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INSTRUCTION MANUAL

FOR
AFASR
ANALYTICAL ROTATOR

PINE INSTRUMENT COMPANY
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8/20/03

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1.0 INTRODUCTION

1.1 GENERAL

Pine Instrument Company's AFASR Rotator has been designed to rotate a disc or ring-disc electrode at precise adjustable speeds up to 10,000 RPM. The Rotator is generally used as part of a system, which may include a potentiostat, X- Y recorder, electrodes and cell.

1.2 SPECIFICATIONS

Power:	115 V AC or 230 V AC, 50/60 Hz, factory connected
Weight:	Electronic Control Unit (ECU): 14.25lbs Body-Motor Assembly: 43lbs
Operating Temp:	10 deg C to 40 deg C
Dimensions:	ECU: 11-3/8" W x 10-1/8" D x 5-3/4" H Base: 16" x 21" x 3/4" Overall height: - 18-3/4"
Motor Power Supply:	0 - 150 VDC at 1 amp
Speed Range:	Lower pulley: 200 to 10,000 RPM Upper pulley: 50 to 2,500 RPM
Accuracy:	Better than 1 % of control setting
Electrode Projection:	5 inches
Electrode Rotation Direction:	Clockwise when viewed down into cell

2.0 OPERATION

2.1 INITIAL INSPECTION

Inspect the packing case and rotator for any damage; notify the carrier and Pine Instrument Company in case of any apparent damage. Check the shipment against the packing list. Included with the rotator system should be:

1 - Base Assembly
1 - Electronic Control Unit
1 - Body-Motor Assembly
1 - Toothed Belt
1 - Draw Bar
1 - Instruction Manual
1 - Inspection Sheet
Electrodes Per Packing List (Optional)

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2.2 GENERAL

Pine Instrument Company's AFASR Rotator is a solid state controlled servo-system capable of rotating an electrode at speeds from 50 to 2,500 RPM and 200 to 10,000 RPM. The rotator system consists of two separate sections: the electronic control unit, and the body/motor-tach assembly, which are connected via a cable in operation.

The rotational speed may be set on a Digital-Push-Button-Control located on the front panel. An externally generated voltage may be applied to the control unit such that rotational speed is proportional to the applied voltage. An output is available which provides a voltage proportional to the rotational speed.

The rack and pinion system of the rotator body allows easy height adjustment to facilitate introduction and removal of the cell.

The electrode is held in a permanently lubricated precision mounted spindle, with high-speed bearings. Rotating shield plates cover the bearings to help keep out dirt and corrosive vapors. Electrical connections are made to the electrode by silver carbon brushes on brass slip rings.

A toothed rubber belt couples the motor to the spindle.

2.3 DESCRIPTION

Electronic Control Unit

The control unit contains the drive circuitry, power supply, and control circuitry:

Line Cord:	Connect to 3 prong 115V (or 230V if so wired) 50/60Hz AC outlet with a good quality earth ground.
Motor Cable:	Makes connection to Motor-Tach; keyed.
Power Switch:	"Up" applies power to control box.
Lamp:	When lit, indicates AC power is on.
Speed Adjust:	Digital-Push-Button-Control.
Common Jack:	Connected to DC common; used as common for measuring rotator speed output and applying external input.
Output Jack:	A voltage output appears at this point which is an indication of the rotator speed: 1 volt per 1000 RPM; this is a low impedance output (<100 ohms).
Input Jack:	A voltage may be applied to this point from an external source, to cause the rotator to turn at a rate of 1000 RPM per volt applied. The voltage applied at this point is summed with the Digital-Push-Button-Control setting. The input impedance is 50K ohms. For example: If the Digital-Push-Button-Control is set to "1000",

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and + 1 VDC is applied to the input jack, the rotational speed at the electrode will be 2000 RPM.

Ground Jack: Connected to the case and the ground wire in the AC Power Cord; isolated from the AFASR' s circuitry. May be connected to the Common Jack to reduce noise.

Body and Motor-Tach Assembly

This assembly contains the rotating components, frame, and base:

Motor: DC Permanent Magnet Motor

Tach: Produces DC voltage output proportional to rotational speed; temperature compensated. Coupled to motor shaft.

Control Unit Connector: Mates to connector from Control Unit; Connector: keyed.

