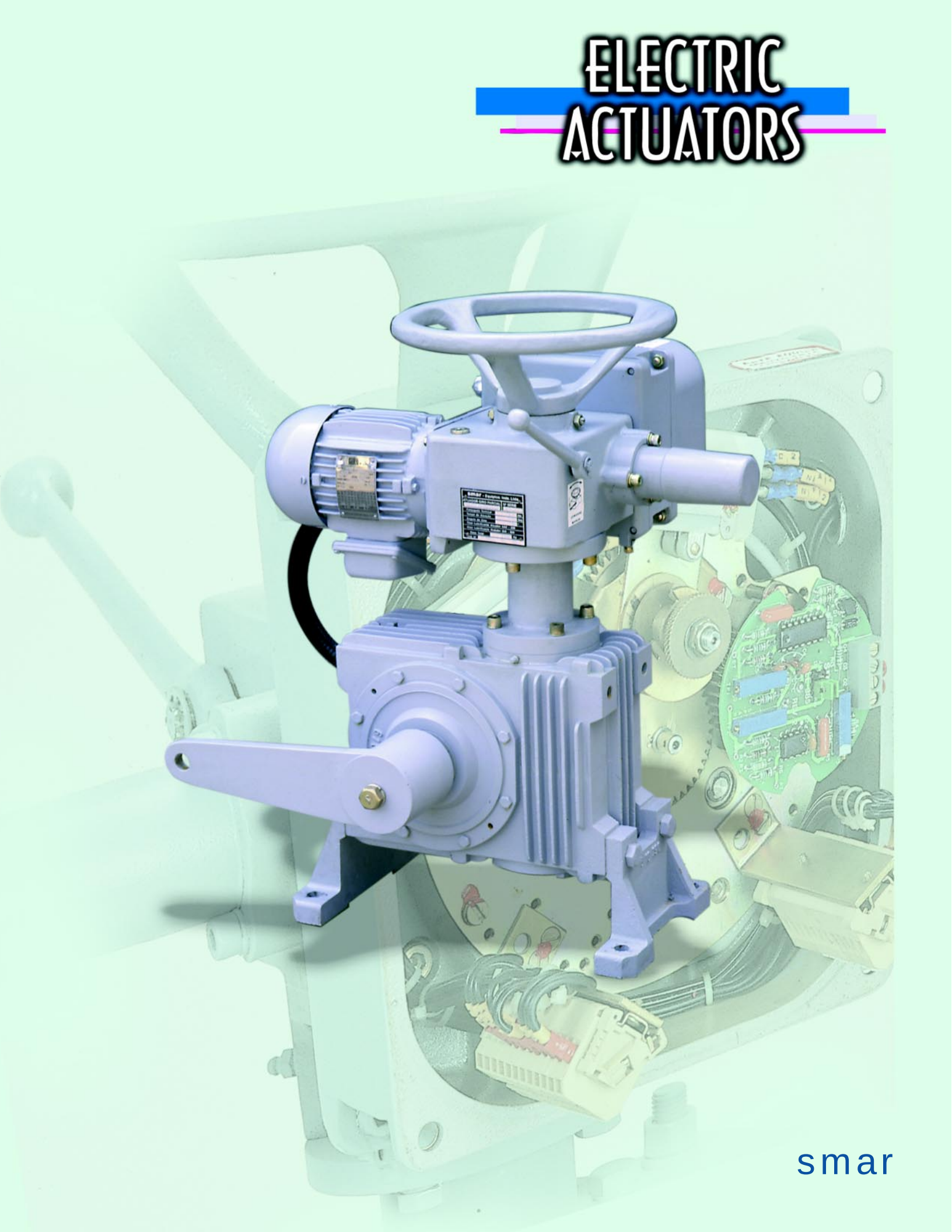
ELECTRIC ACTUATORS



smar

INTRODUCTION

Electric Actuators are electromechanical devices that are highly reliable in replacing the manual operation of valves in:

- Remote or hazardous locations;
- Applications demanding high actuation torque;
- Valves requiring quick positioning, particularly those with large numbers of turns;
- Automatic process control applications where valves operate in two limit positions, or intermediate repositioning (modulation).

