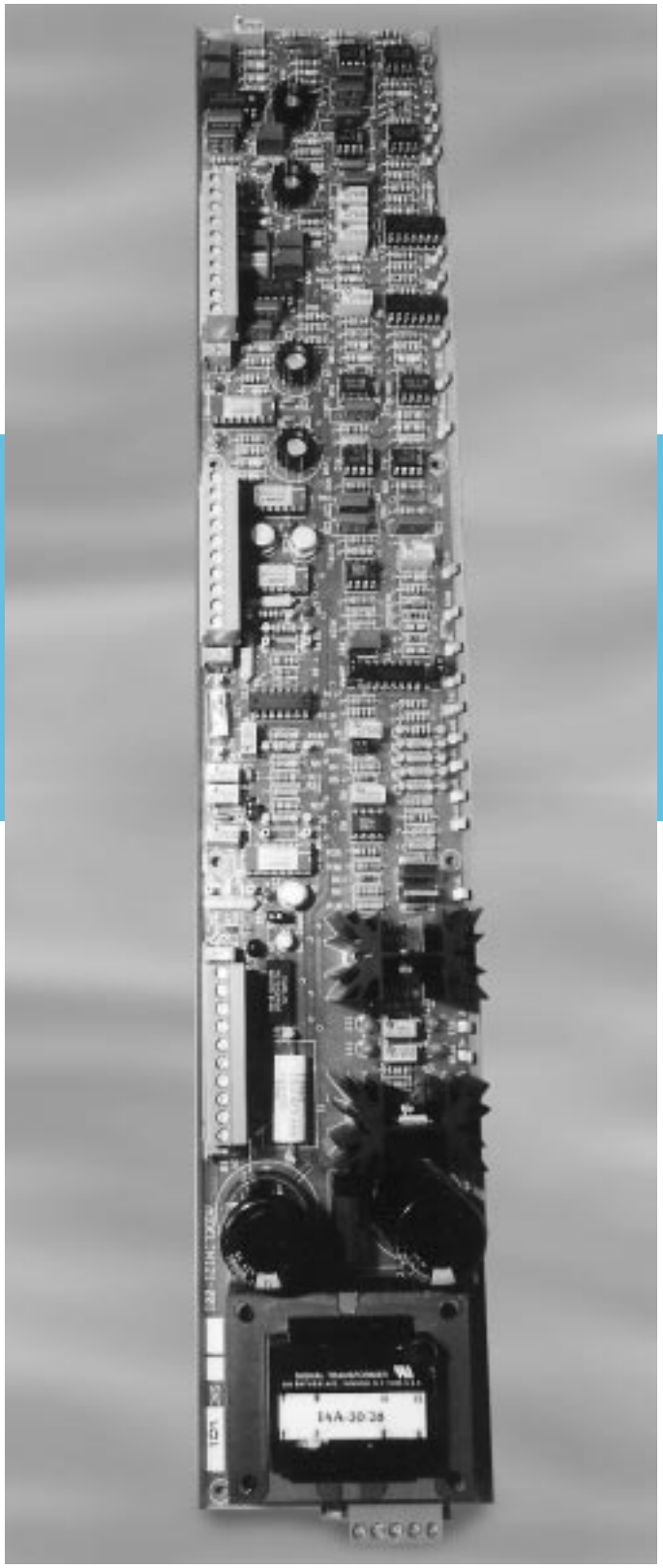
MOOG

N121-001A Series

Dual Transducer Servocontroller



SPECIFICATIONS

Servoamplifier

Servovalve Drive:
±8 mA into 1,250 Ω

Input Command:
4 to 20 mA ungrounded current loop

Proportional Gain:
1.0 to 47 mA/V

Integral Gain:
0.5 to 250 mA/V-sec

Differential Gain:
0.04 to 4 mA-sec/V

Frequency Response:
≤ 3 dB amplitude ≥ 800 Hz
(1 Henry load)

Transducer Demodulator

Outputs:
4 to 20 mA
(monitor transducer demodulated signals & selected feedback)

Ripple:
≤ 10 mVrms @ twice the excitation frequency

Linearity:
≤ ±0.2% at 3 kHz (preliminary)

