

Service
Service
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VR666/02/16/39

VR668/02/05/06/16/39

VR768/02/05/16/39/59

VR967/02/16/39/58

VR969/02/05/16/39/58



VR668



VR768



VR967

Service Manual

Contents

Chapter

- 1 Table of contents per page
Survey of features
Survey of PCBs and PCB location
Technical data
Safety instructions
Supplementary service information
Front/rear view of the video recorder
Description of the controls and connections
and direction for use
- 2 Error diagnosis system
Servicing of SMD's
Dismantling of the set
Circuit description
- 3 Electrical adjustment instructions
Survey of abbreviations used
Wiring diagram
Block diagram
PCB layout
Circuit diagrams
Measurements
- 4 Tape deck documentation
Adjustments
Exploded view of the tape deck
Parts list tape deck
- 5 Cabinet exploded view
Parts lists cabinet and PCB's

Safety regulations require that the set be restored to its original condition and that parts which are identical with those specified be used.

Survey of types:

VR666: VHS
VR668: VHS, Front connectors
VR768: VHS, Jog/Shuttle, Flying Erase Head
VR967: S-VHS, Jog/Shuttle,
VR969: S-VHS, Jog/Shuttle, Flying Erase Head, RS232

Survey of versions:

/02	PAL B/G German Stereo
/05	PAL I, NICAM
/16	PAL B/G, NICAM & German Stereo
/39	PAL B/G & SECAM L, NICAM
/58	PAL B/G & SECAM DK
/59	PAL B/G & SECAM DK

Survey of remote controls:

VR666 english:	RT167/101	4822 218 10757
french (/39):	RT167/104	4822 218 10758

VR668, VR768, VR967, VR969 english:	RT567/101	4822 219 10084
french (/39):	RT567/104	4822 219 10085

Survey of tape decks:

VR66x PAL:	WDMT-P4/2	4 Video+ 2 FM-Audio Heads
VR66x SECAM:	WDMT-S4/2	4 Video+ 2 FM-Audio Heads
VR768 PAL:	WDMT-P4/2/1 S	4 Video+ 2 FM-Audio Heads, Jog/Shuttle, Fl. Erase Head
VR768 SECAM:	WDMT-S4/2/1 S	4 Video+ 2 FM-Audio Heads, Jog/Shuttle, Fl. Erase Head
VR967:	WDMT-P4/2 SV	S-VHS, 4 Video+ 2 FM-Audio Heads, Jog/Shuttle
VR969:	WDMT-P4/2/1 SV	S-VHS, 4 Video+ 2 FM-Audio Heads, Jog/Shuttle, Flying Erase Head



Table of contents

	Page	Page
Chapter 1		
TECHNICAL DATA AND FEATURES		
Front page	1-1	
Table of contents	1-2	
Survey of sets and features	1-3	
Survey of sets and PCB's	1-4	
Technical specifications	1-5	
Safety instructions	1-6/7	
Survey of direction for use	1-8	
Remote control	1-9	
Direction for use	1-10/22	
Chapter 2		
TOOLS FOR ERROR DIAGNOSIS		
Dismantling of the set	2-1/3	
Servicing of SMDs	2-4/5	
Error diagnosis system	2-6/12	
Circuit descriptions	2-14/30	
Chapter 3		
PRINTED BOARDS		
Adjustment procedures	3-1/8	
List of abbreviations	3-11/17	
Wiring diagram VHS	3-19	
Wiring diagram VR967	3-20	
Wiring diagram VR969	3-21	
Block diagram analog part S-VHS	3-22	
Block diagram digital part	3-23	
Block diagram analog part VHS	3-24	
<i>Power supply PSM</i>		
PCB drawing PSM	3-26	
Circuit diagram PSM (PS)	3-27	
<i>Front End Board PAL B/G/I</i>		
PCB drawing Front End PAL B/G/I	3-28	
Circuit diagram Front End PAL B/G/I (FE)	3-29	
<i>Front End Board Multistandard</i>		
PCB drawing Front End Multistandard	3-30	
Circuit diagram Front End Multistandard (FE)	3-31	
<i>Mother Board</i>		
PCB drawing Mother Board	3-32/33	
Tuner/Modulator (TM) circuit diagram	3-34	
SECAM Processing (SE) circuit diagram	3-35	
Head Amplifier (HC) circuit diagram	3-36	
Video Signal Processing (VS) circuit diagram	3-37	
Deck Electronics (DE) circuit diagram	3-38	
On Screen Display (OS) circuit diagram	3-39	
Central Control (CC) circuit diagram	3-40	
VPS (VP) circuit diagram	3-41	
<i>Input/Output Board</i>		
PCB drawing Input/Output Board	3-42/43	
In/Out (IO) circuit diagram	3-44	
Audio (AU) circuit diagram	3-45	
<i>VPT Board</i>		
VPT (VT) circuit diagram	3-46	
PCB drawing VPT Board	3-47	
<i>S-VHS Board</i>		
PCB drawing S-VHS Board	3-48/49	
Comb Filter (CF) circuit diagram	3-50	
Luminance Processing (SH) circuit diagram	3-51	
<i>SECAM/PAL Transcoder Board</i>		
PCB drawing SECAM/PAL Transcoder Board	3-52	
Chrominance Processing (SF) circuit diagram	3-53	
Transcoder Part (SP) circuit diagram	3-54	
<i>Key Board PKP31</i>		
PCB drawing, Circuit diagram PKP31	3-55	
<i>Display Control PDCPN4</i>		
PCB drawing PDCPN4	3-56	
Circuit diagram PDCPN4 (DC)	3-57	
<i>Display Control PDCPN3</i>		
PCB drawing PDCPN3	3-58	
Circuit diagram PDCPN3 (DC)	3-59	
<i>Display Control PDCPN2</i>		
PCB drawing PDCPN2	3-60	
Circuit diagram PDCPN2 (DC)	3-61	
<i>Display Control PDCPN1</i>		
PCB drawing PDCPN1	3-62	
Circuit diagram PDCPN1 (DC)	3-63	
<i>Display Control PCUPN1</i>		
Circuit diagram PCUPN1 (DC)	3-64	
PCB drawing PCUPN1	3-65	
Chapter 4		
TAPE DECK		
<i>Deck parts replacement</i>		
Auxiliary tools for deck adjustment	4-1	
Deck layout diagrams	4-2	
Lift	4-2	
Head disc	4-3	
A/C Head	4-4	
Threading motor	4-4	
Capstan motor	4-4	
Pressure roller	4-4	
Roller unit right	4-4	
Roller unit left	4-5	
<i>Adjustments</i>		
Tape path	4-5	
Roller unit left; roller unit right	4-5	
A/C Head	4-5	
Horizontal distance	4-6	
Brake band	4-6	
Tape tension adjustment	4-6	
Friction clutch control	4-6	
Reverse brake control	4-6	
Top view, Underside view	4-7	
<i>Exploded view</i>		
Cleaning and lubrication	4-8/9	
Parts list	4-10	
Chapter 5		
PARTS LIST		
Exploded view of cabinet parts	5-1	
Cabinet parts	5-2	
Front panel parts	5-3/4	
Power supply	5-5	
Front End Board PAL B/G/I	5-6	
Front End Board Multistandard	5-7/8	
Mother Board	5-9/15	
Input/Output Board	5-15/18	
S-VHS Board & Transcoder Board	5-18/22	
Display Control PDCPN4	5-22	
Display Control PDCPN3	5-23	
Display Control PDCPN2	5-24	
Display Control PDCPN1	5-25	
Display Control PCUPN1	5-26	
Complete PCBs, Cables	5-26	
Sockets, Extension Adapter	5-26	

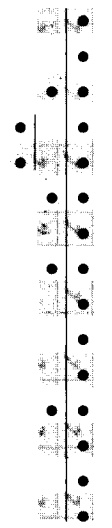
Features

	VR666/02	VR666/16	VR666/39	VR668/02	VR668/05	VR668/06	VR668/16	VR668/39	VR768/02	VR768/05	VR768/16	VR768/39	VR768/59	VR967/02	VR967/16	VR967/39	VR967/58	VR969/02	VR969/05	VR969/16	VR969/39	VR969/58	
Special features	Direct Record analog (WYSIWYR)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Follow TV analog	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Back-up time h	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
	VCR1/VCR2 selection	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	16:9 (via Scart pin 8)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Edit Insert				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Rapid Timecode																				✓	✓	✓
	Time and Date download	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Synchro Time	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Subtitle recording in correct colours				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	EASY LINK (Project 50)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Teletext				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	On Screen Display (without TXT)	✓	✓	✓																			
	Jog/Shuttle									✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Comb filter																		✓	✓	✓	✓	✓
Edit	Synchro Edit				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	RS 232 interface																		✓	✓	✓	✓	
	MEI Edit																		✓	✓	✓	✓	
	LANC Edit									✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Programming	Transm. identif. via VPS/PDC	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Record prep. mode Scart 1&2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	FOLLOW TV (analog)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	PDC	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	VPS	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	
	Gemstar Video+					✓					✓												
	Gemstar Showview	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
Video	SVHS													✓	✓	✓	✓	✓	✓	✓	✓	✓	
	S-VHS Playback (SQPB)				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	NTSC Playback			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Studio Picture Control	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Sound	Sound system: Nicam			✓		✓	✓	✓		✓	✓	✓			✓	✓			✓	✓	✓	✓	
	Sound system: German stereo	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	
Mechanism	Audio only recording	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Audio Dubbing				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Audio Longplay [8h]	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Tape counter linear	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Quick view	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Winding Time E180 90s	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Flying Erase Head																		✓	✓	✓	✓	
	Videoheads	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Tuning	Autoinstall				✓					✓										✓			
	ATS-EURO+	✓			✓				✓					✓				✓			✓	✓	
	Autostore with Preset Allocation		✓	✓		✓	✓	✓		✓	✓	✓	✓		✓	✓	✓			✓	✓	✓	
TV system	PAL BG DK, SECAM BG DK					✓							✓				✓					✓	
	PAL BG, SECAM L-L', SECAM BG			✓			✓					✓					✓					✓	
	PAL I / IRELAND			✓		✓		✓				✓					✓			✓			
	PAL BG	✓	✓		✓		✓		✓		✓			✓	✓			✓		✓			

PCBs & Tape Decks

PSM2B
PSM3

VR666/02 ●
VR666/16 ●
VR666/39 ●
VR668/02 ●
VR668/05 ●
VR668/06 ●
VR668/16 ●
VR668/39 ●
VR768/02 ●
VR768/05 ●
VR768/16 ●
VR768/39 ●
VR768/59 ●
VR967/02 ●
VR967/16 ●
VR967/39 ●
VR967/58 ●
VR969/02 ●
VR969/05 ●
VR969/16 ●
VR969/39 ●
VR969/58 ●



TMP91C642AF O.SW
TMP91C642AF SW
TMP91C642AF SW-L
TMP91C642AF SW-RS

PVT1
PVT2
PVT6

PKP31
PDCPN4
PDCPN3
PDCPN2
PDCPN1
PCUPN1

WDMT-P4/2
WDMT-S4/2
WDMT-P4/2/1 S
WDMT-S4/2/1 S
WDMT-P4/2 SV
WDMT-P4/2/1 SV

POWER SUPPLY

FRONT END BOARD PAL BG/
FRONT END BOARD PAL/SECAM L

MOTHER BOARD

- TM Tuner/Modulator
- SE SECAM
- HC Head Amplifier
- VS Video Signal Processing
- DE Deck Electronics
- OS On Screen Display (not for TXT)
- CC Central Control
- VP VPS / PDC

Deck microprocessor 7085

IN/OUT BOARD

- IO Input/Output
- AU Audio (FM + Linear Audio)

TELETEXT BOARD

S-VHS BOARD

- CF Comb Filter
- SH S-VHS Luminance Processing

TRANSCODER BOARD

- SF S-VHS Chrominance Processing
- SP SECAM/PAL Transcoder

DISPLAY CONTROL

TAPE DECK

27

29 31

34 35

36 37

38 39

40 41

44 45

46

50 51

53 54

55 57

59 61

63 65

Technical Data

Mains voltage
 Mains frequency
 Power consumption:
 with Low Power Standby
 Ambient temperature
 Relative humidity
 Weight
 Fast forward/rewind time
 Position of use
 Video resolution

D

Technische Daten

... Netzspannung
 ... Netzfrequenz
 ... Leistungsaufnahme:
 Standby mit geringem Verbrauch
 Raumtemperatur
 Relative Luftfeuchtigkeit
 Gewicht
 Vor-/Rückspulzeit
 Betriebslage
 Video-Auflösung

Audio

F

Caractéristiques

. Tension secteur 220 – 240 V
 . Fréquence 47 – 63 Hz
 . Puissance absorbée: 18 W during operation
 15 W standby
 avec la fonction veille faible consommation < 1 W
 . Température ambiante +10°C to +35°C
 . Humidité relative 20 – 80 %
 . Poids 5.4 kg
 . Temps (re-)bobinage typ. 95s (E180 cass.)
 . Position d'emploi horizontally, max. 15°
 . Résolution vidéo ≥ 240 lines VHS
 ≥ 400 lines S-VHS
 . Audio SP: 80Hz – 10kHz (±5dB)
 . Audio LP: 80Hz – 5kHz (±5dB)
 . FM Audio: 20Hz – 20kHz (±3dB)

NL

Technische Gegevens

Netspanning
 Netfrequentie
 Opgenomen vermogen: ...
 met Low Power Standby
 Omgevingstemperatuur
 Relatieve vochtigheid
 Gewicht
 Vooruit/terugspoeltijd
 Gebruikspositie
 Oplossend vermogen

E

Datos Tecnicos

Tensión de red
 Frecuencia de red
 Consumo de potencia
 con standby de bajo consumo
 Temperatura ambiente
 Humedad relativa
 Peso
 tiempo de (re-)bobinado
 Posición de uso
 Resolución video


Audio

I

Dati Tecnici

Tensione di alimentazione 220 – 240 V
 Frequenza di rete
 Potenza assorbita:
 18 W during operation
 15 W standby
 in attesa a basso consumo < 1 W
 Temperatura ambiente
 Umidità relativa
 Peso
 Tempo di (ri-)avvolgimento ...
 Posizione di funzionamento ..
 Risoluzione video
 ≥ 240 lines VHS
 ≥ 400 lines S-VHS
 Audio SP:
 Audio LP:
 FM Audio: ...

Safety instructions


- Safety regulations demand that the set be restored to its original condition and that components identical with the original types be used.
- Safety components are marked by the symbol 
- All ICs and many other semi-conductors are susceptible to electrostatic discharges (ESD). Careless handling during repair may reduce life drastically. When repairing, make sure that you are connected with the same potential as the mass of the set via a wrist wrap with resistance. Keep components and tools on the same potential.
 - A set to be repaired should always be connected to the mains via a suitable isolating transformer.
 - Never replace any modules or any other parts while the set is switched on.
 - Use plastic instead of metal alignment tools. This in order to preclude short-circuit or to prevent a specific circuit from being rendered unstable.

Remarks

- The direct voltages and oscillograms ought to be measured relative to the set mass.
- EXCEPTION**
At the power supply, the DC voltages and the oscillograms at the primary side are measured to LIVE GND.
 - The direct voltages and oscillograms mentioned in the diagrams ought to be measured with a colour bar signal and the picture carrier at 503.25 MHz (C25).
 - The oscillograms and direct voltages have been measured in RECORD or PLAY mode.
 - The semiconductors, which are mentioned in the circuit diagram and in the parts lists, are fully exchangeable per position with the semiconductors in the set, irrespective of the type designation of these semiconductors.

Sicherheitshinweise

- Die Sicherheitsvorschriften erfordern es, daß sich das Gerät nach der Reparatur in seinem originalen Zustand befindet und daß die zur Reparatur benutzten Ersatzteile mit den Originalersatzteilen identisch sind.

Sicherheits-Bauteile sind mit der Markierung  versehen

- Alle IC's und Halbleiter sind empfindlich gegen elektrostatische Entladungen (ESD). Unvorschriftsmässige Behandlung von Halbleitern im Reparaturfall kann zur Zerstörung dieser Bauteile oder zu einer drastischen Reduzierung der Lebensdauer führen. Sorgen Sie dafür, daß Sie sich im Reparaturfall über ein Armband mit Widerstand auf dem gleichen Potential, wie die Masse des Gerätes befinden. Alle Bauteile, Werkzeuge und Hilfsmittel sind auf das gleiche Potential zu legen.
- Ein zu reparierendes Gerät ist immer über einen Trenntransformator an die Netzspannung anzuschließen.
- Bei eingeschaltetem Gerät dürfen keine Module oder sonstige Einzelteile ausgetauscht werden.
- Zum Abgleich sind ausschließlich Kunststoffwerkzeuge zu benutzen (keine Metallwerkzeuge verwenden). Dadurch wird vermieden, daß ein Kurzschluß entstehen kann oder eine Schaltung instabil wird.

Anmerkungen

- Die Gleichspannung und Oszillogramme sind gegen Gerätemasse zu messen.
- AUSNAHME**
Beim Netzteil sind die Gleichspannungen und Oszillogramme auf der Primärseite gegen Live GND gemessen.
 - Die Gleichspannungen und Oszillogramme angeführt in den Schaltbildern sollen unter folgenden Bedingungen gemessen werden: Farbbalkensignal, Bildträger auf 503.25 MHz (C25)
 - Die Oszillogramme und Gleichspannungen sind in RECORD oder PLAY gemessen. Die in den Stücklisten aufgeführten Bauteile sind positionsweise voll auswechselbar gegen die Bauteile in dem Gerät, ungeachtet der etwaigen Typenbezeichnungen.

Avertissements

- Les normes de sécurité exigent qu'après réparation l'appareil soit remis dans son état d'origine et que soient utilisées les pièces de rechange identiques à celles spécifiées.

Les composants de sécurité sont marqués 

- Tout les IC et beaucoup d'autres semi-conducteurs sont sensibles aux décharger statiques (ESD). Leur longévité pourrait être considérablement écourté par le fait qu'aucune précaution n'est prise à leur manipulation. Lors de réparations s'assurer de bien être relié au même potentiel que la masse de l'appareil et enfiler le bracelet serti d'une résistance de sécurité. Veiller à ce que les composants ainsi que les outils que l'on utilise soient également à ce potentiel.
- Toujours alimenter un appareil à réparer à travers un transfo d'isolement.
- Ne jamais remplacer les modules ni d'autres composants quand l'appareil est sous tension.
- Pour l'ajustage, utiliser des outils en plastique au lieu d'instruments métalliques. Ceci afin d'éviter les court-circuits et exclure l'instabilité dans certains circuits.

Observations

- La mesure des tensions continues et des oscillogrammes doit se faire par rapport à la terre de l'appareil.
- EXCEPTION**
Sur l'unité d'alimentation la tension continue et l'oscillogramme sont mesurés sur le côté primaire en Live GND.
 - La mesure des tensions continues et des oscillogrammes figurant sur le schéma doit se faire dans un signal de barre couleur porteuse image sur 503.25 MHz (C25).
 - Les oscillogrammes et tension sont mesurées en mode RECORD ou PLAY.
 - Les semi-conducteurs indiqués dans le schéma de principe et à la liste des composants, sont interchangeable par repère sur ce chassis avec les semi-conducteurs de l'appareil quelle que soit la désignation de type donnée sur ces semi-conducteurs.

Veiligheidsinstructies

- Veiligheidsbepalingen vereisen, dat het apparaat in zijn oorspronkelijke toestand wordt teruggebracht en dat onderdelen, indientiek aan de oorspronkelijke, worden toegepast.
- De veiligheidsonderdelen zijn aangeduid met het symbool




- Alle IC's en vele andere halfgeleiders zijn gevoelig voor elektrostatische ontladingen (ESD). Onzorgvuldig behandelen tijdens reparatie kan de levensduur drastisch doen verminderen. Zorg ervoor, dat U tijdens reparatie via een polsband met weerstand verbonden bent met hetzelfde potentiaal als de massa van het apparaat. Houd componenten en hulpmiddelen ook op hetzelfde potentiaal.
- Sluit een apparaat dat gerepareerd wordt altijd via een scheidingstransformator aan op de netspanning.
- Verwissel nooit modules of andere onderdelen terwijl het apparaat is ingeschakeld.
- Gebruik voor het afregelen plastic i.p.v metalen gereedschap. Dit om mogelijke kortsluiting te voorkomen of een bepaalde schakeling instabil te maken.

Opmerkingen

- De gelijkspanningen en oscillogrammen dienen gemeten te worden ten opzichte van de apparaat aarde.
- De gelijkspanningen en oscillogrammen vermeld in de schema's dienen gemeten te worden met een kleurbalkensignaal beeldraaggolf op 503.25 MHz (C25).
- De oscillogrammen en gelijkspanningen zijn in RECORD of PLAY mode gemeten.
- De halfgeleiders, die in het pricipeschema en in de stuklijsten zijn vermeld, zijn per positie volledig uitwisselbaar met de halfgeleiders in het apparaat, ongeacht de typeaanduiding op deze halfgeleiders.

Avvertimenti

– Le prescrizioni di sicurezza richiedono che l'apparecchio sia ricondotto alle condizioni originali e che siano usati ricambi originali.

Componenti di sicurezza sono marcati con 

- Tutti gli IC e semiconduttori sono sensibili a scariche elettrostatiche (ESD). Noncuranze durante la riparazione di semiconduttori possono danneggiarli o condurre ad una riduzione drastica della durata. Durante la riparazione assicurarsi di essere collegati allo stesso potenziale attraverso un bracciale di protezione contro scariche elettrostatiche. Inoltre tenere anche tutti i componenti e gli attrezzi a questo potenziale.
- Apparecchi da riparare bisogna collegarli sempre via un trasformatore isolante (separatore) alla tensione normale.
- Non scambiare moduli o altri componenti quando l'apparecchio è in funzione.
- Per l'accordo usare soltanto attrezzi di plastica (non usare attrezzi metallici). Così si evitano cortocircuiti e collegamenti instabili.

Osservazioni

- Misurare le tensioni continue e gli oscillogrammi riferendosi alla massa dell'apparecchio.
ECCEZIONE
Le tensioni continue e gli oscillogrammi dall'alimentatore sono misurati sulla parte primaria contro GND-Live.
- Le tensioni continue e gli oscillogrammi indicati negli schemi di collegamento devono essere misurati secondo le condizioni seguenti: segnale barre colore, portante dell'immagine su: 503.25 MHz (C25).
- Gli oscillogrammi e le tensioni continue sono misurati in RECORD o PLAYBACK.
- I componenti indicati nelle liste sono intercambiabili con quelli nell'apparecchio nonostante l'eventuale denominazione di modelli.

WARNING FOR LITHIUM BATTERIES!

Lithium batteries, if incorrectly used (excessive heat, wrong connection of terminals, short circuit) represent a danger of explosion!

Lithium batteries must be replaced only by original spare parts.

WARNHINWEIS ZU LITHIUM-BATTERIEN!

Bei falscher Handhabung (Überhitzung, Falschpolung oder Kurzschluß) der Lithium-Batterien besteht Explosionsgefahr!

Lithium-Batterien dürfen nur gegen Originalersatzteile getauscht werden.

ATTENTION!

Pile au lithium.

Danger d'explosion si traitée incorrectement. Ne peut être remplacée que par un spécialiste (comme décrit dans les instructions de réparation).

OPGELET MET LITHIUM-BATTERIJEN!

Bij foutieve behandeling (oververhitting, foutieve poling of kortsluiting) van lithium-batterijen bestaat er explosiegevaar! Lithium-batterijen mogen slechts door originele onderdelen vervangen worden.

Avisos

– Las instrucciones de seguridad exigen que después de la reparación el aparato se encuentre en el estado original y que las piezas de repuesto, utilizadas para la reparación, sean idénticas a las originales.

Los componentes de seguridad están marcados con 

- Todos los IC y semiconductores son sensibles a descargas electrostáticas (ESD). Un tratamiento no conforme a las instrucciones de semiconductores en caso de reparación, podría llevar a la destrucción de estos componentes, o a una reducción drástica de la duración. Tenga cuidado de que, en caso de reparación, estar al mismo potencial que la masa del aparato, por una pulsera con resistencia. Ponga todos los componentes, herramientas y recursos al mismo potencial.
- Para reparar un aparato hay que conectarlo siempre a la alimentación a través de un transformador de aislamiento.
- Cuando un aparato está en marcha no pueden ser cambiados módulos u otras piezas de repuesto.
- Para los ajustes hay que utilizar exclusivamente herramientas de plástico (nunca herramientas metálicas). Así se evitan cortocircuitos y circuitos inestables.

Notas

- Hay que medir las tensiones continuas y los oscilogramas contra la masa del aparato.
- Las tensiones continuas y los oscilogramas mencionados en los esquemas tienen que ser medidos de manera siguiente: señal barra de color portadora de imagen en 503.25MHz (C25)
- Los oscilogramas y las tensiones continuas son medidas en „RECORD“ y „PLAYBACK“
- Los componentes mencionados en las listas se los puede cambiar por los componentes en el aparato, a pesar de eventuales designaciones de tipos.

ATTENZIONE CON LE PILE AL LITIO!

In caso di utilizzo errato (surriscaldamento, errata posizione dei poli o cortocircuito) delle pile al litio consiste pericolo di esplosione! Le pile al litio si possono sostituire solo con pezzi di ricambio originali.

AVISO!

Bateria de litio.

Por una inadecuada intervención puede explotar.

Solo debe ser cambiada por una persona con conocimientos técnicos (como en la guía de reparación se describe).

ADVARSEL!

Lithium batteri. Eksplosionsfare.

Udskiftning må kun foretages af en sagkyndig, og som beskrevet i servicemanualen.

VARNING!

Eksplosionsfara vid felaktigt batteribyte!

Ävänd samma batterityp eller ekvivalent typ som rekommenderas av apparattillverkaren.

VAROITUS!

Paristo voi räjähtää, jos se on virheellisesti asennettu!

Vaihda paristo ainoastaan laitevalmistajan suosittelemaan tyyppiin.

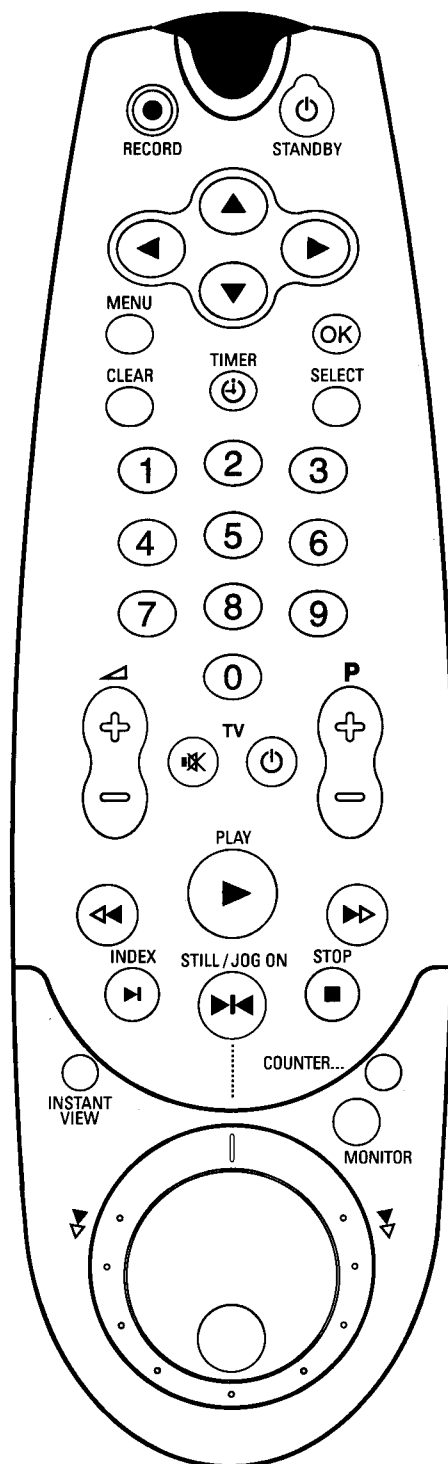
Survey of Direction for use (only VHS sets included)

The remote control	1-9
Savin energy	1-10
Connecting to a decoder	1-10
Connecting to a satellite receiver	1-10
Connecting to hifi equipment	1-10
Emergency interrupt	1-10
Storing tv channels	1-10
Still picture/super slow motion	1-12
Slow motion	1-12
The Jog/Shuttle functions	1-12
Correcting picture interference	
The cleaning function	1-13
Selecting the audio track, audio-mix	1-13
Surround-sound playback	1-13
How do I know where I am currently on the tape?	1-13
Index search	1-13
Intro-scan	1-13
How can I record directly?	1-14
Direct recording with TV sets without "Easy Link" function	1-14
Erase protection	1-14
Longplay function	1-14
HiFi stereo reception	1-14
Programming with "ShowView"	1-15
How can I record from a satellite receiver?	1-15
A few general notes on programming	1-15
Sorting TV programmes for TIMER programming	1-16
Editing video recordings	1-16
The TXT decoder. Reading TXT with the video recorder	1-20
How can I read TXT?	1-20
Externally controlled TIMER recording	1-20
Tuner mode. Your video recorder as an extension of your TV set	1-20
Recording from another video/audio source	1-21
Recording audio only	1-21
View mode	1-21
The TV monitor function	1-21
Switching between VCR 1 and VCR 2	1-21
Playback via the aerial cable	1-22
Switching the built-in mod	1-22
Remote control of TV sets	1-22

1. BUTTONS, CONTROLS AND SOCKETS

For detailed explanations of the functions, see the corresponding chapters.

The remote control



- RECORD ●** Recording
- STANDBY ◻** Switching off
- ▲ / ▼ / ◀ / ▶** Cursor up/down, left/right
- MENU ◻** Call up the OSD page MAIN MENU
- OK ◻** Confirm entry
- CLEAR ◻** Reset/clear
- TIMER ⌚** TIMER programming
- SELECT ◻** Select function
- 0 - 9** Numeric buttons
- ◀◀** Rewind/picture search reverse
- PLAY ▶** Playback
- ▶▶** Fast forward wind/picture search forwards
- INDEX ▶▶** Search index mark
- STILL / JOG ON ▶◀** Still picture, Jog/Shuttle on/off
- STOP ■** Stop/Pause
- INSTANT VIEW ◻** Picture search during fast wind
- COUNTER ◻** Tape counter
- MONITOR ◻** TV monitor function
- ◻** Jog/Shuttle

Additional TV functions: only for TV sets with the **same** remote control code.

- TV ▲ + / -** TV volume +/-
- TV ✖** TV sound on/off
- TV ◻** TV off
- TV P + / -** TV programmes +/-

The buttons which are not listed have **no** function

2. INSTALLATION.

HOW DO I INSTALL THE VIDEO RECORDER ?

Saving energy

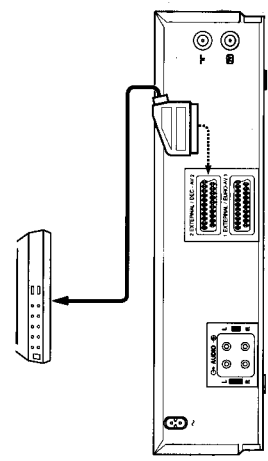
There are two ways of switching off to choose from.

1. Normal switch-off. Switch off by pressing the button [LOW POWER / STANDBY]. The time remains visible.
2. Energy-saving mode. Press the button [LOW POWER / STANDBY] once again. The time in the display disappears. You can switch back on again by pressing the same button.

Note:
* It is not possible to switch to energy-saving mode as long as a TV set connected with a scart cable is switched on. "TV ACTIVE" appears in the video-recorder display.

Connecting to a decoder

Some TV stations transmit encoded (encrypted) signals which you can only decode for viewing if you use a bought or hired decoder (descrambler).

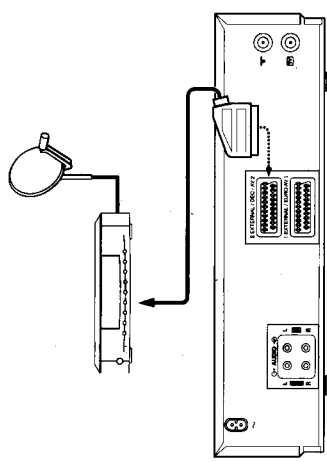


- 1 Connect the decoder with a Scart cable to the [DEC-AV2] socket on the video recorder. How to programme the decoder function when storing TV channels is described in the chapter 'Storing TV channels'.

Notes:
* It is not possible to use the decoder at the same time for the video recorder and the TV set.
* The video recorder will automatically use the decoder when a programme position is selected on the video recorder which has been assigned to the decoder function when storing TV channels.

Connecting to a satellite receiver

It is possible to connect a satellite receiver to this video recorder.



- 1 Connect the satellite receiver by means of a Scart cable to the video recorder (socket [DEC-AV2]).
- 2 Switch the video recorder on and select the programme position 'E 2'.

Connecting to hifi equipment

You can play the sound of your video recorder via your hifi equipment.

- 1 Connect the [AUDIO L IN R] and [AUDIO L OUT R] sockets on the back of your video recorder with the corresponding sockets on your hifi equipment. A cable can be purchased at a specialized dealer.

Emergency interrupt

The video recorder and the remote control have an emergency interrupt function. You can interrupt any function by pressing the [STANDBY] button. Whenever you have any problems while operating the video recorder, you can simply interrupt any function and start again. You can practise using the video recorder without worrying. No matter which button you press, you won't damage the video recorder.

3. STORING TV CHANNELS

In order that your video recorder can record TV programmes, the TV channels (e.g. "ARD") must first be stored in the video recorder. You can store up to 99 TV channels. Your video recorder has a receiver of its own. This means it can be used independently of the TV set.

The "Easy Link" function



This function enables your video record to exchange information with the TV set. For this reason, also take note of the operating instructions that accompany your TV set.

The TV set and video recorder ([EURO-AV] scart socket) must be connected using the **special scart cable supplied** and your TV set must **have** the "Easy Link" function.

- 1 Switch on the TV set.
- 2 Pull out the mains plug and plug it back in again.
- 3 The video recorder automatically loads all of the TV channels stored in the TV set in the correct order. This can also take a few minutes. The following display appears on screen: "EASY LINK loading from TV - please wait". "EASY LINK" appears in the video-recorder display. Once all TV channels have been found, the video recorder switches itself off.
- 4 Select the desired display language. To do this, press the button [ATS] on the video recorder.
- 5 The OSD page "LANGUAGE" appears on screen. Select the desired display language.
- 6 Confirm the setting by pressing the button [OK]. The OSD page "COUNTRY" appears on screen. Select your country.
- 7 Confirm the setting by pressing the button [OK]. "EASY LINK" appears briefly in the videorecorder display.

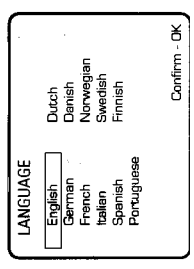
It is still possible at this stage to assign special functions to certain channel numbers. For further information, see the section "Manual search".

ATS Euro+ (Automatic channel search)

The ATS Euro + function is not possible if the connected TV set has "Easy Link".

The video recorder will make a search for all TV channels. It orders them in a logical sequence in the memory.

- 1 Switch the TV set on and select the channel number for the video recorder.
- 2 Press the button [ATS] on the video recorder.
- 3 The OSD page "LANGUAGE" appears on screen. Select the display language desired.



- 4 Confirm by pressing the button [OK]. The OSD page "COUNTRY" appears on screen. Choose your country.
- 5 Confirm by pressing the button [OK]. The automatic tuning begins.
- 6 Wait until all TV channels have been found. This may take a few minutes. Once all TV channels have been found, a message, e.g. "ATS Euro+ ready 28 TV channels found" appears on screen. The automatic channel search is over.
- 7 Press the button [OK]. The OSD page "INSTALLATION MENU" appears on screen.
- 8 Complete the setting by pressing the button [MENU].

Note:

*When an ATS Euro+ is restarted, the "INSTALLATION MENU" appears after Step 2. Select "ATS Euro+" and proceed with Step 6. TV channels already stored will be retained. If the message "FULL" appears briefly in the video recorder display, all of the video recorder's channel storage places have been occupied.

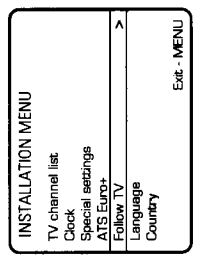
For details of how to change the sequence, please read the section entitled "Channel preset". At this stage, you can still determine special functions for certain channel numbers. See the section "Manual search" for further information.

Assigning TV channels automatically (Follow TV)

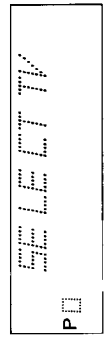
The following setting is not necessary if the TV channels have been set using the "Easy Link" function.

Only if the video recorder (socket [EURO-AV1]) and the TV set are connected by means of a **scart cable** can the TV channels be allocated automatically. This means that the video recorder takes on the same channel sequence as the TV set.

- 1 Switch the TV set on and select the channel number for the video recorder.
- 2 Press the button [ATS] on the video recorder.
- 3 Select the line "Follow TV". Press the button []

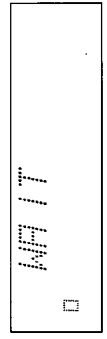


- 4 The video recorder's display indicates "SELECT TV P01".

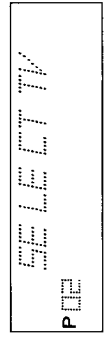


- 5 Select the programme position '1' on the TV set.