Smar Actuators provide the following characteristics:

- ✓ Easy operability;
- ✓ Ruggedness;
- ✓ Long service life;
- ✓ Internal parts protected against aggressive environments;
- ✓ Easy maintenance;
- ✓ Accurate positioning;
- ✓ Available options include explosion proof enclosures, fail-safe operation and proportional control;
- ✓ Attachments are in accordance with ISO 5211 and DIN 3337;

Such characteristics fulfill the most important requirements in the following applications.

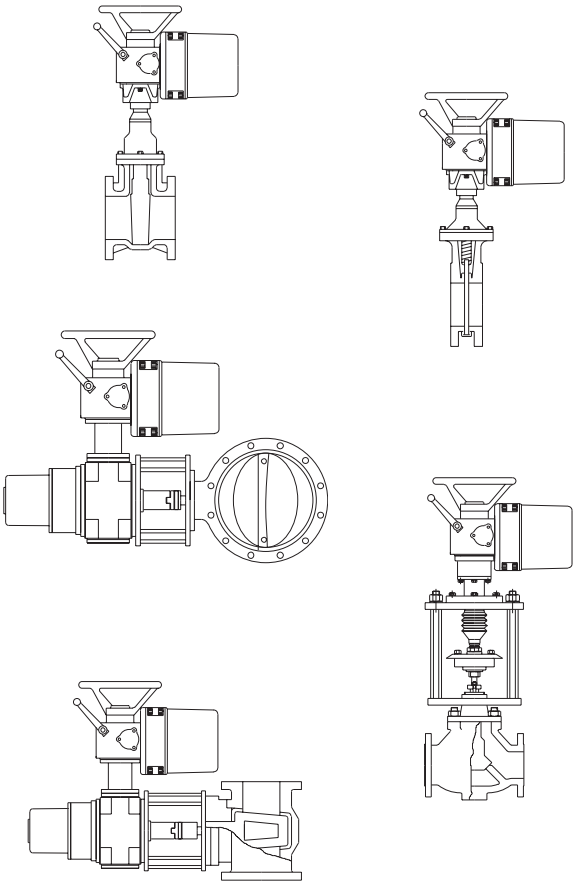
- ✓ Oil refineries;
- ✓ Petrochemical plants;
- ✓ Sugar and ethanol mills;
- ✓ Food industries;
- ✓ Pharmaceutical industries;
- ✓ Chemical plants;
- ✓ Cement and steel mills, and glassworks;
- ✓ Water, natural gas and oil pipelines;
- ✓ Sewage stations and water treatment stations (sanitation);
- ✓ Oil drilling rigs and production platforms;
- ✓ Air conditioning units;
- ✓ Pneumatic dispatch lines.

