IRVC2 pc board/kit Assembly Notes. Ver 1.1 4/17/2011

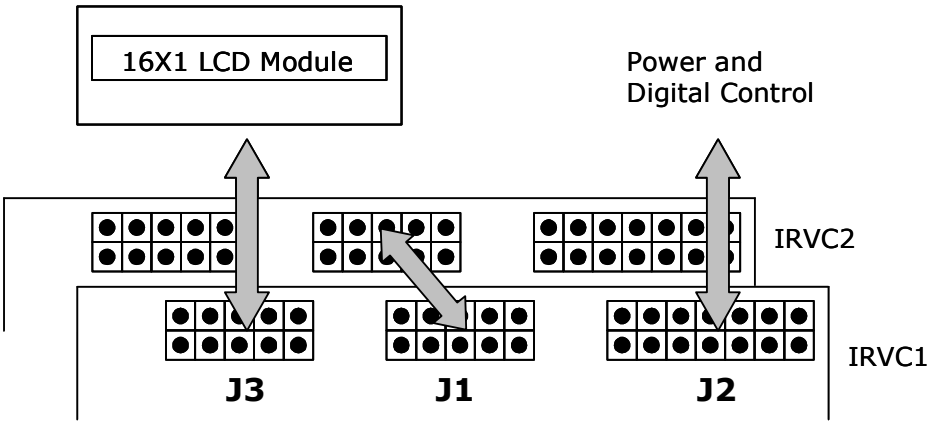
(Special thanks to Guillermo L. for his improvements to this document)

Please read before assembling your kit.

Make sure you have the polarities and voltages correct before applying power to your board. Incorrect polarity can damage the voltage regulator, the IRVC2 chip, the PGA chips, the opamps, and the IR sensor.

J2 is the power and digital connection between the IRVC2 board and the outside world. J3 can be used to connect an optional 16x1 LCD module. J1 is for connecting to PGA chips mounted off of the main IRVC2 board, either on a second IRVC2 board, with no IRVC2 chip on it, or on some other type of board.

Board Connectors:



You may want to install the lower components (resistors) first and install the higher ones last. That gives the most time for the board to lie flat while you are trying to solder it. You will need to bend the resistor leads fairly close to the body of the resistors to fit the hole spacing used.

The cylindrical electrolytic capacitors are polarized, and must be installed correctly. The square pad is the **positive** end, and is also marked with a + sign nearby. The negative lead of the capacitor is usually marked with a – sign.

Make sure that the notches on the chips (or sockets, if used) are next to the square pad (pin 1) before soldering.

The voltage regulator and the IR sensor must be installed as shown on the parts placement diagram. The dome-shaped bulge on the IR sensor faces away from the center of the board.

The flat side of the LED is closer to the negative, or cathode lead. This end connects to pin 6 of the IRVC2 chip. The lead farther away from the flat is the positive, or anode end, which connects to the 240 ohm resistor R2. You may want to bend the LED leads so that the LED will face sideways, instead of straight up. If the LED doesn't light when you have power applied to the board and you go into "learn" mode, it may be installed backwards. This won't hurt it, it just won't light.

If necessary, you can mount the IR sensor on one of our remote sensor boards and leave the LED on the IRVC2 pc bd, or you can mount the LED remotely, and attach it to the IRVC2 pc bd with wires. If you do use remote mounting, try to keep the IR sensor away from the LED, to avoid interference.

Shorting jumpers ("JPxx") are provided on the pc bd for setting up different configurations. To short across the jumper, place a blob of solder on it. This can be removed later with solder wick if a different configuration is desired.

Connecting optional LCD Module

Use of an LCD module for display is optional. One line by 16 character modules based on Hitachi 44780 or equivalent controllers are supported. Two line, four line, or any displays with more than 16 characters will probably not work correctly, and have not been tested. The display module can either be powered whenever the board is powered, by shorting jumper JP15, or its power can be provided by the IRVC2 chip, by shorting JP16. **Do not short both JP15 and JP16, as this will definitely damage the IRVC2chip.** If the LCD module is powered by the IRVC2 chip, it will be powered down when the IRVC2 powers down. A resistor (R7) is provided that can be placed in series with the V0 connection of the display module if it is too dark. Any value can be used to make the display dimmer.

