

Chapter 56

ACTUATORS, ROTAX, A1700 SERIES

LIST OF CONTENTS

	Para.		Para.
<i>Introduction</i>	1	<i>Electrical connections</i>	12
Description	2	Installation	15
<i>Motors</i>	4	Servicing	16
<i>Brake and clutch</i>	5	<i>Brushgear</i>	17
<i>Gearbox</i>	7	<i>Lubrication</i>	20
<i>Ram and screwshaft</i>	9	<i>Insulation resistance test</i>	21
<i>Limit switches</i>	11		

LIST OF ILLUSTRATIONS

	Fig.
<i>Actuator, typical of A1700 series</i>	1
<i>Typical circuit diagram</i>	2

LIST OF APPENDICES

	App.		App.
<i>Actuator, Rotax Type A1702</i>	1	<i>Actuator, Rotax, Type A1706</i>	5
<i>Actuator, Rotax, Type A1703</i>	2	<i>Actuator, Rotax, Type A1708</i>	6
<i>Actuators, Rotax, Types A1704 and A1704A</i>	3	<i>Actuator, Rotax, Type A1709</i>	7
<i>Actuators, Rotax, Types A1705 and A1705A</i>	4	<i>Actuator, Rotax, Type A1711</i>	8

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Introduction

1. These actuators are general purpose 28 volt d.c. machines having two identical motors, either one of which, when selected, will drive the ram via a spur type gearbox and differential. They have been designed for operating aircraft ancillary equipment.

DESCRIPTION

2. The various types forming the A1700 series (*fig. 1*) are of the same general construction and differences between any one type and the basic type are normally confined to the amount and speed of ram travel. In external appearance, however, the position of the supply plugs may vary, being in either one of two positions, to suit the re-

quirements of the installation for a particular type of unit. From one position, the alternative is obtained by traversing the mounting plate through 180 deg. For information relating to a particular type of actuator in the A1700 series, reference should be made to the appropriate Appendix to this chapter.

3. These actuators comprise two identical motor units mounted either side of a central housing containing the ram, screwshaft and differential gearing. In addition, this housing contains an arrangement of limit switches provides the means for mounting two supply plugs for the motors.

Motors

4. The motors are 2-pole, 2 brush machines and are split series wound with laminated

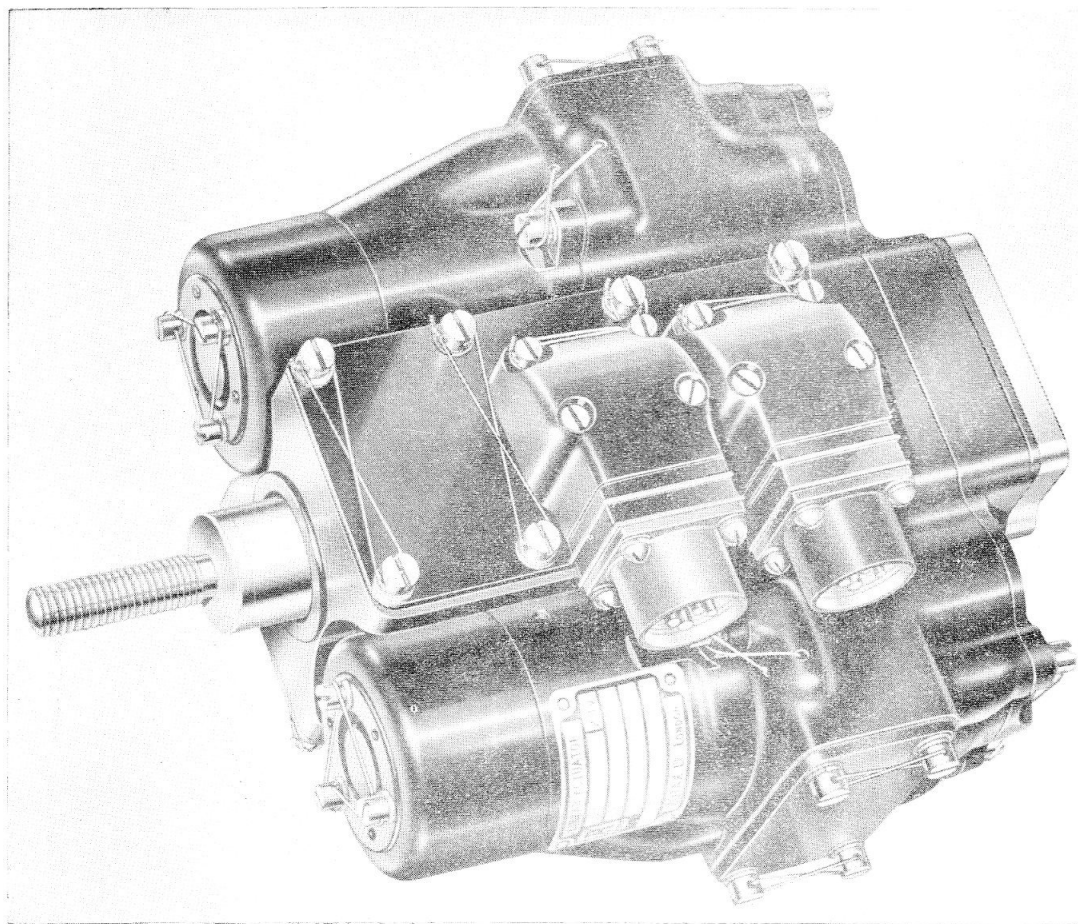


Fig. 1. Actuator, typical of A1700 series

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yoke and pole shoes. The armature is supported at the commutator end by a ball bearing; at the drive end it is located in a plain bearing in a driving plate which, in turn, runs in a ball bearing. Relative rotation between the armature and the driving plate occurs only during clutch slip. Reversal of rotation is effected by changing the field connections.

