

U.S. Patent 4,079,189

DESCRIPTION

Increasing sophistication of modern sound systems has been accompanied by significant advances in the design of ancillary components that improve system performance. A major factor vital to speech reinforcement is reduction or control of acoustic feedback. To handle this pervasive problem, the ALTEC LANSING Model 1620A Acoustic Feedback Suppressor detects acoustic feedback, automatically lowers sound system gain, and then operates the system optimally below the threshold of feedback.

Feedback Detector. Audio sound produced by oscillation due to feedback is distinguished in character from that produced by the system audio program. Presence of any persistent feedback frequency is sensed by the 1620A's phase-lock loops and timing circuitry. Feedback sensing also occurs at critical thresholds of time and amplitude. Threshold sensitivity of the feedback detector circuit is manually adjustable from approximately -26 to $+4$ dBm. Detected signals are sent to the attenuation computer for further processing.

Attenuation Computer. System gain is automatically adjusted upon the detection of acoustic

feedback. 'Normal sound' does not affect system gain. Feedback sound' is coupled to an attenuator circuit which lowers gain. When feedback occurs, the attenuation computer cycles to determine how much attenuation is required to stop feedback. Optimum attenuation is then introduced and indicated on an LED display. Attenuation range is in 3 dB increments to 18 dB, and a final 10 dB increment for a total range of 28 dB. Unity gain may be restored through the 1620A with a manually operated reset switch on the front panel. Provision is also made for remote resetting.

If power is turned off or disconnected from the 1620A, the signal path is automatically bypassed through a bypass relay. When power is restored, the relay energizes to return the signal path through the 1620A. Noise suppression circuitry assures quiet operation of the bypass relay and guards against turn on/off transients.

The 1620A is housed in a 19-inch chassis that occupies $1\frac{3}{4}$ inches of vertical rack space in a standard 19-inch equipment rack. XLR type receptacles and barrier type terminal strips are provided for input and output connections.

OPERATING INSTRUCTIONS

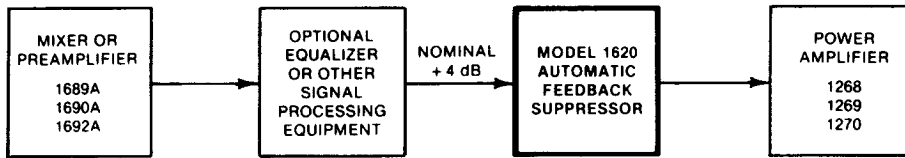


Figure 1. System Sequence

INSTALLATION

Rack Mounting

The 1620 may be installed in a standard 19-inch equipment rack. Vertical space required is 1¾". Rack installation is accomplished by using the appropriate four mounting screws supplied.

Ventilation

The 1620 must be adequately ventilated to prevent excessive temperature rise. Maximum rated ambient operating temperature is 55°C (131°F).

100V, 200V, 220V, 240V, 50/60 Hz Power Connections

Refer to Authorized Altec Service Representative.

Input Connections

Connect the mixer or preamplifier of the system to the BALANCED INPUT of the 1620. Balanced input connections are made at the screw-terminal connectors or the XLR-3 type connector. Wiring for the XLR3 type connector is shown in Figure 2; Pin 2 is high, as on all Altec Lansing Products.

Output Connections

Connect the BALANCED OUTPUT of the 1620 to the power amplifier of the system, or to any signal processing equipment such as an equalizer. Balanced output connections are made at the associated screw-terminal connectors or the XLR-3 type connector. Wiring for the XLR-3 type connector is shown in Figure 2.

GND Connection

The chassis ground terminal is connected only when required to correct unsatisfactory grounding conditions for system configurations.

Input Signal Level

After the system is connected, turn on the equipment and adjust the mixer or preamplifier gain. Speak into the microphone at the anticipated average sound level and adjust the mixer or preamplifier for approxi-

mately +4 dBm to the 1620 input. At this nominal level, the green SIGNAL indicator on the front panel should flicker on and off. If the green SIGNAL indicator does not flicker, adjust the Sensitivity Control clockwise until the indicator begins to blink. All indicators of the ATTENUATION display should remain extinguished.