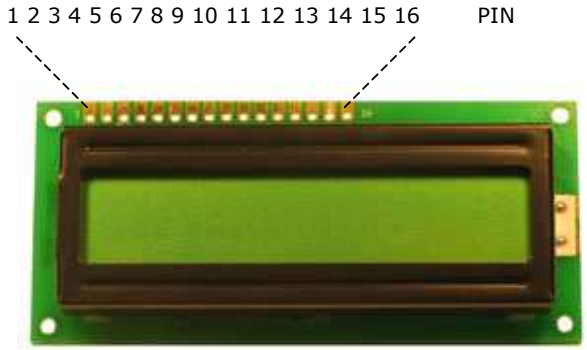
The resistor in series with V0 (R7) adjusts the contrast of the module. You could use a single turn 10K potentiometer instead for easy adjustment.

The connector for the LCD module provides the signals needed for this interface. The wires at the other end of the cable will need to be wired to the correct signals on the LCD module. The signals are not in the same order on J3 as they would be on a normal 16x1 LCD module. Please download the data for the module that you use to see how to connect it properly.

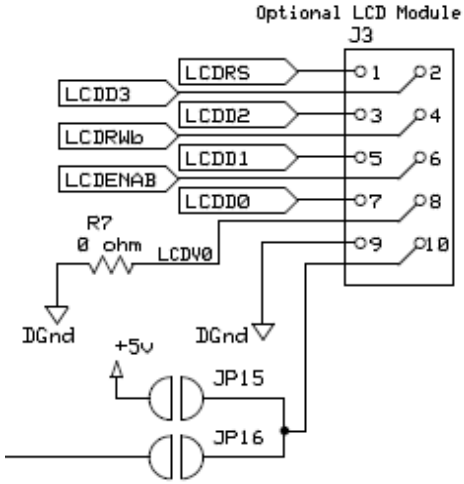
Pin 10 of J3 is the +5V power connection to the module. **Four-bit data bus mode is used to talk to the LCD module. In this mode, data connections are made to the upper four bits of the LCD module data bus, not the lower four bits. So LCDD0 should connect to D4 of the module, not D0, and LCDD3 should connect to D7 of the module.** Backlit LCD modules can be used, but please make sure you understand how the backlight is powered on the module. In general, the backlight connections are separate from the rest of the module electrical connections. This is what you want.

Please do not attempt to power the backlight from the 5V regulator on the IRVC2 board. Backlights often draw hundreds of mA's, whereas the 78L05 can only supply 100 mA max. Please keep the positive and negative backlight connections off of the IRVC2 board. You can use the signal at pin 9 (JP16) of the IRVC2 to control a backlight. It will be high when the module is ON and low when it's off. You would need to use this signal to control a transistor, which could either control a relay or maybe the backlight power itself. The IRVC2 output can only supply about 15 mA or so.

Typical 16X1 Backlit LCD Module Pin Configuration and Circuit Diagram for IRVC2 Connector J3



TYPICAL 16x1 LCD MODULE



Connections to a typical LCD Module

LCD Module		IRVC2 J3 Connector	
Description	Pin #	Pin #	Description
VSS, Ground	1	9	DGnd
VDD, +5V	2	10	+5V
Vo, Contrast Adjustment	3	8	LCDVo
RS, Register Select	4	1	LCDRS
R/W, Read/Write	5	4	LCDRWb
E, Enable	6	6	LCDENAB
DB0, Data Bit 0	7		
DB1, Data Bit 1	8		
DB2, Data Bit 2	9		
DB3, Data Bit 3	10		
DB4 Data Bit 4	11	7	LCDD0
DB5, Data Bit 5	12	5	LCDD1
DB6 Data Bit 6	13	3	LCDD2
DB7, Data Bit 7	14	2	LCDD3
A, Back Light +	15	External power. Do not use power	
K, Back Light -	16	from IRVC2 Board	

General Purpose Outputs

JP1-5 are used to configure the five general-purpose outputs as either one on at a time (source selects) or toggle. If you install JP3, then GP1-3 will be source selects, and GP4 and GP5 will toggle. Only short across at most one of these jumpers. If no jumpers are shorted, then all GP outputs will be in toggle mode.

