

Assembly Manual
for
IsoCat
Isolated USB Transceiver
Control
Plus
Sound Card Interface



First Edition – November 2006
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Introduction

This kit is intended for experienced builders familiar with through-hole assembly and basic shop practice. Skills necessary to successfully complete this kit include basic circuit board soldering, hand tool operation, and the ability to read schematics, mechanical drawings, and component location drawings.

All components necessary to assemble the IsoCat circuit board are included in the kit. To aid assembly, small components are clearly identified. Surface mount components are already installed on the board.

Deluxe kits also contain additional components to package the completed circuit board as well as all required cables. The transceiver-specific accessory cable must be assembled. The USB cable, audio in and out cables, and the control signal cable are supplied assembled and are available at most computer and consumer electronics stores.

Preparation

All assembly work must be accomplished in a static-grounded workspace. Even in humid climates, most workshops have low enough humidity to generate static charges that can degrade the surface mount ICs. See Appendix A in this guide for a partial list of suggested tools.

Assembly

Use the following steps to assemble the IsoCat:

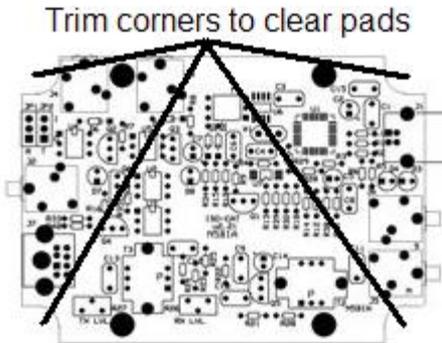
1. Prepare the circuit board.
2. Assemble the circuit board.
3. Attach the circuit board to the enclosure bottom plate.
4. Prepare the enclosure.
5. Apply the case label.
6. Install the LEDs.
7. Build the auxiliary cable.
8. Test and adjust the IsoCat.
9. Complete the assembly.

Circuit Board Preparation

To fit in the supplied enclosure, the four corners of the circuit board must be trimmed. If an alternate packaging design will be used, you can omit this step.

IMPORTANT: Do not remove the anti-static material from the board until all cutting operations are completed.

Using a nibbling tool, cut away the portions of the circuit board as indicated by the silkscreen.



Using a Dremel® tool with a sanding drum or a round file, remove the rough edges from the corners. Be sure the board will fit inside the top enclosure without interference from the molded screw posts before proceeding.

Circuit Board Assembly

To avoid possible static damage to the components, all assembly work must take place at the anti-static work area. Remove the anti-static material from the printed circuit board. Remove any residue from the preparation step, and then begin assembly of the circuit board.

See the component location diagram in Appendix C. All component locations are also silk-screened on the circuit board.

IMPORTANT: Do not remove the components from the identification sheet until you are ready to install them.

Install the resistors and diodes first, working out from the center of the board. Bend the leads down to form a 'U' approximately 0.4 in wide and insert the component in the holes. Turn the board bottom side up, place it on a flat surface to hold the components flush against the top side, and solder each lead in place. Clip each lead flush with the solder fillet. It is not necessary to bend the leads flush against the board before soldering. The solder is strong enough to hold the components in place.

Next, install opto-isolators, optical relays, potentiometers, and capacitors. Finish the assembly steps by installing the 1/8 in phone connectors, the USB and accessory connectors, and transformers. The LEDs will be installed during mechanical assembly.

IMPORTANT: Flux removers can attack plastics. Be careful when cleaning the top of the board, especially around the phone jacks.

After all components are soldered in place, clean the flux from the board. Digi-Key and Mouser list flux removers in their catalog. Local electronic supply vendors will also have flux remover solutions in stock.

Inspect both sides of the circuit board for solder splashes or shorts. For best results, work in a well-lit work area and use a magnifier.

Enclosure Preparation

Begin mechanical assembly by installing the completed board on the enclosure bottom plate. Use short (1/8") #6 self-tapping machine screws and the cardboard washers.

IMPORTANT: Do not over-tighten these screws. Tighten just enough to keep the board from moving with moderate lateral pressure.

