DECADE ENGINEERING

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XBOB-S PCB Application Guide ~ Firmware v1.00 ~ March 26, 2007

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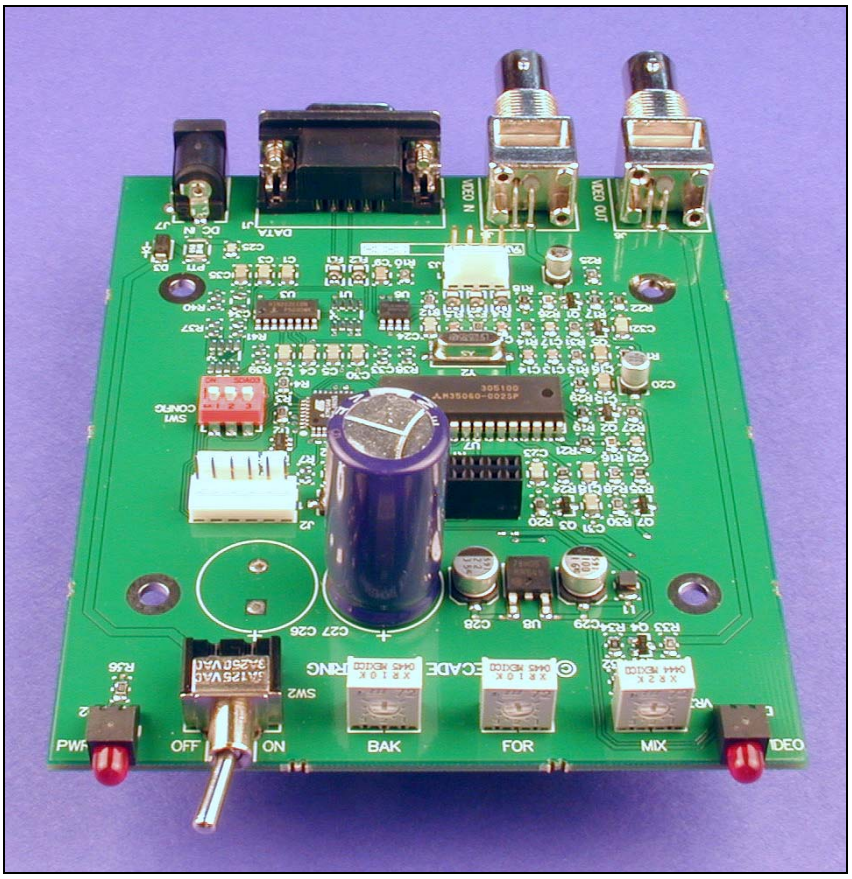


Cautions:

ESD (electro-static discharge) safety precautions must be followed at all times when handling XBOB-S boards. Use a grounded wrist strap and grounded work surface. XBOB-S boards must be stored and shipped in static-shield (metallic, not pink poly) packaging.

Introduction:

XBOB-S offers a simple stand-alone videotext overlay function for distance data. Unlike standard XBOB boards, the “S” version does not interact with a host computer or microcontroller. A set of four operator control switches is used instead. XBOB-S works directly with industry-standard incremental quadrature distance encoders.

XBOB-S monitors the video input, and automatically switches to internal video if the external video source is missing. Internally generated video provides a blue matte background, permitting a stable display of distance information in remote viewing systems even when the video camera fails or becomes disconnected.

Specifications:

Physical	PCB nominal length and width is 4.825 x 3.950 inches (122.6 x 100.3 mm), exclusive of controls and connectors. Overall height is less than 1.50 inches (38mm). Weight is about 4.06 ounces (115g). Ambient operating temperature range is 0~50 degrees C.
Power Supply	Nominal supply voltage range is 11~15VDC at 90~100mA, not including power supplied to the distance encoder. Decade Engineering recommends the use of power supplies with substantially higher current ratings, e.g. 500mA, for better voltage regulation. Use a standard coaxial DC power plug with 2.1mm ID and 5.5mm OD, and wire the center pin positive. *RadioShack.com* part number 910-0902 is a suitable DC power input plug. Note that unregulated "9VDC" power supplies typically deliver about 12VDC with a light load, and "12VDC" supplies often exceed 15VDC output!
Data I/O	Not provided. The RS-232 interface circuit and connector may be installed, but are not active in this version of XBOB.
Video I/O	XBOB-S's video environment is RS-170A (NTSC) composite baseband, 1Vpp 75 ohms unbalanced. BNC jacks are provided for video I/O. PAL-B video compatibility is available as an ordering option. The video input accommodates up to +2.5VDC bias mixed with incoming video. The video output contains a small DC bias (+1V), which is common to many video sources and is well tolerated at the inputs to most video equipment. An internal color video background signal (blue screen) is automatically generated if video input is not supplied.
Distance Encoder	XBOB-S requires a 5V incremental quadrature distance encoder that delivers 10 electrical cycles per foot of metered distance, regardless of data display mode (English or Metric). Open-collector as well as standard logic or "totem-pole" encoder outputs are acceptable. The encoder connector provides regulated (±5%) 5VDC power at up to 100mA, which adds directly to XBOB-S power supply input current. The maximum count rate for no missing counts is greater than 200KHz. Displayed units of distance may be English (f) or Metric (m), and may be changed freely during operation. In Metric mode, the display will skip some values in the least significant digit, in order to display the closest calculated result. Metric display error is +0.0656% plus rounding error, relative to English display accuracy.
Display Format	Distance data is displayed as a polarity symbol ("+" or "-") followed by three most-significant digits, a decimal point, a single least-significant digit, and a measurement units symbol ("f" or "m"). The data display field may be placed in any of the four corners of the screen, in the center, or turned off. Data characters are white with a thin black outline, yielding good legibility regardless of video background scene content.

