Jordan CONTROLS

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AD-8850 AND AD-8860 SERVO AMPLIFIERS

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I. Description

The AD-8850 and AD-8860 amplifier is an on-off reversing ac drive used for positioning and controlling bi-directional ac motors. In general the amplifier is used in closed loop servos where there is a positional feedback signal such as a feedback potentiometer, dc voltage or dc current.

The command may be manually programmed using a 1K ohm potentiometer with reference voltage supplied from the amplifier. The command may instead come from a normal process control current or voltage signal. When the command signal is a dc current signal from the customer supplied source, a shunt resistor is placed from the command input terminal to dc common on the amplifier to convert the signal to a dc voltage.

The amplifier is a solid-state, self-contained unit with a reference and power supply, and operates from a command and feedback voltage comparator. The input power to the amplifier may be either 120 or 240 Vac depending on the model number. The output voltage to the motor will correspond to the input voltage.

II. Specifications

Circuit Board: 5.25" x 9.75"

Amplifier Height: 2.1" (Allow a minimum of .5" beneath circuit board when mounting)

Mounting Hole Dimensions: 4.4" x 9.0"

Amplifier Weight: 2.2 lbs. (≈ 1 kg)

Operating Temperature Range:0° to 55° C

Storage Temperature Range:-40° to 105° C

Dielectric Test Voltage: 1000 Vac, 60 Hz, 1 min. between ac power circuits and dc signal input circuits

Quiescent Operating Current:

Input Volts	1 LED on	Null
100 Vac	46 mA ac	49 mA ac
117 Vac	59 mA ac	61 mA ac
134 Vac	80 mA ac	82 mA ac

Hysteresis:

Terminals 2 to 4 Typical 10 mV

Input Resistance:

Terminals 1 to 4	65K ohms
Terminals 2 to 4	74K ohms
Terminals 1 to 2	139K ohms

Maximum Possible Operating Input Voltage Range:

Terminals 1 to 4	±45 Vdc
Terminals 2 to 4	±23 Vdc

+15 and -15 Vdc regulated supply output ±15 Vdc ±5%

Maximum External Load (for each output)
200 mA

III. Features

This amplifier features triac switching which is electronically isolated from the dc control input; a null output which may be used for releasing an electro-mechanical brake when the amplifier is not at a null; regulated reference voltage supplies; dynamic braking; and loss of command signal detection.

A. Electronic Isolation

The signal input circuits of this amplifier are electronically isolated from the ac power input and output circuit through two opto-isolators. The dc common is the signal common from the command and feedback signals. The isolation is used to protect the amplifier circuitry in the event that a customer's supplied signals are internally referenced to the ac line.

B. Null Output

Null output is 120 or 240 Vac depending on the amplifier model number. This voltage is normally "off" at null but may be inverted by removing jumper J3 and installing resistors R26 and R24 and transistor Q2. The maximum output current of the null circuit is 6 amps at 25° C and 5 amps at 40° C.

C. Dynamic Braking

Dynamic braking is controlled with a slide switch on the circuit board. This is an aid in stopping the motor when the signal inputs to the amplifier are within the deadband region. With the switch in the "off" position, the dynamic brake circuit is disabled. With the switch in the "on" position, the brake circuit simultaneously applies line voltage to both windings of the motor for a period of 130 milliseconds each time the amplifier nulls. After the 130 milliseconds, the output voltage (terminals 9 and 11) turn off. The action of this circuit electrically stalls the motor eliminating motor coast.

D. Loss of Signal Detection

The loss of signal circuitry incorporated in the amplifier was designed so that if a command signal failure ever occurred, the actuator would respond in a user selected fashion.

There are two options available to the user: the lock-in-place and the preset positioning. The lock-in-place option is selected by installing a jumper between terminals 2 and 13. When this option is selected and a loss of signal is experienced, the actuator will stay in position and will not move. When the preset positioning option is selected, a jumper is required to connect terminal 13 to 14. When a loss of signal occurs, the actuator will run to a preset position no matter where the actuator was positioned when the loss occurred.

There are three potentiometer adjustments associated with the loss of signal circuitry: loss of signal trim, loss of signal set, and preset. The preset adjustment is only used when the preset option is chosen, and the loss of signal trim is only used when the lock-in-place option is chosen. The loss of signal potentiometer must be adjusted for both options.

