BARCO Projection Systems

SECTION L

service sheet

L

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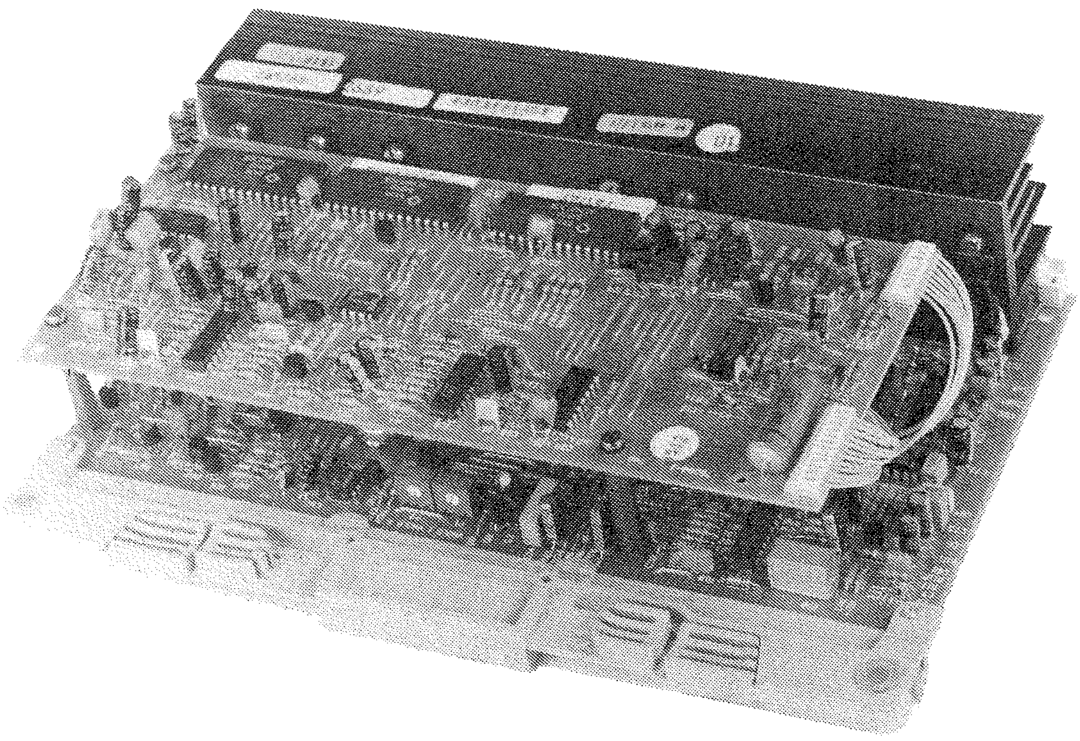
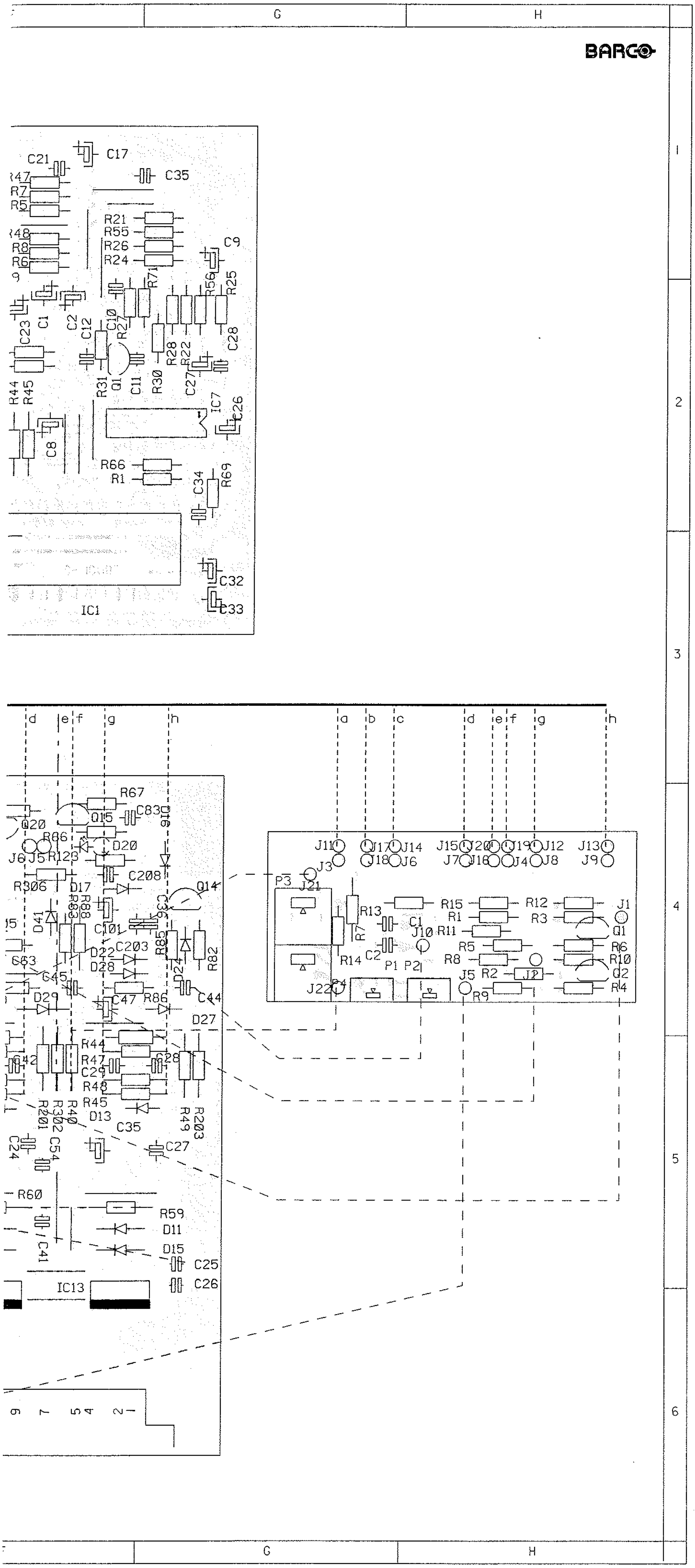
VERTICAL DEFLECTION + SYNC MODULE 76 1738

SUB-MODULE VERTICAL DEFLECTION + SYNC 76 1769





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C1	D 5	C205	C 5	P2	H 4	R44	F 5	R302	F 5
C2	G 4	C206	E 5	P2	E 4	R45	F 2	R303	C 6
C2	F 2	C207	C 5	P3	G 4	R45	F 5	R304	C 5
C2	D 5	C208	F 4	P4	G 4	R46	F 1	R305	C
C3	D 3	C214	E 2			R46	F 5	R306	F
C3	D 5	C219	E 1	Q1	H 4	R47	F 1	R307	C 5
C4	D 3	C300	F 2	Q1	F 2	R47	F 5		
C4	B 4	C302	C 2	Q1	C 5	R48	F 1	SR1	E 5
C5	D 2			Q2	H 4	R48	F 5	SR2	E 5
C5	D 5	D1	E 1	Q2	E 1	R49	F 2		
C6	F 2	D1	D 5	Q2	C 5	R49	G 5	Z1	B 4
C6	B 4	D2	E 1	Q3	E 2	R50	F 2	Z2	D 5
C7	E 2	D2	C 4	Q3	D 4	R50	E 4	Z3	C 4
C7	B 4	D3	E 2	Q4	D 5	R51	C 5		
C8	F 2	D3	B 4	Q5	E 2	R52	D 1		
C8	C 4	D4	E 2	Q5	D 5	R52	C 4		
C9	G 1	D4	C 4	Q6	C 2	R53	D 3		
C9	D 4	D5	E 1	Q6	C 4	R53	E 5		
C10	F 2	D5	D 4	Q7	C 2	R54	D 3		
C10	B 4	D6	E 1	Q7	D 4	R54	D 5		
C11	F 2	D6	D 4	Q8	C 2	R55	F 1		
C11	C 5	D7	E 1	Q8	D 4	R55	D 5		
C12	F 2	D7	D 4	Q9	C 4	R56	G 2		
C12	C 4	D8	E 3	Q10	D 4	R56	E 4		
C13	F 2	D8	D 4	Q11	E 4	R57	D 2		
C13	D 4	D9	E 3	Q12	E 4	R57	E 4		
C14	F 2	D9	D 4	Q14	G 4	R58	E 2		
C14	D 4	D10	F 3	Q15	F 4	R58	E 4		
C15	E 3	D10	D 5	Q16	F 4	R59	E 1		
C15	E 4	D11	D 3	Q17	C 5	R59	G 5		
C16	E 1	D11	G 5	Q18	C 5	R60	D 3		
C16	D 4	D12	D 1	Q19	D 4	R60	F 5		
C17	F 1	D12	D 5	Q20	F 4	R61	F 2		
C18	F 1	D13	D 2	Q21	B 4	R61	E 5		
C18	D 5	D13	F 5			R62	F 2		
C19	F 2	D14	E 4	R1	H 4	R62	F 4		
C19	D 5	D15	C 2	R1	F 2	R63	D 3		
C20	F 1	D15	G 5	R1	D 5	R63	F 4		
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C21	D 4	D17	C 2	R2	D 5	R65	D 3		
C22	D 1	D17	F 4	R3	H 4	R65	F 4		
C22	D 4	D18	F 4	R3	F 1	R66	F 2		
C23	F 2	D19	F 4	R3	D 5	R66	F 4		
C23	C 4	D20	F 4	R4	H 4	R67	D 2		
C24	F 2	D21	F 5	R4	F 1	R67	F 4		
C24	F 5	D22	F 4	R4	C 4	R68	D 2		
C25	F 1	D23	E 5	R5	H 4	R68	F 4		
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C26	G 6	D26	F 4	R6	H 4	R70	C 6		
C27	G 2	D27	G 4	R6	F 1	R71	G 2		
C27	G 5	D28	F 4	R6	D 6	R71	C 5		
C28	G 2	D29	F 4	R7	G 4	R72	D 1		
C28	G 5	D30	C 4	R7	F 1	R72	B 6		
C29	D 1	D31	E 5	R8	H 4	R73	D 1		
C29	F 5	D32	E 5	R8	F 1	R73	B 5		
C30	D 1	D33	F 5	R8	D 5	R74	C 2		
C30	C 4	D34	D 4	R9	H 4	R74	D 6		
C31	E 1	D35	C 4	R9	E 1	R75	C 2		
C31	C 4	D36	D 4	R9	B 4	R75	C 5		
C32	G 3	D37	C 4	R10	H 4	R76	C 2		
C32	D 5	D38	C 4	R10	E 1	R76	F 5		
C33	G 3	D39	C 5	R10	C 4	R77	C 2		
C33	D 5	D40	C 5	R11	H 4	R77	F 5		
C34	G 2	D41	F 4	R11	E 2	R78	C 2		
C34	F 4			R11	C 4	R78	F 5		
C35	G 1	IC1	F 3	R12	H 4	R79	C 3		
C35	F 5	IC1	C 5	R12	E 2	R79	F 5		
C36	D 2	IC2	E 3	R12	B 4	R80	C 3		
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C37	E 4	IC3	D 3	R13	D 2	R81	C 3		
C38	E 2	IC3	D 6	R13	C 5	R81	F 5		
C38	B 5	IC4	D 2	R14	G 4	R82	C 3		
C39	D 1	IC4	B 5	R14	E 2	R82	G 4		
C39	B 5	IC5	D 2	R14	C 5	R83	D 3		
C40	C 2	IC5	C 5	R15	H 4	R83	F 4		
C41	C 1	IC6	D 2	R15	C 4	R84	E 2		
C41	F 5	IC6	C 5	R16	F 2	R84	F 4		
C42	C 2	IC7	G 2	R16	D 4	R85	C 3		
C42	F 5	IC7	C 4	R17	F 2	R85	G 4		
C43	C 2	IC8	D 1	R17	B 4	R86	C 2		
C43	F 5	IC8	D 5	R18	F 2	R86	G 4		
C44	C 2	IC9	E 2	R18	C 4	R87	C 2		
C44	G 4	IC9	E 4	R19	D 2	R87	F 4		
C45	C 3	IC10	D 2	R19	C 5	R88	C 2		
C45	F 4	IC10	D 5	R20	D 2	R88	F 4		
C46	C 3	IC11	F 1	R20	C 5	R89	C 3		
C46	F 4	IC11	F 6	R21	F 1	R89	D 4		
C47	C 3	IC12	C 2	R21	C 5	R90	C 4		
C47	F 4	IC12	E 6	R22	G 2	R91	C 4		
C48	C 2	IC13	F 6	R22	C 5	R92	C 4		
C48	E 4	IC14	C 5	R23	E 1	R93	C 4		
C49	C 2			R23	D 4	R94	C 4		
C49	F 4	J1	H 4	R24	F 1	R95	C 4		
C50	D 1	J1	D 6	R24	C 4	R96	C 4		
C50	B 4	J2	H 4	R25	G 2	R97	E 5		
C51	C 5	J2	E 6	R25	D 4	R98	E 5		
C52	F 5	J3	G 4	R26	F 1	R99	C 4		
C53	E 5	J3	C 3	R26	D 4	R100	D 4		
C54	F 5	J3	D 5	R27	F 2	R101	C 4		
C55	E 5	J4	H 4	R27	D 4	R102	C 4		
C56	F 5	J4	C 2	R28	G 2	R103	C 4		
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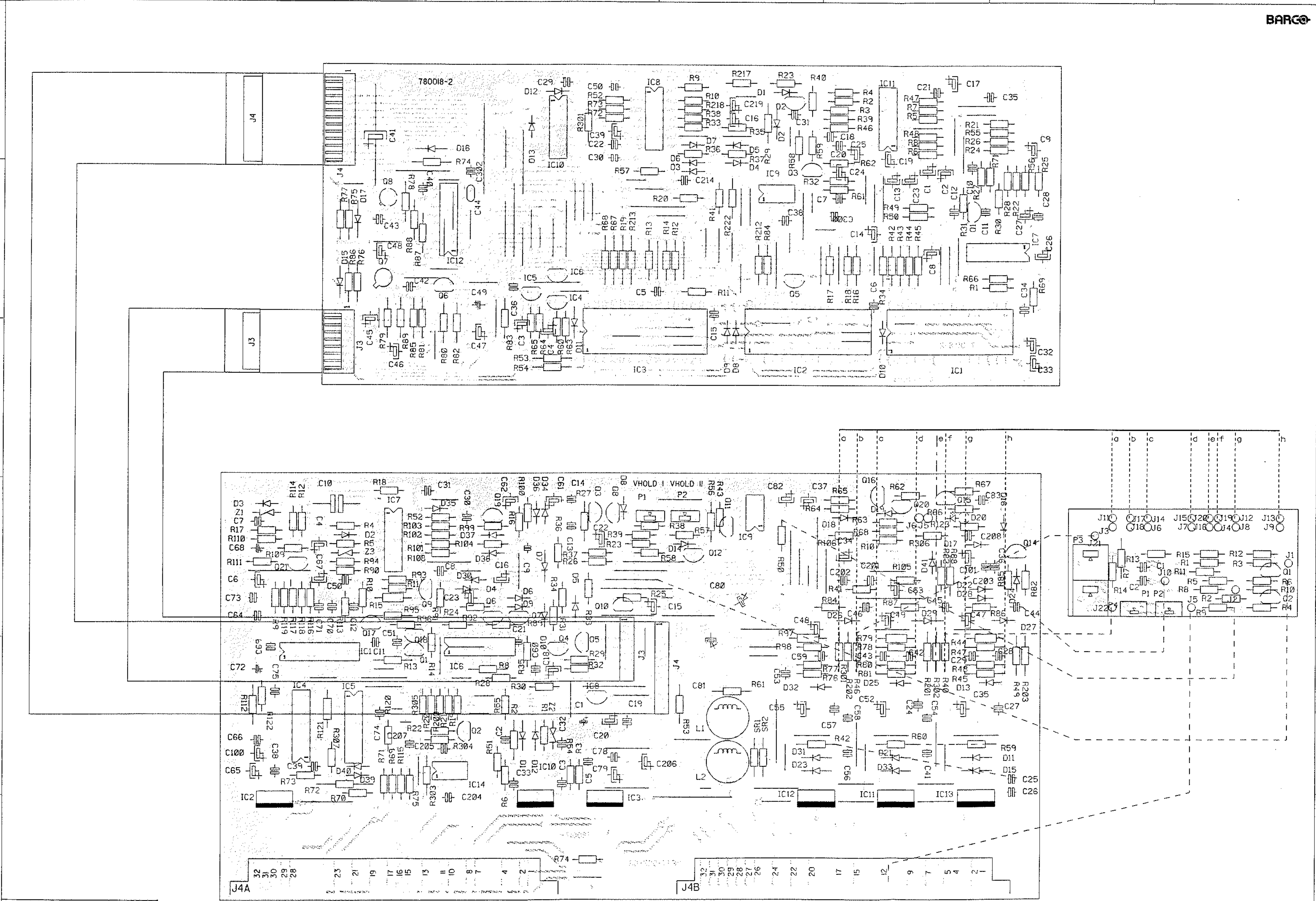
C59	E 5	J5	F 4	R29	D 5	R106	E 4		
C60	D 5	J6	G 4	R30	G 2	R107	F 4		
C61	D 4	J6	F 4	R30	D 5	R108	C 4		
C62	D 4	J7	H 4	R31	F 2	R109	B 4		
C63	F 4	J8	H 4	R31	D 4	R110	B 4		
C64	B 4	J9	H 4	R32	E 2	R111	B 4		
C65	B 5	J10	H 4	R32	D 5	R112	B 5		
C66	B 5	J11	G 4	R33	E 1	R113	C 4		
C67	B 4	J12	H 4	R33	D 4	R114	B 4		
C68	B 4	J13	H 4	R34	F 2	R115	C 5		
C69	B 5	J14	G 4	R34	D 4	R116	B 4		
C70	B 4	J15	H 4	R35	E 1	R117	B 4		
C71	B 4	J16	H 4	R35	D 5	R118	B 4		
C72	B 5	J17	G 4	R36	E 1	R119	B 4		
C73	B 4	J18	G 4	R36	D 4	R120	C 5		
C74	C 5	J19	H 4	R37	E 2	R121	B 5		
C75	B 5	J20	H 4	R37	D 4	R122	B 5		
C78	D 5	J21	G 4	R38	E 1	R123	F 4		
C79	D 5	J22	G 4	R38	E 4	R200	C 5		
C80	E 4			R39	F 1	R201	F 5		
C81	E 5	L1	E 5	R39	D 4	R202	F 5		
C82	E 4	L2	E 5	R40	E 1	R203	G 5		
C83	F 4			R40	F 5	R212	E 2		
C100	B 5			R41	E 2	R213	D 2		
C101	F 4			R41	F 4	R217	E 1		
C201	F 4			R42	F 2	R218	E 1		
C202	F 4			R42	F 5	R222	E 2		
				R43	F 2				



