Z1203A
Active Antenna Power Coupler/DC Injector

Assembly and Operation Manual



Revised 14 September 2010

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Model Z1203A Active Antenna Power Coupler

Revised 14 September 2010

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Warranty

This warranty is effective as of the date of first consumer purchase.

What is covered: During the ninety (90) days after date of purchase, Clifton Laboratories will correct any defects in the Z1203A due to defective parts or workmanship (if purchased as an assembled unit) free of charge (post-paid). You must send the unit at your expense to Clifton Laboratories, but we will pay return shipping. Clifton Laboratories' warranty does not extend to defects caused by your incorrect assembly or use of unauthorized parts or materials or construction practices.

What is not covered: If the Z1203A is purchased as a kit, this warranty does not cover correction of assembly errors or misalignment; repair of damage caused by misuse, negligence, or builder modifications; or any performance malfunctions involving non-Clifton Laboratories accessory equipment. *The use of acid-core solder, water-soluble flux solder, or any corrosive or conductive flux or solvent will void this warranty in its entirety.* Whether purchased as an assembled unit or as a kit, also not covered is reimbursement for loss of use, inconvenience, customer assembly or alignment time, or cost of unauthorized service.

Limitation of incidental or consequential damages: This warranty does not extend to non-Clifton Laboratories equipment or components used in conjunction with our products. *Any such repair or replacement is the responsibility of the customer. Clifton Laboratories will not be liable for any special, indirect, incidental or consequential damages, including but not limited to any loss of business or profits.*

Under no circumstances is Clifton Laboratories liable for damage to your equipment connected to the Z1203A resulting from use of the Z1203A, whether in accordance with the instructions in this Manual or otherwise.

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Safety Information

The Z1203A operates with a user-supplied DC power supply of 12 to 14 Volts. The Z1203A's purpose is to couple this DC voltage to an active antenna over a coaxial cable. By design, therefore, one side of the Z1203A has +12V on it. If inadvertently connected to a receiver or similar device, excess current may flow and damage the receiver or other device. It is the user's responsibility to ensure that the Z1203A is properly connected to the remote active antenna and the receiver.

The Z1203A has no replaceable fuses; rather a self-resetting polyfuse limits short circuit current to approximately 200 mA.

The Z1203A is designed to be used only with receive-type power levels. It should not be used to inject DC voltage into a transmitting system. *Transmit power levels may damage the Z1203A or equipment connected to it, or both.*

Although the Z1203A has several protective features, these are intended to reduce, not prevent, damage from catastrophic events, such as nearby lightning damage. The user always remains responsible for following good engineering practices with respect to antenna design, installation, lightning protection and grounding. Clifton Laboratories recommends that remote antennas be disconnected from the Z1203A except when actually in use and that under no circumstances should the Z1203A be connected to a remote antenna or preamplifier or used when there is a possibility of nearby lightning.

General Information and Specifications

Description

The Z1203A Active Antenna Power Coupler provides a way to couple or inject DC power into a coaxial cable so as to power remote devices, such as Clifton Laboratories' Z1501C Active Antenna.



The Z1203A has two RF connections:

- ACTIVE ANTENNA—the port to be connected to the device requiring remote power. This port has the RF signal from the active antenna plus DC power on it when the output is enabled. The shell is connected to the enclosure and hence the ground stud.
- RECEIVER—the port to be connected to the receiver. This port has RF signal and no DC voltage. It is isolated from the enclosure and ground.

In addition, the Z1203A has power input and control connectors and a ground stud:

- DC IN—a standard 5.5/2.1 mm coaxial power connector. DC power is supplied to the Z1203A through this connection. A maximum of 200 mA may be sourced to the remote device.
- TX PWR CTRL—the Z1203A's DC output to the remote active antenna or preamplifier can be turned on/off through this port, a standard RCA connector. Jumper JP1 on the printed circuit board selects between two control modes:
    - Mode 1: Ground on the TX PWR CTRL port enables the output; +12V on the control port disables the output. To bypass the control feature and enable the output at all times, select Mode 1and make no connection to the control connector.
    - Mode 2: +12V on the TX PWR CTRL port enables the DC voltage output; ground on the control port disables the output.
- Ground Stud: A 4-40 threaded connector with thumb nut for station ground.

DC power input to the Z1203A is indicated by the green LED under the front panel's "POWER" legend. There is no power on/off switch.



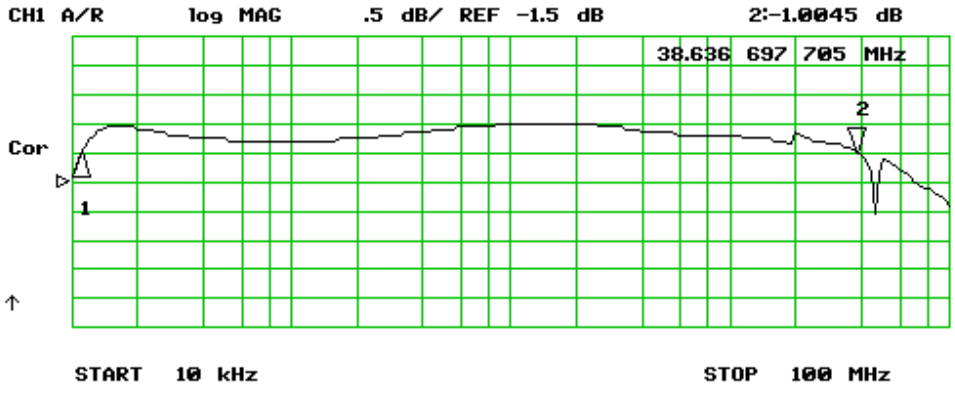
Specifications

Parameter	Value
Dimensions	(Width, Depth, Height) Approx. 3.75" x 4.5" x 1.62 inches, (95mm x 115mm x 42mm) powder coated, silk screened steel enclosure, excluding extensions for BNC connectors, DC power connector, feet and LED. Weight approx. 8 ounces (225 grams).
DC Ratings	Voltage not to exceed 15V, negative to ground. Current to remote device not to exceed 200 mA. Current consumption approx. 25mA plus current supplied to remote device
Maximum RF Power	The Z1203A is designed to be used with typical receiver power levels and should not be used to inject DC voltage into a transmitting circuit.
Frequency Range	20 KHz – 30 MHz; usable to 10 KHz - 100 MHz
Insertion Loss	1.0 dB typical over range 20 KHz – 30 MHz; not to exceed 2 dB over this frequency range.
Protective Measures	Gas trap on active antenna input; reverse voltage protection; automatic resetting overload fuse and over-voltage MOV.

Typical Insertion Loss versus Frequency

The figure below shows the measured composite insertion loss for a Z1203A DC Power Coupler and Z1501C Active Antenna over the frequency range 10 KHz to 100 MHz (log frequency horizontal axis). Due to component tolerance and assembly practices, this performance should be regarded as typical, not guaranteed. The plot scale is 0.5 dB/division with the center horizontal graticule line (identified with the ▷ symbol at the left) indicating -1.5 dB.

The "N Stimulus val" data at the bottom of the plot identifies the data markers, their associated frequency and the insertion loss at that frequency. (The particular piece of test equipment used to collect this data uses spaces to separate 1,000 units. Hence 38.636 697 707 MHz is more often displayed as 38.636697707 MHz.)

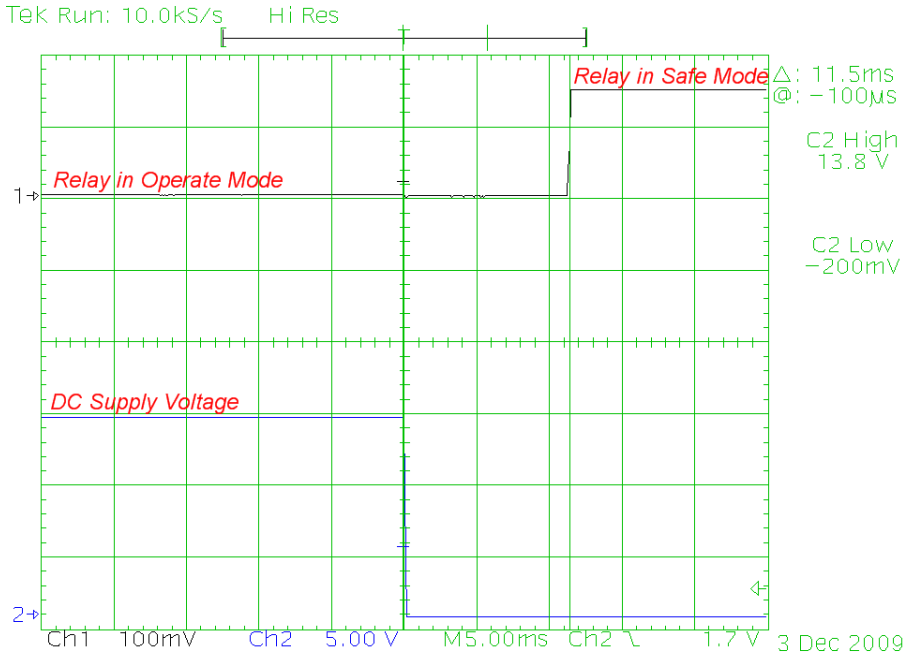


Improvement in Relay Switching Time with Active Pull Down

The Z1203A is equipped with "Active Pull Down" which shunts a low value resistance across the Active Antenna port when the TX PWR CTRL input is in disable mode. (The resistance is connected after the RF isolation circuitry so it only shunts DC.) Active pull down discharges filter and bypass capacitors in the remote device faster than simply switching the DC source into high impedance disconnect mode. For remote devices with an input disconnect relay (such as Clifton Laboratories Z10040B and Z10042A Norton amplifiers and its Z1501D Active Antenna) the faster the DC supply voltage bleeds down, the shorter the time required for the remote device to switch to "safe" mode where the input is disconnected. Safe mode is intended to prevent damage due to strong RF signals when the remote device is used in conjunction with transmitting equipment, such as a typical amateur radio installation.

To demonstrate the improvement the time required to switch the remote device relay into "safe" or disconnect mode, Clifton Laboratories Z10040B Norton Amplifier is used as an example.

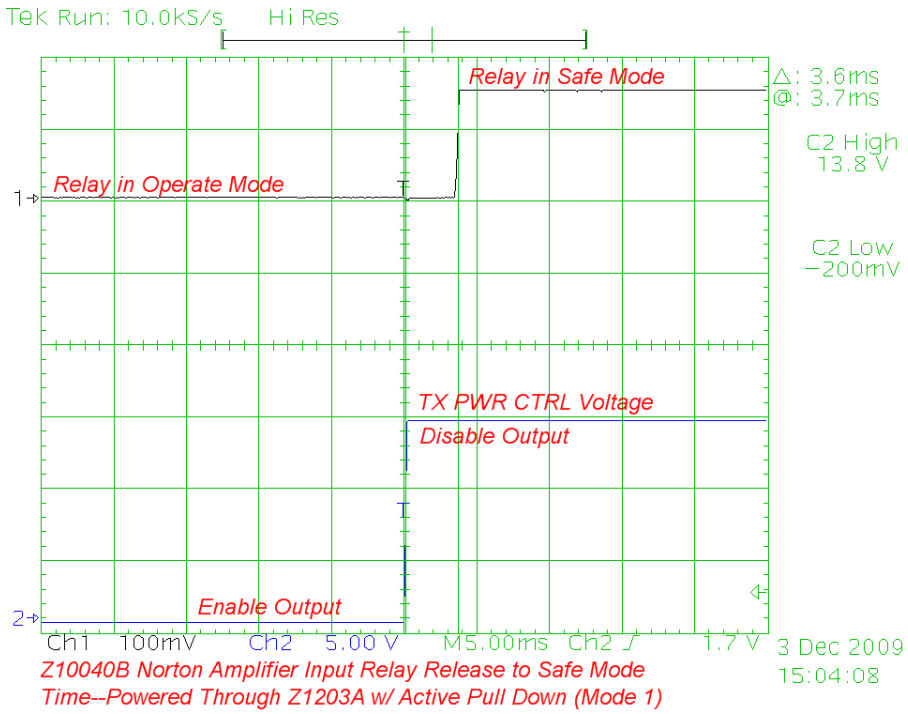
The oscilloscope capture below shows that if power is simply removed from the Z10040B Norton Amplifier, approximately 11.5 milliseconds elapses between power removal and the protective input relay switching to safe mode. This measurement is taken with a diode isolated DC power supply to simulate the effect of a regulator providing isolation to reverse current flow.



Z10040B Norton Amplifier Input Relay Release to Safe Mode Time

When the Z10040B is powered through a Z1203A (configured for Mode 1 control in this example, although the same results hold for Mode 2 as well), the relay is placed into safe mode 3.6 ms after the disable command is asserted on the Z1203A's TX PWR CTRL line. The Z1203A's active pull

down feature thus provides a significant improvement in the time required to switch to safe mode over simply removing DC voltage from the Z10040B.



Installation and Use

Receiver Level Only – Not for Transmitting Power Levels



It is critical to remember that the Z1203A is intended to operate with receive signal levels and should, under no circumstances, be connected to a transmitter or a transceiver's output. Transmitting into the Z1203A will cause damage that is not covered under the warranty and may also damage any remote equipment to which it is connected.

Power Supply Quality

Noise on the DC power supply may be coupled into the remote active antenna or remote preamplifier. A low noise power supply, which will almost inevitably be of analog, not switching, design, should be used. An excellent discussion of the care required in designing a low noise DC power supply to be used with an active antenna can be found in "The AMRAD Active LF Antenna," QST, p 34, September 2001. The complete text of this article is available on the American Radio Relay League's web site at http://www.arrl.org/tis/info/pdf/0109031.pdf.

Common Mode Choke

In many cases, noise from computers, switching power supplies and other electronic devices can be picked up in the radio room and carried over the coaxial cable braid to the active antenna, where it couples into the active antenna input. A common mode choke installed near the active antenna can be beneficial in reducing this type of noise. For more details, consult the Z1501C Active Antenna manual.

Grounding, Disconnecting and Lightning



Although the Z1203A has protective measures incorporated in its design, a nearby lightning strike, let alone a direct hit, will cause damage to the Z1203A and equipment to which it may be connected. You should take the following safety precautions:

1. Do not operate the Z1203A when there is a risk of lightning. Disconnect the remote active antenna or remote preamplifier cable from the Z1203A.
2. When not actually using the Z1203A, disconnect the remote active antenna or remote preamplifier cable from the Z1203A.

Do you need Remote Power Control?

