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DUET

CONSOLE

USER'S HANDBOOK

TECHNICAL INFORMATION

DUET

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USER'S HANDBOOK

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A DIVISION OF RANK AUDIO VISUAL LIMITED

User's
Handbook

ISSUE 1

DUET Console
User's Handbook

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1. INTRODUCTION

The DUET Memory lighting control system is a small control offering sophisticated lighting facilities to users from 48 to 120 channels with a range of options to enable both budget and needs to be matched. Both the main console and the options are available packaged for installation by the local supplier or the user if competent. It is the function of this handbook to provide sufficient information to allow an experienced electrician to install and commission the main DUET console, and to service the unit by exchange of sub-assemblies (first line maintenance).

A companion handbook, the DUET Operators Handbook provides a description of all the controls and preferred methods of operation. Each option has a DUET Option Users Manual providing details of its installation, operation and general maintenance. For users prepared and equiped to undertake full servicing themselves, a full DUET Maintenance Handbook is available, covering the console and all options as they are introduced.

Training courses are also offered in the operation, first line maintenance and the full maintenance of the DUET console and its' options.

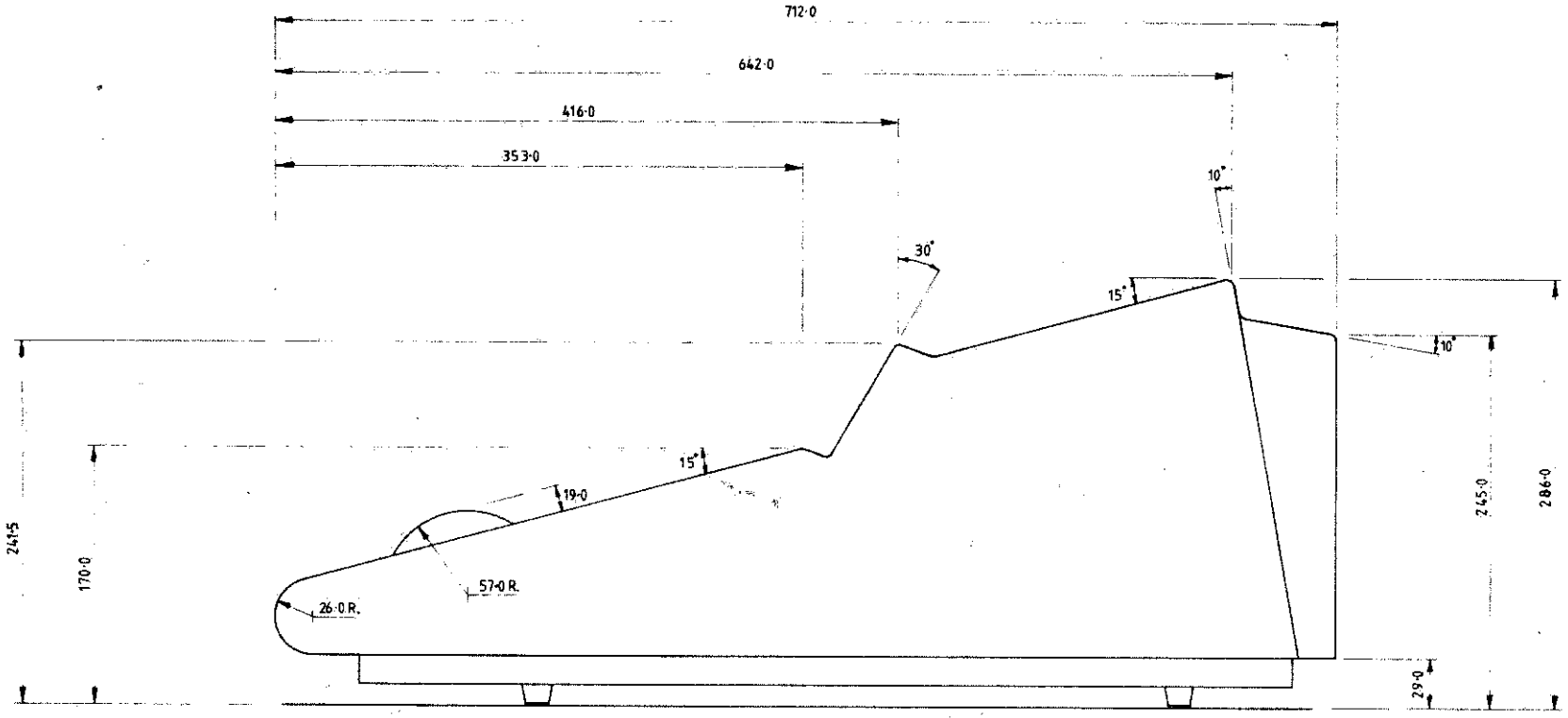
2. TECHNICAL SPECIFICATION

The DUET console and many of its' options are controlled by a microprocessor (a small computer) which executes a program defining the functions and facilities performed. This program, defining operations, commences by scanning the operator controls. Then if any have been operated, the program translates them into the requisite actions on channels or memories held stored. Following this, a channel by channel update of all the channel outputs is performed to maintain them at their current stored levels, the VDU screen data is updated, and the cycle repeats.

The channel outputs are normally 0V to -10V as described below, but may be varied to suit other dimmers in some cases.

Detail Technical Specification

Power Input :	110-120V or 220-240V, 47-63Hz, 300VA Max. Single Phase.
Dimmer Output :	0V (No light) to -10V (Full Light) via 10K Resistor + Silicon Diode. Connection via RTG18/26 (per 24 ways) to Din 41618.
VDU Mimic Output :	1V positive composite video 312/262 line 50/60Hz, Field. Connection via 75 OHM BNC. socket.
Enviroment :	Operation 0°C to +35°C, 10%-90% maximum relative humildity. (non-condensing). Storage -25°C to +50°C, 10%-90% relative humidity. "Office" level cleanliness.
Processor :	6800 microprocessor, (8 bit data, 16 bit address).
System Cycle Time :	Less than 35 ms.
Fade Processing Accuracy :	8 bit (256 step).
Recording Accuracy :	6 bit (64 step). (8 bit to special order).
Memory :	CMOS semi-conductor, battery maintained for minimum of 1 month. Maximum recharge time 12 hours Maximum number of memories 199.
Size :	280 x 560 x 710 mm (H x W x D).
Weight :	19Kg.
Cooling :	Natural convection.



OVERALL WIDTH = 560·0

3.2.2 DUET Programming Switch

Located inside the console behind the front panel is a small 8 way programming switch (SW2) providing selection of the number of channels, highest or latest-takes-precedence on + memory, and the facility of either THRU or SET LEVEL. Again, normally this switch would be set by the supplier before delivery, but these are variables which the user may wish to change with experience or time. In this case section 5.3.2 gives details of how to obtain access to the console and section 5.7.1 describes the switch settings.

3.3 Mains Power Connections

Each unit in the DUET system is separately mains powered and is supplied with a 3m length of 1.25 mm^2 3 core cable. The connection and distribution of power to the units is left for the user or local supplier to provide, in accordance with local regulations.

Each unit may be fed from a common distribution point or from separately fused outlets. In either case the maximum fuse rating that may be used is 13A, to protect each unit's supply cable. The correct fuse or circuit breaker to protect each unit is fitted at the rear of each unit.

