First, you need to build a wiring harness to connect the Rambo headers to the reprapdiscount lcd. I took the short ribbon cables provided and hacked off the end. The I took a 2x4 crimp connector housing to use for the SPI connection and a 2x8 crimp connector housing to use for the Extension 2 connection. In the table below, the reprap discount A connector is also labeled EXP1 and the B connector is labeled EXP2. The connectors when completed should map to the following:

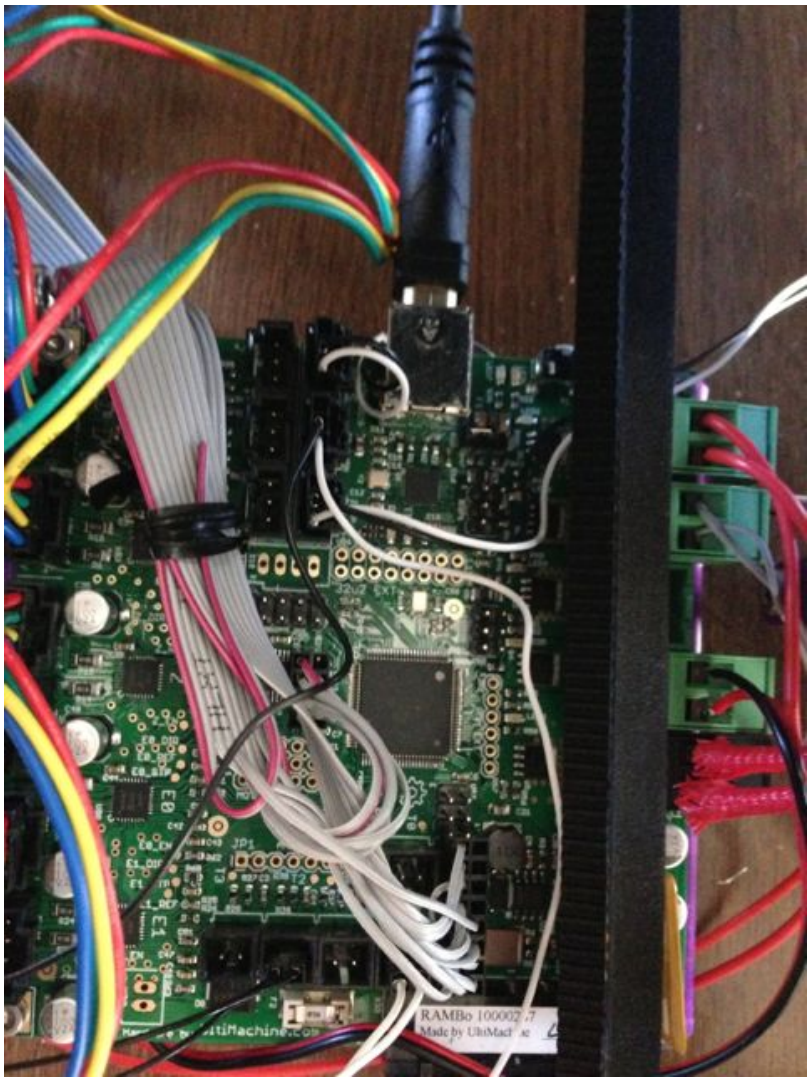
SPI Connector

| Reprapdisc Pin | Rambo Pin | Rambo Pin | Reprapdisc Pin |
|---|---|---|---|
| A10 | VCC | X | |
| B1 | MISO | MOSI | B6 |
| B2 | SCK | SS | B4 |
| A9 | GND | X | |

Extension 2 Connector

| Function | Reprapdisc Pin | Rambo Pin | Rambo Pin | Reprapdisc Pin | Function |
|---|---|---|---|---|---|
| | X | VCC | VCC | X | |
| | X | GND | GND | X | |
| RS | A4 | PG4 | PH7 | X | |
| EN | A3 | PG3 | PH2 | X | |
| D4 | A5 | PJ2 | PD6 | X | |
| D5 | A6 | PJ3 | PD5 | X | |
| D6 | A7 | PJ7 | PD4 | B7 | SDCARDDETECT |
| D7 | A8 | PJ4 | PE7 | B8 | KILL_PIN |
| BTN_ENC1 | B3 | PJ5 | PE6 | A1 | BEEPER |
| BTN_ENC2 | B5 | PJ6 | PE2 | A2 | BTN_ENC |

