

TS series

Proportional miniature thumb controls •
non-contacting Hall effect technology



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, IP69K¹ (subject to mounting style & final specifications)
- EMC Immunity Level: EN61000-4-3
- EMC Emissions Level: EN61000-6-3:2001
- ESD: EN61000-4-2



SENSOR SPECIFICATIONS

- Technology: Hall effect sensors, single or dual
- Supply Voltage Range: 5.00 V \pm 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: 2 Ω
- Return to Center Voltage Tolerance: \pm 200 mV initial



U.S. Patent #D816,169 S
U.S. Patent #D732,047 S
U.S. Patent #D816,169 S
U.S. Patent #D734,138 S

The company reserves the right to change specifications without notice.

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MECHANICAL SPECIFICATIONS

- Operating Force: 3.1 N \pm 0.5 N (0.70 lbf \pm 0.11 lbf)²
- Maximum Vertical Load: 200 N (45 lbf)²
- Maximum Horizontal Load: 150 N (33.7 lbf)²
- Mechanical Angle of Movement: 50° X & Y axis (subject to limiter plate)
- Expected Life: 1 million cycles
- Mass/Weight: 18.25 g \pm 5.0 g (0.64 oz \pm 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
(Termination options 1 & 2)

Black	Ground & button common, or LED common
Red	Power (5 V) ¹
Blue	X axis output (alpha)
Yellow	Y axis output (alpha)
Orange	Pushbutton switch (option 6 handle) or LED supply (option H handle) ^{2 2}
Blue/White Stripe	X axis output (beta)
Yellow/Black Stripe	Y axis output (beta)
Red/White Stripe	Power (5 V) (beta)
Black/White Stripe	Ground (beta)

¹ Hall sensor and LED supply (LED control option 1)

² User controllable (LED control option 2)



PUSHBUTTON SWITCH SPECIFICATIONS (OPTION 6 HANDLE)

- 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
- Operating Temperature: -25 °C to +70 °C (-4 °F to +158 °F)
- Storage Temperature: -30 °C to +85 °C (-22 °F to +158 °F)
- Vibration Resistance: MIL-STD-202F METHOD 201A
- Shock Resistance: MIL-STD-202F METHOD 213B



LED SPECIFICATIONS (OPTION H HANDLE)

LED CONTROL	OPERATING VOLTAGE	OPERATING CURRENT
1 – ON, driven by joystick supply voltage	-	6 mA
2 – User controlled	5 V	6 mA

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NEW OPTIONS AVAILABLE

PLASTIC THREADED HOUSING

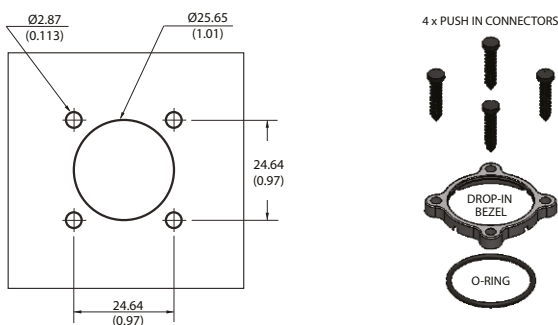


LED ILLUMINATION · OPTION H HANDLE



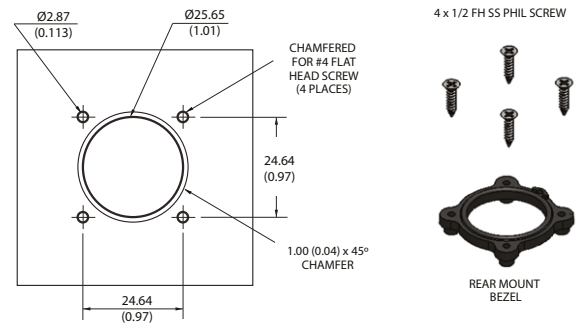
MOUNTING

PLASTIC HOUSING - DROP-IN CUTOUT



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

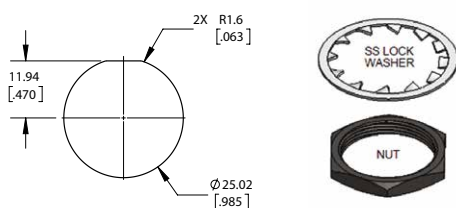
PLASTIC HOUSING - REAR MOUNT OPTION CUTOUT



- The maximum panel thickness for the Rear Mount configuration is 2.032 mm (0.08 in).

