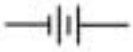
MODEL SR445

FAST PREAMPLIFIER

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

Revision 1.2 (10/2001)

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)

INTRODUCTION

The Model SR445 Fast Preamp contains four wide bandwidth, DC coupled amplifiers designed to be used independently or cascaded to provide gains of 5, 25, and 125.

The fast rise time, low noise, and DC accuracy of the SR445 make it the ideal instrument for amplifying outputs of fast photomultiplier tubes and photodiodes.

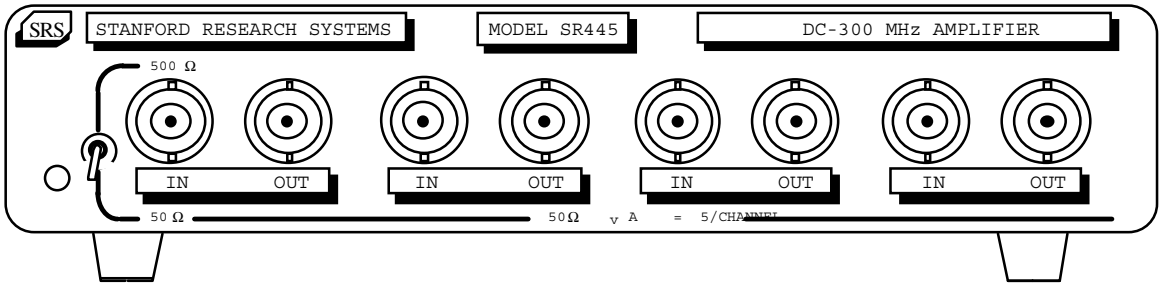


Figure 1 - SR445 Front Panel

TYPICAL SPECIFICATIONS

INPUTS	50 Ω impedance, DC coupled, BNC connectors (channel 1 selectable 50 or 500 Ω).
OUTPUTS	DC coupled, BNC connectors (terminate into 50 Ω).
VOLTAGE GAIN	5.0 per channel (up to 3 channels can be cascaded).
BANDWIDTH	DC to 300 MHz (-3 dB).
RISE/FALL TIME	1.2 ns.
PROPAGATION DELAY	2.2 ns.
RECOVERY TIME	<4 ns for a times 20 overload.
OPERATING RANGE	inputs ±200 mV, outputs ±1.0 V.
OVERSHOOT	±5%.
NOISE	<50 μV rms referenced to the input, (2.2 nV/√Hz).
STABILITY	10 μV/°C referenced to the inputs (0 to 50°C).
OFFSET	input ±50 μV (adjustable).
PROTECTION	±3.5 V DC, ±50 V transient.
MECHANICAL	7.7" x 6.7" x 2".
POWER	16W, 100/120/ 220/240 VAC, 50/60 Hz.
WARRANTY	One year parts and labor on materials and workmanship.

OPERATION

The SR445 Fast Preamplifier is useful for amplifying small signals to levels that allow processing by other instruments such as the SR430 Multichannel Scaler, or the SR400 Gated Photon Counter. The four channels may be used independently or cascaded. The following table shows the maximum input voltage for linear operation as a function of amplitude gain.

Number of Channels	Gain	Maximum Input
1	5	200 mV
2	25	40 mV
3	125	8 mV

The input impedance of channel 1 can be increased to approximately 500 Ω by using the front panel switch. This can improve the sensitivity to signals from current and charge output devices such as photo-multiplier tubes. However, under these conditions cable capacitance must be kept as low as possible to preserve the frequency response and rise time of channel 1. The other three channels are unaffected.

TROUBLESHOOTING

WARNING: Dangerous voltages are present on the printed circuit board. Always turn the power off and disconnect the line cord before removing the cover or changing components.

The diodes in the overload protection circuit can be damaged by excessive voltages at the input of any stage. To check for damage, measure for 0.6 Volts across diodes D1 through D4. Recalibration is necessary if any of the diodes are changed.

CALIBRATION

There are two rows of 4 holes in the cover, which access the offset calibration pots. The first row is the input offset adjust, and the second row the output offset adjust.

Allow at least 30 minutes for the unit to warm up before calibrating. To calibrate the input offset, connect a voltmeter to the input and adjust the pot at the front hole in line with that channel to 0.0 V ±10 μV. To calibrate the output offset, connect a voltmeter to the output and adjust the pot at the back hole in line with that channel to 0.0 V ±50 μV.

CIRCUIT DESCRIPTION

Input signal coupling is provided by D1, D2, D3, and D4 which are biased by R14, R8, R9, and R27. Positive overload protection is supplied by the action of Q6 and D10. When the output reaches +1.25 Volts, Q6 begins to conduct, stealing bias current from D1 and D3. Thus, the input voltage is effectively clamped at ±0.25 Volts. Similarly, Q5 and D8 provide negative overload protection. Input offsets are nulled out with P1. SW1 allows the channel 1 input impedance to be increased to 500 Ω by the use of bootstrapping. Q1 and Q2 comprise a fully symmetrical push-pull output stage that is driven by the complimentary pair of Q3 and Q4. U1 uses feedback to maintain DC accuracy and P2 adjusts the output offset voltage of the amplifier.

