MOOG

NF123-211A1 Series

Dual Signal Conditioner Circuit Card

SPECIFICATIONS

Transducer Power Supply

Output: +10 VDC nominal, 350 mA max; lower voltages available by fitting suitable resistor at R38

Drift: < 1 mV/°C max

Signal Amplifiers

Differential Inputs: 10^9 Ω/10 pF impedance; compatible with bridge resistances from 60 to 1000 Ω

Outputs: to ± 10 VDC nominal, 5 kΩ min. load

Gain (typical):
J1/J4 closed:
0.480 to 1.680 V/mV
J2/J5 closed:
0.330 to 1.160 V/mV
J3/J6 closed:
0.190 to 0.670 V/mV

Frequency Response:
≤ 3 db down at 4 kHz

Drift: -P1, -P2: < 200 µV/°C
P1, P2: <270 µV/°C
Δ: < 350 µV/°C

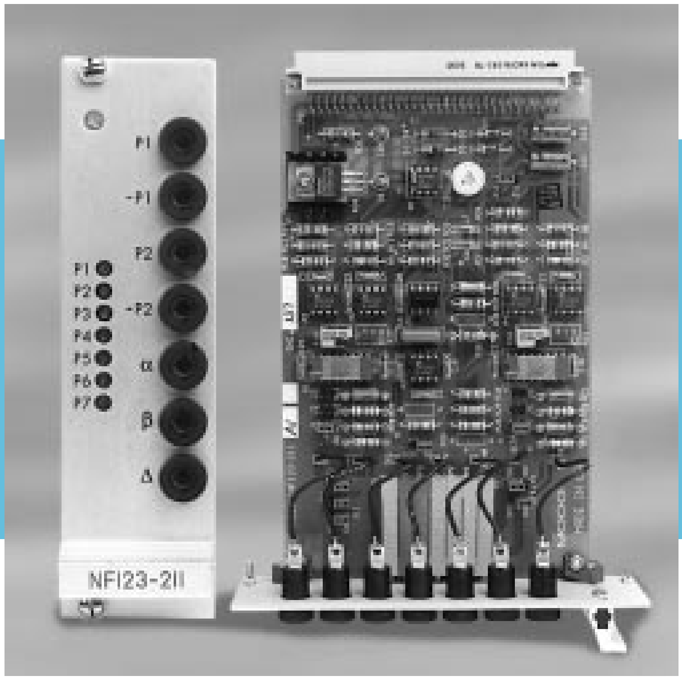
Temperature Range:
10°C to 50°C (50˚F to 120˚F)
Connector DIN 41612 style C

Form Factor:
Eurocard 100 X 160 mm, 7 HP, 3 U

Weight:
0.40 lb (0.18 kg)

The Dual Signal Conditioner circuit card is designed for use with pressure transducers, strain gauges, and load cells in high-performance servosystems. The card contains circuitry to supply DC power to two transducers and to amplify the outputs of the transducers. The card also can be used to generate a voltage that is proportional to the difference between the two conditioned transducer signals.

The NF123-211A1 Dual Signal Conditioner card is a forward compatible replacement for the F123-211A001.



ADJUSTMENTS

R17 Input Offset Null-1: Provides input offset bias of channel 1. Adjust for 0 VDC at terminal 5 with zero pressure (or force) on transducer. R17 not provided. Must be customer installed. Recommended size is 10K.

R18 Input Offset Null-2: Provides input offset bias of channel 2. Adjust for 0 VDC at terminal 9 with zero pressure (or force) on transducer. R18 not provided. Must be customer installed. Recommended size is 10K.

P1 Excitation Voltage: Changes DC voltage supplied to transducer at terminal 1. Turn CW to increase voltage. Adjust for a voltage level appropriate to the transducer.

P2 Alpha (α) Trim: Changes proportion of ±P1 voltage present at test point a. Turn CW to increase a. Adjust per notes below.

P3 Beta (β) Trim: Changes proportion of ±P2 voltage present at test point b. Turn CW to increase b. Adjust per notes below.

