BSCB-2
BASIC STAMP CARRIER BOARD
Technical Manual

Document Revision: 1.04

Date: 06 August 2003

BiPOM Electronics, Inc.

TABLE OF CONTENTS

WARRANTY:

1. Overview

BSCB-2 is a general purpose, low-cost and highly expandable micro-controller system. It is based on the Parallax, Inc.: BASIC Stamp Microcontroller Modules (BS2).
For detailed information on BS2 Modules, refer to Parallax http://www.parallaxinc.com/

"The BS2-IC is the single most popular BASIC Stamp module. Widely used in educational, hobby, and industrial applications. This module normally has 2K bytes of program space and 16 I/O pins. Serial PC interface provides enhanced debug features."

BSCB-2 has a 24-pin DIP socket for a BASIC Stamp BS2 Module, a keypad controller and connector, connector for standard alphanumeric LCD modules and an RS232 Serial Port. BSCB-2 should be powered from 6 to 12 Volts DC of external power source.

BSCB-2 is compatible with the following Parallax BS2 Modules:

BS2-IC; BS2e-IC; BS2sx-IC; BS2p-IC; BS2pe-IC

BSCB-2 does not include the BS2 module which is supplied by the user.

2. Specifications

BSCB-2 board has the following configuration:

- 24-pin DIP socket for a BS2 Module
- RS232 Serial Port connector for In-circuit Programming of the BS2 and for data communications.
- 512-byte I^{2}C EEPROM (optional 128-Kilobyte EEPROM)
- Controller (PIC16F818) and a connector for matrix and non-matrix keypads
- 4 channels of the PIC16F818 10 bit ADC with an access for BS2 via I2C bus
- On board 4.096V precision voltage reference source
- 10-pin connector for analog inputs with 5V VCC and 4.096V reference outputs.
- 128 byte EEPROM of the PIC16F818 with an access for BS2 via I2C bus
- Single row and dual row 14-pin LCD connectors (with software contrast adjustment for LCD)
- 20-pin Expansion connector to a variety of peripheral boards (http://www.bipom.com/periph1.htm)
- Single operating unregulated voltage 6 … 9V
- On-board 5 Volt regulator
- Dimensions are 2.35 X 2.40 inches (5.97 X 6.10 centimeters).
- Mounting holes of 0.125 inches (3.2 millimeters) are on four corners.
- 0° - 70° C operating, -40° - +85° C storage temperature range.
- 2-layer PCB, no vias for maximum reliability.

3. Software

Software examples for BSCB-2 and BiPOM Peripheral boards are available from the link below:

http://www.bipom.com/bscb.htm

4. Functional Blocks

Figure 1 shows the block diagram of the BSCB-2 board
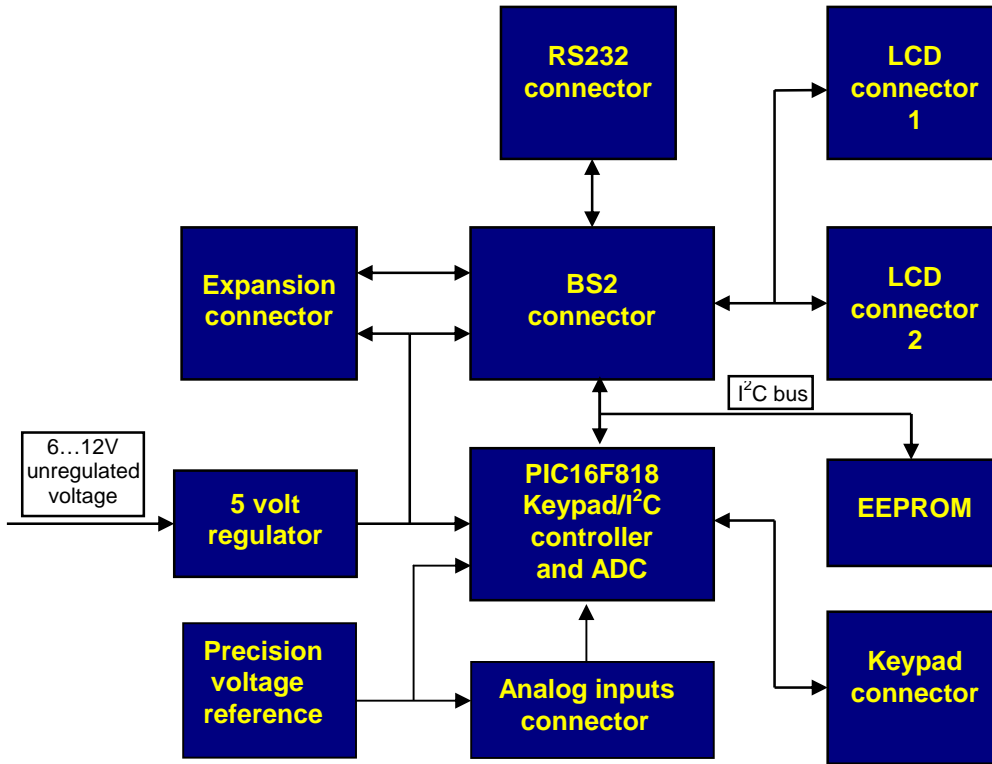

