

Hall Effect Switches



3-POSITION ANALOG OUTPUT ROCKER WITH BACKLIGHTING



The HFNR is compact, robust and reliable, ideal for grip or panel mount applications. This 3-position switch provides operator comfort by reducing the movement required to change direction or switch gears. Backlighting provides enhanced visibility; making them easy to see in poor lighting or nighttime operation. The electronics are sealed to IP68S and the switch has excellent EMI/RFI immunity; it withstands RFI of 100V/M, 14Hz to 1GHz EMI withstanding per MIL-STD-461D/SAE J1113-22, and a mechanical life of three million cycles.

Features:

- **3 million cycle life, full forward to full backward**
- **Hall effect contactless sensing technology**
- **Choice of bezel and button colors**
- **2V to 24V LED backlighting options**
- **Electronics sealed to IP68S**
- **Outstanding EMI/RFI immunity**
- **Snap-in panel mounting—accepts multiple panel thicknesses**
- **RoHS/WEEE/Reach compliant**

Standard Characteristics/Ratings:

MECHANICAL:

Mechanical Life: 3,000,000 full forward to full back

Angle of Throw Between Adjacent Positions: 10 degrees typical

Max Allowable Radial Load: 30.0 lbs.

ELECTRICAL RATINGS:

Electrical	Units	Min	Typ	Max
Supply Voltage	VDC	4.5	5	5.5
Output Voltage, Tolerance at Center	VDC @ 5V Vcc	-0.35	N/A	+0.35
Output Voltage, Tolerance at Full Travel	VDC @ 5V Vcc	-0.35	N/A	+0.35
Supply Current Per Sensor	mA	N/A	N/A	10

ELECTRONICS:

Seal Integrity: Electronics sealed to IP68S

ENVIRONMENTAL:

Operating Temp Range: -40°C to +85°C

Humidity: 96% RH, 70°C, 96 hours

Vibration: Per MIL-810F minimum integrity

Sand/Dust: Per SAE J1455

EMI: Withstand per MIL-STD-461D/SAE J1113-22

RFI: Withstand 100V/M, 14Hz to 1GHz

MATERIALS:

Button: Thermoplastic

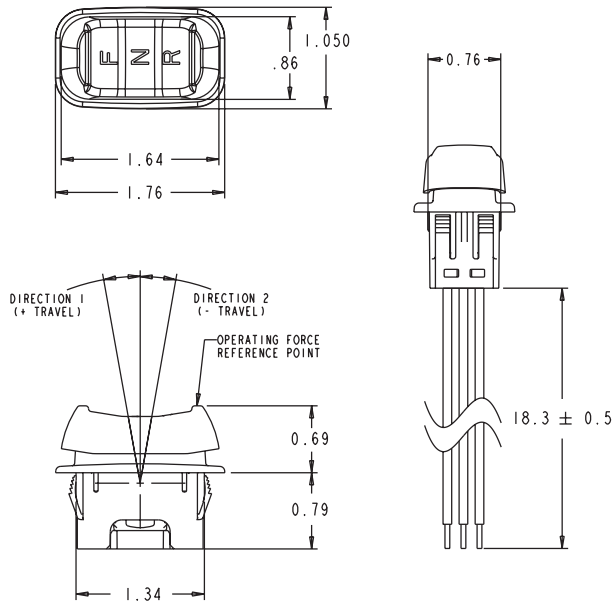
Bezel: Thermoplastic

Mounting Hardware: None provided

HALL EFFECT FORWARD/NEUTRAL/REVERSE ROCKER

HFNR
HALL EFFECT
ROCKER

3-POSITION ANALOG OUTPUT ROCKER WITH BACKLIGHTING

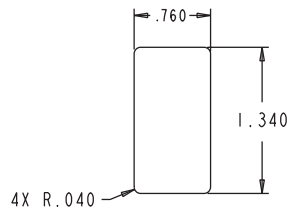


MOUNTING:

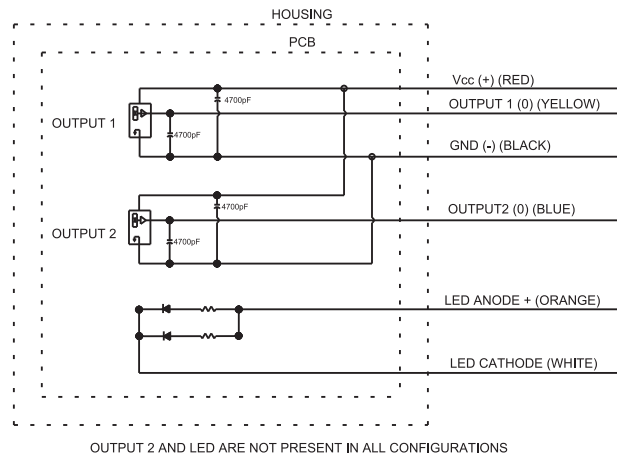
RECOMMENDED PANEL THICKNESS: 0.112 OPTIMUM THICKNESS
(0.040 MIN. - 0.205 MAX.)

RECOMMENDED PANEL OPENING: 0.760 X 1.340 OPTIMUM
(0.760/ .770 X 1.335/ 1.345)

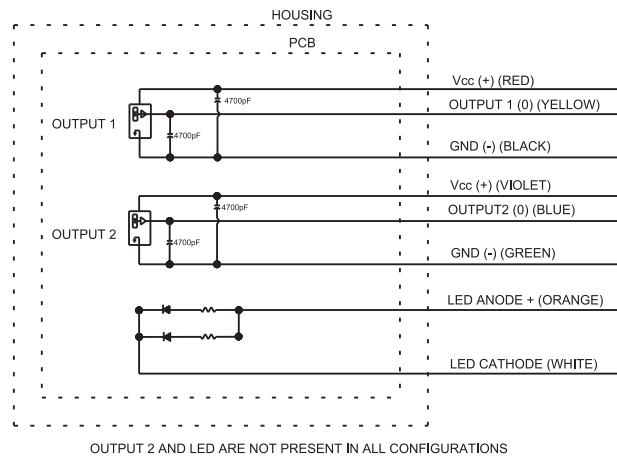
RECOMMENDED PANEL RADII: 0.040 OPTIMUM
(0.070 MAX.)



WIRING OPTION 1 COMMON POWER AND GROUND



WIRING OPTION 2 SEPARATE POWER AND GROUND



HFNR PART NUMBER CODE

Light Source ①	Output 1 ②	Output 2	Wiring Option	Operating Force Direction 1 & 2 to Center/ Center to Direction 1 & 2	Button Style	Termination	Bezel Color ③	Button Color ③	FNR Legend
A. NONE	A. 4.5/2.5/0.5VDC	NONE ④	1. Common Power and Ground ④	1. 2.6/3.6 lbs.	1. Rocker	A. 20 AWG Wires 18.3" Long, Stripped and Tinned Ends	1. Red 2. Black 4. Yellow 6. Blue 8. Gray	1. Red 2. Black ① 3. Orange 4. Yellow 5. Green 6. Blue 7. Violet 8. Gray 9. White	A. NONE B. FNR/White ①
B. 2V Green LED	B. 4.5/2.5/0.5VDC	4.5/2.5/0.5VDC	2. Separate Power and Ground						
C. 2V Amber LED	C. 4.5/2.5/0.5VDC	0.5/2.5/4.5VDC							
D. 5V Green LED	D. 4.0/2.5/1.0VDC	NONE ④							
E. 5V Amber LED	E. 4.0/2.5/1.0VDC	4.0/2.5/1.0VDC							
F. 12V Green LED	F. 4.0/2.5/1.0VDC	1.0/2.5/4.0VDC							
G. 12V Amber LED	G. 1.0/2.5/4.0VDC	4.0/2.5/1.0VDC							
H. 24V Green LED	H. 1.0/1.0/4.0VDC	4.0/1.0/1.0VDC							
J. 24V Amber LED									

① Only button color black is available on backlit version; only legend color translucent white is available on backlit version.

② Outputs are when switch is in detented position.

③ Minimum lot charges may apply for certain color options.

④ For single output switches, wiring option 1 should be selected.

9 MILLION LIFE CYCLE

The HJFC Hall Effect Foot Pedal is built to perform under the worst possible conditions. The unique design places Hall effect sensors and electronics behind a solid plastic diaphragm that separates the top and bottom halves of the front pedal, sealing the electronics in an IP68S rated enclosure. The bottom half of the pedal utilizes the same proven contactless analog output Hall effect technology used in OTTO joysticks and is available in J1939 and CANopen® formats. The CAN interface provides three analog input channels, 12 digital input channels, two digital output channels and I/O extension for up to 40 digital input channels, eight analog input channels and 40 digit output channels by means of I²C interface. It will withstand operating temperature extremes of -40°C to +85°C, is sealed to IP68S immersion requirements and passes EMI/RFI immunity testing to 100V/M.

The HJFC Hall Effect Foot Pedal provides a life of nine million cycles. The pedal's pivot point itself is also sealed against large debris. Customer specified features such as pretravel (dead band) and overtravel, along with a minimum and maximum output, are programmable. The sensor programming is completed in automated fixtures during assembly ensuring tight output tolerances. The HJFC Hall Effect Foot Pedal offers more performance features and a higher cycle and seal rating than any other foot pedal on the market.

Features:

- Outstanding EMI/RFI immunity
- Heavy gauge, corrosion-resistant metal
- Proven contactless analog output Hall effect technology
- J1939 CANopen® formats available
- Life expectancy of 9 million cycles
- Hall sensors & electronics are sealed against the elements, behind a solid plastic diaphragm that separates the top & bottom halves of the foot pedal
- Electronics are sealed to IP68S
- Pedal pivot point sealed against large debris
- Programmable pretravel (dead band) & overtravel along with minimum & maximum output
- Sensor programming is completed in automated fixtures during assembly ensuring tight output tolerances
- Reverse polarity protection available
- RoHS/WEEE/Reach compliant



Bidirectional
Foot Pedal

Standard Characteristics/Ratings:				
MECHANICAL:				
Mechanical Life:	9,000,000 cycles			
Vibration:	10g 10Hz to 2KHz swept sinusoidal			
TRAVEL ANGLE:				
Degrees:	13° nominal dual direction, 15° nominal single direction			
Operating Force (lbs.):	14.0 lbs. typical -40°C to +85°C at load reference point			
Electrical Life:	9,000,000 cycles			
ELECTRICAL RATINGS:				
Electrical	Units	Min	Typ	Max
Supply Current Per Sensor	mA	N/A	N/A	10
Output Resistance (I _o ≤ -2mA)	Ω	N/A	100	N/A
Analog Supply Voltage (Option 1)	VDC	4.5	5	5.5
Analog Supply Voltage (Option 2)	VDC	8	12	18
Analog Output Voltage Tolerance at Center (see graph for output values)	VDC @ 5V V _{cc}	-0.15	N/A	+0.15
Analog Output Voltage Tolerance at Full Travel (see graph for output values)	VDC	-0.15	N/A	+0.15
Limit Switch Supply Voltage (if applicable)	V	5	N/A	30
Limit Switch Actuation (if applicable)	Degrees	1°	2°	3°
Analog Output Pretravel	Degrees	1°	2°	3°
Analog Output Overtravel	Degrees	1°	2°	3°
<i>Note: Limit switch outputs will source limit switch supply voltage when actuated.</i>				
ELECTRONICS:				
Seal Integrity:	Electronics IP68S			
RFI:	Withstand 100V/M, 14KHz to 1GHz (excludes output options 3 & 5)			
EMC:	Withstand per MIL-STD-46 ID/SAE J1113-22			
ENVIRONMENTAL:				
Operating Temp Range:	-40°C to +85°C			
Storage Temp Range:	-65°C to +105°C			
Humidity:	96% RH, 70°C, 96 hours			
Sand/Dust:	Withstand per SAE J1455			
MATERIALS:				
Foot Pedal Plate:	Plated steel			
Housing:	Glass filled thermoplastic			
Cable:	22 AWG (19 strands of 34 AWG TSC) PVC/Polyurethane blend outer jacket			
Mounting Hardware:	None provided			

HALL EFFECT FOOT PEDAL

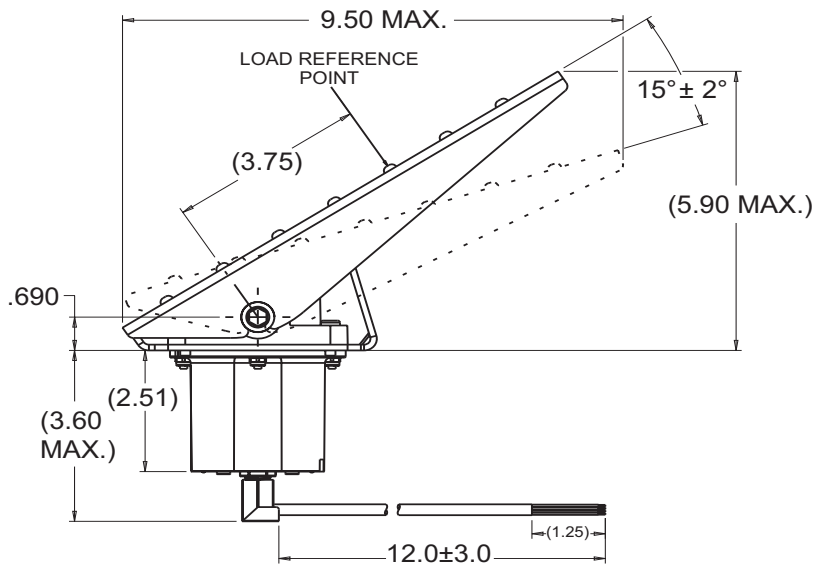
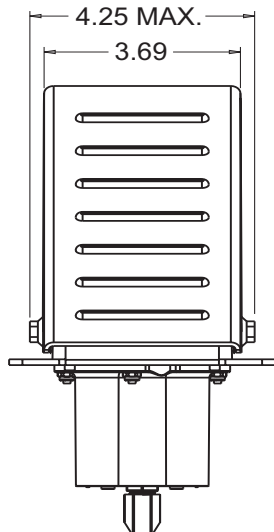
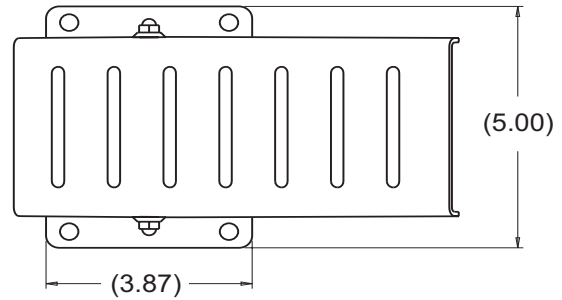
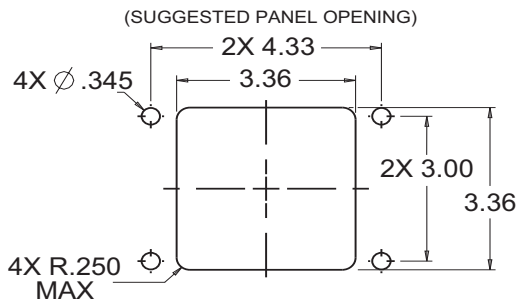
SINGLE DIRECTION & DUAL DIRECTION

HJFC PART NUMBER CODE

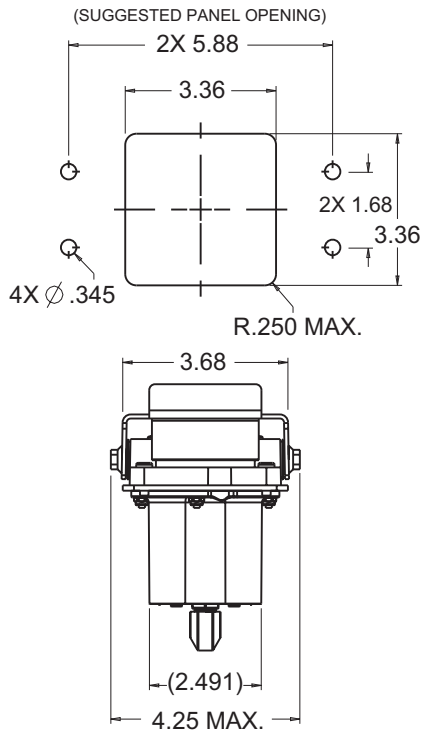
HJFC		-	X	X	X	X	X	X	X
Direction	Travel	Output*			Sealing	Power	Termination	Pedal	
1. Single	1. 15 Degrees Single Direction	1. Single Direction Analog Output: (Rest/Full) 0.5/4.5VDC			1. Fully Sealed	1. Regulated 5VDC Clean Supply, No Reverse Polarity Protection	1. 0.225" Dia., 12" Cable, Unterminated	1. Narrow Mounting**	
2. Dual	2. 13 Degrees Dual Direction	2. Dual Direction Analog Output: (REV/CTR/FWD) 0.5/2.5/4.5VDC			2. Unsealed	2. 12VDC Power Supply with Reverse Polarity Protection		2. Wide Mounting	
		3. Dual Direction Analog Output: (REV/CTR/FWD) 0.5/2.5/4.5VDC & Bidirectional Position Indication				3. 24VDC Power Supply with Reverse Polarity Protection			
		4. Dual Direction Dual Analog Output 1: (CTR/FWD) 0.5/4.5VDC Output 2: (REV/CTR) 4.5/0.5VDC							
		5. Single Direction Analog Output: (Rest/Full) 0.5/4.5VDC & Unidirectional Position Indication							
		6. Single Direction Dual Analog Output 1: (Rest/Full) 0.5/4.5VDC Output 2: (Rest/Full) 4.5/0.5VDC							
		7. Dual Direction Analog Output 1: (REV/CTR/FWD) 0.5/2.5/4.5VDC Output 2: (REV/CTR/FWD) 0.5/2.5/4.5VDC							
		8. Dual Direction Dual Analog Output 1: (REV/CTR/FWD) 0.5/2.5/4.5 Output 2: (REV/CTR/FWD) 4.5/2.5/0.5							

* Additional configurations are available. Contact factory.
** Unidirectional not available in Narrow Mounting.

