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Find the *Stanford Research FS735-1-1* at our website: ***Click HERE***

Operation and Service Manual

FS730 (Single) & FS735 (Dual)
Distribution Amplifiers



1290-D Reamwood Avenue
Sunnyvale, California 94089
Phone: (408) 744-9040 • Fax: (408) 744-9049
email: info@thinkSRS.com • www.thinkSRS.com

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Version 1.2 (11/2012)

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Certification

Stanford Research Systems certifies that this product met its published specifications at the time of shipment.

Warranty

This Stanford Research Systems product is warranted against defects in materials and workmanship for a period of one (1) year from the date of shipment.

Service

For warranty service or repair, this product must be returned to a Stanford Research Systems authorized service facility. Contact Stanford Research Systems or an authorized representative before returning this product for repair.

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Stanford Research Systems, Inc.
1290-C Reamwood Avenue
Sunnyvale, California 94089
Phone: (408) 744-9040
Fax: (408) 744-9049

www.thinkSRS.com

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Safety and Preparation for Use

Line Voltage

The FS730 & FS735 operate from a 90 to 132 VAC or 175 to 264 VAC power source having a line frequency between 47 and 63 Hz.

Power Entry Module

A power entry module on the back panel of the instruments provides connection to the power source and to a protective ground.

Power Cord

A detachable, three-wire power cord for connection to the power source and protective ground is provided.

The exposed metal parts of the box are connected to the power ground to protect against electrical shock. Always use an outlet which has a properly connected protective ground. Consult with an electrician if necessary.

Grounding

BNC shields are connected to the chassis ground and the AC power source ground via the power cord. Do not apply any voltage to the shield.

Line Fuse

The line fuse is internal to the instrument and may not be serviced by the user.

Operate Only with Covers in Place

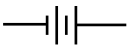
To avoid personal injury, do not remove the product covers or panels. Do not operate the product without all covers and panels in place.

Serviceable Parts

The FS730 & FS735 do not have any user serviceable parts inside. Refer service to a qualified technician.

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Symbols you may Find on SRS Products

Symbol	Description
	Alternating current
	Caution - risk of electric shock
	Frame or chassis terminal
	Caution - refer to accompanying documents
	Earth (ground) terminal
	Battery
	Fuse
	On (supply)
	Off (supply)

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Introduction

Distribution amplifiers are used to create several copies of a signal. There are many application areas and each requires different amplifier characteristics. In each application the amplifier is selected to preserve, improve (or minimally degrade) the input signal's bandwidth, amplitude, pulse shape, phase noise and jitter characteristics.

SRS distribution amplifiers are available in two chassis form factors:

The FS730 is a half-width, 1U high chassis that holds one distribution amplifier with BNC connectors and indicator LEDs on the *front* panel. The power cord is on the *back* panel. Two FS730s may be mounted side-by-side in a 19" rack using the optional rack mount accessory.



Figure 1. Front panel of FS730 (10MHz distribution amplifier shown here)



Figure 2. Rear panel of FS730 Distribution amplifier.

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The FS735 is a full-width, 1U high chassis that can hold two distribution amplifiers. The BNCs and power cord are on the *rear* of the instrument. The indicator LEDs are on the *front* panel of the instrument.



Figure 3. Front panel of FS735 dual, rack-mounted, distribution amplifiers



Figure 4. Rear panel of FS735 dual, rack-mounted, distribution amplifiers.

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Distribution amplifier options

10 MHz and 5 MHz distribution amplifiers.

It is common to distribute a 10 MHz or 5 MHz frequency reference (from a rubidium or cesium oscillator, for example) throughout a facility. This frequency reference is used as the timebase for instruments in test & measurement, broadcast, telecommunication or basic research applications.

A distribution amplifier used in this application should provide sine wave outputs, amplitude leveling, low additive phase noise, low spur levels, narrow bandwidth, high channel-to-channel isolation, small phase variation with temperature, and high return loss on all 50Ω inputs and outputs.

CMOS Logic distribution amplifier.

A CMOS Logic distribution amplifier has one logic-level input and several outputs. A typical application is the distribution of a 1 pulse-per-second timing mark from a GPS receiver or an 8kHz frame clock for telecommunications.

There are no established standards for sending 5 V logic pulses over 50Ω coax. Standard logic ICs are not designed to drive 50 Ω loads. To avoid problems, a logic distribution amplifier should have the following characteristics: high input impedance with hysteresis, high current outputs with 50 Ω source impedance, fast transition times, small overshoot, small ground bounce, small insertion delay and low channel-to-channel timing skew.

Broadband 50 Ω and 75 Ω distribution amplifiers.

Broadband distribution amplifiers have one analog input and several analog outputs. A wide bandwidth allows these distribution amplifiers to be used in many applications including the distribution of frequency references, IRIG timing signals, composite video, audio, etc. Typically test & measurement and research applications will use 50 Ω inputs and outputs while video and broadcast applications will use the 75 Ω version.

Important characteristics of broadband amplifiers include input protection, wide bandwidth (including dc), flat frequency response, large dynamic range, low offset voltage, low noise, high slew rate, and low distortion. Outputs should have high current compliance and accurate 50 Ω or 75 Ω output impedance for high return loss. Composite video applications require low differential gain and low differential phase errors to prevent color shifts or color saturation changes verses luminance levels.

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SDI distribution amplifier

SDI (serial digital interface) is a physical interface used to transmit uncompressed component digital video in a variety of formats. There are several standards defined by the Society of Motion Picture and Television Engineers (SMPTE) which transmit 800 mV_{pp} logic over 75 Ω coax at rates up to 2.97Gb/s.

Cable attenuation and dispersion degrade SDI signals. Two techniques are used to restore signals: equalization and reclocking. Equalization circuits modify the frequency response of the input amplifier to compensate for the cable losses at high frequencies. Reclocking circuits recover the data clock (by phase locking a local oscillator to transitions in the data stream) and resynchronize the output data to this recovered clock.

Important characteristics of an SDI distribution amplifier include input cable equalization, agile clock recovery and resynchronization, good matching of the 75 Ω cable impedance to both inputs and outputs, fast output transition times, small overshoot, and compliance with common data rates (270, 1483.5, 1485, 2967 and 2970 Mb/s).

More in development

Other distribution amplifiers, which are compatible with the FS730 & FS735 systems, are currently in development. Check the SRS web site, www.thinkSRS.com, for current information.

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10MHz Distribution Amplifier

(Option 01)

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10 MHz distribution amplifier (Option 1)



Figure 5. Single 10MHz Distribution amplifier, FS730/1.
The FS735 dual distribution amplifier is also available.

Overview

This distribution amplifier is intended to distribute a low noise 10 MHz frequency reference. The amplifier has one input and seven outputs, all on BNC connectors. The input is coupled through a series LC network allowing the use of inputs with a dc offset. The input source impedance is 50 Ω at 10 MHz.

The input is conditioned by a limiter. The limiter provides several advantages in this application; amplitude modulation is removed from the input signal, outputs have fixed amplitude, input noise that occurs more than 50 mV away from the zero-crossing is blocked, and virtually any waveform with a duty cycle near 50% may be used as an input.

The input limiter is followed by a bandpass filter and a fixed gain amplifier. This signal is passed to seven output amplifiers, each of which is followed by a low pass filter and an output transformer. All of the outputs have 50 Ω source impedance and provide a 1Vrms (+13 dBm) sine wave into a 50 Ω load.

There are four indicator LEDs. The “power” LED indicates that the unit has ac power. The “signal” LED indicates that an input signal is present. The “overload” LED indicates that the input signal has excessive amplitude. The “fault” LED indicates one or more of these conditions: no input signal, excessive input signal, or low internal dc power supply.

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Specifications

Input

Frequency	10 MHz, ±1%
Level	0 dBm to +16 dBm ($0.6V_{pp}$ to $4V_{pp}$)
Waveform	Any with ≈ 50% duty
Impedance	50 Ω, ±5% at 10 MHz
Coupling	Series LC. (Open at dc)

Outputs

Waveform	Sine
THD	<1%
Level (50 Ω load)	+13±1 dBm (1 V_{RMS}, 2.82 V_{PP})
Level (high-Z load)	2 V_{RMS} (5.6 V_{PP})
Impedance	50 Ω, ±5% at 10 MHz
Coupling	Transformer. (Short at dc)
Bandwidth	±200 kHz (-3 dB)
Spurious	< −120 dBc within 100 kHz
Isolation	> 100 dB (1)
Pulling	< 1 ps (1, 2)
TC of phase	≈ −5 ps/°C

(1) Measured with 1Vrms at 10.001 MHz from a 50 Ω source applied to an adjacent output. The isolation increases at frequencies far away from 10 MHz.
(2) The pulling is comparable to that caused by a reflected wave from an unterminated cable on an adjacent output.

Additive phase noise
(with +7 dBm input)

Offset (Hz)	**Noise (typ) (dBc/Hz)**
1	−125
10	−135
100	−146
1k	−155
10k	−158
100k	−158

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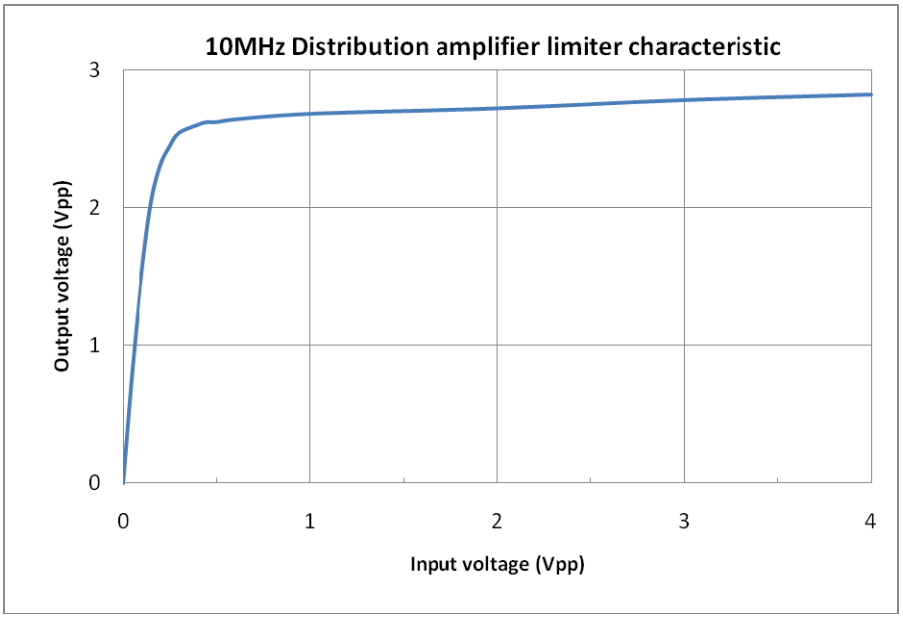


Figure 6 . The 10MHz Distribution amplifier input limiter characteristic.

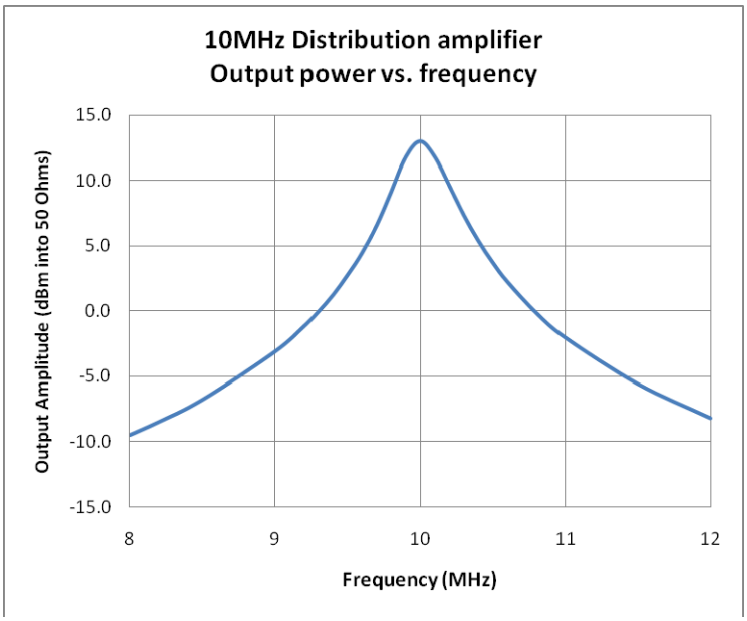


Figure 7. The 10MHz distribution amplifier, output power vs. frequency.

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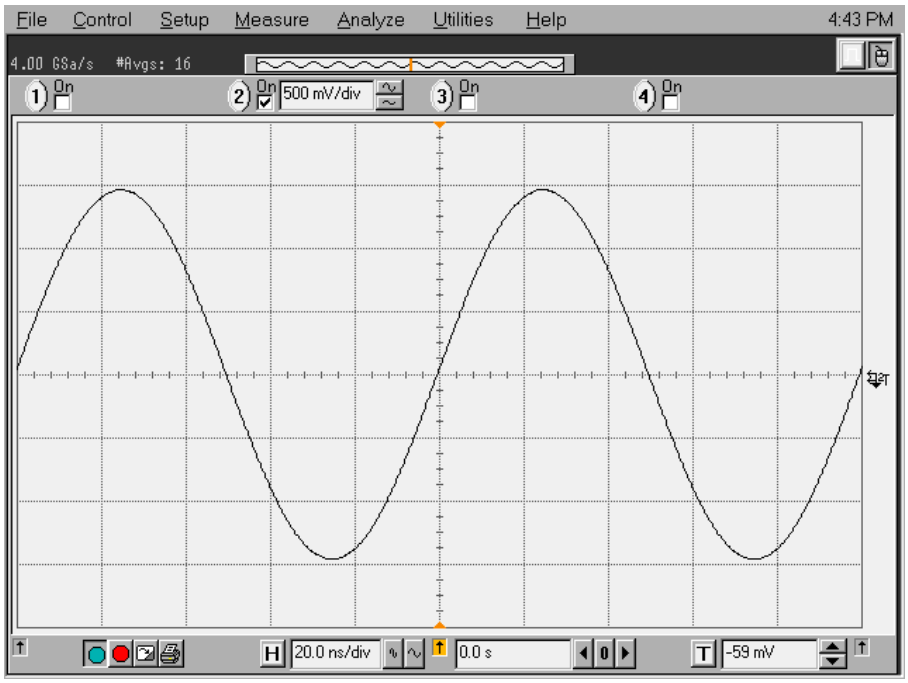


Figure 8. The 10MHz Distribution amplifier sine wave output.