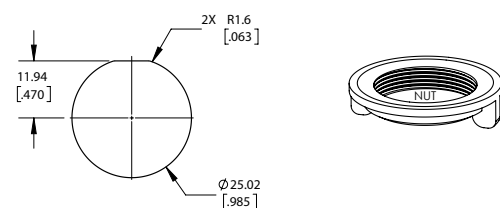
- Mounting screws can be driven to a recommended torque of 4 lbf.

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 - 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

TS

SERIES

HANDLE¹

MOUNTING OPTIONS

TERMINATION²

LIMITER

0

None

1

Castle

2

Winged Hat

3

Conical

4

Finger Tip

5

Round Jog

6

Pushbutton¹⁻¹

7

Mushroom¹⁻¹⁺¹⁻²

8

Low Profile¹⁻¹⁺¹⁻²

A

Handles 1, 2, 3

B

Castle, elastomer

C

Winged Hat, elastomer

D

Conical, elastomer

E

Quadcave

F

Puck

G

Roller

H

Castle, LED illumination

OUTPUT OPTIONS ⁴

LED CONTROL

POWER SUPPLY OPTIONS

LED COLOR

00

0 V to 5 V

01

0.25 V to 4.75 V

02

0.5 V to 4.5 V

03

1 V to 4 V

04

0 V to 5 V - Sensor 1
0 V to 5 V - Sensor 2

05

0.25 V to 4.75 V - Sensor 1
0.25 V to 4.75 V - Sensor 2

06

0.5 V to 4.5 V - Sensor 1
0.5 V to 4.5 V - Sensor 2

07

1 V to 4 V - Sensor 1
1 V to 4 V - Sensor 2

08

0 V to 5 V - Sensor 1
5 V to 0 V - Sensor 2

09

0.5 V to 4.5 V - Sensor 1
4.5 V to 0.5 V - Sensor 2

10

0.25 V to 4.75 V - Sensor 1
4.75 V to 0.25 V - Sensor 2

11

1 V to 4 V - Sensor 1
4 V to 1 V - Sensor 2

12

Customer specified

13

PWM ³

14

USB (Game Controller)

15

Joyball (Cursor emulation)

BLANK

No illumination

1

ON, driven by joystick supply voltage ⁶

2

User controlled ⁷

A

Single

B

Independent ⁵

BLANK

No illumination

BB

Blue

RR

Red

1

22 AWG 25 cm PTFE ²⁻¹

2

28 AWG 25 cm PTFE²⁻²

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

U

Single axis

S

Square

G

Guided feel

P

Plus

Single axis

Square

Guided feel

Plus

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

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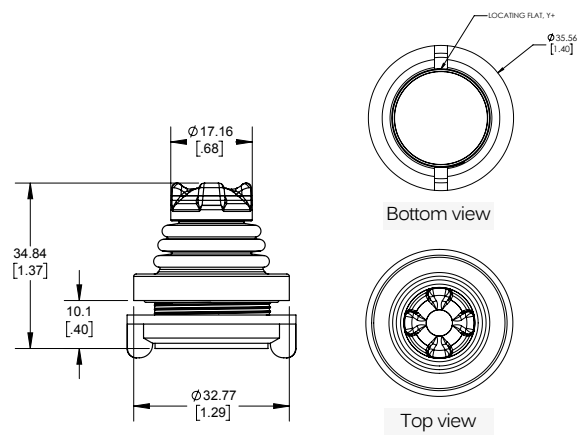
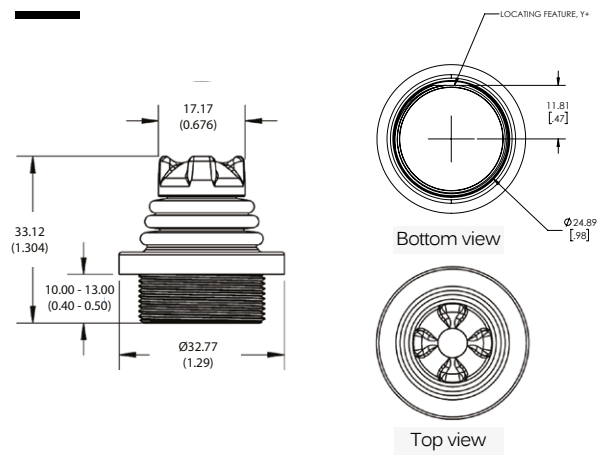
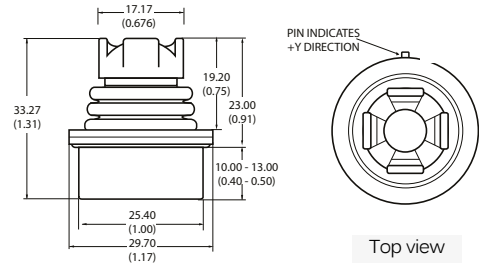
PLASTIC HOUSING



