If a preamplifier input or circuit ground is connected to a portion of this ground bus, feedback and oscillation can occur. This issue can be resolved by positioning all output stages closest to the ground terminal, with pre-amps further away.

By observing this simple rule, you will save hours of troubleshooting. Many audio ICs have separate input and output grounds to prevent ground loops.

**By-Pass Capacitors:** Even though the PB-203A's power supplies are tightly regulated, even a short length of power bus can cause a linear IC to break into oscillation at high frequencies due to increased inductance. This increased inductance can be offset by adding simple by-pass capacitors. By-pass capacitors (0.1pF ceramic disk type will be sufficient) should by-pass the power buses as close to the ICs power supply pins as possible. Utilize this technique for each IC.

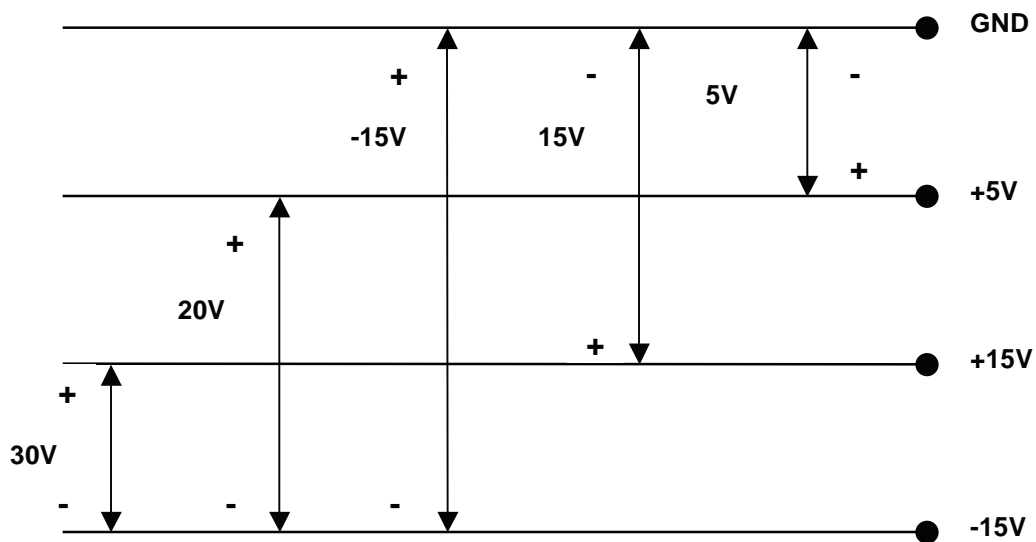
Do not use electrolytic or paper capacitors as power bus by-pass capacitors. They have high inductances, and become unreliable as by-passes above 1MHz.

Good by-passing should also be used with digital ICs to prevent the inability to reset or clear, and false triggering.

## COMBINING POWER SUPPLIES

The PB-203A can be configured in 2 additional voltage configurations beyond the 3 available fixed supply voltages. (See figure 3 below)

1. 30V Supply. By adding the 15 Volt supplies we can produce a 30 Volt supply at 0.25 Amps. This configuration requires that the load be placed across the +15 Volt terminal and the -15 Volt terminal.
2. 20V Supply. The +5 V supply can be added to the -15 V supply to make a 20 V supply. This configuration will require that the load be placed across the -15 Volt terminal and the +5 V terminal.



**FIGURE 3. Power Supply Combinations**

## **BREADBOARDING TECHNIQUES**

This section contains information, which may prove useful when constructing circuits using the PB-203A. While there are no hard and fast rules for breadboarding, the following tips may save time and trouble.

Unless a circuit is being prepared for a demonstration or display, avoid cutting component leads very short. While short wires and leads may look neat, the clipped components will only fit into a limited "span" of connector sockets, limiting the use of the component. It is perfectly permissible to use untrimmed components while exploring different circuit possibilities. The only time short leads may be necessary is when operating at higher frequencies and experiencing mysterious malfunctions. Sometimes the only way to correct high frequency circuit problems is to shorten all circuit connections.

Be cautious when using components which have been removed from a tape reel used in automatic insertion equipment. Suppliers of surplus components often sell components which are taped together in small batches. Removing the components from the tape does not always remove the adhesive from the leads of the components. Placing a formerly taped component into a socket connector may result in a poor electrical connection and, worse still, leave tape adhesive in the socket. Avoid this problem by either carefully cleaning taped component leads, clipping the taped portion of the lead off, or avoiding the use of taped components altogether.

Be especially careful when inserting integrated circuits into the breadboard sockets. Unless the IC pins are straight, it is very easy to crush the pin into a zigzag shape or fold the pins underneath the body of the IC. Either way the result is a bad connection or no connection at all.

Always use solid wire for breadboard connections. When stripping the wire ends, be careful not to strip more than about three-eighths of an inch of insulation from the wire. Too much bare wire may result in unintentional connections near the wire end.

After you have built up a few circuits, you will have a good collection of pre-stripped jumper wires. Save them. By reusing these wires, you can save even more time and effort in assembling future circuits. Pre-formed wires in various sizes are also available from Global Specialties (please visit web site for available options and accessories).

## SERVICE AND WARRANTY INFORMATION

For instructions on how to obtain a return merchandise authorization number (RMA), please visit our website, or call our customer service department.

Global Specialties will service and repair this instrument free of charge for a period of 3 full years, subject to the warranty conditions below.

### WARRANTY

Global Specialties warrants the PB-203A to be free from defective material or workmanship for a period of 3 full years from date of original purchase. Under this warranty, Global Specialties is limited to repairing the defective device when returned to the factory, shipping charges prepaid, within 3 full years from date of original purchase.

Units returned to Global Specialties that have been subject to abuse, misuse, damage or accident, or have been connected, installed or adjusted contrary to the instructions furnished by Global Specialties, or that have been repaired by unauthorized persons will not be covered by this warranty.

Global Specialties reserves the right to discontinue models, change specifications, price or design of this device at any time without notice and without incurring any obligation whatsoever.

The purchaser agrees to assume all liabilities for any damages and/or bodily injury which may result from the use or misuse of this device by the purchaser, his employees, or agents.

This warranty is in lieu of all other representations or warranties expressed or implied and no agent or representative of Global Specialties is authorized to assume any other obligation in connection with the sale and purchase of this device.

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