Name	Interconnection Vertical deflection	Article nr. 76738-76769
Date 15/09/1990	Drawn PG	Checked CT

BARCO PROJECTION SYSTEMS

Modifications reserved

COMP.	LOC.
C1	H 4
C1	F 2
C1	D 5
C2	G 4
C2	F 2
C2	D 5
C3	D 3
C3	D 5
C4	D 3
C4	B 4
C5	D 2
C5	D 5
C6	F 2
C6	B 4
C7	E 2
C7	B 4
C8	F 2
C8	C 4
C9	G 1
C9	D 4
C10	F 2
C10	B 4
C11	F 2
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C13	F 2
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C73	B 4
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C79	D 5
C80	E 4
C81	E 5
C82	F 4
C83	F 4
C100	F 5
C101	F 4
C201	F 4
C202	F 4

COMP.	LOC.	COMP.	LOC.
C1	G 7	Q1	G 2
C2	G 8	Q2	E 4
C3	F 8	Q3	L 2
C4	H 6	Q4	K 3
C5	F 8	Q5	J 1
C6	G 5	Q6	J 2
C7	H 5	Q7	K 2
C8	I 2	Q8	L 2
C9	K 3	Q9	J 2
C10	G 5	Q10	L 1
C11	F 4	Q11	N 3
C12	E 4	Q12	N 2
C13	L 1	Q14	J 8
C14	L 2	Q15	J 7
C15	K 1	Q16	I 8
C16	J 1	Q17	I 2
C18	K 3	Q18	H 3
C19	K 1	Q19	L 3
C20	J 1	Q20	H 8
C21	J 2	Q21	F 5
C22	K 2		
C23	K 2	R1	F 7
C24	L 7	R1	J 5
C25	M 4	R2	J 5
C26	M 5	R2	F 7
C27	L 4	R3	J 5
C28	M 5	R3	F 8
C29	N 5	R4	J 5
C30	L 3	R4	H 6
C31	L 3	R5	J 5
C32	F 8	R5	H 5
C33	G 8	R6	K 5
C34	L 4	R6	G 8
C35	M 4	R7	K 6
C36	J 8	R8	G 3
C37	H 8	R8	J 5
C38	D 2	R9	J 5
C39	D 2	R9	G 5
C41	M 8	R10	J 5
C42	M 7	R10	I 2
C43	N 7	R11	H 5
C44	K 8	R11	K 6
C45	K 7	R12	H 5
C46	K 8	R13	G 2
C47	K 8	R14	H 2
C48	K 7	R15	I 2
C49	K 7	R16	K 3
C50	H 2	R17	G 4
C51	H 2	R18	G 5
C52	M 7	R19	F 5
C53	N 6	R20	F 4
C54	M 7	R21	E 5
C55	M 5	R22	E 4
C56	M 6	R23	L 1
C57	L 6	R24	K 2
C58	M 5	R25	L 1
C59	M 6	R26	L 1
C60	J 3	R27	L 2
C61	N 3	R28	J 2
C62	M 3	R29	K 3
C63	H 7	R30	K 3
C64	F 5	R31	K 1
C65	D 6	R32	K 3
C66	E 6	R33	L 1
C67	E 6	R34	K 1
C68	F 5	R35	J 2
C69	G 4	R36	K 1
C70	F 4	R37	K 2
C71	F 5	R38	K 1
C72	F 5	R39	K 1
C73	G 5	R40	L 7
C74	F 2	R41	L 8
C75	F 3	R42	M 6
C78	E 6	R43	N 3
C79	D 6	R44	N 5
C80	E 7	R45	N 4
C81	E 7	R46	L 6
C82	E 6	R47	M 5
C100	E 6	R48	N 4
C101	D 6	R49	L 4
C201	M 8	R50	L 4
C202	M 6	R51	G 8
C203	M 5	R52	M 3
C204	D 5	R53	F 7
C205	E 5	R54	F 8
C206	D 1	R55	G 8
C207	G 3	R56	N 2
C208	H 8	R57	O 3
		R58	O 2
D1	G 7	R59	L 5
D2	H 6	R60	M 7
D3	H 5	R61	J 8
D4	I 2	R62	I 8
D5	J 2	R63	J 8
D6	K 2	R64	I 8
D7	K 2	R65	I 8
D8	K 2	R66	I 7
D9	K 3	R67	I 7
D10	K 3	R68	I 7
D11	M 4	R69	E 3
D12	G 8	R70	E 2
D13	M 4	R71	E 3
D14	O 2	R72	D 2
D15	M 4	R73	D 2
D16	J 7	R74	D 1
D18	I 8	R75	D 1
D19	I 8	R76	N 6
D20	I 7	R77	N 6
D21	M 7	R78	M 7
D22	K 7	R79	N 8
D23	M 5	R80	N 7
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D25	M 7	R82	K 8
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D27	K 8	R84	K 7
D28	K 7	R85	K 8
D29	K 7	R86	K 8
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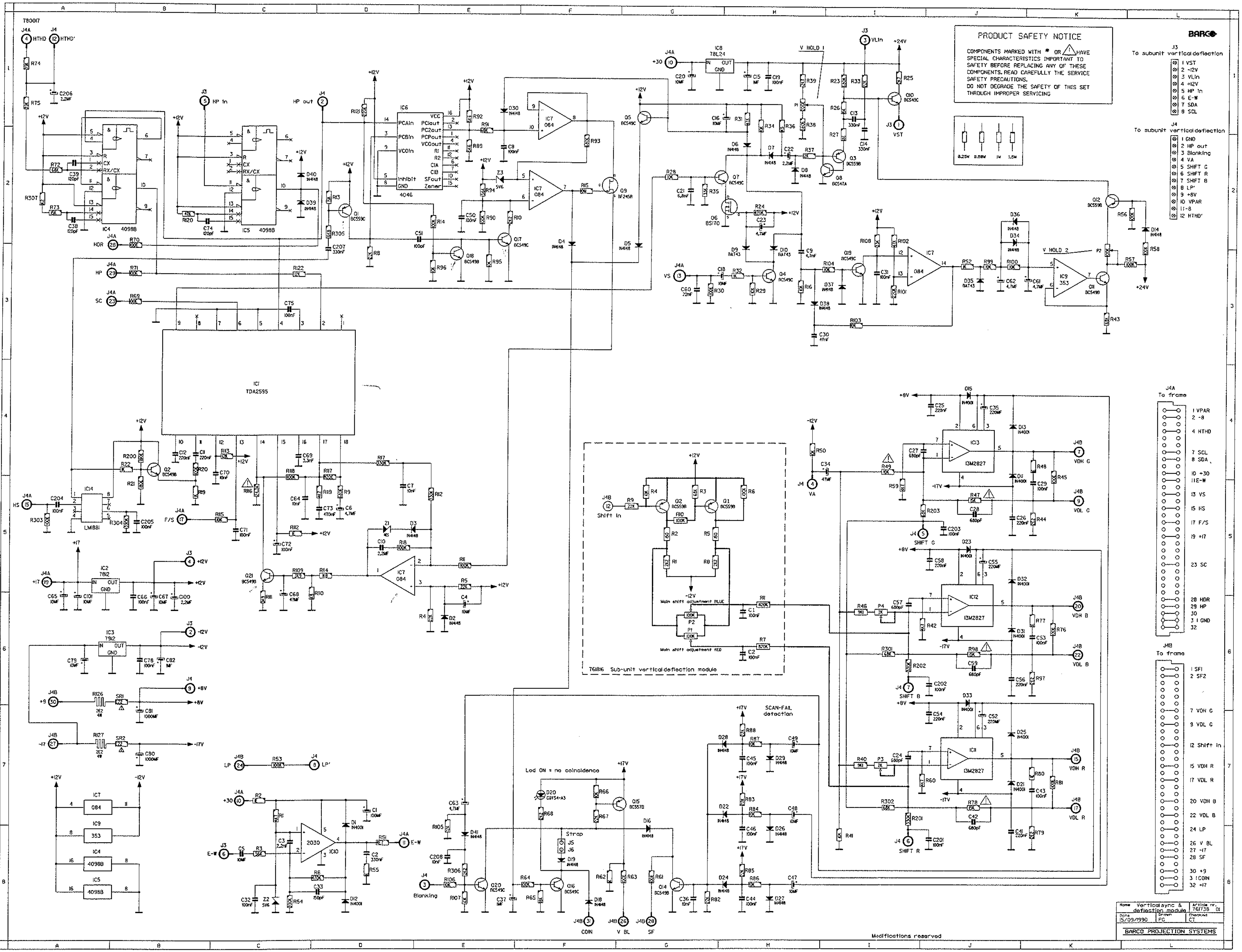
D32	M 5	R89	H 2
D33	M 6	R90	H 2
D34	M 2	R91	H 1
D35	M 3	R92	H 1
D36	M 2	R93	I 2
D37	L 3	R94	H 2
D38	L 3	R95	H 3
D39	G 2	R96	H 3
D40	G 2	R97	N 6
D41	H 8	R98	M 6
		R99	M 3
IC1	F 4	R100	M 3
IC2	E 5	R101	L 3
IC3	E 6	R102	L 2
IC4	E 2	R103	L 3
IC4	D 8	R104	L 3
IC4	E 8	R105	H 8
IC5	F 2	R106	H 8
IC5	D 8	R107	H 8
IC5	E 8	R108	L 2
IC6	G 1	R109	F 5
IC7	E 7	R110	G 5
IC7	D 7	R111	F 6
IC7	I 1	R112	F 5
IC7	I 2	R113	F 4
IC7	M 3	R114	G 5
IC7	G 5	R115	F 5
IC8	K 1	R116	F 5
IC9	E 7	R117	G 4
IC9	E 7	R118	F 4
IC9	N 3	R119	G 5
IC10	G 8	R120	E 2
IC11	M 7	R121	G 1
IC12	M 6	R122	F 3
IC13	M 4	R126	E 6
IC14	D 5	R127	E 7
		R200	E 4
J3	O 1	R201	L 7
J4	O 1	R202	L 6
		R203	M 5
P1	K 1	R301	L 6
P1	J 6	R302	L 7
P2	N 3	R303	D 5
P2	J 6	R304	E 5
P3	L 7	R305	G 2
P4	L 6	R306	H 8
		R307	D 2
		SR1	E 6
		SR2	E 7
		Z1	G 5
		Z2	F 8
		Z3	H 2