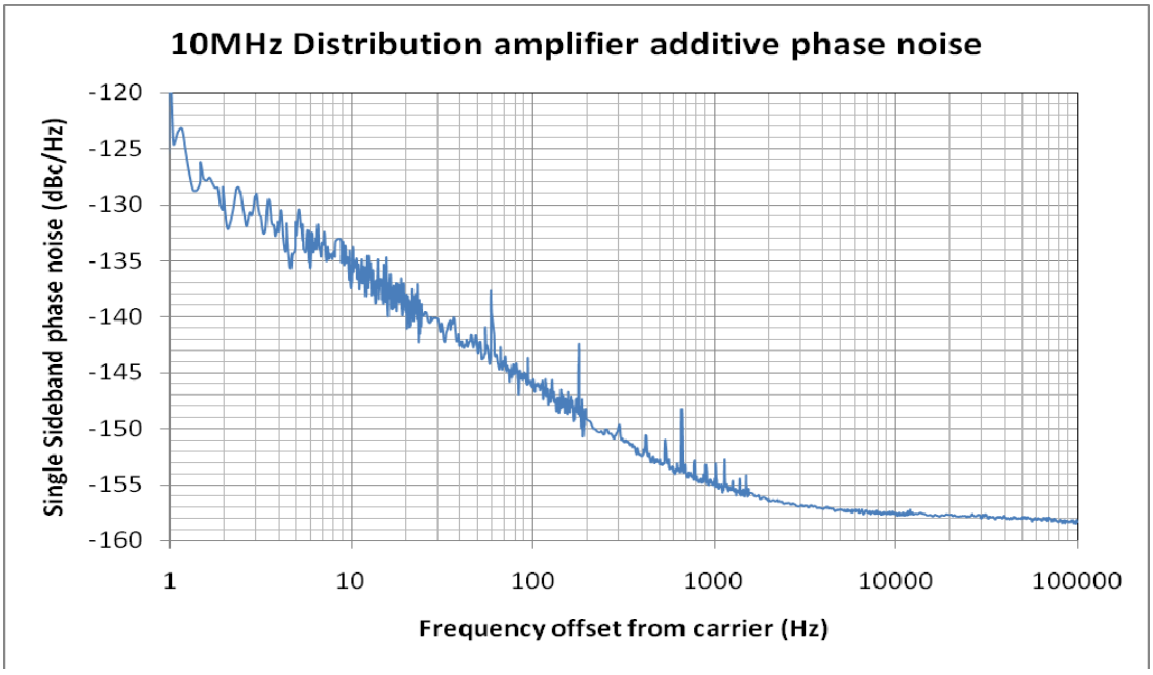


Figure 9. The 10MHz Distribution amplifier additive phase noise vs offset frequency.

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Test and calibration.

Check out. With the instrument plugged into an ac power source and turned "on", apply a 10MHz (±1kHz or ±100ppm), 1.41V_{PP} (+7dBm or 0.5 V_{RMS}) sine wave to the 50Ω input. Verify that each of the seven outputs provides a clean sine wave output of 2.82V_{PP} on an oscilloscope when driving a 50Ω load.

The output amplitude should decrease by a few percent when the input is changed to 9.9MHz or 10.1MHz. The SIGNAL LED should go "off" if the amplitude is reduced below 0.4V_{PP}. The OVERLOAD LED should go "on" when the input is increased above 5.2 V_{PP} (but do not exceed 6 V_{PP} while testing).

Calibration. With the instrument plugged into an ac power source and turned "on", apply a 10MHz (±1kHz or ±100ppm), 1.41V_{PP} (+7dBm or 0.5 V_{RMS}) sine wave to the 50Ω input.

1. Adjust the core of the tuned transformer (T101) to maximize the amplitude of the Channel 1 output when driving a 50Ω load.
2. Adjust the amplitude control pot (P100) for 2.82V_{PP} (+13dBm or 1.00 V_{RMS}) sine wave amplitude on the Channel 1 output when driving a 50Ω load.
3. Verify that 10MHz is present at each of the seven outputs.

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Circuit Description

10MHz distribution amplifier

(Refer to schematics FS1_1B and FS1_2B)

This distribution amplifier is intended to distribute a low noise 10 MHz frequency reference. The amplifier has one input and seven outputs, all on BNC connectors.

Power. The unit is powered from a universal input, +24Vdc power supply. Passive L-C filters (L100, L101, C100, C101) are used to remove switching noise from the +24V. The power supply is regulated by a low drop-out regulator (U100) to provide a clean +22Vdc supply.

Input. The user-supplied 10MHz is applied at J102. A low-Q, series resonant L-C circuit (C109, C110, L102) is used to ac couple and band-pass the input signal and drive the primary of the transformer T100. The transformer doubles the amplitude of the input signal to improve the input noise figure. The transformer input impedance is about 50Ω (R113 divided by the square of the turns ratio of T100). The inductor, L103, compensates for the input capacitance of the transistor pair, Q100 &Q101.

Limiter. The balanced output from T100 drives the input to the differential pair/limiter (Q100 & Q101). The limiter amplitude is set by the constant current source, Q102, which has 4.096 V across its 1.24kΩ emitter resistor to provide 3.3mA of collector current. Q103 is used to temperature compensate the base-emitter voltage (≈0.65V) across Q102. The R-C filter, R133 & C117, has a 0.5Hz cutoff frequency to filter residual voltage reference noise.

The output from the limiter is a differential square wave of 3.3mA. The limiter has relatively high gain: the output will reach about 90% of full scale for inputs greater than 200mV_{pp}. This signal is applied to the primary of the tuned transformer, T101. This transformer is a 10.7MHz intermediate frequency transformer (IFT) that has been tuned down to 10MHz by C112 and C113. The turns ratio of T101 is 7:1 and so the input impedance is about $7^2 \times 249 = 12.2\text{k}\Omega$. The output from T101 has an amplitude of about 5.4V_{pp}. The output is a relatively low distortion sine wave owing to the high-Q of the IFT.

Amplifier. The output of T101 is amplified by U102, which has a nominal gain of ×2.4 to provide an output of about 13V_{pp}. This output drives the seven buffer amplifiers which provide the seven output channels of the distribution amplifier. It also drives the output amplitude peak detector, D101 & C121.

Buffer Amplifiers. There are seven identical output amplifiers. This description will refer to the reference designators for the channel 1 output. The buffer amplifier consists of three emitter followers, Q210, Q211 and Q212. The emitter followers are connected in series to

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provide very large channel-to-channel isolation. The emitter of the third follower drives a 2:1 output transformer via a series R-C (R219 & C212) to reduce the output impedance by 4:1 in order to drive a 50Ω load. The 50Ω user load is driven via a low-pass filter. The filter has a pass-band to 11.5MHz and a notch at 20MHz in order to eliminate harmonic distortion at the output.

Status LEDs. The input level detector is used to detect signal levels which are too small or too large. The detector, D100, is a dual Schottky diode that is biased "on" by R104, R105 and R107. (Biasing the detector "on" improves its ability to detect low signal levels.) The output of the level detector is compared with fixed thresholds by two comparators (U101). The SIGNAL LED will be "on" for inputs greater than about $500mV_{pp}$ and the OVERLOAD LED will be "on" if the input signal exceeds about $5V_{pp}$. The user supplied 10MHz input should be somewhere between these two levels.

The FAULT LED is controlled by U104 & U105 which turns the LED "on" if any of the following conditions exist: no signal at the input, overload at the input, +22V supply is below +20.5V.

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Option 01 (10MHz) Component parts list.

Part Number	Reference	Value	Description
5-00516	C-100	330U HIGH RIPPL	Capacitor, Electrolytic, High Ripple, High Temp (-55/+105 DEG C)
5-00516	C-101	330U HIGH RIPPL	Capacitor, Electrolytic, High Ripple, High Temp (-55/+105 DEG C)
5-00319	C-102	10U/T35	SMD TANTALUM, D-Case
5-00319	C-103	10U/T35	SMD TANTALUM, D-Case
5-00299	C-104	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-105	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00399	C-106	.01U	Capacitor, Mono, 50V, 5%, X7R, 1206
5-00399	C-107	.01U	Capacitor, Mono, 50V, 5%, X7R, 1206
5-00399	C-108	.01U	Capacitor, Mono, 50V, 5%, X7R, 1206
5-00378	C-109	180P	Capacitor, Mono, 50V, 5%, NPO, 1206
5-00380	C-110	270P	Capacitor, Mono, 50V, 5%, NPO, 1206
5-00299	C-111	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00365	C-112	15P	Capacitor, Mono, 50V, 5%, NPO, 1206
5-00365	C-113	15P	Capacitor, Mono, 50V, 5%, NPO, 1206
5-00299	C-114	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-115	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-116	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00516	C-117	330U HIGH RIPPL	Capacitor, Electrolytic, High Ripple, High Temp (-55/+105 DEG C)
5-00299	C-118	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-119	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00399	C-120	.01U	Capacitor, Mono, 50V, 5%, X7R, 1206
5-00399	C-121	.01U	Capacitor, Mono, 50V, 5%, X7R, 1206
5-00299	C-210	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-211	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00387	C-212	1000P	Capacitor, Mono, 50V, 5%, NPO, 1206
5-00380	C-214	270P	Capacitor, Mono, 50V, 5%, NPO, 1206
5-00375	C-215	100P	Capacitor, Mono, 50V, 5%, NPO, 1206
5-00380	C-216	270P	Capacitor, Mono, 50V, 5%, NPO, 1206
5-00299	C-218	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-220	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-221	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00387	C-222	1000P	Capacitor, Mono, 50V, 5%, NPO, 1206
5-00380	C-224	270P	Capacitor, Mono, 50V, 5%, NPO, 1206
5-00375	C-225	100P	Capacitor, Mono, 50V, 5%, NPO, 1206
5-00380	C-226	270P	Capacitor, Mono, 50V, 5%, NPO, 1206
5-00299	C-228	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-230	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-231	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00387	C-232	1000P	Capacitor, Mono, 50V, 5%, NPO, 1206
5-00380	C-234	270P	Capacitor, Mono, 50V, 5%, NPO, 1206
5-00375	C-235	100P	Capacitor, Mono, 50V, 5%, NPO, 1206
5-00380	C-236	270P	Capacitor, Mono, 50V, 5%, NPO, 1206
5-00299	C-238	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-240	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-241	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00387	C-242	1000P	Capacitor, Mono, 50V, 5%, NPO, 1206
5-00380	C-244	270P	Capacitor, Mono, 50V, 5%, NPO, 1206
5-00375	C-245	100P	Capacitor, Mono, 50V, 5%, NPO, 1206

