INSTRUCTION MANUAL

ALLISON LABS INSTRUMENTATION MODULES

Model 658 — 60 MW Amplifier — Class A
Model 659 — 60 MW Amplifier — Class B
Model 660 — Preamplifier

Proved dependable in years of service

Allison Laboratories, Inc.
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ERRATA

PAGE 3

FIGURE 2

Please revise to show
Model 660 Response as follows:

20 DB	10 CPS TO 1 MCPS
30 DB	Same
40 DB	10 CPS TO 50 KCPS

WARRANTY

All Allison Laboratories Instrumentation Modules are warranted free from defects of material and workmanship for one year from date of original sale. The transistors are warranted for one year from date of sale except for catastrophic failures. The repair or replacement shall be at the option of Allison Laboratories and all warrantees are F. O. B. La Habra, California.

CONTENTS

1. GENERAL INFORMATION

The Allison Models 658, 659 and 660 are very adaptable low noise solid state amplifiers. The flexibility allowed by variation in D. C. supply and open feedback terminals make them useable in many widely varied applications. Potting in solid epoxy gives them ruggedness and facilitates mounting by molded in tapped inserts. Molded in sockets for the transistors also facilitate replacement and allows selection of transistors for particular characteristics.

The similarity of the three models, plus the probable use of more than one unit in a circuit has prompted us to publish the instructions in a single manual. The variation of characteristics due to supply voltage, feedback values, and load impedance make it necessary to tabulate specifications. In many cases the specifications are the same for both 658 and 659. The Model 658 is designed for Class A operation while the 659 is the Class B counterpart. Current consumption is therefore the major difference.

2. MOUNTING

All 3 models are dimensionally the same for mounting purposes. They may be mounted at any angle. Two 6-32 machine screws are required for attachment. Mounting and shielding can be combined by using the Model 661 variable gain kit (Page).

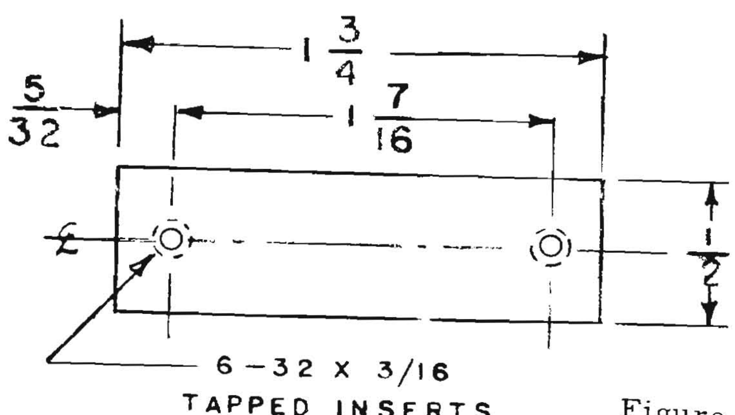


Figure 1

3. OPERATING VOLTAGE & CURRENT REQUIREMENTS

All Models may be operated with D. C. voltages from 13.5 volts to 22.5 volts. These units are common positive. Current consumption varies with model used and as shown in the chart below.

Model 660 - Average Current .7 MA at 22.5 V
Model 658 - " " *10 MA at 22.5 V
Model 659 - Average No Signal 2.2 MA and up to 17 MA Max. signal at 22.5 V

* Maximum current on 658 is 12 MA

4. GAIN & BANDWIDTH (See also Feedback 9)

Since the feedback loop is open when received, (unless gain is specified on the order), it is necessary for the user to apply the proper resistor in this circuit to obtain the gain and/or bandwidth desired. The chart below shows the approximate resistance values to obtain a given gain and the related bandwidth. The high frequency rolloff figure is based on minimum bandwidth variation.

GAIN DB	R FB	658-9	660
20	3K Ω	*	10 CPS TO 50 KCPS
30	10K Ω	10 CPS TO 400 KCPS	10 CPS TO 250 KCPS
40	33K Ω	10 CPS TO 250 KCPS	10 CPS TO 1 MCPS

* NOT RECOMMENDED BELOW 25 DB

Figure 2

NOTE: Open loop gain is dependent on transistors and is approximately 57 to 69 db.

