

SM09

SD/960H Distribution Amplifier

User Manual

Revision 0.2
20th January 2022

Revisions

Date	Revisions	Version
22-04-2021	First draft	0.1
20-01-2022	Design revision. No. of outputs changed to 6.	0.2

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1. Introduction

SM09 is a video distribution amplifier module. It accepts a PAL/NTSC/SECAM or PAL/NTSC 960H input and provides 6 simultaneous outputs. Each output is individually buffered and filtered.

SM09 requires 5VDC which is provided via the supplied AC-DC converter.

2. Quick start guide

Connect the SM09 to the supplied AC/DC adaptor. The adaptor should be supplied with a power lead appropriate to your country. The adaptor accepts AC between 100 and 240VAC – the full specification is provided in Appendix A.

Connect the 5VDC jack from the adaptor to the +5VDC 'Power in' socket on the SM09. The 'Power On' LED should light up yellow.

Connect a composite video input to the 'Video In' BNC. Any or all of the six 'Video Out' BNCs may be connected. Each 'Video out' is a copy of the video input.

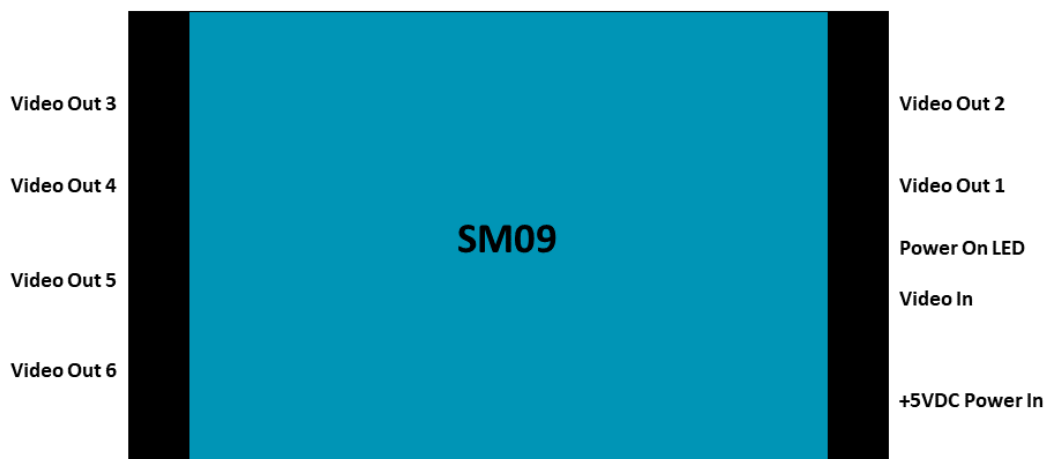


Figure 1 SM09 Connections.

3. SM09 Technical Details

A simplified block diagram of the SM09 is shown in Figure 2.