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5-00380	C-246	270P	Capacitor, Mono, 50V, 5%, NPO, 1206
5-00299	C-248	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-250	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-251	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00387	C-252	1000P	Capacitor, Mono, 50V, 5%, NPO, 1206
5-00380	C-254	270P	Capacitor, Mono, 50V, 5%, NPO, 1206
5-00375	C-255	100P	Capacitor, Mono, 50V, 5%, NPO, 1206
5-00380	C-256	270P	Capacitor, Mono, 50V, 5%, NPO, 1206
5-00299	C-258	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-260	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-261	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00387	C-262	1000P	Capacitor, Mono, 50V, 5%, NPO, 1206
5-00380	C-264	270P	Capacitor, Mono, 50V, 5%, NPO, 1206
5-00375	C-265	100P	Capacitor, Mono, 50V, 5%, NPO, 1206
5-00380	C-266	270P	Capacitor, Mono, 50V, 5%, NPO, 1206
5-00299	C-268	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-270	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-271	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00387	C-272	1000P	Capacitor, Mono, 50V, 5%, NPO, 1206
5-00380	C-274	270P	Capacitor, Mono, 50V, 5%, NPO, 1206
5-00375	C-275	100P	Capacitor, Mono, 50V, 5%, NPO, 1206
5-00380	C-276	270P	Capacitor, Mono, 50V, 5%, NPO, 1206
5-00299	C-278	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-280	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
3-00538	D-100	MMBD352L-ROHS	MMBD352L, DUAL SCHOTTKY DIODE
3-00538	D-101	MMBD352L-ROHS	MMBD352L, DUAL SCHOTTKY DIODE
1-00469	J-100	2 PIN, RT.ANGLE	Header, SIM, Right Angle, Polarized
1-01158	J-102	73100-0195	
1-01158	J-210	73100-0195	
1-01158	J-220	73100-0195	
1-01158	J-230	73100-0195	
1-01158	J-240	73100-0195	
1-01158	J-250	73100-0195	
1-01158	J-260	73100-0195	
1-01158	J-270	73100-0195	
6-00647	L-100	47UH	
6-00647	L-101	47UH	
6-00595	L-102	.56UH	Inductor, SMD, Iron Core, 200MHz, 620mA, 10%, Shielded, 1206
6-00649	L-103	.22UH - SMT	Inductor, SMD, Iron Core, 300MHz, 875mA, 10%, Shielded, 1210
6-00236	L-104	FR47	Ferrite Bead, SMD, Type 43/44, 1812
6-00264	L-210	100UH - SMT	Inductor, SMD, Type S, Q=40 at 1.5MHz, 5mA, 10%, Shielded, 1210
6-00595	L-211	.56UH	Inductor, SMD, Iron Core, 200MHz, 620mA, 10%, Shielded, 1206
6-00264	L-220	100UH - SMT	Inductor, SMD, Type S, Q=40 at 1.5MHz, 5mA, 10%, Shielded, 1210
6-00595	L-221	.56UH	Inductor, SMD, Iron Core, 200MHz, 620mA, 10%, Shielded, 1206
6-00264	L-230	100UH - SMT	Inductor, SMD, Type S, Q=40 at 1.5MHz, 5mA, 10%, Shielded, 1210
6-00595	L-231	.56UH	Inductor, SMD, Iron Core, 200MHz, 620mA, 10%, Shielded, 1206
6-00264	L-240	100UH - SMT	Inductor, SMD, Type S, Q=40 at 1.5MHz, 5mA, 10%, Shielded, 1210
6-00595	L-241	.56UH	Inductor, SMD, Iron Core, 200MHz, 620mA, 10%, Shielded, 1206
6-00264	L-250	100UH - SMT	Inductor, SMD, Type S, Q=40 at 1.5MHz, 5mA, 10%, Shielded, 1210
6-00595	L-251	.56UH	Inductor, SMD, Iron Core, 200MHz, 620mA, 10%, Shielded, 1206
6-00264	L-260	100UH - SMT	Inductor, SMD, Type S, Q=40 at 1.5MHz, 5mA, 10%, Shielded, 1210
6-00595	L-261	.56UH	Inductor, SMD, Iron Core, 200MHz, 620mA, 10%, Shielded, 1206
6-00264	L-270	100UH - SMT	Inductor, SMD, Type S, Q=40 at 1.5MHz, 5mA, 10%, Shielded, 1210
6-00595	L-271	.56UH	Inductor, SMD, Iron Core, 200MHz, 620mA, 10%, Shielded, 1206

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4-00326	P-100	200	Pot, Multi Turn, Top Adjust
7-01925	PC-1	FS715/720 OPT.	
3-01815	Q-100	MMBT5089LT1	
3-01815	Q-101	MMBT5089LT1	
3-01815	Q-102	MMBT5089LT1	
3-01815	Q-103	MMBT5089LT1	
3-00601	Q-210	MMBT3904LT1	MMBT3904LT1, 3904 NPN
3-00580	Q-211	MMBT3906LT1	MMBT3906LT1, 3906 PNP
3-00601	Q-212	MMBT3904LT1	MMBT3904LT1, 3904 NPN
3-00601	Q-220	MMBT3904LT1	MMBT3904LT1, 3904 NPN
3-00580	Q-221	MMBT3906LT1	MMBT3906LT1, 3906 PNP
3-00601	Q-222	MMBT3904LT1	MMBT3904LT1, 3904 NPN
3-00601	Q-230	MMBT3904LT1	MMBT3904LT1, 3904 NPN
3-00580	Q-231	MMBT3906LT1	MMBT3906LT1, 3906 PNP
3-00601	Q-232	MMBT3904LT1	MMBT3904LT1, 3904 NPN
3-00601	Q-240	MMBT3904LT1	MMBT3904LT1, 3904 NPN
3-00580	Q-241	MMBT3906LT1	MMBT3906LT1, 3906 PNP
3-00601	Q-242	MMBT3904LT1	MMBT3904LT1, 3904 NPN
3-00601	Q-250	MMBT3904LT1	MMBT3904LT1, 3904 NPN
3-00580	Q-251	MMBT3906LT1	MMBT3906LT1, 3906 PNP
3-00601	Q-252	MMBT3904LT1	MMBT3904LT1, 3904 NPN
3-00601	Q-260	MMBT3904LT1	MMBT3904LT1, 3904 NPN
3-00580	Q-261	MMBT3906LT1	MMBT3906LT1, 3906 PNP
3-00601	Q-262	MMBT3904LT1	MMBT3904LT1, 3904 NPN
3-00601	Q-270	MMBT3904LT1	MMBT3904LT1, 3904 NPN
3-00580	Q-271	MMBT3906LT1	MMBT3906LT1, 3906 PNP
3-00601	Q-272	MMBT3904LT1	MMBT3904LT1, 3904 NPN
4-01146	R-100	2.00K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01029	R-101	121	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01059	R-102	249	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01213	R-103	10.0K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01117	R-104	1.00K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01021	R-105	100	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01059	R-106	249	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01309	R-107	100K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01050	R-108	200	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01172	R-109	3.74K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01050	R-110	200	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01163	R-111	3.01K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01146	R-112	2.00K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01050	R-113	200	Resistor, Thin Film, 1%, 50 ppm, MELF
4-00963	R-114	24.9	Resistor, Thin Film, 1%, 50 ppm, MELF
4-00963	R-115	24.9	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01407	R-116	1	Resistor, Thick Film, 5%, 300 ppm, SMT
4-01407	R-117	1	Resistor, Thick Film, 5%, 300 ppm, SMT
4-01213	R-118	10.0K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01059	R-119	249	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01117	R-120	1.00K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01103	R-121	715	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01059	R-122	249	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01117	R-123	1.00K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01309	R-124	100K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01271	R-125	40.2K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01213	R-126	10.0K	Resistor, Thin Film, 1%, 50 ppm, MELF

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4-01184	R-127	4.99K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01184	R-128	4.99K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01184	R-129	4.99K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01184	R-130	4.99K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01117	R-131	1.00K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01175	R-132	4.02K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01117	R-133	1.00K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01021	R-134	100	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01126	R-135	1.24K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01021	R-210	100	Resistor, Thin Film, 1%, 50 ppm, MELF
4-00992	R-211	49.9	Resistor, Thin Film, 1%, 50 ppm, MELF
4-00992	R-212	49.9	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01146	R-213	2.00K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01117	R-214	1.00K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-00992	R-215	49.9	Resistor, Thin Film, 1%, 50 ppm, MELF
4-00992	R-216	49.9	Resistor, Thin Film, 1%, 50 ppm, MELF
4-00992	R-217	49.9	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01088	R-218	499	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01045	R-219	178	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01021	R-220	100	Resistor, Thin Film, 1%, 50 ppm, MELF
4-00992	R-221	49.9	Resistor, Thin Film, 1%, 50 ppm, MELF
4-00992	R-222	49.9	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01146	R-223	2.00K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01117	R-224	1.00K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-00992	R-225	49.9	Resistor, Thin Film, 1%, 50 ppm, MELF
4-00992	R-226	49.9	Resistor, Thin Film, 1%, 50 ppm, MELF
4-00992	R-227	49.9	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01088	R-228	499	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01045	R-229	178	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01021	R-230	100	Resistor, Thin Film, 1%, 50 ppm, MELF
4-00992	R-231	49.9	Resistor, Thin Film, 1%, 50 ppm, MELF
4-00992	R-232	49.9	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01146	R-233	2.00K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01117	R-234	1.00K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-00992	R-235	49.9	Resistor, Thin Film, 1%, 50 ppm, MELF
4-00992	R-236	49.9	Resistor, Thin Film, 1%, 50 ppm, MELF
4-00992	R-237	49.9	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01088	R-238	499	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01045	R-239	178	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01021	R-240	100	Resistor, Thin Film, 1%, 50 ppm, MELF
4-00992	R-241	49.9	Resistor, Thin Film, 1%, 50 ppm, MELF
4-00992	R-242	49.9	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01146	R-243	2.00K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01117	R-244	1.00K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-00992	R-245	49.9	Resistor, Thin Film, 1%, 50 ppm, MELF
4-00992	R-246	49.9	Resistor, Thin Film, 1%, 50 ppm, MELF
4-00992	R-247	49.9	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01088	R-248	499	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01045	R-249	178	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01021	R-250	100	Resistor, Thin Film, 1%, 50 ppm, MELF
4-00992	R-251	49.9	Resistor, Thin Film, 1%, 50 ppm, MELF
4-00992	R-252	49.9	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01146	R-253	2.00K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01117	R-254	1.00K	Resistor, Thin Film, 1%, 50 ppm, MELF

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4-00992	R-255	49.9	Resistor, Thin Film, 1%, 50 ppm, MELF
4-00992	R-256	49.9	Resistor, Thin Film, 1%, 50 ppm, MELF
4-00992	R-257	49.9	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01088	R-258	499	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01045	R-259	178	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01021	R-260	100	Resistor, Thin Film, 1%, 50 ppm, MELF
4-00992	R-261	49.9	Resistor, Thin Film, 1%, 50 ppm, MELF
4-00992	R-262	49.9	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01146	R-263	2.00K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01117	R-264	1.00K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-00992	R-265	49.9	Resistor, Thin Film, 1%, 50 ppm, MELF
4-00992	R-266	49.9	Resistor, Thin Film, 1%, 50 ppm, MELF
4-00992	R-267	49.9	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01088	R-268	499	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01045	R-269	178	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01021	R-270	100	Resistor, Thin Film, 1%, 50 ppm, MELF
4-00992	R-271	49.9	Resistor, Thin Film, 1%, 50 ppm, MELF
4-00992	R-272	49.9	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01146	R-273	2.00K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01117	R-274	1.00K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-00992	R-275	49.9	Resistor, Thin Film, 1%, 50 ppm, MELF
4-00992	R-276	49.9	Resistor, Thin Film, 1%, 50 ppm, MELF
4-00992	R-277	49.9	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01088	R-278	499	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01045	R-279	178	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01000	R-280	60.4	Resistor, Thin Film, 1%, 50 ppm, MELF
6-00767	T-100	TC4-1T	
6-00195	T-101	10.7 MHZ	
6-00767	T-210	TC4-1T	
6-00767	T-220	TC4-1T	
6-00767	T-230	TC4-1T	
6-00767	T-240	TC4-1T	
6-00767	T-250	TC4-1T	
6-00767	T-260	TC4-1T	
6-00767	T-270	TC4-1T	
3-01842	U-100	LM1086CS-ADJ	
3-00728	U-101	LM393	LM393, Dual Comparator, SO-8
3-01118	U-102	THS3001	
3-01186	U-103	MAX6241BCSA	
3-00728	U-104	LM393	LM393, Dual Comparator, SO-8
3-00728	U-105	LM393	LM393, Dual Comparator, SO-8
0-01259	Z-0	1/2" CUSTOM	
7-02021	Z-0	BNC TOOL	
7-01929	Z-2	BNC BLOCK	
0-00241	Z-3	4-40X3/16PP	
0-00241	Z-4	4-40X3/16PP	
0-00241	Z-5	4-40X3/16PP	
0-00241	Z-6	4-40X3/16PP	
0-00241	Z-7	4-40X3/16PP	
0-00241	Z-8	4-40X3/16PP	
0-00241	Z-9	4-40X3/16PP	
0-00241	Z-10	4-40X3/16PP	
0-00241	Z-11	4-40X3/16PP	

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5MHz Distribution Amplifier

(Option 02)

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5 MHz distribution amplifier (Option 2)



Figure 10. Single 5MHz Distribution amplifier, FS730/2.
The FS735 dual distribution amplifier is also available.

Overview

This distribution amplifier is intended to distribute a low noise 5 MHz frequency reference. The amplifier has one input and seven outputs, all on BNC connectors. The input is coupled through a series LC network allowing the use of inputs with a dc offset. The input source impedance is 50 Ω at 5 MHz.

The input is conditioned by a limiter. The limiter provides several advantages in this application; amplitude modulation is removed from the input signal, outputs have fixed amplitude, input noise that occurs more than 50 mV away from the zero-crossing is blocked, and virtually any waveform with a duty cycle near 50% may be used as an input.

The input limiter is followed by a bandpass filter and a fixed gain amplifier. This signal is passed to seven output amplifiers, each of which is followed by a low pass filter and an output transformer. All of the outputs have 50 Ω source impedance and provide a 1Vrms (+13 dBm) sine wave into a 50 Ω load.

There are four indicator LEDs. The “power” LED indicates that the unit has ac power. The “signal” LED indicates that an input signal is present. The “overload” LED indicates that the input signal has excessive amplitude. The “fault” LED indicates one or more of these conditions: no input signal, excessive input signal, or low internal dc power supply.

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Specifications

Input

Frequency	5 MHz, ±1%
Level	0 dBm to +16 dBm (0.6 V_{pp} to 4 V_{pp})
Waveform	Any with ≈ 50% duty
Impedance	50 Ω, ±5% at 5 MHz
Coupling	Series LC. (Open at dc)

Outputs

Waveform	Sine
THD	<1%
Level (50 Ω load)	+13±1 dBm (1 V_{RMS}, 2.82 V_{PP})
Level (high-Z load)	2 V_{RMS} (5.6 V_{PP})
Impedance	50 Ω, ±5% at 5 MHz
Coupling	Transformer. (Short at dc)
Bandwidth	±100 kHz (-3 dB)
Spurious	< −120 dBc within 100kHz
Isolation	> 100 dB (1)
Pulling	< 1 ps (1, 2)
TC of phase	≈ −5 ps/°C

(3) Measured with 1 Vrms at 10.001 MHz from a 50 Ω source applied to an adjacent output. The isolation increases at frequencies far away from 5 MHz.
(4) The pulling is comparable to that caused by a reflected wave from an unterminated cable on an adjacent output.

