

# Instruction Publication P15836

## INTRODUCTION

All E50 Limit Switches consist of three modular, interchangeable, plug-in components: operating head, switch body, and wiring receptacle. Operating heads (side rotary, top and side push, and wobble stick) are mounted on top of the switch body in any of four positions. Both SPDT and DPDT switch bodies employ snap-acting, leaf contact springs providing high reliability and extended life. All assembled limit switches are UL Listed, CSA Certified, and rated with Enclosure Types 3, 3S, 4, 4X, 6, 6P and 13. Obtain renewal parts by ordering the catalog number labeled on each of the three limit switch components.

NEMA ICS 2-225 describes preferred installation recommendations which assures greatest reliability and longest life expectancy for Industrial Limit Switches.

**TABLE 1 - DESIGN CHARACTERISTICS**

|                 |  |
|-----------------|--|
| Contacts        | SPDT, DPDT Form Z (Four Terminal, Double-Break -Double Make)   |
| Contact Ratings | Except gravity return: Without pilot light: NEMA A600, R300; With pilot light: NEMA A150, R150; Gravity return-only: Without pilot light: NEMA B600, With pilot light: NEMA B150 |
| Repeat Accuracy | 0.3% maximum deviation   |
| Construction    | Die-cast zinc alloy  |
| Enclosure Type  | IP67 / NEMA / UL Enclosure Types 3, 3S, 4, 4X, 6, 6P, & 13   |
| Operating Temp. | See Operating Head Temperature Chart pg. 2   |

## CONNECTION DIAGRAM – SPDT, DPDT

The following connection diagram appears on switch body nameplate.



For pre-wired cable or pin connector versions, refer to wiring label on side or receptacle.

## ELECTRICAL DATA - CONTACT RATINGS PER POLE

**TABLE 2 - SPDT, DPDT - EXCEPT GRAVITY RETURN SWITCH**

| Volts | AC (NEMA A600)  |       |             | DC (NEMA R300)  |       |             |
|-------|-----------------|-------|-------------|-----------------|-------|-------------|
|       | Current Amperes |       | Voltamperes | Current Amperes |       | Voltamperes |
|       | Make            | Break | Cont.       | Make            | Break |             |
| 120   | 60              | 6     |             |                 |       | 120 0.25    |
| 240   | 30              | 3     |             |                 |       | 240 0.125   |
| 480   | 15              | 1.5   | 10          | 7200            | 720   |             |
| 600   | 12              | 1.2   |             |                 |       |             |

**TABLE 3 - GRAVITY RETURN SWITCH ONLY - NEMA B600 RATING**

| AC Volts | Current Amperes |       |       | Voltamperes |       |
|----------|-----------------|-------|-------|-------------|-------|
|          | Make            | Break | Cont. | Make        | Break |
| 120      | 30              | 3     |       |             |       |
| 240      | 15              | 1.5   |       |             |       |
| 480      | 7.5             | 0.75  | 5     | 3600        | 360   |
| 600      | 6               | 0.60  |       |             |       |

Contacts on same polarity <sup>1&2</sup>

<sup>1</sup> Gravity Return switches are rated AC only - DC ratings do not apply.

<sup>2</sup> Switch bodies with indicating light are for application on 120V or less.

## TORQUE REQUIREMENTS FOR LIMIT SWITCH ASSEMBLY

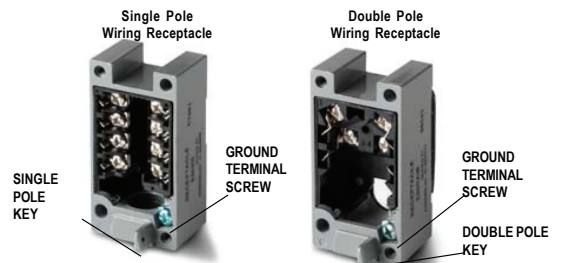
Tighten the operating head and switch body screws to a torque value within the following ranges to assure and maintain the Enclosure Type Ratings for the assembled limit switch.

Switch Body Screws – Tighten to insure contact of switch body to wiring receptacle: 25 – 30 in.-lb.

Operating Head Screws – Tighten to insure contact of head to switch body: 14 – 18 in.-lb.