The use of TI 2N1306 & 2N1307 or TI1308 & 2N1309 will give greater gain and consequently greater bandwidth with the same gain setting. For continuously variable gain the Model 661 (See Pg) variable gain kit may be used. This unit consists of a bracket, trimpot, and series resistor which can be wired into the circuit. If the customer furnishes the control, a series resistor of 2700 ohms on Model 660 and 8.6 K on the Models 658 & 659 should be used to limit maximum negative feedback to prevent unstable operation and oscillation. See Figure 3.

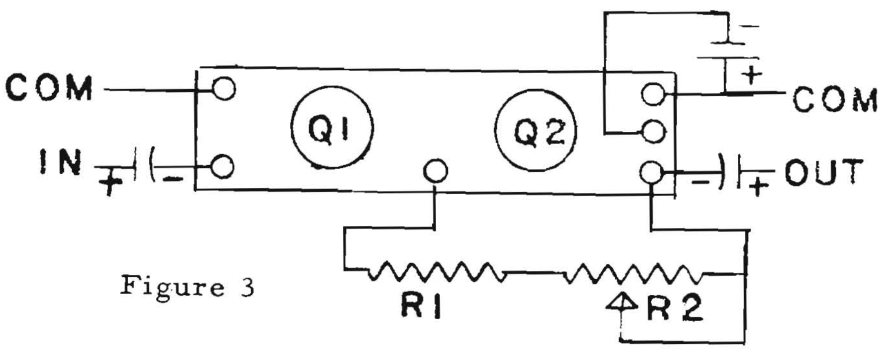


Figure 3

For other causes of oscillation, see Section 8.

With a voltage gain of 40 db a change in battery supply voltage from 22.5 volts to 13.5 volts will cause a gain change of less than 1 db. A temperature change of 0° to 50° C causes a gain change of less than 1 db. Compared to voltage and temperature stability, the stability with time is negligible.

5. CIRCUIT COUPLING

Low frequency response of the module is directly dependent on the value of coupling capacitors on the input and output of the module. For this reason these capacitors are not molded into the module. Furnished with each module are 1 each 2 mfd. at 25 volts and 1 each 100 mfd. at 12 volts.

Low frequency response is -1 db at 10 CPS using 2 MFD on the input and 100 MFD on the output. If the furnished capacitors are not used, note that the negative pole is adjacent to the amplifier on both input and output. (The input and output are from 6 to 10 volts minus with reference to the common). Replacement capacitors should be rated at 12 volts or higher.

6. INPUT IMPEDANCE

The input impedances of all three models are similar as shown in the table below. The Model 660 is somewhat affected by gain setting. DC supply voltage does not affect this.

	660			658-9	
GAIN	20 DB	30 DB	40 DB	30 DB	40 DB
Z	42 K	40 K	35 K	40 K	40 K

Figure 4

7. OUTPUT IMPEDANCE

The output impedance of the Models 658 and 659 are quite stable with gain and other variables. The impedance is quite low as a characteristic of the emitter follower. The Model 660 varies with gain settings shown.

	660			658-9	
GAIN	20 DB	30 DB	40 DB	30 DB	40 DB
Z	70 Ω	200 Ω	800 Ω	≅ 2 Ω	≅ 2 Ω

Figure 5

8. LOAD IMPEDANCE

Care should be taken in connecting reactive loads which may cause oscillation. For the Model 660 the minimum recommended load impedance is 10 k ohms.

The Models 658 and 659 are designed to operate into 600 ohms. The amplifiers will operate down to 300 ohms. Loads as low as 200 ohms and input voltage as high as 2.0 volts will not damage the amplifiers.

The following chart gives the curve of voltage output versus the load impedance for the 658 & 659.

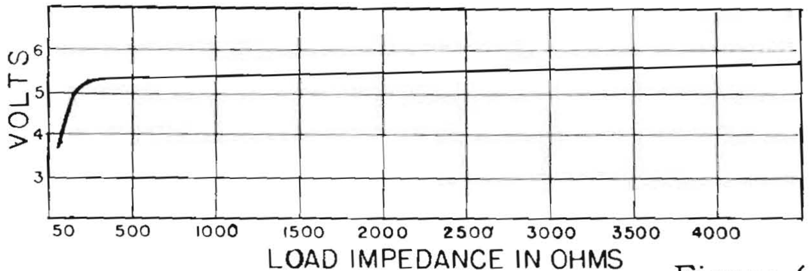


Figure 6

CAUTION. DO NOT SHORT THE OUTPUT OF THE AMPLIFIER UNDER OPERATING CONDITIONS. THIS WILL DAMAGE THE OUTPUT TRANSISTORS.

