Duff-Norton, the market leader in Screw Jack technology has been supplying customers worldwide with lifting devices for over 125 years and with customized control systems to enable precision movement for over 17 years.

Why buy from Duff-Norton?

- Duff-Norton electronic control systems are based on programmable microcontrollers set on either a board or in an enclosure.
- All design, manufacture and programming is carried out by Duff-Norton engineers and technical personnel.
- At Duff-Norton we work closely with our customers to gain an understanding for the associated applications in order to develop the optimum solution.
- One stop shopping for relatively simple configurations or for the development of complex solutions to suit your specific custom requirements.
- Duff-Norton controllers can be mounted within a shock proof enclosure or integrated within the customer’s existing control panels.

**Features**

* Duff-Norton control systems provide
  - Fewer interfaces
  - Better Performance
  - One integrated system
  - Automated machine cycling
  - Scalable hardware and software
Duff-Norton designs and manufactures a wide range of electronic logic control systems that are optimized for linear motion control and general automation applications. Duff-Norton can provide you with a complete turnkey solution to meet all your custom solution requirements. Our control panels are installed by our factory trained technical personnel therefore there is no need for customers to spend time fidgeting with wires or adding components.

Duff-Norton control panels can be designed around 3 hp to 200 hp systems with ratings from 200 V to 575 V

### Features

**Standard Feature**
- UL approved, heavy-duty NEMA 12 enclosure
- Manual and touch screen interface
- UL approved control panels on request
- Spacious layout for simple installation

### Benefits

**Standard Benefits**
- Improving speed and precision
- Simplifying operation and operator interface
- Automating repetitive tasks
- Complete turnkey solutions

Electric control systems support a wide range of applications:

Duff-Norton has designed and provided numerous control panels with simple operator controls, limit indicators, position potentiometer, position feedback, along with the required “in-sight” disconnect motor and motor circuit protection to make complying with safety regulations and electrical codes easy.

**Industry specific expertise in the following areas:**
- Extend, retract, lifting and lowering equipment
- Position synchronization
- Position control

**Software:**
- PLC Panels
  (Siemens, Allen Bradley, Rockwell Automation)
- Operator Interface (Siemens)
- AC Inverters (Siemens, Allen-Bradley, Yaskawa)
Duff-Norton Offers Turnkey Solutions for Applications in the Following Markets

Rail Maintenance Equipment
Duff-Norton designs and manufactures a wide range of Rail Shop Equipment for performing maintenance and inspection work on locomotive and rail car transport vehicles. Duff-Norton Rail Shop Equipment products support a broad range of lifting heights, weights and vehicle dimensions. Our products consist of in-ground lifting systems, mobile and fixed lifting jacks, drop tables, car hoists, turntables and workshop equipment. Duff-Norton will design and install a custom system that’s tailored to fit your lifting needs.

Stage & Theatre
Duff-Norton designs and manufactures a wide range of equipment for stages and theatre applications. We use acme screws, winches, and hoists in the design and install stage and theatre lifts in addition to products that move props, lower podiums or shift floors. Duff-Norton offers a total solution that conforms perfectly with your demands and requirements. Our actuators and lifting elements are fast, efficient, reliable and safe. These systems require only a minimal amount of routine maintenance each year, which can be scheduled for times when the facility is not normally in operation.

Motion Solutions
Duff-Norton is a designer and manufacturer of complete turnkey solutions for a variety of industries such as aluminum, steel, agriculture, construction, communications, energy, food & beverage and industrial machinery. If you want to tilt an object fixed at one end, lift, lower, roll, slide, open or close and object or if you have an application that requires periodic adjustment, Duff-Norton can use linear actuators and electrical cylinders to design a custom solution that’s tailored to your specific needs.
# Rotary Limit Switches

**Features**

- Available in two control voltage ratings: 250 or 480, and in three gear ratios.
- Can be used in applications where there is a need to control equipment that rotates and/or reverses.
- Simple to adjust. Two switches, one for up/stop and one for down/stop, are activated by the adjustable limit-switch nuts which travel laterally when the internal screw is rotated through gear reduction.
- Operating temperature range -20° to + 150°F.
- Lifetime lubricated.
- Can be mounted on right or left extension of actuator worm shaft in any of four quadrants.
- Optional 4-position limit switch available. Consult factory for dimensions.

