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Tempus M24

MEMORY LIGHTING CONTROL

OPERATOR'S HANDBOOK



Strand Lighting

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CHAPTER 1

INTRODUCTION

1.1 GENERAL

Tempus M24 is a new, compact, memory lighting control system which is intended for use in installations which would previously have been served by a manual system. It offers many of the sophisticated facilities previously available only on much more expensive systems and has an added advantage in that it often may be incorporated in an existing manual system with the minimum of rewiring.

The basic system consists of two units: a Control Console and a 24-way Multiplex Interface unit which produces the dimmer control signals. Additional Multiplex Interface units may be added for systems with more than 24 lighting channels.

In addition to producing dimmer control outputs, the Multiplex Interface unit may accept inputs from another lighting control system, e.g. a Tempus or AMC desk. The contribution from the second system combines with the M24 output on a 'Highest-takes-precedence' basis and may be controlled by a MANUAL master on the M24 console and recorded in the M24 memories.

The number of memories available depends on the number of lighting channels, but this only affects full size, 60-channel systems which have 185 memories. Systems with fewer channels, i.e. 48, 36, 24 and 12, all have 199 memories, the maximum which can be selected on the keypad.

M24 uses battery-maintained electronic memories which will retain their data for at least a week if the system is not used. For longer term storage, the memories may be copied onto tape; most domestic cassette recorders are suitable.

1.2 CONTROLS

The Tempus M24 control console provides all the facilities necessary for effective theatre lighting control. The panel consists of three sections: output controller, fade controller and channel and memory controller.

1.2.1 Output Controller

This section of the panel has two master faders, one (MEMORY) controlling the output of the M24 system and the other (MANUAL) the output of the manual fader wing or other associated system (if provided). The resulting outputs combine on a 'Highest-takes-precedence' basis. There is also a blackout switch, a Record Lock keyswitch and Record Total and Record Blind push-buttons.

1.2.2 Fade Controller

These controls provide the means by which memories are normally recalled. Memories are selected on the keypad (in memory mode - see next section) and recalled using the FADE button. The recall action takes place in the time set on the two Fade Duration controls (one for channels fading up and the other for those fading down), the time being variable between instant and 10 minutes. An infinity position on each control allows either part of the fade to be stopped at any point.

Other facilities include the use of recorded fade times, manual fades and automatic memory sequence.

1.2.3 Channel and Memory Controller

M24 has a single keypad and display window for both Channel and Memory selection. This operates in any one of three modes, selected by MEMORY, 'CUE' and CHANNEL buttons. These respectively allow the keypad to select memories for recall using the fade system or to record lighting scenes; to select memories for control using the fader wheel; or to select and control individual channels. The

adjacent wheel control allows channels and, in 'CUE' mode, memories to be faded up and down as required.

The keypad includes an '@' (At) button for setting levels and '+', '-' and THRU buttons for multiple channel selection.

1.3 OPTIONAL EXTRAS

As mentioned at the beginning of this chapter, the basic 24-channel Tempus M24 system consists of only two units, a Control Console and a Multiplex Interface unit. The system may be expanded by adding Multiplex Interface units to increase the number of channels, and also by adding certain optional facilities described below.

Many of these extras involve the fitting of additional printed circuit boards and connector panels to the Control Console. If the extras required are specified at the time of ordering, this is normally carried out prior to delivery. Retrospective fitting should only be performed by a suitably qualified person, e.g. an accredited Rank Strand service agent.

1.3.1 Video Mimic

A normal addition to the basic system is the Video Interface, which augments the desk indicators, etc. by producing a comprehensive 'system status' display on a standard monochrome television (not supplied by Rank Strand) or a video monitor. The information shown includes the current output levels of all channels, channels currently under control and fade progress. For a full description see section 4.8.

1.3.2 Patch/Effects System

M24Fx, a simple, independently powered control system with an electronic on/off memory, is available to act as a back-up to M24. The unit includes a special effects system and it can also provide a convenient means of controlling practical circuits and working lights.

CHAPTER 2

EQUIPMENT

2.1 GENERAL

The basic 24-channel M24 system consists of two units: the Control Console and a single Multiplex Interface module. Systems with more than 24 channels will have additional Multiplex Interface modules, each providing the dimmer outputs for a further 24 channels.

Optional additional equipment includes a cassette tape recorder for long-term memory storage, a manual fader wing and a video mimic.

2.2 CONTROL CONSOLE

The M24 Control Console is a desk-top unit with a removable lid, which houses the control panel and most of the system electronics. It requires a mains supply of 220/240V or 110/120V a.c. single phase (L. N. and E.), which connects via an I.E.C. 3-pin plug at the rear of the desk. A suitable mains cable is provided, but this must be fitted with a mains plug by the user. Other connections are as follows:

- i) Data link to the Multiplex Interface unit(s). Two core 0.5mm² cable with overall screen, fitted with 3-pin type XLR connectors wired as follows:

Pin 1	Screen	0V
Pin 2	Red	Multiplexed Input (to desk)
Pin 3	Blue	Multiplexed Output (from desk)

The Control Desk is supplied with a suitable cable 5 metres in length; longer (25 metre) cables are available if required.

ii) Connection to a tape recorder (if required). A 5-pin 180° DIN socket is provided adjacent to the Multiplexed Output connector at the rear of the desk. The wiring of this connector is as follows:

Pins 1 & 4	Red	Output to Tape Recorder
Pins 3 & 5	Blue	Input from Tape Recorder
Pin 2	Screen	ØV

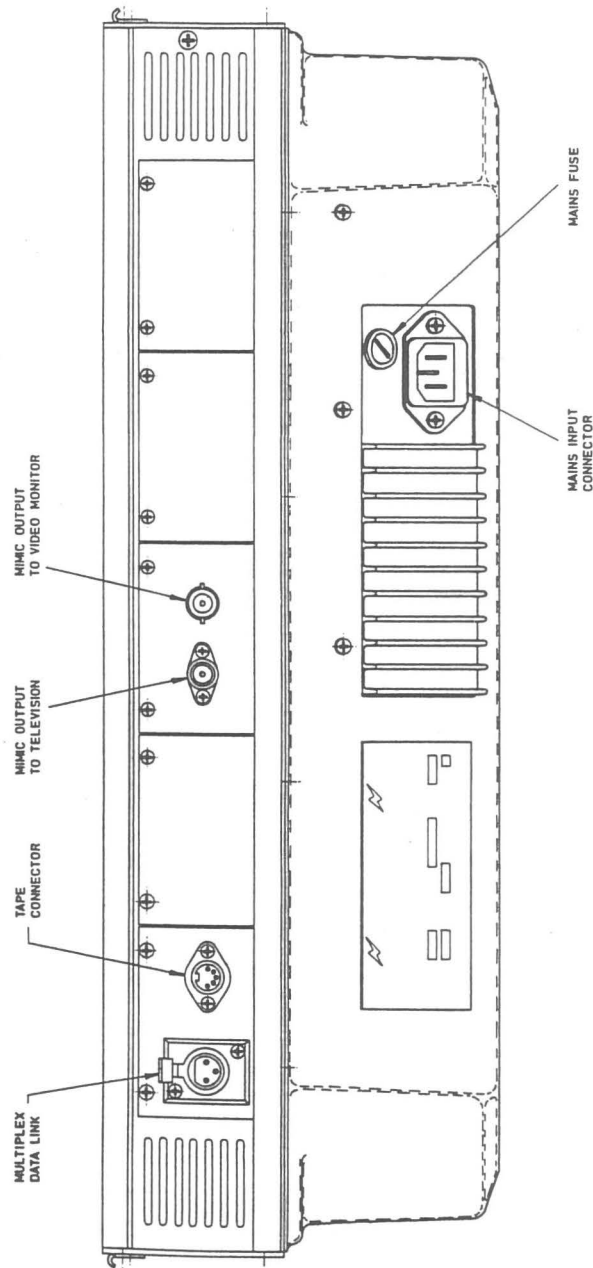
A suitable cable is provided, for connection to a tape recorder which also has a 5-pin 180° DIN socket.

iii) Output to Video Mimic. Systems provided with this optional facility have an additional connector panel at the rear of the desk. Two outputs are provided: a UHF signal to drive a standard monochrome television set (VHF is available to special order) and a composite video output for use if a video monitor is available. A co-axial cable fitted with suitable connectors is provided for use with a television set, while the video output appears on a 75 Ohm BNC connector. In the latter case, suitable coaxial cable should be available from the supplier of the video monitor.

2.3 MULTIPLEX INTERFACE UNIT

This is a small unit which may be placed in any convenient position. Two types are available: one intended for use with Tempus dimmer packs and control desks, and the other for use with other types of equipment (e.g. Permuc dimmers and AMC control desks). Each unit provides control outputs for 24 dimmers. In installations with more than 24 lighting channels, the Multiplex Interface Units link together, so that only a single connection is necessary from the Control Console.

In general, if a manual fader wing is provided, the Multiplex Interface units may be positioned close to the dimmers or the control position as convenient, while if there is no manual wing a location close to the dimmers should be chosen to reduce the wiring between the Interface units and the dimmers.



REAR VIEW OF CONSOLE
Fig. 2.2.1

2.3.1 Connections

Each Multiplex Interface unit requires a mains input of 220/240V or 110/120V a.c. single phase (L, N, and E.), which connects via an I.E.C. 3-pin plug. A suitable mains lead is provided, but this must be fitted with a mains plug by the user. An adjacent 'Power On' indicator illuminates when the supply is connected.

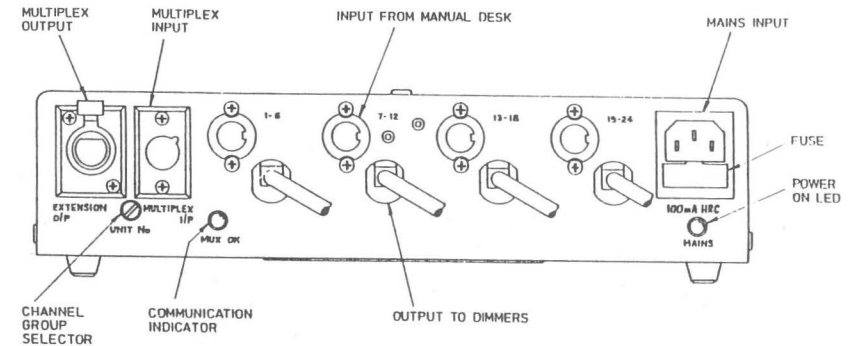
The data link from the Control Console connects to a three-pin XLR plug (see Fig. 2.3.1.1), wired as described in section 2.2(i). If more than one Interface unit is used, they should be linked together by connecting the Multiplex Output (EXTENSION O/P) socket on one unit to the MULTIPLEX I/P plug on the next as shown in the diagram. A cable for this purpose, 0.5 metres long, is provided with each Multiplex Interface unit. With the system operating correctly, the 'Communication' indicator (MUX OK) illuminates.

The units for use with Tempus dimmers and control desks are fitted with four control cables, one for each group of six channels (i.e. 1-6, 7-12, etc.). Each cable is fitted with the necessary 8-pin plug, wired as shown in Fig. 2.3.1.2, for connection to a Tempus dimmer pack. The control cable for the corresponding channels on the Tempus desk plugs into an 8-pin socket above and to the left of each cable outlet.

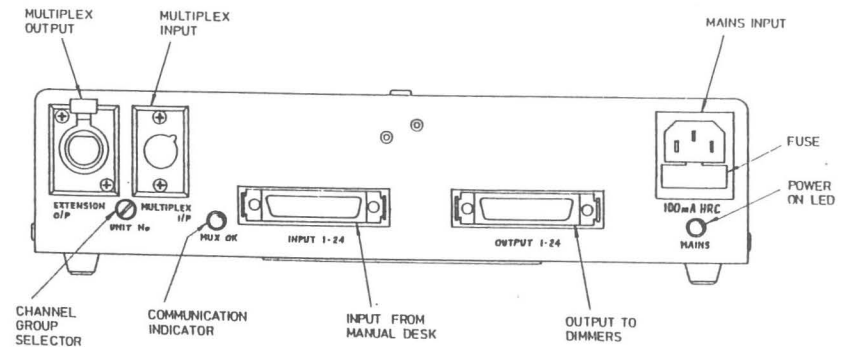
The other type of unit has two 25-way D-type connectors labelled OUTPUT 1-24 and INPUT 1-24 for connection to the dimmers and the manual desk respectively. Suitable connectors and prewired cables are available from Rank Strand; wiring details are given in Table 2.3.1.1.

Other combinations of equipment are possible, but may necessitate the construction of special cables and/or distribution boxes. Connectors of various types are available for this purpose.

Note: The dimmers from the current Rank Strand range require a control voltage of -10V (full) to 0V (zero). For systems using other types of dimmers, Multiplex Interface units



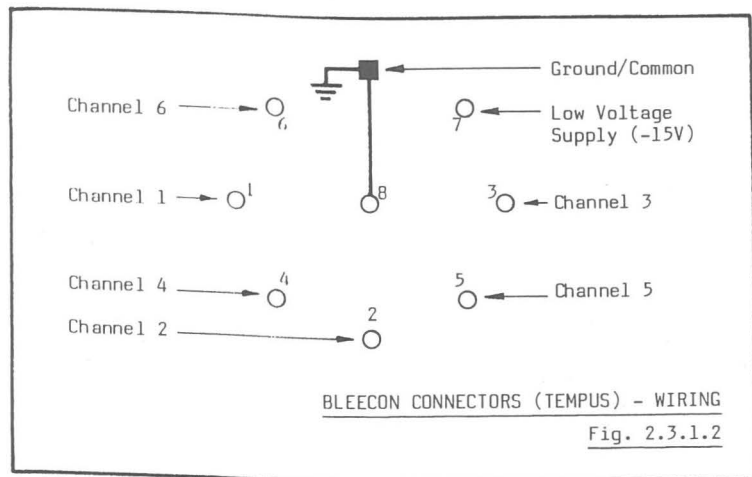
Tempus/Bleecon Type



D-Connector Type

MULTIPLEX INTERFACE UNITS

Fig. 2.3.1.1



giving different control voltage outputs, positive or negative, are available.

2.4 ENVIRONMENT

The Tempus M24 system will operate in ambient temperatures within the range 0°C to 35°C . All electronic components gradually suffer an ageing process which is accelerated as the temperature rises, i.e. the higher the ambient temperature, the more likely faults become. Similarly, wide fluctuations in temperature will adversely affect the reliability of the system. To maximise system reliability and minimise operator fatigue and discomfort, an operating temperature between 18°C and 25°C is recommended. Relative humidity should be between 10% and 90% (non-condensing).

The cleanliness of the surroundings has a direct effect on the life expectancy of the system. Excessive dust and fluff obstruct ventilation and accumulation of cigarette ash can cause partial short circuits.

Both the control panel buttons and the slider faders may be damaged by an accumulation of grime, smoke or other contaminants. In

Table 2.3.1.1

Dimmer	Pin	Colour
1	1	Red
2	2	Blue
3	3	Green
4	4	Yellow
5	5	White
6	6	Black
7	7	Brown
8	8	Violet
9	9	Orange
10	10	Pink
11	11	Turquoise
12	12	Grey
13	13	Red/Blue
14	14	Green/Red
15	15	Yellow/Red
16	16	White/Red
17	17	Red/Black
18	18	Red/Brown
19	19	Yellow/Blue
20	20	White/Blue
21	21	Blue/Black
22	22	Orange/Blue
23	23	Yellow/Green
24	24	White/Green
Common	25	Orange/Green

particular, liquids must not be spilt on the equipment, as the effect on the electronics immediately below could be destructive. In the event of any liquids being spilt onto the electronics, power must be turned off immediately; then notify the Rank Strand service department.