9. FEEDBACK CIRCUITS

The open feedback loop offers the opportunity to use these modules in many different ways aside from selection of gain and flat bandwidth, it may also be used for equalization and selective amplification. Standard RC circuits may be added for equalization. Figures 7 and 8 on page 7 show typical circuits for equalization of tape or phono outputs for the Model 660.

In figure 7 response may be adjusted by the following changes. Low frequency response is changed by changes in R_1. Larger values of R_1 will give increased low frequency output.

High frequency response is adjusted by changes of C_2. Larger values of C_2 will increase high frequency response.

In figure 8 the low frequency response is changed by changes in R_2.

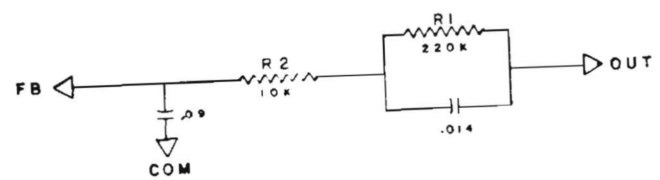


Figure 7 TAPE PLAYBACK EQUALIZER

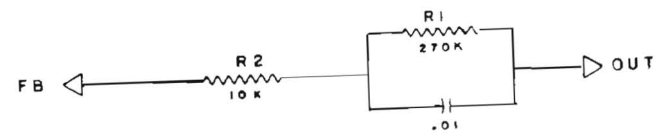


Figure 8 PHONO EQUALIZER (GE VRII)

For both preamplifiers and amplifiers selective amplification can be accomplished by LC circuits in the feedback loop. A typical circuit with values and resulting curves is shown below.

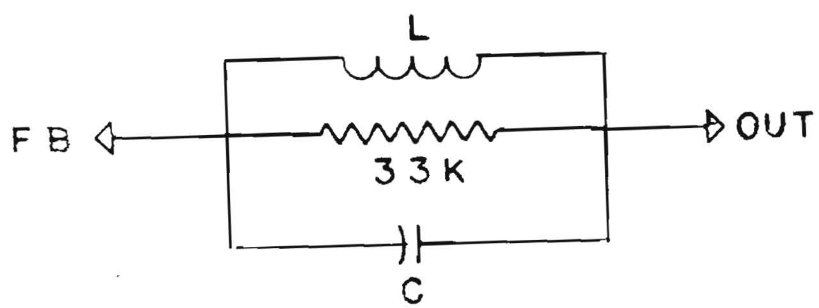
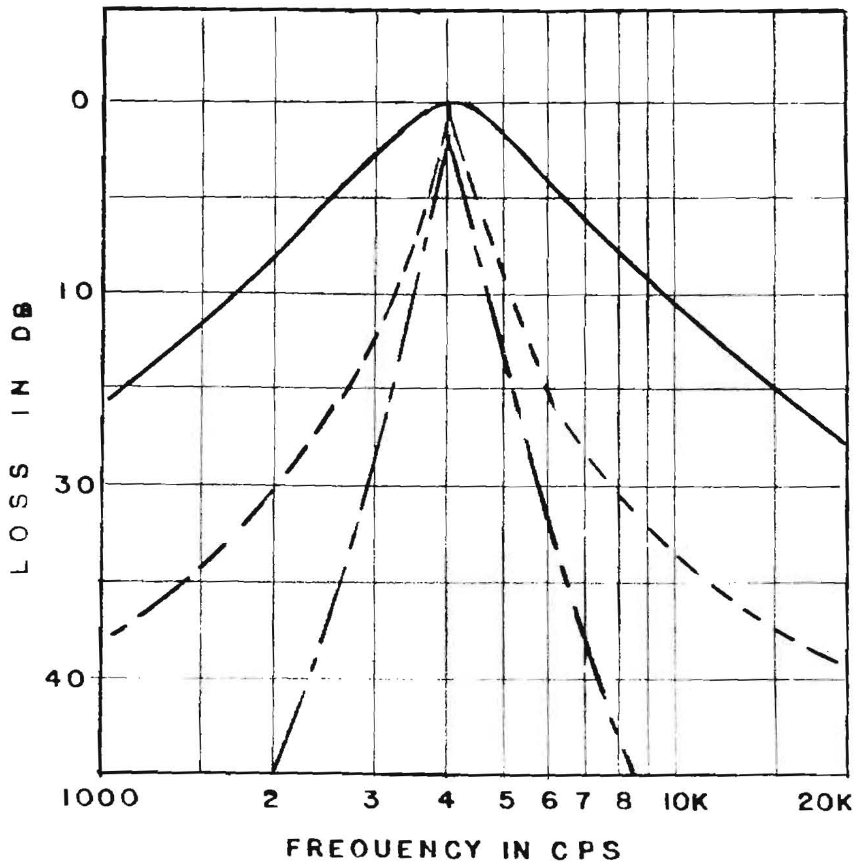


