Chapter 7
Specifications

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Video and RF

Outputs

CVBS Video

Voltage (Vpp into 75 Ω)	1 V (nominal setting)
Setting range	0 to 1.5 V
Tolerance of setting	10 mV or 5%, whichever is greater, 5 mV or 2%, whichever is greater, at reference temperature
Step size	1%, 10 mV for internal video
Resolution	10 mV
Impedance	75 Ω
Polarity	Positive/ negative, selectable
Coupling	DC
Luminance/chrominance timing difference	≤ 40 ns
Connector	VIDEO OUT, BNC front, EURO AV OUT, EURO AV connector rear
Max. external voltage	±9 V

CVBS SYNC, LINE SYNC and FIELD Synchronization

Voltage (Vpp into 75 Ω)	2 V
Tolerance	0.3 V
Impedance	75 Ω
Polarity	Negative
Coupling	DC
Connector	SYNC OUT: COMP, LINE; FIELD, BNC rear
Max. external voltage	±4 V

EURO AV Control Voltages

Aspect Ratio	Pin 8, Automatically or Off
OFF	0 V to +2 V
Ratio 4:3	+9.5 V to +12 V
Ratio 16:9	+4.5 V to +7 V
Impedance	850 Ω

Fast Blanking	Pin 16, Automatically or Off
RGB ON	+1 V to +3 V
RGB OFF	0 V to +0.4 V
Impedance	75 Ω
Max. external voltage	±9 V

Terrestrial RF Carrier

Frequency	32 to 900 MHz
Tolerance	10 kHz
Resolution	50 kHz
Spectral purity	Harmonics, intermodulation products and spurious -60 dBc inside actual TV channel -30 dBc outside actual TV channel
Voltage (Vrms into 75 Ω)	100 mV for high range 10 mV for low range
Attenuation	0 to 80 dB for high range 0 to 60 dB for low range
Readout	mV, dBµV
Resolution	0.01 mV for level ≤ 10 mV 0.1 mV for level > 10 mV 1 dB for dBµV indication
Tolerance	3 dB
Impedance	75 Ω
Modulation	Internal, external
Connector	RF OUT, BNC front
Max. external voltage	±7 V

Video Modulation

Double sideband AM, internal/external switchable

TV Systems	All systems except L	SECAM L
Polarity	Negative	Positive
RF sync level:		
Residual carrier low	100%	10%
Residual carrier high	100%	20% *[2]
RF 100% white level:		
Residual carrier low	10% *[1]	100%
Residual carrier high	20%	100%
	*[1] not available for NICAM sound systems	*[2] only available with NICAM sound

Group delay pre-correction

Reference	Related to CCIR Rep. 624-4, 1990
Types	2 different types (or off) Automatically switched with the respective TV system

TV systems	B, G, N	PAL M, NTSC M
Characteristics	Closely matches CCIR B, G (type A)	Closely matches CCIR M/PAL, M/NTSC

Inputs

Video IN

Voltage (Vpp)	1 V (nominal)
Setting range	100% fixed for video modulation 0 to 150% for video outputs
Tolerance of setting	10 mV or 5%, whichever is greater, 5 mV or 2%, whichever is greater, at reference temperature
Step size	1%
Superimposed dc component	-2 V to +2 V
Max. voltage (Vpp + dc)	-5 V to +5 V
Impedance	75 Ω
Polarity	Positive
Coupling	DC
Connector	VIDEO IN, BNC front, EURO AV IN, EURO AV connector rear

Video

Synchronization

Reference	CCIR Rep. 624-4, 1990 ANSI/SMPTE 170M-1994
System	625 lines (50 Hz) 525 lines (59.94 Hz)
Line frequency	15.625 kHz for 625 line systems 15.734265 kHz for 525 line systems
Tolerance	3 ppm for +5 to +45 °C 1 ppm at reference temperature
Aging	≤ 2 ppm per year
Level	-43% for 625 line systems -40 IRE for 525 line systems
Tolerance	3% for 625 line systems 3 IRE for 525 line systems

Luminance

Reference	CCIR Rep. 624-4, 1990 ANSI/SMPTE 170M-1994
Blanking level	0% (0 IRE)
Black level	0% for 625 line systems +7.5 IRE for 525 line systems
White level	100% (100 IRE)
Tolerance	2% for 625 line systems at reference temperature 2 IRE for 525 line systems at reference temperature