The paint finish of the equipment will be damaged by direct heat such as cigarettes or soldering irons. To clean, a judicious application of anti-static aerosol cleaner is suitable. Under no circumstances should spray polishes be used near the panels as they may destroy the slider faders.

If a carpet is fitted in the control room, suitable precautions should be taken to ensure that this does not lead to a build-up of

Static Electricity. All wool carpets or synthetic carpets with woven-in conductive threads overcome this problem. Alternatively, anti-static treatments for nylon or polyester carpets are available.

2.5 INSTALLATION

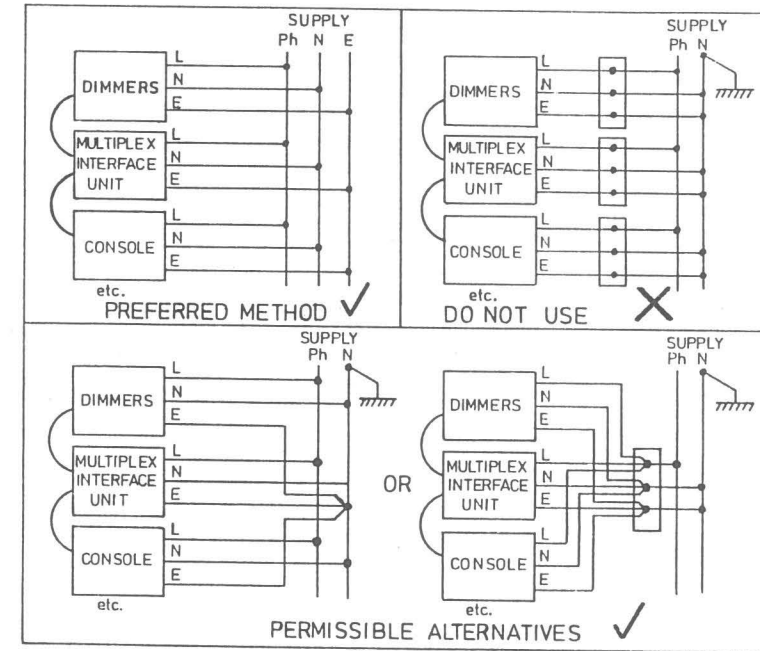
WARNING: Rank Strand Tempus M24 lighting control equipment must be properly earthed if it is to function correctly. IT IS ESSENTIAL THAT EARTH BE AT THE SAME POTENTIAL AT ALL POINTS IN THE SYSTEM. If this is not the case, circulating currents may be generated in the signal earth connections, leading to fluctuating light levels and, in extreme cases, severe damage to the equipment.

In cases where the earth is provided via the supply neutral, all units (i.e. Console, Manual Fader Wing, Multiplex Interface units, Effects unit and dimmers) should ideally be powered from the same source via adequately rated three core (L. N. E.) cable. If this is not possible, a single earth point must be chosen and all the units earthed ONLY AT THIS POINT (see diagram). The conductors used must be able to carry any potential fault current.

If damage is caused as a result of failure to observe the above recommendations, any warranty will be invalidated. If in doubt, your local Rank Strand agent will be pleased to advise.

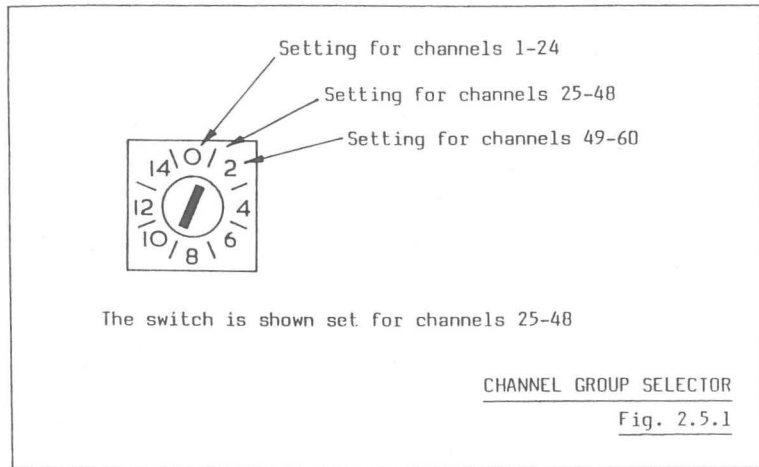
- i) Install the dimmers and connect the dimmer loads in accordance with the instructions supplied with the racks.
- ii) Decide which Multiplex Interface unit will serve which group of channels and set the Channel Group Selector on each to the required group of 24. The selector is normally set before despatch, but may easily be adjusted by the user if necessary.

Access to the selector switch requires the use of a small electrical screwdriver and is via a hole (labelled UNIT NO. -



see Fig. 2.3.1.1) in the connector panel. The switch starts at 0 for channels 1-24 and should be turned clockwise one position for each additional 24 channels (see Fig. 2.5.1). As a reminder, the switch setting may be noted on the adjacent panel using a 'Chinagraph' pencil or an adhesive label.

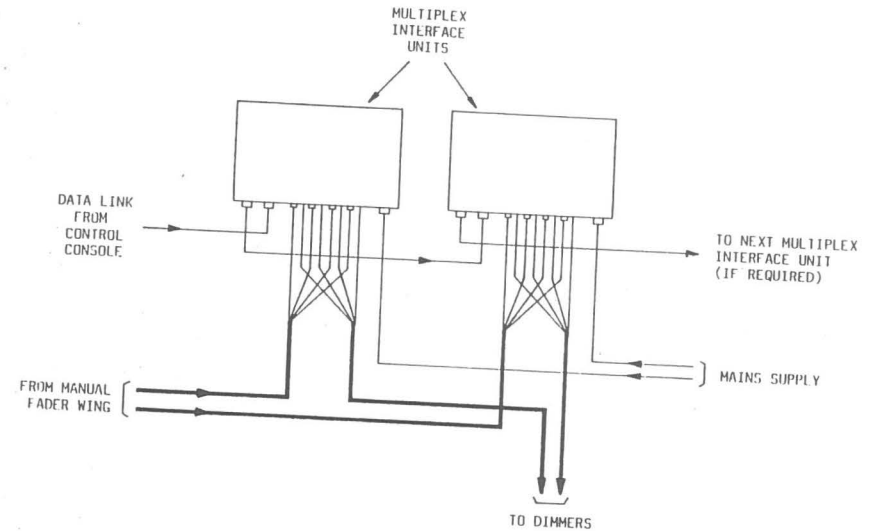
- iii) Connect the outputs of the Multiplex Interface units to the appropriate dimmer control inputs. On installations using Tempus dimmers the output cables simply plug into the dimmer packs (extension cables are available for use where the dimmers are further than 2 metres away from the desk). Where other types of dimmer are used, the racks must be 'hard-wired'; the colour codes used in the cable supplied for the purpose by Rank Strand are given in Table 2.3.1.1.
- iv) Connect the appropriate outputs from the Manual Fader Wing (if provided) to the Multiplex Interface units. As in the case of the dimmers, the output cables from Tempus desks simply plug



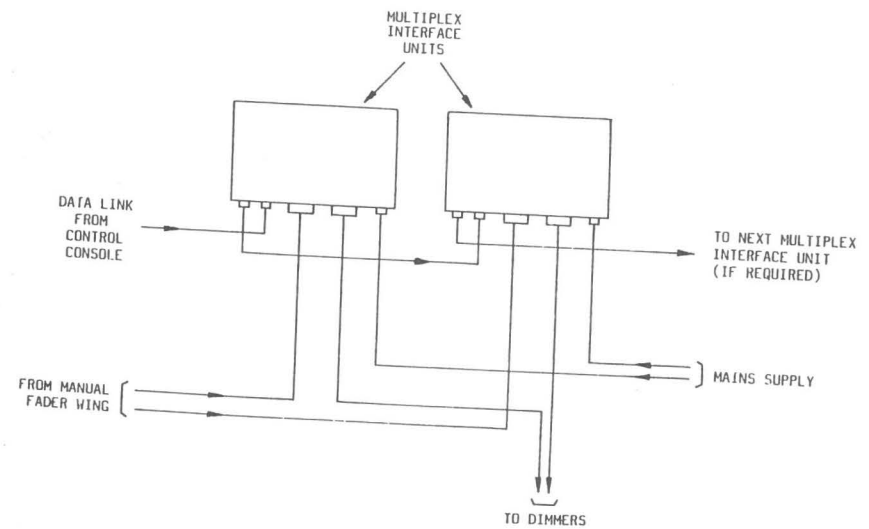
into the appropriate sockets on the Multiplex Interface units, while other types of desk must be hard-wired; refer to Table 2.3.1.1 for wiring details.

- v) Connect the data link from the Control Console to one of the Multiplex Interface units (whichever is most convenient) and link all the units together as shown in Fig. 2.5.2. Remove the lid from the Control Console.
- vi) Connect the video mimic (if provided) to the Control Console.
- vii) Connect a mains supply to each part of the system and switch on (ideally, this should be controlled from a central on/off switch). If a television is used as a video mimic, this should be tuned to channel 39 (UHF) and the sound turned down. Adjust the tuning, brightness and contrast to obtain a clear display.

On power-up, the system carries out a self-test procedure and, if this is satisfactory, it then sets the desk into the initial state described in section 3.1. If a fault is found this will be indicated on the desk displays and the video mimic (if provided); refer to chapter 5.



Tempus/Bleecon Type



D-Connector Type

MULTIPLEX INTERFACE UNIT CONNECTIONS

Fig. 2.5.2

2.6 SPECIFICATION

Power input - 220V-240V or 110V-120V, 47-63Hz.
Each unit requires a separate power input.

Desk output - Multiplexed analogue link via 2-core screened cable.

Dimmer drive outputs (from Multiplexed Interface unit).

- 0V (Off) to -10V (Full) via 10k ohm and silicon diode.
- Optionally 0V (Off) to +10V (Full) via 1k ohm and silicon diode.
- Other control voltages are possible, within the limits +/-15V.

Connection is via 4 x 2m long control cables, each terminated in an 8-pin 'Bleecon' plug to mate with Tempus dimmer packs, or via a 25-way 'D' type connector.

Input from Manual Fader Desk or Wing.

- As for dimmer drive outputs.

Control Channels.

- In increments of 12, from 24 to 60 maximum. One Multiplex Interface unit is required for each 24 channels.

Operating Environment.

- Temperature, 0°C to 35°C. Maximum relative humidity, 10% to 90% (non-condensing). 'Office' level cleanliness.

Processors - M6803: 8-bit data, 16-bit address.
M68B09: 8-bit data, 16-bit address.

Cycle Time - Executive: typically 48ms.
Contact scan: typically 12ms.

Fade Processing Accuracy - 16-bit.

Recording Accuracy - 8-bit (256 step).

Output Accuracy - 8-bit (256 step).

Fast Access Memory.

- Low-power semiconductor, battery-maintained for a minimum of one week.
- Number of memories available depends on number of channels fitted. 60 channel systems have 185 memories, while smaller systems have 199.

Video Mimic Output.

- Modulated UHF (optionally VHF) 625/525 line, 50/60Hz field with connection via co-axial connector, and 1V positive composite video with connection via 75 ohm BNC socket.

Tape Memory Storage

- Uses standard domestic audio recorder. 100mV rms input/output on standard 5-pin DIN socket; mono or stereo.

Dimensions

- Control Console

Width	: 530mm
Depth	: 360mm
Height	: 175mm
Clearance required at rear	: 90mm
Height including lid	: 235mm
OR	: 190mm (depends on position of lid).
- Multiplex Interface Unit

Width	: 280mm
Depth	: 75mm
Height	: 200mm
Clearance required at front	: 110mm

CHAPTER 3

BRIEF OPERATIONAL DESCRIPTION

3.1 HOW TO SWITCH THE SYSTEM ON

Before any lighting may be controlled, the mains supply to the dimmers, the Multiplex Interface modules and the M24 console must be turned on. Also turn on the power to the video mimic and manual fader wing, if these are provided (in many cases the power to the latter will be provided from the dimmer racks). If a UHF television is used as a video mimic, this should be tuned to channel 39. The equipment is now ready for use.

The initial state of the system on power-up is as follows:

- i) CHANNEL indicator illuminated, indicating that the keypad is in channels mode. All other indicators and displays are cleared.

Note: Before the CHANNEL indicator lights, the desk windows will momentarily display dashes as part of the power-up self-test procedure (see chapter 5). This is normal and can be disregarded.

- ii) Video mimic (if provided) showing OUTPUT display. The top line will initially include the messages 'M24 VERSION ...' and 'SELF TEST OK', but these will disappear after about eight seconds.
- iii) All channels are restored to the states which were current when the system was switched off. However, no channels or memories will be selected, no fades will be running and no special facilities (MEM TIME, SEQUENCE, MANUAL, etc.) will be selected.

Before starting to control lights, check that the MEMORY master fader is at full and the MANUAL master at zero. Check also that the blackout switch is in the up (●) position.

3.2 HOW TO GET LIGHTS UP

- i) Check that the CHANNEL indicator is lit. If not, press the CHANNEL button.
- ii) Enter the number of the first channel to be controlled on the keypad. The number entered will appear in the display window above the keypad.
- iii) Adjust the channel to the required level using the channel control wheel.
- iv) Select the next channel and adjust its level as required.
- v) Continue as above until the lighting scene is complete.

Note that there is no need to press the Clear (CL) key between entries as the system assumes that once a channel has been controlled, the next key entry will be a new channel number.

3.3 HOW TO MODIFY THE LEVEL OF A CHANNEL ALREADY ON

This procedure is identical to that outlined above. The channel is simply selected on the keypad and the wheel is used to adjust it upwards or downwards to the new level.

3.4 HOW TO RECORD A SCENE

Once a lighting state has been set-up to the satisfaction of the operator it may be recorded in the memory. It is important, at this stage, to know if previously recorded memories are still required - whether they may be overwritten or should be preserved. If in doubt, the memory contents may be saved on cassette (see section 4.7).

- i) Enable recording by inserting a key (TOK4) in the REC LOCK keyswitch and turning it 90° clockwise to the horizontal position. The key cannot now be removed without turning it back to the vertical position.
- ii) Press the MEMORY button to set the keypad into Memory mode, thus allowing memory numbers to be selected. The indicator above the button will light.
- iii) Enter the required memory number on the keypad. The number will appear in the display window above the keypad.
- iv) Press the REC TOTAL button to record the lighting scene. The indicator above the button illuminates momentarily to indicate a successful recording. Note that if a manual fader wing is provided, any lighting which it contributes to the scene will also be recorded. To prevent this, set the MANUAL master fader to zero.

Note: Unless MEM TIME is selected, the fade times set on the Fade Duration controls are automatically recorded with each memory. If the memory is likely to be recalled in MEM TIME mode, set the required fade time (instant to 10 minutes) before pressing the REC TOTAL button.

