These Actuators are designed to control a 2- or 3-way valve in response to the output from a HVAC controller or BAC system.

All NEC-440 actuators can be controlled in modulating or 3-point floating modes.

**Features:**
- Manual operation mechanical and/or electrical
- Position indication, LED signalization
- Selectable speed 2 or 6 s/mm
- Automatic adaptation of stroke to valve's end positions (self-adjustment).
- Integrated auxiliary switch
- Characteristics optimization
- Adjustable stroke limitation
- Anti-oscillation function
- Pulse or continuous output signal
- Voltage or current feedback signal
- External reset button
- Auto detection of control signal
- 3-point or modulating control selection
- Galvanic insulation Y, X and output terminals 4&5
- Thermal and overload protection
- Precise control and fast response in 3-point mode (0.01 s)

**Technical data:**
- Power supply: (AC or DC): 24 V, 50 Hz/60 Hz
- Control input: modulating or 3-point 0/2 - 10 Vdc 4 -20 mA
- Force: 440 lbs (2000 N)
- Stroke: 2” (50 mm)
- Speed (selectable): 2 or 6 s/mm
- Max. pipe temperature: 392 °F (200 °C)
## Actuators

<table>
<thead>
<tr>
<th>Type</th>
<th>Power supply (V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEC-440</td>
<td>24</td>
</tr>
<tr>
<td>NEC-440FC</td>
<td>24</td>
</tr>
<tr>
<td>NEC-440FO</td>
<td>24</td>
</tr>
</tbody>
</table>

### Specifications

<table>
<thead>
<tr>
<th>Property</th>
<th>NEC-440</th>
<th>NEC-440FC</th>
<th>NEC-440FO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply</td>
<td>24 +10 / −15 %; AC or DC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power consumption</td>
<td>VA 25 (24 V) Transform. 40VA</td>
<td>40 (24 V) Transform. 75VA</td>
<td>40 (24 V) Transform. 75VA</td>
</tr>
<tr>
<td>Frequency</td>
<td>Hz 50/60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control input</td>
<td>V Modulating 0-10 (2-10) [Ri = 40 kΩ]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control output (Position Feedback)</td>
<td>mA Modulating 0-20 (4-20) [Ri = 500 Ω]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control output (Position Feedback)</td>
<td>V 0-10 (2-10) [Ri = 10 kΩ]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control output (Position Feedback)</td>
<td>mA 0-20 (4-20) [Ri = 510 Ω]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closing force</td>
<td>440 lbs. (2000 N)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. stroke</td>
<td>2” (50 mm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Speed (selectable)</td>
<td>s/mm 2 or 6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. pipe temperature</td>
<td>°F / °C 392 °F / 200 °C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>32 - 140 °F / 0 - 60 °C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage and transport temperature</td>
<td>°F / °C -40 - 128 °F / -40 - 70 °C (storing for 3 days)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Humidity</td>
<td>5-95% (non-condensing)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protection class</td>
<td>II</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enclosure rating</td>
<td>NEMA 3 (IP 54)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>lbs / kg 11.7 / 5.3</td>
<td>18.9 / 8.6</td>
<td>18.9 / 8.6</td>
</tr>
<tr>
<td>Safety function</td>
<td>- Yes Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safety function runtime/50 mm stroke</td>
<td>s - 120</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manual operation</td>
<td>Electrical and mechanical</td>
<td>Electrical and mechanical</td>
<td>Electrical and mechanical</td>
</tr>
<tr>
<td>Power failure response</td>
<td>Stem remains in last position</td>
<td>Safety function stem down</td>
<td>Safety function stem up</td>
</tr>
<tr>
<td>CE marking in accordance with the</td>
<td>Low Voltage Directive 2006/95/EEC</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Disposal

The actuator must be dismantled and the parts sorted into various material groups before disposal.

Complete the mechanical and electrical installation (see instructions) and perform the necessary checks and tests:

- Turn on the power
- Set the appropriate control signal and check that the valve stem direction is correct for the application.

The unit is now fully commissioned.
Design

1. Manual operation crank
2. Function buttons
3. Service cover
4. Cable knockouts
5. End position indicator ring (2)
6. Stem connector
7. Valve connector (yoke)

Installation

Mechanical

Please check the allowed installation positions for the valve and actuator. The actuator can be installed in all positions (see below). Allow clearance for maintenance purposes. The actuator has position indication rings which should be pushed together before power-up. After self-adjustment they indicate end positions of the stroke.

