MOOG

NF122-202A1Series

Servoamplifier

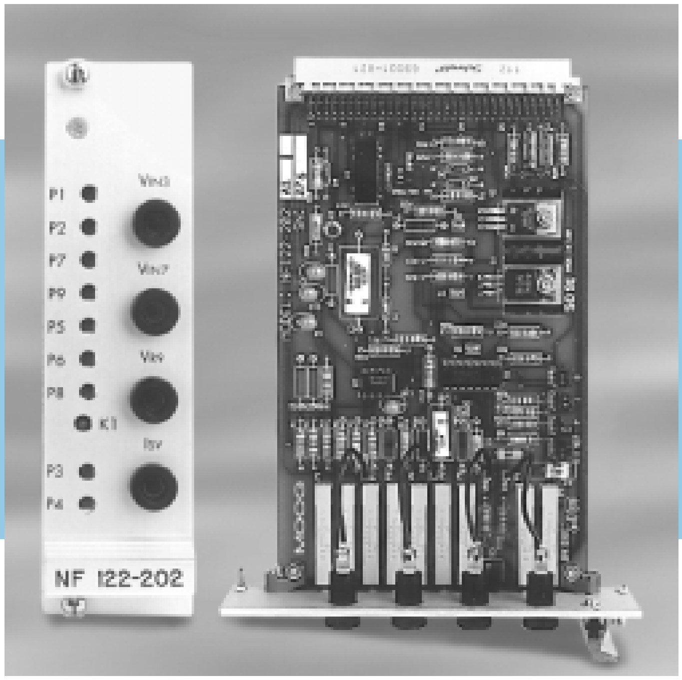
SPECIFICATIONS

Proportional Gain:
5 to 200 mA/V
Integral Gain:
16 to 3,000 mA/V-sec
Derivative Gain:
0.02 to 8 mA-sec/V
Current Output:
to ± 50 mADC into 130 Ω coil
Voltage Output:
to ± 10VDC nominal
Input Levels:
to ± 15VDC on terminals 3 and 7
to ± 120VDC on terminal 9
Drift:
≤ 0.1 mV/°C from 10°C to 50°C
(with 100K Ω inputs and
proportional gain at 50 mA/V)
Temperature Range:
10°C to 50°C (50˚F to 120˚F)

Frequency Response:
-3 dB ≥ 800 Hz (1 Henry load)
Linearity:
± 3% full scale
Dither:
25 to 300 Hz, 0 to 20 mA p-p
Relay:
contacts: ≤ 2 A/24VDC/SPDT
consumption: 15mA from +24VDC line
Coil:
18VDC max pick-up @ 20°C
2VDC min drop-up @ 20°C
Connector:
DIN 41612 style C
Form Factor:
Eurocard 100 X 160 mm, 7 HP, 3 U
Weight:
0.36 lb (0.16 kg)

The NF122-202A1 servoamplifier is designed to drive servovalves or proportional valves in closed-loop servosystems. It provides any combination of proportional, integral, and derivative control (PID). It may also be used as a simple voltage-to-current converter to drive servovalves.

The NF122-202A1 Servoamplifier is a forward compatible replacement for the F122-202A001.



ADJUSTMENTS

P1 Bias: Changes bias voltage at input (summing) stage. Turn CW for positive input bias voltage. Adjust for offset between command and feedback.

P2 Gain: Changes proportional gain of input (summing) stage. Also changes integral and/or derivative gains if jumpers I or D are on. Turn CW to increase gain. Adjust for system stability.

P3 Dither Frequency: Turn CW to increase frequency. Adjust for a frequency appropriate for system dynamics.

P4 Dither Amplitude: Turn CW to increase amplitude. Adjust for desired dither current amplitude, typically ±10% of rated current. Note: jumper DITHER must be on.

P5 Integral Gain: Changes integral gain if jumper I is on. Turn CW to increase gain. Adjust for system stability.

P6 Filter Frequency: Changes corner frequency of low-pass filter on differentiator. Turn CW to increase frequency. Adjust to reduce excessive noise.

P7 Trim: Changes authority of signal on terminal 7. Turn CW to reduce authority. Adjust to provide scaling of input at terminal 7.

P8 Derivative Gain: Changes derivative gain if jumper D is on. Turn CW to decrease gain. Adjust to add phase lead.