Use the marks on the template to locate the position of the four holes for the LEDs in the top of the case. Center-punch and drill these holes. Using a 1/4 in or larger drill bit, clean up the edges by rotating the drill bit by hand.

See the mechanical drawings to transfer the locations of the openings to the top of the enclosure. Using the completed circuit board/case bottom assembly, verify that the openings are in the correct locations. Remember the old carpenters adage - measure twice, cut once.

Using a Dremel® tool or an Xacto saw, cut the sides of the rectangular openings for the connectors. Using an Xacto knife, carefully score the top portion of the rectangular opening. Bend the tab back and forth until it separates from the enclosure. Smooth the rough edges with a file.

Drill a 3/16 in diameter hole at each phone plug location. Cut slots from each connector to the edge of the enclosure with a Dremel® tool or Xacto saw. Smooth the edges with a file and test fit the enclosure. Use a file to make any final adjustments to the fit.

Drill a pilot hole for the accessory connector. Be sure that the hole is centered on the face of the connector. Using a hand reamer or a file, enlarge the hole to 5/8 in diameter.

Label Application

Cut out the label and trim it to fit. Partially separate the backing from a sheet of clear laminating film and position the label between the backing and the laminating sheet. Firmly press the backing and the label onto the laminating film. Work out any air bubbles between the label and the film. Trim the film so that a 1/16" border remains around the label.

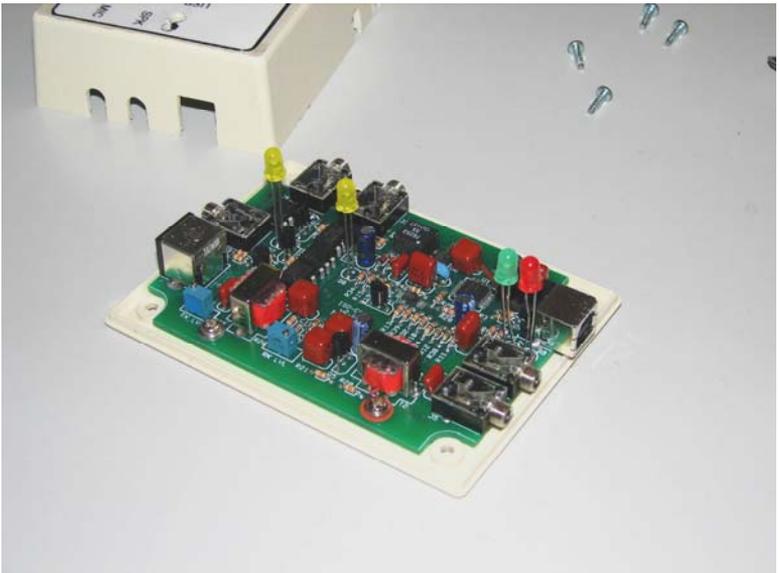
Remove the backing material and apply strips of double-sided tape to the back of the label. Be sure the strips do not overlap or come closer than 1/16" to the edge of the label. Carefully align the label with the enclosure and press it down. Work out any air bubbles. Use a sharp pointed Xacto blade to trim the LED openings. Test-fit the enclosure top and bottom and trim or file to obtain a good fit. Obstructions, then set top aside until the testing and alignment is complete.

LED Installation

Temporarily place each of the LEDs in the appropriate location on the circuit board, then test-fit the top of the enclosure over the LEDs. The LEDs should fit snugly against the enclosure top and not prevent it from seating fully against the bottom plate.

If the top does not seat fully without bending the leads, note the separation between the case top and plate. Lift the case top away from the bottom plate, remove the LEDs, and trim the leads by the distance you measured between the top and the plate. Re-insert the LEDs and test fit the case top.

When satisfied with how the case fits together, remove the top and verify the LED polarity with the silkscreen or component location diagram. Carefully tack solder one lead of each LED to the circuit board. Remove the circuit board, turn it over, and solder both leads. Clean any remaining flux from the board. Reattach the circuit board to the bottom plate.



Auxiliary Cable Assembly

The auxiliary cable must be assembled to connect the transceiver to the IsoCat. All components necessary to assemble this cable are supplied in the kit. See the cable diagram in Appendix D.

