

MSR/O

OPERATORS HANDBOOK
FOR
SYSTEM MSR



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OPERATORS
HANDBOOK

MSR/O

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SYSTEM MSR

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○ INTRODUCTION

Operator training is provided free of charge by Rank Electric for each new installation.

This handbook lists the functions of each control and allows trained operators to extend the board's capabilities beyond those which are taught during training.

1. HARDWARE

MSR is supplied in the standard configuration shown in Figures 1 and 2.

2. DIRECT MANUAL CONTROLS (Figures 3 and 4)

Associated with each control channel is a fader unit and a 3 position switch. These controls form the basis of a conventional single preset control board with two group masters. The main purpose of this manual control is to make the initial setting of levels for recording into the memory.

The manual controls are also used to modify played-back lighting states either prior to re-recording or when, accidentally, during a performance a luminaire has been changed from its correct position, focus, or colour, and has to be used at a different level to that recorded.

The manual controls can also be used to execute cues when it is required to have lighting levels changing simultaneously at rates being produced by playback mastering controls.

The manual controls also form the basis of a back-up system that can be

used independently of the main drum memory.

2.1. Selection to Direct Manual Control and Red Display

Each channel has an associated fader unit consisting of an individual channel fader lever (potentiometer) controlled by a knob (45)

Each channel fader is identified by channel number which is engraved on a strip (46) located between the Fader unit and group switches. In some installations the strip above the fader units (42) is engraved with the names of luminaire socket outlets corresponding to the channels.

The channel fader scale (44) is translucent and can become internally illuminated in one or both of two colours - red or white. The fader lever can provide direct manual control only when the scale is lit in red.

Channel fader scales can be lit in red, or the red display switched off, either individually or all together.

2.1.1. Individual Red On and Off

Associated with each channel fader scale is a push button action microswitch controlled by pushing the top of the Fader Scale (43). This switch is known as the Channel Scale Microswitch. The Channel Scale Microswitch is used in conjunction with other functions (see also section 8.2 - Metering, and section 8.3.1. - Individual Wipe).

In order to select a particular channel to red, the scale microswitch is held down while the 'INDIVIDUAL RED ON' Master Push (18) is pressed down. In order to select a particular channel out of the red state, the scale microswitch is held down while the 'INDIVIDUAL RED OFF' Master Push (19) is pressed down.

2.1.2. All Red On and Off

All channels can be switched to the red state by pressing the 'ALL RED ON' Master Push (12). All channels can be selected out of the red state by pressing the 'ALL RED OFF' Master Push (11).

2.2. Manual Mastering Controls

When fader scales are lit red, then the output of the fader lever, the Fader Level, is usually the Fader Position shown by the position of the fader knob against the fader scale. However the Channel Fader Level is altered by the manual mastering.

The manual mastering controls are the Channel Grouping Switches (47), the A Group Master Fader (16) and the B Group Master Fader (14).

2.2.1. Channel Grouping

The grouping switches (47) have three positions:-
top, middle and bottom.

In the top position, the channel fader is mastered by the A group master fader (16) alone.

In the middle position, the channel fader is mastered by the higher of the two group master faders (16) and (14).

In the bottom position, the channel fader is mastered by the B group master fader (14) alone

2.2.2. Group Master Faders

The group master faders (16) and (14) provide a proportional reduction in the output of channel faders they control.

$$\text{Channel Fader Level} = \frac{\text{Channel Fader Position} \times \text{Master Fader Position}}{10}$$

3. OVERRIDING CONTROLS (see Figure 3)

In common with the other theatrical lighting controls, the MSR is fitted with three controls which override levels produced elsewhere in the system. They provide DBO, FOH and Flash facilities. The overriding controls can affect the level that is recorded (see Section 5.3) so each control brings on a warning pilot to remind the operator that the board is not in the normal state for using the memory.

3.1. DBO

The DBO (Dead Black Out) switch (23) overrides all other controls. The DBO switch has 3 positions, top, middle and bottom. In the middle position the switch has no

effect on the system, while the top and bottom positions of the switch produce a dead black out. The top position is sprung and will automatically return to the middle position.

The dead black out state is when all the dimmers are off as a result of the control signals from the MSR being reduced to zero. Thus on stage, the effect of a dead black out is that all the lights controlled by the dimmers are off.

