DISTINCTIVE FEATURES

- One or two axis
- Analog, PWM or USB outputs
- IP67 Above panel sealing mounting
- Rear or drop-in mounting
- Pushbutton option

ENVIRONMENTAL SPECIFICATIONS

- Operating Temperature: -40 °C to +85 °C (-40 °F to +185 °F)
- Storage Temperature: -40 °C to +85 °C (-40 °F to +185 °F)
- Above Panel Sealing: IP67, IP69K (subject to mounting style & final specifications)
- EMC Immunity Level: EN61000-4-3
- EMC Emissions Level: EN61000-6-3:2001
- ESD: EN61000-4-3 Level 2 (± 4 kv contact, ± 6 kv air)

SENSOR SPECIFICATIONS

- Technology: Hall effect sensors, single or dual
- Supply Voltage Range: 5.00 V ± 0.01 VDC
- Supply Current: 11 mA max
- Ratiometric Output Options: See options
- Reverse Polarity max: -10 V
- Transient overvoltage max: 16 V
- Start-up time: 15 ms max
- Output Impedance: 2Ω
- Return to Center Voltage Tolerance: ± 200 mV initial
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**MECHANICAL SPECIFICATIONS**

- Operating Force: 3.1 N ± 0.5 N (0.70 lbf ± 0.11 lbf)
- Maximum Vertical Load: 200 N (45 lbf)
- Maximum Horizontal Load: 150 N (33.7 lbf)
- Mechanical Angle of Movement: 50° X & Y axis (subject to limiter plate)
- Expected Life: 1 million cycles
- Mass/Weight: 18.25 g ± 5.0 g (0.64 oz ± 0.18 oz)
- Lever Action (centering): Spring

1 All options are IP68 and IP69K rated, however drop-in mounting does not prevent panel ingress.
2 Force applied to the top of the castle cap.

**MATERIALS**

- Body: Glass filled nylon
- Threaded Housing: Black oxide plated brass
- Boot: Silicone
- Handles:
  - 1, 2, 3, E, F, G - Glass filled nylon
  - 4, 5, 6, 7, 8 - Silicone
  - B, C, D - Thermoplastic elastomer
  - H - Polycarbonate

APEM products may be recycled at end-of-life for the re-claiming of valuable metal components.

**CONNECTIONS**

**WIRING SPECIFICATION**

<table>
<thead>
<tr>
<th>WIRING SPECIFICATION</th>
<th>Operating Voltage</th>
<th>Operating Current</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
<td>Ground &amp; button common, or LED common</td>
<td>-</td>
</tr>
<tr>
<td>Red</td>
<td>Power (5 V)</td>
<td>-</td>
</tr>
<tr>
<td>Blue</td>
<td>X axis output (alpha)</td>
<td>5 V</td>
</tr>
<tr>
<td>Yellow</td>
<td>Y axis output (alpha)</td>
<td>5 V</td>
</tr>
<tr>
<td>Orange</td>
<td>Pushbutton switch (option 6 handle) or LED supply (option H handle)</td>
<td>5 V</td>
</tr>
<tr>
<td>Blue/White Stripe</td>
<td>X axis output (beta)</td>
<td>-</td>
</tr>
<tr>
<td>Yellow/Black Stripe</td>
<td>Y axis output (beta)</td>
<td>-</td>
</tr>
<tr>
<td>Red/White Stripe</td>
<td>Power (5 V) (beta)</td>
<td>-</td>
</tr>
<tr>
<td>Black/White Stripe</td>
<td>Ground (beta)</td>
<td>-</td>
</tr>
</tbody>
</table>

1 Hall sensor and LED supply (LED control option 1)
2 User controllable (LED control option 2)

**PUSHBUTTON SWITCH SPECIFICATIONS**

- Electrical Life: 100,000 cycles
- Rating: 50 mA, 12 VDC.
- Terminal: Brass with silver plating
- Contact Resistance: 100 mΩ max
- Insulation Resistance: 100 MΩ min. 500 VDC
- Dielectric Strength: 250 VAC /1 minute
- Contact Arrangement: 1 pole 1 throw
- Stop Strength: Max 3 kgf vertical static load for 15 seconds

**LED SPECIFICATIONS**

<table>
<thead>
<tr>
<th>LED CONTROL</th>
<th>OPERATING VOLTAGE</th>
<th>OPERATING CURRENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 – ON, driven by joystick supply voltage</td>
<td>-</td>
<td>6 mA</td>
</tr>
<tr>
<td>2 – User controlled</td>
<td>5 V</td>
<td>6 mA</td>
</tr>
</tbody>
</table>

1 Hall sensor and LED supply (LED control option 1)
2 User controllable (LED control option 2)
TS series
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NEW OPTIONS AVAILABLE

METAL THREADED HOUSING - DROP-IN CUTOUT

- The under panel depth for the Metal Threaded Housing configuration is 14.55 mm (0.573 in).
- Mounting nut can be tightened to a recommended torque of 10 lbf.

PLASTIC THREADED HOUSING

- The under panel depth for the Plastic Threaded Housing configuration is 16.02 mm (0.631 in).

MOUNTING

PLASTIC HOUSING - DROP-IN CUTOUT

- The maximum panel thickness for the Rear Mount configuration is 2.032 mm (0.08 in).
- Mounting screws can be driven to a recommended torque of 4 lbf.

PLASTIC HOUSING - REAR MOUNT OPTION CUTOUT

- The under panel depth for the Drop-in configuration is 14.55 mm (0.573 in).