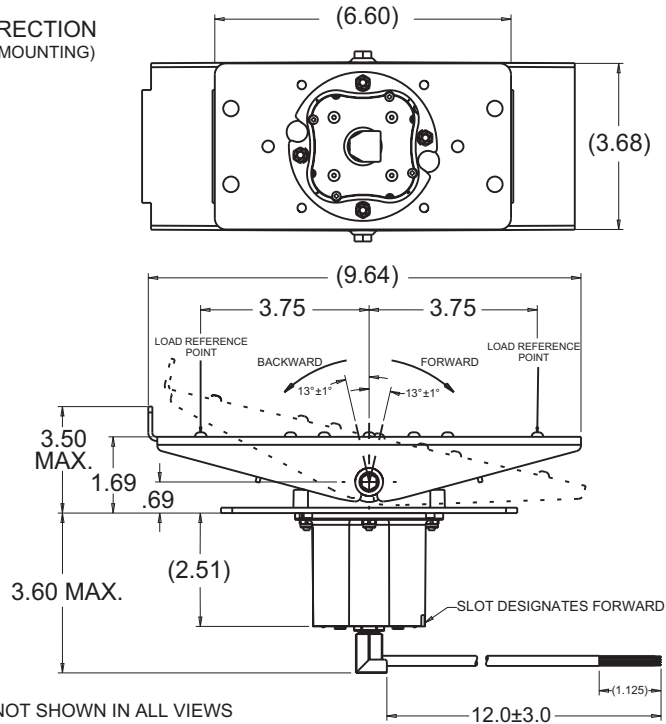
SINGLE DIRECTION WIDE MOUNTING



SINGLE DIRECTION & DUAL DIRECTION

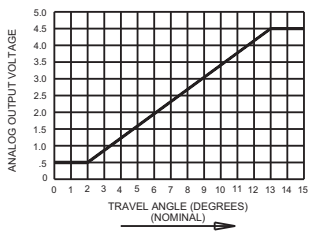


DUAL DIRECTION
(NARROW MOUNTING)

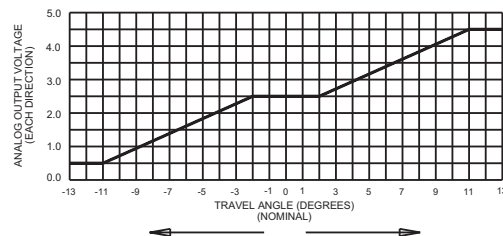


CABLE NOT SHOWN IN ALL VIEWS

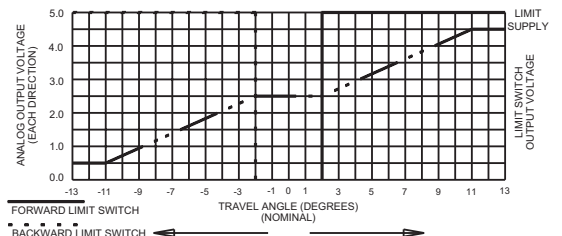
OUTPUT OPTIONS



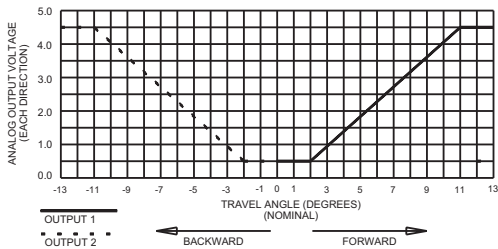
OPTION 1



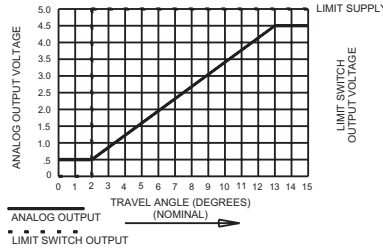
OPTION 2



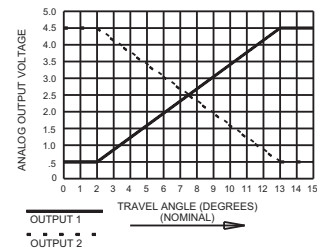
OPTION 3



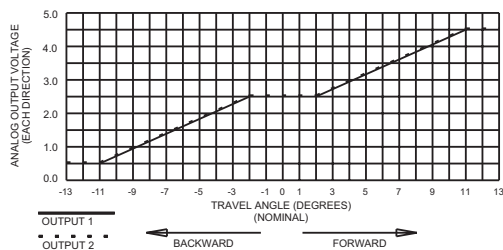
OPTION 4



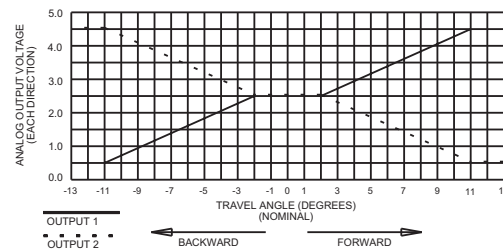
OPTION 5



OPTION 6



OPTION 7



OPTION 8

HALL EFFECT PUSHBUTTON SWITCHES

HP7
HALL EFFECT
PUSHBUTTONS

10 MILLION CYCLES, CONTACTLESS HALL EFFECT TECHNOLOGY

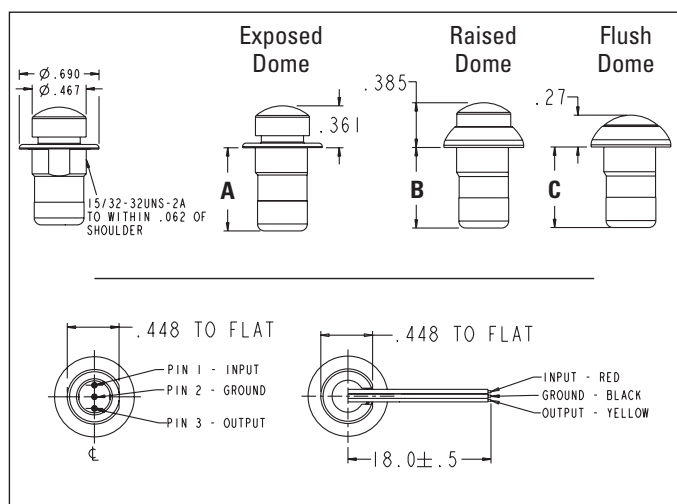
Designated the HP7 series, these momentary pushbutton switches utilize Hall effect sensor technology for long life force contactless switching, with 10 million cycles. Available in dusttight and moistureproof sealed configurations, these switches can also be watertight sealed to IP68S. The stylish dome-shaped pushbuttons are available in nine colors.

Case and bezel are precision-machined aluminum alloy, available with either a black or clear coat anodized finish. Three case and button styles are offered in raised dome, flush dome and exposed dome styles. PC pins or wire leads are standard, with value-added connectors available to specification.

This rugged switch is designed to withstand harsh environments while being subjected to high rates of actuation. Applications that require repeated "jogging" and other continuous operations are prime applications for the HP7 Hall Effect Switch. Examples of such can be found in material handling equipment such as loaders, lift trucks, bucket and shovel, and other applications where positioning of the load is critical.

Features:

- 10 million cycles
- Hall effect sensor technology for long life
- Moistureproof & dusttight to IP64 or watertight to IP68S
- Stylish dome-shaped buttons in 9 colors
- Momentary action
- Choice of termination styles
- Mechanical detent available for tactile feedback
- RoHS/WEEE/Reach compliant

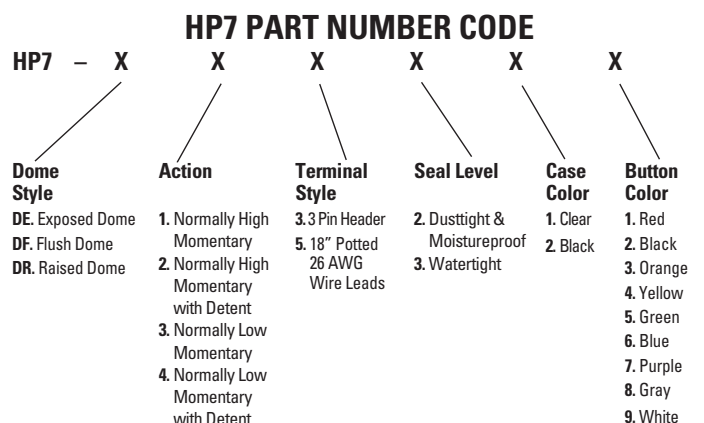


	PIN HEAD	WIRE LEAD
A - Exposed Dome	.716	.652
B - Raised Dome	.693	.628
C - Flush Dome	.693	.628



Standard Characteristics/Ratings:

MECHANICAL:			
Mechanical Life:	10,000,000 cycles without detent		
Button Travel:	0.080 inches max		
Overtravel:	0.010 inches min		
Operating Force:	Without detent: 16 oz +/- 8 oz With detent: 28 oz +/- 8 oz		
Operating Point:	0.040 inches +/- 0.010		
Electrical Life:	10,000,000 cycles		
ELECTRICAL RATINGS: Rated at Vcc = 5V @ 25°C Load = 1mA (4.7KΩ)			
Electrical	Units	Min	Max
Supply Voltage	VDC	4.5	24
Reverse Output Voltage	VDC	N/A	0.5
Supply Current	mA	N/A	9
Continuous Output Current	mA	N/A	25
Reverse Battery Protection	VDC	N/A	-30
ELECTRONICS:			
Seal Integrity:	IP64 or IP68S		
ENVIRONMENTAL:			
Operating Temp Range:	-40°C to +85°C		
Storage Temp Range:	-55°C to +105°C		
MATERIALS:			
Button:	Thermoplastic		
Case:	Aluminum alloy		
Mounting Hardware:	Hex nut & lockwasher		



10 MILLION LINEAR OUTPUT CYCLES USING CONTACTLESS HALL EFFECT TECHNOLOGY

The HPL Hall Effect Linear Output Pushbutton Switch is a revolutionary switch utilizing Hall effect technology to provide the user an output proportional to the travel of the button. The HPL delivers up to 10 million cycles. This rugged switch is ideal for applications where a simple on/off control is insufficient and a linear output is desired. Using the HPL, an operator can control the motion of a device as well as the speed of the movement. The HPL switch is an ideal control device for valves and variable speed drives, and can be used in industrial control, heavy equipment and material handling applications.

The HPL is offered as a stand-alone switch and in a dual HPL rocker assembly. As with all OTTO switches, a wide variety of case and button styles and colors are offered, along with various termination styles and two levels of sealing. OTTO can provide custom configurations as well as provide the HPL switches installed in a control grip.



HPL-4 15/32" - 32
Thread Rear Mount
Shown with Wire
Leads



HPL-R Hall
Effect Rocker



HPL-3 -
5/8" Front Mount
with Wire Leads

Features:

- Programmable outputs of 0.5 to 4.5 volts
- 10 million cycles
- Hall effect for reliable contactless switching
- Watertight per IP68S available
- Front or behind panel mounting
- Choice of termination styles
- Rocker version available
- RoHS/WEEE/Reach compliant

HPL PART NUMBER CODE

HPL	-	X	X	X	X	X	X
Case Style		Output	Terminal Style	Seal Level	Case Color	Button Color	Button Style*
1. Press Fit		1. 1.0 - 4.0VDC	1. 3 Straight Pins, 0.100" Centers	1. IP65 Splashproof	1. Clear Anodized	1. Red	1. 0.375" OD (Case Styles 1, 3, 4 & 6)
3. Front Mount 5/8" Thread		2. 4.0 - 1.0VDC	2. 18" Potted 22 AWG Wire Leads	2. IP68S Watertight	2. Black Anodized	2. Black	2. 0.500" OD Domed (Case Styles 1, 3 & 6)
4. Rear Mount 15/32" Thread		3. 0.5 - 4.5VDC				3. Orange	R. Rocker Assembly (Case Style R)
6. Rear Mount 5/8" Thread		4. 4.5 - 0.5VDC				4. Yellow	
R. Rocker Assembly						5. Green	
						6. Blue	
						7. Purple	
						8. Gray	
						9. White	

* For availability of larger button diameters, contact factory.

HALL EFFECT LINEAR OUTPUT PUSHBUTTONS

HPL
LINEAR OUTPUT
PUSHBUTTONS

10 MILLION LINEAR OUTPUT CYCLES USING CONTACTLESS HALL EFFECT TECHNOLOGY

Standard Characteristics/Ratings:

MECHANICAL:

Mechanical Life:	1,000,000 cycles full stroke per button, IP68S rated 10,000,000 cycles full stroke per button, IP64 rated
Button Travel:	0.135 inches min to 0.160 inches max
Full Travel Force:	0.15 inches, 3.0 lbs. typical to 3.8 lbs. max @ 25°C
Reset Force:	5 oz min @ 25°C
Electrical Life:	10,000,000 cycles

ELECTRICAL RATINGS: Rated at Vcc = 5V @ 25°C Load = 1mA (4.7KΩ)

Electrical	Units	1 - 4 Volts			4 - 1 Volts			0.5 - 4.5 Volts			4.5 - 0.5 Volts		
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max
Supply Voltage	VDC	4.5	5	5.5	4.5	5	5.5	4.5	5	5.5	4.5	5	5.5
Output Voltage (Button Up)	VDC @ 5V Vcc	0.85	1	1.15	3.85	4	4.15	0.35	0.5	0.65	4.35	4.5	4.85
Output Voltage (Button Down)	VDC @ 5V Vcc	3.85	4	4.15	0.85	1	1.15	4.35	4.5	4.65	0.35	0.5	0.65
Supply Current	mA	N/A	8	10	N/A	8	10	N/A	8	10	N/A	8	10
Continuous Output Current	mA	-1	N/A	1	-1	N/A	1	-1	N/A	1	-1	N/A	1
Output Resistance (Io ≤ -2mA)	Ω	N/A	1	10	N/A	1	10	N/A	1	10	N/A	1	10

ELECTRONICS:

Seal Integrity: IP65 or IP68S

ENVIRONMENTAL:

Operating Temp Range: -40°C to +85°C

Storage Temp Range: -65°C to +105°C

Humidity: 96% RH, 70°C, 96 hours

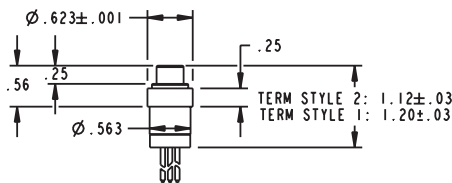
MATERIALS:

Housing: Anodized Aluminum alloy

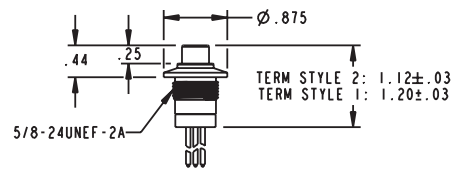
Button Cap: Thermoplastic

Mounting Hardware: Lockwasher, hex nut, washer when applicable

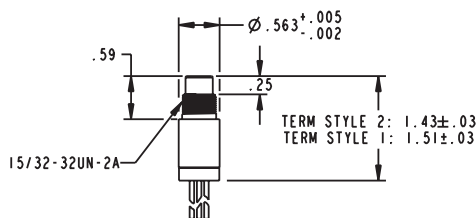
.375" O.D. Button Style



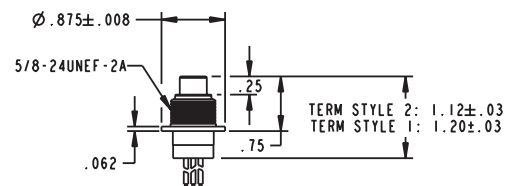
HPL - 1XXXXXI
PRESS FIT



HPL - 3XXXXXI
5/8" THREAD
FRONT MOUNT



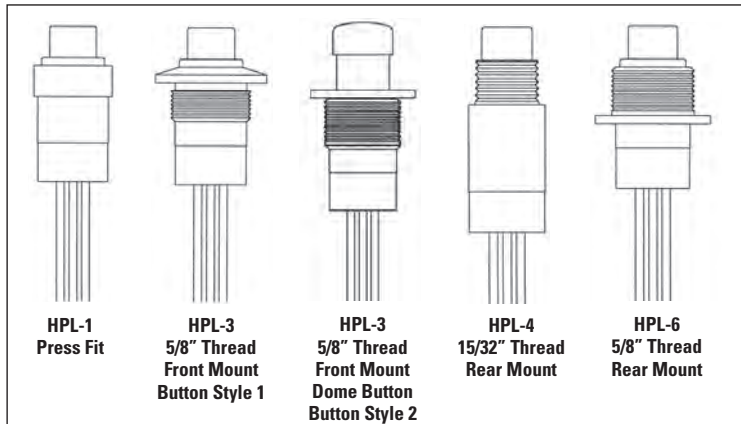
HPL - 4XXXXXI
15/32" THREAD
REAR MOUNT



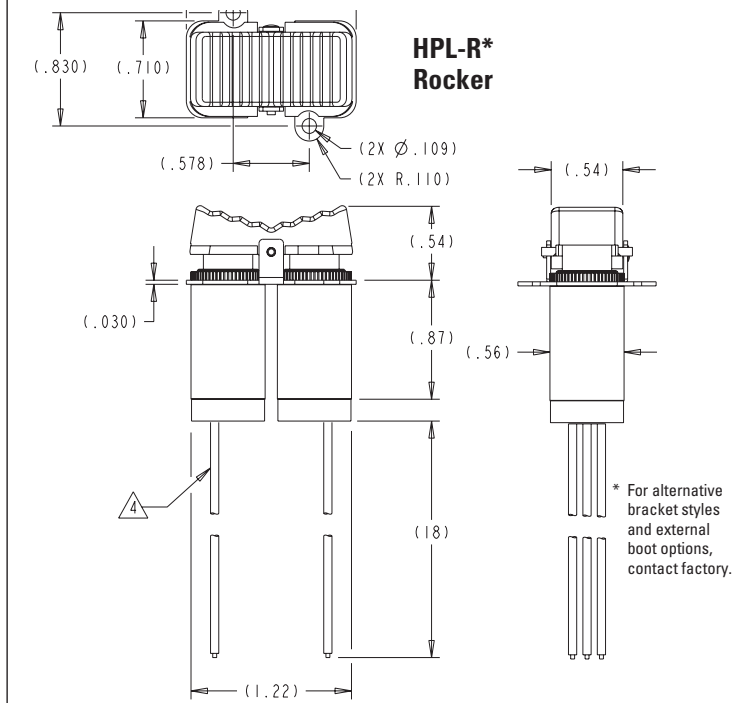
HPL - 6XXXXXI
5/8" THREAD
REAR MOUNT

10 MILLION LINEAR OUTPUT CYCLES USING CONTACTLESS HALL EFFECT TECHNOLOGY

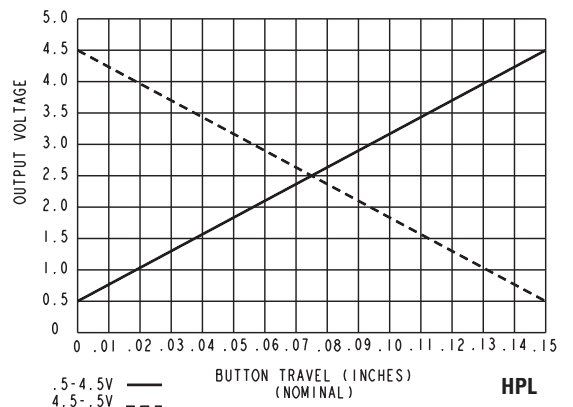
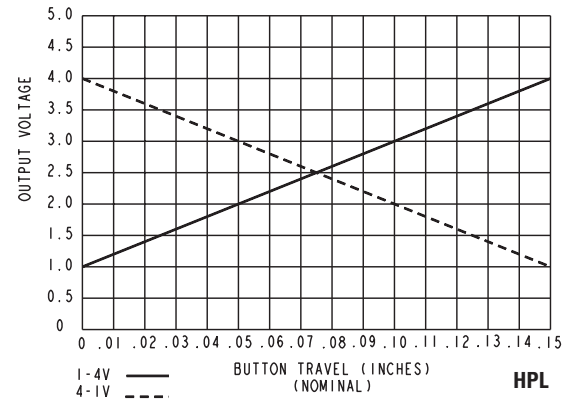
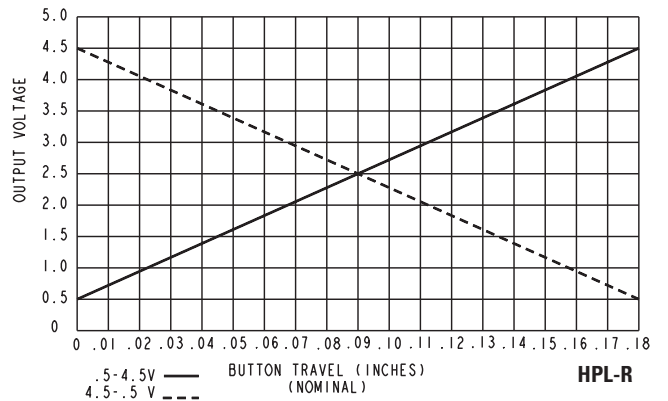
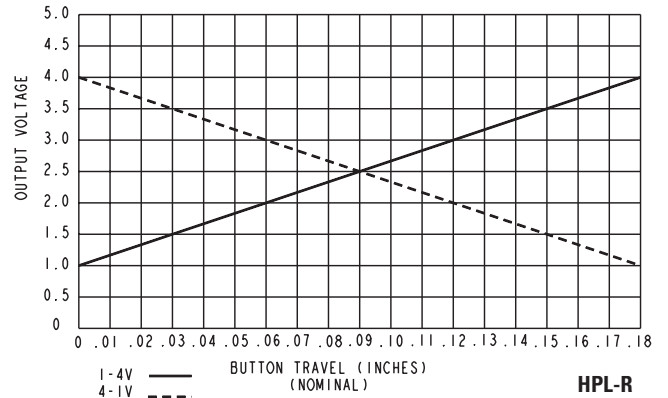
Case Styles



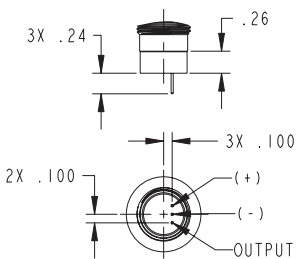
HPL dimensions are equivalent to standard OTTO P1 Pushbutton dimensions as shown in the catalog except for overall length. Total button height is 0.25" on standard 0.375" OD buttons. Overall length from button top to rear of potting is 1.26" nominal, except for the HPL-4 and 0.500" OD button styles which measure 1.56". Panel mounting hardware is included, except with the HPL-1 which is meant to press fit into mounting hole in a control grip. Refer to the dimensions shown or consult OTTO to design the control grip to meet your specifications.



