

power outlet. Some countries and some installations are more troublesome than others. Knowing that *MX* would be toured from venue to venue, country to country throughout the world, R + D engineers needed to exceed the absolute worst of all conditions.

Conveniently Strand can reproduce these environments in the lab. The environmental specification (based on IEC 801-4) stated that tests had to exceed 2000 volts of very fast risetime transients on the mains connected directly to a complete system, hooked up to dimmers.

During the test, special precautions are taken not to shut down the whole company by upsetting every computer in the building! The specification, if exceeded, makes the unit almost totally immune.

Should there be *really* serious problems, causing everything in sight to fail, many safety features are incorporated into the electronic design.

There is the ubiquitous watchdog timer, which the software has to 'kick' several times a second to prevent the processor from being reset, and more importantly, a unique memory locking facility, which actually prevents the processor from scrambling the valuable information that has been recorded.

Furthermore, in the event of this data being corrupted, the user is informed because each scene etc is individually checksummed. Every time you switch on *MX*, it checks the validity of the stored information.

The other main electronic assistance is provided by comprehensive power failure detection circuitry. This ensures that the processor is always warned in good time if the power droops or fails completely, allowing it to 'clean up' after

■ Richard Farthing, Project Team Leader.



■ MX LCD display.

itself, leaving no tasks undone when the power is restored. These are just a few of the special features of *MX*.

One important feature of the control PCB is that the majority of components are surface mounted. This assembly method was used for two reasons:

Firstly, using conventional methods it would have been impossible to pack the functionality of the control section into one PCB; this would have made manufacturing and assembly more difficult, and affected reliability through use of more interconnections.

Secondly, this method of manufacture is more reliable than conventional methods, because it is more difficult to make a good surface mount PCB. A bad one will never scrape through test, because it simply won't work. The process is therefore a catalyst for all sorts of quality control. These are, briefly, the use of a BS5750 approved process, automated assembly, and automated test.

SOFTWARE

Reliability can be designed into software too. One of the keys to this was to adopt a system design with easily understood modules and high level interfaces.

This goal was achieved by using the C programming language and the debug tools on SUN workstations. Less than 1% of the code in *MX* is written in error-prone assembler, meaning that it could be developed on a workstation without the hindrance of the actual *MX* electronics.

Approximately 11% of the total code resident in every unit is purely for test purposes. Most functions use the low level interface software as well, so test routines amount to quite a large total. As well as allowing the factory to test the units thoroughly, the user may access most of these routines via the menu. If there are any serious faults detected these are logged and may be printed out, allowing us to track any faults quickly in

the field. Furthermore, 18 of the 32 possible tests can be and are performed every time the system is turned on.

The use of standard interfaces in the software enabled Strand to compile easily the menu software to run on a PC and send demo disks around the world before launch.

It was also decided to use the MS-DOS disk format for the memory card, the budget not, unfortunately, allowing the luxury of a real disk drive. This feature means that newer systems will not make old data obsolete. Research shows that third party access to stored data is very important for the customer. By using a suitable third party PC plug-in card drive, the user can access his data meaningfully.

FEATURES OF THE MX 12,24,48

- 12, 24, or 48 channels of two scene preset faders
- Electronic patching for up to 512 dimmers
- Flash buttons operate in solo, pile-on, or inhibitive modes, and at selected levels
- Split crossfader with LED display
- Rapid recording of up to 192 memories in four pages for playback on scene masters or via the Sequence Fader
- Split time fader for timed crossfades between two scene presets and/or Sequence Fader
- Live or Blind memory modification
- Unique 'Hold' feature for two scene operation in combination with Scene Master operation
- 24 real time programmable Effects with pre-programmed or improvised control
- Pre-programmed Effect Types including Chase, Build, Cycle, Flicker, Random and Audio/MIDI input
- MIDI interface permitting playback of lighting states and effects from musical instruments
- Menu driven 4 x 20 LCD backlit display
- Software selectable multiplexed outputs: SMX, DMX512, D54, AMX192 all included in the standard console
- Optional Memory Card for library storage
- English, French and German language software included as standard.