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Human Interface Board (#40003) for QuickStart

The Human Interface Board brings the functionality of the Propeller Demo Board to the QuickStart development platform. The Human Interface Board stacks directly on top of the QuickStart development platform, creating a minimal footprint for both boards.

With multiple audio and video outputs and keyboard or mouse inputs, as well as a microSD card socket, the Human Interface Board can add an interactive interface to any project.

Like the QuickStart development platform, the Human Interface Board is an open-source hardware design, so all design files—including layout, schematics, and firmware—are available under licenses that allow free distribution and reuse. The Human Interface Board's design can be incorporated into new applications royalty free and without a non-disclosure agreement.
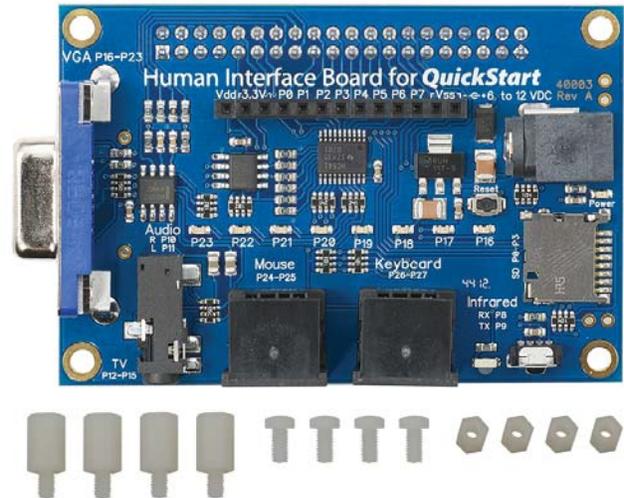
Features

- Designed for perfect compatibility with the multicore Propeller P8X32A microcontroller QuickStart development board (#40000)
- microSD card socket
- Eight-bit auxiliary I/O socket with power connections
- Infrared transmitter and receiver for remote control or communications
- Line-level stereo audio output
- Baseband line-level video output for NTSC or PAL signals
- VGA output capable of resolutions up to 1900 x 1200
- Eight LEDs mirror VGA signal states
- Dual PS/2 inputs for either keyboards or mice
- 2.1 mm ID, 5.5 mm OD center-positive barrel-jack power connector
- All the mounting hardware for connecting to the QuickStart board is included

Application Ideas

- Control system kiosk
- Embedded video game system

Key Specifications

- Power Requirements: 3.0–3.6 or 6–12 VDC; or 5 VDC via USB; 55 mA typical when idle
- Communication Interface: QuickStart header, VGA, PS/2, line-level A/V, 38 kHz infrared carrier
- Operating temperature: -13 to +185 °F (-25 to +85 °C)
- Dimensions: 2 x 3.2 x 0.9 in (51 x 81 x 23 mm)

Packing List

- Human Interface Board PCB
- (4) nylon pan-head M3 screws
- (4) nylon M3 hex standoffs
- (4) nylon M3 nuts

Synopsis

The Human Interface Board has a VGA output for high-definition televisions and computer monitors, as well as a line-level baseband output for NTSC or PAL monitors. It has two PS/2 ports, each of which can connect to a mouse or a keyboard, and it has an infrared receiver that works with most television remotes. It also includes an infrared transmitter so it can emulate a television remote, or communicate with other Human Interface Boards. The Human Interface Board includes a socket for a microSD card, which is quite useful for storing images or sounds to use in conjunction with the audio and video ports.

Except for the addition of a microSD card socket, and the replacement of the microphone with an infrared transmitter and receiver, the I/O pin map matches the Propeller Demo Board (#32100), giving full software compatibility with programs written to use the same peripherals.
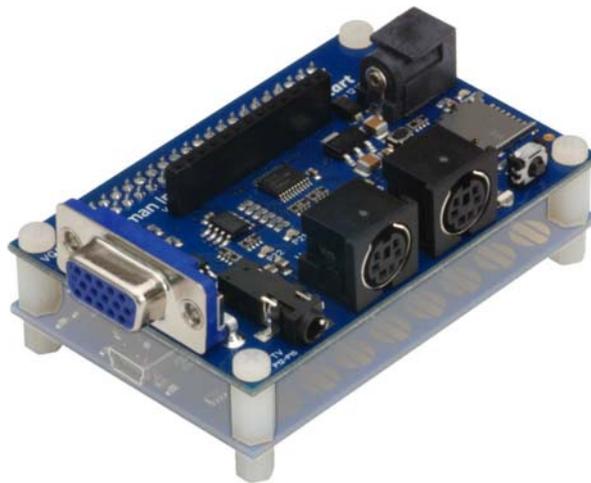
The Human Interface Board can be powered from a 6 to 9 volt DC output AC adapter, from the QuickStart development platform's USB port, or from the power pins on the I/O header.

