Order code: Y5.MAN.TRX

ARRI (GB) LIMITED

1-3 AIRLINKS, SPITFIRE WAY, HESTON, TW5 9NR

ARRI (GB) LTD

LIGHTING CONTROL DIVISION

REFLEXION

Universal DMX Backup System

Technical Manual

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SECTION 1 – REFLEXION SYSTEM OVERVIEW

1.1 SYSTEM OVERVIEW

1. SYSTEM OVERVIEW

The standard REFLEXION console consists of two pcbs in a steel case with a sloping control panel. All system controls and most indicators are mounted on the Control pcb, fitted to the control panel. The power supply, I/O and processing systems plus the Input Data led indicator are carried on the CPU pcb, which is fitted inside the base pan. All connectors and the mains supply lead emerge on the rear panel.

The standard console handles backup functions for one DMX data stream. The system can be expanded to handle up to four DMX streams by connecting up to three additional Slave modules. Each one contains a CPU pcb, identical with the CPU pcb in the standard console, but with jumpers set to define its Slave address. The Master CPU transmits fader and button information (interpreted from the Control pcb) to each Slave via the Expansion socket (9 pin D). The Slave CPUs return status messages which allow the Master CPU to set the control panel leds so that they reflect the status of the system as a whole. Thus an expanded system uses the panel controls and indicators of the (standard) Master console. REFLEXION is operated in the same manner whether it is backing up one or four DMX data streams.

Any full console REFLEXION (ie one with a Control panel) can be configured as a Master unit. It is also possible for full console units with REV 4 and onwards CPU pcbs to be configured as Slave units. If a full console unit is configured as a slave, its faders and buttons will be disabled. Only information from the Master unit's faders and switches can control its output.

The CPU pcb is the heart of the system. It carries the toroidal supply transformer and regulators for the three main rails plus the +5V isolated rail which supplies the optoisolated DMX line receiver and driver. It digitises fader signals, drives the control panel indicators, scans the bump switches and supplies regulated power to the Control pcb through the main loom connecting the two pcbs.

The microprocessor is a Phillips 80C552 (a microcontroller developed with automotive engine management in mind) clocked at 16MHz. As well as the 8051 processor core it contains on-chip a UART, used to decode the incoming DMX stream, a 10 bit A/D converter and an I^2C port, which is used for intercommunications between CPUs in an expanded system. It is a high speed bidirectional bus, clocked and controlled by the Master CPU. The high data rate on this 3 wire link sets a limitation on its maximum length - no further than 2 metres between Master and furthest Slave.

Fast as the 80C552 is, on its own it is not fast enough to make all the necessary calculations in real time, ie fast enough to keep up with the fastest DMX stream allowable under the USITT DMX512/1990 standard. To achieve maximum throughput, the 80C552 feeds incoming DMX data and analogue/fader level data to a hardware subsystem which calculates the correct output for each dimmer and passes that value back to the 80C552 for transmission as the outgoing DMX512 data stream. In normal operation DMX data is delayed by between one and two DMX byte time, ie 44μs to 88μs. We believe this makes REFLEXION the fastest DMX processor in production.

The Control pcb has no intelligence. It carries the led driver, which is controlled by the CPU pcb via the main interconnection loom, and the analogue mixing circuits. These receive 12 analogue inputs from the rear panel connector and merge them with the submaster faders' wiper voltages on a highest takes precedence basis. The combined analogue voltage is then buffered and sent down the main loom to the CPU pcb for analogue-to-digital conversion and processing. The rail feeding the top of the 13 faders is generated by an adjustable sub-regulator on the Control pcb. All Control Panel switches are connected between digital ground and port lines which are taken down the main loom and read by IC17 (an 8255 PIO) on the CPU pcb.

SECTION 2 – CPU PCB TECHNICAL DESCRIPTION

2. TECHNICAL DESCRIPTION – CPU PCB, BAB.001

The CPU PCB is the heart of the system. It carries the PSU section for all system regulated supplies, the control and scanning for the faders, buttons and LEDs on the control PCB, the DMX I/O subsystem in addition to the data processing area which includes the lithium backed SRAM memory. Note that the lithium data support batteries contain less than 0.5g of lithium and are therefore IATA approved for air freight.

2.1 POWER SUPPLY SECTION.

CAUTION

To maintain overvoltage and overcurrent protection it is essential that any replacement for the main supply fuse is of the correct rating and type. Use only 20mm glass or ceramic (HRC) fuses rated 250V, 250mA (T), ie anti-surge. Failure to do so may cause a fire hazard and will certainly invalidate your warranty. This unit must be earthed.

The supply isolation transformer T1 is a custom wound 15VA toroidal unit with twin primary windings, mounted on the CPU pcb. In a standard factory unit the primaries are wired in series for operation on 220–240Vac, 50/60Hz mains supplies. Each primary winding has a 130Vac wkg VDR in parallel to clip spikes and protect it from damage due to excessive supply voltage. The three secondary windings give 8Vac @ 1A, 8Vac @ 200mA and 15Vac @ 500mA (nominal output).

All ARRI REFLEXIONS are sold configured for 220–240Vac mains supply. Re-configuring your REFLEXION for operation on 110–120Vac supplies is a simple process. All that is required is a change of links on the CPU pcb. Remove the link marked "240V" and solder insulated wire across the two links marked "120V".

The power supply is divided into three bridge-reservoir-regulator stages to provide Isolated +5V, System +5V and System +15V & –15V rails.

The Isolated +5V rail only provides power for the DMX receiver and driver, IC22 & IC15, and the driver optoisolator, IC4. The optoisolation barrier keeps REFLEXION's processing circuitry safe from damage should any serious faults, such as a short to 240Vac, develop on the DMX line. The isolated supply is taken from the 8Vac 200mA winding on the transformer through a standard bridge rectifier, BR1 to reservoir capacitor C26. REG4 (7805CT) then regulates the voltage to +5V ±10% and is fitted with a small clip-on heatsink. Capacitor C21 improves the stability and high frequency performance of REG4. As this supply is isolated, its 0v line is not attached to chassis earth, but rather to the DMX reference voltage so that the receiver section can float, following the DMX common mode voltage.

The DMX512 data input is connected to REFLEXION at a 5pin XLR chassis mounting plug (Data In) on the rear panel. The signal lines (Data+ & Data-) and reference voltage are brought down to the CPU pcb through PL3. A line termination resistor, R34, is fitted between Data+ & Data- to prevent reflections back along the DMX line. Biassing resistors R16 & R17 hold the data inputs in a defined state (Mark) when there is no DMX source connected.

The Data+ & Data- signals are then fed to a standard RS485 transceiver, IC22 (75176), the output of which drives a fast optoisolator IC10 (6N137). The RXD (Received Data) output from IC10, now isolated from the DMX lines, drives the microprocessor's internal SIO input (IC6 pin24).

The signal path for the output DMX data is similar to that of the input data, but reversed. The microprocessor's SIO output channel generates the serial data stream (TXD, pin 25) and drives one input of NOR gate IC1B. The other input is driven high by the microprocessor (TX_INH, pin 28) to block DMX output from being transmitted, ie hold DMX in 'Mark' state, after a power reset.

While DMX is blocked in this way the red FREEZE led flashes and the system alarm beeps at 1Hz. When the operator presses the FREEZE button the led switches to steady green (assuming DMX input data is good), and the alarm stops beeping at 1Hz. At the same time the microprocessor clears TX_INH (to LOW) to allow the output data stream (TXD) through IC1B. The TXD (transmit data) signal is then buffered (and restored to positive logic) by three NOR gates in parallel (IC1A, C & D). The combined current drive of these three CMOS gates is sufficient to drive IC4 optoisolator's led. IC15 (75176) converts the signal from TTL to RS485. Data+ & Data- lines, along with the reference voltage (0V ISOL), are routed to the 5-pin XLR socket (DATA OUT) on the rear panel via PL2.

2.4 MICROPROCESSOR

The Microprocessor is a Philips 80C552, clocked at 16MHz. This device has a number of on-chip peripheral features built around the main 8051 processing core, including: UART for the DMX decoding/encoding, 10 BIT A/D converter for digitising the fader/analogue input voltages and an I^2C port, for inter-CPU communications, eg with the slave units in an expanded REFLEXION system. The processor should never need to be removed from it's PLCC socket. If you do remove it, however, use a professional PLCC extraction tool. Use of probes or screwdrivers is very likely to damage the socket.

2.5 FADER A/D CONVERSION

The microprocessor's internal A/D converter is used to determine the position (via the wiper voltage value) of the Submaster faders and the Input Master fader. An adjustable reference voltage is applied to pins 58 and 59 of IC6 from the regulator REG1 (TL431CLP). This is factory calibrated so that the A/D converts a fader at full (or a +10.0V analogue input voltage) to 0FFh.

Under v1.xx software versions this is accomplished by powering down, opening the case, placing a shorting clip on Jumper A and then applying power. As soon as the power-on alarm sounds the clear memory operation is complete; it only takes about 0.5 seconds. You must then switch off, remove the short from Jumper A and fasten the case closed.

Under v2.xx software the operation is much simpler and can be done without opening the case. Just hold down bumpbuttons 7, 8 & 9 and apply power. As soon as you hear the power-on alarm sound you can release the bumpbuttons. The unit is then in it's factory default condition, with all stored states blank and ready for programming.

Note that a System Memory Clear operation does just that – it wipes clear all stored states, system variables, scratchpad RAM, etc, ready for the new software to initialise its working variables as it requires. Since the operation will clear all stored states *make sure they are unwanted, or can be reprogrammed before you start a software upgrade.*

2.8 SYSTEM MEMORY & HARDWARE CALCULATOR

REFLEXION's memory and calculator subsystem is structured in a way that allows very fast processing times. If any IC in the hardware calculator fails in service, replace it with the identical device type from the same manufacturer. This will prevent problems due to timing-skews caused by a different propagation delay through the replaced component. Precise control of propagation delays and timing constraints was a significant part of the design & development of the hardware calculator subsystem.

All user-recordable information, ie stored lighting states, is stored in the main Data RAM IC24 (62256LP or SRM20256LC). This low power device is mounted on a SmartSocket, DS1213C. The SmartSocket provides the control circuit and lithium battery backup to maintain data when the +5V supply drops below 4.75V, either when the unit is turned off or during supply 'brownout' conditions. The predicted life of the battery is 10 years from first power-up. If the Data RAM chip is removed for any reason, a System Memory Clear will be required on the subsequent power-up (see section 2.7 for details). In fact it is wise to clear the memory after all service jobs on the CPU pcb, in case static discharge from the service engineer has corrupted data in the main SRAM. This is standard practice for all REFLEXION service jobs at our factory.

To assist in the calculation of the DMX data, IC16 & IC30 (6116) are used as local memory within the hardware calculator subsystem. Data in these 2k x 8 SRAMs is not maintained during power off.

IC25 and IC29 (27C512) are pre-programmed PROMS which contain large lookup tables that are used to calculate the final dimmer levels. If one of these devices becomes faulty, contact your local ARRI dealer or ARRI (GB) for replacements. Note that, unless it is running obviously too hot, it is difficult to be sure that one of these ICs is defective. High quality test equipment (logic analyser and 250Mhz 'scope) is required to conclusively diagnose that any particular ic in the calculator is faulty. Static testing proves nothing.

Up to three Slave units can be connected to one Master. There is no restriction on the order of the Slave units connected to the Master unit. However, it is important to remember that each Slave unit must be configured with its own unique address. If two Slave units are configured with the same address then they will cause an I^2C bus contention which could, potentially, crash the whole system.

2.10 EXPANSION PORT J1

This port is a bidirectional, 8 bit plus control, parallel port. Although currently unused, it is provided for access to future expansion cards planned for the system.

SECTION 3 – CONTROL PCB TECHNICAL DESCRIPTION

3. TECHNICAL DESCRIPTION - CONTROL PCB, BAB.002

3.1 LED DRIVER

All leds on the Control pcb are driven by IC5, an MM5450 from SGS-Thomson. It is a serially loaded, 34 common anode led driver. The led drive current is internally controlled and is set by R7 (5.6kΩ). Capacitor, C9 decouples the 'Brightness' input.

All single colour leds are driven directly, in common anode configuration, by IC5. However LED11, the tri-colour INPUT FREEZE led, is not commonly available in a common anode package. Its two elements are therefore driven via a PNP long tailed pair, TR2 & TR3, with the emitter resistor R6 (100Ω) setting the led current.

IC5's data and clock inputs are directly controlled by the CPU, from its Port1 via the main interconnection loom arriving on the Control pcb at J2. Data presented to IC5 pin 22, via J2 pin 4, is clocked into its input register on the rising edge of the clock pulse presented to IC5 pin 21 via J2 pin 3. IC5's enable pin is permanently tracked low so that, even while data is being clocked in, the leds respond to it. This means that during an led refresh the pattern of illuminated leds shifts through each led in sequence. However the 80C552 achieves this load operation considerably faster than the human eye can respond, so the operator never sees a "ripple chase" effect as the leds are updated.