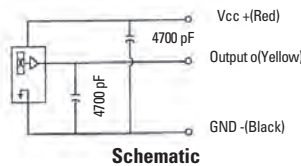
Linear Output Graphs (Vcc = 5V @ 20°C)



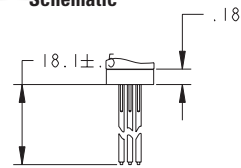
Terminal Styles



TERMINAL STYLE 1
3 STRAIGHT PINS
.100 CENTERS



Schematic



TERMINAL STYLE 2
18" POTTED
22 AWG, UL 1569
WIRE LEADS

HALL EFFECT SINGLE AXIS PADDLE

HPW
HALL EFFECT
PADDLE

ONE MILLION CYCLE ROTATIONAL LIFE



The HPW series is available with eight output options. The HPW series offers a self-centering single axis actuator that provides linear change in voltage output in either direction from center. Options include increasing or decreasing voltage output in either direction from center position to the full travel position in either direction, and single or dual outputs in either direction. The HPW series provides a one million cycle full forward to full back life and the electronics are sealed to IP68S, all the while offering outstanding EMI/RFI immunity.

Features:

- Designed for grip, armrest & panel mounting
- Proven contactless analog output Hall effect technology
- 8 output options available
- Self-centering, single axis actuator
- 1,000,000 mechanical life
- Electronics watertight to IP68S
- 100V/M EMI/RFI immunity
- RoHS/WEEE/Reach compliant

Standard Characteristics/Ratings:				
MECHANICAL:				
Mechanical Life:	1,000,000 full forward to full back			
Travel:	Full travel angle each direction from center to 25° typical			
Operating Force:	4 oz typical @ 25°			
Max Allowable Radial Load:	30.0 lbs.			
ELECTRICAL RATINGS: Vcc = 5V @ 25°C Load = 1mA (4.7KΩ)				
Electrical	Units	Min	Typ	Max
Supply Voltage	VDC	4.5	5	5.5
Output Voltage Tolerance at Center (see graph for output values)	VDC @ 5V Vcc	-0.25	N/A	+0.25
Output Voltage Tolerance at Full Travel (see graph for output values)	VDC @ 5V Vcc	-0.25	N/A	+0.25
Supply Current Options A & D (B = 0, Vcc = 5V, Io = 0)	mA	N/A	8	10
Supply Current All Other Options (B = 0, Vcc = 5V, Io = 0)	mA	N/A	16	20
ENVIRONMENTAL:				
Operating Temp Range:	-40°C min to +85°C max			
Humidity:	96% RH, 70°C, 96 hours			
Vibration:	Per MIL-DTL-810F minimum integrity			
Sand/Dust:	Per SAE J1455			
Seal Integrity:	Electronics watertight per IP68S			
EMI:	Withstand per MIL-STD-461D/SAE J1113-22			
RFI:	Withstand 100 V/M, 14Hz to 1GHz			

HPW PART NUMBER CODE

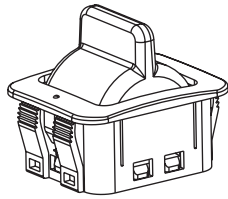
HPW	-	X	X	X	X	X	X
Button Style	Output 1*	Output 2**	Operating Force	Termination	Bezel Color	Button Color	
1. Paddle Style	A. 2.5 +/- 2.0VDC	NONE	1.4.0 oz	A. 22 AWG 18.3" Long, Stripped Ends	1. Red	1. Red	
2. Lever Style	B. 2.5 +/- 2.0VDC	2.5 +/- 2.0VDC		B. 0.025" SQ. Pins, Tin Plated	2. Black	2. Black	
	C. 2.5 +/- 2.0VDC	2.5 +/- 2.0VDC			3. Orange	3. Orange	
	D. 2.5 +/- 1.5VDC	NONE			4. Yellow	4. Yellow	
	E. 2.5 +/- 1.5VDC	2.5 +/- 1.5VDC			5. Green	5. Green	
	F. 2.5 +/- 1.5VDC	2.5 +/- 1.5VDC			6. Blue	6. Blue	
	G. 1.0 - 4.0VDC	1.0 - 4.0VDC			7. Violet	7. Violet	
	H. 0.5 - 4.5VDC	0.5 - 4.5VDC			8. Gray	8. Gray	
					9. White	9. White	

* Outputs are from the center position to the full travel position in each direction. Options A-F provide increasing voltage in Direction 1 and decreasing voltage in Direction 2 from a single output. Options G and H provide increasing voltages in both directions from two separate outputs.

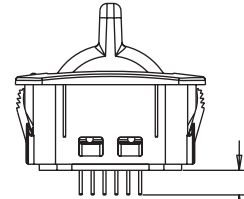
** Options B and E provide redundant output 2 which duplicates output 1. Options C and F provide redundant output 2 which is inverse of output 1.

HALL EFFECT SINGLE AXIS PADDLE

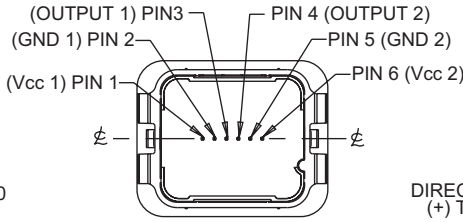
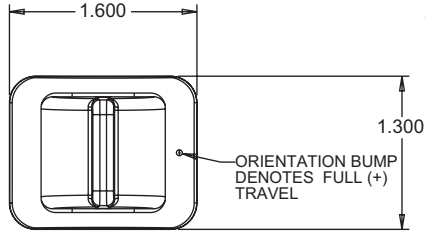
ONE MILLION CYCLE ROTATIONAL LIFE



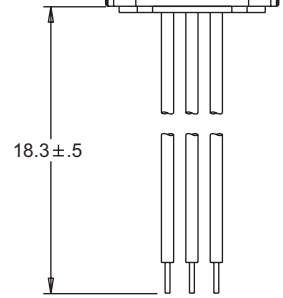
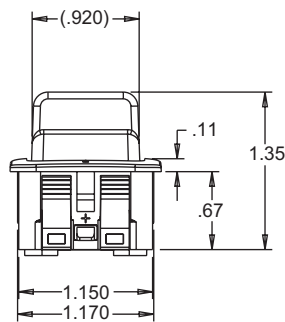
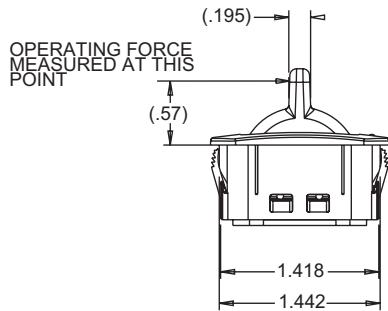
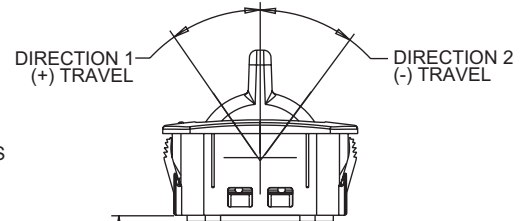
PADDLE STYLE



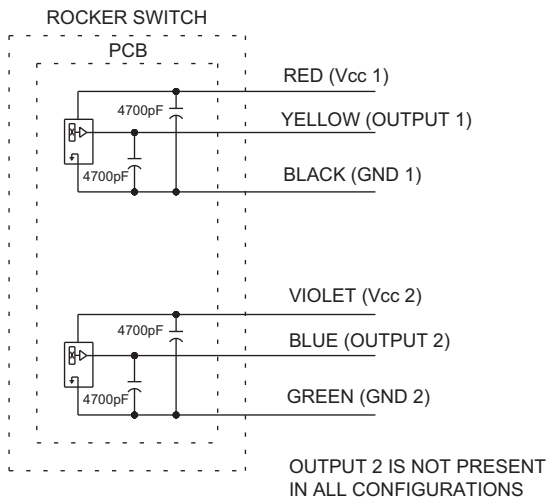
(.100) TYP. →
← (.20) TYP.
← .025 ± .002 SQUARE



PINNED TERMINATION
NOT ALL PINS ARE PRESENT
IN ALL OUTPUT CONFIGURATIONS

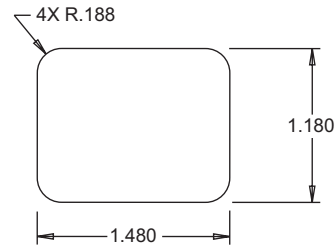


WIRED TERMINATION
NOT ALL WIRES ARE PRESENT
IN ALL OUTPUT CONFIGURATIONS



RECOMMENDED PANEL THICKNESS: 0.100 OPTIMUM THICKNESS (0.065 MIN. - 0.175 MAX.)

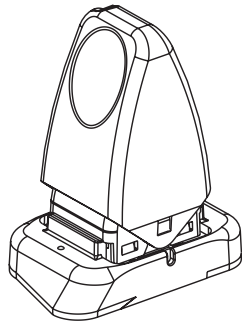
RECOMMENDED PANEL OPENING: 1.180 X 1.480 OPTIMUM (1.175/1.185 X 1.475/1.485)



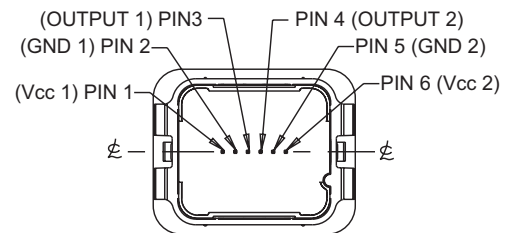
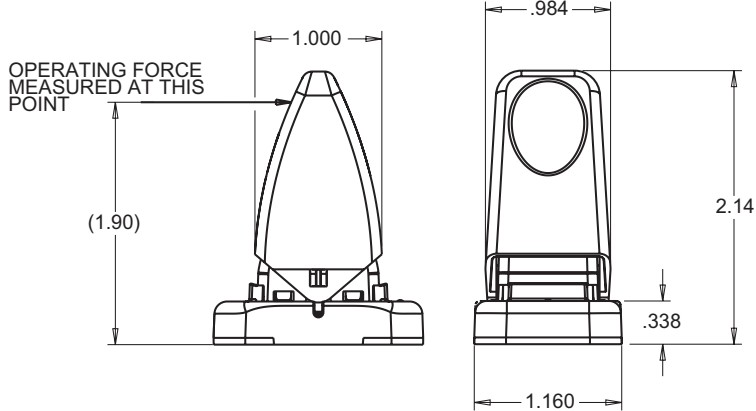
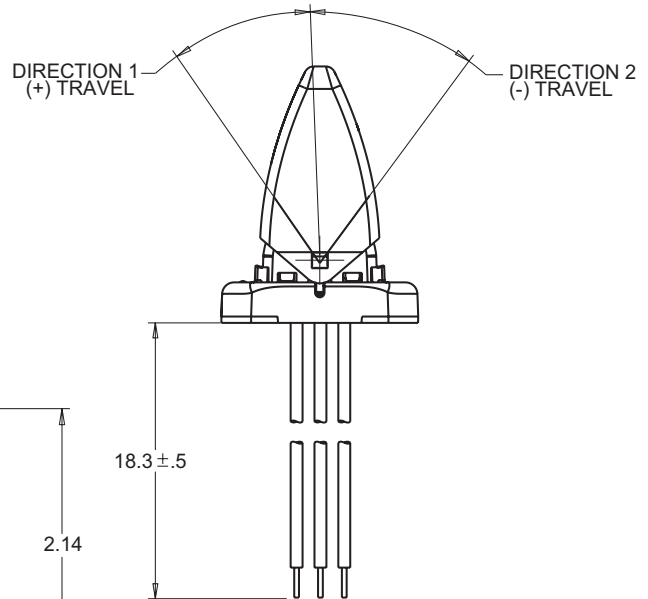
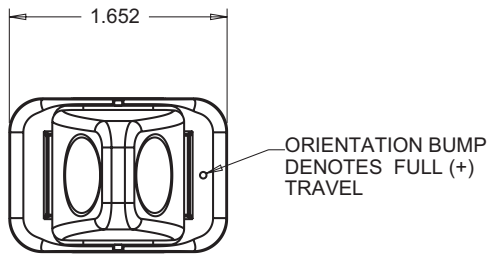
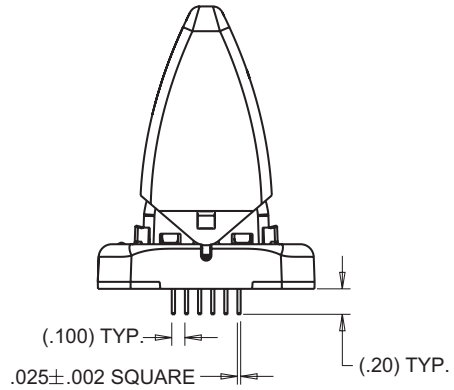
HALL EFFECT SINGLE AXIS PADDLE

HPW
HALL EFFECT
PADDLE

ONE MILLION CYCLE ROTATIONAL LIFE

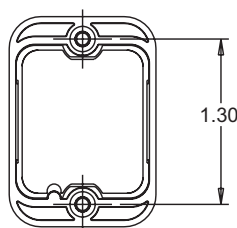
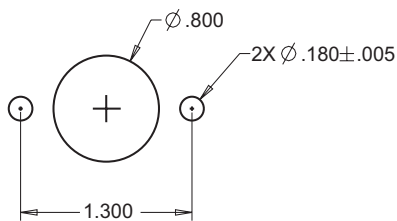


LEVER STYLE



RECOMMENDED PANEL THICKNESS: 0.130 OPTIMUM THICKNESS
(0.125 MIN. - 0.135 MAX.)

RECOMMENDED PANEL OPENING: \varnothing 0.800 OPTIMUM
(0.750 MIN. - 0.850 MAX.)

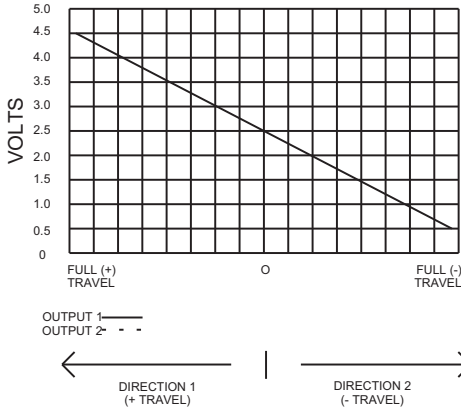


PINNED TERMINATION
NOT ALL PINS ARE PRESENT
IN ALL OUTPUT CONFIGURATIONS

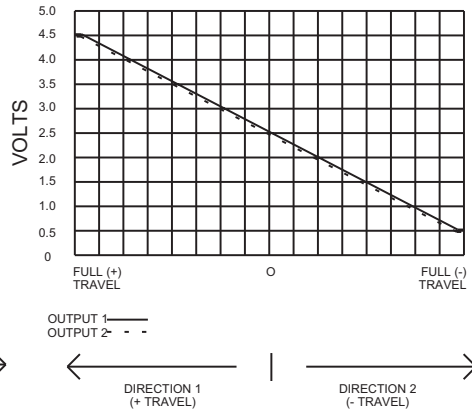
HALL EFFECT

ONE MILLION CYCLE ROTATIONAL LIFE

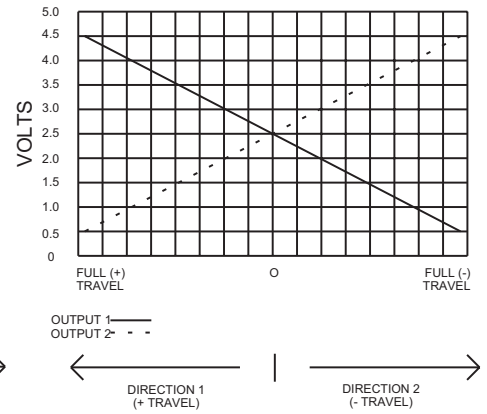
OPTION A



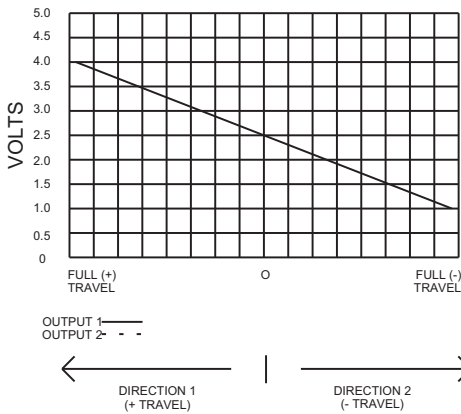
OPTION B



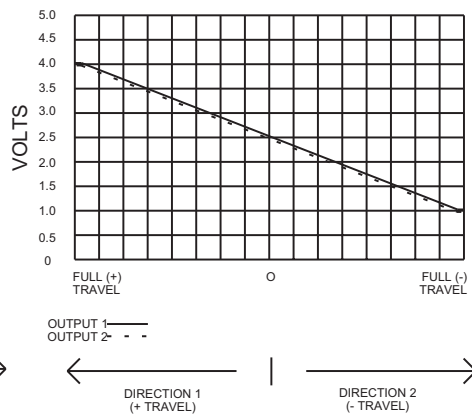
OPTION C



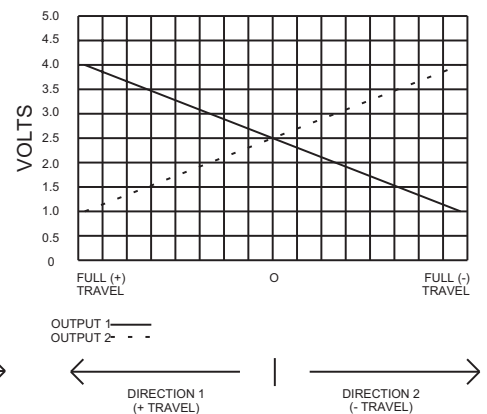
OPTION D



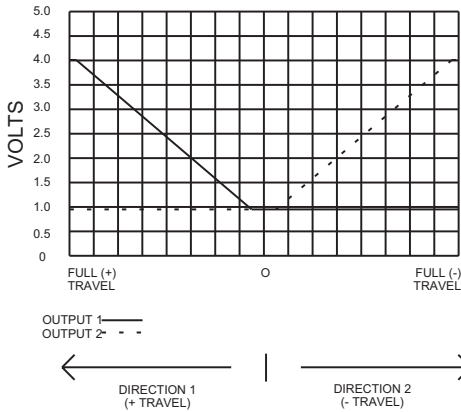
OPTION E



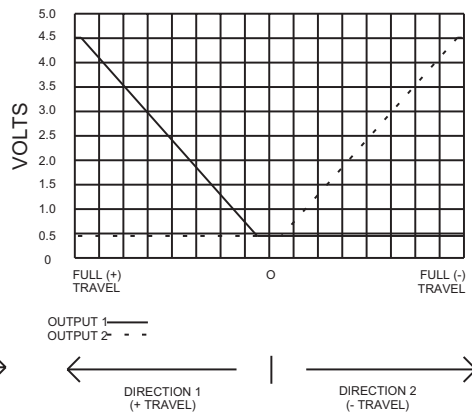
OPTION F



OPTION G



OPTION H



LINEAR HALL EFFECT FINGER JOYSTICK

HTL
HALL EFFECT
JOYSTICK

2 & 4-WAY LINEAR HALL EFFECT FINGER JOYSTICK



HTL4 with Castle Style Button

The HTL series provides all of the performance of a full size, dual axis joystick in a miniature package that can be mounted in control handles, armrests and panels. The Hall effect sensors are immune to electromagnetic and radio frequency interference up to 100V/M. Programmable sensors with built-in temperature compensation ensure consistent and repeatable operation. The HTL series has excellent tactile feel for improved operator control and is available with either dusttight or IP68S watertight seal. A wide variety of output configurations are available to satisfy different applications.

