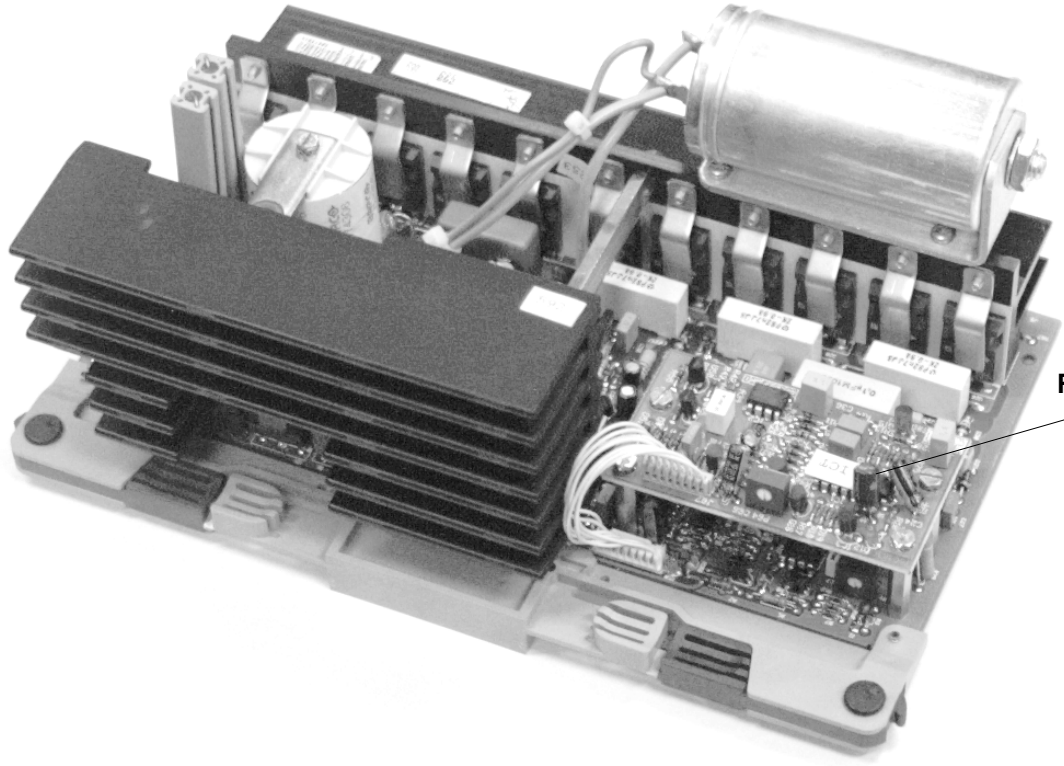
BARCO

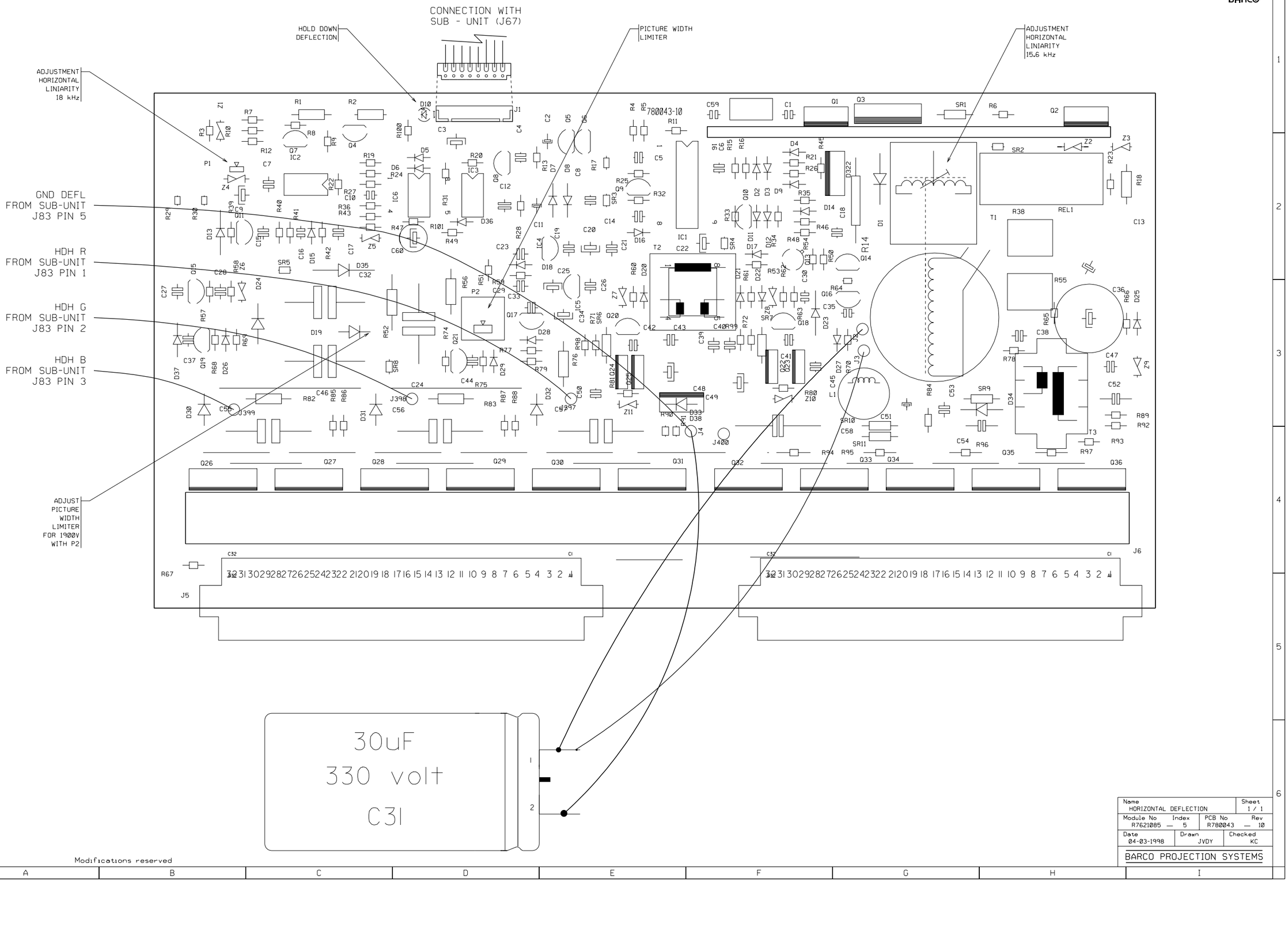
BARCO Projection Systems

SECTION F

service sheet

Horizontal Deflection R7621085




CONNECTION WITH
SUB - UNIT (J67)
HOLD DOWN
DEFLECTION
PICTURE WIDTH
LIMITER
ADJUSTMENT
HORIZONTAL
LINIARITY
15.6 kHz
ADJUSTMENT
HORIZONTAL
LINIARITY
18 kHz
780043-10
GND DEFL
FROM SUB-UNIT
J83 PIN 5
HDH R
FROM SUB-UNIT
J83 PIN 1
HDH G
FROM SUB-UNIT
J83 PIN 2
HDH B
FROM SUB-UNIT
J83 PIN 3
ADJUST
PICTURE
WIDTH
LIMITER
FOR 1900V
WITH P2
REL1
J1
J2
J3
J4
J5
J6
T1
T2
T3
30uF
330 volt
C31
Modifications reserved
Name
HORIZONTAL DEFLECTION
Sheet
1 / 1
Module No
R7621085 — 5
PCB No
R780043 — 10
Rev
Date
04-03-1998
Drawn
JVDY
Checked
KC
BARCO PROJECTION SYSTEMS

BARCO

>J6[23,24]
HDH_R

>J5[16,17]
HDH_G

>J5[22,23]
HDH_B

+17V
D37 BA158
R67 100E
SF >J5[16,17]
Z6 6V2
R58 33K
C28 22K
R57 100K
Q15 BC549C
C27 22K

+17V
R77 8K
D28 IN648
R76 1M
R79 332R
Q17 BC549C
C33 0K

+17V
R75 8K
D29 IN648
R83 1M
R74 332R
Q21 BC549C
C44 0K
J400

+17V
R69 8K
D26 IN648
R82 1M
R68 332R
Q19 BC549C
C37 0K

+17V
R47 1K
REF_VOL
Z5 6V2

R22 470E
R42 330E
C16 0K
R41 0K
IC2 TL082
D15 IN648
R40 1K
C15 10K
>J5[32] H_AMP
D13 BA158
R39 1K
Q11 BC559C
NEG_VOL >SHEET2

J397 TO SUB-UNIT >J83[1]
J398 TO SUB-UNIT >J83[2]
J399 TO SUB-UNIT >J83[3]

ADJUST PICTURE WIDTH LIMITER FOR 1900V WITH P2

N2000.1 N2000.2 N2000.3
D32 BYW96E
D31 BYW96E
D30 BYW96E
SR8 E
D19 BYW96E
C24 6K8
C46 100K
C55 2K7
C56 2K7
C57 2K7
R52 33V

N1000.4 Q31 IXTH2N100 R91 5E
N1000.5 Q30 IXTH2N100 R90 5E
N1000.6 Q29 IXTH2N100 R88 5E
N1000.7 Q28 IXTH2N100 R87 5E
N1000.8 Q27 IXTH2N100 R86 5E
N1000.9 Q26 IXTH2N100 R85 5E