Figure 1

Micro-controller Modules

Table 1 shows the main features of Parallax Microcontroller Modules which can be used with BSCB-2

BS2 main features

Name:	BS2-IC	BS2e-IC	BS2sx-IC	BS2p-IC	BS2pe-IC
Microcontroller	Microchip PIC16C57	Scenix SX28AC	Scenix SX28AC	Scenix SX48AC	Ubicom SX48AC
Processor Speed	20 MHz	20 MHz	50 MHz	20 MHz	8MHz Turbo
Program Execution Speed (instructions/sec.)	4,000	4,000	10,000	12,000	6,000
PBASIC Commands	36	39	39	55	55
RAM Size (Total Bytes / In.Out / Variables)	32 / 6 / 26	32 / 6 / 26	32 / 6 / 26	38 / 12 / 26	38/12/26
EEPROM Program Size (Bytes / Basic instructions)	2K / ~500	8x2K/~4000	8x2K/~4000	8x2K/~4000	16x2K/~8000
Current Draw @ 5V (Run / Sleep)	8 mA/100µA	20mA/100µA	60mA/200µA	40mA/400µA	15mA/60uA
Source / Sink Current per I/O (mA)	20 / 25	30 / 30	30 / 30	30 / 30	30 / 30
Source / Sink Current per 8 I/O pins (mA)	40 / 50	60 / 60	60 / 60	60 / 60	60 / 60

Table 1

4

Asynchronous Serial Port

One asynchronous RS232 serial port is available on a 9-pin male D connector J1. RS232 port can be used for both BS2 In-circuit programming and data communications.

Table 2 shows the pin assignments for RS232 serial port connector

Serial Port Connector (J1)

Name	Signal	Pin
-	Not Connected	1
SOUT	Transmit Output (**TXD**)	2
SIN	Receive Input (**RXD**)	3
ATN	(**DTR**)	4
GND	**GND**	5
DSR	Connected with pin 7	6
RTS	Connected with pin 6	7
-	Not Connected	8
-	Not Connected	9

Table 2

Keypad Controller and Connector

BSCB-2 has a Microchip PIC16F818 micro-controller which can scan attached keypad. 8 pins of RB port serves for this purpose. It allows to use many different keypad types (for example, 3 x 5 or 4 x 4). +5 V Vcc and Ground power lines are also available on the Keypad connector. Alternatively, Keypad connector can be used as a general-purpose I/O port.

BS2 controls PIC16F818 through I^2C bus.
More details of the I^2C protocol can be found at http://www.bipom.com/bscb.htm

Table 3 shows the pin assignments for the Keypad connector.

Keypad Connector (J5)

Name	Signal	Pin
VCC	+5V	10
GND	Ground	9
RA.7	Column 4 input	8
RA.6	Column 3 input	7
RA.5	Column 2 input	6
RB.0	Column 1 input	5
RB.3	Row 4 output	4
RB.5	Row 3 output	3
RB.6	Row 2 output	2
RB.7	Row 1 output	1

Table 3

LCD Connectors

Alphanumeric 24 Characters x 2 lines LCD such as BiPOM's **LCD242** (http://www.bipom.com/periph1.htm) or generic alphanumeric LCD display can be connected directly to BSCB-2.

