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4018 and 4018A Program Distribution Amplifiers

contents

1. general description

1.01 Tellabs' 4018 and 4018A Program Distribution Amplifiers (figure 1) are single-input, eight-output splitting amplifiers designed for use in 8kHz and 15kHz audio program distribution networks. Both the 4018 and 4018A derive eight independent outputs from a single, switch-selectable, 600 ohm or bridging (high impedance) input.

1.02 The output ports of the 4018 provide balanced 600 ohm impedance, whereas those of the 4018A provide balanced 150 ohm impedance. This is the main difference between the two modules. The output ports of both modules are individually isolated via a balanced, low-impedance distribution bus.

1.03 The 4018 and 4018A modules provide adjustable insertion gain (or loss) of from −8 to +8dB (4018) and −5 to +15dB (4018A) between input and output ports. Output levels up to +16dBm (all ports terminated) are accommodated, with distortion less than 0.5 percent for output levels below the overload point. Frequency response of both modules is nominally flat from 50 to 50,000Hz.

1.04 A unique noise threshold circuit in the 4018 and 4018A can be used to significantly reduce background noise during quiet intervals in program material. The circuit does this by removing all gain and inserting approximately 10dB of loss between the input and output ports when the input signal level falls below a predetermined threshold level. This threshold level is adjustable (via a front-panel-accessible potentiometer) from approximately −50 to −20dBm. Signals above the threshold level are amplified in the normal fashion and distributed to the output ports. Thus, noise energy is attenuated during quiet intervals without affecting distribution of desired signal energy. An option switch permits removal of the noise threshold circuit if quieting is not desired.

1.05 Front-panel module access and monitor jacks are provided on both the input and output ports. Gain and threshold controls are also accessible from the front panel to simplify alignment.

1.06 The 4018 and 4018A require input power at any potential between −32 and −56Vdc, at a maximum current of approximately 135mA. An integral voltage-regulating power supply derives

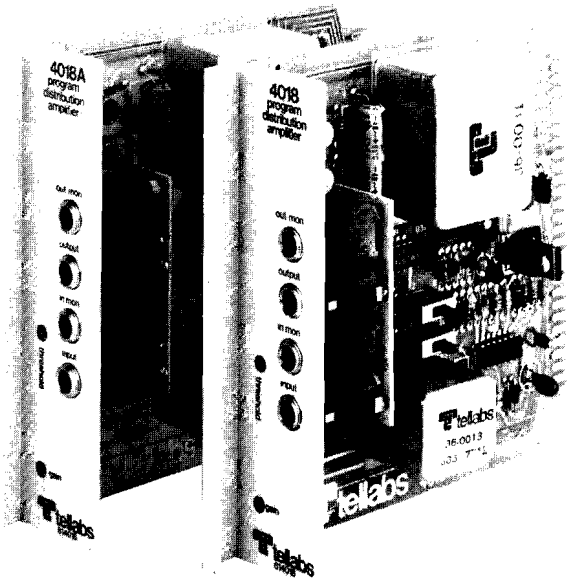


figure 1. 4018 and 4018A Program Distribution Amps

internal power potentials of −15 and −30Vdc. Transient-limiting circuitry and a reverse-polarity protection diode are also provided. Tantalum filter capacitors minimize susceptibility to high-frequency signals introduced via the power leads.

1.07 As Type 10 modules, the 4018 and 4018A each mount in one position of any of Tellabs' Type 10 Mounting Shelves, which are available for relay rack and apparatus case installations.

2. application

2.01 In circuits transmitting high-quality audio signals over nonloaded telephone cable, the 4018 and 4018A Program Distribution Amplifiers are used where a single program source must be distributed to more than two terminations. The broad frequency response and low distortion of the 4018 and 4018A permit their use in either am (100 to 5000Hz), television audio (100 to 8000Hz), or fm (50 to 15,000Hz) program applications. The 4018 provides adjustable insertion gain (or loss) from −8 to +8dB, and the 4018A, from −5 to +15dB, with distortion of less than 0.25 percent (at a +10dBm output level). Maximum output level exceeds +16dBm with all ports terminated. Any number of output ports may be used, and unused ports need not be terminated.