Brake and clutch

5. Between each motor and its gearing is a disc type electro-magnetic brake and a single plate clutch. When the motor is operating, the brake coil, which is wound on a solid core is energized, attracting the brake disc against the influence of helical springs. When the coil is de-energized, the springs force the brake disc against the face of the driving plate which is revolving at armature speed. The brake disc is faced with Langite and is prevented from rotating by three dowel pins locating in the brake solenoid shell.

6. Interposed between the armature and the driving plate is a single plate phosphor bronze clutch. This dissipates the stored energy in the armature when the brake is applied, thus assisting the deceleration of the ram.

Gearbox

7. The gearbox contains a six-stage, spur gear train assembled about three lay shafts. The final stage gear of the train has a shaft formed integral with it which extends beyond the gearbox and carries a pinion. This extended shaft is borne between two ball bearings and receives the drive from the gearbox via the centre lay shaft to which it is secured.

8. The differential gear unit has two similar external gears machined on it and the unit is so positioned as to allow the pinions on the extended shafts (*para. 7*) to engage with it, one pinion meshing with each external gear.

Ram and screwshaft

9. The ram, housing a steel nut, is driven by a high efficiency screwshaft having two tracks of recirculating balls. The screwshaft is borne at the mounting end of the actuator by a thrust race and torque reaction is

absorbed by six key balls. These balls are arranged in two sets of three and they slide in guides in the ram housing. Positioned in the front of the ram housing, and interposed between two circlips, is a rubber sealing ring through which the ram passes.

10. The protruding end of the ram is threaded $\frac{3}{8}$ in. B.S.F. to facilitate the fitting of a suitable shackle (not supplied with the actuator), according to the requirements of the installation.

Limit switches

11. The movement of the ram is controlled by snap action limit switches. Generally speaking, actuators in the A1700 series incorporate four switches, two being provided for each motor to control the ram travel in each direction. (*fig. 2*). For certain applications, however, eight switches may be provided where control of a mid-way position is required.

Electrical connections

12. Electrical connection to each motor is made via a 4-pole plug (Ref. No. 5X/6006). The plugs are mounted on a cover plate of the ram housing. The plate being held in position by eight screws symmetrically spaced, it is possible for the supply plugs to be mounted in one of two positions, 180 deg. traversed (*para. 2*).

13. The two motors are identified as No. 1 and No. 2 Motor, No. 1 being that on the right of the actuator when viewed from the shackle end, plugs uppermost.

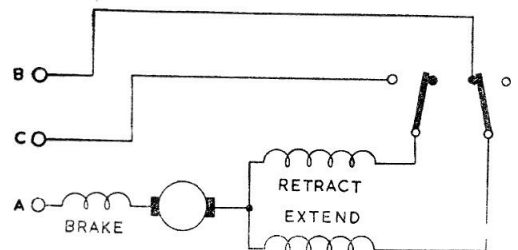


Fig. 2. Typical circuit diagram

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14. The relationship between a plug and the motor it supplies is thus:—

Plug shroud of Motor No. 1	Red
Plug shroud of Motor No. 2	Green

INSTALLATION

15. These actuators are suitable for mounting in any position. A mounting plate, secured to the ram housing at the opposite end from the shackle, is provided with four 2 B.A. tapped holes equi-spaced on a P.C.D. of $2\frac{1}{4}$ in.

Note . . .

When installed, the ram of these actuators should not be subjected to side load.

SERVICING

16. Actuators in the A1700 series should be serviced in accordance with the general chapter in A.P.4343, Vol. 1, Sect. 17, Chap. 2, and the instructions contained in the relevant Servicing Schedule.

Brushgear

17. Access to the brushgear is gained by removal of the end covers, which are secured

in position by three 6 B.A. screws and locked by a tie wire.

18. The minimum length beyond which brushes must not be used is 0.200 in. from the new length of 0.343 ± 0.015 in. Brushes should be renewed at periods prescribed in the relevant Servicing Schedule, and whenever examination reveals that they will not remain serviceable for the period that must elapse before the next servicing.

19. Brush spring pressure, measured with a tension gauge (Ref. No. 1H/59), should be between $2\frac{1}{2}$ and $3\frac{1}{2}$ oz. (71 and 99 gm.), when the tip of the spring is level with the top of the brush box.

Lubrication

20. The bearings are lubricated with grease XG-276 (Ref. No. 34B/9425139) during manufacture and repair, and should not normally require lubrication at servicing periods.

Insulation resistance test

21. The insulation resistance, when measured with a 250-volt insulation resistance tester between all live parts and the frame, should be not less than 50,000 ohms for satisfactory aircraft service.