Confirm with the [OK] button on the video recorder's remote control. The video recorder's display indicates "WAIT". The video recorder compares its programme positions with the programme positions of the TV set. If the programme position on the video recorder and on the TV set is the same (e.g. "P 01"), the video recorder loads the TV channel from the TV set.



- 6 Wait until the video recorder's display indicates, for example, "SELECT TV P02".



- 8 Select the programme position '2' on the TV set.

Confirm with the [OK] button on the video recorder's remote control. The video recorder's display indicates "WAIT".

- 10 Repeat the steps 7 to 9 until all TV channels are allocated.

- 11 Press the [MENU] button to terminate the adjustment. The video recorder's display indicates briefly "READY".

It is possible to assign special functions to certain programme positions. This is explained in the paragraph "Manual search".

Assigning TV channels manually

The following setting is not necessary if the TV channels have been set using the "Easy Link" or "ATS Euro+" functions.

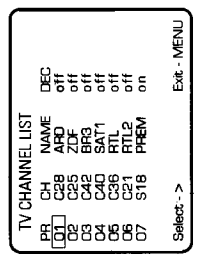
This function enables you to allocate any TV channel found to the programme number of your choice so that you have, for example, the same TV channel sequence as on your TV set.

- 1 Switch on the TV set and select the programme number for the video recorder.

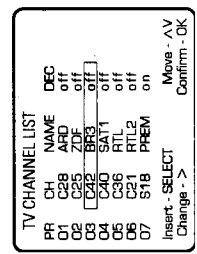
- 2 Call up the "INSTALLATION MENU" by pressing button [ATS]. The line "TV channel list" becomes active.

- 3 Confirm the line by pressing the button [] . The panel "TV CHANNEL LIST" appears. The last programme number selected e.g. "01" becomes active.

- 4 Select the TV channel that you wish to move by pressing the button [] or [] . Press the button [] .



- 5 Using the button [] or [] , move the TV channel to the desired programme storage place.



- 6 Confirm by pressing the button [OK]. The TV channel line is inserted and the other channel lines are moved on a line. If you wish to cancel an **unde sired** TV channel, press the button [CLEAR] instead of button [OK].

- 7 Sort all of the TV channel lines (steps 4 - 6) into the desired order.

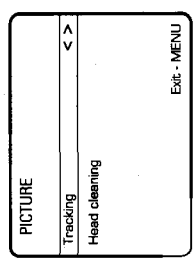
- 8 Complete the setting by pressing the button [MENU] twice. If you wish to change the basic setting, read the detailed notes in the section "Manual search".

Correcting picture interference. The cleaning function

Each time you start a new playback, the video recorder automatically adjusts the correct tracking for the cassette.

For cassettes recorded on another recorder, it is possible to improve the automatically made optimum adjustment as follows.

- 1 Press the **[MENU]** button on the remote control.
- 2 During playback or still picture mode, select the menu line "Picture" and confirm with the **[▶]** button.
- 3 The "PICTURE" menu appears on the screen. The option "Tracking" (on playback) or "Vertical jitter" (still picture) is highlighted.



- 4 Press the **[◀]** or **[▶]** button until the best picture quality is obtained.
- If horizontal interference bars cannot be removed, proceed as follows:
- 5 Select the menu item "Head cleaning". During playback, press the **[▶]** button. The video heads are cleaned.
 - 6 Terminate the adjustment with the **[MENU]** button.

Notes:

- * When using cassettes of bad quality, it is nevertheless possible that interferences occur.

Selecting the audio track, audio-mix

You can select the audio track you want to hear during playback or in tuner mode. This is especially useful for two-channel sound (multi-language) transmissions.

- 1 Press the **[SELECT]** button. The display indicates the current setting. If you press the **[SELECT]** button repeatedly, you can select between four possibilities (STEREO, LEFT, RIGHT, MONO).

Notes:

- * During playback, you can select a further possibility, the "MIXMODE" function. With this function, you will hear the mono sound of the normal (linear) track together with the sound of the stereo track. This enables you to play recordings which have been dubbed on another video recorder.
- * If no stereo sound is recorded on the cassette, the video recorder switches automatically to mono sound.

Surround-sound playback

If your TV set or hi-fi equipment is suited for surround-sound play, the video recordings will be played back with this audio system.

How do I know where I am currently on the tape?

The length of the tape is indicated in minutes on the cassette, e.g. "E180" corresponds to 180 minutes playing time (= 3:00 hrs).

The length indication is found on the front narrow side of the cassette to the left. The actual playing time may be slightly longer than indicated (e.g. 3:05 hrs).

- 1 Start the tape measurement function with the **[COUNTER]** button on the remote control. After a few moments, the video recorder's display indicates briefly, e.g. "TIME LEFT 2:20"

Then the video recorder switches, for example, to "STOP".

The video recorder's display indicates, for example, "P03 L 2:20"

- 2 With the **[COUNTER]** button, you can select between the following indications:
 elapsed playing time e.g. 0:40
 remaining playing time e.g. L 2:20 ("L"=TIME LEFT)
 real time counter e.g. 00:1:45 (in hrs/min).

Notes:

- * When a cassette is inserted, the video recorder must at first calculate the playing time. That is why the display indicates at first ":-:" and only after several seconds tape run the playing time.
- * You can set the tape counter manually to "0". Use the **[COUNTER]** button to select the counter mode, then press the **[CLEAR]** button.
- * If a minus sign appears in front of the real time counter (e.g., "- 0:20"), the tape is not wound to its beginning.
- * The indications can be read off exactly to the minute during recording, playback and pause/stop.

Index search

The video recorder writes a mark on the tape every time a recording is started. With the **[INDEX▶]**, **[▶▶]** or **[PLAY▶]** buttons on the remote control you can find these marks on the tape.

- 1 Press the **[INDEX▶]** and **[▶▶]** buttons to find the next mark and the **[INDEX▶]** and **[▶▶]** buttons to find the previous mark. The video recorder's display indicates "INDEX".
- 2 As soon as the mark is found, the video recorder switches automatically to playback.

Intro-scan

- 1 Press the **[INDEX▶]** and **[PLAY▶]** buttons. The video recorder's display indicates "INTRO".
- 2 The tape is wound to the next mark, played back for 10 seconds, then wound to the next mark and played back for 10 seconds, and so on. When the end of the tape is reached, the tape is automatically rewound to the beginning.

Notes:

- * If you press any tape run button (e.g. **[PLAY▶]** or **[STOP▶]**) during the index search or intro-scan function, the video recorder interrupts this function.
- * For recordings made without marks on another video recorder, the index search and intro-scan functions cannot be used.

7. EDITING VIDEO RECORDINGS

It is not possible to simply cut video tapes with a pair of scissors then splice them.

If you wish to join and/or insert new scenes without disturbing transitions and exactly to the picture into existing recordings, it is necessary to use an electronic cutting facility when copying from one video tape to another.

This creation of "new" video recordings is called "editing". For editing, different methods can be used.

Audio dubbing

This means that an appropriate sound is added to an existing video recording.

With this function, it is possible to **replace** the mono sound track on the video tape with another sound. The old mono track is completely erased. The stereo sound track and the video recording remain unchanged.

The insert and insert-edit functions

With the insert functions, it is possible to conveniently insert other picture and/or sound recordings into existing recordings **without disturbing transitions**. You have the choice between three insert functions.

Synchronous editing (synchro-edit)

When copying between this video recorder and a second video recorder or camcorder being correspondingly equipped, this function provides for a synchronous start of both units.

This ensures that every scene will be copied **exactly to the picture and without disturbing transitions**.

- Enter the programme position number "01" as **two digits** with the numeric buttons [0-9]. When the entry is completed, the selected TV programme is allocated to the first programme position and the other programmes are shifted by one position.

- Select the TV programme you wish to appear at the second position in the list.

Repeat the steps 5 to 7 until your favourite TV programmes are in the desired order.

EASY TEXTPROGRAMMING			
Prog.	Page		
01 ARD	100	100	100
02 ZDF	100	100	100
03 RTL	100	100	100
04 SAT	100	100	100

Select programme - \V Textprog - OK
Insert - SELECT Exit - MENU
Select. page - >

- Terminate with the [MENU] button.

Sorting TV programmes for TIMER programming

Do you prefer certain TV programmes for TIMER recording?

With the Sort function, you can create a separate programme list to your preferences.

Note:

* The programme order stored in the video recorder is **not changed**. Only the TV programmes in the OSD page "EASY TEXTPROGRAMMING" are brought in a new order.

- Switch on the TV set and select the programme position intended for the video recorder.
- Press the [MENU] button on the remote control. The OSD page "MAIN MENU" appears on the picture screen.
- Select the option "Easy Textprogramming". Confirm with the [▶] button.

The OSD page "EASY TEXTPROGRAMMING" appears on the picture screen. A page number of the last selected programme position is highlighted.

Use the [◀] button to select the programme position. The number of the programme position and the programme name are highlighted.

- Select your favourite TV programme from which you wish to make most of your TIMER recordings.

Press the [SELECT] button. The programme name disappears and two horizontal lines appear in the place of the programme position number.

EASY TEXTPROGRAMMING			
Prog.	Page		
14 ARTE	100	100	100
15 CNN	100	100	100
17 ARD	301	302	303
18 PREM	100	100	100

Please enter programme number - 0 - 9
Exit - MENU

Audio dubbing

With this function, it is possible to replace the mono sound track on the video tape with another sound. Connect the sound source (e.g. a CD player) to the input sockets [AUDIO R] (at the front of the video recorder, behind the flap at the left).

Make sure that the "correct" cassette is inserted into the video recorder.

- During playback, search the tape position where dubbing is to be started.
- Press the [STOP] button.
- Press the [MENU] button on the remote control. Select the option "Edit". Confirm with the [▶] button.
- The OSD page "EDIT" appears on the picture screen. Select the option "Dubbing". Confirm with the [▶] button.

Follow the user guide on the OSD page.

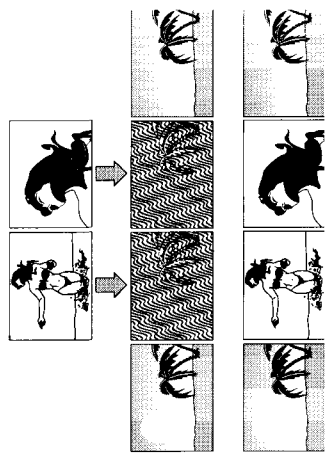
- The OSD page "AUDIO DUB" appears on the picture screen. Switch the sound source on. Start dubbing at the right moment by pressing the [RECORD] button. The video recorder records the sound from the external sound source. The sound level is automatically controlled. The sound track is replaced and recorded again.

- Interrupt dubbing with the [STOP] button.

- Terminate dubbing with the [MENU] button or the [STANDBY] button on the remote control.

The insert functions

With the insert functions, it is possible to conveniently insert other picture and/or sound recordings into existing recordings.



Connect the video/audio source to the input sockets **[VIDEO]** and **[L AUDIO R]** (= AV) of the video recorder. The sockets are located behind the left flap at the front of the recorder, or connect the video/audio source to the Scart sockets **[EURO-AV1]** or **[DEC-AV2]** of the video recorder. The sockets are located on the back of the video recorder.

- You have the choice between three insert functions.
- "INSERT DUBBING": the picture, the hifi sound (helical track), and the mono sound (longitudinal track) are newly recorded.
 - "INSERT VIDEO": the picture and the hifi sound (helical track) are newly recorded, the mono sound (longitudinal track) is maintained.
 - "INSERT COPY": the picture is newly recorded. The mono sound (longitudinal track) is retained and transferred onto the hifi track (helical track).

Please also see the operating instructions of the connected unit.
Insert the recorded cassette into the video recorder. Make sure the cassette is not protected against recording!

Adjusting the video recorder (VCR) to the camcorder (CC) (edit-setup)

You can synchronously copy between this video recorder (VCR) and an appropriately equipped camcorder (CC). Both units are started at the same time with the help of a synchronous impulse and an adjustable start delay (= preroll time). Various operating and cabling variants are possible. You will find an overview of the synchro-edit cables at the end of this operating manual.

Connect the two units with the corresponding synchro-edit cable (socket **[SYNCHRO EDIT]**) on your video recorder. Connect the video/audio source to the input sockets **[VIDEO]** and **[L AUDIO R]** (= AV) on the video recorder. The sockets are to be found behind the left flap at the front of the recorder.

Please also observe the operating instructions of the camcorder.
Insert a cassette **without erase protection** into the video recorder

- 1 Switch on the TV set and select the programme position intended for the video recorder.
- 2 Press the **[MENU]** button on the remote control. The OSD page "MAIN MENU" appears on the picture screen.
- 3 Select the menu option "Edit". Confirm with the **[▶]** button.
- 4 The OSD page "EDIT" appears on the picture screen; the option "Edit Setup" is highlighted. Confirm with the **[▶]** button.

Follow the user guide on the OSD page.

- 5 Switch the **camcorder** to **playback-pause**.
- 6 Press the **[OK]** button on the video recorder's remote control. Wait until the video recorder has recognized the connected camcorder.

Follow the user guide on the OSD page.

- 7 You can call up the default start delay (= preroll time) for the connected camcorder type by pressing the **[CLEAR]** button. It is then possible to alter the preroll time with the **[◀]** or **[▶]** button.
- 8 Press the **[▶]** button.
Select the desired insert edit function: "INSERT DUBBING" or "INSERT VIDEO" or "INSERT COPY".

- 9 Confirm with the **[MENU]** button.

Note:
* The start delay (= preroll time) must be adjusted only once. The video recorder will save this setting. Keep in mind that other camcorder types must also be adjusted when being used the first time.

Synchronous editing (synchro-edit)

- 1 Call up the OSD page "EDIT MENU". Use the **[▶]** button to select the option "Synchro Edit". Confirm with the **[▶]** button.
- 2 The OSD page "SYNCHRO EDIT" corresponding to the connected camcorder type appears on the picture screen.

- 3 Use the **[SELECT]** button to select the OSD page for **video recorder** mode. Search the beginning of the recording on the video recorder. Switch the video recorder to playback-pause.

- 4 Use the **[SELECT]** button to select the OSD page for **camcorder** mode. Search the beginning of the recording on the camcorder. Switch the camcorder to playback-pause.

Follow the user guide on the OSD page.
The way copying is started depends on the camcorder and the corresponding synchro-edit cable used.

Insert-edit functions

With the insert-edit functions, it is possible to conveniently insert other picture and/or sound recordings into existing recordings.

Connect the two units with the corresponding synchro-edit cable (socket [SYNCHRO EDIT] on your video recorder).

Connect the video/audio source to the input sockets [VIDEO] and [L AUDIO R] (= AV) on the video recorder. The sockets are to be found behind the left flap at the front of the recorder.

You have the choice between two insert-edit methods:

- Method 1 "INSERT VCR": you mark on the cassette in the video recorder the tape position where the "new" recording is to end.
 - Method 2 "INSERT CC": you mark on the cassette in the camcorder the **beginning** and the **end** of a "scene" (tape position) you wish to insert into an existing recording.
- However, this works only if the camcorder is equipped with a 2.5 mm \emptyset control socket (LANC control).

You have the choice between three insert-edit functions:

- "INSERT DUBBING": the picture, the hi-fi sound (helical track), and the mono sound (longitudinal track) are newly recorded.
- "INSERT VIDEO": the picture and the hi-fi sound (helical track) are newly recorded, the mono sound (longitudinal track) is maintained.
- "INSERT COPY": The picture is newly recorded. The mono sound (longitudinal track) is retained and transferred onto the hi-fi track (helical track).

Note:

- * The video recorder will always use that insert function you have selected in the paragraph "Adjusting the video recorder to the camcorder".

Method 2 "Insert CC":

- 6 Use the [SELECT] button to select the OSD page for **video recorder** mode. Search on the cassette in the video recorder the tape position where the recording is to begin. Switch the video recorder to playback-pause.

Depending on the camcorder type connected, it is possible to mark the **beginning** and the **end** of the recording. Follow the user guide on the OSD page.

- 7 Use the [SELECT] button to select the OSD page for **camcorder** mode. Search on the cassette in the camcorder the tape position where the insert recording is to begin and – if possible – mark the position with the [] button, or switch the camcorder to playback-pause.

- 8 If necessary, search on the camcorder the desired **end** of the insert recording and mark it with the [] button.

Follow the user guide on the OSD page. How to start the insert recording depends on the camcorder used and the corresponding synchro-edit cable.

Variant 1. The video recorder controls the camcorder

- 9 Start copying with the [RECORD] button on the video recorder. The camcorder starts with "PLAYBACK" and at the same time the video recorder starts with "RECORDING". The sound level is automatically controlled.

- 10 The insert recording is automatically stopped. If you wish to stop earlier, press the [STOP] button on the video recorder.

- 11 Terminate insert-edit recording with the [MENU] button or the [STANDBY] button on the remote control.

Variant 2. The camcorder controls the video recorder (only possible with "Insert CC").

- 9 Start copying with the corresponding button on the camcorder or its remote control. The camcorder starts with "PLAYBACK" and at the same time the video recorder starts with "RECORDING". The sound level is automatically controlled.

- 10 The insert recording is automatically stopped. If you wish to stop earlier, press the PAUSE or STILL button on the camcorder or its remote control.

- 11 Terminate insert-edit recording with the [MENU] button or the [STANDBY] button on the remote control.

Note:

- * If your camcorder is equipped with a 2.5 mm \emptyset control socket (LANC control), the playback and fast wind functions of the camcorder can be controlled with the corresponding buttons on the video recorder.

Please also see the operating instructions of the camcorder.

Insert the recorded cassette into the video recorder. Make sure the cassette is not protected against recording!

- 1 Switch on the TV set and select the programme position intended for the video recorder.
- 2 Press the [MENU] button on the remote control. The OSD page "MAIN MENU" appears on the picture screen.
- 3 Select the menu option "Edit". Confirm with the [] button.
- 4 The OSD page "EDIT" appears on the picture screen. Select the option "Insert Edit". Confirm with the [] button.

The OSD page "INSERT EDIT" corresponding to the connected camcorder type appears on the picture screen.

Follow the user guide on the OSD page.

- 5 Confirm the menu option "Insert VCR" or select the option "Insert CC". Confirm with the [] button.

Method 1 "Insert VCR":

- 6 Use the [SELECT] button to select the OSD page for **video recorder** mode. Search on the cassette in the video recorder the tape position where the recording is to end. Mark this position with the [] button.

- 7 Search on the cassette in the video recorder the tape position where the recording is to begin. Switch the video recorder to playback-pause.

- 8 Use the [SELECT] button to select the OSD page for **camcorder** mode. Search on the cassette in the camcorder the tape position where the recording is to begin. Switch the camcorder to playback-pause.

8. ADDITIONAL FUNCTIONS OF YOUR VIDEO RECORDER

In addition to the already described functions, your video recorder has some special features which still increase its convenient use.

The TXT decoder. Reading TXT with the video recorder

With this video recorder, you can receive TXT programmes broadcast in your country (e.g. Videotext / Teletext / Top / Flot / Fastext / Superext, etc.), even if your TV set is not provided with the TXT function.

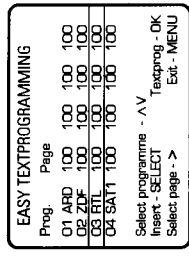
Beside the comprehensive offer of TXT pages, this function offers you two further advantages:

- With your video recorder, you can visualize and record TXT subtitles.
- For record programming, you can take advantage of the convenient help provided by the TXT TV programme overview pages.

How can I read TXT?

- 1 Switch on the TV set and select the programme position intended for the video recorder.
- 2 Switch the video recorder on.
- 3 Select on the video recorder the TV programme the TXT pages of which you wish to read. For this, use the **[V]** or **[A]** button or the numeric buttons **[0-9]** on the remote control.
- 4 Press the **[MENU]** button on the remote control. The OSD page "MAIN MENU" appears on the picture screen.
- 5 Select the option "Easy Textprogramming". Confirm with the **[▶]** button.

- 6 The OSD page "EASY TEXTPROGRAMMING" appears on the picture screen. The selected programme position (e.g. "03 RTL") and one Teletext page (e.g. "100") are highlighted.



- 7 Use the **[SELECT]** button to call up the TXT pages you wish to read. If you wish to have an overview about the entire TXT information offer, press the **[V]** button and then the **[OK]** button. A programme-specific TXT overview page will appear, or enter the number of the desired TXT page with the numeric buttons **[0-9]**. The number must always be entered as three digits.

The entered page number appears at the left in the top information line on the picture screen. After a few seconds search time, the page appears on the screen. If you wish to read another page, simply enter the new page number.

With some TV channels, you can use the **[◀]** or **[▶]** button on the remote control to directly call up the desired TXT page. You will find the corresponding hints in colour on the bottom picture border.

- 8 To switch the TXT decoder off, repeatedly press the **[MENU]** button until the "normal" TV programme appears on the picture screen.

Externally controlled TIMER recording

Do you have another device, such as a satellite receiver, equipped with an integrated clock which can be used for controlling other devices?

If so, you can control the recording from such an external device via the Scart socket **[DEC-AV 2]**.

Insert a cassette not protected against recording.

- 1 Switch the video recorder off with the **[STANDBY @]** button on the remote control.
- 2 Press the **[MONITOR]** button on the remote control for **more than three seconds**. In the video recorder's display appears "E2 REC PREP". The video recorder is prepared for recording.
- 3 Recording is started and stopped by remote control via the Scart socket **[DEC-AV 2]**.
- 4 If you wish to terminate the function **before** a recording is started, press the **[MONITOR]** button a few seconds until the video recorder switches off.
- 5 If you wish to abort the function **during** a running recording, press the **[STANDBY @]** button.

Notes:

- It is **not** possible to use a decoder with this function.
- If the video recorder is prepared for externally controlled recordings, it cannot be switched in the "save energy" mode.

Tuner mode. Your video recorder as an extension of your TV set

You can also use your video recorder as a TV receiver (tuner). This is handy if your TV set does not have a remote control or if it has fewer programme positions than the number of channels it could actually receive. A decoder connected can be used. Proceed as follows:

- 1 Switch on the TV set and select the programme position intended for the video recorder.
- 2 Switch the video recorder off with the **[STANDBY @]** button on the remote control.
- 3 Press the **[STOP]** button for **more than 3 seconds**. The video recorder's display indicates the station name and the current time.
- 4 Select the desired programme position number with the **[V]** or **[A]** button, or enter the number as one or two digits with the numeric buttons **[0-9]**.
- 5 Switch the video recorder off with the **[STANDBY @]** button if you do no longer wish to view TV.

Recording from another video/audio source

With this video recorder, you can make recordings from an external video/audio source, for example a second video recorder or a camcorder. To do this, a Scart cable will be required.

- 1 Connect this video recorder with the unit you wish to record from, for example a second video recorder.

For this, connect the Scart socket of each unit with a Scart cable. On this video recorder, use the **[DEC-AV2]** Scart socket.

Notes:

* In the following example, your video recorder is used as recording recorder and is referred to as VCR B. The second video recorder is used for playback and is referred to as VCR A.

- 2 Insert a recorded cassette into VCR A and a cassette without erase protection into VCR B.
- 3 Select the programme position 'E2' on the VCR B. This is to be found next to the programme position 'P 01' ('P 01' - 'E1' - 'E2' - 'AV'). For this, use the **[V]** or **[A]** button.
- 4 To start recording, press the playback button, for example **[PLAY▶]**, on the VCR A and the record button **[RECORD●]** on the VCR B.
- 5 To stop copying, press the **[STOP■]** button on both video recorders.

Recording audio only

You can use your video recorder as a hi-fi tape recorder.

This means that only the stereo or dual sound is recorded from an external sound source (e.g., hi-fi equipment, second video recorder, etc.).

Connect your hi-fi (stereo) unit with an audio connecting lead to the **[AUDIO L I N R]** at the back of the video recorder.

Insert a cassette without erase protection into the video recorder.

- 1 Press the **[MENU]** button on the remote control. Select the option 'Record modes'. Confirm with the **[▶]** button.

- 2 The OSD page 'RECORD MODES' appears on the picture screen. Select the option 'Audio Only'. Confirm with the **[▶]** button.

- 3 The OSD page 'AUDIO ONLY' appears on the picture screen. Switch on the sound source. Start sound recording at the desired moment with the **[RECORD●]** button.

The video recorder records the sound from the external sound source. The sound level is automatically controlled. The video recording on the cassette is erased.

- 4 To stop the recording, press the **[STOP■]** button.
- 5 To terminate this function, press the **[MENU]** button or the **[STANDBY⊖]** button on the remote control.

View mode

You can view the picture from an external unit connected to the Scart socket **[DEC-AV2]** of your video recorder on the picture screen (monitor) of a TV set. The external unit can be, for example, a second video recorder, a decoder, a satellite receiver or a CD-i player.

- If the external unit transmits a control signal, this is recognized by the video recorder and this switches automatically to the view mode.

You can switch the view mode on and off with the **[MONITOR]** button.

- Even when the video recorder is switched off, the Scart connection between the TV set and the external unit is maintained.

Notes:

- * If the programme position 'E1' or 'E2' is selected, the video recorder cannot switch in the view mode. This also applies for programme positions with activated decoder function.
- * This function is only possible if the TV set is equipped for it and a Scart cable is used for the connection.

The TV monitor function

Pressing the **[MONITOR]** button switches the TV set to the 'AV' (= Audio/Video input) programme position. This is useful if you wish to monitor a 'running' recording on the picture screen (monitor) of your TV set. For this, the video recorder must be switched on. The video recorder's display indicates briefly 'VCR MON'.

A further pressure on the same button switches the monitor function off. The video recorder's display indicates briefly 'TV MON'.

Notes:

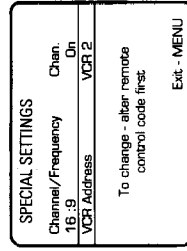
- * The monitor function is **only** possible if the TV set is equipped for it and a Scart cable is used for the connection.
- * During playback, the **[MONITOR]** button has no function.

Switching between VCR 1 and VCR 2

This function is very useful if you have two video recorders operating with the same remote control code. So that you always control the 'right' video recorder, you simply change the remote control code of this recorder and of this remote control handset.

- 1 Switch on the TV set and select the programme position intended for the video recorder.
- 2 Press the **[ATS]** button on the video recorder. The OSD page 'INSTALLATION MENU' appears on the picture screen.
- 3 Select the option 'Special settings'. Confirm with the **[▶]** button.
- 4 The OSD page 'SPECIAL SETTINGS' appears on the picture screen.
- 5 Select the option 'VCR Address'. On the picture screen appears the message 'To change - alter remote control code first'.
- 6 Press **simultaneously** the numeric button **[2]** and the **[OK]** button on the remote control. The code of the remote control is changed. To undo the change, press the numeric button **[1]** and the **[OK]** button.

- 7 Point the remote control at the video recorder and press **any** button (e.g. **[STOP■]**) button on the remote control. The 'new' remote control code is sent to the video recorder. In the OSD page appears the indication 'VCR2'. The code of the video recorder is also changed.



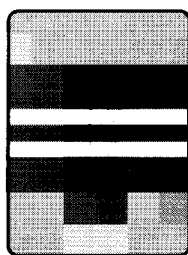
- 8 Complete the setting by pressing the button **[MENU]** twice.

Playback using the aerial cable

If you do not wish to use a scart cable, you must use the **aerial cable already connected** to play from the video recorder.

- 1 Switch on the TV set and select the channel number used for video playback. (This is explained in the operating instructions that accompany your TV set).
- 2 Press the video-recorder buttons **[EJECT]** and **[PLAY]** simultaneously. The message 'MODULATOR' and 'C36' or '591' will appear on the video-recorder display.

- 3 You must now enter and store this channel number or frequency (in MHz) in the TV set. A 'test picture' appears on the TV screen to indicate that the video recorder is transmitting.



Please consult your TV operating instructions for details on setting and storing the right channel or frequency for your TV set.

Note:

- * Check the sound and picture quality of TV reception when playing from the video recorder. If necessary, optimise the picture, colour and sound by re-setting the TV channel.

Information: The UHF-36 TV channel is occupied by your video recorder. It is, however, possible that this channel has been assigned to a different TV station at your reception point. Where this happens, i.e. when one or more TV stations is/are received, the picture quality of TV programmes is reduced. If this happens, proceed as follows:

- 4 Check whether all TV channels function exactly as they did before.

If the picture quality of one or more TV channels has diminished, switch off the video recorder for checking purposes. Check all the TV set's channels again.

- 5 If picture interference only occurs when the video recorder is switched on, you must search for a 'free' video-recorder channel.

- 6 Press the video-recorder buttons **[EJECT]** and **[PLAY]** simultaneously.

- 7 Press the video-recorder button **[FOLLOW TV]**. The video recorder searches for a 'free' channel. The message 'MODULATOR' and e.g. 'C44' or '655' appears on the video-recorder display. Store the setting by pressing the button **[OK]**.

- 8 Reset the TV to the video recorder (Step 5).

- 9 If the result is unsatisfactory, you can also enter the channel number or frequency manually.

- 10 Search for a free channel on your TV set (screen only flickers).

- 11 Press the video-recorder buttons **[EJECT]** and **[PLAY]** simultaneously.

Using the buttons **[V]** or **[A]** or the digit buttons **[0-9]**, enter the 'new' channel number or frequency of your TV set. You will see the test picture. Store the setting by pressing the button **[OK]**.

- 12 Check all channels on the TV set again. Repeat the setting (steps 10 and 11) until such time as you can no longer detect a difference in the picture between when the video recorder is switched on and when it is off.

- 13 Switch off the video recorder by pressing the button **[LOW POWER]**.

Note:

- * If you interrupted the setting described in Chapter 2 'INSTALLATION', continue with initial installation.

Switching the built-in modulator on and off

In the previous section, possible TV reception interference was discussed. If picture/sound interference **can not be eliminated** using the methods mentioned, the built-in modulator can be switched off. "Playback via the aerial cable" is **no longer possible** when the modulator is switched off.

- 1 Press the buttons **[EJECT]** and **[PLAY]** on the video recorder simultaneously.

- 2 Press the remote control button **[▶]** for **more than five seconds**. A message, e.g. "MODUL.", appears in the video recorder display.

- 3 Press the remote control button **[▶]** again for **more than five seconds**. A message, e.g. "MODUL OFF", appears in the video recorder display.

- 4 Store the setting by pressing the button **[OK]**.

Note:

- * If your TV set has the "Easy Link" function, and the TV set and video recorder (scart socket **[EXTERNAL/LEURO-AV]**) are connected with the special scart cable supplied, the modulator is automatically switched off.

Remote control of TV sets

This remote control is equipped to deal with several company specific remote control codes for TV sets. Using the appropriate **code digit** and the **TV** button block, the volume can be adjusted, the TV sound can be switched to 'mute', the programme number selected and the TV set switched off.

- [TV] [▶] [+/-]** TV volume +/-
- [TV] [▶]** switch TV sound on/off
- [TV] [▶]** switch off TV
- [TV] [▶] [+/-]** select TV programme number +/-

Note:

- * Perfect functioning for all models can not be guaranteed in the case of Panasonic, Sony, Radiola and Schneider TV sets.
- * If the selected code does not function for your TV set, or if you can not find the manufacturer of your TV in the list, you can go through all the codes one by one.

- 1 Hold the remote control towards the TV set.
- 2 Press the appropriate TV button and digit button **simultaneously**.
- 3 Switch off your TV set. The "new" remote control code is now loaded by the TV set.

Here is a list of a few manufacturers:

Code digit	TV manufacturer
0	Philips, Radiola (F), Schneider (F), Grundig
1	Grundig
2	Panasonic
3	Panasonic
4	Sony

Dismantling Instructions

General guidelines for dismantling the housing components, the electronics and the drive.

Always disconnect from mains before dismantling or assembly.

Due to supply voltages (hot circuit) on the input side of the switched-mode power supply, an isolating transformer must be used to operate the unit.

The drive or the drive - motherboard combination may not be lifted by holding the cross struts of the lift!

To detect power supply faults, we recommend the use of a variable transformer.

After assembling the unit, check for the earthing screw (M) on the underside of the housing.

In mode 10 of the service test program, the set also functions without drive. (Activate by pressing STOP on the remote control and PLAY on the set, followed by SELECT, input of the mode no., confirmation with SELECT). In this mode, the signal flow can for instance be followed up to the socket of the scanner.

Teletext sets are also operational with the Teletext board removed. After a Power-On Reset, the control microprocessor automatically detects whether the Teletext board is plugged in or not.

S-VHS sets have a special mode in which the set can be operated without the S-VHS PCB plate or drive. In this case the video signal on the In/Out print is connected directly from the Frontend to the output. To call up the function in the service test program, select mode no. 12.

1. Housing cover (Fig. 1,2)

- Remove screws A,B,C and D with Torx screwdriver
- Push centre of housing cover sides on underside approx. 1 cm outwards and lift the housing cover back over the three latch positions.
- Move cover up at least 4 cm.
- Remove housing cover.
- Assemble in reverse order.

2. Base plate (Fig. 3)

Preparation:

Remove housing cover as described in section 1.

- Turn the set upside down
- Unscrew the four support feet.
- The base plate can be lifted after unlocking the nine snap hooks (S1-S9) from left to right.

3. Front panel (Fig. 4)

Preparation:

Remove housing cover as described in section 1.

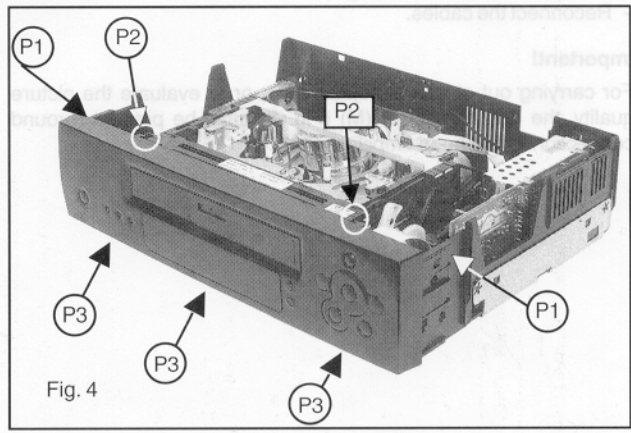
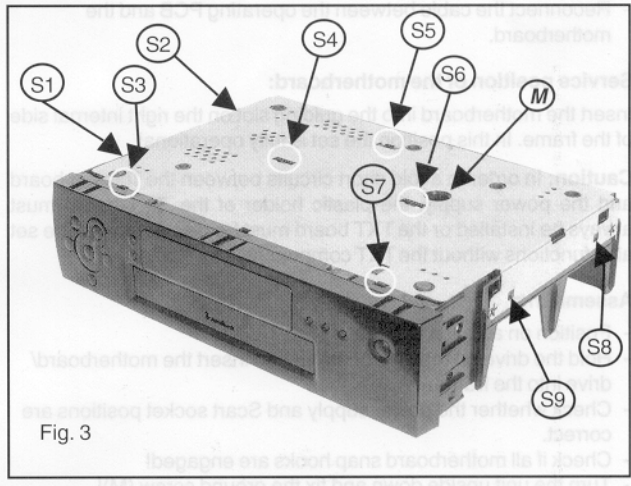
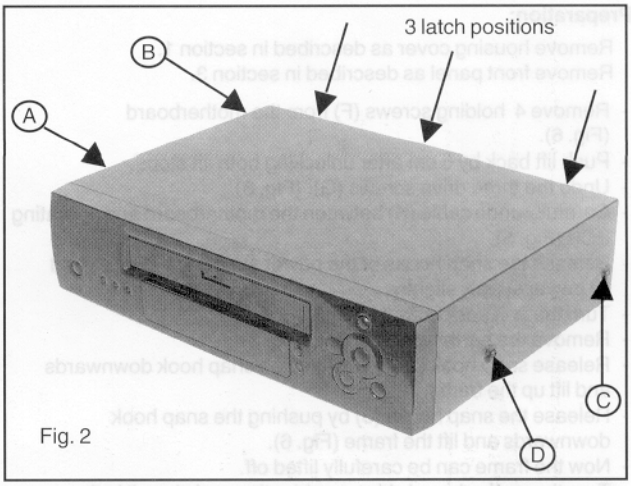
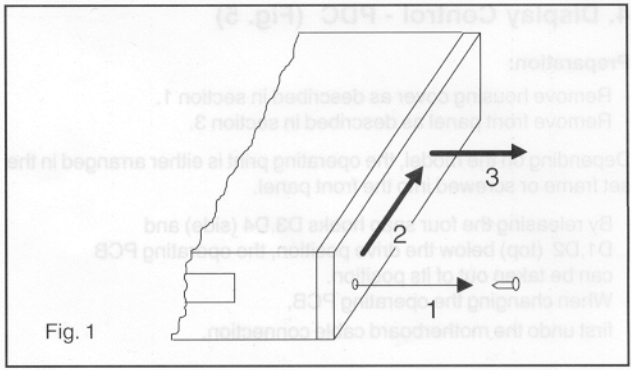
- Push both snap holders (P1) outwards and tilt panel top forward up to stop (approx. 3mm).
- Then release both snap hooks on the top (P2).
- Finally, release the three snap hooks (P3) on the underside and remove front panel by pulling it forward.

Installation:

- Insert front panel parallel to the operating PCB until snap hooks engage.
- Connect lift flap lever to guide of lift flap.

Important!

- Check whether all snap hooks are engaged!