2.02 The 4018 module is normally used in program distribution applications where a number of 600 ohm outputs must be derived from a single input. Such networks are commonly encountered in radio and television studios and at network branching points comprised of carrier derived channels or very short cable distribution loops.

2.03 The 4018A module finds primary application where the distribution network consists of telephone cable pairs. In such applications, the 150 ohm source impedance interfacing each cable pair provides nominal amplitude equalization for each of the multiple loops. By virtue of its 150 ohm output impedance, the 4018A may also be used in wired music systems in which program material is distributed to several locations from a telephone central office.

2.04 Isolation between the output ports of the modules is provided by a low-impedance common bus to which are multipled the impedance-determining resistors for each output port. Because the output ports are resistively derived, output simplex leads are not available. If such leads are required (e.g., if wetting current is to be applied to the facility), separate wideband repeat coils (Tellabs 4424 and 4425) must be used to derive the simplex leads.

2.05 The input port of each of the two modules is derived via a shielded input transformer that provides an input simplex lead. This center tap is used primarily in applications characterized by relatively high longitudinal potentials at the input port.

2.06 Because the 4018 and 4018A can be optioned for either terminating or bridging input impedance, more than one module may be connected to a program source if more than eight output ports are needed. Similarly, a 4018 or 4018A optioned for bridging input may be connected across an output port of another 4018 or 4018A without disturbing the port loading. The modules' front-panel jack arrangement permits bridging the input of one module across either the input or output of another module by means of patch cords with 310-Type plugs.

2.07 The noise threshold circuit in the 4018 and 4018A is most useful when the program source material is contaminated by low-level background noise (usually 60Hz or a harmonic thereof caused by exposure to a 60Hz power potential). While this circuit cannot improve the overall signal-to-noise ratio or reduce background noise simultaneously present with a desired signal, it does decrease circuit noise appreciably during silent intervals, when noise is most noticeable. The noise threshold should be adjusted above idle circuit noise level, which should be several dB below the level of the weakest usable signal. Experience has shown that a threshold level of approximately −46dBm is optimal for most program applications.

2.08 The noise threshold circuit has approximately 4dB of hysteresis so that the gain drop-out level is approximately 4dB lower than the gain activate level. This hysteresis, together with the time constants of the noise detector, ensures that the noise threshold circuit will not activate during momentary pauses in the audio input signal. If "choppiness" or "breakup" is heard in the output of the 4018 or 4018A, especially on the trailing portions of speech segments, the noise threshold is set at too high a level and should be adjusted for a lower level.

2.09 The 4018 and 4018A may be used as part of the 248 Program Transmission Group, a system of modules and prewired enclosures for the transmission and distribution of high quality, wideband audio signals over nonloaded telephone cable. The 4018 and 4018A, however, do not share the common pin assignments of the other modules in the 248 Group (the 4008 Program Amplifier, 4012 Program Distribution Amplifier, and 442X Wideband Repeat Coils). Thus, special wiring will be required if a 4018 or 4018A must be mounted in a prewired 248 Program Amplifier Assembly (see paragraph 3.03). For more complete information on the 248 Group, refer to the practices and catalog sheets describing the individual modules and enclosures or to the 248 Program Transmission Group brochure.

3. installation

inspection

3.01 The 4018 or 4018A Program Distribution Amplifier should be inspected upon arrival to find possible damage incurred during shipment. If damage is noted, a claim should be filed immediately with the carrier. If stored, the module should be visually inspected again prior to installation.

mounting

3.02 The 4018 and 4018A modules each mount in one position of any of the Tellabs Type 10 Mounting Shelves, which are available in configurations for both relay rack and apparatus case installation. Each module plugs physically and electrically into a 56-pin connector at the rear of the Shelf.