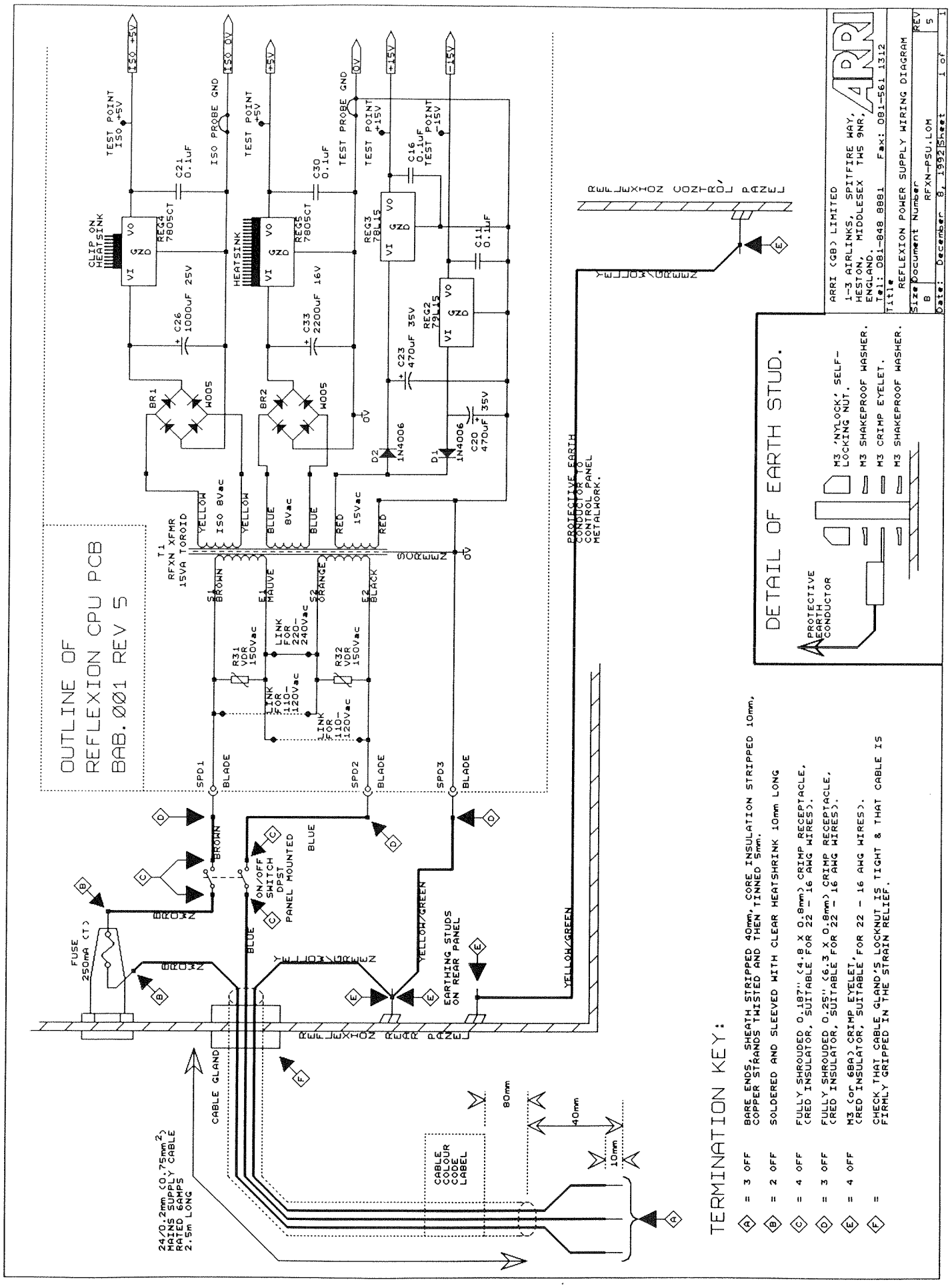
3.2 FADER CONTROL

The control PCB has 13 faders fitted, FAD1 through FAD13; NOTE the Input Master fader is legended FAD7. Each fader is a 60mm travel 10Kohm linear potentiometer with dust seal and is provided with a +10V reference voltage derived from the +15V regulated supply (see next paragraph). The voltage at the wiper of each fader is diode-OR'd with an external analogue signal routed from the rear panel D15 connector (Analogue In). The result is then buffered through an opamp (LM324) and passed to the CPU pcb for A/D conversion, via pins 29 through 40 of J2. The Input Master fader is treated slightly differently in that it has no external signal input. The diode in series with its wiper is still required to match the other faders' calibration. The Input fader voltage is passed to the CPU pcb via pin 23 on J2.

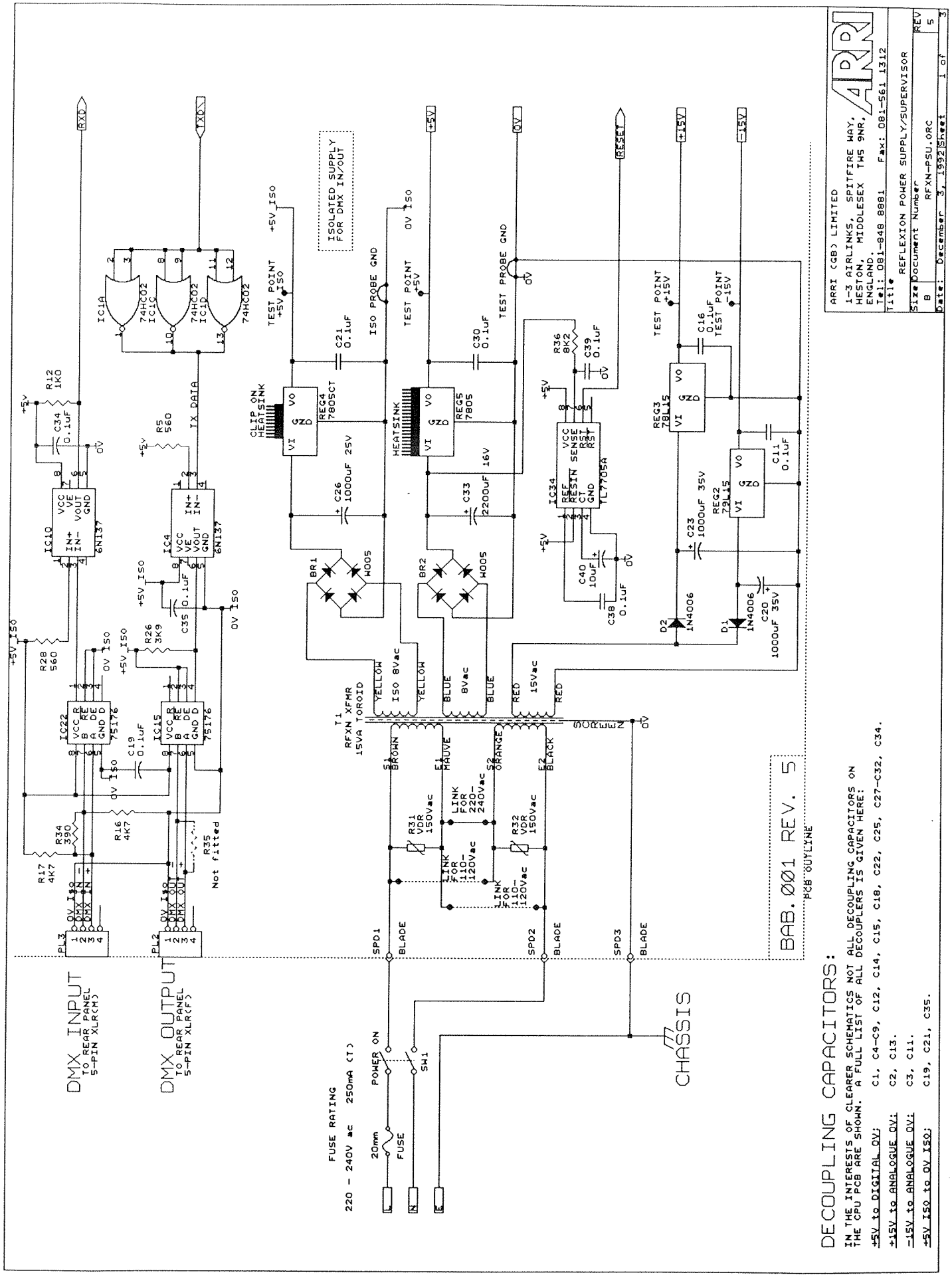
The +10V fader reference supply is simply implemented using an adjustable regulator LM317LZ. The trim pot, VR2, is provided to allow limited adjustment of the Fader Reference voltage while C1 and C10 provide general smoothing/decoupling.

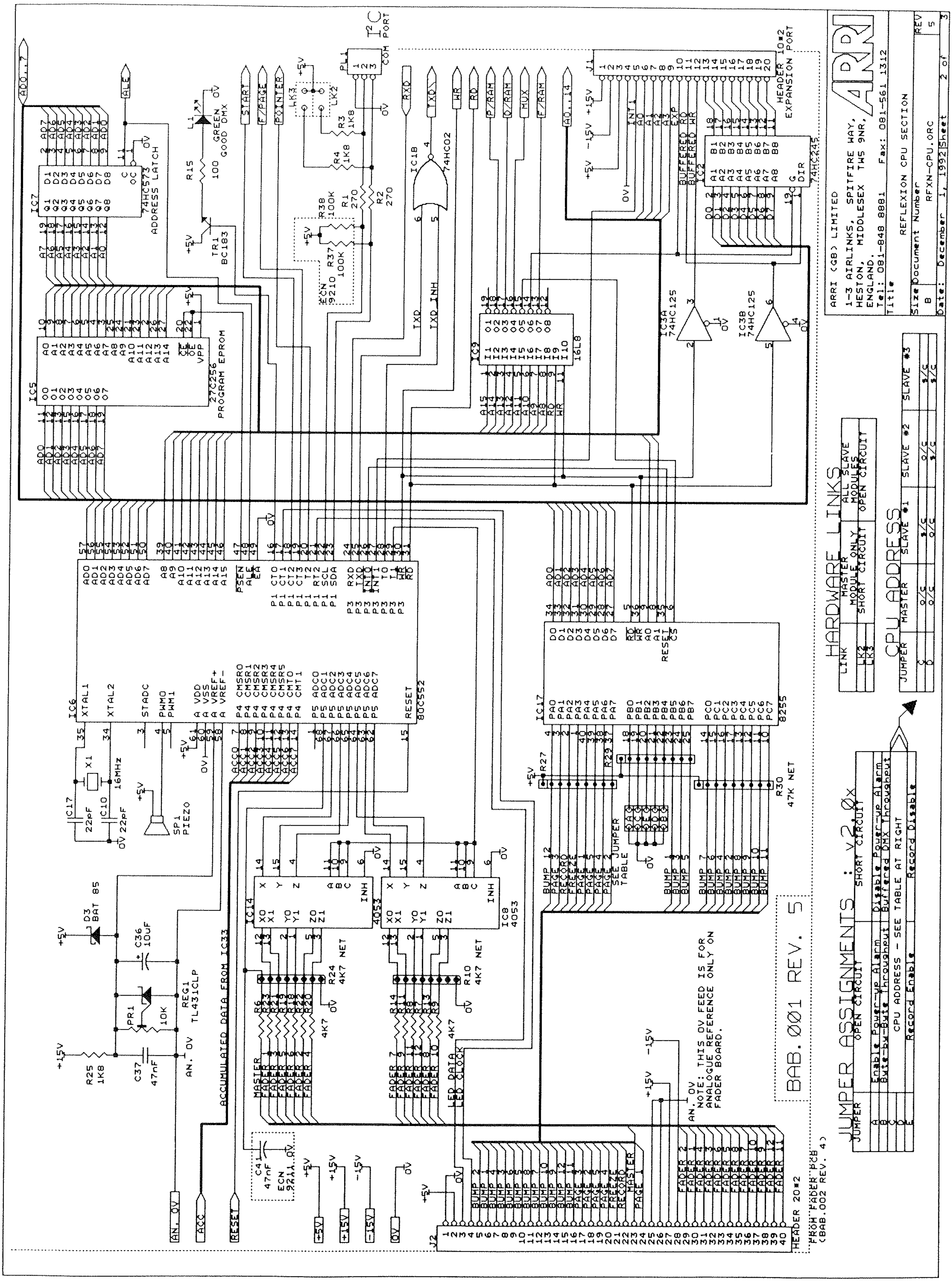
It should be noted that the Analogue 0V rail is routed separately within REFLEXION from the Digital 0V rail. Both 0V lines originate from a common point within the PSU area. The +15V and -15V regulated supplies are decoupled to the Analogue 0V rail because, for the most part, they power opamps which condition the analogue control voltages. All digital ics are powered from the System +5V supply which is decoupled to the Digital 0V rail. This technique prevents switching noise and 'ground bounce' effects from reaching any analogue signals.