COMP.	LOC.	COMP.	LOC.
C1	C 1	R1	C 3
C2	D 1	R2	D 1
C3	A 2	R3	C 1
C4	A 1	R4	C 1
C5	B 6	R5	C 1
C6	B 5	R6	D 1
C7	B 5	R7	D 2
C8	G 2	R8	D 2
C9	G 3	R9	D 3
C10	F 3	R10	C 4
C11	G 2	R11	B 6
C12	G 2	R12	B 6
C13	F 1	R13	B 6
C14	C 3	R14	B 6
C15	A 1	R16	B 5
C16	B 2	R17	B 4
C17	D 1	R18	B 5
C18	E 1	R19	B 5
C19	D 2	R20	C 6
C20	D 2	R21	G 3
C21	F 1	R22	G 3
C22	E 2	R23	G 1
C23	E 1	R24	G 2
C24	F 1	R25	G 3
C25	F 1	R26	F 3
C26	H 3	R27	G 2
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C28	H 3	R29	G 1
C29	D 6	R30	G 2
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C39	F 4	R39	C 1
C40	C 4	R40	C 1
C41	C 5	R41	C 1
C42	D 5	R42	F 2
C43	F 5	R43	F 2
C44	D 5	R44	F 2
C45	F 4	R45	F 2
C46	E 4	R46	E 1
C47	F 6	R47	F 1
C48	F 5	R48	E 1
C49	E 4	R49	E 1
C50	F 3	R50	F 1
C214	C 1	R52	F 3
C219	C 3	R53	G 6
C297	B 4	R54	G 6
C302	D 4	R55	G 3
C303	F 3	R56	H 3
		R57	D 6
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D2	G 1	R59	F 1
D3	C 1	R60	A 1
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D5	C 2	R62	F 1
D6	C 1	R63	A 2
D7	C 2	R64	A 2
D8	G 5	R65	A 2
D9	G 5	R66	D 3
D10	G 6	R67	B 5
D11	G 6	R68	B 5
D12	D 6	R69	D 3
D13	D 6	R71	G 2
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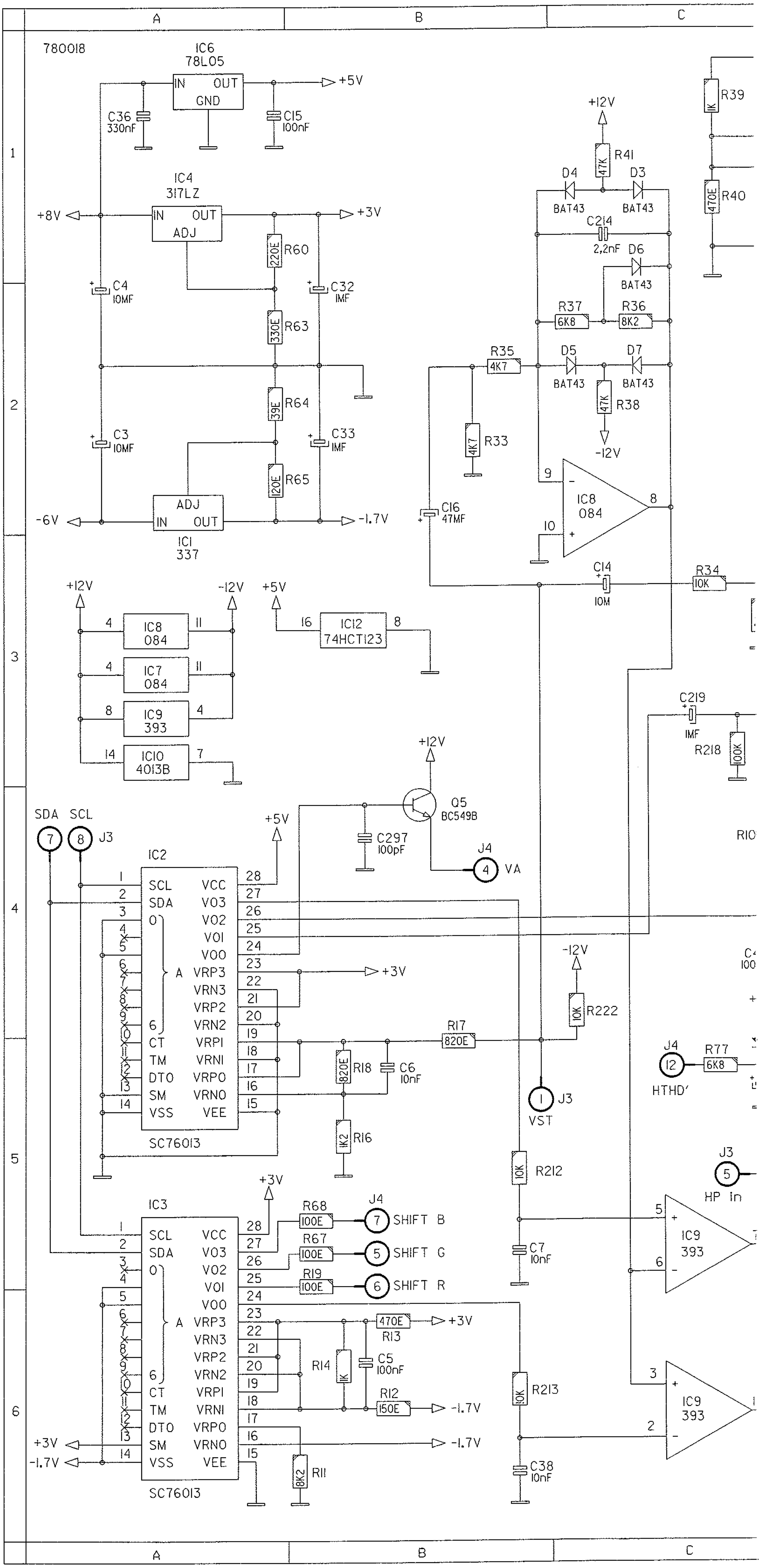
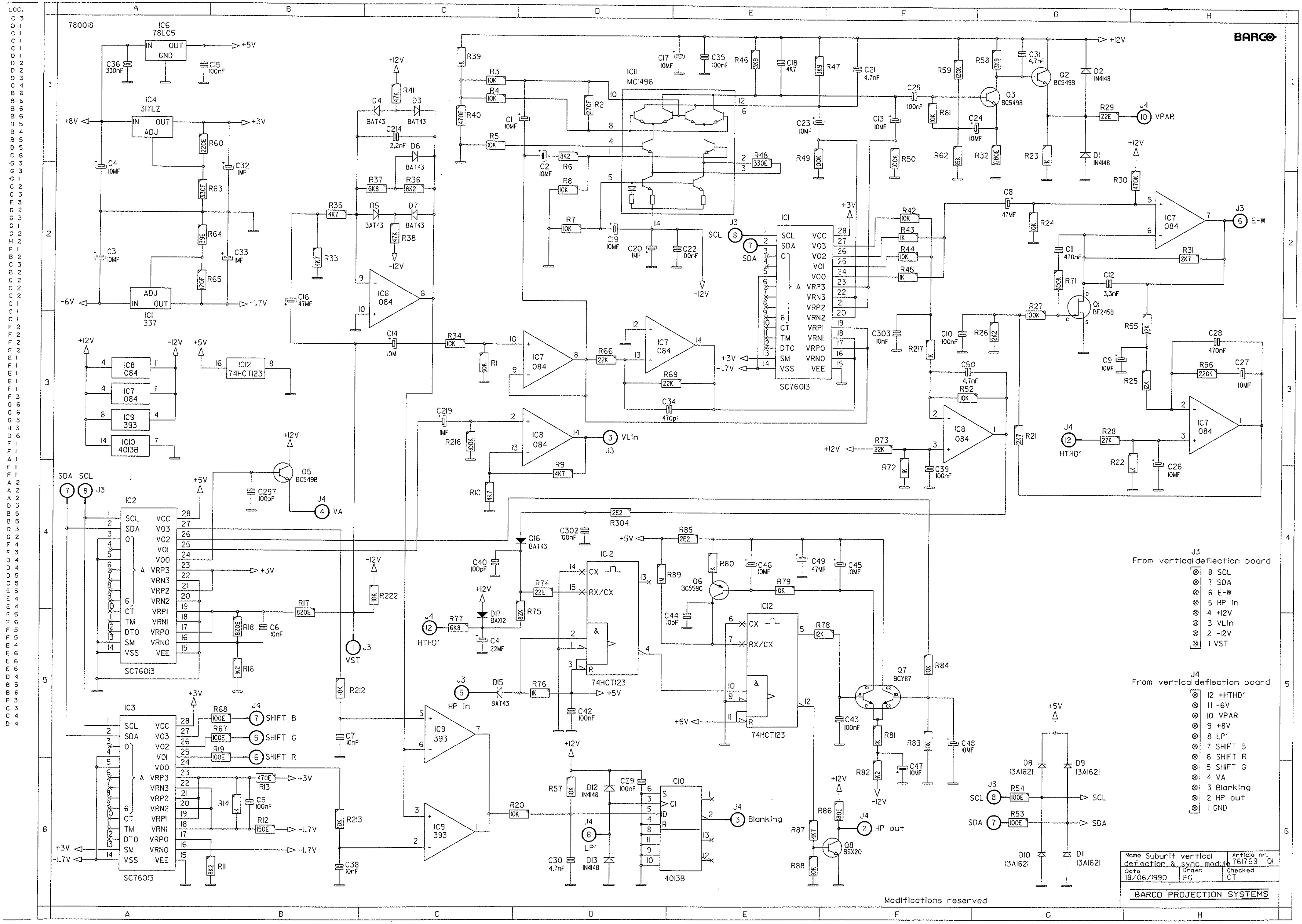
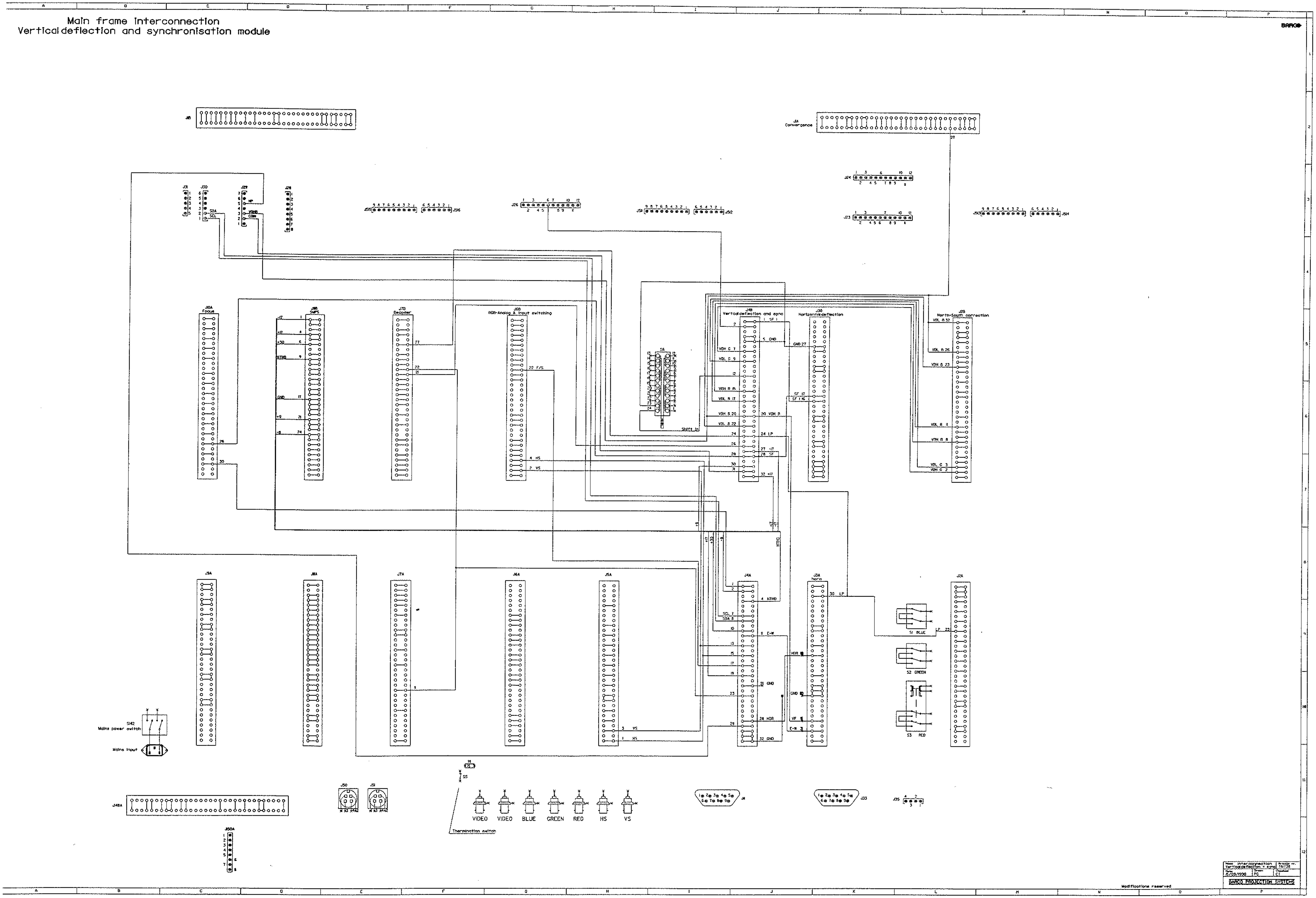
D16	D 4	R73	F 3
D17	C 5	R74	D 4
		R75	D 4
IC1	A 3	R76	D 5
IC1	E 2	R77	C 5
IC2	A 4	R78	E 5
IC3	A 5	R79	E 4
IC4	A 1	R80	E 4
IC6	A 1	R81	F 5
IC7	D 3	R82	F 6
IC7	D 3	R83	F 5
IC7	H 3	R84	F 5
IC7	H 2	R85	E 4
IC7	A 3	R86	E 6
IC7	A 3	R87	E 6
IC8	D 3	R88	E 6
IC8	A 3	R89	D 4
IC8	A 3	R212	B 5
IC8	C 2	R213	B 6
IC8	F 3	R217	F 3
IC9	A 3	R218	C 3
IC9	A 3	R222	C 4
IC9	C 6	R304	D 4
IC9	C 5		
IC10	E 6		
IC10	A 3		
IC10	A 3		
IC11	D 1		
IC12	E 4		
IC12	B 3		
IC12	B 3		
IC12	D 4		
J3	H 4		
J4	H 5		
Q1	G 2		
Q2	G 1		
Q3	G 1		
Q5	B 4		
Q6	E 4		
Q7	F 5		
Q8	F 6		

