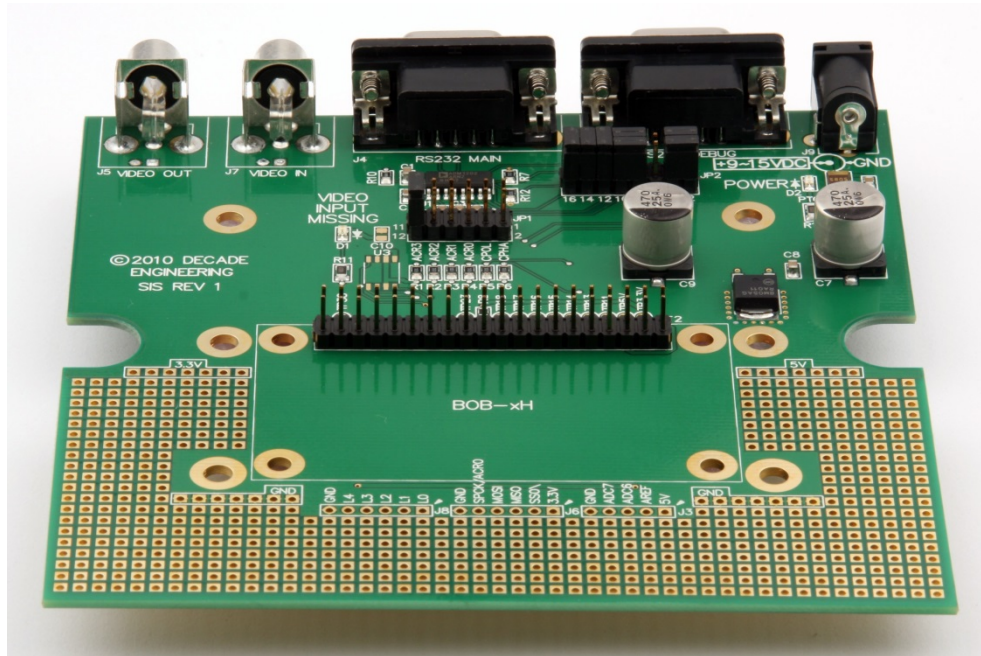




SIS Board Application Guide

05 June 2015



Introduction

SIS is a demonstration and development board for Decade Engineering's BOB-4H video overlay module, to assist new users in getting BOB-4H up and running quickly. SIS provides RS-232 compatible 9-pin serial data connectors for the main control port and debug port of BOB-4H, along with numerous on-board hookup options and a generous circuit prototyping area to support the extensive application flexibility of the BOB-4H module. Please use this document together with the [BOB-4 Application Guide](#).