Before using the Z1203A, decide whether you will use the remote power control feature. Remote power control enables the Z1203A to remove DC voltage from the remote active antenna or amplifier when a control signal from a transceiver or transmitter is applied. If the active antenna has relay disconnect upon power off features (as does Clifton Laboratory's Z1501D Active Antenna and its Z10040B snf Z10042A Norton amplifiers), removing DC voltage places the remote device in "safe" mode reducing the chance of damage due to strong RF signals that might be induced by a nearby transmitter. The guidelines for deciding whether remote power control is necessary are:

You do not need remote power control if:

- If you are a shortwave listener and do not transmit.

- If you are an amateur radio operator but use low power (10 watts or less)
- If you are an amateur radio operator transmitting > 10 watts up to 1.5 KW output if your active antenna is located sufficiently far from your transmitting antennas. Sufficiently far is difficult to define categorically, but separation between the active antenna and the transmitting antenna of 150 feet (45 meters) or more is usually adequate.

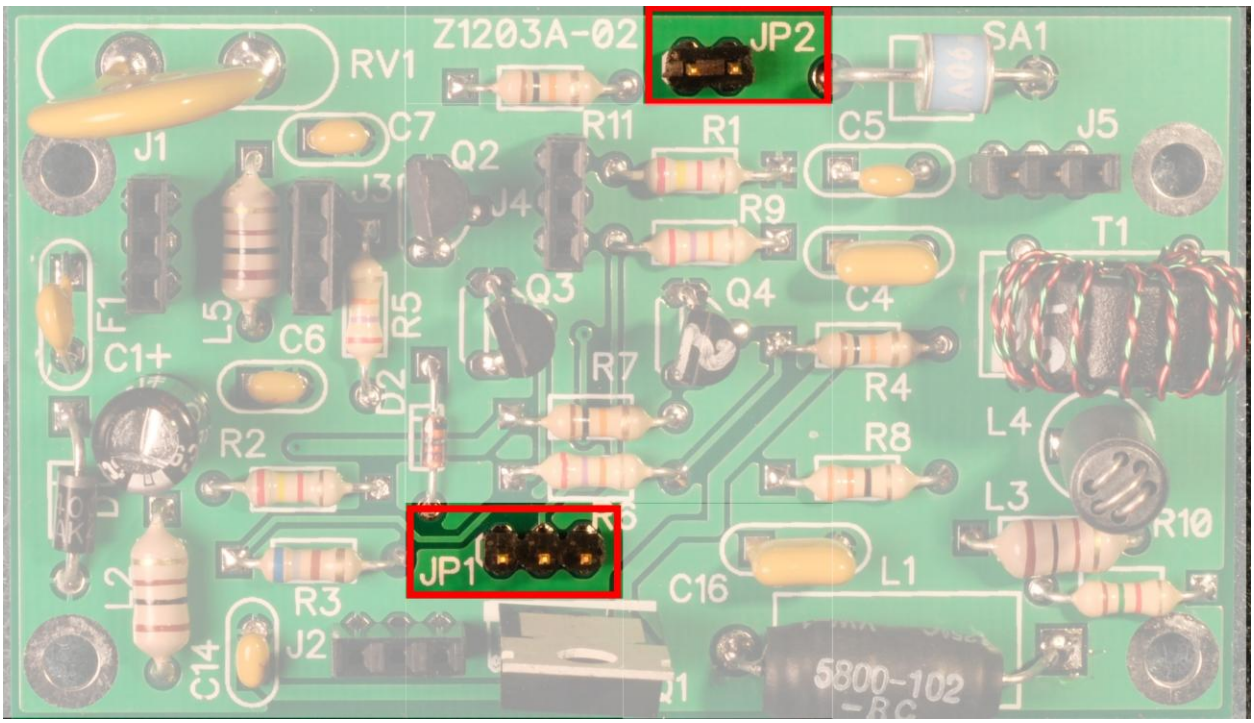
You should consider using remote power control if your installation does not meet one of these three categories. In this case, the choice of Mode 1 or Mode 2 will be determined by the control voltage available from your transceiver.

If you do not need to use remote power control, set jumper JP1 for Mode 1. JP2 should be disabled. No connection need be made to the TX PWR CTRL port to place the Z1203A into continuous DC power enable.

Setting the Mode Jumpers

Remote power control configured by moving a jumper (JP1) on the Z1203A's printed circuit board to one of two positions, Mode 1 and Mode 2. In Mode 2, jumper JP2 permits enabling a 10K "pull up" resistor. Both jumper settings are easily reconfigurable if your plans change.

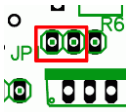
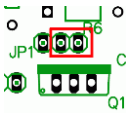
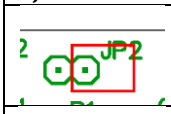
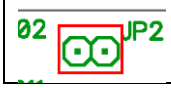
If necessary, remote the four sheet metal screws securing the Z1203A's enclosure top to access the printed circuit board. Jumper JP1 is located near the PCB's front adjacent to the large power tab transistor Q1. Jumper JP2 is located near the back of the printed circuit board.



Movable "shunts" are provided for both JP1 and JP2. To remove the shunt, pull it up with long nose pliers. JP1's shunt may be placed in either of two positions to select Mode 1 or Mode 2, as detailed

in the illustration and table below. If the pull up feature is not used, JP2's shunt may be stored by slipping it onto one one of JP2's pins.

The mode and jumper summary below is reproduced on a card attached to the inside of the Z1203A's top cover.

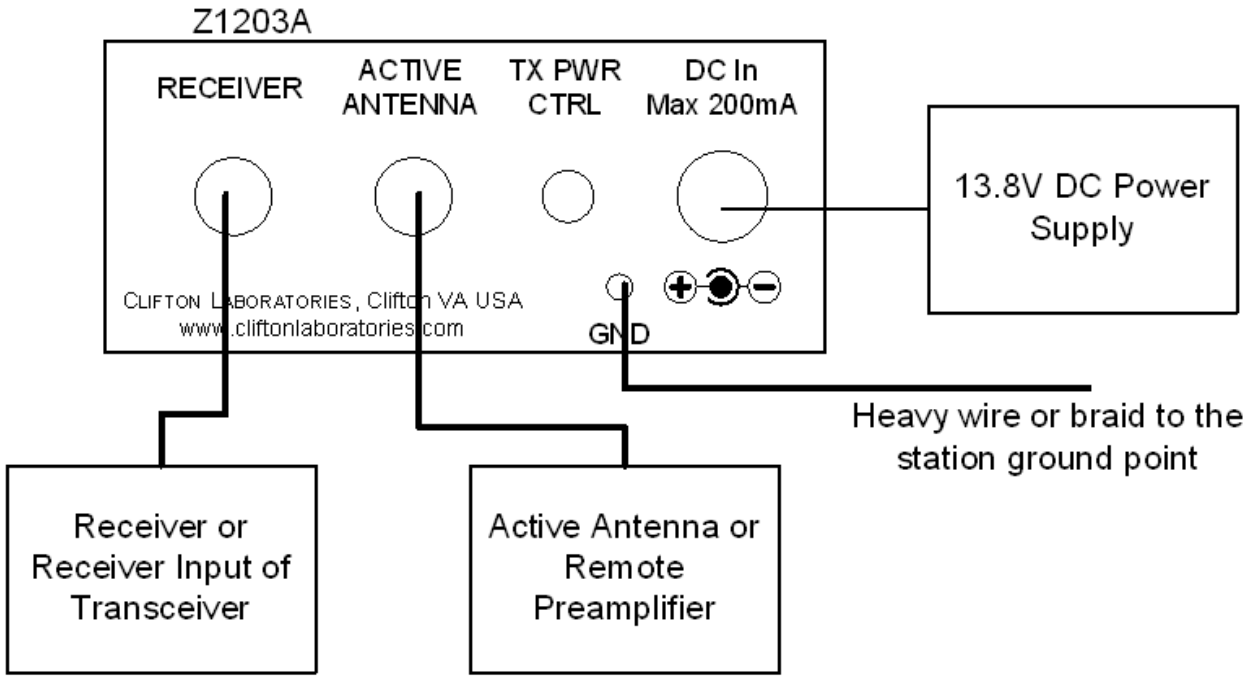
TX PWR CTRL Operating Modes.			
JP1 Position	**TX PWR CTRL**	**AA Output?**	**Comments**
 **Mode 1**	No Connection	Yes	Use Mode 1: if remote control is not desired or where the transceiver provides +13.8V on transmit.
	Low Voltage/Short Circuit	Yes	
	+13.8V	No	
 **Mode 2**	No Connection	No	Use Mode 2 where the transceiver provides ground on transmit. 10K pull-up may be needed. See JP2
	Low Voltage/Short Circuit	No	
	+13.8V	Yes	
JP2 Position			
	10K Pull up is not enabled. Jumper is in storage position		Disengage JP2 unless needed.
	10K Pull up is engaged.		Use with **Mode 2** when pull up is required.

Connection where Remote Power Control is not used

The figure below shows the typical connection when remote power control is not used. In this configuration, Mode 1 is selected. No connection need be made to the Z1203A's TX PWR CTRL connector, as Mode 1 defaults to continuous DC voltage output for an open circuit on the TX PWR CTRL connector.

When operating with Mode 1, jumper JP2 should be set to the disengaged position, with the red jumper block stored by pushing it onto one pin only.

Of course, if the Z1203A is to be used with a transceiver, it must be connected to the transceiver's auxiliary receiver input port, never to the transmitting antenna connector!



Connection Where Remote Power Control is used

It is not possible to provide detailed connection instructions for all the possible connection arrangements involved in using Remote Power Control. A few guidelines and an example should be sufficient to explain the concept.

Almost all transceivers have a keying output, usually used to control an external amplifier. When the transceiver is placed into transmit mode, the keying output changes state. The most commonly used keying outputs, and the associated Z1203A modes are:

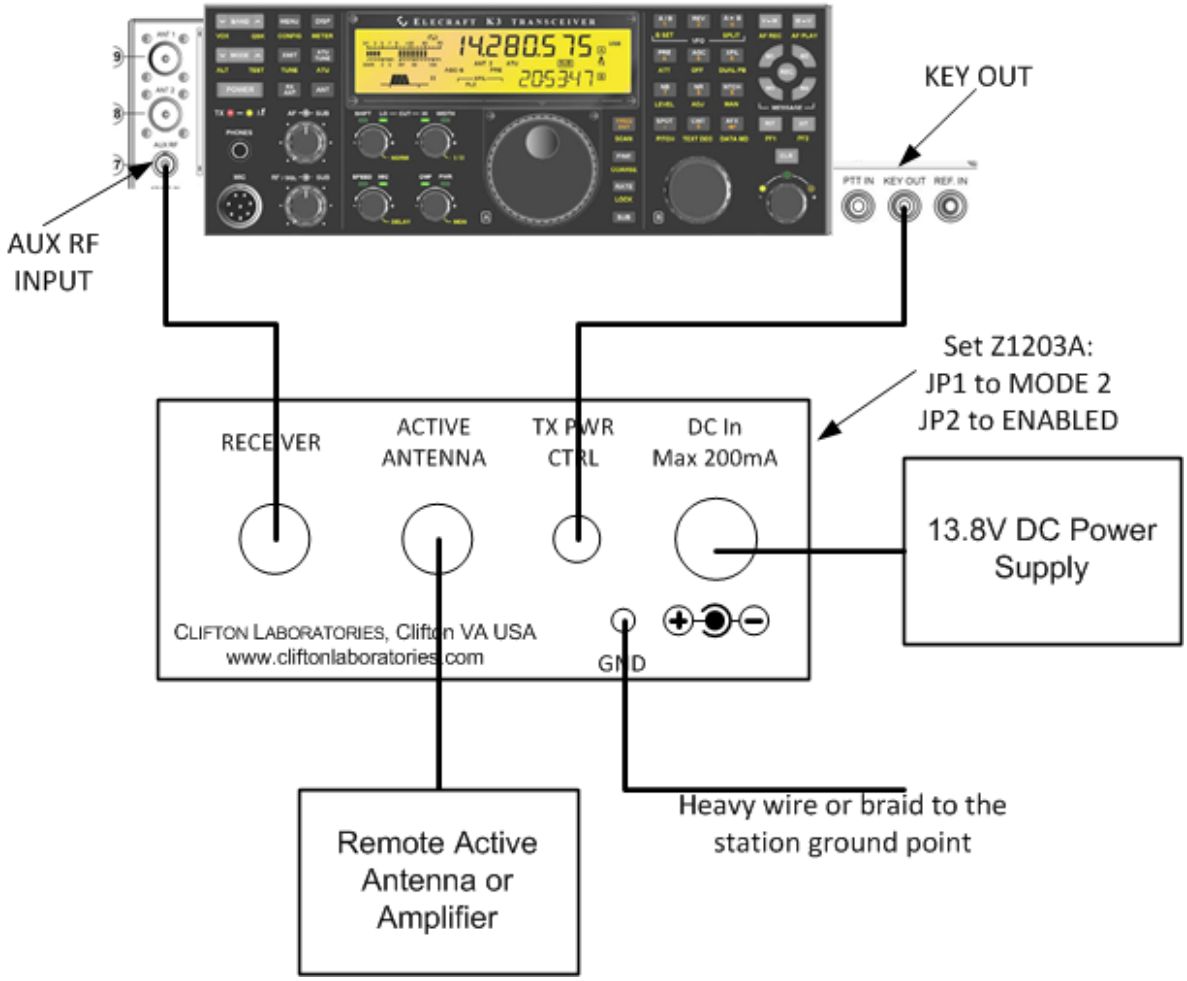
Transceiver Action when in <u>Transmit</u> Mode	**Transceiver Action when in <u>Receive</u> Mode**	**Z1203A Mode Jumper to be Used**	**Comments**
Outputs a +12V control signal	Open circuit or ground	Mode 1	
Takes a control line to ground	+12V	Mode 2	
Takes a control line to ground	Open circuit, not affirmatively asserted at +13.8V	Mode 2	Enable jumper JP2 to provide pull up during receive.

When in Mode 1, the Z1203A's output is enabled by either grounding or open circuiting the TX PWR CTRL line and disabled by a positive voltage near the 13.8 V supply level. If the transceiver provides ground on transmit and +13.8V on receive, it may be directly connected to the Z1203A's TX PWR CTRL line.

However, some transceivers do not affirmatively assert +13.8V on the control line during receive. Rather, the control line is held near ground on transmit and allowed to disconnect or float upon receive. In this case, the Z1203A's internal 10K ohm pull-up resistor should be enabled.