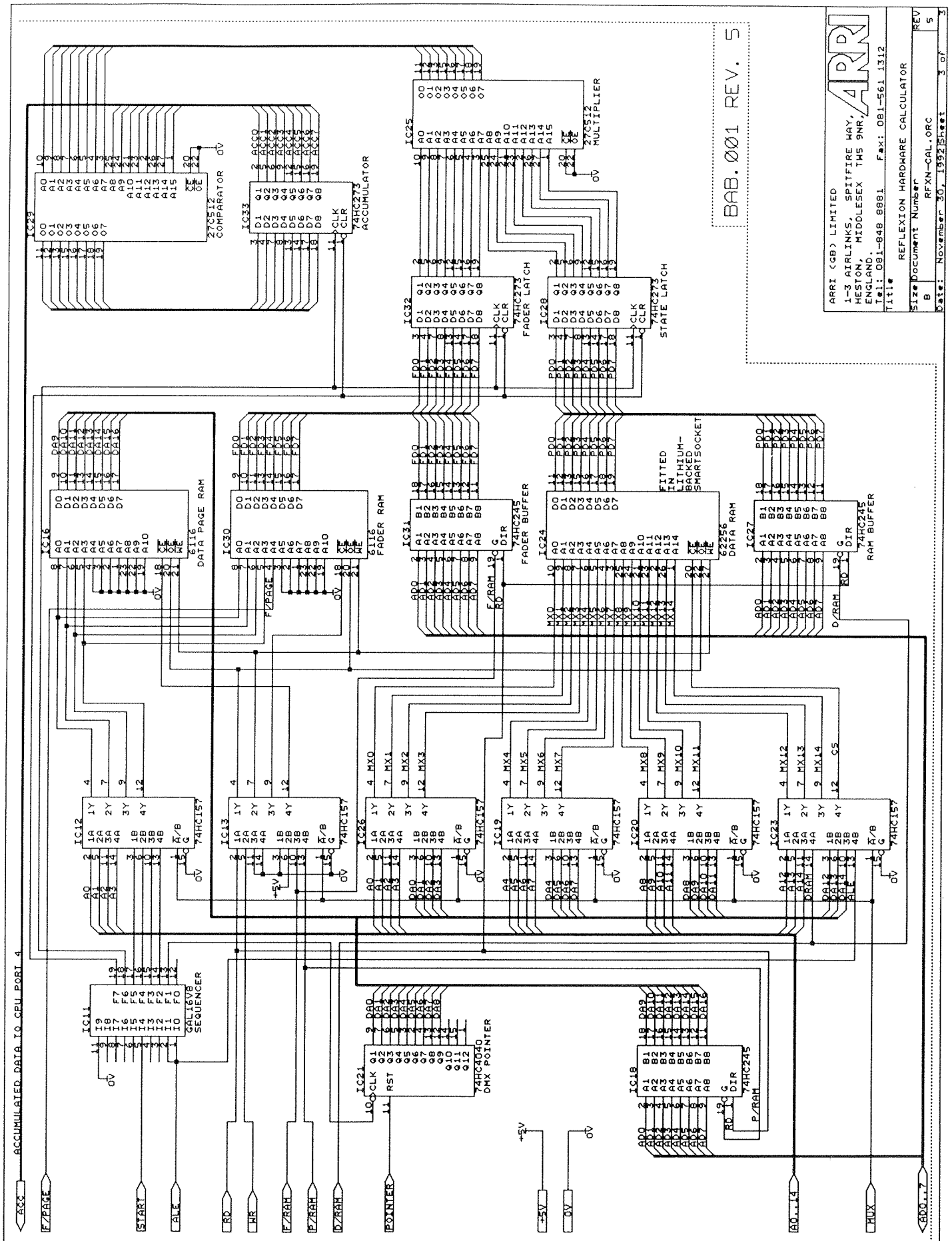
SECTION 4 – POWER SUPPLY WIRING DIAGRAM

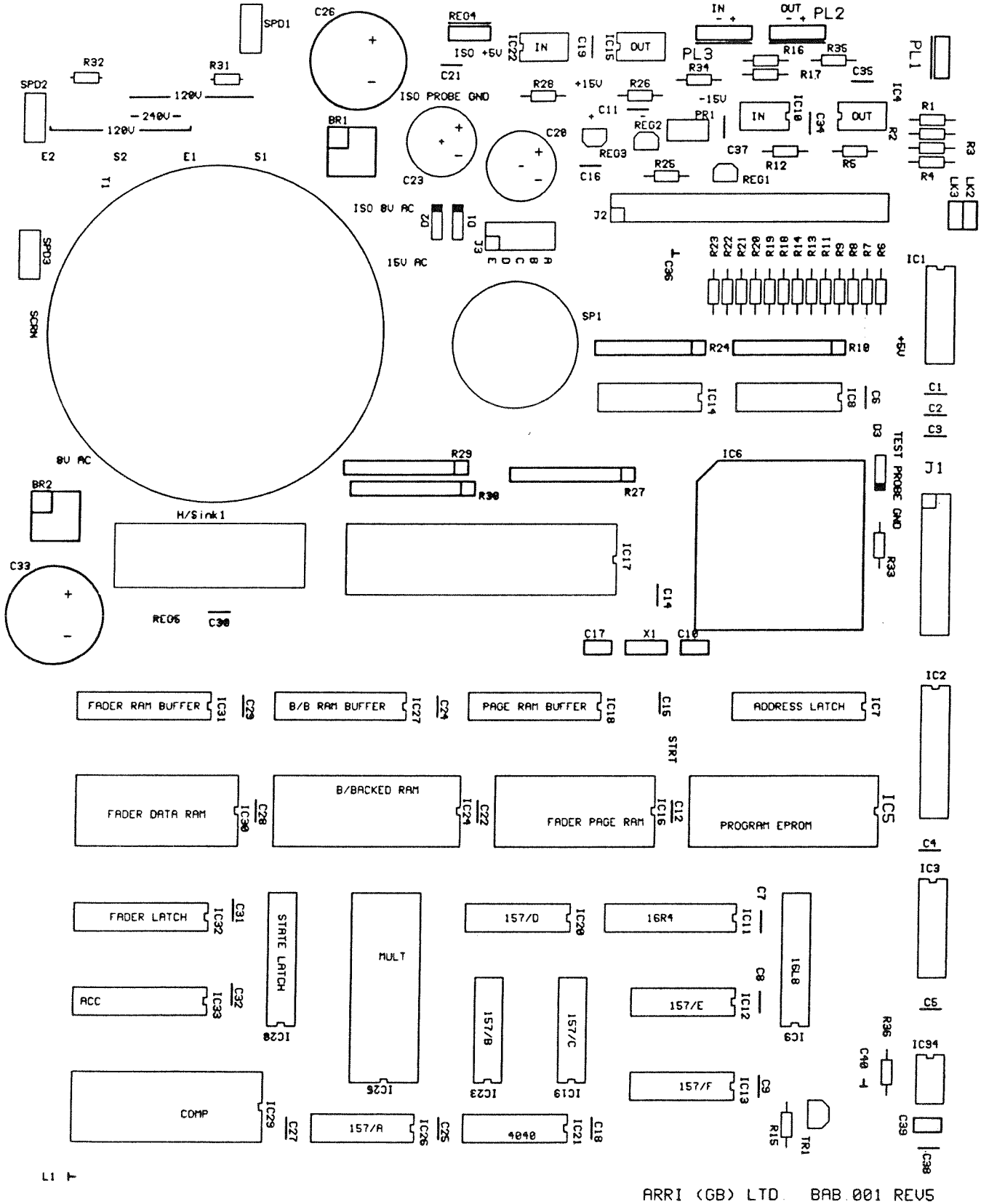

OUTLINE OF
REFLEXION CPU PCB
BAB.ØØ1 REV 5
T1
RFXN XFMR
15VA TOROID
YELLOW
ISO 8Vac
BLUE
8Vac
RED
15Vac
BR1
WØ05
BR2
WØ05
D1
1N4006
D2
1N4006
REG2
79L15
REG3
78L15
REG4
7805CT
REG5
7805CT
C20
470uF 35V
C23
470uF 35V
C26
1000uF 25V
C33
2200uF 16V
C11
0.1uF
C16
0.1uF
C21
0.1uF
C30
0.1uF
TEST POINT
ISO +5V
ISO PROBE GND
TEST POINT
+5V
TEST PROBE GND
TEST POINT
+15V
TEST POINT
-15V
CLIP ON
HEATSINK
HEATSINK
+ISO +5V
ISO 0V
+5V
0V
+15V
-15V
SPD1
SPD2
SPD3
BLADE
BROWN
MAUVE
ORANGE
BLACK
S1
E1
S2
E2
R31
VDR
150Vac
R32
VDR
150Vac
LINK
FOR
220-
240Vac
LINK
FOR
110-
120Vac
LINK
FOR
110-
120Vac
FUSE
250mA (T)
ON/OFF
SWITCH
DPST
PANEL MOUNTED
EARTHING STUDS
ON REAR PANEL
REAR PANEL
REFLEXION CONTROL PANEL
PROTECTIVE EARTH
CONDUCTOR TO
CONTROL PANEL
METALWORK.
YELLOW/GREEN
BROWN
BLUE
CABLE GLAND
24/0.2mm (0.75mm²)
MAINS SUPPLY CABLE
RATED 6AMPS
2.5m LONG
CABLE
COLOUR
CODE
LABEL
80mm
40mm
10mm
DETAIL OF EARTH STUD.
PROTECTIVE
EARTH
CONDUCTOR
M3 'NYLOCK' SELF-
LOCKING NUT.
M3 SHAKEPROOF WASHER.
M3 CRIMP EYELET.
M3 SHAKEPROOF WASHER.
ARRI (GB) LIMITED
1-3 AIRLINKS, SPITFIRE WAY,
HESTON, MIDDLESEX TW5 9NR,
ENGLAND.
Tel: 081-848 8881 Fax: 081-561 1312
Title
REFLEXION POWER SUPPLY WIRING DIAGRAM
Size Document Number REV
B RFXN-PSU.LOM 5
Date: December 8, 1992 Sheet 1 of 1
TERMINATION KEY:
A = 3 OFF BARE ENDS, SHEATH STRIPPED 40mm, CORE INSULATION STRIPPED 10mm, COPPER STRANDS TWISTED AND THEN TINNED 5mm.
B = 2 OFF SOLDERED AND SLEEVED WITH CLEAR HEATSHRINK 10mm LONG
C = 4 OFF FULLY SHROUDED 0.187" (4.8 X 0.8mm) CRIMP RECEPTACLE, (RED INSULATOR, SUITABLE FOR 22 - 16 AWG WIRES).
D = 3 OFF FULLY SHROUDED 0.25" (6.3 X 0.8mm) CRIMP RECEPTACLE, (RED INSULATOR, SUITABLE FOR 22 - 16 AWG WIRES).
E = 4 OFF M3 (or 6BA) CRIMP EYELET, (RED INSULATOR, SUITABLE FOR 22 - 16 AWG WIRES).
F = CHECK THAT CABLE GLAND'S LOCKNUT IS TIGHT & THAT CABLE IS FIRMLY GRIPPED IN THE STRAIN RELIEF.

SECTION 5 – CPU PCB CIRCUIT DIAGRAM


DMX INPUT
TO REAR PANEL
5-PIN XLR(M)
DMX OUTPUT
TO REAR PANEL
5-PIN XLR(F)
Not fitted
FUSE RATING
220 - 240V ac 250mA (T)
20mm
FUSE
POWER ON
SW1
CHASSIS
ISOLATED SUPPLY
FOR DMX IN/OUT
CLIP ON HEATSINK
HEATSINK
TEST POINT
ISO PROBE GND
TEST PROBE GND
RFXN XFMR
15VA TOROID
ISO 8Vac
8Vac
15Vac
SCREEN
LINK FOR 110-120Vac
LINK FOR 220-240Vac
BLADE
PCB OUTLINE
BAB.ØØ1 REV. 5
DECOUPLING CAPACITORS:
IN THE INTERESTS OF CLEARER SCHEMATICS NOT ALL DECOUPLING CAPACITORS ON
THE CPU PCB ARE SHOWN. A FULL LIST OF ALL DECOUPLERS IS GIVEN HERE:
+5V to DIGITAL 0V: C1, C4-C9, C12, C14, C15, C18, C22, C25, C27-C32, C34.
+15V to ANALOGUE 0V: C2, C13.
-15V to ANALOGUE 0V: C3, C11.
+5V ISO to 0V ISO: C19, C21, C35.
ARRI (GB) LIMITED
1-3 AIRLINKS, SPITFIRE WAY,
HESTON, MIDDLESEX TW5 9NR,
ENGLAND.
Tel: 081-848 8881 Fax: 081-561 1312
Title
REFLEXION POWER SUPPLY/SUPERVISOR
Size B
Document Number
RFXN-PSU.ORC
REV 5
Date: December 3, 1992 Sheet 1 of 3


ARRI (GB) LIMITED
1-3 AIRLINKS, SPITFIRE WAY,
HESTON, MIDDLESEX TW5 9NR,
ENGLAND.
Tel: 081-848 8881 Fax: 081-561 1312
REFLEXION CPU SECTION
RFXN-CPU.ORC
December 1, 1992
BAB. 001 REV. 5
HARDWARE LINKS
CPU ADDRESS
JUMPER ASSIGNMENTS : v2.0x
NOTE: THIS 0V FEED IS FOR ANALOGUE REFERENCE ONLY ON FADER BOARD.
HEADER 10*2 EXPANSION PORT
HEADER 20*2 FROM FADER PCB (BAB.002 REV. 4)
ACCUMULATED DATA FROM IC33


BAB.001 REV. 5
ARRI (GB) LIMITED
1-3 AIRLINKS, SPITFIRE WAY,
HESTON, MIDDLESEX TW5 9NR,
ENGLAND.
Tel: 081-848 8881 Fax: 081-561 1312
Title REFLEXION HARDWARE CALCULATOR
Size B Document Number RFXN-CAL.ORC REV 5
Date: November 30, 1992 Sheet 3 of 3
IC25 27C512 COMPARATOR
IC33 74HC273 ACCUMULATOR
IC25 27C512 MULTIPLIER
IC32 74HC273 FADER LATCH
IC28 74HC273 STATE LATCH
IC16 6116 DATA PAGE RAM
IC30 6116 FADER RAM
IC31 74HC245 FADER BUFFER
IC24 62256 DATA RAM
FITTED WITH LITHIUM-BACKED SMARTSOCKET
IC27 74HC245 RAM BUFFER
IC12 IC13 IC26 IC19 IC20 IC23 74HC157
IC11 GAL16V8 SEQUENCER
IC21 74HC4040 DMX POINTER
IC18 74HC245
ACCUMULATED DATA TO CPU PORT 4
A22
F/PAGE
START
ALE
RD
WR
F/RAM
P/RAM
D/RAM
POINTER
+5V
0V
AD0..14
MUX
AD0..7



ARRI (GB) LTD BAB 001 REV5

PARTS LISTING: REFLEXION CPU pcb, BAB.OO1, Rev 5.

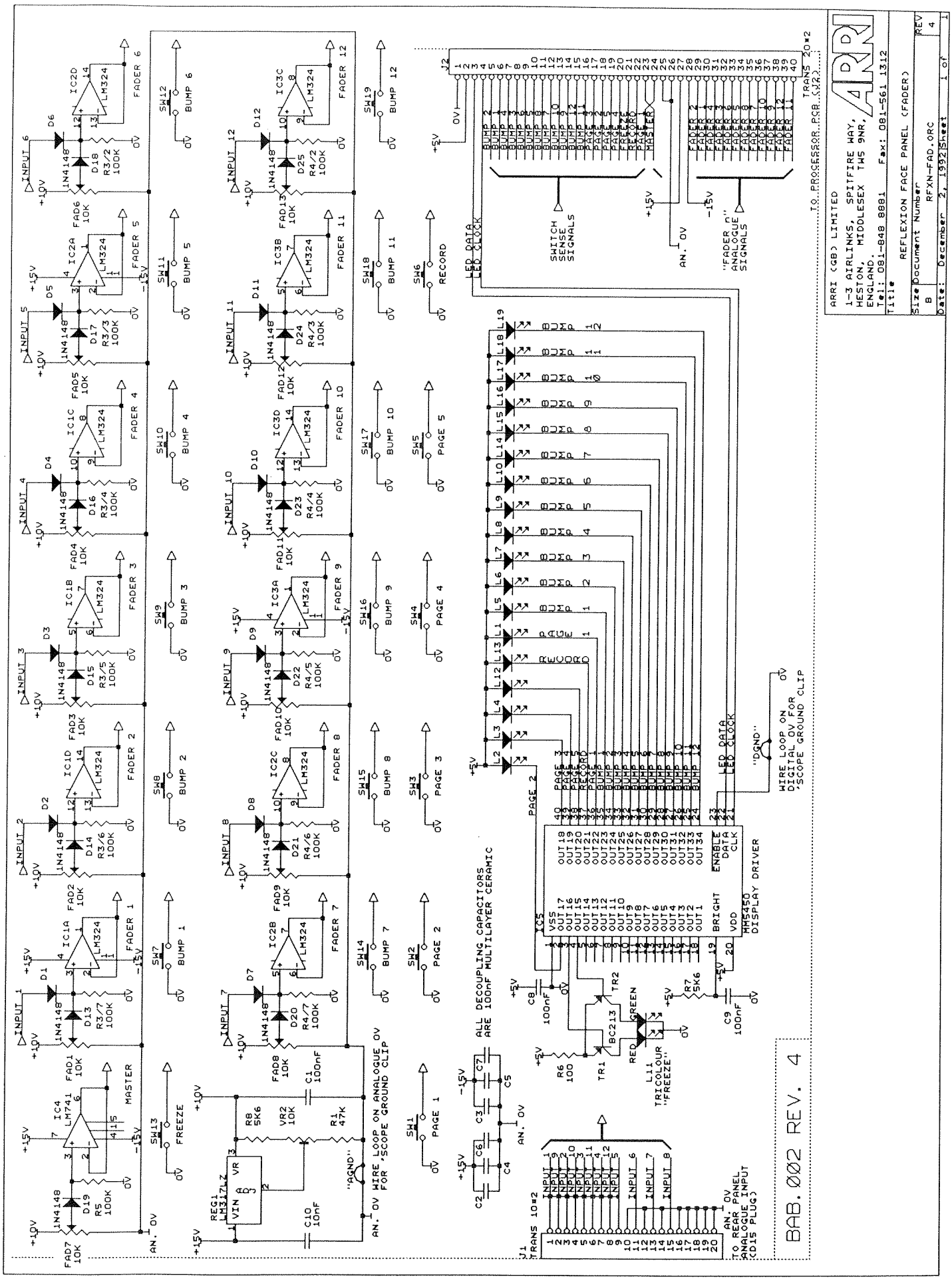
Item	Quantity	Reference	Part	Description
1	2	C17,C10.	22pF	Min ceramic capacitor, 0.1" pitch.
2	2	C37,C41.	47nF	Multilayer ceramic decoupling capacitor.
3	30	C1,C2,C3,C4,C5,C6,C7,C8, C9,C11,C12,C13,C14,C15, C16,C18,C19,C21,C22,C24, C25,C27,C28,C29,C30,C31, C32,C34,C35,C39.	0.1uF	Multilayer ceramic decoupling capacitor.
4	1	C38.	0.1uF, 20%	Sub min boxed polyester cap, 0.1" pitch.
5	1	C36,C40.	10uF, 25V	Axial Al electrolytic, 105°C, 0.1" pitch.
6	1	C26.	1000uF 25V	Axial Al electrolytic, 105°C, 0.3" pitch.
7	2	C23,C20.	1000uF 35V	Axial Al electrolytic, 105°C, 0.2" pitch.
8	1	C33.	2200uF 16V	Axial Al electrolytic, 105°C, 0.3" pitch.
9	1	R15.	100Ω	¼W, 5% carbon film resistor.
10	2	R1,R2.	270Ω	¼W, 5% carbon film resistor.
11	1	R34.	390Ω	¼W, 5% carbon film resistor.
12	2	R5,R28.	560Ω	¼W, 5% carbon film resistor.
13	1	R12.	1.0kΩ	¼W, 5% carbon film resistor.
14	3	R25,R3,R4.	1.8kΩ	¼W, 5% carbon film resistor.
15	1	R26.	3.9kΩ	¼W, 5% carbon film resistor.
16	15	R6,R7,R8,R9,R11, R13,R14,R16,R17,R18, R19,R20,R21,R22,R23.	4.7kΩ	¼W, 5% carbon film resistor.
17	2	R37,R38.	100kΩ	¼W, 5% carbon film resistor.
18	1	R36.	8.2kΩ	¼W, 1% metal film resistor.
19	2	R10,R24.	7 x 4.7kΩ	Commoned SIL resistor pack.
20	3	R30,R27,R29.	8 x 47kΩ	Commoned SIL resistor pack.
21	1	PR1.	10kΩ	Multiturn cermet trimpot, ¼" square.
22	2	R31,R32.	VDR	150Vac wkg, 40J rated.
23	1	D3.	BAT85	Schottky signal diode, 30V, 200mA.
24	2	D1,D2.	1N4006	Silicon rectifier, 800V, 1A.
25	2	BR1,BR2.	W005	Silicon bridge rectifier, 50V, 1A.
26	1	L1.	Green LED	5mm Green, diffused, wide angle, T1 $^3/_4$.
27	1	TR1.	BC183	NPN gen. purpose transistor, TO92.
28	1	IC1.	74HC02	Quad 2-in NOR gate.
29	1	IC3.	74HC125	Quad tri-state buffer, independent strobes
30	6	IC12,IC13,IC19,IC20, IC23,IC26.	74HC157	Quad 2-to-1 multiplexer, non-inverting.
31	1	IC21.	74HC4040	12 bit binary counter.