METAL THREADED HOUSING



PLASTIC THREADED HOUSING

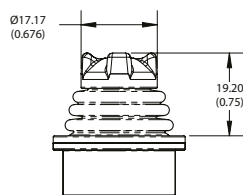


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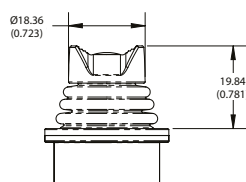
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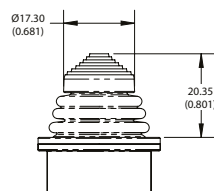
HANDLE OPTIONS



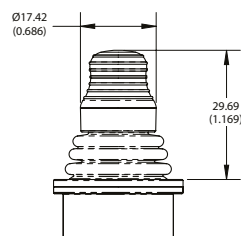
1 Castle
B Castle (elastomer)



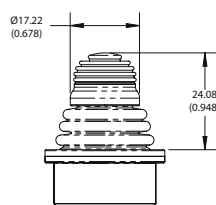
2 Winged hat
C Winged hat (elastomer)



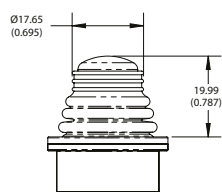
3 Conical
D Conical (elastomer)



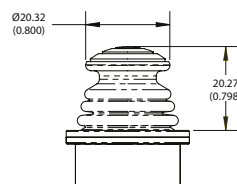
4 Fingertip



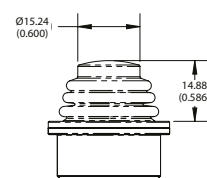
5 Round jog



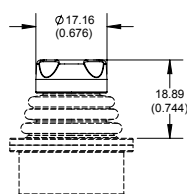
6 Pushbutton



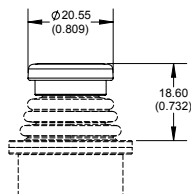
7 Mushroom



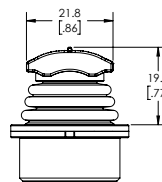
8 Low profile



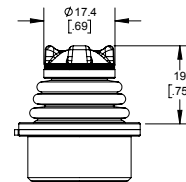
E Quadcave



F Puck



G Roller



H Castle, LED illumination



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)

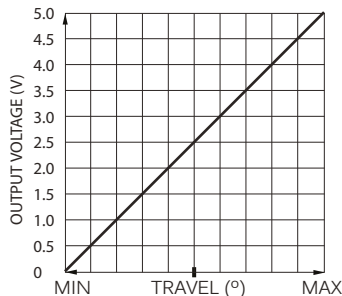
The cursor emulation option converts a multi-axis joystick into a mouse or cursor control device

- 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

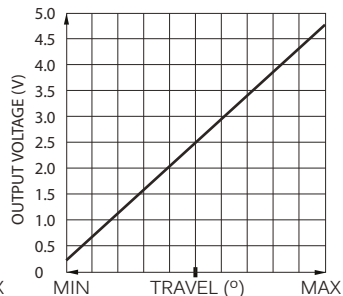
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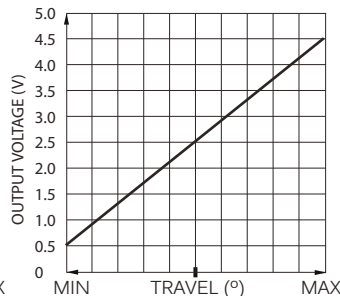
VOLTAGE OUTPUT OPTIONS ¹



