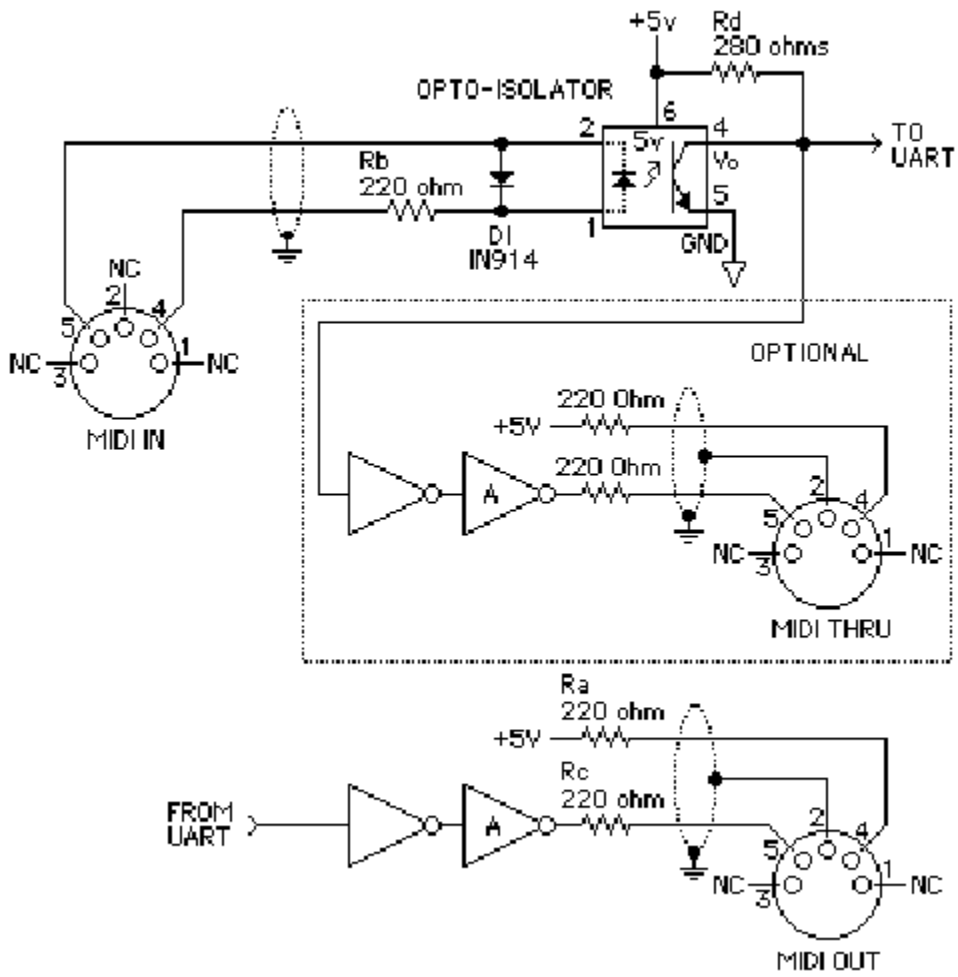
MIDI Electrical Specification Diagram & Proper Design of Joystick/MIDI Adapter