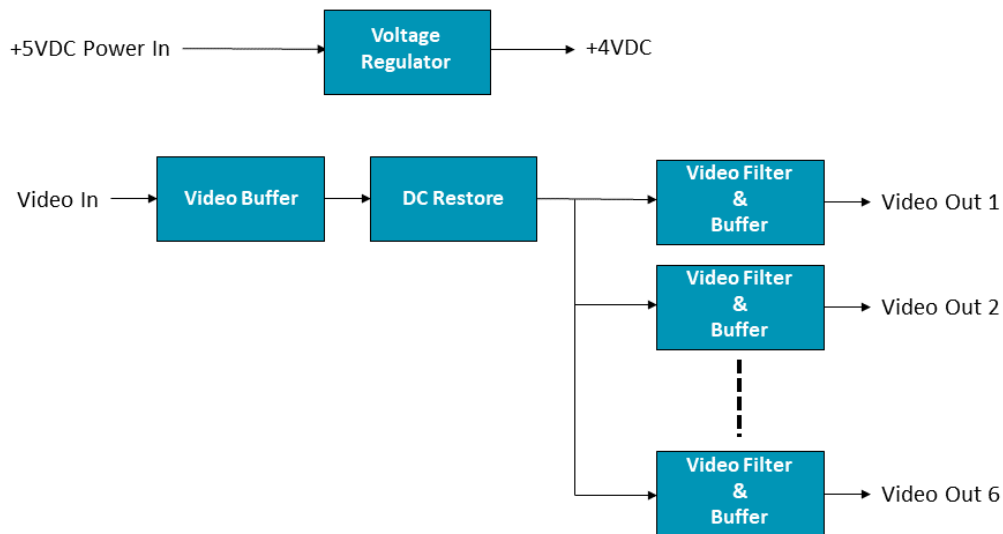


Figure 2 SM09 Block diagram.

The +5VDC from the AC/DC power adaptor is filtered and protected from over-range or reverse polarity inputs by a resettable fuse. This fuse will protect the SM09 until the out-of-range condition is removed when it automatically reset itself. The 5VDC input is then regulated to provide a ‘clean’ +4VDC for the video input buffer and DC restoration circuits and a 3.3VDC supply for the output filter and buffer.

The video input is terminated in 75Ω. It is then buffered and protected against out-of-range inputs. The video input is then DC restored using an active clamp circuit before driving six identical output buffers. Each output is filtered to remove any out of band noise – the filter response is shown in Figure 3.

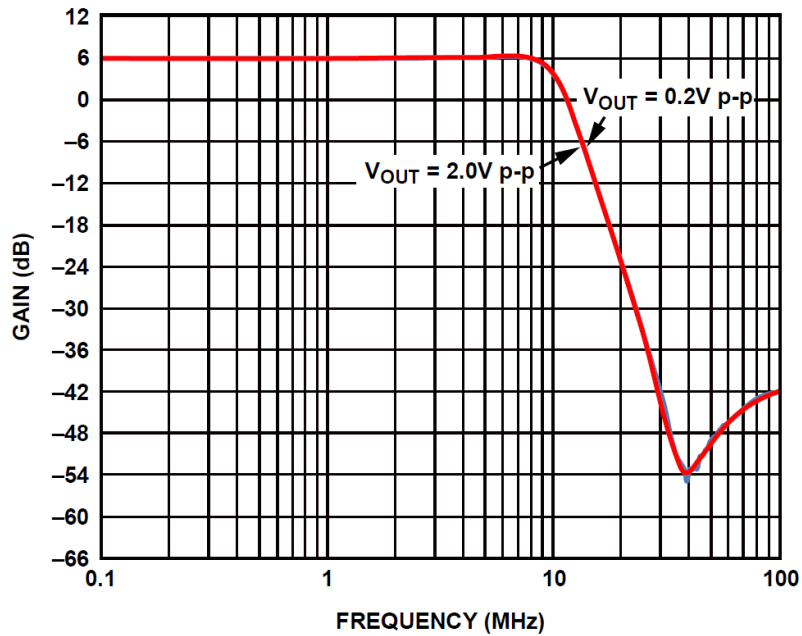


Figure 3 SM09 filter response.

The buffer amplifies the video by a gain x2 (6dB) so that it can drive a series 75Ω resistor. Each output must be terminated in 75Ω for the SM09 to have the correct gain. Because each output is individually buffered any or all of the outputs maybe be connected – unused outputs may be left unconnected.

The SM09 has a nominal gain of x1 (0dB) when the output is terminated in 75Ω. Because of the series termination each output can drive long lengths of cable without overshoot or ringing of the signal. Figure 4 shows the output of the SM09 with a multi-burst frequency sweep video input.