The wiring receptacle provides the mounting means for an assembled limit switch. Two holes provide for front mounting with #10 screws. Two threaded holes provide for rear mounting using #10 – 32 screws. **Sealing of the ½ inch NPT or 20mm conduit entrance threads should be done by using the E50KH6 conduit sealing nut, sealing compound, or Teflon tape. This will assure and maintain the limit switch Enclosure Type Ratings.**

Switch bodies and receptacles are keyed to prevent a single pole switch from being plugged into a double pole receptacle or vice versa. Receptacle wiring terminals are numbered and correspond with diagram on switch body nameplate. Pressure plate terminals accept AWG #18 through #12 wire. A grounding screw (colored green) provides enclosure grounding. Limit switches should be rigidly mounted with suitable clearances to permit component replacement.



INSTRUCTION E50 SINGLE POLE  
DOUBLE THROW, DOUBLE POLE  
DOUBLE THROW LIMIT SWITCHES

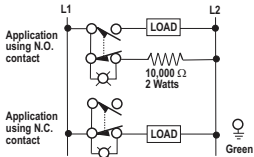
SWITCH BODIES WITH INDICATING LIGHT

Switch bodies with the indicating light should be used at 120V or less. The light is factory-connected. The lamp may be reconnected by lifting the gasket and reconnecting the light across terminals. Replace the gasket. See typical connection diagrams below.

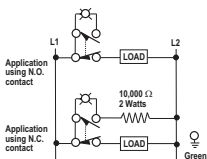
**Notes:** Solid state devices with leakage or residual current may cause false operation of indicating light.

TYPICAL CONNECTION DIAGRAMS - WITH INDICATING LIGHT

Light is on when switch is in tripped position.

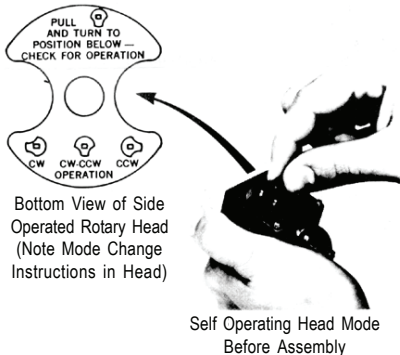


Light is on when switch is in spring return or reset position.

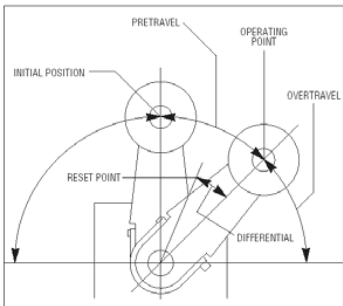


OPERATING HEAD POSITIONING

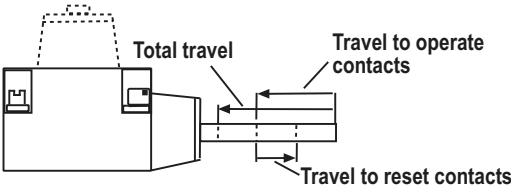
Heads can be mounted on the switch body in any of 4 directions, 90° apart. Torque screws according to requirements on pg 1.



**Side Rotary** - The operating mode (CW, CCW or CW and CCW) of these spring return operating heads is easily changed without tools as shown in the illustration above. Remove the head from the switch body. Pull out the plunger and turn until its position matches that shown on the diagram for the desired operation mode. Levers are adjustable to any angle (360 degrees). The operating shaft screwdriver slot can be used to maintain shaft position during lever installation.



**Push Operated** - These spring return top push or side push operating heads are available in pushbutton and roller styles. The push roller style can be converted from vertical to horizontal operation or vice versa. Pull roller out of the head until it can be rotated 90° to the desired orientation. When released, it will snap into the set position. The Maintained Contact head has the reset pushbutton located opposite of the actuator pushbutton.



**Wobble Stick** - These spring return, top operated heads use different rod-type operators to detect motion in any direction perpendicular to the operator. The operator screws onto the threaded head stub.

TABLE 4 - OPERATING TEMPERATURE <sup>3</sup>

| Table | Operation            | Temp. Range                     |
|-------|----------------------|---------------------------------|
| A     | Side Rotary          | Spring Rtn. CW only or CCW only |
|       |                      | Spring Return CW & CCW          |
| B     | Side Rotary          | Maintained                      |
| C     | Top Push             | Spring Return                   |
| D     | Side Rotary Low Temp | Spring Return CW & CCW          |

<sup>3</sup>Temperature ranges below +32 °F are based on absence of freezing moisture or water.

REPEAT ACCURACY

The type of operating head used on an assembled limit switch determines repeat accuracy for the switch assembly. Assembled limit switches, without rollers used on operating heads or levers, have a repeat accuracy as listed in Table 5 below.

