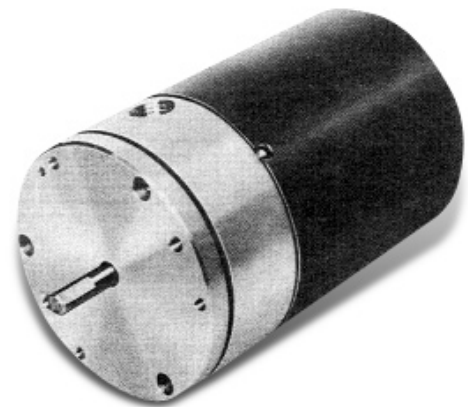


Electric Actuators and Control Systems

# **rotork<sup>®</sup>** **Process Controls**

Established Leaders in Valve Actuation



## **SM-1100 Series**

**Instruction Manual**

## ***SM-1100 Series***

### ***Rotary Actuators***



*Due to wide variations in the terminal numbering of actuator products, actual wiring of this device should follow the print supplied with the unit.*

# GENERAL DESCRIPTION

The SM-1100 series are electro-mechanical, bi-directional rotary actuators. They can provide up to 100 inch-pounds of torque with output shaft turns between .25 and 60. These actuators may be installed in indoor, outdoor, hazardous gas and hazardous dust environments.

These actuators are equipped with minimum and maximum position limit switches. Position feedback options include a 1000 ohm potentiometer or a 4 to 20 mA loop-powered transmitter for remote position indication.

The SM-1100 series include 120 V ac, 240 V ac, and single-phase models as well as 24 V dc and 90 V dc models. These actuators are controlled by "switched" power inputs or a remotely installed servo amplifier.

## FEATURES

- Dust resistant enclosures rated for NEMA Type 12 - indoors
- Compact size
- Temperature range: -40°C (-40°F) to +65°C (150°F)
- Any position mounting
- Permanently lubricated
- Maximum and minimum SPDT position limit switches
- Torque output to 100 inch-pounds (maximum)
- Output speeds from .065 to 140 rpm

## OPTIONS

- Available with or without a built-in ac or dc servo amplifier
- Potentiometer, or 4 to 20 mA transmitter position feedback
- Enclosures rated NEMA Type 4 indoor/outdoor, or hazardous locations for Class I, Division 1, Groups C and D, or Class II, Division 1, Groups E, F, and G, indoor/outdoor. Also rated for NEMA Type 4 applications indoor and outdoor.
- Canadian Standards Association (CSA) approved models
- Custom mounting and interface hardware

## APPLICATION

These actuators have been designed to meet the exacting requirements for closed-loop positioning controls in a number of process industries under the most adverse environmental conditions. They can be mounted to valves, variable speed drives, metering pumps, hydraulic and pneumatic pressure regulators, dampers, and many more industrial/process control applications where reliable remote positioning control is required. Jordan Controls provides a wide range of engineering services to precisely match the SM-1100 series to your exact application requirements. Accessories such as couplings, special mounting brackets and special output shafts are available.

## MATERIALS OF CONSTRUCTION

MAIN HOUSING: cast aluminum alloy  
REAR COVER: (enclosure Type "D"): spun steel, painted blue (enclosure Type "E" and "X"): cast aluminum alloy  
REAR COVER SEAL: Buna N (nitrile) o-ring  
RACK: stainless steel  
OUTPUT SHAFT SEAL: Buna N (nitrile) rotary lip seal

## BASIC MODELS

### SM-1110

120 V ac, 1 phase, 50/60 Hz, running current 0.25A, stall current 0.26A, modulating duty.

**Control Compatibility:** Jordan Controls models AD-8813, and AD-8710 servo amplifiers, MT-6220 remote control and readout, CS-7250 control station or any bi-directional contact type control.

### SM-1120

120 V ac, 1 phase, 50/60 Hz, running current 0.6A, stall current 0.7A, 12% duty cycle, maximum 5 minute on-time.

**Control Compatibility:** Jordan Controls model AD-8813 servo amplifier, MT-6220 remote control and readout, CS-7250 control station, or any bi-directional contact type control.

### SM-1140

24 V dc (permanent magnet field), running current 1.2A, stall current 4.8A, modulating duty.

**Control Compatibility:** Jordan Controls model AD-7530 servo amplifier, battery or power supply with reversing contacts.