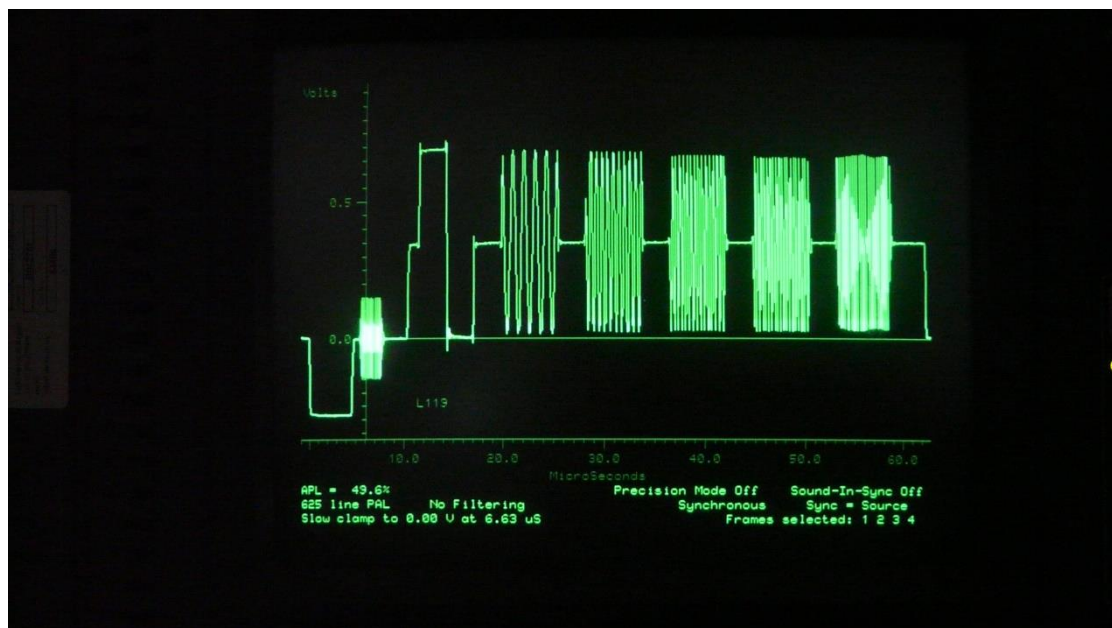


Figure 4 Multiburst frequency sweep.

Figure 5 shows the same signal when the SM09 is driving 100m of low-cost coaxial cable (RG-59). Whilst some 'droop' can be seen, the signal shows no overshoots or ringing artifacts.