Jumper (use only one)	General Purpose Output				
	GP1	GP2	GP3	GP4	GP5
No Jumper	Toggle	Toggle	Toggle	Toggle	Toggle
JP1	Source Select	Toggle	Toggle	Toggle	Toggle
JP2	Source Select	Source Select	Toggle	Toggle	Toggle
JP3	Source Select	Source Select	Source Select	Toggle	Toggle
JP4	Source Select	Source Select	Source Select	Source Select	Toggle
JP5	Source Select	Source Select	Source Select	Source Select	Source Select

Each General Purpose output is controlled by a single key (different number key) on the remote. The ones that are source selects are mutually exclusive. Turning on any one will turn off the others. The ones that are toggle are independent, so they can all be on.

Configuring IRVC2 for the number of PGA chips installed

The IRVC2 chip automatically detects at power-up how many PGA chips are installed. It does this by connecting to the SDO output of the last PGA chip in the chain. If the last chip is located on the IRVC2 board, short across jumper JP13. If only one PGA chip is installed, also short across JP8. If two are installed, use JP9 instead. If three PGA chips are installed, use JP10. To use additional PGA chips on a second IRVC2 board (with no IRVC2 chip installed on it) do not short JP13, but use JP11 instead, plus JP10, assuming that you have three chips installed on the first board. In the case where there are no PGA chips on the IRVC2 board, but you are controlling PGA chips off-board, short across JP12 and JP11, and do not short JP13, JP8, JP9, or JP10.

Scenario	Jumper IRVC2 board 1							Jumper IRVC2 board 2						
	JP8	JP9	JP10	JP11	JP12	JP13	JP17	JP8	JP9	JP10	JP11	JP12	JP13	JP17
One IRVC2 board with one PGA chip	x					x								
One IRVC2 board with two PGA chips		x				x								
One IRVC2 board with three PGA chips			x			x								
One IRVC2 board with three PGA chips plus Additional IRVC2 board with one PGA chip			x	x			x	x			x	x	x	
One IRVC2 board with two PGA chips plus Additional IRVC2 board with two PGA chips		x		x			x		x		x	x	x	
One IRVC2 board with three PGA chips plus Additional IRVC2 board with three PGA chips			x	x			x			x	x	x	x	
All PGA chips are off the IRVC2 board				x	x									

The first PGA chip in the chain will have channels 1 and 2 in it. The second chip will be 3 and 4, etc.

Note: There are two grounds on the IRVC2 board - Analog and Digital. These are kept separate, but a jumper (JP14) is provided to connect the two grounds together at just one point. You need to somehow tie the two grounds together. Either use jumper JP14 or connect them at some other point.

When connecting audio signals to the inputs or the outputs of the IRVC2 pc board, you may want to use some type of shielded cable to reduce the chance of picking up 60 Hz hum.

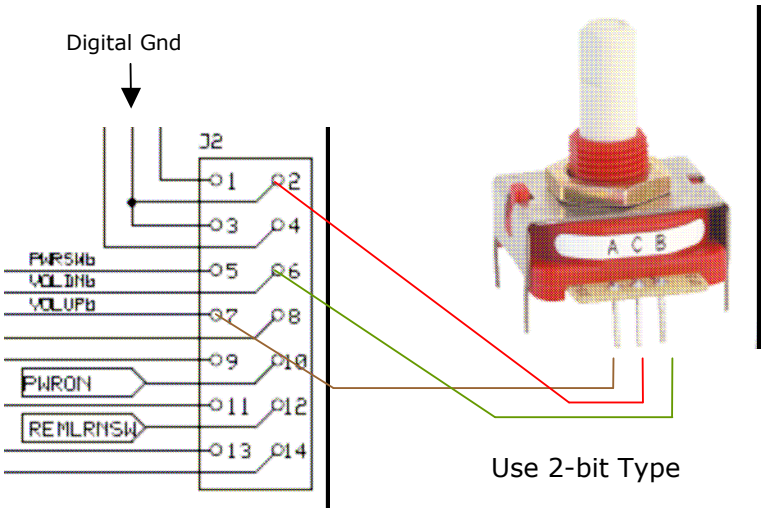
Local Volume Control

Volume can be controlled by the remote and can also be controlled locally by either a rotary encoder, momentary push buttons, or a momentary-on/off/momentary-on toggle switch.