Gain Stability:
±250 ppm gain/°C, ±0.1 mV/°C

Frequency Response:
negligible phase lag @ 10 Hz,
≤ 10° phase lag @ 100 Hz

The N121-001A Series Dual Transducer Servocontroller was developed specifically for General Electric gas and steam turbine upgrades and modifications. This circuit card is designed to interface with various manufacturers' turbine controlllers, existing or new intrinsically safe servovalves and redundant position feedback transducers. Specifically, the N121-001A contains current drivers for driving triple redundant servovalve coils, redundant excitation/demodulation circuits for dual position feedback transducers, a comparator high select circuit, and 4 to 20 mA interface circuits.

Transducer Exciter

Frequency:
2,000 to 4,000 Hz

Amplitude:
0.7 to 8 Vrms

Amplitude Stability:
≤ 250 ppm amplitude/°C
(preliminary)

Built-In Power Regulator

Power Input:
110/220 VAC ±10%, 50/60 Hz, 30 VA

Temperature Range:
0°C to 50°C

Form Factor:
Snap Trac format 3.25" x 19"

Weight:
2.5 lb

K1 Relay Contact Rating

Consumption:
15 mA @ 24 VDC

Contact Rating:
2.50 mA / 175 VDC / 3 watt

Coil Resistance:
2 KΩ @ 20°C

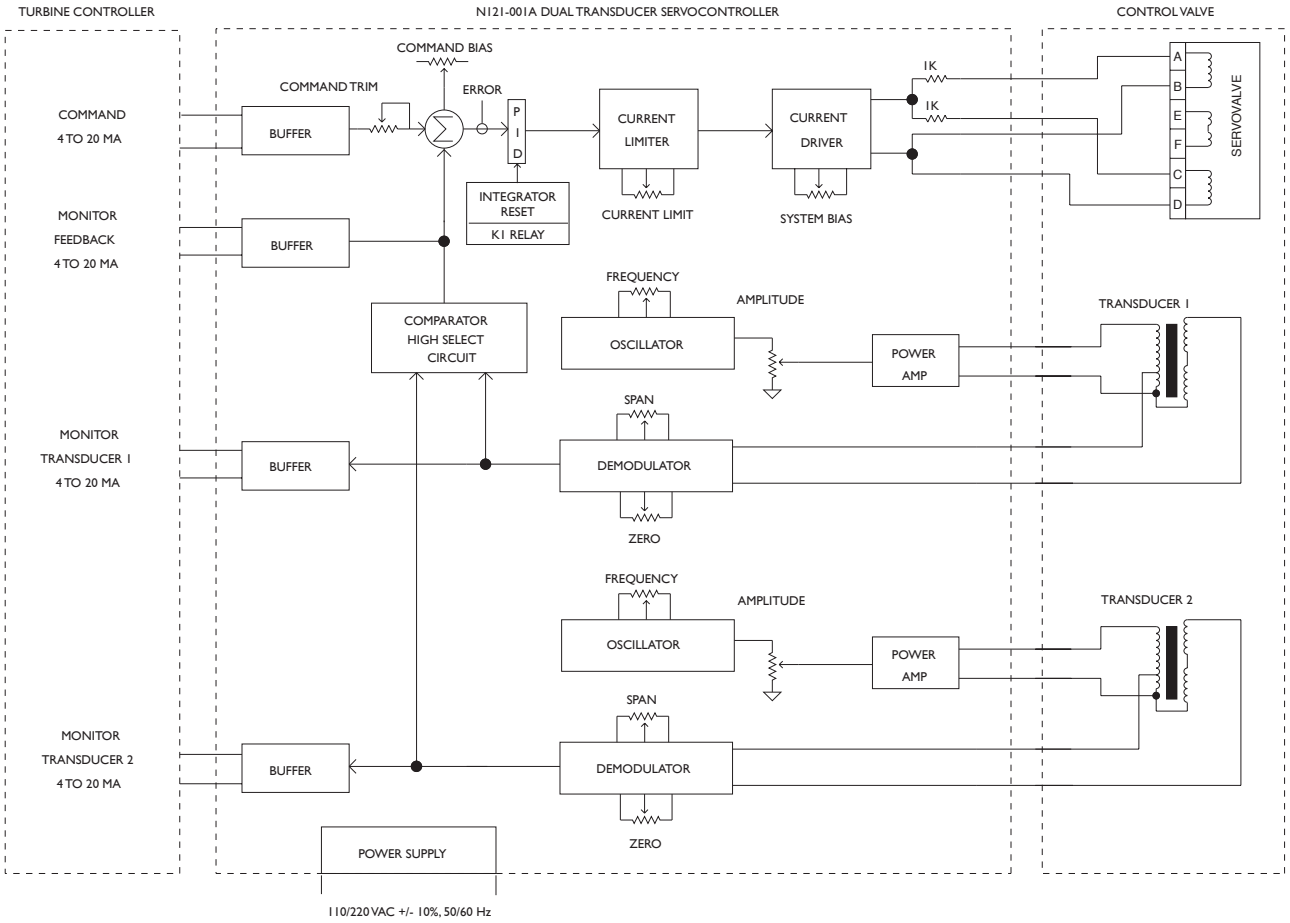
Max Pick-up VDC @ 20°C:
18.0 VDC

Max Drop-up VDC @ 20°C:
2.0 VDC

FEATURES

- Closed-loop control of redundant linear transducer position loops.
- PID control; jumper selectable with independent gain potentiometers.
- Linear transducer signal high selection circuit.