Be sure to use the heatshrink tubing on each wire. The pins are very close together, thus making short circuits between the pins very probable if the tubing is omitted.

When the cable is assembled, check the wiring with an ohmmeter or continuity checker. Be especially careful that pin 1 of either connector or pin 13 of the transceiver accessory connector is not shorted.

Testing

Before connecting the interface to the computer or transceiver, use an ohmmeter to verify that there are no shorts on the supply rails. See the following table for lead placement and measurements.

Black	Red	Reading
C3 can	L1-C1 junction	>7 megohms
C7 can	D1 cathode	>1 megohm
C14 can	R22-C9 junction	>10 kilohms

IMPORTANT: See the operators guide for information on installing the driver software on the computer before continuing the test procedures.

After installing the drivers, connect the interface to the computer USB connector. The red and green LEDs should flash, followed by the yellow LEDs.

See the operators guide for information on completing the connections to the interface, transceiver, and computer and for setup procedures.

Completing the Assembly

When the setup is complete, assemble the case top to the bottom plate. Install the four screws to secure the bottom plate to the case top.

Conclusion

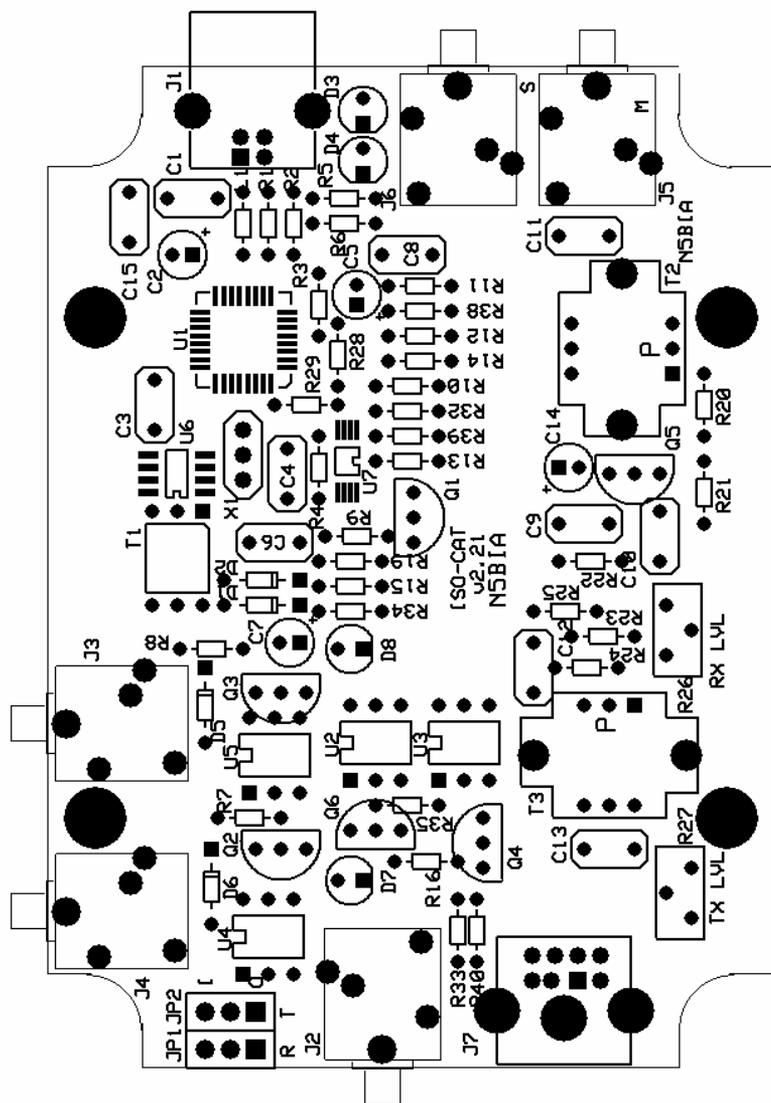
This is an interesting and educational project. Assembly is simple enough to be practical for most builders, yet challenging enough not to be boring. I sincerely hope you have as much enjoyment from building it as I have had designing it.

