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Revision

Rev	Rev By	Approved	Notes
B			
C	RRN	on AS400	CCO #39977
D	R. Nikkels	on AS400	To correct release error

1.0 OVERVIEW:

The RK-4 Rotor Kit Controller Assembly was designed to provide the following features:

a) Proportional, Integral, and Differential (PID) control to the motor. This control system was optimized to provide a compromise between stable and quick response to load changes that can occur during various experiments that the rotor kit was designed to operate under. These experiments include imbalance, rub, fluid instabilities, and perturbation. One advantage to this type of control over previous rotor kit designs is that the motor speed can now be held constant with load changes.

b) Push-Pull amplifier design. This controller can remove power from the motor as well as supply it. Previous control designs were unable to keep rotor speed from increasing above the desired input if energy was supplied to the system that the motor was driving. This new design can now absorb this energy thus maintaining constant rotor speed.

c) DC Power Supply. The RK-4 Controller provides variable 0 - 95 VDC to the motor. This allows for a smoother control of the motor than the "variac" design used in previous controllers. Also longer brush life is expected since the motor is no longer being pulsed with high current transients.

d) Tachometer. The RK-4 controller provides a large easy to read LCD display capable of indicating speeds up to 19,999 RPM.

e) -18 VDC Prox Power. Power for up to ten Proximitor® Assemblies (Two Prox Box Assemblies) is available via the rear panel.

f) EXT Input. An external input was made available on the rear panel which allows a user to hook up a function generator or power supply to control the rotorkit remotely. An input from +5 to -5 VDC will control motor speed from 0 to 10,000 RPM where +VDC is counter clockwise rotation and -VDC is clockwise rotation when viewed from the prime mover.

g) Slowroll Adjust. A potentiometer on the rear panel allows the user to adjust Slowroll speed from about 50 to 500 RPM nominal.

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h) **CCW/EXT/CW Switch. Motor direction of rotation can be controlled via this switch. When in EXT position, rotor direction and speed can be controlled remotely. CCW position will cause a counter clockwise rotation and CW position will cause a clockwise rotation. An internal "lockout" circuit will prevent direction changes if the rotor speed is above 1000 RPM nominal.**

i) **Keyphasor® NOT-OK Shutdown. The controller was designed to shutdown power to the motor should the Keyphasor® probe signal fail due to an open or short circuit.**

j) **Ramp Up/Down Switch. This switch allows the user to select whether the motor will ramp up to a predetermined maximum RPM or ramp down to slowroll.**

k) **Slowroll/Ramp/Stopped Switch. When in the Slowroll position, the motor will rotate at the selected slowroll speed. The Ramp position allows the user to ramp the motor up or down and the stopped position will prevent power from being supplied or removed from the motor. This allows the motor to coast to a stop.**

l) **Max RPM Potentiometer. This potentiometer allows the user to select a maximum motor speed from slowroll to 10,000 RPM. The speed shown on the dial is 0.1 X RPM.**

m) **Ramp Rate potentiometer. Ramp Rates up to 15,000 RPM/minute can be selected by the user from this pot.**

n) **Power Input. The RK-4 controller accepts 110/220 VAC selectable by changing the fuse holder and fuse position.**

2.0 POWER SUPPLY INPUT REQUIREMENTS:

2.1 Input Voltage:

110 Option: 95 to 125 VAC, 50 or 60 Hz, single phase.
220 Option: 190 to 220 VAC, 50 or 60 Hz, single phase.

2.2 Input Current:

3 Amps maximum at 110 VAC.
1.5 Amps maximum at 220 VAC.

2.3 Fuse:

6 Amp 250 VAC slo-blo for 110 VAC.

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3 Amp 250 VAC slo-blo for 220 VAC.