Table 4. **LCD Connector (J6)**

Signal	Pin	Pin	Signal
P15	14	13	P14
P13	12	11	P12
not connected	10	9	Not connected
not connected	8	7	Not connected
P9	6	5	P10
P11	4	3	Vee
VCC (+5V)	2	1	GND

Table 5. **LCD Connector (J7)**

Name	Signal	Pin
P15	Data 3	14
P14	Data 2	13
P13	Data 1	12
P12	Data 0	11
-	Not connected	10 … 7
P9	Enable	6
P10	Write	5
P11	Register Select	4
Vee	Contrast control	3
VCC	+5V	2
GND	Ground	1

Input/Output expansion bus

16 I/O lines and +5 Volt power supply are available on the 20-pin expansion connector (J4) for interfacing to existing peripheral boards. Table 6 shows the pin assignments for the connector.

Table 6. **Expansion Connector (J4)**

Signal	Pin	Pin	Signal
P8	20	19	P9
P10	18	17	P11
P12	16	15	P13
P14	14	13	P15
P7	12	11	P6
P5	10	9	P4
P3	8	7	P2
P1	6	5	P0
VCC (+5V)	4	3	GND
VCC (+5V)	2	1	GND

Analog inputs

A Microchip PIC16F818 micro-controller has built-in 5-channel 10-bit Analog to Digital Converter.

It can use on-board +5V power (Vcc) as reference voltage. For best accuracy and noise performance, ADC can be configured to use external reference, which is provided on BSCB-2 board. It is permanently connected to RA3. Also, for this purpose BSCB-2 board has separate ground circuit for analog signals. This circuit is RA2 (pin #6 of analog inputs connector). JP2 jumper should be set to use RA2 as the analog ground. BSCB-2 board comes with JP2 jumper, already installed at the factory.

Four analog inputs, including AN2 / AGND and Reference voltage (AN3) are available on analog inputs connector J8.

Table 7 shows the pin assignments for the analog inputs connector.

Analog inputs Connector (J8)

Signal	Pin	Pin	Signal
GND	10	9	VCC (+5V)
AN0	8	7	AN1
AN2 / AGND	6	5	AN3 == V ref
N / C	4	3	AN4
VCC (+5V)	2	1	GND

Table 7

EEPROM

BSCB-2 uses the 24C04 (IC3) 512 byte Electrically Erasable Programmable Read-Only-Memory (EEPROM). Typically this EEPROM is used for storing calibration values for sensors, customer identification, serial number and other parameters. This EEPROM is on a socket and can easily be replaced with a higher capacity EEPROM (up to 128 KBytes).

Power Supply Unit

BSCB-2 board comes with a 6 Volts unregulated DC power supply. Other power supplies can also be used. External power supply should be able to supply 6 to 12 Volts DC at minimum 200mA current (more if peripheral boards will be used). The inner pin of the supply connector is positive and the outer ring is negative.

WARNING: Correct polarity should be observed when applying external DC supply to Power connector.

BSCB-2 has an on-board 5 Volt regulator LM2937 (IC1).

CAUTION: Depending on the current requirements of the any external circuitry such as peripheral boards that are attached to BSCB-2 and the level of input voltage applied, the power regulator IC1 may dissipate enough heat to cause skin injury upon touch. Contact with this regulator should be avoided at all times, even after the power to circuit has been switched off.

5. Peripherals

BSCB-2 can be connected to a wide variety of low-cost peripheral boards to enhance its functionality. Some possibilities are:

- Prototyping board (PROTO-1)

- Training Board (TB-1)
- 4-digit 7-segment LED display board
- 12-bit Analog-To-Digital Converter Board
- Digital Input/Output Expander Board
- Real time clock + 128 MB flash card board
- Terminal board
- Reed relay board with 4 relays
- Power relay board with 2 relay
- Stepper motor driver board