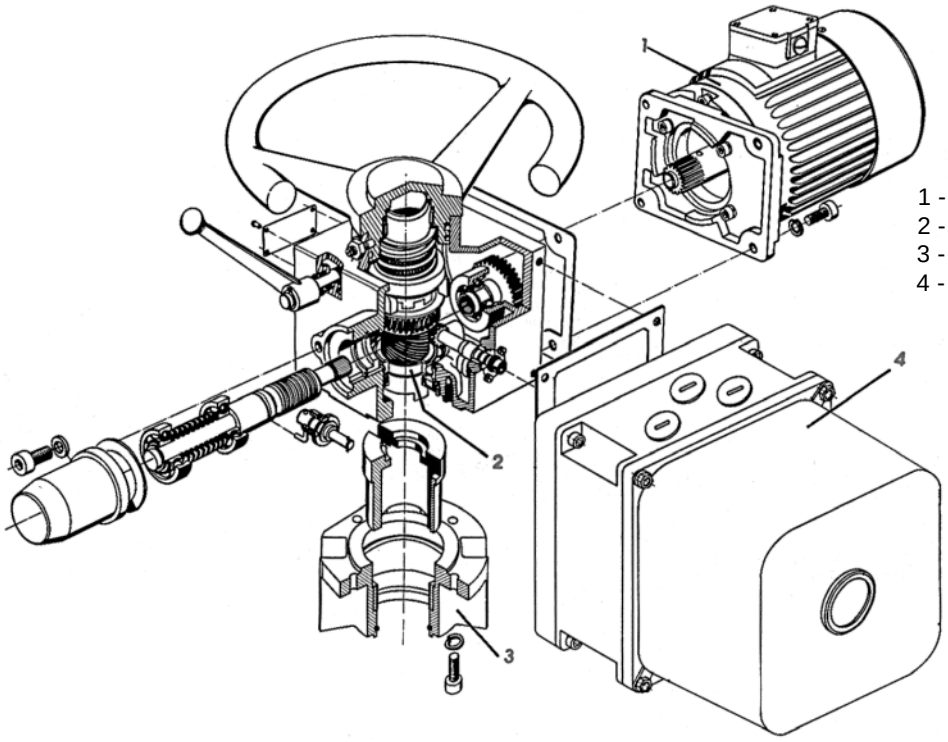
Smar Actuators are available for dampers, gate, slide, diaphragm, globe, butterfly, ball and plug valves. Four torque ranges from 20 to 80 Nm, and rotations from 6 to 48 rpm are available. Higher torque may be obtained by adapting additional gear stages coupled to the output shaft of the actuator.

All models are equipped with an overload protection system for valves operating in limit positions, or in the case of foreign objects obstructing their travel. These are automatic systems that turn off the motor, protecting the actuator/valve system.

As an option, valve position and travel transmitting devices can be supplied with the actuators, providing an operational status for each actuator/valve set.

In case of power failure, all actuators are capable of manual operation by means of a hand-wheel attached to a mechanical coupling. Such coupling will deactivate upon electric motor start-up.





1 - MOTOR
2 - GEAR STAGE
3 - VALVE COUPLING
4 - SWITCHING AND SIGNALING UNIT

Principle of operation

In the gear stage, the motor rotation is transmitted to the output shaft by means of two sets of gears. The primary reduction is carried out by planetary gears, while the secondary reduction is done by means of worm gear, which is kept centralized by a set of pre-tensioned plate springs. Should an overload occur, with the output shaft exceeding the set torque of the plate springs, the central worm will be axially displaced, actuating the microswitches of the switching and signaling unit, providing system protection.

A coupling operated by an external change lever enables the output shaft to be coupled to the travelling worm in the case of motor operation, or to the handwheel, in the case of manual operation. It is possible to uncouple the electric drive and to couple the handwheel simply by pressing the lever while the motor is off. The opposite operation will occur automatically every time the motor is turned on, because the electric motor has priority over manual operation. Thus, it is not possible to turn the handwheel while the motor is on, which protects the operator.

The handwheel, being directly coupled to the output shaft, ensures the manual operation of the valve in the event of broken or damaged internal gears.

The switching and signaling unit, attached to the gear stage, is a sealed enclosure that contains devices to perform the following:

- Local or remote indication of valve position;
- Protection to the actuator/valve set against overload;
- Limiting valve travel;
- Electrical Connections.

Installation of the actuator on different valve models is accomplished by means of output shafts, capable of fitting several existing stem configurations.

Motor

The motor of the actuator is normally a three-phase motor. Its basic specifications are:

- Nominal Voltage: 220/380/440 Vac – 60 Hz;
- Insulation Class F;
- Switched on directly, with change of direction in rotation;
- Protection Class IPW-55.

In applications requiring very accurate valve positioning, the motor can be equipped with an appropriate braking system.