Appendix A – Recommended tools

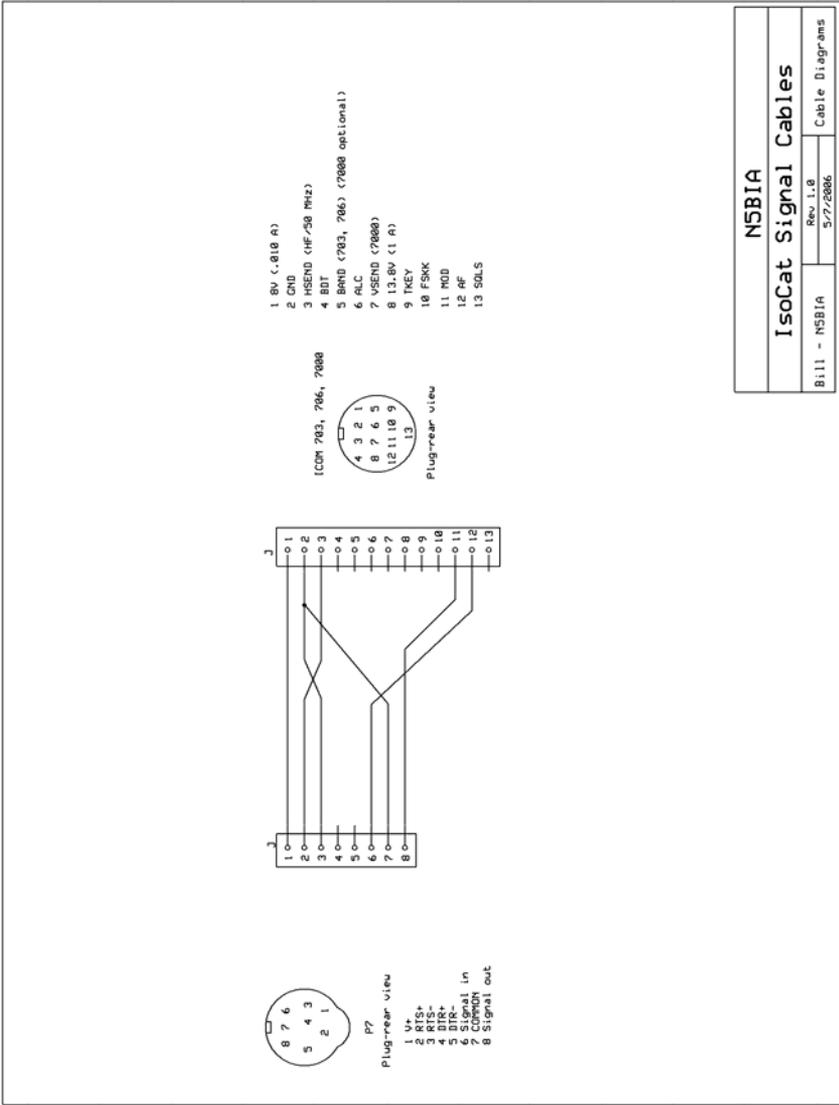
Tools necessary for assembly include the following:

- Anti-static service kit 276-2370.
- Grounded soldering iron – 15W
64-2051
- Magnifying glass/tweezers 63-1310
- Diagonal cutters
- Needlenose pliers
- Solder sponge
- Phillips screwdriver (#2)
- X-ACTO knife with blades
- Dremel® rotary grinder
- Flat file
- Round file
- 3/16 in drill
- Tapered reamer
- Scissors
- Hair dryer/heat gun (for heatshrink tubing)