The mains cable is colour coded thus :

BROWN	= Phase (or live)
BLUE	= Neutral
GREEN/YELLOW	= Earth

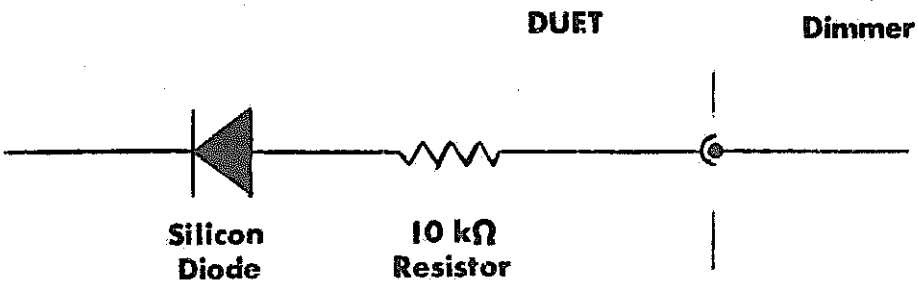
It is imperative for safety and correct operation that a continuous and adequate earth is provided for each unit.

3.4 Dimmer Connections

The DUET system can drive up to 120 channels maximum. These are available as voltage outputs to the dimmers on up to 5x26-pin connectors on the rear of the DUET Console, each connector carrying 24 channels and 2 common connections.

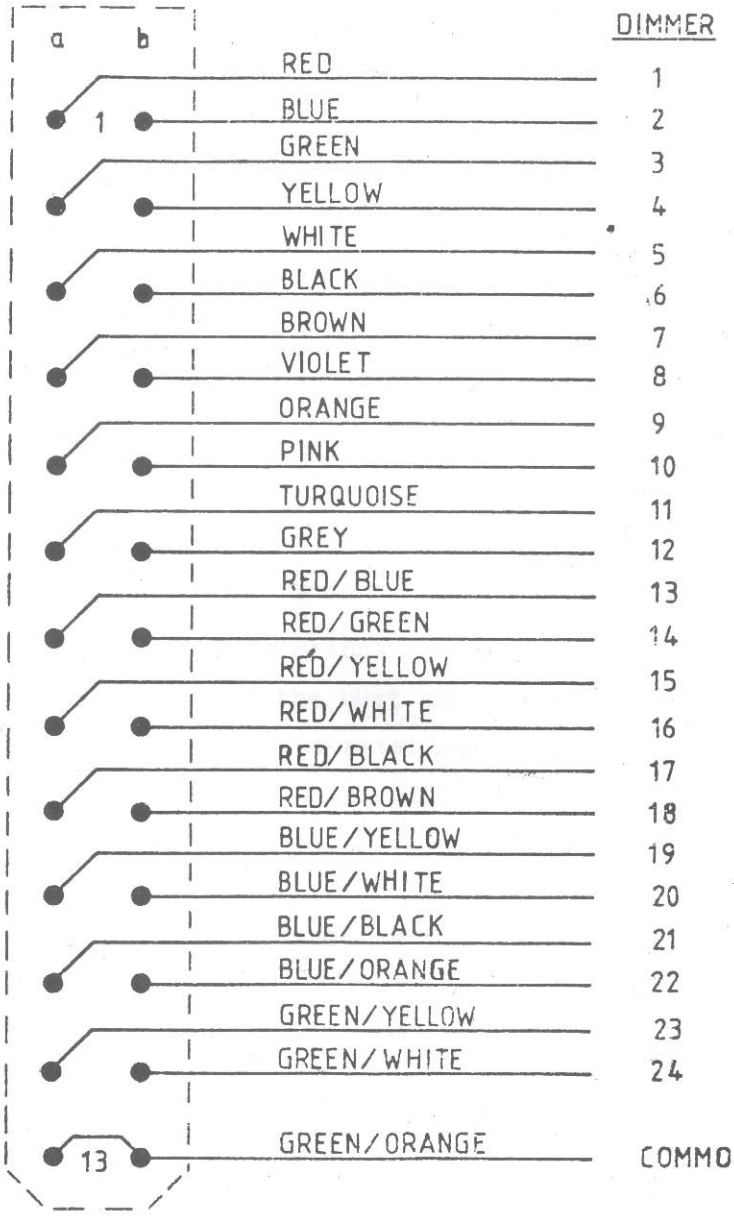
The connector is an ITT Cannon RTG18/26 way connector conforming to Din 41618. A mating connector is supplied pre-wired with 3m of 25-conductor cable to assist in the connection of the dimmers. The connections, conductor colours and channel numbers are shown in section 3.4.1.

The control signal voltage normally output to the dimmers is 0V = NO LIGHT to -10V = FULL LIGHT, via a 10K resistor and a silicon diode. This is the standard Rank Strand Electric convention. If required, other voltage conventions may be supplied to special order.



It should be noted that the 10K resistor will cause some reduction in the maximum voltage seen on the DUET output down to -7 or -8V when loaded by a dimmer. This variation is compensated for in the adjustment of the dimmer.

3.4.1 Dimmer Output Wiring



The five connectors carry channels 1-24, 25-48, 49-72, 73-96 and 97-120 as annotated on their panels, and their connections all progress as per that for 1-24.

3.4.2 Dimmer Connections with Pin Matrix or Faders

Both the Pin Matrix and 2 preset Fader Wing connect to the dimmer by chaining into the DUET console connections. Thus to install, simply disconnect the dimmer cables from the DUET console and plug into the matching connectors on the base of the Pin Matrix or Fader Wing, then plug the trailing dimmer link cables from the Pin Matrix or Fader Wing into the dimmer connectors on the DUET console.

The DUET dimmer control signals are combined for each channel with the dimmer control signals in the Pin Matrix or Fader Wing wiring, thus providing complete independence of the two controls, ensuring that the Pin Matrix or Fader Wing can act as a back-up control system in case of DUET console failure.

3.5 VDU Connections

The VDU is driven by a standard video signal emanating from the BNC socket on the rear of the DUET console marked 'VDU'. This should be connected by the short co-axial cable supplied with the VDU to the BNC socket on the rear of the VDU, and the adjacent slide switch set to 75R.

If a non-standard VDU is to be used with the DUET system it should be compatible with the following :

SIGNAL :	1V, 75 OHM
	POSITIVE WHITE
	COMPOSITE SYNC
	312/262 LINE (SWITCHABLE IN DUET)
	50/60Hz FRAME (SWITCHABLE IN DUET)
	NON - INTERLACE
CONNECTOR :	BNC 75 OHM

4. TESTING

4.1 Console Controls and VDU

Initially check that all push buttons operate freely and that all faders move smoothly and without interference. Next check that all connections have been correctly made in the system; then apply power.

The console should reset to a start condition specified in the Operators Handbook Sect. 3.2. Testing is now a simple task of checking that each push, fader, wheel and switch operates and provides the functions as described in the relevant sections of the Operators Handbook. The connection of a few working dimmers and visible luminaires will aid the rapid testing of the console.

A test should be made to check memory retention. Record different, identifiable patterns in 10 memories randomly spread over the full memory range. Turn the system off and leave overnight, or at least for 10 minutes, then turn on and check the memories can be played back correctly.

The VDU should be checked to ensure that a stable clear picture is presented, and that channel level data and control panel data, is correctly displayed as described in the Operators Handbook.

4.2 Dimmer Testing

Ensure that the control signal connections to all the dimmers are correctly made, as described in Sect. 3.4, that each dimmer has a visible luminaire safely connected to its' load output and that an adequate mains power feed is being provided to the dimmers. Then check that with all channels set to zero, no light is showing. Next raise each channel to full in turn, check that full light output occurs for the correct dimmer/luminaire and no other, then reset to zero.