P4 Gain 1: Changes voltage gain of channel 1 amplifier. Turn CW to increase gain. Adjust to calibrate the span of voltage at terminals 5 and 7.

P5 Gain 2: Changes voltage gain of channel 2 amplifier. Turn CW to increase gain. Adjust to calibrate the span of voltage at terminals 9 and 11.

P6 Zero 1: Changes bias of channel 1 amplifier. Turn CW to decrease voltage at terminal 5. Adjust for 0 VDC at terminal 5 with zero pressure (or force) on transducer.

P7 Zero 2: Changes bias of channel 2 amplifier. Turn CW to decrease voltage at terminal 9. Adjust for 0 VDC at terminal 9 with zero pressure (or force) on transducer.

NOTES: Voltage at terminal 8 (D) is per table below with jumpers J11 and J12 "ON".
Note that $0 \leq \alpha \leq 1$ and $0 \leq \beta \leq 1$.
close J7 & J10: $\Delta = \alpha P1 - \beta P2$
close J8 & J9: $\Delta = \beta P2 - \alpha P1$
Jumpers J13/J14 "OFF" when remote sensing of transducer supply voltage is used.
Jumper J15 must be closed for proper temperature stabilization.

FEATURES

High-Gain Voltage Amplifiers:
Jumper-selectable gain ranges for compatibility with most off-the-shelf resistance-bridge transducers.
Special preamplifier ICs for high precision.
Independent bias and gain adjustments for each channel.

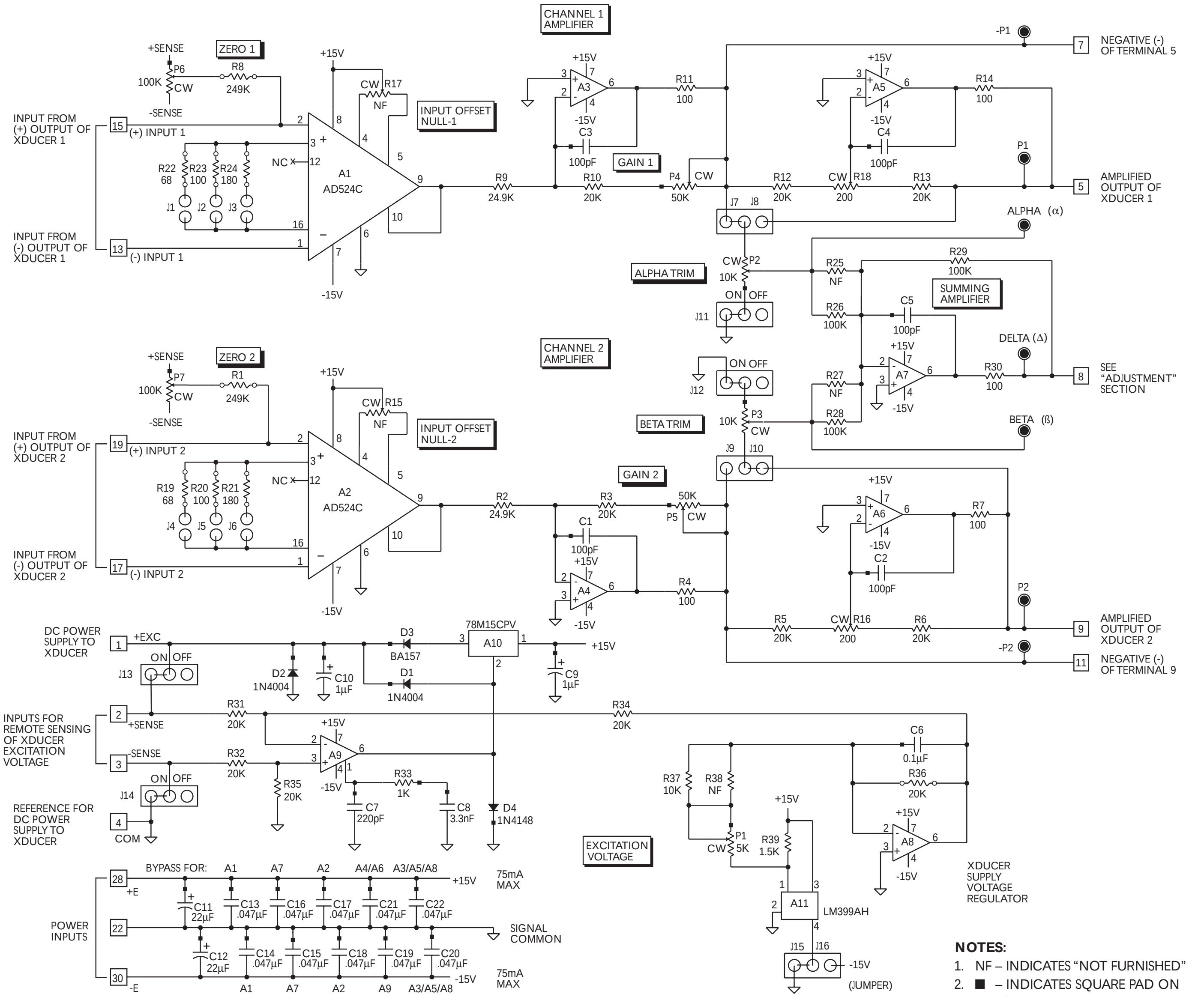
Summing Amplifier:
Easily configured to generate a voltage that is proportional to the force exerted by either single-ended or double-ended hydraulic cylinders.