To use a shaft encoder for local volume control, short pc bd pads JP6. To use momentary pushbuttons or a center off toggle switch for local volume control, or if no local volume control is implemented, short pc bd pads JP7. **Do not short both JP6 and JP7**.

Desired Volume Control		Jumper (Use only one)
Local Rotary Encoder	And remote	JP6
Local switch/button	And remote	JP7
No Local	Remote Only	JP7

Connecting a rotary encoder switch



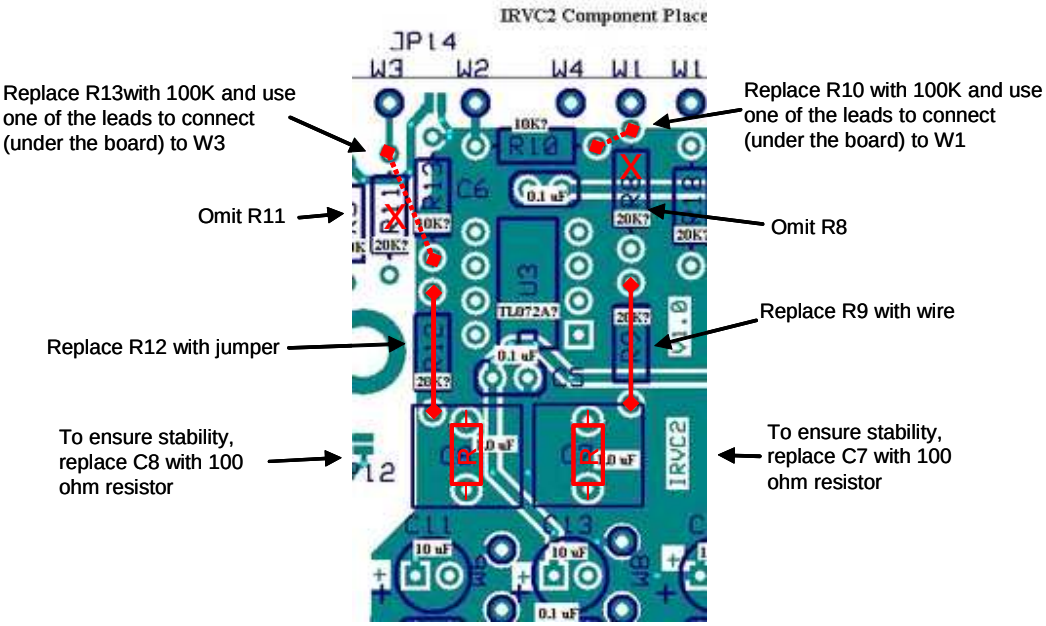
Summary J2 Pin assignments

Pin #	Name	Description	Comments
1	+15V	Power Supply +15V	Note: The +5V for the digital section is generated on-board from this +15V supply
2	Gnd	Power Supply Gnd	IRVC2 Rev 1.1 utilizes a single +/- 15V power supply. Pin 2 and Pin 3 are connected to the GND connection of the power supply
3	Gnd	Power Supply Gnd	
4	-15V	Power Supply -15V	
5	PWRSW	Local IRVC2 chip power/standby switch	Use a momentary-on switch to GND. Performs same function as remote on-off switch
6	VOLDN	Volume down switch	Use momentary-on switch to GND or connect to terminal "B" of rotary encoder switch
7	VOLUP	Volume up switch	Use momentary-on switch to GND or connect to terminal "A" of rotary encoder switch
8	SS/GP5	Source Select 5	See Note[1]
9	SS/GP4	Source Select 4	
10	PWRON	IRVC2 "On" signal	Output that can be used to indicate status or control other things (like a relay). High when the chip is "on", low when it is "off"
11	SS/GP2	Source Select 2	See Note[1]
12	REMLRNW	Remote learn switch	Used to enable remote-learning feature of IRVC2. Use momentary-on switch to GND.
13	SS/GP1	Source Select 1	See Note[1]
14	SS/GP3	Source Select 3	