Note: Product specifications, policies and prices are subject to change without notice. Contact Decade Engineering to confirm current status if any specified parameter is critical to your application.

Front Panel Controls:

XBOB-S provides a power switch and power indicator LED, as well as an LED to indicate missing video at the video input connector.

Two screwdriver adjustments are provided for setting character foreground brightness (FOR) and outline brightness (BAK). These settings are factory-calibrated for video levels near white and black, respectively, in the genlock/overlay mode. It is normal to see some character level variation when switching to local mode (blue screen), but it's usually best to leave the factory settings as-is unless you plan to use local mode exclusively. Use an oscilloscope or video waveform monitor to achieve accurate control settings.

A third screwdriver adjustment is provided for setting overlay transparency (MIX). The factory setting is full clockwise, resulting in maximum overlay contrast. The full CCW setting makes characters almost disappear. This control may be freely adjusted for best results in each application. Mid-range settings allow background video to show through superimposed characters, and also reduce the crawling effect sometimes seen around character

edges when they're placed over intensely colored regions of the image. In local video mode (blue screen), the MIX pot must be set full clockwise.

System Hookup:

The video output jack must be wired to the video input of a TV or video monitor, using 75 ohm coaxial cable with a BNC style plug at XBOB-S. TV inputs marked "Cable" or "RF" are not suitable. It's not necessary to connect XBOB-S's video input jack for a quick operating test, because XBOB-S will generate video. If you want to overlay text on video, connect the composite video output of a camera, or equivalent video source, to XBOB-S's video input jack. This connection also requires 75 ohm coaxial cable terminated with a BNC plug.

See Power Supply specification, above, for guidance on a compatible power supply.

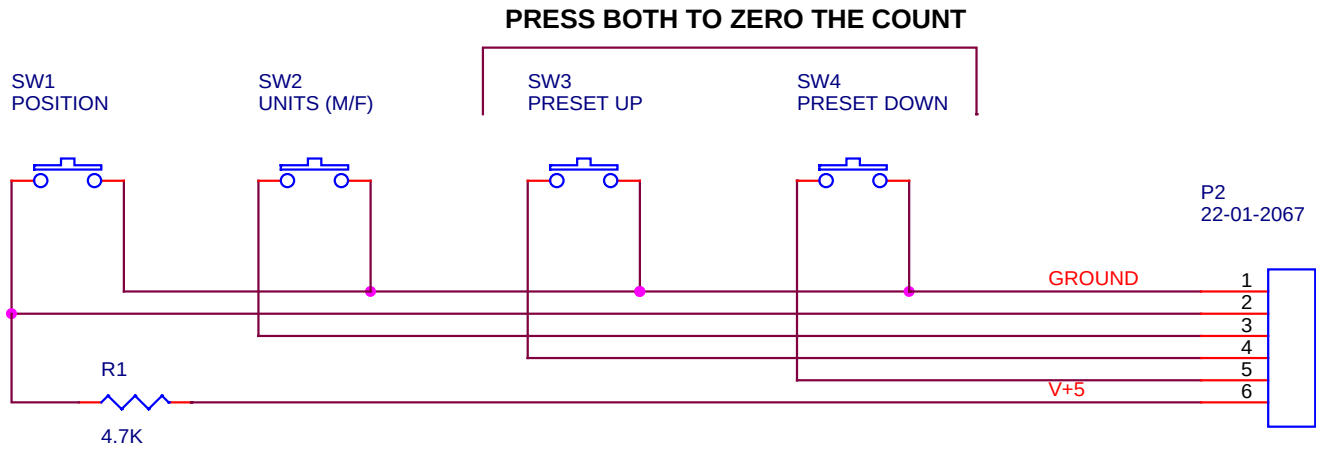
Standard 5V logic or open-collector (open-drain) encoder signal outputs are compatible, but external pullup resistors may be required when long cables are combined with open-collector outputs. Use a Molex 22-01-2047 or equivalent crimp terminal housing, and connect a 5VDC incremental quadrature encoder directly to J3 using the following pin assignments:

J3 Pin	Encoder Connection
1	+5V auxiliary power to encoder (100mA max.)
2	Channel A signal
3	Channel B signal
4	Ground

Note that crimp contacts are often sold separately for this style of connector, and must be installed in the connector housing subsequent to wire attachment. IDC or "punch-down" style connectors are also widely available. These require a punch-down tool instead of a crimper, and are more critical with regard to wire size.

Four operator control switches must be connected to J2 in order to provide the functions described below. These switches must be Normally Open (NO) momentary type, providing contact closure to ground (pin 1) when activated. Short stroke "tactile" (snap-action) switches are preferred for this application. Use a Molex 22-01-2067 or equivalent crimp terminal housing. Note: The CONFIG switch, if present in XBOB-S, must have all stations set to OFF.

Take extra care with operator control selection and installation, to insure that electro-static discharge (ESD) to the operator control switches will not propagate into XBOB. The signal connections at J2 are tied directly to the pins of a CMOS microcomputer chip! Here's a pinout table and hookup schematic for the operator controls:



J2 Pin	Operator Control Connection
1	Ground (switch common)
2	Display Position switch. 4.7K pullup resistor to pin 6 also required (for this pin only).
3	Metric/English switch
4	Count Up switch
5	Count Down switch
6	+5VDC for pullup resistor on pin 2

Operation:

The *Display Position* switch cycles through five possible data display positions (corners of the screen and center), and display OFF. When powered up, XBOB-S retrieves the last saved contents of the count register from non-volatile memory and displays distance at the position last selected by the Display Position switch.

The *Count Up* and *Count Down* switches allow distance register presetting and clearing. If either switch is held down for more than five counts, the count rate increases. Press both switches simultaneously to clear the count. Note: These functions are active even if the count is not currently displayed.

The *Metric/English* switch may be used at any time during normal operation, and causes the displayed units symbol ("m" or "f") as well as the displayed data value to be modified immediately. The current selection is saved in non-volatile memory, and will be used again at power-up time.

Note: Distance readout behavior has changed, relative to Decade's older BOB-II-SDD products. If the distance display is decremented (by the encoder) below +000.0, it rolls under to -000.1 and counts negative from there. If incremented above +999.9, it rolls over to +000.0 and continues upward. The internal count register does not actually overflow until the raw count exceeds $\pm 2^{24}$-1, so displayed rollovers are not forgotten. The display behaves like the least-significant digits of a much larger counter. The current contents of the count register are preserved in non-volatile memory through a power-down interval and recalled to the display at power-up time.

If the encoder counting sense is incorrect:

Swap the encoder signal (channel A/B) wires. It's not unreasonable to install a DPDT switch, wired to allow effortless reversal of these two signals, if system operational convenience benefits from it.

Power Supply Notes:

If the incoming power supply voltage falls below 10.2VDC, however briefly, XBOB-S initiates an orderly shutdown sequence that would result in complete cessation of microprocessor activity if not for the watchdog timer causing a system reset about one second later. Bear this in mind when testing the non-volatile data memory function, or if erratic operation occurs.

The power supply regulator on XBOB-S can supply about 100mA maximum to external devices tied to pin 1 of J3, and this is sufficient for most distance encoders. There are exceptions! Contact Decade Engineering if you need to use an encoder that draws higher current.

If the data overlay isn't stable:

Overlay jitters can be caused by weak and/or noisy input video. Typically, the video signal has been attenuated by passage through a long cable (or double termination). The best cure for long cable woes is a robust cable drive amplifier with pre-equalization for cable loss characteristics. Decade Engineering offers a Camera Adapter Board

(CAB) with broad adjustment ranges and high drive capability for this purpose. A Cable Compensator or Video Processor at the receiving end may also be suitable. Bear in mind that long cables are subject to noise injection from a variety of sources, including ground loops, so the cable receiving circuit may have to deal with several kinds of signal defect simultaneously. Coaxial cable losses in the baseband video spectrum are notoriously nonlinear as a function of frequency, making long cable compensation a distinctly non-trivial exercise.

Note: XBOB-S was not designed to work with tape *playback* signals from VCRs. In many cases it will work as desired, especially with high-performance machines, but overlay stability can be unacceptable with some VCRs. It's generally worse in special effects modes (e.g. freeze frame).

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