HIGH >SHEET2
HDM >SHEET2
LOW >SHEET2

Q36 IXTH2N100 R93 5E
Q35 IXTH2N100 R97 5E
Q34 IXTH2N100 R96 5E
Q33 IXTH2N100 R95 5E
Q32 IXTH2N100 R94 5E
C58 8K2

N1000.2 N1000.3 N1000.1
D24 BYW96E
SR5 E
D35 BYW96E
C32 100K
R56 33V
P2 50K
R51 200K
C29 100P

+17V
R28 47K
C23 470P
IC3 LM393
IC6 LM393
LIN_REF >SHEET2
R100 475K
HDL_REF >SHEET2
C60 22U
R101 68R

HOLD DOWN DEFLECTION
+17V
D10 COY54-A3
R31 4K7
D5 IN648
DEFL_OFF >SHEET2
D36 IN648
+17V
R19 3K3
D6 IN648

R59 22K
C12 820P
R49 22K
IC3 LM393

+17V
R43 8K2
R27 8K2
C10 1K
R36 3K9
IC6 LM393
R24 47K

D18 IN648

CONNECTION WITH FRAME (J3A)

J6
HTHD A1
E/W A3
VDH_B A5
REL A7
FBHD A14
H_DRV A18
HDH_R A23
HDH_R A24
HDM A26
DEFL_ON A28
L_PULSE A30
H_FM A32
+17V
L1
SR11 0E1
C51 100M
64CON

CONNECTION WITH FRAME (J3B)

J5
HDL A7
HDL A8
HDH_G A12
HDH_G A13
SF A16
SF A17
HDH_B A22
HDH_B A23
H_AMP A32
64CON

HDM >J6[26]
L_PULSE >J6[30]
FBHD >J6[14]
P4 P2 P1 P3 P6
T3 774310
SR9 47E
D34 BYV96E
N400.1
R84 2K7 4W
C52 22K
C53 20P
C54 22K

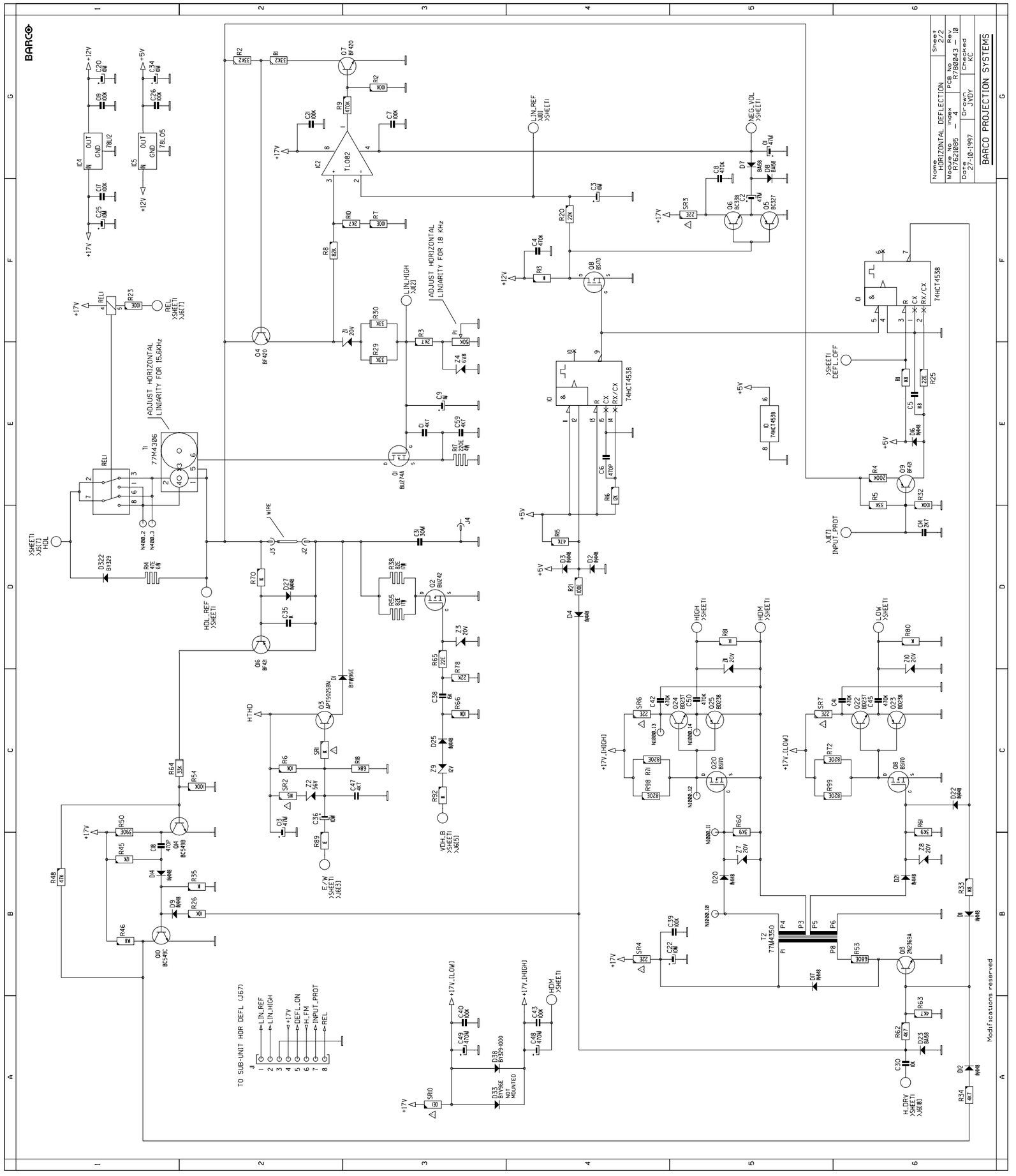
PRODUCT SAFETY NOTICE

COMPONENTS MARKED WITH ✲ OR ⚠ HAVE SPECIAL CHARACTERISTICS IMPORTANT TO SAFETY. BEFORE REPLACING ANY OF THESE COMPONENTS, READ CAREFULLY THE SERVICE SAFETY PRECAUTIONS. DO NOT DEGRADE THE SAFETY OF THIS SET THROUGH IMPROPER SERVICING.

Name HORIZONTAL DEFLECTION			Sheet 1/2
Module No R7621085 – 5	Index	PCB No R780043 – 10	Rev
Date 04-03-1998	Drawn JVDY	Checked KC	