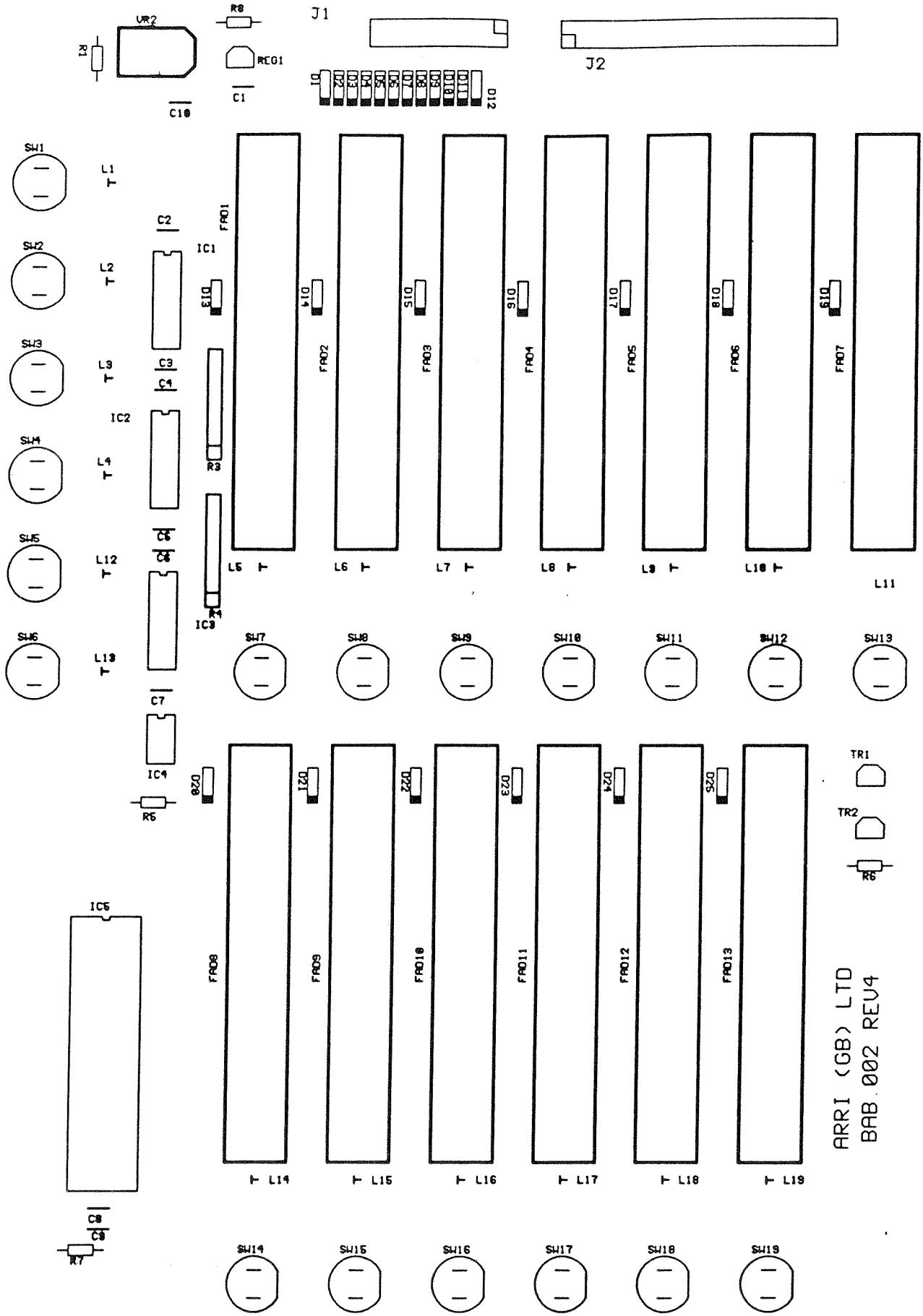
Item	Quantity	Reference	Part	Description
32	4	IC2,IC18,IC27,IC31.	74HC245	Octal non-inverting 3-state transceiver.
33	3	IC28,IC32,IC33.	74HC273	Octal D-type register with Clear.
34	1	IC7.	74HC573	Octal D-type transparent latch.
35	2	IC14,IC8.	4053B	Triple 2-in analogue multiplexer.
36	1	IC24.	62256LP	32k x 8 Static RAM, 100ns, LOW power.
37	1	IC16,IC30.	6116	2k x 8 Static RAM, 150ns access time.
38	1	IC9.	16L8	GAL: programmed spares from ARRI only.
39	1	IC11.	16V8	GAL: programmed spares from ARRI only.
40	1	IC5.	27C256	CMOS UV-eraseable PROM, 120ns.
41	1	IC25.	27C512	CMOS OTPROM, 120ns access time.
42	1	IC29.	27C512	CMOS OTPROM, 120ns access time.
43	1	IC17.	8255	PIO, 3 x parallel I/O ports, CMOS.
44	1	IC6.	80C552	Philips 8-bit microprocessor, 16MHz, PLCC.
45	1	X1.	16MHz	Clock crystal, HC49 case.
46	2	IC22,IC15.	75176	RS485 bus transceiver
47	2	IC10,IC4.	6N137	Fast optoisolator, TTL compatible.
48	1	IC34.	TL7705A	PSU supervisor & reset generator.
49	1	REG1.	TL431CLP	Adjustable precision V reference, TO92.
50	1	REG3.	78L15	Fixed +15V, 100mA regulator, TO92.
51	1	REG2.	79L15	Fixed -15V, 100mA regulator, TO92.
52	1	REG5.	7805	Fixed +5V, 1A regulator, TO220.
53	1	REG4.	7805CT	Fixed +5V, 100mA regulator, TO92.
54	1	HS4.	HEATSINK	Clip-on style, 40°C/W, TO220.
55	1	HS5.	HEATSINK	Vertical pcb mtg, 10°C/W, TO220.
56	1	SP1.	PIEZO	Piezzo sounder, pcb mount, external drive.
57	1	J1.	HEADER 10*2	20way mini-DIP boxed hdr, centre bump.
58	1	J2.	HEADER 20*2	40way mini-DIP header with end latches.
59	1	PL1.	HEADER 3	3way SIL header, .1" pitch w friction lock
60	1	PL2,PL3.	HEADER 4	4way SIL header, .1" pitch w friction lock
61	3	SPD1,SPD2,SPD3.	BLADE	Vertical pcb mtg tab for 0.25" receptacle.
62	3	PR1,PR2,PR3.	RECEPT	0.25" push-on crimp receptacle, red.
63	1	SSKT1.	DS1213C	Lithium-backed SmartSocket for 32k x 8.
64	1	T1.	RFXN XFMR	15VA Toroidal custom wound.
65	1	FUSE.	250mA(T)	20 x 5mm glass or ceramic anti-surge.
66	1	FUSEHOLDER.	20mm x 5mm	250Vac 6A fuseholder, screwdriver access.
67	2	SW1.	SW DPST	250Vac 6A rocker sw, non-illuminated.

NOTE:

Items 37 to 41 inclusive are programmable ic's. Correctly programmed replacement parts are only available from your local ARRI dealer or direct from ARRI (GB) Ltd.

SECTION 6 – CONTROL PCB CIRCUIT DIAGRAM


BAB.002 REV. 4
REFLEXION FACE PANEL (FADER)
ARRI (GB) LIMITED
1-3 AIRLINKS, SPITFIRE WAY,
HESTON, MIDDLESEX TW5 9NR,
ENGLAND.
Tel: 081-848 8881 Fax: 081-561 1312
Size B
Document Number RFXN-FAD.ORC
REV 4
Date: December 2, 1992 Sheet 1 of 1
TO PROCESSOR PCB (VR2)
TRANS 20*2
SWITCH SENSE SIGNALS
"FADER n" ANALOGUE SIGNALS
LED DATA
LED CLOCK
MM5450 DISPLAY DRIVER
ALL DECOUPLING CAPACITORS ARE 100nF MULTILAYER CERAMIC
WIRE LOOP ON DIGITAL 0V FOR 'SCOPE GROUND CLIP
WIRE LOOP ON ANALOGUE 0V FOR 'SCOPE GROUND CLIP
TO REAR PANEL ANALOGUE INPUT (DIS PLUG)
TRANS 10*2
"AGND"
"DGND"
TRICOLOUR "FREEZE"
REGULATOR LM317LZ
MASTER
FREEZE
PAGE 1
PAGE 2
PAGE 3
PAGE 4
PAGE 5
RECORD
BUMP 1
BUMP 2
BUMP 3
BUMP 4
BUMP 5
BUMP 6
BUMP 7
BUMP 8
BUMP 9
BUMP 10
BUMP 11
BUMP 12
FADER 1
FADER 2
FADER 3
FADER 4
FADER 5
FADER 6
FADER 7
FADER 8
FADER 9
FADER 10
FADER 11
FADER 12


J1
J2
VR2
R8
RE01
C1
C10
D1
D2
D3
D4
D5
D6
D7
D8
D9
D10
D11
D12
SW1
SW2
SW3
SW4
SW5
SW6
SW7
SW8
SW9
SW10
SW11
SW12
SW13
L1
L2
L3
L4
L12
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L5
L6
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L10
L11
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L18
L19
C2
C3
C4
C5
C6
C7
IC1
IC2
IC3
IC4
IC5
R3
R5
R7
FR01
FR02
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FR04
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FR08
FR09
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FR11
FR12
FR13
D13
D14
D15
D16
D17
D18
D19
D20
D21
D22
D23
D24
D25
TR1
TR2
R6
C8
C9
SW14
SW15
SW16
SW17
SW18
SW19
ARRI (GB) LTD
BAB.002 REV4

PARTS LISTING: REFLEXION CONTROL pcb, BAB.OO2, Rev 4.

Item	Quantity	Reference	Part	Description
1	1	C10	10nF	Min boxed polyester capacitor, 0.2" pitch.
2	9	C1,C2,C3,C4,C5,C6,C7, C8,C9	100nF	Multilayer ceramic capacitor, 0.2" pitch.
3	1	R6	100Ω	¼W 5% carbon film resistor
4	2	R7,R8	5.6kΩ	¼W 5% carbon film resistor
5	1	R1	47kΩ	¼W 5% carbon film resistor
6	1	R5	100kΩ	¼W 5% carbon film resistor
7	2	R3,R4	6 x 100kΩ	Commoned resistor SIL package, 7 pin.
8	13	FAD1,FAD2,FAD3,FAD4 FAD5,FAD6,FAD7,FAD8, FAD9,FAD10,FAD11,FAD12, FAD13	10kΩ LIN	Low profile 60mm linear fader w dust seal.
9	1	VR2	10kΩ	Horiz. cermet trimmer, through-pcb adjust.
10	25	D1,D2,D3,D4,D5,D6,D7, D8,D9,D10,D11,D12,D13, D14,D15,D16,D17,D18,D19, D20,D21,D22,D23,D24,D25	1N4148	Silicon signal diode, 75V, 75mA.
11	2	TR1,TR2	BC213	PNP general purpose transistor, 45V, 100mA.
12	3	IC1,IC2,IC3	LM324	Quad op-amp, 14 pin DIL.
13	1	IC4	TL071	Single op-amp, 8 pin DIL.
14	1	REG1	LM317LZ	Adjustable voltage regulator, 100mA, TO92.
15	1	L11	TRICOLOUR	5mm round tricolour LED, diffused, T1 $^3/_4$.
16	19	SW1,SW2,SW3,SW4,SW5, SW6,SW7,SW8,SW9,SW10, SW11,SW12,SW13,SW14, SW15,SW16,SW17,SW18, SW19	ITT D6	Momentary keyboard switch, round cap.
17	18	L3,L1,L2,L4,L5,L6,L7, L8,L9,L10,L12,L13,L14, L15,L16,L17,L18,L19	LED	5mm Green LED, diffused
18	1	IC5	MM5450	34 LED c/anode display driver, serial load.
19	1	J1	TRANS 10*2	20way 2 row IDC transition connector.
20	1	J2	TRANS 20*2	40way 2 row IDC transition connector.
21	13	(per fader)	FADER CAP	Grey profiled fader knob.

