MEMS Tilt Angle Sensor

**ESC3000Z Series**

ESC-Series industrial inclinometers are high performance sensors used to determine inclination in X and Y axes with excellent precision. Using Aluminum Die-Cast housing, the versions offer mechanical precision.

- Dual Axis Measurement: up to ±80°
- High accuracy: Absolute Linearity <±0.5%FS
- Various Data Output: Voltage, Current, Serial RS-485

*Requesting other serial interface such as SAE J1939 & CANopen, please contact us.

- Stable measurement under vibration
- Programmable Parameters: Inclination range, Baud Rate, Data

**[Dimension]**  [mm]

**[Tilt Angle Direction]**

**[Easy Resetting Function for Index Point(0°)]**

Only 5 seconds to reset index point (0°) using User-Settable Adjustment Card. (USAC)

1. Please touch ESC 3times with USAC
   - front→② back→③ front

2. Then current position (±5° max./horizontality) will be changed to index point.
Any electrical connections do not needed.

**[Programmable Digital Damping Control Function]**

ESC3000Z series implements the digital filter that would remove external noise to give the user a choice of certain filter factor from 16 available settings.
Existing inclinometers have to be add extra electrical low-pass filter or mechanical damping structure.
ESC30xxZ apply digital filter. It makes wider choice of cut-off frequency and easy to design frequency response.

Note: Frequency response is set before shipping.
Programmable function will be option.
【Serial communication Function】

This series has RS485 interface as standard function. Using RS485 serial interface command, the following functions will be able to be used.
1. Retrieving of electrical angle position.
2. Retrieving of Serial number.
3. Teach-in setting of index (0°) point. (Option)
4. Changing of elecreial analog angle range. (Option)
5. Changing damper setting. (Option)
6. Changing baud rate. (Option)
7. Changing output cycle of serial data. (Option)

【Specifications】

<table>
<thead>
<tr>
<th>Voltage Ratio</th>
<th>Voltage</th>
<th>Current</th>
<th>Serial (RS-485)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical Angle</td>
<td>±10°, ±20°, ±30°, ±45°, ±60°, ±80°</td>
<td>±0°</td>
<td>±80°</td>
</tr>
<tr>
<td>Angle resetting function by RS-485 command is available (Option)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Absolute Linearity</td>
<td>±0.5%FS</td>
<td>±0.1°(±±10°)</td>
<td>±0.2°(±±30°)</td>
</tr>
<tr>
<td>Input Voltage</td>
<td>DC 5±0.25V</td>
<td>DC 8~30V</td>
<td>DC 24±4V</td>
</tr>
<tr>
<td>Current Consumption</td>
<td>75mA max.</td>
<td>0.5~4.5V</td>
<td>4~20mA</td>
</tr>
<tr>
<td>Output Range</td>
<td>10~90%Vin</td>
<td>0.5~4.5V</td>
<td>4~20mA</td>
</tr>
<tr>
<td>Output Resolution</td>
<td>12bit equivalent</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

- Damper Control
  - Time constant against input step : 443ms (Standard)
  - Selectable 16 steps during 70ms~900ms (Option)
  - Damper resetting function by RS-485 command is available (Option)
- Temp. Characteristics
  - 0° position : ±0.5° (−30°C ~ 85°C deviation from 25°C)
- Mass
  - 300g approx.
- Cable
  - 6 cores Câblyre Cable, Outer-diameter: dia. 7.4mm, Core: 0.5mm²
- EMS
  - ISO11452 corresponding ±1% output shifting at 10MHz~1GHz
  - 100V/m (Ratio, Current, Serial) / 50V/m (Voltage)
- EMI
  - CISPR25 3rd. edit. CLASS1 corresponding
- Operating Temp. Range
  - -30~85°C
- ESD
  - ±12kV
- Vibration
  - 70m/s², 5~200Hz/10min, 2 hours
- Shock
  - 1000m/s², Half sine wave 6ms
- IP Grade
  - IP67
- Index point Teach-in
  - Index point (±5° max., Horizontal) Teach-in setting. (Option)

【Output Characteristics】

**Voltage Ratio**

- Output (%) = Vin / 90°
- Effective electrical travel: -90° to +90°

**Voltage**

- Output (V) = 4.5Vin / 90°
- Effective electrical travel: -90° to +90°

**Current**

- Output (mA) = 20Vin / 90°
- Effective electrical travel: -90° to +90°

2018/10
**[Schematic]**

- Red, black, white, green, yellow, and brown indicate harness colors.