P9 Scale: Changes authority of signal on terminal 9. Turn CW to reduce authority. Adjust to provide scaling of input at terminal 9.

FEATURES

PID Control
- Jumper-selectable proportional, integral, and derivative control
- Independent integral and derivative gain adjustments
- Adjustable low-pass filter on derivative control
- Easily-accessible integrator reset function

Error-Summing Input Stage
- Three standard inputs can be reconfigured for differential input
- Independent gain, bias, trim, and scale potentiometers
- Summed error easily accessible for monitoring

Front-Panel Adjustments
- Provide quick access to gains, scales, bias, and dither

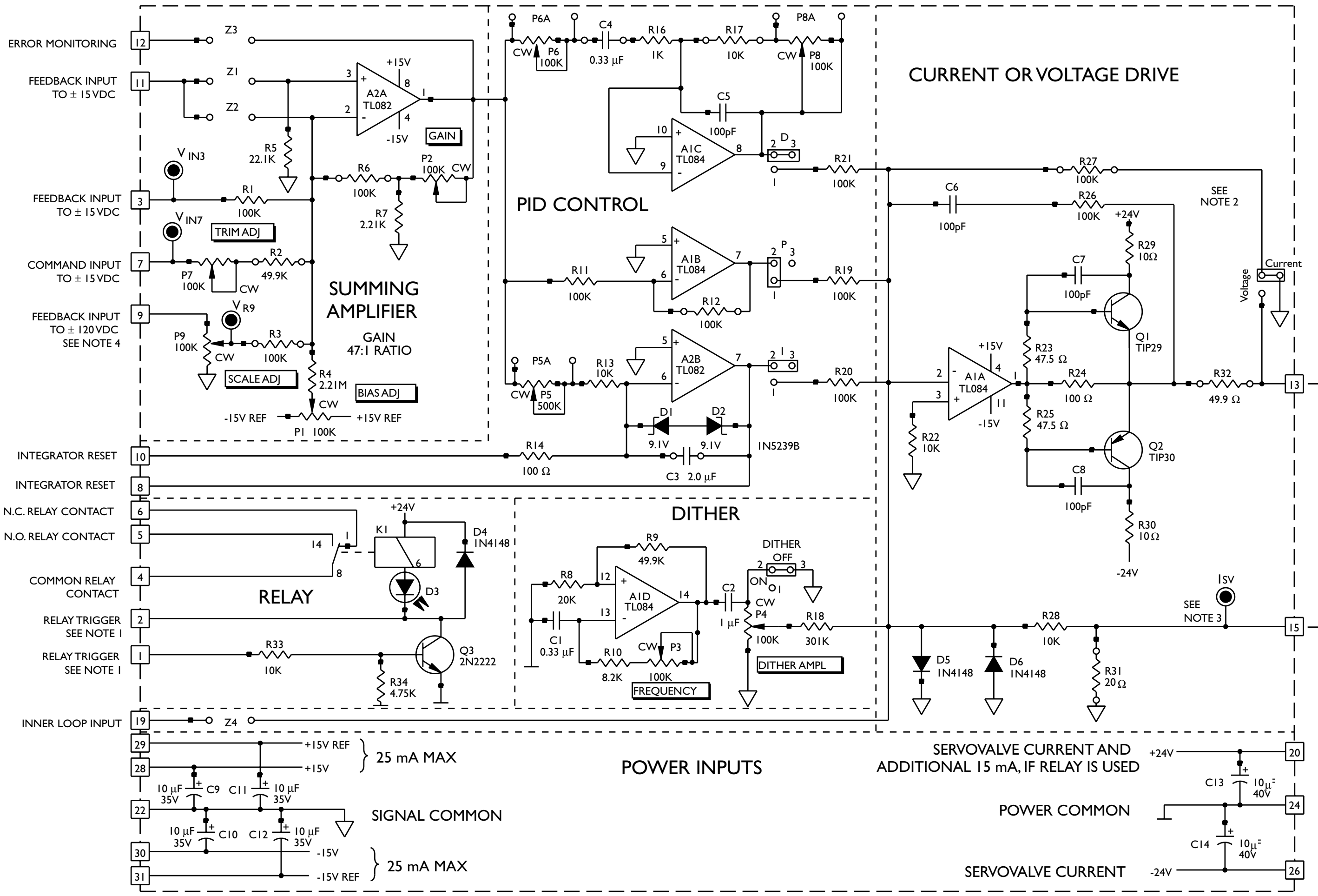
Front-Panel Test Points
- Allow for fast & easy setup, test, & monitoring of parameters