APPENDICES

APPENDIX A – CONNECTOR SCHEDULES

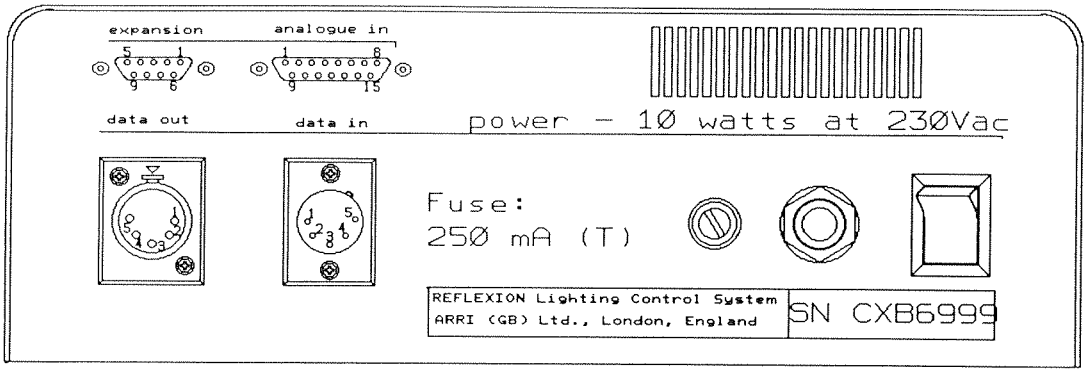
APPENDIX B – JUMPER SETTINGS

APPENDIX C – SOFTWARE UPGRADE PROCEDURE

APPENDIX D – FACTORY TEST PROCEDURE

APPENDIX E – ENGINEERING CHANGE NOTICES

APPENDIX A CONNECTOR SCHEDULES



ANALOGUE INPUT CONNECTOR - D-Type 15 pin Chassis Plug

Remote Analogue Control

pins 1 to 12 = Inputs 1 to 12
pins 13,14 & 15 = 0V (common)

Input voltage range: 0v (off) to +10v (full)

Recommended Cable type : Multi-core cable with overall screen

XLR DATA SOCKETS

DATA IN - 5 Pin XLR Plug
DATA OUT - 5 Pin XLR Socket

These are primarily intended for DMX data in and out. When the system is fitted with the protocol converter option, they may also be used for D54 data (2 wire Strand analogue multiplex, UK standard) or for AMX-192 data (4 wire Strand analogue multiplex, USA standard). Any combination of analogue multiplex and DMX data can be catered for, ie AMX-192 IN with DMX 512 OUT or DMX 512 IN with D54 OUT, etc. For that reason the DATA XLR connectors are wired with 4 core looms.

	DMX-512	D-54	AMX-192
pin 1	0V reference	0V common	0V common
pin 2	RS485 DATA-	An Mux Data	An Mux Data
pin 3	RS485 DATA+	n/c	Clock +
pin 4	reserved	n/c	Clock -
pin 5	reserved	n/c	n/c

APPENDIX B JUMPER SETTINGS

Jumper site J3 has 5 jumper pairs, A to E. Functions are:

Software Versions 1.xx

	Open circuit	Short circuit
A	normal function	Clear System Memory
B	Not used	Not used
C	Not used	Not used
D	Not used	Not used
E	Record Enable	Record Disable (RAM Write Protect)

Software Versions 2.xx

	Open circuit	Short circuit
A	Power-on beep Enabled	Power-on beep Disabled
B	Byte-by-Byte DMX	Buffered DMX throughput
C	} CPU address in	
D	} expanded systems	
E	Record Enable	Record Disable (RAM Write Protect)

Jumper settings shown underlined are factory defaults

With version 2.xx software fitted, it is possible to select the method by which DMX is processed. Two modes are provided, Byte-by-Byte or Buffered. We recommend that you select the factory default Byte-by-Byte processing method unless you experience problems with a particular DMX source, in which case you should switch to Buffered DMX processing.

Byte-by-Byte processing:

When a byte arrives in the processor's input SIO data register it is immediately passed to the hardware calculator. 6μs later the processor gathers the calculated result and immediately passes it to the output SIO data register. The net effect is that one byte is transmitted for every byte received, which in turn means that the output DMX stream is fully synchronised with the input DMX stream. The total system throughput delay will be between 44μs and 88μs (between one and two byte times).

This method deals successfully with all DMX sources and receivers in production today. However, to be able to deal with ever increasing DMX speeds and varieties that are permissible under the DMX512:1990 standard we have included a second handling routine for incoming DMX, referred to as Buffered DMX throughput.

APPENDIX C SOFTWARE UPGRADE PROCEDURE

Upgrading your REFLEXION's software is a simple process of exchanging the programme EPROM. However it is important to note that the EPROM as well as many other components fitted in REFLEXION are CMOS devices and therefore all anti-static precautions must be observed.

For example:

- Ensure that you are working on an approved anti-static work surface that is connected to earth.
- Ensure that you are wearing an approved anti-static wrist strap at all times that is connected to earth.
- Do not remove the EPROM from its protective tube/box until you are ready to fit the device. Avoid touching its pins at all times.
- Avoid wearing clothing made from synthetic fibre, especially in hot, dry climatic conditions.

NOTE: All data that is stored within REFLEXION will be lost after performing the software upgrade. Ensure either that you do not require the data or that you are able to reprogramme those states into REFLEXION afterwards

Procedure :

1. READ THROUGH ALL THE STEPS OF THIS PROCEDURE FIRST. Make sure that you understand them and that you have all necessary tools to hand.
2. Remove all power from REFLEXION and unplug any data cables from the rear panel.
3. Remove the four M3 countersunk posidrive case screws with a No.1 point posidrive screwdriver and put them safely to one side.
4. Lift the Control Panel up and over to the right hand side, so that it is laying on its side. Ensure that none of the internal cables are under any stress.
5. Using a suitable IC extractor or a small flat blade screwdriver, carefully remove the existing EPROM from it's socket, noting its orientation in the socket. The 'notch' should be on your right hand side when viewed from the front of the unit, matching the notch in the socket.
6. Take the new EPROM and fit it in to the socket. Before you finally push it home in the socket ENSURE that the device is the correct way round (as in step 4) and that ALL of the EPROM's legs are located in the socket correctly (ie: check that the EPROM's notch matches the notch in its socket and that none of the legs are bent between the EPROM and the socket.)
7. Check the jumper settings. It is possible that jumper functions may change with a new software version; details of any such changes will accompany the upgrade EPROM. Refit any internal cables that may have been removed, replace the Control Panel and fasten it with the four original screws.

Now you must clear the system's memory so that the new software can set up its own buffers, pointers and working variables (which will all change address from one software version to the next). In clearing the memory you will also clear all stored states - you did check that it is safe to destroy them, didn't you?

APPENDIX D FACTORY TEST PROCEDURE

REFLEXION PRODUCTION TEST PROCEDURE, REVISION 3, 04-12-92.

TEST EQUIPMENT REQUIRED:

1	Known good DMX source (eg Mirage, Imagine, etc.)
2	Known good 12 channel 0V to +10V analogue control voltage source
3	Known good DMX test set (eg Goddard Design's Li'l DMXter)
Or	Connexion Analogue Output Module plus:
either:	96 way led panel, for monitoring AOM outputs
or:	12 way dimmer & 12 x 100w lamp loads
4	Cabling to connect these units to Reflexion under test.
5	DVM accurate to ±1% on 20V DC voltage range.

TEXT CONVENTIONS USED IN THIS DOCUMENT:

DUT = Device Under Test, ie the Reflexion being tested.

AOM = Connexion Analogue Output Module.

DMX Source = Control system with known good DMX output to feed Reflexion.

DMX Monitor = DMX test set such as Goddard Designs' "Li'l DMXter". If one is not available it is possible to use a good, linear DMX demultiplexer (eg AOM) and a DVM to deduce Reflexion's DMX output bytes. If the full scale output from the demultiplexer is +10.00V then the value of Reflexion's output byte for a given dimmer can be calculated as: (Vout/10.00) x 255

HL12 = Single preset 12 channel analogue control voltage source, 0V to +10.0V, with latching bumpbutton per channel and Grandmaster fader. Bumpbuttons are not only latching but also under control of the Grandmaster.

Button presses on the Reflexion are printed in angled brackets, eg <RECORD>.

Unless otherwise stated "Fader" and "LED" refer to the Reflexion control panel. "leds" refers to low current led panels driven from the AOM's outputs.

"Check" indicates that a function of the DUT is to be measured or tested & confirmed good or bad.

"Verify" is used where the operator is asked to make sure that the test system is in the correct state, the state which this procedure assumes has been reached, before continuing to "check" a function of the DUT.

REFLEXION TEST PROCEDURE:

2 EXTERNAL PHYSICAL INSPECTION.

2.1 Transcribe serial number and software version (shown on rear panel) onto test sheet.

2.2 Check paint surface is free of blemishes.

2.3 Check silkscreened legend for good alignment & free of blemishes.

2.4 Check alignment of Control pcb with front panel; all faders travel fully without scraping on the edge of their slots, all pushbuttons are central in their panel apertures. Realign during Part 3 checks if necessary.

2.5 Check Control Panel LED alignment (dome central in hole and level with outside surface of panel) and colour.

2.6 Check fader knobs are all fitted with 1mm gap between base of skirt and metalwork.

2.7 Check INPUT DATA LED protrudes 2.5 ± 0.5mm outside of base pan, ie the whole lens dome protrudes. Realign during Part 3 checks if necessary.

2.8 Check that four feet are affixed squarely, firmly and in correct position.

2.9 Check fuse value and type is 250mA(T).

2.10 Check the free end of the mains supply cable is correctly stripped, twisted and tinned and that the cable colour code sticker is fixed around the cable about 4" from the free end.

2.11 Shake test for loose or foreign objects inside.

4.2 Using the DVM measure the four power supply rails. Acceptable values are:

RAIL	PASS RANGE
+5V	+4.75V to +5.50V with respect to 0V at TEST PROBE GND.
+15V	+13.5V to +16.5V with respect to 0V at TEST PROBE GND.
-15V	-13.5V to -16.5V with respect to 0v at TEST PROBE GND.
Isolated +5V	+4.50V to +5.50V with respect to ISO 0V at ISO PROBE GND.

4.3 Switch off, reassemble the case halves, leaving the screws finger tight for now.

5. ELECTRICAL FUNCTION TEST.

5.1 INITIAL CONDITIONS: Power up DMX Source. Connect from DUT's DATA OUT socket to DMX Monitor (or AOM and output monitoring leds). Unplug DMX and Analogue inputs from DUT. Set all DUT faders at 0%, except Input fader at 100%.

5.2 Switch on DUT, check that INPUT DATA LED flashes on for about 1 second, then stays off. Check that alarm beeps (at 1Hz) and is "at a discreet volume" (assessed by ear against previous experience). Check that INPUT FREEZE LED flashes red at 1Hz. Check that the DMX Monitor reports "No DMX" or that AOM's BAD DATA led is lit.

5.3 Connect DMX from DMX Source to DATA IN plug on DUT. Check that DUT's INPUT DATA LED lights and stays lit. Press <INPUT FREEZE>. Check that alarm stops or, if within 13 seconds of power-on, beeps at 2Hz until about 13 seconds after power on. Check that INPUT FREEZE LED is green, steadily illuminated. Check that AOM's GOOD DATA led is lit.

5.4 Press each <PAGE> button in turn. Check that the associated green LED lights. Press <PAGE 1>. Press <RECORD>. Check that the associated red LED lights. Press <RECORD> again to extinguish the red LED.

5.5 Run Cue 20 in DMX Source playback. Verify that the Cue 20 test pattern is displayed correctly at DMX Monitor (or is output from the AOM) and can be faded up & down, smoothly and progressively, under control of the Input fader. Check that a 15 second manual fade produces no uneven steps or flickering on DMX Monitor display, or visible steps on AOM's output leds.

5.6 Disconnect DMX from DUT's DATA IN plug. Check that INPUT DATA LED goes out within 1 second and stays out. Check that alarm beeps at 2Hz for 10 seconds (20 beeps). Verify that the Cue 20 test pattern is still displayed on the DMX Monitor (or on the AOM output leds) and that it can be faded up and down under control of the Input fader. Return the Input fader to 100%.

5.11 REFLEXION A/D CALIBRATION:

WARNING:

HAZARDOUS VOLTAGES EXIST INSIDE THE CASE. MAKE SURE THAT THE UNIT HAS PASSED PART 2, 3 & 4 CHECKS BEFORE CONTINUING WITH THIS SECTION. TAKE ALL APPROPRIATE PRECAUTIONS FOR WORKING ON LIVE EQUIPMENT. POWER THE UNIT AND TESTGEAR FROM A SUPPLY PROTECTED BY A RESIDUAL CURRENT CIRCUIT BREAKER OF 30mA SENSITIVITY. ONLY USE ONE HAND INSIDE THE CASE, KEEPING THE OTHER AWAY FROM ALL PARTS OF THE UNIT & TESTGEAR.

5.11.1 Switch off the supply to the DUT. Remove the 4 case fastening screws and set them aside safely. Lift the Control Panel assembly up at the front so that the panel is approximately horizontal (so that you don't short the Control pcb to the base pan) and slide it forward to expose the 40 pin header on the CPU pcb. Let the Control Panel assembly rest on its side walls and check that the Control pcb is well clear of the front wall of the base pan. Switch on the supply to the DUT.

5.11.2 Adjust HL12 master fader so that DMX Monitor shows DUT output level = 0F2h. Alternatively adjust HL12 master fader to set AOM output #1 voltage to 9.5V (±0.2V). Verify that HL12 bumpswitch #1 is the only one latched in. Measure and record the value of DUT's output level #1 as shown by DMX Monitor (or alternatively record AOM output #1 voltage). Check that there is no visible crosstalk to any other DUT output level. Release HL12 bumpswitch #1 and latch in HL12 bumpswitch #2.

5.11.3 Repeat the last sub-step for each analogue input (ie each HL12 bumpswitch) in turn, checking for the correct dimmer assignment (HL12 bumpswitch #nn should bring AOM outputs #nn and #1 to approx 9.5V, all others to 0%) and absence of visible crosstalk. In each case record the value for DUT output level #1 as shown by DMX Monitor (or alternatively the voltage on AOM output #1). If the spread of voltages exceeds 0.5V the unit fails due to "EXCESSIVE GAIN VARIATION".

