BARCO

BARCO Projection Systems

SECTION J

service sheet

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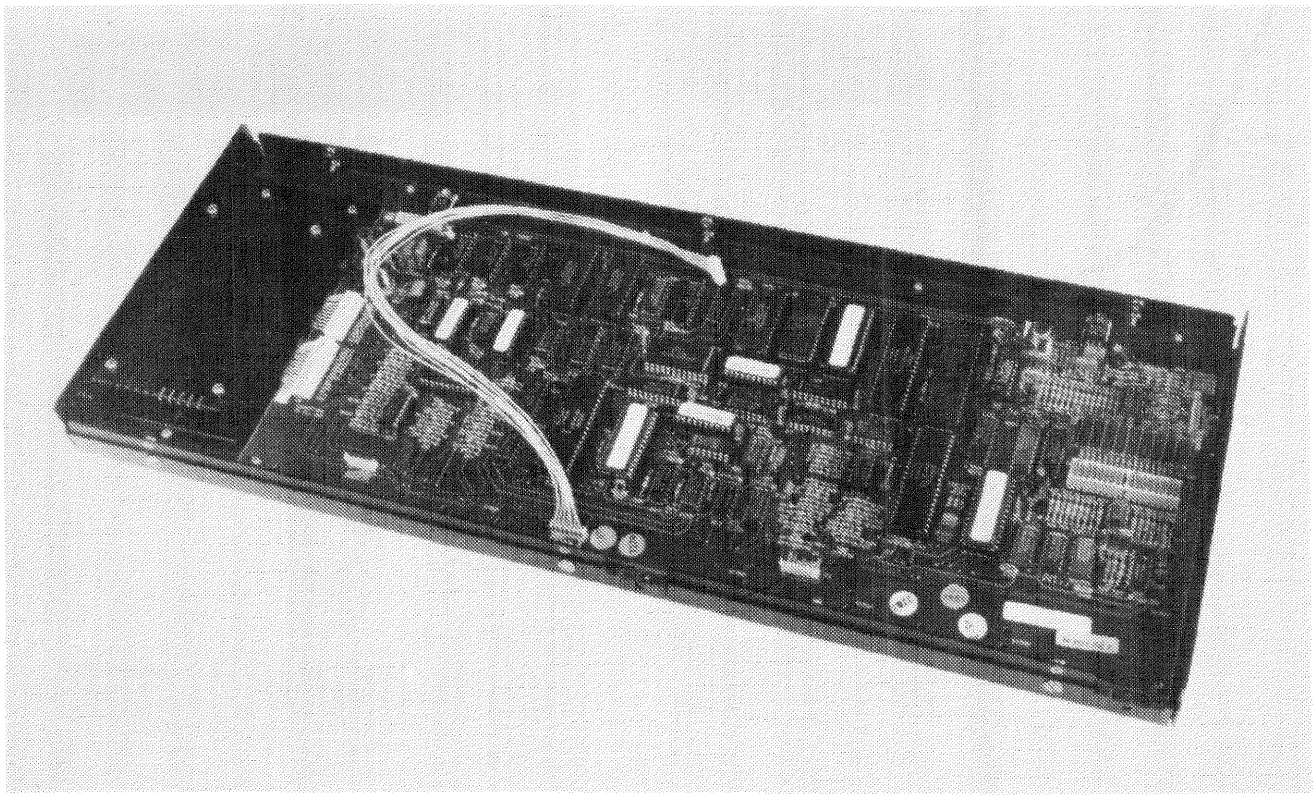
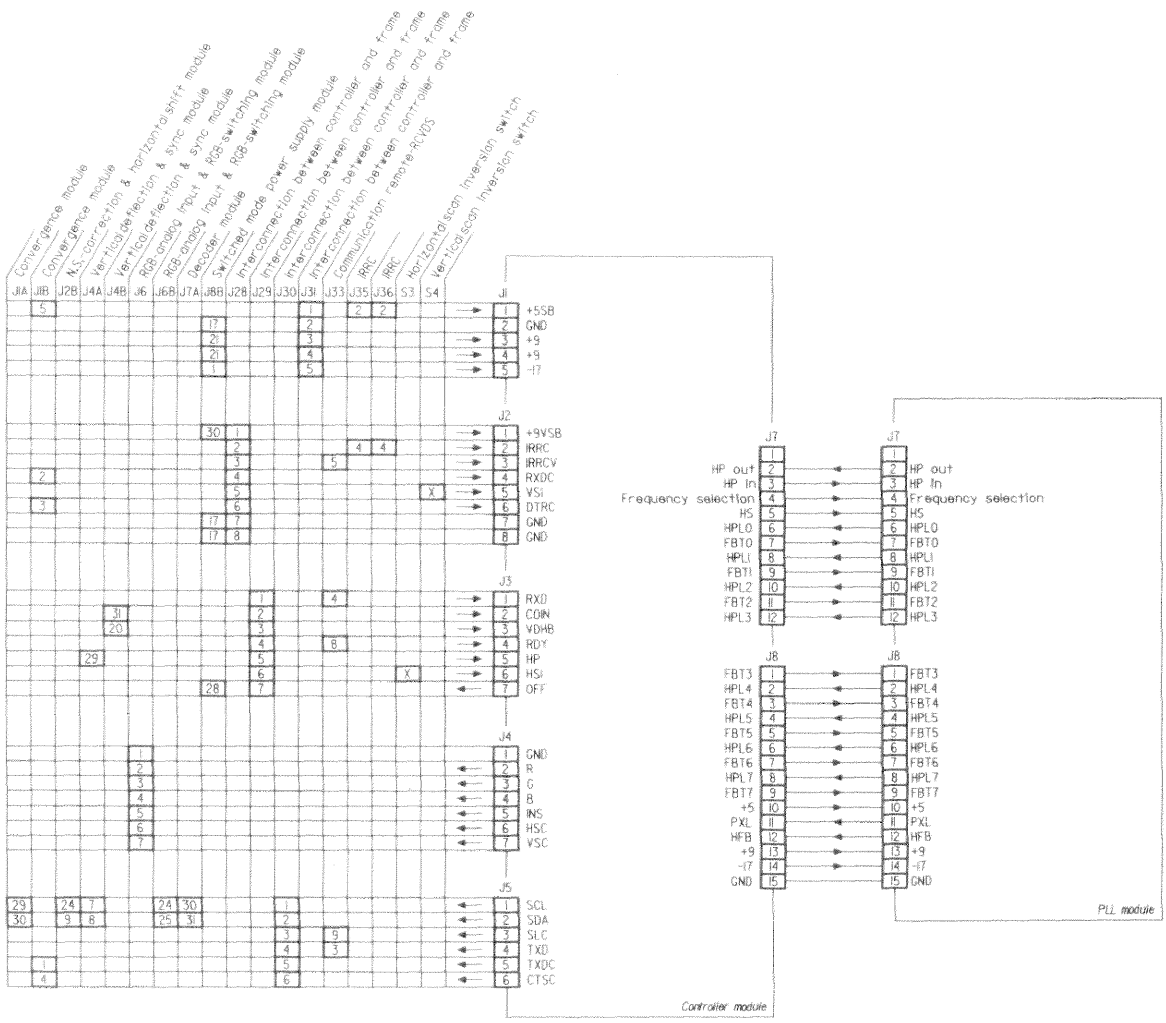
CONTROLLER MODULE

76 1773

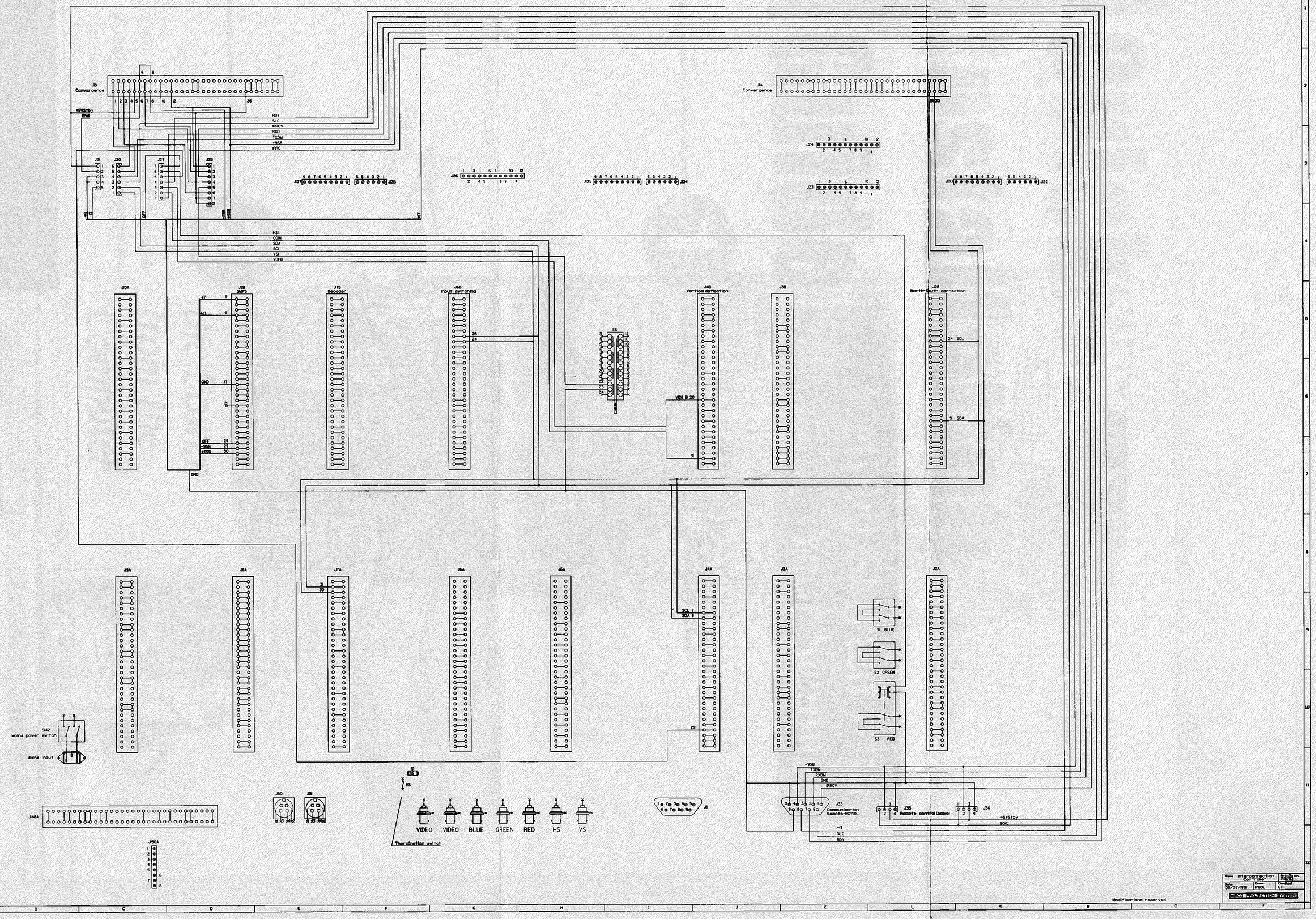




Name Interconnection Controller module		Article nr. 761773
Date 15/09/1990	Drawn PG	Checked GT
BARCO PROJECTION SYSTEMS		