3.0 MOTOR POWER OUTPUT:

3.1 Output Voltage:
0 to 95 VDC minimum.

3.2 Drive current:
3.0 to 4.0 Amps source maximum. (Into 5Ω resistor.)

3.3 Sink Current:
1.3 Amps maximum. (Equates to 8 watts max. removed from motor)

4.0 TACHOMETER:

4.1 Accuracy: +/- 2 RPM steady state

4.2 Resolution: 1 RPM

4.3 Display Range: 50 to 10,000 RPM

5.0 MAX RPM ADJUST POT:

5.1 Accuracy: +/- 1% after calibration of R11 on front panel.

5.2 Repeatability: +/- 0.2%.

6.0 KEYPHASOR:

6.1 Input frequency range:
0 to 3,333 Hz (0 to 10,000 RPM of rotor)

6.2 Accepts input from RAM probes only.

7.0 KEYPHASOR ® NOT-OK DEFEAT:

7.1 Motor voltage to be below 3 VDC within 1.7 seconds from the time the Keyphasor® signal is removed.

7.2 Motor voltage control to be operational when Keyphasor ®signal present.

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8.0 -18 VDC SUPPLY:

8.1 Output Voltage: -17.7 +/-0.05 VDC.

8.2 Constant Output Current: 90 mA maximum.

8.3 Over voltage Protection Mode:

8.3.1 Will never trip below: 90 mA

8.3.2 Will trip always trip above: 210 mA

8.3.3 Current leakage during fold back mode: 21 mA

8.3.4 To reset fuse, output load resistor most be greater than: 215 ohms

Note: The output voltage will drop as the number of the Proximitor® Assemblies are added to the output terminal. The maximum voltage drop will be 0.7 Vdc more positive from the none loaded output voltage level.

9.0 SLOWROLL ADJUST:

9.1 RPM Range: 50 to 500 RPM +/- 100 RPM or +/- 100% whichever is less.

10.0 CCW/EXT/CW SWITCH:

10.1 CCW: Motor voltage polarity should be positive.

10.2 EXT: External input will determine motor polarity. EXTIN > +0.03 +/- 0.01 VDC, polarity is positive. EXTIN < -0.03 +/- 0.01 VDC, polarity is negative.

10.3 CW: Motor voltage polarity should be negative.

11.0 EXTERNAL INPUT:

(Note: Cannot be related to output voltage since different motors run at different speeds for the same voltage.)

11.1 Input Voltage 0 to +5 VDC +/-10%: Motor speed should be Slowroll to 10,000 RPM CCW.

11.2 Input Voltage 0 to -5 VDC +/- 10%: Motor speed should be Slowroll to 10,000 RPM CW.

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12.0 RAMP UP/DOWN SWITCH:

12.1 Ramp Down Position: Motor voltage should ramp down.

12.2 Ramp Up Position: Motor voltage should ramp up.

13.0 RAMP RATE POTENTIOMETER:

13.1 Maximum Ramp Rate: 15,000 RPM/MIN +/-15%.

14.0 SLOWROLL/RAMP/STOPPED:

14.1 Slowroll position: Motor should operate at slowroll set-point.

14.2 Ramp position: Motor should ramp up to max RPM set-point at selected rate or ramp down to slowroll at selected rate.

14.3 Stopped position: Motor should coast down to a stop.

15.0 AC NULL ADJUST:

15.1 Max AC ripple on motor voltage: Adjust for a minimum which must be less than 1.2 VRMS using R25 on amplifier PWA.

16.0 CCW/CW LOCKOUT:

16.1 Lockout Speed: > 945 +/- 195 RPM.

17.0 MANUFACTURING TEST:

Testing shall include but is not limited to:

17.1 Calibrate Max RPM pot using R11 on front panel.

17.2 Null the AC ripple on the motor voltage output using R25 on amplifier PWA.

17.3 Verify slowroll operation.

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17.4 Verify Max RPM operation.

17.5 Verify Ramp Up/Down operations.

17.6 Verify EXT input.

17.7 Verify Prox power output voltage.

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