3.5 HOW TO RECORD LIGHTING SET-UP ON THE MANUAL FADER WING

If the MEMORY master fader is set to zero and the MANUAL master to full, lighting may be set-up on the manual fader wing as for a normal multi-preset system (see the appropriate operator's handbook for details). This lighting may then be recorded in the M24 memory using the REC TOTAL button as described in the previous section.

3.6 HOW TO PLAY-BACK MEMORIES

- i) Ensure that the MEMORY master fader is at maximum.
- ii) Set the keypad into MEMORY mode.

- iii) Select the memory number corresponding to the required lighting state.
- iv) Set the Fade Duration controls to the required fade time (instant to 10 minutes). Alternatively, select MEM TIME (the indicator above the button will light).
- v) On cue, press the FADE button to start the fade.

A crossfade will be carried out automatically in the time set on the Fade Duration controls or, if MEM TIME is selected, that recalled with the memory. The fade rate may be adjusted at any time, although if MEM TIME is in use this must first be deselected. In the latter case, to avoid a sudden change of speed, the Fade Duration controls should first be matched to the active fade rate by means of the indicators above the faders (these light when the rates are matched).

Once a fade has been started, the next memory number may be selected, ready for recall. Alternatively, to eliminate unnecessary button operations, a sequence mode may be selected. When the SEQ button is pressed, the associated lights and the next memory in numeric sequence will then be automatically selected each time a fade is started.

Two types of fade are possible: a Crossfade, in which the state recalled from the memory totally replaces the old lighting state, and a Move-fade, in which the channels which are On in the memory change to new levels, but those which are Off in the memory remain unaffected. A Move-fade is selected by prefixing the memory number with '+' on selection. If there is no prefix, a Crossfade results. (A '-' prefix gives a special type of Move-fade - a Dim-fade - where the channels On in the memory fade to zero.)

A blackout state may be obtained by performing a fade action with no memory selected.

3.7 'BLIND' PLOTTING AND MODIFICATION

If a manual fader wing is provided, this may be used to prepare memories without affecting the lighting currently controlled by M24.

- i) Set the MANUAL master fader on the M24 console to zero.
- ii) Enable recording as described in section 3.4.
- iii) Set-up the scene to be recorded on the manual fader wing.
- iv) Set the M24 keypad into memory mode and select the required memory number.
- v) Press REC BLIND to record the scene. The indicator above the button illuminates momentarily to indicate a successful recording.

Note: The roles of the manual fader wing and M24 may of course be reversed, so that lighting may be set-up and recorded 'blind' using M24, while leaving lighting under manual control undisturbed.

Should it be necessary to modify existing memories without the lighting being seen, adjustments may be made directly into the memories by using the following procedure:

- i) Enable recording as described in section 3.4.
- ii) Set the keypad into memory mode and select the required memory number.
- iii) Set the keypad into channel mode and select the channel requiring modification.
- iv) Hold down the CHANNEL and MEMORY buttons simultaneously and use the fader wheel to adjust the channel level (the '@' button is inoperative in this mode).

3.8 COPYING MEMORIES TO OR FROM TAPE

This facility is described in section 4.7.

CHAPTER 4DETAILED OPERATIONAL DESCRIPTION4.1 CONTROL HIERARCHY

The control of any channel in the Tempus M24 memory system is based on a 'Latest-takes-precedence' philosophy, which means that the level of each channel is always determined by the last action which involved that channel. For example, if a channel which is fading up as a result of a fade action is becoming too bright, it may easily be adjusted while the fade is running; the channel is simply selected on the keypad (in CHANNEL mode) and reduced in level by means of the fader wheel. When the fade is complete, the channel will be at the level set using the wheel, the later instruction having taken precedence over the earlier.

The above, however, is only true of the basic memory system. The outputs of the Manual Fader Wing and M24Fx System (when these are provided) combine with the memory system output on a 'Highest-takes-precedence' basis, subject to the settings of the MEMORY and MANUAL master faders. This means that if the same channel is contributed to a lighting scene by both the memory system and the Manual Fader Wing (or the Back-up system), the level which appears on stage will be that produced by the highest combination of channel and master fader level. For example, if channel 15 is at Full on M24 and at 50% on the Manual Fader Wing and both master faders are fully raised, the output level of that channel will be Full. If the MEMORY master fader is now lowered, the channel will dim until 50% is reached, when the level produced by the Manual Fader Wing becomes the higher. To reduce the level further, both faders must be lowered.

4.2 CHANNEL CONTROL

Channel control mode is selected by pressing the CHANNEL button above the keypad. The associated indicator lights to indicate the mode of operation.

4.2.1 Channel Selection

Channel numbers are selected on the keypad as on a calculator and appear in the CHANNEL/MEMORY display window. If the number entered is greater than the number of channels fitted, the display will blank.

4.2.2 Setting Channel Levels

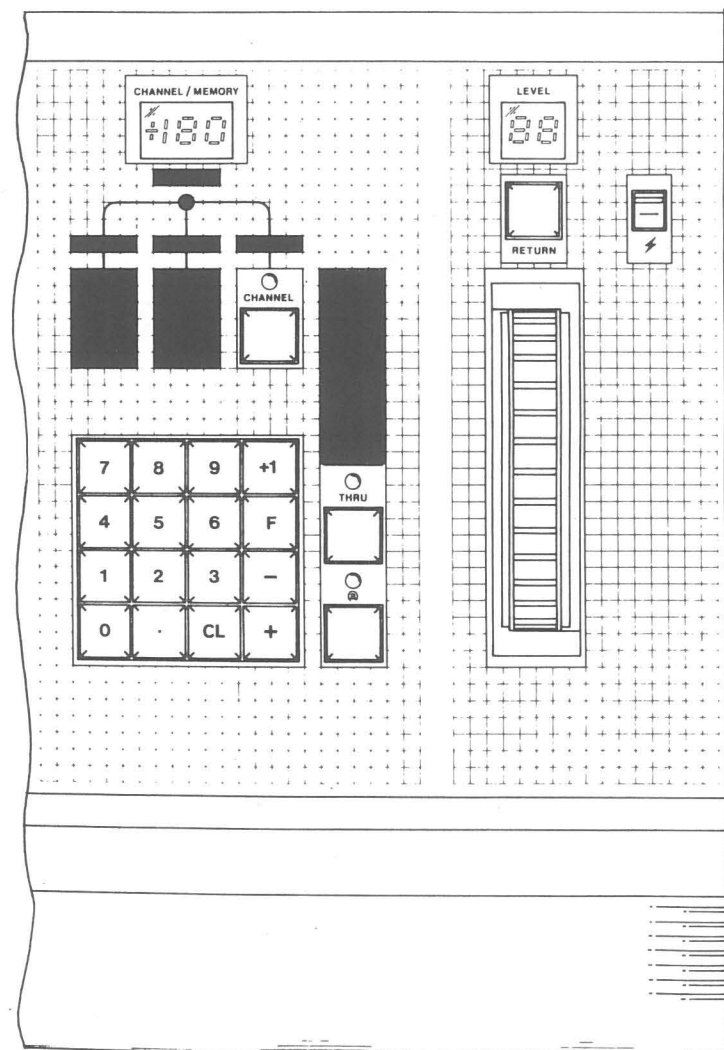
Following selection of a channel number, its level may be set by either of the following methods:

- i) By operation of the '@' key, followed by a single digit, or by two digits separated by a decimal point ('.'). These digits represent levels on a scale of ten and may be considered as a percentage. Thus 5 will set the selected channel to 50% and 5.5 to 55%. The key marked F selects maximum level (100%). The resulting channel level is shown as a percentage (maximum level is shown as 'F') in the LEVEL display window above the fader wheel.

When the '@' key is pressed, the adjacent indicator lights to warn that the next entry will be interpreted as a level. Once the first level digit has been entered, the indicator is extinguished, but it will light again if the '.' key is operated, to indicate that the least significant digit of the level may be entered.

- ii) By use of the fader wheel. Movement of this away from the operator increases the level of the channel and vice versa. One sweep of the exposed section of the wheel corresponds to slightly more than a fade from zero to full.

When a channel level has been set (by either of the above methods) the keypad becomes immediately available for a new selection. There is no need to operate the Clear (CL) key before selecting the next channel.



4.2.2.1 On at Zero

When a lighting state is memorised, channels which have been set to level 0 will be recorded as Off and these channels will then not take part in Move-fades involving the memory concerned. There are occasions, however, when it is required to fade some channels to zero and switch them Off while leaving others unaffected. This may be achieved by setting the channels which must fade out 'On at zero' in the memory.

When setting-up lighting, the selected channel(s) may be set into the 'On at zero' state by typing '@', '.' (decimal point); the channel(s) concerned will be shown at level '00' on the Video mimic. Note that when setting channels in this way, the CL (Clear) button on the keypad must be pressed before entering the next channel number, as the latter would otherwise be interpreted as a level.

4.2.3 Modifying Channel Levels

The level of any channel which is already contributing to the lighting may be easily adjusted by selecting the channel required and then using the '@' key or the fader wheel.

If required, the '@' key may be used in conjunction with the '+' and '-' keys to adjust the level by a predetermined amount. For example, to raise channel 8 by 10% press 8, '@', '+', 1. Use of the decimal point as previously described allows modification to 1% accuracy. The LEVEL display always shows the actual level (in the memory system) of the channel whose number is in the CHANNEL/MEMORY window. The effect of the MEMORY master fader and any contribution from the Manual Fader Wing are ignored.

4.2.4 Selection and Control of Groups of Channels

The ability to control the level of several channels simultaneously (i.e. as a group) is highly desirable and speeds up rehearsals considerably. The channels constituting a group may be selected individually by the following procedure:

- i) Enter first channel, e.g. 2.
- ii) Enter '+'.
- iii) Enter second channel, e.g. 18.
- iv) Enter '+'.
- v) Enter third channel, e.g. 11.
Etc. ...

Channels 2, 11 and 18 would then be controlled together as one channel.

Similarly, a channel may be removed from control as follows:

- i) Enter '-'.
- ii) Enter channel, e.g. 11.

The CHANNEL/MEMORY window shows the number of the last channel selected, preceded by '+' or '-' as appropriate.

If all the channels selected are at the same level when taken under control they remain together when the fader wheel is moved. If, however, the channels are at different levels, an equal amount is added to or subtracted from each channel as they fade up or down. This type of fade is not proportional and is usually referred to as a 'Group' or 'Shaft' fade.

The wheel may be moved up until one-by-one all channels reach full. Moving the wheel in the reverse direction will then restore the original balance, while further downward movement reduces the levels until one-by-one the channels reach zero.

The THRU button may be used to call-up a contiguous group of channel numbers for control, as follows:

- i) Enter the first number, e.g. 7.
- ii) Press THRU.
- iii) Enter the last number, e.g. 13.

THRU may also be used to remove a sequence of channels from control by prefixing the first number with minus (-).

Any numbers may be entered, but the second must be higher than the first. If the second is lower, the keypad will return to the first selection on attempting to take control. The keypad will be cleared if numbers larger than the number of channels controlled by the system are entered.

4.2.5 Incremental Channel Selection

The '+1' key selects the next channel number. When adjusting a sequence of channels, use of this key makes the selection of the individual channel number digits unnecessary.

4.2.6 The Return Button

A feature of the fader wheel, owing to its 'positionless' character, is the ease with which channel levels may be modified. If, however, the initial level is not noted, it can be difficult to correct levels changed in error. To overcome this, an internal return memory is provided, which retains the starting level of each channel whenever a channel or group of channels is modified.

If a channel level is changed by mistake and a rapid return to the original level is necessary, pressing the RETURN button causes all the channels under control to be instantly returned to the levels which were current when they were selected.

4.2.7 Flash

The Flash switch (labelled '⚡') is a three-position centre-biased lever switch. When held in the up position, the channels selected on the keypad are turned on at full, while the down position switches them to zero. When the switch is released, the original channel levels are restored.

The most obvious use of the Flash switch is for lightning effects, etc. However, it may also be used to identify the contributions of individual channels to a complete scene. This is done by holding

the switch up or down and stepping through the channels with the '+1' key.

4.2.8 Channel Control with Memory Mode Selected

When the keypad is set into memory selection mode, any channels which are currently selected may still be controlled using the fader wheel. The RETURN button and Flash switch also continue to function normally. However, the keypad must be returned to channel selection mode to clear the selection or select another channel.

Note: Channel control is not possible if 'CUE' mode is selected, except using the Flash switch. See section 4.6.3.

4.3 OUTPUT MASTERS

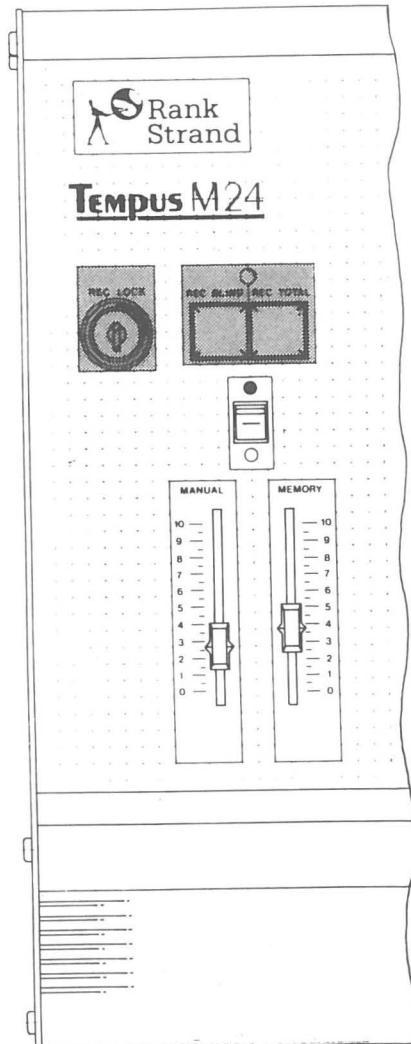
4.3.1 The Blackout Switch

In the down (o) position, this switch turns Off all control signals to the dimmers from both M24 and the manual fader wing or auxiliary M24Fx system, if provided. When returned to the up (●) position, the switch restores the previous lighting. The blackout switch does not stop fades progressing nor alter any system modes.

4.3.2 The Master Faders

The left-hand (MANUAL) and right-hand (MEMORY) faders respectively control the outputs from the manual fader wing and the M24 system. If either is moved down from 10 towards 0, the corresponding lighting is proportionally faded out, while returning the fader to 10 restores the lighting. Any fades which are in progress continue to run while the MEMORY fader is below maximum and all system modes are unaltered.

In the case of common channels, the outputs of the two master faders combine on a 'Highest-takes-precedence' basis.



4.4 SELECTION OF MEMORY NUMBERS

4.4.1 General

When the MEMORY button is operated, the keypad is set into Memory Selection mode. Any integer between 1 and the maximum available memory number (see section 1.1) may be selected on the keypad and a lighting state may be recorded in the associated memory. The number selected will be used when the FADE button or either of the Record buttons is operated.

Once a memory number has been used for recording or playback, any subsequent entry on the keypad is assumed to be a new number. This makes it unnecessary to press CL (Clear) before every entry. The CL key need only be used if an incorrect number has been typed in or when clearing the keypad prior to initiating a fade to blackout.