3.1.1. DBO Warning

Whenever the DBO switch (23) is active (i.e. not in the middle position), the Amber (lower) warning Pilot (1) is illuminated to warn the operator that control is not in its normal operating state. Although no lights appear on stage, the rest of the control behaves as if the DBO were not active. The Amber warning pilot also serves several other warning functions (see Section 9).

3.2. FOH Master Fader

The FOH (Front of House) Master Fader (15) overrides all controls except DBO (see 3.1). It affects those channels controlling dimmers which control luminaires fixed in front of the proscenium curtain. The effect of the fader is:-

Channel output after the FOH fader = Lesser of (i) Channel level before the FOH fader
and (ii) The level of the FOH fader.

3.2.1. FOH Warning Indicator

The FOH Warning Indicator (13) lights in amber whenever the FOH Master Fader (15) is not at full (lever position 10) to warn

the operator that the lighting currently on stage will not be exactly recorded (see Section 5.3).

3.3 Flash Facility

This facility allows the operator to easily identify the lighting effect of particular channels. The flash master switch (7) is a 3 position switch which affects the action of the channel scale microswitch (43).

The top position of the flash switch causes the channel scale microswitch to flash the channel to full light. This is known as Flash Full Mode.

The bottom position of the flash switch causes the channel scale microswitch to flash the channel to no light. This is known as Flash Out Mode.

3.3.1. Flash Warning

When in Flash Full Mode the meter will register 10 + but the channel would record at zero (see Section 5.3) if recording took place during Flash Full. When in Flash Out the meter will register the level on the channel prior to being flashed out and it is this prior level that would be recorded if recording took place during Flash Out (see Section 5.3).

In order to warn the operator of the fact that current stage lighting will not be exactly reproduced if recording takes place during a Flash Full or Out operation, the Amber (lower) Warning Pilot (1) illuminates when the flash switch is in the top or bottom positions.

The Amber Warning Pilot also serves several other warning functions (see Section 9).

4. MEMORY AND MEMORY NUMBER CONTROLS (see figure 3)

4.1. Flying Heads

After switching on the main electrical supply to the system (see Section 10), the rotating drum memory runs up to a predetermined speed - a process taking about 5 minutes. When the drum is running at the correct speed, the reading and recording heads are automatically moved closer to the drum surface so that they can fly on the air being dragged round by the drum surface. When the heads are flying, the drum system is active and can be used for recording and reading lighting states.

If the mains supply voltage is interrupted, or alters so that the drum is not running at its correct speed, the heads are automatically retracted to stop them crashing into the magnetic surface of the drum.

4.1.1. Flying Heads Indicator and Re-fly Push

The Flying Heads Indicator (5) shows green (upper) when the heads are flying and red (lower) when the heads are retracted.

If there is a brief interruption of mains supply (more than 5 milliseconds and less than 30 seconds) the heads will automatically retract during this interruption but will not automatically re-fly when the mains is restored. In order to re-fly the heads, the Re-Fly Push incorporated in the Flying Heads Indicator (5) must be pushed down for 15 seconds and then released - on release the heads will resume flying and the indicator (5) will change from red to green.

4.1.2. System Warning and Inhibit as a result of the Heads not flying

When the heads are not flying (i.e. indicator (5) showing red), the drum memory cannot be used for reading or recording. In order that the memory read controls (see Section 6) and the memory record controls (see Section 5) are not used when the heads are not flying, these controls are inhibited so that pushing them will have no effect. In order to warn the operator that the system is inhibited, the Red (upper) Warning Pilot (1) lights. The Red Warning Pilot lights at any time the system is inhibited (see Section 9).

4.1.3. System Warning and Inhibit as a result of the Tape System being used

When the tape system is active (i.e. mains on to the tape and 'tape system' switch on and the memory drum heads are flying), then the memory cannot be used for reading or recording. To indicate that the tape system is active the Tape Indicator Pilot (6) changes from green (upper) to red (lower) and the Red Warning Pilot (1) comes on to show that the normal reading and recording controls are inhibited (see Section 4.1.2.).

4.2. Normal Memory Number Selection

The memory number is selected by a keyboard (27) and the memory number is displayed in a 3 digit self illuminating indicator (25) known as the Keyboard Display.

4.2.1. Keyboard Operation

The keyboard enters digits into the right of the display and moves them to the left, blanking leading zeros.

4.2.1.1. On pressing the 'clear' key the number 0 will appear in the units position of the display; the

hundreds and tens position will not show any digit, (i.e. they will be blank).