Increase gain of the system power amplifier(s) to the desired level and recheck proper operation of the 1620 by speaking into the microphone at the average anticipated level.

Sensitivity Control

A recessed sensitivity control is accessible from the front panel. Setting of the control determines the threshold input signal level at which the 1620 will begin to automatically introduce attenuation. Approximate range of the control is 30 dB, from -26 dBm to +4 dBm. Clockwise rotation of the control increases the threshold input signal level. Adjust the control clockwise until the green LED indicator begins to blink.

Attenuation Display

If acoustic feedback occurs in the system, the 1620 lowers system gain until the feedback stops. The amber attenuation indicators illuminate according to the amount of attenuation introduced. Attenuation is introduced in steps of 3 dB. If 3 dB of attenuation is sufficient to stop the feedback, only the 3 dB indicator illuminates. If 3 dB of attenuation is insufficient to stop the feedback, the 1620 continues to cycle and introduces another 3 dB of attenuation, and the 6 dB indicator illuminates also. This process will continue, illuminating each 3 dB indicator in sequence until enough attenuation is introduced into the system to stop the feedback. Cumulative steps of attenuation introduced are -3 dB, -6 dB, -9 dB, -12 dB, -15 dB, -18 dB, and -28 dB. The red indicator at the end of the attenuator sequence represents signal overload.

Reset

Once attenuation is introduced into the system, the 1620 maintains system gain at that level until reset with the manual push-button on the front panel, or by a remote

switch connected to the RESET screw terminals on the rear panel. After resetting, all attenuation indicators are turned off, and the 1620 again cycles to correct for any existing acoustic feedback.

If EMI/RFI interference is negligible, remote resetting may be accomplished up to one mile with regular #22 AWG twisted pair cable. In high EMI/RFI fields, #22 AWG twisted pair cable may be used approximately 50 yards; for more than 50 yards, coaxial cable is recommended.

Capture Time

A Capture Time Control is accessible from the rear panel, with the designations shown in Figure 3.



Figure 3. Designations of Capture Time Control

The control affects capture time required to lock on an oscillation produced by feedback. The control has been set at the factory to capture oscillations due to low level feedback in about 2½ seconds. High level oscillations due to feedback are captured immediately.

NOTE

It is not recommended to adjust this control. Attempts to adjust the control may result in unsatisfactory operation. Proper adjustment should be performed by qualified personnel.

General Operation

Purpose: The 1620 is intended to control acoustic feedback in *speech* reinforcement systems. However, the unit is not a panacea for the elimination of feedback. It should not be used as a limiter or compressor to compensate for errors of system gain adjustment. Operation of the 1620 may be enhanced by adding a limiter to the system. For best performance, the 1620 should be installed following all signal processing equipment, as shown in Figure 1. The system is designed to offer the following benefits:

1. Automatically detect acoustic feedback and attenuate system gain to a point below feedback.
2. Protect loudspeakers and amplifiers against possible damage by sustained violent feedback.

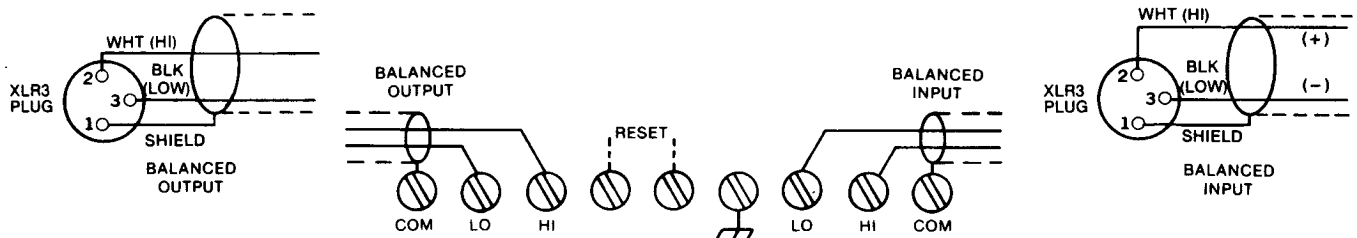


Figure 2. Wiring for Input and Output Connections

3. Safe operation without an operator attending the reinforcement system; the 1620 guards against the effects caused by 'proximity' feedback, yelling into the microphone, or dropping a microphone.

