

3.0 Circuit Description

The Control board is composed of three circuit blocks; the CPU, the Waveform Generator, and the Character Generator. The operation of each block is described in detail below.

3.1 CPU

The CPU circuitry contains two processors - a Motorola 68HC711D3 8-bit microcontroller (U16) and a Motorola 68000 16-bit microprocessor (U27). The microcontroller handles all serial input and output signals. It also outputs discrete control lines and monitors discrete control inputs. The 68000 runs the system software and interfaces with the Waveform Generator, the Character Generator and the DPB. The two processors communicate across a bi-directional 8-bit interface consisting of two latches for data transfer (U18, U20) and two flip-flops for handshaking (U9). Clock signals for both processors are provided by a 16 MHz crystal oscillator (U10) whose output is divided down to 8MHz by a flip-flop (U21).

The microcontroller and its support chips are powered from the +5V-STBY supply rail, which is present as soon as AC power is applied to the projector. The 68000 (and well as most of the Control Module) is powered from the +5V rail, which is not present until the Low Voltage Power Supply (LVPS) is turned on. This is done by the microcontroller in response to a "power-on" command from a hand-held keypad or from RS-232.

Because of the separate supply rails, the microcontroller and its support chips are kept electrically isolated from all other circuits when the LVPS is off. Signals which are not driven low or pulled low (open drain) by default are buffered by ICs U5 and U6, which are tristated by the signal PF (Power Fail) from undervoltage sensor U36.

3.1.1 Microcontroller

The 68HC711D3 is a single-chip microcontroller containing its own internal EPROM and RAM. On the Control Module, it is called the "I/O Processor" (IOP). All input and output is accomplished through four built-in 8-bit ports. This I/O capability is expanded by the addition of an external octal buffer (U19) and an octal latch (U7) connected to port C (C0-C7). The latch drives eight LEDs (LD1-LD8), which indicate the operational status of the projector. They are visible on the Control Module's panel. The buffer chip inputs diagnostic signals, some from other modules in the projector. (The specific function of each of the I/O ports is listed in Appendix A.)

Power-on reset of the microcontroller is handled by a "micromanager" IC (U17). When AC power is first applied to the projector, this IC ensures that the microcontroller is held in a reset state until the +5V-STBY supply rail stabilizes. The micromanager IC also allows a manual reset using a push-button (SW1) recessed into the Control Module's panel.

3.1.1.1 Power Control

When a "power-on" command is received from a hand-held keypad or RS-232, the microcontroller asserts PWR-EN* low to turn the low voltage and high voltage power supplies on. A secondary control signal, HTR-STBY, is also driven low to switch the heater voltage for the CRTs from a standby voltage of 4.0V to the normal operating voltage of 6.3V. Conversely, when a "power-off" command is received, PWR-EN* and HTR-STBY are driven high.