Modifications reserved

Main frame Interconnection Controller module



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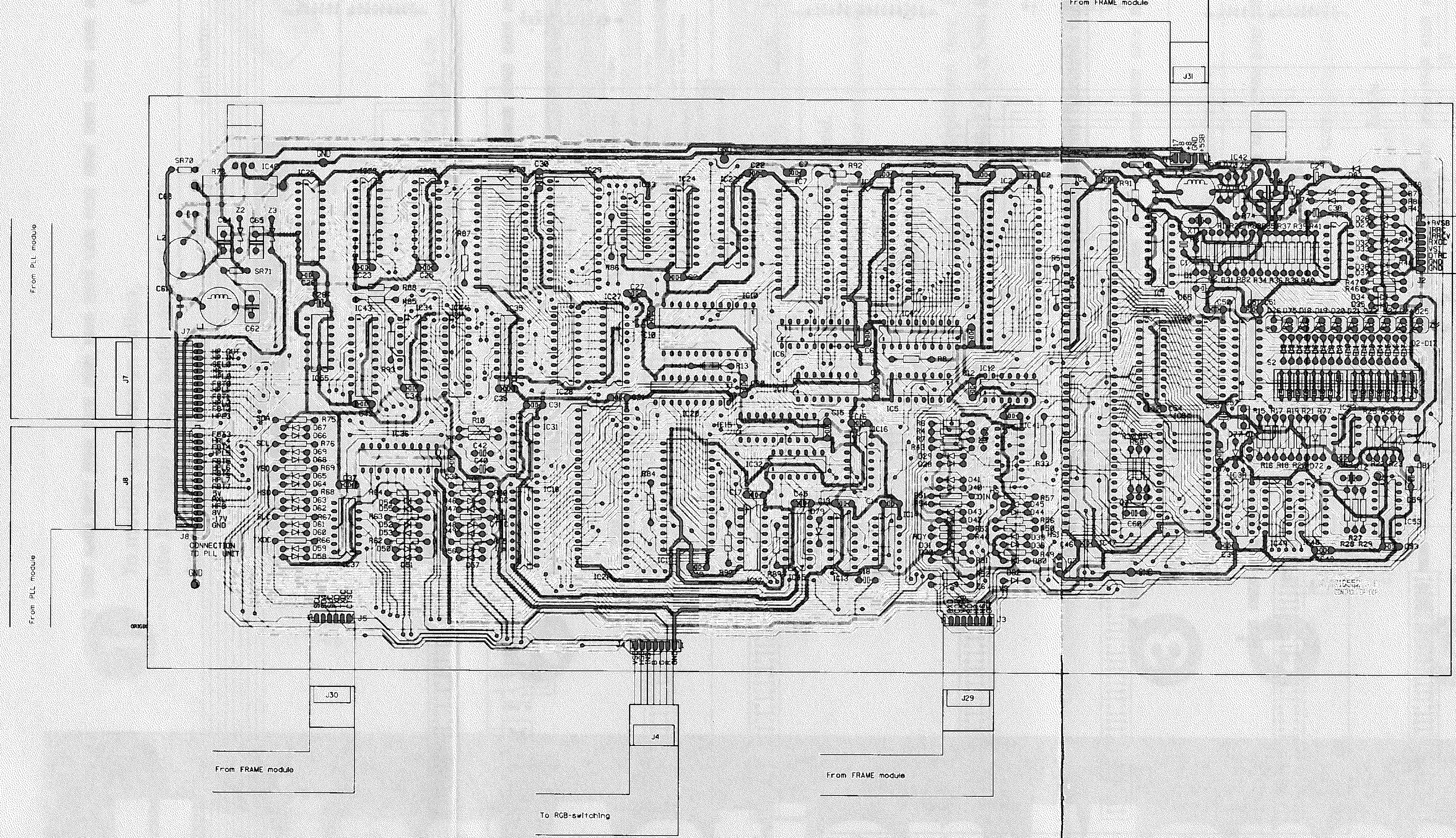
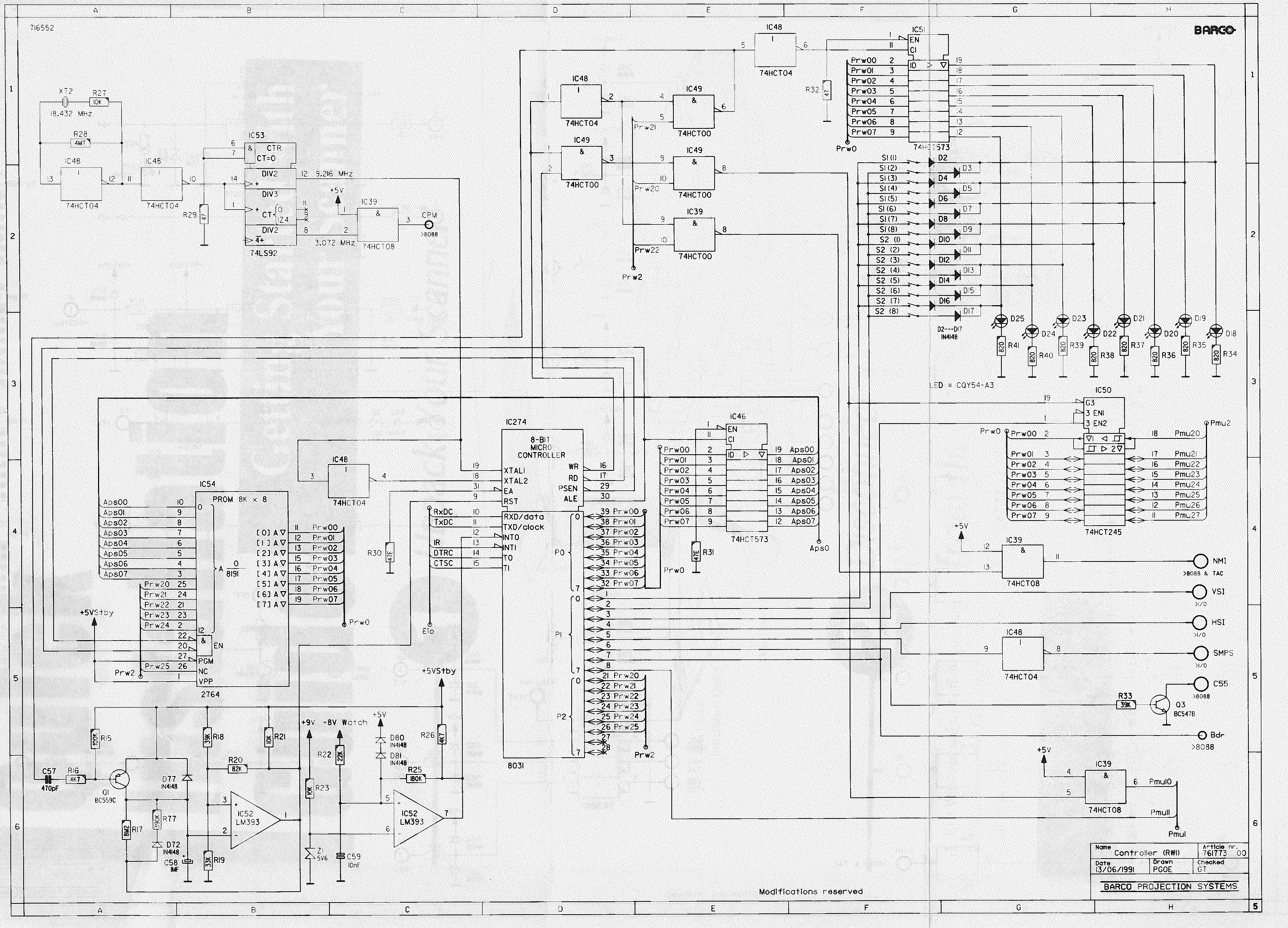
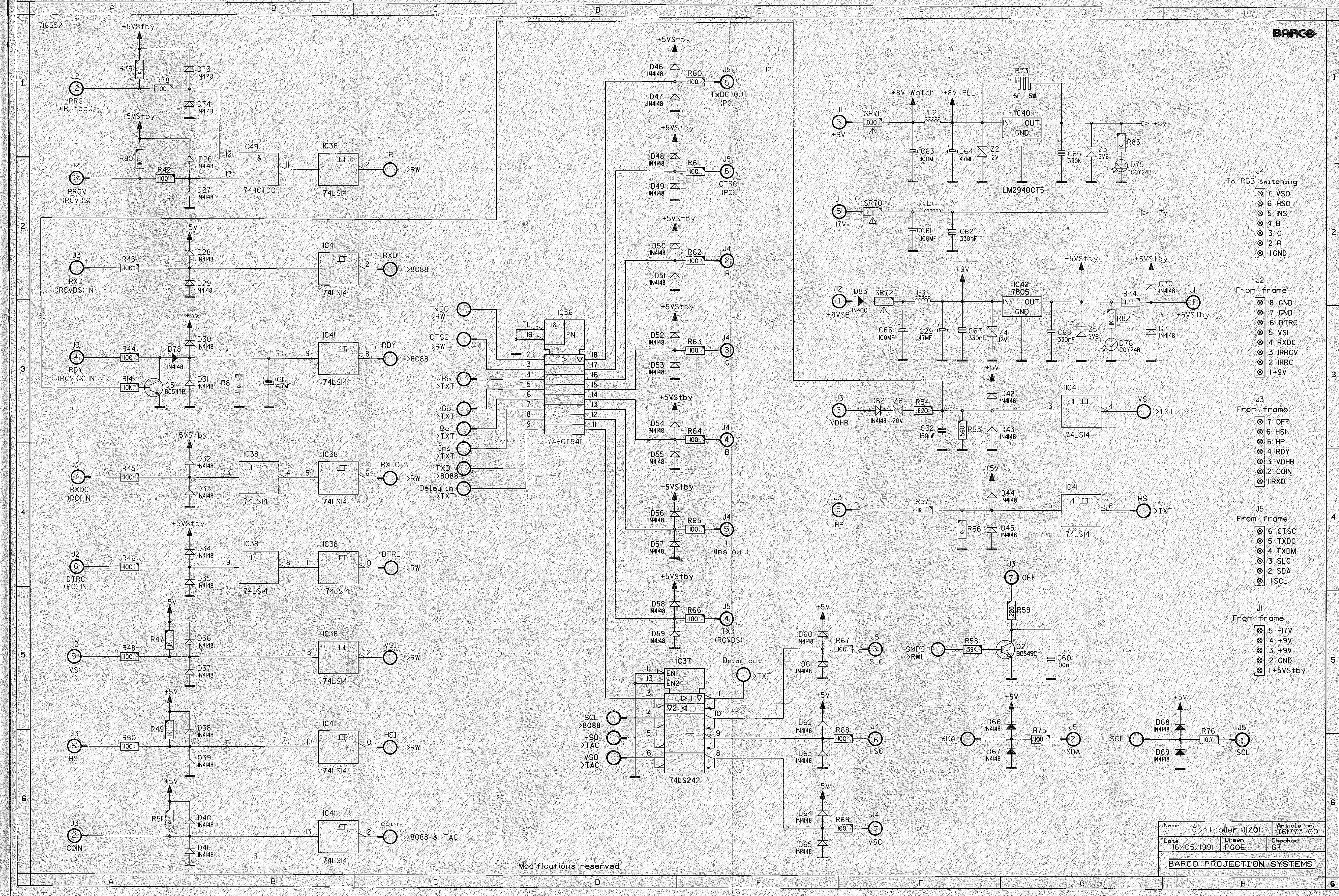


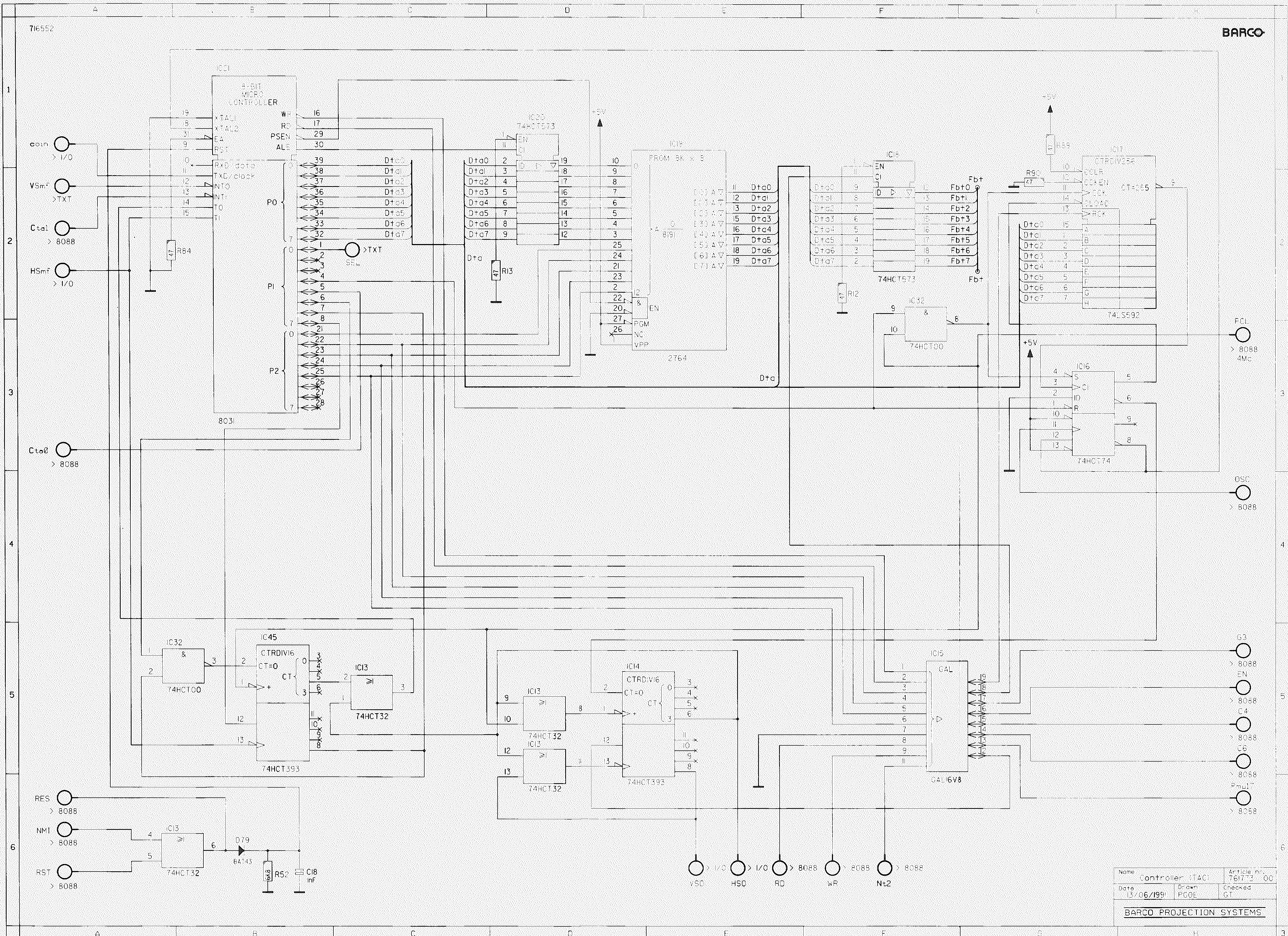
Name		Article nr.
Controller module		761773
Date 15/09/1990	Drawn PG	Checked CT