Drive Belt: Toothed Rubber belt couples motor to electrode spindle.

Electrode Mount: The electrode is held in a spindle, mounted in two high-speed bearings. This assembly is electrically insulated from the frame.

Brushes: Silver carbon material mounted in an insulating holder. Upper brush is electrically connected to disc, lower is electrically connected to ring.

Brush Holders: Upper and lower set (for ring and disc). Two position: engaged - spring pressure forces brush against brass slip ring for consistent electrical connection; disengaged - brush is pulled away from slip ring to prevent damage when changing electrode or during shipment.

Body: Contains and/or supports above components.

Column: Made of 1 1/2" diameter stainless steel; supports the body assembly.

Base: Made of a chemical resistant material with a large surface area for equipment mounting.

Belt Guard: Protects Toothed Rubber Belt and pulleys and helps protect the operator from contact with rotating elements.

2.4 BEARING GREASE

The spindle bearings are lubricated with a heavy grease. During shipment this grease may shift, causing excess friction. It is recommended that the rotator be operated at low speeds for an hour or two when first started to help redistribute the grease in the bearings.

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2.5 DRIVE BELT TENSION

Proper Drive Belt tension is essential for satisfactory operation and long bearing life. The tension is properly adjusted at the factory and should not require readjustment.

2.6 SPEED RANGE SELECTION

The AFASR Rotator comes with the belt installed on lower set of pulleys, 200-10,000 RPM.

To change speed range: Remove the 2 screws that secure the belt guard (use a 3/16 Allen Wrench) and remove the belt guard. Slightly loosen the 4 bolts holding the motor to the rotator body, and slide the motor toward the spindle.

Install the belt on the desired speed range:
Upper Pulleys - 50 to 2,500 RPM
Lower Pulleys - 200 to 10,000 RPM

Apply the proper tension to the belt by sliding the motor in the appropriate direction. Tighten the 4 motor bolts and install the belt guard.

2.7 INSTALLING AND REMOVING ELECTRODES

1. Retract the lower brush. NOTE: Be careful not to allow the brush to snap back against the electrode body, as damage to the brush may result.

2. Insert the draw bar into the spindle.

3. Raise the body assembly via the rack and pinion so that there is ample room below the spindle assembly to safely handle the electrode. Lock the body in position with the lock knob at the rear of the body.

4. Grasp the electrode in one hand, and insert the smaller end into the spindle receptacle hole. With the other hand, tighten the draw bar into electrode. NOTE: Do not excessively twist the electrode body insulator material. It is not necessary to over tighten the draw bar.

5. The brushes may now be moved to the "engaged" position, so that contact is made. The upper brush is the disc contact; the lower brush is the ring contact.

6. Reverse the above procedure to remove the electrode, first disengage the lower brush.

2.8 ELECTRODE HEIGHT ADJUSTMENT

The electrode height may be adjusted by moving the body up or down on the column. This is done by loosening the knob (located on the rear of the body) while supporting the weight of the assembly, and then rotating the knob (located on the side of the body) to move the assembly up or down. Re-tighten the rear knob when the desired height is attained.

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2.9 COOLING OF ELECTRONIC CONTROL UNIT (ECU)

The ECU contains components that generate high temperatures, and therefore requires unrestricted circulation through the case for proper cooling. It is essential that any material that could restrict the airflow does not block the slots in the case top and bottom.

It is recommended that the ECU be placed on a hard surface in an open area to insure proper cooling.

2.10 SET-UP AND RUN

This section briefly describes the proper procedures to operate the Rotator in a typical lab system.

1. The experiment should be conducted in an area that has ample room for all equipment, and has conveniently located power outlets.

2. Connect the Control Unit Cable to the Motor-Tach Cable.

3. Be certain that the belt guard is in place.

4. Turn "off" the Power Switch and connect the Line Cord to a voltage source of the proper rating.

5. Make the necessary connections to the Rotator Brushes, Potentiostat, cell, etc.

6. Install the electrode.

7. Turn "on" the Power Switch. Adjust the Digital-Push-Button-Control to cause the electrode to rotate at the desired speed.

8. Adjust the Electrode Height for proper placement in the cell.

3.0 MAINTENANCE

3.1 GENERAL

The ASR Rotator is covered by a six-month warranty. Attempts to repair, recalibrate or modify the instrument by an unauthorized person may invalidate the warranty. It is suggested that the factory be advised on all matters of improper operation.