Chrominance

Reference	CCIR Rep. 624-4, 1990 ANSI/SMPTE 170M-1994
System	PAL B, D, G, I, K, M, N NTSC M NTSC with 4.433619 MHz subcarrier SECAM B, D, G, K, K1, L
Carrier frequency	4.433619 MHz for PAL B, D, G, I, K and NTSC 4.43 3.575611 MHz for PAL M 3.582056 MHz for PAL N 3.579545 MHz for NTSC M 4.406250 MHz and 4.250000 MHz for SECAM
Tolerance	3 ppm for +5 to +45 °C 1 ppm at reference temperature
Aging	≤ 2 ppm per year

Phase tolerance (PAL/NTSC)	2°, 1° at reference temperature
Freq. deviation (SECAM)	
Δf_{OB} (75% blue)	+230 kHz
Tolerance	4 kHz
Δf_{OR} (75% red)	-280 kHz
Tolerance	5 kHz
Level	100% (nominal setting)
Tolerance	5% (PAL/NTSC) 10% (SECAM) 2% (PAL/NTSC) at reference temperature for nominal setting
Setting range	0% to 150%
Tolerance of setting	1 step or 5%, whichever is greater
Resolution	1%

Patterns

Reference	ITU Rec. 471-1/1994 and SMPTE EG27-1994 for Color Bar SMPTE EG1-1990 for SMPTE Color Bar CCIR Rec. 473-5,1990 and CCIR Rec. R26-1981 for IRS 17 CCIR Rec. 473-5,1990 for Multiburst CCIR Rep. 1221 for PLUGE
Aspect ratio	4:3, 16:9
Circle	Centered circle with 4 additional corner circles in 16:9 mode
Center Cross	With border castellations (overscan indication selectable between 2% or 3%)
White	0, 5, 15 to 100% (5% steps) for 625 line systems 7.5, 15 to 100 IRE (5 IRE steps) for 525 line systems
Purity	Red, green, blue, cyan, magenta, yellow, white, black (100/0/75/0 for 625 line systems and 100/7.5/75/7.5 for 525 line systems)
Dots	17x13 dots in 4:3 mode, 23x13 dots in 16:9 mode With center indication
Crosshatch	18x14 lines in 4:3 mode, 24x14 lines in 16:9 mode With center indication, selectable ‘top-left’ indication and chroma

Checkerboard	12x9 squares in 4:3 mode, 16x9 squares in 16:9 mode
PLUGE	-1.6, 0, +1.6, 100% for 625 line systems 4.8, 7.5, 10.7, 100 IRE for 525 line systems
Greyscale	10 steps linear staircase
VCR	VCR Test (2 types) Resolution Test (2 types) Writing Current
Multiburst	0.5, 1.0, 2.0, 4.0, 4.8, 5.8 MHz for 625 line systems 0.5, 1.0, 2.0, 3.0, 3.58, 4.2 MHz for 525 line systems With time intervals
Digital Scan	ADC Check (2 types) Moving Block Progressive Scan Check (3 types)
Color Bar	75/0/75/0, 100/0/75/0, 75/0/100/25, 100/0/100/25 for 625 line systems 75/7.5/75/7.5, 100/7.5/75/7.5 for 525 line systems SMPTE Color Bar Horizontal Color Bar (75/0/75/0 for 625 line systems and 75/7.5/75/7.5 for 525 line systems)
DEM	Demodulator Test (2 types)
Color Temperature	3 different sizes with adjustable levels for center and border
Diverse	EHT Test (Reference rectangle with switching white/black window) Full field ‘IRS 17’, (in 625 line systems, reference line 17 can be selected separately)
Pattern combination	Circle with every other pattern (except Progressive Scan 3) or combination Center Cross / Crosshatch / Dots / Purity Greyscale / White / Multiburst / Color Bar

Sound

Outputs

Sound Carrier

Voltage (Vpp into 50 Ω)	142 mV for mono carrier and system B, G 200 mV for mono carrier and system D, I, K, K1, L, M, N 63.2 mV for stereo and NICAM B, G, D, I, K carrier (sound carrier 2) 28.3 mV for NICAM L carrier (sound carrier 2)
Setting range	for mono carrier (depends on sound carrier 1 level setting): 112.5 mV to 356 mV at -15 dBc to -5 dBc sound carrier level
Resolution	1 dB
Setting range	for stereo and NICAM carrier: 63.2 mV at -20 dBc sound carrier level 35.6 mV at -25 dBc sound carrier level 28.3 mV at -27 dBc sound carrier level
Tolerance	2 dB
Impedance	50 Ω
Connector	SOUND IF OUT, BNC rear

Audio and Euro AV

Voltage (Vrms in open circuit)	500 mV, 278 mV at 12 kHz intern in NICAM mode
Tolerance	5%
Impedance	600 Ω
Connector	AUDIO OUT, Cinch rear, EURO AV OUT, EURO AV connector rear