5.11.4 Latch in the bumpswitch which produced the LOWEST value for DUT output level #1 (or lowest voltage at AOM output #1) and release all others. Verify that HL12 output #1 voltage is 9.50V (±0.05V), adjusting HL12 master fader if necessary. Adjust the DUT's multiturn preset (located in REG1 site, to the rear of the 40 pin header) to set DUT's output level #1 to 0F2h or to set AOM output voltage to 9.50V (±0.05V). The A/D reference is now calibrated.

5.11.5 Switch off power to DUT. Unplug the analogue input cable from the rear panel. Lift the Control Panel assembly up and place it on its right side-wall, to the right of the base pan, ready for the next step. Whilst doing this ensure that ribbon looms to the Control pcb aren't stressed and that you don't short part of the Control pcb to the base pan.

5.14 Remove the shorting link from jumper J3E. Jumpers J3A to J3E should be all open circuit. This completes the electrical function tests. Now to clear the DUT's memory and afterward finally close the case.

v1.x Software: Switch off the mains supply to the DUT and unplug DMX and analogue input cables. Open the case and stand the Control Panel on its side to the right of, and clear from the base pan, making sure that no looms are stressed. Remove the shorting plug from jumper J3E and place it on jumper J3A. Remove your hand from inside the case and switch on the DUT. Wait about 2 seconds, until the alarm starts beeping and then switch off. Remove the shorting plug from J3A and close the case, making sure that no wiring is trapped. Tighten the case screws, replacing any that are scarred.

v2.0x Software: Switch off the mains supply to the DUT and unplug DMX and analogue input cables. Close and fasten the case, replacing any M3 case screws which are scarred. Hold down DUT bumpbuttons 7, 8 & 9 while you apply power. When you hear the power-on alarm sound release the bumpbuttons. The DUT's memory is now cleared, and it is set up to the factory default configuration.

6. FINAL CLEANUP AND PACKAGING:

6.1 Clean up the case and controls with antistatic cleaner. Coil up the mains cable and secure it with a cable tie.

6.2 Wrap the unit in tubular polythene sheet; add a silica gel drying pack before sealing.

6.3 Tape an envelope, containing the manual (check version is current) and a 1.5m DMX cable, to the bottom of the package.

6.4 Fill in the serial number on three product code stickers. Stick one firmly to the polythene wrapping. Stick a corner of the other two lightly onto the wrapping. Complete all required paperwork for the Production office.

APPENDIX E ENGINEERING CHANGE NOTICES

E.1	9109	-	Y1.CB001.0; REFLEXION CPU PCB. Modification to A/D reference circuit
E.2	9111	-	Y1.CB001.0; REFLEXION CPU PCB. Modification to power-on reset circuit
E.3	9112	-	Y1.CB001.0; REFLEXION CPU PCB. Change of A/D fader divider network
E.4	9203	-	Y1.CB001.0; REFLEXION CPU PCB. Repositioning of DMX input track on PCB
E.5	9209	-	Y1.CB001.0; REFLEXION CPU PCB. Change of value for power-on sense resistor
E.6	9210	-	Y1.CB001.0; REFLEXION CPU PCB. Addition of two 100KΩ pull-up resistors for I^2C BUS
E.7	9211	-	Y1.CB001.0; REFLEXION CPU PCB. Addition of 47nF capacitor between Input Master fader signal and analogue ground

ECN/CPU Revision Status at 2nd December 1992

CPU Revision	Serial number	ECN Applicable
Rev1	0001+	9109, 9111, 9112, 9203, 9209, 9211
Rev2	0011+	9109, 9111, 9112, 9203, 9209, 9211
Rev3	0037+	9111, 9112, 9203, 9209, 9211
Rev4	0048+	9203, 9209, 9210, 9211
Rev5	0087+	9209, 9210, 9211
Rev6	0130+	9211

ECN NUMBER: 9109

>>>> THIS ECN REPLACES ECN9108, WHICH IS NOW OBSOLETE <<<<

DATE OF ISSUE: 20th September 1991

AFFECTS PART NUMBER: Y1.CBOO1.0; Reflexion Backup system CPU pcb.

DESCRIPTION OF CHANGE: Modifies A/D reference circuit. Deletes REG1, replacing it with an adjustable voltage reference, mounted on a small daughter pcb.

REASON FOR CHANGE: To provide a means of calibrating Analogue Inputs.

IMPLEMENTATION DATE: PRODUCTION - IMMEDIATE
FIELD SERVICE - as required, all but two units were modified in production.

DETAILS:

CAUTION !

Many of the components on the CPU pcb are CMOS. Observe anti-static precautions at all times when working on this pcb. Work on an earthed anti-static surface and wear a wrist strap connected to that surface.

Unplug all cables from rear panel and ensure that the mains cable is isolated from mains supply. Unscrew the 4 black M3 countersunk screws fixing the case halves. Lift the Control Panel up and rotate it backwards to stand on its rear edge behind the rear panel, ensuring that it is stable and that cabling between Control panel and CPU is not stressed. Unplug all 4 signal looms and the supply cables from the CPU pcb. Unscrew the 5 pcb fixing screws; remove them and their shakeproof washers and put aside safely. Slide the CPU pcb towards the rear sufficiently to free the INPUT DATA LED and lift it out of the case; place it on the anti-static work surface.

REG1 is a 3-pin TO92 device immediately to the rear of the middle of the 40 pin header. Cut the body of REG1 from its legs. Desolder and remove the stubs. Take care not to use excessive heat, especially on the centre leg as its track is both short and thin; too much heat will cause it to lift.

Cut the body of R25 (10kΩ, ¼W) away from its legs, desolder and remove the stubs. Use a solder sucker to clean old solder from the holes. Fit a 1.8kΩ ¼W metal film resistor in R25's site.

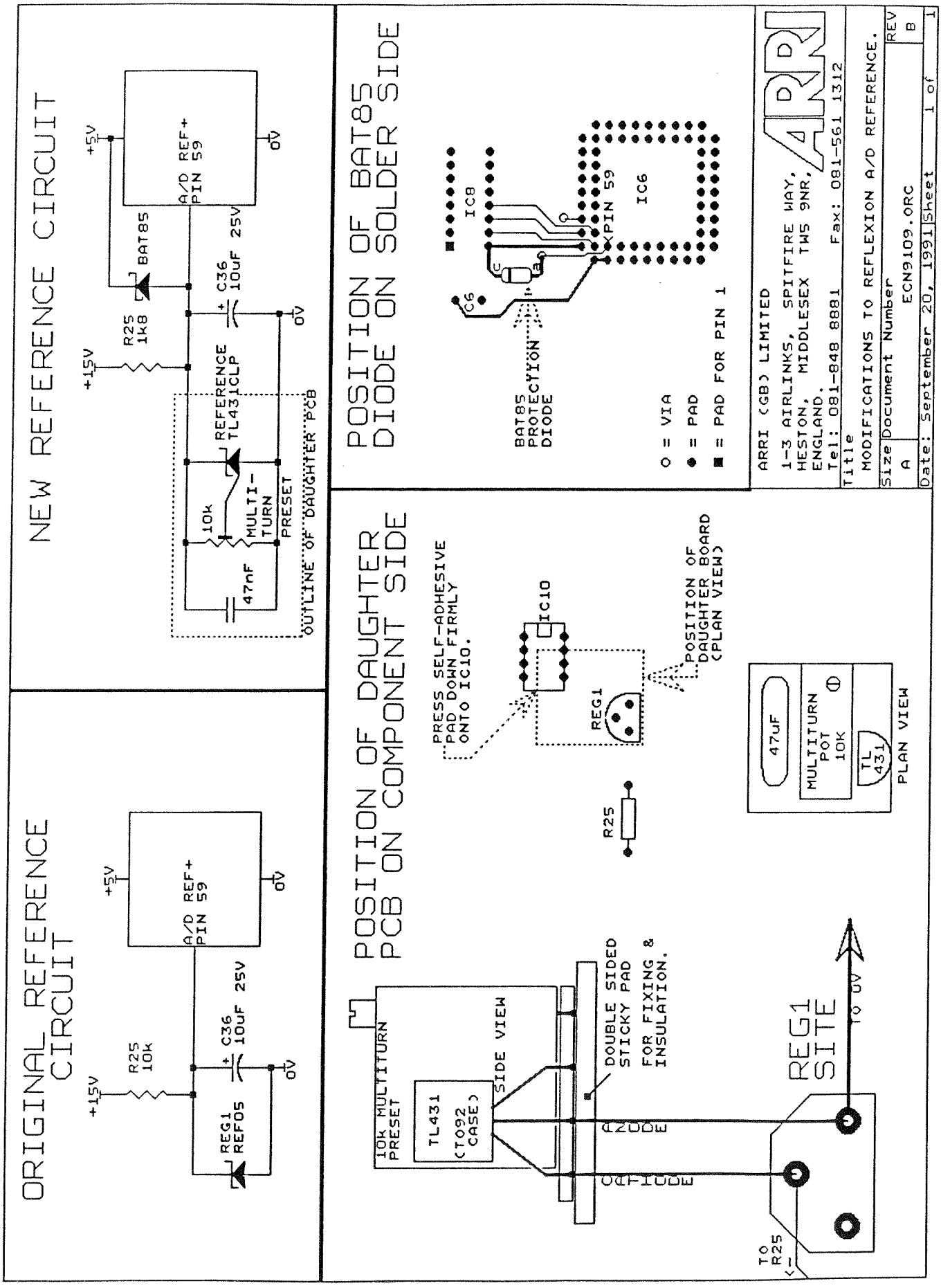
DETAILS (continued):

Now fit the new reference assembly (a multiturn potentiometer and TO92 regulator mounted on a small daughter pcb). Remove the backing from the adhesive pad and solder the two long TO92 legs into REG1 site. It is difficult to get the polarity wrong, but check that you use the correct two pads from the three on the REG1 site. Make sure that the assembly is stuck down onto the top of IC10 for additional support.

Fit a BAT85 Schottky protection diode on the solder side of the pcb. Identify the via nearest the top right corner of IC6 (see accompanying diagram). Carefully scrape off the solder mask on both sides of the pcb with a scalpel. Tin the copper pads both sides then clean the hole of all excess solder with a solder sucker. Insert the BAT85 anode in this via. Form the legs so that the cathode can be soldered to the +5V rail at pin 16 of IC8. Double check that the cathode goes to +5V and the anode to the via on the A/D reference track before soldering it in place. As the via pad is very small it is a wise precaution to solder it on both sides of the pcb. Finally, check with an ohmmeter that both solder joins are good (<0.3Ω). This is important as it is possible to adjust the new reference as high as +12V, which will destroy the CPU unless the Schottky diode clamps the reference to the +5V CPU rail.

The modifications are now complete. Refit the CPU pcb in the case (5 M3 screws and shakeproof washers) then reconnect the supply cabling and signal looms. The unit now requires testing and calibration. This is detailed in the Factory Test Procedure, Revision 2, dated 13-9-91. First carry out the power-up rails checks, Section 4, then follow the calibration procedure from step 5.9 onwards, taking note of the warning at the start of section 4.

IF IN DOUBT CALL 081-848 8881 AND SPEAK TO: **MIKE HAYWARD or IAN FANNING**


NEW REFERENCE CIRCUIT
+5V
A/D REF+
PIN 59
0V
BAT85
C36
10uF 25V
R25
1k8
+15V
REFERENCE
TL431CLP
10k
MULTI-
TURN
PRESET
47nF
OUTLINE OF DAUGHTER PCB
ORIGINAL REFERENCE
CIRCUIT
R25
10k
REG1
REF05
POSITION OF BAT85
DIODE ON SOLDER SIDE
IC8
IC6
C6
PIN 59
BAT85
PROTECTION
DIODE
O = VIA
● = PAD
■ = PAD FOR PIN 1
POSITION OF DAUGHTER
PCB ON COMPONENT SIDE
PRESS SELF-ADHESIVE
PAD DOWN FIRMLY
ONTO IC10.
IC10
REG1
R25
POSITION OF
DAUGHTER BOARD
(PLAN VIEW)
47uF
MULTITURN
POT
10K
TL
431
PLAN VIEW
10K MULTITURN
PRESET
TL431
(TO92
CASE)
SIDE VIEW
DOUBLE SIDED
STICKY PAD
FOR FIXING &
INSULATION.
ANODE
CATHODE
REG1
SITE
TO 0V
TO
R25
ARRI (GB) LIMITED
1-3 AIRLINKS, SPITFIRE WAY,
HESTON, MIDDLESEX TW5 9NR,
Tel: 081-848 8881 Fax: 081-561 1312
Title
MODIFICATIONS TO REFLEXION A/D REFERENCE.
Size
A
Document Number
ECN9109.ORC
REV
B
Date: September 20, 1991
Sheet
1 of 1

ECN NUMBER: 9111

DATE OF ISSUE: 12th December 1991

AFFECTS PART NUMBER: Y1.CBOO1.0; Reflexion Backup system CPU pcb.
Serial no.s CXB-0001 to -0036

DESCRIPTION OF CHANGE: Modifies power up/down reset circuit. Deletes C13, replacing it with a TL7705A supervisory IC.

REASON FOR CHANGE: Stops Reflexion intermittently outputting zero DMX values during power down.

IMPLEMENTATION DATE: PRODUCTION - IMMEDIATE
FIELD SERVICE - as required.

DETAILS:

CAUTION !
Many of the components on the CPU pcb are CMOS. Observe anti-static precautions at all times when working on this pcb. Work on an earthed anti-static surface and wear a wrist strap connected to that surface.