Figure 9



——— L-.755 HY. C-.002 MFD.

- - - - L-.151 HY. C-.010 MFD.

— - — L-.009 HY. C-.167 MFD.

Figure 10

Allison Labs will be happy to quote your needs for tuned LC circuits for feedback.

10. NOISE

The charts on page show typical noise referred to input in microvolts. These values are typical of 2N1302 and 2N1303 transistors furnished as standard. Some difference is experienced due to transistor changes either in germanium or silicon types.

It should be noted that these values are obtainable only with adequate shielding of the module and leads, plus a suitable power supply.

EQUIVALENT INPUT NOISE

All values expressed in microvolts.
S—Shorted Input (8.0 mfd. low impedance short.
O—Open Input.
Taken at 25°C. Bandwidth limited to 35 KCPS.

MODEL 660

22.5 VDC				13.5 VDC			
20 db		40 db		20 db		40 db	
S	O	S	O	S	O	S	O
0.2	2.0	0.97	16.0	0.2	1.7	0.9	11.0

Figure 11

MODEL 658 & 659

22.5 VDC			
30 db		40 db	
S	O	S	O
0.35	5.9	1.0	16.2

Figure 12

The noise present in the amplifier circuit is also dependent on the impedance of the source out of which the amplifier is working. With a source of zero impedance the noise referred to the input of the amplifier will be as shown in the specification sheets. With a source impedance of 600 ohms the noise referred to input will be approximately 2 times the referenced shorted figures. A source impedance of 25000 ohms will show noise of approximately 4 times the referenced shorted figures. The signal to noise ratio of the units using a 600 ohms source is better than 84 db.

For very low noise circuits it is often possible and advisable to limit bandwidth. Reducing the bandwidth to 1/2 reduces the noise 3 db, 1/4 - 6 db and 1/10 - 10 db, etc. Filtering of the output signal is recommended as the most feasible method, or selective circuits in the feedback loop may be used for this purpose. (See section 9).

11. CASCADE OPERATION

More than 1 unit may be connected in series for greater gain than is available in 1 unit. Standard connection of a preamplifier (660) and an amplifier (659) is shown in figure13 below.

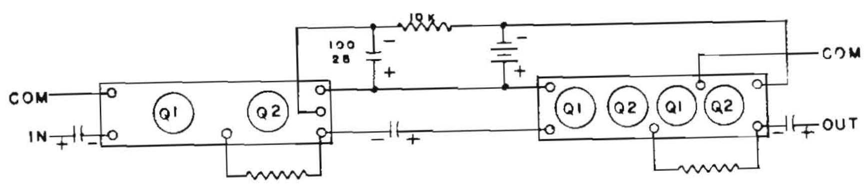


Figure 13

In the event a gain control is required between the amplifiers a coupling capacitor is required on each side of the control. A satisfactory control for this purpose is a 50,000 ohm log taper unit.

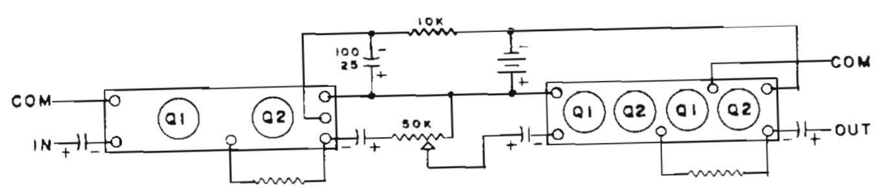


Figure 14

12. MULTIPLE CHANNEL (PARALLEL) OPERATION

In using the modules in multiple channel applications care should be taken to avoid interchannel modulation and feed through. It is recommended that the Model 658 Class A amplifiers be used due to constant current usage.