Dither Generator
- Jumper-selectable with adjustable frequency and amplitude

Current or Voltage Drive
- Jumper-selectable with overcurrent protection

SPDT Relay Section
- Energized by high (5 to 15VDC) or low (0VDC) logic signal
- Used for integrator reset, signal switching, or other functions

NF122-202A1 SERVOAMPLIFIER SCHEMATIC



NOTES:

NOTE 1: TO ENERGIZE RELAY, CONNECT TERMINAL 2 TO TERMINAL 24 OR CONNECT +5 TO +15 VDC TO TERMINAL 1.

NOTE 2: PLACE I/U JUMPER IN I POSITION FOR CURRENT DRIVE. PLACE I/U JUMPER IN V POSITION FOR VOLTAGE DRIVE.

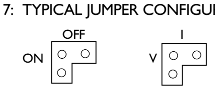
NOTE 3: VOLTAGE AT TEST POINT "ISV" REPRESENTS CURRENT THROUGH VALVE COILS WITH A SCALE FACTOR OF 50 mA/VOLT.

NOTE 4: VOLTAGE AT TEST POINT "VR9" MUST NOT EXCEED ± 15 VDC.

NOTE 5: ■ = PIN 1 (SQUARE PIN).

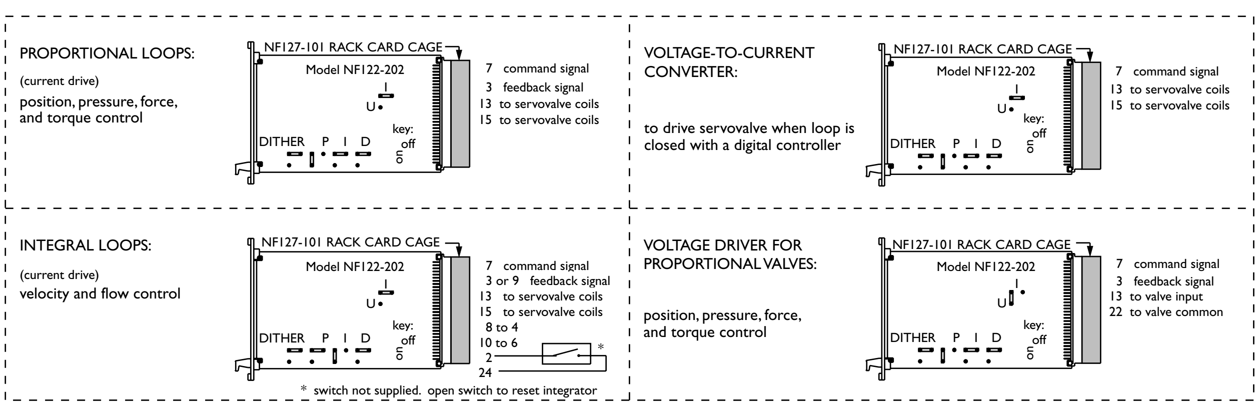
NOTE 6: ⊖ INDICATES COMPONENT STANDOFFS.

NOTE 7: TYPICAL JUMPER CONFIGURATIONS



NOTE 8: GAIN POT (P2) PROVIDES 47:1 ADJUSTMENT

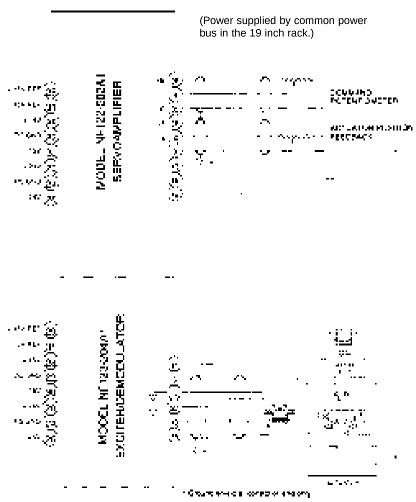
TYPICAL APPLICATIONS



CLOSED-LOOP POSITION CONTROL (3-STAGE VALVE)

Three-Stage servovalves are used in applications where high flow is required. The following examples illustrate the use of an Exciter/ Demodulator card to configure the three-stage servovalve LVDT for inner loop servo control.