As an option, temperature sensors embedded in the motor winding, can be supplied to provide efficient protection against:

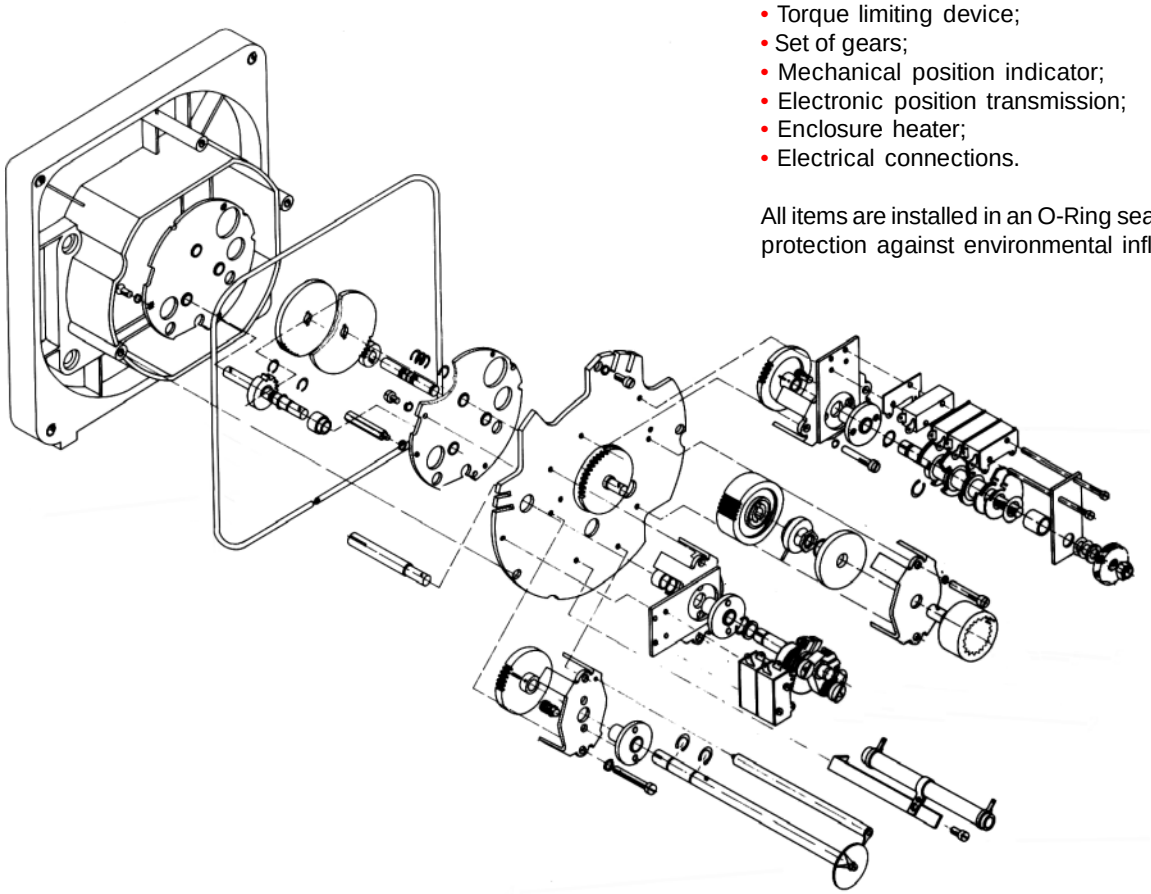
- Stalled rotor;
- Frequent switching;
- Disruption in one of the phases;
- Overload;
- High ambient temperature;
- Insufficient cooling (airflow restriction).

SWITCHING AND SIGNALING UNIT

The switching and signaling unit, in its most complete form includes the following items:

- Travel limiting device;
- Torque limiting device;
- Set of gears;
- Mechanical position indicator;
- Electronic position transmission;
- Enclosure heater;
- Electrical connections.