[1] Note: Each Source Select/General Purpose output is controlled by a single key (different number key) on the remote. Each output can be configured as "source select" or "toggle". The ones that are source selects are mutually exclusive. Turning on any one will turn off the others. The ones that are toggle are independent, so they can all be on. See General Purpose Output section to see how to configure these output

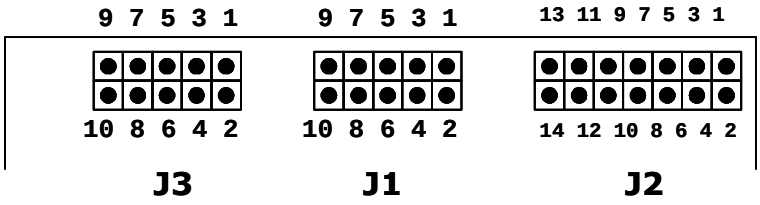
Input Buffers

The input buffers for IRVC2 are configured as unity-gain inverting amplifiers. Although this configuration theoretically results in lower distortion, these opamps can also be configured as non-inverting voltage followers with the following modifications:



Header pin assignments

Pin one of the connector headers has a square pad on the pc board. Pin two is across from it. The odd-numbered pins are down the outside of the connectors, and the even-numbered ones are down the inside.



To attach the connector to the ribbon cable, slide one end of the cable into the interior of connector, and allow about one half inch of it to stick out the other side. The ribbon cable should fit nicely into the ribbed lower side of the top part of the connector. Check the centering of the cable to insure that there is a wire above each of the contacts in the lower section. The connector should lie across the ribbon cable, perpendicular to it. You may want to place a small piece of scotch tape from the ribbon cable, across the top part of the connector, and to the ribbon cable on the other side, to hold the connector in the correct position. Once you have it placed properly, place the connector in a vise and squeeze the two halves of the connector together slowly until the top half locking pieces snap into place on both sides. This will force the cable onto the contacts in the lower part of the connector, which will cut through the insulation and make contact to the wires. (If you are not pleased with the way it looks after the two halves are pressed together, you can gently pry out the locking pieces at either end of the connector and slide the top part up, then carefully remove the cable from the contacts and try again. Don't try taking the connector apart after squeezing it unless you are pretty sure you need to. An ohmmeter can be used to check for shorts or open contacts. You can use a resistor lead to probe the connector contacts.) The outer wire of the cable on the pin, near the pin one side of the header connects to pin one of the header. The next wire connects to pin 2, etc..

On-board +5V voltage regulator

The +5V required by the IRVC2 chip and digital sections of the board is supplied by an on-board voltage regulator. The 78L05 regulator included with the kit is rated for 100 mA maximum continuous output current, but is capable of peak currents of around 250 mA at 25 degrees C. With no heatsink, the regulator can dissipate approx 0.7 watts. (Exceeding this value will cause it to shut down.)

Typical idle current for the IRVC2 board alone is about 4 mA, which is mostly the idle current of the 78L05 regulator. When the Learn LED is on, the current should increase to about 18 mA.

The regulator should provide sufficient current to power the digital parts of a fully populated board.

A second IRVC2 board should have its own 78L05 regulator

DIY Reference

Resistor color bands:

0 ohms	single black band
100 Ohms	brown black brown gold
240 Ohms	red yellow brown gold
10K Ohms	brown black orange gold
20K Ohms	red black orange gold
100K Ohms	brown black yellow gold
470K Ohms	yellow violet yellow gold

Capacitor Marking:

0.1 uF caps may also be marked “104”

And finally, to quote Heathkit:

Always use rosin core, radio type solder (60:40 or 50-50 tin lead content) for all of the soldering in this kit. The warranty will be void for any kit in which acid core solder or paste has been used.