Open-source hardware

The Human Interface Board is an open-source hardware design, so all design files are available under various open-source licenses, as included with each file.
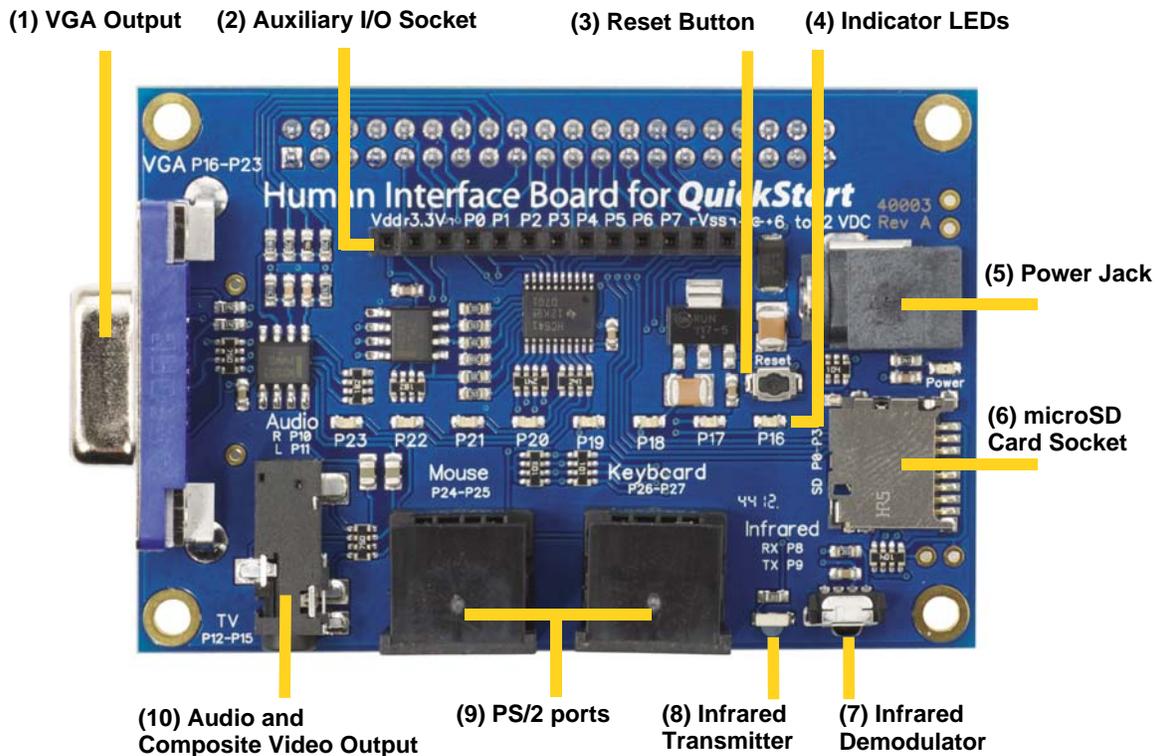
Getting Started

The Human Interface Board is an add-on board for the QuickStart development platform (#40000). The QuickStart is required to use the features in the Human Interface Board. The two boards stack as shown in the photo, and attach together using the included nylon mounting hardware.

Connect the Human Interface Board to the QuickStart development platform before applying power. Power can be supplied through the USB port or the 2.1 mm center-positive barrel jack, or both at the same time. The QuickStart development platform can switch power supplies while it is in operation, although connecting the USB port to a host will cause the USB to serial converter on the QuickStart development platform to reset the Propeller chip.

Human Interface Board Features

The Human Interface Board adds the following functions to the QuickStart development platform.

(1) VGA Output   **(2) Auxiliary I/O Socket**   **(3) Reset Button**   **(4) Indicator LEDs**

(5) Power Jack

(6) microSD Card Socket

(10) Audio and Composite Video Output   **(9) PS/2 ports**   **(8) Infrared Transmitter**   **(7) Infrared Demodulator**

(1) VGA Output

The VGA connector outputs the signal generated by Propeller I/O pins P16 through P23. The signals are all line level signals with a 75 ohm impedance. The amplifier includes a 6th order low-pass filter with a 30 MHz cutoff to reduce the switching noise from the Propeller's duty outputs. The outputs are shared with the Indicator LEDs.

The bottom side of the Human Interface Board has labels for connections to the SCL and SDA lines of the Display Data Channel on compatible VGA devices.