If the dimmers have not previously been adjusted to suit the DUET system, then it may be necessary to adjust each dimmer as it is tested. Always follow the adjustment instructions for the particular dimmer in use and pay particular attention to personal safety when measuring high voltage.

The above dimmer tests should be repeated for any Pin Matrix or Fader Wing installed with the DUET system.

5. MAINTENANCE

5.1 Routine Maintenance

The routine maintenance of a DUET system is minimal, as the system is self-contained and has little need of adjustment. However, the following actions are recommended to obtain optimum service from the DUET.

Every week : Clean all the DUET units and control room or surrounding area, preferably using a vacuum cleaner. Be especially careful to avoid cleansing agents (e.g. foams) obtaining ingress to the faders and other controls.

Every 3 months : Carry out a complete test of all the DUET controls, memory retention and dimmers as outlined in Sections 4.1, 4.2. Ensure any faults so discovered are corrected as soon as possible.

Every year : Arrange for an authorised Rank Strand Service Agent to remove the DUET console cover then test and adjust if necessary the following :

i) Power supply voltages as per section 5.7.3

ii) Motherboard Panel Faders potentiometer as per section 5.7.2.1

iii) Motherboard Meter FSD potentiometer as per section 5.7.2.2.

If any spare printed circuit assemblies are kept, they should be exchanged with their counterparts in use and tested by testing the system.

Every 2 years : Arrange for an authorised Rank Strand Service Agent to test and replace as required the batteries used on the Memory printed circuit cards.

5.2 Fault Diagnosis

The DUET console is a complex piece of electronic equipment and the user is strongly recommended NOT to obtain access or attempt any repair without first obtaining the advice of their local authorised service agent. In most cases the assistance of the service agent will be necessary to carry out repairs and supply any spare sub-assemblies needed.

Before contacting the service agent however, perform a thorough test and examination of the system to ascertain all aspects of the faulty operation so as to aid the agent's diagnosis.

WARNINGS

i) IN ALL UNITS OF THE DUET SYSTEM THERE ARE HAZARDOUS VOLTAGES PRESENT WHEN OPERATING. ONLY QUALIFIED ELECTRICIANS SHOULD ATTEMPT ANY FORM OF REPAIR WHEN THE MAINS POWER IS APPLIED.

ii) DO NOT ATTEMPT ANY FORM OF DISASSEMBLY OR REPAIR UNLESS YOU ARE CONFIDENT IN YOUR KNOWLEDGE OF WHAT YOU ARE DOING AND HAVE READ THE RELEVANT SECTIONS OF THIS HANDBOOK.

iii) DO NOT UNDER ANY CIRCUMSTANCES, UNPLUG OR PLUG ANY COMPONENT, SUB-ASSEMBLY OR PRINTED CIRCUIT BOARD WHEN POWER IS APPLIED.

5.2.1 Trouble-Shooting

To aid the user in diagnosing basic problems, the following trouble-shooting hints are provided.

* means consult your local Service Agent

	SYMPTOM	POSSIBLE FAULTS	ACTION
i)	Total inactivity of the DUET console.	Failure of the mains supply.	Restore.
		Failure of the DUET power supply.	Check Circuit Breaker and rear indicator. Check internal power supply fuse. *Replace power supply sub-assembly.
ii)	DUET console apparently operating but not driving lights.	Failure of mains supply to the dimmers.	Restore.
		Mis-operation or failure of fader or B.O. switch.	*Check and replace as reqd.
iii)	Isolated failure of one or a small group of dimmers to function.	Failure of dimmers, fuses, lamps or connections if Pin Matrix or other auxiliary system also fails to work.	Investigate and repair or replace.
		Red pin in Pin Matrix.	Remove.
		Failure of channel output PCB if auxiliary system does work	*Replace

iv)	Mal-operation of an isolated push, switch, lamp, indicator, fader or wheel.	Failure of that component.	Replace lamp or fader from spares kit. *Replace push, switch, or wheel assembly.
v)	Irrational, random or inert operation of all the DUET console controls.	Failure of any of the microprocessor related PCB's.	*Obtain advice from your local Service Agent.
vi)	Failure of one or a a group of memories to record and play-back correctly, or to be retained during power removal.	Failure of one of the memory PCB's.	*Replace.

5.3 Console Dis-assembly and Re-assembly

All references to front and rear of the system or its' sub-assemblies apply to their position in relation to the operator when the system is fully assembled.

In order to carry out any maintenance on the DUET, it is necessary to remove the top cover to gain access to the PCB's and sub-assemblies located in both base and cover. Instructions for this will be found in section 5.3.2. The location and identification of printed circuit boards in the desk is covered in section 5.5 and replacement of cards and sub-assemblies is described in detail in section 5.6.

TAKE NOTE OF CARD HANDLING PRECAUTIONS DESCRIBED

IN SECTION 5.4.

It is recommended that the following notes are read in full before commencing work on a DUET.

5.3.1 Case Construction

The base of the DUET desk is a metal chassis plate onto which are mounted the processor motherboard, power supply and card frame. The desk top of DMC material is secured to the base by screws around the edge of the base. The desk carries some sub-assemblies which interconnect with the processor motherboard via ribbon cabling.

5.3.2 Case Top Removal

Note that operation will require a clear working area in excess of twice the base area of the DUET desk. Two persons ease the task of lifting the desk.

Disconnect all peripheral units and dimmer lines from the DUET and clear the working area.

DISCONNECT THE MAINS POWER CORD FROM THE SOURCE OF SUPPLY.

Place a piece of foam or other protective material, equal in area to the DUET, beside the desk. With one person at the front and one at the rear of the desk, turn the desk over onto the protective materialto expose the underside of the base plate. Remove the twelve case securing screws which are located at intervals around the edge of the base section.

Having removed the screws, turn the DUET back the right way up, holding the case top securely to the base while doing so.

Position the DUET in the working area to provide a clear space to the left of the desk as this is the direction in which the case top will be removed. Place protective material on this area.

Depress the two side catches on the case (if fitted) then lift the front of the case top slightly and move the whole top rearwards by about 3 cms to clear the rear panel connectors.

The top can then be lifted clear of the base unit. Take note of the ribbon cables. Place the desk top on its' side to the left of the base unit. Do not attempt to turn the case top completely over until the interconnecting cables have been removed - see section 5.3.3. Note that access to the base unit will not require complete removal of the case top.

5.3.3 Signal Interconnections

The processor motherboard is linked to certain sections of the desk by means of ribbon cables. These must be disconnected to enable the desk top to be completely separated. Disconnect by pulling vertically on the cable close to the connector. The front panel PCB supporting plate is also linked to the power supply chassis by an earthing strap. This is removed by unplugging the blade connector at the PSU end of the wire, by pulling the housing of the connector only, not the wire.