Typical Setup with Remote Power Control

The figure below shows how an Elecraft K3 transceiver might be used with the Z1203A and remote power control.



Several points of interest should be noted:

- The K3 has (optionally) an Auxiliary RF Input that connects to the K3's receiver circuit. It does not have transmitted power upon it and hence is well suited for connection to the Z1203A's RECEIVER port.
- The K3's KEY OUT control line goes low when the K3 is in transmit state and hence calls for the Z1203A to be used in Mode 1. However, the K3 does not include a pull-up resistor on the KEY OUT control line. Rather, the KEY OUT line floats during receiver, so the Z1203A's internal 10K pull-up resistor must be enabled by JP2 to ensure the Z1203A enters operate mode when the K3 is in receive.

- The K3 has (not shown in the illustration) an auxiliary +12V output connector. This may be used to power the Z1203A.

Control Voltage Levels



Control voltages applied to the TX PWR CTRL input should be as close as possible to 0 volts and the DC supply voltage, nominally 13.8 V. With intermediate voltages, it is possible to place Q1, the series transistor switch, into linear mode with a resulting risk of excess power dissipation. Certain intermediate voltages also might partially forward bias Q1 but not disable Q4, the active pull down, with consequential overheating and damage to R8.

Safe limits for the low control voltage are 0 to 0.6 volts and for the high control voltage DC supply voltage to DC supply voltage – 0.6 volts.

Assembly

Appendix B contains a complete parts list for the Z1203A. Before commencing construction, please check the parts list against the parts provided.

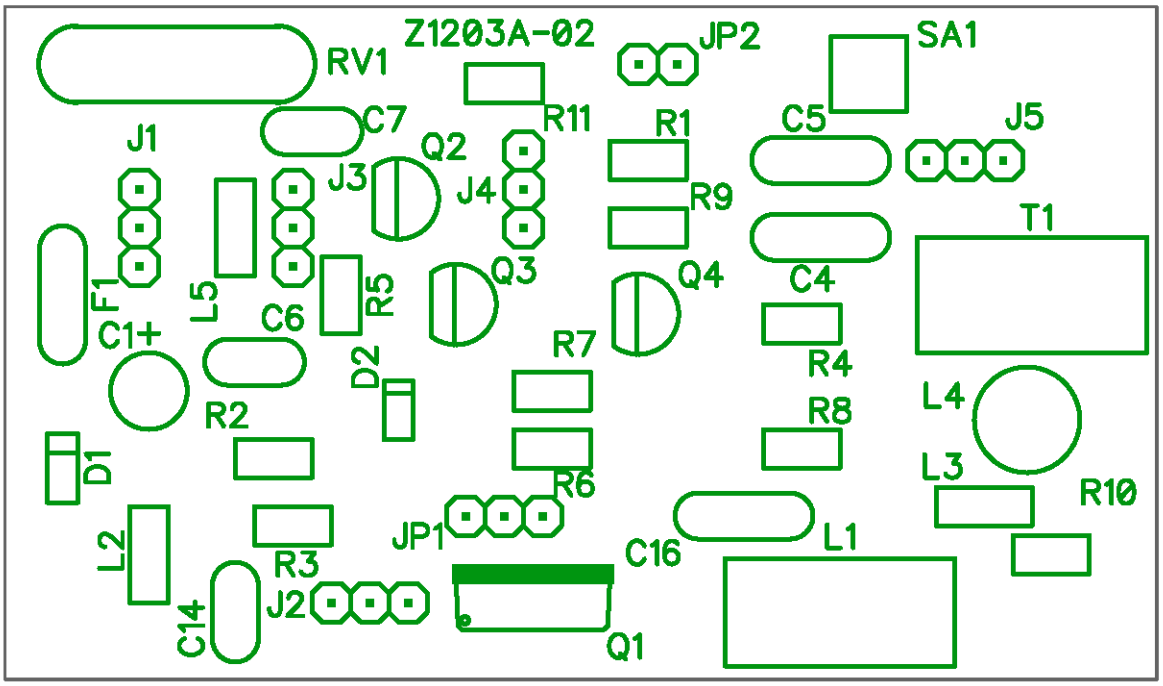
☞ C2 and C3 are not used in the Z1203A. RV1, SA1 and C7 install off the PCB.

A note on how component values are identified in this manual

This document follows the international practice of using the value multiplier to indicate the decimal point. Thus, a 1.0µF capacitor is identified as 1µ0 and a 10,000 ohm resistor is identified as 10K0.

PCB Parts Location

Although the Z1203A PCB is silk screened, it's useful to have a larger view of component location.



Version Applicability

This manual applies to Z1203A's with printed circuit board revision 02. Z1203A-02

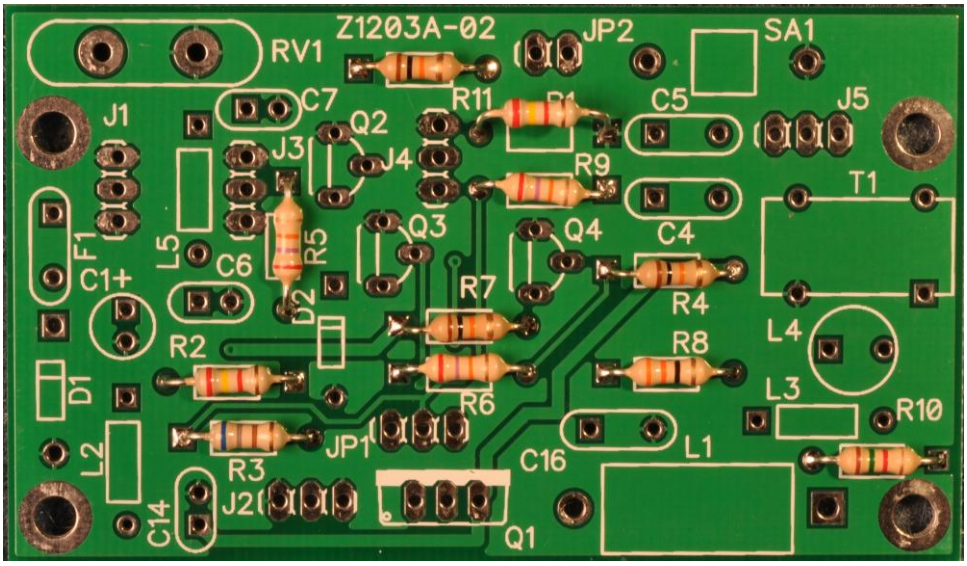
Assembly Order

The Z1203A is a simple kit and the order of assembly is not critical. However, following the order provided below will simplify the construction.

Printed Circuit Board Assembly

- ❑ Install R1 2K4 5% ¼ watt resistor red-yellow-red-gold
- ❑ Install R2 2K4 5% ¼ watt resistor red-yellow-red-gold
- ❑ Install R3 680R 5% ¼ watt resistor blue-gray-brown-gold
- ❑ Install R4 10K0 5% ¼ watt resistor brown-black-orange-gold
- ❑ Install R5 27K0 5% ¼ watt resistor red-violet-orange-gold
- ❑ Install R6 27K0 5% ¼ watt resistor red-violet-orange-gold
- ❑ Install R7 10K0 5% ¼ watt resistor brown-black-orange-gold
- ❑ Install R8 33R 5% ¼ watt resistor orange-orange-black-gold
- ❑ Install R9 27K0 5% ¼ watt resistor red-violet-orange-gold
- ❑ Install R10 1K5 5% ¼ watt resistor brown-green-red-gold
- ❑ Install R11 10K0 5% ¼ watt resistor brown-black-orange-gold

After R1-R11 installed

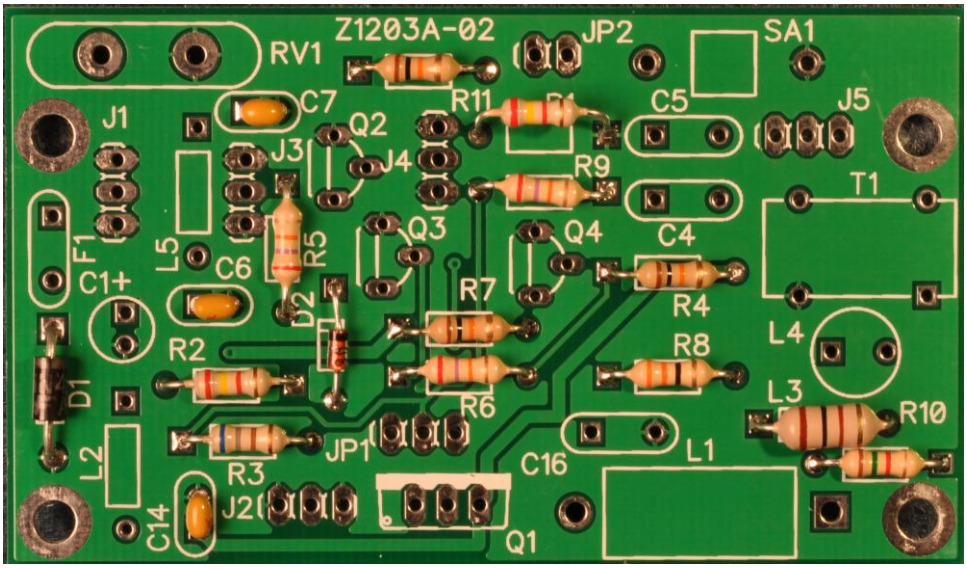


- ❑ Install L3, 100uH RF Choke (brown-black-brown-gold) L3 looks like a fat resistor
- ❑ Install D1 (1N4007 or similar diode). This is a black plastic body power diode with thick leads. Note the orientation; the band on the diode must match the bar on the PCB silk screen.
- ❑ Install D2 (1N4148 or similar diode). This is a small signal diode with a small glass body and thin leads. Note the orientation; the band on the diode must match the bar on the PCB silk screen.

❑ Install C6 (0u1, marked 104).

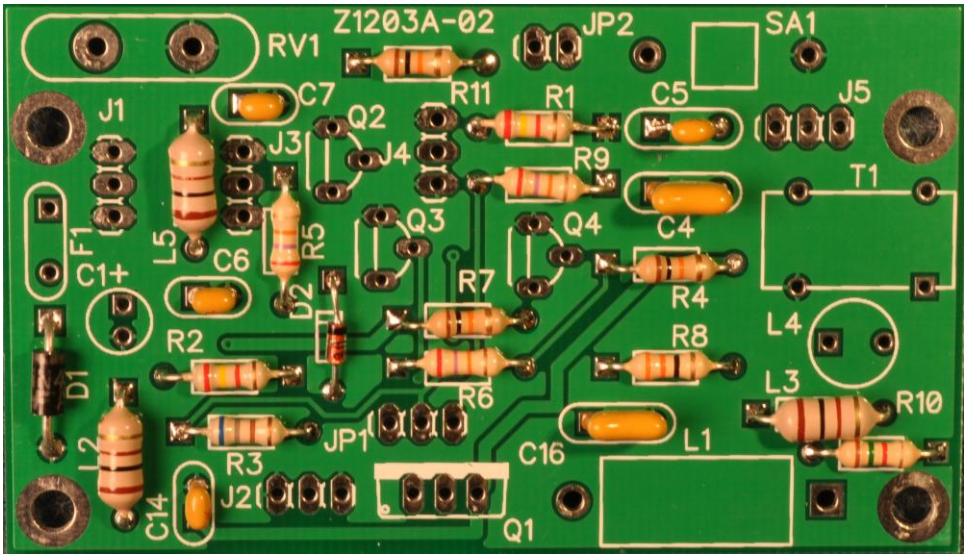
❑ Install C14 (0u1, marked 104).

The photo below shows the Z1203A at this stage.



❑ Install C5 (1000pF, marked 102)
❑ Install L5 (100uH, marked brown-black-brown-gold) L5 looks like a fat resistor.
❑ Install L2 (100uH, marked brown-black-brown-gold) L2 looks like a fat resistor
❑ Install C4 (1u0, marked 105)
❑ Install C16 (1u0, marked 105)

The photo below shows the Z1203A at this stage.



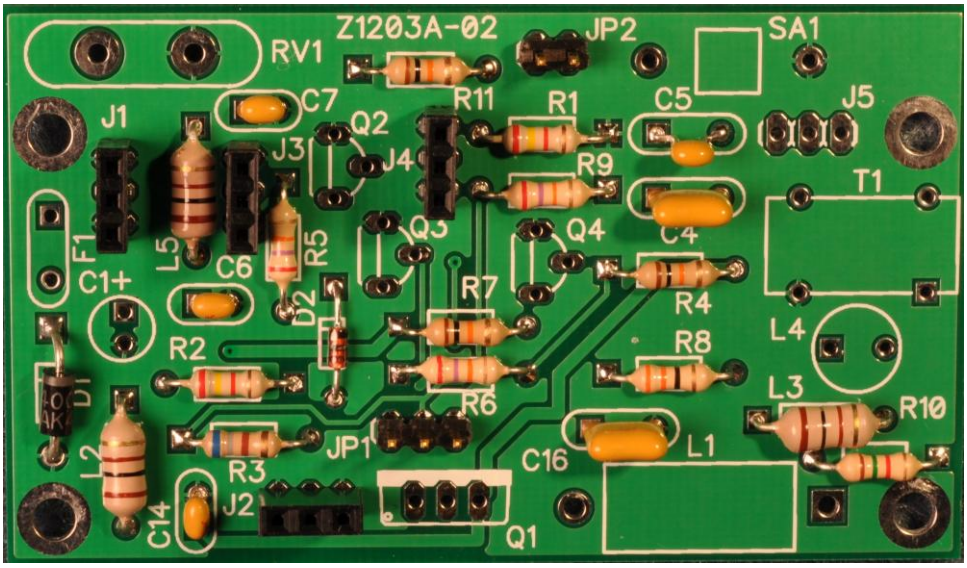
- ❑ Install a 3-place socket at J1
- ❑ Install a 3-place socket at J2
- ❑ Install a 3-place socket at J3
- ❑ Install a 3-place socket at J4

The two instructions below require removing sections from the header pin strip. Note that the header strip has indentations between each pin. The strip may be cut with standard wire cutters at the indentation points. Or, the strip may be held with pliers at the indentation and the strip broken.

When installing JP1 and JP2, it is convenient to slip the red jumper block over the pins to serve as a holding point.