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Appendix 1

ACTUATOR, ROTAX, TYPE A1702

LEADING PARTICULARS

Actuator, Type A1702	Ref. No. 5W/417
<i>Voltage</i>	28V d.c.
<i>Current (one motor driving)</i>	2.5A at 250 lb. load
<i>Speed (one motor driving)</i>	0.086 in./sec. at 250 lb. load
<i>Average load</i>	250 lb.
<i>Maximum load</i>	500 lb.
<i>Motor No. 1 driving —</i>	
<i>Retracted length</i>	5.785 in.
<i>Extended length</i>	6.815 in.
<i>Motor No. 2 driving —</i>	
<i>Retracted length</i>	5.625 in.
<i>Extended length</i>	7.125 in.
<i>(above dimensions taken over mounting face to ram shoulder)</i>	
<i>Overrun</i>	0.010 in.
<i>Brush spring pressure</i>	2½ to 3½ oz. (71 to 99 gm.)
<i>Brush length (new)</i>	0.343±0.015 in.
<i>Minimum brush length</i>	0.200 in.
<i>Brush grade</i>	K.C.E.G. 11
<i>Commutator diameter (new)</i>	0.571+0 in. -0.005
<i>Commutator diameter (minimum permissible)</i>	0.535 in.
<i>Overall dimensions—</i>	
<i>Width</i>	5.875 in.
<i>Depth</i>	3.516 in.
<i>Length of actuator body</i>	5.812 in.
<i>Weight</i>	5 lb. 4 oz.

1. The A1702 actuator is similar to that described and illustrated in the main chapter; the ram travel dimensions are detailed under Leading Particulars. The supply plugs are mounted 180 deg. from the position illustrated, and face No. 2 motor.

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Appendix 2

ACTUATOR, ROTAX, TYPE A1703

LEADING PARTICULARS

Actuator, Type A1703	Ref. No. 5W/418
<i>Voltage</i>	28V d.c.
<i>Current (one motor driving)</i>	2.5A at 250 lb. load
<i>Speed (one motor driving)</i>	0.086 in./sec. at 250 lb. load
<i>Average load</i>	250 lb.
<i>Maximum load</i>	500 lb.
<i>Motor No. 1 driving —</i>	
◀ <i>Retracted length</i>	5.875 in. ▶
<i>Extended length</i>	6.875 in.
<i>Motor No. 2 driving —</i>	
<i>Retracted length</i>	5.625 in.
<i>Extended length</i>	7.125 in.
<i>(above dimensions taken over mounting face to ram shoulder)</i>	
<i>Overrun</i>	0.010 in.
<i>Brush spring pressure</i>	2½ to 3½ oz. (71 to 99 gm.)
<i>Brush length (new)</i>	0.343±0.015 in.
<i>Minimum brush length</i>	0.200 in.
<i>Brush grade</i>	K.C.E.G. 11
<i>Commutator diameter (new)</i>	0.571+0 in. -0.005
<i>Commutator diameter (minimum permissible)</i>	0.535 in.
<i>Overall dimensions—</i>	
<i>Width</i>	5.875 in.
<i>Depth</i>	3.516 in.
<i>Length of actuator body</i>	5.812 in.
<i>Weight</i>	5 lb. 4 oz.

1. The A1703 actuator is similar to that described and illustrated in the main chapter; the ram travel dimensions are detailed under Leading Particulars. The supply plugs are mounted 180 deg. from the position illustrated, and face No. 2 motor.

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Appendix 3

ACTUATORS, ROTAX, TYPES A1704 AND A1704A

LEADING PARTICULARS

Actuator, Type A1704	Ref. No. 5W/722
Actuator, Type A1704A	Ref. No. 5W/1350
Voltage	28V d.c.
Current (both motors driving)	5A at 250 lb. load
Speed (both motors driving)	0.172 in./sec. at 250 lb. load
Average load	250 lb.
Maximum load	500 lb.
Maximum static load	1,200 lb.
Actuator lengths (from mounting face to centre of shackle hole)—	
Retracted	8.719 in.
At mid-way position	9.719 in.
Extended	10.719 in.
Overrun	0.010 in.
Brush spring pressure	2½ to 3½ oz. (71 to 99 gm.)
Brush length (new)	0.343 ± 0.015 in.
Minimum brush length	0.200 in.
Brush grade	K.C.E.G. 11
Commutator diameter (new)	0.571 + 0 in.
	— 0.005
Commutator diameter (minimum permissible)	0.535 in.
Overall dimensions—	
Width	5.875 in.
Depth	3.516 in.
Length of body (including 5-pole plug)	8.562 in.
Weight	5 lb. 8 oz.