- 4.2.1.2. On pressing any (non-zero) digit key, the corresponding digit will appear in the units position of the display.
- 4.2.1.3. On pressing another (non-zero) digit key, the digit in the units display moves to the tens display and the new digit appears in the units display.
- 4.2.1.4. Further pressing of (non-zero) digit keys causes the whole 3 digit display to be shifted to the left and the new digit to appear in the units position.
- 4.2.1.5. The zero digit key has the same effect described in 4.2.1.2./3/4 except that at any time the number in the display would appear with a zero digit in the hundreds or in both the hundreds and tens positions, the zero digit(s) concerned are blanked.

4.2.2. Indexing Switch

The indexing switch (26) is a 3 position switch but both top and middle positions are sprung to return to the middle position.

If pushed towards the top, the switch adds one unit to the keyboard display (25).

If pushed towards the bottom the switch subtracts one unit from the keyboard display (25).

The Indicating Push is also used for Cut Sequence (see Section 6.4.).

4.3. Back-up Memory Number Selection

If the normal memory number selection system (see 4.2.) fails, then a back up memory number selection system can be used. This back up consists of three finger-operated ten position wheels (28) mounted edge-on to the master panel surface.

4.3.1. Memory Number Selection Mode Latching Push and Indicator

In order to transfer memory number selection from normal to back-up and vice-versa, the Memory Number Selection Mode Push (2) must be pressed. When the indicator in this push (2) shows green (upper), then the normal system is active and the edge-wheels (28) are not internally illuminated.

When the indicator in the push (2) shows red (lower), then the back-up system is active, the edge-wheels (28) are internally illuminated and the keyboard display is totally blanked as is the Record display (see Section 5.2.), the Read C display and Read D display (see Section 6.1.).

4.3.2. Back-Up Memory Number Selector Warning

Whenever the Back-Up Edge-wheels are active, the Amber (lower) Warning Pilot (1) is illuminated to warn the operator that the Normal Memory Number Selection (see Section 4.2.) and Sequence (see Section 7.4) are inactive.

The Amber Warning Pilot also serves several other warning functions (see Section 9).

5. RECORDING CONTROLS (see figure 3)

Under normal operating conditions, the information recorded by the MSR system into its drum memory is that information which, when played-back (see Sections 6 & 7), will reproduce exactly the lighting

intensity levels current, on stage, at the time of recording.

The only exceptions to this principle are use of Blind Mode (see Section 5.4.) and the Override controls (see Section 3).

5.1. Record Keyswitch

To stop unauthorised or inadvertent recording into the drum, the record function can be switched off by a key operated switch (20) and the key removed. When the record function is switched off, the whole of the Record Display (22) is blanked and the Record Push (21) is not illuminated.

When the record function is switched on, the Record Push (21) lights yellow to show that recording is possible, and the Record Display is enabled.

5.2. Normal Recording

The number of the memory location that will be filled with new information as a result of recording is shown in the Keyboard Display (25). When the Record Keyswitch (20) is switched on and the Record Push (21) is pressed three things occur. These happen provided neither the Red Warning Pilot (1) is illuminated (see Section 9) nor the Amber Warning Pilot is illuminated (see Section 9):

- (i) Information corresponding to the current stage lighting (with exceptions listed in section 5 above) at levels corresponding to those which could be monitored by metering (see Section 5.3), is received into the drum in the memory location whose number address is shown in the Keyboard Display (25).
- (ii) The number in the Keyboard Display (25) is copied into the Record Display (22) to indicate that a recording has been made in that memory location with that number address.

- (iii) The Red Warning Pilot (1) lights momentarily to show that the Master Timing is operating (see Section 9) and that no further reading or recording can be started during this time. In fact for a short period the system is inhibited (see Section 9).

5.3. Recorded Level

On pressing a channel scale microswitch (43), the meter (8) shows the actual level that will be recorded. This level shown on the meter can be derived from the manual controls (see Section 2) or playback information (see Sections 7 and 8).

In Blind Mode (see Section 5.4) the meter, again, just registers the (blacked out) manual levels that alone will be recorded independently of playback levels.

In Flash Full (see Section 3.3) the meter will show 10+, but if a recording takes place while a scale microswitch is held down, the particular channel will be recorded at zero.