### SM-1150

120 V ac, 1 phase (synchronous motor), 60 Hz, running current 0.1A, stall current 0.1A, modulating duty.

**Control Compatibility:** Jordan Controls models AD-8813 and AD-8710 servo amplifiers, MT-6220 remote control and readout, CS-7250 control station, or any bi-directional contact type control.

### SM-1160

90 V dc (permanent magnet field), running current 0.3A, stall current 1.7A, modulating duty.

**Control Compatibility:** Jordan Controls model AD-7300 (90 V dc output), or any compatible 90 V dc output servo amplifier.

### SM-1170

240 V ac, 1 phase, 50/60 Hz, running current 0.14A, stall current 0.15A, modulating duty.

**Control Compatibility:** Jordan Controls models AD-8833 or AD-8730 servo amplifiers, or any bi-directional contact type control.

### SM-1180

24 V dc (permanent magnet field) with built-in tachometer for rate feedback, running current 1.9A, stall current 5.2A, modulating duty.

**Control Compatibility:** Jordan Controls model AD-7530 servo amplifier, or other compatible 24 V dc output servo amplifier. This actuator is most often used on applications requiring high-speed positioning or precise speed control over a broad speed range.

## STORAGE

If the actuator will not be installed immediately, it should be stored in a clean, dry area where the ambient temperature is not less than -20°F. The actuator should be stored in a non-corrosive environment. The actuator is not sealed to NEMA 4 until the conduit entries are properly connected.

## MOUNTING

Outline and mounting dimensions are shown on page 7 for standard models. (For special models, drawings will be supplied.) Allow clearance above the unit for removal of cover.

When the actuator is directly coupled to a driven shaft, it is recommended that a flexible no-backlash type coupling be used. The two shafts should be carefully aligned to minimize side loading.

Be sure that no excessive inward thrust is applied to the output shaft. Equipment coupled to the output shaft should be positively secured so no slippage may occur.

## ELECTRICAL INTERCONNECT

The internal wiring of the actuator is shown on page 6 for standard models. (For special models, drawings will be supplied.) Wire size should be compatible for voltage and current rating as shown on nameplate.

If the unit is used with a Jordan Controls servo amplifier, the interconnect information is supplied with the amplifier.

## START-UP

If the actuator is to be used with a Jordan Controls servo amplifier, factory phasing has been accomplished and all that is necessary is the zeroing of the actuator to match the minimum/maximum requirements of the equipment being controlled. (See appropriate amplifier instruction manual.)

Before mounting, ensure the actuator is moving in the correct direction. To change directions:

3 wire motors - reverse wires 2 with 3; and 4 with 6  
dc motors - reverse wires 1 with 2; and 3 with 5

Apply power and drive the actuator to the zero position. Move controlled equipment to mechanical zero position and couple.

Loosen potentiometer jam nut and turn body to reach electrical zero. If no limit switches are supplied, loosen 3 pan head screws and rotate complete servo disc.

Limit switches are actuated by the flat of the cam or by the adjustment screw in the multiplier assembly. When the mechanical zero is reached, adjust the proper limit switch to cut motor power at this point. Apply power and drive actuator to maximum desired position and adjust other limit switch.

## OPERATION

The SM-1100 series is a self-contained bi-directional, electrically operated motor, coupled to a reduction gear train to give a low speed, high torque output suitable for rotary positioning.

AC units have dual balanced windings and use a tuning capacitor for phase shift and reversal of direction.

DC units have a permanent magnet field and require polarity reversal of armature voltage to reverse direction.

## MOTOR SPECIFICATIONS

MODEL DESIGNATION AND CODE EXPLANATION  
(Refer to Nameplate)

Model: SM-1110 Standard  
SM-1110-1006 Non-Standard  
5P73-38 Special

Code: 1114 / 2.5 / .7 - Feedback gearing revolutions  
Power gearing R.P.M.  
(Output shaft speed)  
Engineering revisions not affecting  
function or dimensions  
Motor type  
Basic unit

Serial: 110B77-24485 Factory designated  
PH/HZ/V/A: Phase/Cycles/Voltage/Amps  
AC units 1 50-60 115  
DC units 24 V dc  
90 V dc

Several gear reductions are available to provide a choice of speed-torque ranges. Maximum gear train rating is 100 inch-pounds.

**NOTE:** Actuator should never be subjected to excessive shock loads nor run into mechanical stops at full speed or damage may result.

The speed and torque information is given at the maximum power point of the motor which is about two-thirds the no-load speed. Actual speed of the output shaft will depend upon the load. Since the motor stall torque is greater than the running torque, a slight safety margin for overload is provided.