Features:

- Designed for grip, armrest & panel mounting
- Proven contactless analog output Hall effect technology
- Redundant outputs available
- 1 million cycles
- Electronics watertight to IP68S
- Outstanding EMI/RFI immunity
- Variety of button styles
- RoHS/WEEE/Reach compliant

Standard Characteristics/Ratings:

MECHANICAL:

Mechanical Life: 1,000,000 all directions

Travel Angle: 23° min to 27° max

Operating Force with Boot: 16 oz typical to 20 oz max (at top of button) @ 25°C

Max Allowable Vertical & Radial Force on Button: 25.0 lbs.

Max Allowable Torque on Button: 7.5 lbs.

ELECTRICAL RATINGS:

HTL2: Rated at Vcc = 5V @ 20°C Load = 1mA (4.7KΩ)

Electrical	Units	Min	Typ	Max
Supply Voltage	VDC	4.5	5	5.5
Output Voltage Tolerance at Center <i>(see graph for output values)</i>	VDC @ 5V Vcc	-0.25	N/A	+0.25
Output Voltage Tolerance at Full Travel <i>(see graph for output values)</i>	VDC @ 5V Vcc	-0.25	N/A	+0.25
Supply Current per Sensor	mA	N/A	N/A	10
Output Source Current	mA	-1	N/A	1
Output Resistance (Io ≤ 2mA)	Ω	N/A	1	10

HTL4: Rated at Vcc = 5V @ 20°C Load = 1mA (4.7KΩ)

Electrical	Units	Min	Typ	Max
Supply Voltage	VDC	4.5	5	5.5
Output Voltage Tolerance at Center <i>(see graph for output values)</i>	VDC @ 5V Vcc	-0.25	N/A	+0.25
Output Voltage Tolerance at Full Travel <i>(see graph for output values)</i>	VDC @ 5V Vcc	-0.25	N/A	+0.25
Supply Current per Sensor	mA	N/A	8	10
Output Source Current Limit	mA	-1	N/A	+1

ELECTRONICS

Seal Integrity: Electronics IP68S

ENVIRONMENTAL:

Operating Temp Range: -40°C to +85°C

Storage Temp Range: -40°C to +85°C

RFI: Withstand 100V/M, 14Hz to 1GHz

EMI: Withstand per MIL-STD-461D/SAE J1113-22 at 50Hz and 60Hz

MATERIALS:

Boot:	Elastomer
Button:	Thermoplastic, black
Case:	Thermoplastic, black
Flange:	Thermoplastic, black
Wires:	22 or 24 AWG
Mounting Hardware:	Panel fastener assembly

2 & 4-WAY LINEAR HALL EFFECT FINGER JOYSTICK

HTL2 PART NUMBER CODE

HTL2	-	X	X	X	X	1	X	XX	X	X
Button Style	Case Style	Seal	Travel	Operating Force	Output 1 ①	Output 2 ②	Termination	Button Color		
1. Castle	1. 0.970" SQ.	1. Dusttight	1. 25°	1. 16 oz	AA. 2.5 +/- 2.0VDC	NONE	1. Wire Leads	2. Black		
2. External Castle Boot		2. Watertight *			BB. 2.5 +/- 2.0VDC	2.5 +/- 2.0VDC	22 AWG, UL 1569			
3. Short Double Stadium					CC. 2.5 +/- 2.0VDC	2.5 -/+ 2.0VDC	2. Pins			
4. Tall Concave Stadium					DD. 2.5 +/- 1.5VDC	NONE	3. Wire Leads			
5. External Bat Handle Boot					EE. 2.5 +/- 1.5VDC	2.5 +/- 1.5VDC	24 AWG, SAE AS22759			
6. External Smooth Boot					FF. 2.5 +/- 1.5VDC	2.5 -/+ 1.5VDC				
7. Long Concave Y Axis Button					GG. 0.5 - 4.5VDC	0.5 - 4.5VDC				
					HH. 1.0 - 4.0VDC	1.0 - 4.0VDC				

* Watertight sealed option available with button styles 2, 5 and 6.

① Outputs are from the center to the full travel position. Options "AA," "BB," "CC," "DD," "EE," and "FF" provide increased voltage in +Y; and decreasing voltage in -Y direction from one output per axis. Options "GG" and "HH" provide increasing voltages in all directions (+Y, -Y) from 2 outputs per axis.

② Options "BB" and "EE" provide redundant output 2 which duplicates output 1. Options "CC" and "FF" provide redundant output 2 which is inverse of output 1.

HTL4 PART NUMBER CODE

HTL4	-	X	X	X	X	X	XX	X	X
Button Style	Case Style	Seal	Travel	Gating	Operating Force	Output 1 ①	Output 2 ②	Termination	Button Color
1. Castle	1. 0.970" SQ.	1. Dusttight	1. 25°	1. Omnidirectional; Square on Axis Guided Feel**	1. 16 oz	AA. 2.5 +/- 2.0VDC	NONE	1. Wire Leads	2. Black
2. External Castle Boot		2. Watertight *		2. Gated; Dual Axis Return to Center		BB. 2.5 +/- 2.0VDC	2.5 +/- 2.0VDC	22 AWG UL 1569	
3. Short Double Stadium				3. Omnidirectional; Round: Smooth Feel		CC. 2.5 +/- 2.0VDC	2.5 -/+ 2.0VDC	2. Pins	
4. Tall Concave Stadium						DD. 2.5 +/- 1.5VDC	NONE	3. Wire Leads	
5. External Bat Handle Boot						EE. 2.5 +/- 1.5VDC	2.5 +/- 1.5VDC	24 AWG SAE AS22759	
6. External Smooth Boot						FF. 2.5 +/- 1.5VDC	2.5 -/+ 1.5VDC	4. Wire Leads	
7. Long Concave Y Axis Button						GG. 0.5 - 4.5VDC	0.5 - 4.5VDC	22 AWG, UL 1569 shared powers and grounds (see schematic)	
						HH. 1.0 - 4.0VDC	1.0 - 4.0VDC	5. Wire Leads	
								24 AWG, SAE AS22759 shared powers and grounds (see schematic)	

* Watertight sealed option available with button styles 2, 5 and 6.

① Outputs are from the center to the full travel position in each direction. Options "AA," "BB," "CC," "DD," "EE," and "FF" provide increased voltage in +X, +Y; and decreasing voltage in -X, -Y direction from one output per axis. Options "GG" and "HH" provide increasing voltages in all directions (+X, +Y, -X, -Y) from 2 outputs per axis.

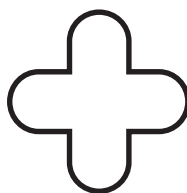
② Options "BB" and "EE" provide redundant output 2 which duplicates output 1. Options "CC" and "FF" provide redundant output 2 which is inverse of output 1.

**Positive tactile feel when moved off X and Y axis positions.

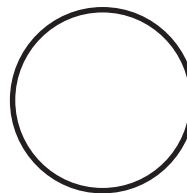
Gating Icons



Omnidirectional
Square On-Axis-
Guided Feel***



Gated
Dual Axis
Return to Center



Omnidirectional
Round
Smooth Feel



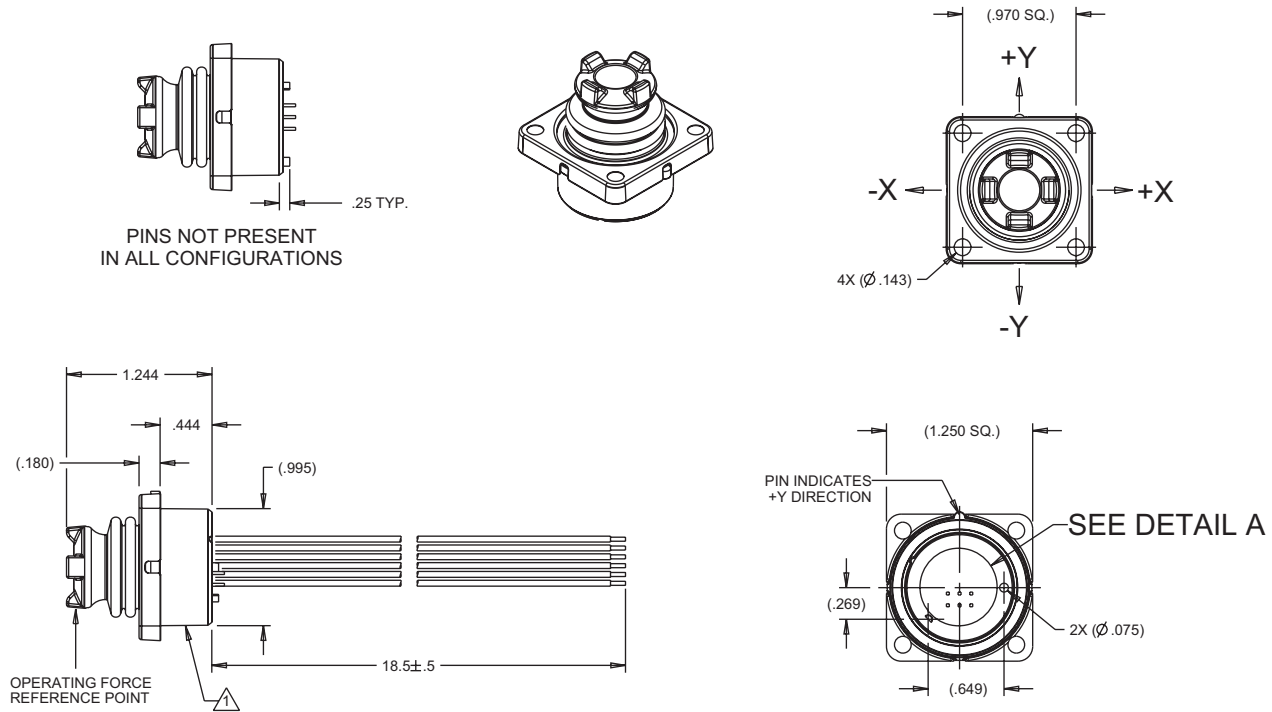
Single Axis
(HTL2 version)