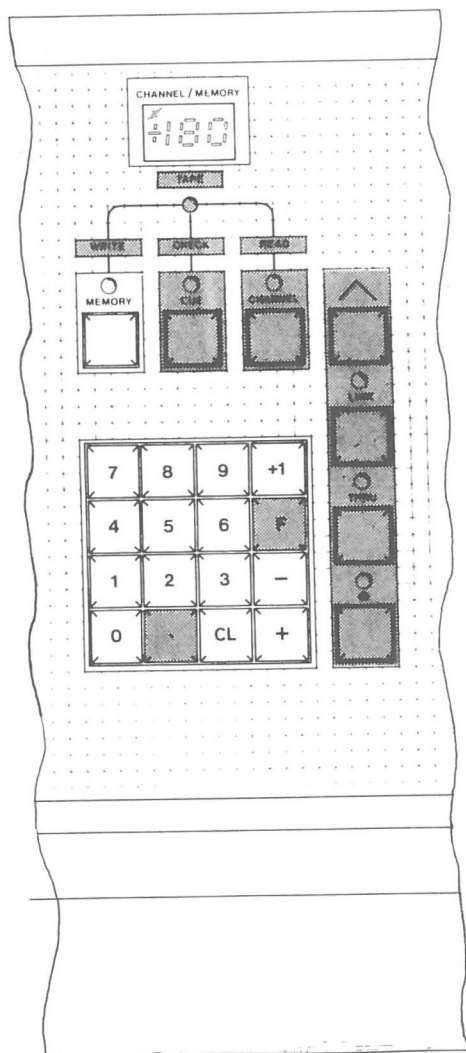
4.4.2 Combining Memories with the Plus (+) and Minus (-) Keys

As in the case of channels, which may be combined into groups, memories may be combined prior to recall by means of the Plus and Minus keys. In addition, these keys may be used to prefix a memory number in order to affect the way in which the memory combines with the current output when the FADE button is operated.

When recording, if the memory number is prefixed with a Plus or Minus sign, the prefix will also be memorised so that the required fade type will be selected automatically when the memory is recalled in Sequence mode (see section 4.6.2.5).

4.4.2.1 Adding Memories

Any memory may be added to the existing channels contributing to the output by prefixing the memory number with '+' on selection. While a normal fade would totally substitute the selected memory for the previous lighting (Crossfade), the recall of a memory with a plus prefix will simply add in the extra channels at their memorised levels (Move-fade). A channel which is On both at the output and in the memory added, will be set, on completion of the fade, to the



memorised level, in accordance with the 'Latest-takes-precedence' philosophy.

4.4.2.2 Subtracting Memories

If a memory number is prefixed with minus, the channels which are On in the memory will fade to zero at the output when recalled.

4.4.2.3 Combining Memories Prior to Recall

Memories may be combined prior to recall using the Plus and Minus buttons in the same way as when combining channels into groups. In the case of common channels, the resulting level will be in accordance with the Latest-takes-precedence philosophy. If a memory number is prefixed with Minus, the channels On in the memory will be removed from the combination.

As in the case of individual memories, whole groups may be prefixed with '+' or '-'. The complete combination will then combine with the current lighting as described in sections 4.4.2.1 and 4.4.2.2 above. If the group has no prefix a crossfade results.

4.4.3 Returning to Channel Selection Mode

When the keypad is set into channel selection mode, any memory (or memories) which is selected remains available for recall or recording.

4.5 RECORDING

4.5.1 General

Once a lighting scene has been set-up to the operator's satisfaction, it may be recorded in the memory. Separate buttons (REC TOTAL and REC BLIND respectively) are provided for recording the system output and any lighting which has been set-up 'blind'. In each case, the previous contents of the memory will be overwritten. To prevent unauthorised or accidental modification of

memories, a REC LOCK keyswitch is fitted; the key may only be removed from this if the memory is locked.

Record actions are disabled under the following circumstances:

- i) If the REC LOCK keyswitch is in the vertical, disabled, position.
- ii) If no memory number is selected.

If the memory number is prefixed with a Plus or Minus sign when recording, the prefix will also be memorised. The required fade type will then be selected automatically when the memory is recalled in Sequence mode (see section 4.6.2.5).

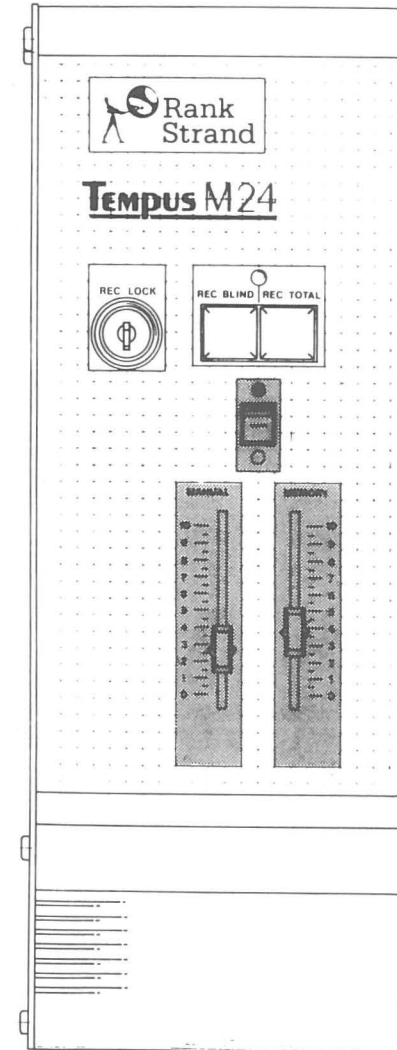
Note that if an existing memory includes a link, this will be cleared when a new or modified lighting state is recorded in that memory. This is obviously desirable when creating new memories, but if a modification has been made to the existing memory it will be necessary to re-enter the link after recording (see section 4.5.7).

4.5.2 Recording System Output (REC TOTAL)

When pressed, this button copies the total lighting state which is currently seen into the selected memory. The state recorded is that shown on the OUTPUT Mimic display (if provided) and includes any contribution from the manual fader wing (if provided) and the effects of the two master faders. The indicator above the record buttons lights momentarily to indicate a successful record action.

Recording may take place at any time, even while fades are in progress, the lighting set-up remaining totally unaffected.

Note: Unless MEM TIME is selected, the settings of the Fade Duration controls will be automatically recorded with each memory, for use when MEM TIME is selected. See section 4.5.6.



4.5.3 Recording Blind (REC BLIND)

It is unfortunately often necessary to set-up lighting while the stage is in use and it is useful under these circumstances to be able to record new scenes without affecting the current output state. To facilitate this, a REC BLIND button is provided, which operates if one or both of the master faders is at zero.

Assuming that all the current lighting is under the control of M24, setting the MANUAL fader to zero will permit the manual fader wing to be used to set-up lighting without it being seen. A memory may then be selected on the M24 keypad and the scene recorded using the REC BLIND button (the indicator above the record buttons lights to indicate a successful record action).

The roles of the manual fader wing and M24 may also be reversed, so that, with the manual faders controlling the current scene, M24 may be set 'blind' and used to set-up new memories. If both master faders are set to zero, REC BLIND will record the combination of the two scenes, while if neither is at zero, no record action takes place and the Record indicator does not light.

If there is no manual fader wing, blind plotting is less easy, but may be achieved using the same method as for blind modification, as described in the next section.

Note: Unless MEM TIME is selected, the settings of the Fade Duration controls will be automatically recorded with each memory, for use when MEM TIME is selected. See section 4.5.6.

4.5.4 Blind Modification of Memories

If the manual fader wing is controlling the current lighting state, existing memories may be modified using the method described in the previous section; i.e. by recalling the memories concerned with the MEMORY master at zero and using the REC BLIND button. If, however, M24 is producing the current lighting, or if there is no fader wing,

this method cannot be used. To overcome this problem, a special 'blind modification' facility is provided on the keypad.

If the CHANNEL and MEMORY buttons are held down simultaneously, the fader wheel operate directly into the selected memory. The required memory and channel must first be selected and recording enabled. The facility is used as follows:

- i) Enable recording by turning the REC LOCK keyswitch clockwise to the horizontal position.
- ii) Select the memory and channel requiring modification.
- iii) Hold down the CHANNEL and MEMORY buttons and use the fader wheel to adjust the channel level (the '@' button is inoperative under these circumstances).
- iv) Repeat for each of the channels and memories requiring modification.

Note: If several channel or memories are to be modified in this way, the '+1' button may be used to step to the next channel or memory required. Which this will be depends on which is selected first at stage 'ii' above. If the memory is selected first, it will be possible to step through the channels within that memory using the '+1' button, while if the channel is selected first, the same channel may be modified in several different memories.

4.5.5 Making a Copy of a Memory

If a copy of an existing memory is required, this may be made by recalling the memory concerned, selecting a new memory number and re-recording.

4.5.6 Recording Time

The settings of the Fade Duration controls are automatically recorded with each memory, for use when MEM TIME is selected. Care must be taken, however, when modifying memories using REC BLIND or REC TOTAL as the currently memorised times will be changed when the record action takes place. This may be prevented, if required, by performing the record actions with MEM TIME selected.

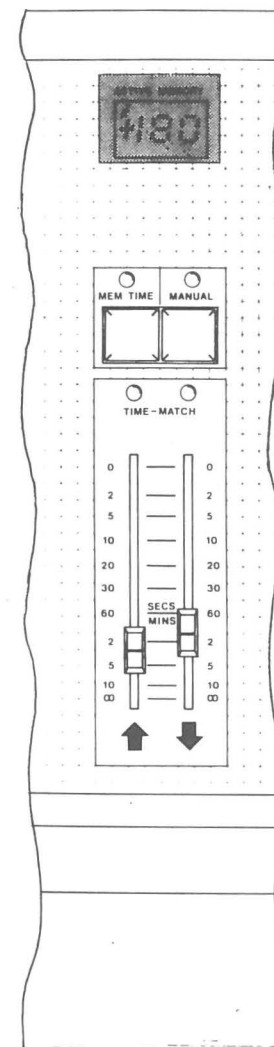
If it is necessary to modify the memorised times this may be done by recalling the memory concerned, setting the Fade Duration controls to the required up and down times and then re-recording. Alternatively, the memory may simply be selected and the time modified by holding down the '^' (Shift) button on the right of the keypad and pressing MEM TIME. This will not affect the current MEM TIME status (see section 4.6.2.2).

Note that, although the Fade Duration controls may be set to '∞', it is not possible to record a time of infinity. If this is attempted, a fade time of 10 minutes results. A time of 'manual' may be recorded, however, so that Manual mode will be selected automatically when the memory is played-back. The latter is achieved by pressing the MANUAL button to select Manual mode before performing the record action. Manual mode may then be cancelled by pressing MANUAL a second time.

The fade times remain unchanged when the 'blind modification' facility is used.

4.5.7 Recording Links

When recalling memories with Sequence (SEQ) selected, the next memory in numeric sequence will normally be automatically selected each time a fade is started, ready for recall. It is, however, possible to change the order in which the memories are recalled by recording a link, i.e. the number of the next memory required in the sequence, with each memory. If no link is recorded with a memory, the normal numeric sequence will be used.



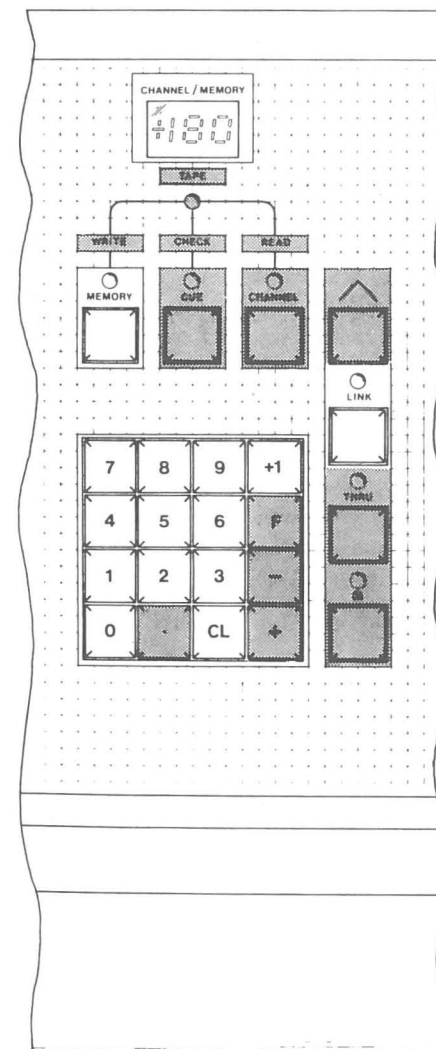
The link facility allows the insertion of additional memories in a numeric sequence and allows memories to be recorded as convenient and put into the required order for playback when this has been finalised.

Links are recorded as follows:

- i) Ensure that recording is enabled.
- ii) Select Memory mode on the keypad.
- iii) Enter the number of the memory with which the link is to be recorded.
- iv) Press the LINK button. The associated indicator will light and any existing link will be shown in the keypad display window.
- v) If required, enter the new link memory number.
- vi) Press LINK a second time. The associated indicator will be extinguished and the number of the selected memory will again appear in the display window.

For example, to cause memory 84 to be inserted between memories 16 and 17, when recalled with SEQ selected, a link to number 84 must be recorded with memory 16 and memory 84 should be linked to number 17 as follows:

- i) Enable recording and select Memory mode.
- ii) Select memory 16.
- iii) Enter LINK, 84, LINK.
- iv) Select memory 84.
- v) Enter LINK, 17, LINK.



A link may be cleared by entering the required memory number followed by LINK, Clear (CL), LINK, or simply by recalling the memory concerned and re-recording. Links are automatically cleared by REC TOTAL and REC BLIND. However, if a memory is modified using the CHANNEL and MEMORY buttons as described in section 4.5.4, the associated link will be unaffected.

If recording is not enabled, or if the keypad is in Channel or Cue mode, links may still be examined using the LINK button. Under these circumstances, however, links may not be changed and the window will return to its previous display when the button is released.