- Current limiter (rate limit control possible).
- 4 to 20 mA input for position command signal.
- 4 to 20 mA outputs to monitor the position feedback signals.
- SPDT relay section - jumper selectable Hi (+5 to 15 VDC) or Low (0 VDC) activation logic state.

N121-001A SERVOCONTROLLER BLOCK DIAGRAM



CUSTOMER INTERCONNECT DIAGRAM AND SET-UP

110 VAC POWER HOOKUP

J1

1	110 VAC POWER INPUT
2	110 VAC POWER INPUT
3	JUMPER TO J1-1
4	JUMPER TO J1-2
5	CHASSIS GROUND

220 VAC POWER HOOKUP

J1

1	220 VAC POWER INPUT
2	JUMPER TO J1-3
3	JUMPER TO J1-2
4	220 VAC POWER INPUT
5	CHASSIS GROUND

LVDT HOOKUP

J2

1	LT-1 SECONDARY SIGNAL (-) VOLTAGE INPUT
2	LT-1 SECONDARY SIGNAL (+) VOLTAGE INPUT
3	LT-1 EXCITATION SIGNAL (+) VOLTAGE INPUT
4	LT-1 EXCITATION SIGNAL (-) VOLTAGE INPUT
5	LT-2 SECONDARY SIGNAL (-) VOLTAGE INPUT
6	LT-2 SECONDARY SIGNAL (+) VOLTAGE INPUT
7	LT-2 EXCITATION SIGNAL (+) VOLTAGE INPUT
8	LT-2 EXCITATION SIGNAL (-) VOLTAGE INPUT
9	COMMAND SIGNAL (-) CURRENT LOOP INPUT
10	COMMAND SIGNAL (+) CURRENT LOOP INPUT

SERVO COIL HOOK-UP

J3

1	SERVOVALVE COIL -1 SIGNAL (+) CURRENT LOOP OUTPUT
2	SERVOVALVE COIL -2 SIGNAL (+) CURRENT LOOP OUTPUT
3	SERVOVALVE COIL -1 SIGNAL (-) CURRENT LOOP OUTPUT
4	SERVOVALVE COIL -2 SIGNAL (-) CURRENT LOOP OUTPUT
5	MONITOR LT-1 SIGNAL (+) CURRENT LOOP OUTPUT
6	MONITOR LT-1 SIGNAL (-) CURRENT LOOP OUTPUT
7	MONITOR FEEDBACK (+) CURRENT LOOP OUTPUT
8	MONITOR FEEDBACK (-) CURRENT LOOP OUTPUT
9	N.C.
10	N.C.

