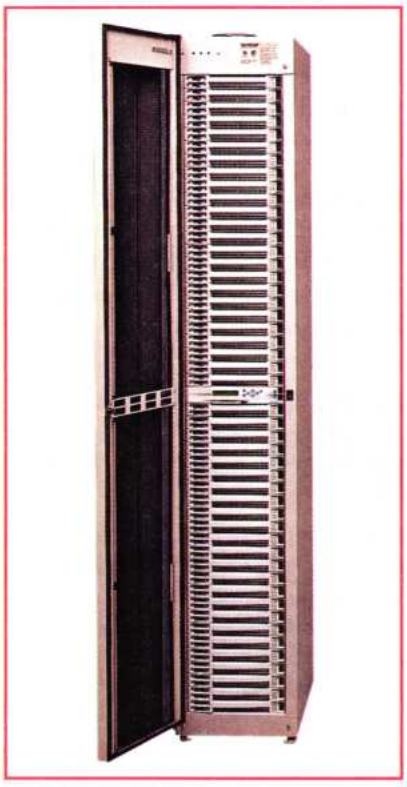

EXHIBIT 520.1 A typical high-density digital SCR dimmer switchboard. *(Courtesy of Electronic Theatre Controls, Inc.)*

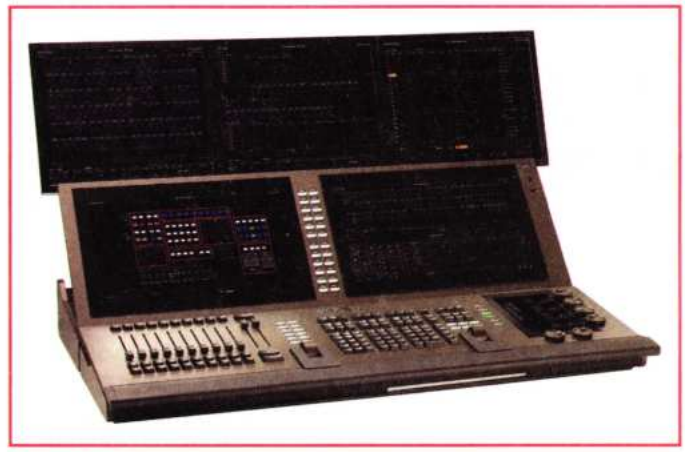

EXHIBIT 520.2 An electronic computer lighting control console for remotely controlling solid-state-type dimmers. (*Courtesy of Electronic Theatre Controls, Inc.*)

Exhibit 520.1 shows a high-density digital silicon-controlled rectifier (SCR) dimmer switchboard. Dimmers for individual circuits are contained in dual plug-in dimmer modules, which also contain circuit breakers for overcurrent protection and filter chokes to minimize acoustic noise from the lamp filaments. The digital control electronics in this exhibit are contained in a plug-in module with front-panel controls for configuration and testing.

**(A) Disconnection and Overcurrent Protection.** If dimmers are installed in ungrounded conductors, each dimmer shall have overcurrent protection not greater than 125 percent of the dimmer rating and shall be disconnected from all ungrounded conductors where the master or individual switch or circuit breaker supplying such dimmer is in the open position.

**(B) Autotransformer-Type Dimmers.** The circuit supplying an autotransformer-type dimmer shall not exceed 150 volts between conductors. The grounded conductor shall be common to the input and output circuits.

Informational Note: See 210.9 for circuits derived from autotransformers.

Any desired voltage may be applied to the lamps, from full-line voltage to voltage so low that the lamps provide no illumination, by means of a movable contact tap. This type of dimmer produces very little heat and operates at high efficiency. Its dimming effect, within its maximum rating, is independent of the wattage of the load.

**(C) Solid-State-Type Dimmers.** The circuit supplying a solid-state dimmer shall not exceed 150 volts between conductors unless the dimmer is listed specifically for higher voltage operation. Where a grounded conductor supplies a dimmer, it shall be common to the input and output circuits. Dimmer chassis shall be connected to the equipment grounding conductor.

Solid-state stage dimmers are often used since stage switchboards are usually remote controlled. The switchboard or dimmer rack normally is located offstage in a dimmer room, where proper climate control can be furnished and noise from the rack cooling fans does not interfere with the performance onstage. Branch circuits usually are connected to the dimmer rack on a dimmer-per-circuit basis. One or more control cables connect the dimmer rack to a remote lighting control console, such as the computer-style one shown in Exhibit 520.2, which can be located onstage or in the auditorium in view of the stage.

**520.26 Type of Switchboard.** A stage switchboard shall be either one or a combination of the types specified in 520.26(A), (B), (C), and (D).

**(A) Manual.** Dimmers and switches are operated by handles mechanically linked to the control devices.

**(B) Remotely Controlled.** Devices are operated electrically from a pilot-type control console or panel. Pilot control panels either shall be part of the switchboard or shall be permitted to be at another location.

**(C) Intermediate.** A stage switchboard with circuit interconnections is a secondary switchboard (patch panel) or panelboard remote to the primary stage switchboard. It shall contain overcurrent protection. Where the required branch-circuit overcurrent protection is provided in the dimmer panel, it shall be permitted to be omitted from the intermediate switchboard.

The intermediate-stage switchboard located between the dimmer switchboard and the branch circuits is usually called a patch