Hardware and Software Requirements

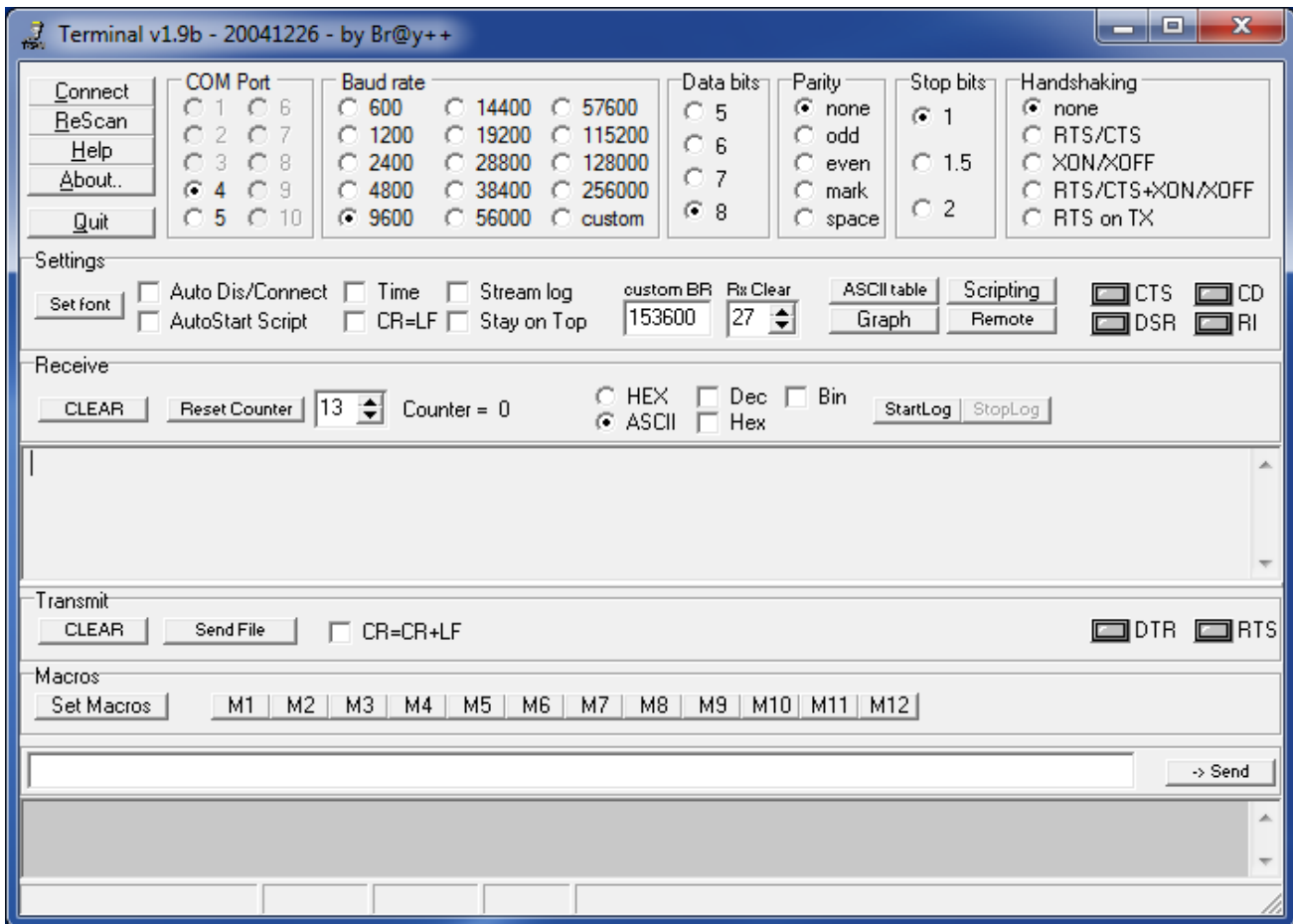
A BOB-4HGI module, a compatible power supply unit (see *Specifications*), and at least one compatible serial data cable is required for basic SIS operation. A video signal source is not required, because BOB-4 can generate video on-board, but you should have one if you wish to investigate video overlay performance. Cameras and DVD players with composite video output (yellow RCA jack) generally work well. A TV with video input or TV monitor is required in any case. It's best to have access to more than one TV monitor, because some of the newer flat-screen models can be quirky.

To follow the *Quick Start* instructions closely, use a Windows PC with available serial COM port or USB/Serial adapter, and [Bray's Terminal](#) software. I/O Gear USB adapters such as model GUC232A are recommended, especially for firmware upgrades and custom font installations, but most adapter brands are acceptable for basic operation. Bray's Terminal is a free download and provides a useful macro capability.

Quick Start

Carefully install the BOB-4H module as described under *Connector Pinout & Hookup Notes* (for J2) below. Make sure that SIS board configuration shunts are mounted in the factory default positions. See the discussion under *Serial Port Configuration Headers (JP1 & JP2)* if necessary. Connect video I/O cable(s) as desired, then power up your TV monitor and select its active video input if necessary. Make sure that the main serial port on SIS is connected to a PC serial COM port (or USB adapter) and power it up. A big “BOB-4” logo will appear on the TV screen.

We’re going to use what is arguably the simplest and most direct method to make BOB-4 print text on the TV monitor: a terminal emulation program running on your PC. Terminal programs make the PC behave like a serial terminal — once the standard user interface for central ‘mainframe’ computers. These exercises were developed with Bray’s Terminal V1.9B running on a Win7 Pro 64-bit machine. Terminal doesn’t require ‘installation.’ Just place the downloaded .exe file in a convenient location and launch it. Depending on version, the Terminal window looks something like this:



Terminal should find available COM Ports automatically. If the COM Port number buttons are all gray, confirm that another program isn’t using the desired port and click the ReScan button. As shown above, select an available COM Port, set Baud rate to 9600, Data bits to 8, Parity to none, Stop bits to 1, and Handshaking to none. Click **Connect** – the same button should now say **Disconnect**.

In case your PC has assigned a COM port number beyond Terminal’s range, open Device Manager > Ports (COM & LPT), and double-click the desired port. A window titled “USB Serial Port (COMx) Properties” should appear. Click the “Port Settings” tab and then click the “Advanced...” button. In the COM Port Number drop-down menu, select an available port assignment within Terminal’s range and then click “OK.” Click the “ReScan” button in Terminal, which should now recognize the modified port.