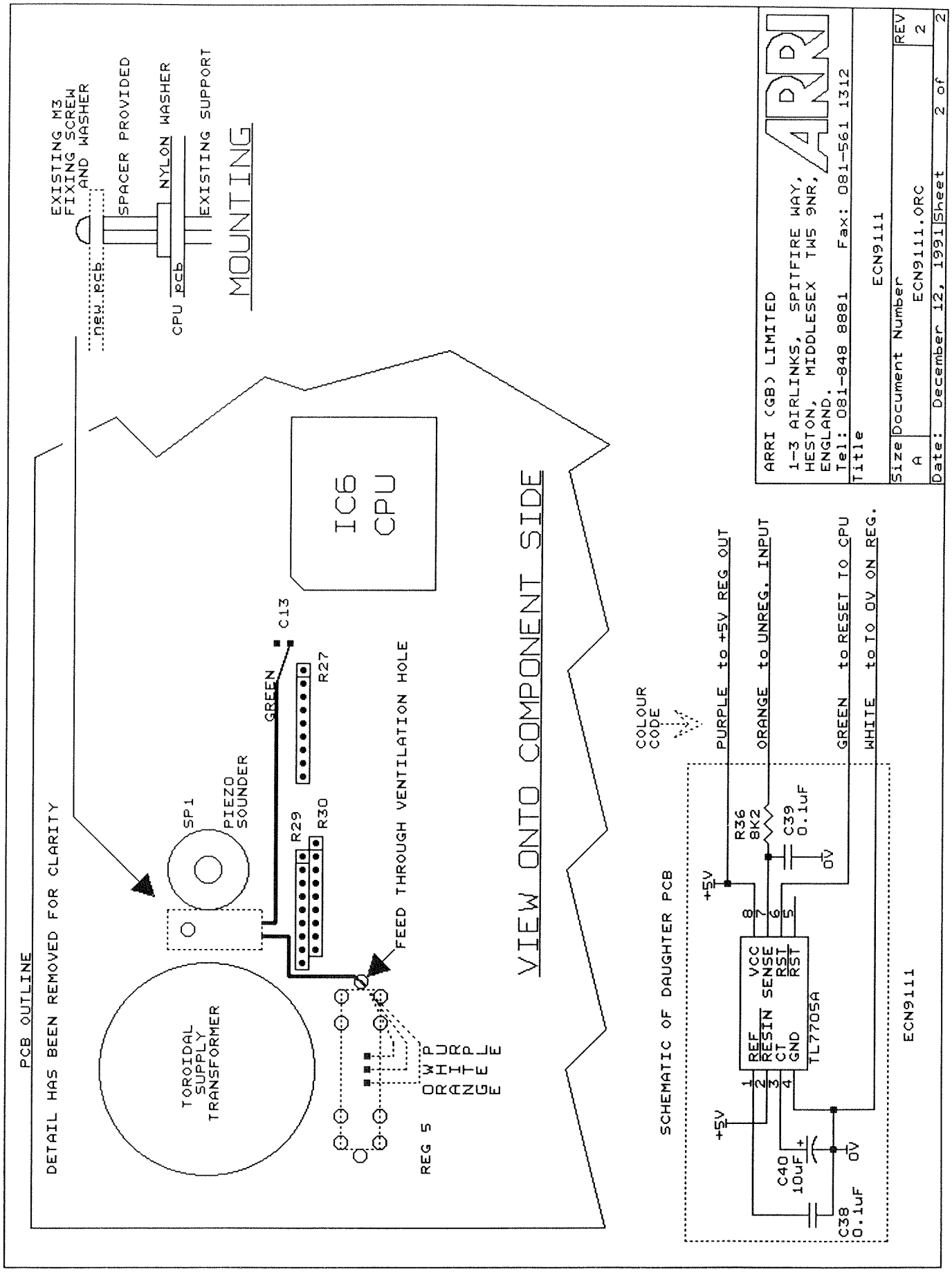
Unplug all cables from rear panel and ensure that the mains cable is isolated from mains supply. Unscrew the 4 black M3 countersunk screws fixing the case halves. Lift the Control Panel up and rotate it backwards to stand on its rear edge behind the rear panel, ensuring that it is stable and that cabling between Control panel and CPU is not stressed. Unplug all 4 signal looms and the supply cables from the CPU pcb. Unscrew the 5 pcb fixing screws; remove them and their shakeproof washers and put aside safely. Slide the CPU pcb towards the rear sufficiently to free the INPUT DATA LED and lift it out of the case; place it on the anti-static work surface.

Remove C13 (10μF 16V) capacitor and clear the PTH. Take the add-on pcb provided and solder the four wires as shown on the following page, keeping in mind the final mounting position also shown. The wires have been cut to length taking the above into account, so do not shorten any lead wires.

Replace the CPU pcb, using its original mounting screws, and replace the central mounting screw (near the toroidal transformer) with the 10mm spacer and nylon washer provided. Carefully screw the pcb onto the spacer using the original M3 screw. Do not over tighten the screw as you may crack the pcb.

Finally re-assemble the Reflexion and ensure it is still 100% functional. When you apply power, listen for the power-on alarm. If it does not sound within 2 seconds or if it does not sound normal then SWITCH OFF IMMEDIATELY and inspect for solder splashes, broken wiring, scarred insulation, etc.

IF IN DOUBT CALL 081-848 8881 AND SPEAK TO: **MIKE HAYWARD** or **STEVE VIALARDI**


MOUNTING
EXISTING M3 FIXING SCREW AND WASHER
SPACER PROVIDED
NYLON WASHER
EXISTING SUPPORT
new pcb
CPU pcb
VIEW ONTO COMPONENT SIDE
IC6 CPU
C13
GREEN
R27
R29
R30
SP1
PIEZO SOUNDER
FEED THROUGH VENTILATION HOLE
TOROIDAL SUPPLY TRANSFORMER
PCB OUTLINE
DETAIL HAS BEEN REMOVED FOR CLARITY
REG 5 ORANGE WHITE WIRE
COLOUR CODE
PURPLE to +5V REG OUT
ORANGE to UNREG. INPUT
GREEN to RESET TO CPU
WHITE to TO 0V ON REG.
SCHEMATIC OF DAUGHTER PCB
R36 8K2
C39 0.1uF
+5V
0V
REF
RESIN
CT
GND
SENSE
VCC
RST
RST
TL7705A
C40 10uF
C38 0.1uF
ECN9111
ARRI (GB) LIMITED
1-3 AIRLINKS, SPITFIRE WAY,
HESTON, MIDDLESEX TW5 9NR,
ENGLAND.
Tel: 081-848 8881 Fax: 081-561 1312
Title
ECN9111
Size A
Document Number ECN9111.0RC
REV 2
Date: December 12, 1991 Sheet 2 of 2

ECN NUMBER: 9112

DATE OF ISSUE: 12th December 1991

AFFECTS PART NUMBER: Y1.CBOO1.0; Reflexion Backup system CPU pcb.

DESCRIPTION OF CHANGE: Change of A/D control voltage divider network from existing 1.0kΩ to new 4.7kΩ. Increase +15/−15V smoothing caps from existing 470μF to new 1000μF 35V.

REASON FOR CHANGE: Decrease load on +15 Volt supply to maintain a sufficient dropout voltage across regulator. Avoids symptoms in some units of jitter on DMX output with all faders at full, especially with low AC supply voltage.

IMPLEMENTATION DATE: PRODUCTION – IMMEDIATE
FIELD SERVICE – as required.

DETAILS:

CAUTION !

Many of the components on the CPU pcb are CMOS. Observe anti-static precautions at all times when working on this pcb. Work on an earthed anti-static surface and wear a wrist strap connected to that surface.

Unplug all cables from rear panel and ensure that the mains cable is isolated from mains supply. Unscrew the 4 black M3 countersunk screws fixing the case halves. Lift the Control Panel up and rotate it backwards to stand on its rear edge behind the rear panel, ensuring that it is stable and that cabling between Control panel and CPU is not stressed. Unplug all 4 signal looms and the supply cables from the CPU pcb. Unscrew the 5 pcb fixing screws; remove them and their shakeproof washers and put aside safely. Slide the CPU pcb towards the rear sufficiently to free the INPUT DATA LED and lift it out of the case; place it on the anti-static work surface.

Take care when removing components. Undue force or an overtemperature soldering iron (>380°C) can easily damage pads or tracks.

1. Carefully remove discrete 1K resistors (parallel with J2, 40-way fader pcb interface connector) **R6,7,8,9,13,14,18,19,20,21,22,23**.

2. Remove SIL resistor packs **R24 and R10**. Grip the body with fine nosed pliers and bend it back and forth until the legs fracture. The legs can now be removed one by one. This technique reduces the risk of damage to the pcb.

3. Clear any remaining solder from the plated-through holes (PTH), preferably with an anti-static solder sucker. Replace all discrete resistors removed with 4.7kΩ 5% ¼W carbon film resistors. Replace SIL resistors removed with 7 x 4.7kΩ commoned resistor SIL packs (ie 7 resistor, 8 pin packages). Check that the common pin (normally marked with a dot) is in the pad marked with a box.

4. Remove supply smoothing capacitors **C20 and C23** (470μF). Replace with 1000μF 35V electrolytic capacitors. Double-check their polarity is correct before soldering them.

5. Inspect the pcb for any solder debris and re-assemble in the reverse order above.

IF IN DOUBT CALL 081-848 8881 AND SPEAK TO: **MIKE HAYWARD** or **STEVE VIALARDI**

ECN NUMBER: 9203

DATE OF ISSUE: 29 JULY 1992

AFFECTS PART NUMBER: Y5.CB001.0; REFLEXION BACKUP UNIT CPU PCB
REVISION 1 THRU 4 ONLY, IF MODIFIED TO ECN 9112.

DESCRIPTION OF CHANGE: RE-ROUTING OF DMX INPUT TRACKING ON PCB TO PREVENT CROSSTALK TO FADERS 5 AND 6.

REASON FOR CHANGE: REQUIRED ONLY IF ECN 9112 HAS BEEN IMPLEMENTED.

IMPLEMENTATION DATE: PRODUCTION - IMMEDIATE
FIELD SERVICE - NOT APPLICABLE. ALL UNITS HAVE BEEN MODIFIED TO THIS ECN IN THE FACTORY.

DETAILS:

IF IN DOUBT CALL 081-848 8881 AND SPEAK TO: **MIKE HAYWARD or STEVE VIALARDI**

ECN NUMBER: 9209

DATE OF ISSUE: 25th September 1992

AFFECTS PART NUMBER: All ARRI Reflexion consoles, Y1.CB001.0

DESCRIPTION OF CHANGE: Change of value for resistor R36 (in the power supply supervisory circuit built around IC34) from 11.0kΩ to 8.2kΩ. This circuit is tracked on BAB.001 (CPU pcb) Revs 4 and later (Reflexion serial nos 0048+). See ECN#9111 for details of this circuit on Rev 3 and earlier CPU pcbs.

REASON FOR CHANGE: PURELY DISCRETIONARY. Improves (reduces) minimum supply voltage for operation from 208Vac to 200Vac.

IMPLEMENTATION DATE: PRODUCTION: From next production batch; no retrofit required. FIELD SERVICE: Discretionary, only necessary on units used where mains supply voltage is low. Otherwise implement at next service action if client requests precautionary modification.

WARNING !

Some CPU pcb components carry mains supply voltage. Unplug the Reflexion power cable from its mains supply outlet and disconnect all signal cables from the rear panel before opening the case.

CAUTION !

Many of the components on the CPU pcb are CMOS. Observe anti-static precautions at all times when working on this pcb. Work on an earthed anti-static surface and wear a wrist strap connected to that surface. Read these instructions fully and make sure you understand them before starting the modification.

DETAILS:

Unscrew the four M3 countersunk screws fastening the case halves together. Lift the face panel up and rotate it up and over the rear panel so that it stands behind. Make sure you position it so that the two ribbon cable looms are not under tension.

Rev 4+ pcbs: With care R36 can be changed without removing the pcb. IC34, a TL7705A 8-pin IC, is located in the front right hand corner. R36, 11kΩ 1%, is mounted just inboard of IC34. Use a sharp, fine pair of sidecutters to cut the body of R36 from its legs. Use a fine tipped soldering iron with an earthed tip and a tip temperature of 350°-380°C to remove the leg stubs. Heat the stub, grip it with tweezers or fine pliers and withdraw it gently.

NOTE: Use of excessive force or excessive heat may damage the Plated Through Hole (PTH) or pad and invalidate the warranty.

Remove excess solder from the PTH with a solder sucker. Form the legs of an 8.2kΩ, 0.25W, 1% metal film resistor to fit the site and crop them so that they will project no more than 2mm below the solder side of the pcb. Fit this 8.2kΩ resistor in the vacant R36 site and solder in place.

Rev 3- pcbs:

The power supply supervisory circuit is on a small daughter pcb mounted on a pillar alongside the supply transformer. Unscrew the fixing screw to free the daughter pcb; avoid pulling on the wires connecting it to the CPU pcb. Lay a sheet of card over the CPU pcb and under the daughter pcb to catch any loose solder. R36 is the only resistor on the daughter pcb. Sketch its position or mark the pcb so that you can identify the right pads later. Cut its body from its legs. Use a fine tipped soldering iron with an earthed tip and a tip temperature of 350°-380°C to remove the leg stubs. Heat the stub, grip it with tweezers or fine pliers and withdraw it gently. Remove excess solder with a solder sucker.

NOTE: Use of excessive force or excessive heat may damage the daughter pcb and invalidate the warranty.

Fit an 8.2kΩ, 0.25W, 1% metal film resistor in the vacant R36 site and solder it in place. Crop the legs so that they project no more than 2mm below the solder side of the pcb. Fasten the daughter pcb back onto its support pillar, ensuring that its connecting wires are neatly dressed in their original positions.

All units:

Inspect the modification carefully and check there are no solder bridges, splashes of solder, shards of wire or other foreign objects inside the case. Reassemble the case, making sure that no wires become trapped between the two halves or rest on the main regulator heatsink. Plug the power cable into a mains outlet and switch on. The green data led should light almost immediately for about 0.5 second whether or not DMX is connected. [If it doesn't light switch off at once, open the case and check for solder splashes, wire shards or trapped wires which could short the main +5V rail.]

Finally give the unit a full functional test, particularly checking the stored states. It is possible, if your antistatic precautions were not good enough, for static discharges to corrupt the contents of the battery backed RAM. If you do find stored states are not as you programmed them it would be wise to clear the memory and re-record all the states from scratch.

With software versions 1.x this is achieved by switching off, shorting jumper A on the CPU pcb and switching on again. When the FREEZE led starts to flash switch off, remove the short on jumper A and close the case. With software versions 2.x the procedure is simpler. To clear the memory switch on whilst holding down bump buttons 7, 8 & 9. When the FREEZE led starts to flash release the bump buttons.

Your REFLEXION is now ready for programming and full use.

ECN NUMBER: 9210

DATE OF ISSUE: 10th November 1992

AFFECTS PART NUMBER: Y1.CBOO1.0; REFLEXION Backup system CPU pcb, Revs 4 and 5.

DESCRIPTION OF CHANGE: Addition of two 100kΩ 1/8 or 1/4 Watt Pull-Up resistors on the I^2C port (Expansion port).

REASON FOR CHANGE: Provides a defined state on the Expansion bus for units are configured as Slaves Modules when the I^2C cable is removed.

IMPLEMENTATION DATE: PRODUCTION - IMMEDIATE
FIELD SERVICE - As required. Only applicable for units to be configured as Slave Modules.

DETAILS:

CAUTION !

Many of the components on the CPU pcb are CMOS. Observe anti-static precautions at all times when working on this pcb. Work on an earthed anti-static surface and wear a wrist strap connected to that surface.

