

# Phillips Scientific

## Quad DC-300 MHz Amplifier

## NIM MODEL 770 771

### FEATURES

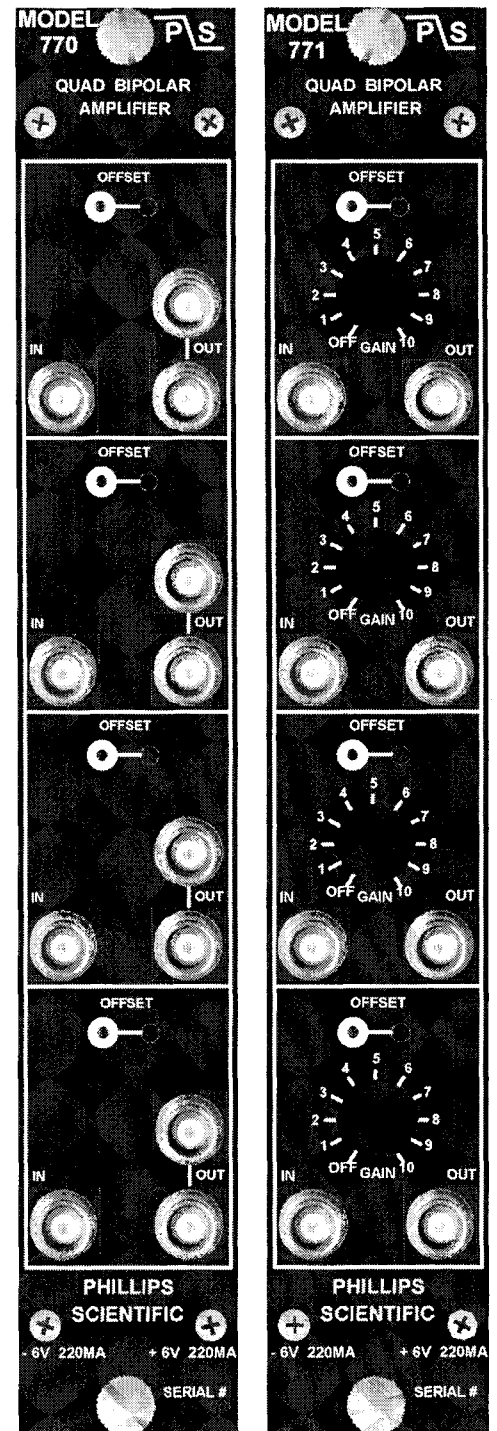
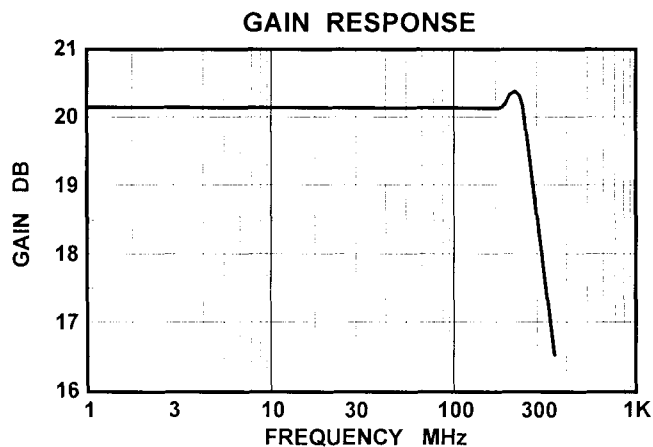
- \* Model 770 with a Fixed Gain of Ten
- \* Model 771 with Calibrated Gains from One to Ten
- \* Four Channels Per NIM Module
- \* DC to 300 MHz Bandwidth
- \* Typically 1nSec Risetime and Faltime
- \* Cascadable for Higher Gains
- \* Noise Less than 25  $\mu$ V RMS
- \* Offset Control with  $\pm 250$  mV Range
- \* Inputs and Outputs Protected
- \* Excellent Stability - Gain and Offset

### DESCRIPTION

The Models 770 and 771 are four channel, direct-coupled amplifiers packaged in a single width NIM module. The Model 770 provides a non-inverting voltage gain of ten, and the Model 771 features calibrated gain steps from one to ten. Both models are fully bipolar and capable of amplifying positive or negative signals making them compatible with most detectors or preamplifiers.