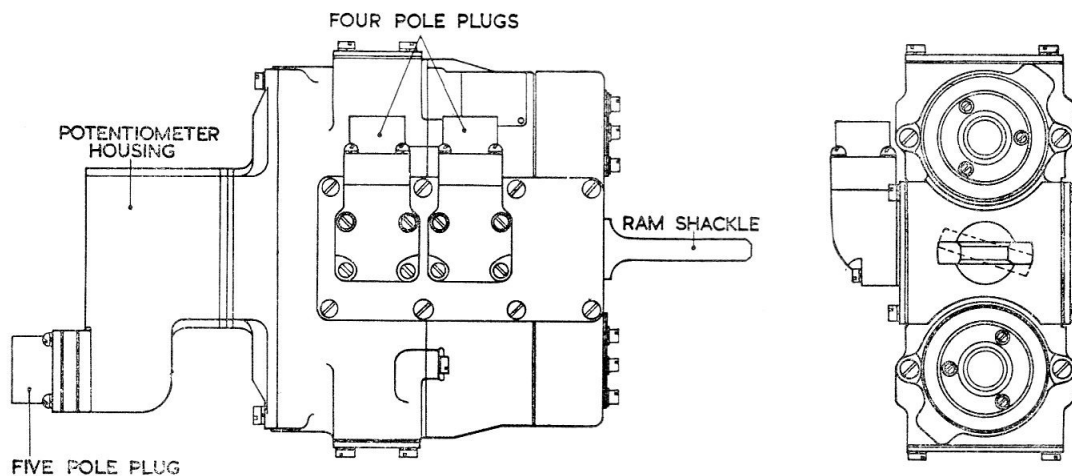


Fig. 1. Outline of Types A1704 and A1704A actuators

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1. The A1704 and A1704A actuators are basically similar to the machine described and illustrated in the main chapter, but differ in certain particulars. Characteristic features of these actuators are:—

- (1) The supply plugs are mounted to face No. 1 motor.
- (2) A shackle is fitted to the end of the ram, instead of a threaded stud. The