To confirm Terminal communication with BOB-4, type some text into the **Send** edit box and click the **Send** button. If your hookup is working, the big BOB-4 logo clears and your text immediately prints using the default 12x13 font in the upper left corner of the TV screen. Garbage printing usually indicates a baud rate mismatch.

Now let's learn to transmit commands to BOB-4. One of the most common application requirements is to clear the screen. BOB-4 obediently does this upon receipt of the **J** command. Here's the **J** command syntax statement as it appears in the BOB-4 Application Guide:

```
<CSI>nJ
```

<CSI> stands for Control Sequence Introducer, which must be entered as "\$1b[" or "\$1B[" in Terminal. 1B is the [ASCII](#) Escape code as a hexadecimal number, while the dollar sign commands translation into ASCII. Other terminal emulators may handle this issue differently. In Bray's Terminal's **Send** edit box, a complete **J** command looks like:

```
$1b[2J
```

The **n** parameter in the syntax statement was given a value of 2 in order to clear the entire screen instead of a portion. Click **Send** to transmit the command. If you send another string of printable text after clearing the screen, you will see that print position was also restored to the upper left corner by this version of the **J** command. See the **J** command entry in the BOB-4 Commands section of the App Guide for details.

Carriage-Return <CR> and Line-Feed <LF> codes may be embedded in printable text sent via Terminal in the same way that Escape <ESC> was entered, i.e. <CR> is entered as **\$OD**, and <LF> is entered as **\$OA**. Try 'em!

It's often useful to review BOB-4's current configuration. For that purpose, send

```
$1b[5}
```

Yup, the right-brace is another command specifier. This command also provides a convenient way to test outbound communication. The lengthy configuration report scrolls beyond the receive window in Terminal, but you can easily scroll back to the beginning if desired. Here's an example report:

```
BOB4 (software v4.3.5, boot v4.3.1, logic rev.22, board v4.2)
```

```
Running parameters:
```

```
video mode: local NTSC non-interlaced
pixel rate: 9.375 MHz
first pixel position: 123
last pixel position: 539
pixels per line: 416
first line: 39
last line: 246
lines per frame: 208
SPI memory device 0: none (0 bytes)
SPI memory device 1: none (0 bytes)
SPI memory device 2: none (0 bytes)
SPI memory device 3: none (0 bytes)
slave SPI mode: 0
comms ACR pins: 0x9 (SPI master, rate = conf)
```

```
Configuration:
```

```
NTSC (16=0)
interlaced: no (17=0)
external video mode: automatic (18=3)
external video mode follow: yes (19=1)
high pixel rate: yes (20=1)
underscan restriction: yes (21=1)
frame buffer size: 3 (34560 bytes) (22=3)
pixel rate: 0 MHz (23=0)
horizontal position: 0 (24=0)
horizontal size: 0 (25=0)
```

```

vertical position: 0 (26=0)
early lines: 0 (36=0)
vertical size: 0 (27=0)
overlay enabled: yes (28=1)
local horizontal adjustment: 54 (29=54)
NTSC chroma rate: 100.000 % (30=100000)
PAL chroma rate: 100.000 % (31=100000)
blinking enabled: no (32=0)
blink period: 10 (33=10)
blink duty: 50 (34=50)
screen flip: normal (35=0)
BOB-4 only mode: yes (9=1)
STX allowed for string start: no (10=0)
CR/LF mode: not set (11=0)
config baud rate: 9600 (40=9600)
flow control: XON/OFF (41=1)
8 bits, 1 stop bit, no parity, echo mode off (42=4)
slave SPI signaling mode: (pin configured) (44=4)
boot script size: 13 bytes (8=13)
10: low (48=0)
11: low (49=0)
12: low (50=0)
13: low (51=0)
14: low (52=0)
SPI memory device 0: none (rate=8) (56=0)
SPI memory device 1: none (rate=8) (57=0)
SPI memory device 2: none (rate=8) (58=0)
SPI memory device 3: none (rate=8) (59=0)

```

Fonts:

0: bob3	304 chars	12 x 13	2 bpp	internal
1: 8x13	96 chars	8 x 13	2 bpp	internal
2: target	14 chars	13 x 13	2 bpp	internal
3: misc	96 chars	8 x 14	1 bpp	internal
4: 6x10	96 chars	6 x 10	2 bpp	internal
5: 13x34	96 chars	13 x 34	2 bpp	internal
6: 20x40	96 chars	20 x 40	2 bpp	internal
7: bob4	1 chars	136 x 33	2 bpp	internal