Stability was given particular attention during the amplifier's design. Both the DC and fast pulse characteristics are exceptional. This allows for cascading of channels for gains in excess of 500 without suffering significant overshoot or baseline drift. Each channel has individual offset controls which can compensate for DC offsets due to the input source impedance or differences in ground levels.

The output stage is a low-impedance voltage source design with short-circuit protection. No damage can occur from overloading or continuous shorts to ground. The outputs have been designed to drive two 50 ohm loads for fanout of the amplified signal. However, unused outputs may be left unterminated with no adverse effects.



**Phillips Scientific**

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## INPUT CHARACTERISTICS

### **General :**

One input connector per channel; bipolar input, accepts positive or negative voltages.

### **Impedance :**

50 ohms  $\pm 1\%$  direct coupled input.

### **Protection :**

Protected with clamping diodes, no damage will occur from transients of  $\pm 100$  Volts ( $\pm 2$  Amps) for 1  $\mu$ Sec or less duration.

### **Reflections :**

Less than  $\pm 4\%$  for input risetime of 1 nSec.

### **Input Offset :**

Less than  $\pm 300$   $\mu$ Volts, typically 12  $\mu$ Amps.

### **Overdrive Response :**

Recovery time of 20 nSec for a  $\pm 1$  Volt input.

## OUTPUT CHARACTERISTICS

### **General :**

Model 770: Two bridged output connectors per channel.

Model 771: One output connector per channel. Low impedance voltage source output stage.

Both the 770 and 771 are capable of driving two 50 ohm loads.

### **Protection :**

Outputs can be continuously shorted to ground without damage.

### **Output Voltage Swing :**

Bipolar outputs deliver over  $\pm 2.5$  Volts across single 50 ohm load, and  $\pm 2$  Volts across two 50 ohm loads.

### **DC Offset :**

A front panel 15-turn potentiometer provides  $\pm 250$  mV adjustment. A front panel test point allows easy monitoring of the DC offset.

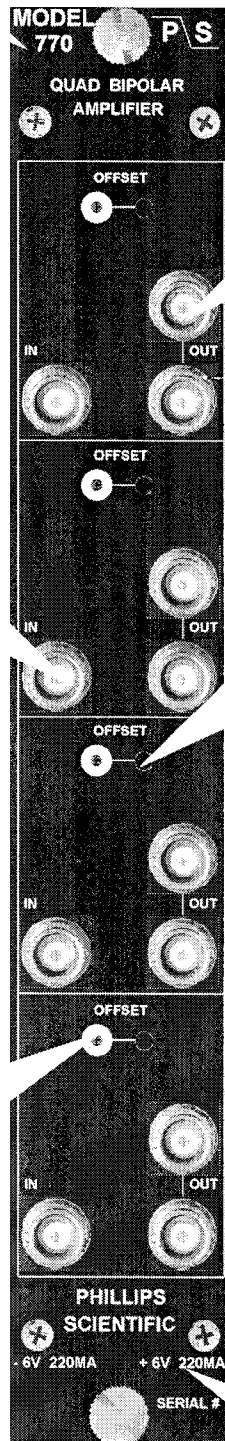
## GENERAL PERFORMANCE

- Gain** : Model 770 : Fixed gain of 10,  $\pm 2\%$ , non-inverting.  
Model 771 : Calibrated gain steps from 1 to 10,  $\pm 2\%$  non-inverting.
- Stability** : Better than  $\pm 5.0$   $\mu$ Volt/ $^{\circ}$ C from DC to 1 MHz, and  $\pm 0.01\%$ / $^{\circ}$ C above 1 MHz.
- Linearity** :  $\pm 0.1\%$  for  $\pm 2.0$  Volts across one 50 ohm load or  $\pm 1.5$  Volts across two 50 ohm loads.
- Bandwidth** : DC to 300 MHz, 3 db point for 1 Volt peak to peak.
- Wideband Noise** : Less than 25  $\mu$ Volts RMS, referred to the input (1.5 nV/ $\sqrt{\text{Hz}}$ ).
- Risetime** : Typically 1.1 nSec, for a 1 Volt output excursion.
- Insertion Delay** : Typically 3.5 nSec.
- Crosstalk** : Greater than 60 db, DC to 300 MHz.
- Power Supply Requirements** : +6V @ 220 mA    -6V @ 220 mA  
**Note:** All currents are within NIM power supply limits for a single width NIM module.
- Operating Temperature** : 0  $^{\circ}$ C to 70  $^{\circ}$ C ambient.
- Packaging** : Standard single width NIM module in accordance with TID-20893 and Section 524.
- Connector Type** : BNC connectors, unless otherwise specified. (LEMO or SMA female are available as options).
- Quality Control** : Standard 36 hour cycled burn-in with switched power cycles.

