

## Chapter 66

### ACTUATOR, ROTAX, TYPE A2001

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#### LEADING PARTICULARS

<b>Actuator, Type A2001</b> .....	<i>Ref. No.</i> 5W/1378
<i>Voltage</i> .....	28V d.c.
<i>Current at normal load</i> .....	2.8 amperes
<i>Stall current at normal voltage</i> .....	7 amperes
<i>Brush spring pressure</i> .....	2½ to 3½ oz.
<i>Brush grade</i> .....	KC, DM. 4A
◀ <i>Brush length (new)</i> .....	0.343±0.015 in.
<i>Brush length (minimum permissible)</i> .....	0.200 in.
<i>Commutator diameter (new)</i> .....	0.571 in.
<i>Commutator diameter (minimum permissible)</i> .....	0.535 in. ▶
<i>Normal load</i> .....	10 lb.
<i>Maximum static load</i> .....	1,500 lb.
<i>Normal stroke</i> .....	0.750 in.
<i>Time of stroke</i> .....	7 sec.
<i>Rating</i> .....	Intermittent
<i>Gearbox reduction ratio</i> .....	850 : 1
<i>Operational temperature range</i> .....	-60 deg. C. to +90 deg. C.
<i>Operational ceiling</i> .....	60,000 ft.
◀ <i>Length extended (between centres)</i> .....	10.350 in.
<i>Length retracted (between centres)</i> .....	9.600 in. ▶
<i>Width</i> .....	4.407 in.
<i>Height</i> .....	3.000 in.
<i>Weight</i> .....	3 lb. 2 oz.

#### Introduction

1. The Type A2001 actuator is a linear machine without provision for stopping the ram at intermediate positions. It is designed to operate from a 28V d.c. supply, with a normal load of 10 lb.

#### DESCRIPTION

2. The actuator is of "in line" construction and comprises a reversible motor driving a screw-shaft through a four stage epicyclic gearbox. A brake and clutch are incorporated between the motor and the gearbox. The rotary motion of the screwshaft is con-

verted to linear motion by means of a recirculating ball thread nut, which is integral with the ram.

3. The actuator is enclosed in two main housings with two large access panels. The securing shackle end housing contains the motor armature, yoke, brushgear, commutator end ball bearing, brake and clutch. The ram end housing contains the epicyclic gearbox, screw-shaft and ram. The smaller access panel is fitted below the ram end housing and the large access panel is fitted along the top of both housings, permitting access to limit switches and wiring con-

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nections. A five-pole plug is mounted on the large access panel. Two small cover plates on the securing shackle end housing give access to the brushgear.

#### Motor

4. The motor is a two pole, two brush, split series wound machine with laminated pole-shoes and yoke. Reversal of rotation is obtained by changing the field connections.

5. The armature shaft revolves in two ball bearings. The commutator end ball bearing is supported in the end of the main housing. The drive end of the armature shaft projects through the brake solenoid and revolves in a plain bearing in the driving plate which runs in a ball bearing; relative motion occurs between the armature and driving plate only during clutch slip. The brushgear is secured to the shackle end of the main housing.

#### Brake and clutch

6. The brake solenoid is mounted about the armature shaft and carries, on the ram side, a disc type brake shoe. The brake shoe is located by pins in the brake solenoid core and is forced against the driving plate by helical springs. The brake shoe mates with the outer portion of the driving plate and the clutch plate engages with the inner portion. The brake solenoid is in series with the motor armature and when energized, the shoe is pulled in from the driving plate, leaving it free to rotate.

7. The clutch plate is mounted on the armature shaft, the boss projecting into the bore of the brake solenoid. A helical spring about the armature shaft presses the clutch plate against the driving plate. The driving plate is integral with the first gear pinion and revolves in a ball bearing supported in a plate screwed into the end of the shackle end housing. When the driving plate is arrested, as a result of the actuator supply being switched off, the clutch slips to dissipate armature momentum and to limit overrun.

#### Gearbox

8. The first stage sun-gear of the four stage epicyclic gear box is part of the driving plate. The drive end of the gearbox is formed by the bearing support plate screwed into the

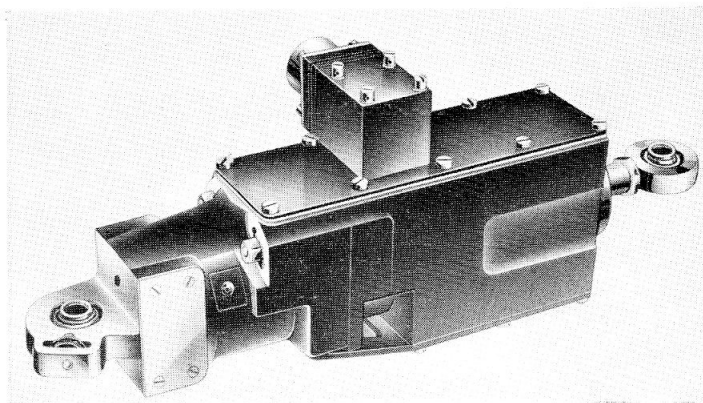


Fig. 1. Type A2001 actuator

shackle end housing. The fourth stage planet gear carrier is integral with the screw-shaft and revolves in a double row of ball bearings. The common annulus is located by pins engaging the bearing support plate.