(2) Auxiliary I/O Socket

The Auxiliary I/O header connects to Propeller pins P0 through P7. It shares P0 through P3 with the microSD Card Socket. It has two V_{SS} pins and three power pins. The two pins labeled 3.3V connect to the output of the QuickStart development platform's 3.3 VDC regulator. It can be used to draw power from the QuickStart development platform, or to power it and the Human Interface Board, with 3.3 ± 0.3 VDC. When Human Interface Board is powered through the 3.3V pins, the PS/2 ports and the DDC interface on the VGA connector will not have sufficient power to operate.

The pin labeled Vdd connects to the output of the Human Interface Board's 5 VDC regulator and the input of the QuickStart development platform's 3.3 VDC regulator.   It can be used to draw power from the QuickStart development platform, or to power it and the Human Interface Board, with 5 ± 0.5 VDC.

Caution: The power pins on the (2) Auxiliary I/O Socket can both provide and draw power. When using them to power the Human Interface Board and QuickStart, place a diode in series with the power supply, if it is capable of sinking current.

The Auxiliary I/O header pin functions are as follows:

Label	Function
Vdd	4.5 to 5.5 VDC input or output
3.3V	3.0 to 3.6 VDC input or output
P0	Propeller I/O pin P0 and microSD SPI data out
P1	Propeller I/O pin P1 and microSD SPI clock
P2	Propeller I/O pin P2 and microSD SPI data in
P3	Propeller I/O pin P3 and microSD SPI chip select
P4	Propeller I/O pin P4
P5	Propeller I/O pin P5
P6	Propeller I/O pin P6
P7	Propeller I/O pin P7
Vss	Ground

(3) Reset Button

The reset button, when pressed, will force the Propeller to reset and reload any code stored in the EEPROM.

(4) Indicator LEDs

The indicator LEDs are connected to Propeller I/O pins 16 through 23, shared with the VGA Output. P23 controls the leftmost LED and P16 controls the rightmost LED.

(5) Power Jack

The 2.1 mm ID, 5.5 mm OD center-positive barrel power jack powers the 5 VDC regulator with voltages up to 12 VDC. It outputs 5 VDC, to directly power the PS/2 Ports, the Infrared Receiver, the DDC supply on the VGA Port, the VDD pin on the Auxiliary I/O Socket, and the QuickStart's 3.3 VDC regulator, through its VIN pin.

(6) microSD Card Socket

The microSD card socket is connected to Propeller pins P0 through P3, which are shared with the Auxiliary I/O Socket. All pins except the microSD SPI data in pin are pulled to 3.3 volts through 100 kΩ resistors. The microSD SPI data in pin is pulled low when a card is present and high with no card present. For more information regarding communications with an SD card, refer to the "SD Specifications Part 1 Physical Layer Simplified Specification" published by the SD Association. The microSD card socket is a push-pull socket. To insert a card, push it into the socket; to remove a card pull it out of the socket.

Caution: The firmware running on the QuickStart can make changes to the microSD card contents, including erasing the card. Do not remove the card while the QuickStart firmware is writing to the card.

(7) Infrared Demodulator

The infrared demodulator, connected to Propeller I/O pin P8, includes a built-in pull-up resistor and drives the I/O pin low when it receives a signal. It can receive signals from devices that transmit an infrared signal modulated at 38 kHz, including signals from the Infrared Transmitter on a Human Interface Board or from many TV and camera remotes.

(8) Infrared Transmitter

The infrared transmitter is a right-angle LED that is directly driven by Propeller I/O pin P9. It should be modulated at 38 kHz to work with the Infrared Demodulator. It can also work with modulation schemes for other receivers. Use it to transmit to other Human Interface Boards or to various infrared receivers such as TVs, cameras, LCD shutter glasses, and printers.

(9) PS/2 Ports

The PS/2 ports connect to Propeller I/O pins P24 and P25 for the left port and P26 and P27 for the right port. Traditionally, Propeller Demo Board programs used Propeller I/O pins P24 and P25 for the mouse and Propeller I/O pins P26 and P27 for the keyboard, so the ports are labeled to match.

(10) Audio and Composite Video Output

The A/V connector works with both 1/8" audio devices, such as headphones and speakers, and with baseband video devices, such as TVs. The left channel draws its signal from Propeller I/O pin P11, the right channel from P10, and the video from P12 through P15, with P12 as the most significant bit, P14 as the least significant bit, and P15 as the aural subcarrier. The TRRS connector is compatible with TRS cables, with the tip carrying left-channel audio, the ring carrying right-channel audio, and the sleeve acting as the return path. When used with a TRRS cable, the tip carries left-channel audio, the outer ring carries right-channel audio, the inner ring carries video, and the sleeve acts as the return path. The signals are all line level signals with a 75 ohm impedance. The amplifier includes a 6th order low-pass filter with an 8 MHz cutoff to significantly reduce the switching noise from the Propeller's duty mode outputs.