BARCO PROJECTION SYSTEMS

Modifications reserved

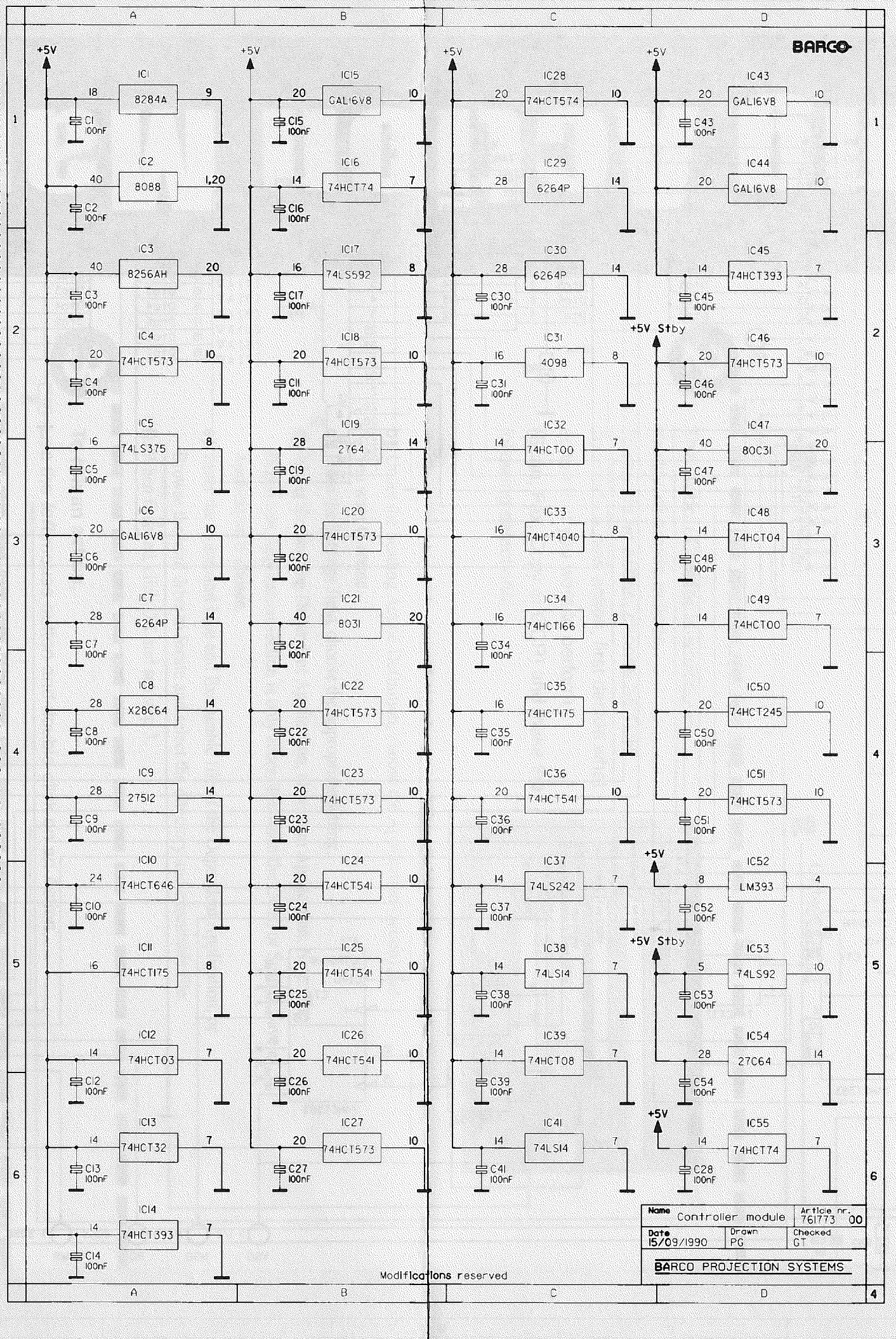

716552
BARCO
XT2
R27 10K
18.432 MHz
R28 4M7
IC48
74HCT04
IC53
CTR
CT=0
DIV2
DIV3
CT
DIV2
74LS92
9.216 MHz
3.072 MHz
R29 47
+5V
IC39
74HCT08
CPM
>8088
IC48
74HCT04
IC49
74HCT00
Prw21
Prw20
Prw22
Prw2
IC48
74HCT04
R32 47
IC51
EN
C1
1D
74HCT573
Prw00
Prw01
Prw02
Prw03
Prw04
Prw05
Prw06
Prw07
Prw0
S1 (1)
S1 (2)
S1 (3)
S1 (4)
S1 (5)
S1 (6)
S1 (7)
S1 (8)
S2 (1)
S2 (2)
S2 (3)
S2 (4)
S2 (5)
S2 (6)
S2 (7)
S2 (8)
D2---D17
IN4148
D25
D24
D23
D22
D21
D20
D19
D18
R41
R40
R39
R38
R37
R36
R35
R34
820
LED = CQY54-A3
IC50
G3
3 EN1
3 EN2
74HCT245
Pmu2
Pmu20
Pmu21
Pmu22
Pmu23
Pmu24
Pmu25
Pmu26
Pmu27
IC274
8-BIT
MICRO
CONTROLLER
XTAL1
XTAL2
EA
RST
WR
RD
PSEN
ALE
RxDC
TxDC
IR
DTRC
CTSC
RXD/data
TXD/clock
INT0
INT1
T0
T1
P0
P1
P2
8031
Elo
R30 47E
IC46
74HCT573
Aps00
Aps01
Aps02
Aps03
Aps04
Aps05
Aps06
Aps07
R31 47E
IC54
PROM 8K x 8
A 0 8191
EN
PGM
NC
VPP
2764
Prw20
Prw21
Prw22
Prw23
Prw24
Prw25
+5VStby
Prw2
IC39
74HCT08
NMI
>8088 & TAC
VSI
>I/O
HSI
>I/O
IC48
74HCT04
SMPS
>I/O
R33 39K
Q3
BC547B
C55
>8088
Bdr
>8088
Pmul0
Pmul1
Pmul
C57 470pF
R16 4K7
Q1 BC559C
R15 100K
R17 8M2
R77 390K
D77 IN4148
D72 IN4148
C58 1MF
R18 39K
R19 33K
R20 82K
R21 10K
IC52 LM393
+9V
+8V Watch
R22 22K
R23 10K
Z1 5V6
C59 10nF
D80 IN4148
D81 IN4148
R25 180K
R26 4K7
Name
Controller (RWI)
Article nr.
761773 00
Date
13/06/1991
Drawn
PGOE
Checked
GT
BARCO PROJECTION SYSTEMS
Modifications reserved
5

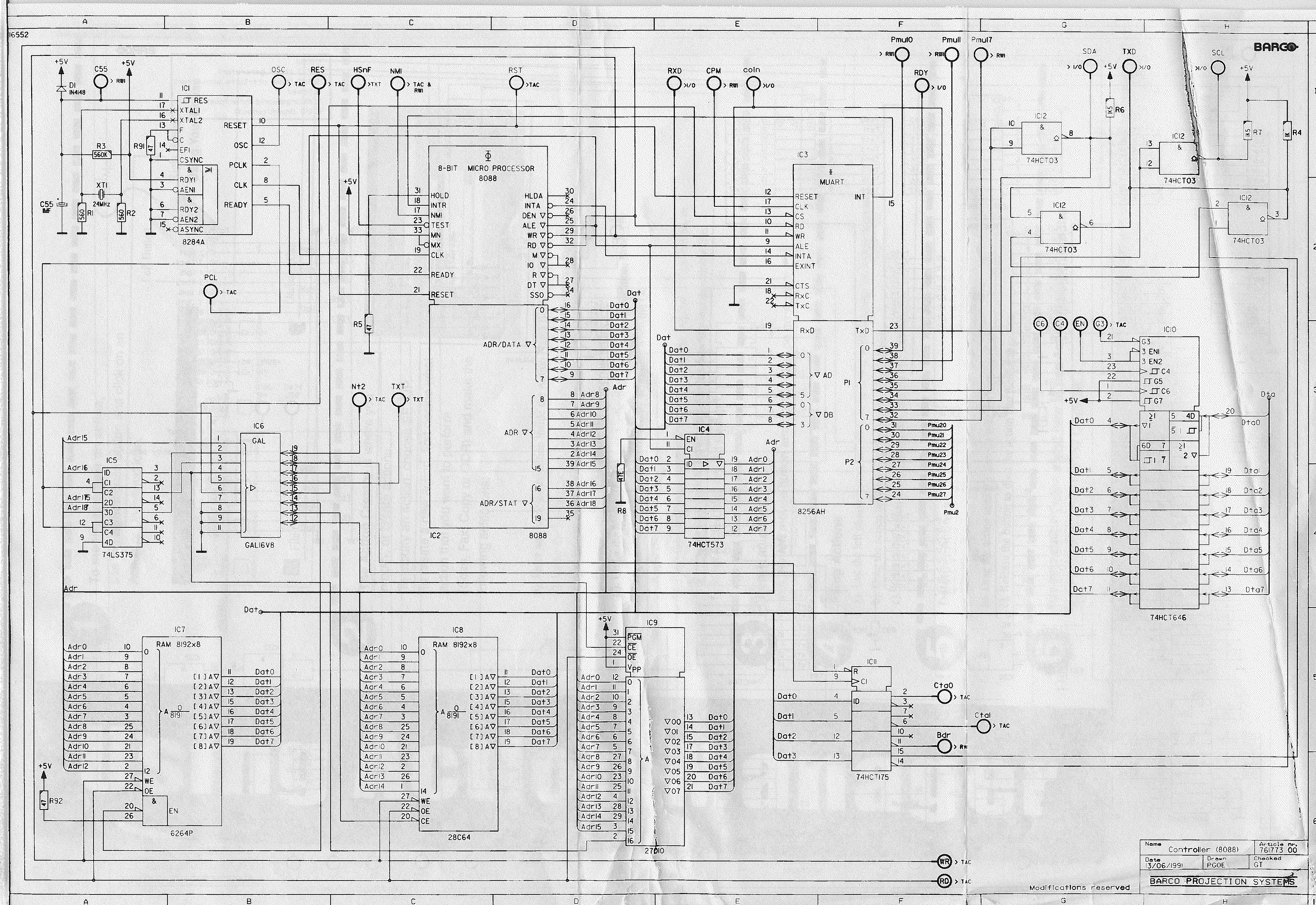

716552
BARCO
J2 2 IRRC (IR rec.)
J2 3 IRRCV (RCVDS)
J3 1 RXD (RCVDS) IN
J3 4 RDY (RCVDS) IN
J2 4 RXDC (PC) IN
J2 6 DTRC (PC) IN
J2 5 VSI
J3 6 HSI
J3 2 COIN
+5VStby
+5V
R79 R80 R78 100 R42 100 R43 100 R44 100 R14 10K R45 100 R46 100 R47 R48 100 R49 R50 100 R51 R81
D73 D74 D26 D27 D28 D29 D30 D31 D32 D33 D34 D35 D36 D37 D38 D39 D40 D41 IN4148
D78 IN4148
Q5 BC547B
C11 4,7MF
IC49 & 74HCT00
IC38 74LS14
IC41 74LS14
IR >RWI
RXD >8088
RDY >8088
RXDC >RWI
DTRC >RWI
VSI >RWI
HSI >RWI
coin >8088 & TAC
TxDC >RWI
CTSC >RWI
Ro >TXT
Go >TXT
Bo >TXT
Ins >TXT
TXD >8088
Delay in >TXT
IC36 & EN 74HCT541
D46 D47 D48 D49 D50 D51 D52 D53 D54 D55 D56 D57 D58 D59 IN4148
R60 100 R61 100 R62 100 R63 100 R64 100 R65 100 R66 100
J5 5 TxDC OUT (PC)
J5 6 CTSC (PC)
J4 2 R
J4 3 G
J4 4 B
J4 5 I (Ins out)
J5 4 TXD (RCVDS)
J2
IC37 EN1 EN2 74LS242
SCL >8088
HSD >TAC
VSO >TAC
Delay out >TXT
D60 D61 D62 D63 D64 D65 IN4148
R67 100 R68 100 R69 100
J5 3 SLC
J4 6 HSC
J4 7 VSC
J1 3 +9V
SR71 0,0
+8V Watch
+8V PLL
L2
R73 15E 5W
IC40 IN OUT GND LM2940CT5
C63 100M
C64 47MF
Z2 12V
C65 330K
Z3 5V6
R83
D75 CQY24B
+5V
J1 5 -17V
SR70
L1
C61 100MF
C62 330nF
-17V
J2 1 +9VSB
D83 IN4001
SR72
L3
+9V
IC42 7805 IN OUT GND
C66 100MF
C29 47MF
C67 330nF
Z4 12V
C68 330nF
Z5 5V6
R82
D76 CQY24B
R74
D70 D71 IN4148
J1 1 +5VStby
J3 3 VDHB
D82 IN4148
Z6 20V
R54 820
C32 150nF
560 R53
D42 D43 D44 D45 IN4148
IC41 74LS14
VS >TXT
J3 5 HP
R57 1K
R56
HS >TXT
J3 7 OFF
R59 220
SMPS >RWI
R58 39K
Q2 BC549C
C60 100nF
SDA
D66 D67 IN4148
R75 100
J5 2 SDA
SCL
D68 D69 IN4148
R76 100
J5 1 SCL
J4 To RGB-switching
7 VSO
6 HSO
5 INS
4 B
3 G
2 R
1 GND
J2 From frame
8 GND
7 GND
6 DTRC
5 VSI
4 RXDC
3 IRRCV
2 IRRC
1 +9V
J3 From frame
7 OFF
6 HSI
5 HP
4 RDY
3 VDHB
2 COIN
1 RXD
J5 From frame
6 CTSC
5 TXDC
4 TXDM
3 SLC
2 SDA
1 SCL
J1 From frame
5 -17V
4 +9V
3 +9V
2 GND
1 +5VStby
Modifications reserved
Name Controller (I/O)
Article nr. 761773 00
Date 16/05/1991
Drawn PGOE
Checked GT
BARCO PROJECTION SYSTEMS
6