Regulated DC Power Supply:
With voltage-feedback stabilization for low-drift performance. Load-sensing circuitry allows use of very long cabling between the circuit card and the transducer by compensating for transducer supply line voltage drops.

Front-Panel Adjustments:
Provide quick access to gain, bias, and scaling potentiometers.

Front-Panel Test Points:
Allow for fast and easy setup, test, and monitoring of signals.

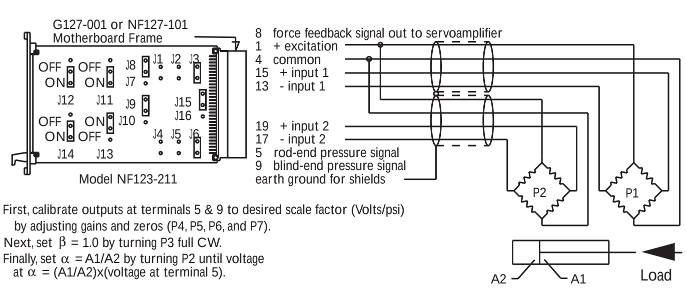
NF123-211A1 DUAL SIGNAL CONDITIONER SCHEMATIC



NOTES:

1. NF – INDICATES "NOT FURNISHED"
2. ■ – INDICATES SQUARE PAD ON PCB (PIN 1)
3. ⊖ – INDICATES COMPONENT MOUNTED ON STANDOFFS
4. NC – NOT CONNECTED

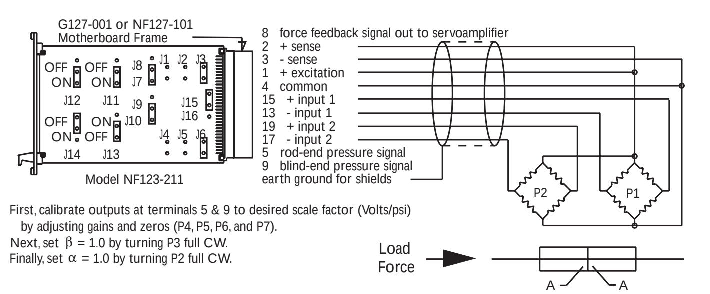
FORCE FEEDBACK WITH SINGLE-ENDED CYLINDER



First, calibrate outputs at terminals 5 & 9 to desired scale factor (Volts/psi) by adjusting gains and zeros (P4, P5, P6, and P7).
Next, set β = 1.0 by turning P3 full CW.
Finally, set α = A1/A2 by turning P2 until voltage at α = (A1/A2)x(voltage at terminal 5).