**[Temperature Characteristics]**

By our unique technology, ESC3000Z series is individually compensated temperature characteristics for each unit. ESC3000Z series realized stable temperature characteristics.

**[ESC3000Z Series Model Number Designation]**

<table>
<thead>
<tr>
<th>ESC30</th>
<th>10</th>
<th>Z</th>
<th>R</th>
<th>DB</th>
<th>L</th>
<th>O</th>
<th>O</th>
<th>O</th>
</tr>
</thead>
<tbody>
<tr>
<td>Series number</td>
<td>X axis analog output</td>
<td>Y axis analog output</td>
<td>Output type</td>
<td>Damper control characteristics</td>
<td>Output Baud rate</td>
<td>Terminating resistance</td>
<td>USAC</td>
<td></td>
</tr>
<tr>
<td>10: ±10°</td>
<td>20: ±20°</td>
<td>30: ±30°</td>
<td>45: ±45°</td>
<td>60: ±60°</td>
<td>80: ±80°</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Z: X &amp; Y (Standard)</td>
<td>X: X axis only</td>
<td>Y: Y axis only</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

R: Ratio 10~90%Vin
V: Voltage 0.5~4.5V
A: Current 4~20mA
D: RS485 only

Cut-off frequency and Time constant against Damper time constant are shown in the below table. It is possible to choose the best Damper time constant by operating speed and vibration condition.

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Level</th>
<th>Cut-off frequency</th>
<th>Time constant</th>
</tr>
</thead>
<tbody>
<tr>
<td>D0</td>
<td>0</td>
<td>11.2Hz</td>
<td>60ms</td>
</tr>
<tr>
<td>D1</td>
<td>1</td>
<td>9.27Hz</td>
<td>114ms</td>
</tr>
<tr>
<td>D2</td>
<td>2</td>
<td>7.65Hz</td>
<td>126ms</td>
</tr>
<tr>
<td>D3</td>
<td>3</td>
<td>6.32Hz</td>
<td>140ms</td>
</tr>
<tr>
<td>D4</td>
<td>4</td>
<td>5.21Hz</td>
<td>156ms</td>
</tr>
<tr>
<td>D5</td>
<td>5</td>
<td>4.30Hz</td>
<td>181ms</td>
</tr>
<tr>
<td>D6</td>
<td>6</td>
<td>3.55Hz</td>
<td>205ms</td>
</tr>
<tr>
<td>D7</td>
<td>7</td>
<td>2.93Hz</td>
<td>246ms</td>
</tr>
<tr>
<td>D8</td>
<td>8</td>
<td>2.42Hz</td>
<td>277ms</td>
</tr>
<tr>
<td>D9</td>
<td>9</td>
<td>2.00Hz</td>
<td>321ms</td>
</tr>
<tr>
<td>DA</td>
<td>10</td>
<td>1.65Hz</td>
<td>378ms</td>
</tr>
<tr>
<td>DB</td>
<td>11</td>
<td>1.36Hz</td>
<td>443ms(Standard)</td>
</tr>
<tr>
<td>DC</td>
<td>12</td>
<td>1.21Hz</td>
<td>532ms</td>
</tr>
<tr>
<td>DD</td>
<td>13</td>
<td>0.92Hz</td>
<td>627ms</td>
</tr>
<tr>
<td>DE</td>
<td>14</td>
<td>0.76Hz</td>
<td>749ms</td>
</tr>
<tr>
<td>DF</td>
<td>15</td>
<td>0.62Hz</td>
<td>900ms</td>
</tr>
</tbody>
</table>
【Handling Instruction】

- Hall-IC sensor is impossible to measure resistance value as a variable resistor.
- Use this sensor in the place where is protected from ESD.
- Under acceleration 12m/s² or Vibration Min.3000Hz, angle may not measured accurately.
- In certain temperature environment, output at 0° may be shifted by aging effect.
We are here for you. Addresses and Contacts.

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