To ensure that limit switch has sufficient travel capability for the actuator unit, use the following formula:

Maximum raise of actuator model in inches = \[
\frac{\text{Maximum Input Revolutions of Limit Switch}}{\text{Turns of Actuator Worm per Inch of Raise}}
\]

**Note:** For water-tight connection, use a weather-tight connector and sealant around threads. Limit switches will be damaged if overtraveled. For shipping purposes, the 1/2” NPT hole is closed with a plastic plug which is not water tight.
## Rotary Limit Switch Performance Specifications

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>SKA6000AT10</td>
<td>125 1095 AC</td>
<td>15 1095 DC</td>
<td>1/TPI</td>
<td>24/1TPI</td>
<td>1/1TPI</td>
</tr>
<tr>
<td>SKA6000AT20</td>
<td>250 2190 AC</td>
<td>15 2190 DC</td>
<td>48/1TPI</td>
<td>2/1TPI</td>
<td></td>
</tr>
<tr>
<td>SKA6000AT40</td>
<td>4380 4380 AC</td>
<td>15 4380 DC</td>
<td>96/1TPI</td>
<td>4/1TPI</td>
<td></td>
</tr>
<tr>
<td>SKA6000BT10</td>
<td>125 750 AC</td>
<td>.50 750 DC</td>
<td>29/1TPI</td>
<td>2/1TPI</td>
<td></td>
</tr>
<tr>
<td>SKA6000BT20</td>
<td>480 1500 AC</td>
<td>.25 1500 DC</td>
<td>57/1TPI</td>
<td>2/1TPI</td>
<td></td>
</tr>
<tr>
<td>SKA6000BT40</td>
<td>250 3000 AC</td>
<td>.25 3000 DC</td>
<td>115/1TPI</td>
<td>4/1TPI</td>
<td></td>
</tr>
</tbody>
</table>

TPI = Turns per Inch of Raise of Actuator Unit

## Rotary Limit Switch Mounting and Adjustment

### Switch Position

- **All models except 75, 100, and 150 Ton**
- **Switch Position**
  - 1
  - 2
  - 3
  - 4

- **1/2" N.P.T.**

- **3/32" Male"**

- **6.5/8"**

### 75, 100, and 150 Ton only

- **Switch Position**
  - 1
  - 2
  - 3
  - 4

- **6 1/4"**

- **6.5/8"**

- **3/32" Male"**
 Rotary Limit Switches

Limit Switch Field Installation Dimensions

**Note:** Limit switch cannot be fitted directly to 1/4, 1/2 and 1 Ton series. Anti-backlash mounting is the same as machine screw actuators. Dimensions are subject to change without notice.

**Worm Shaft Dimensions**

<table>
<thead>
<tr>
<th>Capacity</th>
<th>Mounting Dimensions</th>
<th>Worm Shaft Dia.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 &amp; 3 Ton MS</td>
<td>6 3/4</td>
<td>.500</td>
</tr>
<tr>
<td>3 Ton BS</td>
<td>6 3/4</td>
<td>.500</td>
</tr>
<tr>
<td>5 Ton MS &amp; BS</td>
<td>7 3/4</td>
<td>.750</td>
</tr>
<tr>
<td>10-15 Ton MS &amp; BS</td>
<td>8 3/4</td>
<td>1.000</td>
</tr>
<tr>
<td>20 Ton MS &amp; BS</td>
<td>8 3/4</td>
<td>1.000</td>
</tr>
<tr>
<td>25 Ton MS &amp; BS</td>
<td>10 1/4</td>
<td>1.375</td>
</tr>
<tr>
<td>50 Ton MS &amp; BS</td>
<td>14 1/4</td>
<td>1.500</td>
</tr>
<tr>
<td>75 Ton MS</td>
<td>15 1/4</td>
<td>1.750</td>
</tr>
<tr>
<td>100 Ton MS</td>
<td>14 3/4</td>
<td>1.750</td>
</tr>
<tr>
<td>150 Ton MS</td>
<td>14 3/4</td>
<td>1.875</td>
</tr>
</tbody>
</table>