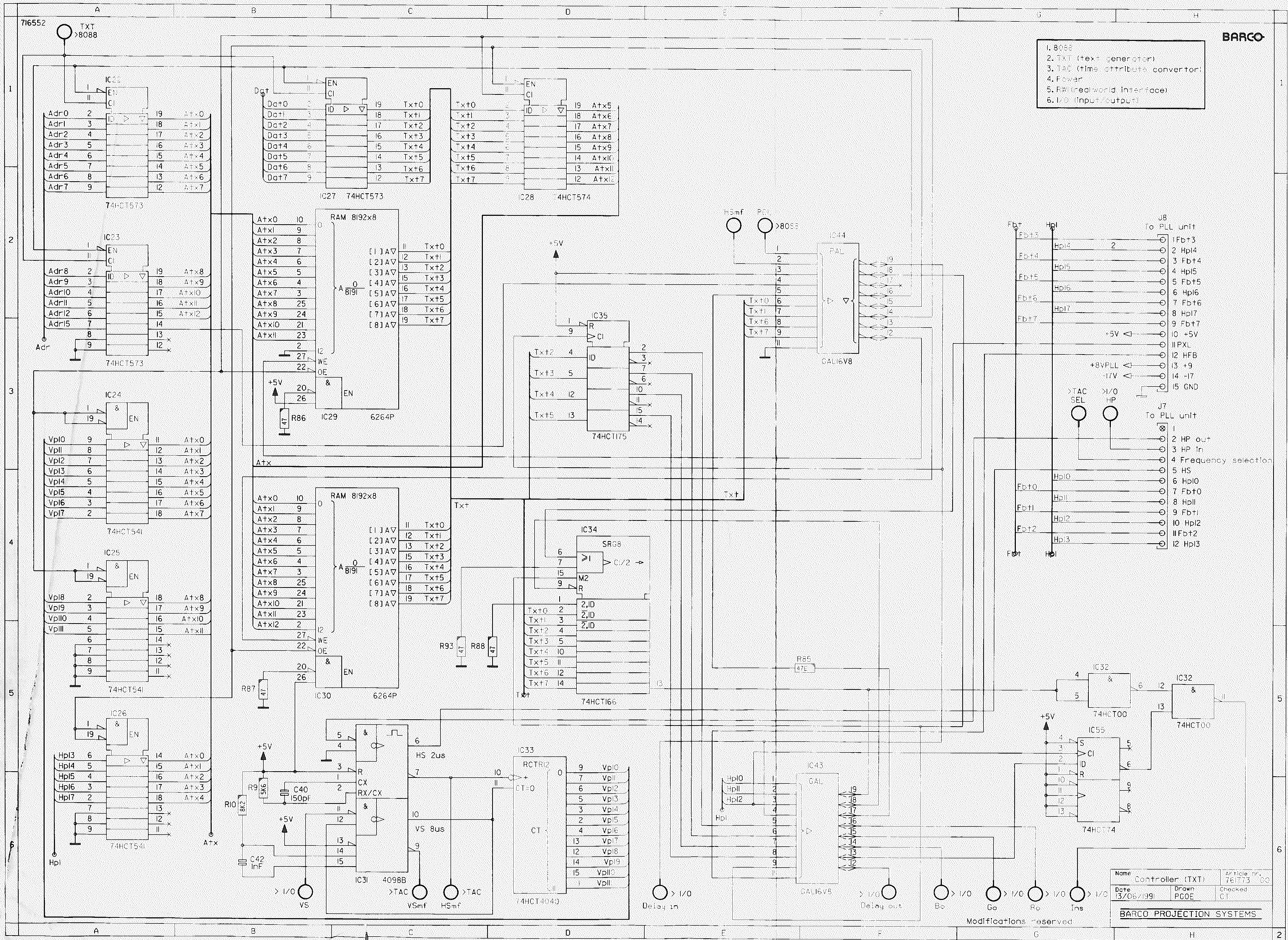


716552
BARCO
8-BIT MICRO CONTROLLER
8031
XTAL1
XTAL2
EA
RST
RXD/data
TXD/clock
INT0
INT1
T0
T1
WR
RD
PSEN
ALE
P0
P1
P2
coin
> I/O
VSmf
>TXT
Cta1
> 8088
HSmf
> I/O
Cta0
> 8088
SEL
>TXT
R84
R13
IC20
74HCT573
IC19
PROM 8K x 8
2764
PGM
NC
VPP
EN
+5V
Dta0
Dta1
Dta2
Dta3
Dta4
Dta5
Dta6
Dta7
Dta
IC18
74HCT573
Fbt0
Fbt1
Fbt2
Fbt3
Fbt4
Fbt5
Fbt6
Fbt7
Fbt
R12
IC32
74HCT00
IC17
CTRDIV256
CCLR
CCKEN
CCK
CLOAD
RCK
CT=255
74LS592
R55
R90
IC16
74HCT74
FCL
> 8088
4Mc
OSC
> 8088
IC45
CTRDIV16
CT=0
74HCT393
IC13
74HCT32
IC14
CTRDIV16
74HCT393
IC15
GAL
GAL16V8
G3
> 8088
EN
> 8088
C4
> 8088
C6
> 8088
Pmul7
> 8088
RES
> 8088
NMI
> 8088
RST
> 8088
D79
BAT43
R52
6K8
C18
1nF
VSO
> I/O
HSO
> I/O
RD
> 8088
WR
> 8088
Nt2
> 8088
Name
Controller (TAC)
Article nr.
761773 00
Date
13/06/1991
Drawn
PGOE
Checked
GT
BARCO PROJECTION SYSTEMS

COMP.	LOC.	SHEET
C1	A 1	sheet 4
C2	A 1	sheet 4
C3	A 2	sheet 4
C4	A 2	sheet 4
C5	A 3	sheet 4
C6	A 3	sheet 4
C7	A 3	sheet 4
C8	A 4	sheet 4
C9	A 4	sheet 4
C10	A 5	sheet 4
C11	B 2	sheet 4
C11	B 3	sheet 6
C12	A 6	sheet 4
C13	A 6	sheet 4
C14	A 6	sheet 4
C15	B 1	sheet 4
C16	B 1	sheet 4
C17	B 2	sheet 4
C18	B 6	sheet 3
C19	B 3	sheet 4
C20	B 3	sheet 4
C21	B 3	sheet 4
C22	B 4	sheet 4
C23	B 4	sheet 4
C24	B 5	sheet 4
C25	B 5	sheet 4
C26	B 6	sheet 4
C27	B 6	sheet 4
C28	D 6	sheet 4
C29	F 3	sheet 6
C30	C 2	sheet 4
C31	C 2	sheet 4
C32	F 3	sheet 6
C34	C 3	sheet 4
C35	C 4	sheet 4
C36	C 4	sheet 4
C37	C 5	sheet 4
C38	C 5	sheet 4
C39	C 6	sheet 4
C40	B 6	sheet 2
C41	C 6	sheet 4
C42	B 6	sheet 2
C43	D 1	sheet 4
C45	D 2	sheet 4
C46	D 2	sheet 4
C47	D 3	sheet 4
C48	D 3	sheet 4
C50	D 4	sheet 4
C51	D 4	sheet 4
C52	D 5	sheet 4
C53	D 5	sheet 4
C54	D 6	sheet 4
C55	A 2	sheet 1
C57	A 6	sheet 5
C58	A 6	sheet 5
C59	C 6	sheet 5
C60	G 5	sheet 6
C61	F 2	sheet 6
C62	F 2	sheet 6
C63	F 1	sheet 6
C64	F 1	sheet 6
C65	G 1	sheet 6
C66	F 3	sheet 6
C67	F 3	sheet 6
C68	G 3	sheet 6
D1	A 1	sheet 1
D2	G 1	sheet 5
D3	G 2	sheet 5
D4	G 2	sheet 5
D5	G 2	sheet 5
D6	G 2	sheet 5
D7	G 2	sheet 5
D8	G 2	sheet 5
D9	G 2	sheet 5
D10	G 2	sheet 5
D11	G 2	sheet 5
D12	G 2	sheet 5
D13	G 2	sheet 5
D14	G 2	sheet 5
D15	G 2	sheet 5
D16	G 2	sheet 5
D17	G 2	sheet 5
D18	H 3	sheet 5
D19	H 3	sheet 5
D20	H 3	sheet 5
D21	H 3	sheet 5
D22	H 3	sheet 5
D23	G 3	sheet 5
D24	G 3	sheet 5
D25	G 3	sheet 5
D26	B 1	sheet 6
D27	B 2	sheet 6
D28	B 2	sheet 6
D29	B 2	sheet 6
D30	B 3	sheet 6
D31	B 3	sheet 6
D32	B 4	sheet 6
D33	B 4	sheet 6
D34	B 4	sheet 6
D35	B 4	sheet 6
D36	B 5	sheet 6
D37	B 5	sheet 6
D38	B 5	sheet 6
D39	B 6	sheet 6
D40	B 6	sheet 6
D41	B 6	sheet 6
D42	G 3	sheet 6
D43	G 3	sheet 6
D44	G 4	sheet 6
D45	G 4	sheet 6
D46	D 1	sheet 6
D47	D 1	sheet 6
D48	D 1	sheet 6
D49	D 2	sheet 6
D50	D 2	sheet 6
D51	D 2	sheet 6
D52	D 3	sheet 6
D53	D 3	sheet 6
D54	D 3	sheet 6
D55	D 4	sheet 6
D56	D 4	sheet 6
D57	D 4	sheet 6
D58	D 5	sheet 6
D59	D 5	sheet 6
D60	E 5	sheet 6
D61	E 5	sheet 6
D62	E 5	sheet 6
D63	E 6	sheet 6
D64	E 6	sheet 6
D65	E 6	sheet 6
D66	F 5	sheet 6
D67	F 6	sheet 6
D68	G 5	sheet 6
D69	G 6	sheet 6
D70	G 2	sheet 6
D71	G 3	sheet 6
D72	A 6	sheet 5
D73	B 1	sheet 6
D74	B 1	sheet 6
D75	G 1	sheet 6
D76	G 3	sheet 6
D77	A 6	sheet 5
D78	A 3	sheet 6
D79	B 6	sheet 3
D80	C 5	sheet 5
D81	C 5	sheet 5
D82	F 3	sheet 6
D83	F 2	sheet 6
IC1	B 1	sheet 1
IC1	A 1	sheet 4
IC1	A 1	sheet 4
IC2	C 4	sheet 1
IC2	A 1	sheet 4
IC2	A 1	sheet 4
IC3	E 1	sheet 1
IC3	A 2	sheet 4
IC3	A 2	sheet 4
IC4	E 3	sheet 1
IC4	A 2	sheet 4
IC5	A 3	sheet 1
IC5	A 2	sheet 4
IC5	A 2	sheet 4
IC6	B 3	sheet 1
IC6	A 3	sheet 4
IC6	A 3	sheet 4
IC7	B 5	sheet 1
IC7	A 3	sheet 4
IC7	A 3	sheet 4
IC8	C 5	sheet 1
IC8	A 4	sheet 4
IC8	A 4	sheet 4
IC9	D 5	sheet 1
IC9	A 4	sheet 4
IC10	H 3	sheet 1
IC10	A 4	sheet 4
IC10	A 4	sheet 4
IC11	F 5	sheet 1
IC11	A 5	sheet 4
IC11	A 5	sheet 4
IC12	H 1	sheet 1
IC12	G 1	sheet 1
IC12	G 2	sheet 1
IC12	H 2	sheet 1
IC12	A 5	sheet 4
IC12	A 5	sheet 4
IC13	D 5	sheet 3
IC13	A 6	sheet 3
IC13	C 5	sheet 3
IC13	D 5	sheet 3
IC13	A 6	sheet 4
IC14	D 5	sheet 3
IC14	A 6	sheet 4
IC15	F 5	sheet 3
IC15	B 1	sheet 4
IC16	G 3	sheet 3
IC16	B 1	sheet 4
IC17	G 1	sheet 3
IC17	B 2	sheet 4
IC18	F 1	sheet 3
IC18	B 2	sheet 4
IC19	E 1	sheet 3
IC19	B 2	sheet 4
IC20	D 1	sheet 3
IC20	B 3	sheet 4
IC21	B 1	sheet 3
IC21	B 3	sheet 4
IC22	A 1	sheet 2
IC22	B 4	sheet 4
IC23	A 2	sheet 2
IC23	B 4	sheet 4
IC24	A 3	sheet 2
IC24	B 4	sheet 4
IC25	A 4	sheet 2
IC25	B 5	sheet 4
IC26	A 5	sheet 2
IC26	B 5	sheet 4
IC27	B 2	sheet 2
IC27	B 6	sheet 4
IC28	D 2	sheet 2
IC28	C 1	sheet 4
IC29	B 3	sheet 2
IC29	C 1	sheet 4
IC30	B 5	sheet 2
IC30	C 2	sheet 4
IC31	C 6	sheet 2
IC31	C 2	sheet 4
IC32	G 5	sheet 2
IC32	H 5	sheet 2
IC32	A 5	sheet 3
IC32	F 2	sheet 3
IC32	C 2	sheet 4
IC33	D 5	sheet 2
IC33	C 3	sheet 4
IC34	D 4	sheet 2
IC34	C 3	sheet 4
IC35	D 2	sheet 2
IC35	C 4	sheet 4
IC36	C 4	sheet 4
IC36	D 3	sheet 6
IC37	C 4	sheet 4
IC38	C 5	sheet 4
IC38	B 1	sheet 6
IC38	B 4	sheet 6
IC38	B 4	sheet 6
IC38	B 5	sheet 6
IC38	B 4	sheet 6
IC39	C 5	sheet 4
IC39	G 4	sheet 5
IC39	E 2	sheet 5
IC39	C 2	sheet 5
IC40	G 1	sheet 6
IC41	C 6	sheet 4
IC41	B 3	sheet 6
IC41	B 2	sheet 6
IC41	G 3	sheet 6
IC41	B 5	sheet 6
IC41	G 4	sheet 6
IC42	G 2	sheet 6
IC43	F 5	sheet 2
IC43	D 1	sheet 4
IC44	F 2	sheet 2
IC44	D 1	sheet 4
IC45	B 5	sheet 3
IC45	D 2	sheet 4
IC46	D 2	sheet 4
IC46	E 3	sheet 5
IC47	D 2	sheet 4
IC48	D 3	sheet 4
IC48	G 5	sheet 5
IC48	E 1	sheet 5
IC48	D 1	sheet 5
IC48	A 1	sheet 5
IC48	C 3	sheet 5
IC49	D 3	sheet 4
IC49	E 1	sheet 5
IC49	E 1	sheet 5
IC49	D 1	sheet 5
IC49	B 1	sheet 6
IC50	D 4	sheet 4
IC50	H 3	sheet 5
IC51	D 4	sheet 4
IC51	F 1	sheet 5
IC52	D 4	sheet 4
IC52	B 6	sheet 5
IC52	C 6	sheet 5
IC53	D 5	sheet 4
IC53	B 1	sheet 5
IC53	D 5	sheet 4
IC54	D 5	sheet 4
IC54	B 4	sheet 5
IC55	G 5	sheet 2
IC55	D 6	sheet 4
J1	H 5	sheet 6
J2	H 2	sheet 6
J3	H 3	sheet 6
J4	H 2	sheet 6
J5	H 4	sheet 6
J7	H 3	sheet 2
J8	H 2	sheet 2
L1	F 2	sheet 6
L2	F 1	sheet 6
L3	F 2	sheet 6
Q1	A 6	sheet 5
Q2	G 5	sheet 6
Q3	H 5	sheet 5
Q5	A 3	sheet 6
R1	A 2	sheet 1
R2	A 2	sheet 1
R3	A 1	sheet 1
R4	H 1	sheet 1
R5	C 3	sheet 1
R6	G 1	sheet 1
R7	H 1	sheet 1
R8	D 4	sheet 1
R9	B 6	sheet 2
R10	B 6	sheet 2
R12	F 2	sheet 3
R13	D 2	sheet 3
R14	A 3	sheet 6
R15	A 5	sheet 5
R16	A 6	sheet 5
R17	A 6	sheet 5
R18	B 5	sheet 5
R19	B 6	sheet 5
R20	B 6	sheet 5
R21	B 5	sheet 5
R22	B 5	sheet 5
R23	B 6	sheet 5
R25	C 6	sheet 5
R26	C 5	sheet 5
R27	A 1	sheet 5
R28	A 1	sheet 5
R29	B 2	sheet 5
R30	C 4	sheet 5
R31	E 4	sheet 5
R32	F 1	sheet 5
R33	H 5	sheet 5
R34	H 3	sheet 5
R35	H 3	sheet 5
R36	H 3	sheet 5
R37	H 3	sheet 5
R38	H 3	sheet 5
R39	G 3	sheet 5
R40	G 3	sheet 5
R41	G 3	sheet 5
R42	A 2	sheet 6
R43	A 2	sheet 6
R44	A 3	sheet 6
R45	A 4	sheet 6
R46	A 4	sheet 6
R47	A 5	sheet 6
R48	A 5	sheet 6
R49	A 5	sheet 6
R50	A 6	sheet 6
R51	A 6	sheet 6
R52	B 6	sheet 3
R53	F 3	sheet 6
R54	F 3	sheet 6
R56	F 4	sheet 6
R57	F 4	sheet 6
R58	F 5	sheet 6
R59	G 5	sheet 6
R60	E 1	sheet 6
R61	E 1	sheet 6
R62	E 2	sheet 6
R63	E 3	sheet 6
R64	E 3	sheet 6
R65	E 4	sheet 6
R66	E 5	sheet 6
R67	E 5	sheet 6
R68	E 5	sheet 6
R69	E 6	sheet 6
R73	G 1	sheet 6
R74	G 2	sheet 6
R75	G 5	sheet 6
R76	H 5	sheet 6
R77	A 6	sheet 5
R78	A 1	sheet 6
R79	A 1	sheet 6
R80	A 1	sheet 6
R81	B 3	sheet 6
R82	G 3	sheet 6
R83	G 1	sheet 6
R84	B 2	sheet 3
R85	E 5	sheet 2
R86	B 3	sheet 2
R87	B 5	sheet 2
R88	C 5	sheet 2
R89	G 1	sheet 3
R90	G 2	sheet 3
R91	A 1	sheet 1
R92	A 6	sheet 1
R93	C 5	sheet 2
S1	F 2	sheet 5
S1	F 2	sheet 5
S1	F 2	sheet 5
S1	F 2	sheet 5
S1	F 2	sheet 5
S1	F 1	sheet 5
S2	F 2	sheet 5
S2	F 2	sheet 5
S2	F 2	sheet 5
S2	F 2	sheet 5
S2	F 2	sheet 5
SR70	F 2	sheet 6
SR71	F 1	sheet 6
SR72	F 2	sheet 6
XT1	A 2	sheet 1
XT2	A 1	sheet 5
Z1	B 6	sheet 5
Z2	F 1	sheet 6
Z3	G 1	sheet 6
Z4	F 3	sheet 6
Z5	G 3	sheet 6
Z6	F 3	sheet 6