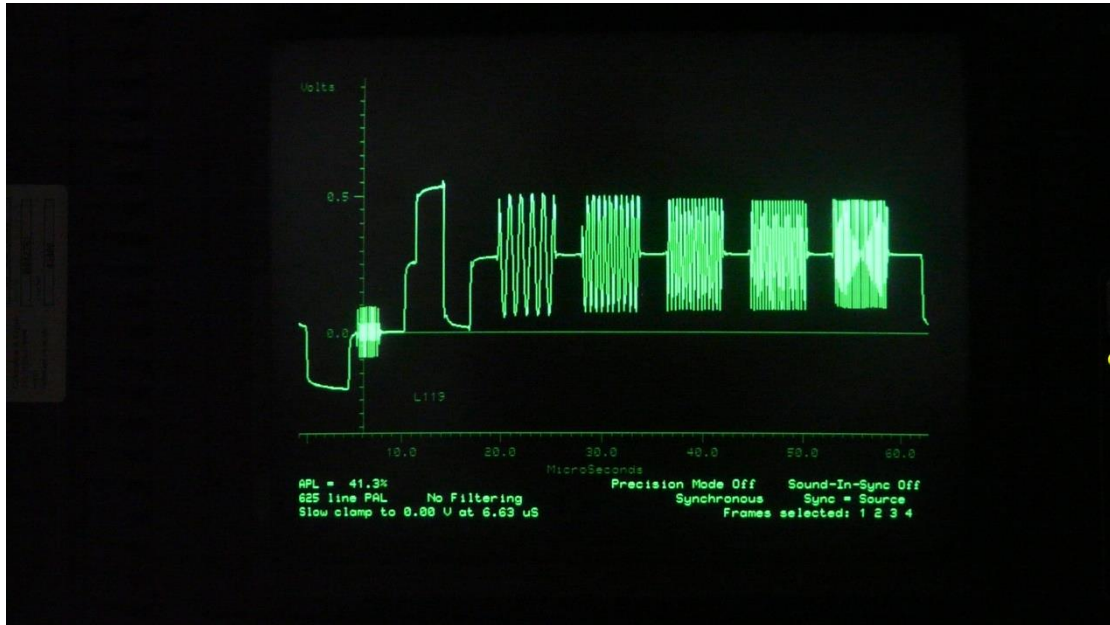


Figure 5 Multi-burst frequency driving 100m of cable.

4. Specification

Power:	+5VDC \pm 5% @ \sim 100mA (all outputs driven).
Dimensions:	160mm x 78mm x 27mm.
Video input:	NTSC-M / PAL /SECAM or NTSC / PAL 960H. 75 Ω input impedance. 1V pk-pk nominal input. Maximum input before clipping 1.6V pk-pk.
Luma bandwidth:	8.5MHz \pm 0.1dB.
Gain:	0dB \pm 0.5dB.
Differential gain/phase:	<1%, <1 $^\circ$.
K-factor:	<1%.
Group delay:	\pm 10ns.
Operating temperature:	-10 – 40 degC.

Appendix A: AC-DC adaptor

The specification for the supplied AC-DC adaptor is shown in Figures 6-8.


TE10 Family
10W-12W Single Output External Power Industrial Grade











FEATURES AND BENEFITS

Universal Input 90VAC-264VAC Input Range Desktop and Wall-Plug Versions	Meets "Heavy Industrial" Levels of EN61000 EMC Requirements
Up to 12W of AC-DC Power	>10 Year E-Cap Life
IP22 Rated Enclosure	>1,000,000 Hours MTBF
Approved to EN/IEC/UL60950-1 2 nd Edition, Am.2	3 Year Warranty
Meets EN55022/CISPR22, FCC Part 15.109 Class B Conducted & Radiated Emissions, with 6db Margin	Meets DoE Efficiency Level VI Requirements No Load Input Power Average Efficiency

MODEL SELECTION

Model Number	Volts	Output Current	Output Power	Ripple & Noise ¹	Line Regulation	Load Regulation	Output Connector	Input Configuration
TE10A0503F01	5.0V	2.0A	10W	75mV pk-pk	±1%	±5%	2.5mm x 5.5mm x 9.5mm Straight Barrel Type, Center Positive	Class I Desktop, IEC60320 C14 Receptacle
TE10A0603F01	5.9V	1.6A	10W	75mV pk-pk	±1%	±5%		
TE10A0703F01	7.5V	1.3A	10W	75mV pk-pk	±1%	±5%		
TE10A1203F01	12.0V	1.0A	12W	120mV pk-pk	±1%	±5%		
TE10A2403F01	24.0V	0.5A	12W	240mV pk-pk	±1%	±5%	2.5mm x 5.5mm x 9.5mm Straight Barrel Type, Center Positive	Class II Desktop, IEC60320 C8 Receptacle
TE10A0503N01	5.0V	2.0A	10W	75mV pk-pk	±1%	±5%		
TE10A0603N01	5.9V	1.6A	10W	75mV pk-pk	±1%	±5%		
TE10A0703N01	7.5V	1.3A	10W	75mV pk-pk	±1%	±5%		
TE10A1203N01	12.0V	1.0A	12W	120mV pk-pk	±1%	±5%	2.5mm x 5.5mm x 9.5mm Straight Barrel Type, Center Positive	Class II Desktop, IEC60320 C18 Receptacle
TE10A2403N01	24.0V	0.5A	12W	240mV pk-pk	±1%	±5%		
TE10A0503Q01	5.0V	2.0A	10W	75mV pk-pk	±1%	±5%		
TE10A0603Q01	5.9V	1.6A	10W	75mV pk-pk	±1%	±5%		
TE10A0703Q01	7.5V	1.3A	10W	75mV pk-pk	±1%	±5%	2.5mm x 5.5mm x 9.5mm Straight Barrel Type, Center Positive	Class II Desktop, IEC60320 C18 Receptacle
TE10A1203Q01	12.0V	1.0A	12W	120mV pk-pk	±1%	±5%		
TE10A2403Q01	24.0V	0.5A	12W	240mV pk-pk	±1%	±5%		
TE10A0503B01	5.0V	2.0A	10W	75mV pk-pk	±1%	±5%		
TE10A0603B01	5.9V	1.6A	10W	75mV pk-pk	±1%	±5%		
TE10A0703B01	7.5V	1.3A	10W	75mV pk-pk	±1%	±5%		
TE10A1203B01	12.0V	1.0A	12W	120mV pk-pk	±1%	±5%		
TE10A2403B01	24.0V	0.5A	12W	240mV pk-pk	±1%	±5%		