In Flash Out (see Section 3.3) the meter will show the level of the channel prior to flashing out and it is this level that would be recorded if a recording is made while a scale microswitch is held down.

If the FOH Master (15) is not at full, that is the FOH Indicator (13) is alight (see Section 3.2.1.), the meter will show the level of the channel as if the FOH master were at full.

If the DBO switch (23) is active (see Section 3.1), levels will be recorded and metered as if the DBO were not active.

5.4. Blind Mode

This facility is used for the setting up of lighting states in advance of their actual appearance on stage.

This is a useful facility when a lighting designer comes to a lighting rehearsal with a prepared draft control plot or in those theatres where touring companies arrive with so little time prior to public performance that lighting states have to be set into the memory while the show is running.

This facility is also very useful when the memory is not being used, in that it provides, when used with Local Mode (see Section 6.2), a 3 preset control with full MSR Playback Mastering Facilities (see Section 7).

5.4.1. Normal/Blind Latching Indicator Push

This push (4), when pushed to Blind Mode, changes in indication from green (upper) to red (lower).

In Blind Mode, the manual output (see Section 2) is disconnected from the combined playbacks output (see Section 7) and the dimmers. Moreover, if the Record Push (21) is pushed on, the manual levels are recorded.

5.4.2. Blind Mode Warning

When the MSR system is in Blind Mode, with the Blind Push (4) showing red, the Amber Warning Pilot (1) comes on to warn the operator that the board is not in a normal operating state. The Amber Warning Pilot also serves several other warning functions (see Section 9).

5.5. Recording using Back Up Memory Number Selector

If the Number Selector Indicator (2) is showing red, then recording will take place, as described in Section 5.2, except that the number of the memory location will be taken from the edgewheels (28) and no copying of the memory number into the record display (22) will take place.

6. READING CONTROLS (see figure 3)

The MSR is equipped with two Playbacks called C and D, for holding level information from the memory.

Each playback acts like a preset of individual faders that are automatically set.

If channels are active in a playback then they indicate in white (see Section 8) in a way similar to that in which channels indicate in red when they are under manual control (see Section 2)..

Channels can also be selected out of white indication (see Section 8).

Each Playback has a Playback Master Fader to master the played back levels (see Section 7).

Level information gets in to Playback by a process called Reading which is triggered off by a Read Push.

6.1. Reading from Memory

The number of the memory location that is required to be transferred to a playback, is selected into the Keyboard Display (25).

The Read Push, either C (31) or D (33), is pushed and provided the Red Warning Pilot (1) is not alight the following 4 events occur:

- (i) Level information is transferred from the memory location whose number is shown by the Keyboard Display (25) into the playback.
- (ii) The number in the Keyboard Display is copied into the Read Display, either C (30) or D (29).
- (iii) The Red Warning Pilot (1) lights momentarily to show that the Master Timing is operating (see Section 9) and that no further reading or recording

can be started during this time. In fact for a short period the system is inhibited (see Section 9).

- (iv) The Read Push itself, either C (31) or D (33) becomes lit white to indicate that the playback contains level information.

6.2. Local Reading

If the 'Local' Latching Push Button Indicator (3) shows red (lower), then the read pushes still have an effect, but not that described in 6.1.

Level information is not obtained from the memory. The level information obtained is that which would be recorded if the controls were in their current positions. The provisions of Section 5.3. apply to levels that would appear in a playback as the result of Reading in Local Mode. (Thus Blind (see Section 5.4) can be used in conjunction with Local).

The Keyboard Numbers still copy into the Read Displays, (30) and (29), in Local and act as labels for level information in the playbacks.

6.3. Reading Using Back-Up Number Selection

If the Number Selector Indicator (2) is showing red, then reading will take place, as described in Sections 6.1. and 6.2., except that the number of the memory location will be taken from the edge-wheels (28) and no copying of the memory number into the read displays (30) and (29) will take place.

6.4. Cut Sequence

When reading normally (as Section 6.1.), information can be read quickly in succession into the same playback from sequentially numbered memory locations by using the Index Switch (26) (see Section 4.2.2.). If the Index Switch is held either up or down

while pushing a Read Push (31) or (33), the number in the Keyboard Display (25) will automatically increase or decrease by 1 unit each time a Read Push (31) or (33) is pressed.

7. PLAYBACK MASTERING AND MSR LEVEL COMBINATIONS (see figure 3)

Special, simple to operate facilities are provided for combining the level outputs of the two playbacks so that both dipless and profiled crossfades can occur and also so that the two playback level outputs may be combined on a higher-level-takes-precedence basis.