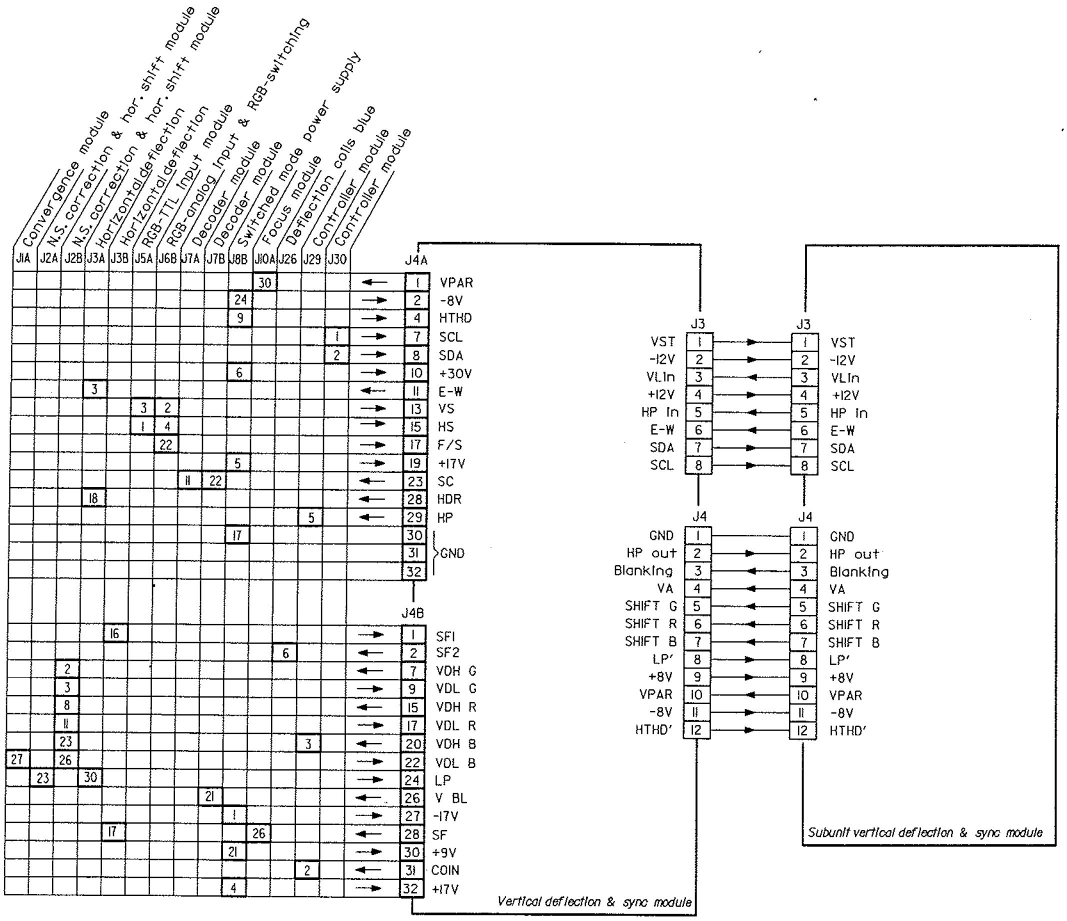



780018
BARCO
J3
From vertical deflection board
8 SCL
7 SDA
6 E-W
5 HP in
4 +12V
3 VLin
2 -12V
1 VST
J4
From vertical deflection board
12 +HTHD'
11 -6V
10 VPAR
9 +8V
8 LP'
7 SHIFT B
6 SHIFT R
5 SHIFT G
4 VA
3 Blanking
2 HP out
1 GND
Modifications reserved
Name Subunit vertical deflection & sync module
Article nr. 761769 01
Date 18/06/1990
Drawn PC
Checked CT
BARCO PROJECTION SYSTEMS

Main frame interconnection
Vertical deflection and synchronisation module



BARCO



Name	Interconnection Vertical defl. & sync module	Article nr. 761738-761769
Date 15/09/1990	Drawn PG	Checked CT

BARCO PROJECTION SYSTEMS

Modifications reserved

Introduction

The following adjustments are provided on the mainboard:

a: Vertical oscillator adjustments
on the lowest frequency P1
on the highest frequency P2

Important: The following adjustments are provided on the main board in order to correct the Vert. Shift range and the Vert Amplitude of the red and blue picture after replacement of the respective picture tube.

b: Vertical amplitude adjustment
Blue picture P4
Red picture P3

c: Vertical Shift adjustment
Blue picture P2
Red picture P1

Vertical oscillator adjustments

P1 Adjustment on the lowest Vert. frequency **50Hz**
- Projector has to operate on a signal with 50Hz frame frequency
- Turn the potentiometer P2 in its mid-position
- Adjust P1 for synchronisation of the picture

P2 Adjustment on the higher Vert. frequency **100Hz**
- Projector has to operate on a signal with 100Hz frame frequency
- Adjust P2 for synchronisation of the picture

Vertical Shift adjustment

Preparation:

- Projector has to operate on a signal with standard line- and frame frequency.
- Adjust for the red and blue picture, by means of the RCU800 (refer to the owner's manual of the projector), the Vert Shift adjustments in their mid-position (refer to bar scale 50).

Adjustment

Adjust the Vert Shift for red and blue separately for vertical coincidence of the horizontal center line with green.

Vertical amplitude Red - Blue

Adjust the Vert. Ampl. for Red and Blue separately for same amplitude as the green picture

INTRODUCTION.

On this board and its subunit we find the sync separator, the autolock circuits for driving the line and vertical oscillators, the vertical power output stages and the preparation of the waveforms for the east-west correction.

The horizontal drive pulses for the Mosfet switchers in the horizontal deflection are equally prepared on this board.

A Barco designed IC, comprising four (4) digital potentiometers, is utilised for the adjustment of the amplitude of the waveforms, or, for some dc controls.

This IC, customer made for Barco, is driven by a I2C (serial data) from the microprocessor on the controller board.

I.THE VERTICAL OSCILLATOR.

a) Sawtooth oscillator:

The vertical sawtooth relaxation oscillator is built up around Q3 and Q8.

The +28 volts from the Switched Mode Power Supply is stabilised at 24 volts by IC8 and charges the capacitors C13, C14. As soon the emitter voltage of Q3 reaches the voltage set by P1 (V HOLD I) the transistor starts conducting and Q8 is doing the same.

A very rapid discharge of the capacitors occurs and the cycle can start again.

b) Synchronisation of the vertical oscillator.

1) By means of the composite sync :

The composite video or composite sync is applied to pin 2 of IC14, a sync separator. The composite sync output, pin 8, is proceeding to the IC1 via a buffer Q2, and to the base of Q1.

The output pin 9 is providing vertical pulses which are now sent to the base of Q7. If we assume that the switcher Q6 is conducting (see later), the negative pulses on the collector of Q7 can trigger the vertical oscillator.

The vertical oscillator can equally be triggered by means of the vertical pulses VS introduced directed to the projector (see RGB Switching board).

2) By means of the vertical pulses, if applied separately.

These vertical pulses enter the board at C13/A13 of the J1 connector and arrive on the base of Q4.

The negative pulses on the collector trigger the oscillator now via D18/D7.

To prevent triggering via Q7 the fet Q6 is blocked as follows.

The negative pulses at the collector of Q4 cause a decrease via D9 of the voltage at the gate of Q6 in order to block the latter. Note that these pulses are integrated by C23 and arrive on the gate via D9.

c) Barco made IC : 4 x digitally controlled potentiometer .

The voltage or waveform, applied between VRP and VRN is adjustable in 128 steps and is available at the output VO. The corresponding pins are eg. VRP1, VRN1 and VO1.

We find 4 of such potentiometers in one chip, and there are three of these on the subunit : IC1, IC2 and IC3 , which we will meet in the explanation.

The status of the output is controlled by the SCL (Serial Clock) and SDA (Serial Data) lines which are connected to the microprocessor on the controller board.

The address, arriving via the data SDA line is identified by a hardware addressing of the slave (the address pins are differently connected).

Obviously, as there are 4 potentiometers, the address is followed by a slave-address to drive the requested potentiometer.

d) Vertical Linearity control.

The shape of the sawtooth can be adapted by means of a feedback of a regulated sawtooth to the capacitor C14 via R33. This sawtooth is the result of the dig. potentiometer VRP1/VRN1/VO1 in IC2 on the subunit.

Indeed,the sawtoooth at the emitter of Q10 leaves the board and arrives on the subunit at contact J3(4), where it is applied, amongst others, to pin 19 of IC2 (VRP1).