TE10 Datasheet v0819
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Figure 6 Power supply specification – Page 1.



Model Number	Volts	Output Current	Output Power	Ripple & Noise ¹	Line Regulation	Load Regulation	Output Connector	Input Configuration
TE10A0503C01	5.0V	2.0A	10W	75mV pk-pk	±1%	±5%	2.5mm x 5.5mm x 9.5mm Straight Barrel Type, Center Positive	Class II Wall-Plug, Fixed North American Blades ³
TE10A0603C01	5.9V	1.6A	10W	75mV pk-pk	±1%	±5%		
TE10A0703C01	7.5V	1.3A	10W	75mV pk-pk	±1%	±5%		
TE10A1203C01	12.0V	1.0A	12W	120mV pk-pk	±1%	±5%		
TE10A2403C01	24.0V	0.5A	12W	240mV pk-pk	±1%	±5%		

Notes:

- Measured at the output connector, with noise probe directly across output and load terminated with 0.1µF ceramic and 10µF low ESR capacitors. For 5V and 6V models, values listed are typical, 100mV pk-pk maximum with 0.1µF ceramic and 47µF low ESR capacitors used at measurement point.
- Order blade kit KT-1027K for other blades (EU, UK, Australia).
- For EU fixed blades, replace 'C' in the model number with 'M', for UK blades, replace 'C' with 'G', for Australia blades, replace 'C' with 'H'.
- For Input Class I models: For AC GND connected to output common (-), insert a 'B' in the part number where the 'A' is located (TE10B0503F01).
- All specifications are typical at nominal input, full load, at 25°C ambient unless noted.

INPUT

Input Voltage and Frequency	100VAC-240VAC, ±10%, 47Hz-63Hz, 1ø
Input Current	115VAC: 0.45A, 230VAC: 0.28A
Inrush Current	264VAC, cold start: will not exceed 40A
Input Fuses	F1, F2: 3.15A, 250VAC fuses (line & neutral lines) provided on all models
Earth Leakage Current	Input-GND: <500µA@264VAC, 60Hz, NC Output-GND: <4mA@264VAC, 60Hz, NC
Efficiency	Meets US DoE Efficiency Level VI Average efficiency levels
No Load Input Power	<0.1W per DoE Efficiency Level VI Requirements

OUTPUT

Output Voltage	See models chart on page 1
Output Power	10W to 12W continuous - See models chart for specific voltage model ratings
Turn On Time	Less than 700mS @115VAC, full Load
Hold-up Time	20mS min., at full Load, 100VAC input
Ripple and Noise	See models chart on pg 1
Transient Response	500µs response time for return to within 0.5% of final value for any 50% load step over the range of 5% to 100% of rated load, ΔI/Δt< 0.2A/µs. Max. voltage deviation is +/-3.5%
Total Load Regulation	See models chart on page 1

PROTECTION

Overtemperature Protection	Will shutdown upon an overtemperature condition, Auto-recovery
Overload Protection	130% to 180% of rating, Hiccup Mode
Overvoltage Protection	130% to 150% of output voltage, Hiccup mode
Short Circuit Protection	Hiccup Mode, Auto-recovery

SAFETY

Safety Standards	EN/CSA/UL/IEC 60950-1 2 nd Edition, Am 2
Drop Test	1.4m from table top to wooden platform, 6 faces

ISOLATION

Isolation	Input-Output: 4000VAC Input-Ground: 1500VAC Output-Ground: 1500VAC
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Figure 7 Power supply specification – Page 2.