**NOTE:** Intermittent duty ac units and dc units will burn out under prolonged stall conditions.

The optional feedback device, which consists of a combination of potentiometers and/or limit switches, is coupled to the output shaft through appropriate gearing.

Potentiometers are used as position transmitters for meter readout or feedback when used in conjunction with servo amplifiers in closed-loop applications.

Limit switches are single pole double throw (SPDT), with isolated contacts which are used to interrupt the motor circuit when end-of-travel is reached. They can also be used for remote indication of travel limits.

Feedback Gearing Revolutions, as shown in the nameplate "CODE" indicates the gearing between the output shaft and feedback shaft. The output shaft revolutions on page 6 describe the number of output shaft revolutions for 270° rotation of the feedback shaft. For instance 1/2 would indicate that the output shaft will make 1/2 revolution while the feedback device shaft rotates 270°. The "ACTUAL" revolutions available can be increased by a factor of 12 if a 10-turn potentiometer or a limit switch "MULTIPLIER" assembly is used as feedback.

Approximately 30% more range can also be realized if a precision, single-turn potentiometer is used instead of a commercial type.

## MAINTENANCE

**LUBRICATION** - The actuator has been factory lubricated, but should the unit be disassembled, repack the gear housing with Penola Thixotropic grease or equivalent.

The 1110 and 1120 motors have lifetime lubricating spherical bearings and require no further attention. All other motors have ball bearings.

**TROUBLESHOOTING** - If the actuator fails to operate check the following in sequence: (1) power input, (2) limit switch continuity and operation, (3) motor, (4) continuity of potentiometer winding and wiper, (5) gear train including feedback gearing, for wear or breakage.

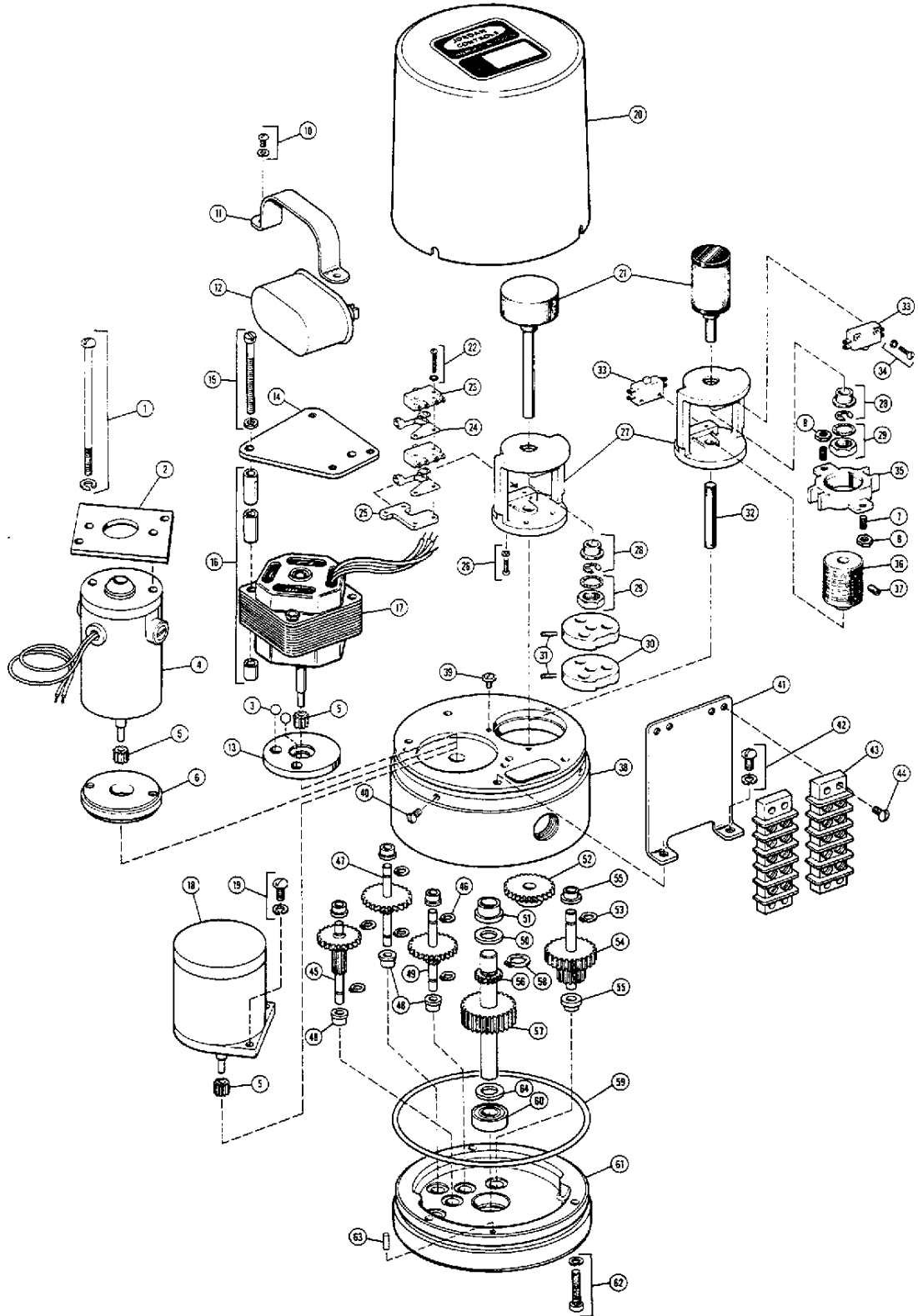
Motor Type	Duty	Input	Resistance (Ohms)	Running Current (Amps)	Stall Current (Amps)	Motor Speed No-Load RPM	Tuning Capacitor
1110	Continuous	115 V ac 1 Phase 50-60 Cycle	135	.27	.31	2000	3 MFD 330 VAC
1120	Intermittent	115 V ac 1 Phase 50-60 Cycle	110	.38	.56	2000	7.5 MFD 220/365 VAC
1140	Continuous	24 V dc	5	1.2	4.8	3500	--
1150	Continuous	115 V ac 1 Phase 50-60 Cycle	1100	.27	.27	72	.68 MFD 600 VAC & 500 Ohm 10W Res.
1160	Continuous	90 V dc	55	.35	1.7	3620	--
1170	Continuous	220 V ac 1 Phase 50-60 Cycle	270	.14	.15	2000	1 MFD 660 VAC
1180	Continuous	24 V dc 1 Phase	1.70-2.50	2.2	5.2	5800-7000	--