- ❑ Cut or break a 3 pin section from the header pin strip. Install at JP1
- ❑ Cut or break a 2 pin section from the header pin strip. Install at JP2

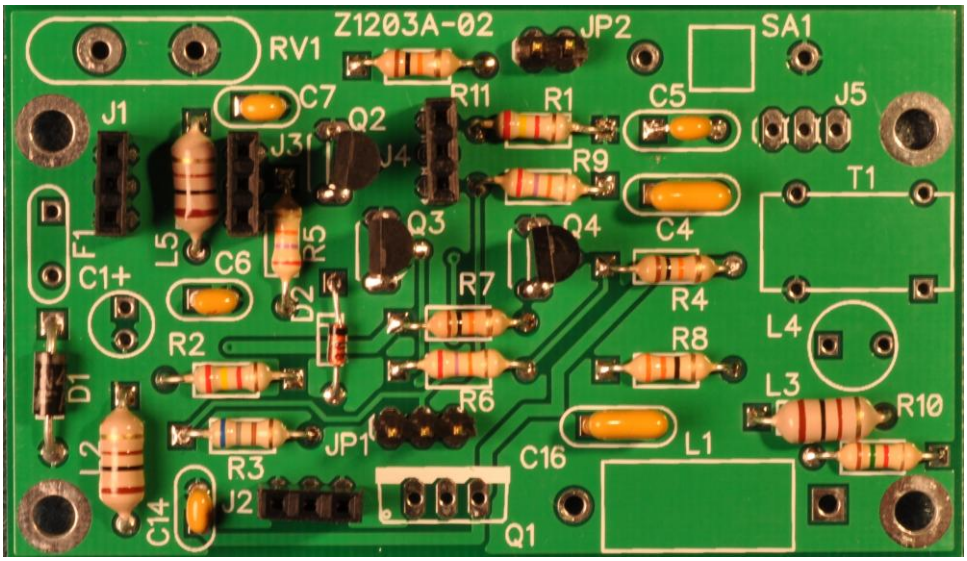
At this stage, your board should match the photograph below.



When installing transistors Q1-Q4 it is essential that the devices are installed matching the orientation (flat side) shown on the silk screen. The photograph following this instruction set provides additional guidance.

- ❑ Install Q2 (2N4401 NPN transistor). When installing Q2, follow the orientation shown on the PCB silk screen.
- ❑ Install Q3 (2N4401 NPN transistor). When installing Q3, follow the orientation shown on the PCB silk screen.
- ❑ Install Q4 (2N7000 MOSFET transistor). When installing Q4, follow the orientation shown on the PCB silk screen. The 2N7000 is a MOSFET transistor and normal anti-static procedures should be used when handling and installing Q4.

The photo below shows the Z1203A at this stage.



❑ Install Q1 (PNP power transistor, marked TIP30). Q1's metal tab is oriented to the white stripe on the silk screen outline. See the photograph below for more detail.

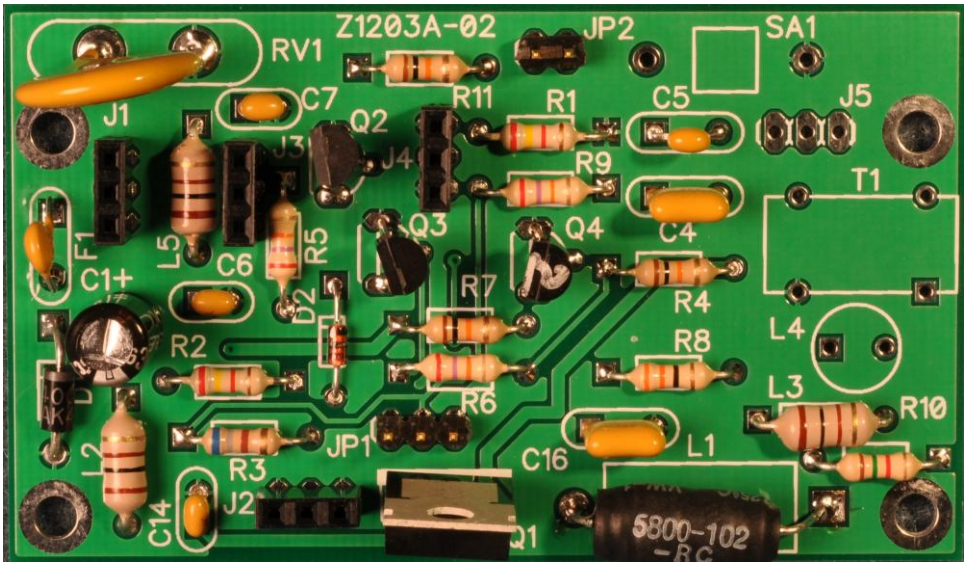
❑ Install F1 (RXE020 polyfuse, marked XF020). I find it easier to solder F1 in place from the top, rather than holding it in place and inverting the PCB as is usually the case.

❑ ⚠ Install C1 (33µF, 63V electrolytic capacitor). This is a polarized part. Polarity may be indicated by either (or both) of the following: (a) The capacitor has a negative side marking; (b) the positive lead is the longest.

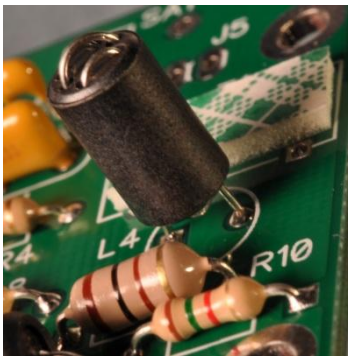
Install C1 <u>with the positive lead to the pad identified with the + sign.</u>

❑ Install L1 (1000 µH RF choke, marked 5800-102). I find it easier to solder L1 in place from the top, rather than holding it in place and inverting the PCB as is usually the case.

The photo below shows the PCB at this stage of construction.



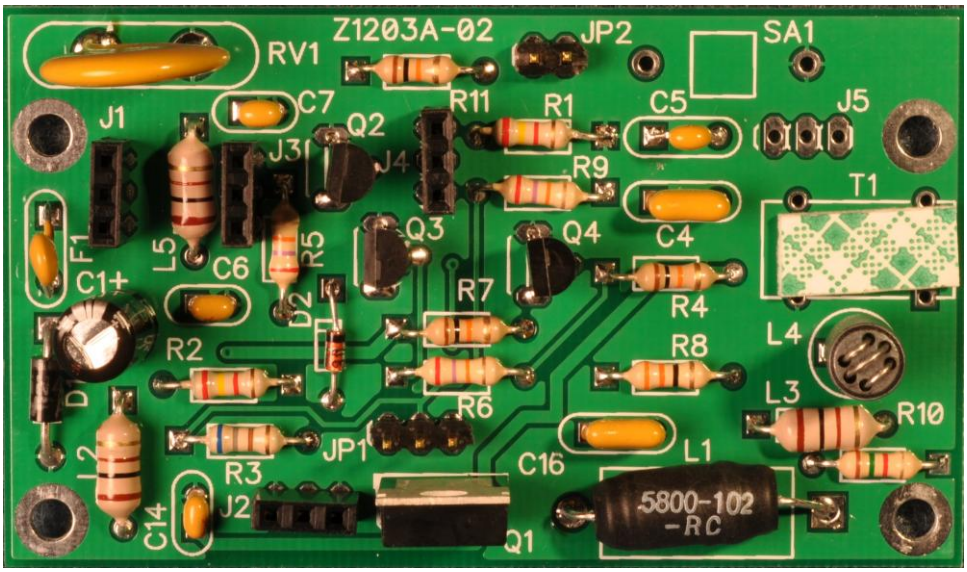
❑ Install L4, the multi-turn ferrite bead. Space L4's bottom winding approximately 1/8" (3mm) above the PCB surface.



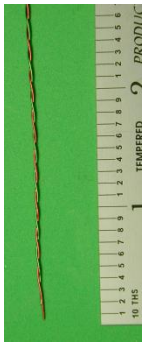
Install a length of double sided foam tape at T1. Leave the protective paper in place until T1 is ready for installation. Carefully position the tape to avoid obstructing the four connection pads.

The photo below shows the PCB at this stage of construction.

❑

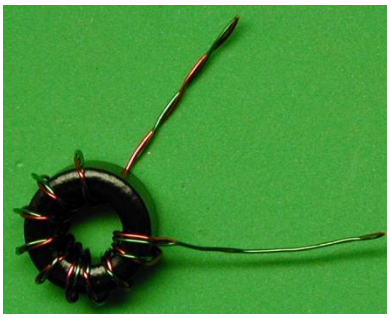


❑ Locate the No. 26 AWG magnet wire. One length of green insulated wire is provided and one of red insulated wire. Each wire is approximately 11 inches (280 mm) long.



Twist the red and green wires together with approximately 60 turns. (A variable speed drill, running slow speed, speeds up the twisting process.)

The end nearest the drill may be twisted more tightly than the far end. If so, cut an inch (25mm) or so from the most tightly twisted end.

❑ 

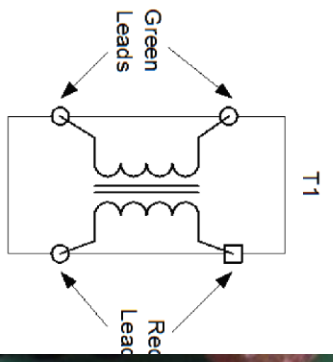
Wind the twisted wire 10 turns onto the ferrite core.

As a reminder, a turn is counted when the wire passes through the hole in the core.

Start by inserting the cut end approximately one inch (25 mm) through the core. Thread the end through and wind 10 turns. Space the turns so that the windings are roughly evenly spaced and occupy approximately 75% of the core perimeter (270 degrees if you prefer to think in those terms).

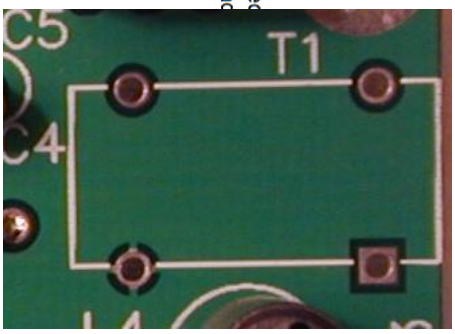
Congratulations. You have completed winding T1, a bifilar broadband transformer.

❑ Locate the PCB and look at the silk screen outline for T1. It has four pads, comprised of three round pads and one square pad, oriented as shown in the drawing.



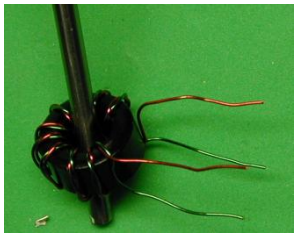
The green wires connect to the two round pads on one side and the red wires connect to the one square and one round pad on the opposite side.

Un-twist the wire extensions so that you have four separated wires. Remove the insulation and tin the four wires. The red and green wire supplied is "solderable" and the insulation will melt if heated with a blob of molten solder. This heating and tinning must be done <u>before</u> the transformers are installed in the PCB.



The wire leads should be formed as illustrated in the photo to the right. (The photo has the foam tape removed for clarity.)

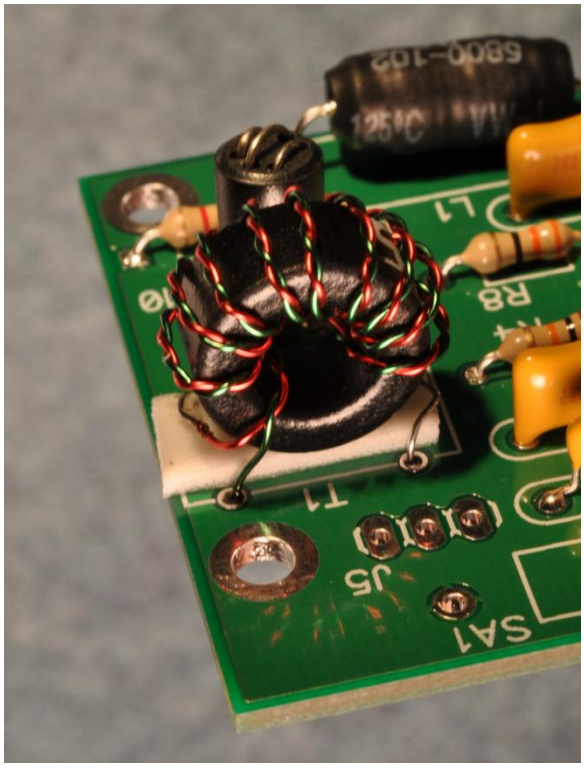
Remove the protective tape from the foam tape and install the transformer at T1 as shown in the drawing.



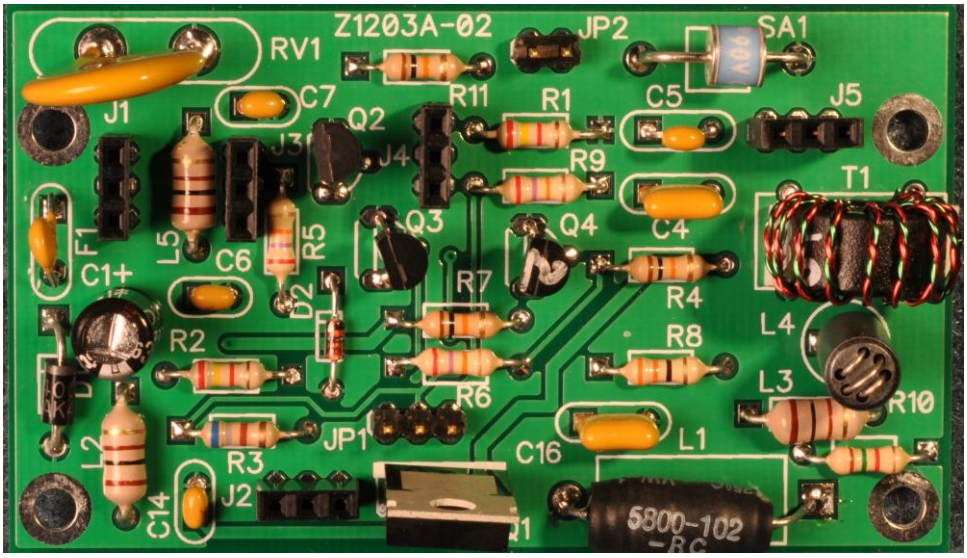
A common error in installing T1 is that the insulation is not fully removed from the wire due to insufficient heating.

The photo shows T1 installed on the foam tape.

Inspect the leads and, if necessary, bend the leads so that any bare conductor does not touch the transformer core or other leads.



- ❑ Install a 3-pin socket at J5.
- ❑ Install spark gap SA1.



This completes the printed circuit board assembly.

Initial PCB Checkout

The following resistance readings are taken with a digital multi-meter. Most of the resistance readings in the table below are influenced by the voltage the DMM uses and also the scale selected. For example, when the 20K range is selected, one particular test point

☞ read 14K but 60K when the 200K range was selected. Different DMMs will use different test voltages on ohms scale and the resistance values measured may depart significantly from the values in the table below. Hence the table should be regarded as only a rough guide to verification.