/RTS and /CTS connections

The bottom side of the Human Interface Board has labels for connections to the /RTS and /CTS lines of the QuickStart's USB serial port.

Propeller I/O Connections

I/O pin	Connection	Function
P0	I/O header	Bidirectional I/O
	microSD SPI data out	Input from microSD card
P1	I/O header	Bidirectional I/O
	microSD clock line	Output to microSD card
P2	I/O header	Bidirectional I/O
	microSD SPI data in	Output to microSD card
	microSD card detect pin	Pulled low when card present, high with no card
P3	I/O header	Bidirectional I/O
	microSD SPI chip select	Output to microSD card

I/O pin	Connection	Function
P4	I/O header	Bidirectional I/O
P5	I/O header	Bidirectional I/O
P6	I/O header	Bidirectional I/O
P7	I/O header	Bidirectional I/O
P8	38 kHz infrared demodulator	Input from infrared demodulator
P9	Infrared transmit LED	Output to infrared LED
P10	Audio out, right channel	Output to audio amplifier/filter
P11	Audio out, left channel	Output to audio amplifier/filter
P12	Composite video signal, most significant bit	Output to video DAC/amplifier/filter
P13	Composite video signal, center bit	Output to video DAC/amplifier/filter
P14	Composite video signal, least significant bit	Output to video DAC/amplifier/filter
P15	Composite video signal, aural subcarrier	Output to video DAC/amplifier/filter
P16	Blue LED indicator	Output to buffered LED
	VGA vertical sync signal	Output to VGA connector
P17	Blue LED indicator	Output to buffered LED
	VGA horizontal sync signal	Output to VGA connector
P18	Blue LED indicator	Output to buffered LED
	VGA blue signal, most significant bit	Output to video DAC/amplifier/filter
P19	Blue LED indicator	Output to buffered LED
	VGA blue signal, least significant bit	Output to video DAC/amplifier/filter
P20	Blue LED indicator	Output to buffered LED
	VGA green signal, most significant bit	Output to video DAC/amplifier/filter
P21	Blue LED indicator	Output to buffered LED
	VGA green signal, least significant bit	Output to video DAC/amplifier/filter
P22	Blue LED indicator	Output to buffered LED
	VGA red signal, most significant bit	Output to video DAC/amplifier/filter
P23	Blue LED indicator	Output to buffered LED
	VGA red signal, least significant bit	Output to video DAC/amplifier/filter
P24	Mouse data	Bidirectional I/O to/from mouse port
P25	Mouse clock	Output to mouse port
P26	Keyboard data	Bidirectional I/O to/from keyboard port
P27	Keyboard clock	Output to keyboard port
P28	I2C clock (inside QuickStart)	Output to EEPROM
P29	I2C data (inside QuickStart)	Bidirectional I/O to/from EEPROM
P30	Propeller boot loader transmit (inside QuickStart)	Transmit during boot process
P31	Propeller boot loader receive (inside QuickStart)	Receive during boot process

Propeller Demo Board Compatibility

The Human Interface Board uses the same Propeller I/O pins as the Propeller Demo Board for the Auxiliary I/O Socket, Audio and Composite Video Output, VGA Output, Indicator LEDs, and PS/2 Ports. Because all of the accessories that are common between the Human Interface Board and the Propeller Demo Board use the same I/O pins, Propeller programs that only use these accessories are interchangeable between the two boards. The only accessory on the Propeller Demo Board that is not present on the Human Interface Board is the microphone. The Human Interface Board adds a microSD Card Socket, sharing P0 through P3 with the Auxiliary I/O Socket, and an Infrared Demodulator and Infrared Transmitter using P8 and P9, which the Propeller Demo Board used for its microphone.

Specifications

Symbol	Parameter	Minimum	Typical	Maximum	Units
Vdd	Supply Voltage on Vdd	4.5	5.0	5.5	V
3.3V	Supply Voltage on 3.3V pin	3.0	3.3	3.6	V
	Supply Voltage on Power Jack	6.0		12	V
Iin	Power consumption when idle		55.0		mA

Absolute Maximum Ratings

Symbol	Parameter	Minimum	Maximum	Units
Vdd	Supply Voltage on Vdd	-0.5	16	V
3.3V	Supply Voltage on 3.3V pin	-0.5	3.6	V
	Supply Voltage on Power Jack	-0.5	16	V

Revision History

Version 1.1: Labeling fixes

Version 1.0: original
release