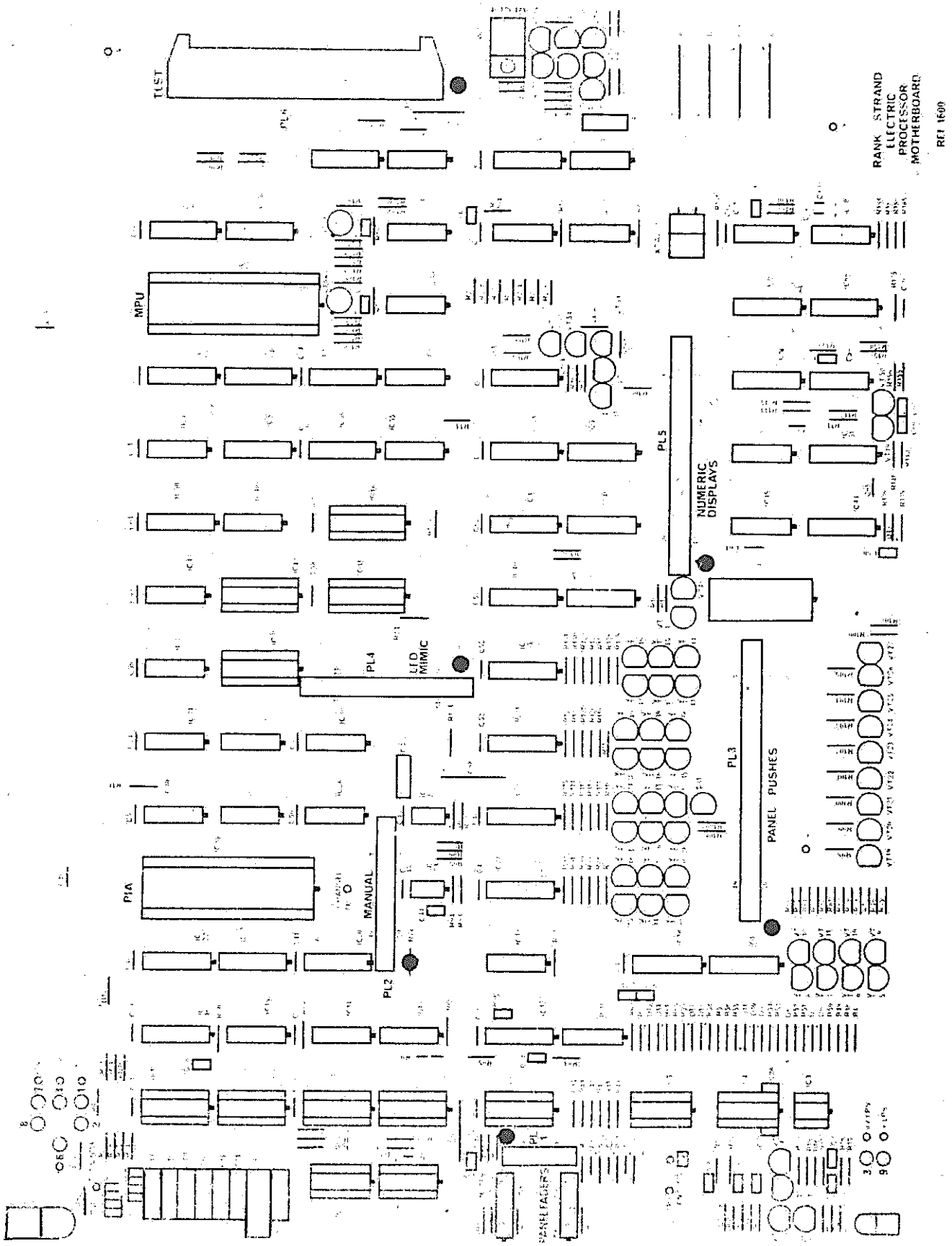
5.3.3.1 Processor Motherboard Plugs

The function of each plug will be found listed in the table below. Note that each of the plugs 1-5 has a different number of contacts and cannot, therefore, be confused when re-assembling. Additionally, each of the plugs is keyed as shown in the table. The cables are each marked with a red line at one side - this goes to the end of the plug shown (●) on drawing 5.3.3.2.

PLUG	FUNCTIONS	NO OF WAYS	KEY	SOURCE
PL1	Panel Faders	10	8	Front Panel PCB
PL2	Manual Input	20	18	Fader Desk
PL3	Contacts/Mimics	50	24	Front Panel PCB
PL4	LED Channel Mimic	26	18	Mimic
PL5	Displays	40	10	Front Panel PCB
PL6	Test	50	42	External Test Equipment

The locations of plugs PL1-PL6 on the processor motherboard are shown on drawing 5.3.3.2.

5.3.3.2 Processor Motherboard Plugs



5.3.4 PCB and Sub-assembly Location

5.3.4.1 Power Supply Unit

The power supply is located at the rear left hand side of the base. It is secured by four screws - two on each side of the chassis. Electrical connection is by means of a nine way Molex plug/socket on the front of the chassis. For detailed replacement instructions - see section 5.6.3.1.

5.3.4.2 Card Frame

The card frame provides a rigid mounting for the PCBs which plug into the twleve edge connectors at the rear of the processor motherboard. These cards must all be removed before taking off the card frame. Rear panels with their associated cables may be left in position but a careful note must be taken of the correct connection. See section 5.3.5.

TAKE NOTE OF CARD HANDLING PRECAUTIONS DESCRIBED SECTION 5.4.

The card frame is secured to the motherboard by four screws and nuts and to the baseplate by four screws which pass through clearance holes in the motherboard. The latter are the two outer screws on each side. When they have been taken out, together with the two front screws and the centre barb clips released, the motherboard and card frame can be removed as a complete unit for bench servicing.

For motherboard replacement, separate the card frame after removal from the base plate.

Note that the cable to the 'Manual input' socket is plugged directly into PL2 of the processor motherboard and must be removed before the card frame can be taken out of the desk.

5.3.4.3 Processor Motherboard

Before the card frame can be removed, the processor motherboard must be released from the base plate. This is secured by six screws and two nylock connectors. The latter support the centre section of the card. Separate the card cage after removal of the motherboard.

If the motherboard is to be removed leaving the power supply on the base, care must be taken to disconnect the low voltage feed to the motherboard at the front of the power supply chassis.

5.3.4.4 Front Panel PCB

To obtain access to front panel displays and lamps, the front panel PCB assembly must be taken out of the case top. Before this can be carried out, the LED mimic panel, if fitted, must be removed - see section 5.6.3.3. Before the front panel assembly can be released from the desk top, the knobs must be pulled off the four faders and the key taken out of the record lock switch.

The assembly is secured by nine screws spaced around the edges of the metal support panel. After their removal, the assembly can be lifted free.

5.3.4.5 Alignment

There is a small amount of lateral adjustment in the front panel fixings. When refitting, check that all the controls operate freely before tightening the fixing screws.

5.3.5 Peripheral Connections

All connection to peripheral units of DUET are by plug and socket on the card frame rear panels. The rear panels for each option are only fitted if the option is supplied, with the exception of the VDU/Manual panel which is always fitted.

The recommended rear panel layout and their connectors are listed for each option in table 5.3.5.1.

When options and channel outputs are not supplied, blank panels are fitted in place of the connector section.

5.3.5.1 Rear Panel Layout

PANEL	OPTIONS	CONNECTOR	CARD
1	Riggers	6W Hypertak	1605/R
2	Submasters	39W RTG	1636
3	Print-out	10W RTG	1605/P
4	Floppy Disc	10W RTG	1605/F
5	VDU/Manual	BNC/20W RTG	1604
6/7	Channels 1-48	2 x 26W RTG	1603
8/9	Channels 49-96	2 x 26W RTG	1603
10	Channels 97-120	26W RTG	1603

5.3.6 Re-assembly

In general, the re-assembly of the DUET is always the reverse of the strip down procedure. Particular points which should be noted are as follows :

Cleanliness :

On no account must any loose parts, screws etc. be left inside the DUET.

Fixings :

All fixing screws and fasteners must be tightened and checked as secure before the desk is closed.