**Rotary Limit Switch Electrical Wiring Diagram and Setting Instructions**

1. **CAUTION:** Disconnect power before making any adjustment.
2. Check drift before adjusting limits.
3. Remove screw “A” and nut guide keeper “B” to adjust limits.
4. Run actuator unit to desired limit.
5. Rotate appropriate nut until switch clicks, then turn 1/2 turn more.
6. Replace “A” and “B.
7. Run actuator unit to other limit.
8. Repeat steps 2, 4 and 5 to adjust this nut.

Slight adjustments may be necessary. See Performance Specification Chart on the previous page for notch adjustment value.

N.O. = Normally Open
N.C. = Normally Closed

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ACTUATOR CONTROLS

The Duff-Norton SKA6205 Series Position Feedback Potentiometer/Transducer is designed to mount on the end of any SKA6000T limit switch. Its active component is a precision potentiometer which may be used as voltage divider to provide a feedback voltage that is proportional to actuator position.

Features

- Multiple gear ratios allow for a wide range of raises.
- Standard resistance is 5000 ohms. Other resistances are available on special order.
- Power rating: 2 watts at 40°C
- Max. service temp.: 85°C
- Interface directly with the Model SK6300-4K Digital Position Indicator to provide a scalable readout of position. The SKA6205 series models can also be used with most motor controls that have provision for potentiometer feedback signal.
- Transducer supplied with black anodized finish as standard.

Potentiometer Performance Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>Max. Turns Potentiometer</th>
<th>Worm Shaft</th>
</tr>
</thead>
<tbody>
<tr>
<td>SKA6205-30</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>SKA6205-50</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>SKA6205-60</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>SKA6205-100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>SKA6205-200</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>SKA6205-400</td>
<td>400</td>
<td>400</td>
</tr>
</tbody>
</table>

Note: When used with Duff-Norton actuators and limit switched the potentiometer selection should be:

Desired pot turns = total stroke x
Worm turns per inch / L.S. gear ratio

Note: Transducer shipped unattached, to be installed at site.
Includes required mounting hardware; soldering to potentiometer required.
Digital Position Indicator for Duff-Norton Potentiometers

The Duff-Norton model SK6300-4K Digital Position Indicator processes a feedback signal from a the SKA6205 series potentiometers to provide position readout with user selectable scaling factor. By running the actuator to two positions in its stroke and keying in the desired readout at each point, the indicator automatically scales the input signal to provide linear readout over the full travel of the actuator.

The SK6300-4K has a universal, 85-250 VAC power input and generates a regulated 24 VDC excitation signal to the potentiometer. The SK6300-4K operates seamlessly with any potentiometer equipped Duff-Norton actuator.

**Features**

- Self scaling by inputting minimum and maximum readings – either by key stroke or input signal
- Two adjustable up / down limits with 0 to +/- 99999
- Accepts 1K to 10K potentiometer inputs
- Programmable decimal point location
- Input power requirement from 85 – 250 VAC
- Programmable front panel functions
- For use with Duff-Norton 2 through 150 ton machine or ball screw actuators

**DIMENSIONS In inches (mm)**

Note: Recommended minimum clearance (behind the panel) for mounting clip installation is 2.1” (53.4) H x 5.0” (127) W.
The Duff-Norton Digital Encoder and Digital Display is a more advanced way to determine an actuator’s position.

A digital encoder can be used to provide an extremely precise position signal to devices such as the Duff-Norton SK10006-35 digital display or 3rd party PLC’s.

Duff-Norton uses two styles of incremental encoders, with the type used depending on the layout of the actuator. When one end of the actuator worm shaft is accessible, a Hollow Bore style of encoder is used, mounted on the worm. When the worm is not accessible, and the actuator is using a flange-mounted motor, a Ring Kit style encoder can be fitted on the drive motor.