3.03 As stated previously, although the 4018 and 4018A are part of the 248 Program Transmission Group, they do not share the common pin arrangement of the other modules in the Group that allows their use in the prewired 248 Program Amplifier Assemblies. If, for any reason, a 4018 or 4018A module must be mounted in a relay-rack-configured 248 Assembly, additional wiring will be necessary to accommodate the module's additional output ports and to tandem-connect the 4018 or 4018A to an associated 4008 Program Amplifier. (The 4018 and 4018A are virtually never used in apparatus-case-configured 248 Assemblies.)

installer connections

3.04 Before making connections or wiring changes to the 4018's or 4018A's connectors, ensure that power is **off** and that modules are **removed**. The 4418 or 4418A should be inserted into place only **after** wiring is completed.

3.05 External connections to the 4018 and 4018A are listed in table 1. All connections are made via wire-wrap to the 56-pin connector at the rear of each module's mounting shelf position. Pin numbers are shown on the body of the connector.

option selection

3.06 Two option switches must be set before the 4018 or 4018A is placed in service. Locations of these switches are shown in figure 2. Option switch *S1* selects the input impedance, which may be either

connect:	to pin:
AMP INPUT (amplifier input)	7 and 13
INPUT SX (input simplex)	9
PORT 1 output	53 and 55
PORT 2 output	51 and 52
PORT 3 output	49 and 50
PORT 4 output	47 and 48
PORT 5 output	45 and 46
PORT 6 output	43 and 44
PORT 7 output	41 and 42
PORT 8 output	39 and 40
−V IN (−32 to −56Vdc input)	35
GND (power ground)	17

table 1. External connections to 4018 and 4018A

600 ohms (terminating) or high impedance (bridging). Set *S1* to the *600* position for 600 ohm terminating impedance or to the *HI Z* position for bridging operation. Switch *S2* is used to enable or disable the noise threshold circuit. Set *S2* to the *NORM* position if quieting is desired or to the *OFF* position if the noise threshold circuit is not to be used.

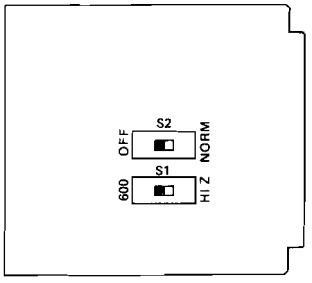


figure 2. Switch positions

alignment

3.07 Alignment of the 4018 or 4018A consists simply of adjusting the module's insertion gain as required for the application and adjusting the noise threshold if the noise threshold (quieting) circuit is to be used. Insertion gain is adjusted by means of the potentiometer labeled *gain* on the front panel. The input port and output port 1 may be accessed via the module's front-panel jacks to assist in alignment.

Note: Ensure that the input impedance is taken into account when aligning levels via the input *jack, as the input source will be unterminated if switch* S1 *is set to the* HI Z *position.*

3.08 To adjust the noise threshold, proceed as follows:

A. Insert a 1000Hz signal at the desired threshold level (for example, −40dBm) at the amplifier input. (The *input* jack may be used to introduce this signal.)

B. Adjust the *threshold* potentiometer (accessible through the module's front panel) fully clockwise (maximum threshold level).

C. Connect a transmission measuring set (TMS) terminated in 600 ohms for the 4018 or in 150 ohms for the 4018A to any output port or, via a suitable patch cord, to the *output* jack on the module's front panel. Observe the output level, which will be approximately 16dB below the input signal level.

D. Slowly rotate the *threshold* potentiometer counterclockwise until the output level suddenly increases markedly. (To prevent meter damage, it is advisable to set the TMS scale to the expected output level, taking into account the gain previously established, before adjusting the *threshold* potentiometer.)

Note: There will be no observable change in the output level until the threshold level is reached.