Additive phase noise
(with +7 dBm input)

Offset (Hz)	**Noise (typ) (dBc/Hz)**
1	−125
10	−135
100	−146
1k	−155
10k	−158
100k	−158

For circuit description and other performance characteristics see Option 01 (10MHz distribution amplifier.)

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Test and calibration.

Check out. With the instrument plugged into an ac power source and turned "on", apply a 5MHz (±1kHz or ±100ppm), 1.41V_{PP} (+7dBm or 0.5 V_{RMS}) sine wave to the 50Ω input. Verify that each of the seven outputs provides a clean sine wave output of 2.82V_{PP} on an oscilloscope when driving a 50Ω load.

The output amplitude should decrease by a few percent when the input is changed to 4.9MHz or 5.1MHz. The SIGNAL LED should go "off" if the amplitude is reduced below 0.4V_{PP}. The OVERLOAD LED should go "on" when the input is increased above 5.2 V_{PP} (but do not exceed 6 V_{PP} while testing).

Calibration. With the instrument plugged into an ac power source and turned "on", apply a 5MHz (±1kHz or ±100ppm), 1.41V_{PP} (+7dBm or 0.5 V_{RMS}) sine wave to the 50Ω input.

1. Adjust the core of the tuned transformer (T101) to maximize the amplitude of the Channel 1 output when driving a 50Ω load.
2. Adjust the amplitude control pot (P100) for 2.82V_{PP} (+13dBm or 1.00 V_{RMS}) sine wave amplitude on the Channel 1 output when driving a 50Ω load.
3. Verify that 5MHz is present at each of the seven outputs.

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CMOS Logic Distribution Amplifier

(Option 03)

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CMOS logic distribution amplifier (Option 3)



Figure 11. Single CMOS Logic level distribution amplifier, FS730/3. The FS735 dual distribution amplifier is also available.

Overview

This distribution amplifier is intended to distribute CMOS level logic pulses. The amplifier has one input and seven outputs, all on BNC connectors. All inputs and outputs are logic levels.

The Schmitt trigger input has a switching threshold of +1.3 Vdc with 350 mV of hysteresis. The input impedance is 1 kΩ (and so does not terminate a 50 Ω line.)

Each output has a 50 Ω source impedance with logic levels of 0V and 5.0 V. The 50 Ω source impedance will reverse terminate reflected pulses when driving unterminated lines. High impedance loads will be driven to 5 V and 50 Ω loads will be driven to 2.5 V. All of the outputs are driven by separate drivers to provide high isolation. The outputs have fast transition times and very low overshoot. The polarity of each output may be configured with a jumper inside the unit: installing the polarity jumper inverts the corresponding output. As shipped, the outputs are non-inverting.

The unit has two indicator LEDs. The “power” LED indicates that the unit has ac power. The “signal” LED will flash for 100ms on each rising or falling edge seen at the input.

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Specifications

Input

Impedance	1 kΩ
Threshold (L-H)	1.50 Vdc
Threshold (H-L)	1.15 Vdc
Transition time	no restriction
Frequency	dc-50 MHz
Pulse width	> 5 ns

Outputs

Impedance	50 Ω ±5 %
Levels (high-Z load)	0 V & 5 V
Levels (50 Ω load)	0 V & 2.5 V
Rise time	< 1.5 ns
Fall time	< 1.0 ns
Jitter	< 10 ps rms
Delay	9 ns, typ
Delay skew	±1 ns, typ
Overshoot	< 5 %
Undershoot	< 5 %
Polarity control	internal jumper

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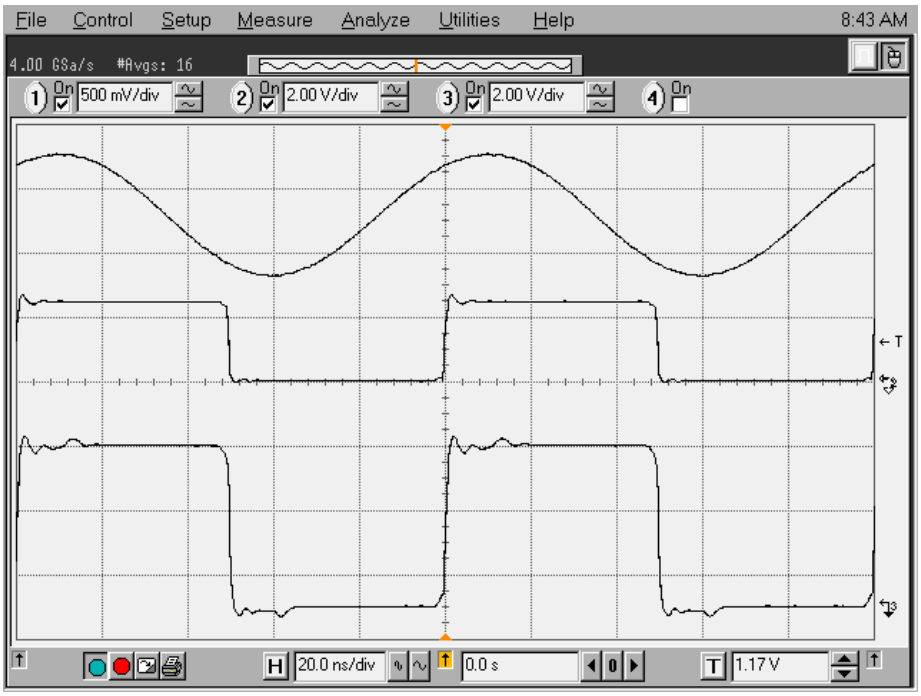


Figure 12. CMOS Distribution amplifier: Offset 10MHz sine input (500mV/div), logic output (2V/div into 50Ω) and logic output (2V/div, unterminated & showing small reflection artifacts with 1m cable between output and oscilloscope.)

Check out.

1. With the instrument plugged into an ac power source and turned "on", apply a 1 kHz offset sine wave (amplitude=1V_{PP}, offset = 1.35V) to the 1kΩ input BNC.
2. Triggering the oscilloscope on the sine wave input, observe 1kHz square waves at each of the seven outputs. The square waves should have about 50% duty cycle (indicating that the input switching thresholds are nominally correct) and very fast transition times (typically 1.0ns rise and 0.6ns fall). The phase may be shifted by 180° if an internal polarity control jumper is installed. The outputs should switch between 0V and 2.5V when driving 50Ω loads. The outputs should switch between 0V and 5V when driving high impedance loads.
3. Increase the sine wave frequency to 10MHz and verify the square wave outputs remain about 50% duty cycle.

Calibration. The CMOS distribution requires no calibration.

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Circuit Description

CMOS Distribution amplifier
(Refer to schematics FS3_1C)

This distribution amplifier is intended to distribute CMOS level logic pulses. The amplifier has one input and seven outputs, all on BNC connectors. All inputs and outputs are logic levels.

Power. The unit is powered from a universal input, +24Vdc or +12Vdc power supply. The power supply is regulated by a linear regulator (U3) to provide a clean +5Vdc supply. The current draw is normally very low except when operated at high input frequencies or when driving 50Ω loads with high duty cycle.

Input. The input BNC is connected to ground via a 1kΩ resistor (R12). The input is protected by a series input resistor (R4) and clamping diodes (D2) which limit the input excursions to -0.7V and +5.7V.

Comparator. The input signal is conditioned by a fast Schmitt trigger comparator (U1) with logic thresholds of +1.5V (rising) and +1.15V (falling). The comparator inverts the input signal. Its output is buffered by a triple-gate line-driver (U4) which drives a 75Ω line to distribute the input signal to the seven output channel drivers. The buffered line is terminated by R10 & R11.

Polarity control. The buffered and inverted signal is received by an XOR gate. The second input to the XOR gate is pulled high by a resistor so that it also operates as an inverter (with respect to the other input) to restore the signal to non-inverted polarity. Installing a jumper will pull the second input low so that the signal remains inverted allowing that channel to operate with an inverted output if desired.

Output driver. The output of the XOR gate drives a triple-gate line-driver, U101 (for Channel 1). The inputs and outputs of the triple-gate line-driver are ganged together to reduce the output impedance to a few Ohms. A resistor in series with this output (R102 for Channel 1) provides a driver impedance of very nearly 50Ω to reverse terminate reflected pulses in cases where a 50Ω load is not provided by the user. A small resistor is used in series with the output driver +5V supply to reduce ringing of the output on low-to-high transitions.

Status LEDs. Only two status LEDs are active: POWER and SIGNAL. The POWER LED is "on" whenever AC power is present and the unit is turned "on". The SIGNAL LED will blink "on" with each rising and falling edge at the input.

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Option 3 (CMOS Logic) Component parts list

Part Number	Reference	Value	Description</TD< tr>
5-00319	C-1	10U/T35	SMD TANTALUM, D-Case
5-00319	C-2	10U/T35	SMD TANTALUM, D-Case
5-00611	C-5	4.7U - 16V X5R	
5-00299	C-7	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-8	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-9	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-10	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-100	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00611	C-101	4.7U - 16V X5R	
5-00299	C-200	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00611	C-201	4.7U - 16V X5R	
5-00299	C-300	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00611	C-301	4.7U - 16V X5R	
5-00299	C-400	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00611	C-401	4.7U - 16V X5R	
5-00299	C-500	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00611	C-501	4.7U - 16V X5R	
5-00299	C-600	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00611	C-601	4.7U - 16V X5R	
5-00299	C-700	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00611	C-701	4.7U - 16V X5R	
3-00649	D-1	BAW56LT1G -ROHS	BAW56LT1, Dual Switching Diode
3-00896	D-2	BAV99	BAV99, DUAL SERIES DIODE, 70V BREAKDOWN
1-01158	J-1	73100-0195	
1-00469	J-2	2 PIN, RT.ANGLE	Header, SIM, Right Angle, Polarized
1-01158	J-100	73100-0195	
1-00006	J-101	2 PIN DI	Header, SIM
1-01158	J-200	73100-0195	
1-00006	J-201	2 PIN DI	Header, SIM
1-01158	J-300	73100-0195	
1-00006	J-301	2 PIN DI	Header, SIM
1-01158	J-400	73100-0195	
1-00006	J-401	2 PIN DI	Header, SIM
1-01158	J-500	73100-0195	
1-00006	J-501	2 PIN DI	Header, SIM
1-01158	J-600	73100-0195	
1-00006	J-601	2 PIN DI	Header, SIM
1-01158	J-700	73100-0195	
1-00006	J-701	2 PIN DI	Header, SIM
6-00236	L-3	FR47	Ferrite Bead, SMD, Type 43/44, 1812
6-00236	L-4	FR47	Ferrite Bead, SMD, Type 43/44, 1812
6-00236	L-100	FR47	Ferrite Bead, SMD, Type 43/44, 1812
6-00236	L-200	FR47	Ferrite Bead, SMD, Type 43/44, 1812
6-00236	L-300	FR47	Ferrite Bead, SMD, Type 43/44, 1812
6-00236	L-400	FR47	Ferrite Bead, SMD, Type 43/44, 1812
6-00236	L-500	FR47	Ferrite Bead, SMD, Type 43/44, 1812
6-00236	L-600	FR47	Ferrite Bead, SMD, Type 43/44, 1812
6-00236	L-700	FR47	Ferrite Bead, SMD, Type 43/44, 1812
0-00241	M-1	4-40X3/16PP	
0-00241	M-2	4-40X3/16PP	
0-00241	M-3	4-40X3/16PP	
0-00241	M-4	4-40X3/16PP	
0-00241	M-5	4-40X3/16PP	
0-00241	M-6	4-40X3/16PP	
0-00241	M-7	4-40X3/16PP	

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0-00241	M-8	4-40X3/16PP		
0-00241	M-9	4-40X3/16PP		
0-00241	M-10	4-40X3/16PP		
0-00241	M-11	4-40X3/16PP		
4-01134	R-1	1.50K		Resistor, Thin Film, 1%, 50 ppm, MELF
4-01088	R-2		499	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01184	R-3	4.99K		Resistor, Thin Film, 1%, 50 ppm, MELF
4-00992	R-4		49.9	Resistor, Thin Film, 1%, 50 ppm, MELF
4-00992	R-5		49.9	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01405	R-6	1.00M		Resistor, Thin Film, 1%, 50 ppm, MELF
4-01405	R-7	1.00M		Resistor, Thin Film, 1%, 50 ppm, MELF
4-01071	R-8		332	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01071	R-9		332	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01038	R-10		150	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01038	R-11		150	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01117	R-12	1.00K		Resistor, Thin Film, 1%, 50 ppm, MELF
4-01423	R-100		4.7	Resistor, Thick Film, 5%, 300 ppm, SMT
4-01213	R-101	10.0K		Resistor, Thin Film, 1%, 50 ppm, MELF
4-00988	R-102		45.3	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01423	R-200		4.7	Resistor, Thick Film, 5%, 300 ppm, SMT
4-01213	R-201	10.0K		Resistor, Thin Film, 1%, 50 ppm, MELF
4-00988	R-202		45.3	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01423	R-300		4.7	Resistor, Thick Film, 5%, 300 ppm, SMT
4-01213	R-301	10.0K		Resistor, Thin Film, 1%, 50 ppm, MELF
4-00988	R-302		45.3	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01423	R-400		4.7	Resistor, Thick Film, 5%, 300 ppm, SMT
4-01213	R-401	10.0K		Resistor, Thin Film, 1%, 50 ppm, MELF
4-00988	R-402		45.3	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01423	R-500		4.7	Resistor, Thick Film, 5%, 300 ppm, SMT
4-01213	R-501	10.0K		Resistor, Thin Film, 1%, 50 ppm, MELF
4-00988	R-502		45.3	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01423	R-600		4.7	Resistor, Thick Film, 5%, 300 ppm, SMT
4-01213	R-601	10.0K		Resistor, Thin Film, 1%, 50 ppm, MELF
4-00988	R-602		45.3	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01423	R-700		4.7	Resistor, Thick Film, 5%, 300 ppm, SMT
4-01213	R-701	10.0K		Resistor, Thin Film, 1%, 50 ppm, MELF
4-00988	R-702		45.3	Resistor, Thin Film, 1%, 50 ppm, MELF
3-01791	U-1	TLV3501AID		
3-01467	U-2	74HC4538		Monostable Multivibrator
3-01101	U-3	MC7805ACD2T		
3-01852	U-4	74LVC3G34DCTR		
3-01854	U-100	74LVC1G86DBVR		
3-01852	U-101	74LVC3G34DCTR		
3-01854	U-200	74LVC1G86DBVR		
3-01852	U-201	74LVC3G34DCTR		
3-01854	U-300	74LVC1G86DBVR		
3-01852	U-301	74LVC3G34DCTR		
3-01854	U-400	74LVC1G86DBVR		
3-01852	U-401	74LVC3G34DCTR		
3-01854	U-500	74LVC1G86DBVR		
3-01852	U-501	74LVC3G34DCTR		
3-01854	U-600	74LVC1G86DBVR		
3-01852	U-601	74LVC3G34DCTR		
3-01854	U-700	74LVC1G86DBVR		

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3-01852	U-701	74LVC3G34DCTR
0-01259	Z-0	1/2" CUSTOM
7-02021	Z-0	BNC TOOL
7-01926	Z-1	FS730/735 OPT3
7-01929	Z-2	BNC BLOCK

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Broadband 50Ω Distribution Amplifier

(Option 04)

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Broadband 50 Ω distribution amplifier (Option 4)



Figure 13. Single broadband 50Ω distribution amplifer, FS730/4.
The FS735 dual distribution amplifier is also available.

