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, IP69K[1] (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 ± 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

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

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MECHANICAL SPECIFICATIONS

- Operating Force: 3.1 N ± 0.5 N (0.70 lbf ± 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 ± 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 (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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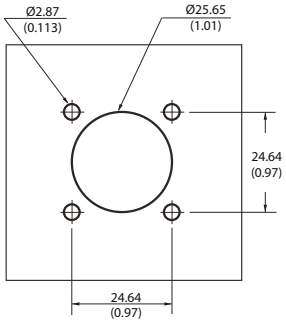
NEW OPTIONS AVAILABLE

PLASTIC THREADED HOUSING

LED ILLUMINATION OPTION H HANDLE

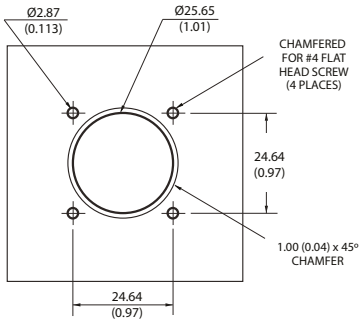
MOUNTING

PLASTIC HOUSING - DROP-IN CUTOUT



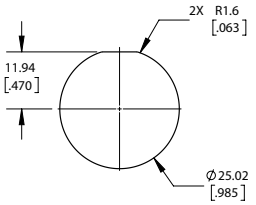
- The under panel depth for the Drop-in configuration is 16.02 mm (0.631 in).

PLASTIC HOUSING - REAR MOUNT OPTION CUTOUT



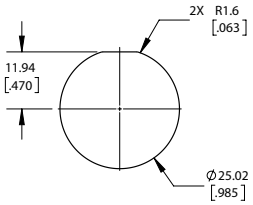
- The maximum panel thickness for the Rear Mount configuration is 2.032 mm (0.08 in).
- Mounting screws can be driven to a recommended torque of 4 lbf.

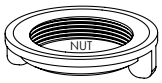
METAL THREADED HOUSING - DROP-IN CUTOUT



- 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

TS

HANDLE[1]

0	None
1	Castle
2	Winged Hat
3	Conical
4	Finger Tip
5	Round Jog
6	Pushbutton[1]
7	Mushroom[1]
8	Low Profile[1]
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

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[2]

1	22 AWG 25 cm PTFE [2-1]
2	28 AWG 25 cm PTFE[2-2]
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

LIMITER

U	Single axis
S	Square
G	Guided feel
P	Plus

OUTPUT OPTIONS [4]

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)

LED CONTROL

BLANK	No illumination
1	ON, driven by joystick supply voltage [6]
2	User controlled [7]

POWER SUPPLY OPTIONS

A	Single
B	Independent [5]

LED COLOR

BLANK	No illumination
BB	Blue
RR	Red

[1] Pushbutton, Mushroom and Low profile handle not available with P (threaded housing, plastic),
[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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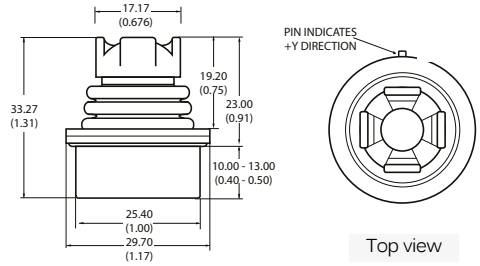
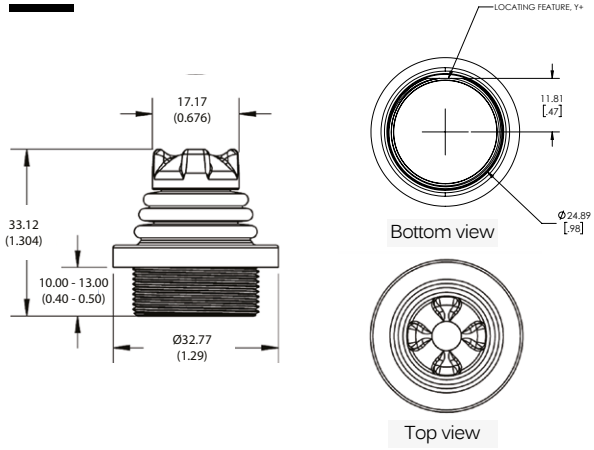
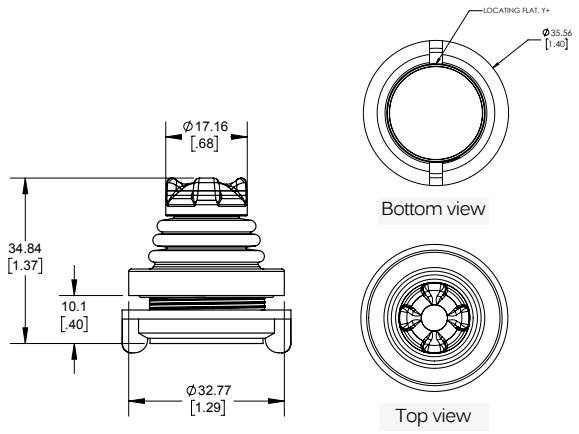
PLASTIC HOUSING



METAL THREADED HOUSING



PLASTIC THREADED HOUSING



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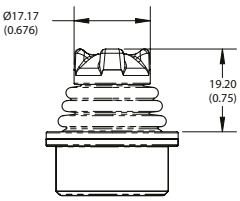
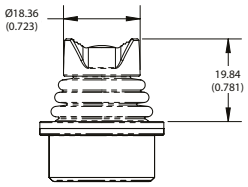
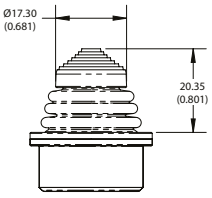
HANDLE OPTIONS