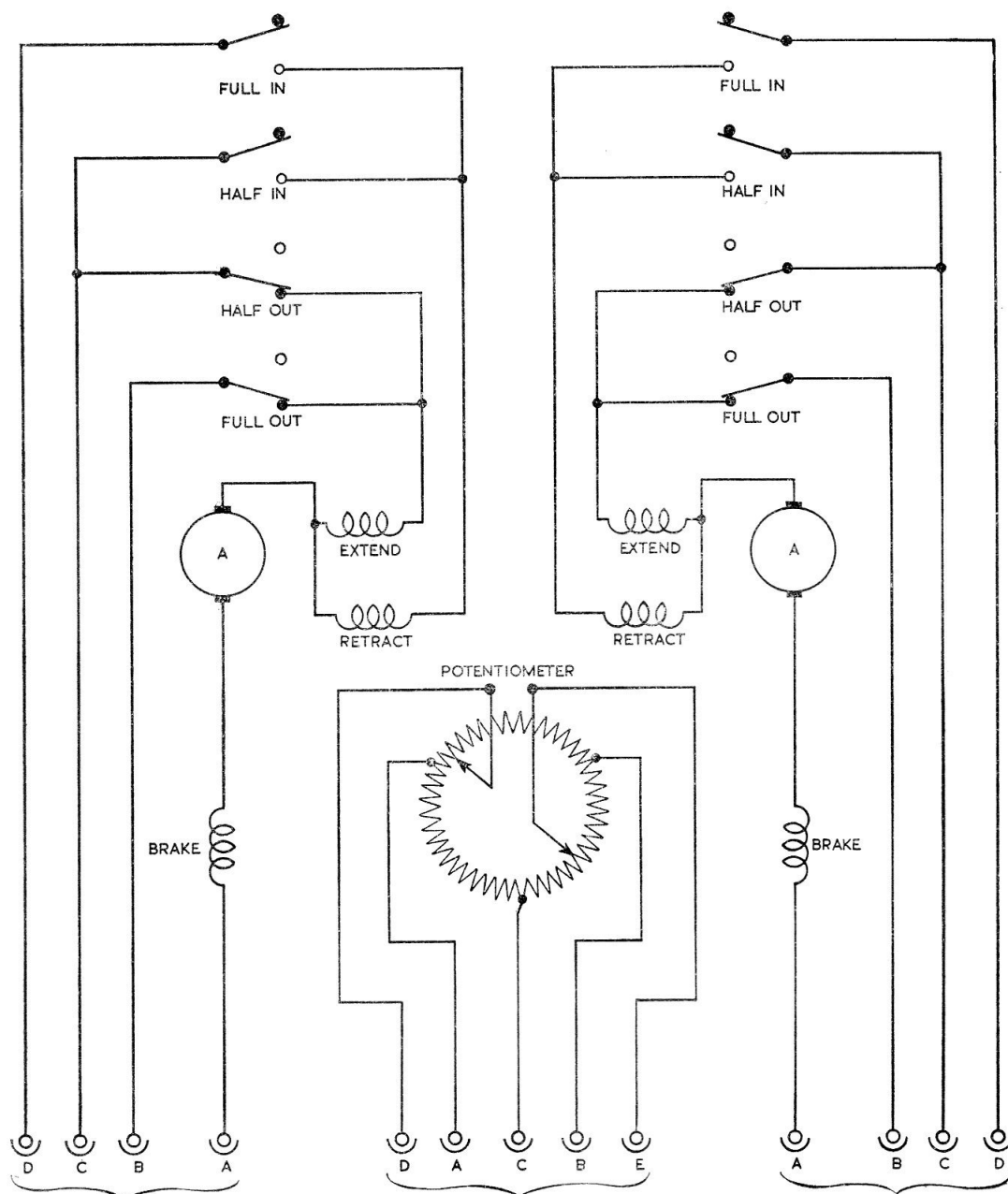


Fig. 2. Diagram of internal connections

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Appendix 3

ACTUATORS, ROTAX, TYPES A1704 AND A1704A

LEADING PARTICULARS

Actuator, Type A1704	Ref. No. 5W/722
Actuator, Type A1704A	Ref. No. 5W/1350
Voltage	28V d.c.
Current (both motors driving)	5A at 250 lb. load
Speed (both motors driving)	0.172 in./sec. at 250 lb. load
Average load	250 lb.
Maximum load	500 lb.
Maximum static load	1,200 lb.
Actuator lengths (from mounting face to centre of shackle hole)—	
Retracted	8.719 in.
At mid-way position	9.719 in.
Extended	10.719 in.
Overrun	0.010 in.
Brush spring pressure	2½ to 3½ oz. (71 to 99 gm.)
Brush length (new)	0.343 ± 0.015 in.
Minimum brush length	0.200 in.
Brush grade	K.C.E.G. 11
Commutator diameter (new)	0.571 + 0 in.
	— 0.005
Commutator diameter (minimum permissible)	0.535 in.
Overall dimensions—	
Width	5.875 in.
Depth	3.516 in.
Length of body (including 5-pole plug)	8.562 in.
Weight	5 lb. 8 oz.

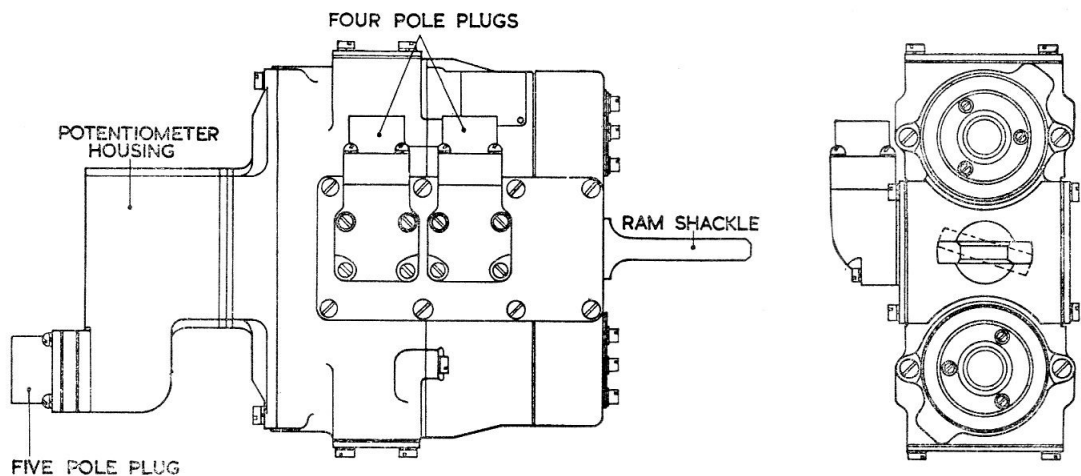


Fig. 1. Outline of Types A1704 and A1704A actuators

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shackle has a 0.875 in. dia. clearance hole, to receive a universal bearing, and a 0.187 in. dia. hole for a locking device. The flats of the shackle for the A1704 lie in planes at right angles to the common plane of the motor axes, whilst the shackle of the A1704A is set 15 deg. clockwise (looking on the ram end) from this position, as shown dotted in fig. 1.

- (3) A desynn type potentiometer transmitter is incorporated, being intended to monitor a receiver instrument giving continuous indication of ram position. Internal connections are as shown in fig. 2.

Potentiometer

2. The potentiometer is a miniaturized desynn type for use with a standard desynn pattern indicator. It is housed in an extension to the ram housing (potentiometer housing, fig. 1), and is operated by the rotation of the screwshaft, which is transmitted to the potentiometer spindle through a single stage epicyclic reduction gear train. The potentiometer is permitted 300 deg. travel for full (2 in.) ram travel. Electrical connections to the potentiometer are made through a 5-pole plug (Ref. No. 5X/6016), set to one side of the actuator mounting surface.

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Appendix 4

ACTUATORS, ROTAX, TYPES A1705 AND A1705A

LEADING PARTICULARS

Actuator, Type A1705	Ref. No. 5W/1016
Actuator, Type A1705A	Ref. No. 5W/1351
Voltage	28V d.c.
Current (both motors driving)	5A at 250 lb. load
Speed (both motors driving)	0.172 in./sec. at 250 lb. load
Average load	250 lb.
Maximum load	500 lb.
Maximum static load	1,200 lb.
Actuator lengths (from mounting face to centre of shackle hole)—	
Retracted	8.719 in.
At mid-way position	9.719 in.
Extended	10.719 in.
Overrun	0.010 in.
Brush spring pressure	2½ to 3½ oz. (71 to 99 gm.)
Brush length (new)	0.343 ± 0.015 in.
Minimum brush length	0.200 in.
Brush grade	K.C.E.G. 11
Commutator diameter (new)	0.571 + 0 in.
	— 0.005
Commutator diameter (minimum permissible)	0.535 in.
Overall dimensions—	
Width	5.875 in.
Depth	3.516 in.
Length of body (including 5-pole plug)	8.562 in.
Weight	5 lb. 8 oz.