The DC voltage from the Exciter/Demodulator is proportional to the position of the servovalve third-stage spool. The DC voltage, the servoamplifier, and the signal from a position feedback transducer create a position servo controller. The inner loop gain can be adjusted independent of the outer loop gain.



Eurocard Example

Modifications to the NF122-202A1 card:
(Reference Moog Document NF122-202A1)
- Set PID for P control.
- Set I/U jumper for current drive.
- Calculate proper resistor valve for "Z4" to yield desired inner loop gain of three-stage valve. Insert resistor in position Z4.

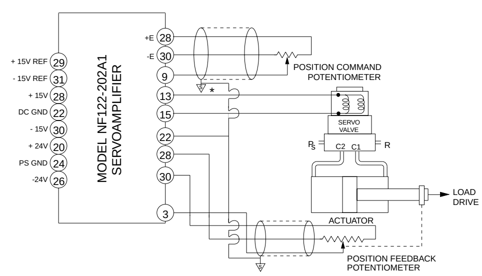
Suggested Setup Procedure:
(Reference Moog Documents NF122-202A1 & NF123-204A1)
1. Turn off hydraulic power and relieve pressure.
2. Set the GAIN pot (P2) on the NF122-202A1 card approximately five turns from full counter-clockwise.
3. Set the SCALE pot (P9) on the NF122-202A1 full clockwise.
4. Select resistor valve for position Z4 to give proper inner loop gain of three-stage valve.
5. Apply electrical power.
6. On the NF122-202A1 card, temporarily remove the feedback connection from terminals [3] and [19]. Adjust the BIAS pot (P2) for zero coil current with pin 9 grounded. Re-connect terminal [3]. Set the scale pot (P9) on the NF122-202A1 full counter-clockwise.
7. Apply hydraulic pressure.
8. Adjust the NF123-204A1 Exciter/Demodulator card for proper demodulator GAIN (P3) by monitoring the voltage at terminal [11]. Adjust the N123-204A1 output BIAS pot (P4) for zero volts with the valve at null (zero current drive to the valve).
9. Re-connect terminal [19] of the NF122-202A1 card.
10. Increase the NF122-202A1 GAIN pot (P2) clockwise until the system exhibits the desired sensitivity. Check the stability of the system throughout the full load range.
11. Adjust the NF122-202A1 BIAS pot (P1) for mid actuator position at zero command signal, or as desired.

CLOSED-LOOP POSITION CONTROL (2-STAGE VALVE)

A closed-loop, load positioning system uses a high performance control valve, an input command generator (potentiometer or other), a servoamplifier, an actuator, and a position transducer to monitor the output location, eliminating the need for human observation. The two output control ports of the valve are connected across the actuator.

In the servoamplifier, the command input is compared to the present position output of the feedback transducer. If a difference between the two exists, it is fed to the servovalve as an error signal. This signal shifts the valve spool position, adjusting flow to the actuator, until the feedback position output agrees with the command input and the desired physical position is achieved or maintained.

The servoamplifier and a DC position transducer, such as a DCDT or linear potentiometer, can be used to create a closed-loop position controller capable of fast, accurate control.



* Ground shield at servoamplifier end only.

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

Eurocard Example

Modifications to the NF122-202A1 card:
(Reference Moog Document NF122-202A1)
- Set PID for P control.
- Set I/U jumper in "I" position for current drive.

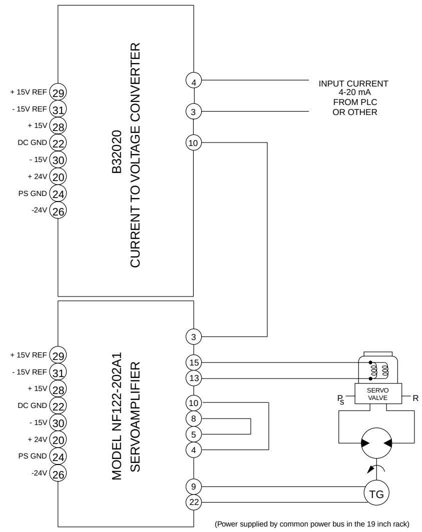
Suggested Setup Procedure:
(Reference Moog Document NF122-202A1)
1. Turn off hydraulic power and relieve pressure.
2. Set the GAIN pot (P2) on the NF122-202A1 card approximately five turns from full counter-clockwise.
3. Set the SCALE pot (P9) on the NF122-202A1 card full counter-clockwise.
4. Apply electrical power.
5. On the NF122-202A1 card, temporarily remove the feedback connection from terminal [3]. Adjust the BIAS pot (P1) for zero coil current at midstroke of the command pot. Re-connect terminal [3].
6. Apply hydraulic pressure. If the actuator extends fully hardover, reverse terminals [13] and [15].
7. Increase the GAIN pot (P2) clockwise until the system exhibits the desired sensitivity. Check the stability of the system throughout the full load range.
8. Adjust the BIAS pot (P1) for mid actuator position at zero command signal, or as desired.

