

Overview

The **BioMouse™ Plus** is a fingerprint scanner and smartcard reader in one product. From the end-user's point of view it comes with the following components:

- Fingerprint scanner and smartcard reader module
- PCMCIA interface card for laptops
- Desktop extension for parallel port interfacing to desktop computers
- 12VAC power adapter for desktop extension

The electronics consists of six circuit boards all together. The first three (Processor, Imager and Smartcard module) reside within the fingerprint scanner/smartcard reader component. The next two boards (Passthrough and extension modules) reside within the desktop extension. The last circuit board resides within the PCMCIA card. A function description of each of these circuits boards follows.

Processor Module (DBI-0008-001-DW)

This is the main control module within the fingerprint scanner. It consists of the following main circuit functions, described by their schematic sheet.

Sheet 1

Micro-controller (U1) controls operation of both imaging and smartcard interfacing of the product. Connectors to the external cable (J1) and the smartcard module (J4) are shown. The system runs off of a 20 MHz clock.

Sheet 2

Level shifting logic (U2, R6, D2, C14, R3-6, and Q1) generate clocking signals at voltage levels required by the CCD (see imager module). The Imager module's connector (J2) is also defined in this sheet. The analog signal from the CCD is passed to an analog to digital converter (U6) to generate digital inputs for the micro-controller. In addition the A/D converter's bottom reference voltage is modulated (D3, C18, C17, and R7) by a PWM output signal from the micro-controller.

Sheet 3

Power supply generation is shown on this sheet. The main power input to the scanner is 5 VDC. This is stepped up to 12 VDC through a charge pump (U4). The 12 VDC is then stepped up to 22 VDC again. The rest of the components on this sheet supply de-coupling and charge storage functions for the two charge pumps. All of these voltages are required to control the CCD imager.

Sheet 4

This sheet contains the scanner's illumination function. It consists of a set of high efficiency LEDs strung in pairs. Each set has a current limiting resistor included in series with two LEDs. All LEDs are switched on and off with a low-side power MOSFET – which is controlled by a digital output from the micro-controller.

Imager Module (DBI-0008-002-DW)

This module performs the imaging function of the fingerprint scanner. There is a single sheet of electronics defining this module. The connector, J1, allows the module to be plugged into the processor module. Through this connector all of the power supplies and input clocks are received from the processor module. These clocks control the CCD (U5) – which generates an analog stream of pixels. The analog pixels are passed through a simple amplifier configuration (R1-5, Q1, and Q2) before passing the signal back to the processor module (through J1).

Smartcard Module (DBI-0008-003-DW)

This module performs the smartcard reader functions of the device. There is a single sheet of electronics defining this module. The connector, J1, allows this module to be plugged into the processor module. Through this connector, control signals are passed from the micro-controller to the smartcard interface IC (U1). This interface IC is responsible for performing all electrical interfacing to the smartcard through the card socket (J2). The interface IC is supplied a 20 MHz clock (Y1). The rest of the components on this module perform either de-coupling (capacitors) or configuration option functions.

Passthrough Module (DBI-0008-004-DW)

This module provides the interface between the fingerprint scanner and the host computer. It is designed to connect to a Personal Computer parallel port in a pass-through configuration. That is, another parallel port device can be connected to the PC through this module. The main power supply for the product is connected to this module.

The first sheet of this module defines the logic necessary to perform the pass-through function. It consists of two quad two-to-one multiplexers and one octal line-driver. The multiplexers are used to switch five signal lines between the printer connector (P2) and the fingerprint scanner. Normally, the signals from the printer are selected – allowing other devices to use the parallel port transparently. When the fingerprint scanner is activated, the multiplexers are switched to allow the scanner to drive these five signals. The line driver device, U2, is used to provide a degree of isolation between the three devices (host computer, BioMouse and a third-party printer) interfacing to the pass-through module.

The resistor networks RN1 and RN2 were designed to allow the introduction of pull-up resistors if required. These devices are not populated in the final design. Resistors R1 through R7 act as pull-downs on the input signals to the device. Resistors R8 and R9 act as series resistance in output signals to the fingerprint scanner.

The second sheet of the pass-through module defines the signal paths for external connectors of the module. Connector J1 provides the interface to the scanner. The cable connecting this port to the fingerprint scanner is defined on sheet 4. Connectors P1 and P2 define the two parallel-port DB-25 interfaces. P1 plugs into the host and P2 is available for a third-part printer. All signals not required by the scanner are passed straight through from P1 to P2.

Finally, the third sheet of the pass-through module generates the primary power supplies. The input power comes from a 500mA, 12VAC wall adapter. This input signal is immediately rectified and stabilized by D1, C4 and C7. A 5 VDC power supply generated from a standard 5 VDC regulator (U4).

Desktop Extension Module (DBI-0008-006-DW)

This is a passive module designed to provide a connector conversion function. It takes the 2x5 Hirose connector in one end and provides a receptacle for the fingerprint scanner's miniature RMC connector. The circuit board is necessary simply because the receptacle for the RMC connector is available only in a PCB mounted configuration.

PCMCIA Card Module (DBI-0008-005-DW)

This module is again described on a single sheet of electronics. It is a standard PCMCIA card. J1 provides the 68-pin interface to the PCMCIA host socket. The core of this module is an Altera FPGA (U2) - which performs all of the digital logic associated with the board. Specifically, it provides the PCMCIA card-side interface to the host controller. The EEPROM (U3) stores both the FPGA image and the PCMCIA attribute, or CIS, memory. J2 provides the fingerprint scanner interface. Both I/O signals and power are provided through this circuit. The power is switched (D1, R4, R7, C8, Q1) under control by the host. In addition, there is an over-current detection circuit (U1, R1-R10, C7, C9) which causes the card to remove power from the scanner if its current draw exceeds PCMCIA specifications. The remaining components perform de-coupling and pull-up or pull-down functions.