All items are installed in an O-Ring sealed enclosure, providing protection against environmental influences.

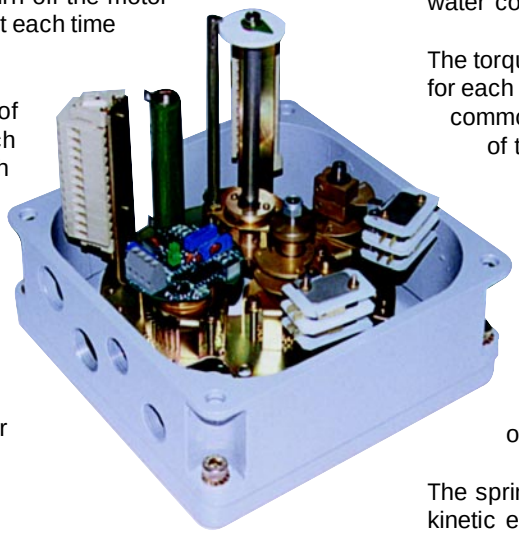


Travel Limiting Device

This device prevents sticking of the valve in its seat. The travel limiting device is driven by a set of gears and is comprised by 2 microswitches, one for each direction of rotation, these are actuated by cams which turn off the motor protecting the actuator/valve set each time the travel limit is reached.

Each cam set is comprised of three identical segments, each one covering 90°. Such segments can be moved independently of each other, and makes it possible to set the switching point within an interval of 0° to 270°.

In addition to the standard microswitches, four more may be supplied as an option, for intermediate points.



Torque Limiting Device

This device is responsible for protecting the actuator against overloads due to blocked valve travel. Examples of such blocking might include wood, drawn into the valve through a water collection system.

The torque-limiting device consists of two microswitches, one for each direction of rotation, and a set of cams mounted on a common axis. These cams are connected to the worm shaft of the gear stage.

Should an overload occur with the output shaft exceeding the set torque of the plate springs, the central worm will be axially displaced. This acts to actuate the microswitches of the switching and signaling unit, turning off the motor in the specific direction of rotation. The self-blocking type control worm will remain out of its neutral position until the motor starts running in the opposite direction of rotation.

The springs are sized to provide the capability to absorb all kinetic energy from moving parts when the motor is turned off.

Output Torque

Actuator selection shall be based on the torque required to actuate each specific valve. Such torque shall be measured on the most critical operational conditions, so that all pertinent variables are taken into consideration. These include fluid thrust on the valve, fluid friction against internal surfaces, etc. Therefore, measured variables shall be entered on the equation:

$$C = \frac{M}{i \times \eta}$$

C = output torque provided by the actuator.
M = actually measured valve torque.
i = reduction ratio for the additional stage of gears between actuator and valve.
η = efficiency of the additional stage of gears.

Should there be no additional stage of gears between actuator and valve, consider $\eta=1$ and $i=1$.

Output Speed

This choice will consider the period of time for complete valve travel, in accordance with the equation:

$$RPM = \frac{N_V \times i}{t}$$

RPM = speed of the actuator's output axle.
N_V = total number of turns required for complete valve travel.
i = reduction ratio for the additional stage of gears.
t = time selected for complete valve travel expressed in seconds.

Should there be no additional gear stage between actuator and valve, consider i=*1.*

Number of turns required for output shaft complete travel

The standard number of turns to be selected shall be one stage immediately above the number of turns required to provide complete valve travel. This is in accordance to the following equation:

$$N_A = N_V \times i$$

N_A = number of turns required for output shafts complete travel.
N_v = total number of turns of the valve stem.
i = reduction ratio for the additional gear stage.

Should there be no additional stage of gears between actuator and valve, consider $i=1$.