1. The A1705 and A1705A actuators are basically similar to the machine described and illustrated in the main chapter, but differ in certain particulars. Characteristic features of these actuators are:—

- (1) The supply plugs, which are mounted to face No. 1 motor, are non-interchangeable; that for No. 1 motor is a Breeze type (Ref. No. 5X/6006), coloured red, and that for No. 2 motor a Cannon type (WK-4-325), coloured green (fig. 1).
- (2) A shackle is fitted to one end of the ram, instead of a threaded stud. The shackle has a 0.875 in. dia. clearance hole, to receive a universal bearing, and a 0.187 in. dia. hole for a locking device. The flats of the shackle for the A1705 lie in planes at right angles to the common plane of the motor axes, whilst the

shackle of the A1705A is set 15 deg. clockwise (looking on ram end) from this position.

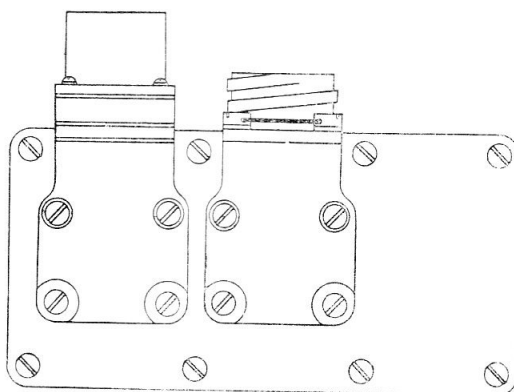


Fig. 1. Plug arrangement for Types A1705 and 1705A actuators

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- (3) A desynn type potentiometer transmitter is incorporated, being intended to monitor a receiver instrument giving continuous indication of ram position. Internal connections are as shown in fig. 2.

Potentiometer

2. The potentiometer is a miniaturized desynn type for use with a standard desynn

pattern indicator. It is housed in an extension to the ram housing, and is operated by the rotation of the screwshaft, which is transmitted to the potentiometer spindle through a single stage epicyclic reduction gear train. The potentiometer is permitted 180 deg. travel for full (2 in.) ram travel. Electrical connections to the potentiometer are made through a 5-pole plug (Ref No. 5X/6016), set to one side of the actuator mounting surface.