4.6 MEMORY PLAYBACK

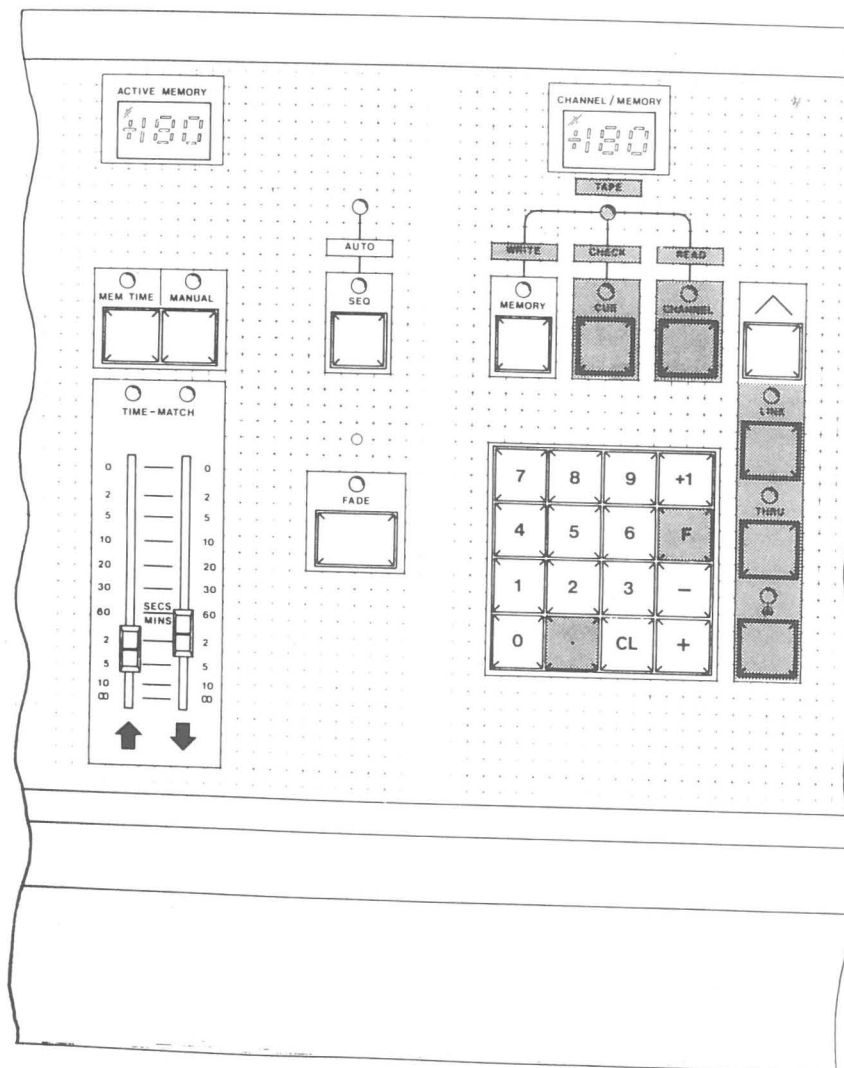
4.6.1 General

There are two ways in which memories can be recalled on M24. The normal method is by using the automatic fade system. The memories are selected on the keypad in Memory mode, the fade time set on the Up (↑) and Down (↓) Fade Duration controls and the fade is started by pressing the FADE button. The fade is then carried-out automatically and completes in the time set.

The other method of recalling memories is intended for use when the fade system is not available (e.g. when a long fade is in progress or AUTO SEQ is selected) and involves using the keypad in Cue mode. This mode is selected by means of the CUE button above the keypad and permits the selection of memories, which are then introduced by moving the fader wheel upwards or by setting a level using the '@' button.

4.6.2 Fade System

When using the automatic fade system, the fade times must first be set on the two Fade Duration controls, or alternatively, the fade times recorded with each memory may be used by selecting MEM TIME (the adjacent indicator lights when this facility is selected). The fastest fade rate is almost instant, for 'snap' cues, while at the



slowest speed a fade will take 10 minutes to complete. The lowest position on each control is an infinity (∞) setting, at which the fade is stopped. Separate times may be set for those channels increasing and those decreasing in intensity, using the ' \uparrow ' (up) and ' \downarrow ' (Down) Fade Duration controls respectively.

When the FADE button is pressed to start a fade, the associated indicator lights and the number of the selected memory is shown in the ACTIVE MEMORY display window. The indicator remains lit until the fade completes, while the memory number remains displayed after completion until another fade is started.

Up to six fades may be running at once and the last of these to be started may be speeded-up, slowed-down, completed instantly or halted by adjusting the settings of the Fade Duration controls (MEM TIME must first be de-selected - see section 4.6.2.2). It is also possible to manually profile a fade, using the Fade Duration controls as master faders - see section 4.6.2.3.

4.6.2.1 Crossfades and Move-fades

When a memory is selected for recall, it will normally have no prefix and, when faded, will completely replace the current output. However, if the memory number is given a prefix ('+' or '-') the memory will be added to (or subtracted from) the current lighting. These two types of fade are known as Crossfades and Move-fades respectively.

When the memory number is given a '+' prefix, the Move-fade changes those channels which are On in the memory from their current levels to their memorised levels. If the prefix is '-', however, the channels which are On in the memory will fade to zero at the output. The latter is a special type of Move-fade, sometimes called a 'Dim-fade'. Move-fades are usually used to add channels or to remove them from an existing scene. M24 may perform several Move-fades, at different speeds, simultaneously.

A Crossfade (i.e. a fade to a memory selected without any prefix) substitutes the scene in the memory for the current lighting,

including channels which are not On in the memory - the latter fade to zero. To do this, all channels are taken under control and thus only one Crossfade may take place at a time, the latest cancelling any previous Crossfades and Move-fades.

Fades do not affect lighting contributed by the manual fader wing or M24Fx system (if provided). All fades are 'dipless'; channels progress linearly from old to new levels and channels which are at the same level in both states do not change during the fade.

4.6.2.2 Using Recorded Times

The current settings of the Fade Duration controls are recorded automatically in the selected memory each time a record action is carried out (see section 4.5.6). The recorded times will only be used, however, if the MEM TIME button has been pressed (the associated indicator lights to indicate that MEM TIME is selected).

When a memory is recalled with MEM TIME selected, the current settings of the Fade Duration controls will be ignored and adjusting them will have no effect. However, the latest fade may be speeded-up or slowed-down if MEM TIME is deselected. It is best, though not essential, to match the Fade Duration controls to the current fade times before deselecting MEM TIME mode, so as to avoid a sudden change of speed. An indicator above each fader lights when the corresponding times are matched.

MEM TIME mode may be reselected immediately if required, ready for the next fade action. The current fade will continue at the speed which was set on the Fade Duration controls at the moment MEM TIME was reselected.

4.6.2.3 Manual Fades

The need to manually profile a fade to match the action is quite common, particularly in theatre or television drama. Manual fades may be carried out on M24 as follows:

- i) Select the next memory on the keypad (operating in Memory mode), prefixing the number with '+' or '-', if required, to determine the type of fade.
- ii) Press the MANUAL button. The associated indicator lights to indicate that Manual mode is selected (if MEM TIME is in use, this must first be deselected).
- iii) Press the FADE button to start the fade. The associated indicator lights to indicate that the fade is under control.
- iv) Move the Fade Duration controls, which are now manual masters, to the bottom to 'collect' the fade (the indicators above the faders light to indicate that the fade has been collected). The fade is then actioned by moving the controls from the bottom to the top at the required rate.

The fade may be reversed at any time by simply moving the faders down again.

Manual mode may be selected or de-selected while a fade is in progress. In the former case, the fade will stop and the faders must then be moved to the top or bottom before being matched to the appropriate point of progress using the indicators above the faders. The faders will not collect the fade unless they have first been moved to one end; choose the end which will allow the faders to continue in the required direction when the fade has been collected.

If Manual mode is de-selected while a fade is in progress, the fade will immediately resume at the speed currently set on the faders. If MEM TIME is selected, this will have to be de-selected before the speed can be adjusted.

If it is known that a particular fade will be carried-out manually at each performance, a 'time' of Manual may be recorded (see section 4.5.6). Manual mode will then be selected automatically if the memory is recalled with MEM TIME selected.

Note: Because only the latest fade may be controlled by the Fade Duration controls, it is impossible to continue a Manual fade once another fade has been started. As a result, only one manual fade may be in progress at a time.

4.6.2.4 Multiple Move-fades

As indicated in section 4.6.2, up to six fades may be in progress at once, each at different speeds. As each fade is started, control of the previous one is lost and it continues at its last speed setting, until it completes or until a Crossfade is started. This means that Manual fades will, in effect, cease to run once the next fade is started. When a Crossfade is started all other fades will stop, leaving only the Crossfade.

If there are six fades already in progress and a seventh is started, the fade which is closest to completion stops.

4.6.2.5 Sequential Playback of Memories

When a fade action has been started, the next memory required may be selected on the keypad. Alternatively, the system may be switched to Sequence mode.

When the SEQ button is pressed, the associated indicator lights. Then, each time a fade is started, the next memory is automatically selected ready for the next fade. The next memory in numeric sequence will normally be selected, but any recorded links will be taken into account.

4.6.2.6 Auto-Sequence Mode

If the '^' (Shift) button to the right of the keypad is held down while the SEQ button is operated ('Shift<SEQ>'), the system is set into 'Auto-sequence' mode. Both the SEQ indicator and the AUTO indicator above it light to indicate that this mode is selected.

If a fade is now started, this will be carried out in the normal way, in the time set on the Fade Duration controls or recalled with

the memory (if MEM TIME is selected). The next memory in sequence will be automatically selected when the fade is started in a similar way to normal Sequence mode, but in this case the number is 'hidden' and the number in the CHANNEL/MEMORY window does not change. On completion of the fade, the next fade action will be initiated automatically. A continuous sequence of lighting changes is therefore carried out without the operator having to press the FADE button to start each fade. Note, however, that if a memory has been recorded with MANUAL selected, it will still be necessary for the operator to carry out the fade action using the Fade Duration controls as described in section 4.6.2.3.

Note: It is recommended that only Move-fades be recorded for recall in Auto-sequence, particularly if it is intended to use the keypad in Channel or Cue modes. If Crossfades are used, the Latest-takes-precedence philosophy will mean that each time a new fade starts, the channels under Channel or Cue control will be 'stolen' by the fade system.

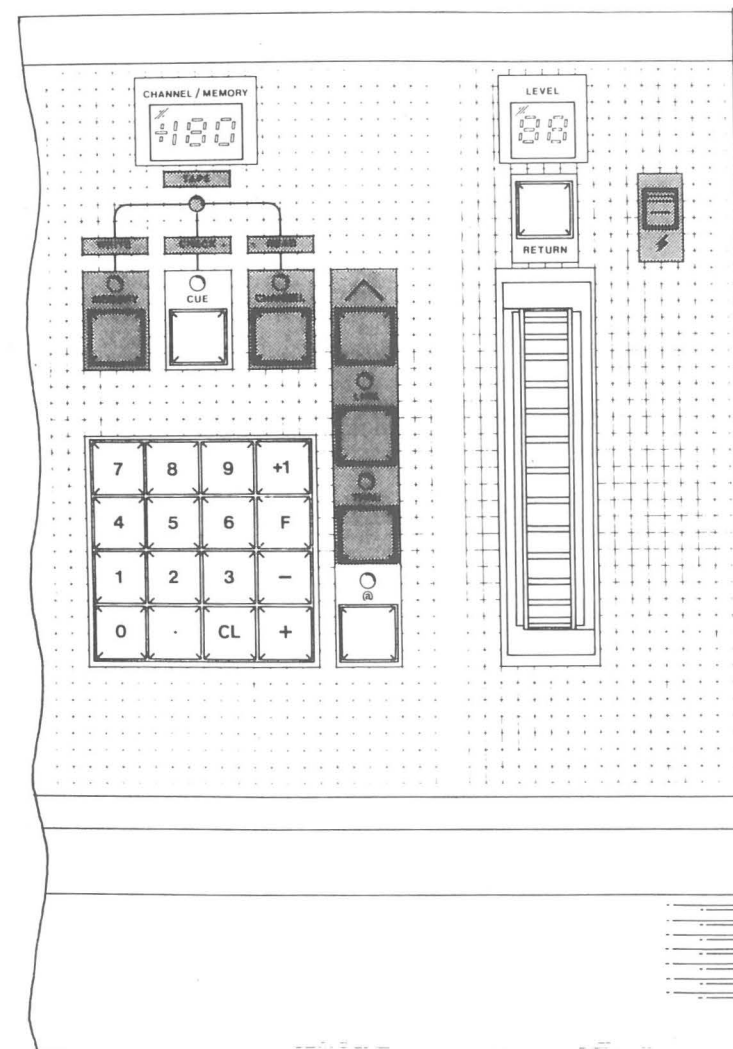
If Auto-sequence mode is selected while a fade is running, this fade will complete in the normal way. The FADE button must then be pressed to initiate Auto-sequence.

Auto-sequence mode is cancelled by pressing the SEQ button. There is no need to hold down the Shift key.

Note: The first 'Shift<SEQ>' action always selects Auto-sequence, even if normal Sequence is already selected. A second 'Shift<SEQ>' action, or pressing SEQ on its own, will then cancel Auto-sequence. To cancel normal Sequence mode press SEQ without Shift.

4.6.3 Recalling Memories using Keypad Cue Mode

An alternative method of recalling memories is provided by a third keypad mode - Cue mode. This is intended for use when the fade system is not available (e.g. when a manual fade is in progress or AUTO SEQ is selected) or when simultaneous manual control of two fades is required.



Note: It is recommended that, if it is intended to use the keypad in Cue mode while recalling memories using Auto-sequence, only Move-fades be recorded for recall in Auto-sequence. If Crossfades are used, the Latest-takes-precedence philosophy will mean that each time a new fade starts, the channels under Cue control will be 'stolen' by the fade system.

Cue mode is selected by pressing the CUE button above the keypad; the associated indicator lights and the previously selected mode (Memory or Channel) is cancelled. If a memory number is now entered, the corresponding memory may be introduced as a Move-fade by moving the fader wheel upwards. Both up and down parts of the fade occur simultaneously and, once the channels concerned have reached their recorded levels, further forward movement of the wheel has no effect. The fade may be reversed by moving the wheel towards the operator until the starting levels are restored or, for a rapid return to the original state, the RETURN button may be used. The progress of the fade is shown as a percentage in the LEVEL display window.

As an alternative to using the fader wheel, the '@' key may be used in conjunction with the keypad. The 'level' entered is interpreted as the percentage of the fade which is to be carried out and the channels are set immediately to the levels that they would reach by fading. For example, CUE, 10, '@', 5 would switch channels from their current levels to the levels they would reach half-way (50%) through a Move-fade to memory 10.

Only Move-fades may be carried out in this way, entering the memory number without a prefix having the same effect as using a '+' prefix. The '-' prefix, however, will still produce a Dim-fade, the channels on in the memory fading out as the wheel is moved upwards.

As in Memory mode, memories may be combined in Cue mode before being introduced; see section 4.4.1.3.

Note: Selecting Cue mode does not affect the current channel selection, but, unlike in Memory mode, the wheel and the

RETURN button are not available for the control of selected channels. The Flash switch, however, may still be used to flash the selected channel(s).

Keypad Cue mode may also be used when setting-up lighting. If separate memories are prepared containing, for instance, the red, blue and green cyclorama channels at pre-balanced levels, these may then be introduced by means of keypad Cue mode and balanced using the fader wheel.