#### Ram

9. A nut incorporating a recirculating ball thread is integral with the inner end of the ram. The screw-shaft drives the nut to give the ram linear movement. Torque reaction is opposed by steel balls located in the ram and moving in guides in the ram housing.

#### Limit switches

10. The stroke is controlled by two single pole limit switches with an additional switch which opens to indicate when the ram is within  $\pm 0.040$  in. of the mid-stroke position. Access to the limit switches is gained through the two access panels.

#### Operation

11. Pole "A" of the five-pole plug is the negative line; pole "B" is positive for anti-clockwise rotation to extend the ram and pole "C" is positive for clockwise rotation to retract the ram. Poles "D" and "E" are connected to the indicator circuit operated by the centre position switch.

12. When positive supply is connected to the required pole of the plug, the appropriate motor field is energized and the brake solenoid is energized via the armature. The brake shoe is withdrawn from the driving plate and the motor rotates the screwshaft and actuates the ram. When the ram reaches the end of its stroke the appropriate limit switch is operated and breaks the supply circuit. The driving plate is arrested by the brake shoe, released by the brake solenoid thus preventing overrun of the

ram. The clutch allows the motor to rotate after the supply is broken until the armature momentum is dissipated.

### INSTALLATION

**13.** The actuator is provided with two shackles, one at the end of the ram and the other at the opposite end of the main housing. Both shackles are horizontal when the plug is uppermost and have self aligning ballraces with an 0.3125 in. diameter bore. The housing shackle has a vertical roller, on the horizontal centre line of the shackle, which serves to support the actuator during radial movement.

**14.** Electrical connection is made by a five-pole Breeze plug (Ref. No. 5X/6016).

### SERVICING

**15.** Make a general inspection of the actuator to ensure that it has not sustained damage. Ensure that it is secure on its mounting shackles and that the electrical connection is sound.

#### Brushes and commutator

**16.** Remove the two cover plates from the shackle end housing and make the following inspections.

**17.** Remove the brushes and examine them for cracks, security of flexible connections and wear. Ensure that the length of the brush is adequate to give satisfactory performance until the next servicing.

**18.** Examine the commutator for scores and burns. If its condition is such that commutation is likely to be impaired, the actuator is to be considered unserviceable.

**19.** Measure the tension of each brush spring with a tension gauge (Ref. No. 1H/59). Each spring should exert a pressure of  $2\frac{1}{2}$  to  $3\frac{1}{2}$  oz. (70 to 100 gm.) when level with the top of the brush box.

**20.** Ensure that the brushes are free in their boxes and if carbon dust has accumulated, blow it clear of the machine with a supply of clean, dry compressed air.

#### Insulation resistance test

**21.** Measure the insulation resistance between live parts and the frame, using a 250V insulation resistance tester. A reading of at least 50,000 ohms should be obtained.

#### Note . . .

*The value of insulation resistance given in para. 21 applies to actuators being tested under normal workshop conditions. Due allowance should be made for the climatic conditions of the locality and those of the aircraft servicing area or dispersal point where the tests are being applied. In particularly damp climates, the readings obtained may be low enough to give apparently sufficient reason for rejection and, in these instances, discretion should be exercised.*

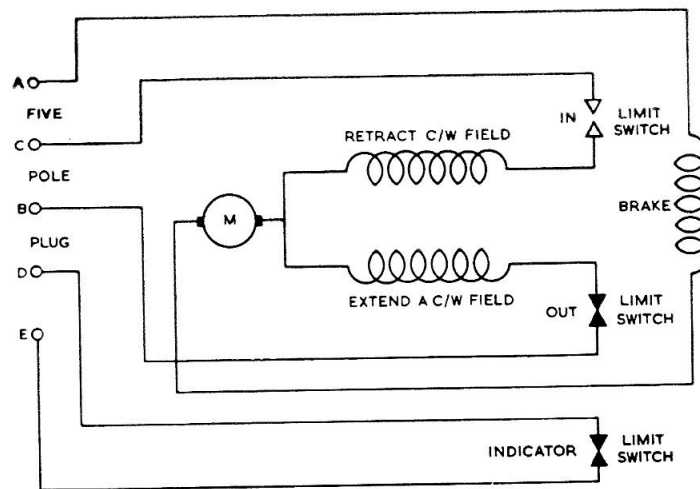


Fig. 2. Diagram of internal connections