System Gain: For *normal operation*, sound system gain should be adjusted to introduce *no* attenuation. When one or more of

the 1620 attenuation indicators have illuminated, additional gain should *not* be introduced into the system to compensate for attenuation of sound. When the occurrence of feedback persists, the level controls of system mixers, preamplifiers and power amplifiers should be 'fine tuned' to obtain the best overall system performance without introducing attenuation from the 1620.

Bypass: The power switch may be turned off at any time to de-activate the 1620 while continuing to operate the reinforcement system. However, switching off the 1620 automatically restores any attenuation that may have been introduced to compensate for feedback; feedback may occur in the system.

SPECIFICATIONS

Type:	Acoustic feedback suppressor	Controls:	1 Sensitivity control (recessed screwdriver adjustment) 1 Reset pushbutton 1 AC line power switch/ bypass (off)
Gain:	Unity ± 1 dB	Indicators:	1 Attenuation display at -3 dB, -6 dB, -9 dB, -12 dB, -15 dB, -18 dB and -28 dB 1 LED signal indicator
Maximum Output Before Clipping:	+18 dBm (6.16V)	Connections:	1 XLR type (female) 3-pin input connector 1 XLR type (male) 3-pin output connector 1 barrier strip with screw terminals for input, output and remote reset
Frequency Response:	± 0.5 dB from 20 Hz to 20 kHz	Dimensions:	1 $\frac{3}{4}$ " (4.45 cm) H 19" (48.26 cm) W 8" (20.3 cm) D
THD:	Less than 0.05% 100 Hz to 20 kHz Less than 0.35% 20 Hz to 100 Hz	Weight:	5 pounds (2.27 kg)
Detector Sensitivity:	Continuously adjustable over 30 dB range (approximately -26 to +4 dBm)	Color:	Black
Input Impedance:	15,000 ohms, Balanced	Enclosure:	Rack mount chassis
Load Impedance:	600 ohms, Balanced		
Signal to Noise Ratio:	Better than 90 dB		
Operating Temperature:	Up to 55°C (131°F)		
Power Required:	100/120/200/220/240 Vac, 50/60 Hz, 5W		

ARCHITECT'S AND ENGINEER'S SPECIFICATIONS

The acoustic feedback suppressor shall detect oscillations due to acoustic feedback, automatically lower gain, and operate the system optimally below the threshold of feedback. Attenuation introduced into the system shall be presented on an LED display. Successive increments of available attenuation shall be approximately -3 dB, -6 dB, -9 dB, -12 dB, -15 dB, -18 dB, and -28 dB or greater. Manual reset to unity gain shall be provided, with capability for remote resetting. Automatic bypass of the feedback suppressor shall be provided. Noise suppression shall be included to eliminate turn on and turn off transients.

The acoustic feedback suppressor shall meet the following performance criteria. Output level, +18 dB (6.16V). Frequency response, ± 0.5 dB from 20 Hz to 20 kHz. THD, less than 0.05% from 100 Hz to 20 kHz, and 0.35% from 20 Hz to 100 Hz. Detector sensitivity, continuously adjustable over 30 dB range (approximately -26 to +4 dBm). Input impedance, 15,000 ohms balanced. Load impedance, 600 ohms balanced. Signal to noise ratio, better than 90 dB.

The acoustic feedback suppressor shall have dimensions of 1 $\frac{3}{4}$ " H x 19" W x 8" D, and shall weigh 5 pounds.

The acoustic feedback suppressor shall be the ALTEC LANSING Model 1620A.



10500 WEST RENO AVENUE
P.O. BOX 26105, OKLAHOMA CITY, OK 73126-0105