BTSC MPX and FM Stereo Pilot

Impedance	600 Ω
Connector	MTS/PILOT OUT, BNC rear
Voltage (Vrms open circuit)	Nominal
BTSC mode	BTSC baseband signal
Main channel	500 mV, at 13.5 kHz deviation
Pilot carrier	185 mV, equivalent to ±5 kHz deviation of sound carrier
SAP carrier	555 mV, equivalent to ±15 kHz deviation of sound carrier
Tolerance	5%

Stereo / Dual mode for sound systems	Germany, A2
Pilot signal	90 mV
Tolerance	5%

Stereo / Dual mode for sound system	Mk
Pilot signal	180 mV
Tolerance	5%

NICAM Data and NICAM Clock

Frequency	728 kHz
Tolerance	3 ppm for +5 to +45 °C 1 ppm at reference temperature
Aging	≤2 ppm per year
Voltage (Vpp into 50 Ω)	1 V
Tolerance	10%
Impedance	50 Ω
Connector	NICAM OUT DATA, BNC rear NICAM OUT CLOCK, BNC rear

Inputs

Audio, Euro AV and MTS Multiplex

Voltage (Vrms)	500 mV (nominal)
Modulation bandwidth	40 Hz to 15 kHz
Impedance	0.1 MΩ
Connector	AUDIO IN, Cinch rear, EURO AV IN, EURO AV connector rear, MTS IN, BNC rear
Max. external voltage	±40 V

Mono

Sound Carrier

Frequency	4.5 MHz for system M, N 5.5 MHz for system B, G 6.0 MHz for system I 6.5 MHz for system D, K, K1, L
Tolerance	3 ppm for +5 to +45 °C 1 ppm at reference temperature

Aging	≤ 2 ppm per year
Level	-13 dBc for system B, G -10 dBc for system D, I, K, K1, L, M, N
Tolerance	2 dB at reference temperature
Setting range	-5 dBc to -15 dBc
Tolerance	2 dB at reference temperature
Resolution	1 dB

Modulation

Frequency	0.5, 1.0, 3.0 kHz: for system B, D, G, I, K, K1, L (S1 Modulation) or off 0.3, 1.0, 3.0 kHz: for system M and N (S1 Modulation) or off 0.5, 1.0, 3.0 kHz: (S3 Modulation) or as NICAM for system NICAM B/G, NICAM DK, DC, I, L or off
Type	FM for system B, D, G, I, K, K1, M, N AM for system L
Deviation	27 kHz for system B, D, G, I, K, K1 (pre-emphasis off), 13.5 kHz for system M, N (pre-emphasis off)
Tolerance	5%
Pre-emphasis (FM)	50 µs for system B, D, G, I, K, K1 or off 75 µs for system M, N or off
Modulation depth	54% for system L
Tolerance (absolute)	5%

Stereo /Dual

Sound Carrier 1

Data	As Mono
Modulation matrix: Stereo	(L+R)/2
Dual	CH1 (S1 Modulation)

Sound Carrier 2

Frequency	5.7421875 MHz for system B, G 6.2578125 MHz for system D, K (A2) 4.724 MHz for system Mk
Tolerance	3 ppm for +5 to +45 °C 1 ppm at reference temperature
Aging	≤ 2 ppm per year
Level	-20 dBc
Tolerance	3 dB at reference temperature

Setting range	-20, -25, -27 dBc
Tolerance	3 dB at reference temperature

Modulation

Frequency	0.5, 1.0, 3.0 kHz for system B, D, G, K or off 0.3, 1.0, 3.0 kHz for system Mk or off
Type	FM
Deviation	27 kHz for system B, D, G, K (pre-emphasis off) 13.5 kHz for system Mk (pre-emphasis off)
Tolerance	5%
Pre-emphasis	50 µs for system B, D, G, K or off 75 µs for system Mk or off
Modulation matrix: Stereo	L for systems B, D, G, K L-R for system Mk
Dual	CH2 (S2 Modulation)

Identification/Subcarrier

Reference	CCIR Rec. 707
Pilot carrier frequency	3.5 x f_H
Identification frequency	f_H / 133 for stereo and system B, D, G, K f_H / 105 for stereo and system Mk f_H / 57 for dual
Tolerance	3 ppm for +5 to +45 °C 1 ppm at reference temperature
Aging	≤ 2 ppm per year
Type	AM
Modulation depth	50%
Tolerance (absolute)	5%

NICAM Stereo

Sound Carrier 1

Data	As MONO SOUND CARRIER
Modulation matrix: Mono	As NICAM (S1 Modulation) or independent selectable (S3 Modulation)
Stereo	(L+R)/2
Dual	CH1 (S1 Modulation)

