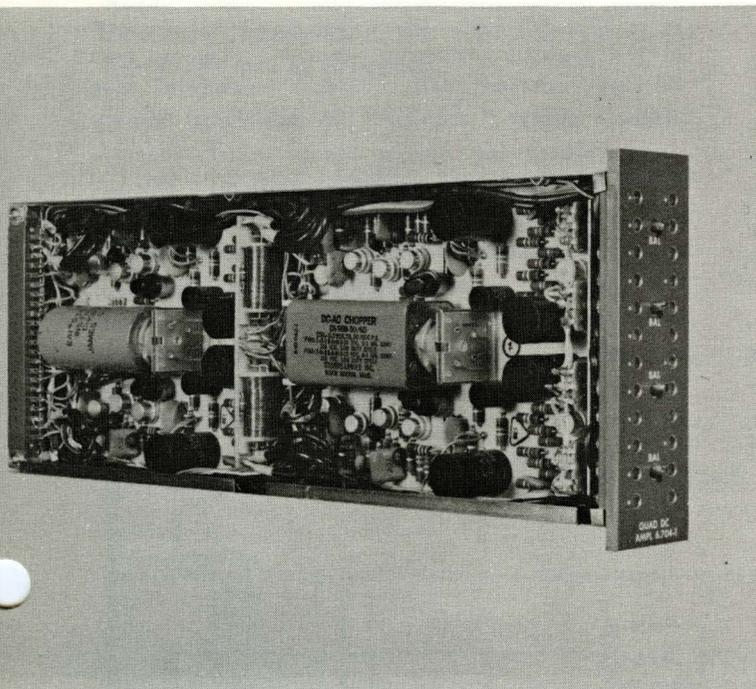


an accessory for PACE[®] TR-48 Analog Computers

QUAD AMPLIFIER, TYPE 6.704-1



FEATURES

- Expands PACE[®] TR-48 Analog Computer Capacity – up to 58 amplifiers
- Programming Facilitated . . .
 - integral color-coded patch panel simplifies connections
 - amplifiers short-circuit protected against patching error
- Compact, Flexible . . .
 - four independent amplifiers with resistor elements in single, plug-in module
- Superior, Reliable Performance . . .
 - wide-bandwidth, drift-stabilized, solid state design

GENERAL DESCRIPTION

The Type 6.704-1, Solid State DC Amplifier is a high quality computing component of proven, conservative design. Supplied for use in the PACE TR-48 Analog Computer, it combines superior performance characteristics with computer precision and reliability.

Each unit contains four independent, stabilized dc amplifiers in a compact plug-in case. Designed as a basic expansion component for the PACE TR-48 Analog Computer, it can be used to expand the computer's complement from 48 to 58 amplifiers. A separate, interconnecting harness accommodates up to 5 Type 6.704-1 Units (20 amplifiers) in replacing 5 standard Type 6.514 Dual Amplifier Units normally supplied in the computer. Each amplifier can be used with other solid state computing components to perform a wide variety of operations – including function generation, multiplication, voltage comparison, switching and others. The amplifiers in each unit are supplied as uncommitted operational amplifiers to provide “operator select” versatility.

Precision 10K ohm input and feedback resistors, matched to within $\pm 0.01\%$, are included in the unit and are connected to the amplifiers with patch cords or bottle-plugs on the unit's color coded patch panel.

(EAI reserves the right to revise its product specifications in accordance with its continuing program of product development.)

EAI

ELECTRONIC ASSOCIATES, INC., West Long Branch, New Jersey

TECHNICAL DESCRIPTION

Each amplifier in the quad amplifier package includes an ac stabilizing section and a directly coupled section. The ac stabilizing section consists of a mechanical chopper type modulator/demodulator, a high-gain three-stage transistor amplifier and a filter network. The directly coupled section is a five stage directly coupled transistor amplifier with a zero drift balancing potentiometer.

