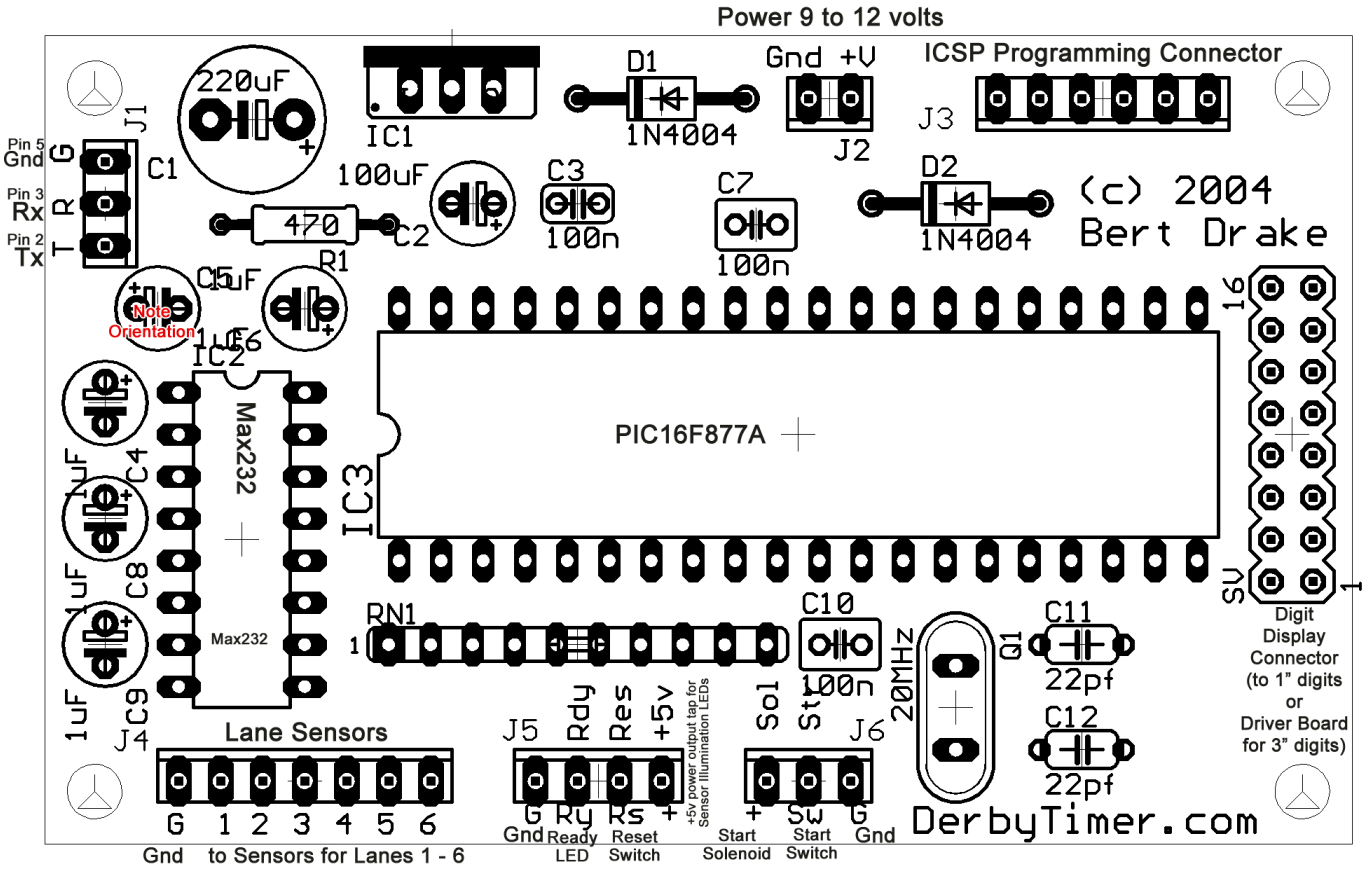
DerbyTimer.com Rev2 Timer Board Manual

The information in this manual is for the revision 2 (Rev2) DerbyTimer.com Timer Board.
The parts placement, part ID numbers, etc., will not match the original revision 1 boards.

Annotated Parts Placement Guide



Note the reverse orientation of capacitor C5. This is a polarized capacitor. Polarized capacitors must be mounted in the proper direction. Capacitors C1, C2, C4, C5, C6, C8, and C9 are polarized. Be sure to orient them correctly.

The common pin for the resistor network goes to the left, next to the RN1 component ID.

The diodes must be mounted as shown, with the silver bands to the left.