Many soldering or component selection errors will cause gross departure from the table values. For example, shorting a pad to ground (difficult with a solder masked board, but still not impossible) will reveal itself as a near zero ohms reading.

Unless otherwise indicated, the resistance readings are taken with the negative DMM probe connected to ground. In making the readings, you may find it convenient to cut or break a 3-pin section from the male header pin strip and plug the 3-pin section into the socket being tested.

❑

Connector	Pin (to ground unless otherwise noted)	Resistance	Comments
J1	center	9K*	20K range
J1	center	570 Ohms	2K range. Reverse test leads; positive to ground, negative to J1 center pin. This tests D1 for forward conduction. (Return negative lead to ground after completing this measurement.)
J2	center	11.8K*	Should be approximately 2K above J1 center value
J3	center	68K	200K range.
J3	center	56K	200K range. Reverse test leads; positive to ground, negative to J3 center pin. This tests D2 for forward conduction. (Return negative lead to ground after completing this measurement.)
J4	center	2.4K	Dominated by R1
J5	All pins	infinity	J5's connections float to ground
J5	Center to either end pin	zero	Measures T1's secondary winding. Should be close to zero ohms.
JP1	center	infinity	May indicate a few hundred K ohms on some ohmmeters.
JP1	Pin nearest "JP1" on silk screen	4K	
JP1	Pin furthest from "JP1" on silk screen	14K	

*60K when measured with a different DMM. Look for very low or very high values as an error condition.

❑ If the resistance checks are passed, you may wish to apply +13.8V to the PCB. If possible, this should be done with a laboratory power supply with current limiting set to a low value, say 50 mA. With + connected to J1 center pin and – to either of J1's outside pins, the current drain should be 40 mA or less.

Connector and Cable Preparation and Fabrication-General Construction Method

- ❑ The next assembly stage is fabricating the cables that connect the PCB to the various connectors. Since several steps are common to cable assembly, the details will be described once for each assembly type.

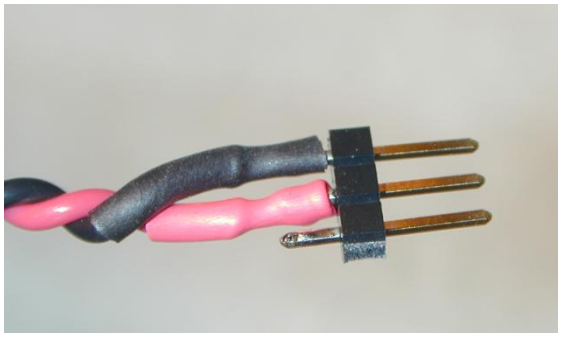
  The Z1203A's PCB connects to the outside world through five 3-pin 0.1" non-polarized header sockets. The sockets are configured so that the outside pins are common (and connected to ground except for J5) with the center pin being active. Thus, the pin connector is correctly inserted regardless of the orientation, 0 or 180 degrees and a polarized connector is unnecessary.

  Heatshrink tubing is used in assembling the pin header cables. If you do not have a hot air gun, you may be able to shrink the tubing with a hair dryer on its highest temperature setting. Using stray heat from a soldering iron inevitably results in a ragged result with stray bits of solder stuck to the shrink tubing. (Inexpensive hot air guns can often be found at an arts and crafts store where they are sold as "embossing guns.")

Red/Black Wire Connection to Header Pins

- ❑ Cut one red and one black wire to the appropriate length and strip approximately 3/16" (5mm) insulation from both ends of each wire. Twist the strands back together if necessary and tin all the ends.
- ❑ Cut or break a 3-pin section from the header pin strip. Tin two of the short end of the pins, one on the outside and the center pin. Either outside pin may be used.
- ❑ Solder the red wire to the center pin
- ❑ Solder the black wire to the outside pin.
- ❑ Cut lengths of 1/8" heat shrink tubing (one black, one red) long enough to cover the bare wire and pins and to extend a short distance over the wire insulation. Slide the heat shrink tubing over the joints (red tubing over red wire; black tubing over black wire) and heat to shrink the tubing.

  The result is shown at the right.



- ❑ (Optional) Cut a length of approximately ½" (12.5mm) of ¼" heat shrink tubing and slip it over the pin header so that one end is flush with the base of the projecting pins. Apply heat to shrink the tubing with the result shown at the right.

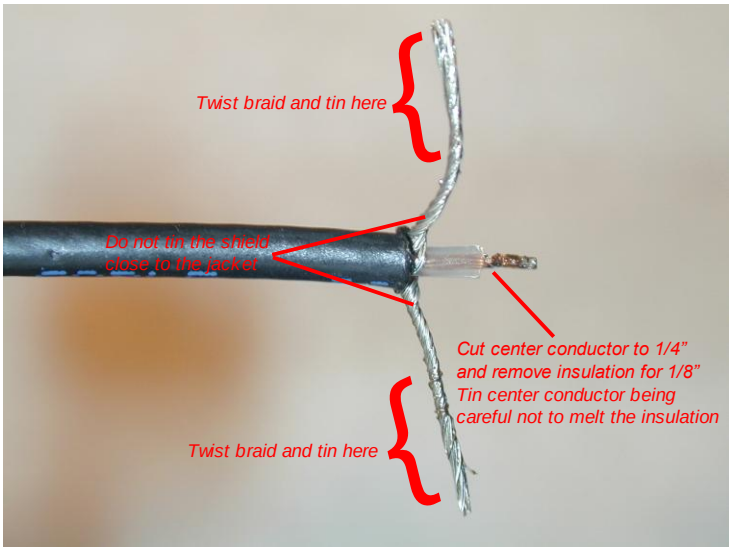


  Although this results in a neater connector, during final assembly, the wires must be bent 90 degrees to the connector, which is much easier if the large heat shrink tubing is not applied.



Coaxial Cable Connection to Header Pins

❑ Cut the coaxial cable to the specified length and remove the jacket for a length of ½" (12.5mm). Using a sharp pointed tool, such as a probe, or a straight pin, comb out the braid. Divide the combed out braid into two approximately equal groups, one extending on each side of the cable and twist each group.



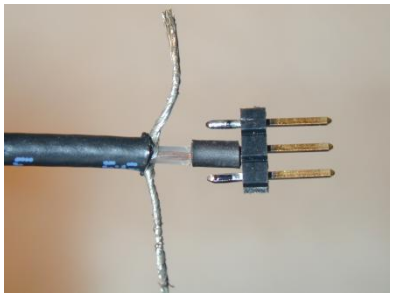
Cut the center conductor back to approximately ¼ inch (6mm) and remove the insulation from 1/8 inch (3mm). Twist the center conductor wires back together if necessary.

Tin the outer two-thirds of the twisted braid but <u>do not tin the braid close to the jacket</u>. Tin the center conductor, being careful not to melt the polyethylene insulation.

❑ Cut or break a 3-pin section from the header pin strip. Tin all three of the short end of the pins.

❑ Cut a short length of 1/8" heat shrink tubing. (Either black or red may be used.) The length cut should be approximately two-thirds the length of the center conductor projection (including the stripped wire end.)

❑ The next step works best if the 3-pin strip is held in a vise. It is necessary to work quickly to avoid prematurely shrinking the tubing.

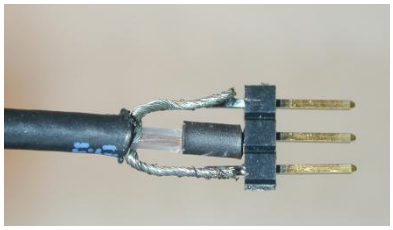


Slip the short length of heat shrink tubing over the center conductor and solder the center conductor to the center pin. Note that not all the bare wire end may be visible as the heat shrink partially covers it. Still, it should be possible to carefully solder nearly the entire length of the stripped end to the center pin.

Slide the heat shrink tubing to cover the bare wire and pin. Apply heat to shrink the tubing with the result shown at the right.

❑ Bend the two shield sections down to the outside pins, in the form of a "U" bending at the un-tinned section near the jacket.

Cut the excess length off the shield section ends to fit against the outside pins without extending into the plastic retention bar. Solder the shield sections to the pins as illustrated at the right.



❑ (Optional) Cut a length of approximately ½" (12.5mm) of ¼" heat shrink tubing and slip it over the pin header so that one end is flush with the base of the projecting pins. Apply heat to shrink the tubing with the result shown at the right.

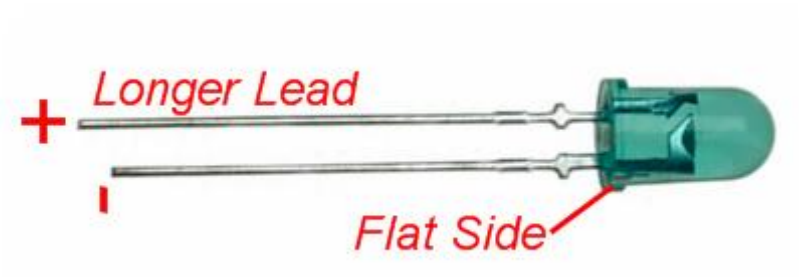


Cable Fabrication

Fabricate two red/black wire cables with 3-pin connectors on one end, following the instructions above.

	Wire Length	Purpose
❑	3 inch (75mm)	DC PWR
❑	3 inch (75mm)	POWER ON LED

❑ Locate the green LED and identify the lead to be connected to the + power source that will result in the LED being forward biased and emitting light. Depending on the diode supplier, the + lead is identified in one (or both) of the following: (a) If the leads are of unequal length, + is longer lead; (b) if the leads are of equal length, one side of the LED base will have a flat. The flat identifies the negative lead so the + lead is adjacent to the rounded side.

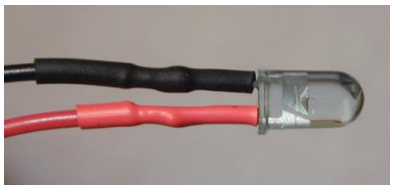


❑ As a quick check that you have correctly oriented the LED, you may temporarily plug it into the Z1203A PCB. Apply 13.8V DC power to the Z1203A PCB. You may use the completed power connector sub-assembly for the connection if you wish. Plug the 3-pin connector into J1 (either orientation) and apply +13.8V to the PCB. Plug the LED into J2, with the lead you believe is + into the J2's center and the lead you believe is – into either outside receptacle. If correct, the LED should illuminate. If it does not illuminate, reverse the LED. If it still does not illuminate, you have uncovered a problem.



After you have verified the LED's orientation and polarity, remove power from the Z1203A board and set it aside.

❑ Cut ½" (13mm) lengths of 1/8th inch red and black heat shrink tubing. Using one of the red/black wire sub-assemblies, slide the red tubing over the red wire and the black tubing over the black wire.



Cut the LED leads to approximately 3/8" (10mm). Don't forget which side is + and – after cutting the leads! Solder the red wire to the LED's + lead and the black wire to the LED's – lead.

Slide the heat shrink tubing into place and apply heat to shrink.

For a neater appearance, twist the wires. Place this sub-assembly aside until the enclosure stage.

❑ Prepare the other end of the DC power cable. Note that the power connector's hardware is large enough to fit over the 3-pin connector so the power cable may be completed as a sub-assembly and installed as a single piece. Cut a ½ inch (12mm) length of red and black 1/8th inch heat shrink tubing and slip over the corresponding color wire.



When soldering to the power connector, a small amount of liquid RMA type solder flux is useful.

Solder the red wire to the power connector center pin. Solder the black wire to the power connector shell lug.

Slide the shrink tubing in place and apply heat to shrink.

Twist the wires for a neater apperance.



❑ Prepare the control cable. To simplify installation, the 3-pin connector will be installed at a later stage.



Cut lengths of red and black wire 3 inches (75mm) long. Strip approximately 3/16" (5mm) insulation from both ends of each wire. Twist the strands back together if necessary and tin all the ends.

In making the connections below, apply a bit of liquid RMA solder flux if available.

Remove the solder lug from the RCA connector and solder it to the black wire. (The other end of the black wire has no connection at this point.)

Solder one end of the red wire (the other end has no connection at this point) to the RCA connector's center pin. Cut a ½ inch (12mm) length of red shrink tubing and slide over the center pin joint. Apply heat to shrink in place.

❑ Cut a length of black hookup wire 3 inches (75mm) long. Strip approximately 3/16" (5mm) insulation from both ends of each wire. Twist the strands back together if necessary and tin all the ends.



Solder a solder lug to each end of the wire.

❑ Prepare the coaxial cable for the Active Antenna port. Cut a length of RG-174 coaxial cable to approximately 3.5 inches (90mm). Using the earlier instructions, attach a 3-pin connector to one end of the cable.



Remove approximately ½ inch (12mm) of jacket from the other end of RG-174 and comb out the braid. Twist the combed braid and tin the end. Remove 1/8th inch (3mm) of insulation from the center conductor and tin.

Locate the metal body BNC connector and remove the ground lug. Solder the ground lug to the combed out braid as illustrated in the photograph.

❑ Cut a length of RG-174 cable 5-½ inches (140mm) long.

Using the earlier instructions, attach a 3-pin connector to one end of the cable.

Locate the remaining ferrite toroid core and thread the free end of the RG-174 cable through the core with a total of three turns. Position the core along the cable so that about 1.5 inches (38mm) of cable extends at the free end.

Remove approximately ½ inch (12mm) of jacket from the free end of the RG-174 and comb out the braid. Twist the combed braid and tin the end. Remove 1/8th inch (3mm) of insulation from the center conductor and tin.

Final Assembly

❑ Using 4-40 hardware, install the ground stud as described in the following photographs. The ground lug is one end of the black wire previously prepared.