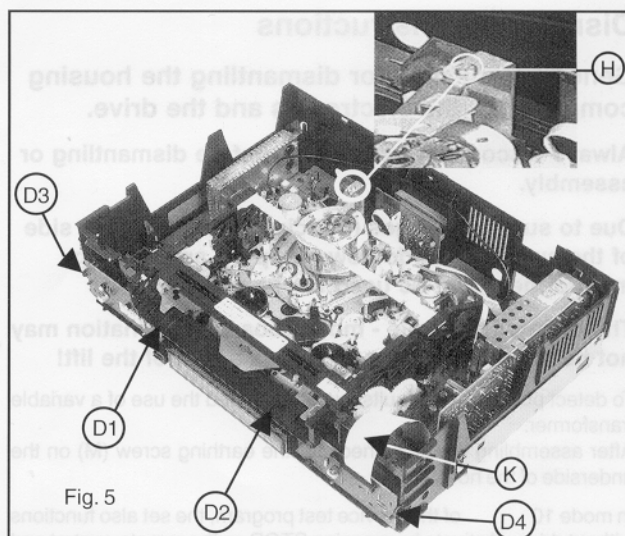
4. Display Control - PDC (Fig. 5)

Preparation:

- Remove housing cover as described in section 1.
- Remove front panel as described in section 3.

Depending on the model, the operating print is either arranged in the set frame or screwed into the front panel.

- By releasing the four snap hooks D3,D4 (side) and D1,D2 (top) below the drive position, the operating PCB can be taken out of its position.
- When changing the operating PCB, first undo the motherboard cable connection.



5. Dismantling the motherboard-drive combination

Preparation:

- Remove housing cover as described in section 1.
- Remove front panel as described in section 3.

- Remove 4 holding screws (F) from the motherboard (Fig. 6).
- Push lift back by 5 cm after unlocking both lift stops.
- Undo the three drive screws (G), (Fig. 6).
- Carefully undo cable (K) between the motherboard and operating PCB (Fig. 5).
- Release the snap hooks of the power supply (1) (Fig. 6) and lift power supply slightly.
- Turn the unit upside down (Fig.3).
- Remove the earthing screw (M), (Fig. 3).
- Release snap hook (2) by pushing the snap hook downwards and lift up the frame.
- Release the snap hooks (3) by pushing the snap hook downwards and lift the frame (Fig. 6).
- Now the frame can be carefully lifted off.
- Turn the motherboard-drive combination and place it in the service position (Fig. 7) if necessary. The set can be operated in this position.
- Reconnect the cable between the operating PCB and the motherboard.

Service position of the motherboard:

Insert the motherboard into the guiding slot on the right internal side of the frame. In this position the set is fully operational.

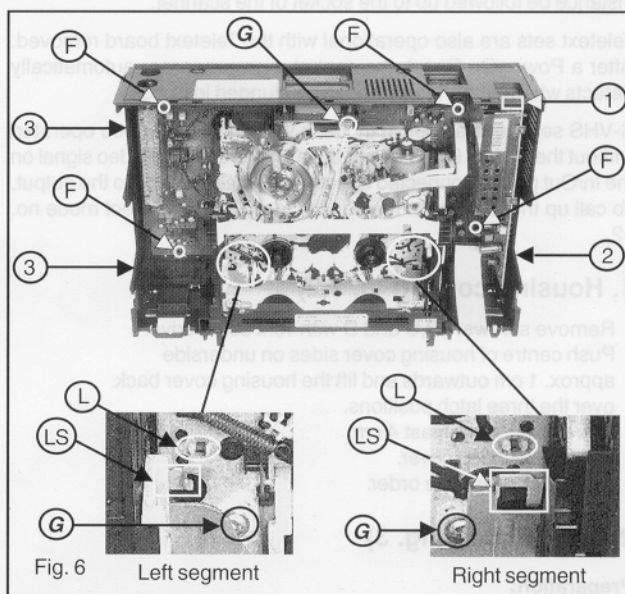
Caution: In order to avoid short circuits between the Teletext board and the power supply, the plastic holder of the TXT board must always be installed or the TXT board must be disconnected (the set also functions without the TXT component)

Assembling:

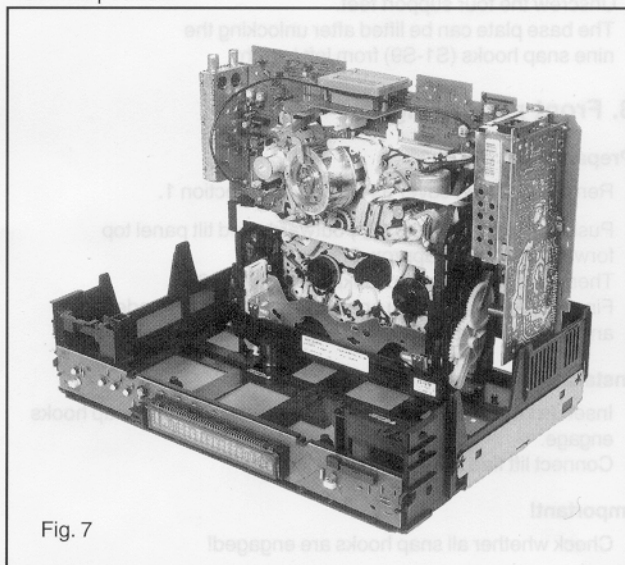
- Position on an even surface
- Hold the drive on the side of the lift and insert the motherboard/drive into the frame.
- Check whether the power supply and Scart socket positions are correct.
- Check if all motherboard snap hooks are engaged!
- Turn the unit upside down and fix the ground screw (M)!
- Fix screws (F), if applicable (Fig. 6).
- Fix the drive screws (G) (Fig.6).
- Reconnect the cables.

Important!

For carrying out electrical adjustments, or to evaluate the picture quality, the earthing screw (M) (Fig. 3) must be present (ground connection for the head amplifier).



Service position



6. Dismantling the drive

Preparation:

- Remove housing cover as described in section 1.
- Remove front panel as described in section 3.

- Position set upside down.
- Undo earthing screw of drive M (Fig. 3).
- Return unit to initial position.
- Push lift back by 5 cm after unlocking both lift stops.
- Undo the three drive screws G (Fig. 6).
- Position lift up to the stop in the 'Eject' position.
- Undo screw H with Torx screwdriver 8. (Fig.5)
- Carefully undo all cable connections to the motherboard.
- Slightly lift the left rear side of the drive to undo the plug-in connection.
- Loosen both snap hooks with pliers (L) and lift up the drive around the snap hooks (Fig. 6).
- The drive can now be released from the motherboard (Fig. 8).

Important!

Push back the shielding of the cable to the scanner nearby the screw (H) approx. 1cm. (Fig.4).

Assemble in reverse order.

Important!

Push back the shielding of the cable to the scanner nearby the screw (H) approx. 1cm. (Fig.4).
Position drive parallel to motherboard on left guiding pin of frame.
Check if all snap holders are engaged.

7. S-VHS PCBs

In mode 12, the set is operational without S-VHS board and drive (the video signal is connected through from the Frontend to the output sockets).

Service position:

- After undoing both screws holding the board supports on the motherboard, the S-VHS boards can be removed.
- Remove Transcoder board from the S-VHS board and connect using adapter PCBs.
- Replace flexible 18-pin cable 1526 by longer cable contained in the service kit.
- Install the two board holders of the VHS - board in the adapter PCB.
- Plug in the S-VHS board in the motherboard by means of the adapter (fig 9.)

Remove drive

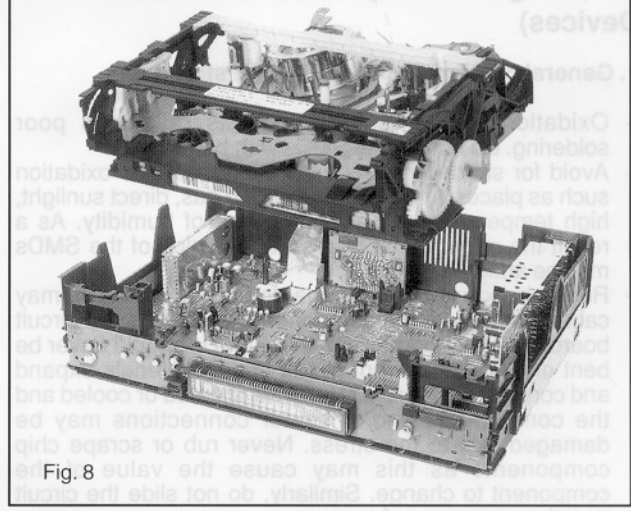


Fig. 8

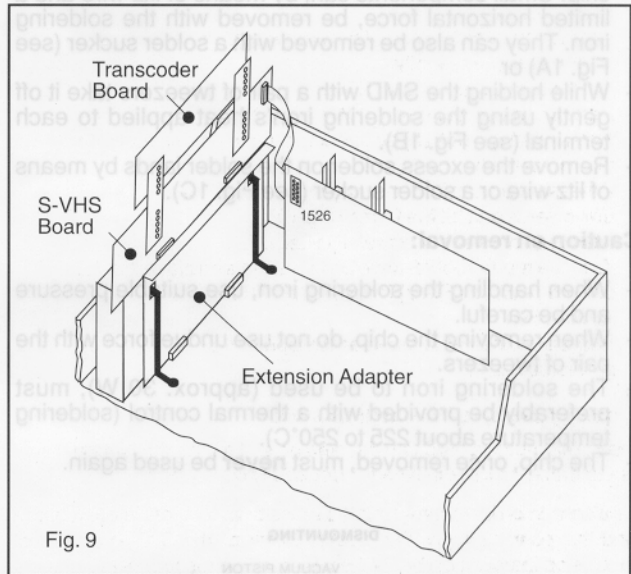
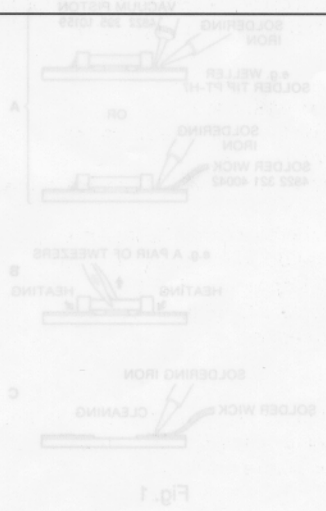


Fig. 9



Servicing of SMDs (Surface Mounted Devices)

1. General cautions on handling and storage.

- Oxidation on the SMDs terminals results in poor soldering. Do not handle SMDs with bare hands.
- Avoid for storage places that are sensitive to oxidation such as places with sulfur or chlorine gas, direct sunlight, high temperatures or a high degree of humidity. As a result the capacitance or resistance value of the SMDs may be affected.
- Rough handling of circuit boards containing SMDs may cause damage to the components as well as the circuit boards. Circuit boards containing SMDs should never be bent or flexed. Different circuit board materials expand and contract at different rates when heated or cooled and the components and/or solder connections may be damaged due to the stress. Never rub or scrape chip components as this may cause the value of the component to change. Similarly, do not slide the circuit board across any surface.

2. Removal of SMDs

- Heat the solder (for 2-3 seconds) at each terminal of the chip. Small components can, by means of litz wire and a limited horizontal force, be removed with the soldering iron. They can also be removed with a solder sucker (see Fig. 1A) or
- While holding the SMD with a pair of tweezers take it off gently using the soldering iron's heat applied to each terminal (see Fig. 1B).
- Remove the excess solder on the solder lands by means of litz wire or a solder sucker (see Fig. 1C).

Caution on removal:

- When handling the soldering iron, use suitable pressure and be careful.
- When removing the chip, do not use undue force with the pair of tweezers.
- The soldering iron to be used (approx. 30 W), must preferably be provided with a thermal control (soldering temperature about 225 to 250°C).
- The chip, once removed, must **never** be used again.

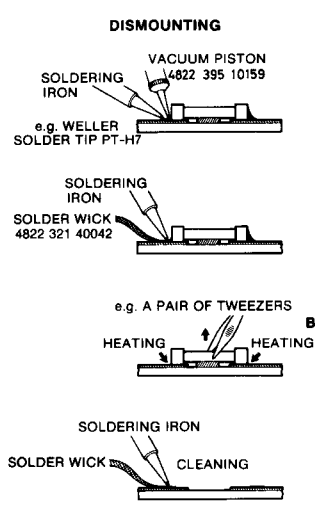


Fig. 1

3. Attachment of SMDs

- Locate the SMD on the solder lands by means of tweezers and solder the component at one side. Ensure that the component is positioned well on the solder lands (see Fig. 2A).
- Next complete the soldering of the terminals of the component (see Fig. 2B).

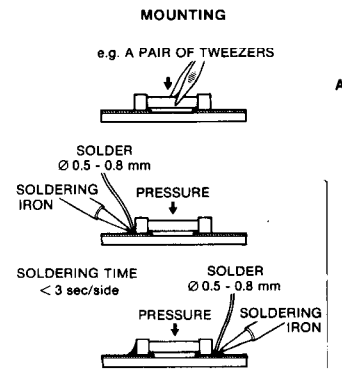


Fig. 2

Caution on attachment:

- When soldering the SMD terminals, do not touch them directly with the soldering iron. The soldering must be as quick as possible; care must be taken to avoid damage to the terminals and the body itself.
- Keep the SMD's body in contact with the printed board when soldering.
- The soldering iron to be used (approx. 30 W) must preferably be provided with a thermal control (soldering temperature about 225 to 250°C).
- Soldering should not be done outside the solder land.
- Soldering flux (of rosin) may be used but should not be acidic.
- After soldering, let the SMD cool down gradually at room temperature.
- The quantity of solder must be proportional with the size of the solder land. If the quantity is too great, the SMD might crack or the solder lands might be torn loose from the printed board (see Fig. 3).

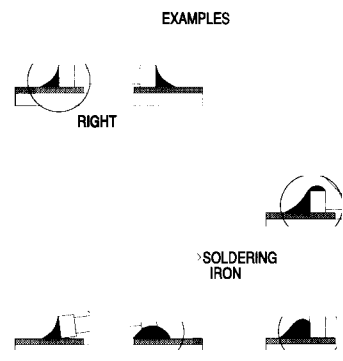



Fig. 3

Flatpack replacement


TOOLS TO BE USED

ANTISTATIC MAT




MAGNIFYING GLASS


HAIR DRYER



METAL BRUSH



FLUX



BRUSH



DESOLDER BRAID



SOLDERING IRON WELLER TCP 50



SOLDER TIP WELLER PT-CC7



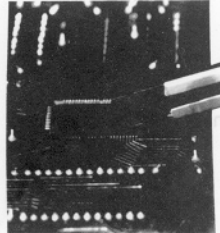
SOLDER
ø0,5-0,8 MM



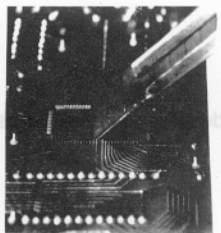
KNIFE



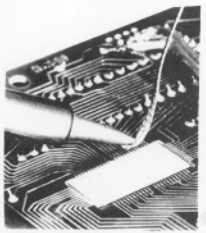
DISMOUNTING



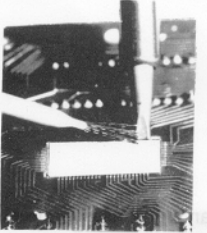
CUTTING THE LEADS



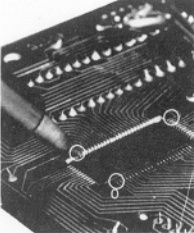
WRONG TRACKS WILL BE DAMAGED



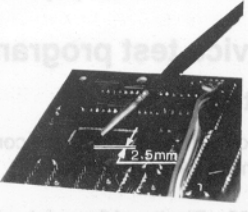
CLEANING THE TRACKS



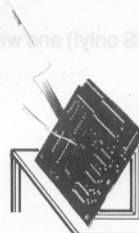
MOUNTING



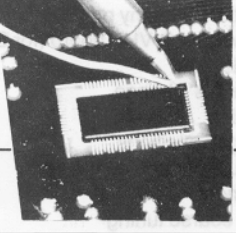
FIXING IC AT THE CORNERS

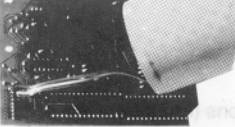


APPLYING FLUX
2.5mm




SOLDERING: SPEED 1 CM IN 5 SEC.



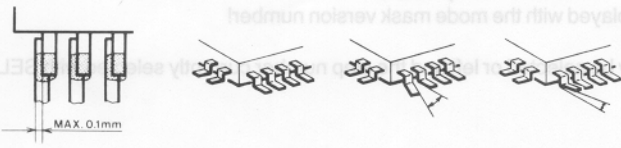


DRYING



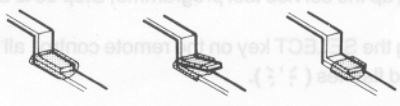
VISUAL CHECK

ALIGNING THE LEADS



RIGHT **WRONG** **WRONG**

SOLDERING



RIGHT **WRONG** **WRONG**

Tools for error diagnosis

Erasing the EEPROM

Disconnect from mains

Press and hold down the Standby key, reconnect to mains and keep the Standby key depressed until the display illumination is switched off (approx. 8 sec.)

All EEPROM data will then be erased and initialised (timer and transmitter channels). The internal processor Ram is also erased, but the option codes, deck parameters, operating hours counter, fast finder and adjustment values are maintained.

After changing the EEPROM

the following steps must be carried out:

- Step 40: Option code - entry
- Step 41: Guide channels
- Step 51: Setting the gap positions
- Step 52: 'Studio Picture control' adjustment
- Step 54: ATS adjustment
- Step 55: Stereo dec. coarse tuning
- Step 56: Stereo dec. fine tuning
- Step 58: Audio linear playback level

Service test program

1 Introduction

The software program for the control, deck and operating microprocessors includes a service test program. It is divided into the following steps, with the following 'modes':

- Step 00: Display of the mask version number
- Step 01: Inspection of the drive positions
- Step 02: Display of the deck - error codes
- Step 03: Deck - sensors and manual tracking
- Step 04: Display of operating hours counter
- Step 05: Display of bus communication error
- Step 10: Drive condition - dummy mode
- Step 12: Operation without S-VHS board (for S-VHS only!) and without drive
- Step 40: Options code input
- Step 41: 'Guide channels' change
- Step 50: X value setting
- Step 51: Setting the gap positions
- Step 52: 'Studio Picture control' adjustment
- Step 54: ATS adjustment
- Step 55: Stereo dec. coarse tuning
- Step 56: Stereo dec. fine tuning
- Step 57: Follow Me
- Step 58: Test tone playback level
- Step 60: Audio 1.4/1.8 MHz
- Step 61: Tone envelope adjustment (THK)
- Step 98: Display test
- Step 99: Clock frequency output

In the service test program, all drive functions (apart from the picture search!) can be carried out, with the exception of the channel search and channel change mode. The program position set before entering the service test program is maintained.

2 Activating the service test program

Press and hold down the STOP key on the remote control. Then press the PLAY key on the recorder and keep it depressed for at least 5 sec. The STOP key on the remote control may be released whilst the PLAY key on the recorder is depressed.

After calling up the service test programme, Step 00 is automatically displayed with the mode mask version number!

By pressing the SELECT key on the remote control, all step modes may be selected or left and the step number currently selected with SELECT appears and flashes ($\bar{\cdot}$),



Step

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Step

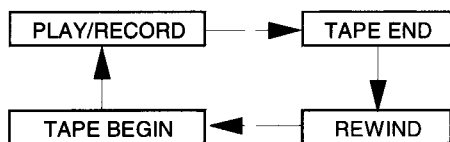
SELECT key on the remote control whilst the Step is flashing, the corresponding mode can be entered or left. If a step is selected to which no mode is assigned, the displays shows - - and flashes.

To leave the service program, press the STAND-BY key or disconnect recorder from mains.

3 Service mode functions

Endurance test

In the service test program, the recorder can be endurance tested. For this, use a cassette and activate "PLAY" or "REC". The functions are then repeated continuously. In RECORD, the recorder does not move to EJECT at the tape end, but to REWIND, after which it starts RECORD again. This test serves to detect intermittent faults. The last error is stored in the EEPROM. (The fault remains stored even after a power failure.) The endurance test is ended by pressing STOP or leaving the service test program.

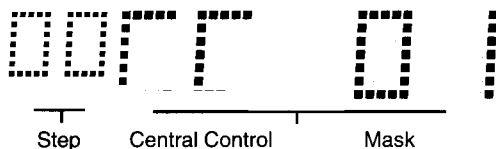


4 Description of steps:

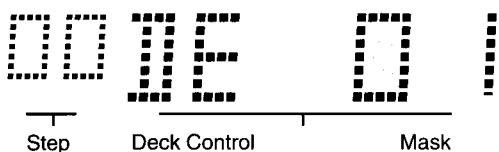
Step 00: Display of mask version numbers

After activating the service test program, Step 00 with the mode mask version number is automatically displayed.

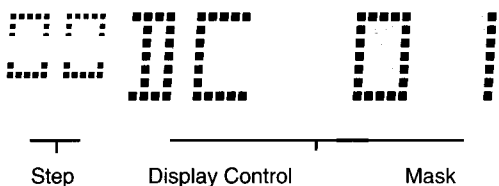
a) After calling up the service test programme, the control microprocessor is displayed,



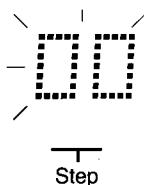
after pressing the "Up" or "Down" key,
b) the deck microprocessor is displayed



and after pressing the "Up" or "Down" key again
c) the operating microprocessor is displayed.



This mode can be left again by pressing the "SELECT" key on the remote control. The currently selected position number appears and flashes on the display.



A step between 00 and 99 can now be selected

Step 01: Checking the drive positions

By calling up Step 01, the drive position appears on the display.
 The FTA signal from the light barriers controlling the speed of the threading motor is used to check the drive condition.
 The drive position is shown as a 3-digit decimal number by counting the FTA pulses on the display.

(e.g. 07 = Eject)

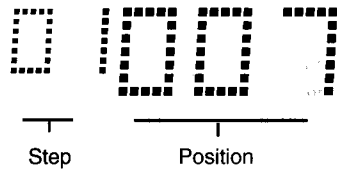


Table of drive positions:

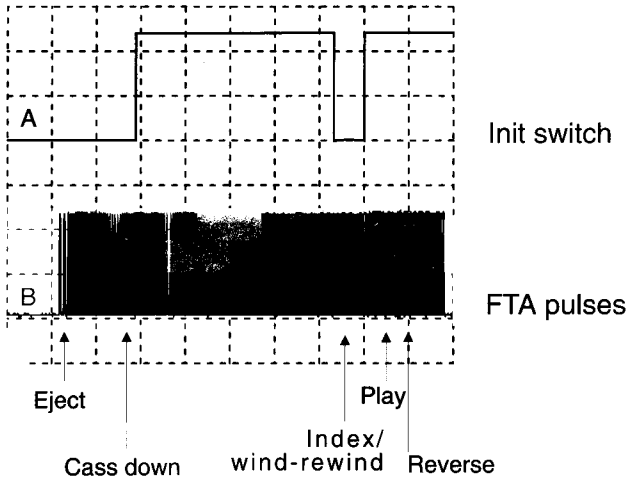
Status	Position (FTA dec.)	Display
Eject	7 +2/-2	007
Wind/Rewind	191 +0/-2	191
Stop	200 +4/-4	200
Play (Pause)	211 +4/-4	211 [With SWING SEARCH]
	213 +4/-4	213 [Without SWING SEARCH]
Reverse	237 +2/-0	237

Function of the Init switch:

The diagram shows the function of the Init switch, depending on the position of the drive. The number of FTA pulses is important for the position of the drive.

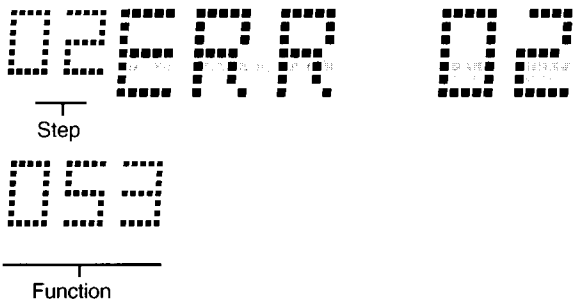
A: DC, 2 V/Div, 0.5 s/Div

B: DC, 2 V/Div, 0.5 s/Div



Step 02: Display of the deck error code

By calling up Step 02, the deck error code is shown on the display



(e.g.: Error 2 = Capstan fault)

Error table

0	no error
1	threading error
2	no capstan pulses
3	tape broken
4	no pulses left reel
5	no pulses right reel
6	head motor error

The bottom 3 digits show the deck fault condition:
(e.g.: 053 = for Play)

Function table:

012	Standby	114	VISS write	211	Slowmotion 1/24
014	Autotracking	115	Viss erase	212	" " 1/14
031	Play-3	125	Tuner - Stopout	215	" " 1/7
034	Slow_reverse	126	Auto Remain Funct.	216	" " 1/2
041	Still Picture	130	ATTS Function	217	" " -1/24
042	Fast	168	Frame+	218	" " -1/14
044	Play-9	169	Frame-	219	" " -1/7
045	Eject	170	Play-11	220	" " -1/2
046	Play9	171	Play-7	222	Edit Record
047	Play-1	172	Play-5	223	Align of Gap
048	Pause	173	Play5	238	Pause
050	Rewind	174	Play7	239	SPC align
052	Wind	175	Play11	246	Edit Pause
053	Play	196	Tuner - Eject	247	Slow motion 1/10
054	Stop out	197	Standby Eject	248	" " 1/18
055	Record	199	Audio Dubbing	249	" " -1/10
112	Index next	202	Audio Dubb. Pause	250	" " -1/18
113	Index previous	206	Reset Tapecounter	253	Key Released

The error code can be reset with the CLEAR key.

Checking the drive functions:**Threading and unthreading time**

The signal of the photoelectric barrier which controls the revolutions of the threading motor is used as a reference for the threading and unthreading time.

Stopping of the left or right winding disk

The tachometer signals of the left (WTL) and right (WTR) winding disks are used as a control reference.

Stopping of the axial head motor

This is monitored with the PG/FG signal. The signal is discharged from the e.m.f. of the non-conducting spools of the axial head motor, showing the position of the head cylinder.

Capstan motor fault

This is monitored with the capstan tachometer signal.

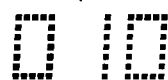
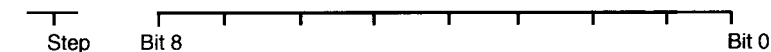
If one of the above sensor signals is not available, the recorder tries to put the lift in the "EJECT" position.

Explanation of deck error code and deck error status

The last error code is stored and remains in the EEPROM, even if the recorder is disconnected from the mains. The error code can be erased by pushing the CLEAR key on the remote control during the service mode.

Step 03: Deck sensors and manual tracking

By activating Step 03, the deck sensors will be displayed in one digit as either 1 or 0.



Function

- Bit 0 Tape end
- Bit 1 Tape start
- Bit 2 Record protection switch
- Bit 3 Tacho right
- Bit 4 Tacho left
- Bit 5 Init switch
- Bit 6 Threading tacho
- Bit 7 S-VHS switch (only for S-VHS!)
- Bit 8 —

In the service test program, the tracking is always set to the centre position. Only in this step can the value for the required tape operation setting be changed with the UP / DOWN keys.

After leaving the mode by pressing the SELECT key, the tracking value always resets itself to the centre position and cannot be changed.

Step 04: Display of the operating hours counter:

By activating Step 04, the operating hours counter shows how many hours the head disk has turned. The hours are displayed as a 4-digit decimal number.



Step

Step 05: Bus communication error display and other detectable errors

By activating Step 05, the error code of the malfunctioning or missing IIC - component is displayed



By pressing the DOWN key, all error codes can be selected in succession. If a version does not contain the IIC bus component, this is also shown as an error.

Error code table:

Code	Description	Pos.
00	no error	
01	Tuner	1750 (TM)
02	Modulator	1750 (TM)
05	VPS/PDC	7720 (VP)
06	Teletext	7140 (VT)
07	Audio Processor	7400 (AU)
08	Video Matrix	7200 (IO)
09	NICAM	7200 (FE)
10	Stereo Decoder	7100 (FE)

If the EEPROMs 7024, 7025 are defective the main controller does not start up and the display remains dark (there is activity on the IIC bus)
 If the audio processor does not recognise the head change-over pulse HI-S (HP2), the display shows "CARR ERROR".

Step 10: Operation without drive - dummy mode

Enter the mode by pressing the SELECT key. All motors are then switched off and the sensors will be ignored by the deck microprocessor. The drive can now be dismantled from the motherboard (see dismantling instruction). **Only install drive with the recorder disconnected from the mains!** For signal tracking, the recorder can be set to all drive conditions, i.e. signal electronic, audio and IO processing are switched to the corresponding operating mode.



Step



Step 12: Operation without S-VHS board (for S-VHS only!) and without drive

Dismantle S-VHS hardware and drive; connect set to mains. This step connects the front end signals to the E1 socket. Leave the step by a mains reset.



Step

Step 40: Option code input

If, as part of repair work, a new EEPROM is installed, it has to be initialised.

After activating Step 40, option A appears in the display.



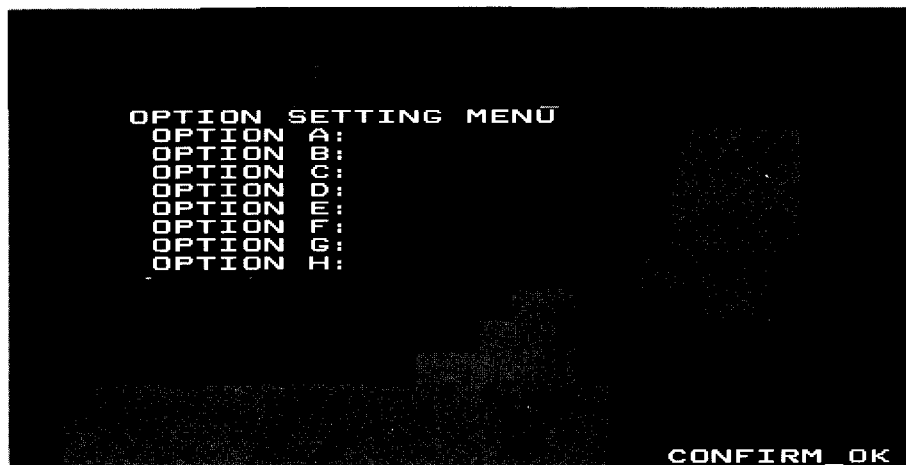
Step

Option Byte (decim.)

The available options can be selected with the UP and DOWN keys.



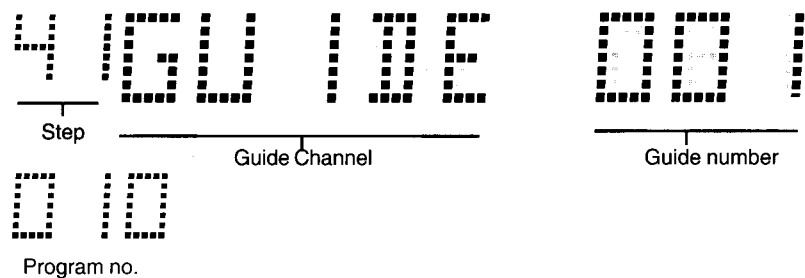
By entering a 3-digit decimal code, the correct options (features) are set. The codes are listed on the type sign on the set. After pressing the "OK" key, the entered code is saved and "Ready" appears on the display for approx. 5 sec.



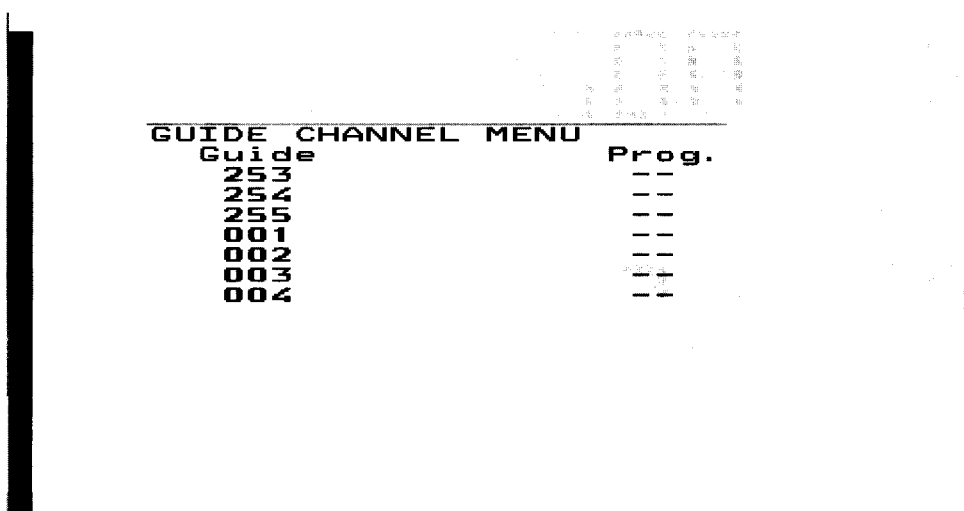
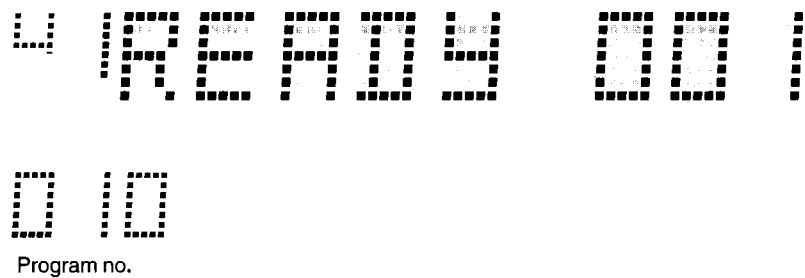
By using the "CLEAR" key on the remote control, incorrectly entered values can be cancelled.

Step 41: "Guide channel" changes (guide numbers)

After activating Step 41, guide channels can be assigned to a program number between 1 and 99. Select a guide channel between 001 and 255 with the UP or DOWN keys and enter a program number for the selected channel with the numerical keys. More than one guide channel may be assigned to a program number.



The value can be erased at any time with the "CLEAR" key and stored with the "OK" key.



Step 98: Display Test

After activating Step 98, all display sections are illuminated with half the brightness.

Circuit descriptions

1. Power Supply PSM (PS)

Technical data:

Supply voltage	: 187 - 264 Vrms
Max. output	: 50 W
Switching frequency	: 100 kHz
Efficiency	: 78 % at max. output

Operational principle (blocking oscillator principle):

During the conductive phase of switching, transistor energy passes from the supply to the transformer. This energy is then passed on to the load during the blocking phase. Regulation is achieved by varying the switch-on time and the frequency of the drive waveform. The energy passed on in every cycle is regulated so that the Power Supply output voltages do not vary under changing load or with Mains input voltage variations. Integrated circuit [7020] has over all control of the Power Transistor.

LOW STANDBY MODE: (PSM2/3/2B)

The Power Supply operates in Burst Mode. The power consumption is less than 1Watt. Only the 5VSTBY remains.

STAND BY MODE: (PSM2A/2AF/1/1B)

The Power Supply operates at a controlled low frequency of approx. 50 kHz. This minimises switching losses.

POINT OF REVERSAL:

At this point of the output characteristic, the transferred output will be at maximum.

OVERLOAD:

The power supply operates in Burst-Mode. The energy of every cycle is limited. In this case the Power Supply outputs will be low.

Circuit description:

The supply voltage is firstly filtered by the components around coil [5010], is then rectified by bridge rectifier [6050] and screened by capacitor [2070].

Electrolytic capacitor [2036] charges via [3050, 3052] and provides the initial start up voltage for the IC [7020]. After the start-up phase the Power Supply maintaining voltage is produced by transformer winding 4-3 and by Diode [6036].

During activation of the switching transistor, a current flows from the rectified supply voltage through the primary winding of the transformer, through Transistor [7040] and then through resistors [3048, 3046] to ground.

As the positive voltage at pin 9 of the transistor is constant (in this example), the current rises linearly, forming a ramp which is dependent on the supply voltage and the inductivity of the primary winding.

A magnetic field will then be formed in the transformer. This current represents a certain energy quantity. During this time, voltages will be produced on the secondary side of the Transformer. These voltages will be polarised in such a way so that the secondary Diodes block. A voltage image of the primary current is then applied to the IC [7020] at pin 7 via resistors [3048, 3046, 3026]. This image voltage is then checked and on reaching a certain value - dependent on the control voltage at pin 14 of the IC, Transistor [7040] will be switched off.

Once the switching transistor has switched off, no further energy will be transferred to the transformer. The transformer inductivity now attempts to keep the current which has flown through the transformer at a constant level ($u=L \cdot di/dt$). The current decreases, di/dt becomes negative. Consequently the polarity of the voltages present on the transformer reverses, causing a current to flow through the secondary winding of the transformer, through the diodes, the electrolytic capacitors and on to the load. This current is also ramp-shaped, but decreasing (See fig. 1).

The circuit supply is controlled by changing the conductive phase of the switching transistor, so that either more or less energy is passed into the transformer from the supply. The control information stems from reference element [7074], this will compare the 5V to an internal reference voltage of 2,5V. The control information for 7074

passes via an optocoupler to pin 14 of [7020] for galvanic isolation. The IC [7020] compares this voltage to an internal reference. The resulting value changes the level at which the voltage at pin 7 of the IC (image of primary current) is compared. The voltage at pin 5 of the IC serves as fold-back control during overload conditions. The maximum removable secondary output is determined by [3048, 3046]. At a certain voltage (normally 1V) at pin 7 of the IC the power supply will pass to the reversal point. The circuitry at pin 11 is optional. The start-up phase is carried out with shortened pulses using by using 2014, the switching frequency in this case will be outside the audible range. The secondary side of the Transformer produces seven voltages. These voltages are rectified by [6076, 6082, 6081, 6092, 6080, 6088, 6098 (Y6096)].