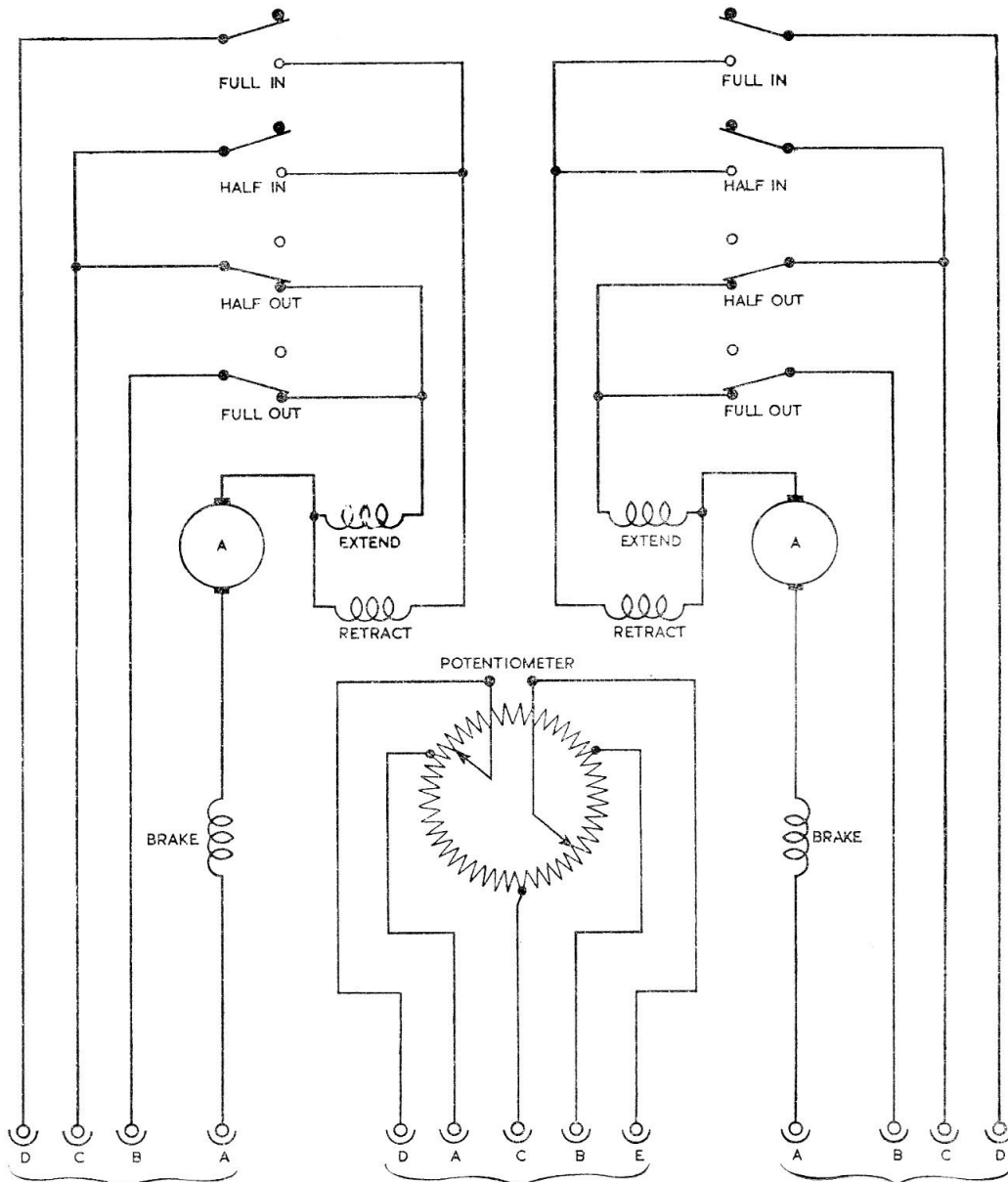


Fig. 2. Diagram of internal connections

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Appendix 5

ACTUATOR, ROTAX, TYPE A1706

LEADING PARTICULARS

Actuator, Type A1706	Ref. No. 5W/1115
<i>Voltage</i>	.....	.....	.....	.....	.....	.....	.....	.....	.....	28V d.c.
<i>Current (one motor driving)</i>	.....	.....	.....	.....	.....	.....	.....	.....	.....	2.5A at 250 lb. load
<i>Speed (one motor driving)</i>	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.05 in./sec. at 250 lb. load
<i>Average load</i>	.....	.....	.....	.....	.....	.....	.....	.....	.....	250 lb.
<i>Maximum load</i>	.....	.....	.....	.....	.....	.....	.....	.....	.....	500 lb.
<i>Either motor driving—</i>										
<i>Retracted length</i>	.....	.....	.....	.....	.....	.....	.....	.....	.....	6.175 in.
<i>Extended length</i>	.....	.....	.....	.....	.....	.....	.....	.....	.....	6.575 in.
<i>(above dimensions taken over mounting face to ram shoulder)</i>										
<i>Overrun</i>	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.010 in.
<i>Brush spring pressure</i>	.....	.....	.....	.....	.....	.....	.....	.....	.....	2½ to 3½ oz. (71 to 99 gm.)
<i>Brush length (new)</i>	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.343 ± 0.015 in.
<i>Minimum brush length</i>	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.200 in.
<i>Brush grade</i>	.....	.....	.....	.....	.....	.....	.....	.....	.....	K.C.E.G. 11
<i>Commutator diameter (new)</i>	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.571 + 0 — 0.005 in.
<i>Commutator diameter (minimum) permissible</i>	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.535 in.
<i>Overall dimensions—</i>										
<i>Width</i>	.....	.....	.....	.....	.....	.....	.....	.....	.....	5.875 in.
<i>Depth</i>	.....	.....	.....	.....	.....	.....	.....	.....	.....	3.516 in.
<i>Length of actuator body</i>	.....	.....	.....	.....	.....	.....	.....	.....	.....	5.812 in.
<i>Weight</i>	.....	.....	.....	.....	.....	.....	.....	.....	.....	5 lb. 4 oz.

1. The A1706 actuator is identical to that described and illustrated in the main chapter, and differs only in the ram travel dimensions, and speed of ram under average load, as detailed under Leading Particulars. The position of the supply plugs is as illustrated, i.e., facing No. 1 motor.

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Appendix 6

ACTUATOR, ROTAX, TYPE A1708

LEADING PARTICULARS

Actuator, Type A1708	Ref. No. 5W/2847
<i>Voltage</i> .....	.....	.....	.....	.....	28V d.c.
<i>Current (one motor driving)</i> .....	.....	.....	.....	.....	2.5A at 250 lb. load
<i>Speed (one motor driving)</i> .....	.....	.....	.....	.....	0.086 in./sec. at 250 lb. load
<i>Average load</i> .....	.....	.....	.....	.....	250 lb.
<i>Maximum load</i> .....	.....	.....	.....	.....	500 lb.
<i>Maximum static load</i> .....	.....	.....	.....	.....	1,200 lb.
<i>Either motor driving—</i>					
<i>Retracted length</i> .....	.....	.....	.....	.....	5.860 ± .010 in.
<i>Extended length</i> .....	.....	.....	.....	.....	6.890 ± .010 in.
<i>(above dimensions taken over mounting face to ram shoulder)</i>					
<i>Overrun</i> .....	.....	.....	.....	.....	0.010 in.
<i>Brush spring pressure</i> .....	.....	.....	.....	.....	2½ to 3½ oz. (71 to 99 gm.)
<i>Brush length (new)</i> .....	.....	.....	.....	.....	0.343 ± 0.015 in.
<i>Minimum brush length</i> .....	.....	.....	.....	.....	0.200 in.
<i>Brush grade</i> .....	.....	.....	.....	.....	K.C.E.G. 11
<i>Commutator diameter (new)</i> .....	.....	.....	.....	.....	0.571 + 0 — 0.005 in.
<i>Commutator diameter (minimum permissible)</i> .....	.....	.....	.....	.....	0.535 in.
<i>Overall dimensions—</i>					
<i>Width</i> .....	.....	.....	.....	.....	5.875 in.
<i>Depth</i> .....	.....	.....	.....	.....	3.516 in.
<i>Length of actuator body</i> .....	.....	.....	.....	.....	5.812 in.
<i>Weight</i> .....	.....	.....	.....	.....	5 lb. 5 oz.