Sound Carrier 2

Frequency	5.85 MHz for system B, D, G, K, L 6.875 MHz for system D, K 6.552 MHz for system I
Tolerance	3 ppm for +5 to +45 °C 1 ppm at reference temperature
Aging	≤ 2 ppm per year
Level	-20 dBc for system B, D, G, I, K -27 dBc for system L
Tolerance	3 dB at reference temperature
Setting range	-20, -25, -27 dBc
Tolerance	3 dB at reference temperature

Modulation

Reference	NICAM-728 CCITT Rec J17
Frequency	0.5, 1.0, 1.5, 3.0 kHz for channel 1 (S1 Modulation) or off 1.0, 1.5, 3.0, 12 kHz for channel 2 (S2) or off Test 1: Demodulator pattern Test 2: Decoder pattern Test 3: Unmodulated carrier
Type	QPSK
Mode	Mono, Dual, Stereo, Test
Bit-rate	728 kbits/s
Tolerance	3 ppm for +5 to +45 °C 1 ppm at reference temperature
Aging	≤ 2 ppm per year
Level	High, low
RSSF	On, off

BTSC Stereo

Sound Carrier

Frequency	4.5 MHz for system M
Tolerance	3 ppm for +5 to +45 °C 1 ppm at reference temperature
Aging	≤ 2 ppm per year

Level	-10 dBc
Tolerance	2 dB at reference temperature
Setting range	-5 to -15 dBc
Tolerance	2 dB at reference temperature
Resolution	1 dB

Modulation

Frequency	0.3, 1.0, 3.0 kHz for channel 1 (S1 Modulation) or off 1.0, 3.0 kHz for channel 2 (S2 Modulation) or off 3.1 kHz and 8.0 kHz in Test modes 5.0 kHz for SAP (0.3 and 1.0 kHz in Test modes) or unmodulated or off
Type	FM with BTSC base band
Base band	Main channel (L+R) Pilot subcarrier Stereo sub channel (L-R, BTSC compressed) SAP sub channel (SAP signal, BTSC compressed)
Stereo sub channel	Subcarrrier AM modulated with suppressed carrier by BTSC compressed L-R signal
SAP sub channel	Subcarrier FM modulated by SAP signal
Mode	Mono, Stereo, SAP
Deviation	13.5 kHz (with de-emphasis on) 15 kHz by SAP 5 kHz by pilot
Tolerance	5%
Pre-emphasis	75 µs

Identification

Pilot subcarrier frequency	f_H
Stereo subcarrier frequency	2 x f_H
SAP subcarrier frequency	5 x f_H
Tolerance subcarrier	3 ppm for +5 to +45 °C 1 ppm at reference temperature
Aging	≤ 2 ppm per year

Digital Services

Wide Screen Signalling (WSS)

Reference	ETSI, ETS 300 294, November 1994 PALplus System Description, Revision 3.0, January 1994 Rec. ITU-R BT.1119
TV systems	625 line systems
Data line	23 (field 1)
Signalling method	Bi-phase coding, NRZ-L
Clock frequency	5 MHz
Tolerance	3 ppm for +5 to +45 °C 1 ppm at reference temperature
Aging	≤ 2 ppm per year
Level	0.5 V for ‘1’ at 0.7 V maximum video level Black level for ‘0’
Tolerance	5% for ‘1’ 3% of sync amplitude for ’0’

Teletext DIDON ANTIOPE (CCIR System A)

Reference	CCIR Rec. 653-1 CCIR Doc. 11/345-E
TV systems	625 line systems
Data line	20, 21, 333, 334
Signalling method	Binary NRZ
Clock frequency	6.203125 MHz
Tolerance	3 ppm for +5 to +45 °C 1 ppm at reference temperature
Aging	≤ 2 ppm per year
Level	7/3 of sync amplitude for ‘1’ Black level for ‘0’
Tolerance	0 to -10% for ‘1’ 3% of sync amplitude for ’0’

Teletext UK (CCIR System B)

Reference	CCIR Rec. 653-1 CCIR Doc. 11/282-E
System	625 line systems
Data line	13, 14, 20, 21, 326, 327, 333, 334 for 8 line mode (PAL) 20, 21, 333, 334 for 4 line mode (PAL and SECAM)
Signalling method	Binary NRZ
Clock frequency	6.9375 MHz
Tolerance	3 ppm for +5 to +45 °C 1 ppm at reference temperature
Aging	≤ 2 ppm per year
Level	66% of the difference between black level and peak white level for ’1’ Black level for ‘0’
Tolerance	6% for ‘1’ 2% of the difference between black level and peak white level for ‘0’