J4

1	INTEGRATOR RESET (GROUND TO ACTIVATE) SIGNAL
2	INTEGRATOR RESET (+5 TO +15 VDC TO ACTIVATE) SIGNAL
3	+V POSITIVE UNREGULATED VOLTAGE
4	+E POSITIVE REGULATED VOLTAGE
5	DC COMMON (GROUND)
6	-E POSITIVE REGULATED VOLTAGE
7	-V NEGATIVE UNREGULATED VOLTAGE
8	MONITOR LT-2 SIGNAL (+) CURRENT LOOP OUTPUT
9	MONITOR LT-2 SIGNAL (-) CURRENT LOOP OUTPUT
10	N.C.

TEST POINT DESCRIPTION

TP1	ERROR SIGNAL
TP2	PROPORTIONAL COMPENSATION SIGNAL
TP3	INTEGRAL COMPENSATION SIGNAL
TP4	SERVOVALVE CURRENT VOLTAGE DRIVE SIGNAL
TP5	SERVOVALVE CURRENT RETURN SENSE SIGNAL
TP6	DIFFERENTIAL COMPENSATION SIGNAL
TP7	SUMMED COMPENSATION SIGNAL
TP8	NULL BIAS CURRENT POT (P17) MONITOR SIGNAL
TP9	+V POSITIVE UNREGULATED VOLTAGE
TP10	+E POSITIVE REGULATED VOLTAGE
TP11	-E NEGATIVE REGULATED VOLTAGE
TP12	-V NEGATIVE UNREGULATED VOLTAGE
TP13	LT-1 SECONDARY SIGNAL
TP14	LT-1 DEMODULATED SIGNAL
TP15	LT-1 EXCITATION SIGNAL (+)
TP16	LT-1 EXCITATION SIGNAL (-)
TP17	LT-2 SECONDARY SIGNAL
TP18	LT-2 DEMODULATED SIGNAL
TP19	LT-2 EXCITATION SIGNAL (+)
TP20	LT-2 EXCITATION SIGNAL (-)
TP21	COMMAND VOLTAGE SIGNAL
TP22	SELECTED FEEDBACK VOLTAGE SIGNAL
TP23	DC COMMON (GROUND)

POTENTIOMETER DESCRIPTION

P1	PROPORTIONAL COMPENSATION GAIN ADJUST
P2	INTEGRAL COMPENSATION GAIN ADJUST
P3	DIFFERENTIAL COMPENSATION LPF ADJUST
P4	DIFFERENTIAL COMPENSATION GAIN ADJUST
P5	CURRENT LIMIT ADJUST
P6	POSITIVE REGULATOR (+15) ADJUST
P7	NEGATIVE REGULATOR (-15) ADJUST
P8	BIAS ADJUST
P9	LT-1 DEMODULATOR SPAN ADJUST
P10	LT-1 DEMODULATOR ZERO ADJUST
P11	LT-1 EXCITATION FREQUENCY ADJUST
P12	LT-1 EXCITATION SYMMETRY ADJUSTMENT
P13	LT-1 EXCITATION SYMMETRY ADJUSTMENT
P14	LT-1 EXCITATION AMPLITUDE ADJUST
P15	LT-2 DEMODULATOR SPAN ADJUST
P16	LT-2 DEMODULATOR ZERO ADJUST
P17	LT-2 EXCITATION FREQUENCY ADJUST
P18	LT-2 EXCITATION SYMMETRY ADJUSTMENT
P19	LT-2 EXCITATION SYMMETRY ADJUSTMENT
P20	LT-2 EXCITATION AMPLITUDE ADJUST
P21	COMMAND TRIM ADJUST
P22	COMMAND BIAS ADJUST

JUMPER DESCRIPTION

JUMPER	DESCRIPTION
JUMPR1	PROPORTIONAL COMPENSATION SIGNAL SELECT
JUMPR2	INTEGRAL COMPENSATION SIGNAL SELECT
JUMPR3	DIFFERENTIAL COMPENSATION SIGNAL SELECT
JUMPR4	LT-2 DISABLE SELECT
JUMPR5	LT-1 DISABLE SELECT