The metal tab of the 7805 should be nearest to the outer edge of the board.

Be sure the metal case of the crystal doesn't short any other components.

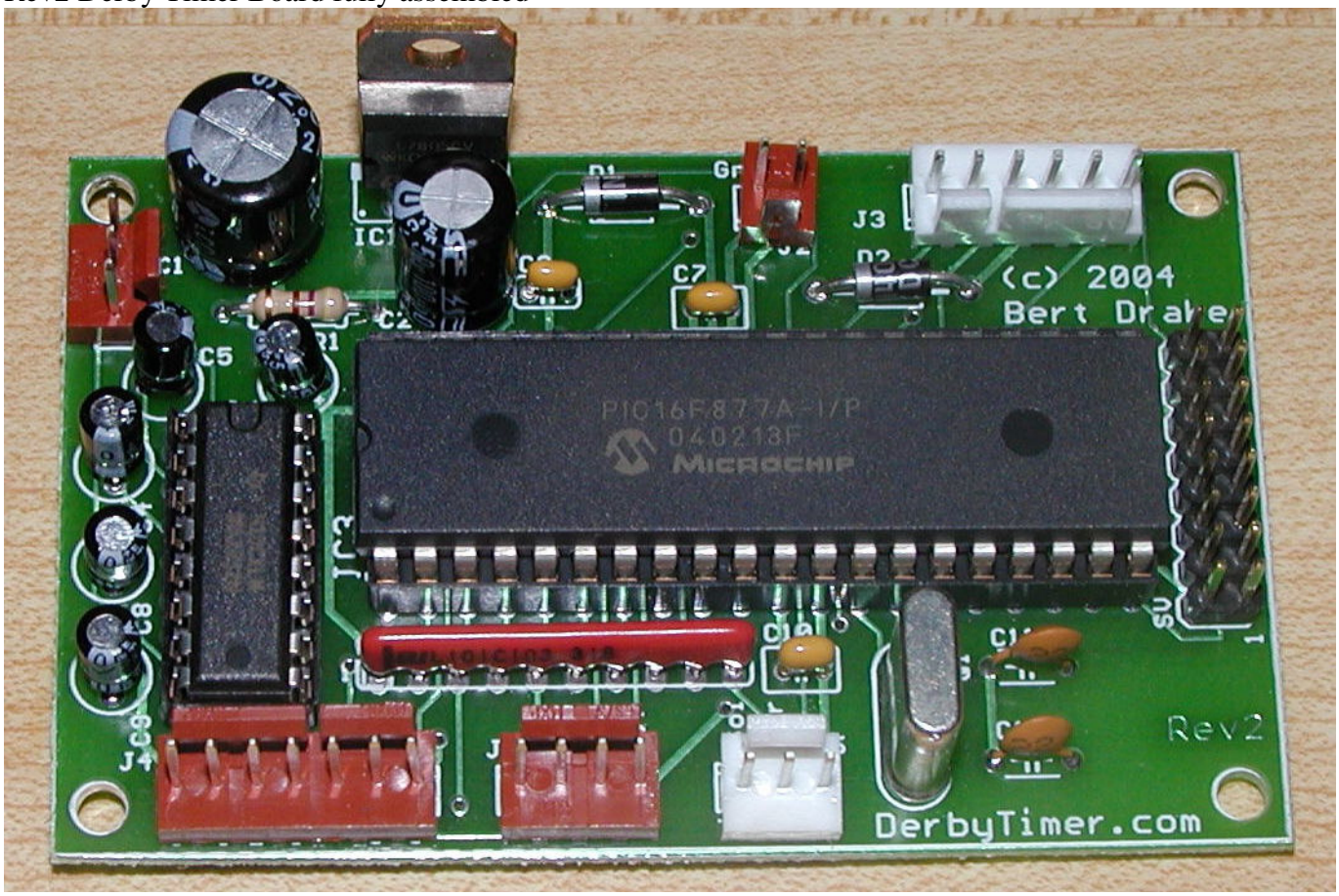
Connectors are optional, but highly recommended. You may, however, choose to solder wiring directly into the board. This will make removal of the board more difficult, however, should you ever need to upgrade or repair it.

I recommend Molex KK-100 series friction lock connectors or equivalent for the single row connectors.