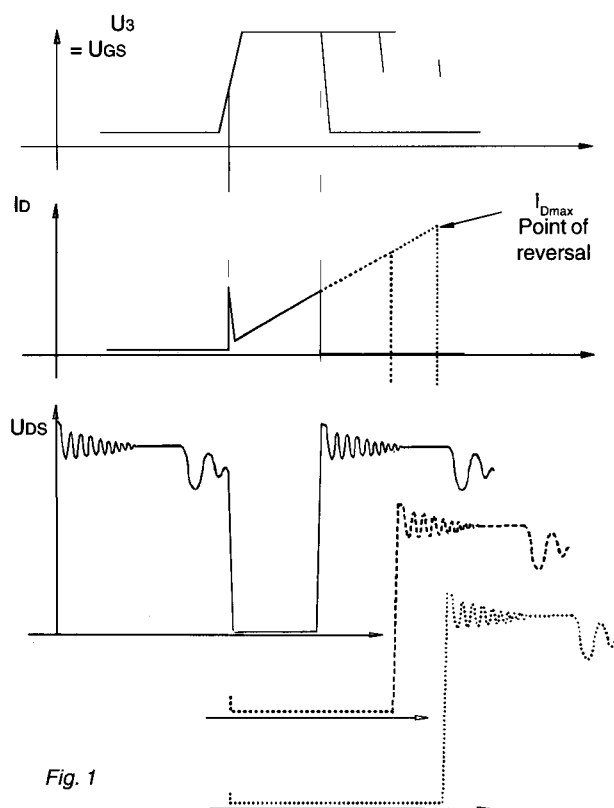


Fig. 1

The Display heating supply is an alternating current and is produced by transistors [7058, 7060]. Transistor [Y7090] switches the motor supply 8/17M.

(PSM2/3 only): Transistor [7050] together with resistor [3071], influences the control loop for the 5V supply voltage. This combination produces the effect of the 5V voltage [7020] being high (via the optocoupler[7070], which causes the IC to switch to BURST MODE (See 1.4 Nominal, overload and standby operation) . A high level on STBY (Pin 18 of pin strip [1519]) switches the power supply to LOW STANDBY MODE. The IC [7085] stabilizes the 5VSTBY voltage, which is unable to supply more than 1mA.

Description of start-up phase

After connection to the Mains supply the following voltages are produced. The start up sequence will now be described. (see Fig. 2). At time t_0 : V_{cc} (pin 1) is presented with a half-wave charge via resistors [3050, 3052], the V_{cc} Start voltage. The current consumption is in this state is 0.3 mA (normal!). The internal reference voltage (V_{ref} IC 7010) will be activated when the V_{cc} Start voltage reaches approx 13V. The internal oscillator will now start up. The oscillator frequency is determined by the capacitor conected at pin 10 of the I.C. (approx. 100 kHz) In the loaded state this can lead to an increase of current consumption up to 17mA.

The voltage at pin 11 rises linearly (Soft Start). The IC will start up with shortened pulses until pin 11 has reached a voltage of 2.4V. If V_{cc} falls below the limit V_{dis2} or if (through a fault in the regulation loop) V_{cc} rises to V_{ccprot} (typ. 16V) before the reversal point is reached, the start-up sequence will be stopped (pin 3 is disabled)

and the IC will be (V_{re}) switched off. V_{cc} will rise by a half-wave charge. A new start-up cycle will then begin.

Nominal, overload and standby operation

After start-up, the IC [7020] lies inside the normal control range. The voltage at pin 14 is normally 2.5V. A secondary load rise will cause an increase in the switch-on time of the Transistor. As a consequence of the increase in load, the peak voltage value at pin 7 of the I.C (drain current image) will also increase. If the load further increases to a pre determined level, the overload amplifier inside the IC will reduce the pulse width to the so-called reversal point. (at typ. 1V on Pin7)

The IC supply voltage V_{cc} will behave in the same way as the secondary output voltages. Consequently V_{cc} will also decrease with increasing load.

During this condition $V_{cc} < V_{dis1}$ (approx. 9V) the IC will change in to the so called Burst Mode (query operation). The fault power condition output will be low, as the interval between half-wave starts will be

2. Front End (FE)

The front end serves to amplify and demodulate the tuner signal. It also generates the FBAS and the LF signals:

Mono
Stereo - right; left
Dual tone; tone 1; tone 2

PAL: The IF signal passes from the connector contact IF-IN [1624/10] to the dual surface wave filter [Y1030] (video and audio), where the video and audio signals will be separated.

Multistandard: The IF signal passes from the connector contact IF-IN [1624/10] to the surface wave filter [Y1010, Y1020, Y1030] (video and audio), where the video and audio signals will be separated.

The video signal is passed to pins -(1) and -(2), the audio signal to pins -(27) and -(28) of Y7050. Additional processing of the video and audio signals is also carried out by IC [7050].

2.1 Video processing

The video IF input signal is fed to pins 1 and 2 of [Y7050], the signal is then processed by the following blocks, a controlled wide-band amplifier, a synchronous demodulator (including active carrier regeneration) PLL, a video amplifier and the generation of regulated voltage for the tuner. The CVBS-signal is present at IC [7050-(18)].

PAL: Via an internal buffer stage IC [Y7050-(19), -(8)] and the Sound Trap [Y1110] the CVBS signal is passed to the module output (connector contact [1624-(5)], CVBS-HF).

Multistandard: Via the sound-trap filter [Y1090] and an internal buffer stage IC [Y750-(19), -(8)] the CVBS signal passes to an additional sound trap filter [Y1110] and a chroma amplification stage [Y1155, Y1515, Y1519, Y2159] or to the sound trap filter [Y1100] and then to the output switch [Y7150] and the module output, connector contact [1624-(5)] (CVBS-HF).

2.2 Audio processing

PAL: The audio IF signal passes from the surface wave filter [Y1030] to IC [7050-(27, 28)]; and then through an internal amplifier. It then passes through a converter [7050]. This converts the sound IF signal to an intercarrier signal (5.5/5.74 MHz). The intercarrier signal is then applied to IC [7050-(17)]. It passes from the IC [Y7050-(17)] via filters [Y1070] (5.5 MHz), [Y1050] (5.74 MHz) to the FM-PLL demodulators [Y7050-(14), -(15)]. This is then followed by internal buffer amplifiers. The AF1(L) and AF2(R) signals will now be present at pins -(10) and -(11).

Multistandard: The sound IF-signal passes via an audio surface wave filter [Y1010, Y1020] to the audio input of IC [7050-(27, 28)], and via an internal regulation amplifier to a converter [7050]. This converts the sound IF signal to an intercarrier signal (5.5/5.74 MHz) for the FM-sound or directly to an audio-signal for AM-SOUND (standard L) [Y7050-(10)].

Mono

During mono broadcasts only pin 10 of IC [Y7050] will receive a signal. The evaluation circuit in the decoder IC [Y7100], recognises the MONO status and will inform the central controller IC [7300] of this via the I2C bus (pins 1/20), this will set the output selection switches in the IC [7570] to MONO mode. The audio signal will be now present at pins 11 / 12 of the IC. From these two connections the signal is then passed to the I/O switching circuit. (FEL,FER) FM recording. For linear audio recording the audio signal is passed to the audio linear circuit (FEMono) from IC [Y7050-(10)] via T [7143].

Stereo mode

During stereo broadcasts the signals are connected to IC [Y7050] at pins 10 and 11. The R signal (pilot signal amplitude modulated with 117 Hz) is connected to pin 11. The pilot signal passes via the pilot circuit (PAL: [Y2070, Y5070], Multistandard: [Y2130, Y5130] to IC [Y7100] pin 5 and then to the evaluation circuit. This circuit allows

Start Up and Overvoltage protection:

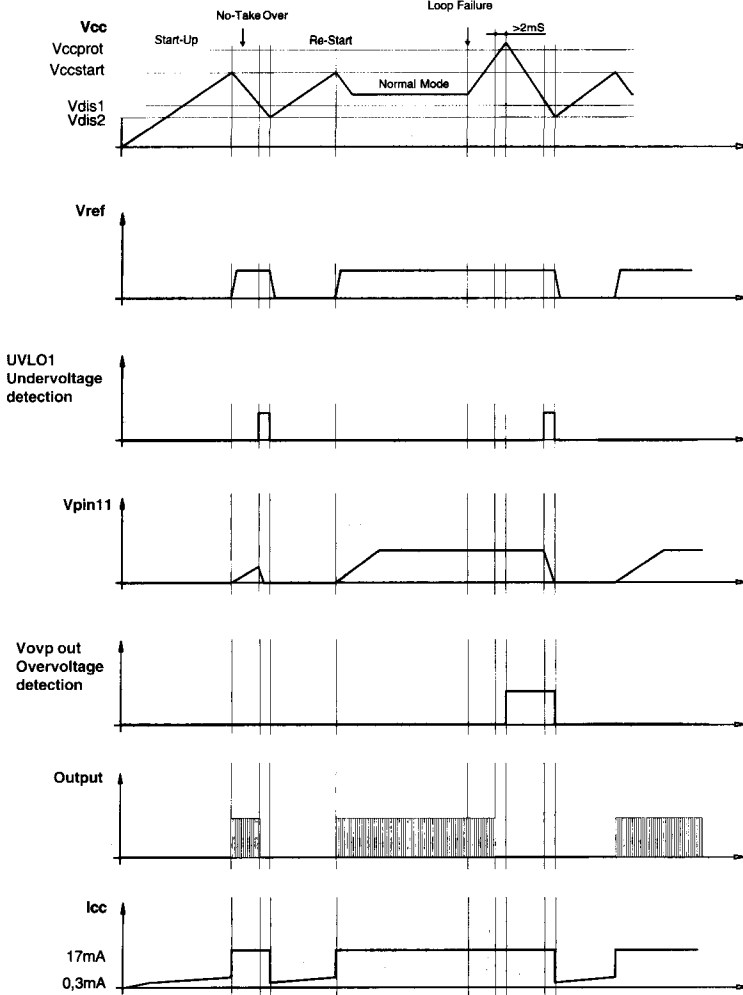


Bild 2

long. A reducing load will shorten the on transition time. If the load drops further at a certain threshold, the IC will switch the frequency back to approximately 50 kHz (Standby mode) via pin 7 (depending on the connections at pins 12, 15).

This keeps any switching losses in the transistor to a minimum.

Over temperature

The IC [7020] has a built in over temperature sensor, blocking by the use of internal logic the drive waveform if excessive IC temperatures are produced (typically 155°C). When the temperature has reduced the power supply will re start.

the decoder to recognise the stereo status from the 117 Hz signal and hence informs the central controller by using the LH2 (Longplay heads) to pins 11 and 9 where the 4 Signals are amplified. The HSC (SP/LP) signal passes on the correct signal at the amplifier outputs of [7600]. At SP HSC is Low. The FM signals of heads SH1 and SH2 are passed on. During LP operation HSC is High and the information from heads LH1 and LH2 is processed further. The HSC signal is passed to pin 21 of IC [7600] via IC [7649]. As the tape information can only be read by one head this means LH1 or LH2 during LP operation and SH1 or SH2 during SPsing the 274 Hz signal. The decoder will identify its status to the sequence controller via the I²C bus. Via the I²C bus both channels will then be electronically switched to pins 11 (tone1) and 12 (tone 2) and then finally once again by the via the I²C bus to the audio (AU) switching circuit.

FER=FRONT END RIGHT

FEL=FRONT END LEFT

3. PCB-Head amplifier (HC)

Operational overview

The Video head amplifier passes the image signals to the rotating transformers. The signals are then written to tape by the video heads or read out by the same.

3.1 Playback:

The mutual SHC and LHC points of the transferring coils are earthed by switches SW-SP and SW-LP (both in IC [7600]). Switches SW1-SP, SW2-SP, SW1-LP and SW2-LP (in IC [7600]) are open. For playback 2 heads are available for LP and SP. The FM information on the tape pass via SH1 and SH2 (Shortplay heads) to pins 6 and 4 of the video head amplifier [7600] and from LH1 and LH2 (Longplay heads) to pins 11 and 9 where the 4 Signals are amplified. The HSC (SP/LP) signal passes on the correct signal at the amplifier outputs of [7600]. At SP HSC is Low. The FM signals of heads SH1 and SH2 are passed on. During LP operation HSC is High and the information from heads LH1 and LH2 is processed further. The HSC signal is passed to pin 21 of IC [7600] via IC [7649]. As the tape information can only be read by one head this means LH1 or LH2 during LP operation and SH1 or SH2 during SP operation. The signal HP1 (pulse) IC [7600-20] switches to the reading head. The unregulated FM signal is passed to pin 19 of IC [7600] as FM UK, the regulated FM signal to pin 18 of IC [7600] as FM-CON.

3.2 Search operation:

The SP and LP signals are rectified in [7600] and compared in a comparator. This determines which head supplies the stronger signal. The comparator output (pin 23 of [7600]) is passed on as ENVC signal to the deck controller 7085, providing the correct HP1 and HSC signals [7600] for the search operation. ENVC is High for SP signal > LP signal and Low for SP signal < LP signal. Using HSC and HP1, the strongest signal is applied to the output of [7600-(pin 19)], to receive an interference-free picture. The HSC is linked with the C-SYNC (in IC [7649]) so that a switch-over can only be made at a line end.

3.3 Recording:

Via resistors [3610, 3611 and 3612] all signals FM>Bd, CH>Bd and SEC-FM (SP mode) are added, showing the relationship of FM>Bd to CH>Bd or FM>Bd to SEC-FM at -12 dB in the summing which is pin [7600/19]. This summing information signal passes at pin 1 into IC [7600], which passes the recording signal to the mutual point (SHC) of the SP head transformers. Condenser [2616] determines a certain recording frequency for SP-mode. In LP-mode the signals are added via the resistors [3617, 3618, 3619] and then passed to IC [7600] at pin 27, which then passes the signal to the mutual line [LHC] of the head transformer. Condenser [2615] which determines the frequency response in LP-mode.

4. Luminance/Chrominance circuit (VS)

General:

During recording the 4.43 MHz colour signal is converted to 627 kHz with a beat frequency (5.06 MHz). The luminance signal is frequency modulated. During playback the 627 kHz colour signal returns to the original 4.43 MHz colour signal (beat frequency 5.06 MHz). It is then amplified, added to the modulated and dropout compensated luminance signal and passed to the IN/OUT circuit.

4.1 Luminance unit

4.1.1 EE operation

The FBAS input signal passes via pin 7 in IC [7320]. From here it passes through a servo amplifier (AGC), a clamping stage and a video amplifier. The signal is output at pin 11 of IC [7320], passes to an emitter follower (transistor [7335]) and is then passed to the IN/OUT circuit via resistor [3534].

The C-SYNC comes from pin 9 of IC [7320]. The C-SYNC is gained from the FBAS-IN signal at pin 7 of IC [7320].

In IC [7320] the FBAS signal is filtered by a low pass filter before the AGC amplifier and then clamped. The C-SYNC is then separated and output at pin 9 of IC [7320]. (See 1.4 !)

4.1.2 Recording

The FBAS signal is passed from the IN/OUT circuit to pin 7 of IC [7320] and to the SECAM circuit. In IC [7320] the signal is regulated in the AGC stage. It is then clamped, low pass filtered (3.5 MHz) for chroma suppression and output from IC [7320] at pin 46. The Y signal is passed to an emitter follower (transistor [7300]) and then returned into the IC [7320] at pin 47, where it goes through a clamping stage, a DETAIL ENHANCER and the non-linear Emphasis providing non-linear lifting of high the frequencies. The following MAIN EMPHASIS lifts the high frequency parts of the BAS - signal linearly. This lifting is cancelled during playback. After the MAIN EMPHASIS the black and white values are amplitude limited (W/D CLIP). The signal is then FM modulated and output at pin 44 of IC [7320]. A band pass filter consisting of capacitors [2267, 2268, 2269, 2271, 2273] and inductors [5267, 5269] and [5273], limits the Y-FM range for the low frequency ranges (below 1.0 MHz) for non-interfered Chroma signals. The FM modulated signal (FM<BAND/FM T.T.) is then passed on to the head amplifier switching circuit (HC).

The Y-writing current is defined by the adjustable component [3479].

4.1.3 Playback

During playback the regulated FM signal from the tape (FM-CON) is branched after the transistor for luminance processing of SQPB and VHS.

VHS:

For VHS playback the FM signal is passed from the tape to a "Peaking circuit", forming a parallel and a serial oscillating circuit (capacitors [2157, 2159], inductivity [5157]). During serial resonance (5 MHz) the signal passes through unattenuated and during parallel resonance (9 MHz) it is blocked. The group delay of this signal is corrected with transistor [7165], resistors [3365, 3367, 3369], capacitor [2167] and inductor [5167]. The signal is released from the 627-kHz chroma signal by a suction circuit [2175, 5175] and low pass filtered (capacitors [2181, 2179], inductivity [5179]).

The SEC-W signal switches transistor [7185]. If SEC-W is low, the transistor is conductive. Then the Y-FM signal will be passed to pin 43 of IC [7320]. For the playback of Secam-West recordings SEC-W is high so that transistor [7185] blocks. The signal now passes through a 1.1 MHz rejection filter (capacitor [2185], inductivity [5185]) for colour suppression and is only then passed to pin 43 of IC [7320]. There the signal is passed to an AGC stage and checked by the Dropout Detector (DOC DET) for level dropouts, exceeding a certain value. If necessary, a pulse is transmitted to the dropout compensation switch (DOC). From here the signal passes through a limiter (DOUBLE LIMIT), a FM demodulator, a low pass (SUB LPF) and the main deemphasis (MAIN DEEMPH). The main deemphasis block the linear lifting of the high frequency is cancelled. At pin 46 the signal leaves the IC [7320]. At this stage the transistor [7280] switches between the VHS and SQPB demodulator identification lines. At pin 47 the signal is passed back into the IC [7320]. After

clamping, it is passed to a low pass filter (Y-LPF), only letting through luminance signals. Furthermore C-SYNC is taken from the signal and then output at pin 9 of IC [7320]. The BAS - signal from Y-LPF is passed to the output stage (ATT) for dropout compensation and then via pin 15 of IC [7320] to pin 7 of IC [7340]. The signal is delayed by one line and passed via pin 9 of IC [7340] to pin 13 of IC [7320]. After VCA amplification it is clamped and passed to the dropout switch. If dropout signals occur, these are replaced by the clean delayed signal by switching the dropout switch. Furthermore the undelayed and delayed BAS - signals are subtracted from one another in a differential amplifier and the resulting low frequency noise voltage is added in antiphase to the undelayed Y signal by an evaluation filter. The noise reduced BAS - signal passes through a non-linear deemphasis block (NL DEEMPH), cancelling non-linear lifting of the high frequencies, a filter suppressing high-frequency noise voltages (WHP) and a Picture Control. The central controller sends data corresponding to the required picture quality to the shift register [7370], switching the outputs (pins 4, 5, 13 and 14) accordingly. The output signals of the shift register are summed via resistors [3542, 3543, 3544, 3545] and added to the 2.5V, between resistors [3552] and [3523]. The thus generated control signal PIC_CTL is passed to pin 3 of IC [7320], where it controls the lifting or lowering of high frequencies in the PICTURE CONTROL. In the follow on Y/C mixing stage the luminance and chrominance signals are added to one another. The FBAS signal is clamped, passed to a video amplifier and then output at pin 11 of IC [7320].

SQPB (Quasi SVHS):

Transistors [7195] and [7200] determine whether the VHS or SQPB signal path is chosen. If the control signal SQ-PB is low at transistor [7200], the VHS signal path becomes active and if the SQ-PB is high the SQPB signal path is selected.

For SQPB the FM signal is filtered as for VHS with a "peaking circuit" (inductivity provided by [5150], capacitors [2150, 2151]).

The circuit varies the normal VHS resonance frequency. The signal passes through unattenuated at 7,5 MHz (5 MHz for VHS) the rejection frequency being 13 MHz (9 MHz for VHS). After correction for group delay (transistor [7203], resistors [3403, 3404, 3405], capacitors [2203], inductivity [5203]), emitter follower [7210], transistor [7215] with resistors [3415, 3413, 3417], with condensator [2215] and with inductivity [5215] the signal passes through the same path as for VHS playback.

4.2 Chrominance unit

4.2.1 Recording (PAL and MESECAM)

The FBAS signal from the IN/OUT switching unit enters IC [Y7320] at pin 7 where it passes through a servo amplifier (AGC) and a low pass filter, allowing only the colour carrier (4.43 MHz) to pass through. The received chroma signal passes to the main converter after passing through a servo amplifier (ACC) mixing the chroma signal with 5.06 MHz which generates the 627 kHz and 9.49 MHz frequencies. The 9.49 MHz is suppressed by the low pass filter and the 627 kHz signal (chroma) is passed to the colour killer. The chroma signal is then output from IC [Y7320] at pin 38 and passed to potentiometer CAP [Y3387] to adjust the recording current. The chroma signal (CH-tape) is then passed to the head amplifier switching unit (HC).

4.2.2 Playback

To suppress the luminance signal, the non-regulated FM signal of the tape is filtered by the 1.6 MHz suction circuit (capacitor [Y2422], inductivity [Y5422]) improving the cross-talk from luminance to the chroma signal. The chroma signal is matched with the Entry (pin 38) of IC [Y7320] through transistor [Y7225]. At this stage the signal is regulated after passing through a low pass filter it is then amplified (with ACC) and then passed to the main converter. The main converter mixes the 627 KHZ signal with the subcarrier frequency 5.06 MHz thus regaining the 4.43 MHz chroma signal. The 5.687 MHz generated at the same time, is filtered out by the 4.43 MHz band pass. The chroma signal is then output at pin 19 of IC [Y7320] and the inverted signal at pin 17. Both signals are required for the comb filter in IC [Y7340]. The chroma signal is passed to pin 2 and the inverted chroma to pin 4 of IC [Y7340]. The comb filter in IC [Y7340] delays the respective signal at PAL by two lines in a circuit branch and by one line for NTSC and then to add it to the undelayed signal. The switch in the delay branch is controlled by the NTSC-H signal at pin

22. It switches between PAL and NTSC delays. The scanning frequency ($3 + 4.43 \text{ MHz} = 13.29 \text{ MHz}$) is generated internally (IC Y7340) from the chroma frequency. The chroma signal cross-talk compensated by the comb filter is passed from pin 23 of IC [Y7340] to pin 21 of IC [Y7320], where it is released from the 13.29 MHz signal by a low pass filter. The signal is then amplified and passed to a colour killer. The follow-on NAP circuit is only important for NTSC and does not influence PAL signals. From a band pass filter the signal leaves IC [Y7320] at pin 25. PAL and NTSC signals arrive unchanged at pin 23 of IC [Y7320]. There the chroma signal is passed to the Y/C mixing stage, and the chroma and luminance signals are added. The received FBAS signal is then clamped, amplified with the VIDEO AMP and then output at pin 11 of the IC [Y7320]. The FBAS-OUT passes via transistor [Y7335] to the IN/OUT circuit from where it is passed to the modulator and to the SCART sockets.

For MESECAM playback the comb filter is ineffective. The remaining signal path is the same as the PAL signal path.

4.3. Carrier processing

4.3.1 Recording (PAL)

For carrier processing a voltage controlled crystal oscillator (VXO) in the IC is used [Y7320], whose frequency is determined by the crystal [Y1060] connected to pins 27 and 28. The REC-APC detector compares the phase of the incoming transmitter burst with the VXO phase and adjusts the VXO accordingly. The control voltage is then output at pin 29 of IC [Y7320]. Additionally an oscillator (321FH VCO) integrated in IC [Y7320] is used, which is regulated by the synchronising frequency. The VCO oscillates with a $321 \times$ line frequency fH, corresponding to a frequency of 5.015625 MHz which is divided by 8. The thus generated 627 kHz frequency is applied to the sub converter, where it is mixed with the oscillating frequency of the VXO (4.43361 MHz). This forms the sub carrier 5.06 MHz passing through an internal 5.06 MHz band pass and then to the main converter. At this stage the 4.43 MHz signal is mixed with the 5.06 MHz sub carrier, creating the 627 kHz signal.

4.3.2 Playback (NTSC, PAL)

During playback the XO oscillator is running freely on a crystal frequency of 4.43361 MHz and is used as a reference for the VCO oscillator. The VCO is synchronised after re-conversion of the chroma signal from 627 kHz (PAL) or 629 kHz (NTSC) to 4.43 MHz by the burst of the played back colour signal. The PB-APC stage generates the control voltage for the VCO, regulating at the same time the phase of the crystal oscillator with the phase of the re-converted 4.43 MHz burst. The control voltage is smoothed by a filter section [Y3455, Y2253, Y2255]. The frequency of the VCO (5.015625 MHz) is divided by 8 and passed to the sub-converter mixing it with the oscillating frequency of the XO (4.433619 MHz). This also creates the sub carrier 5.06 MHz which is then passed via the internal band filter to the main converter generating a 4.43 MHz signal from the 627 kHz signal with the sub carrier frequency.

5. SECAM L, Chroma Signal Processing

5.1 Recording

The FBAS signal from the I/O circuit part is applied to transistor [7570] and passes through a 2.8 MHz trap circuit [5550, 2551], increasing the selection effect of the next cloche [1080, 2555]. The signal is then passed through an emitter follower [7552], which passes the selected chroma signal to IC [7575-29] via the cloche. The signal then passes through a 15 dB amplifier and is passed to a limiting amplifier with a subsequent frequency divider via pins 25 and 24. The 1.1 MHz recording signal, generated by a 1:4 division of the chroma signal, is passed to pin 21 of IC [7575]. From here, it passes through an external band pass filter [2561,..., 2567], lowering the harmonics created by the frequency division, and returns to IC [7575] at pin 19. The signal then passes through a 10 dB amplifier and is connected to pin 15. Between pins 15 and 14, the 1.1 MHz signal is passed via the anti-cloche [1082, 2575]. In IC [7575], the signal is limited and then passed via pin 17 to an additional 3.3 MHz trap [5586, 2586] and then to the adjustment for the chroma recording

current [3581] (SCWC) to a further emitter follower [7583], from where it is passed on to the video head amplification circuit (HC). The R/P change-over of IC [7575] is carried out at pin 23 by the PB switching status.

5.2 Playback

During playback, the non-stabilised FM tape signal (with 1.1 Colour Under) from band (FM-UNC) that has been supplied by the circuit (HC) is applied to [2556] and is then passed to IC [7575-(23)], where it is amplified by 6 dB. From pin 21, the FM signal (with 1.1 Colour Under) then passes through a band pass filter [2561, ..., 2567], where it is separated from the Y-FM signal. The 1.1 MHz signal on pin 10 of IC [7598] is High. This status signal is passed to the deck controller IC [Y7085] in circuit "DE". The IC also receives the AUTOSEC (VHS) or AUTOSEC (SVHS) switching status.

The data is passed to CC controller [7035-(14), -(20), -(32)] via serial interface [Y7085/-(62), -(63), -(64)]. The data is then linked depending on the operating condition and the respective shift registers are triggered.

In case of VHS, SEC-E is output via the shift register (SR5) [7380-(12)] and SEC-W is output via thl is then passed via IC [7575-(10)] to the band pass [2581, ..., 2576], removing interfering doubling products from the utility signal. In a second doubling stage, which the 2.2 MHz signal enters via IC [7575-(8)], the 4.4 MHz signal is formed. It is then amplified by 10 dB and passes via pin 31, the anti-cloche circuit [1085, 2585], to pin 32. From IC [7575-(1)], the 4.4 MHz signal is passed to the band pass [5590, ..., 5594], also freeing the utility signal from interfering harmonics. The SECAM chroma signal gained thus passes through the amplifier stage [7588] and the emitter follower [7593] and is then passed to [Y7240], circuit part "VS". The signal is then added to the BAS signal or is passed to the "SF" circuit in S-VHS sets.

5.3 SECAM detection

IC [Y7598] receives the 4.4 MHz chroma signal from the "VS" or "SF" circuit via pin 1.

IC [Y7598] detects whether the signal is a SECAM signal during recording or a MESECAM signal during playback. For MESECAM signals, the switching voltage (AUTO-ME) passed to pin 10 of IC [7598] is High. This status signal is passed to the deck controller IC [Y7085] in circuit "DE". The IC also receives the AUTOSEC (VHS) or AUTOSEC (SVHS) switching status.

The data is passed to CC controller [7035-(14), -(20), -(32)] via serial interface [Y7085/-(62), -(63), -(64)]. The data is then linked depending on the operating condition and the respective shift registers are triggered.

In case of VHS, SEC-E is output via the shift register (SR5) [7380-(12)] and SEC-W is output via the same shift register [7380-(6)]. In case of S-VHS, the change-over output of the signal electronic for the SEC-E is carried out via shift register SR9S [7410-(12)], and for SEC-W via shift register SR5 [7380-(6)].

6. Deck Electronics (DE)

The deck electronics can be subdivided into various functional groups:

1. Reset generation
2. Threading motor control
3. Drive interface (deck)
4. Tape start/end recognition
5. Head servo control/commutation
6. Tape servo control
7. Tracking/autotracking

6.1 Reset generation

After connection to the mains IC [7080] and capacitor [2081] generate a reset pulse at pin 19, re setting the central controller on the chassis (family board) IC [7335]. During the initialisation phase of the central controller, shift register [7019] is maintained in the "Disable condition". IC [7240] will then generate a Reset pulse at pins 11 and pin 12. This pulse will reset the Deck [7085] the operating unit, and the camera controller.

6.2 Threading motor control

The drive also contains three switches: INIT (Initialisation switch for the threading tacho counter), REC (erase protection), and S-VHS. The conditions of these switches are coupled via [3203], [3205] and [3201] and then passed to the deck via pin 52. The lift and the threading mechanics are controlled via the threading motor by counting the threading tacho pulses together with the INIT switch and the TAPE START/TAPE END recognition. The threading tacho values are securely linked with the drive positions and passed to the deck controller, [7085] via IC 7080. The rotational direction of the threading motor is determined by pin 35 of the Deck controller. The revolutions are identified at pin 10 of the deck controller, This is a pulse wide modulated signal which is integrated by [3250] and [2093]. The power operation driver IC [7090] serves as power operation amplifier.

The lift is mechanically connected to one impeller turning in a fork light barrier. The tape must be inserted until 3 threading tacho pulses are generated, after which the tape controller activates the threading motor and takes over the loading of the tape. During ejection of the tape and shortly before reaching the end position of the lift, the tape start and tape end sensors are mechanically released at the same time. After a short while the deck switches off the threading motor.

6.3 Drive interface (deck)

The interface module [7080] takes over the following tasks:

- Processing of threading tacho pulses
- Processing of winding tacho pulses
- Processing of Capstan tacho pulses
- CTL, Write/Read

Processing the threading tacho pulses

The lift is mechanically connected to the threading tacho generator. Tapes must be pushed into the lift until 3 threading tacho pulses have been generated. These pulses are passed to the Deck interface module [7080/6]. Via one of the 4 comparators of this IC. The signal is processed and then passed to the Deck [7085/29]. By counting the threading tacho pulses, the INIT switch and the tape start and tape end recognition, the deck controls the threading motor.

Processing of winding tacho pulses

The optocouplers on the left and right winding disks (WT1/WT2) generate 8 pulses per rotation. These are formed to rectangular pulses in the drive interface module [7080] and via a comparator and passed from pins 8 and 9 to the deck [7085]. The controller calculates the actual tape position and tape type from the ratio of the revolutions.

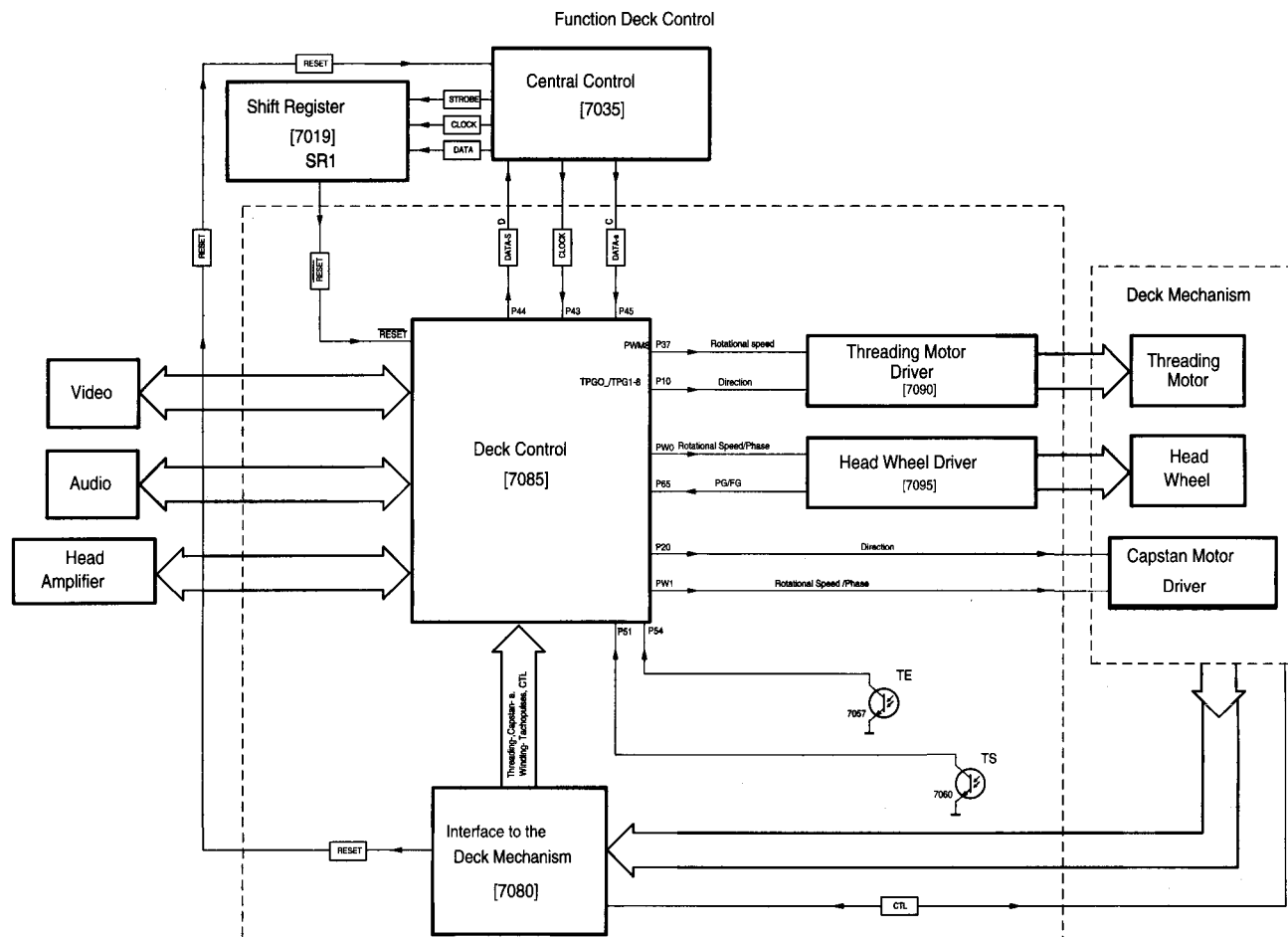
Processing the Capstan tacho pulses

The Magneto Recitive element produces pulses with a frequency of 1514 Hz during playback mode and these pulses provide the revolution control for the Capstan motor. The pulses are passed via connector contact [1502/15] to a comparator on the Deck interface module [7080/9]. Via [7080/12] these actual tacho values are passed to the deck controller [7085/13], which in turn generates a control voltage for the Capstan motor driver IC via a pulse wide modulated square wave voltage from [7085-25], it is integrated with [3214] and [2066].

CTL - Write/Read

During recording, coded 25 Hz CTL pulses are recorded on the tape via the synchronising head, required for tracking during playback, recognising the 16:9 image page format and the index operation. These 25 Hz pulses pass during the recording from IC [7085/11, /14, /16] to the drive interface module [7080/18] and via [7080/2] and connector contacts [1502/6, /7] to the synchronising head.

During playback, the recorded CTL pulses are read off the synchronising head, converted into rectangular pulses in 7080 and passed via [7080/18] to the Deck [7085/11, /14, /16] for evaluation. From the timing of the CTL slopes the controller is also able to recognise the speed e.g (SP, LP PAL, or SP, EP NTSC) of a recording. The respective playback speed is selected automatically.



6.4. Tape start/tape end recognition

To recognise the tape start and end the Video tape contains a piece of clear foil on both tape ends. A transmitter diode placed into the tape centre is clocked by transistor [7073].

The photo transistors are fitted on the left and right sides of the deck, tape start = TAS) tape end (TAE), Both supply a pulse, which goes from 5V towards 0V, if the clear foil is located between transmitter and phototransistor. Both phototransistors are connected to the Deck via pins 51 and 54.

6.5 Head servo control/commutation

The head servo control supplies the correct revolution and phase signals required by the head disc and is carried out within the deck controller [7085].

For commutation, the head motor driver IC [7095] uses the EMF (electro magnetic force) of the currentless motor winding (transformer principle) from which the rotation is derived at the same time. The phase of the head disk is derived from a position coil. Revolution and phase are multiplexed to one signal (IC[7095/6]). At the same time the falling slope of the signal is the revolution (FG) (450 Hz); the position (PG) pulses having a positive slope with 25 Hz. At pin 24 of the deck controller a PWM output with 12 bit resolution is present, the head disk control voltage containing revolution and phase information, is issued from this pin. This pulse wide modulated signal is passed to the head wheel motor driver [7095/14] and integrated with capacitor 2116.