MOOG SERVO DRIVE/LVDT CALIBRATION AND SET-UP INSTRUCTIONS

Bench Top Set-Up

- Adjust Pot (P1- Proportional Gain) Full CW
- Set Jumpers as follows
  for calibration only:
  - JMP1 OFF
  - JMP2 OFF
  - JMP3 OFF
  - JMP4 OFF
  - JMP5 OFF

Initial Power-Up Check

- Verify Positive (+) Regulated Voltage to +15Vdc at Test Point TP-10: if NOT adjust P6
- Verify Negative (-) Regulated Voltage to -15Vdc at Test Point TP-11: If NOT adjust P7
- Connect a DVM between TP-8 and TP-23; Then adjust Pot P8 (Null Bias) until voltage between Test Points is 'Zero'
- Connect Field Wiring and Loop; Check all connections / set-up configuration before reapplying power to the card (use connection diagram supplied with any modifications)

Note-1

- All signals except LVDT excitation signals are referenced to TP-23 (DC Common)
- LVDT Excitation Signals are referenced between TP-15/TP-16 for LT-1 and TP-19/TP-20 for LT-2

Note-2

- In order to be able to calibrate the Moog Servo Drive Card, it is necessary to be able to 'stroke' the valve from 'FULL CLOSED' position to 'FULL OPEN' position
- This is done by increasing the Null Bias current (CCW on P8) until valve Is 'FULL OPEN'
- The valve is then 'closed' by decreasing the Null Bias current (CW on P8)
- Use *Dial Indicator* to measure Full Stroke displacement

LVDT Signal Conditioning Calibration

- Adjust P11 to set LVDT-1 Excitation Frequency to 2.8KHz. Measure freq between TP-15/16.
- Adjust P14 to set LVDT-1 Excitation Amplitude to 7Vrms between TP-15/16
- Adjust P17 to set LVDT-2 Excitation Frequency to 3.2KHz. Measure freq between TP-15/16.
- Adjust P20 to set LVDT-2 Excitation Amplitude to 7Vrms between TP-19/20

Mechanical LVDT Adjustments

- Set Gas Valve at 0% stroke
- Loosen 'locknut' on the LVDT and adjust the position core to obtain LVDT feedback 'rms' voltage of 0.7Vrms for the 0% position (Zero Stroke reference then tighten 'locknut')
- 0.7Vrms is measured between J2-1/ J2-2 for LVDT-1 and J2-5/J2-6 for LVDT-2 (if present)
- Repeat for other valve LVDT's if applicable

Demodulator 'Zero' Calibration with LVDT's Fully Retracted

- Adjust P10 for +2Vdc signal @ TP-14
- Adjust P16 for +2Vdc signal @ TP-18

Demodulator 'Span' Calibration with LVDT's Fully Extended

- Adjust P9 for +10Vdc signal @ TP-14
- Adjust P15 for +10Vdc signal @ TP-18

Repeat Steps in "Mechanical LVDT Adjustments" Section

- Multiple iterations may be required

Command Signal Conversion Calibration

- Apply 4mA Command Signal between J2-10 & J2-9. Adjust P22 for +2Vdc @ TP-21.
- Apply 20mA Command Signal between J2-10 & J2-9. Adjust P21 for +10Vdc @ TP-21.

Null Bias Current Calibration

- Slowly 'increase' the Null Bias (P8) until the valve starts to 'open'.
- After reaching approximately 50% of stroke, adjust the Null Bias Pot (P8) so as to keep the valve fixed in this position.

Proportional Gain Adjustment

- Place JMP1 in the 'ON' position
- Adjust Proportional Gain Pot (P1) to produce a 'smooth' response without 'overshoot' using a step input Command signal
- Set for 'stable' operation of valve

Final Calibration Adjustment

- Apply 4mA Command Signal (if necessary). Adjust P22 Command Bias Signal for valve Full 'closed'.
- Apply 20mA Command Signal (if necessary). Adjust P21 Command Trim for valve Full 'open'.
- Repeat above calibration steps for 4-20mA Command Signal. Multiple iterations may be req'd.

NOTE:

Anytime the Proportional Gain is adjusted, the "Final Calibration Procedure" shown above MUST be repeated!