***Feel defined by shading.

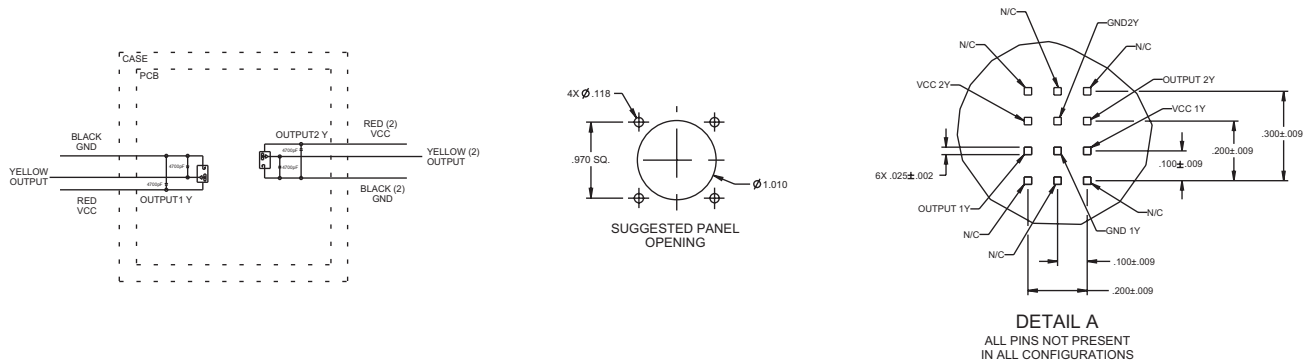
LINEAR HALL EFFECT TOGGLE

HTL
HALL EFFECT
TOGGLE

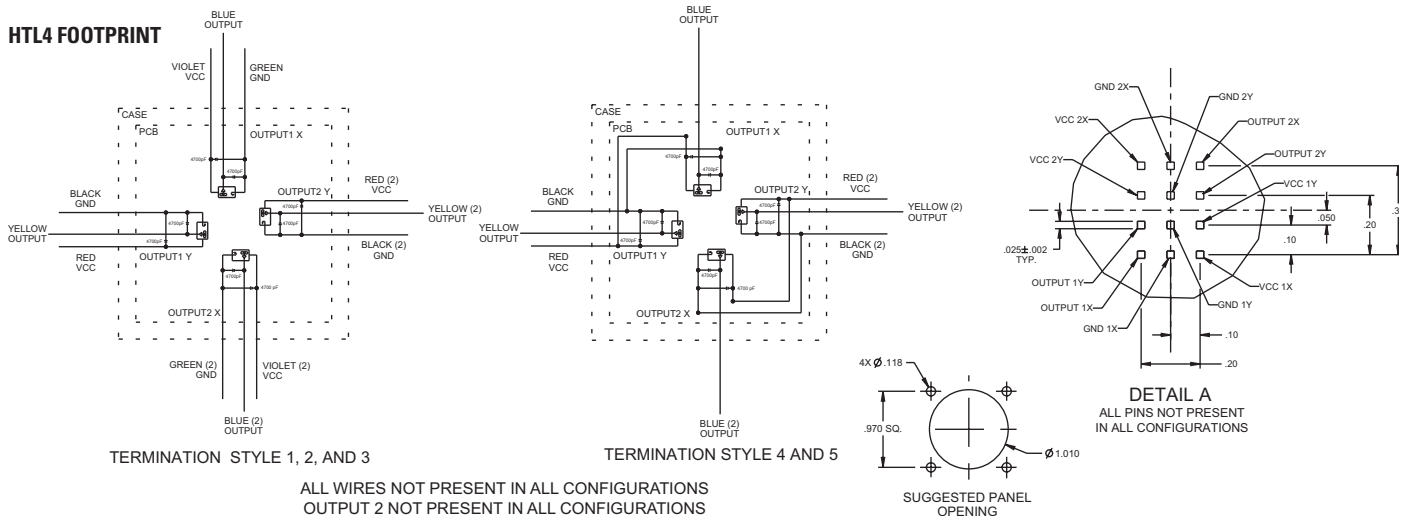
2 & 4-WAY LINEAR HALL EFFECT TOGGLE



HTL2 FOOTPRINT



HTL4 FOOTPRINT

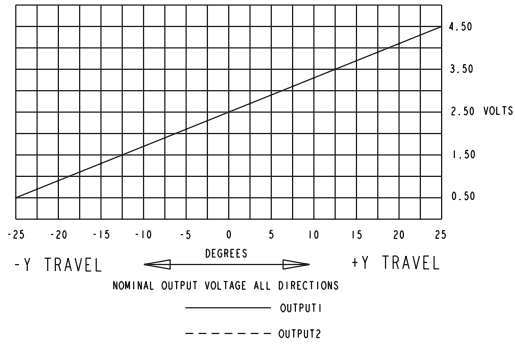


ALL WIRES NOT PRESENT IN ALL CONFIGURATIONS
OUTPUT 2 NOT PRESENT IN ALL CONFIGURATIONS

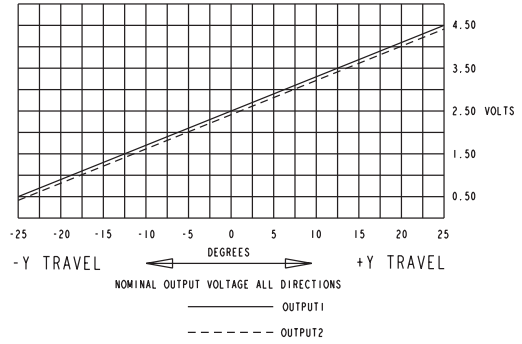
2 & 4-WAY LINEAR HALL EFFECT TOGGLE

HTL2 OUTPUTS

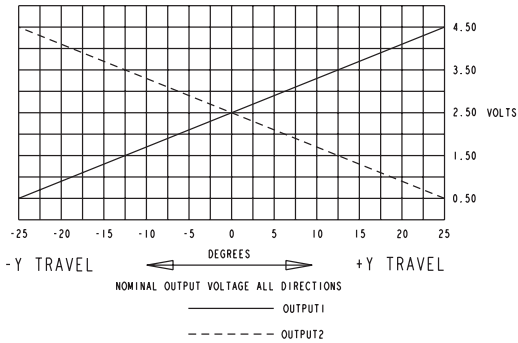
OPTION AA



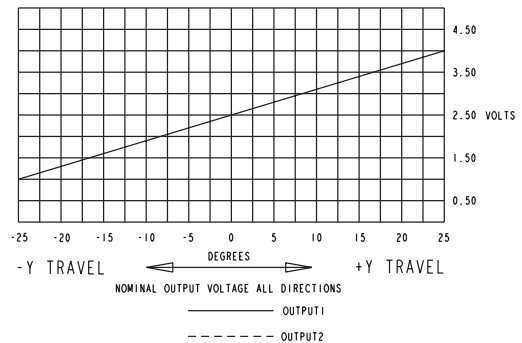
OPTION BB



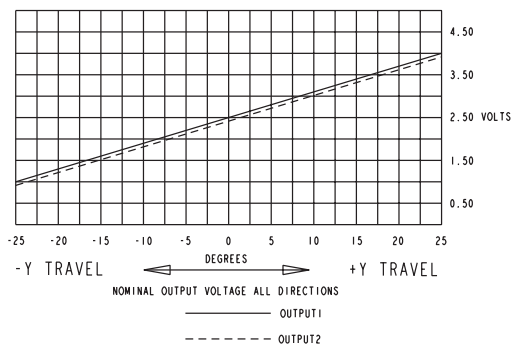
OPTION CC



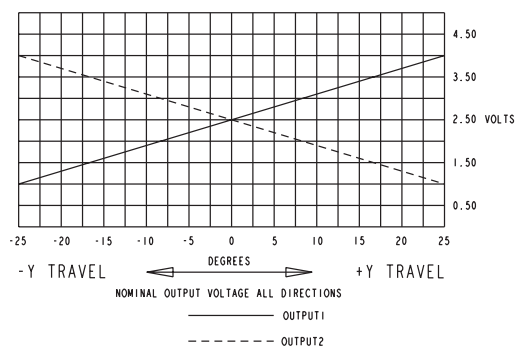
OPTION DD



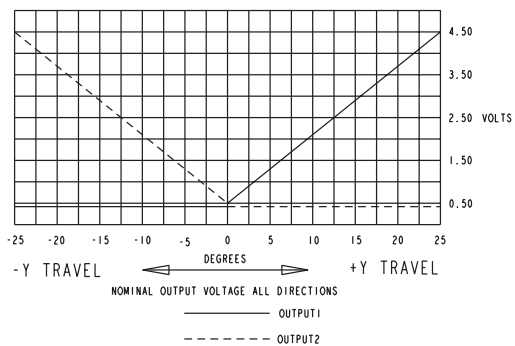
OPTION EE



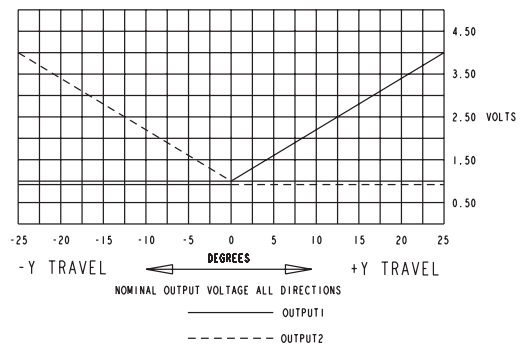
OPTION FF



OPTION GG



OPTION HH



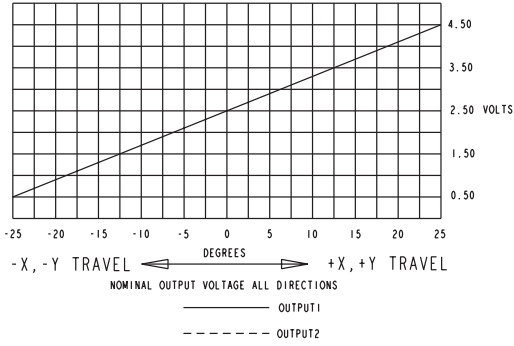
LINEAR HALL EFFECT TOGGLE

HTL
HALL EFFECT
TOGGLE

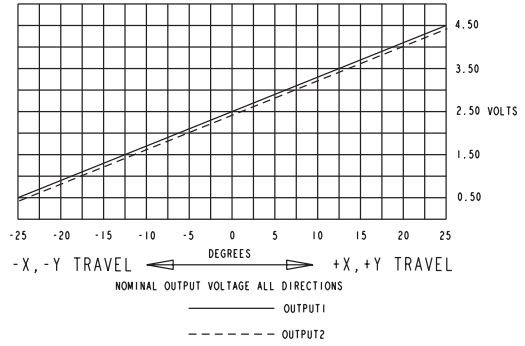
2 & 4-WAY LINEAR HALL EFFECT TOGGLE

HTL4 OUTPUTS

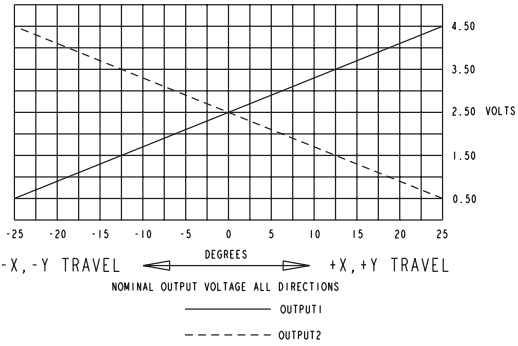
OPTION AA



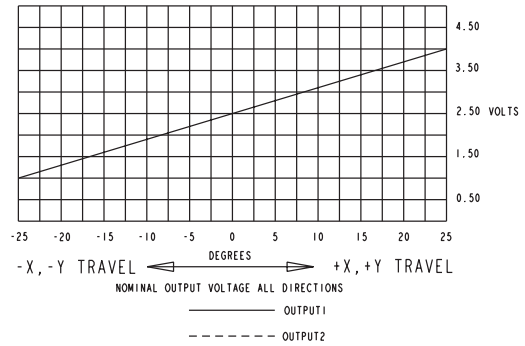
OPTION BB



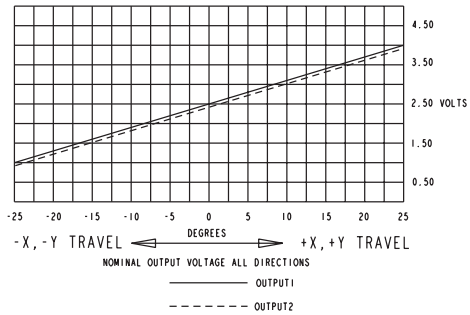
OPTION CC



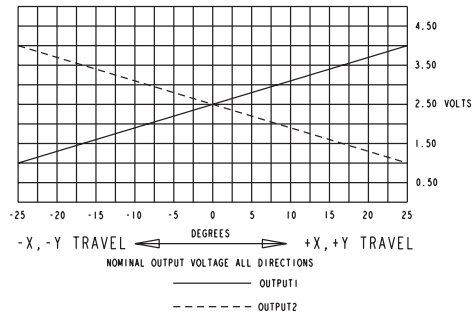
OPTION DD



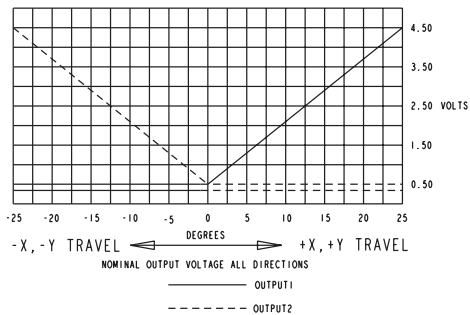
OPTION EE



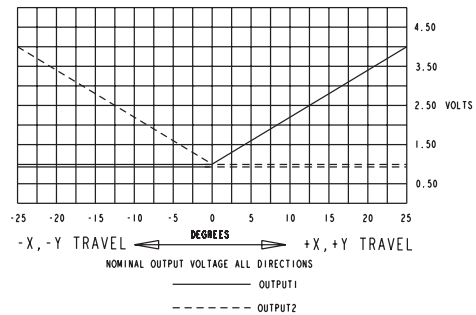
OPTION FF



OPTION GG

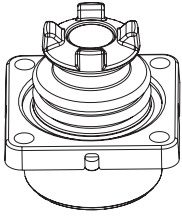


OPTION HH

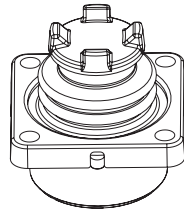


LINEAR HALL EFFECT TOGGLE

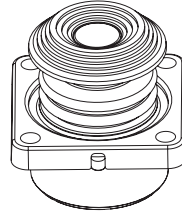
BUTTON STYLE



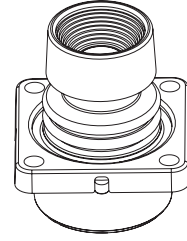
BUTTON STYLE 1
(CASTLE)



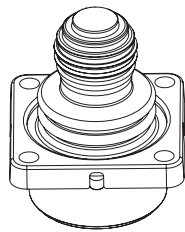
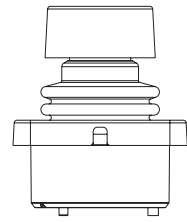
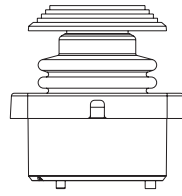
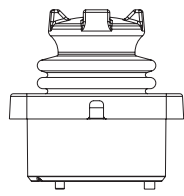
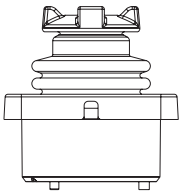
BUTTON STYLE 2
(EXTERNAL CASTLE BOOT)



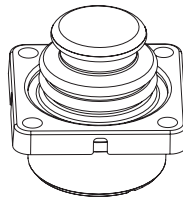
BUTTON STYLE 3
(SHORT DOUBLE STADIUM)



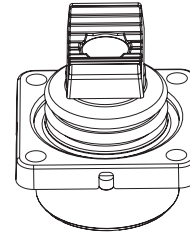
BUTTON STYLE 4
(TALL CONCAVE STADIUM)



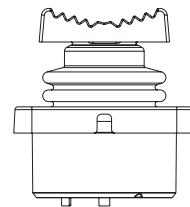
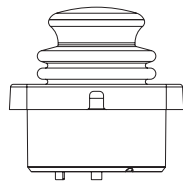
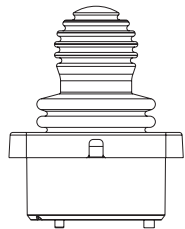
BUTTON STYLE 5
(EXTERNAL BAT
HANDLE BOOT)



BUTTON STYLE 6
(EXTERNAL SMOOTH BOOT)



BUTTON STYLE 7
(LONG CONCAVE
Y AXIS BUTTON)



PROPORTIONAL OUTPUT THUMBWHEEL

HTW
HALL EFFECT
THUMBWHEEL

3 MILLION CYCLE ROTATIONAL LIFE



Paddle Wheel Style (with Pins)

Knurled Wheel Style (with Wires)

The HTW Hall Effect Proportional Output Thumbwheel is a spring-return-to-center, single axis thumbwheel with an actuator that provides linear change in voltage output in either direction from the center. Available with eight output options, including increasing and decreasing voltage output from the center position to the full travel position and single or dual (redundant) outputs. The HTW snaps into a 1.47" x 0.710" panel opening with rocker switch style mounting. A durable switch providing three million cycle rotational life, sealed to IP68S and excellent EMI immunity per MIL-STD-46 ID/SAE J1113-22, and will withstand RFI of 100V/M 14Hz to 1GHz.

Features:

- 8 output options
- Spring-return-to-center single axis actuator
- Snaps into 1.47" x 0.710" panel opening
- Rocker switch style mounting
- 3 million cycle rotational life
- Electronics sealed to IP68S
- Excellent EMI/RFI immunity
- Detent options available
- RoHS/WEEE/Reach compliant

Standard Characteristics/Ratings:

MECHANICAL:

Mechanical Life: 3,000,000 full forward to full back

Mechanical Detent Cycle Life Per Detent: 100,000 (detent @ +/- 21°, full travel is +/- 30° max)

Max Allowable Radial Load: 30.0 lbs.

ELECTRICAL RATINGS: Rated at Vcc = 5V @ 25°C Load = 1mA (4.7KΩ)

Electrical	Units	Min	Typ	Max
Supply Voltage	VDC	4.5	5	5.5
Output Voltage Tolerance at Center (see graph for output values) @ 5V Vcc	VDC	-0.15	N/A	+0.15
Output Voltage Tolerance at Center (for detent version A only) @ 5V Vcc	VDC	-0.25	N/A	+0.25
Output Voltage Tolerance Full Travel (see graph for output values) @ 5V Vcc	VDC	-0.25	N/A	+0.25
Supply Current Per Sensor	mA	N/A	N/A	10

Reverse Voltage Protection: -5VDC max

ELECTRONICS:

Seal Integrity: Electronics IP68S

ENVIRONMENTAL:

Operating Temp Range: -40°C to +85°C

Humidity: 96% RH, 70°C, 96 hours

Vibration: Per MIL-810F minimum integrity

Sand/Dust: Per SAE J1455

EMI: Withstand per MIL-STD-461D/SAE J1113-22

RFI: Withstand 100V/M 14Hz to 1GHz

MATERIALS:

Button: Thermoplastic

Bezel: Thermoplastic

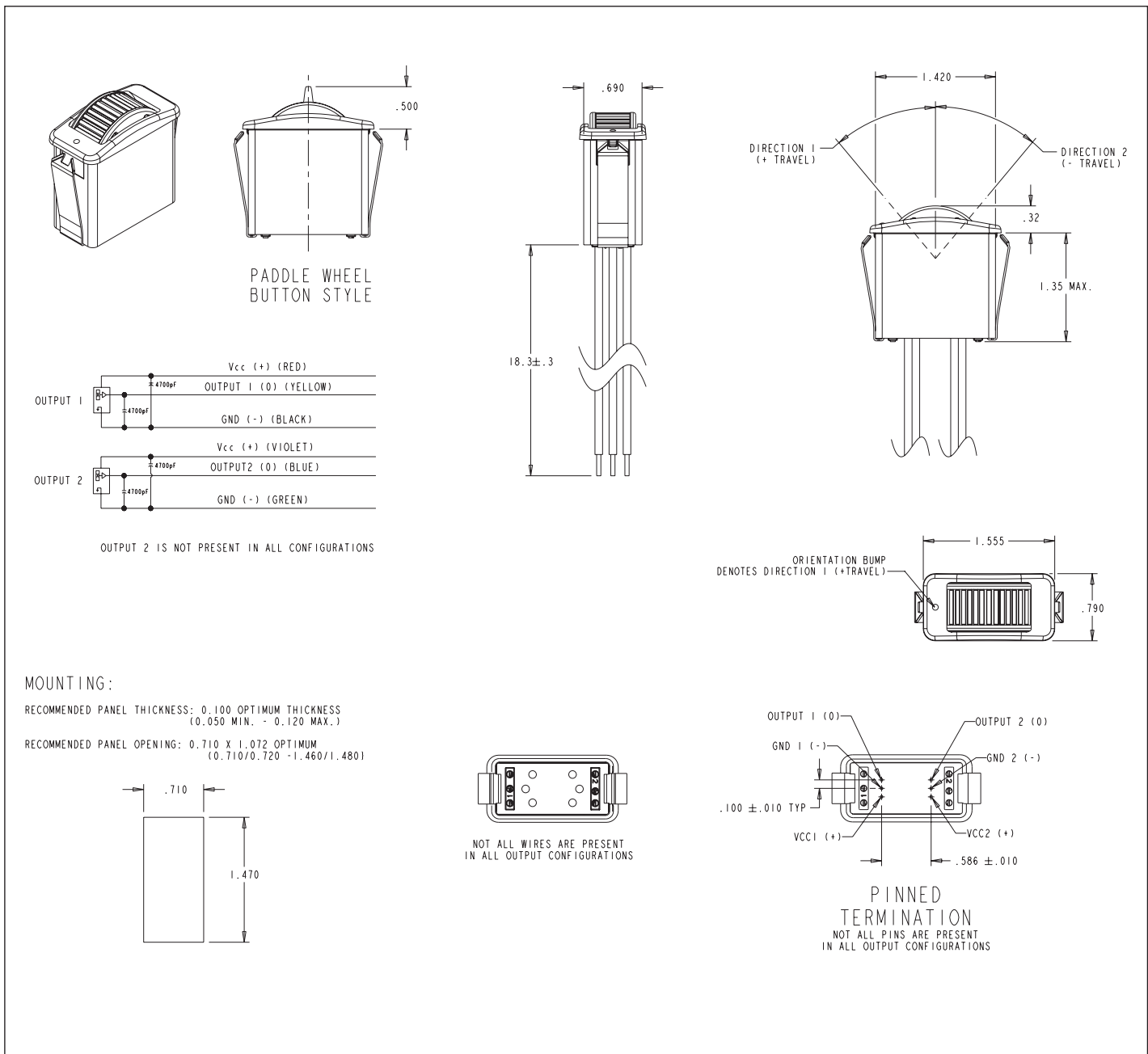
Snap Arms: Stainless steel

Wires: 18 AWG

3 MILLION CYCLE ROTATIONAL LIFE

HTW PART NUMBER CODE

HTW	-	X	X	X	X	X	X	X	X
Travel	Output 1	Output 2	Operating Force	Button Style	Termination	Bezel Color	Button Color	Detent (if required)	
1. +/- 40° 2. +/- 30°	A. 2.5 +/- 2.0VDC B. 2.5 +/- 2.0VDC C. 2.5 +/- 2.0VDC D. 2.5 +/- 1.5VDC E. 2.5 +/- 1.5VDC F. 2.5 +/- 1.5VDC G. 1.0 - 4.0VDC H. 0.5 - 4.5VDC	NONE 2.5 +/- 2.0VDC 2.5 +/- 2.0VDC NONE 2.5 +/- 1.5VDC 2.5 +/- 1.5VDC 2.5 +/- 1.5VDC 1.0 - 4.0VDC 0.5 - 4.5VDC	1. 5.0 oz.	1. Knurled Wheel 2. Paddle Wheel	A. 18 AWG Wires 18.3" Long, Stripped Ends B. 0.025" SQ. Pins	1. Red 2. Black 3. Orange 4. Yellow 5. Green 6. Blue 7. Violet 8. Gray 9. White	1. Red 2. Black 3. Orange 4. Yellow 5. Green 6. Blue 7. Violet 8. Gray 9. White	A. Spring return center +/- 21° 12 oz detent at end of travel, both directions*	* Only available with Travel option 2.