The loss of signal set potentiometer will determine the threshold between a valid and invalid signal. For example: If the loss of signal set potentiometer is adjusted for 3.8 mA threshold, then any command signal larger than 3.8 mA will be considered valid and the actuator will respond normally. Any command signal less than 3.8 mA will be considered invalid and the actuator will respond according to the loss of signal option chosen.The loss of signal trim is a tuning adjustment which nulls the amp out when loss of signal occurs.

The preset adjustment determines the position of travel the actuator will seek when loss of signal occurs.

IV. Calibration

This unit is preset at the factory and should need no further adjustments. The loss of signal set is adjusted slightly below the minimum input command level threshold, and the loss of signal trim is nulled. Should the user choose the preset positioning option, perform Step 5 of the Set-Up procedure. In the event that total re-calibration is ever necessary, the procedure listed should be followed.

V. Installation

Caution: Fusing is not provided internally for the amplifier power circuit. This must be provided externally. Fuse to a current value equal to the driven load or the null output load (whichever is greater) and add .5 amps. (The dc power supplies are self-protecting.)

V. Installation cont

1. The actuator and amplifier have been pre-wired and aligned at the factory.
2. For signal connections less than 50 feet long, standard wiring may be used on dc lines, provided the conductor is not in close proximity to ac power lines. For installation exceeding 100 feet, shield cable is recommended for command signal connections with grounding of the shield to the amplifier common at the amplifier end only.
3. Wire the actuator/amplifier field wiring per the installation wiring diagram.
4. Refer to Set-Up procedure.

VI. Set-Up

1. Adjust the loss of signal set potentiometer, which is located on the amplifier, fully CCW.
2. Set the command signal input to its minimum level and adjust the elevation potentiometer on the amplifier until the actuator nulls at its minimum position.
3. Set the command signal input to its maximum level and adjust the Span potentiometer on the amplifier until the actuator nulls at its maximum position.
4. Repeat steps 2 and 3.
5. Install a jumper from terminal 13 to 14. Remove the command signal from terminal 1. Adjust the preset potentiometer until the actuator stops near the maximum end of travel.
6. Apply the desired command signal's threshold value to terminal 1.
7. If the actuator begins traveling to the minimum end when Step 6 is accomplished, adjust the loss of signal set potentiometer just until the actuator reverses and returns to the maximum end.
8. If the actuator stays at the maximum end when Step 6 is accomplished, adjust the loss of signal set potentiometer just until the actuator starts traveling to the minimum end.
9. If the user would like to use the lock-in-place option, go to Step 10. Otherwise, to adjust for the preset positioning option, leave the jumper between 13 and 14 in place and remove the command signal from terminal 1. Adjust the preset potentiometer until the actuator stops in the desired position.
10. To adjust the lock-in-place option, remove the jumper between 13 and 14 and permanently install a jumper between 2 and 13. Remove the command signal from terminal 1 and adjust the loss of signal trim potentiometer until the actuator stops moving. If the actuator drives to one end of travel before adjustment is complete, apply an appropriate command signal to bring the actuator back to the center of travel and repeat Step 10 until the adjustment is complete.
11. Apply the command signal to terminal 1 and vary the command from minimum to maximum. The actuator should respond accordingly. Set the command signal to any position between minimum and maximum and adjust the deadband potentiometer for maximum response. This will eliminate the oscillation of and hunting for the motor's correct command signal.

Note: **Tighter response may sometimes be obtained by placing the brake switch in the "on" position.**

If the brake is on and the amplifier nulls at the same time the minimum or maximum limit switch is tripped, then the motor may kick back and reset the position limit switch causing oscillation on the switch. To keep this from occurring, re-adjust the elevation and Span potentiometers to null the amplifier just prior to tripping the switches.

When the amplifier is at a null, both LED 1 and LED 2 will be out. If one of the LED's is on, the amplifier will have an output in one direction telling the motor to run. If both LED's are on at a null condition, the input command signal my have ac noise riding the dc signal. If this occurs, the user should clean up the signal.