TEST POINT DESCRIPTION

TEST POINT	FUNCTIONAL DESCRIPTION	RANGE UNITS
TP-1	ERROR SIGNAL (COMMAND SIGNAL HIGH SELECT FEEDBACK)	+10/-10 VDC
TP-2	PROPORTIONAL COMPENSATION SIGNAL	+10/-10 VDC
TP-3	NOT USED	
TP-4	SERVO VALVE CURRENT VOLTAGE DRIVE SIGNAL	+10/-10 VDC
TP-5	SERVO VALVE CURRENT RETURN SENSE SIGNAL	0-80 MVDC
TP-6	NOT USED	
TP-7	SUMMED COMPENSATION SIGNAL (TP-2 + TP-8)	+10/-10 VDC
TP-8	BIAS POT MONITOR SIGNAL (OUTPUT WITH ZERO ERROR)	+15/-15 VDC
TP-9	NOT USED	
TP-10	+E POSITIVE REGULATED VOLTAGE	+15 VDC
TP-11	-E NEGATIVE REGULATED VOLTAGE	-15 VDC
TP-12	NOT USED	
TP-13	LT-1 FEEDBACK SIGNAL	0.7-3.5 VRMS
TP-14	LT-1 DEMODULATED SIGNAL	2-10 VDC
TP-15	LT-1 EXCITATION SIGNAL (+)	7VRMS
TP-16	LT-1 EXCITATION SIGNAL (-)	7VRMS
TP-17	LT-2 FEEDBACK SIGNAL	0.7-3.5VRMS
TP-18	LT-2 DEMODULATED SIGNAL	2-10 VDC
TP-19	LT-2 EXCITATION SIGNAL (+)	7VRMS
TP-20	LT-2 EXCITATION SIGNAL (-)	7VRMS
TP-21	COMMAND VOLTAGE SIGNAL	2-10 VDC
TP-22	HIGH SELECT FEEDBACK SIGNAL	2-10VDC
TP-23	DC COMMON (GROUND)	0 VDC

POTENTIOMETER DESCRIPTION

POTEN. NO.	FUNCTIONAL DESCRIPTION	AUTHORITY INCREASE ⇒ DECREASE ⇐
P1	PROPORTIONAL GAIN	CW ⇒
P2	NOT USED	
P3	NOT USED	
P4	NOT USED	
P5	CURRENT LIMIT ADJUST	CW ⇒
P6	POSITIVE REGULATOR (+15V) ADJUST	CW ⇒
P7	NEGATIVE REGULATOR (-15V) ADJUST	CW ⇒
P8	BIAS ADJUST (OUTPUT WITH NO ERROR)	CCW ⇒
P9	LT-1 DEMODULATOR SPAN ADJUST	CCW ⇒
P10	LT-1 DEMODULATOR ZERO ADJUST	CW ⇒
P11	LT-1 EXCITATION FREQUENCY ADJUST	CW ⇒
P12	LT-1 EXCITATION SYMMETRY (FACTORY SET - DO NOT ADJUST)	
P13	LT-1 EXCITATION SYMMETRY (FACTORY SET - DO NOT ADJUST)	
P14	LT-1 EXCITATION AMPLITUDE ADJUST	CCW ⇒
P15	LT-2 DEMODULATOR SPAN ADJUST	CCW ⇒
P16	LT-2 DEMODULATOR ZERO ADJUST	CW ⇒
P17	LT-2 EXCITATION FREQUENCY	CCW ⇒
P18	LT-2 EXCITATION SYMMETRY (FACTORY SET - DO NOT ADJUST)	
P19	LT-2 EXCITATION SYMMETRY (FACTORY SET - DO NOT ADJUST)	
P20	LT-2 EXCITATION AMPLITUDE ADJUST	CCW ⇒
P21	COMMAND TRIM ADJUST	⇐ CW
P22	COMMAND BIAS ADJUST	CW ⇒

NOTE:

Set-up instructions outlined are for 'specific' GE gas and steam turbine applications. Other adjustments and procedures may be needed as required by the given application. Consult factory as needed.

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