7.1. Playback Master Faders

Both C and D playbacks have conventional looking Master Faders (34) and (36) respectively. The C Master Fader is motorised (see Section 7.5) but can be operated manually against a clutch. The effect of these masters is different to conventional masters and is described in the next two sections.

7.2. Dipless Crossfading between Playbacks

When the Playback Mastering Mode Latching Push Indicator (35) is showing blue (upper single headed arrow) then only the C master fader (34) is active in controlling the combined output of the two playbacks. When the C fader is moved from one end to the other, a proportional crossfade, without dip on channels with the same level on both playbacks, occurs between the levels in one playback to the levels in the other playback.

7.3 Pile Limited Additive Mastering (PLAM) between Playbacks

When the Playback Mastering Latching Push Indicator (35) is showing white (lower double headed arrow) then both C (34) and D (36) master faders are active in controlling the outputs of the two playbacks.

PLAM provides the following facilities:

7.3.1. Blackout

If both master faders are at zero, the combined output of the two playbacks is zero for all channels.

7.3.2. Proportional Mastering

If one master is faded in from zero to full, (the other master being at zero), the levels in that playback are established proportionally throughout the movement of the master.

7.3.3. Piling of Playbacks (Adding of Cue States)

If one master is at full and the other master is moved from zero to full then, for each channel, the higher of the two playback levels is established proportionally throughout the movement of the the master.

7.3.4. Dipless Crossfade

If one master is moved to full from zero while the other master is moved to zero from full, and provided the sum of the two master fader positions is held at 10 throughout the movement, a dipless corssfade from one playback level to the other will occur.

7.3.5. Profiled Crossfade

If, in the situation of 7.3.4., the incoming master is brought in faster than the outgoing master is taken out, then those channels whose light levels are increasing will be controlled by the incoming master, and those channels whose light levels are decreasing will be controlled by the outgoing master, while channels at the same level in each playback will remain at that level throughout the movement.

7.4. Sequence-Playback Master Operated Automatic Sequenced Reading

The sequence move facility considerably eases operation of the MSR during a performance. Sequence move is obtained by pushing the latching Sequence Push Indicator (32) down so that it becomes lit in yellow.

In Sequence move, at the completion of any single (7.2) or Double(7.3) master fader crossfade, the Keyboard Display (25) is automatically advanced by one and the playback, which is, at that point, mastered out, has its Read Push automatically activated with the result described in Section 6.1.

7.5. Motorised C Master Fader

The C Fader (34) is motorised and controlled by two stop/go pushes corresponding to a fast fader travel range (10) and a slow fader travel range (9).

Both ranges are set by a rotary fader (17) which varies the time for total travel of the C fader in one direction from 1 second to 60 seconds in the fast range and from 1 minute to 60 minutes on the slow range.

Whenever the C fader reaches an extreme of its travel the master stops. Pushing either push (10) or (9) causes the motor to drive the C fader towards the opposite extreme at the speed set by the rotary fader (17). Pushing either push (10) or (9) while the fader is being driven causes the motor to stop. Pushing either push again causes the fader to move in the direction it was moving prior to being stopped. The direction of drive only reverses when the C fader reaches the extreme of its travel.

8. PLAYBACK MODIFICATION AND CONTENT DISPLAY (see figures 3 and 4)

The two playbacks act like presets of manual faders that are automatically set by reading (see Section 6).

However, there are no actual faders to give indication; so the indication of which channels are active in playback is provided by the white light in the manual faders.

Similarly the manual fader scale microswitch is used to deselect this white indication.

As there is no fader level controlling the playback levels, modifying the playback levels is accomplished by using the manual fader.

The playback level is metered and the manual level is matched to the playback level.

8.1. White Display

The white light in the channel fader scale lights whenever the playback(s) contain non-zero level information.

The Content Switch (37) is used to control the white display.

The Content Switch has 3 positions: left, centre and right.

In the left position, the white display is limited to the C playback.

In the centre position, the display is a combination of C and D playback displays.

In the right position, the white display is limited to the D playback.

8.2. Metering

On pressing the channel scale microswitch (43) the meter (8) shows the level of the channel.

The actual level shown is the recordable level (see Section 5.3). This level is, in general, the manual output (see Section 2) and the playback output (see Section 7) combined on the 'higher level takes precedence' basis.