16552
BARCO
IC1 8284A
8-BIT MICRO PROCESSOR 8088
IC2 8088
IC3 MUART 8256AH
IC4 74HCT573
IC5 74LS375
IC6 GAL16V8
IC7 RAM 8192x8 6264P
IC8 RAM 8192x8 28C64
IC9 27010
IC10 74HCT646
IC11 74HCT175
IC12 74HCT03
D1 1N4148
XT1 24MHz
R3 560K
OSC RES HSnF NMI RST RXD CPM coln Pmul0 Pmul1 Pmul7 RDY SDA TXD SCL PCL Nt2 TXT
Cta0 Cta1 Bdr WR RD
Name Controller (8088)
Article nr. 761773 00
Date 13/06/1991
Drawn PGOE
Checked GT
BARCO PROJECTION SYSTEMS
Modifications reserved


716552
BARCO
1. 8088
2. TXT (text generator)
3. TAC (time attribute convertor)
4. Power
5. RWI (realworld interface)
6. I/O (input/output)
TXT >8088
IC22 74HCT573
IC23 74HCT573
IC27 74HCT573
IC28 74HCT574
IC29 RAM 8192x8 6264P
IC30 RAM 8192x8 6264P
IC24 74HCT541
IC25 74HCT541
IC26 74HCT541
IC35 74HCT175
IC34 SRG8 74HCT166
IC44 PAL GAL16V8
IC43 GAL GAL16V8
IC31 4098B
HS 2us
VS 8us
IC33 RCTR12 74HCT4040
IC32 74HCT00
IC55 74HCT74
HSmf
PCI >8055
J8 To PLL unit
1 Fbt3
2 Hpl4
3 Fbt4
4 Hpl5
5 Fbt5
6 Hpl6
7 Fbt6
8 Hpl7
9 Fbt7
10 +5V
11 PXL
12 HFB
13 +9
14 -17
15 GND
J7 To PLL unit
2 HP out
3 HP in
4 Frequency selection
5 HS
6 Hpl0
7 Fbt0
8 Hpl1
9 Fbt1
10 Hpl2
11 Fbt2
12 Hpl3
>TAC SEL
>I/O HP
R85 47E
R86 47
R87 47
R88 47
R93 47
R9 5K6
R10 8K2
C40 150pF
C42 1nF
> I/O VS
>TAC VSmf
>TAC HSmf
> I/O Delay in
> I/O Delay out
> I/O Bo
> I/O Go
> I/O Ro
> I/O Ins
Name Controller (TXT)
Article nr. 761773 00
Date 13/06/1991
Drawn PGOE
Checked CT
BARCO PROJECTION SYSTEMS
Modifications reserved

INTRODUCTION.

A detailed description of this board is very difficult because a lot of tasks are executed in a microprocessor or a microcontroller, and several lines (a bus) carry both data and address information in a multiplexed way.

Hereafter we'll limit to the essential interconnections and describe the function of the blocks, followed by a hardware description as outlined hereafter.

This controller board communicates with the rest of the projector and with the equipment attached to it, like the RCVDS switcher or the PC (IBM or MAC).

The controller board measures the scanning frequencies in order to generate a text locked to the horizontal sync and with a pixel rate depending on the actual scanning frequencies.

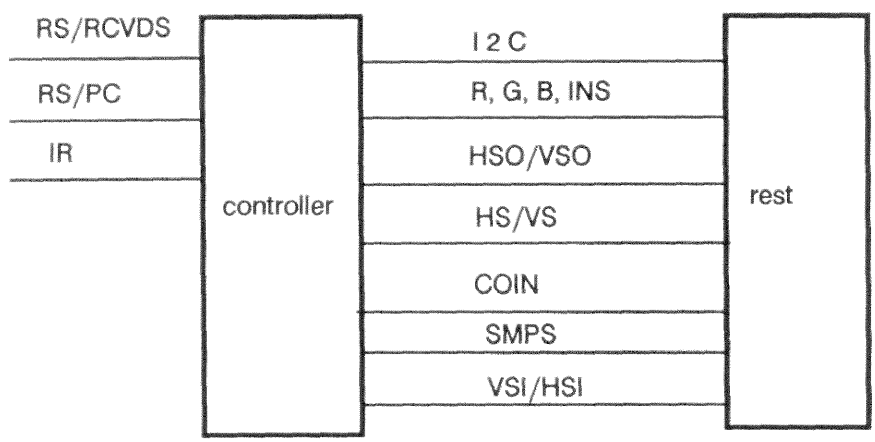
In the event of an alignment, the named board generates a crosshatch at the required frequencies , locked with the incoming signals or locked with syns, generated by the timers on the board.
Informations with regard to the menu in the adjustment mode or data on the selected source are generated and displayed on the screen. The status of the linear controls are equally displayed when the user wishes to change above controls.

The user is informed on the selected source and its frequencies any time the source is selected.

The reader should have acquired a minimum knowledge on digital circuits for the better understanding of the explanations below.

FUNCTIONAL DESCRIPTION OF THE BLOCKS :
8088 / RWI / TAC / TXT.

Communication of the controller with the REST of the projector.



RS/RCVDS :

This serial Input/Output is connected to the RCVDS switcher(s) or to an IR-Receiver Display unit (wired and remote).

By means of a line of this bus, the projector is informed about the connection of an RCVDS or different RCVDS units (up to 10 maximum). If more than one RCVDS is connected , the RCVDS units must be looped is series.

In this case the last input slot of the RCVDS must be replaced by an expansion module. If the user selects an input of the switcher/selector(s), the RCVDS "tells" the projector the source type and links the input to the projector. Or, informs the projector that there is no input in the slot.

If an IR DISPLAY is attached in stead of an RCVDS, this display shows the selected input (up to 5 in this case) : video, SVHS, TTL, RGSB and RGBS, and the IR code is sent to the controller.

NOTE : The IR DISPLAY may or can also be connected to the last RCVDS in the row of RCVDS units.

projector ----------> ----------IR display

projector-> --RCVDS--> -RCVDS-> .....> -RCVDS--> --IR Display

RS/PC :

The RS232 bus is provided for connection to a serial COM port of a PC (Personal Computer, IBM or Apple MAC).

The PC user can in this case change the settings of the projector, store the settings in the hard disk or a floppy disk, or load the projector with setting from a previous alignment (reproduction of the same settings).

IR :

This is the connection to the controller of the IR-RCU unit (Remote Control Unit) or the IR DISPLAY unit.

I2C bus :

I2C bus connection with the rest of the projector to load the different digital potentiometers, or the change the status of the projector during the adjustment (like switching off one or more colours).

R, G, B, INS :

This is the pixel information for the RGB switching board (see this board) delivered by the text-generator.

This text generator is at any time synchronised (locked) with the displayed picture by means of a PLL.

The RGB is the pixel information (pixel stream) for the composition of the characters. INS is the video blanking signal to allow insertion of the text (=window).

HSO/VSO :

This is the Horizontal and Vertical Sync Out from the controller to the RGB switching board to synchronise the projector oscillators when the user has selected an internal crosshatch.

HS/VS :

These are the horizontal and vertical pulses of the source that is 'active' at this moment and they are sent to the counter of the controller.

At the selection of a source these frequencies are displayed at the bottom left corner of the screen.
The pulses are used for the counter itself and also for synchronisation of the text that has to be displayed.

COIN :

This information, provided by the Vert Sync board has to tell the controller if it can use the HS/VS pulses for synchronisation and obviously to tell the user that the selected source is not in use (not active) or, that there is no source for that input selection.

The controller warns the user of the non-availability of the source and switches to the previous source or to the internal generator.

SMPS (or ON/OFF) :

The projector can be in the' stand-by' or the 'operational' mode.

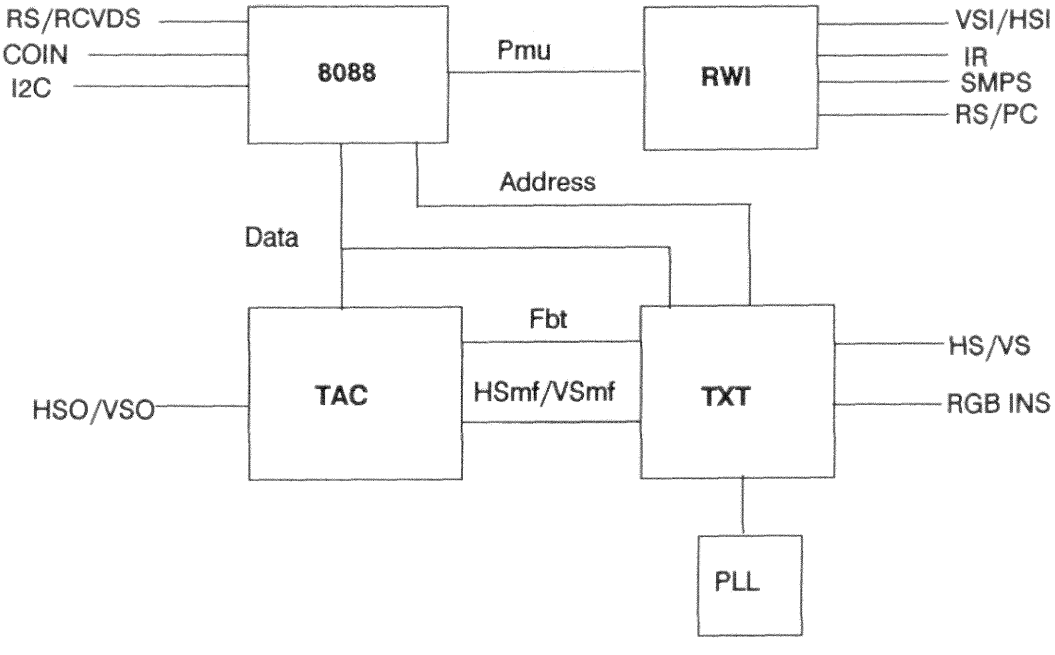
In the stand-by mode some circuits on the RWI are supplied and ready to receive an ON command from the IR (or PC), and part of the SMPS (stand-by power supply) to allow switching on the rest of the SMPS.

If the reader wishes to know more about, we refer to the description of the SMPS board.

VSI/HSI :

The Vertical and Horizontal Scan Information has as task to inform the controller about the mode of projection. This means the table or ceiling and front or rear projection.
Indeed, the key arrows of the RCU have to react (move) accordingly.

Analysis of the Controller by means of a blockdiagram .



The above block diagram indicates only the most important interconnections between the different blocks of the controller. Control lines and less important lines are deleted.

a) 8088 :

The main task of this microprocessor 8088 is the programming of the different Barco-designed digital potentiometers on the boards of the projectors via the I2C bus.

Attached to the uP (microprocessor) is an EEPROM (IC8) where the settings are stored. As this is a non-erasable memory, the settings per source are memorised up to a change or erase (delete) is required by the user, even in the event of a power failure.

38 settings of 38 sources can be memorised in 38 'blocks'.

It is obvious that the 8088 must know which source is selected in order to load the dig. pot. with the correct information.

The number of the source is memorised in the uP itself. When no RCVDS is attached, the type of source is also known by the uP. But, when an RCVDS is connected, the latter tells the uP the type of source via the RS/RCVDS line connection.

As we can see from the block diagram, the 8088 has equally a connection with the TAC module. This part of the controller measures the instant line and vertical frequencies and informs the 8088 of any relevant changes.

The projector can generate frequencies at request. This request, entering via the IR line from the user, is interpreted by the 8088 and on its turn the latter tells the TAC to generate internal frequencies and also which frequencies must to be generated.

The user can see informative text on the screen generated by the text generator (TXT). If, for instance, the user requires a change of contrast, the uP orders the TXT block to insert a barscale at the bottom and indicate the position on this barscale.

Another job for the uP is the 'position' in the menu during the adjustment procedure, and, what action has to be taken next.

Switching between the sources is equally performed by the 8088. The RS/RCVDS connection informs the uP if an RCVDS is connected and the type of source (video, TTL...).

A supplementary job is the communication with a PC via the RS232 I/O connector. The 8088 supports the PC routines. With the PC, settings with regard to the alignment can be transferred to a floppy disk or hard disk or loaded back into the memory of the projector.