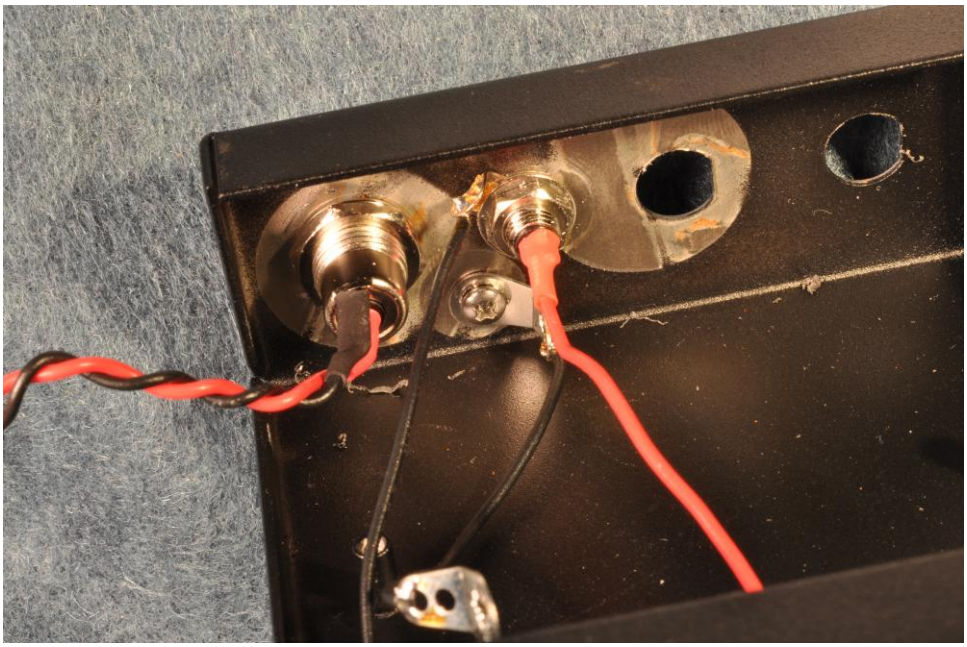
Position the ground lug approximately as shown in the photograph to avoid interfering with other connectors.







The chassis mount connectors are identified as JJx where x corresponds to the mating J series PCB connector number. For example, the DC power input connector is JJ1, as it connects to PCB socket J1.

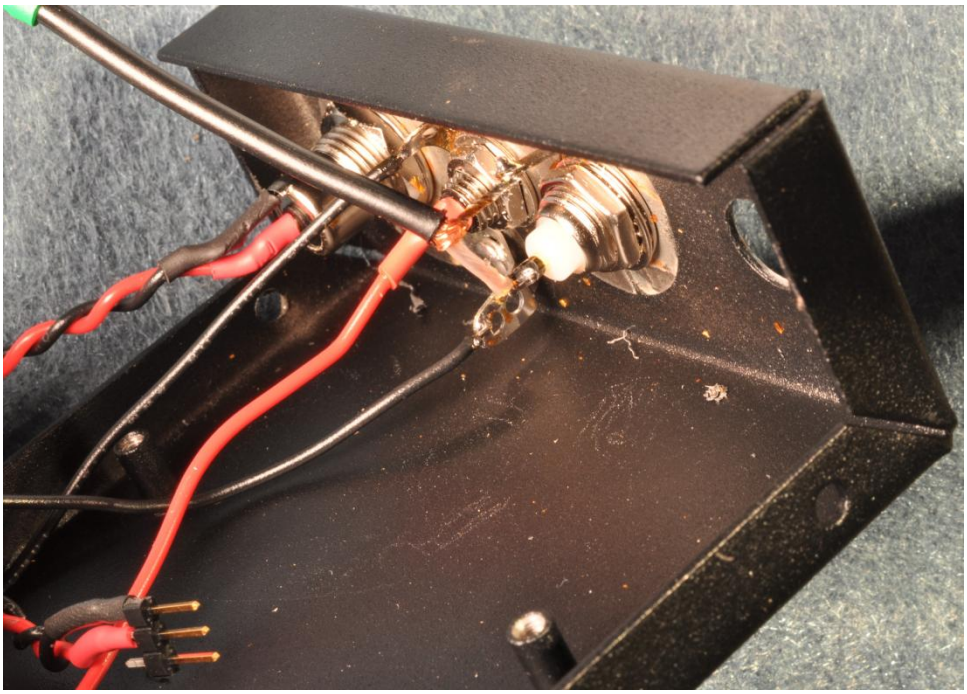


❑ Using the above photograph as a reference, install the power connector (JJ1) sub-assembly. Tighten. The connector has a 14mm hex nut.

❑ Using the above photograph as a reference, install JJ3, the remote control RCA connector in the ¼ inch (6.35 mm) diameter hole adjacent to the power connector. Don't forget the ground lug washer at JJ3.

Using the procedure earlier described, install a 3-pin connector on the free ends of JJ3's wire. Don't forget to slip the heat shrink tubing over the wires before soldering the connector in place.

❑ Install the metal shell BNC at the Active Antenna port. Don't forget the ground lug with the RG-174 coax cable attached.

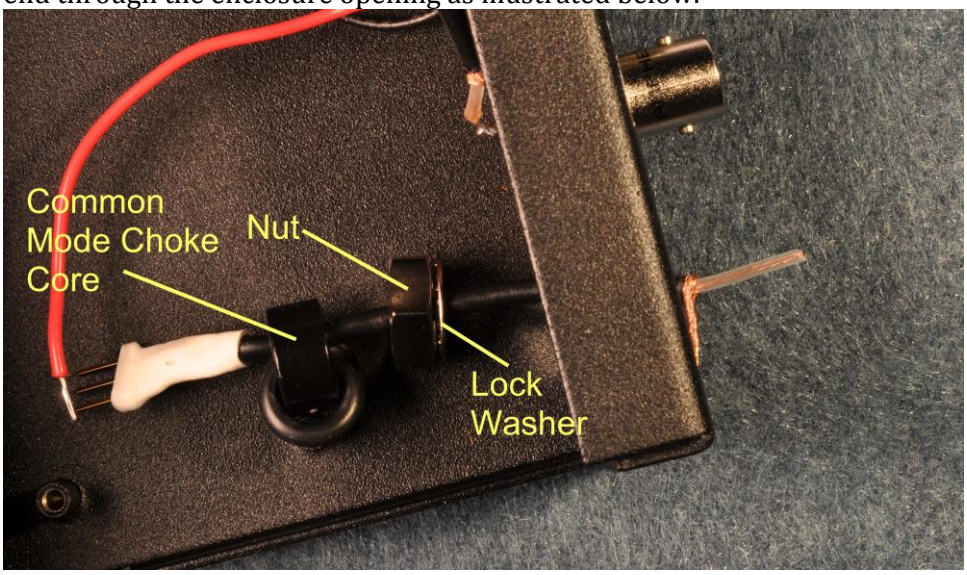


This connector uses a 3/8th inch hex nut. The threads are easily stripped so don't over-tighten.

Tin the connector's center pin and solder the RG-174 center conductor to it. Be careful not to apply excessive heat, as the RG-174 center conductor insulation easily melts.

❑ The final connector to install is the floating BNC, used at the Receiver port.

Slip the nut and lock washer over the prepared length of RG-174 and slide the prepared end through the enclosure opening as illustrated below.

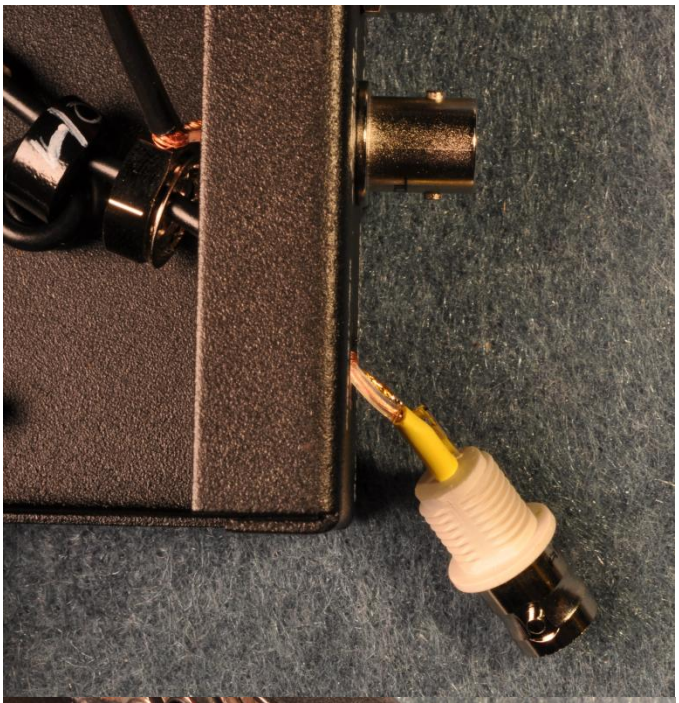


❑ Cut a length of 1/8th inch diameter heat shrink tubing long enough so that when slid over the RG-174's center conductor, the tinned end is exposed.

Tin the floating BNC connector's center tab and ground tab.

Working from outside the enclosure, solder the RG-174 center conductor to floating shell BNC center tab. Slide the shrink tubing over the joint and apply heat to shrink.

Solder the RG-174 braid to the floating shell BNC ground tab.

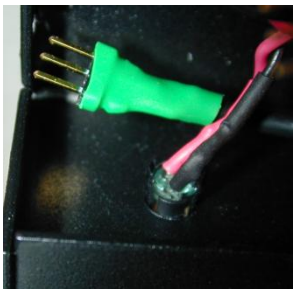


Slide the BNC through the hole and tighten the retaining nut.

The nut requires a ½ inch wrench.



❑ Slip the LED mounting clip into the mounting hole. (Flange is on the outside.) Slide the LED subassembly previously prepared into the clip, bending the leads as necessary. When properly installed, the LED will snap into the mounting clip. The result should match the photo at the right.





When properly installed, the LED body will extend from the flange.

❑ If you have applied the optional "boots" over the three pin connectors, you may wish to use a fine tipped marker to write the associated J numbers on each of the 3-pin assemblies. Write on the heat shrink



tubing near the 3-pin connector.

Connector Use	J identification
DC Power Input	J1
LED Power-on Indicator	J2
Remote Power Control	J3
To Active Antenna	J4
To Receiver	J5

❑ Before plugging the 3-pin assemblies into the printed circuit board, make the following resistance readings to confirm correct cable sub-assembly installation.

LR indicates "low resistance." This is a direct connection that should read close to zero ohms, depending on how carefully your ohmmeter is zeroed and how firmly you press the test leads to the point being measured.

N/A indicates not applicable, no test to be made for this particular item.

OC indicates "open circuit." There is no connection, but leakage resistance might cause reading of some tens of mega-ohms with a very high quality ohmmeter.

Connector Description	ID	Connector Shell to Ground Stud	Connector Center to Ground Stud	Connector Center to Connector Shell
DC Power Input	JJ1	LR	OC*	OC*
LED Power-on Indicator	JJ2	N/A	N/A	N/A
Remote Power Control	JJ3	LR	OC	OC
To Active Antenna	JJ4	LR	OC	OC
To Receiver	JJ5	OC	OC	OC

* RV1 is shunted across the DC input connector. Some ohmmeters may read RV1's leakage resistance as a value > 100K. An Agilent 34410A digital multimeter, for example, reads this as 0.300 GΩ or 300 mega-ohms.

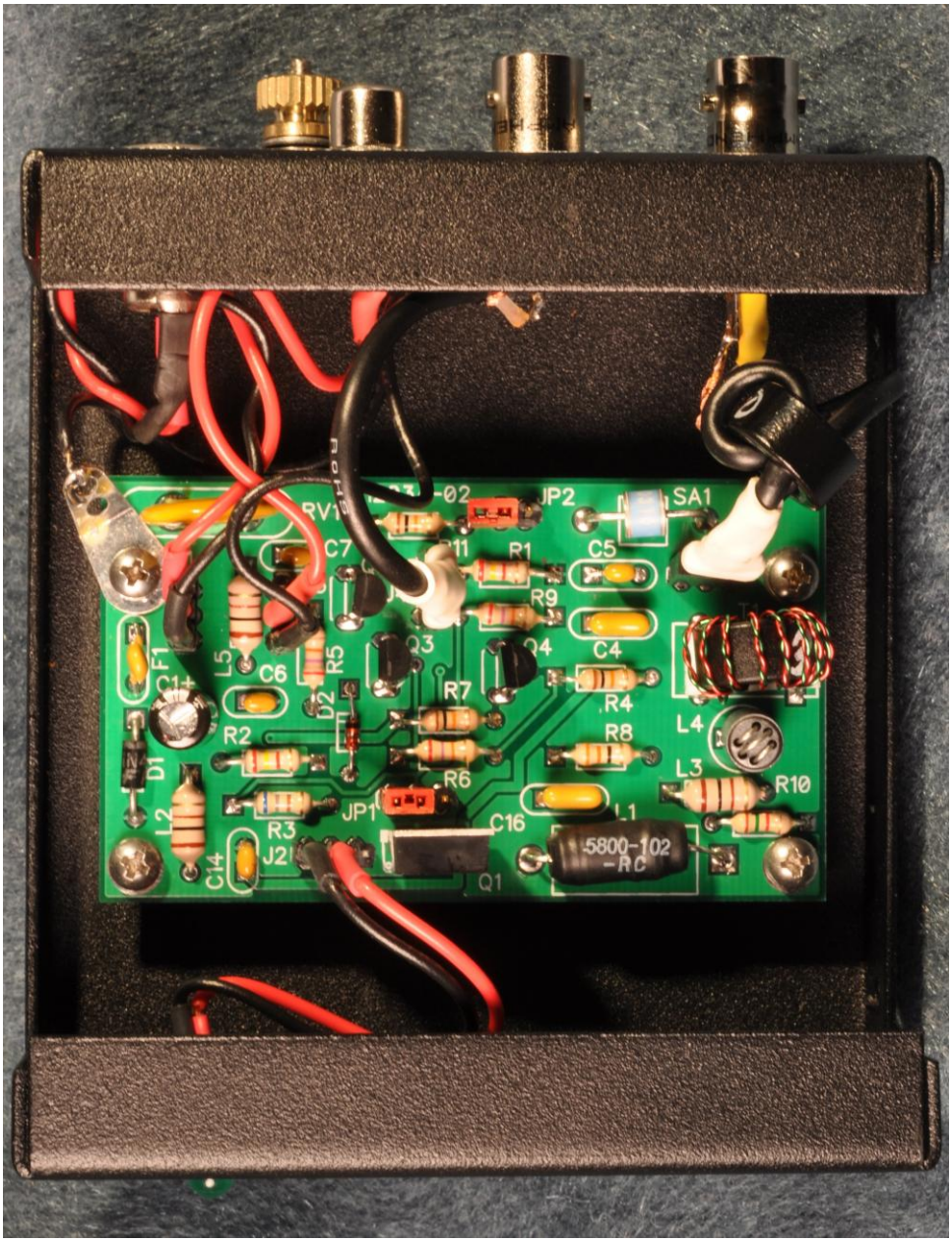
❑ As a second verification, check the resistance between each connector and the associated pin of its 3-pin male header connectors.