CLOSED-LOOP VELOCITY CONTROL WITH ACCELERATION LIMIT

Closed-loop velocity control with acceleration limit can be achieved through the use of a servo-amplifier. Typically, a packaged rotary servomotor is used, and the velocity is measured by a DC tachometer driven directly, or through gearing, from the back of the motor shaft. The velocity command signal is obtained from a potentiometer or a command source such as a Programmable Logic Controller (PLC). Integral control is used for improved speed tracking performance.

Moog Technical Bulletin TB122 contains a detailed summary of sizing criteria and performance characteristics of velocity servos using servomotors.

In these examples, the Current to Voltage Converter is used to interface with the 4mA to 20mA current command source from a PLC to the voltage input of the servoamplifier.



Eurocard Example

Modifications to the NF122-202A1 card:
(Reference Moog Document NF122-202A1)

- ➢ Set PID jumpers for I control.
- ➢ Set jumper JMPR1 for current drive.
- ➢ It may be desirable to activate solenoid to short out integrator when commanding "0" RPM.

Suggested Setup Procedure:
(Reference Moog Documents NF122-202A1)

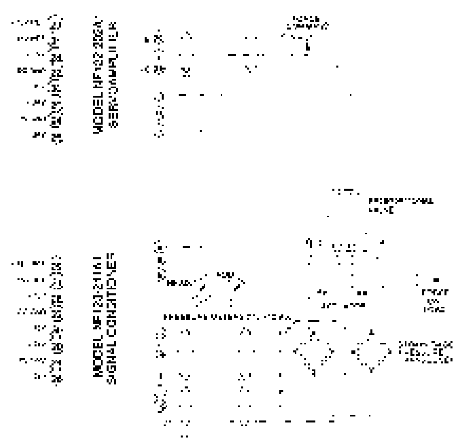
1. Turn off hydraulic power and relieve pressure.
2. Disconnect the tachometer lead from terminal 9 on the NF122-202A1 card.
3. Set the GAIN pot (P2) and the INTEGRATOR pot (P5) on the NF122-202A1 card approximately five turns from full counter-clockwise.
4. Set the SCALE pot (P9) on the NF122-202A1 card full counter- clockwise.
5. Apply electrical power.
6. Adjust ZERO pot (P8) and SPAN pot (P7) on the B32020 card so that 4-20 mA input corresponds to ±10V output to the NF122-202A1 card.
7. Re-connect the tachometer lead to terminal 3 on the NF122-202A1 card.
8. Adjust the GAIN by setting pot (P2) full counter clockwise and adjusting pot (P5) for stability. If pot P5 is at full clockwise and more GAIN is desired, back pot P5 five turns off full clockwise and adjust pot P2 clockwise until the response is achieved.
9. Set the SCALE pot (P9) on the NF122-202A1 card for desired speed range vs command signal range. Check the stability of the system throughout full speed and load range.
10. Adjust the BIAS pot (P1) on the NF122-202A1 card for zero load speed at zero command input.

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

Modifications to the NF122-202A1 card:
(Reference Moog Document NF122-202A1)

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

Suggested Setup Procedure:
(Reference Moog Documents NF122-202A1 and NF123-211A1)

1. Turn off hydraulic power, relieve pressure.
2. Set the GAIN pot (P2) on the NF122-202A1 card approximately five turns from full counter-clockwise.
3. Set the SCALE pot (P9) on the NF122-202A1 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 NF122-202A1 card for zero voltage at minimum setting of the FORCE command pot.
8. Set the GAIN pot (P2) and SCALE pot (P9) on the NF122-202A1 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 NF122-202A1 for zero force corresponding to zero command signal.

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