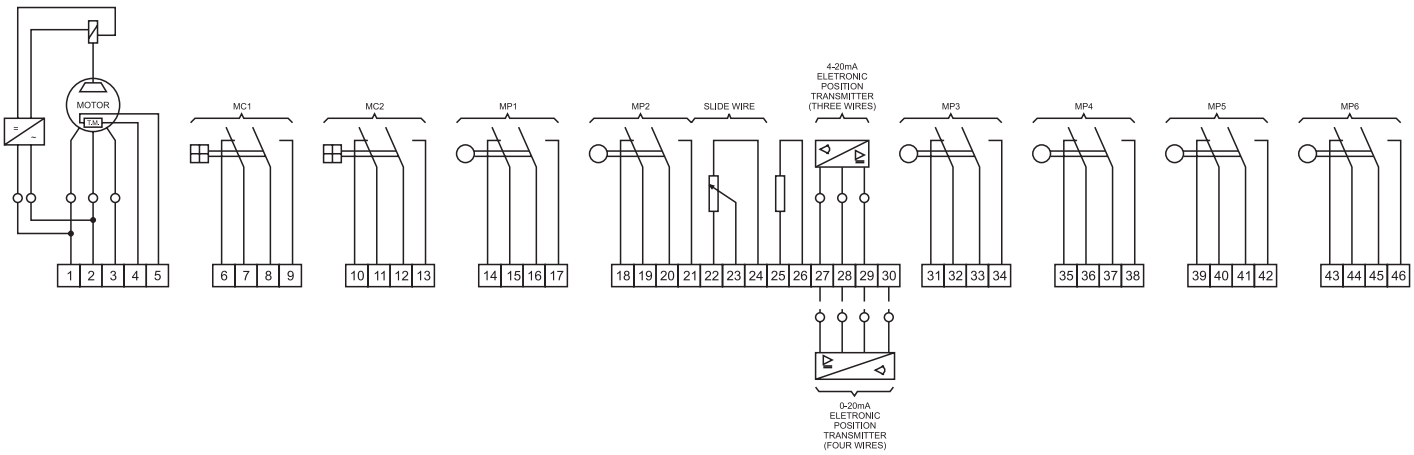
The use of higher values will unnecessarily decrease the accuracy of the position transmission devices installed on the switching and signaling unit.

The standard model supplied includes two torque limit microswitches and two travel limit microswitches. All other items have already been previously described and shall be specified in accordance with the requirements of the control loops where they will be used.

Electrical Connections

The quantity of terminals will be related to the quantity of switching, signaling and protection devices being used. Terminal blocks with up to 24 terminals will be installed in the switching and signaling enclosure. In configurations requiring more than 24 terminals, the terminal blocks will be mounted in the terminal box.

Electrical Diagram



The Electric Actuators are supplied with and protection devices interconnected as shown on the above diagram.

An external Control Unit connected to the Switching and Signaling Unit is necessary to operate the Electrical Actuator. Smar can provide the Control Unit upon request.

ORDERING CODE

MODEL AD	PART - TURN ACTUATOR

CODE	Size
1	Output Torque Up to 550 N.m
2	Output Torque Higher than 550 N.m

CODE	Maximum Output Torque
1	150 N.m Gear Stage K50
2	400 N.m Gear Stage K70
3	550 N.m Gear Stage K80
4	850 N.m Gear Stage K100
5	1850 N.m Gear Stage K140

CODE	Optional Items*
1	90°

CODE	Complete Valve Travel
1	105 seconds
2	80 seconds
3	60 seconds
4	40 seconds
5	30 seconds
6	20 seconds
7	15 seconds

CODE	Torque/Travel Limit Switches
1	Two Travel Limit Switches / Two Torque Limit Switches
2	Four Travel Limit Switches / Two Torque Limit Switches
3	Six Travel Limit Switches / Two Torque Limit Switches

CODE	Local Position Indicator
0	Without Local Indicator
1	With Local Indicator

CODE	Position Transmitter
0	Without Position Transmitter
1	Slide-wire Potentiometer 1KΩ
2	Electronic Position Transmitter 4 to 20mA - two-wire
3	Electronic Position Transmitter 0 to 20mA - four-wire