A. Actuator Span and Elevation Range

The AD-8850 and AD-8860 Span adjustment provides for a null condition with a ratio of 1.5:1 at maximum Span to .3:1 at minimum Span between the feedback signal and the command signal. All Jordan Controls' actuators are designed to use between 60% and 90% of the actuator feedback potentiometer travel while going through their rated output turns. This means that if a command potentiometer producing a command voltage of 0 to +15 Vdc is used, the Span adjustment must be set for a multiplying ratio between .6 and .9 to produce 100% actuator travel. This will increase the minimum range of the actuator travel that can be set with the Span adjustment. For various input signals, the actual minimum Spans that the actuator can be adjusted to are as follows:

Minimum Span

Input Signal	Actuator using 90% of feedback potentiometer	Actuator using 60% of feedback potentiometer
0 to +15 Vdc potentiometer command	33%	50%
0 to + 10 Vdc voltage command	22%	30%
4-20 mA current command with 510 ohm shunt	22%	30%

If an actuator is using a potentiometer command and a smaller Span than is available is required with a 0 to +15 Vdc potentiometer input, the command potentiometer may be connected between terminals 4 and 6 to half the minimum Span range. Terminal 6 is connected to the +15 Vdc reference supply through a 1K ohm dropping resistor. If a 1K ohm command potentiometer is connected between this terminal and common, it will produce a command signal of half the magnitude.

Note: **Loss of signal will not work with a command potentiometer across terminals 4 and 6. If the command signal is less than 0 to +10 Vdc, it may not be possible to obtain less than 100% Span on an actuator with a 0 to +15 Vdc potentiometer feedback. Under these conditions the Span ranges may be doubled by connecting the feedback potentiometer between terminals 4 and 6. A 0 to +15 Vdc command would allow a Span range identical to that obtained with a 0 to +10 Vdc command and a 0 to +15 Vdc potentiometer feedback.**

Dynamic Braking:Switch selectable "on" or "off"

Dynamic Brake Period:
130 millisecond upon reaching a null condition

Null Output Logic:
Output is "off" when amplifier is at null

Deadband Range:
All models ±15 to ±300 mV

Deadband Adjustment:
1 turn potentiometer CW for increase

B. Options

Reverse null output logic-null output is "on" when amplifier is at null.

2K ohms 20 turn Hi trim potentiometer (in place of 1K ohm fixed resistor) terminal (6).

2K ohms 20 turn Low trim potentiometer (in place of -15 Vdc regulated output) terminal (5).

B. Options cont.

Command and feedback input current shunt 680 ohm for 4-20 mA input or other values as required.

Also available as an option is Model AD-88xx-1011 (non-stock) having balanced differential inputs and 2K ohm Hi trim, instead of, Span and Elevation control. (Consult factory for AD-88xx specials.)

VII. Adjustments

Span Range-Command Input as measured by thepercent of the feedback voltage with which a command signal may be nulled:

Max.	Min.
156% (nominal)	30% (nominal)

Span Adjustment: 20 turn potentiometer CW increases Span

Elevation Range as measured by the voltage deviation of the feedback signal: 0 ±5.7 Vdc

Elevation Adjustment: 20 turn potentiometer CW increases voltage at feedback required for null

Preset: 20 turn potentiometer ±15 Vdc at terminal 14

Loss of Signal Set: 20 turn potentiometer adjusts from 1 to 3 Vdc input at terminal 1

Loss of Signal Trim: 20 turn potentiometer balances inputs to 1C1 when terminal 2 is jumpered to 13

VIII. Parts List

Item	Qty	Description	Part Number
A	1	AD-8850 Amplifier	70-D-019383-001
B	1	AD-8860 Amplifier	70-D-019383-002
1	1	Circuit Board (blank)	50-C-019338-001
2	1	Transformer (T1)	26-B-017902-001
3	2	8-32 x .38 Large Screw (T1 Mount)	54-A-015033-038
4	2	#8 Lockwasher (T1 Mount)	56-A-015190-002
5	2	8-32 Hex Nut (T1 Mount)	55-A-015038-001
6	1	Triac Heat Sink	61-B-019340-001
7	2	8-32 x .19 Large Screw (for heat sink)	54-A-015033-019
8	3	Red LED (LED 1, 2 and 3)	30-B-011696-001
9	3	Diode Bridge (D1, 2 and 3)	30-B-015562-002
10	6	Diode IN4004 (D4-9)	30-B-018004-004
11	3	Transistor, 2N2219A (Q1, 4 and 3)	31-B-016634-001
12	6	Test Jacks (TP1-TP6)	43-B-021758-001
13	3	Triac T-2800D (TR1 , 2 and 3) AD-8850	31-B-011866-001
14	3	Triac Insulator	32-B-021235-003