Peripheral boards can either be stacked on top of BSCB-2   using stand-offs or connected in a chain configuration using flat ribbon cable. Figure 2 shows how BSCB-2 can be connected to a peripheral board in a stacked fashion. Figure 3 shows chain connection.
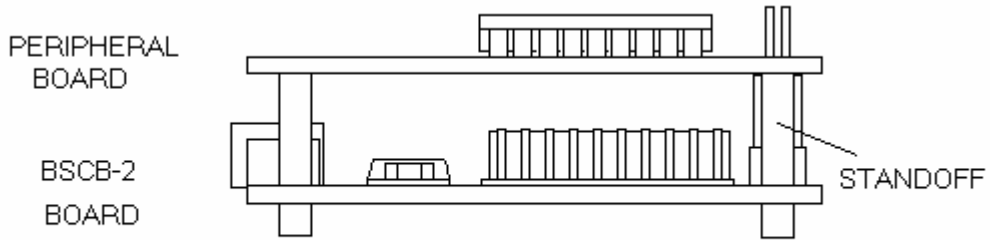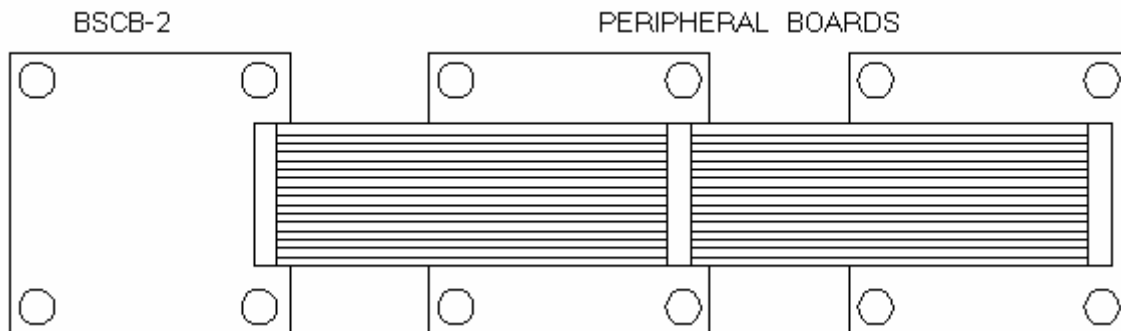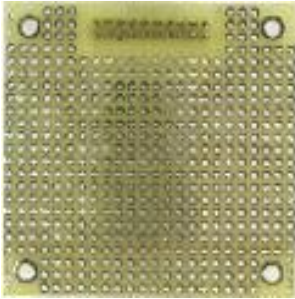

Figure 2

Figure 3

PROTO-1 Board

PROTO-1 provides prototyping area to add custom circuitry to BSCB-1. PROTO-1 can either be stacked with BSCB-1 using standoffs or connected to BSCB-1 as a separate board using ribbon cable (EXPCABLE-6 or EXPCABLE-18). The latter method is useful for mounting behind the panel of an instrument enclosure, for example, as a detachable display board.

LED-1 Board

A peripheral board with four 7-segment LED displays with decimal point. The displays are placed on sockets and can be easily replaced. 4-digit LED-driver with I2C-Bus interface is installed to this board. The segment outputs of LED-driver are controllable current-sink sources. They are switched on by the corresponding data bits and their current is adjusted by control bits. LED-driver on the board is controlled via an I2C-compatible 2-wire serial bus.

TB-1 Training Board

TB-1 Training Board allows performing various experiments with the BSCB-1 board. TB-1 has programmable traffic lights, 4-channel, 8-bit analog inputs, buzzer, switch inputs, and counter/timer inputs to test the interrupts.

DIO-1 Board

DIO-1 is an expander board with 8 open/collector outputs (each capable of 400mA) and 12 TTL/CMOS inputs/outputs. A PIC16C62 micro-controller on this board acts as an I2C 2-wire slave device to control inputs and outputs. DIO-1 can also be used as a standalone PIC micro-controller board

RTC board

Real Time Clock board with DS1307 Real-Time Clock from Dallas Semiconductor. The DS1307 is a battery-backed, low power, full-BCD clock/calendar with 56 bytes of nonvolatile static RAM. Address and data are transferred serially via I2C 2-wire bus. The clock/calendar provides seconds, minutes, hours, day, date, month and year information. RTC board has a 3Volt standard lithium battery which allows clock/calendar to operate in the absence of external power.

MMC/RTC board

MMC/RTC board is a storage flash device which is designed specifically for storage/data logger applications. MMC/RTC board has built-in Multi Media Card (MMC) socket. A Multi Media Card with high capacities such as 128 Megabytes can be installed on this board. MMC/RTC board also includes a DS1307 Real-Time Clock (RTC) from Dallas Semiconductor. The DS1307 has a battery-backed, low power full-BCD clock/calendar with 56 bytes of nonvolatile static RAM.

Terminal-1

Brings out ports 1 and 3 on the BSCB-1 to terminal blocks for easier access.

DAQ-2543 Board

DAQ-2543 is Analog-To-Digital / Digital-To-Analog peripheral board with TLC2543, 11-channel, 12-bit Analog-To-Digital Converter from Texas Instruments. All the channels are available on terminal blocks

X10-1

Connects BSCB-1 to standard X10 devices through the TW523 Power line interface

MOTOR-1

Peripheral board to drive unipolar stepper motors. Provides up to 1.5A, 35V outputs. HALF-STEP and ONE-PHASE jumpers will determine the drive format (one-phase, two-phase or half-step).