CODE	Space Heater
0	Without Space Heater
1	Space Heater 110 Vac, 50 W - 750 Ω
2	Space Heater 220 Vac, 50 W - 3 KΩ

CODE	Motor Thermal Sensor
0	Without Thermal Sensor
1	With Thermal Sensor

CODE	Electrical Connections
2	24 Terminals
3	36 Terminals
4	46 Terminals

CODE	Mounting Type
1	Separate With Lever System
2	Directly on Pipe With Lever System
3	Directly on the Valve

CODE	Optional Items*
ZZ	Special Options - Specify

AD	2	-	1	1	1	-	1	0	3	-	1	0	3	-	1	/	*

TYPICAL MODEL NUMBER

* Leave it blank for no optional items

MODEL AR	Electric Linear Actuator

CODE	Size
1	Output Torque Up to 30 N.m
2	Output Torque Higher than 30 N.m

CODE	Maximum Output Torque
1	20 N.m
2	30 N.m
3	50 N.m
4	80 N.m

CODE	Complete Valve Travel
1	105 seconds
2	80 seconds
3	60 seconds
4	40 seconds
5	30 seconds
6	20 seconds
7	15 seconds

CODE	Torque/Travel Limit Switches
1	Two Travel Limit Switches / Two Torque Limit Switches
2	Four Travel Limit Switches / Two Torque Limit Switches
3	Six Travel Limit Switches / Two Torque Limit Switches

CODE	Local Position Indicator
0	Without Local Indicator
1	With Local Indicator

CODE	Position Transmitter
0	Without Position Transmitter
1	Slide-wire Potentiometer 1KΩ
2	Electronic Position Transmitter 4 to 20mA - two-wire
3	Electronic Position Transmitter 0 to 20mA - four-wire

CODE	Space Heater
0	Without Space Heater
1	Space Heater 110 Vac, 50 W - 750 Ω
2	Space Heater 220 Vac, 50 W - 3 KΩ

CODE	Motor Thermal Sensor
0	Without Thermal Sensor
1	With Thermal Sensor

CODE	Electrical Connections
2	24 Terminals
3	36 Terminals
4	46 Terminals

CODE	Valve Coupling
1	Without (Not Supplied by SMAR)
2	Supplied by SMAR

CODE	Optional Items*
ZZ	Special Options - Specify

AR	1	-	2	2	-	1	1	1	-	1	0	3	-	1	/	*

TYPICAL MODEL NUMBER

* Leave it blank for no optional items

ORDERING CODE

MODEL AL	Electric Linear Actuator

CODE	Size
1	Output Torque Up to 30 N.m
2	Output Torque Higher than 30 N.m

CODE	Maximum Output Torque
1	20 N.m
2	30 N.m
3	50 N.m
4	80 N.m

CODE	Complete Valve Travel
1	105 seconds
2	80 seconds
3	60 seconds
4	40 seconds
5	30 seconds
6	20 seconds
7	15 seconds

CODE	Torque/Travel Limit Switches
1	Two Travel Limit Switches / Two Torque Limit Switches
2	Four Travel Limit Switches / Two Torque Limit Switches
3	Six Travel Limit Switches / Two Torque Limit Switches

CODE	Local Position Indicator
0	Without Local Indicator
1	With Local Indicator

CODE	Position Transmitter
0	Without Position Transmitter
1	Slide-wire Potentiometer 1KΩ
2	Electronic Position Transmitter 4 to 20mA - two-wire
3	Electronic Position Transmitter 0 to 20mA - four-wire

CODE	Space Heater
0	Without Space Heater
1	Space Heater 110 Vac, 50 W - 750 Ω
2	Space Heater 220 Vac, 50 W - 3 KΩ