E. Decrease the input signal level approximately 6dB; then slowly raise the level toward the desired threshold to verify that the gain is enabled at the desired threshold point. If it is not, the threshold is adjusted slightly too high. Adjust the *threshold* potentiometer approximately one-eighth turn counterclockwise. Then recheck the threshold level by slowly increasing the input signal level from below the threshold level while observing the output level. Repeat, if necessary, until the output level decreases markedly when the input signal reaches the desired threshold level.

4. circuit description

Note: Please refer to the associated functional Block Diagram (section 5) as an aid in understanding the following circuit description.

4.01 The 4018 and 4018A Program Distribution Amplifiers consist basically of a wideband preamplifier followed by a power amplifier with low output impedance. The power amplifier drives a distribution bus from which eight resistively-coupled outputs are derived. Associated with the preamplifier is a noise threshold circuit that enables preamplifier gain when the input signal level exceeds a preselected threshold level.

4.02 Input to either module is via an input transformer that derives an input simplex lead and provides for either balanced 600 ohm or high-impedance termination. Input jacks are provided that afford access to both the amplifier and to the connecting facility.

4.03 The preamplifier is a wideband compensated operational amplifier with gain control in the negative feedback path. The power stage makes use of complementary transistors in an emitter-follower configuration driving an output transformer with a turns ratio of nearly unity. Individual output ports are connected to the transformer secondary through matched resistors that establish individual port impedances.

4.04 The noise threshold circuit consists of a high-gain limiter/amplifier followed by a full-wave rectifier and a threshold detector. The output of the threshold circuit, through a gain control stage, either enables or disables preamplifier gain, depending upon the input signal level. Time constants associated with the threshold detector ensure rapid gain enabling and delayed disabling.

4.05 Both modules include an integral voltage-regulating power supply that derives internal power potentials of −15 and −30Vdc. Transient limiting circuitry and a reverse-polarity-protection diode

are also provided. Tantalum filter capacitors are used to minimize susceptibility to high-frequency signals introduced via the powering leads.

6. specifications

input impedance
600 ohm option: 600 ohms±10%, balanced, 50 to 15,000Hz
high-impedance (HI Z) option: greater than 15 kilohms, balanced, 50 to 15,000Hz

output impedance
4018: 600 ohms±5%, balanced, 50 to 15,000Hz, with any number of ports terminated
4018A: 150 ohms±10%, balanced, 50 to 15,000Hz, with any number of ports terminated

frequency response
±1.0dB re 1000Hz level, 50 to 15,000Hz
±1.5dB re 1000Hz level, 50 to 20,000Hz

output overload
1 to 4 ports terminated: +20dBm
8 ports terminated: +16dBm minimum

distortion
less than 0.25% THD at +10dBm output level

output level change as ports are terminated
4018: approximately 0.5dB per port, maximum change of 2.2dB from one-port to eight-port loading
4018A: approximately 1dB per port, maximum change of 6dB from one-port to eight-port loading

gain range (all ports terminated)
4018: approximately –8 to +8dB
4018A: approximately –5 to +15dB

noise threshold range
approximately –50 to –20dBm input signal level, continuously adjustable

output noise
noise threshold in: 0dBrn 15kHz flat weighting, independent of gain
noise threshold out: 5dBrn 15kHz flat weighting at 0dB gain, 15dBrn at maximum gain

gain enable timing
approximately 200μs

gain disable timing
approximately 140ms

insertion loss below threshold
approximately 10dB, independent of gain

power requirements
input voltage: –32 to –56Vdc, with positive ground
input current: 30mA idle, 135mA maximum at +16dBm output level, all ports terminated

operating environment
–40° to +140°F (–40° to +60°C), humidity to 95% (no condensation)

dimensions
5.58 inches (14.17cm) high
1.42 inches (3.61cm) wide
5.96 inches (15.14cm) deep

weight
4418: 16 ounces (0.454kg)
4418A: 16 ounces (0.454kg)

mounting
relay rack or apparatus case in one position of Tellabs Type 10 (or Wescom Type 400) Mounting Shelf or, via special wiring, in a Type 248 Assembly