The 8088 is sending the data to the RWI (Real World Interface) and further to the PC.

b) RWI (Real World Interface) :

It is worth while to know that this is the only part of the controller that is active in the standby mode. Indeed, when in standby, the RWI is checking at any time if an ON command is sent to switch on the whole projector via the SMPS unit. And, on the other hand, when operational, an OFF command must switch off the power supply.

The RWI's most important job is the CONTACT with the 'real world' or the rest of the projector and the attached equipment (PC or RCVDS).

This Real World Interface performs following tasks :

a) The identification of an IR command sent by the IR transmitter or the wired IR control unit. The coded IR signal enters this RWI and the latter (the micro-controller) identifies whether it is a code for this projector (depending on the installed address). If so, the info is transmitted to the 8088 block.

b) Connection with the RS232 serial bus, or, with the PC. If an intervention from the 8088 block is necessary, the RWI will do this as well.

c) Scanning of the status (position) of the dip-switches :

We find 8 + 1 + 3 switches, with following functions :

° **Projector address** : The address of the projector must correspond to the address of the remote control. Obviously, with 8 switches we can install 256 addresses from 0 to 255.
(with the RCU only 9 possible addresses).

° **Power up** : When switching on with the mains switch, the projector can start up in stand-by or fully start up depending on the position of this switch.

° **Password enable** : when in the ON position, the user has to enter a password before he can enter the adjust mode.

° **Baud rate** for communication via RS232 (with PC) : With these switches the user can set the baud rate for communication with the PC.

d) Control of the red mini-LEDs:

We find 10 LEDs on a row with following function :

1. **Standby Power** : as this LED is connected directly on the +SB (standby supply voltage) this LED is on as soon the projector is in the standby mode and obviously also when fully operational.

2. **Main Power** : as this LED is connected directly on the +8 volts (voltage for the supply of the rest of the Controller) it is on as soon the SMPS has started up.

3. **Processor cycles** : this LED is flickering all the time the processor in the RWI is operational.

4. **I2C shorted** : is normally off. It comes on as soon the 8088 can no more send info via the I2C bus, because the line is too heavily loaded or shorted.

5. **Flash Detection** : In the occurrence of an arcing, the supply voltage is shorted temporarily as a result. The RWI is checking this voltage and the LED gets active and the rest of the board is reset.

6. **Error** : this LED is on when there is an ERROR in the COMMUNICATION with one of the following attached equipments :

Note that both diodes are ON in such case, we mean, the ERROR Led is lit together with one of the following :

- RCU : Remote Control UNIT : IR signal not destined for the projector.

- RCVDS : see above , communication error with RCVDS.

- PC : see above, communication error with the PC
(wrong address or baud rate)

7. **Pause** : comes on when the pause button on the RCU has been pushed.

The RWI equally contains a 'watchdog' and a 'voltage check' circuit.

c) TAC : Timing Attributes Controller .

This block can operate in two modes :

- **counter** mode .
- **generator** mode.

In the 'counting mode' the TAC counts constantly the frequencies of the horizontal and vertical frequencies of the selected or active signal.

If significant changes are noticed, these alterations are sent to the 8088.

In the 'generator mode' the TAC receives the command to generate horizontal and vertical pulses from the 8088 and equally which frequencies have to be produced.

The textgenerator TXT requires a byte information from the TAC in order to blank the video for text insertion at the right position, and, this is position depends on the actual scanning frequencies. This byte is referred to as 'fbt' (0 -7)).

d) TXT : textgenerator.

This textgenerator is obviously responsible for the text on the screen.

The information (what exactly must be on display) is delivered by the 8088.

The position on the screen is determined by the 'fbt' coming from the TAC.

The pixelstream is implemented by the PLL of the Textgenerator.

HARDWARE DESCRIPTION OF THE BLOCKS.

I. HARDWARE BLOCK 8088.

The 8088 is a 16 bit microprocessor with an 8 bit multiplexed data/address bus structure.

IC4, comprising 8 x D-type transparent latches, filters the address out of the multiplexed bus (Adr0-Adr7).

The 8284A is a clock generator, taking care of the correct starting up (READY) and the reset (RESET).

The oscillator is built up around a 24 Mhz crystal.

The microprocessor is driven with the 8 Mhz CLK output (pin 8) and the PCLK output at 4 Mhz is amongst others used by the TAC for the frequency measurement and sync generation.

The functional operation of the microprocessor is extended with a MUART, IC3.

The latter is responsible for :

- serial communication with the RCVDS
- parallel communication with the RWI,this, via P2 or Pmu2 bus, pins 24-31.
- check of the 'control lines' :

°P1.0 : Input, for the communication with the RWI (see later).

°P1.1 : Output, see P1.0.

°P1.2 : Input, connected to the RDY line, on other terms, this line is telling the MUART whether an RCVDS is attached and ACTIVE.

Maybe, there is an RCVDS connected but not switched on.

°P1.3 : Input, connected with the COIN-info from the vertical defl. board
It tells the 8088 via the MUART that the projector is locked to the incoming frequencies, or, the source is not active.

°P1.4 : Output, is the **SDL** output (via a NAND-gate in IC12) of the I2C bus.

°P1.5 : Input, is connected to the SDL of the I2C bus (acknowledge bit).

°P1.6 : Output, is the **SC**L output (via a NAND-gate in IC12) of the I2C bus.

°P1.7 : Input, for the communication with the TAC block.

In the Muart we find three timers :

a) The first timer is the 'general' timer.
b) The second one is a 16mS timer and is used to write informations into the E2PROM IC8.
c) The third one is used for the display of the "WARNING" on the screen.

° COIN : is connected to the EXINT (EXternal INTerrupt) of the MUART (pin 16)

and is indeed required in the event of a ' breakdown ' of a source. An active source can all of a sudden be interrupted. The 8088 has then as task to inform the user of this interruption.

Other IC's of the 8088 block hardware:

- IC5 : is a 4 bit bistable latch, and used for filtering (selecting) the addresses 16-18 out of the multiplexed bus. As can be seen, the latch enables are driven by the ALE of the uP.

- IC6 : is a PAL (Programmable Array Logic): used for address -decoding.

- IC7 : RAM memory to stock info of the uP on a temporary basis.

- IC8 : EEPROM (Erasable Electrically Programmable ROM) or E2PROM currently referred to. In this memory we find the settings of the selected sources, up to 38 in total.

- IC9 : EPROM that contains the program of the 8088 uP chip.

- IC10: Octal Bus Transceivers and Registers, with three state O/P and true logic. This one is performing the communication with the TAC.

- IC11: Quad D-type Flip Flop : in connection with the TAC (lines Cta0 and Cta1) and with the RWI.

- IC12: CMOS Quad NAND gate with open drain : as already mentioned is used for the I2C bus interfacing, as a buffer.

II. HARDWARE OF THE RWI (REAL WORLD INTERFACE) :

The 8-bit microcontroller 8031 with its multiplexed address and data bus is the main chip of this block. The PROM IC54 contains the program instructions for this microcontroller.

The serial communication lines arrive at the appropriated in- and outputs (RXD/ TXD/TO and T1).

P0 : is the multiplexed data/address bus, the addresses are filtered out by IC46.

P1 : are the control signals as explained hereafter and P2 is responsible for the High Address bits.

Control signals :

° P1.0 and P1.1 : inputs for checking the position of the dip-switches (see functional description).
One of the outputs of the IC51 (octal D-type latches) is sequentially switched low by 'memory mapping' in order to check two dip switches.
Note that the 80C31 has 'pull-up' resistors at the inputs.

° P1.2 : connected with the VSI info to identify the vertical scanning (table or ceiling).

° P1.3 : connected with the HSI info to identify the horizontal scanning (front or rear).

° P1.4 : Output that controls the SMPS , Stand-by/Operation.

° P1.5 : is connected to the +5 volts of the SMPS in order to tell the 8088 whether the projector is in standby or fully operational.

° P1.6 : Output for communication with the uP to inform the latter on the baud rate.

° P1.7 : Input : Pmu11 ; for communication with the 8088.

P2 is responsible for the higher address bits, only 6 ports are used (Prw2) for memory mapping:

Prw21 combined with a WR pulse, controls IC51.

Prw20 combined with a WR and RD to control IC50.

Prw22 combined with a WR pulse for the NMI of the 8088 and TAC blocks. (see also memory mapping below).

Clock frequencies : The oscillator at 18.432 Mhz is divided by 2 and by 6 in order to obtain the clock freq. for the 8031 (9.216 MHZ) and a frequency for the MUART on the 8088 block (3.072MHZ).

*IC54 contains the program of the microcontroller 8031.

With memory mapping and address decoding following devices are controlled with the gates in IC39, IC49 and IC48 :

* IC51 : (Prw21) 8x D-type latches; input is the Prw0 port of the 8031.
Check of the dip switches and to drive the leds.
The scanning cycle is very small and thus not visible to the user.

* IC50 :(Prw20) communication with the 8088 block.

* NMI : (PRw22: this signal is connected with the NMI of the 8088 and used to 'boot' the latter.

This booting happens at the moment the power supply is fully on and when the RWI does not get any correct answer from the 8088 block.

The NMI and Pmu10 are buffered with gates from the IC39 , whereas the other input is pulled up to the +5 volts. This means that these high signals cannot get through in stand-by to the rest of the controller.

III. HARDWARE OF THE TAC : In this block, we find again as main item, the 8031 microcontroller (IC21) responsible for the communication with the 8088.

The program for the controller is in the PROM IC19.

IC20 filters the addresses out of the multiplexed bus.

The ucontroller contains two internal timers that are used for measuring the period of the horizontal and vertical sync signals (in the measurement mode).

In the generator mode, one of the timers is used for the generation of the vertical syncs.

The horizontal syncs are generated by IC17 and a flip-flop in IC 16.

The 24 Mhz from the 8088 is divided by the second flip-flop and is then the clock for the microcontroller 8031.

The TXT (TextGenerator) must be told at any time, the actual scanning frequencies in order to reproduce the text in a constant format.

Assume the line frequency is increasing and the vertical period stable, the text generator must 'add' lines to keep the same height of the characters.

a) Frequency counter :

1. Vertical period:

For measuring the vertical period, a counter in the 8031 (counter 1) just counts how many lines (=hor syns) there are during a vertical period.
The HSmf (=standard HS pulses from the TXT block) pulses are sent to T1 (counter input). VSmf is applied to an interrupt INTO, thus causing an interrupt, reading out the counter, and, reset the counter 1 of the 8031.

The number of lines per vertical period is thus continuously counted, and the result is sent to the 8088 block.

2. Horizontal period :

The required resolution does not allow the use of a counter in the 8031, as the maximum frequency of the latter is 500 khz, allowing a resolution of 2 uS only.

The horizontal frequency is divided by 16 with IC45 (2x binary resettable 4 bit counter or dividers) just after a vertical flyback.

The HSmf is applied to the clock input pin 13 of IC45. This divider is reset and starts counting with the clear info from the the port P1.7 of IC21, this is just after a vertical flyback.

At the output pin 8 we get a 'high' pulse during 8 lines (and a 'low' during 8 lines).

These 8 horizontal pulses are now one input of the NAND gate in IC32.

The mentioned output is equally input to the P1.6 port (pin 7) and the 8031 will now put the other input of the NAND gate high to reset the other 4-bit divider in IC45.

The clock of this divider is the PCL (4 Mhz). This divider now divides the 4 Mhz by 8 and consequently we get 500 khz pulses at pin 2 of IC13.

Now, the 8031 causes a reset of this counter via the P1.5 port, by pulling pin 1 of IC32 at low level.

The 500 khz pulses pass through IC13 (other input is high, no HSO pulses) and a number of the 500 khz pulses are applied to TO, input of a counter.

As result, the counter in the 8031 counts how many clock pulses at 500 khz there are during 8 lines.
The resolution for one line is thus 400khz/8 = 250 nS.

b) Sync pulse generation :

1. Vertical sync :

Timer 0 is utilised for the generation of the vertical sync pulses. The input TO receives the HSO pulses via the OR gate in IC13 (the other input of this gate is always low in the generation mode).
This counter TO receives by software a preset value (from the 8088 block).

At overflow of this counter an interrupt is produced loading the preset value again into the counter and by memory mapping using P2.4 (part of the address bus) and a write pulse WR the GAL IC15 brings its pin 12 low and resets the divider in IC14. The clock of this counter is the HSO pulses (via the OR-gate).

The output pin 8 comes high during 8 clock pulses (this is 8 x 2uS = 16 uS) and produces the vertical pulse VSO.

When the output switches low, the counter is 'blocked' via the feedback to pin 13 of IC32. In the above explanation we used the horizontal pulses to generate the vertical pulse. We'll see later how we generate this vertical pulse.

By changing the preset value of the counter in the microcontroller by software, we can generate a vertical pulse as a multiple of the horizontal pulses.

2. Horizontal pulse generation.

The speed of the counters in the 8031 is too low, we use the presettable divider by 255 (IC17, 8 bit counter) for the generation, together with a divider by 16 in IC14.

The IC17 receives a preset value (Dta0-Dta7) from the 8031 via memory mapping. At overflow at pin 9, the preset value is re-loaded via a FF in IC16. Pin 5 of IC16 is connected to the CLOAD of IC17.

The other output of the FF is starting the divider in IC14 with a clock of 4Mhz (PCL, via the OR gate). As a result, the output is high for 8 clock pulses of the 4 Mhz clock, thus for 2 uS.

As this output switches low after 8 pulses, the clock at 4 Mhz is 'disconnected' via the OR-gate in IC13. A HSO pulse of 2 uS is generated and is sent to pin 1 of another OR gate in IC13 and from there to the TO of the microcontroller where we use these pulses for the generation of the vertical pulses (see vert. sync generation).

It is obvious that the horizontal sync period can be modified by altering the preset value read in the presettable 8 bit counter IC17 and this is software controlled.

IC 18 is loaded with a value for the TXT (text generator) necessary to guarantee a constant blanking time irrespective of the scanning frequencies, to determine the frequency of the pixelrate and the position of the text.

The GAL IC15 communicates with the 8088 block.

IV. HARDWARE OF THE TEXTGENERATOR.

The textgenerator must be capable of displaying a text locked to the frequency ranges (15 - 92khz, and 45 - 100hz).

Irrespective of these frequencies, the text should always have the same size. Suppose a character needs 8 lines at 15khz, this same character will need 16 lines at 32khz.

Obviously, the textgenerator is "line-oriented" (we mean here a scanning line).

Such a line consists of 256 pixels, or, 32 characters of 8 pixels each.