RELAY-1 and RELAY-2

Relay peripheral board with 1 or 2 power relay respectively. Normally Open and Normally Closed Contacts

RELAY-4REED

Relay peripheral board with 4 reed relays. Normally Open Contacts.

6. Board Layout

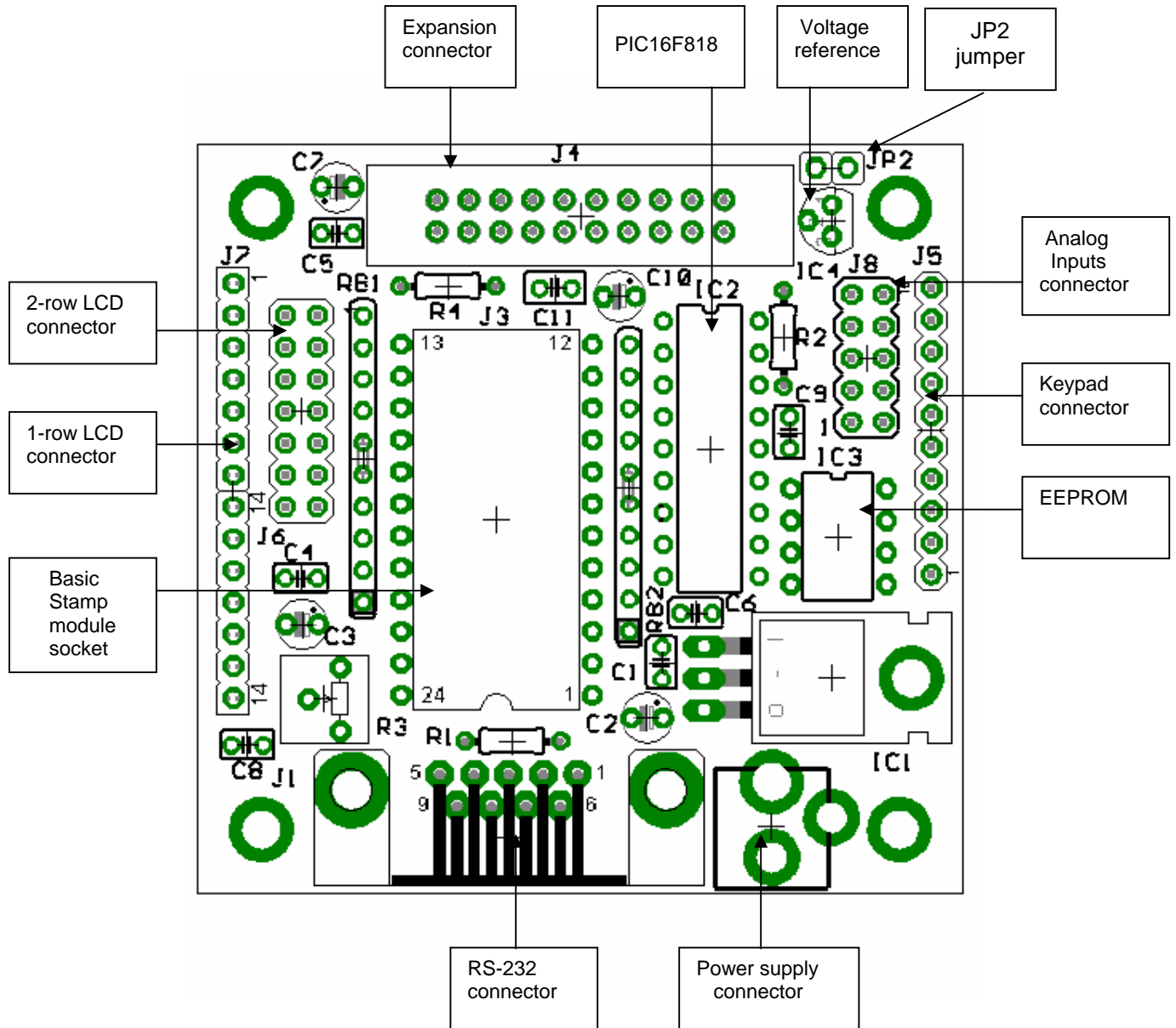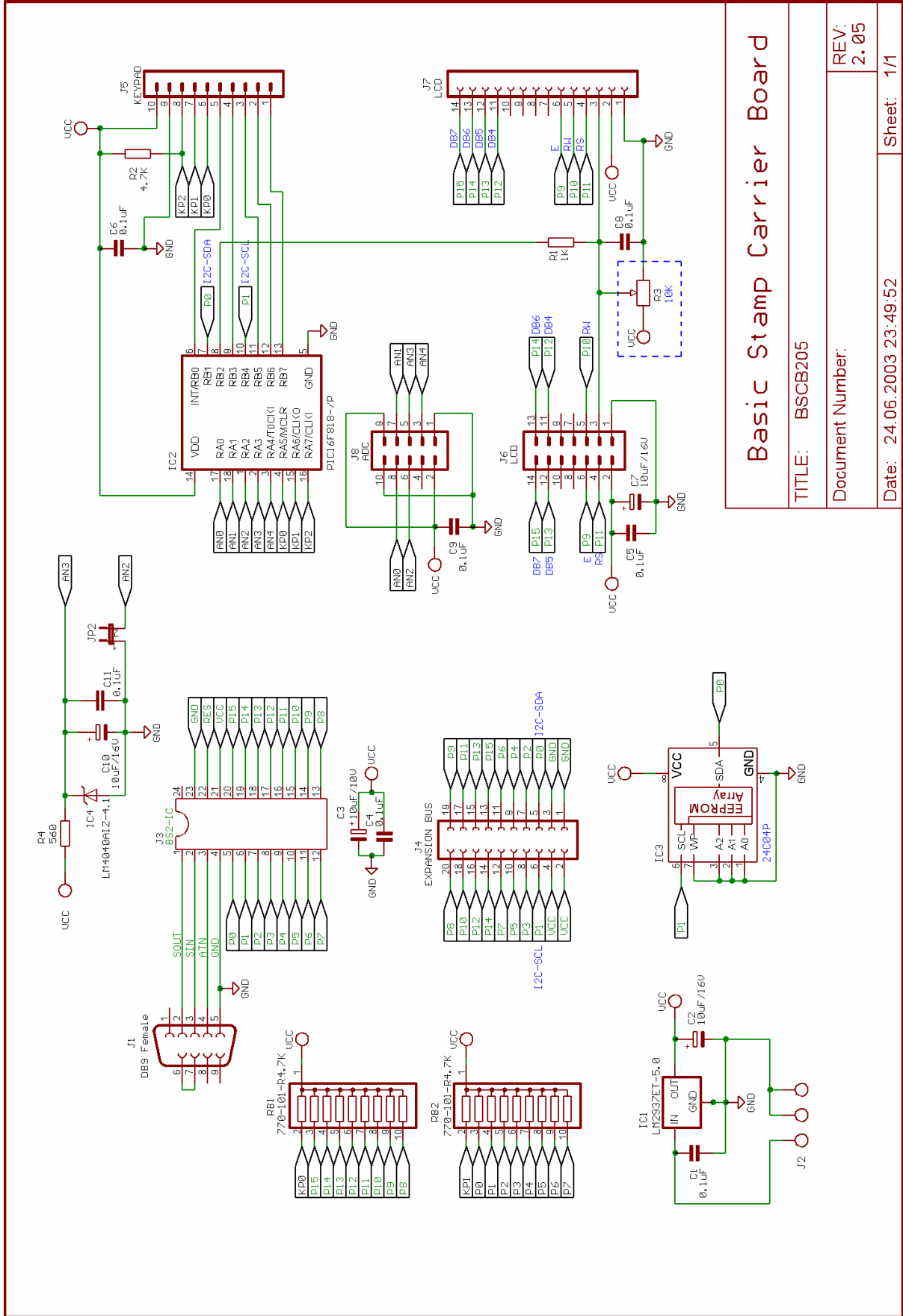Figure 4 shows positions of major components, connectors and terminals on the BSCB-2 board.

Expansion connector

PIC16F818

Voltage reference

JP2 jumper

Analog Inputs connector

2-row LCD connector

1-row LCD connector

Keypad connector

EEPROM

Basic Stamp module socket

RS-232 connector

Power supply connector

Figure 4.

7. Schematics.

Basic Stamp Carrier Board

TITLE: BSCB205

Document Number:

Date: 24.06.2003 23:49:52

REV: 2.05

Sheet: 1/1