PLASTIC THREADED HOUSING - DROP-IN CUTOUT

- Mounting nut can be tightened to a recommended torque of 10 lbf.

LED ILLUMINATION OPTION H HANDLE

- The under panel depth for the Drop-in configuration is 14.55 mm (0.573 in).

PLASTIC HOUSING - REAR MOUNT OPTION CUTOUT

- The maximum panel thickness for the Rear Mount configuration is 2.032 mm (0.08 in).
- Mounting screws can be driven to a recommended torque of 4 lbf.

PLASTIC THREADED HOUSING - DROP-IN CUTOUT

- The under panel depth for the Plastic Threaded Housing configuration is 14.55 mm (0.573 in).
- Mounting nut can be tightened to a recommended torque of 10 lbf.
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**BUILD YOUR PART NUMBER**

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**SERIES**

- TS

**HANDLE**

- 0: None
- 1: Castle
- 2: Winged Hat
- 3: Conical
- 4: Finger Tip
- 5: Round Jog

- 6: Pushbutton
- 7: Mushroom
- 8: Low Profile
- A: Handles 1, 2, 3
- B: Castle, elastomer
- C: Winged Hat, elastomer

**MOUNTING OPTIONS**

- N: None
- D: Drop-in
- R: Rear mount
- A: Drop-in and Rear Mount
- T: Threaded housing, Metal
- P: Threaded housing, Plastic

**TERMINATION**

- 1: 22 AWG PTFE, 25 cm ± 1.27 cm²
- 2: 28 AWG PTFE, 25 cm ± 1.27 cm²
- 3: 72” Overmold Cable with USB Male Type Connector
- 4: 2.54 mm (0.100”) Pitch TE Connector
- 5: 2.54 mm (0.100”) Pitch TE Connector with 10” Mating Harness

**LIMITER**

- U: Single axis
- S: Square
- G: Guided feel
- P: Plus

**POWER SUPPLY OPTIONS**

- A: Single
- B: Independent

**LED CONTROL**

- BLANK: No illumination
- 1: ON, driven by joystick supply voltage
- 2: User controlled

**LED COLOR**

- BLANK: No illumination
- BB: Blue
- RR: Red

---

1. Pushbutton, Mushroom and Low profile handle not available with P (threaded housing, plastic).
2. 3 Wires are thick, robust, and best suited for stand alone applications.
3. Wires are thin and best suited for tightly constrained wire routing.
4. Contact factory for PWM configuration.
5. Output voltage is ratiometric to supply voltage.
6. Only available on dual output. Not available with Handle 6 (Pushbutton). Not available with termination options 4 or 5.
7. LED control is driven by joystick supply voltage. Illumination is constantly on.
8. LED requires independent 5V supply. Illumination is user controlled.
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PLASTIC HOUSING

METAL THREADED HOUSING

PLASTIC THREADED HOUSING

MINIMUM PANEL THICKNESS: .125”
**TS series**

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**HANDLE OPTIONS**

1. Castle
   - Castle (elastomer)
2. Winged hat
   - Winged hat (elastomer)
3. Conical
   - Conical (elastomer)
4. Fingertip
5. Round jog
6. Pushbutton
7. Mushroom
8. Low profile

**USB OPTIONS**

**USB: GAME CONTROLLER**

Featuring USB 2.0 HID compliant interface. APEM’s USB joysticks are recognized as standard HID “game controller” devices. Adhering to the HID specification, APEM’s USB joysticks are plug-and-play with most versions of Windows. Joystick button and axis assignments are dependent upon the controlled application.

- **Features:**
  - USB 2.0 HID compliant “game controller” device
  - Easy to install and operate
  - Functions determined by controlled application
  - Supplied wiring: USB Male Type A Connector with 72” overmolded cable

**USB: JOYBALL (CURSOR EMULATION)**

The cursor emulation option converts a multi-axis joystick into a mouse or cursor control device.

- **Applications:** The cursor emulation option is ideal for vehicle applications subjected to dirt and high vibration which makes operating a traditional cursor control device difficult. The Cursor Emulation option is widely used in shipboard and military applications.

- **Features:**
  - HID compliant “pointing device”
  - Plug-and-play with USB option
  - Supplied wiring: USB Male Type A Connector with overmolded cable
TS series

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VOLTAGE OUTPUT OPTIONS

- Single output configurations feature a five position TE 3-647166-5 connector.
- Dual output configurations feature a seven position TE 3-647166-7 connector.
- A mating harness is not included, but may be specified for single output configurations at the time of order for an additional charge.
- The five function harness is part number 505-499.
- The seven function harness is part number 505-500.

CONNECTOR TERMINATION OPTION

<table>
<thead>
<tr>
<th>PIN</th>
<th>SPECIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>PIN 1</td>
<td>Y (alpha)</td>
</tr>
<tr>
<td>PIN 2</td>
<td>GND / Pushbutton common</td>
</tr>
<tr>
<td>PIN 3</td>
<td>X (alpha)</td>
</tr>
<tr>
<td>PIN 4</td>
<td>GND / Pushbutton common</td>
</tr>
<tr>
<td>PIN 5</td>
<td>Pushbutton / LED</td>
</tr>
<tr>
<td>PIN 6</td>
<td>-</td>
</tr>
<tr>
<td>PIN 7</td>
<td>-</td>
</tr>
</tbody>
</table>

1 Voltage outputs are ratiometric to supply voltage.