## MODEL 770 QUAD 300 MHz BIPOLAR AMPLIFIER

( Front Panel Description )

Standard # 1 NIM Packaging  
in accordance with TID-20893



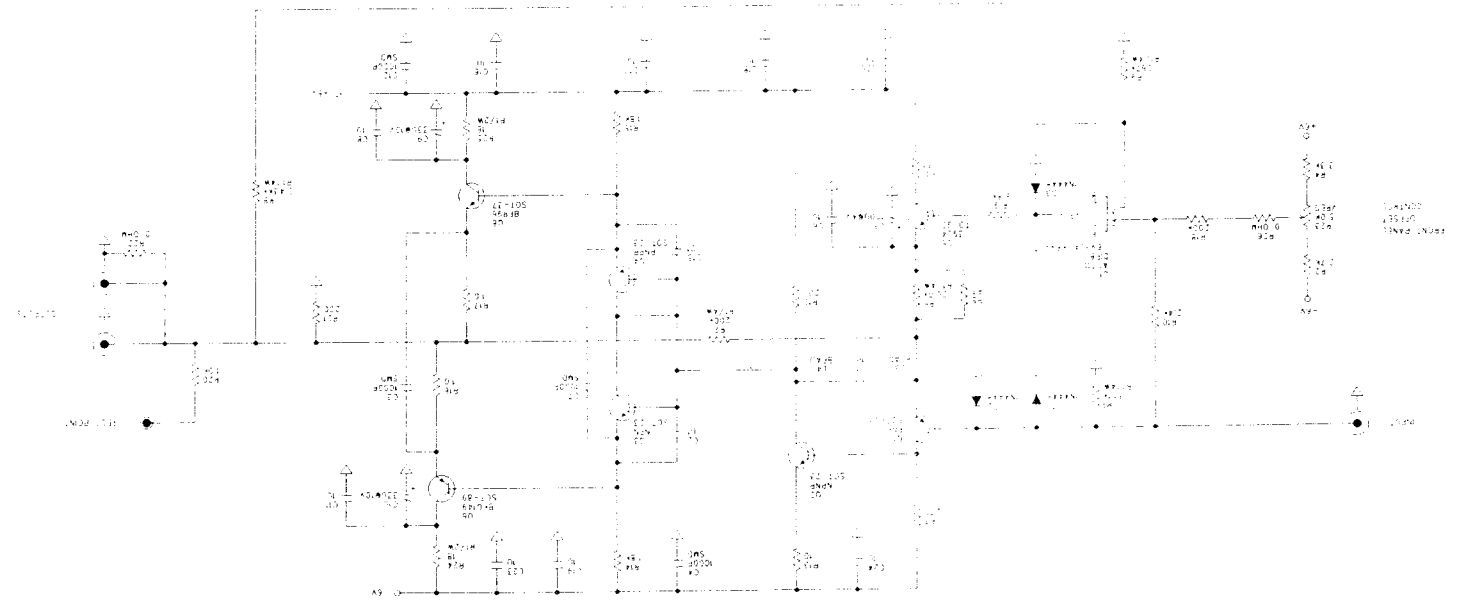
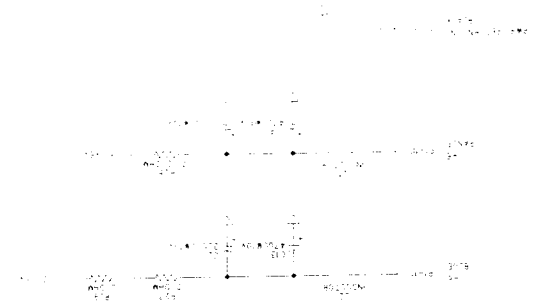
Two Linear Bridged Outputs  
Each Capable of Delivering  $\pm 2.5V$   
into 50 ohm Load; Non-Inverting

Amplifier Input  
50 ohm, Direct Coupled.