6.6 Tape servo control

The Capstan motor is a three-phase motor with a Hall generator. These generate signals which are passed to the driver IC on the Capstan motor (on the deck) via pins 1..6. Depending on these signals, the commutation of the individual phases of the Capstan motor is carried out by the driver IC. The FC Hall element of the Capstan motor issues pulses with a frequency of 1514 Hz at nominal revolutions for the revolution control. These are pre amplified on

the sensor board and passed to a comparator via connector contact [1502/4] and then to pin 9 of 7080. The rectangular shaped tach pulses are then compared in IC [7085] with a set value. Via pin 25 of the deck controller [7085] a pulse wide modulated rectangular voltage is present. This is integrated by [3214] and [2066] and passed to the Capstan IC via the socket contact [1502/6].

The change of rotation direction is carried out by pin 34 of the deck controller [7085].

To avoid heating of the deck from the dissipation of the Capstan motor driver at slow speeds the supply voltage for the motor is switched. For tape speeds of < double, 8V, and for speeds > double a 17V supply voltage is applied. In the latter case (17V) pin 3 of the Deck [7085] is set to High (WIND), switching on transistor [7205].

6.7 Tracking/autotracking

During recording, 25 Hz CTL pulses are written to the tape via the synchronising head which are amplified in IC [7080] and are then passed to the Deck. These pulses are rectangular in shape. The pulses are used for tracking, recognition of the 16:9 page format and the index search.

After inserting a tape, the voltage TRIV derived from the FM audio packets envelope is passed to the deck via pin 50 for optimum tracking. Starting from the centre position the tracking value is increased or decreased until the envelope voltage decreases compared to the highest voltage value. The centre value between the two corner values is set as optimum value. After the measurement, the autotracking function is switched off and the determined phase position is regulated via the CTL pulses.

During AUDIO ONLY - playback the audio envelope FMHT is used for the tracking function.

The autotracking function is only restarted if one of the following conditions is fulfilled:

- 17 missing CTL pulses
- Change between LP and SP
- Change between PAL/SECAM and NTSC standards
- Change between NTSC-SP and NTSC-EP.

this detects whether a carrier recognised by the AFC is also modulated with a video signal.

EP=EXTENDED PLAY
SP=SHORT PLAY

7. Central Control (CC)

Operation overview

The central controller IC [7035] controls peripheral functional groups via various bus systems. The communication with the deck controller controlling all functions of the deck takes place via DATA-S1 and CLK-S, and the communication with the display controller takes place via the I²C bus (connector contacts [1510/12 and /14]) and the bus-interface [1510/18]. The sequence control can be divided into the following functional groups:

1. Central controller with external memory and parallel RAM
2. Generation of operational and switching voltage
3. Various bus systems (OSD, FC, shift registers, SAT-controlling,...)
4. Reset generation for the deck electronics, operating unit (DC) and Edit Controller
5. AGC and AFC, and audio adjustment.
6. Shift register [7019]
7. EEPROM
8. RS 232 Interface

7.1 Central controller with external memory and parallel RAM

The central controller IC [7035] carries out the main control of the VCR. As the multitude of tasks can not be managed by the maximum possible internal program memory 6k x 8 ROM, an external program

Memory is required. An EPROM (depending on type 128kB..512kB), IC [7030] and a LATCH module, IC [7027], are used, the latch controlling the access to the EPROM.

As the linear address area of the central controller allows only 64kB addressing, the access to an up to 1024kB program memory is enabled by bank switching IC [7035/10, /11, and /12]. To allow access to the EPROM, IC [7033/50] (EA) is earthed. Port 0 of the central controller will then have the Low Order Address and port 2 the High Order Address. After switching the LATCH module at pin 51 (ALE), data can be read in via port 0. As the internal RAM of the central controller with 256 Byte is insufficient for C programming, an external static 8kx8 RAM, IC [7032] is used as data memory. Via WR (pin 35) and RD (pin 36) the access to the RAM is controlled (Read/Write), the EPROM [7030] being switched off at the same time via the OE.

7.2 Generation of operational and switching voltages

Via pin 5 of the shift register [7019] transistors [7015, 7013 and 7018] can be switched in sequence, generating a 12V_F switching voltage from a 12V continuous voltage.

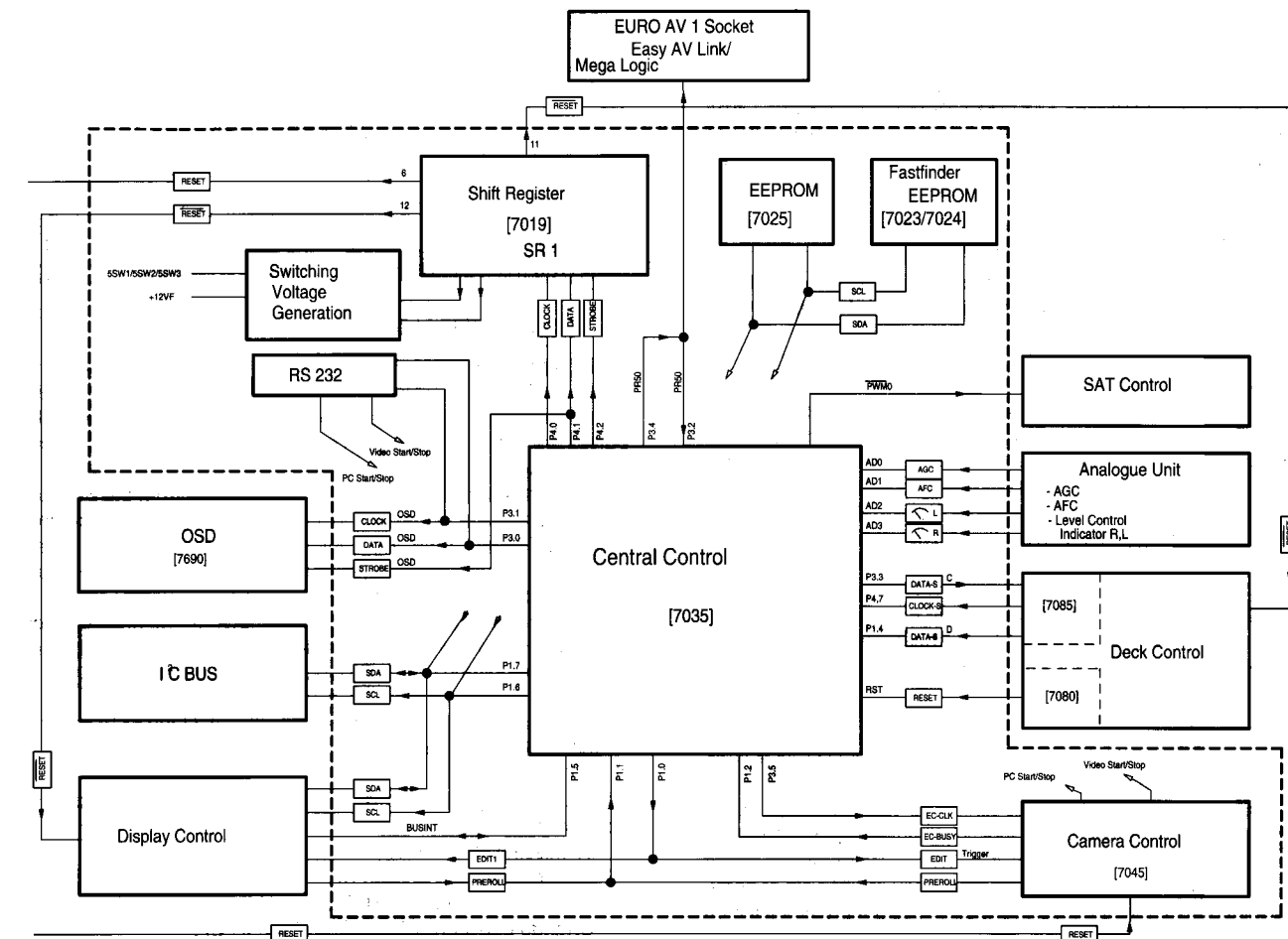
Via pin 4 of IC [7019] transistors [7017 and 7016] are switched to generate the 5SW1, 5SW2- switching voltage which is derived from the 5.2V supply voltage.

7.3 Various bus systems

a) "Easy Link"

A bi-directional single-conductor bus provides the communication between TV, video recorder and peripheral devices, running via contact 10 of the Euro-AV socket 1. The following features are available:

- "One Touch Play": VCR switches on TV
- "One Touch VPT": VCR switches TV on/off is indicated on TV
- "Download": TV transfers station settings to VCR
- "What you See is what You Record": VCR records TV image
- "Pip +/-": TV switches VCR tuner and uses VCR signal as Pip source



b) Serial bus extension port

By using the DATA (port 4.1) and CLOCK (port 4.0) lines, data is loaded into the present shift registers, the serial inputs and parallel outputs are switched to the shift register outputs by the transfer pulses supplied by the STROBE line.

c) Serial interface for camera μ P (Internal!)

The following four lines are required for the data transfer with the camera controller:

Edit 1, [7035-16]:	Data from Central Controller (CC) to Edit Control (EC)
Edit 2, [7035-17]:	Data from EC to CC
EC busy [7035-18]:	Reception acknowledgement EC to CC
EC-CLK, [7035-34]:	Clock from CC to EC

Together with the internal camera controller, edit control can be carried out with DC - Synchro Edit (Panasonic, JVC) and Lanc-Edit (Sony). In devices without camera controllers, lines Edit 1 and Edit 2 are directly passed to the central controller to facilitate Synchro Edit.

d) Serial interface to deck μ P

The DATAD1[7035/14] and CLKD1 [7035-32] lines connect the Deck with the central controller. The serial interface operates in shift-register mode. The central controller is the master, consequently also generating the Clock signal at a transmission rate of 27 Byte per 1.8 msec. A subsequent break in transmission lasting 6 x 1.8 msec serves as synchronisation for the Deck. A complete transmission consequently takes 33 x 1.8 msec = 59.4 msec.

e) Serial interface to OSD

The OSD unit is connected to the central controller via 3 lines:

SCLK	{7035-30}	Serial Clock
SIN	{7035-29}	Serial Data
CS	{7035-20}	Chip Select

The transmission on this 3-conductor bus starts with a change of CS from High to Low. The data transfer takes place with the rising slope of the SCLK. The transmission of the Display RAM writing command can be followed up to CS = High by an infinite number of data characters.

7.4 Reset generation for Deck electronics, operating unit and Edit control

After connection to the mains IC 7080 and capacitor [2081] generate a reset pulse at pin 19. This resets the central controller [7035]. The shift register outputs [7019] are maintained in a disable condition (Outputs Tristate). By using this reset pulse transistor 7022, resistor 3073, Capacitor [2018] until the central controller has ended its initialising phase. IC [7240] then generates a reset pulse at pins 11 and pin 12, resetting the deck controller [7085] and the operating unit. The Edit Controller is reset via pin 6.

7.5 AGC, AFC and audio adjustment

The AGC, AFC analog parts and the audio adjustment are connected to the central controller [7305/1.../4] via 4 analog inputs AD0..AD3.

AGC: The signal coming from the IF IC [7005] is passed via the AD0 input to the central controller [7035/4] where it is used for evaluation of the received field strength (station sorting to field strength).

AFC: The signal coming from the IF IC [7005] is applied at the analog input AD1 of the central controller [7305/3] and serves for adjustment of the tuner to the exact reception frequency. When correctly tuned this input will be (AD1) 2.5V.

Audio control: At analog inputs AD2 and AD3 of the central controller [7305/1, /2] the FM envelopes of the right or left audio channel are applied for evaluation. These supply data for the autoirrcuit part containing [7690], serves to superimpose predefined characters (fixed-programmed character ROM containing 256

characters) onto a self-generated blue background (menus, test pattern, etc.) or onto the EE or playback picture (superimposed). The unit is arranged between the video chroma IC output (VS circuit diagram) and the matrix switch (circuit diagram I/O).

The voltage is supplied via 5SW2 for the digital part and via the filtered +5VAN (see DE circuit diagram) the circuit is de-energized in ister.

At the same time this module can be used to control the switching voltage generation and the generation of reset pulses for deck electronics, operating unit and Edit controller [7019].

7.7 EEPROMs

Timer data, titles, channels and station abbreviations, show view data and child protection data, etc. are stored in IC [7025] (216KB) via the I²C bus. Data about Fast Finder is stored in IC [7023], IC [7024]

via I²C-Bus. The memory for Fast Finder can be extended with ICs [7020] and [7021].

7.8 RS232 - Interface

A PC or μ C can be connected to the VCR via this interface (socket RS 232- connected to [Y1538]). Via this interface commands as Play, Still, Stop, Record,... are transmitted from the PC to the VCR. The VCR can also deliver Time Code - markings via the interface. The serial data transmission between the internal main controller IC [7035] and the PC goes via IC [7046]. The levels of this interface range from +15V ... - 15V.

8. On Screen Display (OS) - Description

The OSD circuit part containing [7690], serves to superimpose predefined characters (fixed-programmed character ROM containing 256 characters) onto a self-generated blue background (menus, test pattern, etc.) or onto the EE or playback picture (superimposed). The unit is arranged between the video chroma IC output (VS circuit diagram) and the matrix switch (circuit diagram I/O).

The voltage is supplied via 5SW2 for the digital part and via the filtered +5VAN (see DE circuit diagram) the circuit is de-energized in the Low Power Stand-By mode.

The crystal oscillator [7690/2, -/3] is balanced via [2695] to the four-fold PAL color sub-carrier frequency and this generates a colored background including the sync signal (w/o line interlace).

The levels for the self-generated background and the white characters to be displayed with a black edge are internally set and relate to a FBAS signal amplitude of 2VSS.

[7690/15] is the FBAS input of the OSD component. At this point, the picture to be recorded or to be played back always has an amplitude of 2VSS. In the superimpose operation, rapid analog switches feed this picture or characters corresponding to the respective brightness values to output [7690/13]. Synchronization is carried out externally, vertically via a picture synchronizing pulse to 7690-(20) and horizontally by the line sync to [7690/17]. In order to receive pulses in the same regular pattern even during interference or noisy picture, the horizontal PLL supplies line pulses of exact frequency and phase to [7082/2]. The low pass filtered FBAS signal of the VS circuit part serves as reference for the [7082/6].

The picture pulse is generated on DE by filtering the mixed sync signal separated from the IC [7082] and pulse shaping with [7091] and [7097]. The artificial V pulse generated by the drive computer (DE) during special playback functions, such as still frame, slow motion and picture search is fed via [7098] to the base of [7099].

The FBAS signal is reduced down to 1VSS by [7664, 3660] and [3662] and is then passed by [7650] as a low-impedance signal to the matrix switch.

The display RAM [7690] facilitates the display of 12 lines with 24 characters each. The main CC writes to this memory via the three-wire bus [7690/9, -/10, -/11] using character codes, with separate registers determining the display position and the background. Each character is made up of a 12x18 dot matrix, whose vertical expansion is limited by the line-scanning pattern. The character width is determined by the LC oscillator [7690/6, -/7]. This oscillator operates at a frequency of 6.55MHz \pm 2% and is synchronized by the trailing edge of line pulses present at [7690/17] or internally generated in case of blue background. Consequently, the character

read-out cycle and the background are firmly assigned. Counters clocked with the line frequency and the LC oscillator take over the addressing of the display RAM and the character codes are converted into image points by the character ROM.

Additional SECAM circuit:

Whilst no chroma signal exists for achromatic picture excerpts in PAL and NTSC systems, the unmodulated color subcarriers are transmitted in SECAM systems. An interruption of a subcarrier by the insertion of a character creates red and blue color streaks in the superposition.

Consequently, the colour information for the EE or the playback modes are formed by switches [7670] and [7674] and the band pass filter [2669] and [5669] into a low impedance signals which is present at [7664].

For blue menu boards or other television standards, the circuit is blocked via a low level at [7690/19].

9. Input/Output (IO)

9.1. Video

9.1.1 General

Due to its numerous functions, the device requires an In/Out circuit part, selecting and distributing arriving or emitted signals depending on the source and the operating condition. The device mainly consists of a matrix switch IC [7200] for the video signals, two Euro-AV sockets (Scart1, Scart2), a "fading in switch" for text [Y7840] and a comparator [7875] for the "FOLLOW TV" function. It also contains various transistors [Y7700, Y7695,...] switching different signals depending on the selected operation.

9.1.2 Recording, loop-through and playback

Signals are selected and distributed in the matrix switches of IC [7200], where the input signals of the reference sources EURO-AV1[Y1916], EURO-AV2 [1917], CV, HF, EE/PB and the S-socket (Y)-IN are applied. These are clamped, selected according to the operating mode and are passed to the image processing circuits or to the output sockets. Applied chrominance input signals (Scart1/Scart2 S-IN) are selected with the switch IC [7110]. If necessary, transistors [7059, 7066, 7070 and 7072] are used to switch input terminating resistors for the RGB or the chrominance signals.

The chrominance output signal is amplified in the chrominance amplifier [7210, 7208] and the respective circuit and is then passed to the chrominance output drivers.

Y and C signals are also added in matrix switch [7200], from where they are passed on as FBAS signals.

Transistors [7006, 7014, 7018] are used to supply the RGB or chroma loop-through signal between EURO-AV1 and EURO-AV2.

9.1.3 "Activation circuit"

The circuit around transistors [7130 and 7134] (at the connector contact 20 of EURO-AV1 or contact 8 of the AV2 socket!) is also active in the "0-watt operation". If a signal is applied to the socket contact 20 of the EURO-AV1 socket in this operating condition, e.g. if the TV is switched on or a switching voltage is applied at socket contact 8 of the AV2 socket, the circuit reports this to the control electronics, which in turn causes the set to switch to Stand By-Mode.

9.1.4 Decoder operation

The decoder (e.g. Pay-TV) is connected to the SCART2 socket and the TV to the SCART1 socket. If the devices are connected in this manner, the decoder can be used without rearranging TV or video recorder connections.

When using the video recorder, the encoded video and audio signals are passed to the decoder via SCART2. The decoded signals are then returned to the video recorder via SCART2. This signal path must be enabled for each program when tuning into the programs. For TV use, the encoded video and audio signals are passed from the TV via SCART1 to SCART2 and on to the decoder (e.g. Pay-TV). Here the signals are decoded and returned via SCART2 and SCART1 to the TV. IC [7770] is used for the connection/switching of these devices.

9.1.5 "FOLLOW TV" circuit

This circuit (arranged on the tuner/modulator unit in the circuit diagrams) places each individual program of the video recorder onto the same program position number as in the connected TV.

For this, the FBAS signal from the IF part of the video recorder is compared with the TV signal.

The recorder signal is passed to transistor [7832], where the signal is inverted and amplified. The adjusted FBAS signal from the TV is passed to amplifier stage [7834] via the EURO-AV1 socket and matrix switch [7200]. Both signals are then added and passed to the negative comparator input [7830-(2)]. In case of equal FBAS signals, the voltage at pin 2 of the comparator is higher than the stipulated input voltage at pin 3. The comparator output (pin 1) is low in this case. If the FBAS signals differ, the voltage at pin 2 of IC [7830] is lower than the voltage at pin 3. In this case, the comparator switches its output to High. The corresponding output level of the comparator is then applied to the central controller [7035/19]. If the central controller only receives a low level via a measuring cycle, the received programme is stored under the same programme number as in the TV.

9.2. Audio

9.2.1 General

Due to its numerous functions, this part of the VCR requires an In/Out circuit section, this enables the selecting and distributing arriving or emitted signals depending on the source and operating condition. This section of the VCR mainly consists of a matrix switch which is in Audio IC [7200] and two Euro-AV sockets (Scart1, Scart2).

9.2.2 Recording, loop-through and playback

Audio signals are selected and distributed in the matrix switch in IC [7400], where the input signals, EURO-AV1[Y1916], EURO-AV2 [1917] and HF are applied. The signals are selected according to the operating mode and passed to the audio processing circuits or a direct "loop-through" of the audio signal to the Euro AV sockets is carried out. Audio IC [7200] is controlled by the I2C bus with the integrated matrix switch.

10. AUDIO (AU)

10.1 FM Audio

Due to the symmetrical design of the audio channels only the left channel (L) is described.

10.1.1 Operational overview

In the FM stereo switching circuit, the audio signals are selected from the different input sources during recording and then compressed. Then the two carrier frequencies (1.4 MHz - left and 1.8 MHz - right channel) are frequency modulated and recorded on to the tape by both rotating audio heads.

During playback, the information read from the tape from the rotating audio heads is passed to the FM tone circuit section. After demodulation the signals are expanded to the original dynamics (noise suppression) and then passed to the audio output sockets.

10.1.2 Recording (eg. via AV I or EI)

The input signals (LINE, Euro-AVI, Euro-AVII (decoder), CV (or E3) and RF) are present at the input selection switch (INPSEL) of IC [7400]. The selected LF signal (L) passes through an internal digital level adjuster and is passed via a summer to the standard audio linear circuit for longitudinal track recording and then via the low pass (LPF) to a compressor stage (factor 2) for noise reduction. From the compressor it passes from pin 64 and pin 63 of IC [7400] through an audio clipper, which serves as a snubber. After passing through a central controller stage and a RF low pass filter (RF LPF) the modulated 1.4 MHz FM signal is added to the 1.8 MHz FM signal of the right channel and passes via pin 56 and connector contacts [1637-(12)] and [1506-(4)] as "FM to tape"(FM TT) to the heads.

When recording both carrier frequencies on to the tape the RF amplitude of the 1.8 MHz carrier is approx 9,5 dB larger, as this carrier is erased more by the subsequent video head. This

guarantees, that both RF carriers have approximately the same amplitude during playback.

All selection switches and regulators in the IC [7400] are controlled by the central controller, IC [7035] via the I²C bus.

10.1.3 Playback

After the head amplifier the tape signal passes via [1637-(14)] to the FM audio circuit, it is then separated by the internal band pass filter (1.4 MHz left / 1.8 MHz right) and passed via the RF limiter (RF LIM) to the demodulators (PLL). The demodulated RF signal (L) passes through a sample-and-hold circuit, which suppresses LF signal interference caused by the head change during reading. The "sample-and-hold" pulse" required for this operation is generated within the IC [7400] by using the "HI sound" pulse (IC [7085] on the motherboard). The LF signal (L) then leaves the IC [7400] at pin 63, passes via pin 64 back into the IC and then via a low pass filter (for noise reduction) to the outputs via the output selection switches. The hi-fi audio signals are added and passed via IC [7400-(18)] to the modulator. From the envelope rectifier the rectified LF-signal passes via the connector contact [1637- (7)] to the main controller IC [7035]. IC [7035] controls the bargraph level display on the operating unit via the serial interface and the display controller IC [7035].

10.1.4 Hi-fi audio recognition

The 1.4 MHz part of the "FM from tape" (FMFT) signal passes in the IC [7400] from the RF limiter (RF LIM) via a level detector (LEV DET), pin 60 and connector contact [1637-(3)] to the central controller IC [7085]. This direct voltage is dependent on the FM signal amplitude and therefore represents the actual signal amplitude.

If the voltage is above 2.14V, the hi-fi audio recording will be played back. If it is below 1.9V, the central controller switches over to the standard track. This value is also used with an A/D converter for tracking adjustment.

10.2 Audio Linear

10.2.1 Operational overview

During the recording the audio signals destined for the longitudinal track recording pass from the input selection switch (INP SELECT) in IC 7400 to the standard track circuit within in the same IC and are then prepared for recording.

During playback the LF signal is taken from the REC/AW head, amplified and passed to the output selection switch [IC 7400].

10.2.2 Recording

From the input selection switch [7400] the selected LF signal passes via an automatic level controller (ALC), at pins 29,28 and then on to the recording equaliser (REC EQ). From the record equaliser via connector contact [1503/1] the signal is then applied to the recording head.

The LF signal leaves the IC [7400] at pin 33, and is added as writing current [3603] to the pre-magnetisation (BIAS current) [3645].

It is then passed via connector contact [1503-1] to the REC/PB head. The other end of the REC/PB head is connected to ground via the connector contact [1503-3] and IC [7400-34]. The pre-magnetisation current is adjustable with [3645] (BIAS).

In Longplay mode, the switch-over of the recording equalisation is carried out with the internal switch at IC [7010/30] under the control of the I²C bus. The S-VHS equalisation is switched through transistors [7640, 7635] controlled by shift register SR4 [7402-(5,11)].

10.2.3 Erasing oscillator

The main and linear audio erasing heads are triggered by two separate oscillators:

The main erasing head oscillator consists of transistors [Y7510] and [Y7515]. The oscillator is triggered by the switching levels WR-A2 (from shift register SR4, IC [7340-6]) and WR-A1. The Linear erasing head oscillator consists of transistor [7655] and oscillator circuit [1250/Y2648]. At this point the pre-magnetising voltage (BIAS) is also tapped.

The Linear erasing oscillator is triggered by the switching level WR-A1 from [IC 7085-(60)] and by transistors [7665] and [7660].

During post-synchronisation only the Linear erasing head is triggered.

10.2.4 Playback

During playback the REC/PB head is earthed via connector contact [1503/1] and transistors [7610] and [7615]. The REC/PB switch-over is controlled via the I²C bus. The LF signal read off the REC/PB head passes via [1503-3] to IC [7400/34]. In IC [7400] it passes through a linear amplifier, an integrated playback level adjuster (PSET) and an integrated playback equaliser (PB EQ). From here it leaves the IC [7400] at pin 29 and passes via capacitor [2627] and pin 28 back into the IC, where it passes through the MUTE circuit (NO MUTE), an output selection switch (OUT SEL) and then to the outputs.

For "LP playback" the integrated switch at pin 35 of IC [7400] effects a rectification change-over with the PB EQ.

10.2.5 Muting

The "Mute" signal, arriving from the I²C bus, mutes the audio outputs of the IC [7400] during servo lock up and all other operations except recording, playback and EE operation.

11. Videotext

The additional VT module contains mainly two functional blocks, [7140] for VPS-, PDC- and Videotext processing, and [7080] for converting the menu or Videotext boards output into either RGB or a standard a PAL-FBAS signal.

The voltage is supplied via the 5D1, with the circuit being de-energized in the Low Power Stand-By mode.

11.1. IVT (Integrated Video-Input-Processor and Teletext Decoder)

IC [7140] provides the following functions:

- Data separation

An adaptive data separation stage generates the VPS-, PDC- or Videotext data from the FBAS signal supplied via the [7140/9]. For this purpose, the video signal is passed to an A/D converter. The data separation and cycle processing, 6.9375MHz for PDC and Videotext, or 5MHz for VPS, is digital. The charging capacitor [7140/8] stores the black level. A reference current for the analog signal processing is generated via [7140/10].

- Cycle PLL

A free-running crystal oscillator [7140/1, -/2, -/3] supplies a frequency of 27MHz. This is passed to the A/D converter, and to a digital PLL, using it to generate the 6MHz, 1MHz and 15.625kHz base frequencies. The line frequency generated is thus passed for phase comparison, as is the sync signal derived from the FBAS signal. The characteristic of the downstream digital loop filter is influenced by a control register and the 6MHz oscillator is corrected accordingly.

In this way, all frequencies generated by the IVT are line coupled with the arriving FBAS signal. During free-running (i. dot matrix, stored in the character ROM of the IVT. The line-coupled 1MHz cycle advances the addressing of the page memory. The character representing the 8-bit code forms another part of the address on the character ROM, the other part is formed by a line counter. The ROM thus supplies a 12-bit data word after each 1µs according to the brightness information. This is loaded into a shift register and is read with a 12MHz pixel cycle derived from a 6MHz cycle. The respective RGB signals are available at the push-pull outputs [7140/16, -/17, -/18]. Their amplitude is determined by the reference voltage at [7140/19]. After amplification by [7045] and [7040], the blank signal of [7140/20] controls the FBAS signal converter [7100] on circuit component I/O (VHS) or [7040 and 7060] on circuit component CF (S-VHS).

11.2. RGB encoder and FBAS converter

The RGB signals are applied to [7080/2, -/3, -/4] and the mixed sync signals of [7140] are applied to [7080/10]. The 4.43MHz color subcarrier supplied by the Vihe page number The acquisition then compares all arriving data with the requested page and saves these in the page memory.

- Page memory

The unit contains an 8kx8 DRAM for saving up to 8 text pages. VPS and PDC data are also stored in the DRAM, from where they can be called up by the main computer CC.

- Character generator

There are 256 characters. An 8-bit data word is assigned to each character. 32 are control characters, the rest are graphical or alphanumeric characters in the form of a 12x10 dot matrix, stored in the character ROM of the IVT. The line-coupled 1MHz cycle advances the addressing of the page memory. The character representing the 8-bit code forms another part of the address on the character ROM, the other part is formed by a line counter. The ROM thus supplies a 12-bit data word after each 1µs according to the brightness information. This is loaded into a shift register and is read with a 12MHz pixel cycle derived from a 6MHz cycle.

The respective RGB signals are available at the push-pull outputs [7140/16, -/17, -/18]. Their amplitude is determined by the reference voltage at [7140/19]. After amplification by [7045] and [7040], the blank signal of [7140/20] controls the FBAS signal converter [7100] on circuit component I/O (VHS) or [7040 and 7060] on circuit component CF (S-VHS).

11.2. RGB encoder and FBAS converter

The RGB signals are applied to [7080/2, -/3, -/4] and the mixed sync signals of [7140] are applied to [7080/10]. The 4.43MHz color subcarrier supplied by the Video-Chroma-IC (VS circuit diagram) is applied via [7080/6].

The IC [7080] uses these signals to generate a Y signal (brightness) at [7080/16] and a PAL-Chroma signal at [7080-(15)], which, in case of VHS, is added to the FBAS via [3148] and [3150] in the I/O circuit part and is passed to the inputs of a rapid converter [7100/1, -/10]. There, [7100/6, -/7, -/8, -/10] correspond to the EE or recording circuit and [7100/1, -/3, -/4, -/5] are also responsible for the playback signal.

For S-VHS, the brightness and chroma signals are passed separately to the converter [7040] and [7060] (circuit component CF), where the pins -(1), -(3), -(4), -(5) correspond to the EE or recording circuit and -(6), -(7), -(8), -(10) to the playback circuit.

The öblankö signal supplied by [7140/20] determines the keying in point of the text information. There are three conditions. For subtitles, the öBlankö corresponds to a square wave signal, for whole text pages the signal is high and, for pages on which no text is superimposed, the signal is low. At I/O there is an additional option to block the blank via shift register 3 [7000-(7)]. This pin is always low, except during subtitle and title generation recording.

11.3. Subtitle recording, title generator

To record subtitles without color defects, the 4.43 MHz subcarrier and the burst phase - important for PAL - must be synchronous to the transmitter picture. For this purpose, the colour subcarrier passes through a phase shifter with [7055, 3057] and [2058]. Apart from the subcarrier, the Chroma-PLL also generates a burst phase identification (VS circuit diagram for VHS [7230] or SF circuit diagram for S-VHS [7312]). This fh/2 signal of approx. 30mVSS is passed to the tuned amplifier [7005, 1001] and [2000] from which [7010] and [7015] form a square wave signal of approx. 5VSS and half the line frequency, which then synchronizes the chroma V component of the FBAS signal generated by [7080] via [7080-(7)]. In case of whole pages, this synchronization is blocked via [7017], in which case [7080-(7)] is approx. 0V.

The detection of "Subtitle" or "Whole page" is automatic via integration capacitor [2027], which only achieves a voltage of approx. 0.7 V for whole pages.

11.4. Colour replacing circuit - SECAM option

For S-VHS sets the colour replacement is carried out by the shift register 6 on circuit diagram CF).

Whilst in PAL and NTSC systems no chroma signal exists for achromatic picture extracts, the unmodulated colour subcarriers are transferred in SECAM. The interruption of a subcarrier by inserting a character results in red and blue color stripes at the point of superposition. For SECAM the color information of the transmission picture is therefore positioned on top of the subtitle superposition which then appears black/white and slightly transparent. The same

effect is used for the Feature Edit Table.

For VHS sets, the colour information of the EE or the recording image is passed via switch [7073] and that of the playback image via switch [7074] to the band pass [2065, 5065] and [3065]. The converter is activated by the playback voltage +5VW. Transistors [7060] and [7070] amplify the chroma signal 2-fold. [7050] and [7052] form another converter, which either switches the PAL chroma of [7080-(15)] to the [7090] or the chroma of the background image via [7050] and a high level at the Open-Collector output. In PAL transmitters, [7140-(21)], [7140-(21)] is on low for whole pages and subtitles.

The delay spool [5095] in the circuit part I/O is shortened via [7097] for SECAM playback and the shift register 4 [7402-(11)] (circuit diagram AU).

11.5. Superposition during playback

The Fast-Finder and Edit-Table features require superposition also during playback. For this, [7140] is externally synchronized via the connectors -(13) and -(14). For the horizontal deflection, the Teletext contains the CS mixed sync signal and, for the vertical selection, a picture pulse from the deck electronics (DE circuit diagram). At this stage, the picture pulse is generated by filtering the mixed sync signal separated from [7802] and amplified by [7083] and by pulse formation via [7092] and [7097]. The base of the [7099] receives the artificial pulse additionally generated by the DE computer during special playback functions, such as still picture, slow motion and picture search via [7098]. Via the shift register [7019-(7)], the CC computer selects the filtered picture pulse during EE mode, recording or playback and the artificial V pulse for special playback functions.

During playback, the voltage +5VW has a level of approx. 5V. [7110] then switches the operating resistor [3111] to the collector of [7115] which in turn inverts the picture pulse and passes it to IC [7140-(14)]. The same applies to the horizontal synchronization with [3012]. IC [7140-(18)] is, however, both an input and an output. When displaying an entire page during playback, the [7140-(13)] supplies the correct mixed sync signal, suppressing the externally applied line sync with [7018].

During recording or EE operation the +5VW is only approx. 0.5V. The external C sync is then also blocked and [7140-(14)] must be a constant +5V.

12. Comb filter (CF)

12.1 Functional overview

This circuit component divides the FBAS signal into a luminance and a chrominance component (for PAL signals), loops subtitles or whole videotext pages into the signal paths, makes a selection from different input signals and carries out a filtration and run-time correction for SECAM (only for multi-standard sets!) MESECAM signals.

12.2 Recording

The FBAS or BAS signal is provided by the IN/OUT module via connector contact [1526-(9)] and passes to IC [7010-17] via emitter follower [7306] and to the "SEC TO PAL" circuit component [FBAS-TR] (only for SECAM).

In the IC [7010], the chroma signal and the brightness signal are separated and passed on to different IC outputs. The chroma signal is provided at IC [7010-12] and the brightness signal at IC [7010-14] for further processing.

With a Y/C input, the chroma signal arriving via connector contact [1526-7] from the IN/OUT module is offered to IC [7010] at pin 10 and the luminance signal at pin 17. The control line at pin 3 of IC [7010] is used in this case to switch (Y/C-IN) to the bypass mode - and IC [7010] for SECAM or MESECAM - i.e. chrominance and luminance are not separated.

The switch IC [7030] switches between the FBAS signal, the colour signal of the comb filter or the colour signal from the SP circuit component. The control is provided by the status lines SR1 and SR2 (pin 2 or pin 4 [IC 7030]). The signal is then passed to the SF circuit component via a further switch IC [7040] and an emitter follower

[7042]. The signal is passed to the connector contact [1526-13] and on to the IN/OUT module via switch IC [7040] and the emitter follower [7545].

The chroma signal (CVT) for subtitles or whole pages, supplied by the text module via connector contact [1526-(16)], is inserted into the respective signal by switch IC [7040]. The control is provided by the status lines "UT-REC" and "GANZE_SEITE" (WHOLE PAGE), applied to ICs [7040/7060] via connector contacts [1526-(15), -(14)] from the IN/OUT module.

The brightness or FBAS signal passes as a "VIDEO_IN" signal from IC [7010-(14)], via IC [7070] (in European sets only!), and via IC [7060], and emitter follower [7062] to the SH circuit component. The YVT signal arriving from the text module via connector contact [1526-(18)] is inserted into the existing video signal with the switch IC [7060] controlled by the status lines "UT_REC" or "GANZE_SEITE" (WHOLE PAGE).

In multi-standard sets or in SEC TO PAL mode, the brightness signal can be connected for signal processing (SH) with IC [7070].

In SEC TO PAL mode (multi-standard sets), the FBAS signal is passed from the connector contact [1526 - (9)] via the emitter follower [7306] and connector contact [1524-(3)](SH) to the SP circuit component. Parallel to this, the signal passes to a 3 MHz low-pass filter [1002] and a trap circuit [1004, 2084]. In this stage, the signal is cleaned from the chroma parts and passed via the run-time correction elements [7092, 5094, 2094, 3094, 7102, 5106, 2106, 3106] and an emitter follower [7108] to switch IC [7070], enabling further signal processing via status lines SR7 and SR8, if necessary.

12.3 Playback

The VIDEO_OUT signal arriving from the SH circuit component passes via ICs [7050], [7060] to the emitter follower [7066] and via the connector contact [1526 - (11)] to the IN/OUT module.

The chroma signal EE/PB_CH arriving from the SF circuit component passes via the two ICs [7050, 7040] and the emitter follower [7545] to the connector contact [1526 - (13)] and to the IN/OUT module for further processing. The signal path through the IC [7050] is determined by both status lines SR4 and SR5.