The completed cable (plugged in) should look like the following:



You'll note the connector at the upper left is the SPI and the one close to the bottom is the Extension 2 connector. I've only used a 2x8 connector in the picture because I didn't have a 2x10 handy.

Next, you need to modify the arduino environment. Find your pins_arduino.c in the hardware/arduino/cores/arduino/ folder. Look at line 202 for the following stanza:

```
PK      , // PK 7 ** 69 ** A15
  };
```

You need to add the lines to make it look like:

```
PG  , // PG 4 ** 70 ** D50
PG  , // PG 3 ** 71 ** D51
PJ  , // PJ 2 ** 72 ** D52
PJ  , // PJ 3 ** 73 ** D53
```

```
  PJ  , // PJ 7 ** 74 ** D54
  PJ  , // PJ 4 ** 75 ** D55
  PJ  , // PJ 5 ** 76 ** D56
  PJ  , // PJ 6 ** 77 ** D57
  PE  , // PE 2 ** 78 ** D58
  PE  , // PE 6 ** 79 ** D59
  PE  , // PE 7 ** 80 ** D60
  PD  , // PD 4 ** 81 ** D61
};
```

Then, you need to go down to line 289 which should look like this:

```
_BV( 7 )          , // PK 7 ** 69 ** A15
};
```

Make it look like the following:

```
  _BV( 7 )          , // PK 7 ** 69 ** A15
  _BV( 4 )          , // PG 4 ** 70 ** D50
  _BV( 3 )          , // PG 3 ** 71 ** D51
  _BV( 2 )          , // PJ 2 ** 72 ** D52
  _BV( 3 )          , // PJ 3 ** 73 ** D53
  _BV( 7 )          , // PJ 7 ** 74 ** D54
  _BV( 4 )          , // PJ 4 ** 75 ** D55
  _BV( 5 )          , // PJ 5 ** 76 ** D56
  _BV( 6 )          , // PJ 6 ** 77 ** D57
  _BV( 2 )          , // PE 2 ** 78 ** D58
  _BV( 6 )          , // PE 6 ** 79 ** D59
  _BV( 7 )          , // PE 7 ** 80 ** D60
  _BV( 4 )          , // PD 4 ** 81 ** D61
};
```

Basically, this maps the ports from Extension 2 so that they can be referenced as pins from the arduino libraries.

Next, you'll need to open up the firmware to make the appropriate modifications. First, open up the fastio.h file. Go to line 1387 and insert the following lines:

```
#define DIO76_PIN              PINJ5
#define DIO76_RPORT PINJ
#define DIO76_WPORT            PORTJ
#define DIO76_DDR              DDRJ
#define DIO76_PWM              NULL

#define DIO77_PIN              PINJ6
#define DIO77_RPORT PINJ
#define DIO77_WPORT            PORTJ
#define DIO77_DDR              DDRJ
#define DIO77_PWM              NULL
```

```
#define DIO78_PIN              PINE2
#define DIO78_RPORT PINE
#define DIO78_WPORT            PORTE
#define DIO78_DDR              DDRE
#define DIO78_PWM              NULL

#define DIO79_PIN              PINE6
#define DIO79_RPORT PINE
#define DIO79_WPORT            PORTE
#define DIO79_DDR              DDRE
#define DIO79_PWM              NULL

#define DIO80_PIN              PINE7
#define DIO80_RPORT PINE
#define DIO80_WPORT            PORTE
#define DIO80_DDR              DDRE
#define DIO80_PWM              NULL

#define DIO81_PIN              PIND4
#define DIO81_RPORT PIND
#define DIO81_WPORT            PORTD
#define DIO81_DDR              DDRD
#define DIO81_PWM              NULL
```

Next, you'll need to open up your configuration.h file. You need to add the appropriate lcd sections within the Rambo motherboard section.