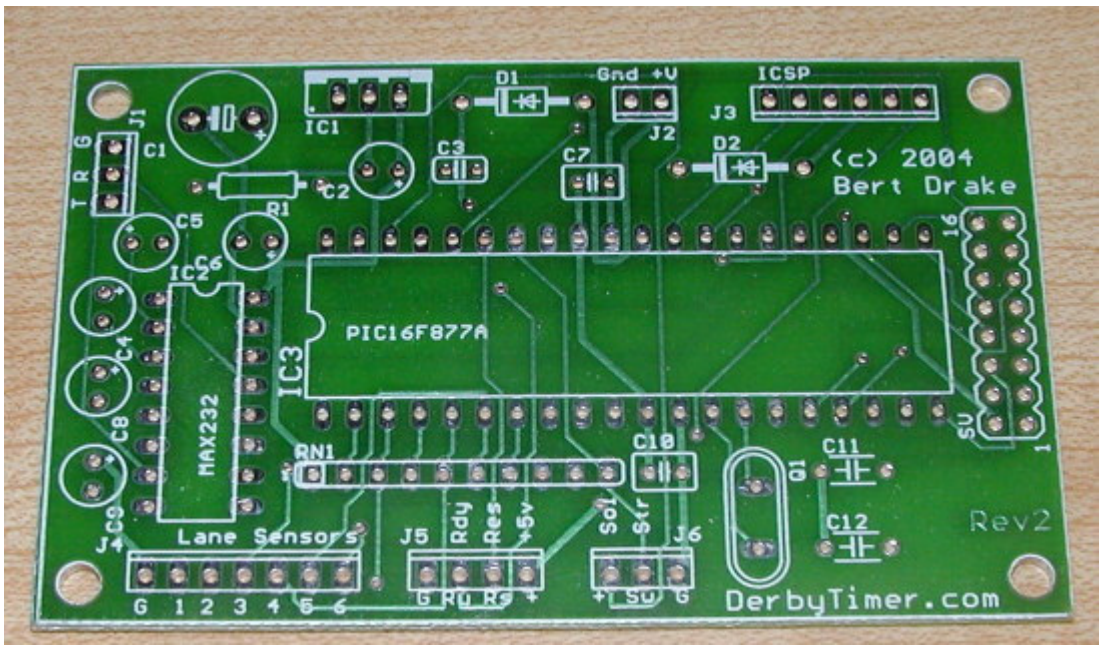
Parts List			
ID	**Part**	**Part Type**	**Purpose**
IC1	7805	+5 Volt Voltage Regulator IC	voltage converter and power regulator
IC2	MAX232	RS-232 Level Line Driver IC	Serial Communication
IC3	PIC16F877A	PIC Microcontroller IC	Processor *(ALWAYS use a socket!)*
C1	220uF 25v	Electrolytic capacitor *(Polarized)*	Power Supply (unregulated side)
C2	100uF 16v	Electrolytic capacitor *(Polarized)*	Power Supply (regulated side)
C3	100nF (0.1uF)	Monolithic capacitor *(non-polarized)*	Power filtration (0.1uF = 100nF)
C4	1uF	Electrolytic capacitor *(Polarized)*	for the MAX232
C5	1uF	Electrolytic capacitor *(Polarized)*	for the MAX232 *Note this polarized capacitor is reversed from the rest*
C6	1uF	Electrolytic capacitor *(Polarized)*	for the MAX232
C7	100nF (0.1uF)	Monolithic capacitor *(non-polarized)*	(0.1uF = 100nF) for power filtration
C8	1uF	Electrolytic capacitor *(Polarized)*	for the MAX232
C9	1uF	Electrolytic capacitor *(Polarized)*	for the MAX232
C10	100nF (0.1uF)	Monolithic capacitor *(non-polarized)*	(0.1uF=100nF) for power filtration
C11	22pF	Monolithic capacitor *(non-polarized)*	Goes with the crystal
C12	22pF	Monolithic capacitor *(non-polarized)*	Goes with the crystal
Q1	20MHz XTAL	Crystal	Clock source for CPU
D1	1N4004	Diode	Reverse Voltage Protection
D2	1N4004	Diode	ICSP Power Isolation
R1	470 ohm	Resistor	current limiting resistor for Ready LED
RN1	10k x 9 Resistor Network	nine 10k-ohm resistors in a single inline strip	Pull-Up resistors for inputs

Connectors		
J1	3-pin	Serial Communication Tx, Rx, and Gnd
J2	2-pin	Power (Gnd and +9 to +24 volts) minimum 16 volts if display driver board is also used
J3	6-pin	ICSP (In-Circuit Serial Programming)
J4	7-pin	Lanes Sensor hookup
J5	4-pin	Finish Gate hookup (Gnd, Ready LED output, Reset Switch Input, +5v power for sensor illumination LEDs)
J6	3-pin	Starting Gate hookup (Gnd, Starting Switch Input, digital level signal for start solenoid)
SV	16-pin	Dual-row header for 1-inch digits or to connect display driver board