7. testing and troubleshooting

7.01 This Testing Guide may be used to assist the installation, testing, or troubleshooting of 4018 or 4018A Program Distribution Amplif module. The Guide is intended as an aid in the calization of trouble to a specific module. If a mo ule is suspected of being defective, a new mod should be substituted and the test conducted aga If the substitute module operates correctly, original module should be considered defective a returned to Tellabs for repair or replacement. I strongly recommended that no internal (compone level) testing or repairs be attempted on the 40 or 4018A module. Unauthorized testing or repa may void the module's warranty.

7.02 If a situation arises that is not covered the Testing Guide, contact Tellabs Customer S vice at (312) 969-8800 for further assistan

7.03 If a 4018 or 4018A is diagnosed as def tive, the situation may be remedied by either *placement* or *repair and return*. Because it is more expedient method, the *replacement* pro dure should be followed whenever time is a cr cal factor (e.g., service outages, etc.).

replacement

7.04 If a defective 4018 or 4018A is encountere notify Tellabs via telephone, letter or twx. Not cation should include all relevant information, cluding the 8X4018 or 8X4018A part numb (from which we can determine the issue of t module in question). Upon notification, we sh ship a replacement module to you. If the warran period of the defective module has not elapsed, t replacement module will be shipped at no charg Package the defective module in the replaceme module's carton; sign the packing list includ with the replacement module and enclose it wi the defective module (this is your return autho zation); affix the preaddressed label provided wi the replacement module to the carton being turned; and ship the equipment prepaid to Tellal

repair and return

7.05 Return the defective module, shipme prepaid, to:

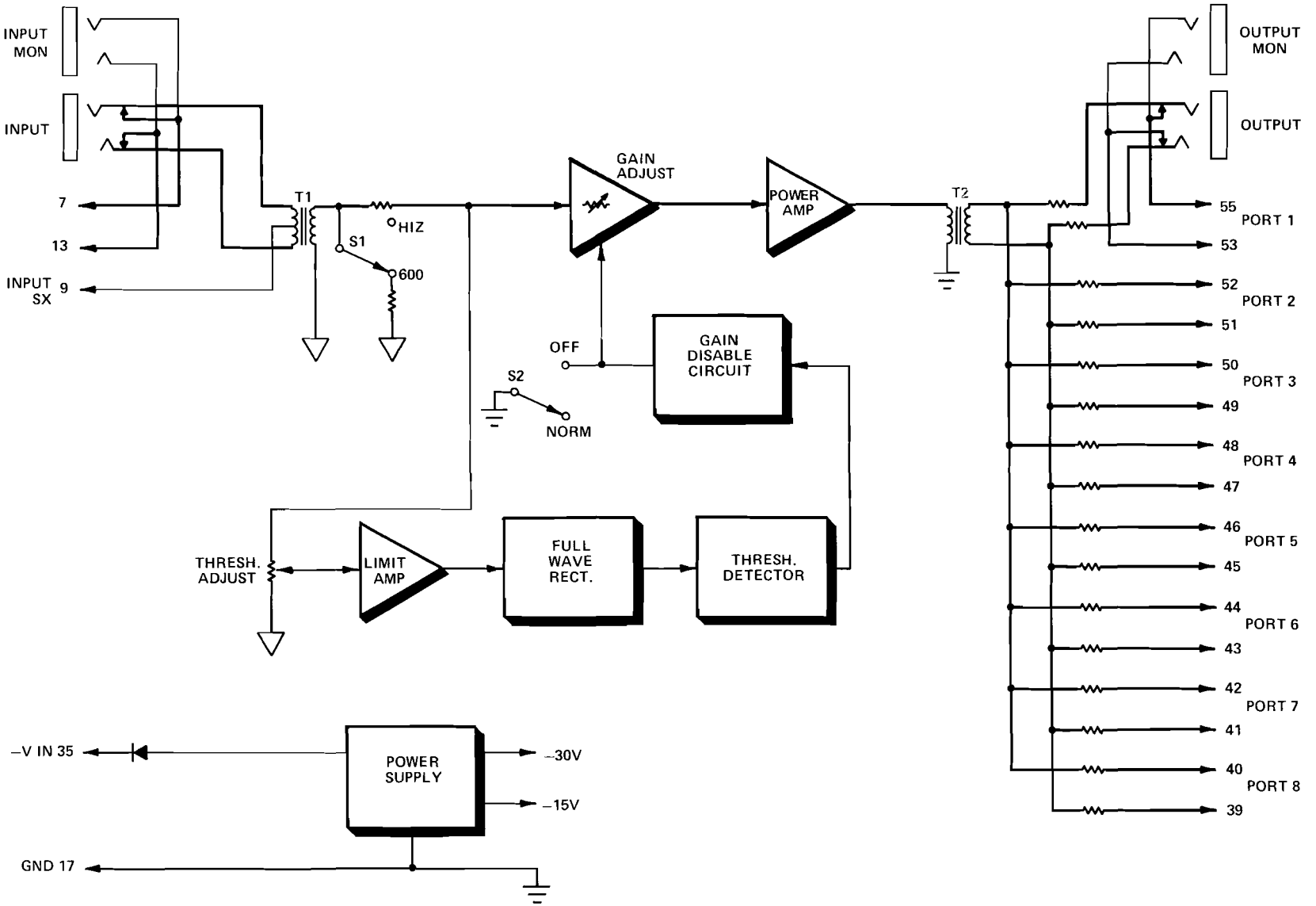
Tellabs Incorporated
4951 Indiana Avenue
Lisle, Illinois 60532
Attn: repair and return dept.