BARCO PROJECTION SYSTEMS

COMP.	LOC.	SHT.
C1	E 3	2
C2	F 5	2
C3	F 4	2
C4	E 4	2
C5	E 6	2
C6	G 3	2
C7	G 3	2
C8	G 3	2
C9	E 3	2
C10	G 5	2
C11	G 5	2
C12	C 6	2
C13	D 6	2
C14	H 2	2
C15	F 2	2
C16	F 2	2
C17	F 2	2
C18	B 1	2
C19	G 1	2
C20	G 5	2
C21	G 2	2
C22	B 4	2
C23	G 3	2
C24	F 3	2
C25	G 3	2
C26	F 3	2
C27	F 1	4
C28	E 1	4
C29	A 6	2
C30	A 6	2
C31	D 3	4
C32	E 4	2
C33	G 1	2
C34	G 2	2
C35	D 2	4
C36	C 3	4
C37	C 3	4
C38	B 3	4
C39	B 4	3
C40	A 3	4
C41	C 4	4
C42	A 4	2
C43	C 4	4
C44	C 4	2
C45	C 4	2
C46	C 4	2
C47	C 4	2
C48	A 3	4
C49	A 3	4
C50	B 6	2
C51	B 6	2
C52	E 6	2
C53	F 6	2
C54	E 6	2
C55	E 3	2
C56	D 3	2
C57	B 3	2
C58	E 3	2
C59	E 3	2
C60	I 3	2
D1	C 4	2
D2	D 4	2
D3	D 4	2
D4	I 4	2
D5	I 4	2
D7	G 5	2
D8	G 5	2
D9	B 4	2
D10	B 3	2
D11	B 6	2
D12	A 6	2
D13	I 1	2
D14	H 1	2
D15	E 6	2
D16	H 2	2
D17	B 5	2
D18	F 2	2
D19	B 5	2
D20	B 5	2
D21	B 6	2
D22	A 6	2
D23	F 3	2
D24	C 3	2
D25	E 1	2
D26	E 1	2
D27	B 1	2
D28	B 1	2
D29	C 3	2
D30	B 3	2
D31	E 3	2
D32	E 3	2
D33	A 3	2
D34	F 6	2
D35	H 4	2
D36	I 4	2
D37	F 1	2
D38	A 3	2
IC1	E 4	2
IC1	F 6	2
IC1	E 5	2
IC2	G 2	2
IC3	H 3	2
IC3	H 4	2
IC4	G 1	2
IC5	G 4	2
IC6	I 3	2
J1	A 2	2
J2	D 2	2
J3	D 2	2
J4	D 3	2
J6	C 4	2
L1	B 6	1
P1	F 3	2
P2	F 4	2
Q1	E 3	2
Q2	C 2	2
Q3	C 2	2
Q4	E 5	2
Q5	F 5	2
Q6	G 2	2
Q7	F 4	2
Q8	F 4	2
Q9	G 1	2
Q10	I 1	2
Q11	I 1	2
Q13	B 6	1
Q14	B 1	2
Q15	D 2	2
Q16	D 2	2
Q17	B 2	2
Q18	C 6	2
Q19	C 6	2
Q20	C 2	2
R1	G 2	2
R2	G 2	2
R3	E 6	2
R4	E 6	2
R5	E 6	2
R6	C 3	2
R7	F 3	2
R8	G 2	2
R9	G 2	2
R10	F 3	2
R11	E 3	2
R12	E 3	2
R13	F 4	2
R14	D 4	2
R15	D 4	2
R16	E 3	2
R17	E 3	2
R18	F 4	2
R19	F 4	2
R21	F 4	2
R22	E 5	2
R23	E 6	2
R24	F 5	2
R25	B 2	2
R26	B 5	2
R27	G 3	2
R28	G 3	2
R29	G 3	2
R30	H 2	2
R31	F 4	2
R32	E 6	2
R33	A 6	2
R34	D 6	2
R35	D 5	2
R36	B 4	2
R37	C 5	2
R38	D 3	2
R39	H 2	2
R40	H 2	2
R41	G 2	2
R42	G 4	2
R43	B 1	2
R45	B 1	2
R46	B 1	2
R47	B 1	2
R48	G 4	2
R49	C 4	2
R50	G 4	2
R51	G 4	2
R52	B 6	2
R53	C 3	2
R54	C 3	2
R55	C 3	2
R56	F 1	2
R57	F 1	2
R58	E 4	2
R59	C 6	2
R60	A 6	2
R61	B 3	2
R62	A 6	2
R63	B 3	2
R64	C 3	2
R65	F 1	2
R66	B 4	2
R67	F 1	2
R68	D 2	2
R69	D 2	2
R70	D 6	2
R71	I 1	2
R72	C 5	2
R74	C 5	2
R75	A 1	2
R76	B 1	2
R77	A 2	2
R78	A 2	2
R79	C 5	2
R80	D 6	2
R81	D 6	2
R82	D 2	2
R83	C 4	2
R84	F 6	2
R85	E 3	2
R86	C 3	2
R87	D 3	2
R88	B 3	2
R89	B 3	2
R90	A 3	2
R91	C 3	2
R92	A 4	2
R93	A 4	2
R94	C 4	2
R95	B 4	2
R96	B 4	2
R97	B 4	2
R98	C 5	2
R99	C 5	2
R100	I 3	2
R101	I 3	2
RELI	F 1	2
RELI	E 1	2
SR1	C 2	2
SR2	C 2	2
SR3	B 4	2
SR4	B 4	2
SR5	B 4	2
SR6	C 4	2
SR7	E 6	2
SR8	C 2	2
SR9	E 6	2
SR10	A 3	2
SR11	B 5	2
T1	E 1	2
T2	B 5	1
T3	E 6	1
Z1	F 3	2
Z2	C 2	2
Z3	E 3	2
Z4	C 2	2
Z5	D 3	2
Z6	E 1	2
Z8	B 6	2
Z9	C 3	2
Z10	D 6	2
Z11	D 5	2



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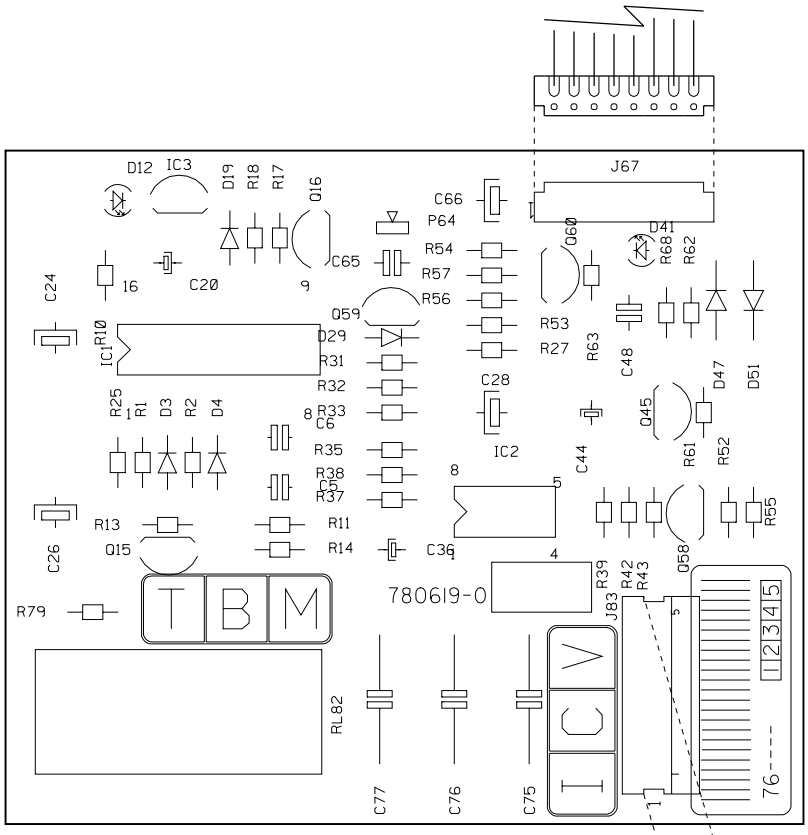
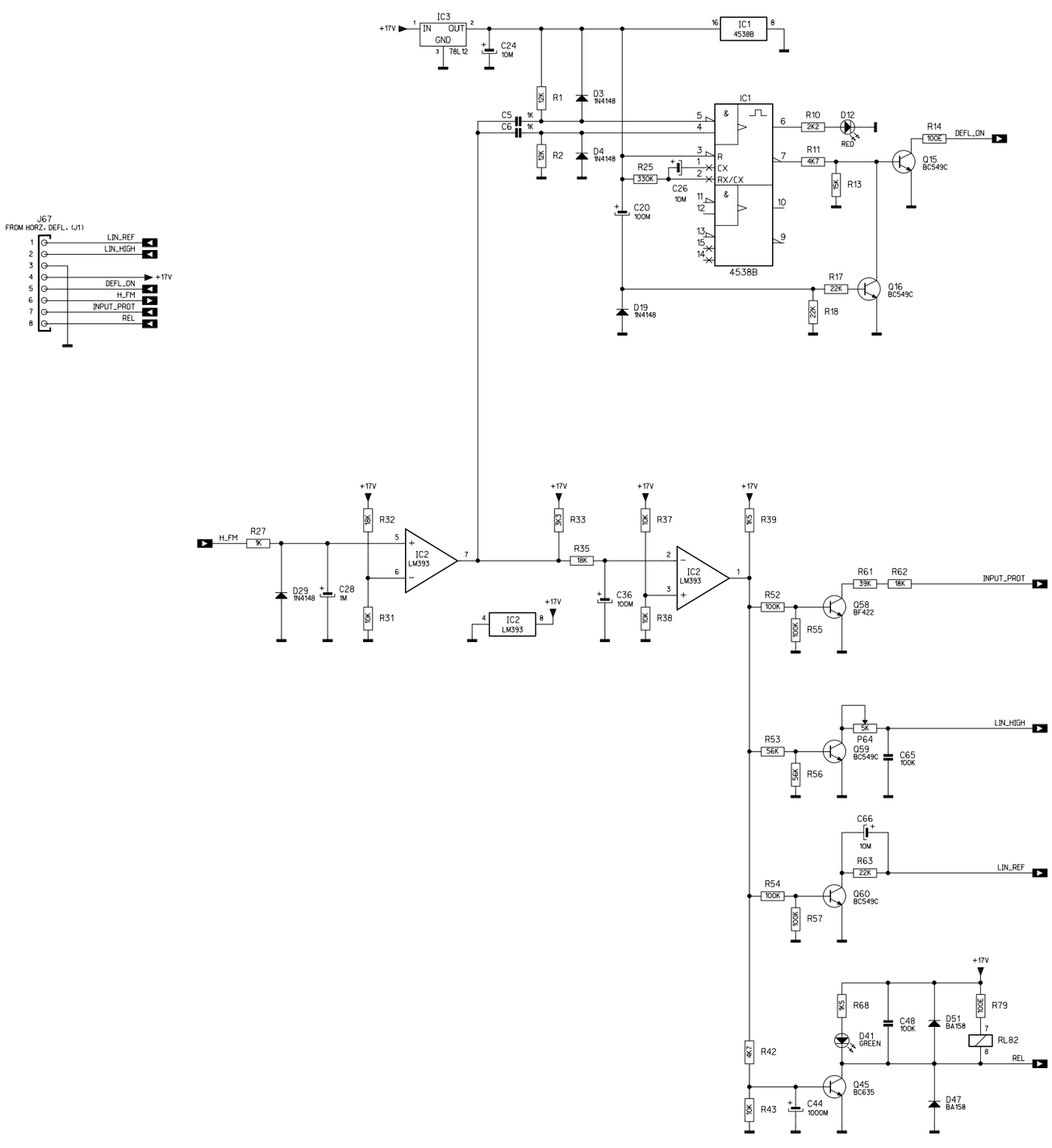
CONNECTION
WITH UNIT (J1)



CONNECTION
WITH UNIT

Name: SUB-UNIT HOR. DEFLECTION			Sheet: 1 / 1
Module No: R7621085S — 0	Index	PCB No: R780619 — 0	Rev
Date: 04-03-1998	Drawn: JVDY		Checked: KC