# PARTS LIST

## PARTS ORDERING PROCEDURE

All parts shown are not supplied with all models, or may differ slightly.  
To order, furnish the following information:

1. Item number, quantity and description.
2. Complete model and code information.
3. Completed serial number. (The serial number is located on the nameplate and is stamped on base casting near the motor.)



Item	Description	Qty.
1	Screw and Lock, Round Head, No. 8-32 x 3-3/4"	2
† 2	End Bell, Upper Motor, SM-1140-1160	1
3	Steel Locator Balls	2
† 4	Motor Assembly, SM-1140-1160	1
5	Motor Pinion, SM-1100	1
† 6	Motor End Bell, Lower, SM-1140-1160	1
7	Screw, Allen, No. 8-32 x 3/8"	2
† 8	Hex Nut, No. 8-32	2
† 9	Deleted	
10	Screw and Lock, Round Head, No. 8-32 x 1/4"	2
11	Bracket, Capacitor Mounting	1
12	Capacitor	1
13	Pilot Adapter	1
14	Plate, Capacitor Mounting	1
15	Screw and Lock, Fillister Head, No. 8-32 x 3-1/4" SM-1110, 1120 W/F.B.	2
16	Spacer Set	4
† 17	Motor Assembly, SM-1110-1120	1
† 18	Motor Assembly, SM-1150	1
19	Screw and Lock, Round Head, No. 8-32 x 3/8"	3
20	Name Plate and Rear Cover	1
**21	Potentiometer, Feedback	1
22	Screw and Lock, Round Head, No. 2-56 x 5/8"	2
**23	Switch, Limit	2
24	Actuator, Limit Switch	2
25	Plate, Limit Switch Mounting	1
26	Screw and Lock, Round Head, No. 2-56 x 5/16"	2
27	Frame, Limit Switch Mounting	1
**28	Switch, Limit, Mounting Frame Bushing and 1/4" E Ring (No feedback pot)	1
29	Nut and Star Washer, 3/8-32	1
30	Cam, Limit Switch	2
31	Screw, Allen, No. 8-32 x 3/8"	2
32	Shaft, Multi-Turn Extension	1
**33	Switch, Limit	2
34	Screw, Self-Tapping, No. 2-56 x 3/8"	4
35	Nut, Traveling	1
36	Screw, Multi-Turn	1
37	Screw, Allen, No. 8-32 x 1/4"	2
38	Gear Case	1
39	Screw, Pan Head, No. 8-32 x 1/4"	3
40	Screw, Round Head, No. 10-24 x 1/4"	3
41	Bracket, Terminal Strip	1
42	Screw and Lock, Round Head, No. 8-32 x 5/16"	2
43	Strip, Terminal	2
44	Screw, Round Head, No. 6-32 x 5/16"	4
* 45	Gear Assembly, First Stage Power	1
* 46	C-Ring, First, Second and Third Stage Assembly, 3/16"	6
* 47	Gear Assembly, Second Stage Power	1
* 48	Bushing, First, Second and Third Stage Assembly	6
* 49	Gear Assembly, Third Stage Power	1
* 50	Washer, Thrust	1
* 51	Bushing, Output Shaft	1
**52	Gear, Feedback Potentiometer	1
* 53	C-Ring, Fourth Stage Assembly, 7/32"	1
* 54	Gear Assembly, Fourth Stage Power	1
* 55	Bushing, Fourth Stage Assembly	2
**56	Gear, Output Shaft Assembly Feedback	1
* 57	Shaft Assembly, Output	1
* 58	C-Ring Output Shaft Assembly, 3/8"	1
59	O-Ring (1 for Gear Case — 1 for Rear Cover)	2
* 60	Bearing, Output Shaft	1
61	Gear Case Cover	1
62	Screw and Lock, Fillister Head, No. 10-24 x 7/8"	3
63	Pin, Dowel, 1/8" x 3/8"	1
64	Output Shaft Spacer	1
† 65	Motor Assembly SM-1170	1