13. S-VHS Luminance processing (SH)

13.1. Functional overview

During recording, the luminance unit (SH) serves to adjust the luminance or FBAS* signal from the CF circuit component (*only for Mesecam or Secam) as well as to convert the luminance signal to a frequency-modulated signal and to provide this signal to the head amplifier for further processing.

During playback, its main function is the processing of the FM signal provided by the VS circuit component which is reconverted into an amplitude-modulated signal, freed from drop-outs in IC [7520] and is then returned to the CF circuit component.

13.2. Recording

During recording, the Mesecam/Secam FBAS or luminance signal is passed to IC [7520-(48)] via capacitor [2591]. Here it passes through an AGC stage and is then available at pin -(4) for further processing. The adjusted signal is passed to the "comb filter" circuit component (CF) via IC [7520-(43)] and transistor [7588].

13.2.1 S-VHS recording

The luminance signal passes from pin 4 of IC [7520] via a frequency response correction circuit [7598, 7608, 7612, 7606, 7636, 7615, 1052] to the 5 MHz low-pass filter [1054] and via 2501 to pin 16 of IC [7520]. The signal leaves the IC at pin 6 and passes through a non-linear peaking circuit [7656, 7662, 7664, 7670, 7672, 7674, 1060, 7678, 7684, 7686, 7688] which is switched between recording and playback by IC [7810] and is then passed via [2713] to pin 14 of the SVHS sub emphasis IC [7700]. The luminance signal then leaves IC [7700] at pin 7 and is passed to pin 7 of IC [7520] via transistor [7702], the recording/playback switch IC [7810] and capacitor [2487]. In this IC, it is passed to the ME stage and to the FM modulator via the

adjusting controller (WV-SVHS) [3513]. The controller (SV-SVHS)[3509] is used to set the SVHS black level. The FM signal leaves IC [7520] at pin 25 and then passes via a SVHS-FM filter [5760, 5758] to the FM output stage [7764, 7766], and via adjuster [3765] to connector contact (CF) [1530-(6)] and then to the head amplifier.

13.2.2 VHS recording

The luminance or FBAS signal for Mesecam or Secam passes from pin 4 of IC [7520] via the frequency response correction circuit (see S-VHS recording) to the 3 MHz low-pass filter [1056] and via the electrolytic capacitor [2500] to pin 14 of IC [7520]. In this IC, the signal then passes to pin -(6), through a non-linear peaking circuit [7656, 7662, 7664, 7670, 7672, 7674, 1060, 7678, 7684, 7686, 7688], which is switched between recording and playback by IC [7810], and then via [2488] to IC [7520-(8)]. It is then passed via a NLE stage (Non-Linear Emphasis) to a ME stage (Main Emphasis) [3502, 2504, 2505, 3500]. It leaves the IC [7520] via pin 19. From the adjuster (WV-VHS) [3507], the signal returns via pin 20 to the IC and to the FM modulator. The black synchronous level (SV-VHS) is determined with adjuster [3503].

The FM signal leaves IC [7520] at pin 25, is then passed to the FM output stage [7768, 7766] via a band-pass filter [5774, ...] and to the connector contact (CF) 1530-(6) via adjuster [3765] and then on to the head amplifier.

13.3. Playback

During playback, the tape FM signal (FMF.T.) is passed from the head amplifier via the motherboard, containing both FM filters for VHS and SVHS (see description VS circuit component for VHS sets), to the connector contact [1530-(1)] on the SVHS board.

13.3.1 S-VHS playback

The FM signal passes to IC [7520 -(29,26)], in which it runs through a limiter and marking stage, before being converted to a luminance signal in a FM demodulator. The de-emphasis is active at pin 36 [3560, 3562, 2560, 2562]. In IC [7520], the signal also passes through a 2.5 dB amplifier and via pin 4, a frequency response correction stage (see recording), to the 5 MHz low-pass filter [1054] and then to pin 16. The luminance playback amplitude is set with the adjusting controller [3545]. The signal path up to pin 7 of IC [7520] is the same as for S-VHS recording. During its further course, the luminance signal is passed to a PIC-CONTROL stage in the IC, controlled by a direct voltage at pin 40. From here, the luminance signal is passed to pin 43 via a further amplifier and then to the IN/OUT module via emitter follower [7588] and connector contact [1526-(11)].

13.3.2 VHS playback

The FM signal is passed to IC [7520 -(30)]. From this stage, the course of the signal corresponds with that of the VHS recording or S-VHS playback, with the exception that it passes through the 3 MHz low-pass filter [1056].

13.3.3 Drop-out - detection and insertion

The FM signal applied to IC [7520-(30)] is passed to a drop-out detection circuit in IC [7520]. In the case of a signal drop out, this circuit emits a pulse to the drop-out switch for the duration of the drop out. The luminance signal from pin 13 of IC [7520] is passed to the 1 H delay line [7725]. At pin 5, the latter receives the clock frequency 2 fsc. The luminance signal delayed by 1 line is applied to IC [7725-(3)], which then passes to IC [7520-(9)] via transistor [7722], a low pass filter and an emitter follower [7728]. In case of a drop out, the switch in the IC uses the drop-out (free) signal delayed by 1 line. The correct amplitude of the signal to be inserted is set with adjuster [3723].

14. Chrominance circuit component [SF]

- Description

14.1 Functional Overview

During recording, the 4.43 MHz colour signal is converted to 627 kHz with the aid of a 5.06 MHz mixing frequency. The pilot burst is also recorded during the H-Sync period [S-VHS standard].

For playback, the signal is converted back from the 627 kHz colour signal to the original 4.43 MHz colour signal with the aid of a mixing frequency. The signal is amplified, added to the BAS signal, and enters the modulator and the FBAS outlet sockets. It also enters the SVHS sockets as a 4.43 MHz colour signal.

14.2 Recording

The signal path for recording is the same for PAL and MESECAM. The FBAS signal or C signal from the CF circuit component enters IC [7270] via pin 9. Inside the IC, the signal passes through a REC/PB switch, leaves the IC at pin 5 and arrives at the external 4.43 MHz band-pass [1025]. At this stage, the chroma and FBAS signals are separated. The chroma signal then enters another REC/PB switch via pin 17, an amplifier [ACC AMP], pin 6, and a capacitor [2266] and then the main mixer [MAIN BM] via pin 7. The 4.43 MHz chroma signal and the 5.06 MHz sub-carrier frequency are then mixed in the main mixer. The converted 627 kHz chroma pass filter [5176, 2180], the phase shift [all pass], the inverter stage [7190] and the switching stage [7192, 7196]. These two signal paths form what is known as a "comb filter" for cross-talk compensation.

The function of a comb filter is to delay the signal by 2 lines for PAL and by one line for NTSC in a switching branch, and to add it to the non-delayed signal. In this case, the playback signal is delayed between [7175-(1)] and [7175-(3)]. It then runs through low pass [5176/2180] and a phase shift the parallel oscillation circuit [1027, 2262]. Its amplitude is determined by adjuster [3295].

14.3 EE mode [Secam only!]

The signal sequence for the EE mode with FBAS input signal and YC output only differs from the recording signal path from pin 6 of IC [7270] onwards. From pin 6, the 4.43 MHz signal travels for further processing in the CF circuit component via the parallel oscillation circuit [5348, 2348] and the impedance converter and/or switch [7348].

14.4 Playback

The unregulated FM tape signal (FM-UNC) from the HC circuit component enters the SH circuit component via the CF circuit component. From here, it runs through the band-pass filter [2823...2826], filtering out the 627 kHz chroma signal. The subsequent transistor stages [7807 and 2708] amplify the signal. From this point, only the 627 kHz signal is passed to the chrominance circuit component (SF). The signal path then splits into a direct [3167] and a delayed signal path [2164]. The latter consists of a CCD delay line [7175], the low pass filter [5176, 2180], the phase shift [all pass], the inverter stage [7190] and the switching stage [7192, 7196]. These two signal paths form what is known as a "comb filter" for cross-talk compensation.

The function of a comb filter is to delay the signal by 2 lines for PAL and by one line for NTSC in a switching branch, and to add it to the non-delayed signal. In this case, the playback signal is delayed between [7175-(1)] and [7175-(3)]. It then runs through low pass [5176/2180] and a phase shift [all pass], in which the voltage of the delayed signal is set with [2184] and [3184] in the phase, thus initialising the inverter stage [7190]. This results in a signal that is phase shifted by 180° at the collector, which enables the signal to be subtracted from the direct signal in the event of a half-picture. For addition, the signal is taken directly from the base of the inverter. The signal, which is controlled by the HI chroma pulse (CROT), travels via switch transistors 7192/7196 to the adjuster [CF = comb filter] [3167], with a 0° phase, and, after switching over, with a 180° phase. At this stage, the delayed signal is added to the direct signal.

The CCD line [7175] is clocked at 1fsc for PAL, thus resulting in a 2-line delay. For NTSC, the CCD line is clocked with 2fsc, resulting in a delay of one line.

During the MESECAM operation, the delayed signal path is bypassed. The 627 kHz chroma signal thus arrives at the adjuster [CF] via [Y7026], where the two direct signals are added. The

[Y7026] is controlled by the shift register with the control voltage +SOST.

The 627 kHz chroma signal arrives at IC [7270 -(15)] from the adjuster [CF] via emitter follower 7166. From here, it enters the main mixer [MAIN BM] via a REC/PB switch, a regulated amplifier [ACC AMP], and pins 6 and 7. The signal is then mixed with the 5.06 MHz sub-carrier frequency. The retrieved chroma signal [4.43 MHz] then passes to the external 4.43 MHz band-pass filter [1025] and pin 17 to IC [7270] via a REC/PB switch [SW2] and pin 5. In MESECAM, it then arrives directly at the PAL/SECAM switch. In PAL/NTSC, it leaves the IC [7270-(47)] after passing through a 4 dB amplifier and arrives at the PAL/SECAM switch via an external trap [1023/2256], IC [7270-(45)] and a comb filter driver [COMB]. It then runs through a playback amplifier with a colour killer and a pilot burst sensor. It leaves IC [7570] at pin 42 and enters the colour standard converter [7200-(14)] via emitter follower [7220]. For NTSC playback ON-PAL-TV, a quasi-PAL signal is generated from this. No standard conversion takes place in PAL and MESECAM playback. The control for this runs via pin 13. The signal then leaves [7200] at pin 11 and is passed via the emitter follower [switch] [7234] to the CF circuit component for further processing.

14.5 Carrier preparation

- Recording [PAL]

A voltage-controlled crystal oscillator [VCXO] in IC [7270] is used for carrier preparation, the oscillator frequency [4.433619 MHz] of which is determined by the crystal [1030] connected at pins 30 and 32. The APC detector REC compares the phase of the incoming transmitter burst with that of the VCXO, adjusting it accordingly. This regulation voltage at IC [7270-(28)] is smoothed with [2399, 2300] and [3300]. An oscillator [321 fH VCO] integrated in IC [7270] is also used, the middle frequency of which is determined by the parallel oscillation circuit at pin 20. This oscillator is controlled by the line frequency. The VCO oscillates at a multiple of the line frequency (321 fH = 5.015625 MHz). This frequency is divided by 8 [rotary] in a decremter and is routed to the sub-mixer [SUB BM]. Here, it is mixed with the oscillator frequency of the VCXO [4.433619 MHz]. This results, amongst other things, in the 5.06 MHz sub-carrier. This passes through an external 5.06 MHz band-pass filter [between pins 36 and 1] and then enters the main mixer [MAIN BM].

- Playback [NTSC/PAL]

For playback, the XO crystal oscillator [VCXO], oscillating freely on the crystal frequency (4.433619 MHz), and the 321 fH VCO oscillator, the middle frequency of which is determined by the parallel oscillation circuit at pin 20, are used as a reference. The VCO is then synchronised from the burst of the played back colour signal after the chroma signal is remixed from 627 kHz to a 4.43 MHz colour-carrier frequency. For this, the PB-APC stage (APC DET PB) produces the regulating voltage for the VCO and compares the phase of the remixed 4.43 MHz burst with that of the crystal oscillator. The time constant of the filter at IC [7270-(27)] is provided by [2297, 2296] and [3296]. This frequency is divided by 8 in the decremter [1/8] [rotary] and enters the sub-mixer [SUB BM]. It is then mixed with the oscillator frequency of the XO. This results in, amongst other things, the sub-carrier of 5.06 MHz. The latter enters the main mixer [MAIN BM] via an external band filter [as in recording].

15. Operating part (Display Control)

15.1. Front Controller

The mask-programmed 8-bit microcontroller [7060] (Front Controller, FC) on the DC board operates as a sub-controller. It activates various function groups on the DC board and the local front keyboard board and evaluates their signals. The correct operation of the FC requires a functioning communication with the Central Controller (CC) [7035] on the motherboard. The FC is physically connected to the motherboard via connector [1510]. The communication is serial and bi-directional with a TTL level via a modified three-line-I2C-Bus by lines SCL (port P3.6/pin 23), SDA (P3.7/pin 24) and Bus-Init (P1.1/pin 2). At SCL and SDA, the signals are standard I2C-Bus signals. The Bus-Init line transmits a decreasing slope as starting condition for a Multimaster-I2C-Bus communication between the CC and the FC in the High-Speed

mode. In the Normal operating mode, the ceramic 8 MHz resonator [1060] functions at inputs XIN/XOUT (pin 13/14) and the 32,768 kHz crystal [1062] at inputs XTIN/XTOUT (pin 10/11).

The system cycle is thus 8 MHz. In the LOW-POWER and Mains-Off operating modes, only the crystal is active. The system cycle is 32,768 kHz in this case.

A defined reset of the FC can be triggered by a LOW pulse at pin 12 of the FC. The generation of the pulse is controlled by IC [7019] on the motherboard. A LOW pulse is transmitted to the circuit group around transistor [7050] via pin 10 of connector [1510], where the rising slope of the pulse generates a LOW level at pin 12 of the FC for approx. 1 msec.

The functions of the FC and the circuit groups arranged on the DC board/flap board are as follows:

- Activate the VFD display
- Determine and control the operating mode of the entire unit
- Adjust the clock cycle
- Receive and decode IR remote control signals
- Query the functional keys
- Activate various LEDs
- Monitor and control the backup system
- Reset and interrupt control
- Various input sockets

15.2. Control and supply of the VFD display

The VFD display is, in principle, a tube triode, with the heating filaments of the tube forming the cathode.

The digits and symbols are triggered by a time-multiplexing process (duty 1:16, scanning period 3.9 ms (16 x 244.14 μ s), voltage range +5V / -28 V). A dimmer function is provided by pulse width modulation of the grid activation signals. During maximum display brightness, the pulse width for each grid is 214 μ s. With the use of software, the width can be reduced to 30 μ s in 7 stages, reducing the brightness of the VFD for the naked eye accordingly.

A display digit or symbol only illuminates, if the corresponding anode and its surrounding grid are switched to +5 V for a certain time during the scanning period. The electrons emitted by the cathode are thus accelerated by the positively charged grid and come into contact with the luminous layer of the anode which is also positively charged.

During the remainder of the scanning period, the corresponding grid is at -28 V, due to an internal pull-down resistor in the FC. As this potential is lower than the average cathode potential of approx. -21 V, an acceleration of electrons is avoided, thus providing a certain dimming of the associated anode segments.

The filament voltage for the VFD filament ($U_{\sim} = 6.5V_{eff}$, $f = 31.25kHz$) is applied by the power supply to pins F1 and F2 of the VFD display via lines HELO and HELI (connector [1510/- 13 and -11]). The Z diode [6070] fixes the alternating filament voltage to approx. -21 Volt via resistor [3074]. Directly in between pins F1 and F2, the alternating filament voltage is approx. 4.1 Veff due to resistors [3073] and [3075].

15.3. Activation of the power supply and clock adjustment

The FC applies two control signals to the power supply.

In the first instance, the FC causes the power supply to generate the filament voltage for the VFD display (see section 2). For this purpose, the FC provides a control signal with a frequency of 31.25kHz via port P5.5/pin 80. This control signal is passed to the power supply via the HEST line at socket [1510/-1] and transistor [7011] on the motherboard. The associated circuit group supplies the filament voltage to the DC board and therefore the VFD display via the HELO and HELI lines. In the LOW-POWER and Mains-Off operating modes, port P5.5 has a HIGH level. No filament voltage for the VFD display is provided.

The HEST line and thus port P5.5 can emit a square wave signal with $F_{soll} = 2048$ Hz in the service mode. The clock adjustment can be carried out with a variable capacitor [2060] and a frequency meter connected to port P5.5. Secondly, the FC is also able to switch the power supply to the "Low Power" operating mode via the STBY line (connector [1510/-14]). In this mode, the power supply only supplies the 5STBY operating voltage, reducing the energy consumption to a few 100mW. The Low Power mode is therefore also called <1-watt mode.

A change to the Low Power Mode is activated by the level of P5.4/pin 79 changing from HIGH to LOW. Transistor [7010] becomes conductive as a result of the level change. The collector and thus contact 14 of the connector [1510] contain a HIGH level. The HIGH level is passed to the associated circuit group of the power supply, changing it to the desired Low Power mode.

15.4. IR receiver and signal evaluation

The IR operating voltage is only available in the "Normal" operating mode. In addition to a photodiode, the IR receiver [7035] contains a selective controlled amplifier. The photodiode converts the radiation (approx. 940 nm) into electrical pulses which are then amplified and demodulated. The output signal of the IR receiver is read in as a TTL level pulse train via the interrupt input INT3/P3.0 (pin 17) of the FC. By evaluating the pulse train, the FC recognises the command emitted by the IR remote control and carries out the instructions linked to this command.

15.5. Keypad (keys)

A keypad input is only possible when the FC is in the Normal-2 mode. Output ports P9.5 to P9.7 [pin 63-65] of the FC are assigned a HIGH level (+5 V) for 40 μ s at different times. These signals are either applied to the keys directly or via the connector contacts [1516/4 and -/5]. When a key is depressed, the FC reads in one HIGH level during each keyscan period (16,384 ms) either directly or via connector [1516/1-3] and the associated input ports P40/KEY0 to P43/KEY3 (Pin 67-70). If no key is depressed, the inputs via the internal pull-down resistors of port P4 are at LOW level (0 V).

15.6. Shuttle (optional)

The shuttle is a binary-encoded rotary switch with a 70 rotating angle and 16 switching conditions. A spring returns the switch into its centre position once released, from which 7 to 8 further switching conditions can be activated on either side. All switching conditions are implemented with voltage 5D1 by different connections of the four different shuttle outputs SHA-SHD. The levels of outputs SHA-SHD are passed via the plug-in contacts [1515/-1...4] to the input ports P3.2 - P3.5. If the SHA-SHD outputs are not at HIGH level, the relevant ports are at LOW potential via the external pull-down resistors [3080, 3081, 3083 u. 3084]. The FC evaluates the supplied levels and starts the corresponding actions.

15.7. Jog (optional)

The Jog on the PDC GN 12 board contains a continuously rotatable pulse generator without earth connection. The generator contains ten latching positions per revolution and two outputs, supplying two square wave signals that are phase-displaced to one another with a level of 0 V or 5 V when turning the Jog. Upon turning the Jog, the operating voltage 5D1 at connector [1515/-9] is connected in sequence with outputs JOG-A and JOG-B, depending on the rotary direction.

The square wave signals generated in this way are passed to the PDC GN 1b board via pins 8 and 10 of connector [1515]. The signals are then debounced by the RC elements [3078, 3079, 2078 or 3076, 3077, 2077] and provided to the FC via ports P4.4/pin 71 and P4.5/pin 72 for evaluation.

The associated Interrupt-Service routine of the FC can detect the rotary direction (left/right) of the Jog from the characteristic phase displacement of the two signals (JOG-A HIGH, JOG-B LOW or vice versa).

15.8. FBAS detection (Scart control)

The FC, and thus the entire unit, can be changed from the LOW-POWER mode to Normal mode by a defined level change at port P2.0/pin16. The activation of a TV set can be detected via a Scart line connected to the recorder. In this case, the detection circuit identifies a FBAS or a noise signal. The SCART-CONTROL line at connector [1510/4], which is HIGH active in the release state, is pulled down to LOW level. Port P2.0 of the FC thus also contains a LOW level. The FC detects the level change and returns the power supply to the Normal mode by a HIGH level at port P5.4.

Once the LOW-POWER mode of the power supply has been activated by pressing the ON/OFF key on the remote control or on the DC board, the power supply remains in the LOW-POWER mode

even if the TV remains switched on. Only after the level on the SCART-CONTROL line has been changed from LOW to HIGH by switching off the TV set, can the power supply be switched on by another level change from HIGH to LOW.

To suppress interference on the SCART-CONTROL line, the FC only reacts to a falling slope at port P2.0, if at least 2s have passed since the rising slope.

15.9. Backup-System

The Goldcap capacitor [2019] on the motherboard secures the operating voltage and function of the FC even in the Mains-Off mode in case of disconnection from the mains via resistor [3024] (2.2k Ω) and the 3VB connector line [1510/16]. In the LOW-POWER mode, the FC is supplied by the 5VSTBY supply voltage. At the same time, the capacitor is charged via line 3VB and resistor [3024]. In Normal mode, the capacitor is charged directly by the operating voltage 5A1 and diode [6066]. With the capacitor fully charged, correct functioning of the FC can be guaranteed for at least 7 hours in case of disconnection from the mains. If the mains voltage is recovered within this defined backup time, the time and date registers are maintained. If the mains voltage is recovered after expiry of the backup time, the relevant time and date registers are overwritten with a defined fault code. The set is in Normal mode after applying the mains voltage and the capacitor is charged. The charging via diode [6066] is instant and, even in the case of an immediate, repeated disconnection, a full 7 hours of backup time is guaranteed.

15.10. Reset and Interrupt control

The RESET switching stage of transistor [7055] facilitates an exact control of the FC during the transition between the various modes. This is achieved with precisely defined levels or level changes on input port INTO (P1.0/pin 1) and the reset input (pin 12) of the FC.

Transition from the Mains-Off operating mode to the Normal or LOW-POWER operating mode:

If the FC is supplied by the backup capacitor [2019] during Mains-Off, the FC operates in energy-saving Sleep-Slow mode. If, however, the backup time was exceeded in the Mains-Off mode, the FC operates in the Stop mode. In both modes, all ports are in a TRISTATE condition. Once the mains voltage is reapplied, the mains part immediately enters Normal mode and all operating voltages are generated. The CC on the motherboard is consequently reset. The CC then activates a reset of the FC (FC RESET) via the shift register [7019] on the motherboard. Consequently, a voltage of approx. 4.4 V is generated on the cathode of diode [6052] after the level change. The capacitor [2050] is charged via resistor [3053] and the series connection of resistor [3055] with the base emitter route of transistor [7055]. Transistor [7055] becod on the STBY line and the power supply changes to the Normal mode. The CC is reset, followed by the operations detailed in the previous chapter.

Transition from the Normal to the LOW-POWER operating mode:

By pressing the Standby key on the DC board or the remote control, the FC initially changes to Slow mode because of a command issued by the CC. The FC then generates a LOW level at port P54/pin 79, changing the power supply to the LOW-POWER mode. The 5VSTBY voltage supplies the FC and only the 32,768ke. During this operating mode, inputs INTO, P1.2 and Reset (pin 1, 2 and 12) of the FC are each at HIGH level.

Transition from the LOW-POWER to the Normal operating mode:

In the LOW-POWER operating mode, the power supply is maintained in the Standby mode. To achieve this, the port P5.4/pin 79 of the FC is at LOW level. This causes a HIGH level at the collector of transistor [7010]. Line STBY at the plug-in contact [1510/-14] is consequently also at HIGH level. The level passes to the power supply, maintaining it in the desired mode. The energy supply of the FC is provided by the 5VSTBY voltage. The FC itself is in Slow mode. In order to detect whether a transition to the Normal operating mode is to be made, the FC monitors ports P0.0/pin 25 and P2.0/pin 16. Upon activation of the ON/OFF button (change LOW->HIGH),

or in case of a positive FBAS detection (change HIGH->LOW), a level

change takes place. The FC switches port P5.4 to the TRISTATE condition. The transistor [7010] blocks; a LOW level is generated on the STBY line and the power supply changes to the Normal mode. The CC is reset, followed by the operations detailed in the previous chapter.

Transition from the Normal to the LOW-POWER operating mode:

By pressing the Standby key on the DC board or the remote control, the FC initially changes to Slow mode because of a command issued by the CC. The FC then generates a LOW level at port P54/pin 79, changing the power supply to the LOW-POWER mode. The 5VSTBY voltage supplies the FC and only the 32,768kHz crystal is active. At the same time it detects a HIGH level via port P1.2/pin 3, due to the 5VSTBY voltage, and remains in Slow mode. A level change at pin 1/INT0 has no effect during this operating mode change.

Transition from the LOW-POWER to the Mains-Off operating mode:

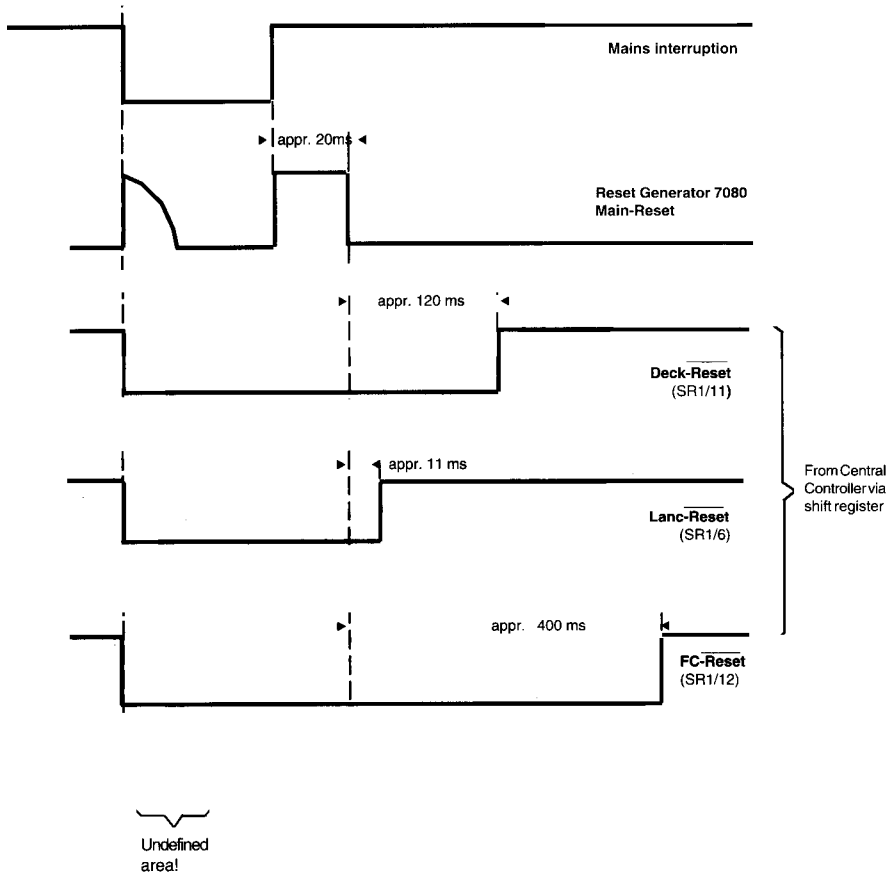
Once disconnected from the mains, the mains supply no longer provides an operating voltage. A LOW level is thus generated at port P1.2/pin 3 of the FC. The FC changes from Slow to Sleep-Slow mode. All FC ports gain a high-resistance. The energy is supplied by the backup capacitor [2019]. The clock and calendar functions of the FC are maintained during the backup period.

Transition from the Normal to the Mains-Off operating mode:

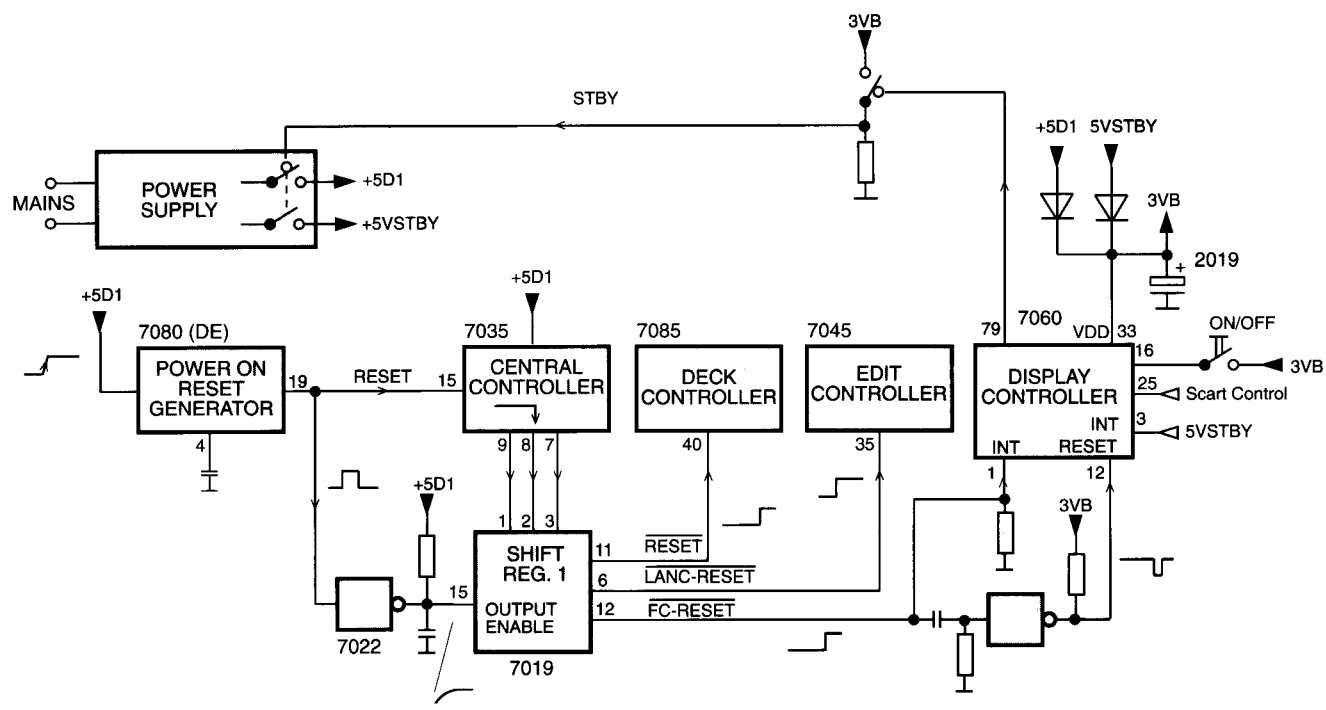
A mains disconnection is carried out in the Normal mode. The detection circuit on the motherboard detects a decreasing 5D1 operating voltage. On the FC-RESET line, and consequently at port P1.0 of the FC, a decreasing slope is generated via IC [7019] and the pull-down resistor [3049]. The FC detects this level change and switches immediately to Sleep-Slow mode. The backup capacitor [2019] supplies the FC.

15.11. Input sockets

An external video or audio signal can be fed into the recorder via the three Chinch sockets [1902] for further processing. Via the Edit socket [1900] a re-recording process can be controlled with a camera. For this purpose, the EDIT-TRIGGER and PREROLL signals are passed via socket [1900] and the plug-in contacts [1510/-9 and -7] to the motherboard for further processing.

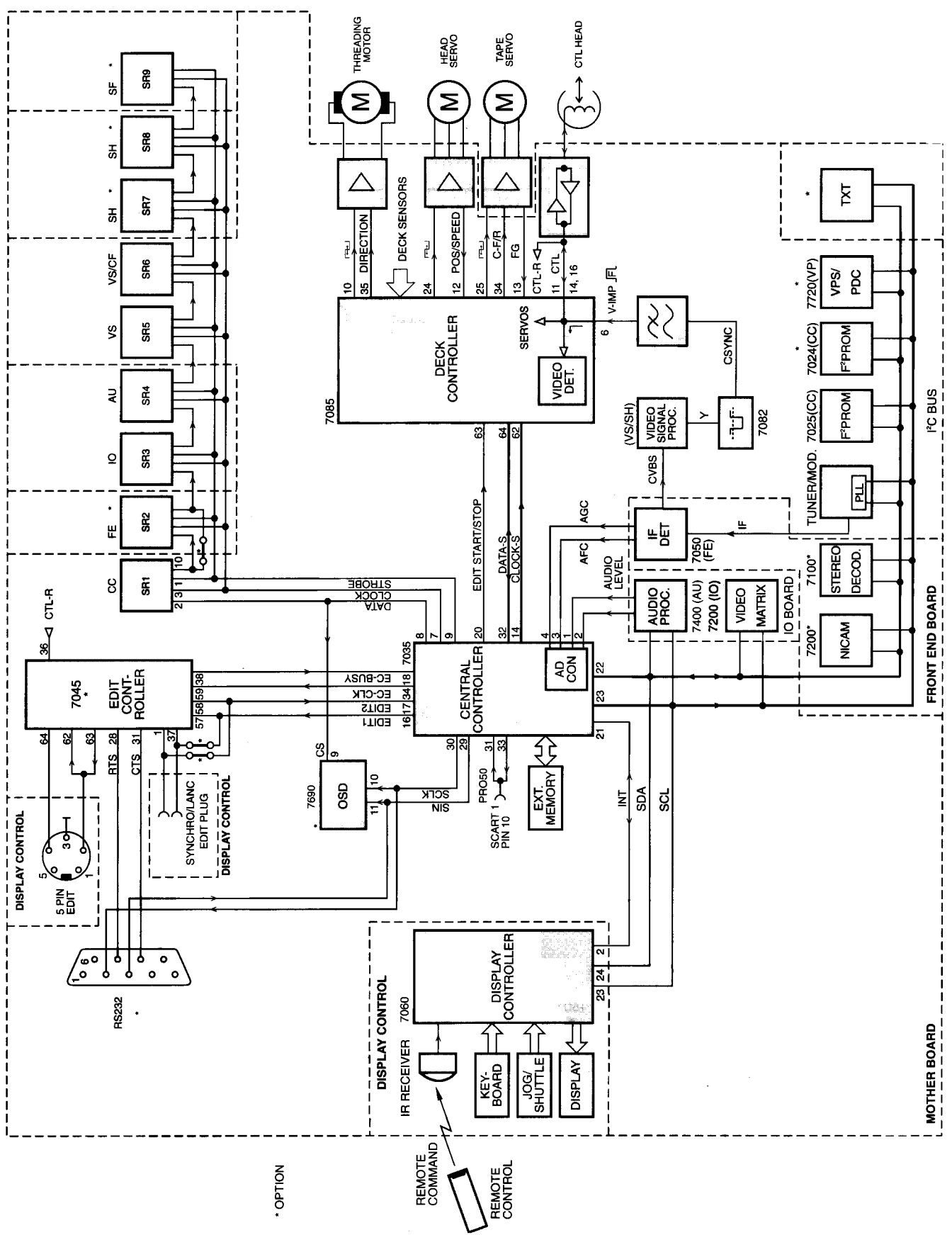


Reset Generation

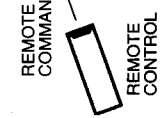


Reset Generation

17. Block Diagram Control



* OPTION



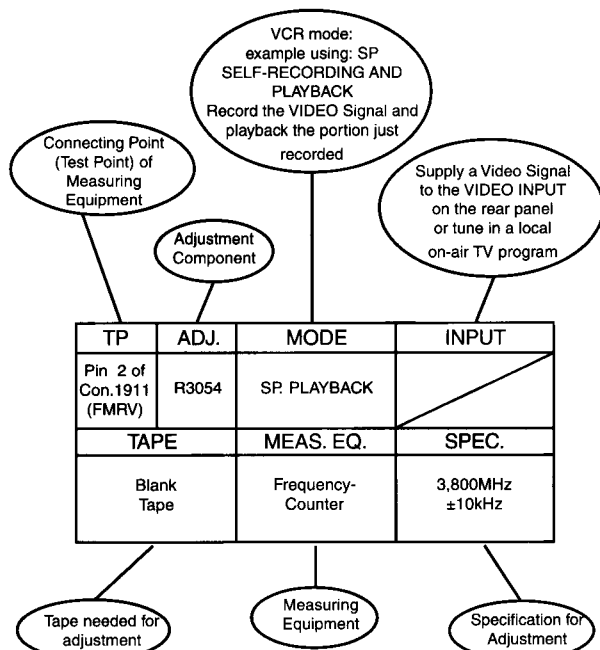
PRINTED CIRCUIT BOARDS

Electrical Alignment Instructions

Measuring Equipment:

- Two-channel oscilloscope
Voltage range : 0.001 ~ 50 V/div
Frequency : DC ~ 50 MHz
Probe : 10:1, 1:1
- Digital voltmeter (DVM)
- AF millivoltmeter
- Frequency counter
- Sinus generator
Sinus : 0 ~ 50 MHz
- Test pattern generator with stereo modulation
- VHS Alignment Tape 4822 397 30103
SPC Alignment Tape 4822 397 30268

Explanation of Alignment Instructions:



- . Cinch audio input
 . Aerial input
 . Euro AV socket (SCART)

The following symbol shows testing points in the circuits and component plans:

1. Power Supply PSM (PS)

1.1 Setting the output voltage +5A :

Purpose: Setting the supply voltage to correct value.

Symptom if incorrectly set:
Incorrect operation of VCR functions.