BARCO PROJECTION SYSTEMS



COMP.	LOC.
C5	C1
C6	C1
C20	D2
C24	C1
C26	D2
C28	B4
C36	D4
C44	E6
C48	E6
C65	E4
C66	E5
C75	F5
C76	G5
C77	G5
D3	D1
D4	D1
D12	E1
D19	D2
D29	B4
D41	E6
D47	E6
D51	E6
IC1	D1
IC1	D1
IC2	C3
IC2	D3
IC2	C4
IC3	C1
J67	A2
J83	G4
P64	E4
Q15	E1
Q16	E2
Q45	E6
Q58	E4
Q59	E4
Q60	E5
R1	C1
R2	C1
R10	E1
R11	E1
R13	E2
R14	E1
R17	E2
R18	E2
R25	D1
R27	B3
R31	C4
R32	C3
R33	C3
R35	D3
R37	D3
R38	D4
R39	D3
R42	D6
R43	D6
R52	D4
R53	D4
R54	D5
R55	E4
R56	E4
R57	E5
R61	E3
R62	E3
R63	E5
R68	E6
R79	F6
RL82	G6
RL82	G6
RL82	F6

Modifications reserved

Name	SUB-UNIT HOR. DELF.
Sheet	1/1
Module No	R7621085S – 0
Index	
PCB No	R780619 – 0
Rev	
Date	27-10-1997
Drawn	JVDY
Checked	KC
	BARCO NV
Division	BPS

Introduction

The following adjustments are provided:

a: Over voltage protection (=scan hold down) P2

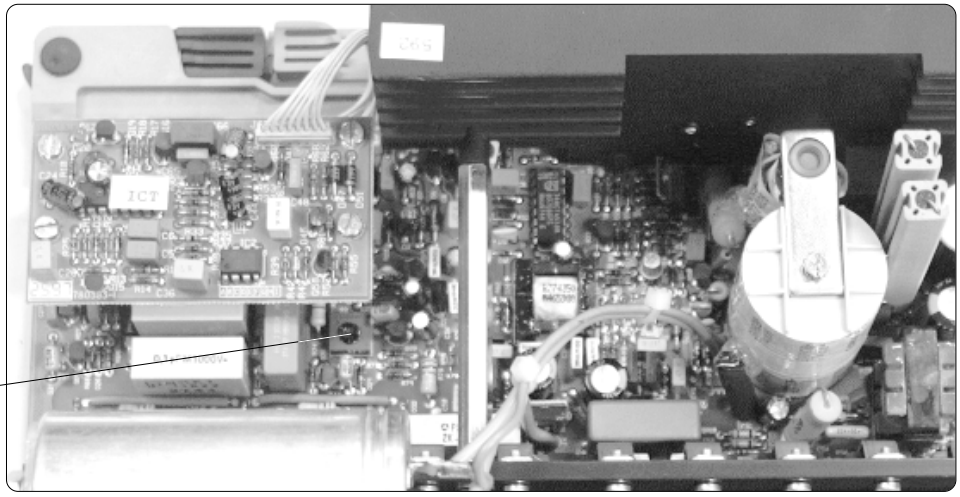
b: Horizontal linearity adj.
Linearity coil at 15 kHz
Potentiometer P1 at 18 kHz and
Potentiometer P64 at an input signal with 1.25us flyback time

Overvoltage protection

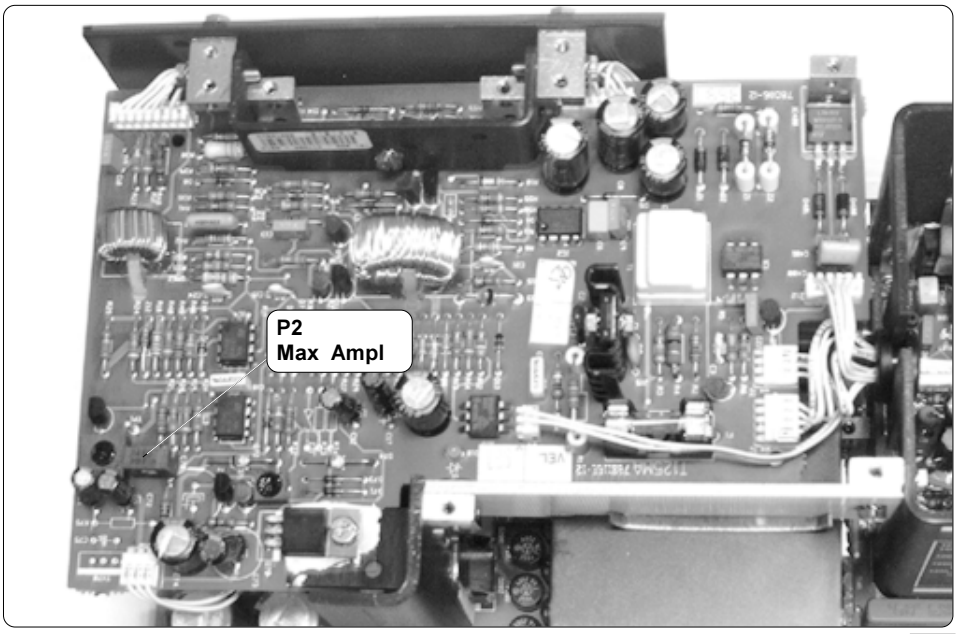
Preparation

Switch **OFF** the projector

Adjust P2 to its physical minimum (turning counter-clockwise)



Adjust P2 "MAX HOR. AMPL." **on the SM Power Supply** to its physical minimum (turning counter-clockwise).



Adjustment

Switch **ON** the projector.

With respect to chassis ground, measure the dc voltage at the cathode of the diode D19.

Adjust P2 **on the SM Power Supply module** for 1950V DC.

Adjust P2 **on the Hor. Deflection module** (turning clockwise) until the ***Horizontal Amplitude*** of the projected picture begins to reduce.

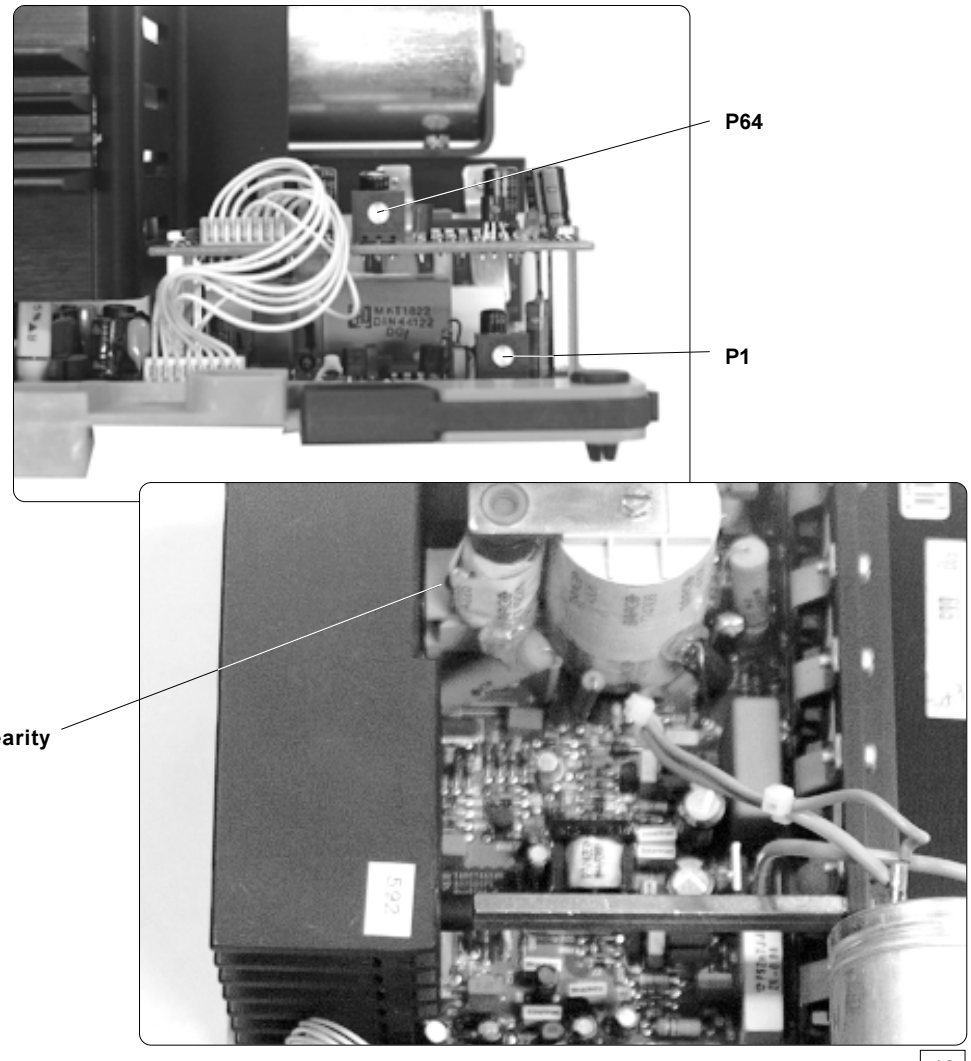
Re-adjust P2 **on the SM Power Supply** as explained in the adjustment procedure of the SM Power Supply (refer to the corresponding service sheet)

Horizontal linearity

1. Adjust the core of the linearity coil using a 15 kHz input source.

2. Adjust P1 using a 18 kHz input source.

3. Adjust P64 using an input source with a retrace time of 1.25us (Green LED on the sub module R7621085S lights up to indicate the high frequency range).