Enclose an explanation of the module's malfun tion. Follow your company's standard procedu with respect to administrative paperwork. Tella will repair the module and ship it back to you. the module is in warranty, no invoice will be issue

testing guide checklist appears on page

testing guide checklist

test	test procedure	normal result	if normal conditions are not met, verify:
insertion gain	Connect a 1000Hz input signal source to connector pins 7 and 13, or insert signal via *input* jack, and measure signal at any output port (or at *output* jack).	Gain of approximately 8dB for 4018, 15dB for 4018A (gain potentiometer fully clockwise) ☐.	Unit properly powered ☐. Input level above threshold ☐. In 4018A, proper accounting for 150 ohm impedance ☐. Ports properly terminated ☐. Switch *S1* properly optioned ☐.
noise threshold	With signal source connected as above, lower input signal level below threshold and observe output level.	For signal levels above the preset threshold, output level should be consistent with unit gain ☐. As input level is lowered through the threshold level, output level should drop 10 to 20dB, depending upon gain setting ☐.	Option switch *S2* in *NORM* position ☐. Output port properly terminated ☐.
distortion	Insert input signal as in "insertion gain" test and, using an oscilloscope or a distortion analyzer, observe output signal at any output port.	Observe undistorted output, with no peak clipping, for output levels below +16 to +20dB, depending upon port loading ☐.	Input power voltage between −32 and −56Vdc ☐. Input signal not distorted ☐. Input signal above threshold ☐. Output port terminated properly ☐.
noise	Short input terminals or insert shorting or 600 ohm terminating plug into *input* jack. Measure noise at any output port or at the *output* jack.	With *S2* in *NORM* position, measure less than 0dBrn ☐. With *S2* in *OFF* position, measure less than 15dBrn ☐.	Proper optioning of *S1* and *S2* ☐. Power supply noise less than approximately 40dBrnC ☐. Noise meter set for proper terminating impedance ☐.



5. block diagram