The adjusted output, pin 25 (or VO1) is now sent to a bufferstage in IC8 and leaves the subunit at contact J3(3) to arrive again at the motherboard.

The sawtooth influences the charging behaviour of C14 through R33, acting consequently as a linearity control.

e) The vertical autolock circuit.

This circuit is built up around Q19 / OP AMP in TL084 / 353 (IC9).

The vertical sync pulses are picked up at the collector of Q7 and differentiated by C9/R16. The named differentiation produces a negative folowed by a positive pulse and it is this positive pulse that triggers the transistor Q19.

The output of the OP AMP, acting as a comparator, is fed back to the base of the transistor in order to prevent it from retriggering after a trigger.

The non-inverting input is pulled up to the +12 Volts line by R108 and a capacitor C31 is connected to ground. When no trigger pulses are applied to the base, the pin 12 is at +12 volts and obviously the output is equally at 12 volts.

Whenever a trigger pulse (vertical pulse) is applied on the base, the capacitor is discharged via Q19, and the output pin 14 switches at -12 volts.

This negative voltage now is slightly delayed by C38 and keeps the base low via D38 to prevent it from being retriggered. The capacitor C31 charges up again to the +12 volts and from the moment the voltage equals the voltage of the inverting input, the output switches high again.

When the next trigger occurs, the cycle starts over again.

The time between two consecutive pulses determines the time the output is high as the time the output is low is invariable and determined by the time constant C31/R108.
The duty cycle of this squared waveform depends on the time between two consecutive pulses.

This squared waveform is now clamped at ground as only to allow the positive part to charge the capacitors C62/ C61. D34 and D36 provide a rapid change in both directions of the voltage across these capacitors.

The resulting voltage at the input of the buffer IC9 (353) is proportional with the vertical period, and consequently a measure of the vertical frequency.

When the vertical frequency increases, the voltage on C61 decreases, which results in a less conducting Q11 and obviously a decrease of the charging current by Q12.

The Vert HOLD II (P2) allows an adjustment of the gain and thus of the highest frequency that must be locked by this system.

f) Vertical output stages - Vertical shift - Vertical amplitude.

The vertical sawtooth at the emitter of Q10 is leaving the board and reaches the subunit to be applied at IC2 (VRN0 and VRP0). The output is VO0 (pin 24) and is coming back to the board at J4 (4). It is now capacitively coupled to the inverting inputs of the power amplifiers IC11/IC12/IC13 together with a DC-voltage (Vertical Shift voltage).

These DC voltages are adjusted in IC3 of the subunit (outputs 25,26,27).

When the green raster is moved on the screen, the red and blue rasters move equally allowing a precise and rapid adjustment.

The amplified sawtoothed output currents flow in the respective scan coils and find their way back to ground via de feedback resistors R44/R97/R79.

The amplitude of the waveforms across these resistors is proportional to the vertical amplitude and can obviously be utilised as feedback for stabilisation of the amplitude.

The TDA8172 allows a short vertical retrace time by doubling the supply voltage during the retrace time.

During the flyback the voltage across the capacitors C35, C55 and C52 is switched in series with the supply voltage of +8 volts . As a result, the voltage during flyback is 8 + (8+17) = 33 volts.

This increased supply voltage garuantees a short flyback time.

g) Vertical scan fail detection.

The flyback pulses at the pins 6 of the output amplifiers are all three AC coupled to a parallel detector. The diodes are conducting when the pulses arrive and keep obviously the voltages on the capacitors low.

As soon one of the output stages fails, the voltage on the corresponding capacitor increases and via the diode the base of Q14 gets enough voltage and switches on. Its collector drops to ground level and the contacts A28/ C28 of the J2 connector are equally at ground level (Scan Fail).

On the other hand, the diode D16 and the saturated Q14 cause a permanent conduction of the Q15 transistor and means a permanent blanking or cut-off of the three crt's.

Vertical blanking pulses are leaving the board and are derived from the flyback pulses at the pin 6 of the red output stage.

Tr Q20 drives Q15 and the VERT BL pulses leave at A,C(26) of the module to the decoder.

II. EAST - WEST CORRECTION.

a) Trapezoidal distortion correction :

The sawtooth waveform (VST) , being applied to the buffer IC7 via C14, is inverted by an inverter stage in IC7, in order to dispose of two opposite phase ramps.

These are now introduced to a digital potentiometer in IC1 (pins 16/17 or VRN0 and VRP0). The correponding output is VO0 and via R45 the regulated sawtooth reaches the adder- amplifier TL084, pin 5.

Note that a parabolic shaped waveform is added by R43.

b) Parabolic or pincushion distortion correction :

The parabolic waveform is obtained by means of the multiplier IC11.

The waveform at pin 8 of IC7, is reaching the pins 10 and 1 through the capacitors C1 and C2. The opposite phase outputs of pins 6 and 12 are then capacitively coupled to the pins VRN2 and VRP2 of IC1.

The output VO2 is now applied, together with the previously discussed sawtooth output to the adder.

c) Frequency depending correction :

The gain of the OP AMP in IC7 is variable and depends on the divider R31/ Q1. The Fet Q1 is biased by the output of an OP AMP in IC7 (pin 1).

The integrated output of the EW-correction, pin 7, is applied to the Miller integrator input pin 2 and the other input receives a portion of the +V voltage.

An increase of the line frequency is equally an increase of the +HTHD, thus an increase of pin 3 voltage.

This results in a more conducting fet Q1 and an increase of the gain of the OP AMP. The pin 2 follows this increase up to the moment both pins 2 and 3 have equal voltage.

By this measure we obtain an increase of the east-west correction for the higher frequencies.

d) Power amplifier :

The sum of the corrections is now sent back to the motherboard to be amplified by the TDA2030 before reaching the 'hor. defl.' board to modulate the scan voltage for horizontal deflection.

III. MIDLINE CORRECTION (BOW AND SKEW).

The midline bow and skew corrections are mixed up with the phase control of the picture. These corrections change in a dynamic way the the phase of the picture as to correct the vertical lines.

The sum of sawtooth and parabolic, added via R44 and R42, are sent to an OP AMP in IC8 and from there led to pin 15 of the monoflop in IC12.

This mopnoflop is triggered by the horizontal square wave from pin 4 of the TDA2595 (HP in).

Triggering happens on the positive transition of the squared waveform, and the time constant of the monoflop is depending on :

- the corrections sent via D16, the dynamic correction of the phase.

- the scan voltage +HTHD voltage; in order to decrease the correction at higher frequencies (see below).

The output pulse at pin 4 is a pulse that is now used to trigger a next monoflop which now will introduce a variable delay as a DC phase shift.

IV. PHASE ALIGNMENT.

The phase of the picture is adjusted by introducing a variable delay of the horizontal drive pulses.

The adjustment range over the whole frequency range must be proportional with the line period.

If we have for example a 6uS range at 15 Khz, this represents 64/6=10% phase shift.

The same 6uS at 90 Khz means 11/6 = 50% (!).

Consequently, the range must be much lower for 90 khz compared with 15 khz, or, the range much be tracked with the line frequency.

This now happens automatically.

The dc-voltage at VO2 (pin 26 of IC2) for the phase shift is sent to a voltage comparator Q7. The other transistor in Q7 receives the integrated horizontal drive pulses, thus a dc voltage related to the ıine period.

The difference, present between the two collectors, is now the base-emitter voltage of Q6. The latter, as we can see, charges the capacitor C44 and part of the time constant of the monoflop in IC12 with the line period.

The width of the output pulse is adapted by the current generator as long as the dc voltages at the bases of Q7 are not the same.

This means now that the width of the pulse (=the phase shift) is becoming smaller for the higher frequencies in order to decrease the range for these frequencies.

The pulse train at pin 12 is sent to the motherboard of the unit, more precisely to the trigger input of the monoflop in IC5. This monostable now produces a horizontal drive pulse with a constant width (> 2uS) that will drive the Mosfets on the 'un hor defl.' board.

V. HORIZONTAL OSCILLATOR - HORIZONTAL AUTOLOCK.

a) Horizontal autolock :

The sync separator IC4 serves Q1 with a composite sync.

The amplified sync is then split to the PLL (IC6) and transistor Q7. The oscillator in the TDA2595 is locked to its exact frequency by a PLL, but the latter has a very limited lock range of approx. 1.2 khz only and cannot lock the range from 15 to 92 khz.

An extra PLL is utilised, the 4046 (IC6).

This IC consists of two phase comparators, and a VCO.

For this application the second phase comparator only is used.

The signal input (pin 14) is the line oscillator of the TDA2595 (squared hor. drive output of the TDA2595) and the comparator input (pin 3) is the horizontal pulses buffered by Q1. The corresponding output is pin 13.

Note that it is a three-level output and thus a pulsed information. If the output is open (in the locked state) the voltage is set at 6 volts with R92/89. On the other hand, pin 6 of IC7 is set at 7.7 volts with R94/R90.

In the locked state, the fet (behaving as a switcher) Q9 is blocked, because the output pin 7 of the voltage comparator in IC7 is low. Indeed, the PLL output is 6 volts, thus pin 5 is lower than pin 6 and the output in low.

b) Line oscillator lower than the horizontal sync :

If we assume that the local oscillator frequency is lower than the hor. sync pulses, then , the voltage on C8 decreases (pull down state). This voltage is now buffered and sent to pin 5 of IC7. But, because of the zener Z3, this voltage cannot decrease and stays at approximately 6 volts.

The other pin 6 is initially at 7.7 volts (divider R90/R94). This voltage now decreases because the transistor Q17 discharges the capacitor C50 as follows:

The squared hor. drive of pin 4 switches on and off Q18.

When the frequency of the local line oscillator is different from the hor sync (as we assumed), these pulses arrive on the base of Q17 at the moment Q18 is not saturated.

These hor sync pulses switch on Q17 and C50 is discharged. The voltage at pin 6 drops and becomes lower than the other input pin 5. The output pin 7 switches high.

The gate of the mosfet Q9 is now positive and Q9 conducts to connect the output pin 8 of the PLL (IC7) to the inverting input pin 2 of the next integrating OP AMP. The decreasing voltage output of the PLL in inverted by IC7 and transistor Q21 draws more current out of pin 14 of the TDA2595 in order to increase the frequency of the line oscillator.

As the line oscillator is increasing, the PLL output increases equally.

This continues up to the moment there is coincidence between the hor drive and the hor sync at the base of Q17.

Once coincidence is reached, the voltage at pin 6 is again 7.7 volts and the state of the Mosfet Q9 changes to a blocked position.

From now onwards the PLL in the TDA2595 takes over and adjusts until the exact frequency and phase is reached. Therefore, the pin 17 output is sent to the same pin 2 of the integrating OP AMP.

In the locked state of the PLL of the TDA2595 this PLL output is at 6 volts.

As pin 3 of the integrating OP AMP is biased at 6 volts, the action via the OP AMP continues up to the moment the oscillator is locked .

Any change in frequency is now compensated or corrected by the PLL of the TDA2595.

c) Line oscillator higher than the hor sync :

A similar explanation is valuable now, allthough, in this case the PLL's output is increasing now. The zener Z3 cannot perform its zener function and the pin 5 follows the PLL output voltage.

Again, because there is no coincidence, the voltage at pin 6 is decreasing and the fet Q9 is unblocked to drive and correct the line oscillator.

VI. ADJUSTABLE TOP/ BOTTOM BLANKING.

The subunit generates blanking pulses for an adjustable blanking of the top and the bottom of the picture.

To achieve a high accuracy, or, on other terms to dispose of a steep ramp, the sawtooth is passed into a so-called 'dead band response amplifier' built up around an OP AMP in IC8.

The sawtooth is entered at pin 9 of IC8. The output is inverted and the ramp is steeper at the start and at the end.

Two clipping levels are installed by clamping circuits in order to obtain a complete feedback between these levels.

As soon the first clipping level is reached, the output is invariable. and obviously no change anymore in the output is noticed.

The resulting waveform is is now led to two level detectors in IC9.

The clipping levels are regulated by the potentiometers in IC2 and IC3.

VII. SIMULATION OF THE FLYBACK PULSE FOR THE PLL OF THE TDA2595.

By means of the monoflops in IC4 a simulated line (flyback) pulse is generated. The first monoflop introduces a small delay for the pulse and the second one standardises the width.

The introduced delay is usefull to mislead the PLL and consequently to allow a negative phase shift.

VIII. BLANKING - COINCIDENCE.

In the event of a non coincidence, the transistor Q16 gets in complete saturation.

This results in :

- Led D20 comes on to show the non coincidence situation.

- if the strap is in postion, the transistor Q15 is equally in saturation and causes a permanent blanking of
the three crt's.

By removing the named strap, the picture is no more blanked at non-coincidence.