Interconnections :

Before final closure of the desk, check that all the cards and plugs are securely in place. Ribbon cables must be checked to avoid snagging or pinching.

The front panel mains earth strap must be replugged onto the power supply chassis.

5.4 Printed Circuit Board Handling and Maintenance Precautions

5.4.1 Construction

All the printed circuit boards - PCBs - used in DUET are constructed on glass fibre reinforced plastic board which is copper clad on both sides. Interconnection between tracks on each side is by means of electro-chemically deposited through-hole plating in predrilled holes. Edge connections are gold plated to ensure reliable contact.

5.4.2 Components

The DUET circuits utilise both TTL, MOS and CMOS integrated circuit devices. The microprocessor and its' peripheral interfacing devices are the Motorola M6800 range. All of the CMOS device fitted cards require special handling precautions due to the static-sensitive nature of these components.

5.4.2.1 Static Electricity Hazards

CMOS devices are susceptible to damage from static electricity. Static is always present in any enviroment to a greater or lesser extent depending on such factors as humidity and surrounding materials. If a static discharge happens to go through a CMOS integrated circuit device, the resulting damage can range from complete destruction to latent degradation that leads to reduced component life and premature failure.

All the DUET circuit cards have been designed to minimise the risks of static discharge but it is, nonetheless, very important that the card handling precautions in section 5.4.3. are observed without exception.

5.4.3 CMOS Device Handling Precautions

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 artificial fibre carpeted control rooms, the use of an anti-static carpet treatment is recommended.

Handle cards only by the edges and do not touch the edge connections.

If spare cards are supplied in static shielding bags, retain the cards in this packing until required and return faulty cards in the same packing after replacement.

Some components are fitted to PCBs in DIL sockets. These must not, under any circumstances, be removed.

5.4.4 Self-Powered PCBs

The channel data memory of DUET is formed by CMOS Random Access Memory Devices (RAMs).

These retain data only while a continuous potential is applied. To achieve this when the system is turned off, rechargeable nickel cadium batteries are fitted to the Ref 1602 CMOS memory cards. These batteries retain sufficient charge for accurate retention of data for a period of one month. However, some charge will remain for periods well in excess of this time. The battery powering of the RAMs takes effect whether the cards are plugged into the DUET or not, thus the data will be retained for use in subsequent re-assembly providing there is no electrical disturbance of the cards.

ANY CMOS MEMORY CARD MUST BE REGARDED AS HAVING CHARGED BATTERIES AND BE TREATED ACCORDINGLY.

The Ref 1602 card is fitted with an insulating cover on the non-component side but the voltages concerned are still exposed around the components. The following must be observed.

5.4.4.1 Handling Precautions - CMOS Memory Cards

These cards must not be put down on any conducting surface excepting anti-static mats and static shielding bags.

NOTE : Due to the conductive nature of anti-static mats and bags, there may be some discharge of batteries when the card is in contact. This will not cause damage but full discharge will cause loss of data.

Jewellery such as rings, metal bracelets and metal watch straps can provide a conducting path if allowed to come in contact with the board and, therefore, should not be worn while handling the equipment.

Normal anti-static precautions must be observed.

5.4.5 Ultra-violet Light

It is possible to erase the programmed data in PROM Memory devices, which are used on many cards in the DUET, by exposing them to ultra-violet light. The cards should, therefore, be kept well away from sources of ultra-violet light, radiation or strong sunlight.

5.5 PCB Identification and Location

The DUET Memory lighting control system has been designed minimising the number of interconnections, individual sub-assemblies and cards. This is achieved by means of a main motherboard which is mounted flat in the desk base, into which the remaining cards and options plug directly.

5.5.1 Options

System options are added in the form of a single PCB fitted within the DUET mainframe and linked via a back panel connector and cabling to the external hardware.

Each option is fitted with the necessary hardware and software required for the option.

System size (Number of channels) and some operational options are switched on the front panel PCB.

For setting refer to section 5.7.1.

5.5.2 Card Referencing

In line with other RSE memory systems, all PCBs used in the DUET have been allocated 4 figure reference numbers, of which the first two digits - 16 - designate DUET. Additionally, each card is named, describing its' functions, and has a three figure PCB number which is suffixed with an issue number above the first or zero issue.

The cards are listed by reference number in table 5.5.2.1.