These lines of pixels are stored in a RAM , the TXT-RAM (IC30). This RAM is a 8kx8, thus can contain 256 lines of information.

The address of this TXT-RAM consists of two informations :

1. The least significant part is a 5 bit info, delivered by the PLL (see later) and indicate the position on the screen. Therefore, Adr15 is applied to the GAL IC44.

2. The most significant part consists of 8 bits (a byte) and indicates which line must be adressed. This information is delivered by another RAM, the MAP-RAM.

The MAP-RAM is on its turn addressed by a 12 bit line counter (IC33), telling the MAP-RAM the actual scanning line at any moment. This MAP-RAM is clocked by the HSmf pulses and reset by the VSmf pulses.

Concrete, this memory (MAP-RAM) 'maps' any line in the horizontal scan to a line in the TXT-RAM. As the MAP-RAM is also a 8Kx8 RAM, it can handle 8192 scanning lines !

Programming of these RAMs is done by the 8088 block via buffer-latches.

IC27 buffers the data bus and IC22, IC23 the address bus.

These latches are written by the 8088 with the TXT signal.

Address 15 plays here an important role :
- when Adr15 = 1 , then data is destined to MAP-RAM.
- when ADr15 = 0 , then data is destined to TXT-RAM.
Therefor, Adr15 is applied to the GAL IC44.

IC31 is a double monoflop used to standardise the width of the sync pulses.

IC33 is a 12 bit counter for the scanning horizontal lines, and, its output is buffered by IC24 and IC25.

IC28 is equally a buffer for the data from the MAP-RAM, this latch is clocked with an output of the GAL IC44 at the moment the output of the MAP-RAM is stable.

IC26 is a buffer for the 5 bit info from the PLL, necessary for the horizontal position of the text.

Finally, IC34 is a parallel-serial register converting the parallel bits from the TEXT-RAM to a pixelstream.
This register is clocked with the PXL (pixel frequency) from the PLL (see later).

The bytes out of this register can also be control bytes, in order to determine the colour of the text and the mode of INS (coincident with the R, G, and B or high as soon one of the colours is high, to create a window).

A correct sequence is here necessary to reproduce the exact pixelstream. Two GAL's are used, the IC44 and IC43 :

a) At a negative transition of a HSmf pulse, the EN (output enable) of the latches IC22, IC23 and IC27 are active and put the address and data of the 8088 on the address bus of the RAM's. Note that Adr15 can determine in which RAM the data is written.

This means that the 8088 block must write once per line to the latches.

b) The EN of the latches IC24 and IC25, containing the line number, are now active and the 12 bit is now put on the address bus of the RAM's to address the MAP-RAM.

c) As soon the data from the MAP-RAM is stable, the data is latched into the buffer IC28.

d) Finally, the TXT-RAM is addressed with the following:

- the byte from the MAP-RAM, this is the output of the latch IC28.
- the 5 bit from the PLL available at the latch IC26.

The GAL's have as task to produce the clock pulses for the latches, to filter the control bytes from the TXT-RAM and to decode the Ro, Bo and Go signals with the aid of the control bytes.

V. PLL (PHASE LOCKED LOOP).

Although the PLL is located on a separate board, we have to discuss it together with the textgenerator.

The PLL has in fact three tasks :

a) To determine the horizontal position of the text on the screen (Hpl0 - Hpl7).

b) To reproduce the PXL frequency for the parallel-serial register, thus, to determine the pixelstream frequency (related obviously to the scanning frequencies).

c) The HFB signal, video blanking time (see later).

A PLL consists of a **VCO**, a **Low Pass Filter**, a **Divider** (if necessary) and a **Phase Comparator**.

The VCO is built up around IC4 and the FF's in IC2. Note that the frequency is regulated by Q1 from the LPF output, and, that the transistor Q2 is switched on from the 33khz line frequency onwards.

The divider is IC3 and IC6 (two 4 bit presettable dividers).

The PC (phase comparator) is IC7.

The horizontal position information is a byte (8 bit), thus variable from 0 to 255.

The counter must start after a flyback (HFB) from 0 and must reach 255 at the end of the horizontal period, or, at the start of a flyback.

The TAC block 'knows' the PXL frequency, as it knows the frequencies of the scanning source. This block can thus calculate a byte (Fbt0- Fbt7) that is clocked into the counter each time the flyback starts.

The named counters IC3 and IC6 now count up to 255 and during this time the HFB signal is active and used to blank the Ro, Bo and Go outputs.

At the moment of overflow, the counter starts again at 0 and counts up to 255 (end of the active line time).

The clock frequency of this counter can now be too high or too low, and in both cases this difference will be detected by the phase comparator. Indeed, the latter compares the HS with the HFB signal.

The phase comparator adjusts the VCO frequency (= indirectly the counter frequency) up to the moment the counter reaches exactly 255 in a line period. To reach this exact counting frequency the VCO has to oscillate at the required frequency.

The pixelstream frequency (PXL) is thus at the exact frequency and equally sync locked with HS by the Phase Comparator.

VI. I / O AND POWER SUPPLY.

The input signals may be TTL compatible, open collector or vary between 0 and 12 Volts, a resistive divider or pull up resistor is provided.

All inputs are protected against arcing with two diodes, and buffered with a hysteresis input (74LS14).

The outputs are equally buffered with bipolar buffers, a 100 Ohm resistor and two parallel diodes.

The supply voltages are filtered, and protected with zener diodes.

Note that D75 is connected directly to the + 8 volts of the main power supply which is thus not lit in Standby.

The other diode D76 is connected with the +9 volts standby and thus lit in standby as well.

The HP pulses are taken from the subunit of the vertical deflection board .

ITEM NO.	SIT.	DESCRIPTION
76 1756		UN CTRL PJ 49 GR800 SUB (PPL)
11 2774	C..1	C CE MI 100K U5 63
11 2774	C..2	C CE MI 100K U5 63
11 2774	C..3	C CE MI 100K U5 63
11 2774	C..4	C CE MI 100K U5 63
11 2774	C..5	C CE MI 100K U5 63
11 2774	C..6	C CE MI 100K U5 63
11 2774	C..7	C CE MI 100K U5 63
11 2774	C..8	C CE MI 100K U5 63
11 2774	C..9	C CE MI 100K U5 63
11 2774	C.10	C CE MI 100K U5 63
11 1550	C.11	C ELPRMI 4M7 M5 50
11 2774	C.12	C CE MI 100K U5 63
11 2774	C.13	C CE MI 100K U5 63
11 2774	C.14	C CE MI 100K U5 63
11 2774	C.15	C CE MI 100K U5 63
11 2774	C.16	C CE MI 100K U5 63
11 2774	C.17	C CE MI 100K U5 63
11 2739	C.18	C CE MI 1K K5 63
11 2774	C.19	C CE MI 100K U5 63
11 2774	C.20	C CE MI 100K U5 63
11 2774	C.21	C CE MI 100K U5 63
11 2774	C.22	C CE MI 100K U5 63
11 2774	C.23	C CE MI 100K U5 63
11 2774	C.24	C CE MI 100K U5 63
11 2774	C.25	C CE MI 100K U5 63
11 2774	C.26	C CE MI 100K U5 63
11 2774	C.27	C CE MI 100K U5 63
11 2774	C.28	C CE MI 100K U5 63
11 1476	C.29	C ELPR 47M Z5 25
11 2774	C.30	C CE MI 100K U5 63
11 2774	C.31	C CE MI 100K U5 63
11 3726	C.32	C POMEFF 150K K5 63
11 2774	C.34	C CE MI 100K U5 63
11 2774	C.35	C CE MI 100K U5 63
11 2774	C.36	C CE MI 100K U5 63
11 2774	C.37	C CE MI 100K U5 63
11 2774	C.38	C CE MI 100K U5 63
11 2774	C.39	C CE MI 100K U5 63
11 2364	C.40	C N750MI 150P J5 63
11 2774	C.41	C CE MI 100K U5 63
11 2739	C.42	C CE MI 1K K5 63
11 2774	C.43	C CE MI 100K U5 63
11 2774	C.45	C CE MI 100K U5 63
11 2774	C.46	C CE MI 100K U5 63
11 2774	C.47	C CE MI 100K U5 63
11 2774	C.48	C CE MI 100K U5 63
11 2774	C.50	C CE MI 100K U5 63
11 2774	C.51	C CE MI 100K U5 63
11 2774	C.52	C CE MI 100K U5 63
11 2774	C.53	C CE MI 100K U5 63
11 2774	C.54	C CE MI 100K U5 63
11 1546	C.55	C ELPRMI 1M M5 50
11 2387	C.57	C N152MI 470P J5 63
11 1546	C.58	C ELPRMI 1M M5 50
11 37121	C.59	C POMEFF 10K K5 100
11 3724	C.60	C POMEFF 100K K5 63
11 1477	C.61	C ELPR 100M Z5 25
11 3730	C.62	C POMEFF 330K K5 63
11 1477	C.63	C ELPR 100M Z5 25
11 1465	C.64	C ELPR 47M Z5 16
11 3730	C.65	C POMEFF 330K K5 63
11 1477	C.66	C ELPR 100M Z5 25
11 3730	C.67	C POMEFF 330K K5 63
11 3730	C.68	C POMEFF 330K K5 63

ITEM NO.	SIT.	DESCRIPTION
13 1621	D..1	D 1N4148 SWITCH
13 1621	D..2	D 1N4148 SWITCH
13 1621	D..3	D 1N4148 SWITCH
13 1621	D..4	D 1N4148 SWITCH
13 1621	D..5	D 1N4148 SWITCH
13 1621	D..6	D 1N4148 SWITCH
13 1621	D..7	D 1N4148 SWITCH
13 1621	D..8	D 1N4148 SWITCH
13 1621	D..9	D 1N4148 SWITCH
13 1621	D.10	D 1N4148 SWITCH
13 1621	D.11	D 1N4148 SWITCH
13 1621	D.12	D 1N4148 SWITCH
13 1621	D.13	D 1N4148 SWITCH
13 1621	D.14	D 1N4148 SWITCH
13 1621	D.15	D 1N4148 SWITCH
13 1621	D.16	D 1N4148 SWITCH
13 1621	D.17	D 1N4148 SWITCH
13 1662	D.18	D LED D3 RED
13 1662	D.19	D LED D3 RED
13 1662	D.20	D LED D3 RED
13 1662	D.21	D LED D3 RED
13 1662	D.22	D LED D3 RED
13 1662	D.23	D LED D3 RED
13 1662	D.24	D LED D3 RED
13 1662	D.25	D LED D3 RED
13 1621	D.26	D 1N4148 SWITCH
13 1621	D.27	D 1N4148 SWITCH
13 1621	D.28	D 1N4148 SWITCH
13 1621	D.29	D 1N4148 SWITCH
13 1621	D.30	D 1N4148 SWITCH
13 1621	D.31	D 1N4148 SWITCH
13 1621	D.32	D 1N4148 SWITCH
13 1621	D.33	D 1N4148 SWITCH
13 1621	D.34	D 1N4148 SWITCH
13 1621	D.35	D 1N4148 SWITCH
13 1621	D.36	D 1N4148 SWITCH
13 1621	D.37	D 1N4148 SWITCH
13 1621	D.38	D 1N4148 SWITCH
13 1621	D.39	D 1N4148 SWITCH
13 1621	D.40	D 1N4148 SWITCH
13 1621	D.41	D 1N4148 SWITCH
13 1621	D.42	D 1N4148 SWITCH
13 1621	D.43	D 1N4148 SWITCH
13 1621	D.44	D 1N4148 SWITCH
13 1621	D.45	D 1N4148 SWITCH
13 1621	D.46	D 1N4148 SWITCH
13 1621	D.47	D 1N4148 SWITCH
13 1621	D.48	D 1N4148 SWITCH
13 1621	D.49	D 1N4148 SWITCH
13 1621	D.50	D 1N4148 SWITCH
13 1621	D.51	D 1N4148 SWITCH
13 1621	D.52	D 1N4148 SWITCH
13 1621	D.53	D 1N4148 SWITCH
13 1621	D.54	D 1N4148 SWITCH
13 1621	D.55	D 1N4148 SWITCH
13 1621	D.56	D 1N4148 SWITCH
13 1621	D.57	D 1N4148 SWITCH
13 1621	D.58	D 1N4148 SWITCH
13 1621	D.59	D 1N4148 SWITCH
13 1621	D.60	D 1N4148 SWITCH
13 1621	D.61	D 1N4148 SWITCH
13 1621	D.62	D 1N4148 SWITCH
13 1621	D.63	D 1N4148 SWITCH
13 1621	D.64	D 1N4148 SWITCH
13 1621	D.65	D 1N4148 SWITCH
13 1621	D.66	D 1N4148 SWITCH
13 1621	D.67	D 1N4148 SWITCH