TP	ADJ.	MODE	INPUT
1509-16; Ground at 1509-10	R3078	Playback	
TAPE		MEAS. EQ.	SPEC.
Any tape		DC Voltmeter	5,3V ±0,05V

2. Frontend End Board (FE) / Mother Board Tuner/Modulator (TM)

Service operations after replacing

- the Mother Board: 2.2, 2.4, 2.5
- the FE Board: 2.2, 2.4, 2.5
- IC 7050: 2.1, 2.2, 2.4, 2.5, 2.6 (SECAM L), 2.7
- IC 7100: 2.4
- the Tuner/Modulator: 2.2, 2.5

2.1 Picture demodulation circuit(AFC-ADJ)

Purpose: Correct setting of demodulator AFC circuit.

Symptom if incorrectly set:

Bad or disturbed reception of TV stations.

TP	ADJ.	MODE	INPUT
83 [1624/3]	AFC-ADJ 1040	E to E	38.875MHz, test picture, TP 82 (FE) [1624/10]
TAPE		MEAS. EQ.	SPEC.
		DC Voltmeter, Video Pattern Generator	2,5V ± 0,1V

2.2 RF AGC take over point (AGC-ADJ)

Purpose: Setting the RF-AGC take-over point.

Symptom if incorrectly set:

AGC does not synchronise correctly if input level is too weak. Input levels which are too strong, may cause picture interference.

Before adjustment ensure that

- unit is warmed up.
- capacitor 4.7 pF is soldered to TP 82 [1624/10]

TP	ADJ.	MODE	INPUT
82 via 4.7pF capacitor	AGC- ADJ R3800 on (TM)	E to E	 2,2mV (67dB _μ V) PAL, CH26 (511.25), audio IF on, no audio modulation
TAPE		MEAS. EQ.	SPEC.
		Oscilloscope Video Pattern Generator	100mV _{pp} (use a 10:1 probe)

2.3 Chroma amplitude adjustment (CHR-ADJ)


Purpose: Adjustment of optimum Chroma amplitude.

Symptom if incorrectly set:

Possible reduced colour quality.

Before adjustment ensure that

– unit is warmed up.

TP	ADJ.	MODE	INPUT
85 [1624/5]	CHR-ADJ 3159	E to E	 2,2mV (67dB _{μV}) PAL, CH26 (511.25) audio modulation off
TAPE		MEAS. EQ.	SPEC.
		Oscilloscope Video Pattern Generator	refer to description below

– Adjust burst amplitude to match Sync pulse size with 3159

2.4 Stereo decoder crosstalk


Purpose: Prevent crosstalk of AF channels.

Symptom if incorrectly set:

Crosstalk of AF channels.

Before adjustment ensure that

– service test program is activated (simultaneous activation of remote control STOP key and PLAY key on the recorder for 5 seconds).

TP	ADJ.	MODE	INPUT
84 [1625/7]	Service Mode	Service Mode	 Test picture, Stereo sound, i.e. l:3kHz, r: 1kHz
TAPE		MEAS. EQ.	SPEC.
		Oscilloscope Video Pattern Generator	minimum crosstalk, refer to description below

- Coarse adjustment: select step 55 of the service mode. Adjust with the "Up" or "Down" keys.
- Fine adjustment: select step 56 of the service mode. Adjust with the "Up" or "Down" keys.

The values will be stored in EEPROM 7025.

2.5 ATS threshold


Purpose: Setting the ATS threshold value for establishing the transmitter sequence according to the received field strength during automatic station search.

Symptom if incorrectly set:

Transmitters without VPS or PDC identification cannot be ordered in the best sequence.

Before adjustment ensure that

– service test program is activated

TP	ADJ.	MODE	INPUT
	Service Mode	Service Mode	 50dB _{μV} PAL, CH26
	TAPE		MEAS. EQ.
Any tape		Video Pattern Generator	Step 54, automatic adjustment

Values are stored in EEPROM 7025.

2.6 Picture demodulator circuit, SECAM band I (3047)

Purpose: Correct setting of demodulator AFC circuit.

Symptom if incorrectly set:

Bad or disturbed reception of TV stations.

TP	ADJ.	MODE	INPUT
83 [1624/3]	3047	E to E, SECAM L' tuned on this preset!	33.375MHz at TP 82 [1624/10]
TAPE		MEAS. EQ.	SPEC.
		DC Voltmeter, Video Pattern Generator	2,5V ± 0,1V

2.7 'Follow TV' amplitude (FMA) (optional)

Adjustment after replacing:

IC 7320 (VS), IC 7050 (FE)



Purpose: Correct adjustment of Follow TV circuit.

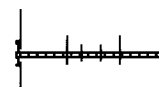
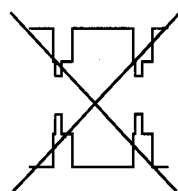
Symptom if incorrectly adjusted:

Incorrect functioning of Follow TV or Direct Record

Before adjustment ensure that

– service test program is activated, Step 57

TP	ADJ.	MODE	INPUT
20 [7832/ Collector]	FMA R3849 on (TM)	Service Mode	1)  >60dB _{μV} , 100% white, 2)  1, Testpicture 100% white, 1V _{pp} (same generator)
TAPE		MEAS. EQ.	SPEC.
Any Tape		Oscilloscope Video Pattern Generator	refer to picture below



OK

3. Mother Board SECAM (SE)

Service operations after replacing

– the Mother Board: none

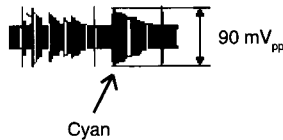
3.1 Chroma writing current (SCWC)

Purpose: Set optimum recording chrominance level.

Symptom if incorrectly set:

If the chrominance levels are too high, picture interference may occur; if the chrominance levels are too low, colour quality may be reduced.

TP	ADJ.	MODE	INPUT
91[7583/B] Trigger: Video Output	SCWC R3581	Record	SECAM Testpicture Colour Bar
TAPE		MEAS. EQ.	SPEC.
Any Tape		Oscilloscope Video Pattern Generator	refer to picture below



4. Mother Board VHS-Videosignal-Verarbeitung (VS)

Service operations after replacing:

– the Mother Board, the head disk, IC 7600: 4.4
– the IC 7320: 4.1, 4.2, 4.3

4.1 Luminance writing current (AY)

Purpose: To set the optimum recording luminance level.

Symptom if incorrectly set:

If the level is too high or low, picture interference may occur

TP	ADJ.	MODE	INPUT
52 [C2268]	AY R3479	Record	AV 1 100% white testpicture
TAPE		MEAS. EQ.	SPEC.
Any Tape		Oscilloscope Video Pattern Generator	300mV _{pp}

4.2 Chroma recording current PAL (CAP)

Purpose: To set the optimum recording chrominance level.

Symptom if incorrectly set:

If the level is too high, picture interference may occur; if the level is too low, colour quality may be reduced.

Before adjustment ensure that

– oscilloscope is applied to TP 52 [C2268], and white test picture to AV 1.
– measure value V_A is noted.
– TP 32 is connected to ground.

TP	ADJ.	MODE	INPUT
51 [C2187]	CAP R3387	Record	AV 1 red testpicture
TAPE		MEAS. EQ.	SPEC.
Any Tape		Oscilloscope Video Pattern Generator	V _A / 2

– Disconnect TP 32 from ground

4.3 S-VHS Detection (REFS, REFV) (optional)

Purpose: Manual alignment of S-VHS recognition.

Symptom if incorrectly set:

During playback, the S-VHS or VHS status is not recognised correctly.

Before adjustment ensure that

– a 100% white test picture is applied to AV 1 and recorded.
– recording is played back.

TP	ADJ.	MODE	INPUT
1) 34, 35 2) 34, 36	1) REFS R3508 2) REFV R3503	Playback	
TAPE		MEAS. EQ.	SPEC.
Any Tape		DC Voltmeter, Video Pattern Generator	refer to description below

- 1)
– Measure voltage values at TP 34 [C2279]; value = V_{34s}.
– Set to V_{34s} + 0.35V with 3508 voltage at TP 35 [R3508].
- 2)
– TP33 (collector of 7280) is then connected to ground.
– Measure voltage values at TP 34; value = V_{34v}.
– Set to V_{34v} + 0.25V with 3503 voltage at TP 36 [R3503].
– Disconnect from ground.

4.4 Studio Picture Control SPC (optional)

Purpose: Setting the SPC reference level.

Symptom if incorrectly set:

Occasional picture loss or picture display at lower resolution than possible.

Before adjustment ensure that

- SPC alignment tape is inserted
- Call up service test program

TP	ADJ.	MODE	INPUT
/	/	Stop Service Mode	TR or AV 1 grey or red Testpicture
TAPE		MEAS. EQ.	SPEC.
SPC Alignment Tape		/	Call up Step 52 of Service Mode

After calling up step 52, the recorder will make a SP recording (approx. 16s), rewind and start to play back the adjustment. After the adjustment has been carried out, the VCR switches to STOP, displaying "READY" if the adjustment was successful, or "FAILED" if the adjustment was unsuccessful.

The adjustment values are stored in EEPROM 7025.

5. Mother Board Deck Electronics (DE)

Service operations after replacing

- the Mother Board, the head disc: 5.1

5.1 Head disk gap position

Purpose: Determining the head switch-over pulse during playback.

Symptom if incorrectly set:

Head switch-over faults and/or vertical picture flickering.

Before adjustment ensure that

- VHS alignment tape is inserted
- service test program is activated

TP	ADJ.	MODE	INPUT
/	/	Service Mode	/
TAPE		MEAS. EQ.	SPEC.
VHS Alignment Tape		/	Call up Step 51 of Service Mode

After a successful adjustment, the recorder automatically switches to the STOP mode and displays "READY".

An unsuccessful adjustment may be due to:

- an incorrect standard video signal
- a defective scanner
- a defective microprocessor

The adjustment values are stored in EEPROM 7025

6. Mother Board On Screen Display (OS)

Service operations after replacing:

- the Mother Board: -
- 7690, 1108, 2695, 2697, 2698: 6.1
- 7690, 1104, 2692, 2694: 6.2

6.1 OSD Crystal oscillator (OSD-SC)

Purpose: Adjusting the exact quartz frequency

Symptom in case of incorrect adjustment:

Incorrect functioning of the OSD

Before adjustment, the following preparations are required:

Connect pin 23 (reset) of IC 7690 to earth.

TP	ADJ.	MODE	INPUT
9 [7690/5]	C2695	E-E	/
TAPE		MEAS. EQ.	SPEC.
/		Frequency counter	17 734 475 Hz ± 50 Hz

- Remove short circuit
- To initialise, switch recorder off and on again

6.2 OSD LC-Oscillator (OSD-LC)

Purpose: Adjusting the letter width and position

Symptom in case of incorrect adjustment:

Incorrect letter width and position

Before adjustment, the following preparations are required:

Connect pin 23 (reset) of IC 7690 to earth.

TP	ADJ.	MODE	INPUT
10 [7690/8]	1104	E-E	/
TAPE		MEAS. EQ.	SPEC.
/		Frequency counter	6.6 MHz ± 0.1 MHz

- Remove short circuit
- To initialise, switch recorder off and on again

7. In/Out Board Audio (AU)

Service operations after replacing:

- the head disk: 7.1, 7.2
- the In/Out Board: 7.1, 7.2, 7.3, 7.4
- the IC 7400: 7.1, 7.2
- the combi-head: 7.3, 7.4 + electro-mechanical adjustment (chapter 4)

7.1 FM envelope voltage (FME)

Purpose: Setting the frequency deviation.

Symptom if incorrectly set:

Incorrect deviation during recording.

TP	ADJ.	MODE	INPUT
22 [1637/3]	FME R3485	Playback	
TAPE		MEAS. EQ.	SPEC.
VHS Alignment Tape, FM Audio section		Oscilloscope	3.6V _{pp} refer to picture below



7.2 Sound envelope voltage (AEL, AER)

Purpose: Setting the IC amplification control.

Symptom if incorrectly set:

Sound is recorded too low, i.e. the signal-to-noise-ratio is too low or overmodulated.

Before adjustment ensure that

- 400 mV_{rms} is fed to Cinch input ⊕.
- the service test program is activated, Step 61, Step 61

TP	ADJ.	MODE	INPUT
23 & 24 [1637/ 7&6]	AEL, R3408 AER, R3410	Service Mode 61	400mV _{rms} , 1kHz ⊕
TAPE		MEAS. EQ.	SPEC.
Any Tape		Oscilloscope	1.4V

Set values are stored in EEPROM 7025.

7.3 Bias current (BIAS)

Purpose: Setting the optimum bias current for recording.

Symptom if incorrectly set:

If the level is too high, the frequency response deteriorates, if it is too low, harmonic distortion increases.

TP	ADJ.	MODE	INPUT
25 [1505/3]	BIAS R3645	Record	
TAPE		MEAS. EQ.	SPEC.
Chromium Dioxid Tape		Oscilloscope with probe 10:1, Sinus Generator	22mV _{pp} ...62mV _{pp}

Controlling the bias setting:

- Feed 5 mV_{rms} (14 mV_{pp}) audio signal from sinus generator to Cinch input (⊕ rear of unit).
- Record for 1 minute at 400 Hz and 8 kHz onto a brand name chromium dioxide tape.
- Playback the recording.
- Connect AF millivoltmeter (oscilloscope) to contact 1/3 of AV1 or to Cinch output (⊗ rear of unit).

- The voltage ratio must not exceed ±3dB.

Increase playback voltage at 8 kHz: decrease bias.

7.4 Playback level

Purpose: Setting the playback level of the audio linear part.

Symptom if incorrectly set:

Playback too faint or overmodulated.

Before adjustment ensure that

- sinus is fed with 333 Hz; 0.4 V_{rms} to Cinch input ⊕.
- recording button is activated.
- service test program is activated, Step 58

TP	ADJ.	MODE	INPUT
	Service Mode	Service Mode	
TAPE		MEAS. EQ.	SPEC.
Chromium Dioxid Tape		Sinus Generator	Step 58, automatic adjustment

The adjustment values are stored in EEPROM 7025.

In case of an incorrect adjustment with the voltage difference between linear audio and FM audio being > 1 dB, "LIN ERR" appears on the display, i.e. the audio linear switching part is faulty.

8. Display Control (DC)

Service work after replacement:

- of the quartz clock: 8.1

8.1 Timer Clock Frequency (2060)

Purpose: Adjustment of the exact clock frequency

Symptom in case of incorrect adjustment:

The clock is too fast or too slow

Before adjustment, the following preparations are required:

- Call up the Service Test Program, select step 99.
- After the call up with select, the display dims and all functions and operations of the recorder stop!

TP	ADJ.	MODE	INPUT
[1921/16]	C2060	Service Mode, Step 99	
TAPE		MEAS. EQ.	SPEC.
		Frequency counter with 7 digits	2048.000Hz

The adjustment must be terminated with a mains reset!

9. S-VHS Board Luminance Processing (SH)


Service work after replacement of the S-VHS Board: -

9.1 Recording Level (REC)

Purpose: To set the optimum luminance level during recording


Symptom in case of incorrect adjustment:

A level which is too high or too low results in interference.

TP	ADJ.	MODE	INPUT
6 [7700/14]	REC R3487	Record	 100% white testpicture 1V _{pp}
TAPE		MEAS. EQ.	SPEC.
S-VHS Tape		Oscilloscope Video Pattern Generator	400mV _{pp}

Symptom in case of incorrect adjustment:

A level which is too high or too low results in interference.


TP	ADJ.	MODE	INPUT
2 [7520/43]	EE R3637	Record	 100% white testpicture 1V _{pp}
TAPE		MEAS. EQ.	SPEC.
S-VHS Tape		Oscilloscope Video Pattern Generator	1V _{pp}

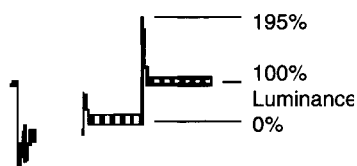
9.3 White Clip (WC)

Purpose: To set the optimum white clip during recording

Symptom in case of incorrect adjustment:

A level which is too high or too low results in interference.

TP	ADJ.	MODE	INPUT
4 [7520/19]	WC R3515	Record, VHS, SP	 100% white testpicture 1V _{pp}
TAPE		MEAS. EQ.	SPEC.
Any Tape		Oscilloscope Video Pattern Generator	refer to picture below




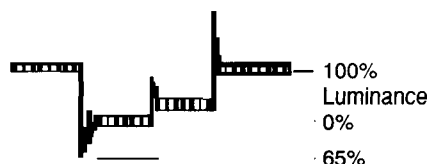
9.4 Dark Clip (DC)

Purpose: To set the optimum black clip during recording

Symptom in case of incorrect adjustment:

A level which is too high or too low results in interference.

TP	ADJ.	MODE	INPUT
4 [7520/19]	DC R3521	Record, VHS, SP	 100% white testpicture 1V _{pp}
TAPE		MEAS. EQ.	SPEC.
Any Tape		Oscilloscope Video Pattern Generator	refer to picture below




9.5 VHS Synchronising Value (SV-VHS)

Purpose: To set the correct synchronising value during VHS recording

Symptom in case of incorrect adjustment:

The VHS standard is not maintained


TP	ADJ.	MODE	INPUT
3 [7520/25]	SV-VHS R3503	Record, VHS, SP	 no input signal
TAPE		MEAS. EQ.	SPEC.
Any Tape		Frequency counter	3.8 MHz

9.6 S-VHS Synchronising Value (SV-S-VHS)

Purpose: To set the correct synchronising value during S-VHS recording

Symptom in case of incorrect adjustment:

The S-VHS standard is not maintained


TP	ADJ.	MODE	INPUT
3 [7520/25]	SV-S-VHS R3509	Record, S-VHS, SP	 no input signal
TAPE		MEAS. EQ.	SPEC.
S-VHS Tape		Frequency counter	5.4 MHz

9.7 VHS White Value (WV-VHS)

Purpose: To set the correct white value during VHS recording

Symptom in case of incorrect adjustment:

The VHS standard is not maintained


TP	ADJ.	MODE	INPUT
3 [7520/25]	WV-VHS R3507	Record, VHS, SP	 1 100% white picture
TAPE		MEAS. EQ.	SPEC.
Any Tape		Frequency counter	4.62 MHz

9.8 S-VHS White Value (WV-S-VHS)

Purpose: To set the correct white during S-VHS recording

Symptom in case of incorrect adjustment:

The S-VHS standard is not maintained


TP	ADJ.	MODE	INPUT
3 [7520/25]	WV-S-VHS R3513	Record, S-VHS, SP	 1 100% white picture
TAPE		MEAS. EQ.	SPEC.
S-VHS Tape		Frequency counter	6.67 MHz

9.9 Luminance Recording Current (YWV)

Purpose: To set the optimum luminance level during recording

Symptom in case of incorrect adjustment:

A level which is too high or too low results in interference

TP	ADJ.	MODE	INPUT
52 [C2268]	YWV R3765	Record S-VHS	 1 100% white testpicture
TAPE		MEAS. EQ.	SPEC.
S-VHS Tape		Oscilloscope Video Pattern Generator	250mV _{pp}


9.10 Playback Amplitude

Purpose: To set the optimum luminance level during playback


Symptom in case of incorrect adjustment:

A level which is too high or too low results in interference


Before adjustment, the following preparations are required:

- Supply a 100% white test picture to  1 and record; VHS and S-VHS
- Play back the recording

9.10.1 VHS Playback Amplitude (PBA-VHS)

TP	ADJ.	MODE	INPUT
6 [7700/14]	PBA-VHS R3543	VHS Playback of own recording of white picture	
TAPE		MEAS. EQ.	SPEC.
VHS Tape		Oscilloscope Video Pattern Generator	400mV _{pp}

9.10.2 S-VHS Playback Amplitude (PBA-S-VHS)

TP	ADJ.	MODE	INPUT
6 [7700/14]	PBA-S-VHS R3545	S-VHS Playback of own recording of white picture	
TAPE		MEAS. EQ.	SPEC.
S-VHS Tape		Oscilloscope Video Pattern Generator	400mV _{pp}


9.11 Drop Out Level (DP)


Purpose: To set the correct amplitude of the drop out correction signal

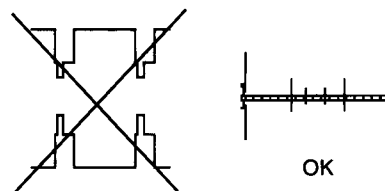
Symptom in case of incorrect adjustment:

Drop out compensation not operating correctly.

Before adjustment, the following preparations are required:

- Supply a 100% white test picture to  1 and record; VHS and S-VHS
- Play back the recording

TP	ADJ.	MODE	INPUT
7 [7520/12]	DP R3723	Playback of own recording	 1 100% white testpicture
TAPE		MEAS. EQ.	SPEC.
S-VHS Tape		Oscilloscope Video Pattern Generator	refer to picture below



9.12 S-VHS Detection (REFS, REFV)

Purpose: Manual alignment of the S-VHS detection

Symptom in case of incorrect adjustment:

During playback, the S-VHS or VHS status is not recognised correctly

Before adjustment, the following preparations are required:

- Supply a 100% white test picture to AV 1 and record in VHS
- Play back the recording

TP	ADJ.	MODE	INPUT
1) 37, 39 2) 37, 38	1) REFS R3791 2) REFV R3795	Playback of own recording	
TAPE		MEAS. EQ.	SPEC.
S-VHS Tape		DC Voltmeter, Video Pattern Generator	refer to description below

- 1)
- Connect pin 4 of IC7800 to ground and pin 5 to +5 V
- Measure voltage at TP 37 [1530/7] : value = V37S
- Using 3791, set voltage at TP 39 [1530/10] to V37S +0.35 V
- Remove short circuits

- 2)
- Connect pin 4 of IC7800 to +5 V and pin 5 to ground
- Measure voltage at TP 37 [1530/7] : value = V37v
- Use 3795 to set voltage at TP 38 [1530/11] to V37v +0.25 V
- Remove short circuits

9.13 Studio Picture Control

See 4.4

10. Transcoder Board Chrominance Processing (SF)

Service operations after replacement:

- of the transcoder board:
- of IC7270: 10.1, 10.2, 10.3
- of IC7175: 10.4

10.1 VXO-Adjustment (XO)

Purpose: Adjustment of the sub-carrier frequency

Symptom in case of incorrect adjustment:
Colour faults

TP	ADJ.	MODE	INPUT
41 [1525/12]	XO C2306	Playback PAL	
TAPE		MEAS. EQ.	SPEC.
Any Tape		Frequency Counter	4.433619 MHz ± 20 Hz

10.2 Chroma Writing Current (CHSP)

Purpose: To set the optimum chrominance level during recording

Symptom in case of incorrect adjustment:

- A level which is too high results in interference.
- A level which is too low results in faint colours.

TP	ADJ.	MODE	INPUT
43 [1524/10]	CHSP R3273	Record	AV 1 colour bar PAL
TAPE		MEAS. EQ.	SPEC.
Any Tape		Oscilloscope Video Pattern Generator	red part: 150mV _{pp}

10.3 Pilot Burst-Amplitude (PBA)

Purpose: To set the correct pilot burst amplitude during recording

Symptom in case of incorrect adjustment:
S-VHS standard is not maintained

TP	ADJ.	MODE	INPUT
43 [1524/10]	PBA R3295	Record S-VHS	AV 1 colour bar PAL
TAPE		MEAS. EQ.	SPEC.
S-VHS Tape		Oscilloscope Video Pattern Generator	Pilot Burst amplitude = 1.1 x PAL Burst amplitude

10.4 627 kHz Comb Filter (CF)

Purpose: To match the amplitude of the delayed and not delayed signal

Symptom in case of incorrect adjustment:
Colour faults

Before adjustment, the following preparations are required:

- Feed red signal (PAL) to AV 1 and record
- Play back the recording

TP	ADJ.	MODE	INPUT
42 [7166/E]	CF R3167	Playback, own recording, red picture	
TAPE		MEAS. EQ.	SPEC.
any Tape		Oscilloscope Video Pattern Generator	adjust vertical blanking, refer to picture below



200µs/Div

D Hinweis zu den Bauteilen:

Verschiedene Bauteile sind mit einem 'X' oder mit einem 'Y' gekennzeichnet. Es handelt sich hierbei um Bauteile, die nicht in allen Gerätetypen enthalten, sondern vorgesehen (X) oder variantenbezogen sind (Y). Die variantenbezogenen Bauteile sind den Features zugeordnet (siehe Feature-Übersichten).

F Information sur les composants:

Certains composants sont identifiés par un 'X' ou un 'Y'. Il s'agit ici de composants qui ne sont pas montés dans tous les modèles d'appareils, mais de composants prévus (X) ou des variantes (Y). Les variantes de composants sont affectées aux diverses versions d'équipements (voir tableaux des versions d'équipements).

E Advertencia sobre los componentes:

Diferentes componentes estan marcados con una 'X' o con una 'Y'. Se trata de componentes no contenidos en todos los modelos de aparatos, sino sólo previstos (X) o variantes (Y). Los componentes relacionados con las variantes se encuentran referenciados en las Features (Ver indice de Features)

GB Note on the components:

Various components are marked with the letter 'X' or 'Y'. These letters are used to identify components which are not common to all types of recorders but either planned to be fitted (X) or used only in certain variants (Y). The components used for different variants are allocated to the features (see features lists).

I Nota sui componenti:

Diversi componenti sono contrassegnati con una 'X' oppure con una 'Y'. Si tratta di componenti che non sono presenti in tutti gli apparecchi, ma previsti (X) oppure varianti (Y). I componenti riferiti alle varianti sono associati alle varie caratteristiche (vedi elenco caratteristiche).


NL Aanwijzing voor componenten:


Verschillende componenten zijn met een 'X' of met een 'Y' aangegeven. Het gaat hierbij om componenten die niet in alle modellen aanwezig zijn, maar mogelijk zijn (X) of afhankelijk zijn van het type verwant (Y). De componenten die type afhankelijk zijn, zijn bij de Features aangegeven (zie hiervoor features overzicht).


D Schaltplansymbole / GB Circuit diagram symbols / F Symboles schema**I Simboli sullo schema / E Simbolos en los esquemas / NL Schema symbolen**


Schaltplansymbole für Video-/Chromasignale und Statusbefehle. Circuit diagram symbols for video signals, chroma signals and status commands./Symboles schema pour video / chroma et status de commandes./Simboli per segnali video, chroma e situazioni di comando./Simbolos de señales de video y cromas de los status de mando./Schema symbolen voor video-/kleursignalen en status commandos.


Unterschiedliche Signale auf einer Leitung/Variou signals on one lead/Signaux différents sur le même cable/Segnali differenti su una linea/Señales diferentes en una conducción/Verschillende signalen op één leiding:


 Aufnahme / Record / Enregistrement / Registrazione / Grabación / Opname


 BD. I/III-Umschaltung / BD. I/III switch-over / Commutation bande I/III / Commutazione banda I/III / Conmutación banda I/III / BD.I/III omschakeling


 Wiedergabe / Playback / Reproduction / Reproduzione / Reproducción / Weergave


 1,1MHz-Signal(SECAM) / 1,1MHzSignal(SECAM) / Signal 1,1MHz (SECAM) / Segnale a 1,1MHz (SECAM) / Señal de 1,1MHz (SECAM) / 1,1 MHz signaal (SECAM)


 Bildformat 16:9 / Aspect ratio 16:9/standard d'écran 16:9/standard di schermo 16:9/estandard de pantalla 16:9/beeldformat 16:9


 Doppelte Hilfsträgerfrequenz / Double subcarrier frequency / Frequence double de la sous-porteuse / Frequenza portante ausil. doppia / Doble frecuencia de portadora auxiliar / Dubbele subcarrier frequentie


 Bildformat 4:3 / Aspect ratio 4:3/Standard d'écran 4:3/standard di schermo 4:3/estandard de pantalla 4:3/Beeldformat 4:3


 Optokopplerimpulse / Optocoupler pulses / Impulsions tachymétriques / Impulsi optoaccoppiatore / Impulsos tacométricos / Optocouplerpuls


 Rahmen / Frame / Cadre / Cornice / Marco / Frame


 627 kHz 627kHz-Signal(PAL) / 627kHzSignal(PAL) / Signal 627kHz(PAL) / Segnale a 627kHz (PAL) / Señal de 627kHz (PAL) / 627kHz signaal (PAL)


 Masse / Chassis / Massa / Masa / Massa


 Bezugspotential / Reference potential/ Potentiel de référence/potenziale di riferimento/ potencial de referencia/ referentie spanning


 Separate Masse / Seperate chassis connection / Connection de masse séparée / Massa separata / Coneción de masa separada/Separate massa


 Schaltspannung bei Aufnahme/ Switching voltage for record / Tension de commutation en enregistrement / Tensione commut.in registrazione / Tension de comutación en grabación / Schakelspanning voor opname

 Von der Empfangsfrequenzeinstellung abhängige Spannung / Voltage dependent on the selected frequency / Tension de CAF / Tensione dipendente dalla regolaz. frequ. di ricezione / Tensión dependiente del ajuste de la frecuencia de recepción / Automatische frequentie controler
















































 Regelspannung für MENU-Signalbalken / Control voltage for MENU signal bar / Tension de régulation pour les signaux menu et mire / Tensione di regolazione per barre segnale MENU / Tensión de regulación para barras de señal MENU / Regelspanning voor menu signaalbalken













































 AM/FM-Umschaltung / AM/FM switch over / Commutation AM/FM / Commutazione AM/FM / Conmutación AM/FM / AM/FM-omschakeling


 Automatic Tuning Search Pegel / Automatic Tuning Search Level / Niveau de recherche automatique (ACP) / Livello ricerca automatica sint. / Nivel ATTS / Auto tuning search niveau


 Status f. autom. SECAM-Umschaltung / Status f. auto SECAM switchover / Statut pour commutation automatique SECAM / Stato per commutaz. autom. SECAM / "Status" para comutación SECAM automática / Status v.autom.SECAM-omschakeling


- AUTO SEC-E** Autom. SECAM-Ost Erkennung / Autom. SECAM-EAST identification/ Détection aut. SECAM-ESTE/ Identificazione SECAM-EAST/ Identificación automática SECAM-EAST/ Autom. SECAM-OOST herkenning
- AV** AV-Schaltspannung / AV switching voltage / Tension de commutation AV / Tensione di commutazione AV / Tensión de conmutación AV / AV schakelspanning
- EURO- AV**
- AV-I** Status f. Schaltspannung an AV-I / Status for the switching voltage on AV-I / Statut de tension de commutation sur la prise péritelévision / Condizione per tens. di commutaz. su AV-I / Status para tensión de conmutación en AV-I / Schakelspanning AV-I
- AV-II** Auswertung einer externen Schaltspannung / Evaluation of an external switching voltage / Analyse d'une tension de commutation externe / Valutazione di una tens. di commutaz. esterna / Evaluación de una tensión de conmutación externa / Herkenning van een externe schakelspanning
- AV-III** Schaltspannung an AV-I (abhängig v. d. Auswertung d. U-AV-II) / Switching voltage on AV-I (dependent on the evaluation of U-AV-II) / Tension de commutation sur la prise péritelévision I (dépendant de l'analyse de la tension de commutation sur la prise péritelévision II) / Tensione di commutazione su AV-I (in base alla valutazione di U-AV-II) / Tensión de conmutación en AV-I (pendiente de la analización de U-AV-II) / Schakelspanning op AV-I (afhankelijk v. d. verwerking v. d. U-AV-II)
- B** Blau / Blue / Bleu / Blu / Azul / Blauw
- BD III** BD. III-Umschaltung / BD. III switch-over / Commutation bande III / Commutazione banda III / Conmutación banda III / BD. III omschakeling
- BK** Burst-Key-Impuls / Burst Key pulse / Impulsion Burst-Key / Impulso Burst-Key / Impulsos de puerta de Burst / Burst Key puls
- BLANK** Signalausstattung / Signal Blanking / Suppression du signal / Soppressione segnale / Supresión de señal / Signaal Blanking
- BOX/ SEC.** Schaltsignal bei DOS- bzw. OSD-Einblendungen in ein SECAM-Signal / Switching signal with DOS or OSD superimposed on a SECAM signal / Tension de commutation DOS ou OSD en SECAM / Tensione di commutazione con sovrapposizione DOS (OSD) in un segnale Secam / Tensión de conmutación de DOS o inserciones OSD sobre una señal SECAM / Schakel signaal bij DOS of OSD invoeging in een SECAM signaal
- BS** Bildspeicher-Status / Field Memory Status / Status mémoire images / Status memoria immagine / Status memoria de imagen / Beeldgeheugen status
- C-F R** Drehrichtung Capstan Motor / Sense of Rotation / Sens de rotation du moteur cabestan / Verso rotaz. Motore Capstan / Sentido de giro motor capstan / Draairichting Capstanmotor
- CAM** Camera
- CCVS** FBAS-Signal / CCVS signal / Signal Video-composite / Segnale FBAS (Video composito) / Señal completa de Videocolor / FBAS-signaal
- CH** Farbsignal / Chroma signal / Signal chroma / Segnale croma / Señal de croma / Chromasignaal
- CH EP** Chroma Hüllkurve (Video) / Chroma envelope (Video) / Courbe envelopante chroma (Video) / Curva d'involuppo chroma (Video) / Chroma-curva envolvente de video / Chroma pakket
- CLK** Clockleitung / Clock line / Ligne horloge / Linea clock / Linea reloj / Clock leiding
- CLOCK**
- CLOCK-S** Clockleitung serielle Schnittstelle / Clock line serial interface / Horloge série interface/ interfaccia seriale linea clock/ interface serie linea de clock/ Clock seriele interface
- CM** Steuerspannung Capstanmotor/ Control voltage, capstan motor/Tension de commande moteur cabestan / Tensione di comando motore capstan / Tensión de mando del motor del capstan / Stuurspanning capstanmotor
- COL B-W** Schwarz/Weiß-Farbe Schaltspannung / Black/White-Colour Switching Voltage / Tension de commutation noir/blanc - color / Tens. commut. bianco/nero-colore / Tensión de comm. b/n-colore / Zwart-Wit-keur omschakel spanning
- COMP** Komponenteneingangssignal Y/C / Y/C component input signal/signal d'entrée composants/ Segnale dentrata componenti Y/C/ Señal d'entrada componentes Y/C / Component input signaal Y/C
- CON.FM** Geregelt FM / Controlled FM / FM réglée / FM regolata / FM Regulada / Geregelt FM
- CONTROL-S** Daten für Fernsteuerung über CONTROL-S-Buchse / Remote Control Data via the CONTROL-S-socket/ Données pour télécommande via la prise CONTROL-S / Dati per telecomando tramite presa CONTROL-S / Datos para el manejo a distancia a través del conector CONTROL-S / Afstandsbedienings data via de CONTROL-S ingang
- CP** Canal Plus
- CTL** Synchronimpuls / Sync pulse / Impulsion Synchro / Impulso di sincronismo / Impulsos de sincronismo / Sync.puls
- SYN**
- CR** Stellerspannung Crispening / Threshold Voltage Crispening / Tension de réglage contours / Tensione Crispening / Tensión rep. "crispening" / Offsetspanning crispening
- CV** Status CV/ CV status/Etat CV / Condizione CV / Status CV CV Status
- CV HF** CV/HF-Umschaltung / CV/RF switch-over / Commutation CV/FR / Commutazione CV/RF / Conmutación banda CV/ RF / CV/HF-omschakeling
- CVS** BAS-Signal / CVS signal / Signal Video / Segnale BAS (Video) / Señal completa de Video / BAS-signaal
- CVBS** FBAS-Signal / CVBS signal / Signal Video / Segnale BAS (Video) / Señal completa de Video / FBAS-signaal
- DATA** Datenleitung / Data line / Ligne de données / Linea dati / Linea datos / Data leiding
- DATA-S** Datenleitung Serielle Schnittstelle / Data line serial interface/ Données série interface/ interfaccia seriale linea dati/ interface serie linea de datos/ data seriele interface
- DOA** Dropout-Abschwächung / Dropout attenuation / Attenuation dropout / Attenuazione dropout / Atenuación dropout / Dropout verzwakking
- DOK** Dropout-Killerspannung / Dropout Killer Voltage / Tension de commutation dropout / Tensione di soppressione dropout / Tension de conmutación dropout / Dropout killerspanning
- DOS** Umschaltung DOS-/Video-Bild / DOS-CCVS/picture switch-over / Commutation DOS-Vidéo / Commutazione Video/ DOS / conmutación DOS/imagen de video / Omschakeling DOS-/video beeld
- DOS REC** Untertitelaufnahme / Subtitle Recording / Enregistrement des sous-titres / Registrazione sottotitoli / Grabación de subtítulos / Ondertitel opname
- DS** Drum Stop-Pegel / Drum Stop Status / Niveau (tambour de tête arrête) / Livello stop tamburo / Nivel de detención del tambor / Drum stop status
- DTL** Datenübernahmeleitung / Data transfer line / Ligne echange de données / Linea di trasferimento dati / Linea transferencia datos / Data transfer leiding