1. The A1708 actuator is similar to that described and illustrated in the main chapter, the ram travel dimensions are as detailed under Leading Particulars. The supply plugs are mounted 180 deg. from the position illustrated, and face No. 2 motor.

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Appendix 7

ACTUATOR, ROTAX, TYPE A1709

LEADING PARTICULARS

Actuator, Type A1709	<i>Ref. No. 5W/2848</i>
<i>Voltage</i>	.....	.....	.....	.....	28V d.c.
<i>Current (one motor driving)</i>	.....	.....	.....	.....	2.5A at 250 lb. load
<i>Speed (one motor driving)</i>	.....	.....	.....	.....	0.086 in./sec. at 250 lb. load
<i>Average load</i>	.....	.....	.....	.....	250 lb.
<i>Maximum load</i>	.....	.....	.....	.....	500 lb.
<i>Maximum static load</i>	.....	.....	.....	.....	1,200 lb.
<i>Either motor driving—</i>					
<i>Retracted length</i>	.....	.....	.....	.....	5.625 ± .010 in.
<i>Extended length</i>	.....	.....	.....	.....	7.125 ± .010 in.
<i>(above dimensions taken over mounting face to ram shoulder)</i>					
<i>Overrun</i>	.....	.....	.....	.....	0.010 in.
<i>Brush spring pressure</i>	.....	.....	.....	.....	2½ to 3½ oz. (71 to 99 gm.)
<i>Brush length (new)</i>	.....	.....	.....	.....	0.343 ± .015 in.
<i>Minimum permissible brush length</i>	.....	.....	.....	.....	0.200 in.
<i>Brush grade</i>	.....	.....	.....	.....	K.C.E.G. 11
<i>Commutator diameter (new)</i>	.....	.....	.....	.....	0.571 + 0 in. — 0.005
<i>Commutator diameter (minimum permissible)</i>	.....	.....	.....	.....	0.535 in.
<i>Overall dimensions—</i>					
<i>Width</i>	.....	.....	.....	.....	5.875 in.
<i>Depth</i>	.....	.....	.....	.....	3.516 in.
<i>Length of actuator body</i>	.....	.....	.....	.....	5.812 in.
<i>Weight</i>	.....	.....	.....	.....	5 lb. 5 oz.

1. The A1709 actuator is similar to that described and illustrated in the main chapter; the ram travel dimensions are as detailed under Leading Particulars. The supply plugs are mounted 180 deg. from the position illustrated and face No. 2 motor.

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Appendix 8

ACTUATOR, ROTAX, TYPE A1711

LEADING PARTICULARS

Actuator, Type A1711	<i>Ref. No. 5W/3718</i>
<i>Voltage</i> .....	.....	.....	.....	.....	28V d.c.
<i>Current (one motor driving)</i> .....	.....	.....	.....	.....	2.5A at 250 lb. load
<i>Speed (one motor driving)</i> .....	.....	.....	.....	0.05 in./sec.	at 250 lb. load
<i>Average load</i> .....	.....	.....	.....	.....	250 lb.
<i>Maximum load</i> .....	.....	.....	.....	.....	500 lb.
<i>Maximum static load</i> .....	.....	.....	.....	.....	1,200 lb.
<i>Either motor driving—</i>					
<i>Retracted length</i> .....	.....	.....	.....	.....	5.860 ± .010 in.
<i>Extended length</i> .....	.....	.....	.....	.....	6.890 ± .010 in.
<i>(above dimensions taken over mounting face to ram shoulder)</i>					
<i>Overrun</i> .....	.....	.....	.....	.....	0.010 in.
<i>Brush spring pressure</i> .....	.....	.....	.....	2½ to 3½ oz.	(71 to 99 gm.)
<i>Brush length (new)</i> .....	.....	.....	.....	.....	0.343 ± 0.015 in.
<i>Minimum brush length</i> .....	.....	.....	.....	.....	0.200 in.
<i>Brush grade</i> .....	.....	.....	.....	.....	K.C.E.G. 11
<i>Commutator diameter (new)</i> .....	.....	.....	.....	.....	0.571 + 0 — 0.005 in.
<i>Commutator diameter (minimum permissible)</i> .....	.....	.....	.....	.....	0.535 in.
<i>Overall dimensions—</i>					
<i>Width</i> .....	.....	.....	.....	.....	5.875 in.
<i>Depth</i> .....	.....	.....	.....	.....	3.516 in.
<i>Length of actuator body</i> .....	.....	.....	.....	.....	5.812 in.
<i>Weight</i> .....	.....	.....	.....	.....	5 lb. 4 oz.

1. The A1711 actuator is identical to that described and illustrated in the main chapter, and varies only in the ram travel dimensions, and speed of ram under average load, as detailed in Leading Particulars. The position of the supply plugs is as illustrated, i.e., facing No. 1 motor.

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