† Consult Code and Motor Specification Table

\* Consult Code and Power Gearing Parts List

\*\* Consult Code and Feedback Variations Parts List

# FEEDBACK VARIATIONS AND GEARING REVOLUTIONS

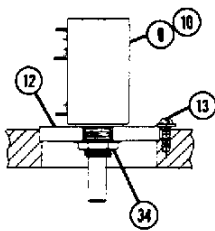


FIGURE 1

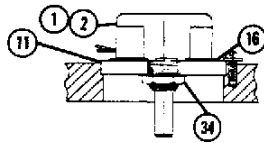


FIGURE 2

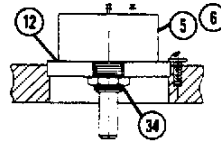


FIGURE 3

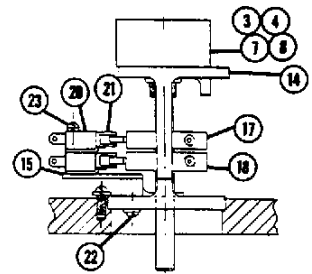


FIGURE 4

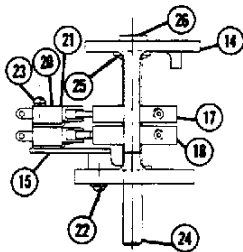


FIGURE 5

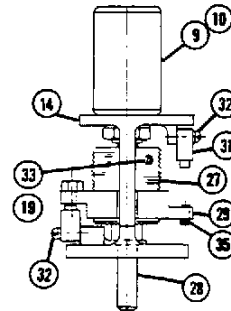


FIGURE 6

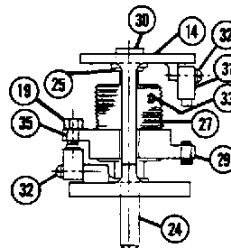


FIGURE 7

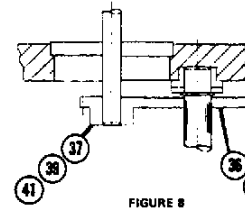


FIGURE 8

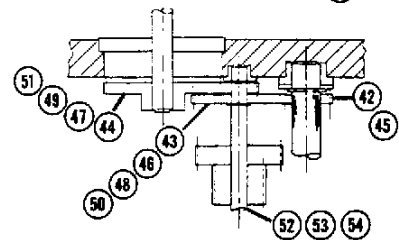


FIGURE 9

Item	Fig.	Description	Stock No.
<b>POTENTIOMETERS</b>			
1	2	Commercial One Turn, 1K	34-B-100078-005
2	2	Commercial One Turn, 15K	34-B-100078-006
3	4	Commercial One Turn, 1K	34-B-100078-005
4	4	Commercial One Turn, 15K	34-B-100078-006
5	3	Precision One Turn, 1K	34-B-100032-013
6	3	Precision One Turn, 10K	34-B-100032-014
7	4	Precision One Turn, 1K	34-B-100032-013
8	4	Precision One Turn, 10K	34-B-100032-014
9	1,6	Precision Ten Turn, 1K	34-B-100033-001
10	1,6	Precision Ten Turn, 10K	34-B-100033-002
<b>HARDWARE</b>			
11	2	Disc, Adapter	61-A-SM3304-001
12	1,3	Disc, Adapter	61-A-SM3304-003
13		Screw, Pan Head, No. 8-32 x 1/4"	14-C-008600-001
14	4,5,6,7	Frame, Limit Switch Mounting	13-A-010187-001
15	4,5	Plate, Limit Switch Mounting	75-A-003858-001
16	2	Insulator, Pot (Commercial pot only)	14-A-SM2341-001
17	4,5	Cam, Limit Switch	54-A-015037-038
18	4,5	Screw, Allen, No. 8-32 x 3/8"	55-A-015038-001
19	6,7	Nut, Hex, No. 8-32	46-B-004053-405
20	4,5	Switch, Limit	46-B-004053-406
21	4,5	Actuator, Limit Switch	54-A-015003-031
22	4,5	Screw and Lock, Round Head, No. 2-56 x 5/8"	54-A-015003-062
23	4,5	Screw and Lock, Round Head, No. 2-56 x 5/8"	62-A-005942-001
24	5,7	Shaft, Feedback (No pot)	18-B-SP1988-006
25	5,7	E-Ring, Truarc, No. 5133-25	61-A-006804-001