Unplug all cables from rear panel and ensure that the mains cable is isolated from mains supply. Unscrew the 4 black M3 countersunk screws fixing the case halves. Lift the Control Panel up and rotate it to the right, to stand on its right side alongside the base pan. Ensure that it is stable and that cabling between Control panel and CPU is not stressed. Unplug all 4 signal looms and the supply cables from the CPU pcb. Unscrew the 5 pcb fixing screws; remove them and their shakeproof washers and put aside safely. Slide the CPU pcb towards the rear sufficiently to free the INPUT DATA LED and lift it out of the case. Place it on the anti-static work surface.

The two 100KΩ 1/8W or 1/4W resistors (R37 & R38) are to be fitted to underside (track side) of the CPU pcb beneath resistors R1-R4. Use the attached drawing to locate the area. The resistors should be pre-formed as shown so that only one lead is connected to the +5v side of LK2 & LK3. The other end of the resistors are then soldered to the innermost side of R1 & R2 (270Ω).

Care must be taken when soldering the single resistor lead to LK2 & LK3 that you do not short across the link pads, which would permanently 'make' the link. (Slave Modules MUST have LK2 & LK3 open circuit.)

Having installed the resistors, you will need to test the unit as described below.

1. Give the pcb a close visual inspection, with a lens, to ensure no solder bridges exist from component legs to tracks nor from component legs to adjacent pads. Fix a small sticker on the component side with "ECN 9210" written on it near LK2 & LK3.

2. Remount pcb and remove links LK2 & LK3. Test resistance between upper and lower pins of each. It must be between 96.7kΩ and 107kΩ. This checks ECN9210. (REPLACE LINKS LK2 & LK3 IF UNIT IS TO BE CONFIGURED AS A MASTER).

3. Plug in looms, close case but do not fix case screws yet. Power up and listen for normal power-on beep. If it isn't normal SWITCH OFF AT ONCE and inspect for short circuits.

4. Plug in a DMX source and set all channels to on. Press Reflexions' FREEZE button to get the green led. Plug Reflexion's output into a DMX receiver and check that all channels are at full with the INPUT fader full. Fade the INPUT fader to zero and check that all channels fade smoothly to off.

5. Now clear the system memory . . .

WARNING: **Hazardous voltages exist inside the case. Do not touch components on the pcb or inside the rear panel whilst the supply lead is plugged into the mains.**

Software v1.xx

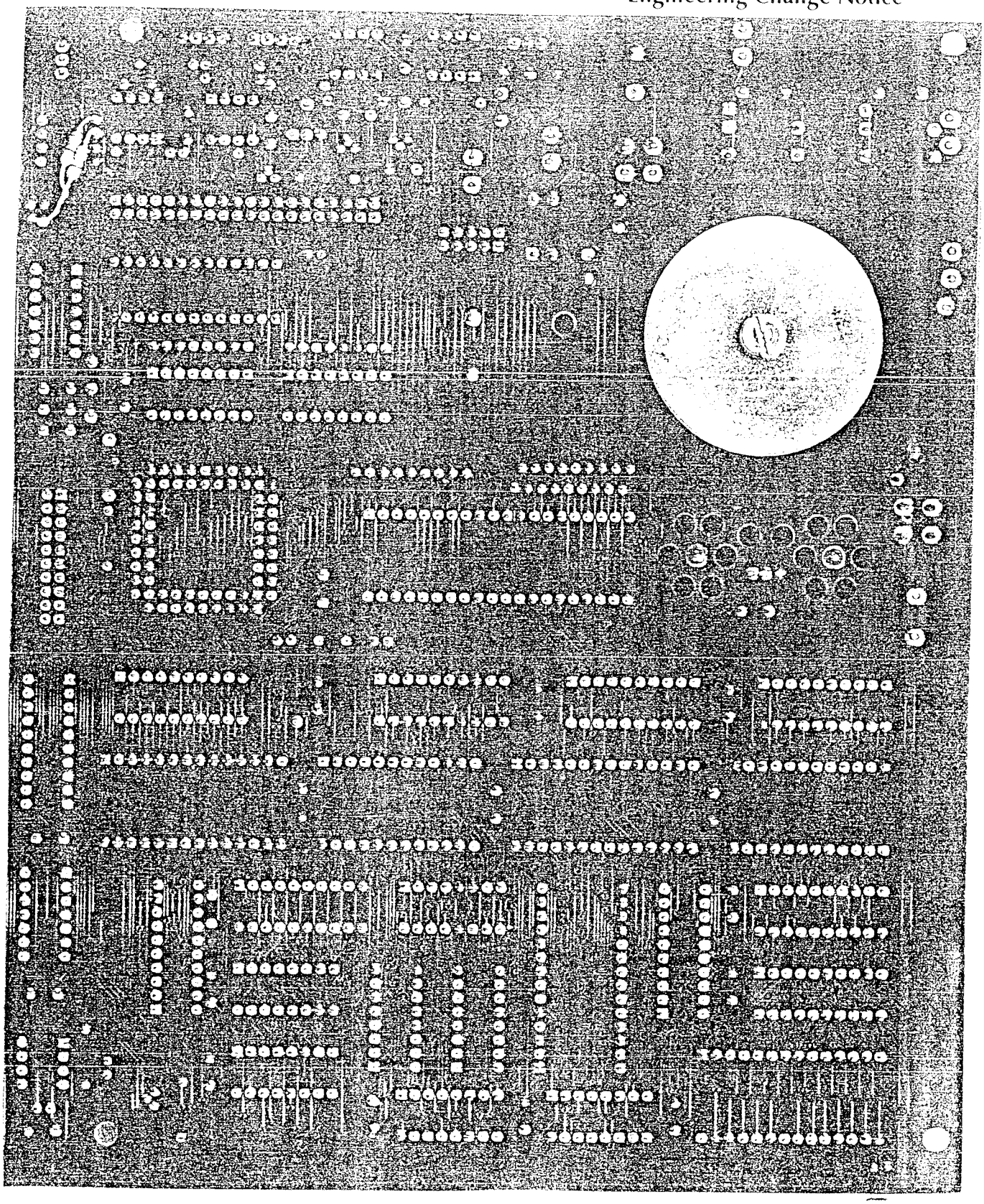
Switch off power. Lift the front panel up and rotate it to the right, to stand on its side alongside the base pan. Take care not to stress the ribbon cable loom and check that the Fader pcb cannot short to the rear panel. Place a shorting clip on Jumper A. Switch on power for about 1 second, until the power-on alarm sounds, then switch off power again. REMOVE THE SHORTING CLIP.

Software v2.xx

Close the case and fasten it. Hold down bump buttons 7, 8 & 9 while you switch on power. Release the bump buttons when you hear the power-on alarm sound.

6. Close the case and fit the four case screws. Your REFLEXION is now ready for use.

IF IN DOUBT CALL 081-848 8881 AND SPEAK TO: **STEVE VIALARDI** or **MIKE HAYWARD**



Underside view of Reflexion CPU pcb with resistors R37 & R38 Fitted

ECN NUMBER: 9211

DATE OF ISSUE:

10th November 1992

AFFECTS PART NUMBER:

Y1.CBOO1.0; REFLEXION Backup system CPU pcb. All revisions up to and including Revision 5.

DESCRIPTION OF CHANGE:

Addition of a single 47nF multilayer or disc ceramic capacitor between the INPUT Fader control signal and analogue ground.

REASON FOR CHANGE:

The Philips Microprocessor 80C552, following a change from Mask 4 to Mask 5, now shows a problem of internal crosstalk between the SIO and A/D network. This can, under certain conditions, cause the Input data to momentarily flash to full when the INPUT fader is set below full.

It is possible to test for this condition by connecting REFLEXION to the DMX output of a control desk and setting all dimmers to 50%. Remove the DMX input from REFLEXION (so that it automatically goes into FREEZE mode) and set all faders to 0. Select a Page that does not have any levels recorded on Fader 10 (ie led 10 is off), hold Bump Button 10 down and slowly raise the Input Fader (30 second fade). You should be able to raise the fader to full without any flashing on the lighting rig.

IMPLEMENTATION DATE:

PRODUCTION - IMMEDIATE
FIELD SERVICE - Recommended

DETAILS:

CAUTION !

Many of the components on the CPU pcb are CMOS. Observe anti-static precautions at all times when working on this pcb. Work on an earthed anti-static surface and wear a wrist strap connected to that surface. Read these instructions fully before commencing this ECN. If you are in any doubt, contact ARRI Lighting Control Technical Support.

Unplug all cables from rear panel and ensure that the mains cable is isolated from mains supply. Unscrew the 4 black M3 countersunk screws fixing the case halves. Lift the Control Panel up and over the right hand side so that the control panel PCB can be seen while still providing easy access to the faders and buttons. Ensure that all looms connected to the Control Panel are not under stress. Unplug all 4 signal looms and the supply cables from the CPU pcb. Unscrew the 5 pcb fixing screws; remove them and their shakeproof washers and put aside safely. Slide the CPU pcb towards the rear sufficiently to free the INPUT DATA led and lift it out of the case. Place it on the anti-static work surface.

The 47nF disc ceramic capacitor, C41, is to be fitted to the underside (track side) of the CPU pcb between the end of R6 nearest to R10 and the 0V pad at the end of resistor pack R10. Use the attached drawing to locate the position. Be very careful not to crack the body of the capacitor when fitting as this will cause deterioration of the capacitor over time and eventual system failure .

Now you must test the unit as described below.

1. Give the pcb a close visual inspection, with a lens, to ensure no solder bridges exist from component legs to tracks nor from component legs to adjacent pads. Fix a small sticker, marked "ECN 9211", on the component side near resistor pack R10.

2. Plug in all looms, close the case but do not fix case screws yet. Power up and listen for normal power-on beep. If it isn't normal SWITCH OFF AT ONCE and inspect for short circuits.

3. Plug in a DMX source and set all channels to 50%. Press REFLEXION's FREEZE button to light the green led. Plug REFLEXION's output into a DMX receiver and check that all channels are at 50% with the INPUT fader full. Record this state into Sub 12, Page 1. Fade the INPUT fader to zero and check that all dimmers fade smoothly to off.

4. Unplug DMX source. Check to make sure that REFLEXION has gone in to Freeze Mode and that the INPUT DATA led is off. While holding down Bump Button 10, check that the INPUT fader will raise all channels to 50% smoothly. Check that Submaster 12 (Page 1) will raise all channels to 50% smoothly.

5. Now clear system memory . . .

WARNING: **Hazardous voltages exist inside the case. Do not touch components on the pcb or inside the rear panel whilst the supply lead is plugged into the mains.**

Software v1.xx

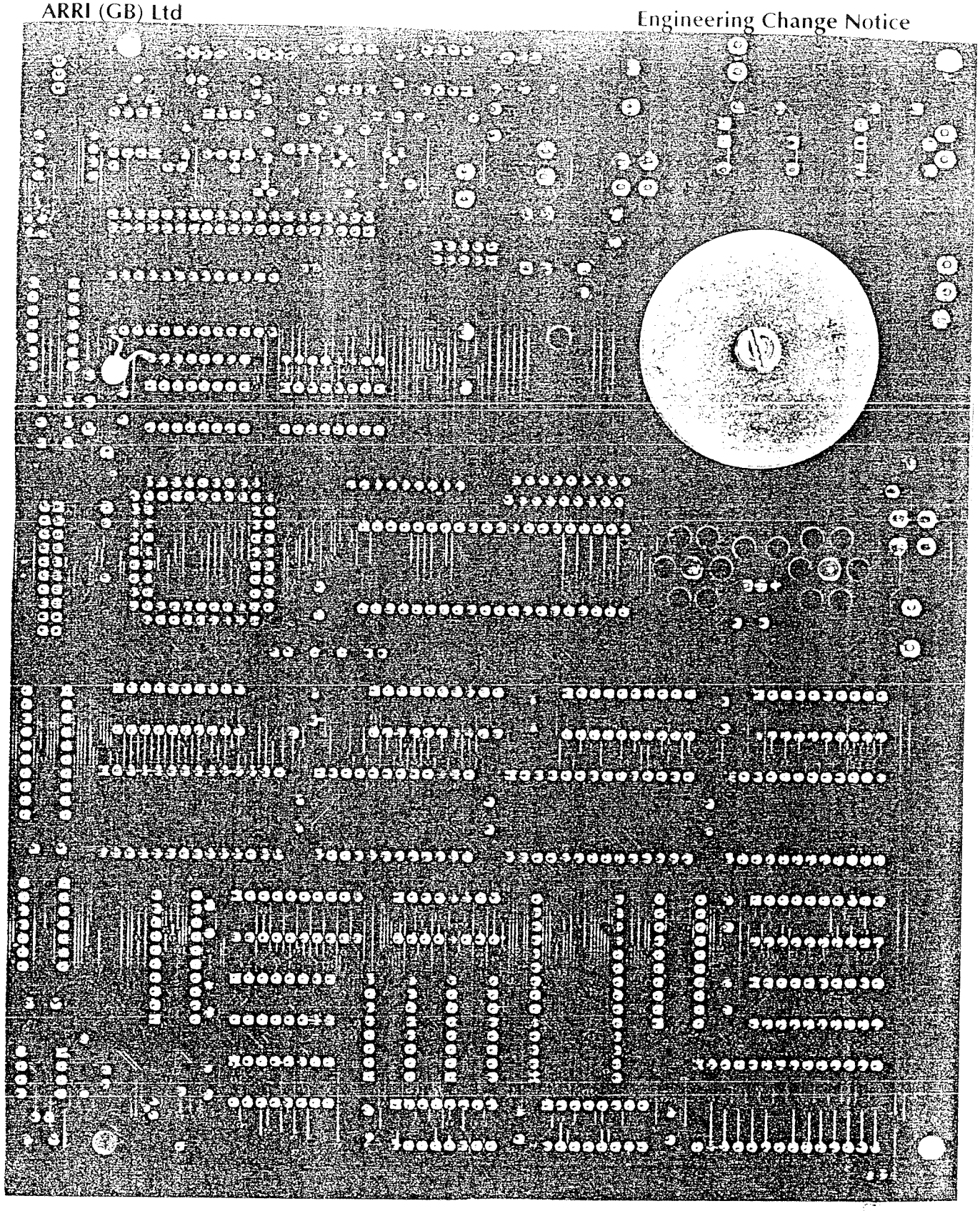
Switch off power. Lift the front panel up and rotate it to the right to stand on its side alongside the base pan. Take care not to stress the ribbon cable loom and check that the Fader pcb cannot short to the base pan. Place a shorting clip on Jumper A. Switch on power for about 1 second, until the power-on alarm sounds, then switch off power again. REMOVE THE SHORTING CLIP.

Software v2.xx

Close the case and fasten it. Hold down bump buttons 7, 8 & 9 while you switch on power. Release the bump buttons when you hear the power-on alarm sound.

6. Close the case and fit the four case screws.

IF IN DOUBT CALL 081-848 8881 AND SPEAK TO: **STEVE VIALARDI**



Underside view of Reflexion CPU pcb with capacitor C41 Fitted