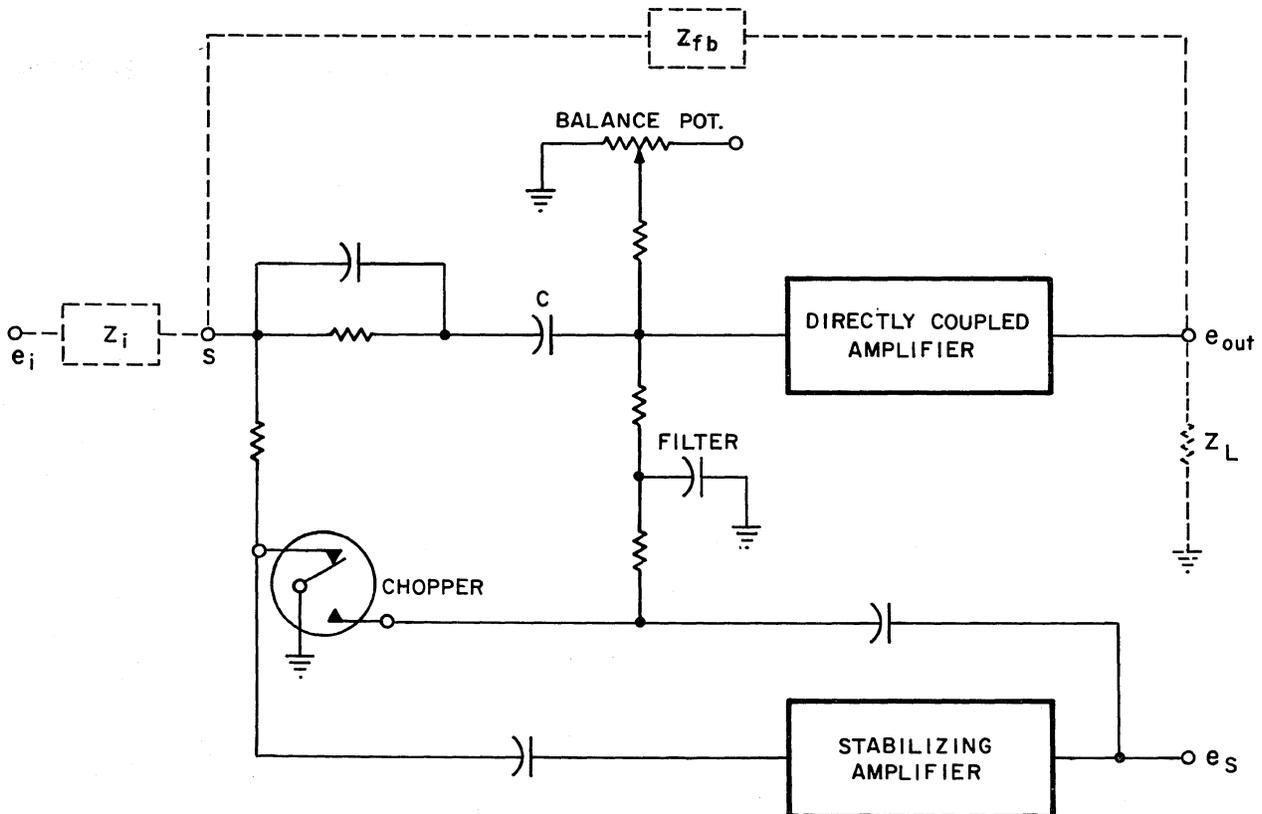
A high input impedance is provided through the use of an emitter follower input stage. A low amplifier output impedance, with linear push-pull type operation results from the use of a single ended, emitter follower, bridge type output stage. In addition, this output stage provides current limiting protection against overloads.

Through the use of complementary semiconductors, the dc amplifier is partially self compensating with regard to drift. With a connection made between the amplifier summing junction and the output, the proper operating point for full drift

correction can be obtained by using the zero drift balancing potentiometer.

Ac components of an amplifier input signal are amplified only by the directly coupled section. Low frequency and dc components are amplified by the ac stabilizing section in cascade with the dc section.

A drift in the voltage at the output of the amplifier causes an unbalance between the feedback and input currents, producing an offset voltage at the amplifier summing junction. The ac stabilizing section will "chop" (modulate) this offset voltage, amplify the resulting square wave voltage and synchronously rectify (demodulate) and filter the amplified voltage. The resulting voltage is applied to the dc amplifier as a bias level and appears at the output of the amplifier as an opposite-polarity voltage — thus compensating for the effects of the offset voltage at the input. Drift is reduced by a factor equal to the gain of the stabilizing section. Good amplifier stability with no sacrifice in high frequency response results.



APPLICATION

In conjunction with the proper input, feedback and attenuating elements (resistors, and potentiometers), the amplifier is used to perform linear computing functions such as,

- 1) Inversion of a variable
- 2) Multiplication/Division of a variable by a constant

When used in conjunction with other special computing components, the following non-linear operations may be performed.

- 1) Multiplication/Division of a variable by a variable
- 2) Generation of standard analytic and arbitrary functions
- 3) Representation of discontinuous functions
- 4) Simulation of transfer functions

In addition, the amplifier can be used for component isolation.