OVERLOAD BEHAVIOR

The SR445 accurately amplifies input signals from -200 mV to +200 mV. Transient overloads to ±50 Volts can be safely accommodated, and DC inputs up to ±3.5 Volts that will not damage the unit. The time required for the amplifier output to return from an overload condition is a function of the duration of the overload and the error allowance of the application. A graph of recovery time versus overload duration is shown in Figure 2. The input referred error bands are defined as the voltage difference

between the input signal and the output voltage divided by the amplifier gain (5 Volts/Volt). For example, after a 100 ns overload, 1 µs is required to reach 2 mV accuracy (input referred). However, if 20 mV accuracy is sufficient, then the amplifier will recover from the same overload in 20 ns.

LINE VOLTAGE SELECTION

The SR445 operates from a 100, 120, 220 or 240 Volt AC nominal, 50 or 60 Hz power source. Before applying power, verify that the line selector card (located in the power entry module) is in the correct position. The selected voltage is indicated by the white dot on the voltage list.

To change the line voltage selection, disconnect the line cord and remove the fuse module with a small screwdriver. Pull out the voltage selection card (located at the right of the power entry module) with a pair of needle nose pliers. Rotate the plastic indicator until it lines up with the correct voltage indicated on the fuse holder and reinsert the card. Install the correct fuse, reinsert the fuse holder and replace the line cord.

LINE FUSE

Verify that the correct line fuse is installed before connecting the line cord. The rear panel indicates the correct fuse size, 1/4 Amp @ 100/120 Volts or 1/8 Amp @ 220/240 Volts. If necessary, the fuse can be changed as indicated in the line voltage selection section.

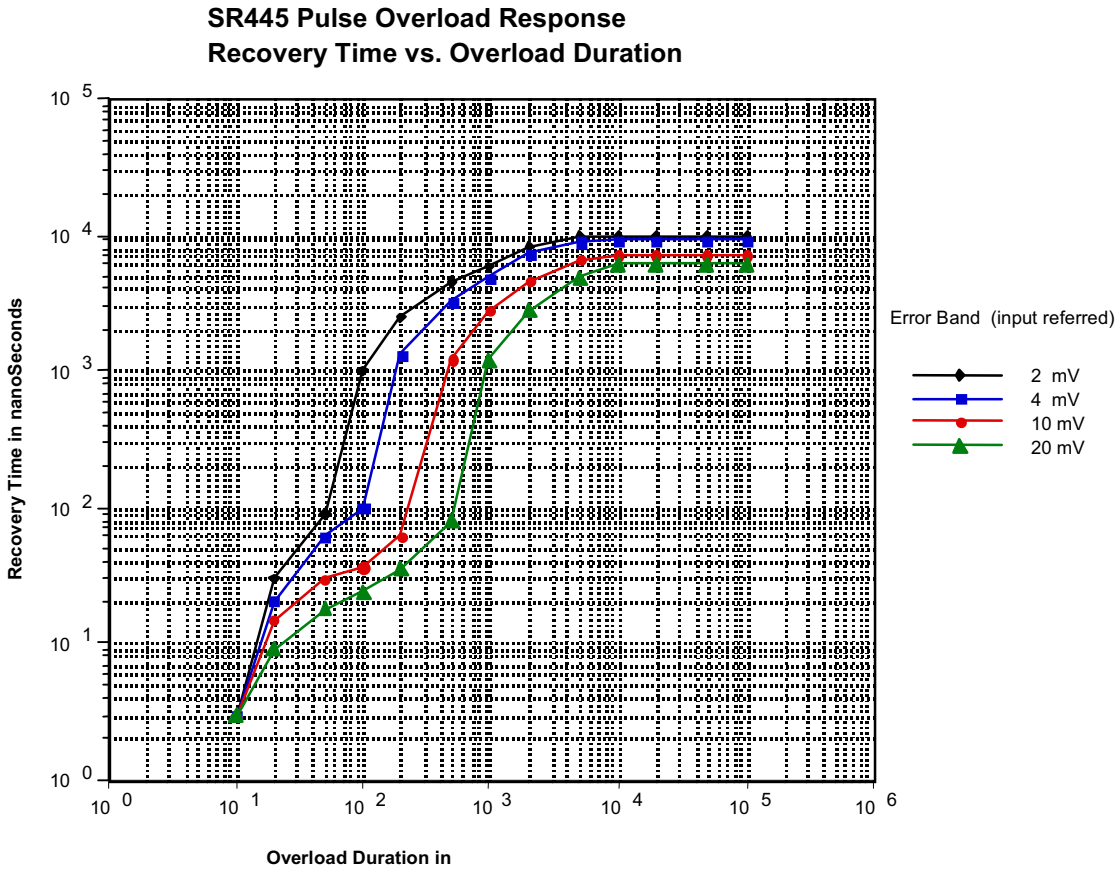


Figure 2