TABLE 5 - OPERATING HEAD REPEAT ACCURACY SPECIFICATIONS

| Operating Head        | Repeat Accuracy <sup>4</sup> |
|-----------------------|------------------------------|
| <b>Side Operated:</b> |                              |
| Standard Construction | within 0.0012"               |
| Low Operating Force   | within 0.0024"               |
| Two-Step              | within 0.006"                |
| Neutral Position      | within 0.006"                |
| Side Push             | within 0.003"                |
| <b>Top Operated:</b>  |                              |
| Top Push              | within 0.002"                |

<sup>4</sup>Measured along arc for 1-1/2" lever or measured along push operator axis.

Assembled limit switches **with rollers** used on operating heads or levers have a repeat accuracy determined as follows: add the repeat accuracy tolerance of Table 6 for the type of operating head used to the concentricity tolerance of Table 6 for the type of roller used on the lever or operator. The combination of these two tolerances is the limit switch repeat accuracy.

# INSTRUCTION E50 SINGLE POLE DOUBLE THROW, DOUBLE POLE DOUBLE THROW LIMIT SWITCHES

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**TABLE 6 - OPERATING HEAD TOLERANCE SPECIFICATIONS**

|              | Type      | Diameter | Width | Concentricity Tolerance |
|--------------|-----------|----------|-------|-------------------------|
| Lever Roller | Nylon     | 3/4"     | 5/16" | +/- 0.002"              |
|              | Metal     | 3/4"     | 5/16" | +/- 0.001"              |
|              | Nylon     | 3/4"     | 1"    | +/- 0.005"              |
|              | Ball Brg. | 11/16"   | 1/4"  | +/- 0.002"              |
| Push Roller  | Nylon     | 1-1/2"   | 9/32" | +/- 0.005"              |
|              | Metal     | 7/16"    | 5/32" | +/- 0.002"              |
|              | Metal     | 3/4"     | 5/32" | +/- 0.005"              |

Mechanical life can be extended if the following guidelines are followed:

a.) Cam arrangement should be such that: the actuator does not receive a severe impact; the actuator does not suddenly slip back freely.

b.) Minimum amount of overtravel should be used. See NEMA ICS 2-225 for additional guidelines.

## SPECIAL PURPOSE LIMIT SWITCHES

**Gravity Return Limit Switch** - These limit switches require a very low operating force. Table 8. The weight of the rod-type lever supplies the return force instead of a return spring. Limit switch operation is either CW or CCW, and may be mounted in any position where the shaft is horizontal (parallel to ground).

**Adjustment** – After mounting in the selected position, adjust for proper operation. Set the rod extension and lock it in place with set-screw. Loosen other setscrew and rotate the INPUT SHAFT in the direction it will turn when operated (clockwise or counterclockwise) until a resistance is felt and a click is heard (contacts trip). Back the shaft away from this point until the contacts reset as indicated by another click – This is about 10°, the minimum pretravel for the Gravity Return limit switch. The shaft may be set for any desired pretravel between 10° and 170° - at more than 170° the contacts may trip. In noisy locations, where the click of contact operation might not be heard, connect a test lamp in series with the normally open contacts for visual indication of contact operation. With the shaft set for the desired amount of pretravel, 10° to 170°, lock the operator in place with setscrew. Check for repeatable switch operation.

**Neutral Position Limit Switch** - This spring return limit switch has two independently operated poles. One pole operates when the shaft rotates clockwise, and the other operates when the shaft is rotated counterclockwise. Both poles are reset in the neutral position (center off). See Table 8 below.

**Two Step Limit Switch** - The mode of operation of this side rotary operated two pole limit switch can be changed for CW, CCW or CW and CCW mode as described for the standard side rotary head on page 2. Two independently-operated poles function as a degree of head shaft rotation. One pole operates after 10° of shaft rotation and the second after an additional 10° of shaft rotation in the same direction (20° total for step two). Both poles reset when the shaft returns to the spring return or neutral position.