However the level is modified during flash operations (see Section 3.3.1.) but is not modified by FOH or DBO (see Section 3) and contains no playback contribution in Blind Mode (see 5.4).

8.3. Playback Modification

This is done by a process of metering, matching and individually removing level information from the playback. This last action is achieved by using the Individual Wipe Push (40) in conjunction with the channel scale microswitch (43).

Complete playbacks can be deleted using the All Wipe Pushes (38) and (39).

8.3.1. Individual Wipe

This Push (40) is used to delete channel level information from a playback. The action of the push is modified by the Content Switch (37) described in Section 8.1. The Push affects the channel with its channel scale microswitch (43) pressed.

With the Content Switch to the left, a C playback level will be deleted. With the Content Switch in the centre, the level in each playback will be deleted. With the Content Switch to the right, a D playback level will be deleted.

8.3.2. All Wipe

Two pushes for clearing all levels in a playback are provided, one for wiping C playback (38) and one for wiping D playback (39). Note that the only way to put information into a playback is by reading (see Section 6) and that wipe pushes are not blackout controls with reversible action.

8.3.3. Playback Modification Procedure

- (i) If only one playback is active, switch the content switch (37) to display this playback.
- (ii) Hold down the channel scale microswitch (43) until step (v) is complete.
- (iii) Check the channel fader lever (45) is out and the channel is grouped (47) to a manual master, (16) or

(14), that is at full, and then press Individual Red On (18).

- (iv) Looking at the meter (8) raise the channel fader lever (45) until its position matches the meter - i.e. the metered level just begins to increase.
- (v) Press Individual Wipe (4).
- (vi) The channel is now under direct manual control.

SYSTEM TYPE	CONTROL ROOM	RACKS ROOM
A 120 WAY MAX WITHOUT TAPE SHORT RACKS	S 120 WAY DESK WITH MASTER PANEL	4 120 WAY DATA RACK 4 PDU AND MEMORY RACK
B 120 WAY MAX WITH TAPE SHORT RACKS	S AS A	4 120 WAY DATA RACK 4 PDU AND MEMORY RACK 4 TAPE RACK
C 120 WAY MAX WITH TAPE TALL RACKS	S AS A	5 PDU AND 120 WAY DATA RACK 5 MEMORY AND TAPE RACK
D 180 WAY MAX WITHOUT TAPE SHORT RACKS	L 180 WAY DESK WITH MASTER PANEL	4 120 WAY DATA RACK 4 PDU 60WAY DATA AND MEMORY RACK
E 180 WAY MAX WITH TAPE SHORT RACKS	L AS D	4 120 WAY DATA RACK 4 PDU 60WAY DATA AND MEMORY RACK 4 TAPE RACK
F 240 WAY MAX WITHOUT TAPE SHORT RACKS	D MASTER PANEL AND PLOT SPACE	4 120 WAY DATA RACK 4 120 WAY DATA RACK 4 PDU AND MEMORY RACK
	W 240 WAY WING OF LEVERS	
	3 MASTER POWER UNITS RACK	
G 240 WAY MAX WITH TAPE SHORT RACKS	D AS F	4 120 WAY DATA RACK 4 120 WAY DATA RACK 4 PDU AND MEMORY RACK 4 TAPE RACK
	W AS F	
	3 AS F	
H 240 WAY MAX WITH TAPE TALL RACKS	D AS F	5 PDU AND 120 WAY DATA RACK 5 120 WAY DATA RACK 5 MEMORY AND TAPE RACK
	W AS F	
	3 AS F	

MSR STANDARD CONFIGURATIONS.
 THE SYMBOLS SHOULD BE READ AS FOLLOWS:-

IDENTIFICATION OF ENCLOSURE TYPE DETAILED DIMENSIONS ARE ON FIG.2.

SHORT IDENTIFICATION OF WHAT IS IN THE ENCLOSURE

N.B. PDU MEANS POWER DISTRIBUTION UNIT

FIG.1. M.S.R. SPEC.1.