The modulation of B - through the power supplies - can be improved by the lowest possible output impedance of a common power supply. In addition isolation filtering can be provided as shown in Figure 13. It may also be beneficial to provide shielding between amplifiers if they are closely mounted. If shielding and variable gain are both required, the use of the Model 661 variable gain kit (See page14) will provide both at minimum cost.

13. DISTORTION

The distortion values of these modules are very good. Best results when this factor is critical are obtained with the highest driving voltage and lowest gain setting. The figures below give maximum values for harmonic and intermodulation distortion.

MODEL 660

HARMONIC DISTORTION

Taken at 1 KCPS and —3 db from overload							
22.5 VDC				13.5 VDC			
20 db		40 db		20 db		40 db	
2nd	3rd	2nd	3rd	2nd	3rd	2nd	3rd
0.3%	0.1%	0.6%	0.3%	0.47%	1.15%	1.3%	0.3%

INTERMODULATION DISTORTION

400 cps & 4000 cps mixed 4:1			
22.5 VDC		13.5 VDC	
20 db	40 db	20 db	40 db
0.25%	0.4%	0.25%	0.4%

Figure 15

HARMONIC DISTORTION

Taken at 1 KCPS and —3 db from overload			
22.5 VDC			
30 db		40 db	
2nd	3rd	2nd	3rd
.15%	.11%	.25%	.20%

INTERMODULATION DISTORTION

400 CPS and 4000 CPS mixed 4:1	
22.5 VDC	
30 db	40 db
1.0%	1.0%

Figure 16

14. PHASE SHIFT

Phase shift in these amplifiers is quite similar and have an area of near zero shift from 100 to 10,000 CPS. Typical phase shift curves are shown below.

MODEL 660

TYPICAL PHASE SHIFT

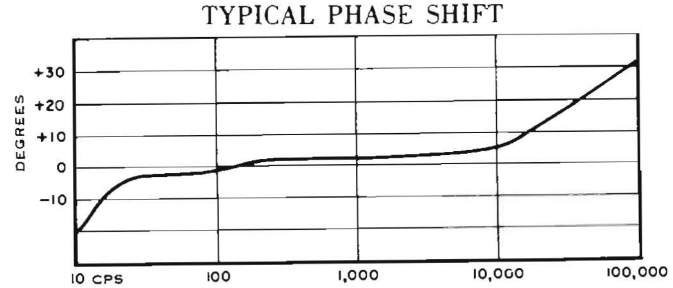


Figure 17

TYPICAL PHASE SHIFT

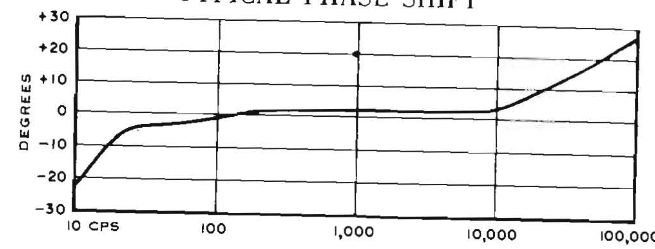


Figure 18

15. ENVIRONMENTAL

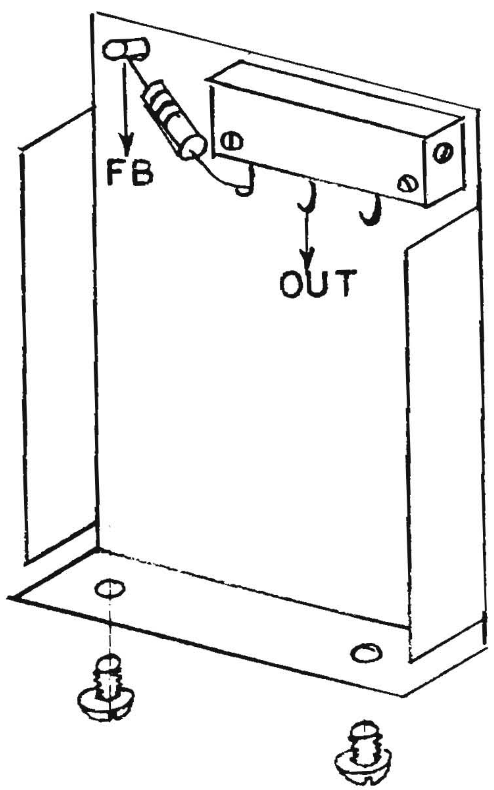
The encapsulation of all components with the exception of feedback circuit and transistors provides a unit which resists most environmental conditions. The epoxy resin used is moisture resistant and will not support fungus. Vibration will not cause microphone noise and in the event of heavy vibration in vertical or horizontal planes, retainers may be added to prevent loss of transistors. Temperatures between 0° C and 50° C will cause only slight changes in output characteristics.