4.7 CASSETTE TAPE STORAGE

4.7.1 General

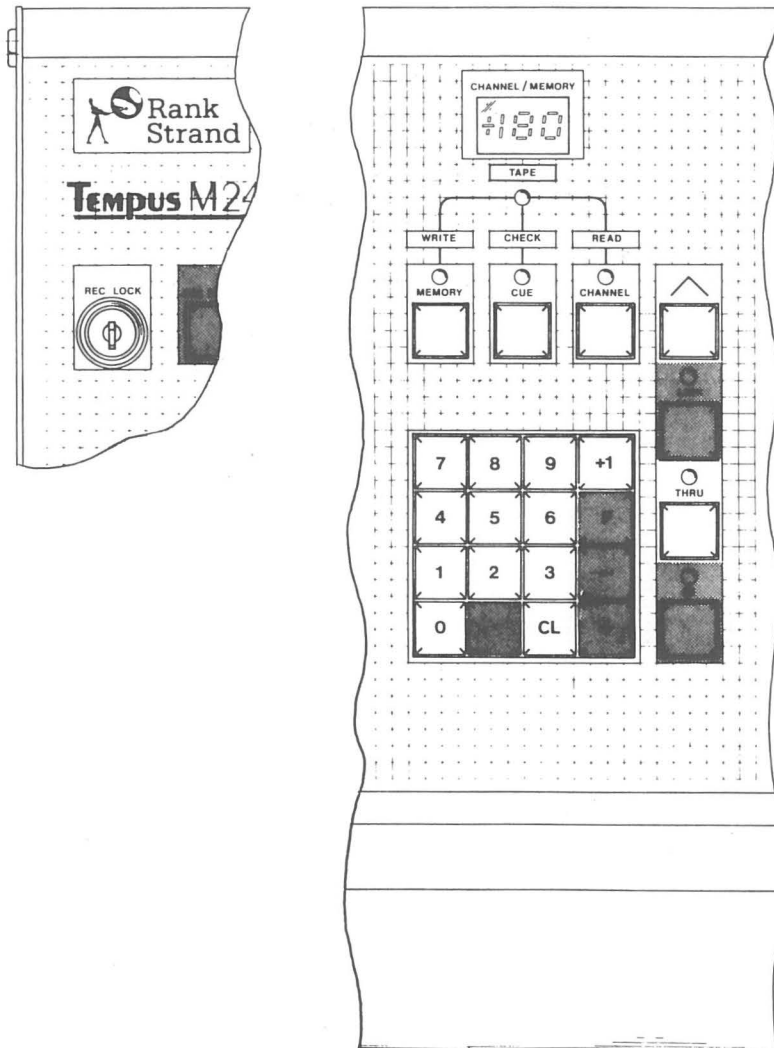
The M24 memory is provided by battery-maintained random-access memory which will retain its contents for at least a week if the system is not used. If the system is not used for long periods, however, or if library storage of the lighting for different productions is required, the contents of the memory should be copied onto magnetic tape. This has the additional advantage of providing a back-up copy in the unlikely event of system or memory failure.

Most domestic audio cassette recorders are suitable for use with M24, provided a good quality cassette tape is used. A lead fitted with 180° 5-pin DIN connectors is provided for the connection between M24 and the radio input of the recorder.

Note: Only limited operating facilities are available on M24 while memories are being copied to or from tape. The Blackout switch and Master faders remain operative and any fade which is in progress will complete. No new fade actions may be started, however, and no new channel or memory selections may be made.

4.7.2 Saving Memories on Tape

- i) Connect the cassette recorder to the M24 desk and load it with a good quality audio cassette.



- ii) Set the keypad into Memory mode and enter the number of the first memory to be copied. Then, if more than one memory is to be recorded, press THRU and enter the number of the last memory. Any numbers may be entered, but when using THRU, the second must be higher than the first. If the second is lower, the keypad display will return to the first number entered on attempting to start the tape action. If a number greater than the highest available memory number is entered, the number will not be accepted and the display will blank.
 - iii) Set the tape recorder to Record and start the tape (make sure that you are not trying to record on the tape leader).
 - iv) Press Shift<Write> to start saving the memories - i.e. hold the '^' key down and press the Write (MEMORY) key. Two indicators light: that immediately below the CHANNEL/MEMORY window ('Tape' indicator) shows that a tape action is in progress, while that above the MEMORY button shows that memories are being saved on tape. As each memory is saved, its number appears in the keypad window.
- Note: If the cassette recorder has manual recording level controls, a 'dry run' should be carried out first in order to set the correct recording level. The best results will be obtained if the level is set to give as high a recording level indicator reading as possible, without entering the red over-recording zone.
- v) Wait until the 'Tape' indicator goes out and then stop the tape.

The process may be terminated at any time by pressing MEMORY a second time (with or without Shift).

4.7.3 Checking a Recording

Once a recording has been made, it should be checked to ensure that no errors have occurred. Rewind the tape to the start of the recording and set the volume to a suitable level (usually between a

quarter and a half). Next enter the range of memories to be checked (see previous section) and press Shift<Check> (i.e. Shift<CUE>). Then set the tape recorder to Play. As each memory is checked, its number will appear in the keypad display window. On completion of a successful check, the 'Tape' and CUE indicators will be extinguished and the keypad will return to memories mode.

If an error is found, the 'Tape' and CUE indicators flash and the number of the faulty memory remains in the keypad window. This will be updated if further errors are found so that, on completion of the check, the number of the last faulty memory checked remains in the window. This number may be cleared at any time by pressing Shift (^); if the tape action is still in progress, the window will resume displaying the number of each memory as it is checked, although the 'Tape' and CUE indicators will continue to flash; if the action is complete, all error indications will be cleared and the keypad will return to Memory mode.

Note: Errors may be caused by incorrect volume control setting. Repeat an unsuccessful check at different levels (e.g. a quarter, half, three quarters and full). If, after several tries, the check is still not successful, re-record using a different tape.

4.7.4 Loading Memories from Tape

- i) Connect the cassette recorder to the M24 desk and load the tape cassette. Run the tape to the beginning of the required recording.
- ii) Set the tape recorder volume to a suitable level (usually between a quarter and a half).
- iii) Set the keypad into Memory mode and enter the number of the first memory to be loaded. Then press THRU and enter the number of the last memory. If a number greater than the highest available memory number is entered, the number will not be accepted and the display will blank.

- iv) Set the REC LOCK keyswitch to the 'Enable' position (see section 4.5). Note that the tape action will be aborted if recording is disabled while reading from tape.
- v) Set the cassette recorder to Play and Press Shift<Read> (i.e. Shift<CHANNEL>) to start the loading process. The 'Tape' and CHANNEL indicators light to show that a tape read action is in progress. As each memory is read, its number appears in the keypad window and the 'Record' indicator lights momentarily.
- vi) Wait until the two indicators go out and the keypad returns to Memory mode. Then stop the tape.

Any errors which are found during the read action will be indicated as described in the previous section. If errors are found, try again using a different volume control setting.

If the range of memories entered is different from that found on the tape, one of the following will occur:

- i) If the range entered is smaller than that on the tape, but all of the memories required are found, the additional memories will be ignored and the tape action will terminate normally.
- ii) If the range found on tape is smaller than that entered, or if there is an overlap, the memories found will be loaded (ignoring those outside the required range) and the tape action will then continue until the remainder are found or until the tape action is aborted. Note that if a second recording is found which includes memories in the same range as the first, common memories will be over-written.

4.8 VIDEO MIMIC (optional)

4.8.1 General

The Video Mimic (if provided) is normally used to display the combined outputs of M24 and the manual fader wing, showing the channels which are On, together with their levels. If the MEMORY

button on the desk is held down, the display changes to show the contents of the selected memory, while if CUE is held down, the display will show the contents of the memory currently under Cue control.

The screen is divided into two sections, the top half displaying the channels controlled by the system, while the bottom half shows system status information such as fades in progress, selected memory, etc. The bottom half of the screen is divided into four sections: '-PLAYBACK-', '-MEMORY-', '-CUE-' and '-CHANNEL-'. This status information remains unchanged when the MEMORY or CUE displays are selected. Note that the selected keypad mode is indicated by the appropriate section heading ('-MEMORY-', '-CUE-' or '-CHANNEL-') appearing in reverse video, i.e. black on white.

4.8.2 Channels Display

The top half of the screen shows all of the channels controlled by the system in tabular format. For example, channels 1 to 3 appear as follows:

```
01:45
02:80
03:60
```

The levels are shown as a percentage of full as in the LEVEL window on the desk, with full level appearing as 'F'. Channels currently selected on the keypad are displayed in reverse video (i.e. black on white), while channels which are at zero and not selected appear at reduced brightness with no level shown.

The top line of the display carries the title of the display, i.e. 'OUTPUT' or 'MEM nnn' as appropriate.

4.8.3 Playback Status Display

Below the heading '-PLAYBACK-' in the bottom half of the screen are two sub-headings, 'UP' and 'DOWN', and below these, up to six lines of information about fades which are in progress. These lines each consist of type of fade, active memory at start of fade, up-fade

time ('minutes'. 'seconds'), up-fade progress, down-fade progress and down-fade time. For example:

```
-----PLAYBACK-----
      --UP--  --DOWN--
MOVE 130  .30  1 1  .30
DIM   27  .20  7 8  .15
MOVE 102  8.00  3 2 10.00
XFADE 5   2.55  6 5  3.20
```

A Crossfade to blackout (i.e. with no memory selected) is shown on the display as 'ALL DIM'.

Each time a new fade is started, the appropriate status information appears on the top line and the details of any other fades which are running move down to make room. Earlier fades are also shown at reduced brightness. If the new fade is a Crossfade, all other fades will stop (see section 4.6.2.1) and their details will be removed from the display. Similarly, as each fade completes, it is removed leaving a blank line. The latest fade, however, remains on the screen.

If either Fade Duration control is at 'oo', the appropriate fade time is shown as '**.**'. If the fade is completely stopped (i.e. both controls are at 'oo') and another fade is started, the fade which was stopped disappears from the display, as it cannot now be restarted.

As each new fade is started, the upper lines of the '-PLAYBACK-' display move down to fill any gaps, so that the details of all the fades currently in progress can always be seen.

4.8.3.1 Manual Fades

If a fade is under Manual control, both fade times appear as '<MAN>'. As in the case of fades which are stopped, if another fade is started, a Manual fade will disappear from the display, as control of this fade is no longer possible.

4.8.3.2 Fading Combined Memories

When fading single memories, the prefix (or the lack of a prefix) in the keypad window determines the 'type of fade' display (i.e. 'XFADE', 'MOVE', 'DIM' or 'ALL DIM') and the active memory number appears without a prefix. If memories are combined before fading, however, the 'type of fade' is determined by the prefix to the first number selected and the active memory number is that which was shown in the keypad window, together with its prefix, at the moment the fade was started.

4.8.3.3 Fade Sequence Modes

If Sequence or Auto-sequence mode is selected, the legend 'SEQUENCE' or 'AUTO-SEQ' (as appropriate) appears to the left of the two sub-headings, 'UP' and 'DOWN'.

4.8.4 Memory Status Display

Under the heading '-MEMORY-' are displayed the currently selected memory, the fade times recorded with that memory and the memory to which the selected memory is linked, if any. Below this, the number of the memory used when the last record action was performed is shown. For example:

```

--MEMORY--
+ 73

UP 4.15
DN 3.45

LINK 102

REC 58

```

If the 'REC LOCK' keyswitch is in the disabled position, no 'last recorded' number is shown. Similarly, the 'UP', 'DOWN' and 'LINK' displays do not appear if there is no memory selected, and 'LINK' only appears if the selected memory has a link recorded.

Note: When a range of memories is selected for copying to or from tape, the memories concerned are shown as follows:

```

--MEMORY--
  1
> 100

```

4.8.5 Cue Display

When the keypad and fader wheel are used in Cue mode, the numbers of the memories selected are shown on the Video Mimic under the heading '-CUE-'. Up to four memory numbers may be displayed at once, the latest appearing on the bottom line. Any numbers already present move up to make room. When numbers are being entered, the bottom line duplicates the information in the keypad display window (including any prefix).

If Cue mode is selected, the proportion of the fade which has been carried out is shown under the sub-heading '-WHEEL-'. The latter display only appears in '-CUE-' section of the screen when Cue mode is selected (or in Memory mode if CUE was the previous selection). If Channel mode is selected, the '-WHEEL-' display appears in the '-CHANNEL-' section of the screen.

```

--CUE--
  27
+135
- 4
+163

--WHEEL--
+ 75%

```

4.8.6 Channel Status Display

The '-CHANNEL-' section of the screen is similar to the '-CUE-' section described above. The last four channels selected are shown, together with their levels, as follows:

-CHANNEL-

1
+ 15
> 27
+ 43 @ 90

-WHEEL-

+ 50%

The symbol '>' indicates THRU and the above display therefore shows that channels '1 + 15 THRU 27 + 43' were selected as a group. Their levels were then increased by 50%, so that the current level of channel 43 is 90% of full.

As each new channel selection is made, the number is added at the bottom of the list and those already displayed move up to make room. As long as Channels mode is selected on the keypad, the bottom line duplicates the keypad and level displays on the desk.

When the level of the selected channel is adjusted using the wheel, the '-WHEEL-' display shows the extent of the change (as a percentage of full level) and the bottom line of the '-CHANNEL-' display shows the absolute level of the last selected channel.

When the '@' button is used to change the channel level, the '-WHEEL-' display will show the extent of the change only if the '+' and '-' are used to prefix the level entry (see section 4.2.3). If several adjustments are made, using both the '@' button in conjunction with the '+' and '-' keys and the fader wheel, the '-WHEEL-' display shows the combined result of all the changes. If, however, an absolute level is entered using the '@' button, the '-WHEEL-' display is set directly to the level entered.

Only the bottom line of the '-CHANNEL-' display is affected when channel levels are adjusted. All the remaining lines show only the channel number.

If Cue mode is selected, the '-WHEEL-' display moves to the '-CUE-' section of the screen.

CHAPTER 5

FIRST LINE SERVICING

5.1 INTRODUCTION

The Tempus M24 system is extremely reliable and should give no trouble, provided the environment is as recommended in section 2.4. In the unlikely event of a fault, users should not, in general, attempt to repair the equipment themselves, but should immediately notify their local Rank Strand service agent. There are, however, a number of potential faults such as blown fuses and broken connections which may be diagnosed and repaired by the user. To assist in the diagnostic process, M24 has a number of test facilities, some of which operate automatically each time the system is switched on.

5.2 POWER-UP SELF TESTS

When the equipment is connected to the mains supply, four test procedures are carried out and the results are shown in the desk display windows and on the Video Mimic (if provided). If no fault is found, the desk windows will momentarily display dashes and then clear, and the top line of the Video Mimic will appear as follows:

```
M24 VERSION A1          OUTPUT          SELF TEST OK
```

The version number and 'SELF TEST OK' messages will disappear after about 8 seconds, leaving only the display heading. In addition to this, the 'MUX OK' indicators on the Multiplex Interface units should light. If any of these do not occur refer to Table 5.2.1, which lists potential fault conditions and checks which should be carried out by the user.

Note: Unlike the 'SELF TEST OK' message, the Video Mimic error messages and desk error codes given at the end of Table 5.2.1 are not cleared automatically. Video error messages may be

cleared if required by pressing '^' (Shift), while desk error codes will clear the first time the keypad is used.

If the checks listed do not reveal an easily rectifiable fault, the nearest Rank Strand service agent should be immediately contacted and a clear description of the fault given, together with details of the checks that were carried out.

5.3 OPERATOR INITIATED TESTS

In addition to the Power-up Self Tests, there are a number of operator-initiated tests which, while they will not point to any easily rectifiable fault, will help to reveal the extent of the fault and may indicate whether the equipment may continue to be used, if only in a limited way. For instance, a Video fault will not prevent operation using only the desk displays; and a tape fault will only prevent the copying of memories to and from tape. The operator-initiated tests may also reveal more subtle faults which are not detected by the Power-up Self Tests.

5.3.1 Panel Tests

The operator-initiated panel tests are selected by pushing any suitable implement (e.g. a matchstick or a grub screwdriver) into the small hole in the panel above the FADE button. Test 1 is selected automatically on entering test mode.

The various tests are selected from the keypad and start immediately the number is entered. The current test may be stopped by pressing CL (Clear) or, if the next test in numerical order is required, by pressing '+1'.

Note: In the case of test 2 it is necessary to press the CL key twice to stop the test, because the first operation tests the button contact. This is also true of the '+1' button.