Overview

This distribution amplifier is intended to distribute broadband (dc-100 MHz) analog signals over 50 Ω coax. The amplifier has one input and seven outputs, all on BNC connectors. The input and outputs are dc coupled with a 50 Ω impedance. Applications include the distribution of frequency references, IRIG timing signals, composite video, audio, etc.

There are four indicator LEDs. The “power” LED indicates that the unit has ac power. The “signal” LED indicates that an input signal greater that 300 mV is present. The “overload” LED indicates that the input signal has exceeded ± 2.2 V. The “fault” LED indicates a problem with the unit’s internal dc power supply.

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Specifications

Input

Impedance	50 Ω, ±1%
Linear range	± 2 V
Damage (dc)	5 V
Damage (1us)	100 V

Outputs

Impedance	50 Ω, ±1%
Nominal load	50 Ω

Performance (50 Ω loads)

Gain (50 Ω load)	× 1.00, ±2%
Gain (high-Z load)	× 2.00, ±1%
Bandwidth (-3 dB)	> 100 MHz
Noise at 1 kHz	< 15 nV/√Hz
Offset	< 1 mV
Isolation (10 MHz)	> 120 dB

Additive phase noise
(With 10 MHz, +7 dBm input)

Offset (Hz)	**Noise (dBc/Hz)**
1	−138
10	−147
100	−152
1k	−153
10k	−153
100k	−153

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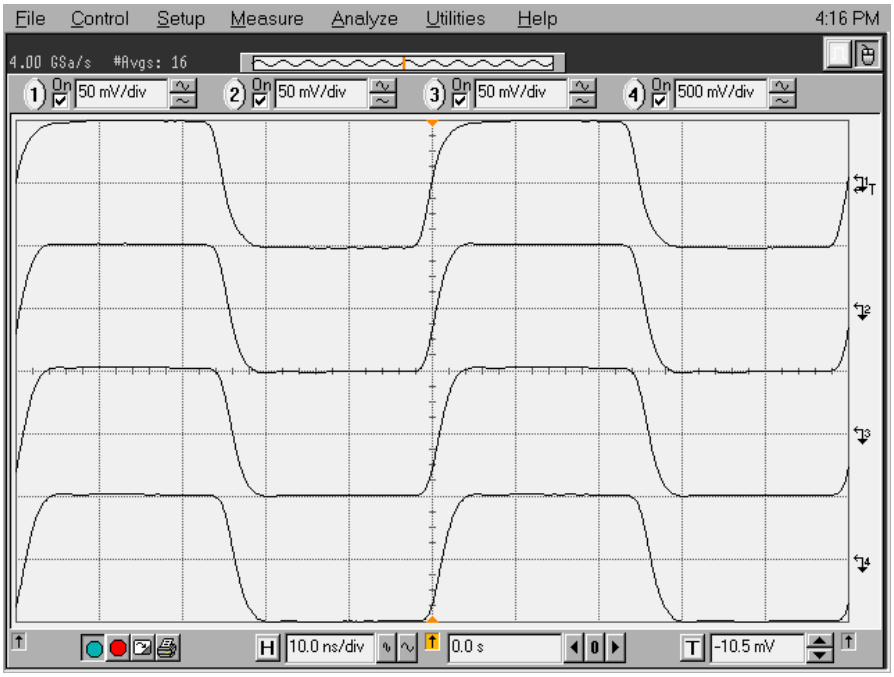


Figure 14. Broadband distribution amplifer small signal response for 20MHz square wave from Channels 1, 3, 5 & 7.

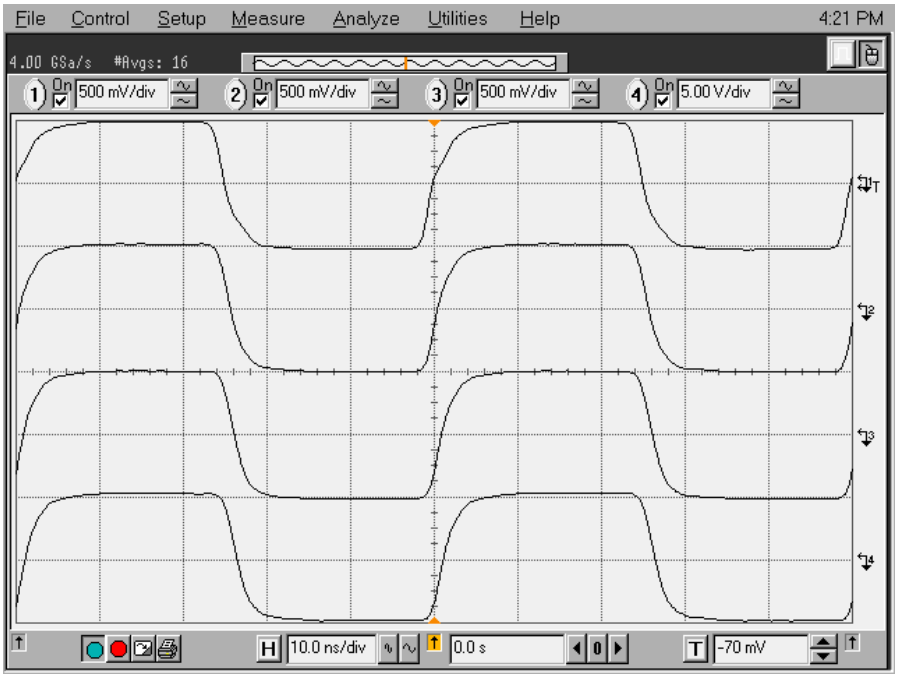


Figure 15. Broadband distribution amplifer large signal response for 20MHz square wave from Channels 1, 3, 5 & 7.

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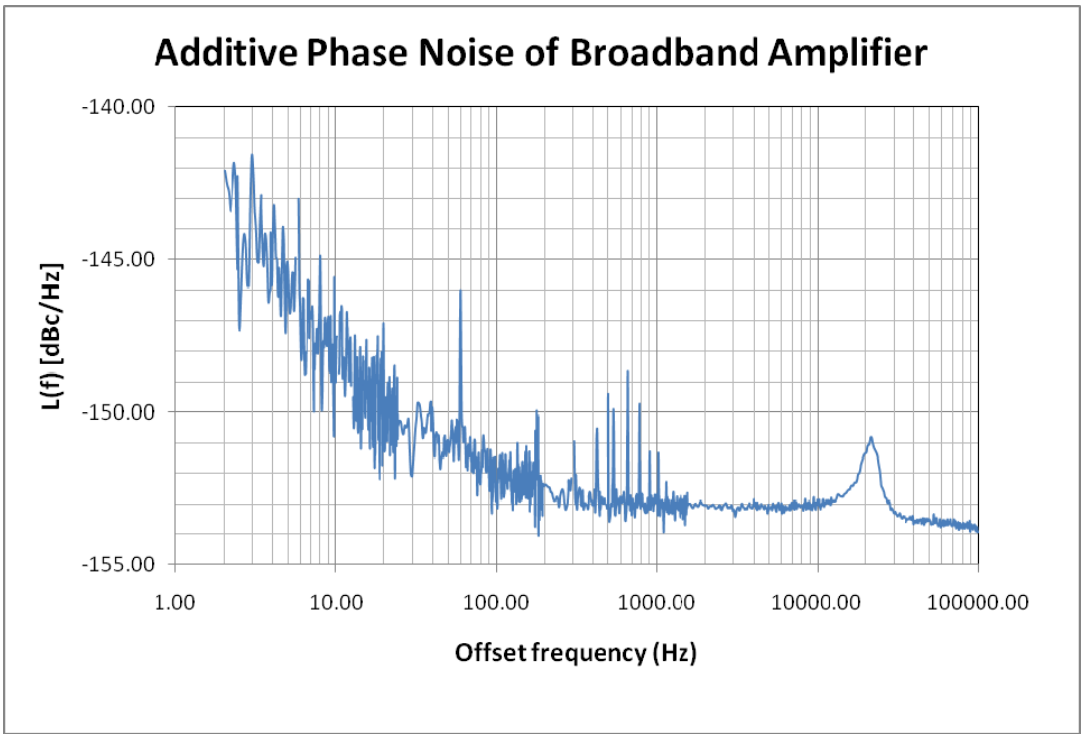


Figure 16. Broadband distribution amplifier additive phase noise vs offset frequency.

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Test and calibration.

Broadband distribution amplifier

Check out.

1. With the instrument plugged into an ac power source and turned "on", but with no input applied, measure the dc voltage at each of the seven outputs and confirm that the output voltage is less than ±1mV.

2. Apply a 10MHz, 0.1V_{PP} square wave to the 50Ω input BNC. The source should have a rise time of <1ns. (The Q-output of a CG635 set to +7dBm with a 20dB attenuator makes a good source.) Verify that the seven outputs have the same amplitude as the input when viewed on an oscilloscope with > 300MHz bandwidth and a 50Ω input impedance. The output transition times should be about 3ns and the overshoot should be < 2%.

Calibration.

1. With the instrument plugged into an ac power source and turned "on", but with no input applied, adjust P2 to null the output offset of the preamp (U5) at the location indicated by the PCB silkscreen.

2. For each of the seven output buffer amplifiers, adjust the offset pot (P100, P200…P700) to null the output voltage at the corresponding BNC output.

3. Apply 1.000Vdc to the input BNC. Adjust the gain pot (P3) for 2.000Vdc at the Channel #1 output BNC (output is unterminated.) (The Q-output of a CG635, Stopped & Toggled and with Q-High adjusted to 1.000V, works.)

4. Apply a 10MHz, 0.1V_{PP} square wave to the 50Ω input BNC. The source should have a rise time of <1ns. (The Q-output of a CG635 set to +7dBm with a 20dB attenuator makes a good source.) Adjust the HF Comp pot (P1) for a small overshoot (0.5%) on the Channel #1 output when viewed on an oscilloscope with > 300MHz bandwidth and a 50Ω input impedance.

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Circuit Description

Broadband Distribution amplifier
(Refer to schematics FS4_1B)

This distribution amplifier is intended to distribute broadband (dc-100 MHz) analog signals over 50Ω or 75Ω coax. The amplifier has one input and seven outputs, all on BNC connectors. There are eight 150Ω resistors that can be added in parallel with eight 75Ω resistors to convert a unit from 75Ω to 50Ω (R16, R103, R203, R303, …R703.)

Power. The unit operates from a floating +24Vdc power supply. A virtual ground is created to split the supply into ±12Vdc supplies. The virtual ground is maintained by the op amp U1 which maintains the midpoint of the supplies at 0V by drawing current from either the +12V supply or the -12V supply to exactly balance the current drawn by the circuit. The ±12Vdc supplies are regulated to ±10Vdc supplies by U2 and U3. The ±10Vdc supplies provide power to the rest of the instrument. The comparator U4 will turn the FAULT LED "on" if the ±10Vdc supplies are not balanced.

Input. The input is terminated by R15 (for 75Ω) or R15 & R16 (for 50Ω). The input op amp (U5) is protected by a series resistor (R18) that is clamped to ±3.5V by D1, D2 & D3.

Amplifier. The input amplifier (U5) is a high bandwidth, current feedback op amp that operates off ±10V power supplies. The circuit operates with a nominal gain of ×2.42. The output drives a PCB trace via a 14Ω resistor (R24) which is terminated into its characteristic impedance by R800 (64.9Ω). This combination attenuates the op amp output by ×0.822 to provide an overall gain of 2.000 for the signal which is distributed to the seven output drivers.

There are three potentiometers which calibrate the front-end amplifier's gain, offset and high frequency compensation. The non-inverting gain is adjusted by P3, which changes the magnitude of the negative feedback. The offset is adjusted by P2 which injects a small current via R21 (499kΩ) to null the op amp's small input offset. The high frequency compensation is adjusted by P1 which sets the Thevenin resistance for the current feedback path which controls the high frequency response of the current feedback amplifier.