26	5	Bushing	62-A-006806-001
27	6,7	Screw, Multi-Turn	14-B-000602-001
28	6	Shaft, Multi-Turn Extension (Precision pot only)	18-B-SP1988-005
29	6,7	Nut, Traveling	46-B-004053-409
30	7	Bushing	18-B-SP1988-002
31	6,7	Switch, Limit	54-A-015037-025
32	6,7	Screw and Lock, Self Tapping, No. 2-56 x 3/8"	54-A-015037-038
33	6,7	Screw, Allen, No. 8-32 x 1/4"	
34	1,2,3	Nut and Star Washer, 3/8" - 32	
35	6,7	Screw, Allen, No. 8-32 x 3/8"	
<b>FEEDBACK GEARING</b>			
36	8	Gear, Output Shaft (1/2 turn)	16-B-003812-090
37	8	Gear, Potentiometer (1/2 turn)	16-B-003811-056
38	8	Gear, Output Shaft (3/4 turn)	16-B-003812-072
39	8	Gear, Potentiometer (3/4 turn)	16-B-003811-072
40	8	Gear, Output Shaft (1 turn)	16-B-003812-058
41	8	Gear, Potentiometer (1 turn)	16-B-003811-082
42	9	Gear, Output Shaft (1 1/4 turn)	16-B-003812-085
43	9	Gear Assembly, Intermediate (1 1/4 turn)	65-A-012605-001
44	9	Gear, Potentiometer (1 1/4 turn)	16-B-003811-064
45	9	Gear, Output Shaft (2, 3 and 5 turn)	16-B-003812-033
46	9	Gear Assembly, Intermediate (2 turn)	65-A-003946-002
47	9	Gear, Potentiometer (2 turn)	16-B-003811-161
48	9	Gear Assembly, Intermediate (3 turn)	65-A-SM3214-002
49	9	Gear, Potentiometer (3 turn)	16-B-003811-132
50	9	Gear Assembly, Intermediate (5 turn)	65-A-SM3215-002
51	9	Gear, Potentiometer (5 turn)	16-B-003811-130

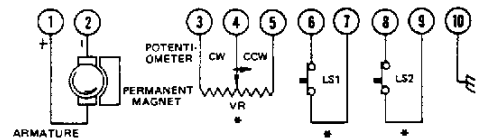
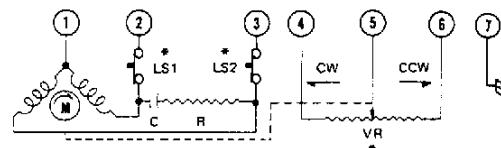
Following items required only when there is 3-stage power gearing (Figure 9)

52	9	Shaft, Intermediate	62-A-007168-001
53	9	Bushing	18-B-SP1988-002
54	9	C-Ring, Truarc, No. 5100-21, 7/32"	58-B-014183-021

Output shaft revolution for 270° rotation of the feedback shaft (limit switches or potentiometer)

SM-1100	1/4	1/2	3/4	1	2	3	5
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## INTERNAL WIRING



### 3-WIRE MOTOR -

To operate actuator without amplifier, if furnished without internal motor capacitor (C), connect proper capacitor as shown.