Due to the wide variety of conditions to which equipment is exposed it is suggested that the particular specifications be submitted to the factory for specific answers to the problem. In the event retainers are added for the transistors, they must be insulated to prevent shorting cases together.

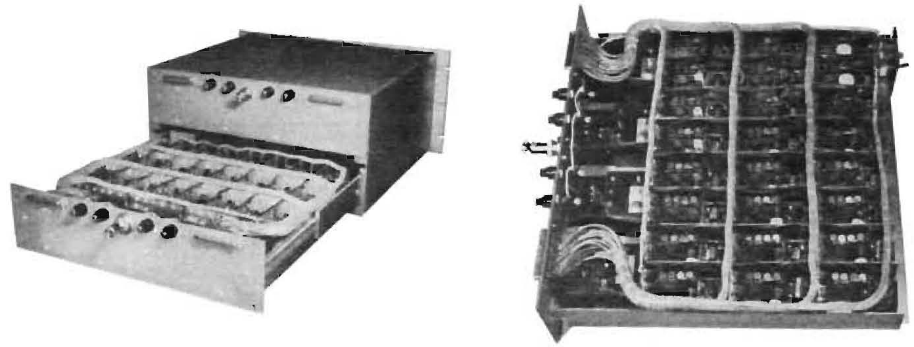
16. ACCESSORY EQUIPMENT

Other Allison modules for use with these amplifiers are the Model 666 Power Supply (22. 5 V at 100 MA), the Model 671 Meter System. This consists of a meter rectifier (same size as the amplifiers) and a 2-1/2" meter for RMS volts and DB. The combination of the power supply, Model 660 preamp, Model 659 amplifier and Model 671 meter system provides a transistorized voltmeter capable of measurements down to .001 V RMS full scale with flat response 10 CPS to 400 KCPS. The power supply may also be replaced by a small battery for complete portability. Suggested batteries - Burgess XX15. See figure 9 for battery power circuit.

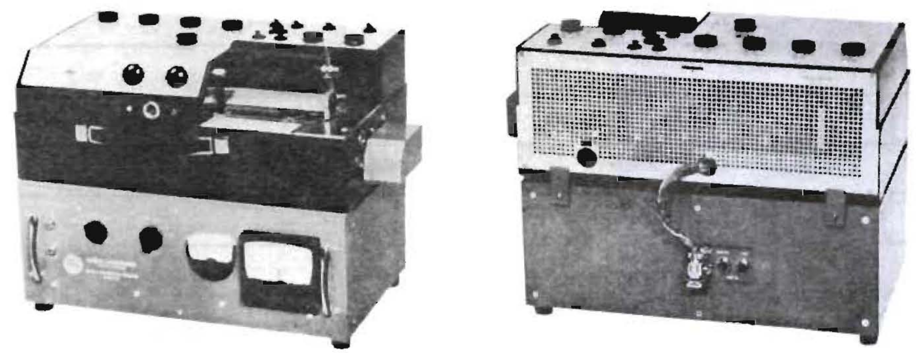
The Model 661 Variable Gain Kit is shown below. This provides continuously variable gain adjustment plus shielding between multiple units or channels.



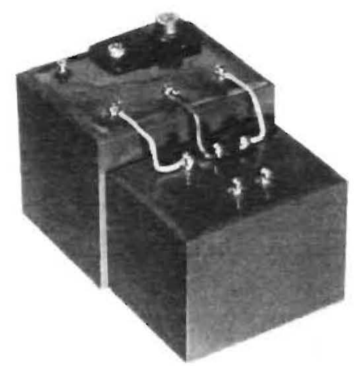
SPECIAL INSTRUMENTS CONSTRUCTED WITH ALLISON MODULES



MODEL 607 — 48 Channel Linear Rectifier



MODEL 570 — 2 Channel Noise & Transmission Recorder



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