Electrical connection

Electrical connections can be accessed by removing the service cover.

NEC-440

Four cable entries are provided for M 16×1,5 (5/8") or M 20×1,5 (3/4") cable glands. Note that in order to maintain the enclosure rating, appropriate cable connectors must be used.

For steam installations always tilt the actuator minimum 45°.
Wiring AME 655
AME 658 SU/SD

Do not touch the circuit board. Do not remove the service cover before the power is fully switched off.

Max. allowed current output on terminals 4 and 5 is 4A. Min. power is 3W.

Recommended cross-sectional area of the wiring is minimum AWG16 (1.5 mm²)

Note:
Terminals 1 & 3 are used only in 3-point floating control mode.

This mode is automatically detected, when 1 & 3 are wired. Terminal Y should not be used in 3-point mode.

If for any reason a 3-point signal and a Y signal is connected at the same time, the 3-point signal will prevail.
Terminals 4 & 5 are auxiliary switch outputs.

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**NEC-440FC/FO wiring for modulating mode**

**NEC-440 wiring for modulating mode**

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**NEC-440 connected as 3-point floating Y terminal not used (Applies to all models)**
**Actuator operating modes**

**LED operating mode indicator**
The three-color (green/yellow/red) LED function indicators are located on the actuator cover. They indicate different operating modes.

**RESET button**
Actuators NEC-440 all have a RESET button which is located on top cover of the actuator next to LED indicators. With this button you can enter or exit Stand-By mode (press once) or Self adjustment mode (press and hold for 5 seconds). See next paragraph for mode details.

### Operating modes

- **Self adjustment mode**
  Self adjustment mode starts automatically the first time when power supply is applied to the actuator. To start another self adjustment, press and hold the RESET button for 5 seconds until the green LED starts flashing. End positions of the valve are automatically set and the actuator goes to stationary mode and starts responding to the control signal.

- **Stand-By mode**
  Press the RESET button for 1 second to enter Stand-By mode. The actuator stops in current position and stops responding to the control signal. You can manually operate the actuator with the mechanical crank or the control push buttons. This mode is useful during the start up of other equipment, or for service. In this mode you can also set the positions of the auxiliary switches. To exit Stand-By mode press the RESET button again.

- **Positioning mode**
  The actuator is operating automatically. The stem is extending (down) or retracting (up) according to the control signal. When the positioning is finished the actuator goes to stationary mode.

- **Stationary mode**
  The actuator is waiting for a control signal change.

- **Error mode**
  Working temperature is too high, check the ambient temperature.
  Stroke is too short - check the connection with valve and valve operation, or check if valve is blocked.

### LED signalling

<table>
<thead>
<tr>
<th>LED</th>
<th>Indication type</th>
<th>Operating mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Green LED]</td>
<td>Constantly lit</td>
<td>Positioning mode - Actuator is retracting, stem up</td>
</tr>
<tr>
<td>![Green LED]</td>
<td>Constantly lit</td>
<td>Positioning mode - Actuator is extending, stem down</td>
</tr>
<tr>
<td>![Green LED]</td>
<td>Flashing (1 s cycle)</td>
<td>Self adjustment mode - Actuator is retracting, stem up</td>
</tr>
<tr>
<td>![Green LED]</td>
<td>Flashing (1 s cycle)</td>
<td>Self adjustment mode - Actuator is extending, stem down</td>
</tr>
<tr>
<td>![Yellow LED]</td>
<td>Constantly lit</td>
<td>Stationary mode - Actuator has reached upper end position (stem up)</td>
</tr>
<tr>
<td>![Yellow LED]</td>
<td>Constantly lit</td>
<td>Stationary mode - Actuator has reached bottom end position (stem down)</td>
</tr>
<tr>
<td>![Yellow LED]</td>
<td>Flashing</td>
<td>Stationary mode - Single blink when Y signal is present and double blinks when Y signal is not connected</td>
</tr>
<tr>
<td>![Red LED]</td>
<td>Constantly lit</td>
<td>Stand-By mode</td>
</tr>
<tr>
<td>![Red LED]</td>
<td>Flashing</td>
<td>Error Mode</td>
</tr>
<tr>
<td>![Red/Yellow LED]</td>
<td>Flashing (1 s cycle)</td>
<td>Set up stroke limitation (stem up)</td>
</tr>
<tr>
<td>![Red/Yellow LED]</td>
<td>Flashing (1 s cycle)</td>
<td>Set up stroke limitation (stem down)</td>
</tr>
<tr>
<td>Dark</td>
<td>No indication</td>
<td>No power supply</td>
</tr>
</tbody>
</table>
**DIP switch settings**

The actuator has a selection of DIP switches (Fig. 1) under the service cover.