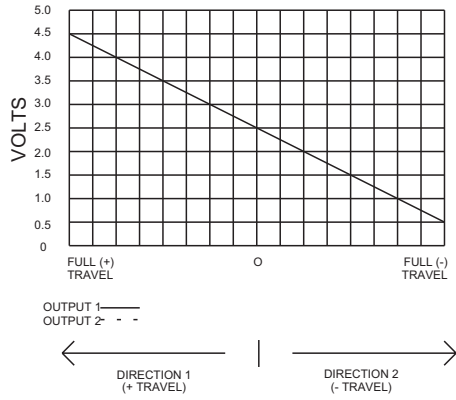


PROPORTIONAL OUTPUT THUMBWHEEL

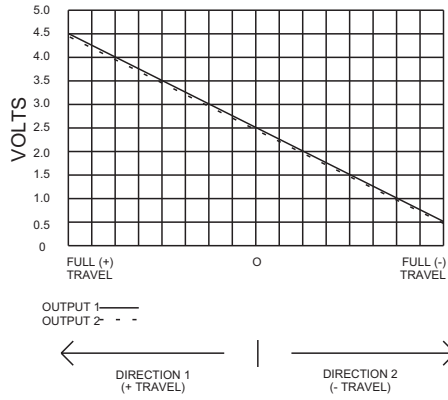
HTW
HALL EFFECT
THUMBWHEEL

3 MILLION CYCLE ROTATIONAL LIFE

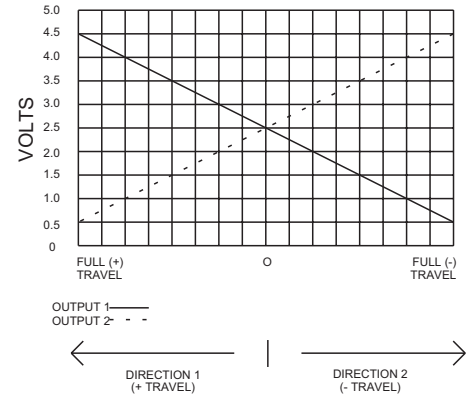
OPTION A



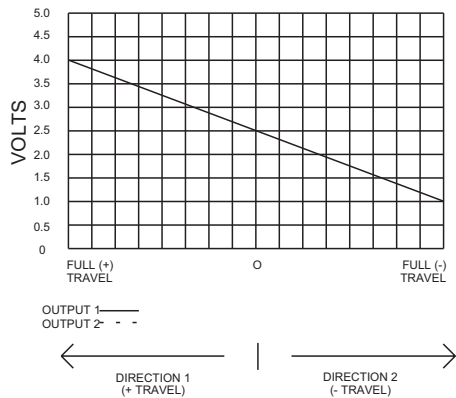
OPTION B



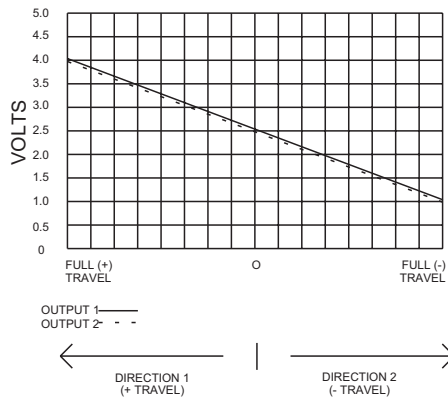
OPTION C



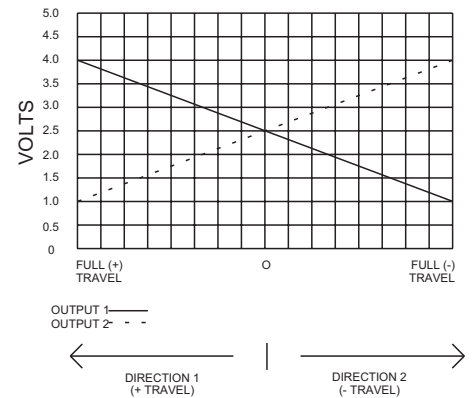
OPTION D



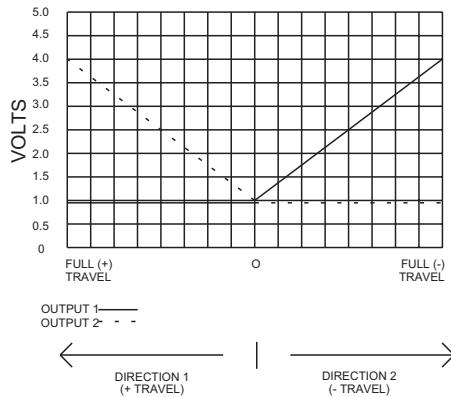
OPTION E



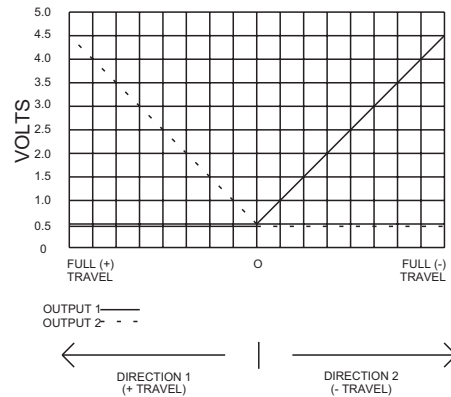
OPTION F



OPTION G



OPTION H



PROPORTIONAL OUTPUT THUMBWHEEL



Paddle Wheel



Knurled Wheel

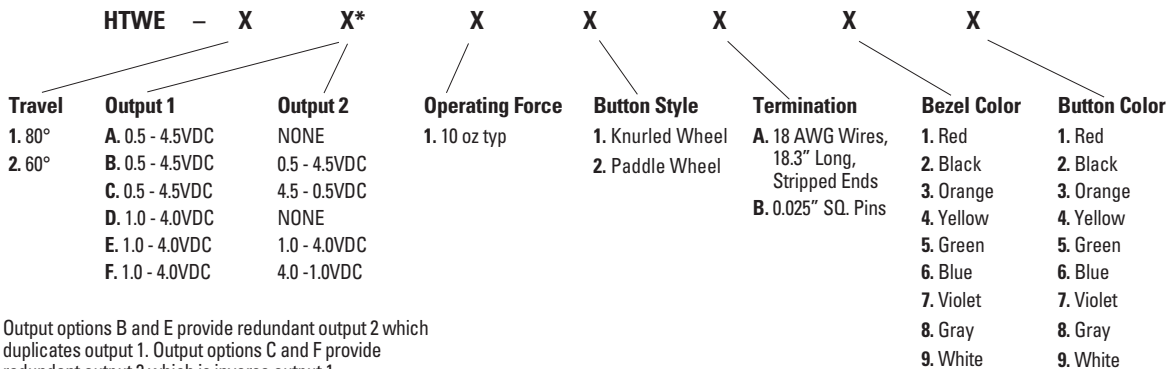
OTTO's HTWE control is a spring return to end, single axis, proportional output thumbwheel. Utilizing non-contact Hall effect technology, the HTWE delivers one million actuations. It also has excellent EMI/RFI shielding per MIL-STD-461D/SAE J1113-22. Configuration options include choice of six linear outputs. The HTWE is available as an individual control ideal for panel mountings, or may be incorporated into one of OTTO's joysticks.

Features:

- Spring-return-to-end single axis actuator
- Knurled & Paddle style actuators
- Wire or pinned termination options
- Variety of button & bezel colors
- 8 output options
- Rocker switch style mounting
- Snaps into 1.47" x 0.710" panel opening
- 1 million cycle rotational life
- Electronics sealed to IP68S
- Excellent EMI/RFI immunity
- RoHS/WEEE/Reach compliant

Standard Characteristics/Ratings:				
MECHANICAL:				
Mechanical Life: 1,000,000 full forward to full back				
Max Allowable Radial Load: 30.0 lbs.				
ELECTRICAL RATINGS: Rated 5V @ 25°C Load = 1mA (4.7KΩ)				
Electrical	Units	Min	Typ	Max
Supply Voltage	VDC	4.5	5.0	5.5
Output at Rest	VDC @ 5V Vcc	-.25	N/A	+.25
Output at Full Travel	VDC @ 5V Vcc	-.25	N/A	+.25
Supply Current Per Sensor	mA	N/A	N/A	10
ELECTRONICS:				
Seal Integrity:	Electronics IP68S			
ENVIRONMENTAL:				
Operating Temp Range:	-40°C to +85°C			
Humidity:	96% RH, 70°C, 96 hours			
Vibration:	Per MIL-810F minimum integrity			
Sand/Dust:	Per SAE J1455			
EMI:	Withstand per MIL-STD-461D/SAE J1113-22			
RFI:	Withstand 100V/M 14Hz to 1GHz			
MATERIALS:				
Button:	Thermoplastic			
Bezel:	Thermoplastic			
Snap Arms:	Stainless steel			
Wires:	18 AWG			

HTWE RETURN TO END STANDARD THUMBWHEEL

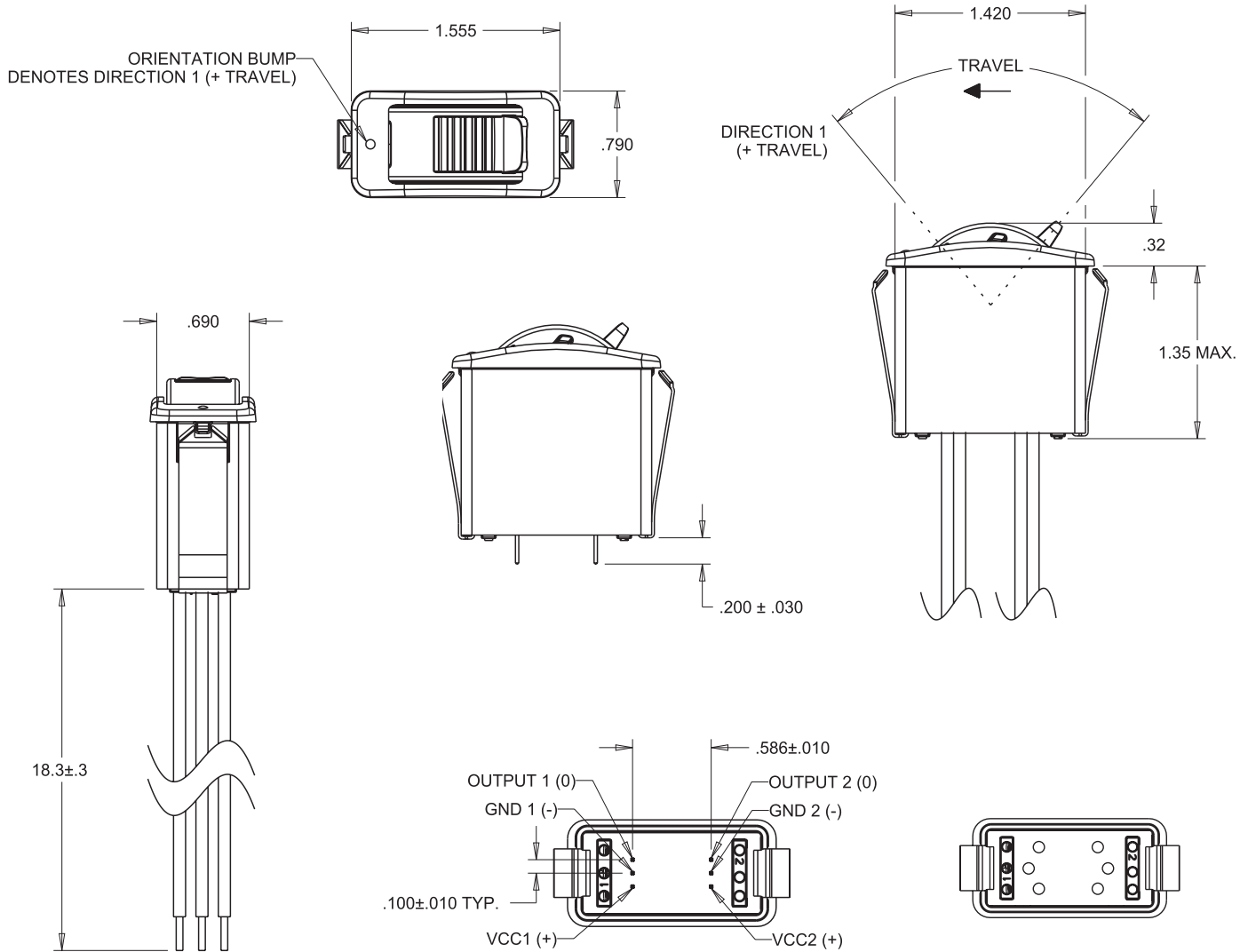


* Output options B and E provide redundant output 2 which duplicates output 1. Output options C and F provide redundant output 2 which is inverse output 1.

RETURN TO END STANDARD THUMBWHEEL

HTWE
HALL EFFECT
THUMBWHEEL

PROPORTIONAL OUTPUT THUMBWHEEL



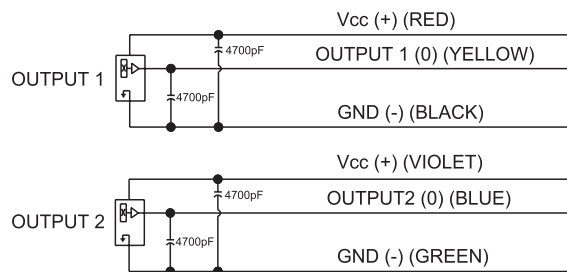
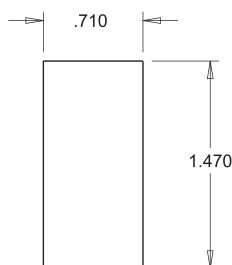
PINNED TERMINATION

NOT ALL PINS ARE PRESENT
IN ALL OUTPUT CONFIGURATIONS

MOUNTING:

RECOMMENDED PANEL THICKNESS: 0.100 OPTIMUM THICKNESS
(0.050 MIN. - 0.120 MAX.)

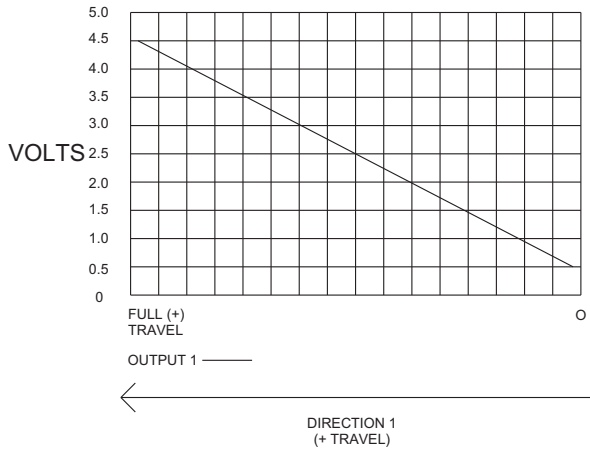
RECOMMENDED PANEL OPENING: 0.710 X 1.470 OPTIMUM
(0.710/0.720 - 1.460/1.480)



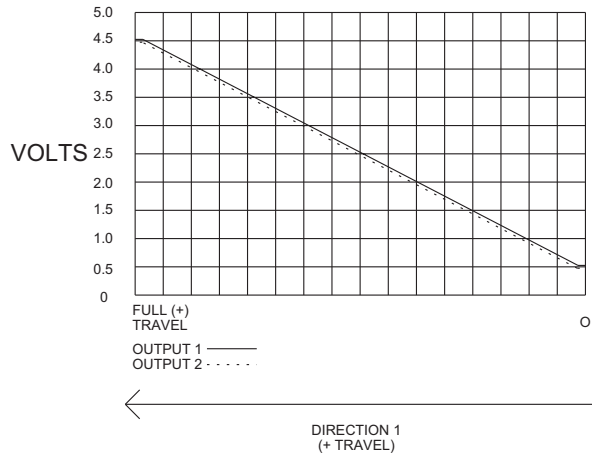
OUTPUT 2 IS NOT PRESENT IN ALL CONFIGURATIONS

PROPORTIONAL OUTPUT THUMBWHEEL

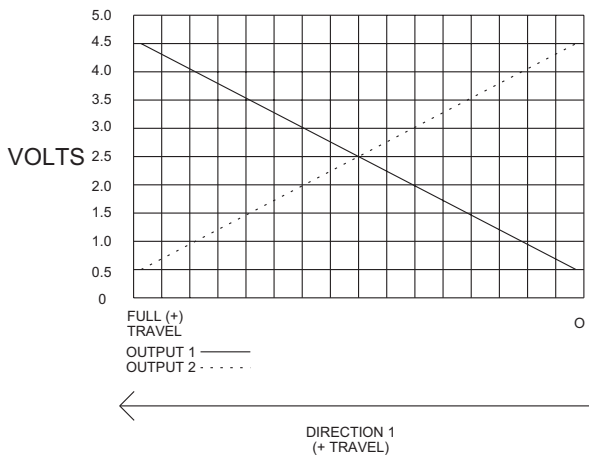
OPTION A



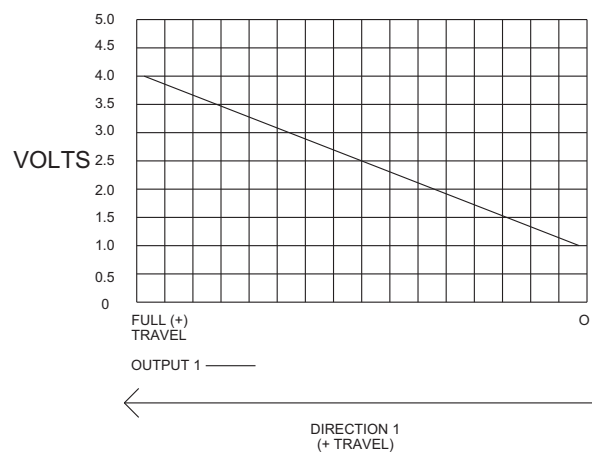
OPTION B



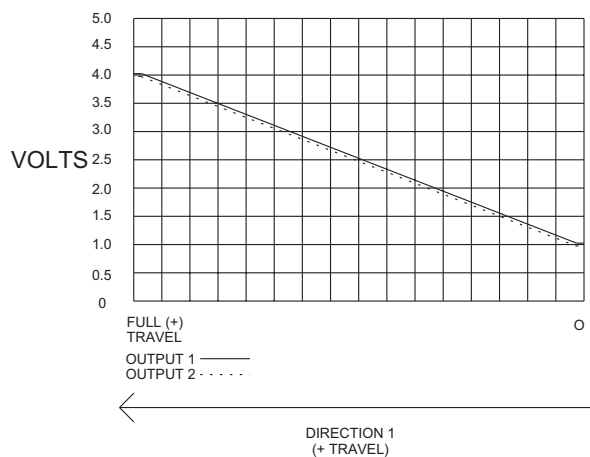
OPTION C



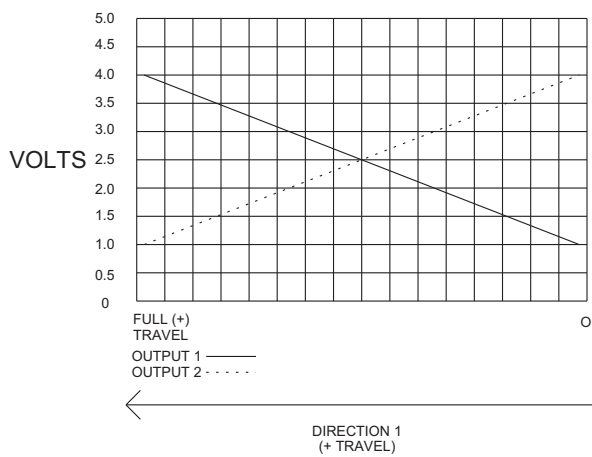
OPTION D



OPTION E



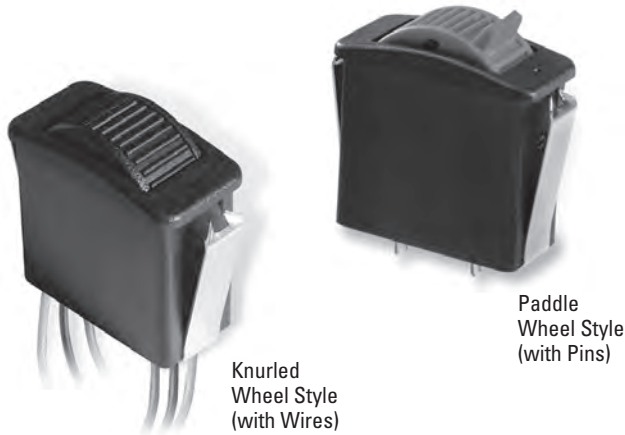
OPTION F



PROPORTIONAL OUTPUT THUMBWHEEL

HTWF
HALL EFFECT
THUMBWHEEL

FRICION HOLD ACTUATION STYLE THUMBWHEEL



Knurled Wheel Style (with Wires)

Paddle Wheel Style (with Pins)

The HTWF Friction Hold Thumbwheel offers a maintained position, single axis thumbwheel actuator that provides a linear change in voltage output in either direction from center. Options include increasing or decreasing voltage output from the center position to the full travel position, and single or dual (redundant) outputs per axis. The HTWF Thumbwheel has a rocker style snap-in mounting feature to accommodate a 1.47" x 0.710" panel opening. The HTWF provides 250,000 cycle life, full forward/full backward, is sealed to IP68S and offers excellent EMI/RFI immunity and a flow through design. Ideal for heavy equipment, industrial machines or remote control applications.

Features:

- 250,000 cycle life, full forward/full backward with center detent
- Maintained control positioning, no return to center
- Hall effect contactless sensing technology
- Number of output options
- Choice of bezel & button colors
- Snaps into 1.47" x 0.710" panel opening
- Electronics sealed to IP68S
- Excellent EMI/RFI immunity
- RoHS/WEEE/Reach compliant

Standard Characteristics/Ratings:

MECHANICAL:

Mechanical Life: 250,000 full forward to full back with center detent

Initial Operating Force at Top of Roller: 2 oz min to 6 oz max @ 25°C

Max Allowable Radial Load: 30.0 lbs.