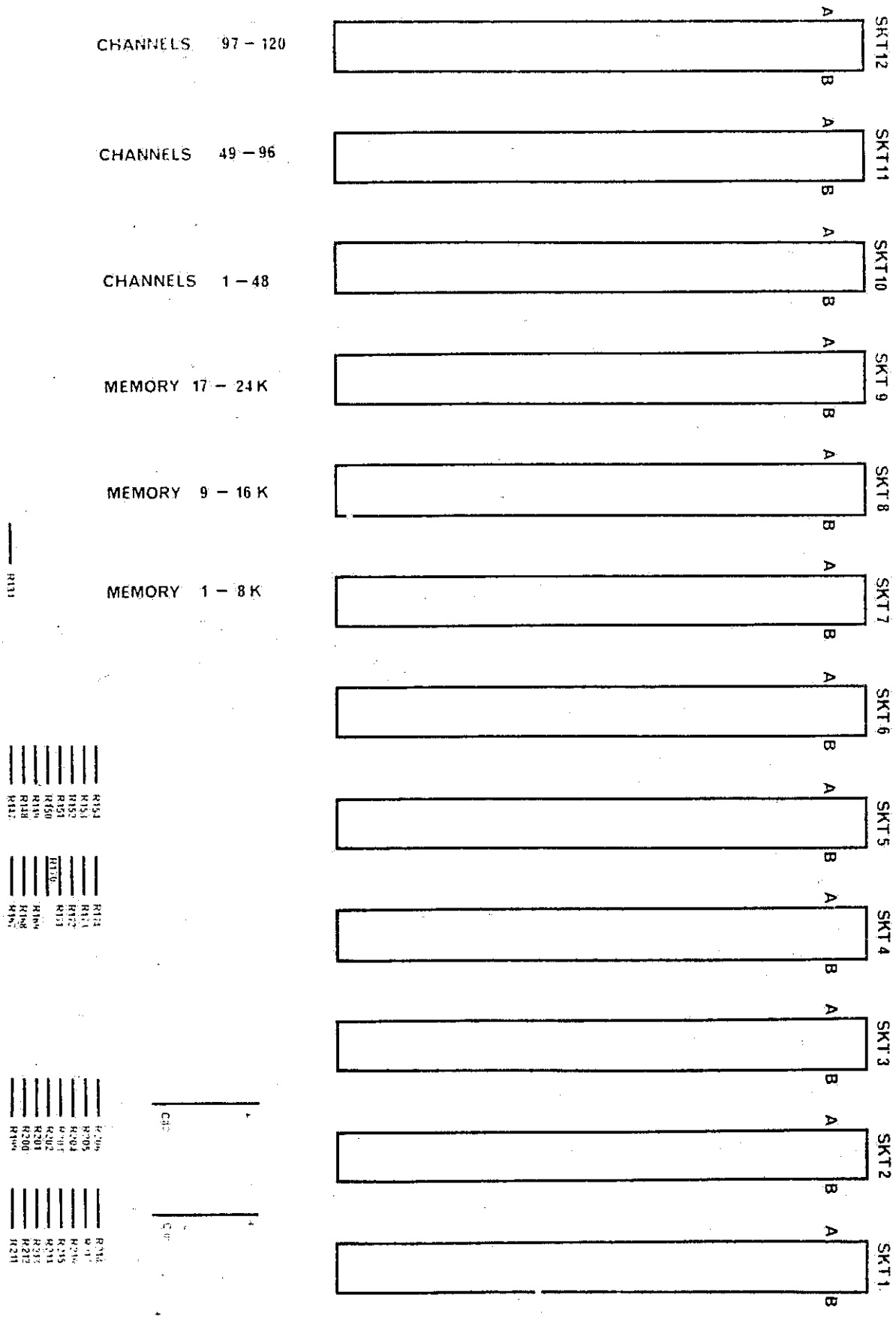
5.5.2.1 Card Reference Table

REF	PCB NO.	DESCRIPTION
1600	574	Processor Motherboard
1601	575	8K PROM Card
1602-4	576	4K8 CMOS Memory Card
1602-8	576	8K8 CMOS Memory Card
1603	577	48 Way Channel O/P Card
1604	578	2K Interface Card
1605/F	580	Serial Link Card (Floppy Disc)
1605/R	580	Serial Link Card (Riggers)
1605/P	580	Serial Link Card (Printout)
1606	581	Front Panel PCB
1607	582	60 Way LED Mimic Board
1608	583	Lamp Regulator
1609	586	Channel/Memory Display
1610	587	Numeric Time Display
1611	588	LED Display
1615	595	120 Way LED Mimic Board
1636	688	Submaster Interface

5.5.3 Processor Motherboard Ref 1600

The main PCB in the base of the DUET desk is the processor motherboard. This card contains the micro-processor, fade processor and contacts/mimics sections. Direct connection is made from this card to the remaining sub-assemblies and PCBs. Sub-assemblies are wired with 'tails' of ribbon multicore which plug into the motherboard. PCBs are housed in a card frame at the rear of the desk where they plug into 12 edge connectors fitted to the processor motherboard. Sockets 1-6 are undedicated card locations (see section 5.5.4), sockets 7-12 are dedicated (see section 5.5.5). The edge connectors are shown on drawing 5.5.3.1.

5.5.3.1 Processor Motherboard Edge Connector Locations



5.5.4 Undedicated Card Positions

Edge connectors 1-6 are positions which can be used for any of the options in addition to the main program card. Because of the bus signal structure used, any PCB in this section can be plugged in each of the six positions. However, the cards do have preferred assembly locations as listed in the table below.

EC POSN	FUNCTION	CARD	REFERENCE
2	Riggers Control	Serial Link Card	1605/R
3	Submasters	Interface Card	1636
4	Printout	Serial Link Card	1605/P
5	Floppy Disc	Serial Link Card	1605/F
6	VDU	2K VDU Interface	1604

Note that the Serial Link Cards for different options, while apparently identical, have links which determine the exact function of the card in conjunction with the program PROM fitted. These cards are not interchangeable between options without modification.

5.5.5 Dedicated Card Locations

Edge connector positions 7-12 are each dedicated to particular functions as listed in the table below.

EC POSN	FUNCTION	CARD	REFERENCE
7	1-8K Memory	8K8 CMOS Memory	1602
8	9-16K Memory	8K8 CMOS Memory	1602
9	17-24K Memory	8K8 CMOS Memory	1602
10	Channel O/P 1-48	48 Way Channel O/P	1603
11	Channel O/P 49-96	48 Way Channel O/P	1603
12	Channel O/P 97-120	48 Way Channel O/P	1603

The allocation of each card position is determined by the processor motherboard, therefore, each card of the two types is identical and can be plugged into any of the three allocated positions without modification.

The number of cards fitted in each case will be dependant on system configuration. See 5.5.7.2 for memory size.

5.5.6 LED Mimic

There are two different cards used depending on the maximum number of channels fitted - 60 or 120.

Both types mount in the same position in the desk top and connect by means of a 26-way ribbon cable to Plug 4 on the processor motherboard.

5.5.7 Front Panel PCB

To eliminate costly wiring and improve reliability, the front panel pushes of DUET are mounted directly onto a PCB which also carries a limited number of components. This PCB is mounted off a metal support panel to provide the necessary rigidity. Connection to the processor motherboard is by means of 2 ribbon cables which are listed in table 5.5.7.1. Faders and displays are mounted on the metal support panel and wired via the front panel PCB.

5.5.7.1 Processor Motherboard Plugs

PLUG	FUNCTION	NO OF WAYS	SOURCE
PL1	Panel Faders	10W	Front Panel PCB
PL2	Manual I/P	20W	Fader Desk
PL3	Contacts/Mimics	50W	Front Panel PCB
PL4	LED Mimic	26W	Mimic
PL5	Displays	40W	Front Panel PCB
PL6	MPU Test	50W	External Test Equipment

The locations of plugs 1-6 are shown on drawing 5.3.3.2.

5.5.7.2 Memory Capacity Options

The reference 1602 CMOS Memory cards come in two capacity options : 4K and 8K. They are allocated slots 7,8 and 9. Memory capacity can range from 4K to 24K in 4K increments. Wiring on the motherboard defines the order in which the three card positions are used by the microprocessor, therefore the optional capacity must be set up as follows :

CAPACITY	POSN 7	POSN 8	POSN 9
4K	4K	-	-
8K	8K	-	-
12K	8K	4K	-
16K	8K	8K	-
20K	8K	8K	4K
24K	8K	8K	8K

A 4K Memory card is identified by its label Ref 1602-4 and the 8K by Ref 1602-8. In addition the 4K card has integrated circuits plugged into sockets only in rows 0K, 1K, 2K and 3K, whereas the 8K has all 8 rows used.

Most DUET systems are provided with 6 bit memory (i.e. recording accuracy is 1 in 64 levels) and the cards for these systems have integrated circuits only in columns labelled BIT 7,6,5,4,3 and 2.

This capacity is automatically optimised by the DUET to provide the maximum number of memories for each system depending on the number of channels controlled. This is given by the table below :

MEMORY	NUMBER OF CHANNELS					
CAPACITY	36	48	60	84	96	120
4K	102	78	64	46	40	33
8K	204	157	128	93	81	66
12K	-	199	192	139	122	99
16K	-	-	199	186	163	132
20K	-	-	-	199	199	165
24K	-	-	-	-	-	198

5.6 Subassembly and Spares Replacement

Certain DUET parts in addition to PCBs are available as unit spare assemblies for replacement by trained operators. These spares are limited to parts which involve only plug in connections and screwdriver or similar mounting.

Additionally, push indicator lamps and power supply fuses are available.

Spares are listed below. Fitting instructions are given in section 5.6.3.

5.6.1 Spare Assemblies

DESCRIPTION	REFERENCE	INSTRUCTIONS
DUET Power Supply Unit	MG 5-20	5.6.3.1.
Lamp Regulator	Ref 1607	5.6.3.2.
LED Mimic 60 way	Ref 1608	5.6.3.3.
LED Mimic 120 way	Ref 1615	5.6.3.3.
Channel Memory No Display)	Ref 1609	5.6.3.4.
Fade Progress Display)	Ref 1610	5.6.3.4.
LED Minute/Second Display	Ref 1611	5.6.3.5.
LED Alarm Display	Ref 1611	5.6.3.5.
Control Wheel Assembly		5.6.3.6.
Fader Assembly	P & G 910/D	5.6.3.7.
Meter		5.6.3.8.
Record Lock Switch		5.6.3.9.