HORIZONTAL DEFLECTION AND SCAN SWITCHING MODULES BG1209S (R7621085 AND R762457)

Introduction.

On this board we find the MOSFET switching transistors, acting as switches to start and stop the currents through the deflection coils. As we need a very short retrace time, the amplitude of the flyback pulse is bigger than the maximum of one Mosfet. Therefore, two Mosfet switches are used in series. On the other hand, the amplitude of the current, especially in the mode where the two half windings are in parallel, is so high that the scan current must be divided over two Mosfets in parallel.

The very high scanning computer sources require a very short retrace time and thus blanking time of the projector. The lower scanning frequencies do not require such a short blanking time.
This is obtained by switching the two horizontal deflection windings of the deflection yoke unit in parallel (we further call this the **"Higher Freq Range"**) for the high scanning frequency.

For the lower scanning sources however these same two windings on the yoke are connected in series in order to double the retrace time compared with the parallel connection (further called the **"Lower Freq Range"** range). This switching of the yoke configuration is accomplished with three relays on the "Deflection Switching Module" mounted on the CRT unit cover.

When switching from the low range to the high range, or vice versa, the deflection voltage +HTHD on the SMPS **MUST** be switched off (or at least reduced) the moment the relays are active.
The circuits which inhibit the deflection voltage and the drive circuit which control these relays are located on the Subunit of the Hor Defl. board.

Furthermore, on this board , we find the required protection circuits such as *"scan hold down"* and "*scan failure".*

Preparation of the drive pulses.

The horizontal deflection circuit uses two MOSFETS in series in order to be capable of handling more than 1000 volt pulses. Therefore, two drive pulses on different ground reference levels are required.
The "bottom" MOSFETS are driven by a pulse train referenced to ground or chassis ground, the "top" MOSFETS by drive pulses referenced to the mid-point of the two series connected MOSFETs, the **HDM** point. The Vcc of each opto-coupler must therefore have a different ground reference.
The power supply for generating the "top drive pulses" is taken from the +17 volt via diode D33 to block the pulses, as HDM, the reference ground for the top drive pulses, carries line pulses.
The hor. drive pulses, prepared on the *"UN SYNC+VERT DEFL"* board, are sent to the amplifier Q13. By using a transformer T2, a "floating" drive pulse referred to HDM for the top Mosfets can easily be obtained.
When the flyback pulse is present during retrace, D33 becomes reversed biased and act like an open circuit to the 17VDC line. At that time, the drive circuit receives its voltage supply from the charge stored in C48.
The "high" drive pulses reach the gate-source of the top Mosfets, and the "low" drive pulses drive the bottom Mosfet switches.

Modulation of the scan voltage / East-West correction

The +HTHD voltage from the SMPS board is modulated in Q3 by the East-West correction signal prepared on the “Sync + Vert Defl” board. Z2 protects the transistor and SR2 limits the charging current of this coupling capacitor through the zener. Q2 transistor is used to discharge the boosting capacitor C31 at the start of a vertical scan. A vertical flyback pulse, derived from VDH B (Vertical Deflection High Blue) is sent to the gate. This minimizes keystone problems at the top due to a remaining charge on C31 after the vertical retrace. It causes the charge on C31 to always start from the same amplitude after each vertical retrace, regardless of the voltage that was built up at the end of the vertical scan.

Horizontal linearity tracking control.

The problem we meet with such a big frequency range, is the frequency dependent characteristic of the linearity coil. At a higher scanning frequency, the impedance of the linearity coil would increase.
To overcome this, a second coil T1 is magnetically coupled to the standard linearity coil. This current in this modulating coil is delivered by a Mosfet Q1.

The needed current for tracking is got via the biasing circuit of the gate of Q1 (LIN HIGH) as follows.
The drive pulses trigger a one-shot in IC1 at the positive going transient input. The output pulses are then applied to the gate of a Mosfet Q8 and at the drain split to two circuits :

- the simple integrator R20 / C3, the obtained voltage across the capacitor is consequently a voltage proportional with the line frequency labelled *"LIN REF"*.
- the push-pull Q5 / Q6 and the top/top detector just to obtain a negative voltage to supply amongst others the OPAMP IC2.

The DC level of this LIN REF voltage is not correct to drive the Mosfet Q1 and a level shift is realised with the OPAMP 1-2-3 of IC2.
This OPAMP receives at the inverting input a voltage that is proportional with the line frequency, the amplitude adjustment does not affect this LIN REF voltage.
The other non-inverting input receives a voltage that is proportional with the scan voltage. This voltage is proportional with the line frequency and with the amplitude adjustment. The influence of the amplitude adjustment must be minimized and this done as follows.
For one typical frequency, we obtain one typical LIN REF voltage. The HTHD voltage however depends also on the horizontal amplitude. Any change in the emitter voltage of Q4 is compensated via the feedback Q7 - base Q4.

Corrections in the "Higher Freq. Range". (on the subunit)

In the "High Freq. Range" mode, due to the change of the flyback time and the appropriated scan voltage, adaptations on different line frequency dependent circuits are required.

The HFM (Hor Freq. Mode) voltage, coming from the " UN SYNC + VERT DEFL" is compared to the level set by R31/R32 in the level detector 5-6-7 of IC2.

The output changes from high to low or vice versa are detected by IC1 to turn off the scan voltage (see later).
The output level is further inverted by a similar detector and the output pin 1 is used for different functions :

a) To switch on and off Q45. When this transistor is "on", the relays on the "Deflection Switching" module are "activated". These relays realize the commutation from series to parallel. The same transistor also "serves" the relay "REL1" on the HOR

DEFL board. With this relay a correction on the linearity coil is obtained between the high and low frequency ranges.

b) To switch on and off Q58. This transistor permits a correction on the efficiency of the HTHD voltage for the second range of the input protection circuit (transistor Q9 - IC1) that will be discussed under the paragraph "Protections".

c) To switch on and off Q60. When this transistor is 'on' the LIN REF voltage is dropped by the divider R20 / R63 (=on the subunit) as a compensation for the drop of the HTHD voltage.

d) To switch on and off Q59 . When "on", P64 is added in parallel to the gate of Q1and allows a correction on the linearity tracking

Protection circuits.

a) Overcurrent protection.

If the sum of the currents of the three scan coils exceeds a pre-determined level, the drive is inhibited as follows :
The wire J2-J3 in series with the three scan coils , acts as a low value resistor and is connected across the base-emitter of Q16. When a 0.6 volt or greater voltage is dropped across the wire, Q16 starts to conduct and triggers the monoflop Q10/ Q14.As long Q10 is blocked, the drive transistor Q13 remains "on", inhibiting the drive. BY re-applying the drive pulse to the base of Q10 via D9 (a kind of feedback), a faster reaction on the overcurrent can be obtained.

b) Overvoltage protection.

The sum of flyback pulses on each of the series connected Mosfets are checked by a rectifier network consisting of diodes D30, D31 and D32 and common decoupling capacitors. The pulses at the node of the two Mosfets (HDM) are rectified with D24 . This voltage must be half of the total flyback voltage in order to protect the mosfets against overvoltage. This is realised with the circuit R73/C46/ D24/SR5/ R56/C32.
The rectified voltage is dropped with R52 / P3 / R51 and sent to two level detectors. The threshold level is set by a zener at 6.2 volt with Z5. At the moment pin 6 of IC2 exceeds the threshold, the horizontal amplitude is reduced with Q11. This will avoid the action of the "Hold Down Deflection" protection circuit.
If for any reason, the 1950V level is reached the HOLD DOWN DEFLECTION circuit is activated.

1) The drive is inhibited through the DEFL OFF.
2) The input pin 6 remains "high" as transistor Q12 is blocked and D18 conducts via R28 to keep pin 6 of IC1 high. This requires that the set be powered off to reset this circuit.
3) The red LED D10 (HOLD DOWN DEFLECTION) is illuminated in order to show that "scan hold down" has occurred.
4) As the deflection is stopped, there is also a horizontal scan failure and the associated circuit will drop the EHT voltage and blank the three CRT's to prevent damage to the CRT phosphorus.

c) Too low drive protection (+17V monitoring).

It is imperative that the Mosfets are fully switched on, so that the internal resistance will be as low as possible. Due to the large deflection current, even a small amount of excess resistance, will cause the Mosfets to generate too much heat.
This Mosfet drive pulse amplitude depends in part on the **+17 volt** supply and the

voltage supplied from the +17VDC line . The drive signals are developed from the 17VDC and to prevent damage, due to insufficient drive, if this voltage becomes too low, IC1 pin 3 gets low and inhibits the drive signal via the 'DEFL OFF'.
The DEFL OFF is connected with the R(eset) of the monoflop in IC1. The function of the latter will be explained hereafter.

d) Input protection :

The H DR from the UN SYNC + VERT DEFL has as task to start and stop the conduction of the Mosfets. If however the Mosfets are in conduction and there is a "stop" that does not arrive, there is a risk of damaging the power switchers.
In such case, a stop pulse will be automatically generated by the monoflop in IC1, output 7. This output remains low as low the input is retriggered at pin 5. When such a trigger pulse is absent, the output switches high after a time determined by the time constant R25 / C5 + current delivered by Q9. This current is tracked with the line frequency by using the scan voltage as emitter supply. Note that a correction on the base voltage occurs in the second range with Q58 on the subunit.

e) Horizontal scan failure.