Configuration statements such as “16=0” mean that configuration item 16 is set to zero, making BOB-4 compatible with NTSC video rather than PAL video. All of the corresponding **v** commands are listed and described in the App Guide by parameter **n** value: 16 in this case. The example setting could have resulted from a user command entered as follows, where parameter **m** is zero:

```
$1b[16;0v
```

Many of the **v** commands don’t take effect until they’re saved into flash memory and BOB-4 is rebooted. The configuration save command may be issued just once after a salvo of configuration setting commands. Here it is:

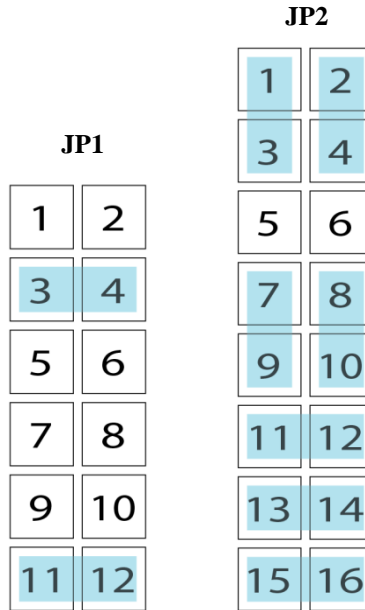
```
$1b[1v
```

Have fun with BOB-4, but take care to avoid typing anything other than “[“ after the Escape code until you achieve a good understanding of command structure. That little error can be confounding.

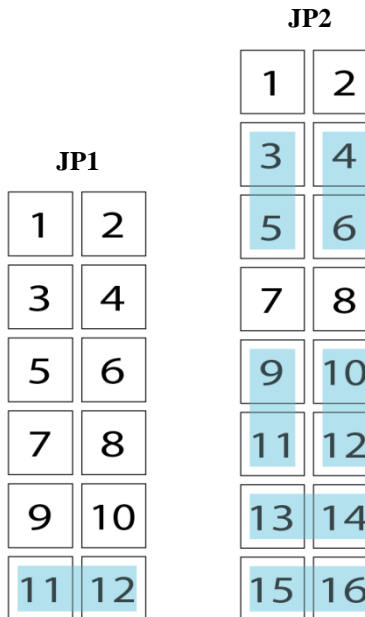
This document, although written for XBOB-4, is also highly relevant to BOB-4 applications that involve interfacing with existing data source equipment: [XBOB-4 Quick-Start Guide & POS Tutorial](#)

Serial Port Configuration Headers (JP1 & JP2)

There are two primary possibilities for loading the configuration shunts at JP1 and JP2. The factory default setup configures the main port to 9600 bps and leaves RTS/CTS handshaking disabled. BOB-4H uses XON/XOFF software handshaking by default, but it's generally safe to ignore this at 9600 bps or lower. The debug port is enabled (and always runs at 115.2 kbps). **This illustration shows factory default shunt locations in blue:**



To enable RTS/CTS hardware handshaking at the main port, move JP1 and JP2 shunt plugs to the following positions. Note that hardware handshaking must be configured in BOB-4H as well, by software command. See `v` command (n=41). The debug port is inoperative in this configuration:



For a third alternative, move the one remaining JP1 shunt to pins 5~6 to configure BOB-4H for 115.2 kbps and RTS/CTS handshaking. This option doesn't require software configuration of the BOB-4H module. Many other configuration options are available. See the [BOB-4 Application Guide](#) and the SIS schematic (appended to this document) for additional details.

SIS Specifications

Physical	Board outline dimensions are 4.80 x 4.80 inches. Board form factor is compatible with Hammond 1598B series enclosures. Overall height is 0.86 inches, comprising 0.70 inches above the surface of the board, 0.06 inches board thickness, and 0.10 inches for bottom side projections. Weight is 0.17 pounds (78g) without BOB-4H video module and mounting hardware, or 0.23 pounds (104g) with BOB-4H module installed. SIS operating temperature range is 0~50°C.
Power Supply	9~15 VDC at 125 mA typical, with BOB-4H module installed. Requires industry-standard coaxial DC power input plug with 2.1 mm ID and 5.5 mm OD. Center pin connection is positive. Decade Engineering part number 9VDC-0A5-120VAC is recommended in North America. The specified 15 VDC upper limit must not be exceeded on a continuous basis, to avoid overheating and prevent failure of the internal current limiting device. Power supply input is protected against reverse polarity. An on-board regulator supplies +5V power to the BOB-4H module. A green LED indicates when power input is present.
Async Serial I/O	D-Subminiature 9-pin female RS-232 compatible jacks are provided for the main and debug serial ports of BOB-4H. Pin assignment is suitable for direct connection to PC serial COM ports using 'modem' (straight-through; no crossover) cables. The optional RTS/CTS hardware handshake signals in the main control port are accessible only if the debug port is not in use. Data rate may be limited to 250kbps or 460kbps, depending on RS-232 interface chip used in production.
Video I/O	SIS provides female RCA jacks linked directly to BOB-4H video I/O pins. The BOB-4H video environment is RS-170A (NTSC) or PAL-B composite baseband, 1Vpp, 75 ohms, unbalanced. A red LED indicator lights when video input is missing (controlled by BOB-4H module).