Appendix C – Component Locations



Appendix D – Accessory Cable



NSBIA	
IsoCat Signal Cables	
Rev 1.8	Cable Diagrams
Bill - NSBIA	5/7/2006

Appendix E – Parts List

Reference	Title	Detail
	Board, printed circuit	
C1, C3, C9, C10, C12	Capacitor, stacked metal film, 1uf, 50v	
C11, C13	Capacitor, polyester, 0.01uf, 50v	
C14	Capacitor, electrolytic, 100 uF, 16V	
C2, C5	Capacitor, electrolytic, 33 uF, 16V	
C4, C6, C8, C15	Capacitor, polyester, 0.1uf, 50v	
C7	Capacitor, electrolytic, 22 uF, 16V	
D1, D2, D5, D6	Diode, small signal, 1N914	
D3	Diode, light emitting, red	
D4	Diode, light emitting, green	
D7, D8	Diode, light emitting, yellow	
J1	Connector, USB	7877801
J2, J3, J4, J5, J6	Connector, 1/8 phone,	
J7	Connector, DIN	CP-2280
L1	Inductor, ferrite bead	axial lead
Q1, Q4, Q5, Q6	Transistor, NPN, 2N3904, TO-92	
Q2, Q3	Transistor, PNP, 2N3906, TO-92	
R1, R2	Resistor, 1/8w, 5% 27 ohm	axial lead
R11	Resistor, 1/8w, 5%, 47 ohm	axial lead
R12, R25, R38	Resistor, 1/8w, 5%, 10 ohm	axial lead
R13, R39	Resistor, 1/8w, 5%, 110 ohm	axial lead
R14, R19	Resistor, 1/8w, 5%, 300 ohm	axial lead
R15, R29, R34	Resistor, 1/8w, 5%, 10000 ohm	axial lead
R20	Resistor, 1/8w, 5%, 3300 ohm	axial lead
R21	Resistor, 1/8w, 5%, 33000 ohm	axial lead
R22	Resistor, 1/8w, 5%, 100 ohm	axial lead
R23	Resistor, 1/8w, 5%, 560 ohm	axial lead
R24	Resistor, 1/8w, 5%, 6.2 ohm	axial lead

R26	Potentiometer, 12-turn, 10K ohm	
R27	Potentiometer, 12-turn, 1K ohm	
R28	Resistor, 1/8w, 5%, 2200 ohm	axial lead
R3	Resistor, 1/8w, 5%, 1500 ohm	axial lead
R32	Resistor, 1/8W, 5%, 100K	axial lead
R33	Resistor, 1/8w, 5%, 1000 ohm	axial lead
R4, R10	Resistor, 1/8w, 5%, 470 ohm	axial lead
R5, R6	Resistor, 1/8w, 5%, 270 ohm	axial lead
R7, R8, R9, R16, R35, R40	Resistor, 1/8w, 5%, 4300 ohm	axial lead
T1	Transformer, power, switching	7825355
T2, T3	Transformer, audio	1:1, 600 ohm
U1	IC, USB-serial converter	FT-232-BL
U2, U3	IC, optoisolator, 4N33	6-pin DIP
U4, U5	Relay, solid state. 400V, .15A	PS1741E- 1A-A
U6	IC, DC-DC converter	MAX253
U7	IC, memory	93C46
X1	Crystal, oscillator, 6-mHz	

Notices

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Warranty

Seller warrants the IsoCat to be free from defects in material and workmanship when used as described herein. Seller's obligation under this warranty is limited to replacing or repairing, free of charge, any item manufactured by Seller which is returned to Seller not later than 30 days after the date of purchase. Transportation charges or duties shall be borne by Purchaser. This shall be the limit of Seller's liability for any breach of warranty. Purchaser must notify Seller by registered mail or certified mail, return receipt requested, of a breach of warranty within 14 days after discovery thereof, but not later than the guarantee period; otherwise, such claims shall be deemed waived. No allowance will be granted for any repairs or alterations made by Purchaser without Seller's prior written consent. **THE EXTENT OF THIS WARRANTY IS EXCLUSIVELY LIMITED TO THE REPAIR OR REPLACEMENT OF THE DEFECTIVE OR MISSING ITEM. IN NO EVENT SHALL THE SELLER'S LIABILITY EXCEED THE PURCHASE PRICE PAID BY THE PURCHASER FOR THE IsoCat KIT.**

This warranty shall not apply to any IsoCat which has been repaired or altered, without Seller's written consent, or assembled or altered in any way so as, in the judgment of Seller, to affect adversely the stability or reliability of the IsoCat, or has been subject to misuse, negligence or accident.

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Bill Buoy

N5BIA

16214 Hollow Rock Dr.

Houston, TX 77070