Horizontal pulses are fed into the transistors Q17, Q21 and Q19. As long as there are horizontal pulses on the base of these transistors, they are conducting for each horizontal period, and the collectors are held "low" by C33, C44 and C37. These smoothened collector voltages keep the gating diodes D28, D29 and D26 blocked.
If either one of the pulses or all pulses are missing, Q19 transistor gets in conduction and turns its collector at low level. The SF line will be pulled low and the scan fail condition will be met.

f) Inhibition of the scan at relay switching period.

The **HFM** (=Horizontal Frequency Mode) **voltage** (HIGH in the “low freq.” range and LOW in the “high freq.” range) comes from the “Sync+Vert Defl” board . This voltage is applied to IC2 pin 5 (on a level detector in IC2).

When HFM switches from HIGH to LOW (when the "high freq. range" is selected), the output follows, and, a negative voltage transition occurs at the output . This negative transition triggers the monoflop on the “active low” pin 5 input of the monoflop IC1.
When on the other hand the freq. mode changes from “Low” to “High”, the positive transition triggers now the monoflop at pin 4 (“active high”).
The end result is that for either transition, the output pin 6 will go "High". The time that it will remain high is determined by the time constant C26/R25.
The "high" at pin 6 turns on the red LED D8 and it will stay on as long as pin 6 is "high".
The second inverted output pin 7 (low pulse) turns off Q15. The collector of this transistor “DEFL ON” is connected with the SMPS and as this an active LOW output, the scan voltage +HTHD is inhibited when this DEFL ON voltage is high (see SMPS).
Therefore, the scan is inhibited, when Q15 is "OFF" during switching of the frequency range.

Starting conditions

When the projector is first turned on, Q16 is forward biased due to the high charging

current of C20 through R18. This causes a "high" on the base of Q16, pulling it's collector "low". During the charging time the HTHD is dropped and the Hor Scan is inhibited.
When C20 is charged, Q16 turns off releasing Q15's base and switching on the scan voltage +HTHD.

This delayed start of the HTHD allows the monoflop circuit in IC2 to reach a "steady state" since the line oscillator first has to lock to the selected input source.

Feedback to the SMPS (to stabilise the horizontal width).

The scan voltage +HTHD has to track the line frequency in order to regulate the horizontal width of the picture. The amplitude of the flyback pulses at the connection of the top and bottom Mosfets (=HDM) is a direct result of the horizontal width and can be taken as a reference. These pulses are coupled and isolated by transformer T3, rectified by D34 and the **FBHD** voltage is sent to the SMPS, to regulate the HTHD.
This voltage is proportional to the width of the raster on the CRT faceplate.

g) Scan coil switching (R762457).

Each horizontal deflection yoke consists of two horizontal windings which may be connected in either a series or parallel configuration. The inductance of the parallel connection is obviously lower than the series configuration (parallel and series inductance uses the same formula as resistance) therefore they are connected in parallel for the "high" frequency mode.
The lower inductance in the parallel configuration causes the resonant frequency of the flyback pulse to increase, thereby producing a more rapid horizontal retrace.

Note: HDM is the mid-point of the two series connected deflection MOSFETS. HDL is the common connection to the three horizontal yoke windings, that supplies the yokes with the +HTHD voltage, after passing through Q3 and the linearity coil.

The DC horizontal shift voltage from the "Focus and Shift Board (76 2271) is applied between HDH*X* and HDL*X* (X stands for R, G or B or the Red, Green or Blue) of the red, green and blue deflection yokes. The HDLX is in fact a feedback to the *"Focus + SHIFT"* board in order to to stabilise the horizontal width.

In the LOW FREQ mode, the two horizontal width alignment coils are in series. When switched to the "High Freq." mode only one coil is in the circuit, (see schematics).

S10, S20 and S30 allow the horizontal scan to be inverted to adapt the projector for a front or rear projection. S10 is also used to provide the **HSIC** information to the controller board , so that the controller board will know the configuration of the horizontal scan switches.
The **HSI** also goes to the "HOR SHIFT+FOCUS" board and is used by Q1 and Q2 to invert the shift voltages on P1 and P2 (horizontal shift Red and Blue).

Note that this board also contains the switch for the inversion of the vertical scan. Here the same **VSI** info can be used for both, the controller and the Vert Defl board (similar to Hor Defl).

The Scan Fail loop (SF3-SF4-SF5-SF6) passes through two contacts of the deflection connectors. In the event that one of these yoke connectors is disconnected, the projector will go into scan fail, terminating the EHT.

Parts listing R7621085

SIT.	ITEM NO.	DESCRIPTION	QUANTITY
5	Z345617	CD SL 3AWG20 P5 $	1
50	R133036	SPR L 6 D 2,4D 6 CE	1
100	R313220	R ACC HLDR H10 WW	2
110	R133036	SPR L 6 D 2,4D 6 CE	1
700	A576211	SPR L25 M 3 H 5 IBR	4
350	R133074	HTSN@A I_SIL W30	
460	R133074	HTSN@A I_SIL W30	
470	R133074	HTSN@A I_SIL W30	
	R3470080	SLVU GLCL OIL D 1,5RD	1
240	R362020	SCR D84 M 3 X 4 STZ	2
230	R3631059	SCR Z933 M 3 X 8 SS	1
340	R3631059	SCR Z933 M 3 X 8 SS	3
420	R3631059	SCR Z933 M 3 X 8 SS	2
710	R3631059	SCR Z933 M 3 X 8 SS	8
430	R3631069	SCR Z933 M 3 X 10 SS	1
412	R3631239	SCR Z933 M 4 X 10 SS	1
241	R367502	SPR D6798AD 3,2D 6 S	2
411	R367608	SPR L70 M 4 H 7 NBR	1
610	R367699	RVT AVTRON2,5L 8,1 A	6
600	R722276	LOCK49 PCB UN CPL	1
210	R802665	FRM49 HOR CORE LIN F	1
300	R802691	HTSN D800 HOR A GRA	1
500	R802741	HTSN D800 HOR F.CAP	1
220	R802751	COIL LIN PJ49 POSITION	1
200	R802827	FRM V700 LIN CTRL CPL	1
441	R804525	HTSN A GEN SPG 1X 3	1
320	R804674	HTSN A GEN SPG 1XM	11
440	R804831	HTSN A GEN SPG 1X 3	2
221	R805060	SPRCL 1 D 6 D10 FIY	1
410	R805848	HTSN D801 HOR BG	1
450	V3621217	SCR $7500CM 3 X 6 ST	3
330	V3621227	SCR $7500CM 3 X 8 ST	11
510	V3621227	SCR $7500CM 3 X 8 ST	2
	R133036	SPR L 6 D 2,4D 6 CE	1
	R3421991	WU UL1015 AWG18 ST	1
	R3421991	WU UL1015 AWG18 ST	1
	R3421991	WU UL1015 AWG18 ST	1
	R3469930	SLVU SHR D 9,6/4,8 BK	1
	R3481107	WU JUMP 0,51 27,5 ISO	1
	R3481122	WU JUMP 0,51 32,5 ISO	1
	R3481135	WU JUMP 0,51 35 ISO	1
C 36	R1114169	C EL RA 10M M350E2	1
C 2	R111476	C EL RA 47M M 25E2	1
C 11	R111476	C EL RA 47M M 25E2	
C 51	R111477	C EL RA 100M M 25E2	
C 48	R111479	C EL RA 470M M 25E2	1
C 49	R111479	C EL RA 470M M 25E2	1
C 3	R111531	C EL RA 10M M 35E2	
C 20	R111531	C EL RA 10M M 35E2	
C 22	R111531	C EL RA 10M M 35E2	
C 25	R111531	C EL RA 10M M 35E2	
C 34	R111531	C EL RA 10M M 35E2	
C 60	R111532	REPLACED BY V111485	1
C 9	R111546	C EL RA 1M M 50E2	
C 13	R1116491	C EL RA 47M T385SKT	1
C 58	R111714	C PPMERA 8N2J162E9	1
C 24	R1117201	C PPMERA 6N8J202E9	1
C 29	R112242	C NP0 MI 100P G100E2	1
C 53	R112692	C N750MI 120P G500E2	1
C 23	R112735	C CE MI 470P K100E2	1
C 10	R112739	C CE MI 1N K100E2	1
C 35	R112739	C CE MI 1N K100E2	
C 1	R112747	C CE MI 4N7K100E2	
C 59	R112747	C CE MI 4N7K100E2	
C 16	R112763	C CE MI 10N Z 63E2 8	1
C 30	R112763	C CE MI 10N Z 63E2 8	1
C 14	R112797	C CE DI 2N7K500E2	1
C 47	R112833	C CE DI 4N7S400E3 8	1
C 15	R1137121	C POMERA 10N K250E	1
C 33	R1137131	C POMERA 12N K100E	1
C 37	R1137131	C POMERA 12N K100E	1
C 44	R1137131	C POMERA 12N K100E	1
C 38	R1137141	C POMERA 15N K100E	
C 27	R1137161	C POMERA 22N K100E	
C 28	R1137161	C POMERA 22N K100E	1
C 7	R113724	C POMERA 100N K 63E	
C 17	R113724	C POMERA 100N K 63E	
C 19	R113724	C POMERA 100N K 63E	
C 21	R113724	C POMERA 100N K 63E	
C 26	R113724	C POMERA 100N K 63E	
C 39	R113724	C POMERA 100N K 63E	
C 40	R113724	C POMERA 100N K 63E	
C 43	R113724	C POMERA 100N K 63E	
C 4	R113732	C POMERA 470N K 63E	
C 8	R113732	C POMERA 470N K 63E	
C 41	R113732	C POMERA 470N K 63E	
C 42	R113732	C POMERA 470N K 63E	
C 45	R113732	C POMERA 470N K 63E	
C 50	R113732	C POMERA 470N K 63E	
C 52	R114154	C POMERA 22N K400E	1
C 54	R114154	C POMERA 22N K400E	1
C 32	R114603	C POMERA 100N M102	1
C 46	R114603	C POMERA 100N M102	1
C 31	R114799	C PPMERA 30M J220B	1
C 55	R1150564	C PPMERA 2N7J202E9	1
C 56	R1150564	C PPMERA 2N7J202E9	1
C 57	R1150564	C PPMERA 2N7J202E9	1
C 6	R1159081	C PP RA 470P J100E2	
C 18	R1159081	C PP RA 470P J100E2	
C 12	R1159141	C PP RA 820P J100E2	1
C 5	R115922	C PP RA 1N8J100E2	1
D 2	R131621	D S 1N4148 075150 DO3	
D 3	R131621	D S 1N4148 075150 DO3	
D 4	R131621	D S 1N4148 075150 DO3	
D 5	R131621	D S 1N4148 075150 DO3	
D 6	R131621	D S 1N4148 075150 DO3	
D 9	R131621	D S 1N4148 075150 DO3	
D 11	R131621	D S 1N4148 075150 DO3	
D 12	R131621	D S 1N4148 075150 DO3	
D 14	R131621	D S 1N4148 075150 DO3	
D 15	R131621	D S 1N4148 075150 DO3	
D 16	R131621	D S 1N4148 075150 DO3	
D 17	R131621	D S 1N4148 075150 DO3	
D 18	R131621	D S 1N4148 075150 DO3	
D 20	R131621	D S 1N4148 075150 DO3	
D 21	R131621	D S 1N4148 075150 DO3	
D 22	R131621	D S 1N4148 075150 DO3	
D 25	R131621	D S 1N4148 075150 DO3	
D 26	R131621	D S 1N4148 075150 DO3	
D 27	R131621	D S 1N4148 075150 DO3	
D 28	R131621	D S 1N4148 075150 DO3	
D 29	R131621	D S 1N4148 075150 DO3	
D 36	R131621	D S 1N4148 075150 DO3	
D 7	R131637	D R BA158 600400 DO7	1
D 8	R131637	D R BA158 600400 DO7	1
D 13	R131637	D R BA158 600400 DO7	
D 23	R131637	D R BA158 600400 DO7	