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3.2 TROUBLE SHOOTING

This section provides some suggestions for an operator to follow in the event of problems.

Problem	Cause and/or action
Motor fails to rotate:	Check motor shaft and spindle for freedom of rotation.
	Confirm that the unit is connected to a live outlet of the proper voltage, that the power switch is "on" and the lamp glows.
	Check the connection from the ECU to the motor-tach assembly.
	The Digital-Push-Button-Control is set to a speed other than "0".
	Remove the top cover and insure that the printed circuit board is fully inserted into the connector.
	Faulty connection, or wire - contact factory.
	Faulty circuitry or motor - contact factory.
Motor runs at high speed at any dial setting:	Faulty connection or wire - contact factory.
	Faulty circuitry - contact factory.
Excessive noise:	Spindle bearings are worn out - replace as described in section 3.3.
	Drive belt tension too great - adjust tension.
	Drive belt is contacting adjacent pulley - remove belt, turn it over and reinstall.
	Motor bearings are worn - contact factory.
Excessive electrical noise in system:	Connect DC Common to Ground Jack; use only one point in the system as the common; eliminate ground loops. **CAUTION:** Care must be taken when making connections to ground. This should be done only on a "floating" system. Contact the factory for more information.
	Use shielded cables as connections to the brushes.
	Clean the surface where the brushes contact the rotating rings.

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3.3 REPLACEMENT OF SPINDLE AND BEARINGS

Refer to Dwg. No. ACAR3271, ASR Spindle Assembly, on page 11.

1. Remove top brush holder and bottom lock nut 9.

2. Remove pulley assembly (7) by loosening the 2 set screws, pull off of spindle (6).

3. Pull spindle assembly up out of the rotator body. The .bottom bearing will remain in the body and the top bearing will come out with the spindle.

4. Remove top lock nut (8) and carefully remove the bearing from the spindle with your fingers. The bottom bearing can be removed by removing the bottom retainer 11 and taking the bearing out.

5. Be very careful to keep the bearings clean and remove the rubber covers (3) from the bearings and place the covers on the new bearings.

6. Install the lower bearing with the numbers up or with the wider gap in the bearing down. Replace retainer (11).

7. Place the upper bearing on the spindle so that the numbers will face down or toward the bottom bearing and the widest gap toward the lock nut. Replace top lock nut 8 and install spindle in body.

8. Replace bottom lock nut (9) and make sure that all nuts are tight.

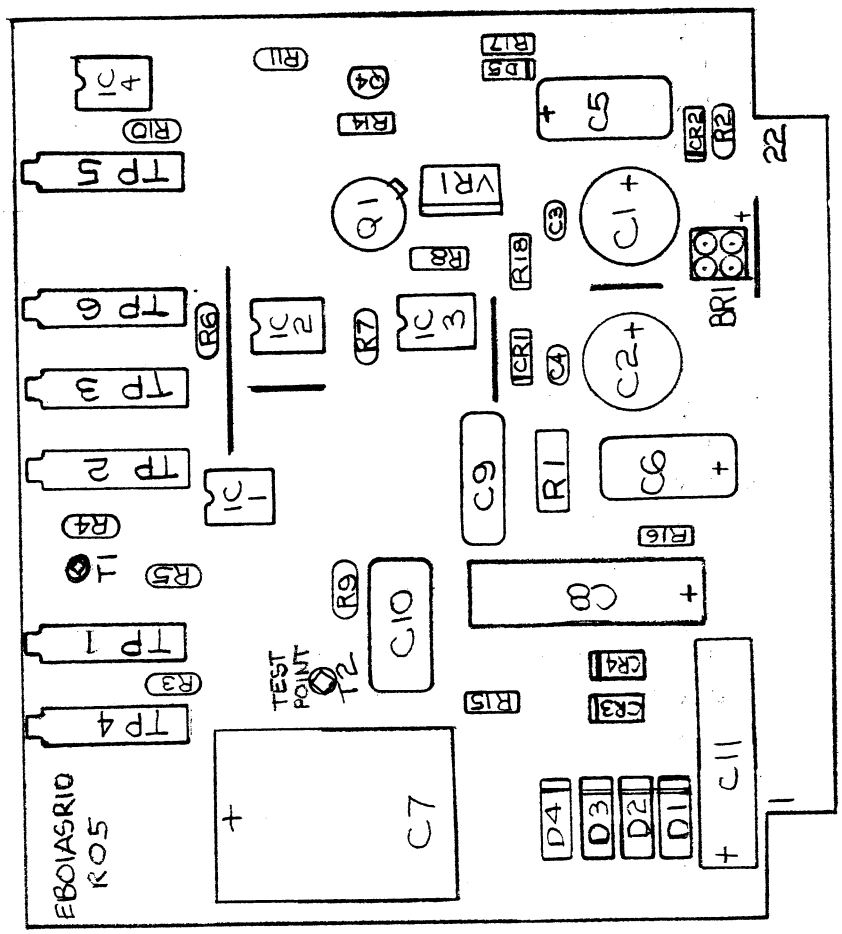
9. Operate rotator (with drive belt in position): run at 1000 RPM for one hour, and increase speed in 1000 RPM increments each hour until 10,000 RPM is reached. This positions the lubricant in the bearings for proper operation.