Connector Description	ID	Connector Shell to Outside Pin(s)**	Connector Center to Center Pin
DC Power Input	JJ1	LR	LR
LED Power-on Indicator	JJ2	N/A	N/A
Remote Power Control	JJ3	LR	LR
To Active Antenna	JJ4	LR	LR
To Receiver	JJ5	LR	LR

** Coaxial cable subassemblies should show low resistance from the connector shell to both outside pins. Subassemblies made with red/black wire will show shell continuity to only one outside pin.

❑ Mount the PCB to the standoffs with four 4-40 machine screws and lockwashers. Orient the board as shown in the photograph below with the four 3-pin connectors towards the rear.

Three of the mounting screws use standard split-C lockwashers. The mounting screw nearest the DC in connector uses the solder lug connected to the other end of the ground stud. Orient the ground lug to avoid shorting F1 or RV1.



❑ Plug each 3-pin connector into the associated PCB mounted socket.

Cable routing is not critical, but it's best to keep as much distance as is feasible between the ACTIVE ANTENNA cable and the RECEIVER cable. The photo to the right shows a typical routing.

❑ A final resistance check can now be made.

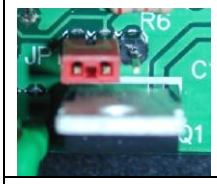
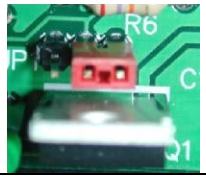
Connector Description	ID	Connector Shell to Ground Lug
DC Power Input	JJ1	50K
LED Power-on Indicator	JJ2	N/A
Remote Power Control	JJ3	0.125M
To Active Antenna	JJ4	2.4K
To Receiver	JJ5	OC

❑ Locate the two-pin jumper shunts.

JP1: It may be installed in two positions, identified elsewhere in this manual as "Mode 1" and "Mode 2" and in the photographs below. (Mode 1 has the jumper next to the JP1 silk screen legend; Mode 2 has it furthest from the JP1 silk screen legend.)

Install JP1 in Mode 1 position and measure the resistance from JJ1 (DC IN) center pin to ground. Move JP1 to Mode 2 and repeat the measurement. The results should be similar to the ones shown in the table below.

The measurements are taken with an Agilent 34410A digital multimeter and data taken with a different meter may show different results. Look for Mode 2 to read somewhat greater than Mode 1 and both to be greater than a few kilo-ohms.

Mode 1	Mode 2
	
6KΩ	9.5Ω

If you have selected mode 1 for operation, install the shunt at JP2 so that JP2 is open. That is to say, install the shunt on one pin with the other side hanging in air. (This is done so that the jumper isn't lost and is in position for future use.)

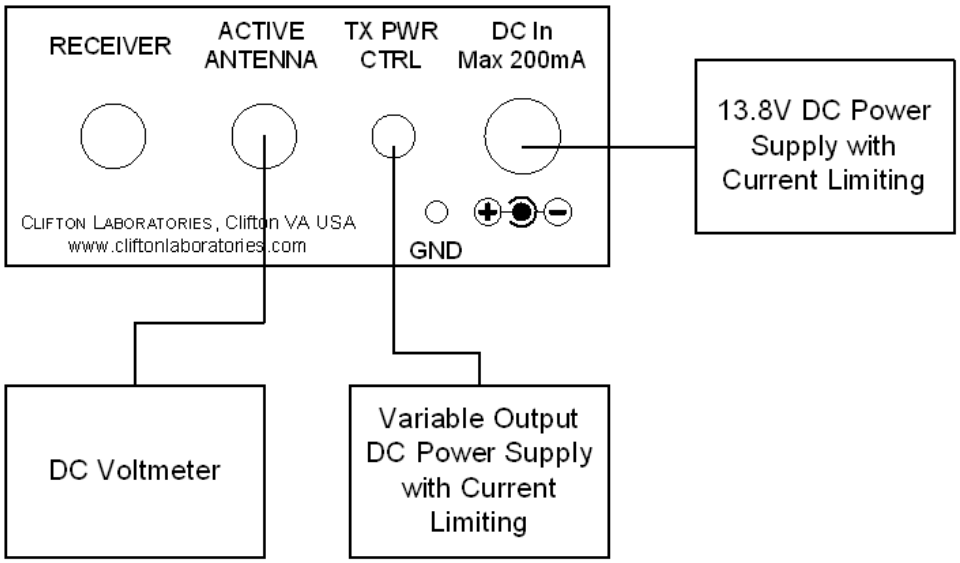
If you have selected mode 2 for operation, you should install the shunt at JP2 based upon your need for a pull up.

❑ An operational check is performed next. As with any newly constructed kit, a laboratory power supply with current limiting should be used, if available. If not, be alert for signs of damage such as the odor of an overheated resistor.

The test setup used during product development and test is shown below. If no variable

DC power supply is available, the steps requiring it may be omitted.

The DC voltmeter is connected between the center pin of the ACTIVE ANTENNA port and the ground stud. The 13.8V DC power supply current limit should be set for a value between 50 and 75 mA. The variable output power supply current limit should be set to 50 mA.



❑ Set JP1 to Mode 1 as described above and apply 13.8 V DC power. JP2 should be removed or connected to one pin only. Set the variable DC power supply to 0 volts. Or, if no variable DC supply is available, apply a short circuit across the TX PWR CTRL connector. The DC voltmeter should indicate approximately 0.4 to 0.5 volts below the DC power supply, i.e., 13.4 to 13.3 V if the supply voltage is 13.8 V.

Temporarily connect the DC voltmeter across JJ5, the RECEIVER connector, with the negative voltmeter lead to the connector shell and the positive lead to the center conductor. Verify that no DC voltage is found. Return the DC voltmeter to the original connection on JJ4, the ACTIVE ANTENNA connector.

If a variable voltage power supply is available and connected as illustrated, increase the voltage to 5V. The DC voltmeter should drop to 1 V or less.

❑ Disconnect both power supplies and change JP1 to Mode 2. Set the variable supply to 0 V. Reconnect both power supplies. The voltmeter should read 1 V or less. Quickly increase the variable DC supply to 12V. The voltmeter should indicate approximately 0.4 to 0.5 volts below the DC power supply, i.e., 13.4 to 13.3 V if the supply voltage is 13.8 V.

Final Assembly

❑ Attach the adhesive Mode Summary to the inside of the enclosure top half.

❑ Sight along the enclosure bottom half to see if any cable sub-assemblies extend above the enclosure top. If so, gently bend the wire/shrink tubing point until no sub-assembly cable

extends above the enclosure top.

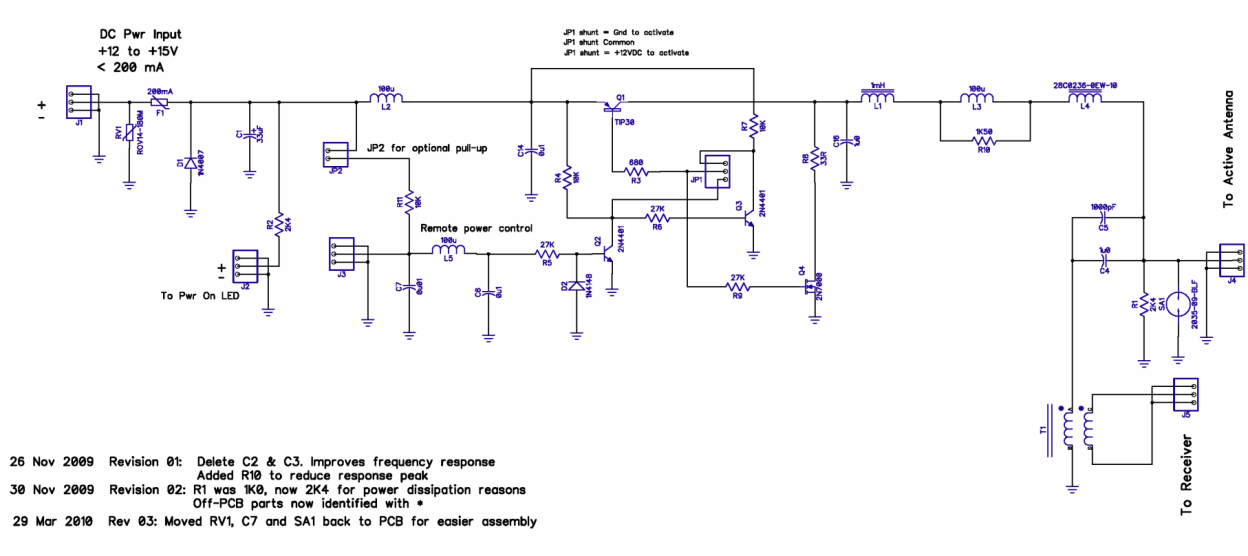
- ❑ Attach the top enclosure half with the 4 #8x3/8” sheet metal screws.

- ❑ Apply four plastic adhesive feet to the corners of the enclosure bottom.



This completes the assembly and verification of your Z1203A active antenna coupler.

Theory of Operation



In order to inject DC voltage into a transmission line also carrying RF signal, the Z1203A accomplishes two essential tasks:

- Prevents the DC power source from appearing as low impedance at RF frequencies; and
- Prevents the DC voltage from appearing on the signal output (receiver) port.

The Z1203A also adds several useful features:

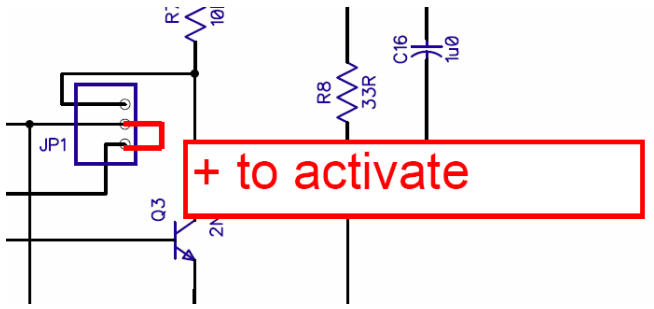
- Provides an isolated (floating ground) signal output to break any potential ground loop between the receiver and the remote antenna system;
- Protects from over-voltage on both the DC supply line and the remote antenna system feedline;
- Protects against reverse voltage and over current; and
- Remotely controls the DC supply feed to the remote antenna system, including an active pull down circuit.

DC power enters through J1. Over-current protection is provided by F1, a 200 mA "polyfuse" or positive temperature coefficient (PTC) thermistor. In the event that more than 200 mA current is drawn, F1's temperature increases as does its resistance. While the fault condition continues, F1 stays in a high temperature, high resistance state, thereby protecting the power source from overload. When the short circuit is cleared, F1 reverts to normal operation. During the tripped state, F1 dissipates 0.4 watts so if the DC power supply is at 13.8V the tripped state current will be approximately 29 mA.

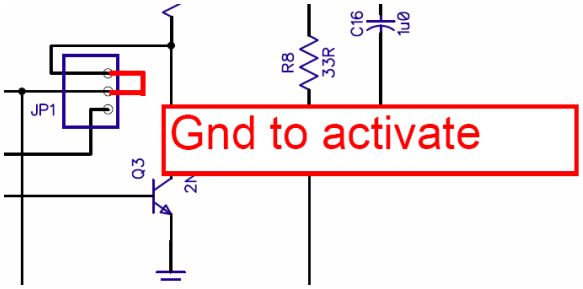
Excessive DC supply voltage is clamped by RV1, a metal oxide varistor (MOV) with a threshold voltage of 18V ±20% (DC). C1, a 33uF/63V electrolytic capacitor, in conjunction with L2 (100uH) and C14 (0u1) forms a low pass filter to reduce power supply noise above a few KHz.

Q1, a TIP30 PNP power transistor, enables and disables DC voltage on the remote antenna port. Holding Q1's base near ground places it into saturated conduction and enables DC voltage on the output port. Conversely, if Q1's base is near the supply voltage, it is cut off and the output port DC voltage drops to near zero. Q1's base is controlled by Q2 and Q3, as determined by the position jumper JP1 is placed in and the voltage level appearing at J3, the remote control port.

When JP1 is placed in the lower position, as reflected in the schematic fragment at the right, a positive voltage > 6V at J3 causes Q2 to turn on and pulls Q1's base voltage to near zero, thereby placing Q1 into conduction and applying voltage to the Z1203A's output port. Bringing J3's voltage to ground level turns Q2 off and increases Q1's base voltage to near 12V thereby placing it into cutoff and removing the output voltage.



When JP1 is placed in the upper position, as reflected in the schematic fragment at the right, Q1's base connection is shifted to Q3 which inverts Q2's output. Hence Q1's action is reversed; a ground at J3 places Q1 into conduction and +12V at J3 places Q1 into cutoff and removes DC from the output.



The remote control input, J3, has RF filtering to reduce the possible effect of nearby transmitted signals. C6, C7 and L5 form a Π-section low pass filter. R5 and D2 protect Q2 against reverse voltage and over-voltage that might be inadvertently applied at J3.

Jumper JP2 provides an option setting for an internal 10K pull up resistor.

Clifton Laboratories's Z10040B and Z10042A Norton amplifiers and Z1501D active antenna have input relays that disconnect their inputs when power is removed. This feature has two purposes:

- Protection when the device is not being used; and
- When used in conjunction with amateur radio equipment, disconnection during transmit reduces the chances of damage due to transmitted power being coupled into the device.

The Z1203A's remote disable feature facilitates immediate disconnection when transmitting. The remote disable input can be connected to a transceiver at a point where a suitable control voltage appears during transmit. The control voltage may be +12V during transmit or ground during transmit.

Q4, a 2N7000 MOSFET, provides active pull down of the DC output voltage when Q1 is placed into the deactivated state. The purpose of active pull down is to shorten the time a remote antenna is powered up via its internal filtering capacitor(s) when DC power is removed. Since both the

Z10040B and Z1501C have internal filter capacitors in the 10 – 33 uF range, it takes a few milliseconds for the voltage to decay to the point where the input disconnect relays are in the safe position. This time can be improved upon if a low value resistance is shunted across the transmission line immediately upon Q1 assuming a high impedance (off) state. Q4's gate is driven from the same voltage source as is Q1's base, so when Q1 is on, Q4 is off and vice versa. R8, 33R, limits discharge current to a safe level.

To isolate the DC supply from the RF signal and prevent the DC source from appearing as a short circuit to RF, three series inductors, L1, L3 and L4 are used. Cascading multiple inductors minimizes problems with self-resonance and with inadvertently creating an unwanted series-resonant notch trap created by the choke and its bypass capacitor. This is particularly troublesome when very broadband performance is desired, as inductors suitable in one part of the frequency range can be problematic at higher or lower frequencies. L4 is a multi-turn ferrite inductor which has broadband isolation characteristics and is useful above 5 MHz. R10, 1K5, is a "Q-spoiling" resistor that dampens an otherwise objectionable notch in the frequency response caused by L3-L1-C16.