**Digital Incremental Encoders**

The EN260C60 is a compact yet rugged encoder designed for harsh factory environments and can easily accommodate clockwise or counter clockwise rotational requirements. Standard encoders are low-level, open collector output. Push-pull and line driven outputs are also available. Installation or removal is quick and simple. A M12, 5-pin body mount connector is provide as standard, and a shielded 4-meter cable with connector is available. Contact Duff-Norton Application Engineering for more specifics.

### Features

- Up to 600 pulses per revolution (60 ppr standard)
- Pulse frequency - 200kHz, with a 90° phase shift
- Input voltage - +5 VDC to +28VDC
- Operating temperature (-0° to +70°C)
- Shock resistance to 200g, vibration resistance to 10g
- IP 64 rated seal
- Black non-corrosive housing

<table>
<thead>
<tr>
<th>Function</th>
<th>Cable Wire Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Com</td>
<td>Black</td>
</tr>
<tr>
<td>+VDC</td>
<td>White</td>
</tr>
<tr>
<td>A</td>
<td>Brown</td>
</tr>
<tr>
<td>B</td>
<td>Red</td>
</tr>
</tbody>
</table>
Ring Kit Encoder

The Ring Kit Encoder counts motor revolutions and is mounted between the C-face motor and motor mounting flange. This mounting allows the actuator worm opposite the motor to be available for mounting a limit switch or driving another actuator. With 60 pulses per motor revolution, the ring kit offers a high pulse count relative to actuator travel. A small junction box with NPT opening is attached to the ring, allowing easy, protected electrical connections. Available for all sizes of NEMA C flanges used on Duff-Norton actuators. Additional output types available. Contact Duff-Norton Application Engineering for specifics.

Specifications

Sensor Type ......................... Bidirectional shaft speed sensor
Pulse Per Revolution ............. 60 cycles each channel
Supply Voltage ..................... +12 Volts DC +/-5%
Supply Current .................... 60 mA typical (115 mA maximum)
Output Drive Capability ......... 250 mA per channel continuous
Maximum Load ...................... 50 ohms per channel
Programmable Digital Position Indicator for Duff-Norton Encoders

Displays position of actuator lifting screws in increments of up to .001”, depending on PPR (Accuracy is relative to ratio and backlash. Please consult factory for details).

The Duff-Norton SK10006-35 Digital Position Indicator provides a high degree of accuracy and versatility when incorporated in machine or ball screw actuator systems. Operating as a revolution counter, it is ideal for use in a wide range of precision positioning applications to indicate inches or millimeters of lifting screw travel. Two built-in relays act as limit switches for travel limit control. Start-up/shut-off, audio/visual warning, multiple actuator system sequencing or the initiation of subsequent operations may also be controlled.

Electrical connections are made at the rear of the unit to UL recognized terminal strips. Clamp-type pressure plate terminals accept AWG-14 wire without lugs.

**Features**

- Five digit input scaling with 0.0000 to +/- 5.0000, programmable decimal point location and lead zero blanking.
- Two adjustable up/down output limits with 0 to +/- 999999.
- Non-volatile E2-PROM Memory retains all programmed information and count value in event of power interruption.
- Input power requirement is 115/230 VAC, 50/60 Hz.
- Can be provided with optional 4 - 20 mA current loop to provide capability of 2-way digital communication.
- On-line self-test permits complete check of all functions and reset capability allows reset to zero from front panel.
- Compact, die cast NEMA 4 rated front panel has six digit LED display with 0.56” high characters and negative sign (-).
- Display convertible to English, metric or other units of measurement.
- Field Programmable front panel functions may be locked out to prevent unauthorized adjustment.
- For use in precision positioning applications with Duff-Norton 2 ton and larger machine or ball screw actuators.
Magnetostrictive Position Sensor

Duff-Norton offers Magnetostrictive Position Sensors for machine and ball screw actuators. These sensors offer analog or digital outputs, and can be used for accurate position indication or with a PLC in a closed loop control system. Magnetostrictive position sensors are non-contacting, resulting in longer life than other linear transducers or potentiometers.

Due to the fact that the magnet senses actual screw displacement, position indication is absolute and unaffected by gearset backlash.