4.0 WARRANTY

Equipment manufactured by Pine Company is warranted to be free from defects in material and workmanship for a six month period from date of shipment to original purchaser and used under normal conditions. The obligation under this warranty being limited to replacing or repairing any part or parts which shall upon examination disclose to Pine Instrument's satisfaction to have been defective and shall have been returned freight prepaid and clear of encumbrances to Pine Instrument Company in Grove City, Pa. within the warranty period. This warranty being expressly in lieu of all other warranties, expressed or implied and all other obligations or liabilities. All specifications are subject to change without notice.

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ASR 2883



REV	DATE	DESCRIPTION / ECO NO.	BY
1	3-30-83	CR3 REMOVE, 1 LESS JUMPER R024	JW
2	10/11/83	C11 ADD, MOVE VARTS ECO 44	JW

PINE INSTRUMENT COMPANY GROVE CITY, PA.
EBOIASRIO R05
TITLE ASR SHORT BRD. - COMP. NOS.
DR. BY J. WATSON
DATE 1-20-82
DRAWING NO. ASR-2883-2
REV

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AFASR Calibration

Equipment needed:

- Digital Voltmeter
- Line-triggered Strobe or Tachometer
- Small blade screwdriver

Procedure:

1. With Digital-Push-Button Control set to "0000", adjust TP1 for 0.00 volts at T1.

2. Adjust TP3 to dead stop the motor; adjust TP5 for 0.000 volts at the OUTPUT JACK.

3. Set the pulley speed to 3600 RPM (motor speed to 1800 RPM) using a strobe or tachometer, and adjusting the Digital-Push-Button-Control. Adjust TP6 for 3.600 volts on the OUTPUT JACK.

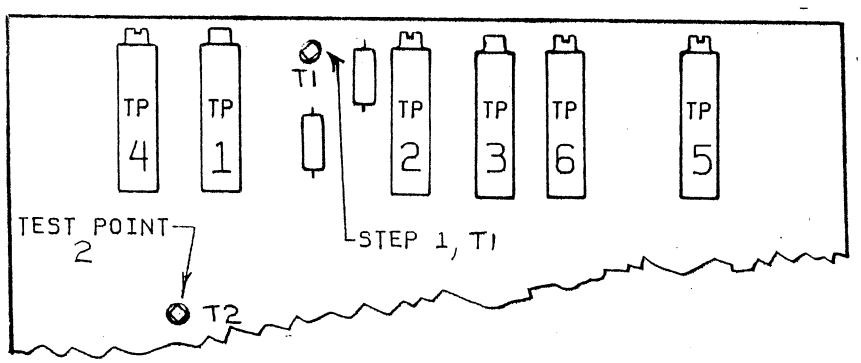
4. Set the Digital-Push-Button-Control to "0200" (200 RPM); adjust TP3 for 0.02 volts on the OUTPUT JACK.