5.6.2 Spare Components

DESCRIPTION	REFERENCE/STOCK NO.
Keyboard Lamp	T1 1/4 5V 60 mA
Power Supply Fuse	3.15A HRC 20mm

5.6.3 Spares Fitting Instructions

The following instructions for each item assume that the DUET has already been stripped down to the base section and the desk top including control panel and mimic (if fitted) - see section 5.3.2.

5.6.3.1 DUET Power Supply Unit

CHECK THAT THE MAINS POWER CORD IS FULLY DISCONNECTED FROM THE SOURCE OF SUPPLY.

Mains input voltage rating is determined by the type of power supply fitted as per the following table.

MAINS VOLTAGE	PSU REFERENCE
220-240V	MGT 5-20B
110-120V	MGT 5-20A

a. Disconnect the 9 way MOLEX plug from the front of the chassis, lifting the retaining clip on the top before pulling.

b. Disconnect the earth strap from the blade terminal on the front LHS of the chassis, by pulling on the connector housing, not the wire.

c. Remove the two securing screws from each side of the chassis and lift the unit away from the base plate.

d. Carry out functional checks and adjustment if necessary as per section 5.7.3.

5.6.3.2 Reference 1607 Lamp Regulator

This card can be changed without removing the power supply from the base unit.

CHECK THAT THE POWER CORD IS FULLY DISCONNECTED FROM THE SOURCE OF SUPPLY.

a. Disconnect the 6 way MOLEX connector from the card, lifting the top clip before pulling.

b. Remove the card by closing the barbs on the 4 nylon card mountings.

c. Replacment is the reverse of removal.

d. Carry out functional checks.

5.6.3.3 Reference 1608/1615 LED Channel Mimic Display

CHECK THAT POWER IS SWITCHED OFF.

a. Disconnect the 26 way scotchflex cable from the PL4 on the processor motherboard.

b. Remove the card from the desk top by closing the barbs on the three nylon fasteners and easing the PCB from the mountings.

c. Replacement is the reverse of removal.

d. Power up and carry out functional checks.

5.6.3.4 Reference 1609/1610 Fade Progress and Channel/Memory Number Display

This assembly comprises of two printed circuit boards - Ref 1609 and Ref 1610 - and the interconnecting cable and plug. The assembly can only be replaced as a complete unit.

CHECK THAT POWER IS SWITCHED OFF.

a. Remove the front panel PCB away from the desk top as detailed in section 5.3.4.4.

b. Remove the 4 screws, washers and spacer bars which secure each display card to the metal support panel. Note that the spacer bars are not secured to either the support panel or the display cards.

c. After carefully easing the cable away from its retaining clips, angle the display cards to pass out rearwards through the metal support panel.

d. Refitting is the reverse of removal.

e. Power up and carry out functional checks.

5.6.3.5 LED Minute/Second Display Card
LED Alarm Display Card

CHECK THAT POWER IS SWITCHED OFF.

Both these displays are based on the Ref 1611 PCB differing only by one LED being fitted for Alarm and two for Minute/Second displays.

a. Remove the front panel PCB assembly from the desk top as detailed in section 5.3.4.4.

b. Disconnect the card from :
PL8 for Alarm
PL4 for Minutes/Seconds

c. Remove the two screws and washers holding each card and remove from the front of the metal support panel.

d. Replacement is the reverse of removal.

e. Power up after re-assembly and carry out functional checks.

5.6.3.6 Control Wheel Assembly

This unit can be removed without taking the front panel PCB assembly out of the desk top. Replacement requires alignment with the outer case.

CHECK THAT POWER IS SWITCHED OFF.

a. Disconnect the wheel assembly at PL9 on the front panel PCB.

b. Withdraw the two mounting screws and washers and remove the unit.

c. Adjustment of the 'feel' can be made by releasing the locknut on the base in the assembly and making a small adjustment to

the screw until correct. Relock the locknut. DO NOT attempt any adjustment of the sensor assembly and be careful to avoid distortion of the slotted disc.

d. Replacement is the reverse of removal. Before tightening the mounting screws, check that the wheel can rotate freely without touching the outer case.

e. Power up and carry out functional checks.

5.6.3.7 Fader Lever Assemblies

These units are identical for all positions and are always mounted with the lead out wires to the front of the desk. They can be replaced without removal of the front panel PCB assembly.

CHECK THAT POWER IS SWITCHED OFF.

a. Unplug the fader concerned from the front panel PCB.

Grandmaster	PL3
Timefader	PL5
Manual downfader	PL6
Manual upfader	PL7

b. Remove the fader knob by pulling.

c. Withdraw the two mounting screws and remove the fader and mounting brackets from the metal support panel.

d. If the replacement fader is not fitted with mounting brackets, transfer the existing ones from the old fader.

e. Replacement is the reverse of removal. Power up and carry out functional checks.

5.6.3.8 Panel Meter

Replacement requires prior removal of the front panel PCB assembly as per section 5.3.4.4.

a. Note the polarity of the meter leads. Undo the stud nuts and disconnect.

b. Undo the mounting nuts and withdraw the meter from the front of the metal support panel.

c. Replacement is the reverse of removal.

d. Re-adjust meter zero and full as per section 5.7.2.2.

THIS UNIT IS A MOVING COIL METER. HANDLE WITH CARE.

5.6.3.9 Record Lock Keyswitch

Replacement requires prior removal of the front panel PCB assembly as per section 5.3.4.4.

CHECK THAT POWER IS SWITCHED OFF.

a. Note the position of the two leads and pull off connectors.

b. Slacken the hexagonal locknut on the rear of the panel.

c. Unscrew and remove the front ring and remove the packing ring.

d. Withdraw the switch to the rear.

e. Refitting is the reverse of removal. Note - screw the front ring on until flush with the top before tightening the rear locking nut.

5.7 Option Switch Settings

Switch SW2 on the Ref 1606 Front panel PCB is used to set up

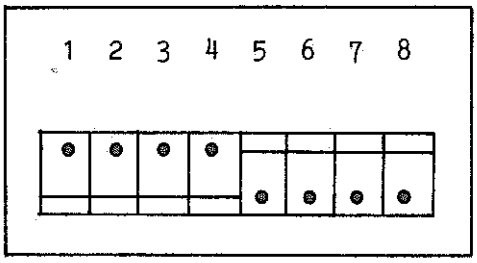
a. The number of channels fitted

b. Highest or latest procedures on cue addition

c. Set level or through facility

The switch is an 8 way Dual-in-line unit, each of the switches function as listed in table 5.7.1.1.
The switches are set as shown below :

SWITCH 2



5.7.1 Options Switch Functions

(X = Not relevant)

THRU OR SET LEVEL OPTION

	Switch No.							
	1	2	3	4	5	6	7	8
Thru	X	0	X	X	X	X	X	X
Set level	X	1	X	X	X	X	X	X

CHANNEL SIZE

No of Channels	Switch No. 1	2	3	4	5	6	7	8
10	X	X	X	0	0	0	0	0
12	X	X	X	0	0	0	0	1
20	X	X	X	1	0	0	0	0
24	X	X	X	1	0	0	0	1
30	X	X	X	0	1	0	0	0
36	X	X	X	0	1	0	0	1
40	X	X	X	1	1	0	0	0
48	X	X	X	1	1	0	0	1
50	X	X	X	0	0	1	0	0
60	X	X	X	0	0	1	0	1
70	X	X	X	0	1	1	0	0
72	X	X	X	1	0	1	0	1
80	X	X	X	1	1	1	0	0
84	X	X	X	0	1	1	0	1
90	X	X	X	0	0	0	1	0
96	X	X	X	1	1	1	0	1
100	X	X	X	1	0	0	1	0
108	X	X	X	0	0	0	1	1
110	X	X	X	0	1	0	1	0
120	X	X	X	1	1	0	1	0

MEMORY ADDITION PRECEDENCE ON COMMON CHANNELS

	Switch No. 1	2	3	4	5	6	7	8
Highest	X	X	0	X	X	X	X	X
Latest	X	X	1	X	X	X	X	X

5.7.2 Processor Motherboard Adjustments

There are two system adjustments which are both controlled by multi-turn potentiometers on the motherboard. These are the output 'Panel faders' control and 'Meter FSD'.