Figure 1: Electrical Specification Diagram

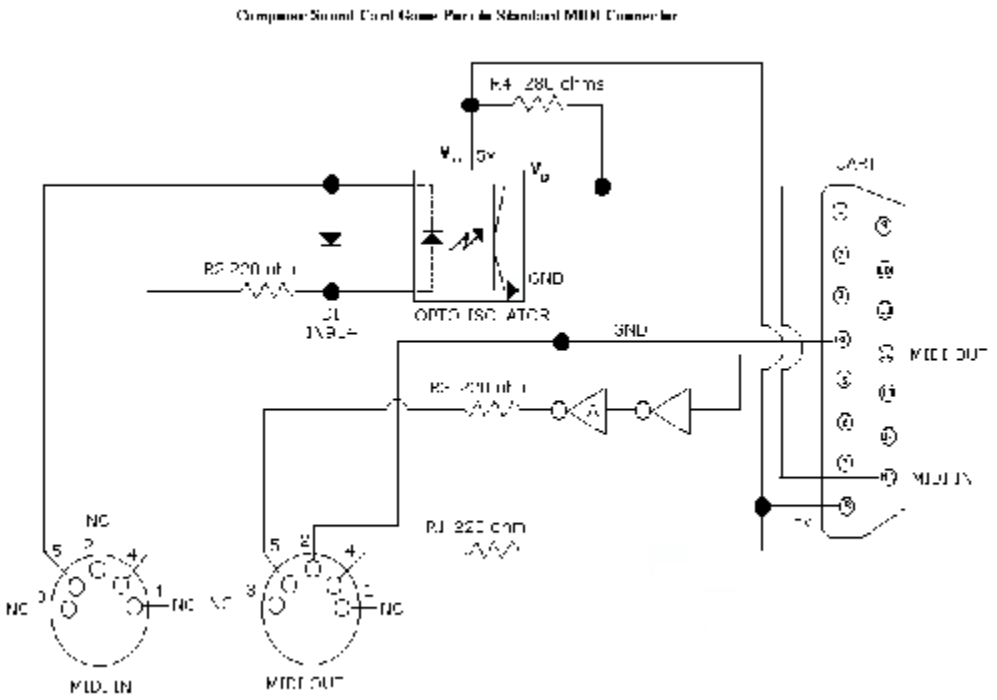


MIDI Standard Hardware NOTES:

1. Opto-isolator shown is Sharp PC-900. HP 6N138 or other can be used with changes.
2. Gates "A" are IC or transistor; Resistors are 5%.
3. Maximum cable length is fifty feet (15 meters), terminated on each end by a 5-pin DIN male plug (i.e. SWITCHCRAFT 05GM5M).
4. Cable is shielded twisted pair, with shield connected to pin 2 at both ends.

Figure 2: Joystick/MIDI Adapter Diagram

(Note: Clicking on the Image will open a full size Image in a new Window.)



Joystick Adapter NOTES:
1. A good choice for the Optoisolator 6N137. A 6N138 will work, but is slower.
2. Resistors are 5%
3. Inverter A can be an IC or a transistor.
4. It is extremely important not to ground pin 2 of the MIDI IN connector. A noise-causing ground loop will result if you do. Pin 2 of the MIDI OUT connector should be grounded. That way the shield of the MIDI cable will be grounded on one end as desired.

Ground loops will cause horrendous hum, buzzes, and other noises, especially when connected to computerized gear or lighting equipment. The noises are caused by differences in voltage potential from one end of the cable to the other. The remedy, of course, is to run balanced audio lines and to NEVER physically connect the chassis grounds of different pieces of equipment together. MIDI instrument designers understand ground loops. In fact, a major design goal of MIDI, as seen in the electrical specification explanation in the MIDI Specification Document, is to prevent any ground loops that might occur with the MIDI cables. This is done by using a balanced current loop through an opto-isolator and only grounding the MIDI outputs. The MIDI IN connector is not grounded to the receiver's chassis. When done correctly, there are no ground

loops and no hum or other noises caused by the MIDI setup.

Designers of personal computers are not generally audio engineers and apparently have not heard of ground loops. In fact, given the noisy fans and screaming disk drives that go into the PC, it is a wonder they can hear at all. All that noise forces some audio professionals keep the computer in a closet or another room. But the primary source of ground loop problems in PC audio is the PC soundcard MIDI interface.

A PC soundcard exports the serial MIDI signal from its UART on two pins of its joystick or game port. A $50 cable converts this to the approved MIDI connector, and is supposed to include the necessary opto-isolator for conversion to the required balanced current loop. The MIDI IN connector is supposed to have the opto-isolator and no ground connection to pin 2 or to the shield for the express purpose of avoiding a ground loop.

We were able to locate six different such cables, all of which violate the MIDI hardware specification by grounding both MIDI connectors (MIDI IN and MIDI OUT). ALL of these cables will cause ground loops, and generate hum and other unnecessary noise.