Output buffers. The amplified input signal is distributed to seven output buffers which are operated as (nearly) unity gain amplifiers. The signal is applied to the non-inverting input via a 301Ω resistor which de-couples the distributed signal from each amplifier. Each amplifier is operated near unity gain (actually gain is about ×1.0018 due to the offset control). The 909Ω feedback resistor between the op amp output and its inverting input controls the high frequency response of the current feedback amplifier. A multi-turn pot is used to null the offset voltage for each channel individually. (These offset controls are adjusted *after* the front-end amplifier input offset control is adjusted.)

Status LEDs. The output of an eighth buffer amplifier (U6) is rectified and compared to fixed thresholds to detect the presence of a signal or an overload. The SIGNAL LED will go

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"on" if the input exceeds ±175mV and the OVERLOAD LED will go "on" if the input signal exceeds ±2.2V. (The linear range of operation is ±2.5V.)

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Option 04 (Broadband Amplifier) Component parts list

Part Number	Reference	Value	Description
7-01929	BL-1	BNC BLOCK	
5-00516	C-1	330U HIGH RIPPL	Capacitor, Electrolytic, High Ripple, High Temp (-55/+105 DEG C)
5-00516	C-2	330U HIGH RIPPL	Capacitor, Electrolytic, High Ripple, High Temp (-55/+105 DEG C)
5-00319	C-3	10U/T35	SMD TANTALUM, D-Case
5-00319	C-4	10U/T35	SMD TANTALUM, D-Case
5-00299	C-5	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-6	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-7	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-8	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-9	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-10	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-11	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-12	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00375	C-13	100P	Capacitor, Mono, 50V, 5%, NPO, 1206
5-00375	C-14	100P	Capacitor, Mono, 50V, 5%, NPO, 1206
5-00298	C-15	.01U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00375	C-16	100P	Capacitor, Mono, 50V, 5%, NPO, 1206
5-00375	C-17	100P	Capacitor, Mono, 50V, 5%, NPO, 1206
5-00298	C-18	.01U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00319	C-21	10U/T35	SMD TANTALUM, D-Case
5-00299	C-100	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-101	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-102	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-103	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-200	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-201	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-202	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-203	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-300	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-301	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-302	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-303	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-400	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-401	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-402	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-403	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-500	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-501	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-502	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-503	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-600	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-601	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-602	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-603	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-700	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-701	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-702	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-703	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
3-00896	D-1	BAV99	BAV99, DUAL SERIES DIODE, 70V BREAKDOWN

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3-00783	D-2	MMBZ5226	MMBZ5226, 3.3V ZENER
3-00783	D-3	MMBZ5226	MMBZ5226, 3.3V ZENER
3-00538	D-4	MMBD352L-ROHS	MMBD352L, DUAL SCHOTTKY DIODE
3-00538	D-5	MMBD352L-ROHS	MMBD352L, DUAL SCHOTTKY DIODE
1-00469	J-1	2 PIN, RT.ANGLE	Header, SIM, Right Angle, Polarized
1-01158	J-2	73100-0195	
1-01158	J-100	73100-0195	
1-01158	J-200	73100-0195	
1-01158	J-300	73100-0195	
1-01158	J-400	73100-0195	
1-01158	J-500	73100-0195	
1-01158	J-600	73100-0195	
1-01158	J-700	73100-0195	
6-00174	L-1	6611 TYPE 43	Ferite Bead, Thru-hole, Type 43
6-00174	L-2	6611 TYPE 43	Ferite Bead, Thru-hole, Type 43
6-00236	L-3	FR47	Ferrite Bead, SMD, Type 43/44, 1812
6-00236	L-4	FR47	Ferrite Bead, SMD, Type 43/44, 1812
6-00236	L-5	FR47	Ferrite Bead, SMD, Type 43/44, 1812
6-00236	L-6	FR47	Ferrite Bead, SMD, Type 43/44, 1812
6-00236	L-100	FR47	Ferrite Bead, SMD, Type 43/44, 1812
6-00236	L-101	FR47	Ferrite Bead, SMD, Type 43/44, 1812
6-00236	L-200	FR47	Ferrite Bead, SMD, Type 43/44, 1812
6-00236	L-201	FR47	Ferrite Bead, SMD, Type 43/44, 1812
6-00236	L-300	FR47	Ferrite Bead, SMD, Type 43/44, 1812
6-00236	L-301	FR47	Ferrite Bead, SMD, Type 43/44, 1812
6-00236	L-400	FR47	Ferrite Bead, SMD, Type 43/44, 1812
6-00236	L-401	FR47	Ferrite Bead, SMD, Type 43/44, 1812
6-00236	L-500	FR47	Ferrite Bead, SMD, Type 43/44, 1812
6-00236	L-501	FR47	Ferrite Bead, SMD, Type 43/44, 1812
6-00236	L-600	FR47	Ferrite Bead, SMD, Type 43/44, 1812
6-00236	L-601	FR47	Ferrite Bead, SMD, Type 43/44, 1812
6-00236	L-700	FR47	Ferrite Bead, SMD, Type 43/44, 1812
6-00236	L-701	FR47	Ferrite Bead, SMD, Type 43/44, 1812
0-00241	M-1	4-40X3/16PP	
0-00241	M-2	4-40X3/16PP	
0-00241	M-3	4-40X3/16PP	
0-00241	M-4	4-40X3/16PP	
0-00241	M-5	4-40X3/16PP	
0-00241	M-6	4-40X3/16PP	
0-00241	M-7	4-40X3/16PP	
0-00241	M-8	4-40X3/16PP	
0-00241	M-9	4-40X3/16PP	
0-00241	M-10	4-40X3/16PP	
0-00241	M-11	4-40X3/16PP	
4-00485	P-1	1K	Pot, Multi Turn, Top Adjust
4-00013	P-2	50K	Pot, Multi Turn, Top Adjust
4-00487	P-3	20	Pot, Multi Turn, Top Adjust
4-00013	P-100	50K	Pot, Multi Turn, Top Adjust
4-00013	P-200	50K	Pot, Multi Turn, Top Adjust
4-00013	P-300	50K	Pot, Multi Turn, Top Adjust
4-00013	P-400	50K	Pot, Multi Turn, Top Adjust
4-00013	P-500	50K	Pot, Multi Turn, Top Adjust
4-00013	P-600	50K	Pot, Multi Turn, Top Adjust
4-00013	P-700	50K	Pot, Multi Turn, Top Adjust

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7-01927	PC-1	FS715/720 OPT	
3-01091	Q-1	MJD44H11	
3-01100	Q-2	MJD45H11	
4-01213	R-1	10.0K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01117	R-2	1.00K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01213	R-3	10.0K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01309	R-4	100K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01021	R-5	100	Resistor, Thin Film, 1%, 50 ppm, MELF
4-00320	R-6	18	Resistor, Wire-wound
4-00320	R-7	18	Resistor, Wire-wound
4-01110	R-8	845	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01029	R-9	121	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01142	R-10	1.82K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01059	R-11	249	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01213	R-12	10.0K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01088	R-13	499	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01213	R-14	10.0K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01009	R-15	75	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01038	R-16	150	Resistor, Thin Film, 1%, 50 ppm, MELF
4-00992	R-18	49.9	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01117	R-19	1.00K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01117	R-20	1.00K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01376	R-21	499K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01103	R-22	715	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01088	R-23	499	Resistor, Thin Film, 1%, 50 ppm, MELF
4-00939	R-24	14	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01146	R-25	2.00K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01146	R-26	2.00K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01146	R-27	2.00K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01146	R-28	2.00K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01067	R-29	301	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01113	R-30	909	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01309	R-31	100K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01117	R-32	1.00K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01021	R-33	100	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01309	R-34	100K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01309	R-35	100K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01021	R-36	100	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01309	R-37	100K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01117	R-38	1.00K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01405	R-39	1.00M	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01309	R-40	100K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01021	R-41	100	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01175	R-42	4.02K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01192	R-43	6.04K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01192	R-44	6.04K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01175	R-45	4.02K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01309	R-46	100K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01021	R-47	100	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01405	R-48	1.00M	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01067	R-100	301	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01113	R-101	909	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01009	R-102	75	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01038	R-103	150	Resistor, Thin Film, 1%, 50 ppm, MELF

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4-01376	R-105	499K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01067	R-200	301	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01113	R-201	909	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01009	R-202	75	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01038	R-203	150	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01376	R-205	499K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01067	R-300	301	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01113	R-301	909	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01009	R-302	75	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01038	R-303	150	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01376	R-305	499K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01067	R-400	301	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01113	R-401	909	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01009	R-402	75	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01038	R-403	150	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01376	R-405	499K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01067	R-500	301	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01113	R-501	909	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01009	R-502	75	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01038	R-503	150	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01376	R-505	499K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01067	R-600	301	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01113	R-601	909	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01009	R-602	75	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01038	R-603	150	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01376	R-605	499K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01067	R-700	301	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01113	R-701	909	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01009	R-702	75	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01038	R-703	150	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01376	R-705	499K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01003	R-800	64.9	Resistor, Thin Film, 1%, 50 ppm, MELF
3-00729	U-1	LM741C	LM741C general purpose op amp
3-01842	U-2	LM1086CS-ADJ	
3-01817	U-3	LM2991S	
3-00728	U-4	LM393	LM393, Dual Comparator, SO-8
3-01118	U-5	THS3001	
3-01118	U-6	THS3001	
3-00728	U-7	LM393	LM393, Dual Comparator, SO-8
3-00728	U-8	LM393	LM393, Dual Comparator, SO-8
3-00728	U-9	LM393	LM393, Dual Comparator, SO-8
3-01118	U-100	THS3001	
3-01118	U-200	THS3001	
3-01118	U-300	THS3001	
3-01118	U-400	THS3001	
3-01118	U-500	THS3001	
3-01118	U-600	THS3001	
3-01118	U-700	THS3001	
0-00772	Z-0	1.5" WIRE	
0-01259	Z-0	1/2" CUSTOM	
7-02021	Z-0	BNC TOOL	

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Broadband 75Ω Distribution Amplifier (Option 05)

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Broadband 75 Ω distribution amplifier (Option 5)



Figure 17. Single Broadband 75 Ω distribution amplifier, FS730/5. The FS735 dual distribution amplifier is also available.

Overview

This distribution amplifier is intended to distribute broadband (dc-100 MHz) analog signals over 75 Ω coax. The amplifier has one input and seven outputs, all on BNC connectors. The input and outputs are dc coupled with a 75 Ω impedance. Applications include the distribution of frequency references, IRIG timing signals, composite video, audio, etc.

There are four indicator LEDs. The “power” LED indicates that the unit has ac power. The “signal” LED indicates that an input signal greater that 300 mV is present. The “overload” LED indicates that the input signal has exceeded ± 2.2 V. The “fault” LED indicates a problem with the unit’s internal dc power supply.

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Specifications

Input

Impedance	75 Ω, ±1%
Linear range	± 2 V
Damage (dc)	5 V
Damage (1us)	100 V

Outputs

Impedance	75 Ω, ±1%
Nom load	75 Ω

Performance (75 Ω loads)

Gain (75 Ω load)	× 1.00, ±2%
Gain (high-Z load)	× 2.00, ±1%
Bandwidth (-3 dB)	> 100 MHz
Noise at 1 kHz	< 15 nV/√Hz
Offset	< 1 mV
Isolation (10 MHz)	> 120 dB



Figure 18. Broadband distribution amplifer small signal response for 20MHz square wave from Channels 1, 3, 5 & 7.

For circuit description and additional performance characteristic see Option 04, Broadband 50Ω Distribution Amplifier.

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Test and calibration

Broadband 75 Ω distribution amplifier

Check out.

1. With the instrument plugged into an ac power source and turned "on", but with no input applied, measure the dc voltage at each of the seven outputs and confirm that the output voltage is less than ±1mV.

2. Apply a 10MHz, 0.1V_{PP} square wave to the 75Ω input BNC. The source should have a rise time of <1ns. (The Q-output of a CG635 set to +7dBm with a 20dB attenuator makes a good source.) Verify that the seven outputs have the same amplitude as the input when viewed on an oscilloscope with > 300MHz bandwidth (use a 25 Ω series resistor to a 50Ω input.) The output transition times should be about 3ns and the overshoot should be < 2%.

Calibration.

1. With the instrument plugged into an ac power source and turned "on", but with no input applied, adjust P2 to null the output offset of the preamp (U5) at the location indicated by the PCB silkscreen.

2. For each of the seven output buffer amplifiers, adjust the offset pot (P100, P200…P700) to null the output voltage at the corresponding BNC output.

3. Apply 1.000Vdc to the input BNC. Adjust the gain pot (P3) for 2.000Vdc at the Channel #1 output BNC (output is unterminated.) (The Q-output of a CG635, Stopped & Toggled and with Q-High adjusted to 1.000V, works.)

4. Apply a 10MHz, 0.1V_{PP} square wave to the 75Ω input BNC. The source should have a rise time of <1ns. (The Q-output of a CG635 set to +7dBm with a 20dB attenuator followed by a resistive 50Ω to 75Ω match makes a good source.) Adjust the HF Comp pot (P1) for a small overshoot (0.5%) on the Channel #1 output when viewed on an oscilloscope with > 300MHz bandwidth (use a 25 Ω series resistor to a 50Ω input.)