Specifications

Supply Voltage .......................... +15 to 26 VDC
Non-Linearity ................................... ± 0.05% of Full Scale or 0.002 in. (±0.05 mm) whichever is greater
Repeatability .................................. ± 0.001% of Full Scale, or ± 0.0001 in. (±0.002 mm) whichever is greater
Hysteresis ....................................... 0.0008 in. (0.076 mm) max.
Measuring Range .................. U.S. Customary: 1 to 60 in. (0.1 in. increments) Metric: 50 to 1500 mm (5 mm increments)
The Duff-Norton Rotary Counter is for actuator customers who are looking for a more economical and easy way to determine an actuator's position. Our counters have been designed to match our most common actuator ratios. An operator viewing the reading in the display window will know his actuator's exact position because the counter's display shows stroke to the nearest 1000ths of an inch up to 99 inches of travel. Custom numeric displays are also available.

### Features

Some of the more important features are:

- Display readings have been pre-matched to the actuator’s ratios.
- Display reading has been extended to the nearest 1000ths of an inch.
- Clockwise and counter clockwise models available.
- Easy mounting kits available for installation to existing field actuators.

#### Rotary Counter Installation

The Duff-Norton Rotary Counter fits over the actuator’s worm shaft. A special worm bushing fills dimensional difference between the counter’s bore and the worms’ diameter (see table). An anti-rotation pin from the counter’s rear into the actuators’ worm flange holds the counter steady.

#### Rotary Counters - Mounting Information

The Duff-Norton Rotary Counter fits over the actuator’s worm shaft. A special worm bushing fills dimensional difference between the counter’s bore and the worms’ diameter (see table). An anti-rotation pin from the counter’s rear into the actuators’ worm flange holds the counter steady.

<table>
<thead>
<tr>
<th>Model#</th>
<th>Clockwise rotation</th>
<th>Turns of Worm For 1&quot; Raise</th>
<th>MS Actuator Capacity and Ratio</th>
<th>Approx. Width</th>
</tr>
</thead>
<tbody>
<tr>
<td>RC16R</td>
<td></td>
<td>16</td>
<td>5-100 Tons</td>
<td>2&quot;</td>
</tr>
<tr>
<td>RC24R</td>
<td></td>
<td>24</td>
<td>2-3 Tons</td>
<td>2&quot;</td>
</tr>
<tr>
<td>RC32R</td>
<td></td>
<td>32</td>
<td>5 Tons</td>
<td>2&quot;</td>
</tr>
<tr>
<td>RC48R</td>
<td></td>
<td>48</td>
<td>10-100 Tons</td>
<td>2&quot;</td>
</tr>
<tr>
<td>RC64R</td>
<td></td>
<td>64</td>
<td>5 Tons</td>
<td>2&quot;</td>
</tr>
<tr>
<td>RC96R</td>
<td></td>
<td>96</td>
<td>2-3 Tons</td>
<td>2&quot;</td>
</tr>
<tr>
<td>RC100R</td>
<td></td>
<td>100</td>
<td>2-25 Tons</td>
<td>2&quot;</td>
</tr>
</tbody>
</table>

**Counter clockwise rotation**

<table>
<thead>
<tr>
<th>Model#</th>
<th>Clockwise rotation</th>
<th>Turns of Worm For 1&quot; Raise</th>
<th>MS Actuator Capacity and Ratio</th>
<th>Approx. Width</th>
</tr>
</thead>
<tbody>
<tr>
<td>RC16L</td>
<td></td>
<td>16</td>
<td>5-100 Tons</td>
<td>2&quot;</td>
</tr>
<tr>
<td>RC24L</td>
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<td>24</td>
<td>2-3 Tons</td>
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<tr>
<td>RC32L</td>
<td></td>
<td>32</td>
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<tr>
<td>RC48L</td>
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<td>RC64L</td>
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<tr>
<td>RC100L</td>
<td></td>
<td>100</td>
<td>2-25 Tons</td>
<td>2&quot;</td>
</tr>
</tbody>
</table>

Note: All dimensions in millimeters.

Note: Capacities greater than 20 Tons have their worm diameters turned down to size.