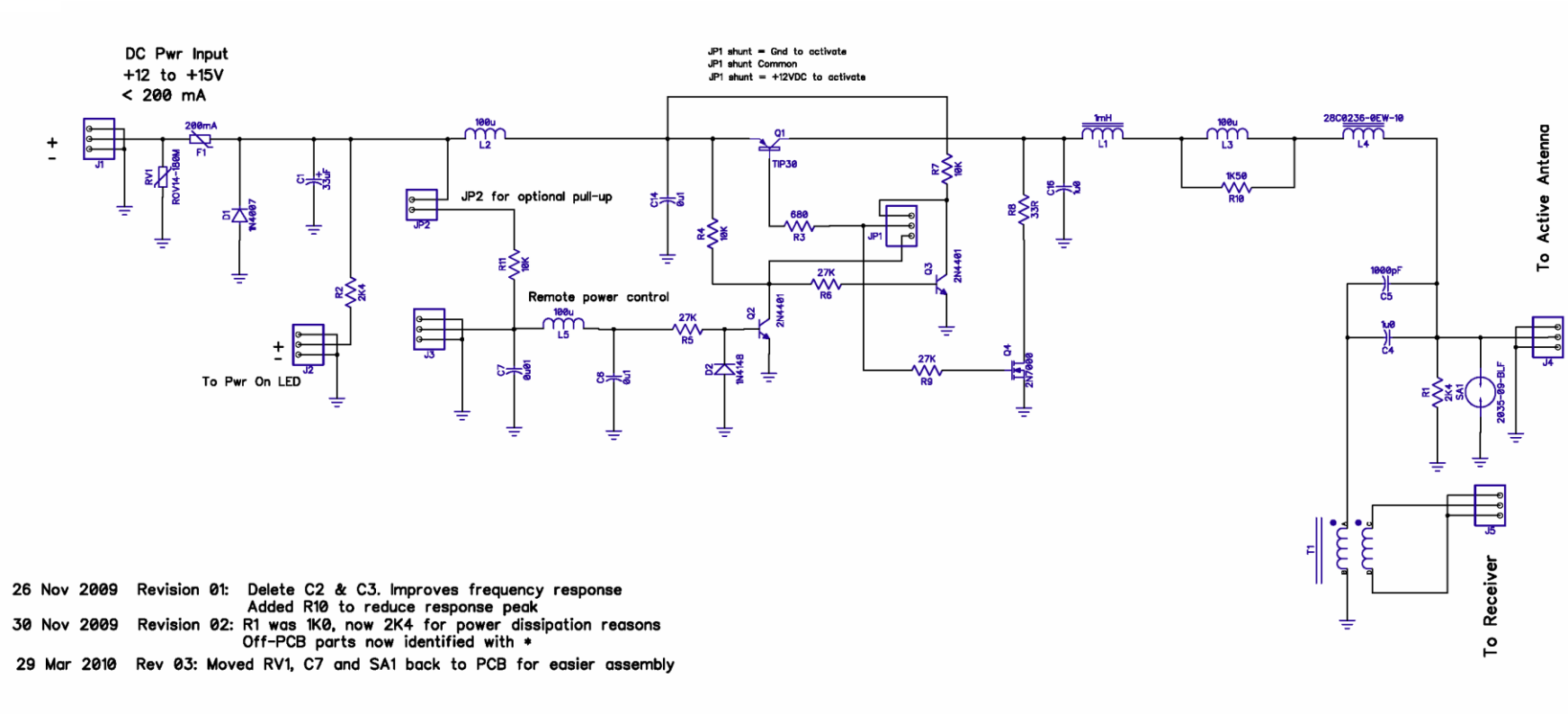
C4 and C5 provide a DC block between the receiver port and the active antenna port, permitting DC voltage to be imposed on the active antenna port without causing damage to the attached receiver. Two parallel capacitors, C4 (1u0) and C5 (1000p), with widely spaced values are used to avoid component parasitic resonance effects at higher frequencies. R1, 2K4, provides a DC drain to ground, should a small amount of leakage voltage appear across C4 and C5, and also provides a safe path to ground for turn-on and turn-off transients. Spark gap SA1 (75 volt) provides protection against gross over-voltage conditions on the remote antenna connection.

T1 is a broadband, bifilar wound transformer that provides an isolated (floating) output to the receiver. Floating the receiver output reduces the noise that may otherwise be coupled onto the active antenna feed line from the receiver and its connection to the AC power mains.



Although the Z1203A has several protective features, these are intended to reduce, not prevent, damage from catastrophic events, such as nearby lightning damage. The user always remains responsible for following good engineering practices with respect to antenna design, installation, lightning protection and grounding. Clifton Laboratories recommends that remote antennas be disconnected from the Z1203A except when actually in use and that under no circumstances should the Z1203A be connected to a remote antenna or preamplifier or used when there is a possibility of nearby lightning.

Appendix A Schematic

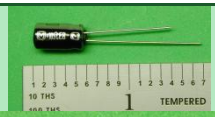
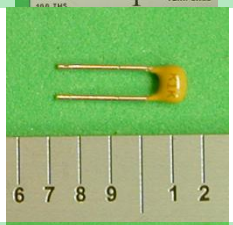
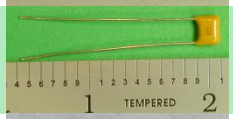
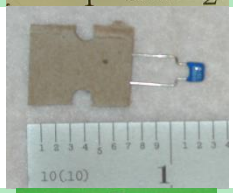
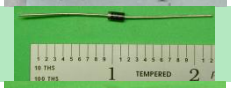


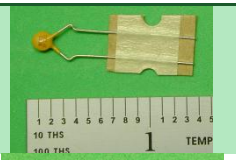
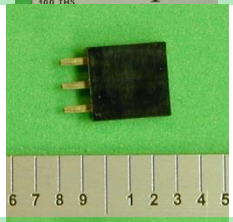
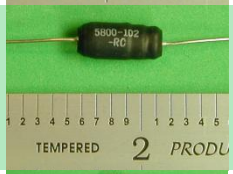
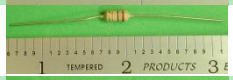
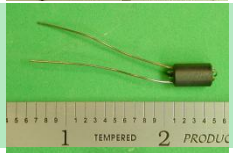
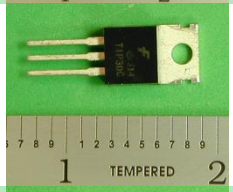
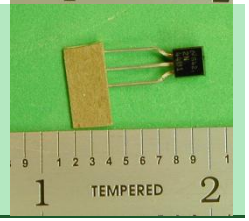
Appendix B Parts List

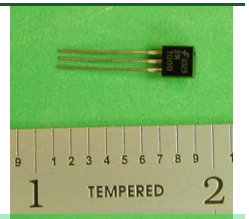
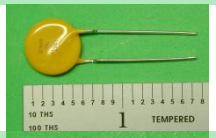
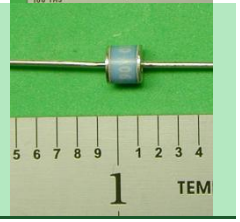
A note on how component values are identified in this manual

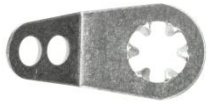
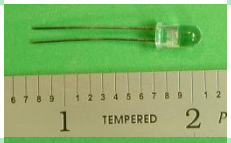
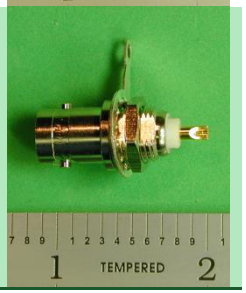
This document follows the international practice of using the value multiplier to indicate the decimal point. Thus, a 1.0µF capacitor is identified as 1µ0 and a 10,000 ohm resistor is identified as 10K0.

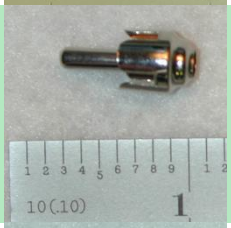
Before starting your build, please take a moment and inventory the parts provided against the list below. The ruler is marked in inches and tenths. (25.4 mm equals one inch.)

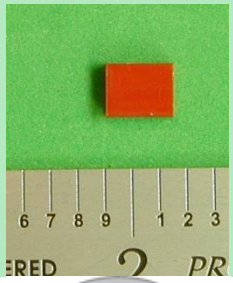
Component	Value	Description	Quantity	Marking	Photo
C1	33uF	33UF 63V ELECT EB RADIAL	1	33uF	
C14, C6, C7	0u1	Ceramic X7R 50V 0.1"	3	104	
C16, C4	1u0	50volts 1uF 20% Z5U 0.2"	2	105	
C5	1000pF	1000pF 50V ceramic 0.2"	1		
D1	1N4007	1N4007 1A 1KV Power Diode axial	1	1N4007	
D2	1N4148	1N4148 Silicon signal diode axial	1	1N4148	

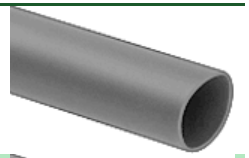
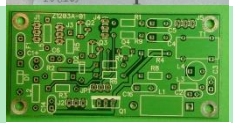
Component	Value	Description	Quantity	Marking	Photo
F1	200mA	200mA polyfuse	1	XF020	
J1, J2, J3, J4, J5		3x1 0.1" pin header socket (F)	5	None	
L1	1mH	1 mH axial RF Choke high current	1	5800-102	
L2, L3, L5	100u	Axial lead RF choke 370mA	3	Bwn-Blk-Bwn-Gold	
L4		multi-turn ferrite bead	1	None	
Q1	TIP30C	Bipolar Transistor 1A 100V 30W PNP	1	TIP30C	
Q2, Q3	2N4401	Bipolar Transistor NPN Transistor General Purpose	2	2N4401	

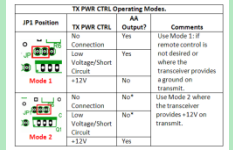
Component	Value	Description	Quantity	Marking	Photo
Q4	2N7000	MOSFET N-Channel 60V 200mA	1	2N7000	
R1	2K4	1/4 watt 5% carbon film resistor axial	1	Red-Yel-Red-Gold	
R2	2K4	1/4 watt 5% carbon film resistor axial	1	Red-Yel-Red-Gold	
R3	680	1/4 watt 5% carbon film resistor axial	1	Blue-Gry-Bwn-Gold	
R4, R7, R11	10K	1/4 watt 5% carbon film resistor axial	3	Bwn-Blk-Org-Gold	
R5, R6, R9	27K	1/4 watt 5% carbon film resistor axial	3	Red-Viol-Org-Gold	
R8	33R	1/4 watt 5% carbon film resistor axial	1	Org-Org-Blk-Gold	
R10	1K50	1/4 watt 5% carbon film resistor axial	1	Bwn-Grn-Red-Gold	
RV1	ROV14-180M	14mm MOV, 18V nominal threshold	1	180M	
SA1	75V	Gas Discharge Tube 75V (color and markings may vary depending on supplier)	1	LF 75	

Component	Value	Description	Quantity	Marking	Photo
T1, Common Mode Choke		Ferrite core for T1, 0.5" OD Nominal Note: The cores are physically identical but are not electrically interchangeable. They are identified in the packaging separately for T1 and for common mode choke purposes	2	None	
Enclosure		Punched & silk screened enclosure (top and bottom sections; 4 sheet metal screws)	1		
		PCB LUG LOCKING TINNED #4	2		
	0.1" pin header	Male 0.1" x 1 header pin strip	20		
		Standard LED Green Diffused T 1-3/4	1	None	
	JJ4	BNC (F) grounded shell 50 ohm through hole mount. This connector has a metal threaded section.	1		

Component	Value	Description	Quantity	Marking	Photo
	JJ5	BNC (F) Floating shell 50 ohm through hole mount. This connector has a plastic threaded section	1		
	JJ1	DC Power Connectors Panel Mount 5.5/2.1MM	1		
	JJ3	RCA (F) Connector Panel Mount	1	None	
		RCA (M) solder-on connector	1		
		LED MOUNTING CLIP	1		
		11" Solderable magnet wire #26 AWG red	1	None	

Component	Value	Description	Quantity	Marking	Photo
		11" Solderable magnet wire #26 AWG green	1	None	
	JP1 & JP2	SHUNT, RED 0.1" x 2 position	2	None	
		4-40 brass thumb nut	1	None	
		4-40 x 5/8" Philips pan head 18-8 SS machine screw	1	None	
		4-40 internal tooth lock washer 18-8 SS	1	None	
		4-40 flat washer 18-8 SS 0.125" ID 0.313" OD	2	None	
		4-40 hex nut, ¼" across flats	1	None	
		Heat shrink tubing red, 1/8" ID before shrinking 2"	1	None	

Component	Value	Description	Quantity	Marking	Photo
		Heat shrink tubing black, 1/8" ID before shrinking 2"	1	None	
		Heat shrink tubing, 1/4" ID before shrinking 3"	1	None	
		RG-174 coaxial cable 12"	1		
		Printed circuit board	1	Z1203A	
		4-40 x 1/4" Philips pan head 18-8 SS machine screw	4		
		4-40 split (spring) 18-8 SS lock washer	3		

Component	Value	Description	Quantity	Marking	Photo
		Red hookup wire #24 AWG 7/32 stranded 300V PVC insulation	1		
		Black hookup wire #24 AWG 7/32 stranded 300V PVC insulation	1		
		5.5/2.1mm DC power cord with molded connector 72" long	1	None	
		Mode 1/Mode 2 summary adhesive label	1	None	 TX PWR CTRL Operating Modes. JP1 Position / TX PWR CTRL / AA Output? / Comments. Mode 1: No Connection — Yes; Low Voltage/Short Circuit — Yes; +12V — No. Use Mode 1 if remote control is not desired or where the transceiver provides a ground on transmit. Mode 2: No Connection — No*; Low Voltage/Short Circuit — No*; +12V — Yes. Use Mode 2 where the transceiver provides +12V on transmit.
		Enclosure, punched steel powder coated / silk screened and accessories, consisting of:			

Component	Value	Description	Quantity	Marking	Photo
		Lower enclosure half	1	Z1203 DC Power Coupler	
		Upper enclosure half	1	None	
		Adhesive plastic bumpers 0.5” x 0.5” x 0.25”	4	None	
		Sheet metal screws #8x3/8”, black w/ Philips head	4	None	