ELECTRICAL RATINGS: Rated at Vcc = 5V @ 25°C Load = 1mA (4.7KΩ)

Electrical	Units	Min	Typ	Max
Supply Voltage	VDC	4.5	5	5.5
Output Voltage Tolerance at Center (see graph for output values)	VDC @ 5V Vcc	-0.15	N/A	+0.15
Output Voltage Tolerance Full Travel (see graph for output values)	VDC @ 5V Vcc	-0.25	N/A	+0.25
Supply Current Per Sensor	mA	N/A	N/A	10

ELECTRONICS:

Seal Integrity: Electronics watertight per IP68S, 1 meter

ENVIRONMENTAL:

Operating Temp Range: -40°C to +85°C

Humidity: 96% RH, 70°C, 96 hours

Vibration: Per MIL-810F minimum integrity

Sand/Dust: Per SAE J1455

EMI: Withstand per MIL-STD-461D/SAE J1113-22

RFI: Withstand 100V/M 14Hz to 1GHz

MATERIALS:

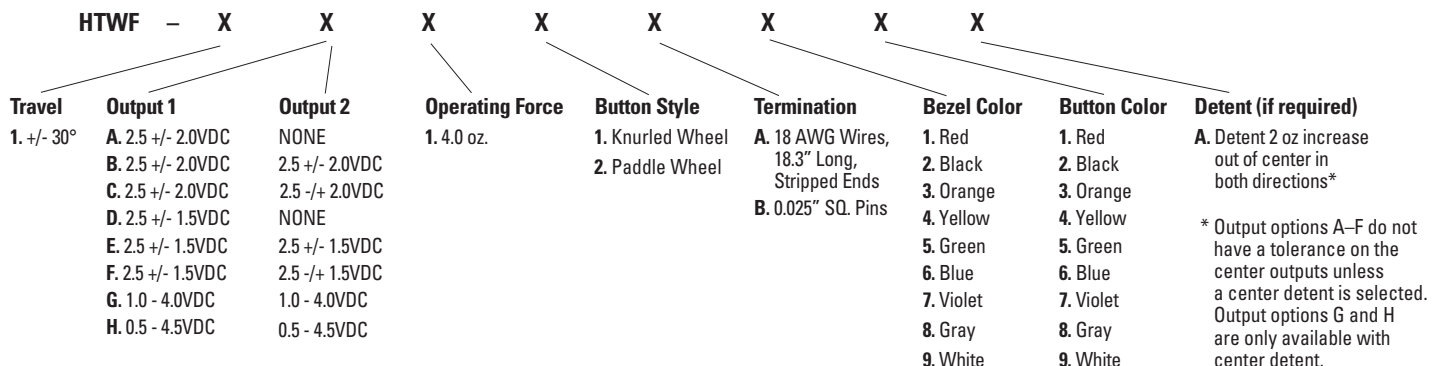
Button: Thermoplastic

Bezel: Thermoplastic

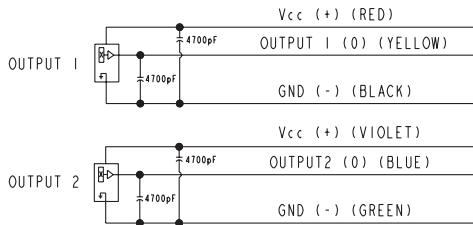
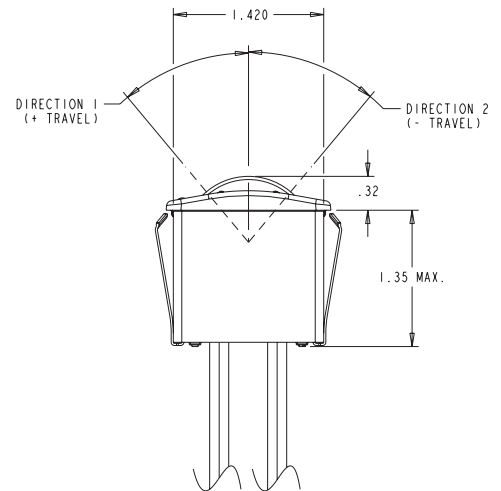
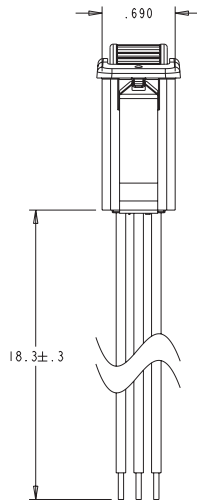
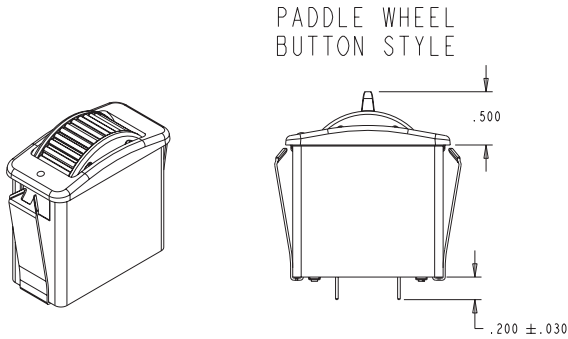
Snap Arms: Stainless steel

Wires: 18 AWG

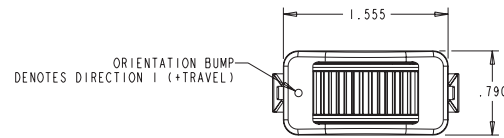
HTWF PART NUMBER CODE



FRICION HOLD ACTUATION STYLE THUMBWHEEL



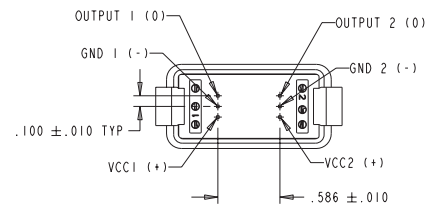
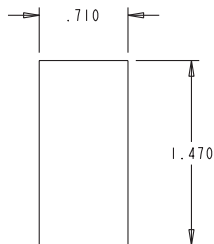
OUTPUT 2 IS NOT PRESENT IN ALL CONFIGURATIONS



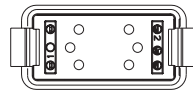
MOUNTING:

RECOMMENDED PANEL THICKNESS: 0.100 OPTIMUM THICKNESS
(0.050 MIN. - 0.120 MAX.)

RECOMMENDED PANEL OPENING: 0.710 X 1.470 OPTIMUM
(0.710/0.720 - 1.460/1.480)



**PINNED
TERMINATION**
NOT ALL PINS ARE PRESENT
IN ALL OUTPUT CONFIGURATIONS



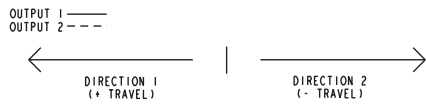
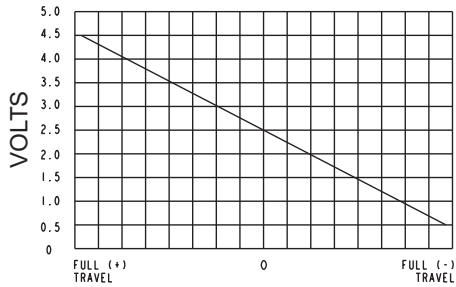
NOT ALL WIRES ARE PRESENT
IN ALL OUTPUT CONFIGURATIONS

PROPORTIONAL OUTPUT THUMBWHEEL

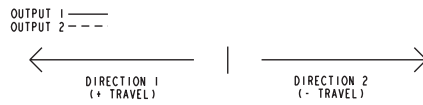
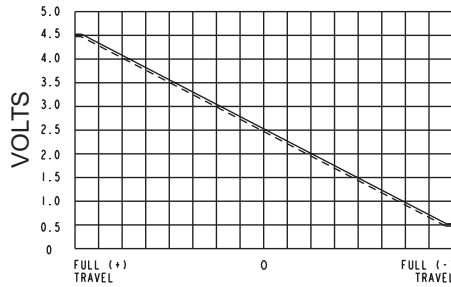
HTWF
HALL EFFECT
THUMBWHEEL

FRICION HOLD ACTUATION STYLE THUMBWHEEL

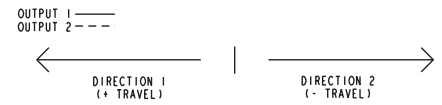
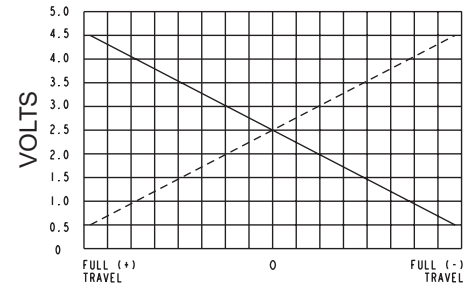
OPTION A



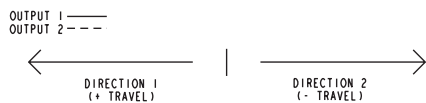
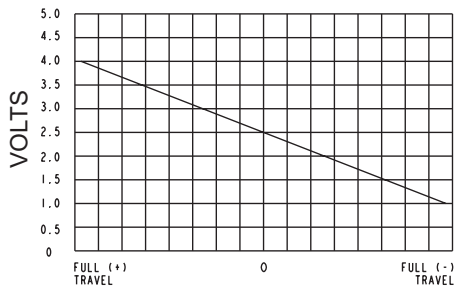
OPTION B



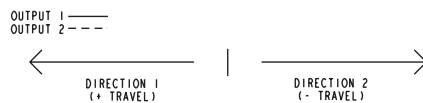
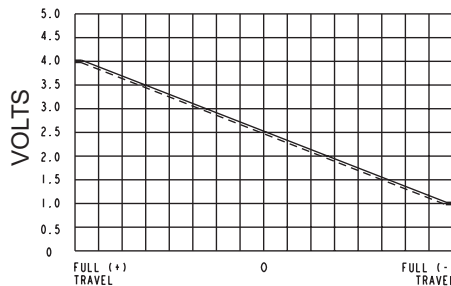
OPTION C



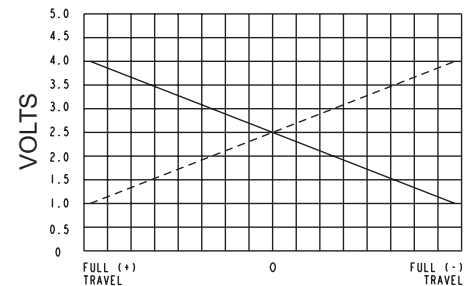
OPTION D



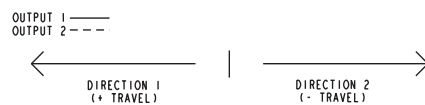
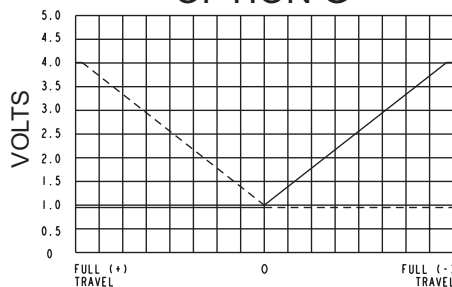
OPTION E



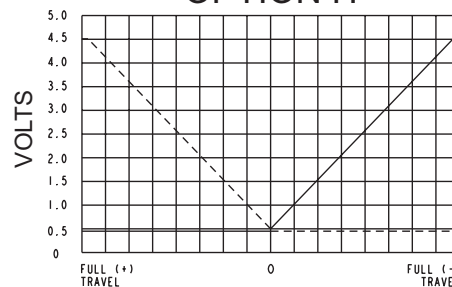
OPTION F



OPTION G



OPTION H



SHORTER BEHIND PANEL DEPTH



The HTWM offers the same performance as the standard HTW Proportional Thumbwheel but with a much shorter behind panel depth, ideal for use in grip, armrest and panel applications. Available with eight output options, the HTWM offers a spring-return-to-center, single axis thumbwheel actuator that provides linear change in voltage output in either direction from center. Options include increasing or decreasing voltage output from the center position to the full travel position, and single or dual (redundant) outputs per axis. The HTWM offers snap-in style mounting and a three million cycle rotational life. The HTWM electronics are sealed to IP68S and have excellent EMI/RFI immunity.

Features:

- Shorter behind panel depth: 0.96" max.
- 8 output options
- Spring-return-to-center single axis actuator
- Rocker switch style mounting
- 3 million cycle rotational life
- Electronics sealed to IP68S
- Excellent EMI/RFI immunity
- RoHS/WEEE/Reach compliant

Standard Characteristics/Ratings:				
MECHANICAL:				
Mechanical Life: 3,000,000 full forward to full back				
Max Allowable Radial Load: 30.0 lbs.				
ELECTRICAL RATINGS: Rated at Vcc = 5V @ 25°C Load = 1mA (4.7KΩ)				
Electrical	Units	Min	Typ	Max
Supply Voltage	VDC	4.5	5	5.5
Output Voltage Tolerance at Center @ 5V Vcc	VDC	-0.25	N/A	+0.25
Output Voltage Tolerance at Full Travel @ 5V Vcc	VDC	-0.25	N/A	+0.25
Supply Current Per Sensor	mA	N/A	N/A	10
ELECTRONICS:				
Seal Integrity:	Electronics IP68S			
ENVIRONMENTAL:				
Operating Temp Range:	-40°C to +85°C			
Humidity:	96% RH, 70°C, 96 hours			
Vibration:	Per MIL-810F minimum integrity			
Sand/Dust:	Per SAE J1455			
EMI:	Withstand per MIL-STD-461D/SAE J1113-22			
RFI:	Withstand 100V/M 14Hz to 1GHz			
MATERIALS:				
Button:	Thermoplastic			
Bezel:	Thermoplastic			
Wires:	18 AWG			

MINI PROPORTIONAL OUTPUT THUMBWHEEL

HTWM
MINIATURE
THUMBWHEEL

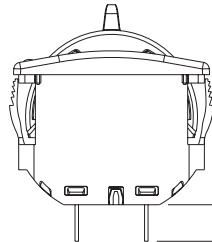
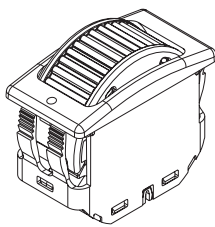
SHORTER BEHIND PANEL DEPTH

HTWM PART NUMBER CODE

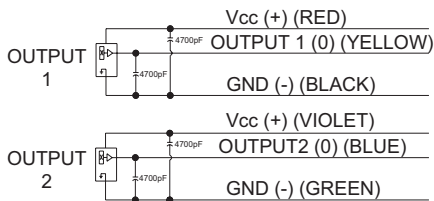
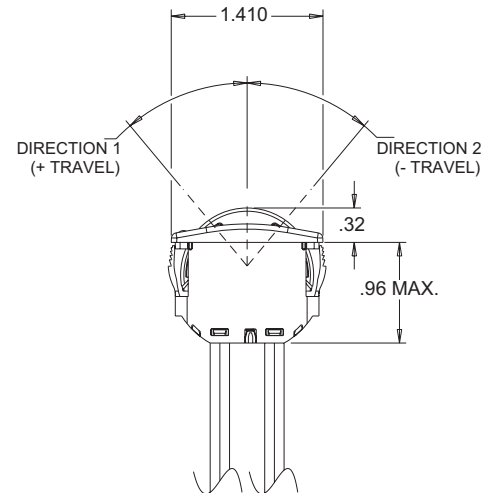
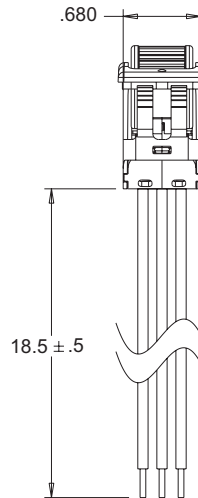
HTWM	-	X	X	X	X	X	X	X
Travel		Output 1*	Output 2**	Operating Force	Button Style	Termination	Bezel Color	Button Color
1. +/- 40°		A. 2.5 +/- 2.0VDC	NONE	1. 5.0 oz.	1. Knurled Wheel	A. 18 AWG Wires, 18.3" Long, Stripped Ends	1. Red	1. Red
		B. 2.5 +/- 2.0VDC	2.5 +/- 2.0VDC		2. Paddle Wheel	B. 0.025" SQ. Pins	2. Black	2. Black
		C. 2.5 +/- 2.0VDC	2.5 +/- 2.0VDC				3. Orange	3. Orange
		D. 2.5 +/- 1.5VDC	NONE				4. Yellow	4. Yellow
		E. 2.5 +/- 1.5VDC	2.5 +/- 1.5VDC				5. Green	5. Green
		F. 2.5 +/- 1.5VDC	2.5 +/- 1.5VDC				6. Blue	6. Blue
		G. 1.0 - 4.0VDC	1.0 - 4.0VDC				7. Violet	7. Violet
		H. 0.5 - 4.5VDC	0.5 - 4.5VDC				8. Gray	8. Gray
							9. White	9. White

* Outputs are from the center position to the full travel position in each direction. Options A-F provide increasing voltage in Direction 1 and decreasing voltage in Direction 2 from a single output. Options G and H provide increasing voltages in both directions from two separate outputs.

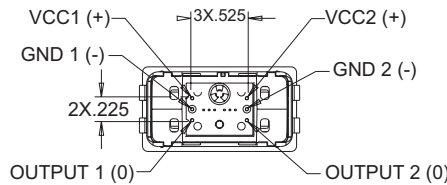
** Options B and E provide redundant output 2 which duplicates output 1. Options C and F provide redundant output 2 which is inverse of output 1.



PADDLE WHEEL
BUTTON STYLE



OUTPUT 2 IS NOT PRESENT
IN ALL CONFIGURATIONS



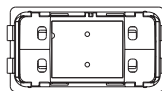
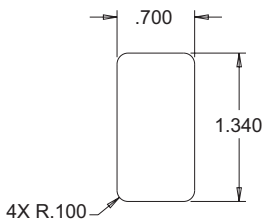
**PINNED
TERMINATION**
NOT ALL PINS ARE PRESENT
IN ALL OUTPUT CONFIGURATIONS

MOUNTING:

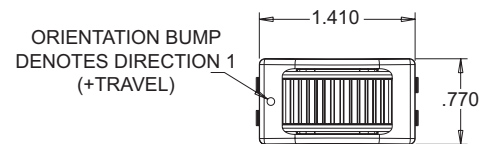
RECOMMENDED PANEL THICKNESS: 0.150 OPTIMUM THICKNESS
(0.040 MIN. - 0.200 MAX.)

RECOMMENDED PANEL OPENING: 0.700 X 1.340 OPTIMUM
(0.695/0.705 X 1.335/1.345)

RECOMMENDED PANEL RADII: 0.100 OPTIMUM
(0.090 - 0.110 MAX.)