CODE	Motor Thermal Sensor
0	Without Thermal Sensor
1	With Thermal Sensor

CODE	Electrical Connections
2	24 Terminals
3	36 Terminals
4	46 Terminals

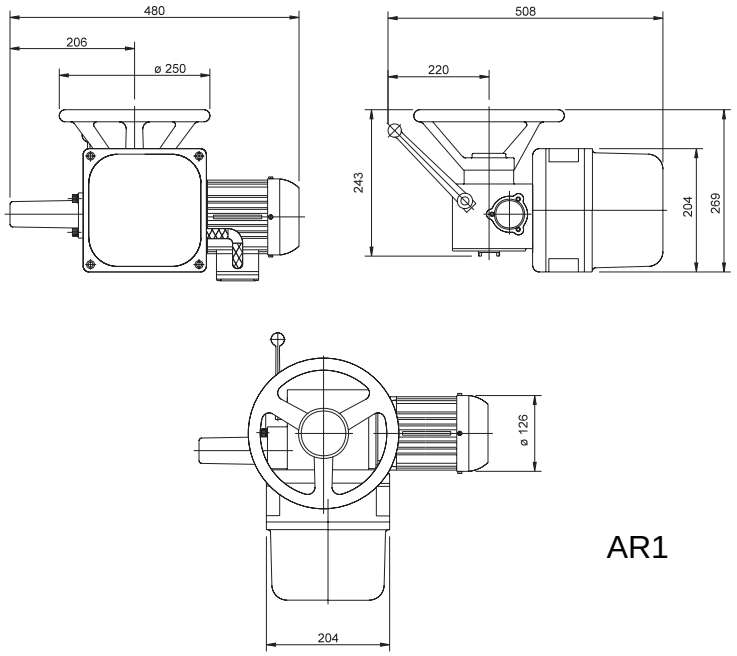
CODE	Valve Coupling
1	Without (Not Supplied by SMAR)
2	Supplied by SMAR

CODE	Optional Items*
ZZ	Special Options - Specify

AL	1	-	2	2	-	1	1	1	-	1	0	3	-	1	/	*

TYPICAL MODEL NUMBER

* Leave it blank for no optional items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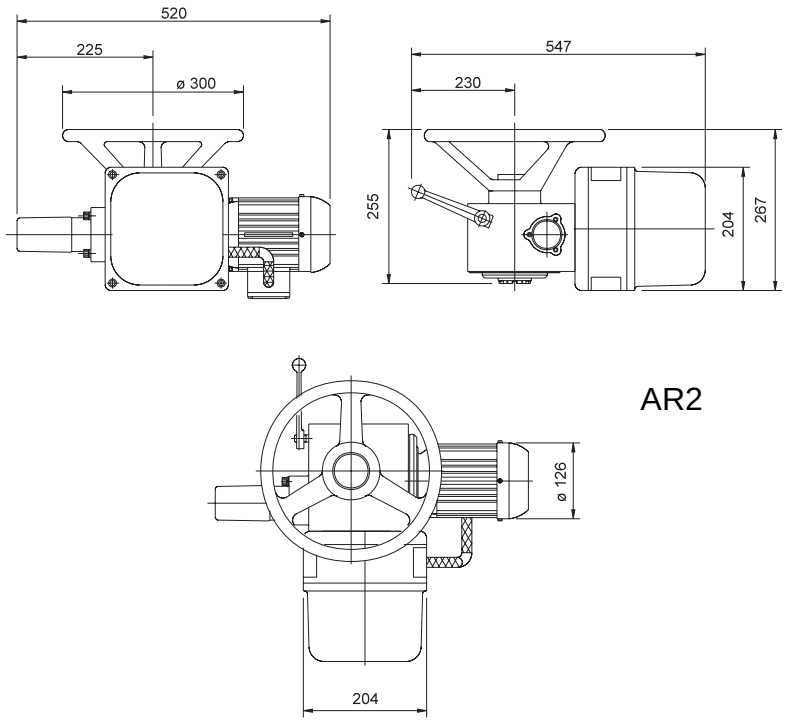
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AD- AL- ARCE