ENVIRONMENT

Operating Temperature	-20°C to +70°C Start Up at -40°C, full Load, (warmup period before all parameters are within published specifications)
Storage Temperature	-40°C to +85°C
Relative Humidity	5% to 95%, non-condensing
Weight	110 grams
Dimensions	See outline drawings
Temperature Derating	See derating chart
Operating Altitude	Operating: to 5000m. Non-operating: -500ft to 40,000ft.
Vibration	Operating: 0.003g/Hz, 1.5 grams overall, 3 axes, 10 min/axis, 1Hz-500Hz. Non-Oper.: random waveform, 3 minutes/axis, 3 axes and Sine waveform, Vib. frequency/acceleration: 10-500Hz/1g, sweep rate of 1 octave/minutes, Vibration time of 10 sweeps/axes, 3 axes
Shock	Operating: Half-sine, 20gpk, 10ms, 3 axes, 6 shocks total Non-Operating: Half-sine waveform, impact acceleration of 100g, Pulse duration of 6ms, Number of shocks: 3 for each of the three axis

RELIABILITY

MTBF	>1,000,000 hours, full load, 110VAC & 220VAC input, 25°C amb., per Telcordia 332 Issue 6, Stress Method
E-Cap Life	>10 year life based on calculations at 115VAC/60Hz & 230VAC/50Hz, ambient 25°C at 24 hours/day, 365 days/year, 6 power up cycles/day.

EMI/EMC COMPLIANCE

Conducted Emissions	EN55022/CISPR22 Class B, FCC Part 15.107, Class B: 6db margin type, at 115VAC and 230VAC
Radiated Emissions	EN55022/CISPR22 Class B, FCC Part 15.109, Class B: 3db margin type, at 115VAC and 230VAC
Electro-Static Discharge (ESD) Immunity on Power Ports	EN55024/IEC61000-4-2, Level 4; ±8kV contact, ±15kV air, Criteria A
Radiated RF EM Fields Susceptibility	EN55022/EN61000-4-3, 10V/m, 80MHz-2.7GHz, 80% AM at 1kHz
EFT/Burst Immunity	EN55024/IEC61000-4-4, Level 4, ±4.4kV, 100kHz rep rate, 40A, Criteria A
Surges, Line to Line (DM) and Line to Ground (CM)	EN55024/IEC61000-4-5, Level 4, ±2kV DM, ±4kV CM, Criteria A
Conducted RF Immunity	EN55022/IEC61000-4-6, 3.6V/m - Level 4, 0.15MHz to 80MHz; and 12V/m in ISM and amateur radio bands between 0.15MHz and 80MHz, 80% AM at 1kHz
Power Frequency Magnetic Field Immunity	EN55024/IEC1000-4-8, Level 4: 30 A/m, 50Hz/60Hz
Voltage Dip Immunity	EN55024/IECEN61000-4-11: -100% dip for 20ms, Criteria A -100% dip for 500ms (250/300 cycles), Criteria B -60% dip for 100ms, Criteria B -30% dip for 500ms, Criteria A
Harmonic Current Emissions	EN55011/EN61000-3-2, Class A
Flicker Test	EN61000-3-3
Common Mode Noise	High Frequency (100kHz-20MHz): <40mA pk-pk

All specifications are typical at nominal input, full load, at 25°C ambient unless noted.

Figure 8 Power supply specification – Page 3.