Table 5.2.1

<u>Fault</u>	<u>Probable cause</u>	<u>Check</u>
No panel displays appear. 'MUX OK' indicators fail to light on all Multiplex Interface units.	No desk power.	1) that the desk is correctly connected. 2) that power is available to the desk. 3) the desk mains fuse (see Table 5.2.2). 4) the desk power supply fuses (see Table 5.2.2).
No panel displays appear, but 'MUX OK' indicators on Multiplex Interface units light. VDU (if provided) displays 'NO PANEL RESPONSE'.	1) Panel processor faulty 2) Panel board disconnected from Motherboard	- Check cable between Panel board and Motherboard.
'MUX OK' indicators on Multiplex Interface units light, but dashes remain displayed in desk windows (these normally appear only momentarily). VDU (if provided) displays 'NO PANEL RESPONSE'	Damaged cable between Panel board and Motherboard.	Check cable.
Dashes remain displayed in desk windows, but 'MUX OK' indicators on Multiplex Interface units light. No error message on VDU (if provided).	Motherboard processor faulty.	-

Table 5.2.1 (cont.)

Fault	Probable cause	Check
Desk starts normally (CHANNEL indicator lights; all other displays cleared), but 'MUX OK' indicators fail to light on one or more Multiplex Interface units.	1) Bad connection between Multiplex Interface units. 2) Faulty Multiplex Interface unit.	Check cables between Multiplex Interface units. 1) Check power is available to Multiplex Interface units. 2) Check Multiplex Interface unit mains fuse (see Table 5.2.2).
	3) Channel group selector on Multiplex Interface unit incorrectly set.	Check setting of selector on appropriate unit.
Desk starts normally (CHANNEL indicator lights; all other displays cleared), but 'MUX OK' indicators on all Multiplex Interface Units fail to light.	1) Bad connection between desk and Multiplex Interface units. 2) Motherboard multiplex output fault. 3) On systems with only one Multiplex Interface unit see also previous category.	Check cables between desk and Multiplex Interface units. - -
Channel level window displays an error code (E1 - E4). The VDU (if provided) shows the appropriate error message - see column 2.	1) E1 - 'MEMORY FAULT' 2) E2 - 'PROGRAM CHECKSUM ERROR' 3) E3 - 'ANALOG INTERFACE FAULT' 4) E4 - 'TAPE INTERFACE FAULT'	Enter 'System Test' mode and run appropriate test programs (see section 5.3).

Table 5.2.2

Fuse	Rating	Size
Desk Mains Fuse, 240V	2A HRC	20mmx5mm ceramic
Desk Mains Fuse, 110V	3.15A HRC	20mmx5mm ceramic
PSU Board Fuses *	5A quick-blow	20mmx5mm
Multiplex Interface Unit, mains fuse	100mA anti-surge	20mmx5mm

* Note: These fuses are only accessible after removing the bottom cover of the desk; see appendix A, section A3.

5.3.1.1 Test 1 - Display Test

When test 1 is selected, all of the displays and mimics flash at about once per second, in order that any which are inoperative may easily be seen. Note that, except for one on the keypad display, the decimal points in the windows are not used and will not light.

5.3.1.2 Test 2 - Contact Test

Selecting test 2 clears all of the displays. If any of the panel buttons are now operated, a corresponding code (see Table 5.3.1.1) will appear in the keypad and ACTIVE MEMORY windows.

Notes: 1) The codes for the REC LOCK keyswitch and the blackout switch will remain in the windows until the switch is returned to the off position or until another contact is operated. All other codes appear only while the appropriate button is held down.

2) The CL and '+1' buttons may each only be tested once. A second operation of CL terminates the test, while a second operation of '+1' selects test 3.

3) If the wheel is operated, the LEVEL window will count up or down as appropriate. The count will remain displayed while contacts are tested, but will be cleared by CL or

'+1'. Note that the count will change much more rapidly than when the system is in normal operational mode, a count from 01 to 99 corresponding to a wheel movement of about a third of the exposed section.

Table 5.3.1.1

Panel Contact Numbers			
Contact Number	Contact	Contact Number	Contact
00	0	17	CUE
01	1	18	CHANNEL
02	2	19	SHIFT
03	3	20	LINK
04	4	21	THRU
05	5	22	@
06	6	23	RETURN
07	7	24	FADE
08	8	25	SEQUENCE
09	9	26	MANUAL
10	+	27	USE TIME
11	-	28	BLACKOUT
12	.	29	RECORD BLIND
13	F	30	RECORD TOTAL
14	CLEAR	31	RECORD ENABLE
15	+1	32	FLASH OUT
16	MEMORY	33	FLASH FULL

5.3.1.3 Test 3 - Communication Test

This tests the serial link between the Panel board and the Motherboard in the control desk. When it is selected, the keypad and ACTIVE MEMORY windows will display a number which increases in value about once per second. If the count is very slow or very fast, or if there is no count at all, this is most probably caused by a Motherboard fault.

5.3.1.4 Test 4 - Program Test

When this test is selected, the Panel PROM is checked continually for errors and the result displayed. If no errors are found, 00 appears in the keypad and ACTIVE MEMORY windows. If a random pattern of displays and indicators lights, this indicates that there is a PROM fault. Because the test is carried out continually, intermittent faults will cause a changing pattern to appear.

5.3.1.5 Test 5 - Select System Tests

Panel test 5 selects 'System Test' mode for testing the desk Motherboard.

5.3.2 System Tests

- WARNINGS:**
- 1) System Test 6 (Cue Store) will destroy the contents of the memories. Save important lighting cues on tape before starting this test.
 - 2) System Test 7 (Analog Interface) will cause the luminaires controlled by the system to flash.

System Test mode is selected by entering Panel Test mode as described in section 5.3.1 above and then selecting test 5. On selection, the Video Mimic (sometimes referred to as the VDU) shows the following:

M24 SYSTEM TESTS

- 1 - VDU TEST (A)
- 2 - VDU TEST (B)
- 3 - MASTER & TIME FADERS
- 4 - TAPE INTERFACE
- 5 - PROGRAM CHECKSUM
- 6 - CUE STORE (CLEARS MEMORY!)
- 7 - ANALOG INTERFACE (FLASHES LIGHTS!)

TO RESUME NORMAL OPERATION, TURN SYSTEM OFF AND ON AGAIN

ENTER TEST NUMBER FOLLOWED BY +1

This shows the tests available. If there is no Video Mimic, the tests may still be selected, but reference will have to be made to this handbook for the list.

The tests are selected by entering the required number on the keypad, followed by '+1' to start the selected test. If a number higher than 7 is selected when '+1' is pressed, the error number '199' will appear in the ACTIVE MEMORY window and the Video Mimic will display the message 'ILLEGAL TEST NUMBER - PRESS CLEAR'.

Once a test is running it may be stopped by pressing CL (Clear). Note that some tests will continue until the end of the current pass, which may take 2 to 3 seconds.

5.3.2.1 VDU Test (A)

Sub-test 1

This test writes 25 lines of 64 characters (the complete character set) to the Video Mimic screen. Each line appears as follows.

```
@ABCDEFGHIJKLMNOQRSTUVWXYZ[\]^_!"#$%&'()*+,-./0123456789:;<=>?
```

Each line has a different attribute, starting with normal and followed by 'flashing', 'inverse', and 'dim', this sequence repeating every four lines.

Sub-test 2

If, having run sub-test 1, the '+1' key is operated, each character in the set will be written, in turn, to the whole screen, starting in the top left-hand corner. Each complete pass has a different attribute, in the same order as above. This test takes a long time to complete.

5.3.2.2 VDU Test (B)

Sub-test 1

This test is similar to VDU Test (A), sub-test 1, but the characters are written one at a time, starting in the bottom right-hand corner.

Sub-test 2

As VDU Test (A) - sub-test 1, but when the screen is full the test repeats, starting with the next character in the set and the next attribute.

Video faults will show-up as anomalies in the otherwise regular patterns appearing on the display.

If no Video Mimic is provided, the above tests may still be selected and run, although they are of no practical use. The number of the selected test is shown in the keypad window and this may be cleared - stopping the test if it is in progress - by pressing the CL key.

5.3.2.3 Master and Time Faders

When this test is selected, the Video Mimic produces the following display:

M24 SYSTEM TESTS

3 - MASTER & TIME FADERS

75 F 00 22

The numbers shown represent the current settings of the four desk faders; i.e., from left to right, the MANUAL master fader, MEMORY master fader, the up fade-duration control (↑) and the down fade-duration control (↓). As the faders are moved from zero to full and vice versa, the numbers should change smoothly, without any jumps or hesitations.

The settings of the faders are also displayed in the LEVEL window on the desk, so that the test may be carried out on systems which do not have a Video Mimic. When the test is first selected, the level of the MANUAL master fader is displayed. Pressing '+1' will then select the MEMORY master fader and subsequent operations select the '↑' and '↓' controls, followed by a repeat of the sequence.

5.3.2.4 Tape Interface

The Video Mimic produces the following display when this test is selected:

M24 SYSTEM TESTS

4 - TAPE INTERFACE

PASS 01

Every time the Tape Interface tests are completed they restart from the beginning and the 'pass' number is incremented (the 'pass' number also appears in the LEVEL window on the desk). If a fault is found, an error message will be displayed on the Video Mimic and an error code in the ACTIVE MEMORY window on the desk. Should the same fault(s) be found on each pass (as is most likely) the test will continue until the Video screen is full, when it will stop, this condition being indicated by the 'Tape' indicator on the desk flashing. The screen may then be cleared and the test resumed by pressing '+1'.

5.3.2.5 Program Checksum

This is a test for program errors. It operates in a similar way to test 4.

5.3.2.6 Cue Store

WARNING: The Cue Store test destroys the contents of the memories. Save important lighting cues on tape before selecting this test.

This test is similar to the previous two, but can only be carried out if the REC LOCK keyswitch is in the horizontal, enabled position.

5.3.2.7 Analogue Interface

WARNING: This test will cause the luminaires controlled by the system to flash. To prevent this, remove the MULTIPLEX O/P connector at the rear of the desk or switch off the power to the dimmers before selecting the test.

This tests the circuits which transmit to and receive from the Multiplex Interface unit(s), and also the panel fader analogue-to-digital converter. The test is similar to the previous three.

5.3.3 Returning to Normal Operation

On completion of the operator-initiated tests, the system should be returned to normal operation by momentarily switching off the mains supply.

APPENDIX AINSTALLATION OF ADDITIONAL FACILITIESA1 INTRODUCTION

As mentioned in Chapter 1 of this handbook, the addition of the optional facilities such as the Video Mimic involves the installation of additional printed circuit boards and connector panels in the Control Console. Only one conversion kit is available at present, for the addition of the Video Mimic, but the console includes provision for up to four additional connector panels, to allow for future expansion of the system.

Each kit consists of a printed circuit board assembly, which plugs onto the Motherboard inside the M24 Control Console, and a connector panel, which replaces one of the blank panels at the rear of the console.

A2 GENERAL CAUTIONSA2.1 High Voltages

The Tempus M24 system is powered from either a 110V-120V or a 220V-240V a.c. source. **THESE VOLTAGES CAN BE FATAL.** Always disconnect the system from the mains before removing the base cover.

A2.2 Static Electricity

Many devices used in M24 are susceptible to damage from static electricity. If a static discharge passes through a CMOS integrated circuit, the resulting damage can range from complete destruction to latent degradation, leading to reduced component life and premature failure.

Avoid unnecessary static; nylon carpets, man-made fibre clothes and rubber soled shoes all lead to a build up of static and should be avoided if at all possible. In control rooms carpeted with artificial fibres, the use of an anti-static carpet treatment is recommended.

Retain printed circuit boards in their packing until required. When removed from the packing, handle boards only by the edges. Some components are fitted in sockets; these should not be removed.

A2.3 Connectors

Note the orientation of any connectors which are removed during the course of the installation, to ensure their correct replacement. In particular, note that the cable from the Multiplex Output connector on the rear of the console connects to the plug marked 'PL4' on the Motherboard (the adjacent connector marked 'PL3' is not used on standard M24 systems).

A2.4 Unauthorised Modifications

Only the modifications described in this chapter are authorised by Rank Strand. If unauthorised modifications are made to the equipment, any warranty will be invalidated.

A3 INSTALLATION

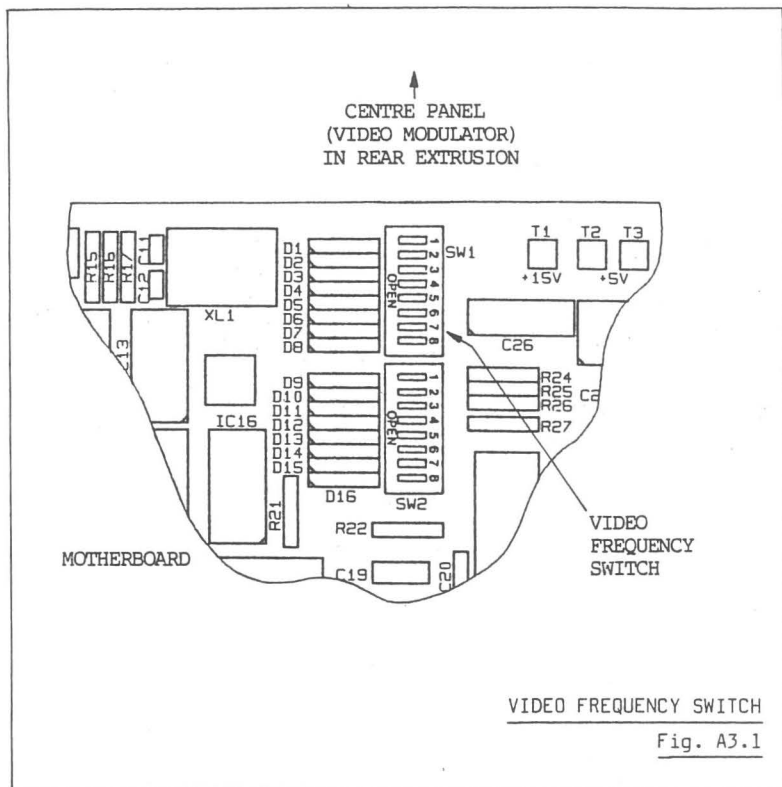
- i) Switch off the mains supply to the console and unplug any cables which are connected.
- ii) Fit the plastic lid to the console to protect the front panel controls and turn it over so that the bottom cover is facing upwards and the rear extrusion towards you.
- iii) Using a 'Posidrive' No.1 screwdriver, remove the eight screws around the edge of the bottom cover and lift it away to one side. The power supply chassis is fitted to the cover and connected to the Motherboard by a cable assembly. If space is limited, the cable assembly and the earth bond (the separate

green/yellow wire) may be unplugged from the power supply unit, allowing the bottom cover to be removed from the working area.

- iv) With the console positioned as described above, the five 64-way sockets (SKT1 - SKT5) are at the right-hand end of the Motherboard. All five sockets carry the same signals, so that any board may be fitted to any socket. However, to ensure that the cableforms of the connector panels do not become tangled if more facilities are subsequently fitted, the Video Interface should be fitted in SKT2.
- v) Before insertion, check each board visually for damage which may have occurred in transit. In particular, the plug connectors should be examined for bent pins. If all is well, fit the plastic retaining clip in the square hole adjacent to the appropriate connector on the Motherboard and then push the board firmly into position with the widest part towards the rear of the console. Ensure that the narrow end of the board engages in the clip.