Cautions!

Be certain to install the BOB-4H module in correct alignment with J2. Connector misalignment in any direction may cause permanent damage when power is applied. Do not allow SIS to rest on bare metal or other conductive surfaces when it's powered up. Add feet or an enclosure if necessary. ESD (electro-static discharge) safety precautions must be followed at all times when handling SIS boards. Use a grounded wrist strap and grounded static-dissipative work surface. SIS boards must be stored and shipped in static-shield (metallic or carbon-black, not pink poly) packaging.

Connector Pinout & Hookup Notes

The pin #1 location is marked with a triangular symbol on the PCB topside at all SIS connectors. Pin #1 is also identified with a square pad on the bottom side of the PCB. Any connectors not called out in this document are reserved for product development or manufacturing use.

The following detailed connector descriptions are grouped roughly by function.

J9: DC power input jack

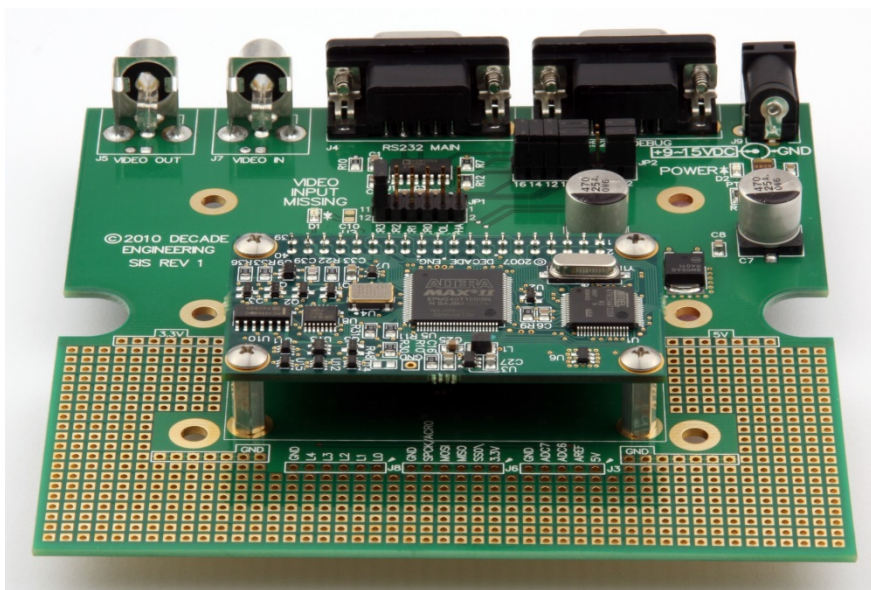
SIS requires 9~15 VDC at about 125 mA with BOB-4H installed. Use an industry-standard coaxial DC power input plug with 2.1 mm ID and 5.5 mm OD. The center pin connection is positive. Decade Engineering part number 9VDC-0A5-120VAC is the recommended power supply unit for North American customers. The specified 15 VDC upper limit must not be exceeded on a continuous basis, to avoid overheating and to prevent failure of the internal current limiting device. A green LED (D2) illuminates when power is applied.

J7 and J5: Video input and output connectors

Use standard 75-ohm coaxial video hookup cables with RCA plugs at both of these jacks. J7 & J5 are routed directly to the BOB-4H module with no intervening circuitry, so all of the video I/O characteristics of BOB-4H apply directly. It's not necessary to connect a video source to the input jack for basic operation. The red warning LED (D1) lights up if video is not supplied at J7, but the BOB-4H module automatically generates black background video and operates normally in other respects.