VERTICAL DEFLECTION + SYNC MODULE 76 1738

SUB-MODULE VERTICAL DEFLECTION + SYNC 76 1769

ITEM NO.	SIT.	DESCRIPTION
11 3724	C..1	CAP POME 100K K5 63
11 1487	C..1	CAP ELPR 100M Z5 40
11 3724	C..2	CAP POME 100K K5 63
11 3730	C..2	CAP POME 330K K5 63
11 2743	C..3	CAP CE MI 2K2 K5 63
11 1531	C..4	CAP ELPRMI 10M M5 35
11 1680	C..5	CAP ELRABI 10M V 40
11 1550	C..6	CAP ELPRMI 4M7 M5 50
11 37121	C..7	CAP POME 10K K5 100
11 3724	C..8	CAP POME 100K K5 63
11 2762	C..9	CAP CE MI 4K7 U5 63
11 3890	C.10	CAP PETPFP 2M2 K 100
11 3728	C.11	CAP POME 220K K5 63
11 3728	C.12	CAP POME 220K K5 63
11 4085	C.13	CAP POMEPO 330K K5 63
11 4085	C.14	CAP POMEPO 330K K5 63
11 1546	C.15	CAP ELPRMI 1M M5 50
11 1531	C.16	CAP ELPRMI 10M M5 35
11 1531	C.18	CAP ELPRMI 10M M5 35
11 3724	C.19	CAP POME 100K K5 63
11 1531	C.20	CAP ELPRMI 10M M5 35
11 5936	C.21	CAP PP RA 6K8 J5 63
11 1548	C.22	CAP ELPRMI 2M2 M5 50
11 1550	C.23	CAP ELPRMI 4M7 M5 50
11 2737	C.24	CAP CE MI 680P K5 63
11 3728	C.25	CAP POME 220K K5 63
11 3728	C.26	CAP POME 220K K5 63
11 2737	C.27	CAP CE MI 680P K5 63
11 2737	C.28	CAP CE MI 680P K5 63
11 3724	C.29	CAP POME 100K K5 63
11 3720	C.30	CAP POME 47K K5 63
11 4079	C.31	CAP POMEPO 100K M5 63
11 3724	C.32	CAP POME 100K K5 63
11 2284	C.33	CAP N150MI 150P J5 63
11 1476	C.34	CAP ELPR 47M Z5 25
11 1488	C.35	CAP ELPR 220M Z5 40
11 37121	C.36	CAP POME 10K K5 100
11 15915	C.37	CAP ELPRMI 4M7 M5 35
11 2363	C.38	CAP N750MI 120P J5 63
11 2363	C.39	CAP N750MI 120P J5 63
11 3728	C.41	CAP POME 220K K5 63
11 2737	C.42	CAP CE MI 680P K5 63
11 3724	C.43	CAP POME 100K K5 63
11 3724	C.44	CAP POME 100K K5 63
11 3724	C.45	CAP POME 100K K5 63
11 3724	C.46	CAP POME 100K K5 63
11 1531	C.47	CAP ELPRMI 10M M5 35
11 1531	C.48	CAP ELPRMI 10M M5 35
11 1531	C.49	CAP ELPRMI 10M M5 35
11 3724	C.50	CAP POME 100K K5 63
11 2362	C.51	CAP N750MI 100P J5 63
11 1488	C.52	CAP ELPR 220M Z5 40
11 3724	C.53	CAP POME 100K K5 63
11 3728	C.54	CAP POME 220K K5 63
11 1488	C.55	CAP ELPR 220M Z5 40
11 3728	C.56	CAP POME 220K K5 63
11 2737	C.57	CAP CE MI 680P K5 63
11 3728	C.58	CAP POME 220K K5 63
11 2737	C.59	CAP CE MI 680P K5 63
11 37161	C.60	CAP POME 22K K5 100
11 1550	C.61	CAP ELPRMI 4M7 M5 50
11 1550	C.62	CAP ELPRMI 4M7 M5 50
11 1550	C.63	CAP ELPRMI 4M7 M5 50
11 4068	C.64	CAP POMEPO 10K M5 63
11 1531	C.65	CAP ELPRMI 10M M5 35
11 3724	C.66	CAP POME 100K K5 63
11 1531	C.67	CAP ELPRMI 10M M5 35
11 1500	C.68	CAP ELPRMI 47M M5 10

ITEM NO.	SIT.	DESCRIPTION
11 3819	C.69	CAP PO PO 3K3 J5 63
11 37121	C.70	CAP POME 10K K5 100
11 3724	C.71	CAP POME 100K K5 63
11 1477	C.72	CAP ELPR 100M Z5 25
11 4087	C.73	CAP POMEPO 470K M5 63
11 2363	C.74	CAP N750MI 120P J5 63
11 3724	C.75	CAP POME 100K K5 63
11 3724	C.78	CAP POME 100K K5 63
11 1531	C.79	CAP ELPRMI 10M M5 35
11 1626	C.80	CAP ELRA 1000M T 40
11 1626	C.81	CAP ELRA 1000M T 40
11 1546	C.82	CAP ELPRMI 1M M5 50
11 2743	C.83	CAP CE MI 2K2 K5 63
11 1548	C100	CAP ELPRMI 2M2 M5 50
11 1531	C101	CAP ELPRMI 10M M5 35
11 3724	C201	CAP POME 100K K5 63
11 3724	C202	CAP POME 100K K5 63
11 3724	C203	CAP POME 100K K5 63
11 3724	C204	CAP POME 100K K5 63
11 3724	C205	CAP POME 100K K5 63
11 1571	C206	CAP ELPR 2M2 M5 350
11 3730	C207	CAP POME 330K K5 63
11 37121	C208	CAP POME 10K K5 100
13 1644	D..1	DIODE 1N4001 50V/1A
13 1621	D..2	DIODE 1N4148 SWITCH
13 1621	D..3	DIODE 1N4148 SWITCH
13 1621	D..4	DIODE 1N4148 SWITCH
13 1621	D..5	DIODE 1N4148 SWITCH
13 1621	D..6	DIODE 1N4148 SWITCH
13 1621	D..7	DIODE 1N4148 SWITCH
13 1621	D..8	DIODE 1N4148 SWITCH
13 1636	D..9	DIODE BAT43,(85) SCHOTTKY
13 1636	D.10	DIODE BAT43,(85) SCHOTTKY
13 1644	D.11	DIODE 1N4001 50V/1A
13 1644	D.12	DIODE 1N4001 50V/1A
13 1644	D.13	DIODE 1N4001 50V/1A
13 1621	D.14	DIODE 1N4148 SWITCH
13 1644	D.15	DIODE 1N4001 50V/1A
13 1621	D.16	DIODE 1N4148 SWITCH
13 1621	D.18	DIODE 1N4148 SWITCH
13 1621	D.19	DIODE 1N4148 SWITCH
13 1662	D.20	DIODE CQY54-A3 LED D3 RED
13 1644	D.21	DIODE 1N4001 50V/1A
13 1621	D.22	DIODE 1N4148 SWITCH
13 1644	D.23	DIODE 1N4001 50V/1A
13 1621	D.24	DIODE 1N4148 SWITCH
13 1644	D.25	DIODE 1N4001 50V/1A
13 1621	D.26	DIODE 1N4148 SWITCH
13 1621	D.27	DIODE 1N4148 SWITCH
13 1621	D.28	DIODE 1N4148 SWITCH
13 1621	D.29	DIODE 1N4148 SWITCH
13 1621	D.30	DIODE 1N4148 SWITCH
13 1644	D.31	DIODE 1N4001 50V/1A
13 1644	D.32	DIODE 1N4001 50V/1A
13 1644	D.33	DIODE 1N4001 50V/1A
13 1621	D.34	DIODE 1N4148 SWITCH
13 1636	D.35	DIODE BAT43,(85) SCHOTTKY
13 1621	D.36	DIODE 1N4148 SWITCH
13 1621	D.37	DIODE 1N4148 SWITCH
13 1621	D.38	DIODE 1N4148 SWITCH
13 1621	D.39	DIODE 1N4148 SWITCH
13 1621	D.40	DIODE 1N4148 SWITCH
13 1621	D.41	DIODE 1N4148 SWITCH
13 2762	I..1	IC 2595 TDA HOR COMB
13 4002	I..2	IC 7812 +12V/1A REGULATOR

VERTICAL DEFLECTION + SYNC MODULE — 76 1738

SUB-MODULE VERTICAL DEFLECTION + SYNC — 76 1769

ITEM NO.	SIT.	DESCRIPTION
13 4016	I..3	IC 7912 -12V/1A REGULATOR
13 73325	I..4	IC 4098B DUAL MONOST MULTIV
13 73325	I..5	IC 4098B DUAL MONOST MULTIV
13 7602	I..6	IC 4046B PLL
13 4113	I..7	IC 084 JFET QUAD OPAMP
13 4025	I..8	IC 78L24 +24V/0A1 REGULATOR
13 4116	I..9	IC 353 JFET DUAL OPAMP
13 2751	I.10	IC 2030V TDA 12W AUD AMP
13 2827	I.11	IC 8172 TDA VERT DEFL OUTP
13 2827	I.12	IC 8172 TDA VERT DEFL OUTP
13 2827	I.13	IC 8172 TDA VERT DEFL OUTP
13 2817	I.14	IC 1881 LM VID SYNC SEPAR
31 3525	J1..	CONN EURO MBS P64
31 3525	J2..	CONN EURO MBS P64
10 7530	P..1	MULTITURN CEM 100K K 0W50
10 6824	P..1	TRIMPOT CEMV 200E K 0W50
10 7530	P..2	MULTITURN CEM 100K K 0W50
10 6833	P..2	TRIMPOT CEMV 100K K 0W50
10 6727	P..3	TRIMPOT CEMH 2K K 0W50
10 6727	P..4	TRIMPOT CEMH 2K K 0W50
78 0103	PC..	PC PJ 49 VER *800 SUB 76 1816
78 0017	PC..	PC PJ 49 VER *800 761768
13 14181	Q..1	TSTR BC559B,BC309B P 30 / 0A1
13 14182	Q..1	TSTR BC559C,BC309C P 30 / 0A1
13 14181	Q..2	TSTR BC559B,BC309B P 30 / 0A1
13 14295	Q..2	TSTR BC549B N 30 / 0A1
13 14181	Q..3	TSTR BC559B,BC309B P 30 / 0A1
13 1411	Q..4	TSTR BC549C,BC239C N 30 / 0A1
13 1411	Q..5	TSTR BC549C,BC239C N 30 / 0A1
13 2910	Q..6	TSTR BS170 FET N 60 / 0A5
13 1411	Q..7	TSTR BC549C,BC239C N 30 / 0A1
13 14072	Q..8	TSTR BC547A,BC237A N 45 / 0A1
13 14651	Q..9	TSTR BF245B FET N 30 / 6
13 1411	Q.10	TSTR BC549C,BC239C N 30 / 0A1
13 14295	Q.11	TSTR BC549B N 30 / 0A1
13 14181	Q.12	TSTR BC559B,BC309B P 30 / 0A1
13 14295	Q.14	TSTR BC549B N 30 / 0A1
13 14131	Q.15	TSTR BC557B,BC307B P 45 / 0A1
13 1411	Q.16	TSTR BC549C,BC239C N 30 / 0A1
13 1411	Q.17	TSTR BC549C,BC239C N 30 / 0A1
13 14295	Q.18	TSTR BC549B N 30 / 0A1
13 1411	Q.19	TSTR BC549C,BC239C N 30 / 0A1
13 1411	Q.20	TSTR BC549C,BC239C N 30 / 0A1
13 14295	Q.21	TSTR BC549B N 30 / 0A1
10 1140	R..1	RES CF 2K2 J 0W25
10 1144	R..1	RES CF 4K7 J 0W25
10 1126	R..2	RES CF 150E J 0W25
10 1100	R..2	RES CF 1E J 0W25
10 1158	R..3	RES CF 68K J 0W25
10 1157	R..3	RES CF 56K J 0W25
10 1148	R..4	RES CF 10K J 0W25
10 1152	R..4	RES CF 22K J 0W25
10 1126	R..5	RES CF 150E J 0W25
10 1152	R..5	RES CF 22K J 0W25
10 1160	R..6	RES CF 100K J 0W25
10 1165	R..6	RES CF 270K J 0W25
10 1171	R..7	RES CF 820K J 0W25
10 1140	R..8	RES CF 2K2 J 0W25
10 1136	R..8	RES CF 1K J 0W25
10 1152	R..9	RES CF 22K J 0W25
10 1134	R..9	RES CF 680E J 0W25