5. Set the Digital-Push-Button-Control to "3600" (3600 RPM); adjust TP2 for 4.80 volts at T2.

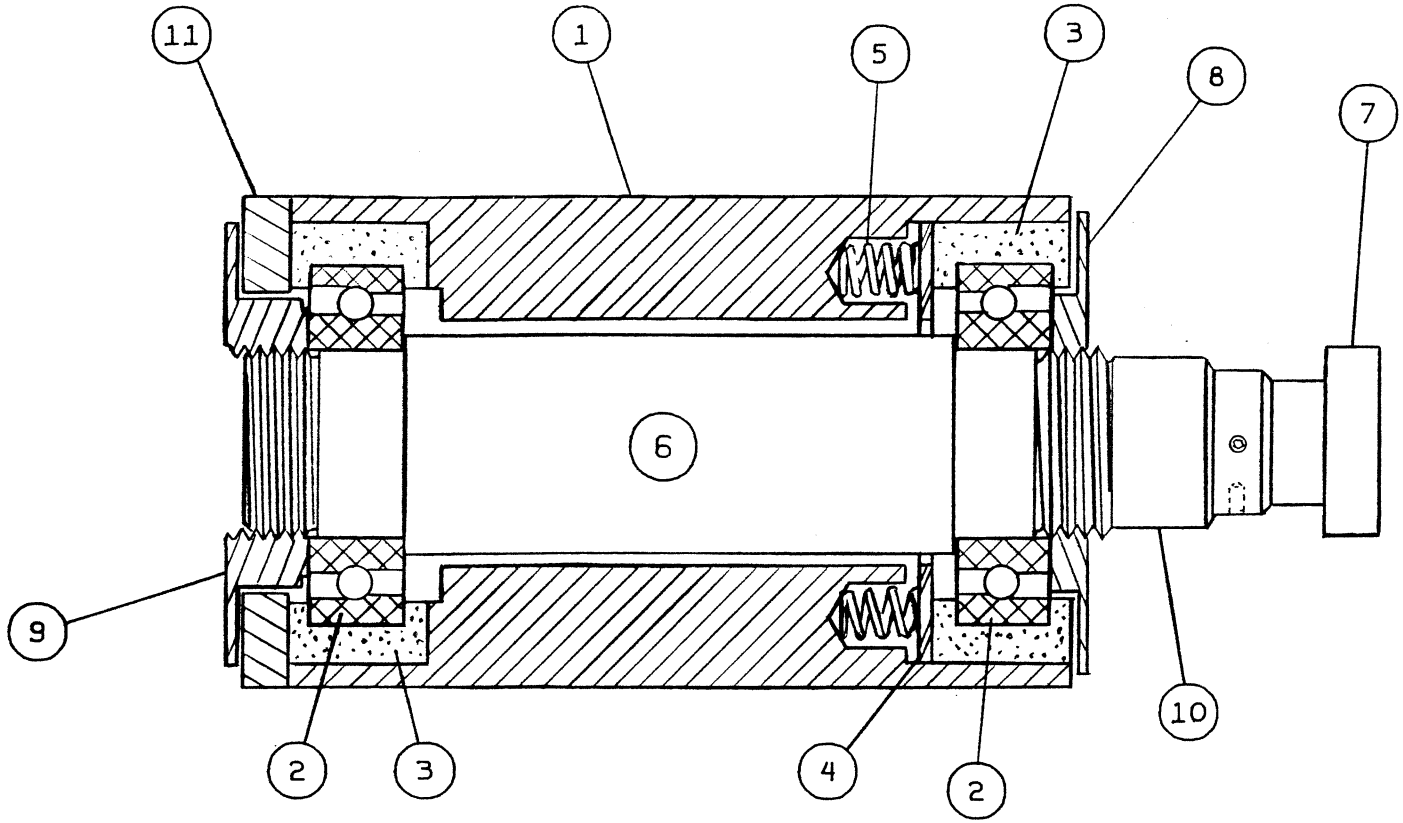
6. With the Digital-Push-Button-Control set to "3600"; adjust TP4 for 3600 RPM of the pulley (motor speed to 1800 RPM).