Each board has a retaining screw fitted to a small bracket at the wide end. This screw passes through a hole in the Motherboard to secure the board and should be tightened using a small screwdriver.

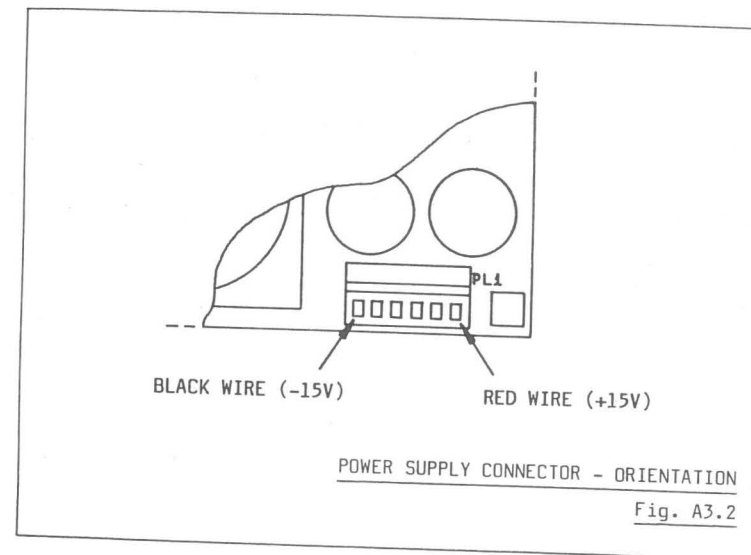
- vi) If fitting a Video Interface, check the setting of the Video frequency switch (switch 7 on SW1 - see Fig. A3.1) on the Motherboard. This should be set to 'OPEN' for 50Hz mains and to '7' for 60Hz. To change the setting, use a suitable implement (e.g. a pencil or a grub screwdriver) to push the rocker down at the appropriate end. Be careful not to disturb the other switches (if they are changed accidentally, refer to appendix B for the correct settings).
- vii) There is space for five connector panels in the rear extrusion of the console, one of which is already used for the Multiplex and Tape connectors. The Video output panel will only fit in the centre position of the five.



First remove the two screws which retain the appropriate blanking plate and lift the plate clear. Then carefully feed the cables attached to the connectors through the aperture. Fit the connector panel in position and fix it with the two screws. Particular care should be taken when fitting the Video output panel to ensure that the video modulator does not damage any components on the Motherboard.

- viii) The cables attached to the connector panels should then be plugged onto the appropriate interface printed circuit board and the cables laid so that they will not be damaged when the base cover is re-fitted.

- ix) The base cover may then be re-fitted, remembering to re-connect the power supply and earth bond if these were unplugged. Note the orientation of the power connector (see diagram); severe damage can be caused if this is replaced incorrectly.



A4

TESTING

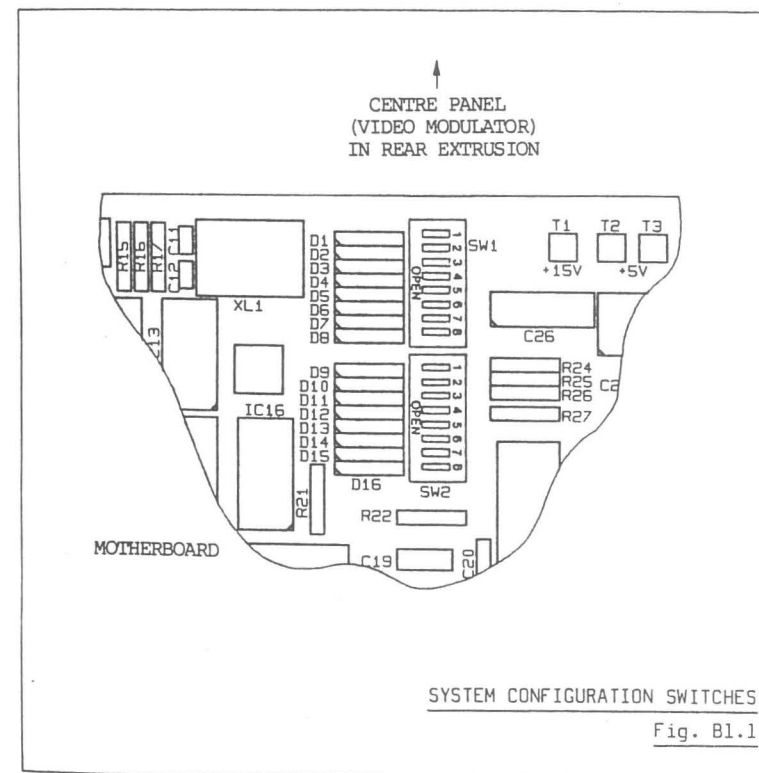
- i) Reconnect the mains power to the console and check for normal operation.
- ii) Connect the interface cables supplied with the conversion kit and check that the new facilities operate as described in chapters 1-4 of this handbook.
- iii) In the event of a failure, disconnect the mains supply immediately and check all connections, both inside and outside the console. If this fails to reveal the fault, consult your nearest Rank Strand service centre.

APPENDIX B

SETTING THE SYSTEM CONFIGURATION SWITCHES

B1 GENERAL

The M24 Motherboard inside the console carries two multipole switches, SW1 and SW2, which are used to configure the system as required by the user. The location of these switches is shown in Fig. B1.1.



The switches are normally set correctly before the system is dispatched and should not be disturbed by the user. However, in the event of the settings being accidentally changed (for example, when fitting the Video Interface - see Appendix A), it will be necessary for the user to reset the switches to their correct settings.

- i) Disconnect the console from the mains, the Multiplex Interface units and any other equipment.
- ii) Fit the plastic lid to the console and turn it over so that the bottom cover is facing upwards. Remove the bottom cover as described in Appendix A, section A3 (iii).

The switch rockers are very small and it is recommended that a suitable implement (such as a sharp pencil or a grub screwdriver be used to push down the appropriate end.

B2 SWITCH SETTINGS

SW1/1-3 - System channel capacity (in multiples of 12).

These switches should be set as follows, depending on the number of channels controlled by the M24 system.

Number of Channels	SW1/1	SW1/2	SW1/3
12	1	OPEN	OPEN
24	OPEN	2	OPEN
36	1	2	OPEN
48	OPEN	OPEN	3
60	1	OPEN	3

SW1/4-6 - Normally set to 'OPEN'.

SW1/7 - Video frequency. Set to 'OPEN' for 50Hz and to '7' for 60Hz.

SW1/8 - Should be set to 'OPEN' for normal operation.

SW2/1-2 - These switches may be set to give VDU displays in languages other than English. The standard system allows English, French and German to be selected, while other languages are available to special order. The switch settings are as follows:

SW2/1	SW2/2	Language
OPEN	OPEN	English (language 0)
1	OPEN	German (language 1)
OPEN	2	French (language 2)
1	2	Not normally used

SW2/3-8 - Normally set to 'OPEN'.

APPENDIX CPROGRAM VERSION BC1 INTRODUCTION

Chapters 1 to 5 and Appendices A and B of this Handbook describe the operation, etc. of M24 systems fitted with program version A. The major difference between versions A and B is that the latter supports the fitting of a Memory Expansion Board; with this addition, systems may have up to 120 lighting channels without any reduction in the number of memories. Systems without the memory expansion may have up to 72 channels, though only 155 memories are then available, instead of 199.

These and other enhancements are described in this appendix.

Note: Early M24 systems with program version A1 can have a maximum of 60 channels. An interim version, A2, supports expansion to 72 channels.

C2 MEMORY EXPANSION BOARD

The Memory Expansion Board fits inside the M24 Console in the same way as the Video Interface (see Appendix A); there is, however, no external connection panel.

Once the board has been fitted, the system configuration switches must be set for the required number of channels. Appendix B describes how this is done, but there are some changes in the functions of these switches on Version B systems, as follows:

SW1/1-4 - System channel capacity (in multiples of 12). Note that expansion beyond 72 channels is not possible unless a Memory Expansion board is fitted and SW1/6 is set to '6' (see below).

<u>Number of Channels</u>	<u>SW1/1</u>	<u>SW1/2</u>	<u>SW1/3</u>	<u>SW1/4</u>
12	1	OPEN	OPEN	OPEN
24	OPEN	2	OPEN	OPEN
36	1	2	OPEN	OPEN
48	OPEN	OPEN	3	OPEN
60	1	OPEN	3	OPEN
72	OPEN	2	3	OPEN
84	1	2	3	OPEN
96	OPEN	OPEN	OPEN	4
108	1	OPEN	OPEN	4
120	OPEN	2	OPEN	4

SW1/5 - Normally set to 'OPEN'.

SW1/6 - Set to '6' if Memory Expansion board fitted. 'OPEN' otherwise.

SW1/7 - Video frequency. Set to 'OPEN' for 50Hz and to '7' for 60Hz.

SW1/8 - Should be set to 'OPEN' for normal operation.

SW2/1-2 - These switches may be set to give VDU displays in other than English. The standard system allows English, French and German to be selected, other languages are available to special order. The switch settings are as follows:

<u>SW2/1</u>	<u>SW2/2</u>	<u>Language</u>
OPEN	OPEN	English (language 0)
1	OPEN	German (language 1)
OPEN	2	French (language 2)
1	2	Not normally used

SW2/3 - Normally set to 'OPEN'.

SW2/4-6 - These switches determine the initial state of the system on power-up. See section C4.

SW2/7-8 - Normally set to 'OPEN'.

C3 CLEARING MEMORIES

It is not strictly necessary to clear a memory before that number can be used to record again, as a recorded memory will be overwritten whenever one of the record buttons is operated. However, when lighting a production it is sometimes desirable to start with a 'clean slate' so that old and new lighting does not become confused.

Any or all of the memories may now be erased by setting the keypad into Memory mode, holding down the '^' (Shift) button and pressing 'REC TOTAL'. When erasing more than one memory, the THRU button on the keypad may be used to select a range of numbers. The procedure is as follows:

- 1) Ensure that recording is enabled.
- 2) Select Memory mode on the keypad.
- 3) Select the first memory to be cleared.
- 4) If erasing a range of memories, press the THRU button; the associated indicator illuminates. Then enter the the number of the last memory in the range.
- 5) Hold down the '^' (Shift) button and press 'REC TOTAL'. The indicator above the record buttons lights momentarily to show that the memories have been cleared.

Note that memory 0 must not be included in a range of memories.

C4 POWER-UP INITIALISATION

On systems with program Version B the initial state of the equipment on power-up depends on the settings of system configuration switches SW2/4-6. Six modes are available:

Mode 0 - As described in section 3.1, i.e. previous lighting state restored, but no fades running and no special facilities (MEM TIME, SEQUENCE, MANUAL, etc.) selected.

Mode 1 - As for Mode 0, but with the previous lighting state cleared, i.e. blackout.

Mode 2 - Select SEQUENCE and USE TIME. Preselect memory 1 (though keypad remains in CHANNELS mode). Restore previous lighting state.

Mode 3 - As for Mode 2, but with the previous lighting state cleared, i.e. blackout.

Mode 4 - As for Mode 2, but select AUTO-SEQ instead of SEQUENCE.

Mode 5 - As for Mode 4, but initiate fade to memory 1.

The switch settings are as follows:

<u>SW2/4</u>	<u>SW2/5</u>	<u>SW2/6</u>	<u>Mode</u>
OPEN	OPEN	OPEN	0
4	OPEN	OPEN	1
OPEN	5	OPEN	2
4	5	OPEN	3
OPEN	OPEN	6	4
4	OPEN	6	5
OPEN	5	6	0
4	5	6	0

See Appendix B for details of how to set these switches.

C5 SYSTEM STATUS AND ERROR MESSAGESC5.1 BLACKOUT

If the Blackout switch is in the down (o) position, the heading at the top of the Video Mimic is 'BLACKOUT' instead of 'OUTPUT'.

C5.2 MEMORY LOCKED

If recording is attempted with the REC LOCK keyswitch in the vertical, disabled position this message will appear; it may be cleared by pressing the '^' (Shift) button, or by turning the keyswitch to the enabled position.

C5.3 TAPE ERRORS

If an error is found when checking or loading memories from tape, the number of the faulty memory is displayed. If the number which appears is '000', this means that M24 was unable to read the memory number from the tape.

C5.4 PANEL IN TEST MODE

This message should not appear in normal operation. If it does, switch the system off for a few seconds. If the message recurs, contact the nearest Rank Strand agent.

C5.5 INSUFFICIENT MEMORY (Desk Error E5)

This is an additional Power-up Self-test message. If the expansion memory is selected (SW1/6 - see section C2), but no memory is found this message will appear. Check the settings of the system configuration switches; if these are correct, enter 'System Test' mode and run Test 6 (Cue Store) - see section 5.3.2.6.

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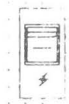
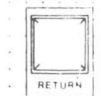
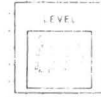
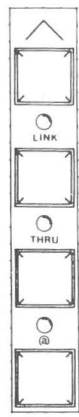
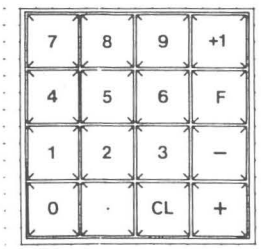
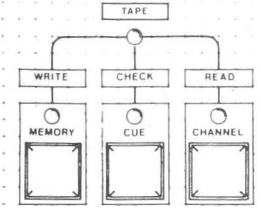
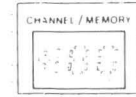
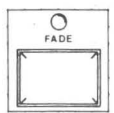
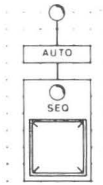
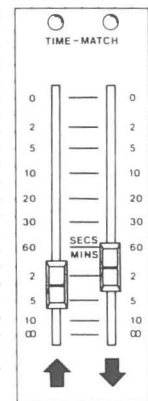
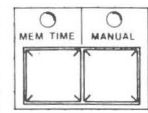
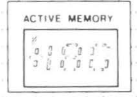
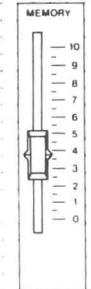
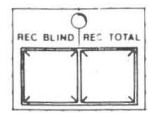
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Tempus M24



OUTPUT

01:50	13:85	25:70	37: F	49:85
02:50	14:80	26:90	38:20	50:
03:00	15: F	27:60	39:35	51:
04:50	16:80	28:30	40:	52:00
05:80	17:80	29: F	41:85	53:
06:90	18:90	30: F	42:85	54:
07:90	19: F	31:80	43:90	55:
08:90	20:65	32: F	44: F	56:
09:50	21:80	33:80	45: F	57:
10:80	22: F	34:80	46:90	58:
11: F	23:80	35:60	47: F	59:
12:50	24:60	36:90	48:85	60:80

-----PLAYBACK----- --MEMORY-- ---CUE--- --CHANNEL--

SEQUENCE	---	UP---		--DOWN--		+115				1
										+ 17
MOVE	130	.20	8	7	.18	UP	10.00	135		+ 20
MOVE	85	3.30	0	0	3.30	DN	10.00	+163		> 27 @ 60
DIM	102	2.15	3	3	2.15					
MOVE	1	2.15	8	7	2.30	LINK	+185			--WHEEL--
DIM	2	5.20	3	4	5.15					+ 50%
XFADE	3	10.00	7	8	10.00	REC	135			