ITEM NO.	SIT.	DESCRIPTION
10 1160	R.10	RES CF 100K J 0W25
10 1140	R.10	RES CF 2K2 J 0W25
10 1171	R.11	RES CF 820K J 0W25
10 1163	R.11	RES CF 180K J 0W25
10 1124	R.12	RES CF 100E J 0W25
10 1166	R.12	RES CF 330K J 0W25
10 1124	R.13	RES CF 100E J 0W25
10 1150	R.13	RES CF 15K J 0W25
10 11473	R.14	RES MF 9K1 G 0W25
10 1160	R.14	RES CF 100K J 0W25
10 11473	R.15	RES MF 9K1 G 0W25
10 1284	R.15	RES CF 10M K 0W50
10 1148	R.16	RES CF 10K J 0W25
10 1166	R.17	RES CF 330K J 0W25
10 1160	R.18	RES CF 100K J 0W25
10 1136	R.19	RES CF 1K J 0W25
10 1124	R.20	RES CF 100E J 0W25
10 1127	R.21	RES CF 180E J 0W25
10 1136	R.22	RES CF 1K J 0W25
10 1170	R.23	RES CF 680K J 0W25
10 1168	R.24	RES CF 470K J 0W25
10 1141	R.25	RES CF 2K7 J 0W25
10 1150	R.26	RES CF 15K J 0W25
10 1115	R.27	RES CF 18E J 0W25
10 1148	R.28	RES CF 10K J 0W25
10 1148	R.29	RES CF 10K J 0W25
10 1124	R.30	RES CF 100E J 0W25
10 1156	R.31	RES CF 47K J 0W25
10 1136	R.32	RES CF 1K J 0W25
10 1152	R.33	RES CF 22K J 0W25
10 1148	R.34	RES CF 10K J 0W25
10 1154	R.35	RES CF 33K J 0W25
10 1138	R.36	RES CF 1K5 J 0W25
10 1149	R.37	RES CF 12K J 0W25
10 1133	R.38	RES CF 560E J 0W25
10 1142	R.39	RES CF 3K3 J 0W25
10 1148	R.41	RES CF 10K J 0W25
10 1146	R.42	RES CF 6K8 J 0W25
10 1158	R.43	RES CF 68K J 0W25
10 2604	R.44	RES MF 2E2 F 0W40
10 11504	R.47	RES MF 15K F 0W25
10 1100	R.48	RES CF 1E J 0W25
10 11484	R.49	RES MF 10K F 0W25
10 1148	R.50	RES CF 10K J 0W25
10 1108	R.51	RES CF 4E7 J 0W25
10 1136	R.52	RES CF 1K J 0W25
10 1160	R.53	RES CF 100K J 0W25
10 1163	R.54	RES CF 180K J 0W25
10 1100	R.55	RES CF 1E J 0W25
10 1160	R.56	RES CF 100K J 0W25
10 1160	R.57	RES CF 100K J 0W25
10 1160	R.58	RES CF 100K J 0W25
10 1146	R.59	RES CF 6K8 J 0W25
10 1146	R.60	RES CF 6K8 J 0W25
10 1124	R.61	RES CF 100E J 0W25
10 1136	R.62	RES CF 1K J 0W25
10 1124	R.63	RES CF 100E J 0W25
10 1160	R.64	RES CF 100K J 0W25
10 1151	R.65	RES CF 18K J 0W25
10 1148	R.66	RES CF 10K J 0W25
10 1152	R.67	RES CF 22K J 0W25
10 1140	R.68	RES CF 2K2 J 0W25
10 1124	R.69	RES CF 100E J 0W25
10 1124	R.70	RES CF 100E J 0W25
10 1124	R.71	RES CF 100E J 0W25
10 1158	R.72	RES CF 68K J 0W25
10 1150	R.73	RES CF 15K J 0W25

VERTICAL DEFLECTION + SYNC MODULE 76 1738

SUB-MODULE VERTICAL DEFLECTION + SYNC 76 1769

ITEM NO.	SIT.	DESCRIPTION
10 1155	R.74	RES CF 39K J 0W25
10 1155	R.75	RES CF 39K J 0W25
10 1124	R.76	RES CF 100E J 0W25
10 1100	R.77	RES CF 1E J 0W25
10 11504	R.78	RES MF 15K F 0W25
10 2604	R.79	RES MF 2E2 F 0W40
10 1100	R.80	RES CF 1E J 0W25
10 1152	R.82	RES CF 22K J 0W25
10 1152	R.83	RES CF 22K J 0W25
10 1148	R.84	RES CF 10K J 0W25
10 1152	R.85	RES CF 22K J 0W25
10 1148	R.86	RES CF 10K J 0W25
10 1148	R.87	RES CF 10K J 0W25
10 1152	R.88	RES CF 22K J 0W25
10 1145	R.89	RES CF 5K6 J 0W25
10 1160	R.90	RES CF 100K J 0W25
10 1158	R.91	RES CF 68K J 0W25
10 1145	R.92	RES CF 5K6 J 0W25
10 1134	R.93	RES CF 680E J 0W25
10 1157	R.94	RES CF 56K J 0W25
10 1148	R.95	RES CF 10K J 0W25
10 1148	R.96	RES CF 10K J 0W25
10 2604	R.97	RES MF 2E2 F 0W40
10 11504	R.98	RES MF 15K F 0W25
10 1148	R.99	RES CF 10K J 0W25
10 1148	R100	RES CF 10K J 0W25
10 1164	R101	RES CF 220K J 0W25
10 1156	R102	RES CF 47K J 0W25
10 1148	R103	RES CF 10K J 0W25
10 1148	R104	RES CF 10K J 0W25
10 1149	R105	RES CF 12K J 0W25
10 1148	R106	RES CF 10K J 0W25
10 1148	R107	RES CF 10K J 0W25
10 1154	R108	RES CF 33K J 0W25
10 1143	R109	RES CF 3K9 J 0W25
10 1139	R110	RES CF 1K8 J 0W25
10 1143	R111	RES CF 3K9 J 0W25
10 1100	R112	RES CF 1E J 0W25
10 1149	R113	RES CF 12K J 0W25
10 1139	R114	RES CF 1K8 J 0W25
10 1148	R115	RES CF 10K J 0W25
10 1151	R116	RES CF 18K J 0W25
10 1135	R117	RES CF 820E J 0W25
10 1160	R118	RES CF 100K J 0W25
10 1144	R119	RES CF 4K7 J 0W25
10 1156	R120	RES CF 47K J 0W25
10 1228	R121	RES CF 220E J 0W50
10 1149	R122	RES CF 12K J 0W25
10 1147	R123	RES CF 8K2 J 0W25
10 3600	R126	RES WW H 0E10 K 4W
10 3600	R127	RES WW H 0E10 K 4W
10 1127	R200	RES CF 180E J 0W25
10 1166	R201	RES CF 330K J 0W25
10 1166	R202	RES CF 330K J 0W25
10 1160	R203	RES CF 100K J 0W25
10 1160	R301	RES CF 100K J 0W25
10 1160	R302	RES CF 100K J 0W25
10 1124	R303	RES CF 100E J 0W25
10 1167	R304	RES CF 390K J 0W25
10 1146	R305	RES CF 6K8 J 0W25
10 1136	R306	RES CF 1K J 0W25
10 1137	R307	RES CF 1K2 J 0W25
10 11917	SR.1	RES CFF E22 J 0W40
10 11917	SR.2	RES CFF E22 J 0W40
13 1768	Z..1	DIODE ZENER 7V5 0W5 B
13 1734	Z..2	DIODE ZENER 5V6 0W5 B
13 1734	Z..3	DIODE ZENER 5V6 0W5 B
76 1769		UN VER+SYN PJ 49 GR800
76 1816		UN VER+SYN PJ 49 *800 SHIFT
31 3276	0010	CONN WAFER MBT P10 2,5
36 7699	0010	RIVET CHOBERT D2,38 L6,35
31 33921	0011	CONN JUMP FMT P 2 2,5
34 8100	0020	WIRE JUMPER 0,6 M AUTOM
80 2644	0100	HEATSINK PJ 49 VER
80 2645	0110	HEATSINK PJ 49 VER FIX LATH
36 20216	0111	SCREW DIN84 M 3 X 6 MP-
36 7502	0112	WASHER DIN6798 A 3,2
80 2628	0120	FIX PJ 49 TSTR SPRING 1X HOR
36 20216	0121	SCREW DIN84 M 3 X 6 MP-
36 7502	0122	WASHER DIN6798 A 3,2
80 2779	0123	TSTR INSULAT SHEET 125X30
80 1591	0200	CASE MN EM IMAGE CTRL SPACER
36 20216	0201	SCREW DIN84 M 3 X 6 MP-
36 7502	0202	WASHER DIN6798 A 3,2
71 23023	0203	WASHER DIA 3,25X 7 T0,5 BAK

VERTICAL DEFLECTION + SYNC MODULE 76 1738

SUB-MODULE VERTICAL DEFLECTION + SYNC 76 1769

ITEM NO.	SIT.	DESCRIPTION
11 2362	C...	CAP N750MI 100P J5 63
11 37121	C...	CAP POME 10K K5 100
11 3724	C...	CAP POME 100K K5 63
11 1531	C..1	CAP ELPR 10M M5 35
11 1531	C..2	CAP ELPR 10M M5 35
11 1531	C..3	CAP ELPR 10M M5 35
11 1531	C..4	CAP ELPR 10M M5 35
11 3724	C..5	CAP POME 100K K5 63
11 37121	C..6	CAP POME 10K K5 100
11 37121	C..7	CAP POME 10K K5 100
11 1500	C..8	CAP ELPR 47M M5 10
11 1531	C..9	CAP ELPR 10M M5 35
11 3724	C.10	CAP POME 100K K5 63
11 3732	C.11	CAP POME 470K K5 63
11 3819	C.12	CAP PO PO 3K3 J5 63
11 1531	C.13	CAP ELPR 10M M5 35
11 1531	C.14	CAP ELPR 10M M5 35
11 3724	C.15	CAP POME 100K K5 63
11 1476	C.16	CAP ELPR 47M Z5 25
11 1531	C.17	CAP ELPR 10M M5 35
11 27475	C.18	CAP CE MI 4K7 K5 63
11 1531	C.19	CAP ELPR 10M M5 35
11 1546	C.20	CAP ELPR 1M M5 50
11 27475	C.21	CAP CE MI 4K7 K5 63
11 3724	C.22	CAP POME 100K K5 63
11 1531	C.23	CAP ELPR 10M M5 35
11 1531	C.24	CAP ELPR 10M M5 35
11 3724	C.25	CAP POME 100K K5 63
11 1531	C.26	CAP ELPR 10M M5 35
11 1531	C.27	CAP ELPR 10M M5 35
11 3732	C.28	CAP POME 470K K5 63
11 3724	C.29	CAP POME 100K K5 63
11 2747	C.30	CAP CE MI 4K7 K5 63
11 27475	C.31	CAP CE MI 4K7 K5 63
11 1546	C.32	CAP ELPR 1M M5 50
11 1546	C.33	CAP ELPR 1M M5 50
11 2735	C.34	CAP CE MI 470P K5 63
11 3724	C.35	CAP POME 100K K5 63
11 3730	C.36	CAP POME 330K K5 63
11 37121	C.38	CAP POME 10K K5 100
11 1531	C.39	CAP ELPR 10M M5 35
11 2362	C.40	CAP N750MI 100P J5 63
11 1230	C.41	CAP ELAX 22M T 160
11 3724	C.42	CAP POME 100K K5 63
11 3724	C.43	CAP POME 100K K5 63
11 2430	C.44	CAP NPO MI 10P G2 63
11 1531	C.45	CAP ELPR 10M M5 35
11 1531	C.46	CAP ELPR 10M M5 35
11 1531	C.47	CAP ELPR 10M M5 35
11 1531	C.48	CAP ELPR 10M M5 35
11 1500	C.49	CAP ELPR 47M M5 10
11 2747	C.50	CAP CE MI 4K7 K5 63
11 2743	C214	CAP CE MI 2K2 K5 63
11 1546	C219	CAP ELPR 1M M5 50
13 1621	D..1	DIODE 1N4148 SWITCH
13 1621	D..2	DIODE 1N4148 SWITCH
13 1636	D..3	DIODE BAT43 BAT85 SCHOTTKY
13 1636	D..4	DIODE BAT43 BAT85 SCHOTTKY
13 1636	D..5	DIODE BAT43 BAT85 SCHOTTKY
13 1636	D..6	DIODE BAT43 BAT85 SCHOTTKY
13 1636	D..7	DIODE BAT43 BAT85 SCHOTTKY
13 1621	D..8	DIODE 1N4148 SWITCH
13 1621	D..9	DIODE 1N4148 SWITCH
13 1621	D.10	DIODE 1N4148 SWITCH
13 1621	D.11	DIODE 1N4148 SWITCH
13 1621	D.12	DIODE 1N4148 SWITCH