5.7.2.1 Panel Faders Adjustment

This is RV1 located on the left side of the processor motherboard. It should be adjusted only if there is a difference between the stage Σ output and the A,B, or T levels on the meter of VDU. With one channel selected or observed on the VDU and set at 90% in one store, adjust until the Σ level is the same as the A.B.T. level. N.B.- the grand master and AB masters must be at full and the blackout off.

5.7.2.2 Meter FSD Adjustment

This is RV2 located on the left hand side of the motherboard and used to adjust the Full Scale Deflection of the meter when required - e.g. after meter replacement. The meter must first be checked for zero set with power off. Adjustment, if necessary, is mechanical by means of a screw reached through a hole in the front panel below the meter face. Then turn on and set a channel to full in a live A, B or T store and check the meter is selected to ABT. Keeping the meter as near to normal mounting angle as possible, lift the edge of the desk top to reach RV2 and adjust to read 10.

5.7.3 Power Supply Adjustments

In order to check or adjust the DUET system power supplies, it is first necessary to open the desk as described in section 5.3.2.

5.7.3.1 Power Supply Outputs

Three main power supply voltages are required by the DUET circuitry. These are as follows :

+15 volts
+ 5 volts
-15 volts

An externally variable supply for the front panel lamps is derived from the 5 volt supply.

5.7.3.2 Power Supply Measurement

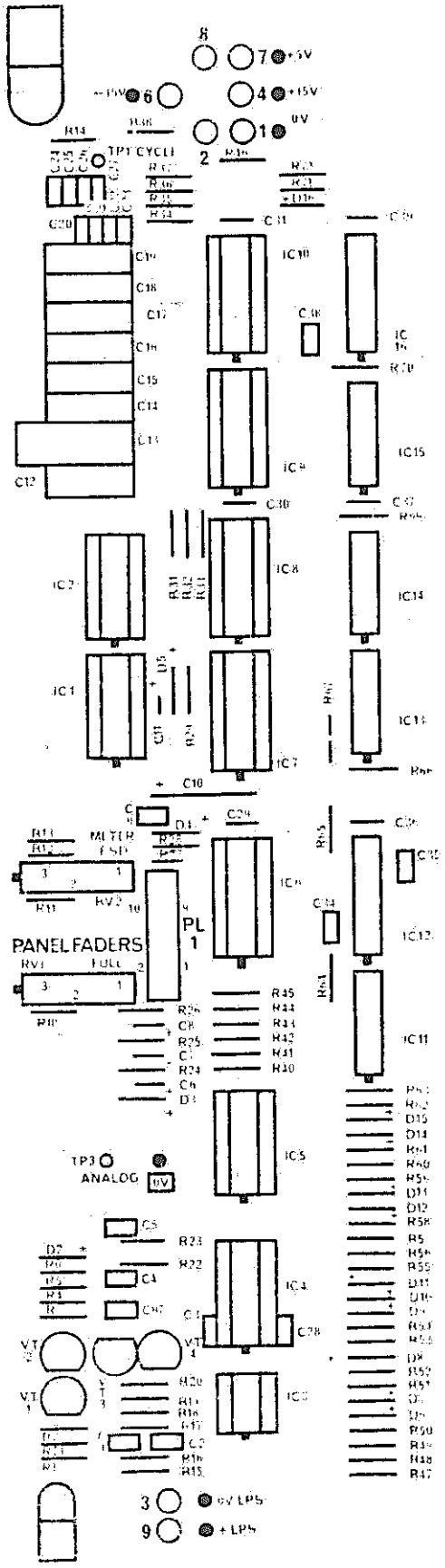
All three main power supplies are measured relative to 0 volts. The lamps supply has its' own separate 0 volt path.

Test points are provided on the processor mootherboard where the various voltages can be monitored.

The test points are to be found on the left hand side of the motherboard and are all labelled. Drawing 5.7.3.3 shows the positions of these test points.

Measurement must be made using either a digital voltmeter (DVM) or a moving coil meter with + 2% accuracy on the required ranges.

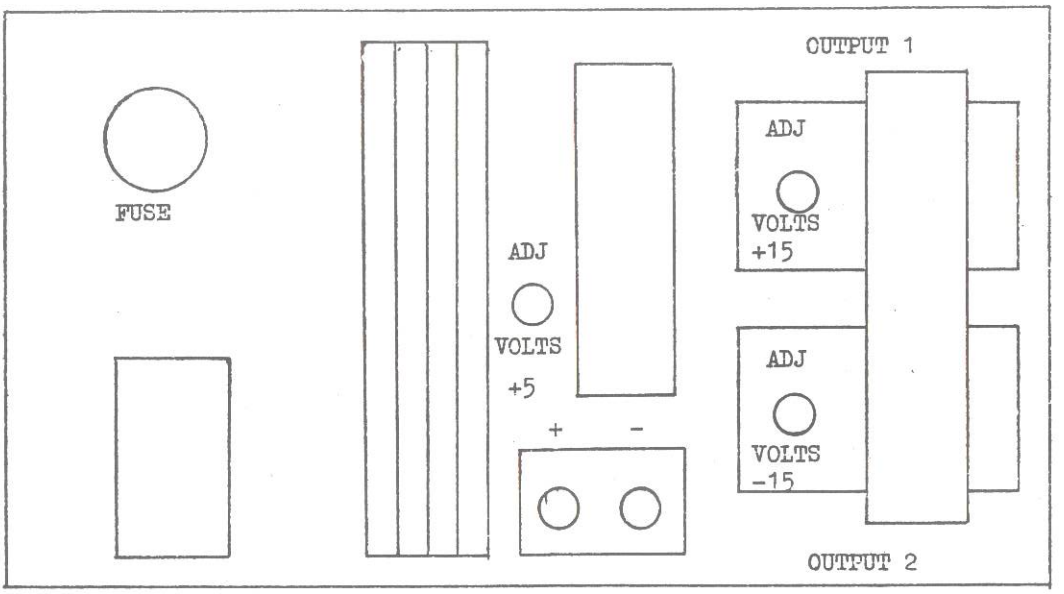
5.7.3.3 Power Supply Test Points



5.7.3.4 Power Supply Adjustment

The lamps power supply is externally variable and its maximum output is determined by the setting of the +5 volt supply. Adjustments for the +5, +15 and -15 volts can be found on the front of the power supply unit. The layout of this panel is shown on drawing 5.7.3.5. The potentiometers used are 10 turn between limits and the range is ± 10% of the nominal voltage.

5.7.3.5 Power Supply Front Panel



Main Output	+ 5 volt 20 Amp
Output 1	+15 volt 1.75 Amp
Output 2	-15 volt 1.75 Amp
Fuse Rating	3.15A 20 mm HRC (220-240V)
	6.3A 20 mm HRC (110-120V)