 EC-BUSY	Edit-Controller Bestätigung / Edit-Controller acknowledge / Bit de confirmation du NO d'Edit/ Abilitazione controllore edit/ reconocimiento controlador edit/ Edit processor bevestiging	 HI-P	Kopfschaltimpuls-Bild / Video head switching pulse / Impulsion de commutation tête image / Impulso di commutazione testina video / Conmutación de cabezas de video / Video head switching puls
 EC-CLK	Clock vom Central- zum Edit-Controller / Clock from Central-to Edit-Controller/Horloge du µc principal vers le µc d'Edit/clock dal centrale al controllore edit/ clock central a controlador edit/Clock van centrale-naar Edit processor	 U HWM	Steuerspannung Kopfradmotor / Control voltage, headwheel motor / Tension de commande moteur tambour de têtes / Tensione di comando motore ruota testine / Tensión de mando del motor del volante de cabezas / Stuurspanning drummotor
 EDIT	Edit Status / Edit Status / Status Edit / Stato Edit / Status Edit/Edit Status	 U KOIN.	Koinzidenz-Spannung / Coincidence voltage / Tension de coincidence / Tensione di coincidenza / Tensión de coincidencia / Coincidence spanning
 EDIT1	Daten vom Central- zum Edit-Controller / Data from Central-to Edit-Controller/ Données du µc principal vers le µc d'Edit/dati dal centrale al controllore edit/ datos central a controlador edit / Data van centrale naar Edit processor	 U KOIN.	
 EDIT2		 U LP	Longplay-Umschaltung / Longplay switchover / Commutation longue duree / Commutazione longplay / Conmutación a longplay / Longplay-omskakeling
 U EE	Durchschleifbild / EE-Betrieb / Loop through video / EE-mode	 NPF LP	Umschaltung Standard/Long/Economy-Play/ Commutation LP-EP/ Commutazione SP-LP-EP/ Conmutación LP-EP/ Omskakeling Standaard-/ Long-/ Economy-play
 U EN-FB	Freigabe des Fastblank Impuls / Fast blank pulse enable / Validation impulsion blanking / Consenso dell' impulso del bianco / Enable impulso Fastblanking / Vrijgave voor fastblanking impuls	 LP REC	Status bei Longplay Aufnahme / Status at longplay record/ status LP-enregistrement/ stato di registrazione longplay/ status LP en grabación/ Status bij Longplay opname
 FL	Bildimpuls / Fieldpulse / Impulsion trame / Impulso di quadro / Impulsos de cuadro / Beeld puls	 U LP-TRICK	LP-Trick status / LP-trick status/ Effets spéciaux LD/ stato trick-LP/ Efectos especiales LP/ LP trick status
 F1	Heizung F1/F2/ Filament F1/F2/ Filament F1/F2/ filamento caldo F1/F2/ filamento de calefacción F1/F2/	 MIX.SYN	Synchrongemisch / Mixed sync. / Signaux synchro / Sincronismo O/V / Sincronismos H/V / Mixed synchroon
 F2	Gloeispannung F1/F2/	 U NTSC	NTSC-Status / Status NTSC / Etat NTSC / Condizione NTSC / Status NTSC / NTSC-Status
 U FCT	Funktion-Ein-Status / Function "ON" status / Statut marche / Funzione inserita / Activación tensión / Functie „ON" status	 U NTSC	
 F1/2	Halbe Zeilenfrequenz / Half line frequency / Fréquence demie ligne / Frequenza di riga dimezzata/ Semifrecuencia de línea / Halve lijnfrequentie	 NTSC PAL	NTSC-PAL Umschaltung/NTSC-PAL switch over/ Commutation NTSC-PAL/ Commutazione NTSC-PAL/ Conmutación NTSC-PAL/ NTSC-PAL omskakeling
 FLY ER	Rotierender Löschkopf / Flying erase head / Tête d'effacement rotative / Testina cancellazione rotante / Cabeza rotativa de borrado / Roterende wiskop	 OE	Ausgangsfreigabe / Output enable / Validation sortie / Consenso di uscita/ Habilitación salida / Output enable
 FM-P	FM-Bild / FM picture / Image - FM / Immagine FM / FM de imagen / FM-Beeld	 U PAL	PAL/NTSC
 U FM-EP	FM-Hüllkurve Bild / FM envelope picture / Enveloppe FM image / Involuppo video FM / Envoltente de FM de imagen	 U PAY-TV	Pay-TV-Schaltspannung / Pay TV switching voltage / Tension de consommation / tele à péage / Tensione di commutazione TV a pagamento / conmutación a TV de peaje / Pay TV schakelspanning
 U FMPI	FM-Bild-Kennung / FM picture identification / Identification Video / FM/Identificazione Video/FM / Identificación FM imagen / FM picture identificatie	 PB	Wiedergabe-Status / Playback status / Status reproduction / Stato riproduzione / Status reproducción / Weergave status
 FSC	Hilfsträgerfrequenz / Subcarrier frequency / Fréquence de la sous-porteuse / Frequenza portante ausil. / Frecuencia de portadora auxiliar / Subcarrier frequentie	 PB-FM	Wiedergabe FM / Playback FM / Reproduction FM / Riproduzione FM / Reproducción FM / Weergave FM
 G	Grün / Green / Vert / Verde / Groen	 U PIC	Bildkontrolle / Picture Control / Contrôle de contour image / Controllo definizione dell' immagine / Control de imagen / Picture control
 U H	Zeilen-Eintastung / Line insertion / Insertion ligne / Inserimento di riga / Inserción de linea / Line insertion	 U PL.CO	
 U H		 PIP	Bild im Bild / Picture in picture / Image en image / Immagine nell' immagine / Imagen en imagen / Beeld in beeld
 U HEIM	Heimlauf / Automatic unthread on switch off / Degament auto.par inter M/A / Sgancio autom. con spegnimento / Desenhebrado preventivo / Automatisch uitrijgen bij uitschakelen	 PLL SYNC	Synchron Impuls von HPLL / Sync pulse from HPLL / Impulsion synchro de HPLL / Impulso di sincronismo di HPLL / Impulso de sincronismo de HPLL / Sync. puls van HPLL
 HF AV	HF/AV-Umschaltung / RF/AV switch. over / Commutation HF/AV / Commutazione HF/AV / Conmutacion banda HF/AV / HF/AV -omskakeling	 U PS	Regelumschaltung bei BSL / Control switching during picture search / Tension de commutation en recherche visuelle / Tensione di regolazione durante la ricerca immagine / Conmutación a búsqueda de imagen / Controle omskakeling tijdens picture search
 HF CV AV	HF/CV-AV-Umschaltung / RF/CV-AV switch-over / Commutation HF/CV-AV / Commutazione HF/CV-AV / Conmutacion banda HF/CV-AV / HF/CV-AV-omskakeling	 R	Rot / Red / Rouge / Rosso / Rojo / Rood
 HI-CH	Kopfschaltimpuls-Chroma / Chroma head switching pulse / Impulsion de commutation tête/chroma / Impulso di commutazione testina/Croma / Conmutación cabezas de croma / Video head switching puls chroma		

	RE-Status / RE status / Status RE / Stato RE / Status RE / RE status		S-VHS Wiedergabe / S-VHS Playback / Lecture S-VHS / Riproduzione S-VHS / Reproducción S-VHS / S-VHS weergave
	Aufnahme-Status / Record status / Status enregistrement / Stato di registrazione / Status de grabación / Opname status		Normumschaltung / Standard switch - over / Commutation norme / Commutazione de norma / Conmutación de norma / Norm omschakeling
	Reset-Impuls / Reset pulse / Impulsion de reset / Impulso reset / Impulso de reset / Reset puls		Datenübernahmeimpuls / Data Transfer Pulse / Impulsion de transfert de données / Impulso trasferimento dati / Impulso de transferencia de datos / Data transfer puls
	HF-Aufnahmespannung / RF record voltage / Tension d'enregistrement HF / Tensione di registrazione HF / Status de grabación RF / HF-Opname spanning		
	Auslesetak / Read out clock / Fréquence de echantillonnage / Cadenza di analis / Frecuencia de lectura / Systeem clock		S-VHS Erkennung / S-VHS detection voltage / Identification S-VHS / Identificazione S-VHS / Detección S-VHS / S-VHS erkenning
	VHS/S-VHS Umschaltung / VHS/S-VHS Switching / CommutationVHS/S-VHS / Commutazione VHS/S-VHS / Conmutación VHS/S-VHS / VHS/S-VHS omschakeling		FM-Hüllkurve Bild S-VHS / FM Envelope Video S-VHS / Envelope FM image S-VHS / Inviluppo video FM S-VHS / Envolvente de FM de imagen (S-VHS) / FM-Paket S-VHS
	SAT Hub / SAT deviation / Excursion SAT / Deviazione SAT / Excursión de SAT / SAT zwaai		Schwarz/Weiß-Schaltspannung / Black/White-Switching Voltage / Tension de commutation noir/blanc / Tens. commut. bianco/nero / Tensión de conmut. b/n / Zwart/Wit schakelspanning
	SAT (Satellit)-Mute-Kennung / SAT (Satellite) Mute identification / Identification mute SAT / Identificazione silenziamento SAT / Código de silenciación SAT (satélite) / SAT (Satelliet) Mute identificatie		SECAM-OST/WEST-Abfragespannung / SECAM EAST/WEST scanning voltage / Tension d'identification Secam FR/Secam ME / Tensione di richiesta SECAM-EST/OVEST / Tensión de encuesta SECAM ESTE/OESTE / SECAM oost/west scan-spanning
	SAT Mute / SAT mute / Silence SAT / Silenziamento SAT / Mute SAT / SAT mute		Bandende / End of tape / Fin de bande / Fine nastro / Final de cinta / Einde band
	Sand castle		Schaltspannung für Testbildgenerator / Switching voltage for testpattern generator / Tension de commutation mire / Tensione di commutazione per generatore di prova / Activación del generador de prueba / Schakelspanning voor testbeeld generator
	Serielle Clockleitung / Serial clock line / Ligne horloge serielle / Linea clock seriale / Linea serie de reloj / Serielle klok leiding		Einfädeln / Threading / Engagement de bande / Caricamento del nastro / Enhebrado / Inrijgen
	I ² C-Bus-Clockleitung / I ² C Bus clock line / Ligne horloge Bus I ² C / Linea clock I ² C-Bus / Linea reloj del Bus I ² C / I ² C-Bus-klok leiding		Transcoder Betrieb / Transcoder mode / Mode transcoder / Modo transcoder / Modo transcoder / Transcoder mode
	Schaltspannung "Scrambler" / "Scrambler" switching voltage / Tension de commutation "décodeur" / Tensione di commutazione "Scrambler" / Tensión de conmutación "Scrambler" / "Descrambler" schakelspanning		Bandanfang / Start of tape / Debut de bande / Inizio nastro / Principio de cinta / Begin band
	I ² C-Bus-Datenleitung / I ² C Bus data line / Ligne de données Bus I ² C / Linea dati I ² C-Bus / Linea datos del Bus I ² C / I ² C Bus data leiding		Bandanfang-/Bandende-Kennung / Tape start/tape end detection / Identification debut/fin de bande / Identificazione inizio/fine nastro / Identification de principio o fin de cinta / Begin band-/einde band detectie
	Status SECAM Ost / Status SECAM east / Statut SECAM EST / Stato SECAM EST / Status SECAM oriental / Status SECAM oost		Bandzug-Spannung / Tape tension voltage / Tension de bande / Tensione nastro / Tensión de cinta / Tape tension regelspanning
	Status SECAM West / Status SECAM west / Statut SECAM Ouest / Stato SECAM ovest / Status SECAM occidental / Status SECAM west		Abstimmspannung / Tuning voltage / Tension d'accord / Tensione di sintonia / Tensión de sintonía / Afstemmings spanning (voltage)
	SECAM		
	Serielle Dateneingabe / Serial data input / Entree serielle de données / Ingresso dati seriali / Entrada serie de datos / Serielle data input		UHF-Umschaltung / UHF switch-over / Commutation UHF / Commutazione UHF / Conmutación banda UHF / UHF - omschakeling
	Serielle Datenausgabe / Serial data output / Sortie serielle de données / Uscita dati seriali / Salida serie de datos / Serielle data output		Ungeregelte FM v. Band / Uncontrolled FM from the tape / FM de bande non contrôlé / FM non regolata da nastro / no arreglado FM de la cinta / Ongeregelde FM van tape
	Kopfschaltimpuls-Standbild / Head switching pulse for freezeframe / Impulsion de commutation pour "Arrêt sur image" / Impulso commutaz. testine per fermo immagine / Impulso de conmutación de cabezas en paro de imagen / Video head switching puls voor stilstaandbeeld		Ausfädeln / Unthreading / Degagement de bande / Scaricamento del nastro / Desenhebrado / Uitrijgen
	Standbildoptimierung / Freezeframe optimisation / Optimisation de l'arrêt sur image / Ottimizzazione fermo immagine / Optimización de la imagen fija		Bild- oder eingetasteter V-Impuls / Vertical sync pulse or inserted V-pulse / Signal synchro vertical image ou signal synchro vertical artificiel / Impulso sincro verticale oppure inserimento sincro verticale / Impulso vertical o impulso de sincro vertical / Raster of inserted V-puls
	Standbild / Still picture / Arrêt sur image / Fermo immagine / Imagen parada / Stilstaand beeld / Stilstaand beeld optimalisering		V-Eintastung / V insertion / Insertion V / Inserimento V / Inserción V / V-insertion


 Freigabe für V-Eintastung / Field insertion enable / Validation impulsion V / Consenso per inserimento V / Habilitación inserción V / Vrijgave voor V-insertion


 VHF-Umschaltung / VHF switch over / Commutation VHF / Commutazione VHF / Conmutación banda VHF / VHF - omschakeling


 FM-Hüllkurve Bild VHS / FM Envelope Video VHS / Envelope FM image VHS / Inviluppo video FM VHS / Envolvente de FM de imagen (VHS) / FM-Pakket VHS

 FM-Hüllkurve / FM-Envelope


 Status VPS/Videotext / Status VPS/Teletexte / Stato VPS/ Televideo / Status VPS/Teletexto / Status VPS/teletekst


 Steuerspannung Wickelmotor / Control voltage, winding motor / Tension de commande moteur / Tensione di comando motor / Tensión de mando del motor / stuurspanning spoelmotor


 Bild-WR-Status / Video WR status / Status WR Video (enregistrement/lecture) / Stato Video / Status grabación / reproducción Video / Beeld WR status


 Y-Eintastung / Y insertion / Insertion Y / Inserimento Y / Inserción Y / Y-insertion


Schaltymbole für Audiosignale-Statusbefehle / Circuit diagram symbols for Audio signals / Status commands Symboles sur schema pour commandes de statut / Audio / Simboli di comando Audio / Simbolos de las señales de Audio y status de mando / Schema symbolen voor Audio signalen en Status commandos

 Aufnahme-Empfindlichkeit, linker Kanal / Record sensitivity, left channel / Niveau d'enregistrement, canal gauche / Sensibilità di registrazione, canale sinistro / Nivel grabación, canal izquierdo / Opname niveau linker kanaal


 Aufnahme-Empfindlichkeit, rechter Kanal / Record sensitivity, right channel / Niveau d'enregistrement, canal droit / Sensibilità di registrazione, canale destra / Nivel grabación, canal derecho / Opname niveau, rechter kanaal


 Meßwertanzeige, analog links / Meter reading, analog left / Indicateur de modulation analogique, gauche / Indicazione valore di misura analogico, sinistra / Indicador de nivel izquierdo / Meterwaarde analoog links


 Meßwertanzeige, analog rechts / Meter reading, analog right / Indicateur de modulation analogique, droit / Indicazione valore di misura analogico, destra / Indicador de nivel, derecho / Meterwaarde analoog rechts


 Zwei-Ton-Status / 2-channel sound status / Statut double son / Stato doppio Audio / Status sonido dual / 2-Kanaal geluid status


 Mikrofon-Eingang / Microphone input / Entrée micro / Ingresso microfono / Entrada micrófono / Microfoon ingang


 Wiedergabe-Status / Playback status / Status reproduction / Stato riproduzione / Status reproducción / Weergave status


 Nullpunkt-Einstellung der Audio-Anzeige / Zero adjustment of audio indicator / Point zéro affichage audio / Regolazione zero dell'indicazione Audio / Punto cero indicador de audio / Nulpunt instelling voor audio indicator


 Verzögerte Regelspannung / Delayed control voltage / Tension de regulation retardée / Tensione di regolazione ritardata / Tensión diferida de cag / Vertraagde stuurspanning


 Automatische Verstärkungsregelung / AGC (Automatic Gain Control) / Contrôle automatique du gain / Regolazione automatica di amplificazione / Regulación automática de la amplificación / Gain control


 Canal Plus-Signal für Audio / "Canal plus" signal for audio / signal Canal Plus pour audio / Segnale canal-plus per audio / Señal de Canal Plus para audio / "Canal plus" signaal voor audio


 Audiosignal, links / Audio signal, left / Signal Audio, gauche / Segnale Audio, sinistro / Señal de Audio, izquierda / Audiosignaal, links


 Audiosignal, rechts / Audiosignal, right / Signal Audio, droit / Segnale Audio, destro / Señal de Audio, derecha / Audiosignaal, rechts


 Audiosignal, Mono / Audio signal, Mono / Signal Audio, Mono / Segnale Audio, Mono / Señal de Audio, Mono / Audiosignaal, Mono


 Automatik/Manuell-Umschaltung / Automatic/manual switch-over / Commutation automatique/manuel /


 Commutazione automatica/manuale / Conmutación automatica manual / Automatic/Manuel omschakeling


 Status Tonkanal 1,2 / Sound channel 1,2 status / Statut canal 1,2 / Stato canale Audio 1,2 / Status canal 1,2 sonido dual / Geluidkanaal 1,2 status


 Kanal 1, Kanal 2, Stereo / Channel 1, channel 2, Stereo / Canal 1, canal 2, Stereo / Canale 1, canale 2, Stereo / Kanaal 1, Kanaal 2, Stereo

 Ansteuerung Eingangswahlschalter / Control input select switch / Commande de sélecteur entrant / Selettore ingresso pilotaggio / Exitación del selector de entradas / Stuuringang keuze schakelaar.


 Nachvertonung / Dubbing / Postsonorisation / Postsonorizzazione / Sonorización posterior / Dubbing


 Ton-Ein-/Ausblendung / Sound fade-in/fade-out / Arrivée et disparition progressive du son / Audio inserito/escluso / Inserción/desinserción de sonido / Geluid fade-in/fade-out


 FM-Ton-Status / FM sound status / Statut Audio FM / Stato Audio FM / Status sonido FM / FM-Geluid status


 Audio FM-Signal vom Band / Audio FM-signal from tape / signal Audio FM rel / segnale audio - FM dal nastro / señal audio FM de cinta / Audio FM signaal van tape


 FM-Ton / FM sound / Son FM / Audio FM / Sonido FM / FM-Geluid


 FM Hüllkurve Ton / FM envelope, sound / Courbe envelopante audio FM / Curva d'inviluppo FM audio / FM-curva envolvente de sonido / FM-Pakket HIFI


 FM-Ton-Kennung / FM sound identification / Identification Audio FM / Identificazione Audio FM / Identificación sonido FM / FM geluid identificatie
































 Status f. Aufn. FM-Ton / FM sound record status / Statut pour enregistrement son FM / Stato di registrazione Audio FM / Status grabación sonido FM / FM geluid opname status

 Audio FM-Signal zum Band / Audio FM-signal to tape / Audio signal FM enregistrement / segnale audio-FM per il nastro / señal audio FM grabación / Audio FM signaal naar tape

 Pegelautomatik - Abschaltung und Rücksetzung / Automatic Level Control - switch-off and reset / Contrôle automatique de niveau - Arrêt et reset / Livello automatico - disinserimento e reinserimento / Nivel automatica - desconexión y Reset / Automatische level controle-uitschakeling en Reset

 Frankreich Band I / France band I / France bande I / Francia banda I / Banda I Francesa / Frankrijk band I

 Hauptlöscher / Full-track erase / Tête d'effacement pleine piste / cancellazione completa / Borrado total / Fulltrack wiskop

	Status Hauptlöcher / Status Mains Erase System / Etat effacem. principal / Stato cancellatore totale / Status de borrado total / Status Fulltrackwiskop		Audio-Aufnahme-Signal z. A/W-Kopf / Audio record signal to R/P head / Tête Audio / mode d'enregistrement / Registrazione Audio segnale alla testina R/A / Grabación (cabeza de Audio) / Audio opnamesignaal naar opname/weergavekop
	Generator-Steuerspannung / Generator control voltage / Tension de commande générateur / Tensione controllo generatore / Tensión de control del generator / Generator stuurspanning		Aufnahme-Umschaltung / Record switch-over / Commutation enregistrement / Commutazione-registrazione / Conmutación de grabación / Opname omschakeling
	Kopfschaltimpuls Ton-Ausgang / Head switching pulse audio out / Impulsion de commutation de tête sortie audio / Impulso commutaz. testine - uscita audio / Salida impulse conmutación cabeza sonido / Head switching puls audio out		Aufnahme/Wiedergabe-Umschaltung / Record/playback switching/Commutation enregistrement/lecture / Commutaz. registrazione / riproduzione / Conmutación grab/repro / Opname/Weergave omschakeling
	Kopfschaltimpuls-Ton / Sound head switching pulse / Impulsion de commutation tête/son / Impulso di commutazione testina Audio/Conmutación cabezas de sonido / Geluid head switching puls		Aufnahme/Wiedergabe-Umschaltung / Record/playback switching/Commutation enregistrement/lecture / Commutaz. registrazione / riproduzione / Conmutación grab/repro / Opname/Weergave omschakeling
	HIFI-Ton links / HIFI sound left / Son HIFI gauche / Audio HIFI sinistro / Sonido HIFI izquierda / HIFI-Geluid links		SAT (Satellit)-Tonkennung / SAT (Satellite) sound identification / Identification son SAT / Identificazione audio SAT/ Código de sonido SAT (satélite) / SAT (Satelliet) Geluid identificatie
	HIFI-Ton rechts / HIFI sound right / Son HIFI droit / Audio HIFI destro / Sonido HIFI derecha / HIFI-Geluid rechts		Tonlöcher / Sound erase / Effacement son / Cancellazione Audio / Borrado sonido / Geluid wiskop
	Stellerspannung "Master"-Pegel / Threshold Voltage "Master"-Level / Tension de réglage du niveau "Master" / Tensione livello "Master" / Tensión para nivel "Master" / Offset-spanning masterlevel		Status Tonlöcher / Status Sound Erase / Etat effacem. audio / Stato cancellatore audio / Status de borrado de sonido / Status geluidwiskop
	Stellerspannung Ausgangspegel / Threshold Voltage Output Level / Tension de réglage niveau de sortie / Tensione livello d'uscita / Tensión nivel de salida / Offset-spanning uitgangsniveau		Status Trick / Function truquage / Situaz. effetto speciale / Status truco / Status Trick
	Microvertonung / Microphone dubbing / Sonorisation micro / Doppiaudio con microfono / Sonorización micro / Microfoon dubbing		Ton-WR-Status / Sound WR status / Statut WR Audio (enregistrement/lecture) / Stato Audio WR / Status Grabación/reproducción sonido / Geluid WR status
	Schaltspannung für Mikrofon / Micro Switching Voltage / Tension de commutation pour micro / Tensione di commutazione microfono / Tensión de conmutación para micrófono -/ Schakelspanning voor microfoon		WR-Status / WR status / Statuts WR / Stato WR / Status WR / WR status
	Schaltspannung Mix-Betrieb / Switching Voltage Mix-Mode / Tension de commutation fonction mix / Tens. commut. funzionam. Mix / Tensión conmutación modo MIX / Schakelspanning Mix gebruik		Tacho Wickelteller links / Tacho generator, left spindle / Générateur tachymétrique du plateau porte-bobine gauche / Piattello avvolg.tachim.sinistro / Tacometro del portacarrete izquierdo / Tacho generator, links
	Stummschaltung / Muting / Circuit de silence / Silenziamento / Silenciador / Muting		Tacho Wickelteller rechts / Tacho generator, right spindle / Générateur tachymétrique du plateau porte-bobine droit / Piattello avvolg.tachim.destro / Tacometro del portacarrete derecho / Tachogenerator, rechts
	Stummschaltung Ton EURO-AV / Muting sound EURO-AV / Circuit silence son EURO-AV / Silenziamento audio EURO-AV / Silenciador sonido EURO-AV / Muting geluid EURO-AV		
	Nicam		
	Normalton / Normal Sound / Son normal / Audio normale / Sonido normal/Normaal geluid		
	Parallelvertonung / Parallel dubbing / Synchronisation simultanée / Sonorizzazione parallela / Sonorización paralela / Parallel weergave		
	Audio-Wiedergabe-Signal v. A/W-Kopf / Audio playback signal from R/P head / Tête Audio / Mode lecture / Riproduzione Audio segnale dalla testina R/A / Reproducción (cabeza de Audio) / Audio weergave signaal naar opname/weergavekop		
	Wiedergabe Trick-Mix / Switching Voltage Playback Trick-Mix / Tension de commutation lecture Trick mix / Tens. commut. riprod.Trick-Mix / Tensión conmut. repro/trick-mix / Weergave Trick Mix		
	Aufnahme-Umschaltung / Record switch-over / Commutation enregistrement / Commutazione-registrazione / Conmutación de grabación / Opname omschakeling		
			Schalterbezeichnungen / Switch designations / Désignation des contacts/ Denominazioni degli interruttori / Denominación de contactos / Schakelaar benaming
		CL 1	Cassettenladekontakte / Cassette loading contacts
		CL 2	/ Contacts de positionnement logement cassette/ Contatti caricamento cassetta / Contactos del portacassetta / Cassette loading contact
		CS	Zählschalter / Counter switch / Contact de comptage / Interruttore di conteggio / Contacto contador / Teller schakelaar
		CPS	Cassettenschachtkontakt / Cassette compartment switch / Contact logement cassette / Contatto vano cassetta / Posición del portacassetta / Cassette compartiment schakelaar
		REC	Aufnahmesperre / Record lock / Sécurité d'enregistrement / Blocco di registrazione / Bloqueo de grabación / Opname vergrendeling
		PIS	Identifikationsschalter / Identification switch / Commutateur d'identification / Interruttore di identificazione / Contacto identificación / Identificatieschakelaar
		INIT	INIT.-Schalter / Deck switch / Commutation deck / Commutazione deck / Conmutador deck / Deck schakelaar

Kopfbezeichnungen / Head designations / Désignation des têtes / Denominazione delle testine / Abreviaturas de las cabezas / Kopbenamingen

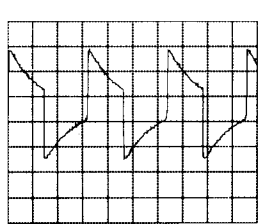
AWK	Aufnahme-/Wiedergabekopf / Record/playback head / Tête combinée enregistrement/lecture / Testina di registrazione / riproduzione / Cabeza de registraci3n/reproducci3n / Opname-/Weergavekop
CTL	Synchronkopf / Sync head / Tête synchro / Testina di sincronismo / Cabeza de sincronismo / Synchroonkop
TLK	Tonlöschkopf / Sound erase head / Tête d'effacement son / Testina di cancellazione audio / Cabeza de borrado de sonido / Geluid wiskop
HLK	Hauptlöschkopf / Full-track erase head / Tête d'effacement pleine piste / Testina de cancellazione completa / Cabeza de borrado total / Full-track wiskop

Sensoren-Abkürzungen / Sensor abbreviations / Abréviations de détecteurs / Abbreviazioni usate per i sensori / Abreviaturas empleadas para sensores / Sensoren afkortingen

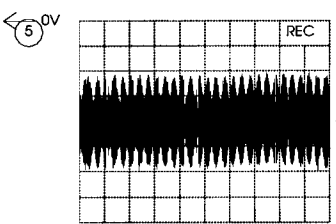
WPL /	Tacho Wickelteller links / Tacho generator, left spindle / Générateur tachymétrique du plateau WM1 porte-bobine gauche / Piattello avvolg.tachim.sinistro / Tacometro del portacarrete izquierdo / Tacho generator, linkse spoelschotel
WPR /	Tacho Wickelteller rechts / Tacho generator, right spindle / Générateur tachymétrique du plateau WM2 porte-bobine droit / Piattello avvolg.tachim.destro / Tacometro del portacarrete derecho / Tacho generator, rechtse spoelschotel
TAS	Bandanfang / Start of tape / Debut de bande / Inizio nastro / Principio de cinta / Begin band
TAE	Bandende / End of tape / Fin de bande / Fine nastro / Final de cinta / Einde band
FTA	Fädeltacho / Threading tacho / Tacho enfilage / Impulsi di caricamento / Taco de enhebrado / Inrijgtacho

Spannungs-Abkürzungen / Voltage abbreviations / Abréviations des tensions / Abbreviaz. delle tensioni / Abreviaturas de las tensiones / Spanningen afkortingen

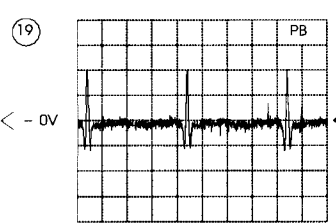
...V₀	Dauerspannung / Unswitched voltage / Tension permanente / Tensione permanente / Tensi3n permanente / Continu spanning
...V_{DM}	Dauer-Motor-Spannung / Unswitched motor voltage / Tension permanente moteur / Tensione permanente motore / Tensi3n permanente motor / Continu motor spanning
...+V_A	Aufnahmespannung / Record voltage / Tension d'enregistrement / Tensione di registrazione / Tensi3n en grabaci3n / Opname spanning
...+V_w	Wiedergabespannung / Playback voltage / Tension lecture / Tensione di riproduzione / Tensi3n en reproducci3n / Weergave spanning
...V_f	Funktionspannung / Function voltage / Tension de fonctionnement / Tensione de regime / Tensi3n funciones / Funktie spanning
...V_{AHF}	HF-Aufnahmespannung / RF record voltage / Tension d'enregistrement HF / Tensione di registrazione HF / Status de grabaci3n RF / HF-Opname spanning
...V_{D UHR}	Dauer-Uhr-Spannung / Unswitched clock voltage / Tension permanente horloge / Tensione permanente orologio / Tensi3n permanente reloj / Continu klok spanning
...V_E	EIN-Spannung (Ein-/Ausschalter gedrückt) / "Machine-on" voltage (ON/OFF switch pressed) / Tension de marche (touche M/A enclenchée) / Tensione d'accensione (interr. accens./spegn.premuto) / Tensi3n "En Marcha" (interruptor pulsado) / Inschakel Spanning (Aan/Uit druk schakelaar)
...V_B	Buchsen-Spannung / Socket voltage / Tension embase / Tensione presa / Tensi3n en conector / Socket-spanning



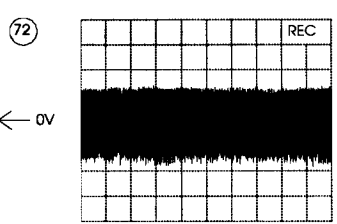
A: DC, 5 V/Div, 10us/Div
Connector 1509 Pin 2



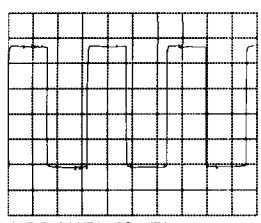
A: DC, 100mV/Div, 1ms/Div
Connector 1637 Pin 12



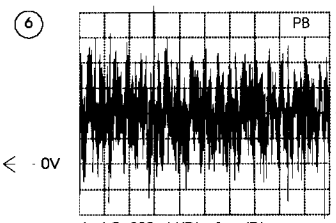
A: DC, 100mV/Div, 10ms/Div
Connector 1501 Pin 5



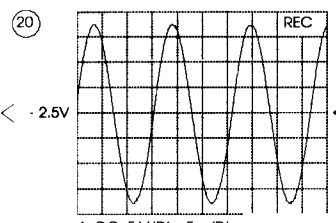
A: DC, 100mV/Div, 10us/Div
Connector 1530 Pin 6



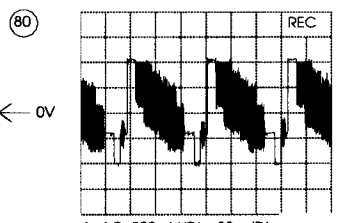
A: DC, 1 V/Div, 10us/Div
Connector 1509 Pin 3



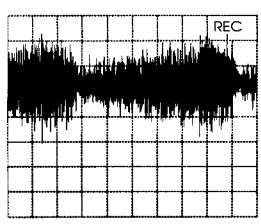
A: AC, 200mV/Div, 1ms/Div
Connector 1637 Pin 14



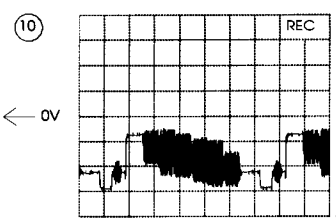
A: DC, 5 V/Div, 5us/Div
Connector 1503 Pin 1



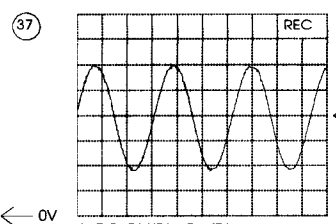
A: AC, 500mV/Div, 20us/Div
Connector 1526 Pin 9



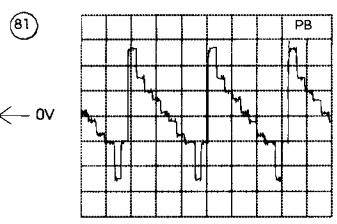
A: DC, 500mV/Div, 10us/Div
Connector 1624 Pin 10



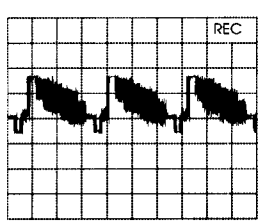
A: DC, 500mV/Div, 10us/Div
Connector 1638 Pin 12



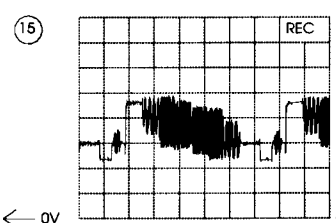
A: DC, 5 V/Div, 5us/Div
Connector 1503 Pin 4



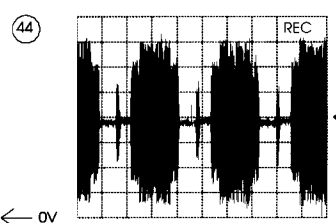
A: AC, 200mV/Div, 20us/Div
Connector 1526 Pin 11



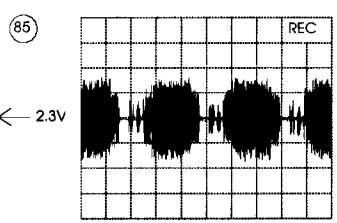
A: DC, 500mV/Div, 20us/Div
Connector 1624 Pin 5



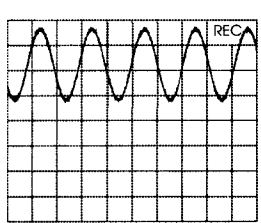
A: DC, 500mV/Div, 10us/Div
Connector 1638 Pin 10



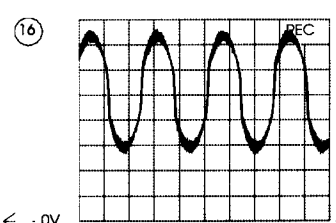
A: AC, 100mV/Div, 20us/Div
Connector 1524 Pin 2



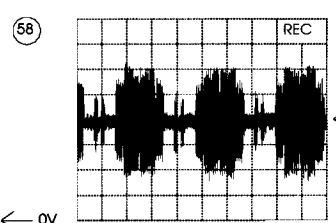
A: AC, 200mV/Div, 20us/Div
Connector 1526 Pin 13



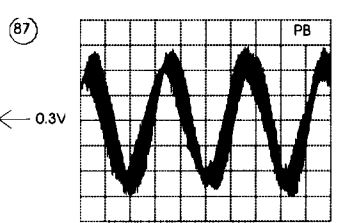
A: DC, 500mV/Div, 500us/Div
Connector 1625 Pin 9



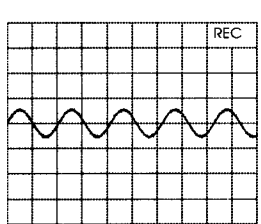
A: DC, 500mV/Div, 500us/Div
Connector 1502 Pin 4



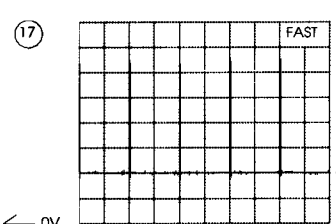
A: AC, 50mV/Div, 20us/Div
Connector 1530 Pin 2



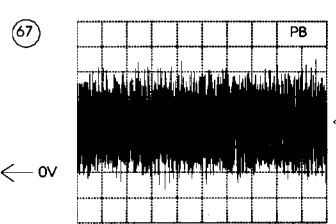
A: AC, 50mV/Div, 500ns/Div
Connector 1525 Pin 15



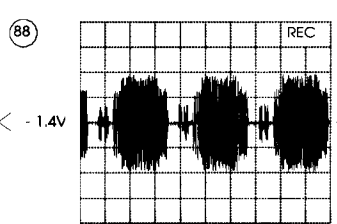
A: DC, 1 V/Div, 500us/Div
Connector 1637 Pin 5



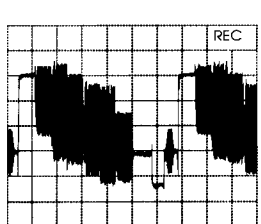
A: DC, 1 V/Div, 10ms/Div
Connector 1530 Pin 9



A: AC, 100mV/Div, 10us/Div
Connector 1530 Pin 4



A: AC, 200mV/Div, 20us/Div
Connector 1525 Pin 14



A: DC, 500mV/Div, 10us/Div
Connector 1638 Pin 7

Interconnections:

PS page 3-27	SE page 3-35	DE page 3-38	VP page 3-41	VT page 3-46	SF page 3-53
FE page 3-29/31	HC page 3-36	OS page 3-39	IO page 3-44	CF page 3-50	SP page 3-54
TM page 3-34	VS page 3-37	CC page 3-40	AU page 3-45	SH page 3-51	DC page 3-57...