Facing output shaft, input to (1) and (2) operates actuator in CCW direction; input to (1) and (3) operates actuator in CW direction.

Feedback potentiometer (VR) resistance increases on terminals (4) and (5) with input to (1) and (2).

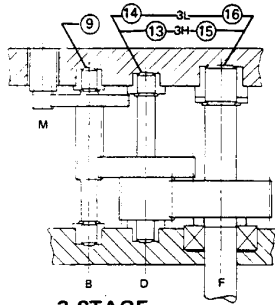
Limit switch (LS1) opens at CCW limit; (LS2) opens at CW limit.

### DC - 2-WIRE MOTOR -

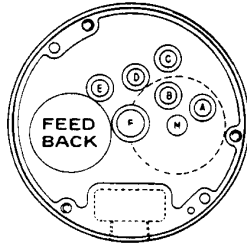
Voltage applied with polarity shown will result in clockwise rotation (facing output shaft). Reverse polarity to terminals (1) and (2) for CCW rotation.

\*OPTIONAL

# POWER GEARING VARIATIONS AND LOCATIONS



3 STAGE

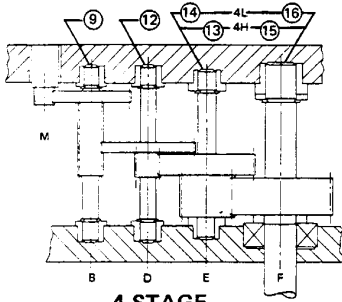


GEAR HOUSING

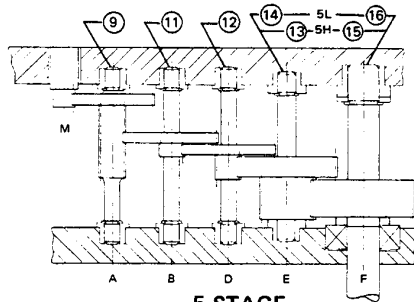
## OUTPUT SHAFT REVOLUTIONS

SM-1110-1120		SM-1140-1160		SM-1150		SM-1170		SM-1180	
RPM	Stages	RPM	Stages	RPM	Stages	RPM	Stages	RPM	Stages
.5	6L	.7	6L		6L	.5	6L	1	6L
1	6H	1.5	6H		6H	1	6H	2	6H
1.7	5L	3	5L	.06	5L	1.7	5L	4	5L
3.5	5H	6	5H	.12	5H	3.5	5H	9	5H
7	4L	12	4L	.25	4L	7	4L	18	4L
14	4H	25	4H	.5	4H	14	4H	35	4H
28	3L	50	3L	1	3L	28	3L	70	3L
56	3H	100	3H	2	3H	56	3H	137	3H

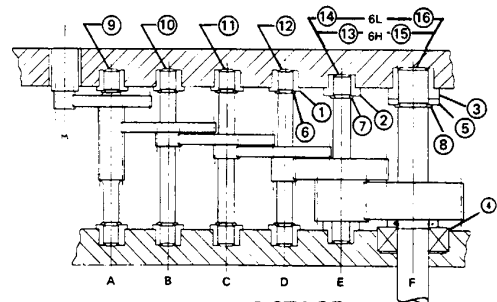
All speeds are at full load rating.



4 STAGE



5 STAGE



6 STAGE

## POWER GEARING PARTS LIST

Item	Description	Stock No.
1	Bushing	18-B-SP1988-011
2	Bushing	18-B-SP1988-002
3	Bushing	18-B-SP1988-003
4	Bearing	17-B-003813-025
5	Washer, Thrust	56-B-004107-020
6	C-Ring, Truarc 5100-18, 3/16"	58-B-014183-018
7	C-Ring, Truarc 5100-21, 7/32"	58-B-014183-021
8	C-Ring, Truarc 5100-37, 3/8"	58-B-014183-037
Note — Hardware shown on 6-stage typical for all stages.		
9	Shaft Assy, Intermediate	65-A-006897-001
10	Shaft Assy, Intermediate	65-A-006896-001
11	Shaft Assy, Intermediate	65-A-006895-001
12	Shaft Assy, Intermediate	65-A-006894-001