SIT.	ITEM NO.	DESCRIPTION	QUANTITY
D 37	R131637	D R BA158 600400 DO7	1
D 10	R131662	D LED D3 T RD	1
D 34	R131906	D R BYV96E 1021A5 SO	1
D 38	R131913	D R BY329 10208A TO2	1
D322	R131913	D R BY329 10208A TO2	1
D 1	R131952	D R BYW96E 10203A S	1
D 19	R131952	D R BYW96E 10203A S	1
D 24	R131952	D R BYW96E 10203A S	1
D 30	R131952	D R BYW96E 10203A S	1
D 31	R131952	D R BYW96E 10203A S	1
D 32	R131952	D R BYW96E 10203A S	1
D 35	R131952	D R BYW96E 10203A S	1
I 5	R134032	U 78L05AC TO92 P	1
I 4	R134033	U 78L12AC TO92 P	1
I 3	R134114	U 393 LM DIP8 P	1
I 6	R134114	U 393 LM DIP8 P	1
I 2	R134124	U 082 TL DIP8 P	1
I 1	R137098	U 74HCT4538 DIP16	1
J 5	R313525	J EUR2C MBS P64 E1C2	1
J 6	R313525	J EUR2C MBS P64 E1C2	1
J 1	R313928	J CT H MBT P 8 M2SN	1
L 1	R305913	CH MNS AX NS 12 UH 3	1
P 2	R106732	R TCE H 50K K 0W5 S1	1
P 1	R106832	R TCE V 50K K 0W5 S1	1
PC	R780043	PCB G800 HOR	1
Q 10	R131411	Q BC549C N SS TO9	1
Q 15	R131411	Q BC549C N SS TO9	
Q 17	R131411	Q BC549C N SS TO9	
Q 19	R131411	Q BC549C N SS TO9	1
Q 21	R131411	Q BC549C N SS TO9	1
Q 11	R1314182	Q BC559C P SS TO9	1
Q 6	R131424	Q BC338 N SS TO92	
Q 14	R1314295	Q BC549B N SS TO9	1
Q 5	R1314311	Q BC327 P SS TO92	
Q 22	R1314446	Q BD237 N P TO126	1
Q 24	R1314446	Q BD237 N P TO126	1
Q 23	R1314451	Q BD238 P P TO126	1
Q 25	R1314451	Q BD238 P P TO126	1
Q 2	R132591	Q BUZ42 FN P TO22	1
Q 1	R132593	Q BUZ74A FN P TO22	1
Q 8	R132910	Q BS170 FN SS TO92	1
Q 18	R132910	Q BS170 FN SS TO92	1
Q 20	R132910	Q BS170 FN SS TO92	1
Q 26	R132918	Q IXTH12N100 FN P TO2	1
Q 27	R132918	Q IXTH12N100 FN P TO2	1
Q 28	R132918	Q IXTH12N100 FN P TO2	1
Q 29	R132918	Q IXTH12N100 FN P TO2	1
Q 30	R132918	Q IXTH12N100 FN P TO2	1
Q 31	R132918	Q IXTH12N100 FN P TO2	1
Q 32	R132918	Q IXTH12N100 FN P TO2	1
Q 33	R132918	Q IXTH12N100 FN P TO2	1
Q 34	R132918	Q IXTH12N100 FN P TO2	1
Q 35	R132918	Q IXTH12N100 FN P TO2	1
Q 36	R132918	Q IXTH12N100 FN P TO2	1
Q 9	R132972	Q BF421 P SS TO92	1
Q 16	R132972	Q BF421 P SS TO92	1
Q 4	R132973	Q BF420 N SS TO92	1
Q 7	R132973	Q BF420 N SS TO92	1
Q 3	R132974	Q APT5025BN FN P TO	1
Q 13	V132504	Q 2N2369A N SS TO1	1
R 89	R101500	R MF H 1E F 0W4 E3	
R 85	R101514	R MF H 15E F 0W4 E3	
R 86	R101514	R MF H 15E F 0W4 E3	
R 87	R101514	R MF H 15E F 0W4 E3	
R 88	R101514	R MF H 15E F 0W4 E3	
R 90	R101514	R MF H 15E F 0W4 E3	1
R 91	R101514	R MF H 15E F 0W4 E3	1
R 93	R101514	R MF H 15E F 0W4 E3	
R 94	R101514	R MF H 15E F 0W4 E3	1
R 95	R101514	R MF H 15E F 0W4 E3	1
R 96	R101514	R MF H 15E F 0W4 E3	
R 97	R101514	R MF H 15E F 0W4 E3	
R 25	R101516	R MF H 22E F 0W4 E3	
R 65	R101516	R MF H 22E F 0W4 E3	
R 7	R101524	R MF H100E F 0W4 E3	
R 21	R101524	R MF H100E F 0W4 E3	
R 23	R101524	R MF H100E F 0W4 E3	
R 67	R101524	R MF H100E F 0W4 E3	
R 42	R101530	R MF H330E F 0W4 E3	
R 50	R101531	R MF H390E F 0W4 E3	
R 22	R101532	R MF H470E F 0W4 E3	
R 53	R101534	R MF H680E F 0W4 E3	
R 68	R101535	R MF H820E F 0W4 E3	1
R 71	R101535	R MF H820E F 0W4 E3	
R 72	R101535	R MF H820E F 0W4 E3	
R 74	R101535	R MF H820E F 0W4 E3	1
R 79	R101535	R MF H820E F 0W4 E3	1
R 98	R101535	R MF H820E F 0W4 E3	
R 99	R101535	R MF H820E F 0W4 E3	
R 13	R101536	R MF H 1K F 0W4 E3	
R 35	R101536	R MF H 1K F 0W4 E3	
R 39	R101536	R MF H 1K F 0W4 E3	
R 40	R101536	R MF H 1K F 0W4 E3	
R 47	R101536	R MF H 1K F 0W4 E3	
R 70	R101536	R MF H 1K F 0W4 E3	
R 80	R101536	R MF H 1K F 0W4 E3	
R 81	R101536	R MF H 1K F 0W4 E3	
R 92	R101536	R MF H 1K F 0W4 E3	
R 11	R101539	R MF H 1K8 F 0W4 E3	
R 33	R101539	R MF H 1K8 F 0W4 E3	
R 46	R101539	R MF H 1K8 F 0W4 E3	
R 3	R101541	R MF H 2K7 F 0W4 E3	1
R 10	R101541	R MF H 2K7 F 0W4 E3	
R 19	R101542	R MF H 3K3 F 0W4 E3	
R 36	R101543	R MF H 3K9 F 0W4 E3	
R 60	R101543	R MF H 3K9 F 0W4 E3	
R 61	R101543	R MF H 3K9 F 0W4 E3	
R 31	R101544	R MF H 4K7 F 0W4 E3	
R 34	R101544	R MF H 4K7 F 0W4 E3	
R 62	R101544	R MF H 4K7 F 0W4 E3	
R 63	R101544	R MF H 4K7 F 0W4 E3	
R101	R101546	R MF H 6K8 F 0W4 E3	1
R 27	R101547	R MF H 8K2 F 0W4 E3	
R 43	R101547	R MF H 8K2 F 0W4 E3	
R 26	R101548	R MF H 10K F 0W4 E3	
R 41	R101548	R MF H 10K F 0W4 E3	
R 66	R101548	R MF H 10K F 0W4 E3	
R 16	R101549	R MF H 12K F 0W4 E3	
R 45	R101549	R MF H 12K F 0W4 E3	
R 69	R101551	R MF H 18K F 0W4 E3	
R 75	R101551	R MF H 18K F 0W4 E3	
R 77	R101551	R MF H 18K F 0W4 E3	
R 20	R101552	R MF H 22K F 0W4 E3	1
R 49	R101552	R MF H 22K F 0W4 E3	
R 59	R101552	R MF H 22K F 0W4 E3	
R 78	R101552	R MF H 22K F 0W4 E3	