ITEM NO.	SIT.	DESCRIPTION
13 1621	D.13	DIODE 1N4148 SWITCH
13 1636	D.15	DIODE BAT43 BAT85 SCHOTTKY
13 1636	D.16	DIODE BAT43 BAT85 SCHOTTKY
13 1639	D.17	DIODE BAX12 SWITCH
13 2833	I..1	IC 76013 SC (1989) DMP I2C
13 2833	I..2	IC 76013 SC (1989) DMP I2C
13 2833	I..3	IC 76013 SC (1989) DMP I2C
13 4028	I..4	IC 317LZ
13 4029	I..5	IC 337LZ
13 4032	I..6	IC 78LO5
13 4113	I..7	IC 084
13 4113	I..8	IC 084
13 4114	I..9	IC 393
13 7397	I.10	IC 4013B
13 27655	I.11	IC 1496
13 7552	IC12	IC 74HCT123
31 3948	J3..	CONN CT-MT MBS P 8 2
31 3952	J4..	CONN CT-MT MBS P12 2
78 0018	PC..	PC PJ 49 VER DATA SUB 761769
13 14651	Q..1	TSTR BF245B
13 14295	Q..2	TSTR BC549B,
13 14295	Q..3	TSTR BC549B,
13 14295	Q..5	TSTR BC549B,
13 14182	Q..6	TSTR BC559C,BC309C
13 2944	Q..7	TSTR BCY87 DUAL N 40 /
13 1491	Q..8	TSTR BSX20,2N2369
10 1124	R...	RES CF 100E J 0W25
10 1148	R..1	RES CF 10K J 0W25
10 1129	R..2	RES CF 270E J 0W25
10 1148	R..3	RES CF 10K J 0W25
10 1148	R..4	RES CF 10K J 0W25
10 1148	R..5	RES CF 10K J 0W25
10 1147	R..6	RES CF 8K2 J 0W25
10 1148	R..7	RES CF 10K J 0W25
10 1148	R..8	RES CF 10K J 0W25
10 1144	R..9	RES CF 4K7 J 0W25
10 1144	R.10	RES CF 4K7 J 0W25
10 1147	R.11	RES CF 8K2 J 0W25
10 1126	R.12	RES CF 150E J 0W25
10 1132	R.13	RES CF 470E J 0W25
10 1136	R.14	RES CF 1K J 0W25
10 1137	R.16	RES CF 1K2 J 0W25
10 1135	R.17	RES CF 820E J 0W25
10 1135	R.18	RES CF 820E J 0W25
10 1124	R.19	RES CF 100E J 0W25
10 1148	R.20	RES CF 10K J 0W25
10 1141	R.21	RES CF 2K7 J 0W25
10 1136	R.22	RES CF 1K J 0W25
10 1136	R.23	RES CF 1K J 0W25
10 1148	R.24	RES CF 10K J 0W25
10 1149	R.25	RES CF 12K J 0W25
10 1140	R.26	RES CF 2K2 J 0W25
10 1160	R.27	RES CF 100K J 0W25
10 1153	R.28	RES CF 27K J 0W25
10 1116	R.29	RES CF 22E J 0W25
10 1168	R.30	RES CF 470K J 0W25
10 1141	R.31	RES CF 2K7 J 0W25
10 1134	R.32	RES CF 680E J 0W25
10 1144	R.33	RES CF 4K7 J 0W25
10 1148	R.34	RES CF 10K J 0W25
10 1144	R.35	RES CF 4K7 J 0W25

VERTICAL DEFLECTION + SYNC MODULE 76 1738

SUB-MODULE VERTICAL DEFLECTION + SYNC 76 1769

ITEM NO.	SIT.	DESCRIPTION
10 1147	R.36	RES CF 8K2 J 0W25
10 1146	R.37	RES CF 6K8 J 0W25
10 1156	R.38	RES CF 47K J 0W25
10 1136	R.39	RES CF 1K J 0W25
10 1132	R.40	RES CF 470E J 0W25
10 1156	R.41	RES CF 47K J 0W25
10 1148	R.42	RES CF 10K J 0W25
10 1136	R.43	RES CF 1K J 0W25
10 1148	R.44	RES CF 10K J 0W25
10 1136	R.45	RES CF 1K J 0W25
10 1143	R.46	RES CF 3K9 J 0W25
10 1143	R.47	RES CF 3K9 J 0W25
10 1130	R.48	RES CF 330E J 0W25
10 1160	R.49	RES CF 100K J 0W25
10 1160	R.50	RES CF 100K J 0W25
10 1150	R.52	RES CF 15K J 0W25
10 1124	R.53	RES CF 100E J 0W25
10 1124	R.54	RES CF 100E J 0W25
10 1149	R.55	RES CF 12K J 0W25
10 1164	R.56	RES CF 220K J 0W25
10 1148	R.57	RES CF 10K J 0W25
10 1143	R.58	RES CF 3K9 J 0W25
10 1161	R.59	RES CF 120K J 0W25
10 1128	R.60	RES CF 220E J 0W25
10 1148	R.61	RES CF 10K J 0W25
10 1150	R.62	RES CF 15K J 0W25
10 1130	R.63	RES CF 330E J 0W25
10 1119	R.64	RES CF 39E J 0W25
10 1125	R.65	RES CF 120E J 0W25

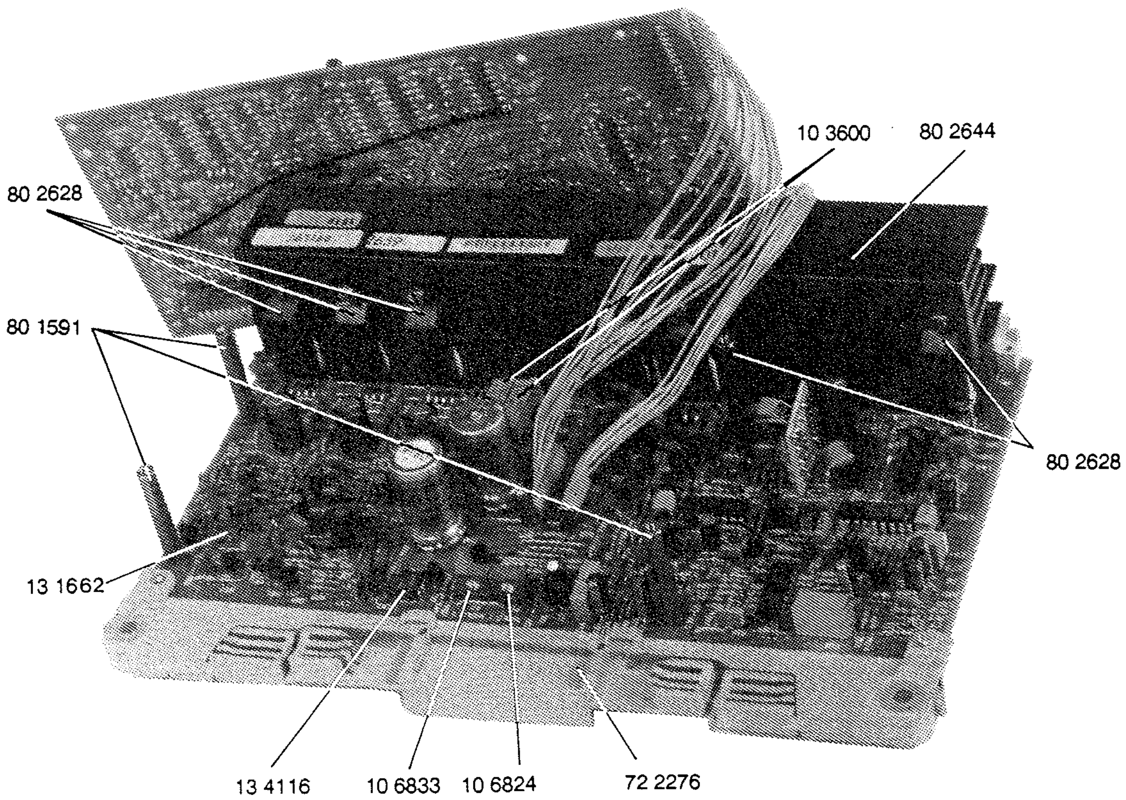
ITEM NO.	SIT.	DESCRIPTION
10 1152	R.66	RES CF 22K J 0W25
10 1124	R.67	RES CF 100E J 0W25
10 1124	R.68	RES CF 100E J 0W25
10 1152	R.69	RES CF 22K J 0W25
10 1160	R.71	RES CF 100K J 0W25
10 1135	R.72	RES CF 820E J 0W25
10 1152	R.73	RES CF 22K J 0W25
10 1116	R.74	RES CF 22E J 0W25
10 1156	R.75	RES CF 47K J 0W25
10 1136	R.76	RES CF 1K J 0W25
10 1146	R.77	RES CF 6K8 J 0W25
10 1149	R.78	RES CF 12K J 0W25
10 1148	R.79	RES CF 10K J 0W25
10 1136	R.80	RES CF 1K J 0W25
10 1136	R.81	RES CF 1K J 0W25
10 1137	R.82	RES CF 1K2 J 0W25
10 1148	R.83	RES CF 10K J 0W25
10 1148	R.84	RES CF 10K J 0W25
10 1104	R.85	RES CF 2E2 J 0W25
10 1127	R.86	RES CF 180E J 0W25
10 1144	R.87	RES CF 4K7 J 0W25
10 1148	R.88	RES CF 10K J 0W25
10 1172	R.89	RES CF 1M J 0W25
10 1148	R212	RES CF 10K J 0W25
10 1148	R213	RES CF 10K J 0W25
10 1136	R217	RES CF 1K J 0W25
10 1160	R218	RES CF 100K J 0W25
10 1148	R222	RES CF 10K J 0W25

VERTICAL DEFLECTION + SYNC MODULE 76 1738

SUB-MODULE VERTICAL DEFLECTION + SYNC 76 1769

ART NO.	DESCRIPTION	QUATITY	ART NO.	DESCRIPTION	QUATITY
10 11917	RES CFF E22 J 0W40	2	13 4016	IC 7912 -12V/1A REGULATOR	1
10 2604	RES MF 2E2 F 0W40	3	13 4025	IC 78L24 +24V/0A1 REGULATOR	1
10 3600	RES WW H 0E10 K 4W	2 *	13 4113	IC 084 JFET QUAD OPAMP	1
10 6727	TRIMPOT CEMH 2K K 0W50	2	13 4116	IC 353 JFET DUAL OPAMP	1 *
10 6824	TRIMPOT CEMV 200E K 0W50	1 *	13 73325	IC 4098B DUAL MONOST MULTIV	2
10 6833	TRIMPOT CEMV 100K K 0W50	1 *	13 7602	IC 4046B PLL	1
10 7530	MULTITURN CEM 100K K 0W50	2	13 4002	IC 7812 +12V/1A REGULATOR	1
11 1571	CAP ELPR 2M2 M5 350	1	31 3276	CONN WAFER MBT P10 2,5	1
11 3890	CAP PETPFP 2M2 K 100	1	31 33921	CONN JUMP FMT P 2 2,5	1
			31 3525	CONN EURO MBS P64	2
13 14072	TSTR BC547A,BC237A N 45 / 0A1	1			
13 1411	TSTR BC549C,BC239C N 30 / 0A1	8	36 20216	SCREW DIN84 M 3 X 6 MP-	17
13 14131	TSTR BC557B,BC307B P 45 / 0A1	1	36 7502	WASHER DIN6798 A 3,2	16
13 14181	TSTR BC559B,BC309B P 30 / 0A1	4	36 7699	RIVET CHOBERT D2,38 L6,35	4
13 14182	TSTR BC559C,BC309C P 30 / 0A1	1			
13 14295	TSTR BC549B N 30 / 0A1	5	71 23023	WASHER DIA 3,25X 7 T0,5 BAK	1
13 14651	TSTR BF245B FET N 30 / 6	1			
13 1621	DIODE 1N4148 SWITCH	25	72 2276	LOCKING PCB BOARD	1 *
13 1636	DIODE BAT43,(85) SCHOTTKY	3			
13 1644	DIODE 1N4001 50V/1A	11	76 1816	UN VER+SYN PJ 49 *800 SHIFT	1
13 1662	DIODE CQY54-A3 LED D3 RED	1 *			
13 1734	DIODE ZENER 5V6 0W5 B	2	78 0103	PC PJ 49 VER *800 SUB 76 1816	1
13 1768	DIODE ZENER 7V5 0W5 B	1			
13 2751	IC 2030V TDA 12W AUD AMP	1	80 1591	CASE MN EM IMAGE CTRL SPACER	4 *
13 2762	IC 2595 TDA HOR COMB	1	80 2628	FIX PJ 49 TSTR SPRING 1X HOR	6 *
13 2817	IC 1881 LM VID SYNC SEPAR	1	80 2644	HEATSINK PJ 49 VER	1 *
13 2827	IC 8172 TDA VERT DEFL OUTP	3	80 2645	HEATSINK PJ 49 VER FIX LATH	1
13 2910	TSTR BS170 FET N 60 / 0A5	1	80 2779	TSTR INSULAT SHEET 125X30	1

* NUMBERS REFERRING TO PICTURE



VERTICAL DEFLECTION + SYNC MODULE 76 1738

SUB-MODULE VERTICAL DEFLECTION + SYNC 76 1769

ART.NO.	DESCRIPTION	QUANTITY	ART.NO.	DESCRIPTION	QUANTITY
11 27475	CAP CE MI 4K7 K5 63	3	13 4029	IC 337LZ	1
			13 4032	IC 78LO5	1
13 14182	TSTR BC559C,BC309C	1	13 4113	IC 084	2
13 14295	TSTR BC549B,	3	13 4114	IC 393	1
13 14651	TSTR BF245B	1	13 7397	IC 4013B	1
13 1491	TSTR BSX20,2N2369	1	13 7552	IC 74HCT123	1
13 1621	DIODE 1N4148 SWITCH	8			
13 1636	DIODE BAT43 BAT85 SCHOTTKY	7	31 3948	CONN CT-MT MBS P 8 2	1 *
13 1639	DIODE BAX12 SWITCH	1	31 3952	CONN CT-MT MBS P12 2	1 *
13 27655	IC 1496	1			
13 2833	IC 76013 SC (1989) DMP I2C	3 *	78 0018	PC PJ 49 VER DATA SUB 761769	1
13 2944	TSTR BCY87 DUAL N 40 /	1			
13 4028	IC 317LZ	1			

* NUMBERS REFERRING TO PICTURE