J2: BOB-4H module interface connector

See *BOB-4 Application Guide* for pin assignments. For convenience, the test points located near J2 are numbered to match J2 (and BOB-4H) pin numbers. SIS is supplied with four internally threaded standoffs and eight 4-40 machine screws to secure the BOB-4H module in place using the four mounting holes at the corners of the module outline. This photo shows SIS with the BOB-4H module installed:



J4: RS-232 main serial port connector

For main control port connection to a PC COM port, SIS requires a 9-pin “D-Subminiature” or “DB9” male/female cable assembly with all pins wired straight through. This is often described as a DCE or modem-style cable. Do not use a null-modem hookup cable. Main port data rate and handshaking options must be configured as described in the *BOB-4 Application Guide*. Factory default configuration is for 9600 bps without RTS/CTS hardware handshake, and provides loop-back for all PC hardware handshake signals. BOB-4H provides the software (XON/XOFF) handshake by default, but it's generally safe to ignore this when operating at 9600 bps and below. J4 pin assignment follows:

Pin	Function
1	Linked to 4 & 6
2	TX data out
3	RX data in
4	Linked to 1 & 6
5	Ground
6	Linked to 1 & 4
7	CTS input
8	RTS output
9	Not connected

J1: RS-232 debug serial port connector

For debug port connection to a PC COM port, SIS requires a 9-pin “D-Subminiature” or “DB9” male/female cable assembly with all pins wired straight through. This is often described as a DCE or modem-style cable. Do not use a null-modem hookup cable. Data on J1 always flows at 115.2 kbps, without handshaking, as described in the *Debug Port Protocol* section of the *BOB-4 Application Guide*. All of the PC hardware handshake signals in J1 are looped back, to simplify PC application programming. J1 is active in the factory default configuration. Be aware that J1 is inactive if SIS is configured to use the hardware handshake (RTS/CTS) option on the main control port at J4. Here’s the pin assignment for J1:

Pin	Function
1	Linked to 4 & 6
2	TX data out
3	RX data in
4	Linked to 1 & 6
5	Ground
6	Linked to 1 & 4
7	Linked to 8
8	Linked to 7
9	Not connected

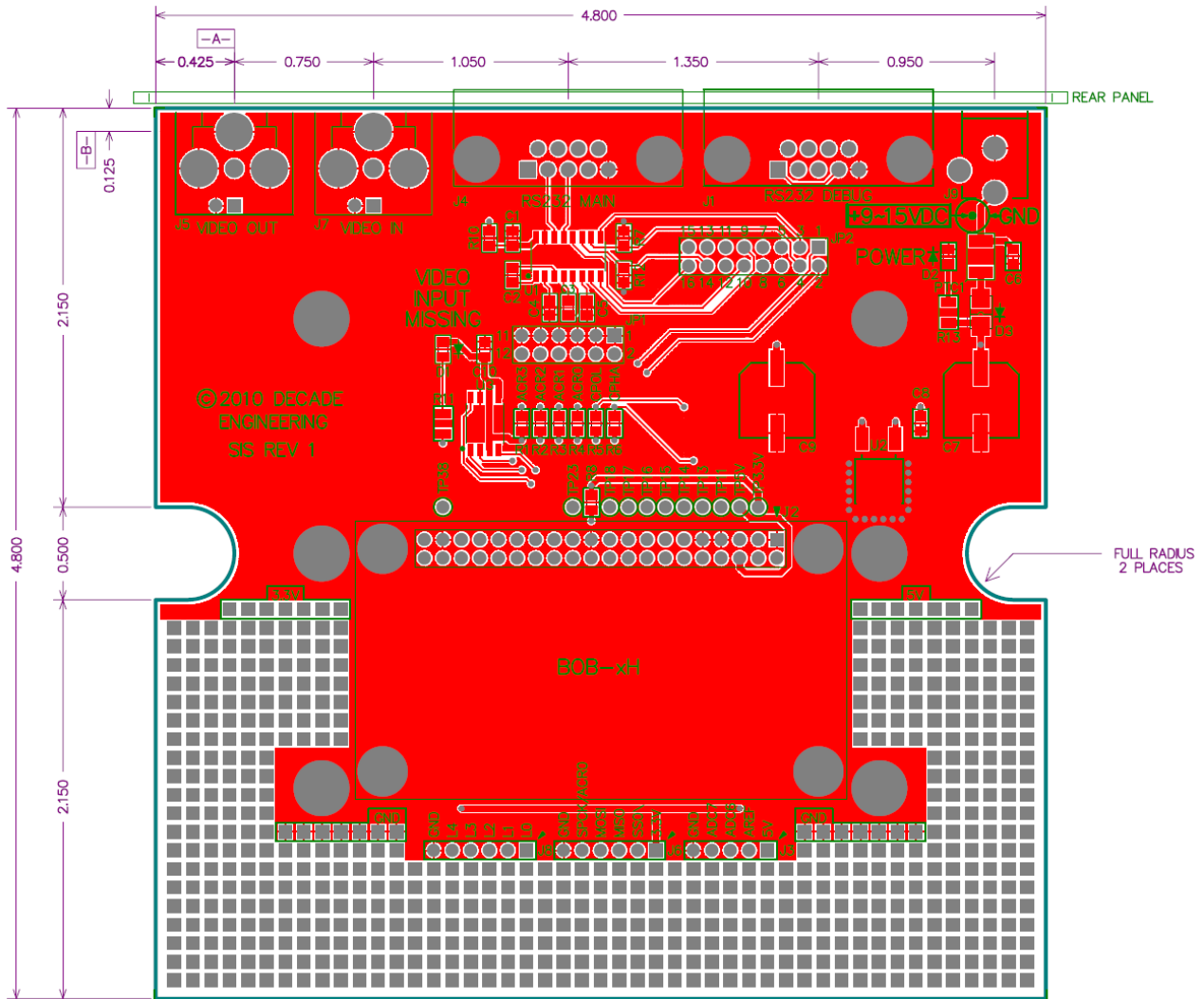
Optional pin header connectors; J3, J6, J8