NOTE: Force signal is proportional to load force ± cylinder friction force.

FORCE FEEDBACK WITH DOUBLE-ENDED CYLINDER AND REMOTE SENSING OF EXCITATION VOLTAGE



First, calibrate outputs at terminals 5 & 9 to desired scale factor (Volts/psi) by adjusting gains and zeros (P4, P5, P6, and P7).
Next, set β = 1.0 by turning P3 full CW.
Finally, set α = 1.0 by turning P2 full CW.

NOTE: Force signal is proportional to load force ± cylinder friction force.

An 'Extender Card' is highly recommended to gain access to 'Test Points' and 'Adjustments' while cards are powered-up within a Eurocard Rack Assembly. Moog ref P/N A81750-1 Extender Card or equivalent.

SET-UP INSTRUCTIONS: GENERAL

1. Connect the Sensors (+ Excitation terminal 1 & 2; - Excitation terminal 3 & 4)
2. Select the proper Sensor Gain at CH1 and CH2 for each transducer by selecting external 'single' Gain Resistor via jumpers JI-J3 (CH1) and J4-J6 (CH2). Selections include: R_{G1} = 68Ω (G ≈ 600); R_{G2} = 100Ω (G ≈ 400);
   R_{G3} = 180Ω (G ≈ 200). Other Gain selections may be obtained by adjusting pin programmable values with proper Input Configuration connections. Consult 'Analog Device' Data Reference Book for external configuration options of the AD524 device.
3. Determine required 'Gain':
   - Use pre-trimmed external component settings
   - Calculate required external resistor for custom desired setting (G = 1 to 1000)
   - Program Gain according to the following equation:

     A_v = Gain = $(40K / 4.44K // R_G) + 1$

     $A_v \approx (40K / R_G) + 1$ or
     $R_G = 40K / A_v - 1$

   - Where 40K = Device Input Resistance (AD524)

     R_G = External single Resistor Gain Range select

     4.44K = Internal resistor at Pin-3 of AD524 device
4. Adjust Sensor voltage supply using P1 (Excitation Voltage). Turn CW to increase voltage, adjusting for a voltage level appropriate to transducer.
5. Adjust 'ZERO OFFSET' with a 'null' pressure by using P6 (Zero-l) @ CH1 and P7 (Zero-2) @ CH2. Adjust for 0 VDC at terminal 5 (CH1) & terminal 9 (CH2) with zero pressure (or force) on transducer. Turn CW to decrease voltage at terminal 5 or 9.
6. Adjust 'GAIN' or output 'LEVEL' by using P4 (Gain-l) @ CH1 and P5 (Gain-2) @ CH2
7. IF 'DIFFERENTIAL' output is used, select the required 'MODE'
8. Close jumpers J11 & J12. Adjust the trim dividers 'α' (alpha) and 'β' (beta).
9. Adjustment at terminal 8 (Delta 'Δ') with jumpers J11 and J12 'ON'
10. When 'remote' sensing of transducer supply voltage is used, J13/J14 are 'OFF'
11. Jumper J15 MUST be closed for proper 'temperature' stabilization

SPECIAL APPLICATIONS

SET-UP INSTRUCTIONS: FORCE FEEDBACK WITH SINGLE-ENDED CYLINDER

1. Calibrate outputs at terminal 5 (CH1) and 9 (CH2) to desired scale factor (Volts/psi) by adjusting 'GAIN' and 'ZERO' using P4, P5, P6 & P7
2. Set β = l.0 by turning P3 full CW
3. Set α = Al / A2 by turning P2 until voltage at α = (A1/A2) x (Voltage @ terminal 5)
4. Force signal is proportional to load force ± cylinder friction force

SET-UP INSTRUCTIONS: FORCE FEEDBACK WITH DOUBLE-ENDED CYLINDER AND REMOTE SENSING OF EXCITATION VOLTAGE

1. Calibrate outputs at terminal 5 (CHI) and 9 (CH2) to desired scale factor (Volts/psi) by adjusting 'GAIN' and 'ZERO' using P4, P5, P6 & P7
2. Set β = 1.0 by turning P3 full CW
3. Set α = 1.0 by turning P2 full CW
4. Force signal is proportional to load force ± cylinder friction force