SIT.	ITEM NO.	DESCRIPTION	QUANTITY
R 5	R101554	R MF H 33K F 0W4 E3	
R 58	R101554	R MF H 33K F 0W4 E3	
R 15	R101556	R MF H 47K F 0W4 E3	
R 24	R101556	R MF H 47K F 0W4 E3	
R 28	R101556	R MF H 47K F 0W4 E3	
R 48	R101556	R MF H 47K F 0W4 E3	
R 8	R101559	R MF H 82K F 0W4 E3	
R 12	R101560	R MF H100K F 0W4 E3	
R 32	R101560	R MF H100K F 0W4 E3	
R 54	R101560	R MF H100K F 0W4 E3	
R 57	R101560	R MF H100K F 0W4 E3	
R 4	R1015641	R MF H200K F 0W4 E3	1
R 51	R1015641	R MF H200K F 0W4 E3	1
R 9	R101568	R MF H470K F 0W4 E3	
R 18	R103158	R MO H 68K J 1W	1
R 29	R103254	R MO H 33K J 2W E10	1
R 30	R103254	R MO H 33K J 2W E10	1
R 64	R103254	R MO H 33K J 2W E10	1
R 84	R103341	R MO H 2K7 J 4W E10	1
R 17	R103640	R WW H220E J 4W E	1
R 38	R104446	R WW V 82E K17W	1
R 55	R104446	R WW V 82E K17W	1
R 76	R104654	R HV H 1M J 0W5 35	1
R 82	R104654	R HV H 1M J 0W5 35	1
R 83	R104654	R HV H 1M J 0W5 35	1
R 52	R104690	R HV H 33M J 0W5 35	1
R 56	R104690	R HV H 33M J 0W5 35	1
R 6	V1026007	R MF H 10K F 0W6 E4	1
R 1	V1026507	R MF H 33K2 F 0W6 E4	
R 2	V1026507	R MF H 33K2 F 0W6 E4	1
R100	V1026658	R MF H475K F 0W6 E4	1
R 14	V103420	R MO H 47E J 6W	1
REL1	R324360	RLY 12V 2C BV MNS	1

SIT.	ITEM NO.	DESCRIPTION	QUANTITY
SR 5	R1003009	R CFFV 1E J 0W25 E1	1
SR 8	R1003009	R CFFV 1E J 0W25 E1	1
SR 4	R1003169	R CFFV 22E J 0W25 E1	1
SR 3	R1011169	R CFFH 22E J 0W25	1
SR 6	R1011169	R CFFH 22E J 0W25	1
SR 7	R1011169	R CFFH 22E J 0W25	1
SR 9	R1011209	R CFFH 47E J 0W25	1
SR10	R1011907	R CFFH E1 K 0W35	
SR11	R1011907	R CFFH E1 K 0W35	
SR 1	R103224	R MO H100E J 2W	1
SR 1	R3469930	SLVU SHR D 9,6/4,8 BK	1
SR 2	V1026176	R MF H 1K5 F 0W6 E4	1
T 1	R774306	T G800 LIN CTRL	1
T 3	R774310	T D800 HOR DEF	1
T 2	R774350	T G801 HOR DVR	1
T2E	R774226	COIL LIN PJ51 HOR G12	1
Z 12	R131701	D ZEN 6V2 2W5 C SO	1
Z 5	R131720	D ZEN 6V2 0W5 C DO3	
Z 6	R131720	D ZEN 6V2 0W5 C DO3	
Z 1	R131730	D ZEN 20V 0W5 C DO3	1
Z 3	R131730	D ZEN 20V 0W5 C DO3	1
Z 7	R131730	D ZEN 20V 0W5 C DO3	
Z 8	R131730	D ZEN 20V 0W5 C DO3	
Z 10	R131730	D ZEN 20V 0W5 C DO3	
Z 11	R131730	D ZEN 20V 0W5 C DO3	
Z 9	R131740	D ZEN 12V 0W5 C DO3	
Z 4	R131767	D ZEN 6V8 0W5 B DO3	1
Z 2	V131711	D ZEN 56V 1W3 C DO4	1

Parts listing R7621085S

SIT.	ITEM NO.	DESCRIPTION	QUANTITY
	R7621085	UN G1200 HOR 09MI TIM	1
C 20	R111477	C EL RA 100M M 25E2	
C 24	R111531	C EL RA 10M M 35E2	
C 66	R111531	C EL RA 10M M 35E2	
C 28	R111546	C EL RA 1M M 50E2	
C 48	R113724	C POMERA 100N K 63E	
C 65	R113724	C POMERA 100N K 63E	
C 26	R114090	C POMERA 1M K 63E2	
C 36	R114090	C POMERA 1M K 63E2	
C 44	R114090	C POMERA 1M K 63E2	1
C 5	R1159161	C PP RA 1N J100E2 8	
C 6	R1159161	C PP RA 1N J100E2 8	
C 75	V115026	C PPMERA 220P J202E	1
C 76	V115026	C PPMERA 220P J202E	1
C 77	V115026	C PPMERA 220P J202E	1
D 3	R131621	D S 1N4148 075150 DO3	
D 4	R131621	D S 1N4148 075150 DO3	
D 19	R131621	D S 1N4148 075150 DO3	
D 29	R131621	D S 1N4148 075150 DO3	
D 47	R131637	D R BA158 600400 DO7	1
D 51	R131637	D R BA158 600400 DO7	1
D 12	R131662	D LED D3 T RD	1

SIT.	ITEM NO.	DESCRIPTION	QUANTITY
D 41	R131667	D LED D3 T GN	1
I 3	R134033	U 78L12AC TO92 P	1
I 2	R134114	U 393 LM DIP8 P	1
I 1	R137378	U 4538B DIP16 P	1
J 83	R313727	J MTA MBT P 5 M3,96 FL	1
J 67	R3484081	CD CT FTMT P 8 80	1
P 64	R106828	R TCE V 5K K 0W5 S1	1
PC	R780619	PCB G1200 HOR SUB /2	1
Q 15	R131411	Q BC549C N SS TO9	1
Q 16	R131411	Q BC549C N SS TO9	
Q 59	R131411	Q BC549C N SS TO9	1
Q 60	R131411	Q BC549C N SS TO9	
Q 58	R132516	Q BF422 N SS TO92	1
Q 45	R132557	Q BC635 N SS TO92	1
R 14	R101524	R MF H100E F 0W4 E3	
R 79	R101524	R MF H100E F 0W4 E3	
R 27	R101536	R MF H 1K F 0W4 E3	

Horizontal Deflection R7621085

SIT.	ITEM NO.	DESCRIPTION	QUANTITY
R 39	R101538	R MF H 1K5 F 0W4 E3	
R 68	R101538	R MF H 1K5 F 0W4 E3	
R 10	R101540	R MF H 2K2 F 0W4 E3	
R 33	R101542	R MF H 3K3 F 0W4 E3	
R 11	R101544	R MF H 4K7 F 0W4 E3	
R 31	R101548	R MF H 10K F 0W4 E3	
R 37	R101548	R MF H 10K F 0W4 E3	
R 38	R101548	R MF H 10K F 0W4 E3	
R 43	R101548	R MF H 10K F 0W4 E3	
R 1	R101549	R MF H 12K F 0W4 E3	
R 2	R101549	R MF H 12K F 0W4 E3	
R 13	R101550	R MF H 15K F 0W4 E3	
R 32	R101551	R MF H 18K F 0W4 E3	
R 62	R101551	R MF H 18K F 0W4 E3	
R 17	R101552	R MF H 22K F 0W4 E3	
R 18	R101552	R MF H 22K F 0W4 E3	
R 63	R101552	R MF H 22K F 0W4 E3	
R 61	R101555	R MF H 39K F 0W4 E3	
R 53	R101557	R MF H 56K F 0W4 E3	
R 56	R101557	R MF H 56K F 0W4 E3	
R 52	R101560	R MF H100K F 0W4 E3	
R 54	R101560	R MF H100K F 0W4 E3