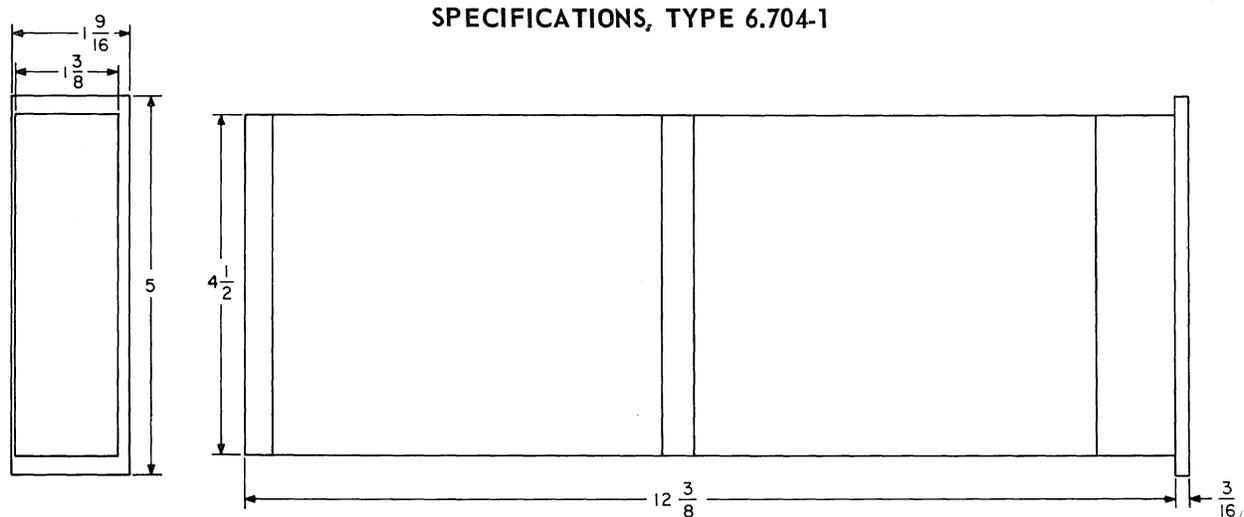
PHYSICAL CHARACTERISTICS

Construction

Four independent solid state dc amplifiers, each with a 10K ohm input and feedback resistor, are mounted in a compact, plug-in module. A U-shaped module chassis of rugged metal construction is used to provide shielding between units.

Positive power connection is made through the use of non-corrosive, gold plated contacts. Built-in guide pins ensure proper connector positioning and alignment.

The excellent amplifier performance characteristics are maintained under long term adverse operating conditions through the use of high quality, glass-epoxy printed circuit cards, Teflon insulated terminals and grounded metal brackets. Leakage and cross-talk is minimized by careful mechanical design, ensuring long-term reliability.



Outline Drawing of Quad Amplifier, Type 6.704-1

Terminal Connections (P1)

PIN NO.	CONNECTION (AMPL.)	H	(Chopper Drive)	S	+30 VDC, (1, 3)
A	-15 VDC, (2, 4)	J	+30 VDC, (2, 4)	T	No Connection
B	Output, (2, 4)	K	Balance Input, (2, 4)	U	No Connection
C	Not Used	L	Stabilizer Output, (2, 4)	V	±Ground, (1, 3)
D	+15 VDC, (2, 4)	M	HQ Ground, (2, 4)	W	+15 VDC, (1, 3)
E	±Ground, (2, 4)	N	HQ Ground, (1, 3)	X	Output, (1, 3)
F	6.3 VAC, (2, 4)	P	Stabilizer Output, (1, 3)	Y	Not Used
		R	Balance Input, (1, 3)	Z	-15 VDC, (1, 3)

SPECIFICATIONS, TYPE 6.704-1 (Continued)

General

Temperature Range—Operating 0°C to +45°C
 Output Power to Full Load
 (each amplifier) 0.2 Watts

Power Requirements: **

Supply Voltage ($\pm 10\%$)	Supply Current (Full Load)
+30 VDC	18 MA
+15 VDC	12 MA
-15 VDC	80 MA
6.3 VAC, 60 CPS	130 MA

Electrical, (25°C)

Amplification:

Voltage Gain-Open Loop

DC	3×10^7 Typical
100 CPS	25,000 Typical
1K CPS	3,500 Typical

Frequency Response

(3 db down, 20 MV P-P Input) .. 200 KCPS, Typical

Phase Shift (20V P-P Input)

100 CPS 0.01° Typical

Gain Error (10V P-P Input) 1 KCPS 0.1%

Transient Response

(0 to Full Scale) 40 Microseconds

Input Characteristics:

Offset Voltage

(10K Ω feedback, balanced condition) ..20 μ V, Max
 10 μ V, Typical

Total Short Term Drift Due to Temperature

(Standard 10K Ω Inverter) ... 0.5 μ V per °F, Typical

Noise (Full Bandwidth) 100 μ V RMS, Typical

Output Characteristics:

Voltage ± 10 Volts, Max

Current (at ± 10 V) 20 MA, Max

Impedance (100 CPS) 0.01 Ohms, Typical

**Supplied by computer power supply.

Dimensions

Unit has standard case dimensions of PACE TR-48 Analog Computer Component, Dual Amplifier, Type 6.514 (see outline drawing).