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Option 05 (Broadband 75 Ω) Component parts list

Part Number	Reference	Value	Description
7-01929	BL-1	BNC BLOCK	
5-00516	C-1	330U HIGH RIPPL	Capacitor, Electrolytic, High Ripple, High Temp (-55/+105 DEG C)
5-00516	C-2	330U HIGH RIPPL	Capacitor, Electrolytic, High Ripple, High Temp (-55/+105 DEG C)
5-00319	C-3	10U/T35	SMD TANTALUM, D-Case
5-00319	C-4	10U/T35	SMD TANTALUM, D-Case
5-00299	C-5	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-6	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-7	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-8	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-9	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-10	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-11	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-12	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00375	C-13	100P	Capacitor, Mono, 50V, 5%, NPO, 1206
5-00375	C-14	100P	Capacitor, Mono, 50V, 5%, NPO, 1206
5-00298	C-15	.01U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00375	C-16	100P	Capacitor, Mono, 50V, 5%, NPO, 1206
5-00375	C-17	100P	Capacitor, Mono, 50V, 5%, NPO, 1206
5-00298	C-18	.01U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00319	C-21	10U/T35	SMD TANTALUM, D-Case
5-00299	C-100	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-101	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-102	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-103	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-200	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-201	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-202	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-203	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-300	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-301	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-302	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-303	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-400	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-401	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-402	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-403	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-500	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-501	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-502	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-503	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-600	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-601	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-602	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-603	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-700	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-701	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-702	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-703	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
3-00896	D-1	BAV99	BAV99, DUAL SERIES DIODE, 70V BREAKDOWN

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3-00783	D-2	MMBZ5226	MMBZ5226, 3.3V ZENER
3-00783	D-3	MMBZ5226	MMBZ5226, 3.3V ZENER
3-00538	D-4	MMBD352L-ROHS	MMBD352L, DUAL SCHOTTKY DIODE
3-00538	D-5	MMBD352L-ROHS	MMBD352L, DUAL SCHOTTKY DIODE
1-00469	J-1	2 PIN, RT.ANGLE	Header, SIM, Right Angle, Polarized
1-01158	J-2	73100-0195	
1-01158	J-100	73100-0195	
1-01158	J-200	73100-0195	
1-01158	J-300	73100-0195	
1-01158	J-400	73100-0195	
1-01158	J-500	73100-0195	
1-01158	J-600	73100-0195	
1-01158	J-700	73100-0195	
6-00174	L-1	6611 TYPE 43	Ferite Bead, Thru-hole, Type 43
6-00174	L-2	6611 TYPE 43	Ferite Bead, Thru-hole, Type 43
6-00236	L-3	FR47	Ferrite Bead, SMD, Type 43/44, 1812
6-00236	L-4	FR47	Ferrite Bead, SMD, Type 43/44, 1812
6-00236	L-5	FR47	Ferrite Bead, SMD, Type 43/44, 1812
6-00236	L-6	FR47	Ferrite Bead, SMD, Type 43/44, 1812
6-00236	L-100	FR47	Ferrite Bead, SMD, Type 43/44, 1812
6-00236	L-101	FR47	Ferrite Bead, SMD, Type 43/44, 1812
6-00236	L-200	FR47	Ferrite Bead, SMD, Type 43/44, 1812
6-00236	L-201	FR47	Ferrite Bead, SMD, Type 43/44, 1812
6-00236	L-300	FR47	Ferrite Bead, SMD, Type 43/44, 1812
6-00236	L-301	FR47	Ferrite Bead, SMD, Type 43/44, 1812
6-00236	L-400	FR47	Ferrite Bead, SMD, Type 43/44, 1812
6-00236	L-401	FR47	Ferrite Bead, SMD, Type 43/44, 1812
6-00236	L-500	FR47	Ferrite Bead, SMD, Type 43/44, 1812
6-00236	L-501	FR47	Ferrite Bead, SMD, Type 43/44, 1812
6-00236	L-600	FR47	Ferrite Bead, SMD, Type 43/44, 1812
6-00236	L-601	FR47	Ferrite Bead, SMD, Type 43/44, 1812
6-00236	L-700	FR47	Ferrite Bead, SMD, Type 43/44, 1812
6-00236	L-701	FR47	Ferrite Bead, SMD, Type 43/44, 1812
0-00241	M-1	4-40X3/16PP	
0-00241	M-2	4-40X3/16PP	
0-00241	M-3	4-40X3/16PP	
0-00241	M-4	4-40X3/16PP	
0-00241	M-5	4-40X3/16PP	
0-00241	M-6	4-40X3/16PP	
0-00241	M-7	4-40X3/16PP	
0-00241	M-8	4-40X3/16PP	
0-00241	M-9	4-40X3/16PP	
0-00241	M-10	4-40X3/16PP	
0-00241	M-11	4-40X3/16PP	
4-00485	P-1	1K	Pot, Multi Turn, Top Adjust
4-00013	P-2	50K	Pot, Multi Turn, Top Adjust
4-00487	P-3	20	Pot, Multi Turn, Top Adjust
4-00013	P-100	50K	Pot, Multi Turn, Top Adjust
4-00013	P-200	50K	Pot, Multi Turn, Top Adjust
4-00013	P-300	50K	Pot, Multi Turn, Top Adjust
4-00013	P-400	50K	Pot, Multi Turn, Top Adjust
4-00013	P-500	50K	Pot, Multi Turn, Top Adjust
4-00013	P-600	50K	Pot, Multi Turn, Top Adjust
4-00013	P-700	50K	Pot, Multi Turn, Top Adjust

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7-01927	PC-1	FS715/720 OPT	
3-01091	Q-1	MJD44H11	
3-01100	Q-2	MJD45H11	
4-01213	R-1	10.0K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01117	R-2	1.00K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01213	R-3	10.0K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01309	R-4	100K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01021	R-5	100	Resistor, Thin Film, 1%, 50 ppm, MELF
4-00320	R-6	18	Resistor, Wire-wound
4-00320	R-7	18	Resistor, Wire-wound
4-01110	R-8	845	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01029	R-9	121	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01142	R-10	1.82K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01059	R-11	249	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01213	R-12	10.0K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01088	R-13	499	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01213	R-14	10.0K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01009	R-15	75	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01038	R-16	omit	Resistor, Thin Film, 1%, 50 ppm, MELF
4-00992	R-18	49.9	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01117	R-19	1.00K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01117	R-20	1.00K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01376	R-21	499K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01103	R-22	715	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01088	R-23	499	Resistor, Thin Film, 1%, 50 ppm, MELF
4-00939	R-24	14	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01146	R-25	2.00K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01146	R-26	2.00K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01146	R-27	2.00K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01146	R-28	2.00K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01067	R-29	301	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01113	R-30	909	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01309	R-31	100K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01117	R-32	1.00K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01021	R-33	100	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01309	R-34	100K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01309	R-35	100K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01021	R-36	100	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01309	R-37	100K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01117	R-38	1.00K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01405	R-39	1.00M	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01309	R-40	100K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01021	R-41	100	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01175	R-42	4.02K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01192	R-43	6.04K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01192	R-44	6.04K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01175	R-45	4.02K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01309	R-46	100K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01021	R-47	100	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01405	R-48	1.00M	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01067	R-100	301	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01113	R-101	909	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01009	R-102	75	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01038	R-103	omit	Resistor, Thin Film, 1%, 50 ppm, MELF

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4-01376	R-105	499K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01067	R-200	301	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01113	R-201	909	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01009	R-202	75	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01038	R-203	omit	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01376	R-205	499K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01067	R-300	301	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01113	R-301	909	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01009	R-302	75	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01038	R-303	150	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01376	R-305	499K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01067	R-400	301	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01113	R-401	909	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01009	R-402	75	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01038	R-403	omit	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01376	R-405	499K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01067	R-500	301	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01113	R-501	909	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01009	R-502	75	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01038	R-503	omit	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01376	R-505	499K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01067	R-600	301	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01113	R-601	909	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01009	R-602	75	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01038	R-603	omit	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01376	R-605	499K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01067	R-700	301	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01113	R-701	909	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01009	R-702	75	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01038	R-703	omit	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01376	R-705	499K	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01003	R-800	64.9	Resistor, Thin Film, 1%, 50 ppm, MELF
3-00729	U-1	LM741C	LM741C general purpose op amp
3-01842	U-2	LM1086CS-ADJ	
3-01817	U-3	LM2991S	
3-00728	U-4	LM393	LM393, Dual Comparator, SO-8
3-01118	U-5	THS3001	
3-01118	U-6	THS3001	
3-00728	U-7	LM393	LM393, Dual Comparator, SO-8
3-00728	U-8	LM393	LM393, Dual Comparator, SO-8
3-00728	U-9	LM393	LM393, Dual Comparator, SO-8
3-01118	U-100	THS3001	
3-01118	U-200	THS3001	
3-01118	U-300	THS3001	
3-01118	U-400	THS3001	
3-01118	U-500	THS3001	
3-01118	U-600	THS3001	
3-01118	U-700	THS3001	
0-00772	Z-0	1.5" WIRE	
0-01259	Z-0	1/2" CUSTOM	
7-02021	Z-0	BNC TOOL	

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SDI Distribution Amplifier (Option 06)

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SDI distribution amplifier (Option 6)



Figure 18. Single SDI distribution amplifier, FS730/6.
The FS735 dual distribution amplifier is also available.

Overview

This distribution amplifier is intended to distribute SDI (Serial Digital Interface) video data. SDI data is received on the 75 Ω input. Data is equalized, reclocked, and output to six SDI outputs. The recovered clock is also available as an output, allowing the system integrator to observe the eye pattern of the recovered data. (The recovered clock is a half the bit rate for 2.97Gb/s data rates.)

The input equalization can compensate for the losses and dispersion in 120 meters of Belden 1694A cable at 2.97 Gb/s. Reclocking circuits operate at the standard rates of 270, 1483.5, 1485, 2967 and 2970 Mb/s. (The unit will pass outputs at other data rates without reclocking.)

There are three indicator LEDs. The “power” LED indicates that the unit has ac power. The “signal” LED indicates that an input SDI signal is present. The “fault” LED indicates that the reclocking oscillator has not locked to one of the supported data rates.

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Specifications

Input

Impedance	75 Ω, ±5%
VSWR	> 15 dB
Equalization range	120 m at 2.97 Gb/s
(Belden 1694A)	140 m at 1.48 Gb/s
	350 m at 270 Mb/s

Outputs

Impedance	75 Ω, ±5%
VSWR	> 15 dB
Amplitude	800 mV, ±10%
Outputs	6 SDI, 3 ASI & 1 clock
SMPTE	259M, 292M & 424M
Reclocking	270, 1483.5, 1485, 2967 & 2970 Mb/s
Pass through	143, 177, 360 & 540 Mb/s

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Option 06 (SDI) Components parts list

Part Number	Reference	Value	Description
5-00525	C-1	1U	CAP 1UF 25V CERAMIC Y5V 1206 +80/ -20%
5-00525	C-2	1U	CAP 1UF 25V CERAMIC Y5V 1206 +80/ -20%
5-00299	C-3	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00525	C-4	1U	CAP 1UF 25V CERAMIC Y5V 1206 +80/ -20%
5-00299	C-5	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-6	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00408	C-7	.056U	Capacitor, Mono, 50V, 5%, NPO, 1206
5-00370	C-8	39P	Capacitor, Mono, 50V, 5%, NPO, 1206
5-00370	C-9	39P	Capacitor, Mono, 50V, 5%, NPO, 1206
5-00299	C-10	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-11	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-12	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-13	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00319	C-14	10U/T35	SMD TANTALUM, D-Case
5-00319	C-15	10U/T35	SMD TANTALUM, D-Case
5-00319	C-16	10U/T35	SMD TANTALUM, D-Case
5-00299	C-20	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-21	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00611	C-22	4.7U - 16V X5R	
5-00611	C-23	4.7U - 16V X5R	
5-00299	C-30	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-31	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00611	C-32	4.7U - 16V X5R	
5-00611	C-33	4.7U - 16V X5R	
5-00299	C-40	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00299	C-41	.1U	Capacitor, Mono, 50V, 10%, X7R, 1206
5-00611	C-42	4.7U - 16V X5R	
5-00611	C-43	4.7U - 16V X5R	
1-01158	J-1	73100-0195	
1-01158	J-2	73100-0195	
1-01158	J-3	73100-0195	
1-01158	J-4	73100-0195	
1-01158	J-5	73100-0195	
1-01158	J-6	73100-0195	
1-01158	J-7	73100-0195	
1-01158	J-8	73100-0195	
1-01043	J-9	5POS .100 JMPR	
1-01043	J-10	5POS .100 JMPR	
1-00250	J-11	2 PIN, WHITE	Header, SIM, Polarized
1-00250	J-12	2 PIN, WHITE	Header, SIM, Polarized
6-00771	L-1	5.6NH	
6-00236	L-2	FR47	Ferrite Bead, SMD, Type 43/44, 1812
6-00236	L-3	FR47	Ferrite Bead, SMD, Type 43/44, 1812
6-00236	L-4	FR47	Ferrite Bead, SMD, Type 43/44, 1812
6-00236	L-5	FR47	Ferrite Bead, SMD, Type 43/44, 1812
6-00647	L-6	47UH	
6-00647	L-7	47UH	
6-00236	L-20	FR47	Ferrite Bead, SMD, Type 43/44, 1812
6-00771	L-21	5.6NH	