ITEM NO.	SIT.	DESCRIPTION
13 1621	D.68	D 1N4148 SWITCH
13 1621	D.69	D 1N4148 SWITCH
13 1621	D.70	D 1N4148 SWITCH
13 1621	D.71	D 1N4148 SWITCH
13 1621	D.72	D 1N4148 SWITCH
13 1621	D.73	D 1N4148 SWITCH
13 1621	D.74	D 1N4148 SWITCH
13 1662	D.75	D LED D3 RED
13 1662	D.76	D LED D3 RED
13 1621	D.77	D 1N4148 SWITCH
13 1621	D.78	D 1N4148 SWITCH
13 1636	D.79	D BAT43,(85) SCHOTTKY
13 1621	D.80	D 1N4148 SWITCH
13 1621	D.81	D 1N4148 SWITCH
13 1621	D.82	D 1N4148 SWITCH
13 1644	D.83	D 1N4001 50V/1A
13 7192	I..1	U 8284A CL GEN,DRIV CPU
13 7191	I..2	U 8088 CPU
13 7274	I..3	U 8256AH MUART
13 7002	I..4	U 74HCT573 8X LATCH
13 7518	I..5	U 74LS375 4B BIST LATCH
32 8045	I..6	IC SOFT CTRL GADEC V102 137530
13 7271	I..7	U 6264-150NS RAM
13 7184	I..8	U 28C64 EPROM
32 80523	I..9	IC SOFT CTRL GCTRL V203 137185
13 7000	I.10	U 74HCT646 8XBUS TRANC/REG
13 7541	I.11	U 74HCT175 4X D FLIP FLOP
13 7005	I.12	U 74HCT03 4X 2NAND GATE
13 7546	I.13	U 74HCT32 4X 2I OR GATE
13 7562	I.14	U 74HCT393 2X BIN COUNT
32 8047	I.15	IC SOFT CTRL GTMOD V101 137530
13 7548	I.16	U 74HCT74 2X D FLIP FLOP
13 7517	I.17	U 74LS592 8B BIN COUNT
13 7002	I.18	U 74HCT573 8X LATCH
32 8054	I.19	IC SOFT CTRL GTAC V203 137194
13 7002	I.20	U 74HCT573 8X LATCH
13 7190	I.21	U 8031AH CPU
13 7002	I.22	U 74HCT573 8X LATCH
13 7002	I.23	U 74HCT573 8X LATCH
13 7550	I.24	U 74HCT541 8X BUF/L DRIV
13 7550	I.25	U 74HCT541 8X BUF/L DRIV
13 7550	I.26	U 74HCT541 8X BUF/L DRIV
13 7002	I.27	U 74HCT573 8X LATCH
13 7567	I.28	U 74HCT574 8X D FLIP FLOP
13 7271	I.29	U 6264-150NS RAM
13 7271	I.30	U 6264-150NS RAM
13 73325	I.31	U 4098B 2XMONOST MULTIV
13 7534	I.32	U 74HCT00 4X 2I NAND GATE
13 7099	I.33	U 74HCT4040 12B BIN COUNT
13 7579	I.34	U 74F166 SHIFT REGIST
13 7541	I.35	U 74HCT175 4X D FLIP FLOP
13 7550	I.36	U 74HCT541 8X BUF/L DRIV
13 7516	I.37	U 74LS242 4XBUS TRANC INV
13 7353	I.38	U 74LS14 6X STRIG
13 7537	I.39	U 74HCT08 4X 3I NAND GATE
13 4030	I.40	U 2940CT5 +05V/1A5 STAB
13 7353	I.41	U 74LS14 6X STRIG
13 4001	I.42	U 7805 +05V/1A STAB
32 8039	I.43	IC SOFT CTRL *TXT1 V100 137529
32 80402	I.44	IC SOFT CTRL *TXT2 V102 137529
13 7562	I.45	U 74HCT393 2X BIN COUNT
13 7002	I.46	U 74HCT573 8X LATCH
13 7193	I.47	U 80C31AH CPU
13 7536	I.48	U 74HCT04 HEX INV
13 7534	I.49	U 74HCT00 4X 2I NAND GATE
13 7544	I.50	U 74HCT245 8X BUS TRANSC
13 7002	I.51	U 74HCT573 8X LATCH

ITEM NO.	SIT.	DESCRIPTION
13 4114	I.52	U 393 DUAL VOLT COMP
13 7495	I.53	U 74LS92 DIV BY 12 COUNT
32 8053	I.54	IC SOFT CTRL GRWI V112 137194
13 7548	I.55	U 74HCT74 2X D FLIP FLOP
31 3925	J..1	J CT-MT MBT P 5 2
31 3487	J.U9	J U FBT P32 0.6TULIP
31 3928	J2..	J CT-MT MBT P 8 2
31 3927	J3..	J CT-MT MBT P 7 2
31 3926	J5..	J CT-MT MBT P 6 2
31 3952	J7..	J CT-MT MBS P12 2
31 3955	J8..	J CT-MT MBS P15 2
77 3215	L..1	COIL CHOKE SMP
77 3028	L..2	COIL CHOKE SMP TV 31
77 3215	L..3	COIL CHOKE SMP
71 6552	PC..	PCB PJ 49 CTRL *800 761773
13 14182	Q..1	Q BC559C P 30 / 0A1
13 1411	Q..2	Q BC549C N 30 / 0A1
13 14071	Q..3	Q BC547B N 45 / 0A1
13 14071	Q..5	Q BC547B N 45 / 0A1
10 1133	R..1	R CF H560E J 0W25
10 1133	R..2	R CF H560E J 0W25
10 1169	R..3	R CF H560K J 0W25
10 1136	R..4	R CF H 1K J 0W25
10 1120	R..5	R CF H 47E J 0W25
10 1138	R..6	R CF H 1K5 J 0W25
10 1138	R..7	R CF H 1K5 J 0W25
10 1120	R..8	R CF H 47E J 0W25
10 1145	R..9	R CF H 5K6 J 0W25
10 1147	R.10	R CF H 8K2 J 0W25
10 1120	R.12	R CF H 47E J 0W25
10 1120	R.13	R CF H 47E J 0W25
10 1548	R.14	R MF H 10K F 0W4 E2
10 1160	R.15	R CF H100K J 0W25
10 1144	R.16	R CF H 4K7 J 0W25
10 1183	R.17	R CF H 8M2 J 0W25
10 1155	R.18	R CF H 39K J 0W25
10 1154	R.19	R CF H 33K J 0W25
10 1159	R.20	R CF H 82K J 0W25
10 1148	R.21	R CF H 10K J 0W25
10 1152	R.22	R CF H 22K J 0W25
10 1148	R.23	R CF H 10K J 0W25
10 1163	R.25	R CF H180K J 0W25
10 1144	R.26	R CF H 4K7 J 0W25
10 1148	R.27	R CF H 10K J 0W25
10 1180	R.28	R CF H 4M7 J 0W25
10 1120	R.29	R CF H 47E J 0W25
10 1120	R.30	R CF H 47E J 0W25
10 1120	R.31	R CF H 47E J 0W25
10 1120	R.32	R CF H 47E J 0W25
10 1155	R.33	R CF H 39K J 0W25
10 1135	R.34	R CF H820E J 0W25
10 1135	R.35	R CF H820E J 0W25
10 1135	R.36	R CF H820E J 0W25
10 1135	R.37	R CF H820E J 0W25
10 1135	R.38	R CF H820E J 0W25
10 1135	R.39	R CF H820E J 0W25
10 1135	R.40	R CF H820E J 0W25
10 1135	R.41	R CF H820E J 0W25
10 1124	R.42	R CF H100E J 0W25
10 1124	R.43	R CF H100E J 0W25
10 1124	R.44	R CF H100E J 0W25
10 1124	R.45	R CF H100E J 0W25
10 1124	R.46	R CF H100E J 0W25

ITEM NO.	SIT.	DESCRIPTION	
10 1136	R.47	R CF H 1K J 0W25	
10 1124	R.48	R CF H100E J 0W25	
10 1136	R.49	R CF H 1K J 0W25	
10 1124	R.50	R CF H100E J 0W25	
10 1136	R.51	R CF H 1K J 0W25	
10 1146	R.52	R CF H 6K8 J 0W25	
10 1133	R.53	R CF H560E J 0W25	
10 1135	R.54	R CF H820E J 0W25	
10 1131	R.56	R CF H390E J 0W25	
10 1136	R.57	R CF H 1K J 0W25	
10 1155	R.58	R CF H 39K J 0W25	
10 1128	R.59	R CF H220E J 0W25	
10 1124	R.60	R CF H100E J 0W25	
10 1124	R.61	R CF H100E J 0W25	
10 1124	R.62	R CF H100E J 0W25	
10 1124	R.63	R CF H100E J 0W25	
10 1124	R.64	R CF H100E J 0W25	
10 1124	R.65	R CF H100E J 0W25	
10 1124	R.66	R CF H100E J 0W25	
10 1124	R.67	R CF H100E J 0W25	
10 1124	R.68	R CF H100E J 0W25	
10 1124	R.69	R CF H100E J 0W25	
10 11907	R.71	R CFFH E10J 0W4	
10 11008	R.72	R CFFH 1E J 0W25	0207
10 3718	R.73	R WW H 15E K 5W	
10 1100	R.74	R CF H 1E J 0W25	211
10 1124	R.75	R CF H100E J 0W25	
10 1124	R.76	R CF H100E J 0W25	
10 1167	R.77	R CF H390K J 0W25	
10 1124	R.78	R CF H100E J 0W25	
10 1136	R.79	R CF H 1K J 0W25	

ITEM NO.	SIT.	DESCRIPTION	
10 1136	R.80	R CF H 1K J 0W25	
10 1136	R.81	R CF H 1K J 0W25	
10 1136	R.82	R CF H 1K J 0W25	
10 1136	R.83	R CF H 1K J 0W25	
10 1120	R.84	R CF H 47E J 0W25	
10 1120	R.85	R CF H 47E J 0W25	
10 1120	R.86	R CF H 47E J 0W25	
10 1120	R.87	R CF H 47E J 0W25	
10 1120	R.88	R CF H 47E J 0W25	
10 1120	R.89	R CF H 47E J 0W25	
10 1120	R.90	R CF H 47E J 0W25	
10 1120	R.91	R CF H 47E J 0W25	
10 1120	R.92	R CF H 47E J 0W25	
10 1120	R.93	R CF H 47E J 0W25	
32 4184	S..1	SWITCH DIL 1A 8P T	
32 4184	S..2	SWITCH DIL 1A 8P T	
10 11008	SR70	R CFFH 1E J 0W25	0207
30 6858	XT.1	X-TAL 24,000 000 MHZ 5MM	
30 6857	XT.2	X-TAL 18,432 000 MHZ 5MM	
13 1734	Z..1	D ZENER 5V6 0W5 B	
13 1740	Z..2	D ZENER 12V 0W5 C	
13 1744	Z..3	D ZENER 5V6 0W5 C	
13 1740	Z..4	D ZENER 12V 0W5 C	
13 1744	Z..5	D ZENER 5V6 0W5 C	
13 1730	Z..6	D ZENER 20V 0W5 C	

CONTROLLER MODULE 76 1773

ART.NO.	DESCRIPTION	QUANTITY
10 11008	R CFFH 1E J 0W25 0207	2
10 1180	R CF H 4M7 J 0W25	1
10 11907	R CFFH E10J 0W4	1
10 1548	R MF H 10K F 0W4 E2	1
10 3718	R WW H 15E K 5W	*1
11 3726	C POMEFF 150K K5 63	1
13 14071	Q BC547B N 45 / 0A1	2
13 1411	Q BC549C N 30 / 0A1	1
13 14182	Q BC559C P 30 / 0A1	1
13 1621	D 1N4148 SWITCH	71
13 1636	D BAT43,(85) SCHOTTKY	1
13 1644	D 1N4001 50V/1A	1
13 1662	D LED D3 RED	*10
13 1730	D ZENER 20V 0W5 C	1
13 1734	D ZENER 5V6 0W5 B	1
13 1740	D ZENER 12V 0W5 C	2
13 1744	D ZENER 5V6 0W5 C	2
13 4001	U 7805 +05V/1A STA	1
13 4030	U 2940CT5 +05V/1A5 STA	1
13 4114	U 393 DUAL VOLT COM	1
13 7000	U 74HCT646 8XBUS TRANC/RE	1
13 7002	U 74HCT573 8X LATC	8
13 7005	U 74HCT03 4X 2NAND GAT	1
13 7099	U 74HCT4040 12B BIN COUN	1
13 7184	U 28C64 EPRO	1
13 7185	U 27C512 EPRO	1
13 7190	U 8031AH CP	1
13 7191	U 8088 CP	1
13 7192	U 8284A CL GEN,DRIV CP	1
13 7193	U 80C31AH CP	1
13 7194	U 27C64A EPRO	2
13 7271	U 6264-150NS RA	3
13 7274	U 8256AH MUAR	1
13 73325	U 4098B 2XMONOST MULTI	1
13 7353	U 74LS14 6X STRI	2
13 7495	U 74LS92 DIV BY 12 COUN	1
13 7516	U 74LS242 4XBUS TRANC IN	1
13 7517	U 74LS592 8B BIN COUN	1
13 7518	U 74LS375 4B BIST LATC	1
13 7529	U 16V8A-15GAL GEN ARRAY LO	2
13 7530	U 16V8-25 GAL GEN ARRAY LO	2
13 7534	U 74HCT00 4X 2I NAND GAT	2
13 7536	U 74HCT04 HEX IN	1
13 7537	U 74HCT08 4X 3I NAND GAT	1
13 7541	U 74HCT175 4X D FLIP FLO	2
13 7544	U 74HCT245 8X BUS TRANS	1
13 7546	U 74HCT32 4X 2I OR GAT	1
13 7548	U 74HCT74 2X D FLIP FLO	2
13 7550	U 74HCT541 8X BUF/L DRI	4
13 7562	U 74HCT393 2X BIN COUN	2
13 7567	U 74HCT574 8X D FLIP FLO	1
13 7579	U 74F166 SHIFT REGIS	1
30 6857	X-TAL 18,432 000 MHZ 5MM	*1
30 6858	X-TAL 24,000 000 MHZ 5MM	*1
31 3487	J U FBT P32 0.6TULIP	1
31 3551	J U FBT P20 0.3	1
31 3925	J CT-MT MBT P 5 2	1
31 3926	J CT-MT MBT P 6 2	*1
31 3927	J CT-MT MBT P 7 2	*1
31 3928	J CT-MT MBT P 8 2	*1
31 3952	J CT-MT MBS P12 2	*1
31 3955	J CT-MT MBS P15 2	*1
31 5302	J PIN MBT D 1,3 L 5,5+3	4
32 4184	SWITCH DIL 1A 8P T	*2
34 8019	WIRE TIE L100	7
34 8071	WIRE TIE MOUNT TM1S6	1
34 8089	FASTENER WIRE SLCSE DIA 5,6	5
36 20226	SCREW DIN84 M 3 X 8 MP-	2
36 26696	SCREW DIN921 M 3 X 8 MP-	15
36 6102	NUT DIN934 M 3 HEXAGO	2
36 7454	RIVET P AL FE TAP/D/BS44 D3,	8
36 7502	WASHER DIN6798 A 3,2	2
72 2209	FIX PJ 49 LED CTRL	1
72 2226	FIX PJ 49 CTRL CABLE	2
76 1756	UN CTRL PJ 49 GR800 SUB (PPL)	1
76 1773A	UN CTRL PJ 49 GR800	1
76 1773D	UN CTRL PJ 49 GR800	1
77 3028	COIL CHOKE SMP TV 31	*1
77 3215	COIL CHOKE SMP	*2
80 1602	ISOL MN 40 PAT STRIP XTAL R5	2
80 2613	FRAME PJ 49 CTRL DOWN 0	1
80 2615	FRAME PJ 49 CTRL FIX FRONT	1
80 2616	FRAME PJ 49 CTRL FIX REAR 0	1
80 2618	FRAME PJ 49 CTRL SCREEN FIX	1

*NUMBERS REFERRING TO PICTURE