**TABLE 7 - OPERATING HEAD DATA**








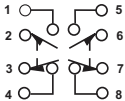

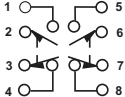
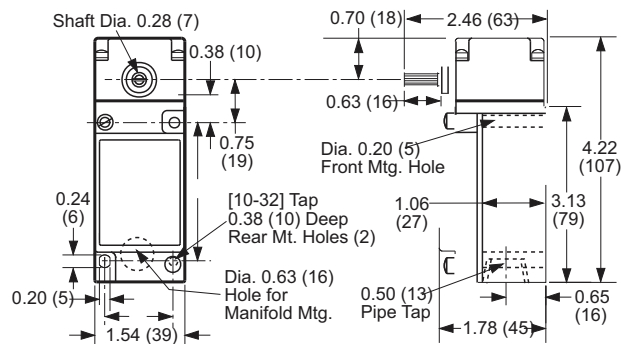
| Description<br>Operating Heads  |                             | Operating Data - Nominal   |                          |              |                  |                          | Minimum Temp. Range (Table 4) | Catalog Number |
|---|-----------------------------|----------------------------|--------------------------|--------------|------------------|--------------------------|-------------------------------|----------------|
|   |                             | Travel to Operate Contacts | Travel to Reset Contacts | Total Travel | Operate Contacts | Force to Return Contacts |                               |                |
|  | Standard Spring Return      | 5°                         | 2°                       | 90°          | 3 in. - lbs.     | 4.5 in.-oz.              | A                             | E50DR1         |
|   | Low Temp. Spring Return     |                            |                          |              |                  |                          | D                             | E50DR19        |
|   | Low Force Spring Return     | 15°                        | 6°                       | 90°          | 1.5 in.-lbs.     | 2.5 in.-oz.              | A                             | E50DL1         |
|   | Maintained Two Position     | 50°                        | 50°                      | 90°          | 3 in.-lbs.       | -                        | B                             | E50DM1         |
|  | Pushbutton Spring Return    | 0.065 in.                  | 0.030 in.                | 0.290 in.    | 4 lbs.           | 8 oz.                    | B                             | E50DS1         |
|   | Pushbutton Adj. Spring Rtn. | 0.065 in.                  | 0.030 in.                | 0.290 in.    | 4 lbs.           | 8 oz.                    | B                             | E50DS2         |
|   | Push Roller Spring Return   | 0.065 in.                  | 0.030 in.                | 0.290 in.    | 4 lbs.           | 8 oz.                    | B                             | E50DS3         |
|   | Push Roller Spring Return   | 0.075 in.                  | 0.030 in.                | 0.290 in.    | 4 lbs.           | 8 oz.                    | B                             | E50DS4         |
|   | Pushbutton Maintained       | 0.200 in.                  | 0.130 in.                | 0.320 in.    | 5 lbs.           | 5 lbs.                   | B                             | E50DH1         |
|  | Pushbutton Spring Return    | 0.040 in.                  | 0.020 in.                | 0.280 in.    | 4lbs.            | 8 oz.                    | C                             | E50DT1         |
|   | Pushbutton Adj. Spring Rtn. | 0.040 in.                  | 0.020 in.                | 0.280 in.    | 4lbs.            | 8 oz.                    | C                             | E50DT2         |
|   | Push Roller Spring Return   | 0.040 in.                  | 0.020 in.                | 0.280 in.    | 4lbs.            | 8 oz.                    | C                             | E50DT3         |
|  | Spring Rtn. (Standard Duty) | 10°                        | 6°                       | 15°          | 2 in.-lbs.       | 2-4 in.-oz.              | C                             | E50DW1         |
|   | Spring Rtn. (Heavy Duty)    | 10°                        | 6°                       | 15°          | 2 in.-lbs.       | 2-4 in.-oz.              | C                             | E50DW2         |