PDC

Reference	EBU SPB 459 Revision 2 Specification of the Domestic Video Programme Delivery Control System February 1992
System	TELETEXT UK (CCIR system B)
Programming	All parameters
Labelling	Single, multi

VPS

Reference	Technische Richtlinie ARD/ZDF Nr. 8 R 2 Video Program System EBU SPB 459 Revision 2 Specification of the Domestic Video Programme Delivery Control System February 1992
TV systems	625 line systems
Data line	16
Signalling method	Bi-phase modulation

Clock frequency	5.0 MHz
Tolerance	3 ppm for +5 to +45 °C 1 ppm at reference temperature
Aging	≤ 2 ppm per year
Level	0.5 V for ‘1’ at 0.7 V maximum video level Black level for ‘0’
Tolerance	5% for ‘1’ 3% of sync amplitude for ’0’
Programming	All parameters

Closed Caption

Reference	FCC 47 CFR Part 15 Report No E-7709-C Draft EIA-608
System	525 line systems 625 line systems
Data line	21 (field 1 and field 2)
Signalling method	Binary NRZ
Clock frequency	503.4965 kHz for 525 line systems 500 kHz for 625 line systems
Tolerance	3 ppm for +5 to +45 °C 1 ppm at reference temperature
Aging	≤ 2 ppm per year
Level	50 IRE (50%) for ‘1’ 0 IRE (0%) for ‘0’
Tolerance	5 IRE (5%) for ‘1’ 1 IRE (1%) for ‘0’
Operation mode	CC1 to CC4 T1 to T4

RGB, YC (S-VHS/Hi-8), YCrCb Outputs

RGB Outputs

Voltage (Vpp into 75 Ω)	700 mV
Tolerance	5% 2% at reference temperature
Impedance	75 Ω
Polarity	Positive
Coupling	DC
Blanking level	0 V
Offset	± 200 mV
Synchronization	Selectable in R, G, B or Off (only for BNC outputs)
Connector	RGB OUT, BNC rear, EURO AV OUT, EURO AV connector rear
Max. external voltage	±9 V

YC Outputs

Luminance signal amplitude (Vpp into 75 Ω)	1 V (including sync)
Tolerance	5% 2% at reference temperature
Coupling	DC
Blanking level	0 V
Offset	± 200 mV
Chrominance signal level	100%, same as chrominance part of CVBS signal
Tolerance	5% 2% at reference temperature
Coupling	AC
Impedance	75 Ω
Connector	Y/C OUT, 4-pin S connector, EURO AV OUT, EURO AV connector rear
Max. external voltage	±9 V

YCrCb Outputs

Voltage Y (Vpp into 75 Ω)	1 V (including Sync)
Voltage CrCb (Vpp into 75 Ω)	0.7 V
Tolerance	5% 2% at reference temperature

Impedance	75 Ω
Coupling	DC
Blanking level	0 V
Offset	± 200 mV
Connector	Y/ C_R/ C_B OUT, BNC rear
Max. external voltage	±9 V

Feedthrough Connection

Connection between rear and front, BNC connectors,
not recommended for vision carrier.

TO REAR	connected with TO FRONT
TO FRONT	connected with TO REAR
Connector	TO REAR, BNC front TO FRONT, BNC rear

IEEE-488 and RS-232 Interface

IEEE-488 Interface

Allows selection and control of all functions

Instrument command set	see Chapter 6, Remote Control
Reference	ANSI/IEEE Std. 488-1987
Compatibility	IEEE-488.2-1987
Interface functions	AH1, SH1, L4, T6, RL1, SR1, DC1, E2
Connector	Amphenol rear (RFI/EMI shielded)

RS-232 Interface

Allows selection and control of all functions

Instrument command set	see Chapter 6, Remote Control
Baud rate	110, 150, 300, 600, 1200, 2400, 4800, 9600, or 19200
Data bits	7 or 8
Stop bits	1, 2 for 110 Baud
Parity check	Odd, even or none (none for 8 data bits only)
Handshake	Software, hardware
Connector	9 pin D-type rear (male)

Power Requirements

Rated line voltage range	100 to 240 V
Line voltage fluctuation	±10%
Rated line frequency range	50 to 60 Hz
Line frequency fluctuation	±5%
Power consumption	60 W

Dimensions and Weight

Width	323 mm (12.72 in)
Height	147 mm (5.79 in) 132.5 mm (5.22 in) without feet (≈ 3HE)
Depth	417 mm (16.42 in)
Weight	Net 9.8 kg (21.6 lb.) Shipping 11.4 kg (25.1 lb.)