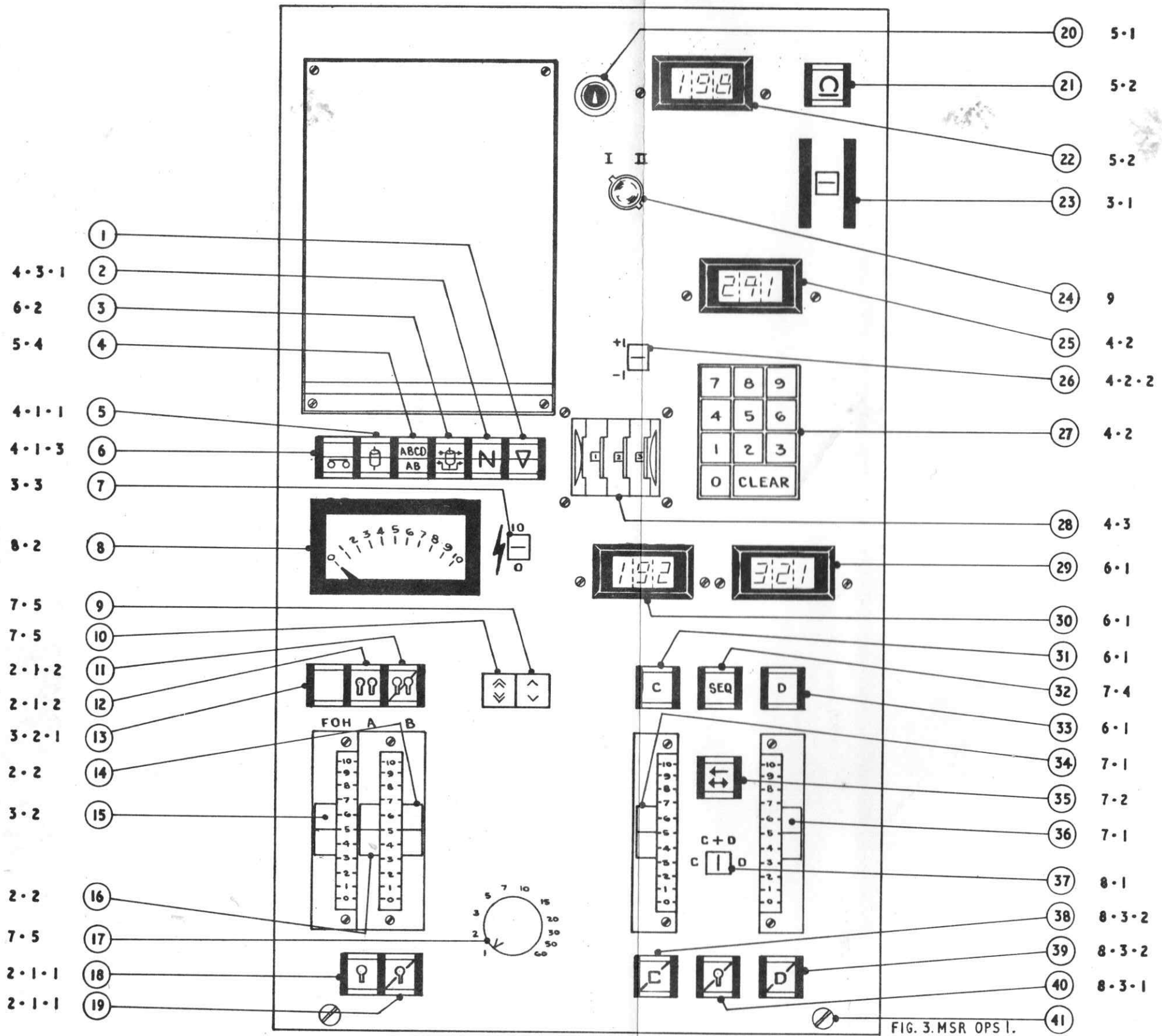
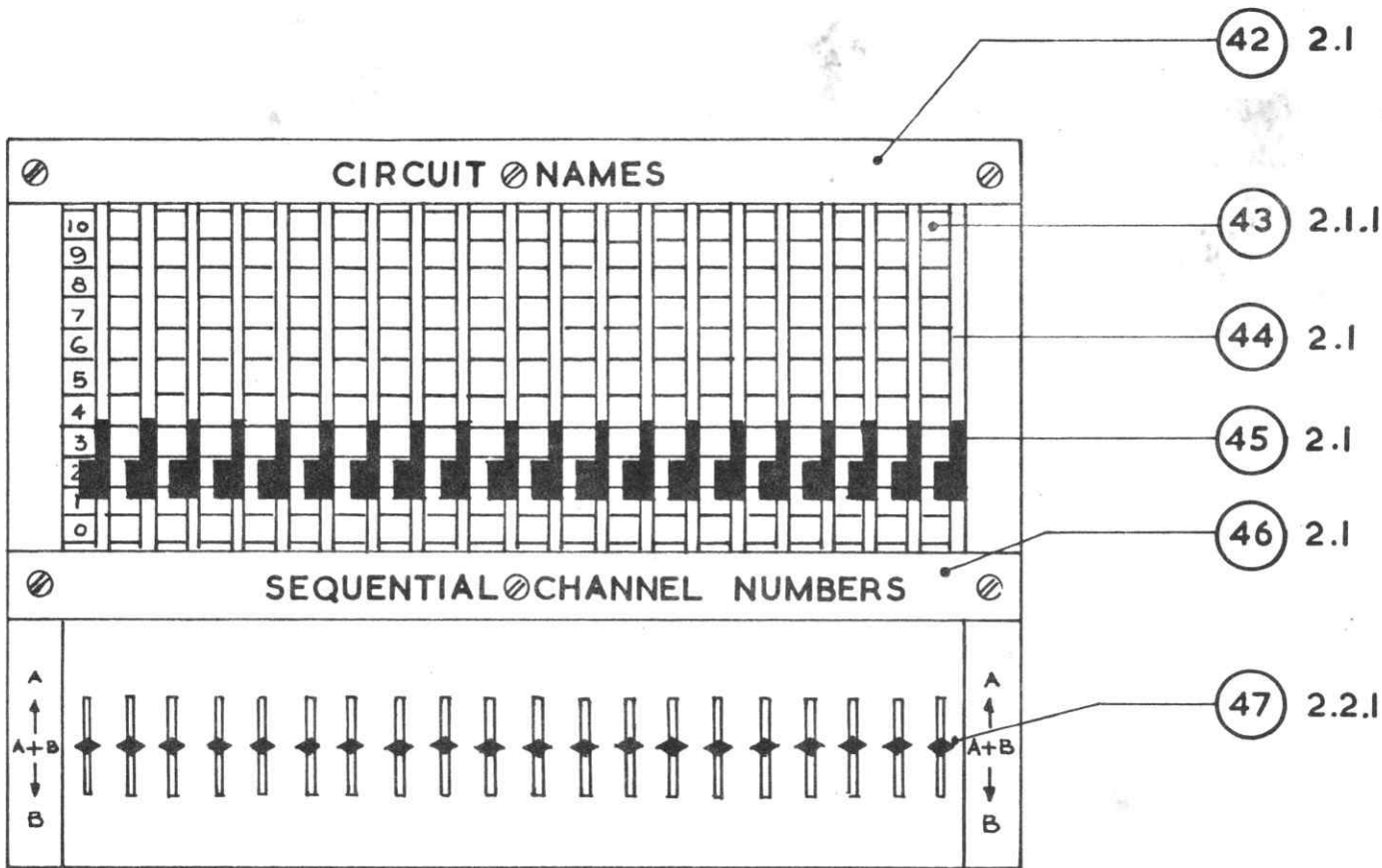


FIG. 3. MSR OPS I.



MSR OPS

FIG. 4.



GENERAL INFORMATION

OAC/G

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REGIONAL OFFICES &
ASSOCIATE COMPANIES

HEAD OFFICE, SOUTHERN REGION & MAINTENANCE DEPT:

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Brentford, Middx., TW8 9HR.
Tel: 01-568-9222 Telex: 24408 Cables: Rankaudio Brentford

NORTHERN REGION:

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Nr. Warrington, Lancs., WA3 2PN
Tel: Ashton-in-Makerfield (0942-) 73811

SCOTLAND:

104 Hydepark Street, Glasgow, G3 8DN.
Tel: 041-248-5735

ASSOCIATE COMPANIES:

Asia:

Rank Strand Asia Ltd.,
1618 Star House, 3 Salisbury Road,
Tsim Sha Tsui, Kowloon, Hong Kong.
Tel: K-677589
Telex: HX 4953 Ranksa Cables: Spotlite Hong Kong

Australia:

Strand Electric (Australia) Pty. Ltd.,
19 Trent Street, Burwood, Victoria, 3125
Tel: 29-3724 Cables: Spotlite Melbourne

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Telex: 06 22204 Cables: Spotlite Toronto

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