Item	Description	Stock No.
13	Shaft Assy, Intermediate	65-A-006893-002(H)
14	Shaft Assy, Intermediate	65-A-006893-001(L)
15	Shaft Assy, Output	65-A-006888-002(H)
16	Shaft Assy, Output	65-A-006889-002(L)
17	Shaft, Spacer Output	61A-017492-001

### NOTES:

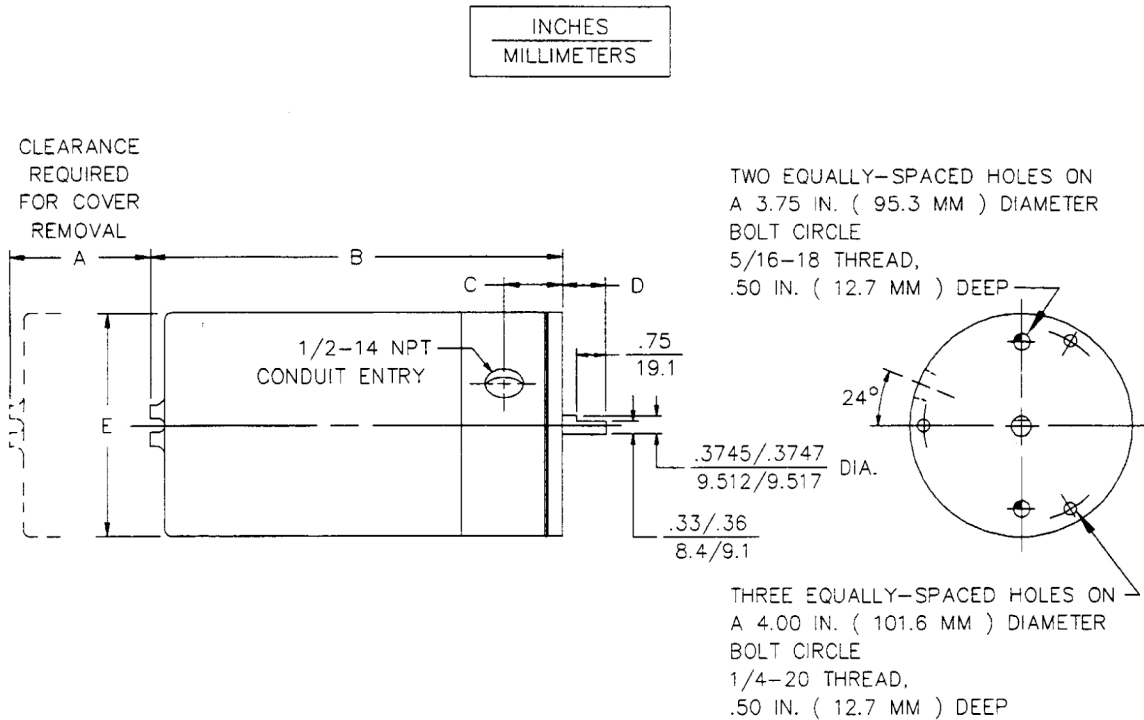
1. Assemblies shown for output shaft are standard unit only. For special output shaft, include serial number and model number as per parts order procedure and include item and description only.

2. C-rings are normally supplied with gear assemblies.

3. Feedback gearing is not supplied as part of power gearing and must be ordered separately. Refer to Feedback Variation Parts List.



# INSTALLATION DIMENSIONS



SM-1100 Series	A	B	C	D	E	Approx. Weight (Lbs.)
NEMA Type 12 (Enclosure "D") (Except model SM-1180)	5.00 127.0	7.13 181.1	1.59 40.4	1.25 31.8	4.50 (DIA.) 114.3	8
NEMA Type 12 (Enclosure "D") (Model SM-1180 only)	5.50 139.7	7.63 193.8	1.59 40.4	1.25 31.8	4.50 (DIA.) 114.3	8
NEMA Type 4 (Enclosure "E") Watertight and X-proof (Enclosure "X")	6.28 159.5	8.65 219.7	1.84 46.7	.88 22.4	4.88 (DIA.) 124.0	12

## Jordan Controls, Inc.

5607 West Douglas Avenue  
Milwaukee, Wisconsin 53218  
Phone: (414) 461-9200  
FAX: (414) 461-1024

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### *UK*

Rotork plc

*tel* +44 (0)1225 733200

*fax* +44 (0)1225 333467

*email* mail@rotork.com

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Rotork Process Controls

*tel* +1 (414) 461 9200

*fax* +1 (414) 461 1024

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