TABLE 8 - OPERATING DATA - SPECIAL PURPOSE LIMIT SWITCHES

|   |   | Operating Data - Nominal  |                          |              |                          |                      |                | Temp. Range                  |  |        |
|---|---|---|--------------------------|--------------|--------------------------|----------------------|----------------|------------------------------|--|--------|
| Switch Body Connection Diagram  |   | Travel to Operate Contacts  | Travel to Reset Contacts | Total Travel | Force to Return Contacts | Minimum Return Force | Catalog Number |                              |  |        |
| <br>Gravity Return   | Single Pole 1 N.O. - 1 N.C.   | ASSEMBLED SWITCH  |                          |              |                          |                      |                | 0°F (-17°C) to 200°F (94°C)  |  |        |
|   |              | 10°-170°  | 8°                       | 360°         | 3 in.-oz.                | Gravity              | E50GG1         |                              |  |        |
|   | SEPERATE COMPONENTS FOR ABOVE SWITCH  |   |                          |              |                          |                      |                |                              |  |        |
|   | Switch Body Only  |   |                          |              |                          |                      | E50SG          |                              |  |        |
|   | Receptacle Only   |   |                          |              |                          |                      | E50RA          |                              |  |        |
|   | Switch Body (Optional with Indicating LED, 120 VAC)   |   |                          |              |                          |                      | E50SGN         |                              |  |        |
|   | Must be Same Polarity   | Operating Head Only   |                          |              |                          |                      |                | E50DG1                       |  |        |
| <br>Neutral Position | CW CCW  | ASSEMBLED SWITCH  |                          |              |                          |                      |                | 14°F (-10°C) to 200°F (94°C) |  |        |
|   |              | 5°  | 2°                       | 90°          | 1.8 in.-lbs.             | 2.5 in.-oz.          | E50NN1         |                              |  |        |
|   |   | 15°   | 2°                       | 90°          | 1.8 in.-lbs.             | 2.5 in.-oz.          | E50NN2         |                              |  |        |
|   | SEPERATE COMPONENTS FOR ABOVE SWITCH  |   |                          |              |                          |                      |                |                              |  |        |
|   | Switch Body Only  |   |                          |              |                          |                      | E50SN          |                              |  |        |
|   | Receptacle Only   |   |                          |              |                          |                      | E50RB          |                              |  |        |
|   | Operating Head Only (5° Travel to Operate)  |   |                          |              |                          |                      | E50DN1         |                              |  |        |
|   | Operating Head Only (15° Travel to Operate)   |   |                          |              |                          |                      | E50DN2         |                              |  |        |
|   | <br>Two Step |  | ASSEMBLED SWITCH         |              |                          |                      |                |                              | CW or CCW 14°F (-10°C) to 250°F (121°C) <sup>5</sup> |        |
|   |   |   | 1st Step 10°             | 4°           | 90°                      | 3 in.-lbs.           | 4.5 in.-oz     |                              |  | E50TD1 |
| 2nd Step 20°  |   |   |                          |              |                          |                      |                |                              |  |        |
| SEPERATE COMPONENTS FOR ABOVE SWITCH  |   |   |                          |              |                          |                      |                |                              |  |        |
| Switch Body Only  |   |   |                          |              |                          | E50ST                |                |                              |  |        |
| Receptacle Only   |   |   |                          |              |                          | E50RB                |                |                              |  |        |
| Operating Head Only   |   |   |                          |              |                          | E50DD1               |                |                              |  |        |

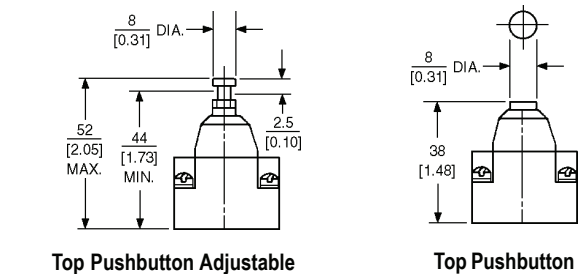
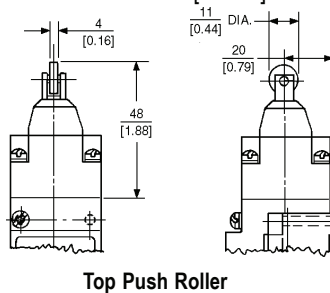
<sup>5</sup> For CW or CCW only operation. For CW and CCW operation, operating temperature is -20°F (-29°C) to 200°F (94°C)

## DIMENSION DIAGRAM - Inches [mm]<sup>6</sup>

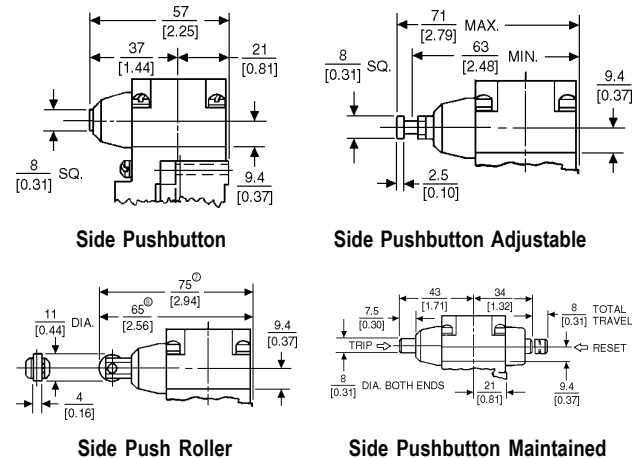


<sup>6</sup>Can accomodate both U.S., 29.4 [1.16] x 59.5 [2.34] and DIN, 30 [1.18] x 60 [2.36] mounting options.

## TOP PUSH OPERATORS - mm [inches]



## SIDE PUSH OPERATORS - mm [inches]



⑦ FOR E50DS4

⑧ FOR E50DS3