Go to line 250 and insert the following lines:

```
//LCD and SD support
//#define ULTRA_LCD  //general lcd support, also 16x2
//#define SDSUPPORT // Enable SD Card Support in Hardware Console

//#define ULTIMAKERCONTROLLER //as available from the ultimaker online store.
#define ULTIPANEL  //the ultipanel as on thingiverse


#ifdef ULTIMAKERCONTROLLER    //automatic expansion
 #define ULTIPANEL
 #define NEWPANEL
#endif

#ifdef ULTIPANEL
#define NEWPANEL  //enable this if you have a click-encoder panel
  #define SDSUPPORT
  #define ULTRA_LCD
  #define LCD_WIDTH 20
  #define LCD_HEIGHT 4

// Preheat Constants
  #define PLA_PREHEAT_HOTEND_TEMP 170
  #define PLA_PREHEAT_HPB_TEMP 60
```

```
  #define PLA_PREHEAT_FAN_SPEED 0                    // Insert Value between 0 and 255

  #define ABS_PREHEAT_HOTEND_TEMP 240
  #define ABS_PREHEAT_HPB_TEMP 100
  #define ABS_PREHEAT_FAN_SPEED 255                  // Insert Value between 0 and 255

#else //no panel but just lcd
  #ifdef ULTRA_LCD
    #define LCD_WIDTH 16
    #define LCD_HEIGHT 2
  #endif
#endif
```

Lastly, you'll need to modify your pins.h to reflect the modifications that you added. Starting at line 1204, you should include the following text:

```
#define SDPOWER            -1
#define SDSS               53
#define LED_PIN            13
#define FAN_PIN            8
#define PS_ON_PIN          4
#define KILL_PIN           80
#define SUICIDE_PIN        -1  //PIN that has to be turned on right after start, to keep
power flowing.

#ifdef ULTRA_LCD

  #ifdef NEWPANEL
  //arduino pin which triggers an piezzo beeper
    #define BEEPER 79                    // Beeper on AUX-4

    #define LCD_PINS_RS 70
    #define LCD_PINS_ENABLE 71
    #define LCD_PINS_D4 72
    #define LCD_PINS_D5 73
    #define LCD_PINS_D6 74
    #define LCD_PINS_D7 75

    //buttons are directly attached using AUX-2
    #define BTN_EN1 76
    #define BTN_EN2 77
    #define BTN_ENC 78  //the click

    #define BLEN_C 2
    #define BLEN_B 1
    #define BLEN_A 0

    #define SDCARDDETECT 81                    // Ramps does not use this port

     //encoder rotation values
    #define encrot0 0
    #define encrot1 2
    #define encrot2 3
```

```
    #define encrot3 1

  #else //old style panel with shift register
    //arduino pin witch triggers an piezzo beeper
    #define BEEPER 33              No Beeper added

    //buttons are attached to a shift register
          // Not wired this yet
    //#define SHIFT_CLK 38
    //#define SHIFT_LD 42
    //#define SHIFT_OUT 40
    //#define SHIFT_EN 17

    #define LCD_PINS_RS 75
    #define LCD_PINS_ENABLE 17
    #define LCD_PINS_D4 23
    #define LCD_PINS_D5 25
    #define LCD_PINS_D6 27
    #define LCD_PINS_D7 29

    //encoder rotation values
    #define encrot0 0
    #define encrot1 2
    #define encrot2 3
    #define encrot3 1

    //bits in the shift register that carry the buttons for:
    // left up center down right red
    #define BL_LE 7
    #define BL_UP 6
    #define BL_MI 5
    #define BL_DW 4
    #define BL_RI 3
    #define BL_ST 2

    #define BLEN_B 1
    #define BLEN_A 0
  #endif
#endif //ULTRA_LCD

#endif
```

And that's it.  When you power up it all should work!