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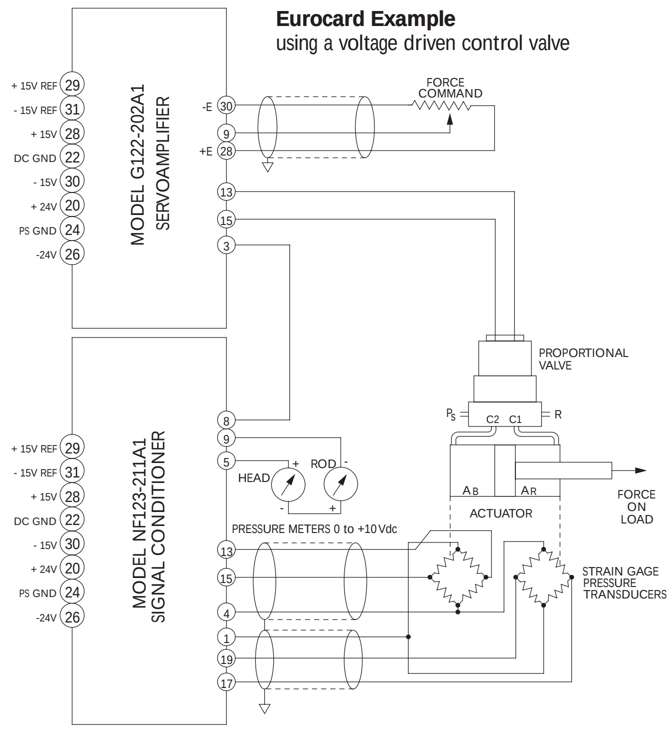
FORCE CONTROL WITH A PROPORTIONAL SERVOVALVE

A closed loop force control system is made up of a control valve, an actuator, a load cell or pressure transducer, and a servoamplifier. The two output control ports on the control valve are connected across the load actuator.

In the servoamplifier, the command input is compared to the present pressure in the actuator ports (Force = Area x Pressure). If a difference between the two exists, it is amplified and fed to the control valve. This signal shifts the valve spool position, adjusting pressure in the actuator until the force output agrees with the command input.

The Signal Conditioner card can be used to process pressure signals and obtain a force feedback signal from the actuator. Strain gauge type pressure transducers are often used in such applications. The signal conditioning provides stable amplification of the millivolt-level strain gauge outputs. DC volt-meters can be connected to provide visual indication of the hydraulic pressures.

Eurocard Example
using a voltage driven control valve



(Power supplied by common power bus in the 19 inch rack.)

Modifications to the G122-202A1 card:
(Reference Moog Document G122-202A1)

- Set PID for P control.
- Set I/U jumper in "U" position for voltage drive.

Suggested Setup Procedure:
(Reference Moog Documents G122-202A1 and NF123-211A1)

1. Turn off hydraulic power, relieve pressure.
2. Set the GAIN pot (P2) on the G122-202A1 card approximately five turns from full counter-clockwise.
3. Set the SCALE pot (P9) on the G122-202A1 card full counter-clockwise.
4. Apply electrical power.
5. Apply hydraulic pressure.
6. If unequal area scaling is required, adjust the ZERO pots (P6, P7) and SPAN pots (P4, P5) on the NF123-211A1 card for corresponding pressures from the strain gauge transducers. Set b=1 by setting P3 full clockwise. Set $a=A_R/A_B$ by setting P2 until voltage at $a=A_R/A_B$ (voltage Pin 5).
7. Adjust the BIAS pot (P1) on the G122-202A1 card for zero voltage at minimum setting of the FORCE command pot.
8. Set the GAIN pot (P2) and SCALE pot (P9) on the G122-202A1 card for the desired force vs command signal range. Check the stability of the system throughout the full load range.
9. Re-set the BIAS pot (P1) on the G122-202A1 for zero force corresponding to zero command signal.

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