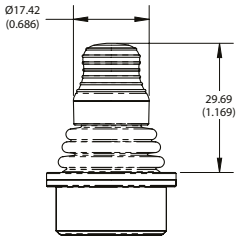
1 Castle
B Castle (elastomer)



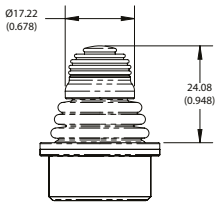
2 Winged hat
C Winged hat (elastomer)



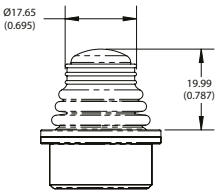
3 Conical
D Conical (elastomer)



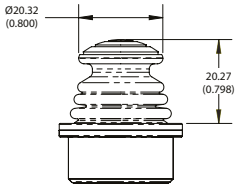
4 Fingertip



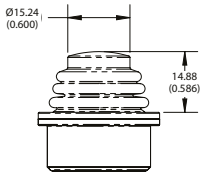
5 Round jog



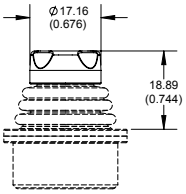
6 Pushbutton



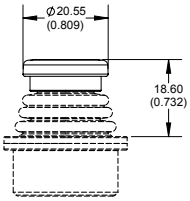
7 Mushroom



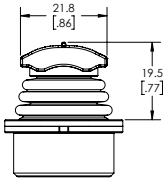
8 Low profile



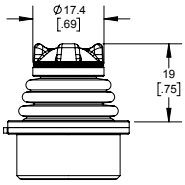
E Quadcave



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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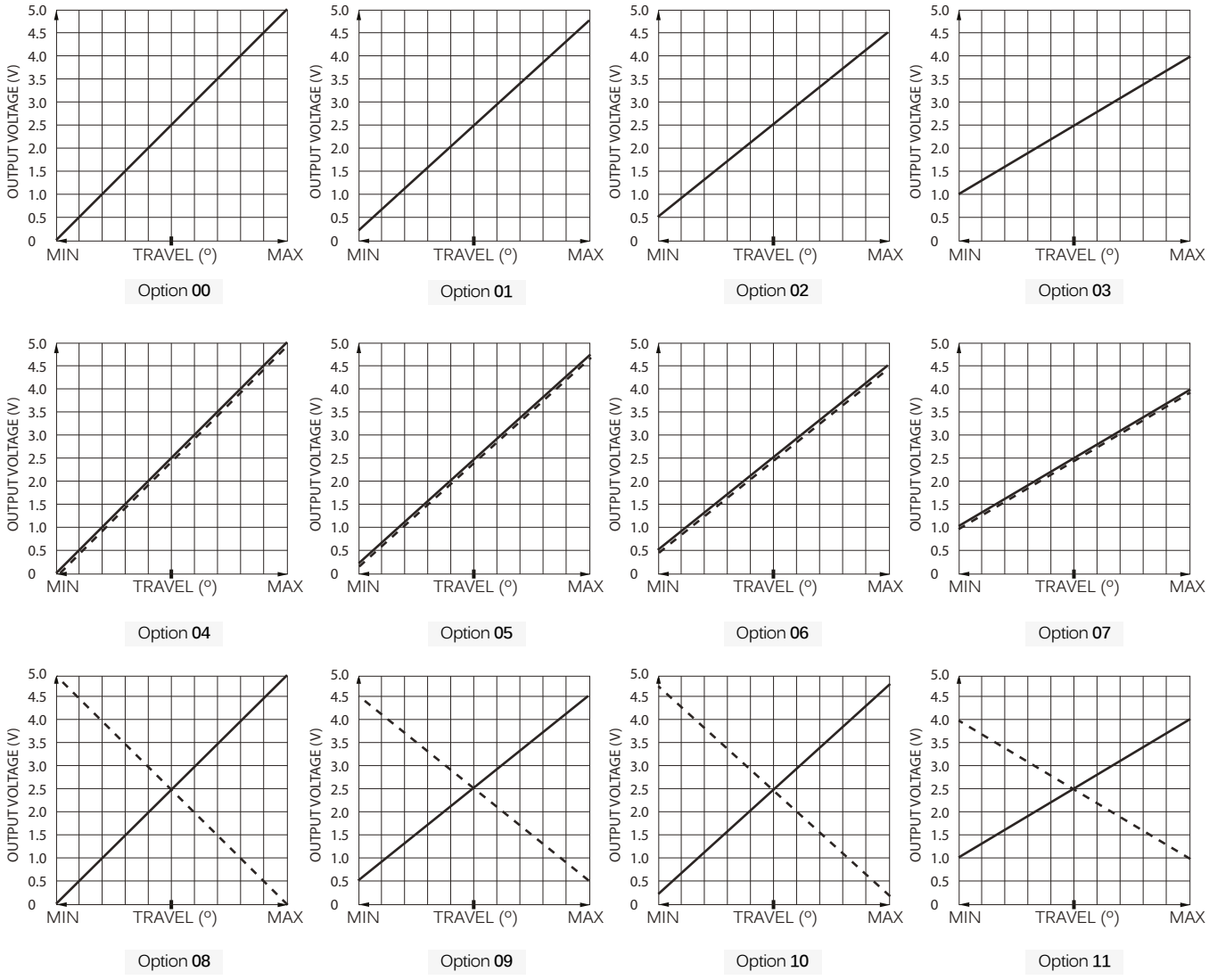
VOLTAGE OUTPUT OPTIONS [1]



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.