Output DC Offset Control  
15-Turn Screwdriver Adjustment,  
Variable Range of  $\pm 250mV$

Test Point for Easy Monitoring  
of Output DC Offset Level

NIM Voltage and Current  
Requirements



ONE OF FOUR IDENTICAL CHANNELS

## MODEL 770 PARTS LIST

Rev. A

| <u>Ident.</u> | <u>Qty.</u> | <u>Part Number</u> | <u>Description</u>             |
|---------------|-------------|--------------------|--------------------------------|
| R1            | 4           | 006551R1           | 51.1 ohm 1% RN 1/4 resistor    |
| R2            | 4           | 00102701           | 2.7K ohm 5% CF 1/8 resistor    |
| R3            | 4           | 00102700           | 270 ohm 5% CF 1/8 resistor     |
| R4            | 4           | 00103301           | 3.3K ohm 5% CF 1/8 resistor    |
| R5            | 4           | 00000000           | Resistor Trim                  |
| R6            | 4           | 006520R0           | 20 ohm 1% RN 1/4 resistor      |
| R7            | 4           | 00652000           | 200 ohm 1% RN 1/4 resistor     |
| R8            | 4           | 00652431           | 2.43K ohm 1% RN 1/4 resistor   |
| R9            | 4           | 00652670           | 267 ohm 1% RN 1/4 resistor     |
| R10           | 4           | 00102401           | 2.4K ohm 5% CF 1/8 resistor    |
| R11           | 4           | 001051R0           | 51 ohm 5% CF 1/8 resistor      |
| R12           | 4           | 00102000           | 200 ohm 5% CF 1/8 resistor     |
| R13           | 4           | 001010R0           | 10 ohm 5% CF 1/8 resistor      |
| R14           | 4           | 00101801           | 1.8K ohm 5% CF 1/8 resistor    |
| R15           | 4           | 00101801           | 1.8K ohm 5% CF 1/8 resistor    |
| R16           | 4           | 00101R00           | 1.0 ohm 5% CF 1/8 resistor     |
| R17           | 4           | 00101R00           | 1.0 ohm 5% CF 1/8 resistor     |
| R18           | 4           | 00102003           | 200K ohm 5% CF 1/8 resistor    |
| R19           | 4           | 00106801           | 6.8K ohm 5% CF 1/8 resistor    |
| R20           | 4           | 00101001           | 1.0K ohm 5% CF 1/8 resistor    |
| R21           | 4           | 00102000           | 200 ohm 5% CF 1/8 resistor     |
| R22           | 4           | 00010200           | .2" 0 ohm 5% CF 1/8 resistor   |
| R23           | 4           | 05105001           | 5.0K ohm 15 turn 3/4 Rect. Pot |
| R24           | 4           | 001218R0           | 18 ohm 5% CF 1/2 resistor      |
| R25           | 4           | 001218R0           | 18 ohm 5% CF 1/2 resistor      |
| R26           | 4           | 00010700           | .7" 0 ohm 5% CF 1/8 resistor   |
| R27           | 1           | 00010700           | .7" 0 ohm 5% CF 1/8 resistor   |
| R28           | 1           | 00010700           | .7" 0 ohm 5% CF 1/8 resistor   |
| R29           | 1           | 00010300           | .3" 0 ohm 5% CF 1/8 resistor   |
| C1            | 4           | 10101P00           | 1 pfd NPO cer disc capacitor   |
| C2            | 4           | 10151002           | .01 mfd cer mono capacitor     |
| C3            | 4           | 10121001           | 1000 pfd SMD cer capacitor     |
| C4            | 4           | 10121001           | 1000 pfd SMD cer capacitor     |
| C5            | 4           | 10791006           | 100 mfd @ 4v tan capacitor     |
| C6            | 4           | 10151003           | .1 mfd cer mono capacitor      |
| C7            | 4           | 10121001           | 1000 pfd SMD cer capacitor     |
| C8            | 4           | 10151003           | .1 mfd cer mono capacitor      |
| C9            | 4           | 10813305           | 33 mfd @ 10v tan capacitor     |
| C10           | 4           | 10813305           | 33 mfd @ 10v tan capacitor     |
| C11           | 4           | 10151003           | .1 mfd cer mono capacitor      |
| C12           | 4           | 10121001           | 1000 pfd SMD cer capacitor     |
| C13           | 1           | 10614706           | 470 mfd @ 10v al el capacitor  |
| C14           | 1           | 10614706           | 470 mfd @ 10v al el capacitor  |
| C15           | 4           | 10151002           | .01 mfd cer mono capacitor     |
| C16           | 4           | 10151003           | .1 mfd cer mono capacitor      |
| C17           | 4           | 10151003           | .1 mfd cer mono capacitor      |
| C18           | 4           | 10151003           | .1 mfd cer mono capacitor      |
| C19           | 4           | 10151003           | .1 mfd cer mono capacitor      |
| C20           | 4           | 10151003           | .1 mfd cer mono capacitor      |
| C21           | 1           | 10612207           | 2200 mfd @ 10v al el capacitor |
| C22           | 1           | 10612207           | 2200 mfd @ 10v al el capacitor |
| C23           | 4           | 10151003           | .1 mfd cer mono capacitor      |
| C24           | 4           | 10151003           | .1 mfd cer mono capacitor      |
| D1            | 4           | 20004448           | 1N4448 diode                   |
| D2            | 4           | 20004448           | 1N4448 diode                   |