**DIP1: FAST/SLOW – Speed selection**
- FAST; 2 s/mm
- SLOW; 6 s/mm

**DIP2: DIR/INV – Direct or inverse acting selector** (Fig. 2):
- INV; the actuator is direct acting to input signal (stem down on increased signal).
- DIR; the actuator is inverse (reverse) acting to control signal (stem up on increased signal).

**DIP3: 2-10 V/0-10 V – Input/output**
- OFF: 2-10 V; the input signal is in the range from 2-10 V (voltage input) or from 4-20 mA (current input)
- ON: 0-10 V; the input signal is in the range from 0-10 V (voltage input) or from 0-20 mA (current input) Signal range selector sets Y and X signal.

**DIP4: LIN/MDF – Characteristic modification function** (Fig. 3):
- LIN; Linear correlation between Y signal and stem position
- MDF (Modified) position; Enables modified correlation between Y signal and stem position. Degree of modification depends on setting of potentiometer CM.

The function enables a change MCV (Motorised Control Valve) characteristic (for example linear to Eq % and Eq % to linear) and works with all combinations of DIP switch settings.

**DIP5: 100%/95% – Stroke limitation** (fig. 4):
- OFF: Set new maximum stem up position of the actuator
- ON: Set new minimum stem down position of the actuator.

**DIP6: C/P – Output signal mode selector** (Fig. 5):
- An output signal is present on terminal 4 when the position of the actuator is equal to or lower than the S4 setting. An output signal is present on terminal 5 when the position of the actuator is equal to or higher than the S5 setting.
- DIP6 position C provides a constant output signal on terminals 4 or 5, regardless of the input signal.
- DIP6 position P provides a pulse signal through parallel or cascade electrical wiring input on terminals 1 and 3 dependents from the controller to output terminals 4 and 5.
DIP switch settings

DIP7: Smart function selector:
- OFF; the actuator does not try to detect oscillations in the system.
- ON; the actuator enables special anti-oscillation algorithm: see section on anti-oscillation algorithm.

DIP8: Uy/Iy – Input signal selector:
- Uy; input signal Y is set to voltage (V)
- Iy; input signal Y is set to current (mA)

NOTE:
Y detection is disabled if DIP8 is set to ON and DIP3 is set to OFF.

DIP9: Ux/Ix – Output (feedback) signal selector:
- Ux; output signal X is set to voltage (V)
- Ix; output signal X is set to current (mA)

Anti-oscillation algorithm
(DIP 7 in position ON)

The actuator has a special anti oscillation algorithm. In case the control signal Y oscillates (Fig. 1) - looking from a time perspective, the algorithm starts to lower the amplification of the ouput to the valve. Instead of having a static characteristics, the actuator changes to a dynamic characteristics. When the control signal does not oscillate anymore, the output to the valve slowly returns back to static characteristics.

Oscillation
Harmonic oscillations are high frequency oscillations with low amplitude that vary around its own equilibrium value and not around a set-point temperature. They can appear in up to 70 % of the time, even though the system is properly commissioned. Harmonic oscillations have a negative influence on control stability, and lifetime of the valve and actuator.

Smoothing function
The smoothing function implemented in the new 2nd generation of anti-oscillation function reduces harmonic oscillations; the actual temperature is closer to the set-point (desired temperature). Smoother operation increases lifetime of the valve and actuator. This saves energy and reduces costs in general.
Manual operation

All NEC-440 actuators can be manually positioned when in Stand-By mode or when there is no power supply (mechanically).

<table>
<thead>
<tr>
<th>Actuator type</th>
<th>Mechanical operation</th>
<th>Electrical operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEC-440</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>NEC-440FC/FO</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

Mechanical manual operation

Actuators have a knob & crank on the top of the housing which enables manual positioning of the actuator.

Use Mechanical manual operation only when the power is disconnected.

Electrical manual operation

Actuators have two buttons on the top of the housing that are used for electrical/manual positioning (up or down) if the actuator is in Stand-By mode. First press the RESET button until the actuator goes to Stand-By mode (red LED on). By pressing the upper button the stem will be extended (stem down) and by pressing the lower button the stem will be retracted (stem up).

Dimensions
Cable connections

3.5–4.5 mm × 0.7 mm

M16 5/8"

M20 3/4"

Cable connections