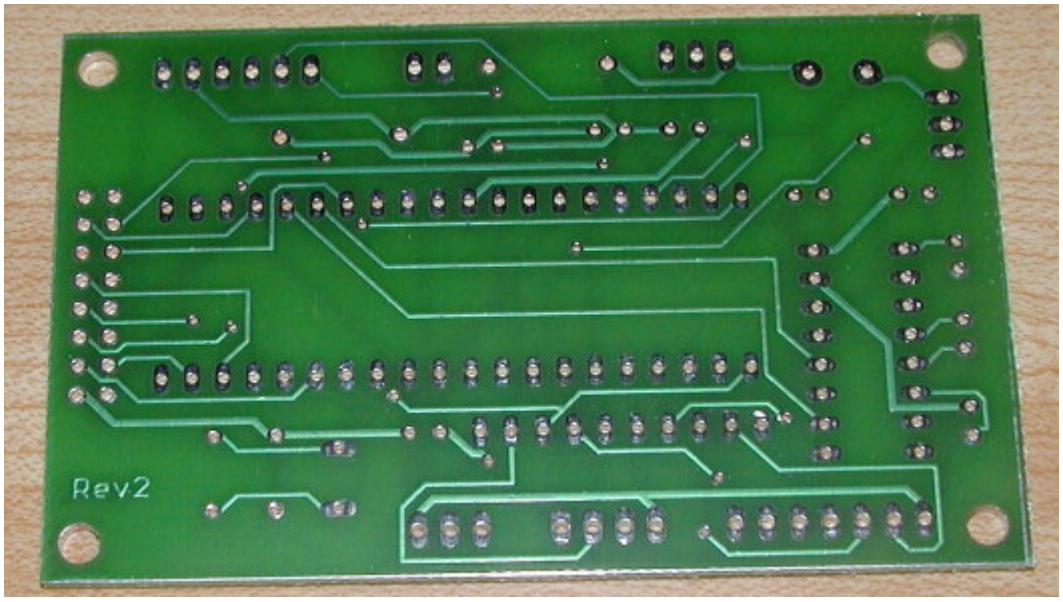
Rev2 Derby Timer Board fully assembled



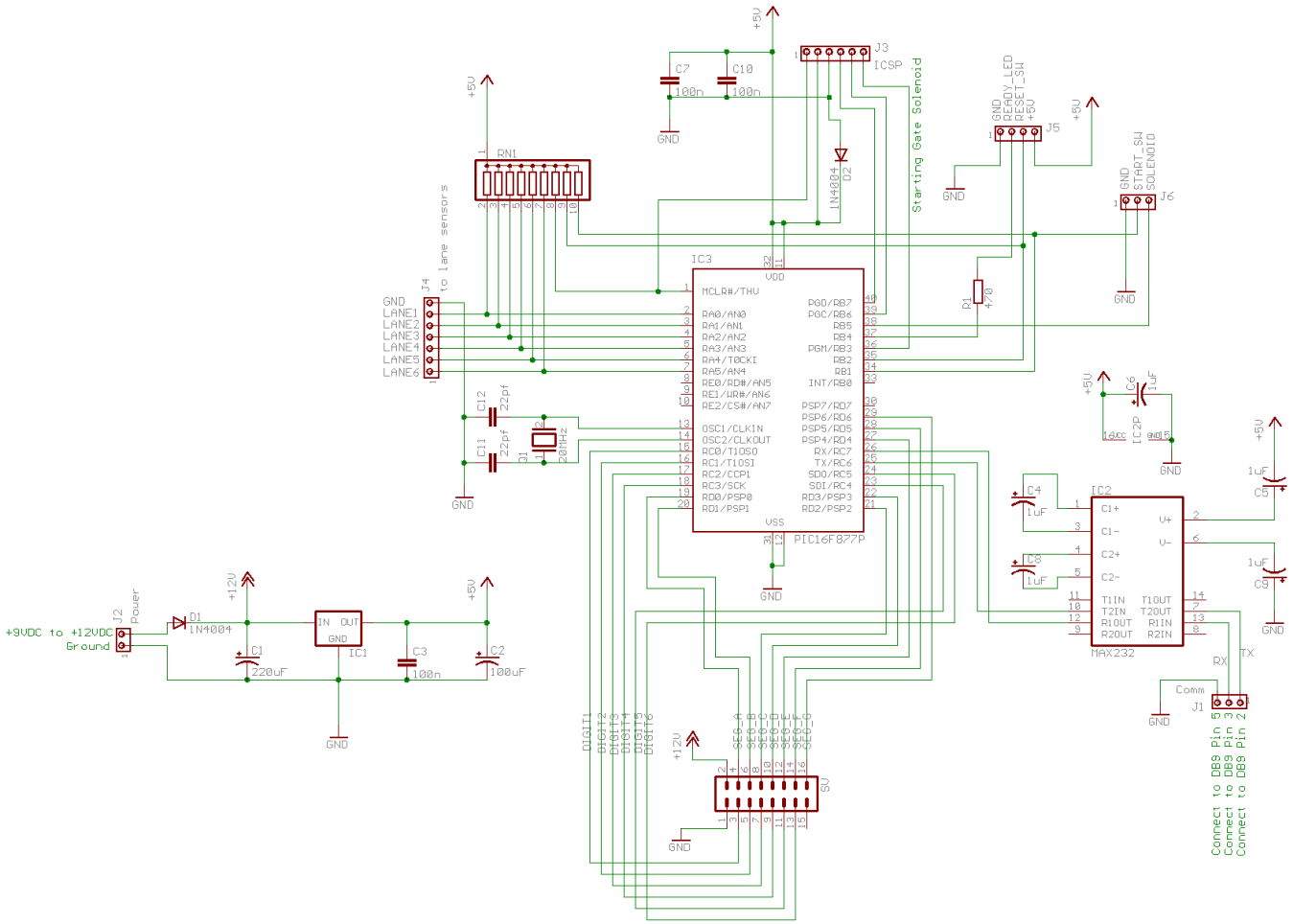
Front view of Rev2 bare board



Underside view of Rev2 board



Rev2 Board Schematic



Board Connections Reference

Connector J1 – Serial Communication	
GND	connects to pin 5 of a DB9 Serial RS-232 Connector
Rx	connects to pin 3 of a DB9 Serial RS-232 Connector
Tx	connects to pin 2 of a DB9 Serial RS-232 Connector

Connector J2 – Power	
GND	Common Ground (Negative voltage)
+	Positive power input, +9 to +24 volts

If you are not using the display driver board, a 9 to 12 volt power supply is recommended.
If you are using the display driver, you should use a power supply rated at at least 15 volts.

Connector J3 – ICSP

ICSP Pinouts	
1	MCLR
2	VDD
3	GND
4	PGD
5	PGC
6	PGM

The ICSP Connector type is the standard used by Olimex ICSP programmers.

IMPORTANT NOTE:

There are several different common pin layouts for ICSP connectors. Be sure to verify you are using the right type, or you could damage the chip, the programmer, or both!

Your programmer's ICSP connector must use the pin layout shown at the left.

Connector J4 – Lane Sensors	
GND	Common ground for sensors – connects to all phototransistors
1	Connects to Lane 1 phototransistor
2	Connects to Lane 2 phototransistor
3	Connects to Lane 3 phototransistor