## MODEL 770 PARTS LIST

Rev. A

| <u>Ident.</u> | <u>Qty.</u> | <u>Part Number</u> | <u>Description</u>                          |
|---------------|-------------|--------------------|---|
| D3            | 4           | 20004448           | 1N4448 diode                                |
| L1            | 1           | 15000000           | Power Inductor                              |
| L2            | 1           | 15000000           | Power Inductor                              |
| L3            | 4           | 14000001           | Sleeve bead                                 |
| L4            | 4           | 14000001           | Sleeve bead                                 |
| U1            | 4           | 3020711J           | AD711JN OP-AMP IC                           |
| Q1            | 4           | 2420PNP0           | PNP (SMD) (MD) transistor                   |
| Q2            | 4           | 2420NPNR           | NPN (SMD) reverse transistor                |
| Q3            | 4           | 2420PNP0           | NPN (SMD) (R2) transistor                   |
| Q4            | 4           | 2420PNPR           | PNP (SMD) reverse transistor                |
| Q5            | 4           | 24003904           | 2N3904 NPN transistor                       |
| Q6            | 4           | 2421PNP0           | BFQ149 PNP (SMD) transistor                 |
| Q7            |             |                    | Not Used                                    |
| Q8            | 4           | 2421NPN0           | BFR96 NPN (SMD) transistor                  |
|               | 4           | 40000008           | 8 Pin DIP Socket                            |
|               | 12          | 40101000           | BNC Connector                               |
|               | 12          | 40101001           | BNC Lock Washer                             |
|               | 24          | 40101002           | BNC Solder Lug                              |
|               | 12          | 40101003           | BNC Hex Nut                                 |
|               | 1           | 40200000           | NIM Connector Block                         |
|               | 1           | 40200001           | NIM Connector Shield                        |
|               | 3           | 40200002           | NIM Elec. Pin Male                          |
|               | 2           | 40200003           | NIM Guide Pin Female                        |
|               | 1           | 40200004           | NIM Guide Pin Male                          |
|               | 1           | 40200005           | NIM Gold Male Pin                           |
|               | 1           | 40200006           | #4 Gold Lock Washer                         |
|               | 1           | 40200007           | #4 Gold Hex Nut                             |
|               | 4           | 40950001           | Test Point                                  |
|               | 1           | 40950002           | Solder Lug                                  |
|               | 1           | 58000102           | NIM Rear Panel                              |
|               | 1           | 58000103           | NIM Right Side Cover                        |
|               | 1           | 58000104           | NIM Left Side Cover                         |
|               | 2           | 58000105           | NIM Square Rail                             |
|               | 2           | 58000106           | NIM Round Rail                              |
|               | 1           | 58007700           | Front Panel                                 |
|               | 4           | 65025603           | 2-56 x 3/16 Flat Head Phillips Screw        |
|               | 6           | 65044003           | 4-40 x 3/16 Flat Head Phillips Screw        |
|               | 6           | 65144006           | 4-40 x 3/8 Round Head Phillips Screw        |
|               | 7           | 65944004           | 4-40 x 1/4 Fillister Head Screw             |
|               | 2           | 65944005           | 4-40 x 5/16 Fillister Head Screw            |
|               | 4           | 70000012           | 3/4" Roll Spacer                            |
|               | 2           | 73010000           | NIM Stand Off                               |
|               | 2           | 73010001           | NIM Captive Screw                           |
|               | 1           | 85007480           | Model 748/770/771/772 Printed Circuit Board |