Item	Qty	Description	Part Number
15	3	6-32 x .38 Nylon Screw	
16	3	#6 Insulating Shoulder Washer	
17	3	6-32 Hex Nut	55-A-015028-001
18	1	Quad Op-Amp LM-124 (IC-1)	31-A-016674-001
19	1	Quad Nand CD4011BE (IC-2)	31-A-017983-001
20	2	Opto-Isolator MCT-2 (IC-3 and 4)	31-B-013258-001
21	2	Voltage Regulator MC78M15CG (IC-5 and 6)	31-B-019345-001
22	2	Heat Sink (for IC-5 and 6)	31-B-019357-001
23	4	2-56 x .31 Large Screw (for heat sink)	54-A-015003-031
24	4	#2 Nylonwasher (for heat sink)	56-A-022877-001
25	1	Integrated Circuit (IC-7)	31-A-028017-001
26	1	Terminal Connector 6 Pin (TB-1)	45-B-019344-006
27	1	Terminal Connector 8 Pin (TB-2)	45-B-019344-008
28	1	Capacitor .22 MFD, 50 V (C-1)	35-B-009235-029
29	1	Capacitor .1 MFD, 50 V (C-2)	35-B-009235-025
30	1	Capacitor 1.0 MFD, 35 V (C-3)	35-B-018313-105
31	1	Capacitor 1300 MFD, 25 V (C-4)	35-B-019358-001
32	2	Capacitor 600 MFD, 50 V (C-5 and 6)	35-B-019358-002
33	3	Capacitor .1 MFD, 50 V (C-7, 8 and 9)	35-B-003885-051
34	3	Capacitor .1 MFD, 400 V (C-10, 11 and 12) AD-8850	35-B-009235-136
34	3	Capacitor .1 MFD, 1000 V (C-10, 11 and 12) AD-8860	35-B-003885-053
35	1	Brake Switch DPDT (S-1)	46-B-018191-001
36	1	Potentiometer, 1K, 20T (Deadband)	34-B-015794-102
37	1	Potentiometer, 10K, 20T (Loss of Signal Set)	34-B-015794-103
38	1	Potentiometer, 5K, 20T (Elevation)	34-B-015794-502
39	1	Potentiometer, 100K, 20T (Span)	34-B-015794-004
40	1	Potentiometer, 10K, 20T (Loss of Signal Trim)	34-B-015794-103
41	1	Potentiometer, 10K, 20T (Preset)	34-B-015794-103
42			
43	1	Relay BBS1C12A10	27-B-020143-003
44	3	Resistor 47K (R-2, 7 and 9)	33-B-018156-473
45	2	Resistor 18K (R-5 and 11)	33-B-018156-183
46	1	Resistor 27K (R-3)	33-B-018156-273
47	6	Resistor 1.2K (R-4, 25, 27, 28, 29 and 44)	33-B-018156-122

Item	Qty	Description	Part Number
48	1	Resistor 22K (R-6)	33-B-018156-223
49	2	Resistor 100K (R-12 and 21)	33-B-018156-104
50	6	Resistor 10K (R-13, 14, 16, 17, 19 and 20)	33-B-018156-103
51	1	Resistor 7.5K (R-15)	33-B-018156-752
52	1	Resistor 47 ohm (R-18)	33-B-018156-470
53	2	Resistor 820 ohm (R-22 and 23)	33-B-018156-821
54	3	Resistor 100 ohm ½W (R-33, 34 and 35)	33-B-018156-101
55	1	Resistor 300K (R-43)	33-B-018156-304
56	1	Resistor 51K (R-40)	33-B-018156-513
57			
58	3	Resistor 100 ohm ¼W, 2% (R-41, 42 and 45)	33-B-018156-101
59	1	Resistor 1K, ½W, 2% (R-38)	33-B-018157-102
60	3	Resistor 82 ohm, 1W, 2% (R-30, 31 and 32)	33-B-018158-820
61			
62			
63	1	Terminal Connector 6 Pin (TC-1)	45-B-019334-106
64	1	Terminal Connector 8 Pin (TC-2)	45-B-019334-108
65	14	Crimp Terminals (for TC-1 and TC-2)	45-B-019334-201

Input Current	Resistor Value	Part Number
1-5 mA	2K, ½ W, 2%	33-B-018157-202
4-20 mA	510 ohms, ½ W, 2%	33-B-018157-511
10-50 mA	200 ohms, ½ W, 2%	33-B-018157-201