4	Connects to Lane 4 phototransistor
5	Connects to Lane 5 phototransistor
6	Connects to Lane 6 phototransistor

Unused lanes should be left unconnected and turned off in the firmware.

Connector J5 – Finish Line Tower	
G	Common ground
Rdy	Connects to Ready LED
Res	Connects to (optional) Reset Switch *Leave unconnected if you are not using a reset switch*
+5v	+5v regulated power for finish line illumination LEDs

Connector J6 – Starting Gate	
G	Common ground
Str	Connects to Starting Gate Detector Switch *(REQUIRED)*
Sol	Connects to (optional) starting gate solenoid driver circuit *Leave unconnected if you are not using a solenoid* ***DO NOT CONNECT THIS DIRECTLY TO A SOLENOID!*** ***YOU WILL OVERLOAD THE CIRCUIT AND DAMAGE THE CHIP!***

The display connector may be used to directly drive 1-inch high digits, or you can plug in the optional driver board to use large 3-inch digits.

Display Connector			
1	Common ground connection *(GND)*	2	Unregulated power for display driver board *(+12 to +24 depending on power supply)*
3	Digit 1 Drive	4	Segment A
5	Digit 2 Drive	6	Segment B
7	Digit 3 Drive	8	Segment C
9	Digit 4 Drive	10	Segment D
11	Digit 5 Drive	12	Segment E
13	Digit 6 Drive	14	Segment F
15	*unused*	16	Segment G

NOTE: *Depending on the 1-inch digits used, current limiting resistors may be required.*