



REF: DDM/DKB/2/72

DDM - A NEW CONCEPT IN
LIGHTING CONTROL.

Issue 2 Dated 5.5.72.

1. INTRODUCTION

System DDM (Digital Dimmer Memory) is a lighting control system with a performance specification which is claimed to have many significant advantages over equipment currently available.

Every electronic lighting control system has a central control or processor unit but conventionally this has in the past been designed specifically for the equipment concerned. Rank Strand have realised that the modern Mini-Computer offers the most attractive solution where advanced specification is required.

The first benefit which results is that the computer is able to handle functions which would be very difficult and costly to achieve by conventional means. Secondly, electronics hardware outside the computer is relegated to the role of communication between control desk, computer and dimmer control lines. This has enabled Rank Strand to produce a highly modularised design using a standard kit of electronic cards to carry out such functions as contact scanning, mimic drive, etc. This not only has obvious advantages from the point of view of servicing but enables Rank Strand to meet the specific requirements of different users with standard proven hardware supported by the computer which is programmed to provide the specific functions required.

Previous systems have used a Mini-Computer notably that developed by C.B.S. Television in the United States. However, Rank Strand have for the first time achieved a completely flexible and indeed elegantly simple solution to the problem of computing crossfades (U.K. Patent Application No. 13748/71 refers).

Undoubtedly the inherent difficulties of solving this problem coupled with relatively recent introduction of high performance low cost Mini-Computers has hitherto deterred manufacturers from adopting the use of the computer.

The computer chosen as the nerve centre of the system is the PDP11 manufactured by Digital Equipment Corporation. In the first 18 months following the introduction of this equipment, 1400 systems were sold thus proving the successful combination of performance, reliability and price which the manufacturers have achieved. Rank Strand have therefore been able to benefit from D.E.C.'s high expenditure on production and reliability engineering which no lighting control manufacturer could have afforded to invest.

2. DESIGN STATUS

The initial version of DDM has been designed for theatre use and the first equipment was delivered to The Royal Shakespeare Theatre, Stratford-upon-Avon in February, 1972, 17 months after the initiation of the full scale development and engineering programme. Further equipments are being manufactured during 1972 for overseas orders including North America and Australia.

3. PRINCIPAL OPERATIONAL ADVANTAGES

3.1. General

- (1) The computer gives the system considerable operational flexibility. For instance special control facilities can be provided by the incorporation of the appropriate pushbuttons, controls and mimics coupled to the computer with standard electronics cards. Special control functions can then be provided by individual programming. However, special to requirement engineering is predictable and can be costed for individual user requirements. Furthermore it has been found in practice that where minor changes are required (e.g. to sequencing logic, interlocks, mimic displays etc), these can be readily accommodated by a programme modification.
- (2) The computer permits the incorporation of comprehensive mimic facilities and warning labels to minimize the likelihood of operator error.

3.2. Dimmer Level Setting and Modification

- (1) In the initial design, the rocker switch has been provided as the means of setting channel levels. This provides means of instantaneously modifying any channel without the need to match to the existing playback level. Rank Strand believes that for theatre use where the geography of luminaire distribution remains to a large degree unchanged, it is essential to have playback mimic combined with the channel selection control. This is achieved with the rocker. However, this remains a flexible area for the incorporation of customer requirements. It is likely that some users may prefer single pushbutton/mimics for channel selection combined with a single level setting control. Alternatively keyboard channel call-up can be provided. This is acceptable in television where circuit numbers have no fixed geographical significance but Rank Strand believes that with the more static setting of a theatre it is preferable to have an integrated mimic/channel selection button.
- (2) Immediately circuit levels are modified, a warning illumination appears in the rocker/channel selection button. However the unmodified states are retained within the computer and the

operation of a simple RETURN button allows selected circuits to automatically return to their unmodified states.

- (3) Circuit states whether currently in use (stage) or on file in memory can be displayed on the channel mimic arrangement. Individual circuit levels can be monitored and adjustments made without the need to match to the existing level.

3.3. Playback Facilities

- (1) Comprehensive playback controls enable memories to be added (highest takes precedence) or for common lighting circuits to be deleted. Also, a crossfade can be stopped at any point and reversed, if necessary, back to the starting conditions. The crossfade may then be repeated using (if required) different fade rate settings etc. These combined facilities provide unsurpassed capability during rehearsal.
- (2) Fade rates for Up and Down going channels can be separately adjusted.
- (3) A CUT facility is provided enabling switched cues to be operated without affecting the levels of common channels currently in use on the playback.
- (4) Two playbacks are provided. These are completely independent in that common channels are processed separately. This means that where a very slow fade is in progress on one playback, common channels can be altered with the second playback but returned to the first playback at a level consistent with unaltered progress of the first fade.
- (5) Transfer facilities between the two playbacks enable cues to be combined or split at any time, even during the middle of a fade.

3.4. Reliability and Maintenance

- (1) The PDP 11 Computer, ferrite store (Ampex) and tape cassette (Cartrifile) are all manufactured to the highest standards. Volume production has enabled the manufacturers to introduce sophisticated quality control procedures including tests under conditions of thermal shock, temperature extremes and vibration.
- (2) All parts of the system including Strand hardware make extensive use of wire wrap and crimped interconnections. Experience in computing, military and aerospace industries shows that these joints are at least 10 times more reliable than the equivalent solder connections.
- (3) When using the magnetic tape store, the computer may be used to check every bit of data recorded onto or played back from the tape. The user is thus protected from malfunction should oxide dust or tape deformation cause cues to be incorrectly read or recorded.

- (4) In the unlikely event of system malfunction, a simple check on computer performance can be made by the operation of a simple pushbutton. Also, in normal circumstances, the malfunction of the computer will cause an audible warning to sound immediately. In addition a simple pushbutton is provided which will check that the programme is still held correctly within the computer. Should a failure be suspected outside the computer, a complete self-diagnosis can be carried out where equipments are fitted with magnetic tape units. A diagnostic programme recorded on a tape cassette is simply loaded into the computer whereupon the computer will carry out a thorough step by step check on every pushbutton, mimic and electronic circuit in the system. Additionally a comprehensive test is carried out on the ferrite core memory to check that every bit of every cue is functional. Step by step control of the tests is conducted from the control desk and if a fault is found, the indication in one of the control desk display windows will indicate the test number and area of location of the fault.
- (5) The modular design possible with the computer controlled system has enabled Rank Strand to minimize the number of printed circuit cards. Likewise, latest versions of the PDP11 computer have completely modular plug-in construction, the complete computer and internal ferrite store being accommodated on five printed circuit cards. The main ferrite memory is constructed from self-contained plug-in units. These may be extended in order to increase core storage or simply replaced in the event of failure.
- (6) An operators manual is provided with each equipment together with simple maintenance and fault finding diagnosis information. Arrangements can be provided to train customer's staff in both operation and maintenance.

3.5. Modification of Dimmer Curve

By using a look-up table within the computer, the dimmer curve can effectively be modified to meet any theoretical requirement. For theatre systems, this technique has been used to produce a revolutionary curve which is considered to be ideally suited to giving the most aesthetically pleasing crossfade characteristic. The principle can however be applied generally.