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6-00771	L-22	5.6NH	
6-00236	L-30	FR47	Ferrite Bead, SMD, Type 43/44, 1812
6-00771	L-31	5.6NH	
6-00771	L-32	5.6NH	
6-00236	L-40	FR47	Ferrite Bead, SMD, Type 43/44, 1812
6-00771	L-41	5.6NH	
6-00771	L-42	5.6NH	
4-01009	R-1	75	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01009	R-2	75	Resistor, Thin Film, 1%, 50 ppm, MELF
4-00980	R-3	37.4	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01021	R-4	100	Resistor, Thin Film, 1%, 50 ppm, MELF
4-00992	R-5	49.9	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01050	R-6	200	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01050	R-7	200	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01050	R-8	200	Resistor, Thin Film, 1%, 50 ppm, MELF
4-00992	R-20	49.9	Resistor, Thin Film, 1%, 50 ppm, MELF
4-00992	R-21	49.9	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01105	R-22	750	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01009	R-23	75	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01009	R-24	75	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01009	R-25	75	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01009	R-26	75	Resistor, Thin Film, 1%, 50 ppm, MELF
4-00992	R-30	49.9	Resistor, Thin Film, 1%, 50 ppm, MELF
4-00992	R-31	49.9	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01105	R-32	750	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01009	R-33	75	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01009	R-34	75	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01009	R-35	75	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01009	R-36	75	Resistor, Thin Film, 1%, 50 ppm, MELF
4-00992	R-40	49.9	Resistor, Thin Film, 1%, 50 ppm, MELF
4-00992	R-41	49.9	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01105	R-42	750	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01009	R-43	75	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01009	R-44	75	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01009	R-45	75	Resistor, Thin Film, 1%, 50 ppm, MELF
4-01009	R-46	75	Resistor, Thin Film, 1%, 50 ppm, MELF
3-01831	U-1	LMH0344SQ	
3-01832	U-2	LMH0346MH	
3-01833	U-3	NB7L14MMNG	
3-01790	U-6	LM1086CT-3.3	
3-01830	U-20	LMH0302SQ	
3-01830	U-30	LMH0302SQ	
3-01830	U-40	LMH0302SQ	
6-00770	Y-1	27MHZ	
0-01259	Z-0	1/2" CUSTOM	
7-02021	Z-0	BNC TOOL	
7-01929	Z-1	BNC BLOCK	
7-01928	Z-2	FS715/720 OPT	

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Distribution amplifier configurations

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Model numbers and chassis configurations

SRS distribution amplifiers are available in two form factors:

> **The FS730** is a half-width 1U chassis which accommodates one distribution amplifier. The BNCs and indicator LEDs are on the *front* of the unit. The AC power entry is on the rear panel. Two units can fit side-by-side in the O730RMD rack mount designed for a 19" rack.
>
> **The FS735** is a full-width, 1U chassis which accommodates one or two distribution amplifiers. The BNCs and ac power entry are on the *rear* of the unit. Indicator LEDs are on the front of the unit.

Both designs have universal power supplies, operate without cooling fans, and have rubber feet but may be mounted in a 19" equipment rack. One of the following may be installed in an FS730. Any two of the following may be installed in an FS735:

Option 0 Cover plate (When there's only one distribution amp in the FS735.)
Option 1 10 MHz. Amplified and limited input, seven 1V_{RMS}, 50 Ω outputs.
Option 2 5 MHz. Amplified and limited input, seven 1 V_{RMS}, 50 Ω outputs.
Option 3 CMOS Logic. One 1 kΩ input. Seven 5 V, 50 Ω outputs.
Option 4 Broadband 50 Ω. Analog DC to 350 MHz, ±3 V. Seven 50 Ω outputs.
Option 5 Broadband 75 Ω. Analog DC to 350 MHz, ±3 V. Seven 75 Ω outputs.
Option 6 SDI. Recovered clock & six equalized and re-clocked SDI outputs.

Model Numbers

FS730-x	**Half-width single distribution amplifier with front panel outputs**
FS731	**Rack mount to hold two FS730s in a 19" equipment rack**
FS735-x-0	**Full-width single distribution amplifier with rear panel outputs**
FS735-x-y	**Full-width dual distribution amplifier with rear panel outputs**

The suffixes x & y denote the installed distribution amplifier(s). Examples: an FS730-6 is a single, half-width, SDI distribution amplifier; an FS735-1-4 is a full width unit with one 10 MHz distribution amplifier and one broadband analog 50 Ω distribution amplifier.

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FS730 Chassis components parts list

Part Number	Reference	Value	Description
0-00095	Z-0	#4 FLAT	
0-01068	Z-0	SR445A FOOT	
6-00779	Z-0	PSA15LN3-240-R	
7-01480	Z-0	SR445A, RCK MT	
7-01935	Z-0	FS730/1 LEXAN	
7-01936	Z-0	FS730/2 LEXAN	
7-01937	Z-0	FS730/3 LEXAN	
7-01938	Z-0	FS730/4 LEXAN	
7-01939	Z-0	FS730/5 LEXAN	
7-01940	Z-0	FS730/6 LEXAN	
7-01930	Z-1	FS715 CHASSIS	
7-01931	Z-2	FS715 COVER	
7-01932	Z-3	FS730 POWER SHD	
0-00197	Z-4	3ED8	
7-01622	Z-5	SR445A MYLAR	
0-00536	Z-6	31894	
0-00517	Z-7	BINDING POST	
0-01213	Z-8	2-520182-2	
0-01213	Z-9	2-520182-2	
0-01213	Z-10	2-520182-2	
0-01213	Z-11	2-520182-2	
2-00060	Z-12	RC1083BBLKBLKFF	
1-00033	Z-13	5 PIN, 18AWG/OR	Non board mount, Female, Seperate wire, 18 AWG
0-01005	Z-14	6" BLACK	
0-01008	Z-15	6" WHITE	
1-00254	Z-16	2 PIN, 22AWG/RD	Non board mount, Female, Seperate wire, 22 AWG
1-00254	Z-17	2 PIN, 22AWG/RD	Non board mount, Female, Seperate wire, 22 AWG
0-00143	Z-18	5.5" #22 RED	
0-00145	Z-19	5.5" #22 BLACK	
0-01212	Z-20	6-32X1/4 BLACK	
0-01212	Z-21	6-32X1/4 BLACK	
0-01212	Z-22	6-32X1/4 BLACK	
0-01212	Z-23	6-32X1/4 BLACK	
0-01212	Z-24	6-32X1/4 BLACK	
0-01212	Z-25	6-32X1/4 BLACK	
0-01212	Z-26	6-32X1/4 BLACK	
0-01212	Z-27	6-32X1/4 BLACK	
0-01212	Z-28	6-32X1/4 BLACK	
0-01212	Z-29	6-32X1/4 BLACK	
0-00240	Z-30	4-40X3/8PF	
0-00240	Z-31	4-40X3/8PF	
0-00240	Z-32	4-40X3/8PF	
0-00240	Z-33	4-40X3/8PF	
0-00187	Z-34	4-40X1/4PP	
0-00043	Z-35	4-40 KEP	
0-00043	Z-36	4-40 KEP	
0-00096	Z-37	#4 SPLIT	
0-00096	Z-38	#4 SPLIT	
0-00096	Z-39	#4 SPLIT	
0-00096	Z-40	#4 SPLIT	
0-00096	Z-41	#4 SPLIT	
1-01043	Z-42	5POS .100 JMPR	
7-01993	Z-43	FS735 / 730	
3-00010	Z-44	GREEN	LED, T1 Package, 3mm diameter
3-00010	Z-45	GREEN	LED, T1 Package, 3mm diameter
3-00011	Z-46	RED	LED, T1 Package, 3mm diameter

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3-00011	Z-47	RED	LED, T1 Package, 3mm diameter
0-00240	Z-48	4-40X3/8PF	
0-00240	Z-49	4-40X3/8PF	
0-00252	Z-50	GROMMET	
0-00222	Z-51	6-32X1/4PP	
0-00222	Z-52	6-32X1/4PP	
0-00222	Z-53	6-32X1/4PP	
0-00222	Z-54	6-32X1/4PP	

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FS735 Chassis components parts list

Part Number	Reference	Value	Description
0-00095	Z-0	#4 FLAT	
0-00221	Z-0	SR440FOOT	
0-01008	Z-0	6" WHITE	
0-01014	Z-0	4"GREEN W/YELL	
6-00779	Z-0	PSA15LN3-240-R	
7-01945	Z-0	FS735 LEXAN	
7-01946	Z-0	FS735/0 LEXAN	
7-01947	Z-0	FS735/1 LEXAN	
7-01948	Z-0	FS735/2 LEXAN	
7-01949	Z-0	FS735/3 LEXAN	
7-01950	Z-0	FS735/4 LEXAN	
7-01951	Z-0	FS735/5 LEXAN	
7-01952	Z-0	FS735/6 LEXAN	
7-01970	Z-0	FS735 RKMNT BKT	
7-01941	Z-1	FS735 CHASSIS	
7-01942	Z-2	FS735 COVER	
7-01943	Z-3	FS735 LINE CVR	
7-01944	Z-4	FS735 P/S COVER	
7-01945	Z-5	FS735 LEXAN	
0-01045	Z-6	3EEA1	
0-00634	Z-7	2-520184-2	
0-00634	Z-8	2-520184-2	
0-00634	Z-9	2-520184-2	
0-01213	Z-10	2-520182-2	
0-01213	Z-11	2-520182-2	
0-01213	Z-12	2-520182-2	
0-01213	Z-13	2-520182-2	
0-00084	Z-14	36154	
2-00060	Z-15	RC1083BBLKBLKFF	
1-00033	Z-16	5 PIN, 18AWG/OR	Non board mount, Female, Separate wire, 18 AWG
1-01195	Z-17	5-PIN, 18GA	
0-00329	Z-18	8" #18 BLACK	
0-00327	Z-19	8" #18 WHITE	
0-01005	Z-20	6" BLACK	
0-00252	Z-22	GROMMET	
0-00252	Z-23	GROMMET	
0-00252	Z-24	GROMMET	
1-00254	Z-25	2 PIN, 22AWG/RD	Non board mount, Female, Separate wire, 22 AWG
1-00254	Z-26	2 PIN, 22AWG/RD	Non board mount, Female, Separate wire, 22 AWG
1-00254	Z-27	2 PIN, 22AWG/RD	Non board mount, Female, Separate wire, 22 AWG
1-00254	Z-28	2 PIN, 22AWG/RD	Non board mount, Female, Separate wire, 22 AWG
0-00154	Z-33-A	7.5" #22 RED	
0-00154	Z-33-B	7.5" #22 RED	
0-00161	Z-34-A	7.5" #22 BLACK	
0-00161	Z-34-B	7.5" #22 BLACK	
0-01212	Z-35	6-32X1/4 BLACK	
0-01212	Z-36	6-32X1/4 BLACK	
0-01212	Z-37	6-32X1/4 BLACK	

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0-01212	Z-38	6-32X1/4 BLACK	
0-01212	Z-39	6-32X1/4 BLACK	
0-01212	Z-40	6-32X1/4 BLACK	
0-01212	Z-41	6-32X1/4 BLACK	
0-01212	Z-42	6-32X1/4 BLACK	
0-01212	Z-43	6-32X1/4 BLACK	
0-01212	Z-44	6-32X1/4 BLACK	
0-01212	Z-45	6-32X1/4 BLACK	
0-01212	Z-46	6-32X1/4 BLACK	
0-01212	Z-47	6-32X1/4 BLACK	
0-01212	Z-48	6-32X1/4 BLACK	
0-00187	Z-49	4-40X1/4PP	
0-00187	Z-50	4-40X1/4PP	
0-00187	Z-51	4-40X1/4PP	
0-00187	Z-52	4-40X1/4PP	
0-00187	Z-53	4-40X1/4PP	
0-00187	Z-54	4-40X1/4PP	
0-00048	Z-55	6-32 KEP	
0-00048	Z-56	6-32 KEP	
0-00048	Z-57	6-32 KEP	
0-00048	Z-58	6-32 KEP	
0-00209	Z-59	4-40X3/8PP	
0-00209	Z-60	4-40X3/8PP	
0-00209	Z-61	4-40X3/8PP	
0-00209	Z-62	4-40X3/8PP	
0-00209	Z-63	4-40X3/8PP	
0-00209	Z-64	4-40X3/8PP	
0-00209	Z-65	4-40X3/8PP	
0-00209	Z-66	4-40X3/8PP	
0-00043	Z-67	4-40 KEP	
0-00043	Z-68	4-40 KEP	
0-00096	Z-69	#4 SPLIT	
0-00096	Z-70	#4 SPLIT	
0-00096	Z-71	#4 SPLIT	
0-00096	Z-72	#4 SPLIT	
0-00096	Z-73	#4 SPLIT	
0-00096	Z-74	#4 SPLIT	
0-00096	Z-75	#4 SPLIT	
0-00096	Z-76	#4 SPLIT	
0-00096	Z-77	#4 SPLIT	
0-00096	Z-78	#4 SPLIT	
1-01196	Z-79	5 COND.	
1-01196	Z-80	5 COND.	
3-00010	Z-81	GREEN	LED, T1 Package, 3mm diameter
3-00010	Z-82	GREEN	LED, T1 Package, 3mm diameter
3-00011	Z-83	RED	LED, T1 Package, 3mm diameter
3-00011	Z-84	RED	LED, T1 Package, 3mm diameter
7-01993	Z-85	FS735 / 730	
0-00240	Z-86	4-40X3/8PF	
0-00240	Z-87	4-40X3/8PF	
0-00222	Z-88	6-32X1/4PP	
0-00222	Z-89	6-32X1/4PP	
0-00222	Z-90	6-32X1/4PP	
0-00222	Z-91	6-32X1/4PP	

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List of Schematics

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2. FS1_2B Opt 1&2 (5/10MHz Distribution Amplifier) Sheet 2 of 2, Rev B
3. FS3_1C Opt 3 (CMOS Logic Distribution Amplifier) Sheet 1 of 1, Rev C
4. FS4_1B Opt 4& 5 (Broadband Distribution Amplifier) Sheet 1 of 1, Rev B

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