J3, J6, and J8 are not installed at the factory. Customers may install these connectors to implement some of the less frequently used BOB-4H features, including a pair of analog voltage measurement (ADC) inputs, an SPI control port, and general-purpose logic outputs. Refer to the *BOB-4 Application Guide* and SIS schematic for pin assignments, usage constraints, and other details.

Optional memory IC footprint; U3

BOB-4 modules can store huge custom fonts and bitmap images in external Atmel DataFlash (AT45 series) memory chips if the SPI control port isn’t placed in service. There’s a list of acceptable part numbers in the BOB-4 App Guide. The U3 footprint accommodates most of these part numbers when ordered in the SOIC package. Be sure to add an 0805 size decoupling capacitor at C10 if you install a font memory expansion chip. Also remember to enable the new SPI slave device and select its bit rate (see **v** command, **n**=56~63). U3 uses chip select line SS0\.

SIS PCB Dimensions



Dimensions are given in inches. The six main PCB mounting holes are 0.156" ID, to clear #6 machine hardware. Those six holes match the PCB mounting post locations in Hammond 1598B series enclosures. The four mounting holes inside the BOB-4H module outline are 0.128" ID, to accommodate #4 hardware.

Decade Engineering Contact Information

Please check our website for the most recent version of this document before concluding that a defect exists. Decade Engineering's standard hardware warranty and service information is posted within the online ordering system.

Phone	503-743-3194
Fax	503-743-2095
Post	5504 Val View Dr SE, Turner, OR 97392 (USA)
Email	Use Feedback/Contact form at website
Web	www.decadenet.com

~o~

JP1 & JP2 Shunt Installation Options

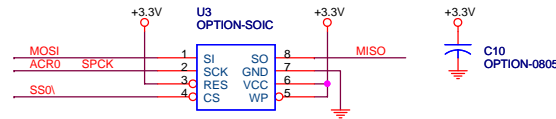
To enable Debug port, shunt JP2 pins 1-3, 2-4, 7-9, 8-10 and 11-12. Shunt JP1 pins 3-4. Shunt JP1 ACRx pins to ground as desired. Main port operates without RTS/CTS handshake. This is the factory default configuration, with ACR3 grounded to select the 9600bps data rate.

OR:

To enable main port RTS/CTS handshake, remove the JP1 pin 3-4 shunt. Shunt JP1 ACRx pins to ground as desired. Shunt JP2 pins 3-5, 4-6, 9-11 and 10-12. Also configure BOB-xH as required. The Debug port is inoperative in this configuration.

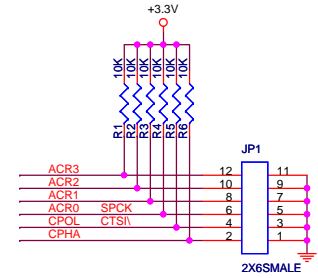
Always keep JP2 shunts 13-14 and 15-16 in place unless a local MCU is connected directly to BOB-xH TXD and RXD pins.

Remove shunts on JP1 pin 6 and JP2 pin 5 when using the SPI bus.