7. Set the Digital-Push-Button-Control to "0200"; adjust TP3 to get 25 rotations of the motor pulley in 15 seconds.

8. Repeat steps 6 and 7 for final fine tune.



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1. ROTATOR BODY
2. BEARING (2)
3. RUBBER HOUSING (2)
4. WASHER
5. SPRING (4)
6. SPINDLE
7. PULLEY
8. TOP LOCK NUT
9. BOTTOM LOCK NUT
10. BUSHING (BRUSH CONTACT)
11. RETAINER

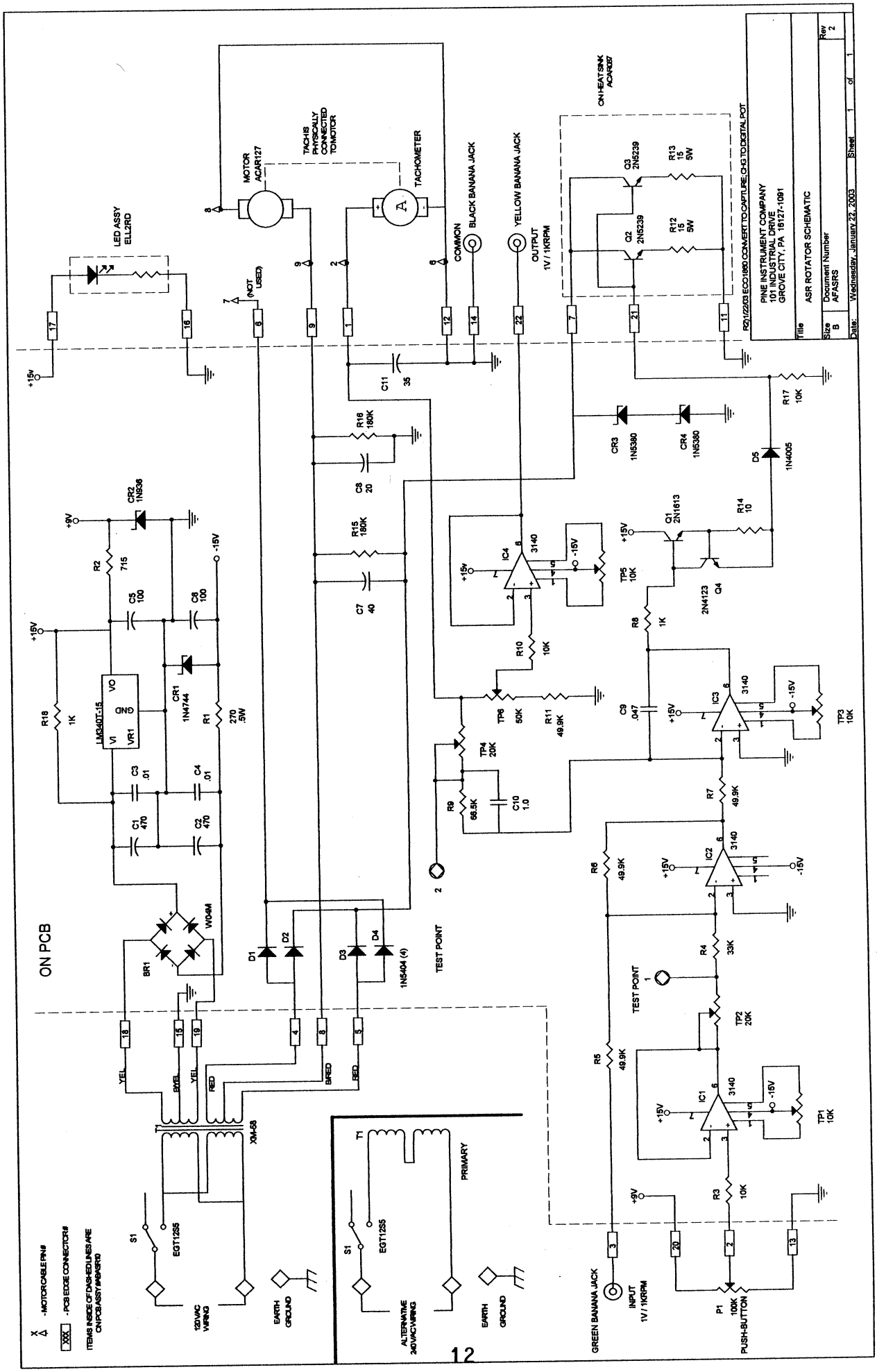
ASR SPINDLE ASSEMBLY

NOTES:

1. BEARINGS MUST BE ASSEMBLED WITH THE SIDE WITH THE WIDEST GAP TOWARD THE LOCK NUT.

PINE INSTRUMENT COMPANY
ACAR3271

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