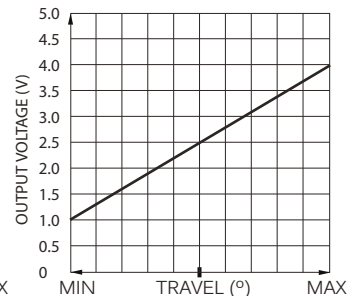
Option 00



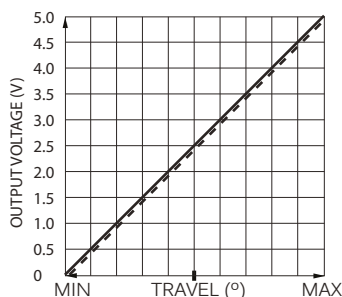
Option 01



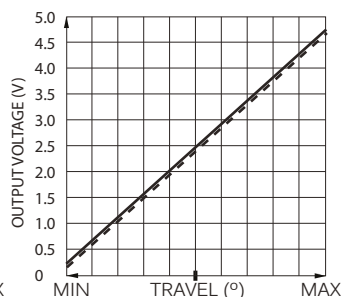
Option 02



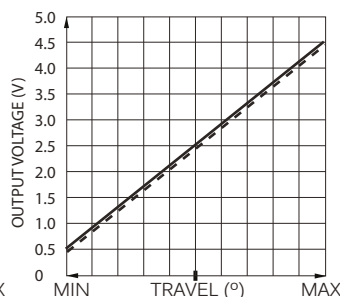
Option 03



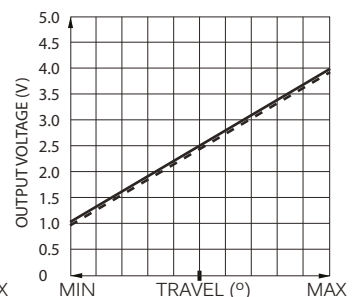
Option 04



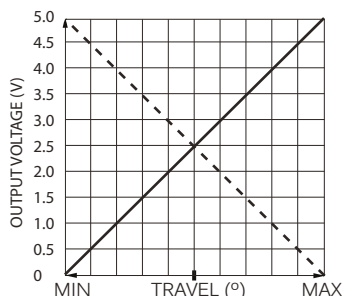
Option 05



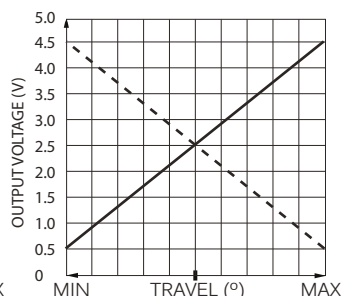
Option 06



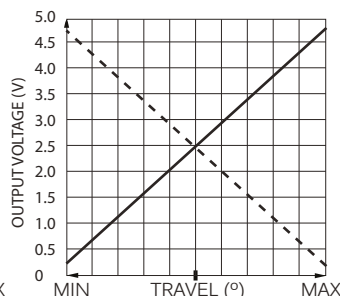
Option 07



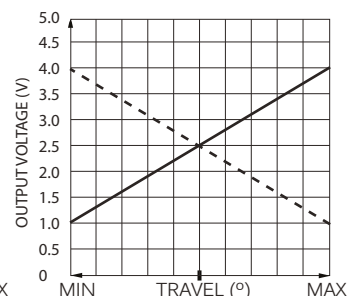
Option 08



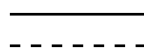
Option 09



Option 10



Option 11



Sensor 1

Sensor 2



CONNECTOR TERMINATION OPTION

PINOUT SPECIFICATION		
	TE 3-647166-5	TE 3-647166-7
PIN 1	Y (alpha)	Pushbutton / LED
PIN 2	5 VDC ¹	GND / Pushbutton common / LED common
PIN 3	X (alpha)	X (alpha)
PIN 4	GND / Pushbutton common / LED common	Y (beta)
PIN 5	Pushbutton / LED	Y (alpha)
PIN 6	-	5 VDC
PIN 7	-	X (beta)

¹ Voltage outputs are ratiometric to supply voltage

- 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.

Mouser Electronics

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[TS1T2S00A](#) [TS2N5U10A](#) [TS5N5U10A](#) [TS5T2S00A](#) [TS2R1U00A](#) [TS6A2S02A](#) [TS6T1G02A](#) [TS6T1S02A](#)