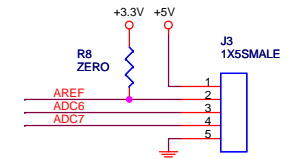


SMT footprint for optional font & bitmap graphics memory expansion; use Atmel AT45 series DataFlash chip, e.g. AT45DB041D-SU. See list in BOB-x Application Guide.

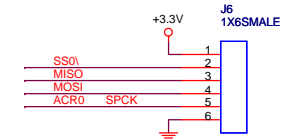
Font memory expansion may not be used simultaneously with optional SPI slave port (J6).



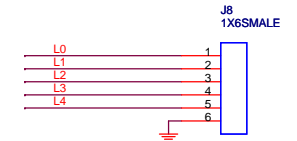
See BOB-x Application Guide for setting ACRx and SPI (slave) clock mode shunts.



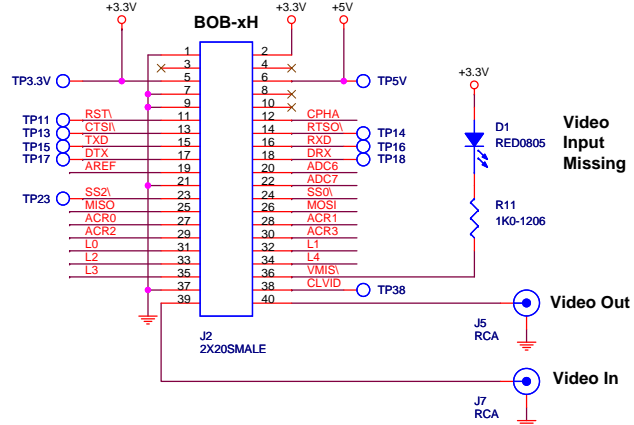
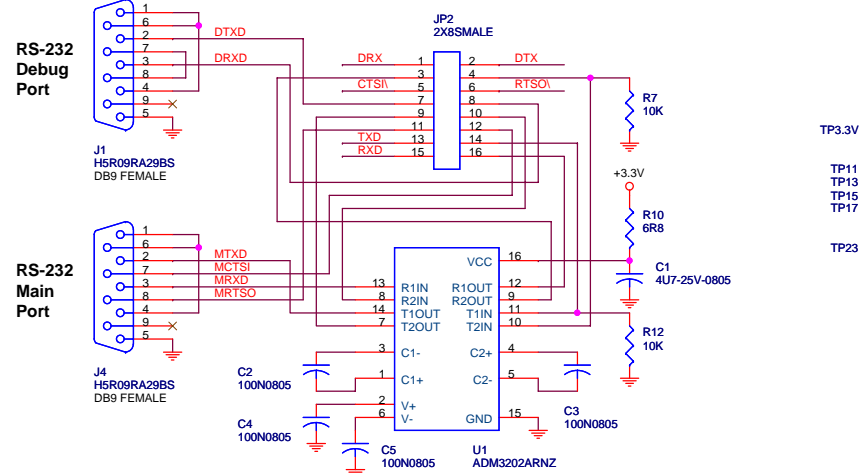
Optional ADC port; remove zero ohm resistor if external voltage reference is used!



Optional 3.3V SPI port
Font memory expansion may not be used simultaneously with optional SPI slave port.



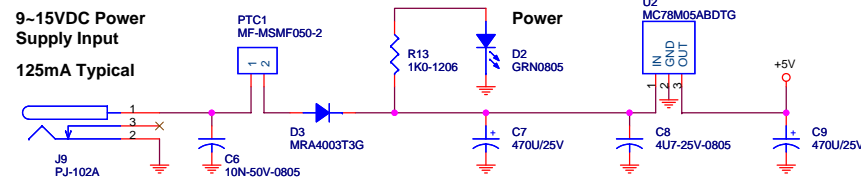
Optional 3.3V logic outputs



Video Input Missing

Video Out

Video In



Center Pin Positive

Note 460kbps maximum data rate for ADM3202.
Resistors are 0805 size unless marked otherwise.

This drawing, including all subject matters indicated thereon or derived therefrom, comprises proprietary information and is the express property of Decade Engineering. Employment, copying of or dissemination of this drawing, in whole or in part, without written permission of Decade Engineering is strictly forbidden. Copyright © 2010 by Decade Engineering. All rights reserved.

Page Title SIS PCB Schematic	
Board Title SIS ~ BOB-xH Demo & Developer Board	
Board Model Number SIS	Revision 1.0
Date: Friday, October 08, 2010	Sheet 1 of 1