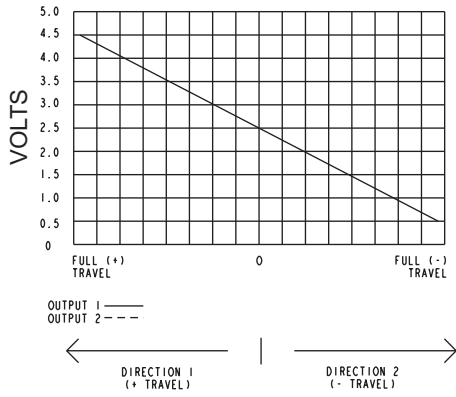
NOT ALL WIRES ARE PRESENT
IN ALL OUTPUT CONFIGURATIONS



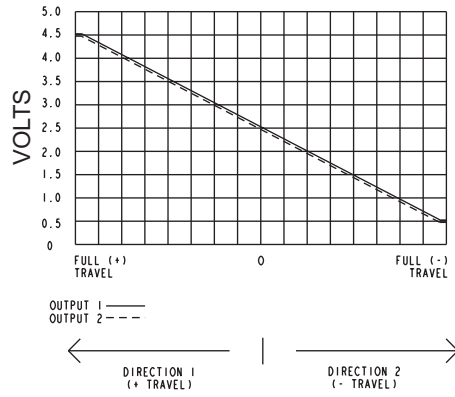
ORIENTATION BUMP
DENOTES DIRECTION 1
(+TRAVEL)

SHORTER BEHIND PANEL DEPTH

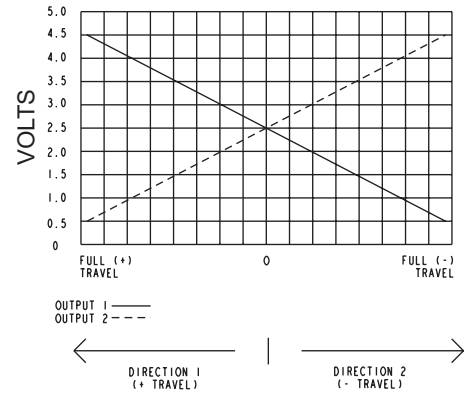
OPTION A



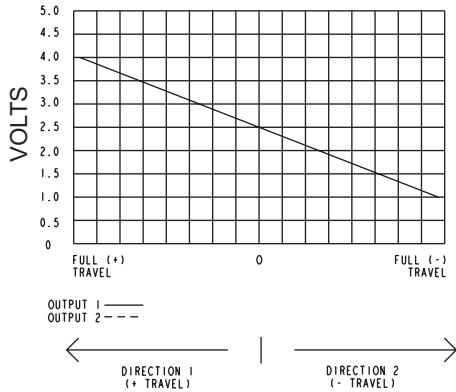
OPTION B



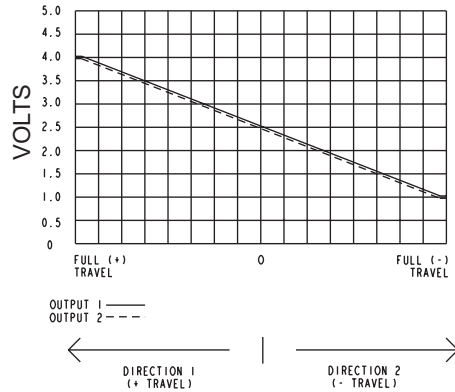
OPTION C



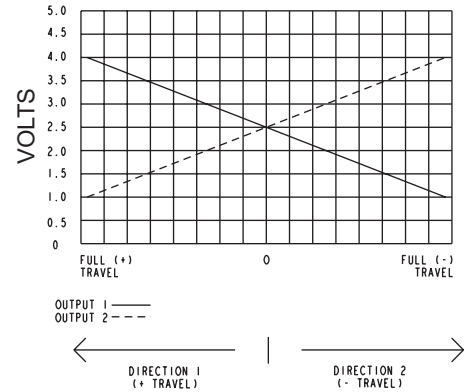
OPTION D



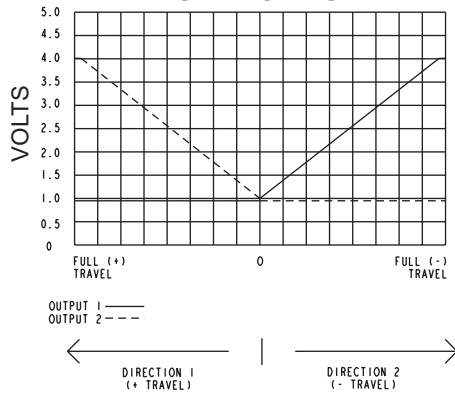
OPTION E



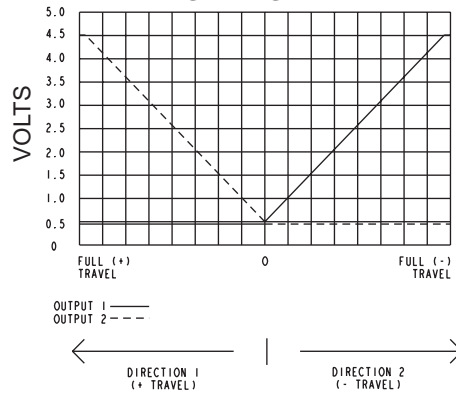
OPTION F



OPTION G



OPTION H



RETURN TO END MINI THUMBWHEEL

HTWME
MINIATURE
THUMBWHEEL

PROPORTIONAL OUTPUT HALL EFFECT MINI THUMBWHEEL



Knurled Wheel



Paddle Wheel

The HTWME offers the same performance as the standard HTWE single axis, proportional output thumbwheel, but has a much shorter behind panel depth. With a panel depth of 0.96" max., the HTWME is ideal for panel or armrest mountings, or can be incorporated into one of OTTO's joysticks. The HTWME provides snap-in style mounting, and also utilizes non-contact Hall effect technology, which accounts for a one million cycle life. It also has excellent EMI/RFI shielding per MIL-STD-461D/SAE J1113-22 and RFI to withstand 100 V/M, 14Hz to 1GHz. Configuration options include a choice of six linear voltage outputs.

Features:

- Return to end single axis actuator
- Shorter behind panel depth: 0.96"
- Knurled & Paddle style actuators
- Wire or pinned termination options
- Variety of button & bezel colors
- 6 output options
- Easy snap-in mounting
- 1 million cycle rotational life
- Electronics sealed to IP68S
- Excellent EMI/RFI immunity
- RoHS/WEEE/Reach compliant

Standard Characteristics/Ratings:

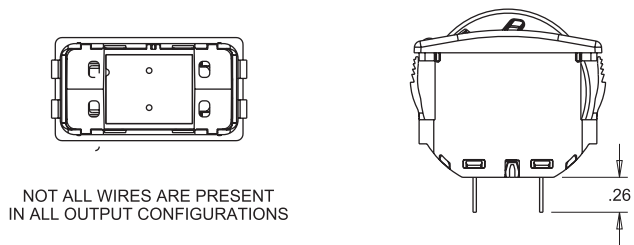
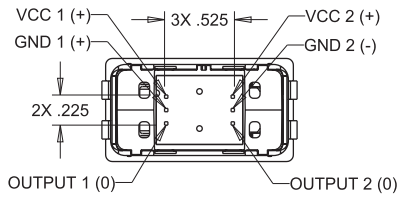
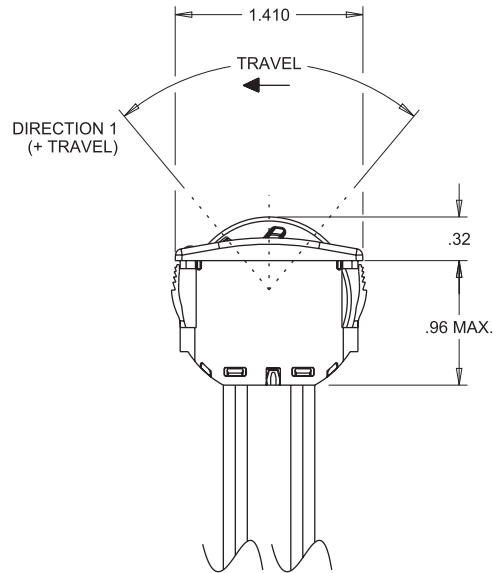
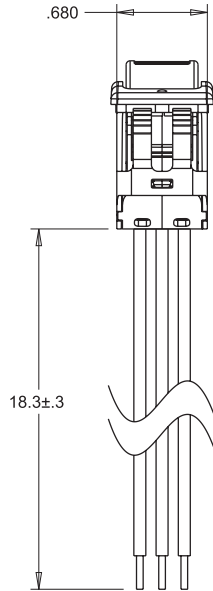
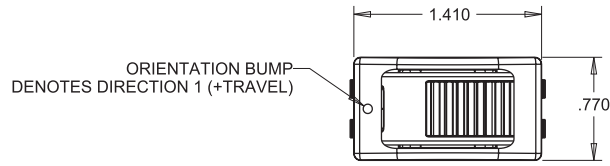
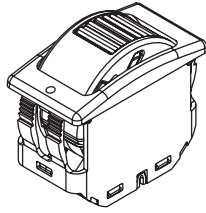
MECHANICAL:				
Mechanical Life: 1,000,000 full forward to full back				
Max Allowable Radial Load: 30.0 lbs.				
ELECTRICAL RATINGS: Rated at 5V @ 25°C Load = 1mA (4.7KΩ)				
Electrical	Units	Min	Typ	Max
Supply Voltage	VDC	4.5	5.0	5.5
Output at Rest	VDC @ 5V Vcc	-.25	N/A	+25
Output at Full Travel	VDC @ 5V Vcc	-.25	N/A	+25
Supply Current Per Sensor	mA	N/A	N/A	10
ELECTRONICS:				
Seal Integrity:	Electronics IP68S			
ENVIRONMENTAL:				
Operating Temp Range:	-40°C to +85°C			
Humidity:	96% RH, 70°C, 96 hours			
Vibration:	Per MIL-810F minimum integrity			
Sand/Dust:	Per SAE J1455			
EMI:	Withstand per MIL-STD-461D/SAE J1113-22			
RFI:	Withstand 100V/M 14Hz to 1GHz			
MATERIALS:				
Button:	Thermoplastic			
Bezel:	Thermoplastic			
Snap Arms:	Thermoplastic			
Wires:	18 AWG			

HTWME RETURN TO END THUMBWHEEL MINIATURE CASE

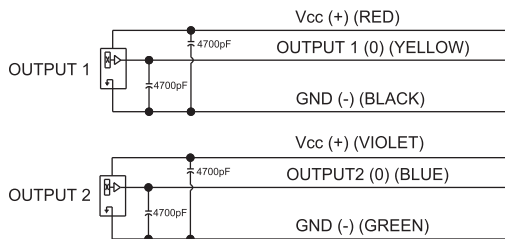
HTWME	-	X	X*	X	X	X	X	X
Travel	Output 1	Output 2	Operating Force	Button Style	Termination	Bezel Color	Button Color	
1. 80°	A. 0.5 - 4.5VDC	NONE	1. 10 oz typ	1. Knurled Wheel	A. 18 AWG Wire, 18.3" Long, Stripped and Tinned Ends	1. Red	1. Red	
	B. 0.5 - 4.5VDC	0.5 - 4.5VDC		2. Paddle Wheel	B. 0.025" SQ. Pins	2. Black	2. Black	
	C. 0.5 - 4.5VDC	4.5 - 0.5VDC				3. Orange	3. Orange	
	D. 1.0 - 4.0VDC	NONE				4. Yellow	4. Yellow	
	E. 1.0 - 4.0VDC	1.0 - 4.0VDC				5. Green	5. Green	
	F. 1.0 - 4.0VDC	4.0 - 1.0VDC				6. Blue	6. Blue	
						7. Violet	7. Violet	
						8. Gray	8. Gray	
						9. White	9. White	

* Output options B and E provide redundant output 2 which duplicates output 1. Output options C and F provide redundant output 2 which is inverse output 1.

SHORTER BEHIND PANEL DEPTH



**PINNED
TERMINATION**
NOT ALL PINS ARE PRESENT
IN ALL OUTPUT CONFIGURATIONS



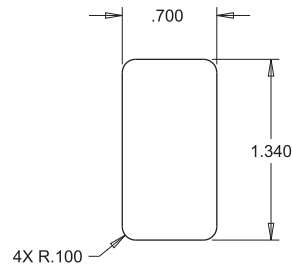
OUTPUT 2 IS NOT PRESENT IN ALL CONFIGURATIONS

MOUNTING:

RECOMMENDED PANEL THICKNESS: 0.150 OPTIMUM THICKNESS
(0.040 MIN. - 0.200 MAX.)

RECOMMENDED PANEL OPENING: 0.700 X 1.340 OPTIMUM
(0.695/0.705 X 1.335/1.345)

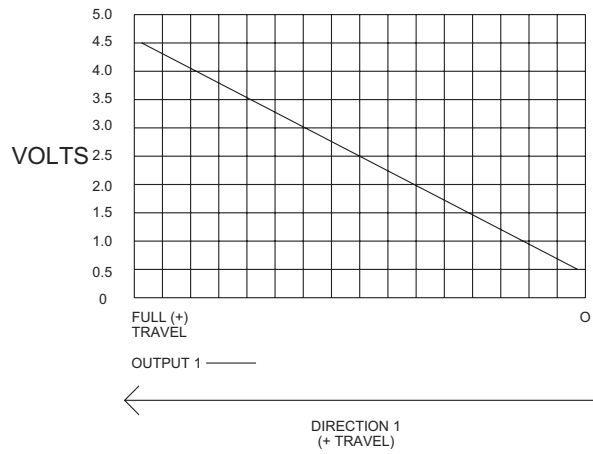
RECOMMENDED PANEL RADII: 0.100 OPTIMUM
(0.090 - 0.110 MAX.)



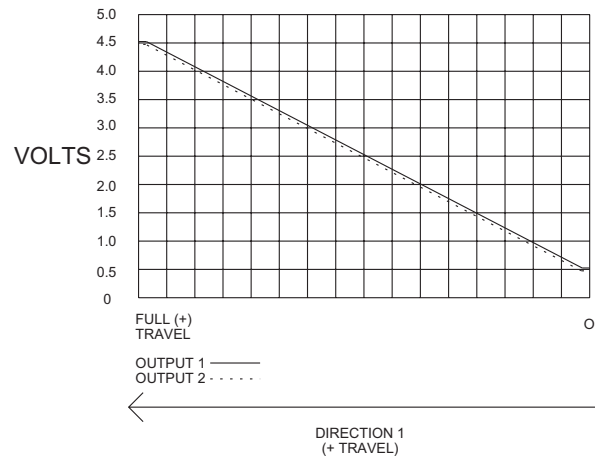
RETURN TO END MINI THUMBWHEEL

SHORTER BEHIND PANEL DEPTH

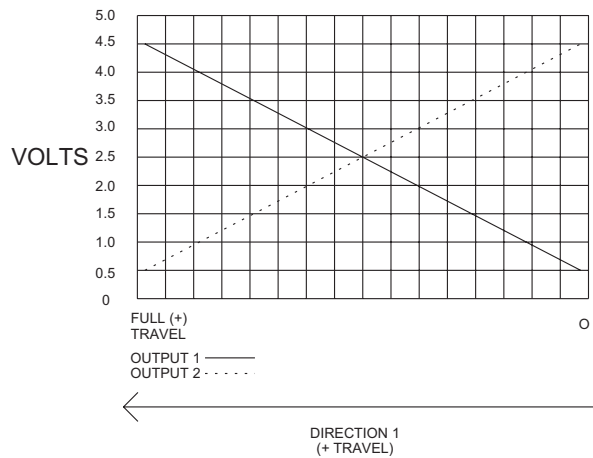
OPTION A



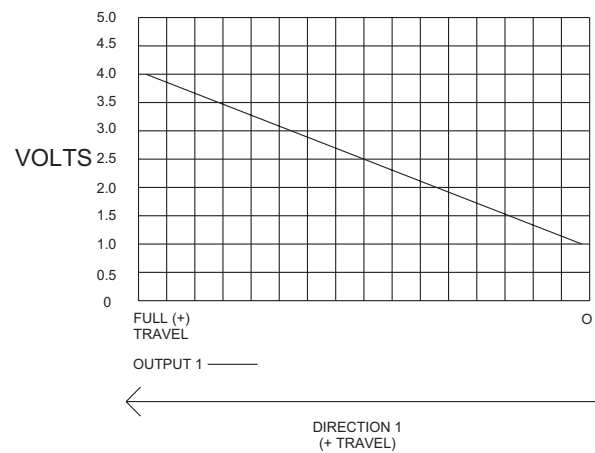
OPTION B



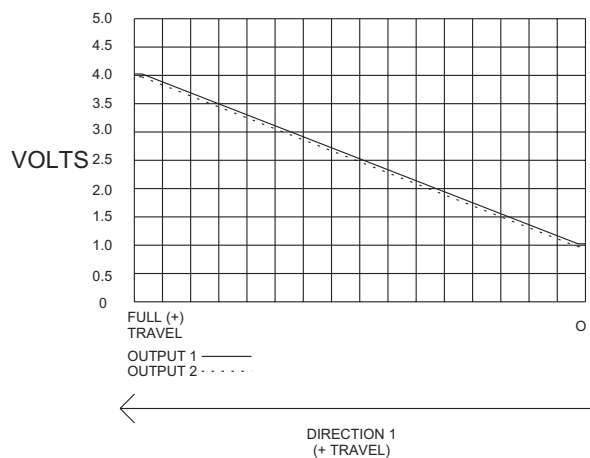
OPTION C



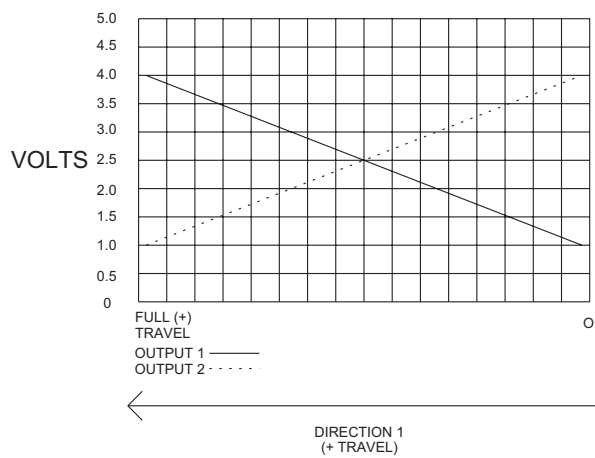
OPTION D



OPTION E



OPTION F



HALL EFFECT

The JH Series Joystick is designed around the rugged mechanism of a traditional 4-way hydraulic joystick, but it utilizes contactless Hall effect technology for increased life and more dependable performance in the field. This combination provides performance and features never before available in an electronic joystick. The JH series uses OTTO's field-proven dual magnet configuration found in OTTO's HPL Linear Output Hall Effect switches. The Hall effect sensors are fully protected against electromagnetic and radio frequency interference (EMI and RFI) up to 100V/M. Programmable sensors with built-in magnetic temperature compensation logic ensure consistent and repeatable operation. The JH series is designed for maximum flexibility in features and in tactile feel. A wide variety of input and output configurations are available to satisfy different applications. The modular electronic package can be configured for both standard and custom I/O requirements including CANbus and other output options available.

Features:

- **Adapts to a wide variety of shaft styles**
- **15 million cycle life in all directions**
- **300 lbs. static load strength at grip reference point (grp)**
- **Electronics sealed to IP68S**
- **EMI/RFI shielding up to 100V/M**
- **Factory programmable pretravel & overtravel**
- **Analog, CANbus, USB & other custom output options available**
- **Redundant outputs available**
- **Fail safe & neutral indicator**
- **Single and dual axis available**
- **Z axis available with universal grip only**
- **Programmable sensors**
- **5V standard regulator available to accommodate a 9-32VDC power supply**
- **Various output configurations**
- **Available with a variety of grip & switch options**
- **RoHS/WEEE/Reach compliant**



JH Joystick Shown with OTTO Medium Universal Grip, K1 Rockers and P3 Pushbutton Switches

HALL EFFECT TECHNOLOGY JOYSTICK

Standard Characteristics/Ratings:

GENERAL:

Sensor Type: Hall effect analog, 1 or 2 outputs per axis

Design: Dual magnet

ELECTRICAL RATINGS: Rated at 5V @ 20°C Load = 1ma (4.7kΩ)

Electrical	Units	Min	Typ	Max
Output Voltage 0° to 2° Deflection Tolerance at Center @ 5V Vcc	VDC	-0.15	N/A	+0.15
Output Voltage 19° to 20° Deflection Tolerance at Full Load @ 5V Vcc	VDC	-0.15	N/A	+0.15
Supply Current Per Sensor	mA	N/A	N/A	10
Output Source Current Limit	mA	-1	N/A	1

MECHANICAL:

Mechanical Life: 9,000,000 min. up to 15,000,000 in all directions depending on configuration

Travel Angle: 20° typical

Overtravel Angle: 0.5° min to 1.5° max

Operating Force: With bellows, 20°C to 85°C at grip, 3.5 lbs. min to 5.5 lbs. max
With bellows, -40°C at grip, 13.0 lbs. min to 18.0 lbs. max

ENVIRONMENTAL:

Operating Temp Range: -40°C to +85°C

Humidity: 96% RH, 70°C, 96 hours

Vibration: 10g, 10Hz to 2KHz swept sinusoidal

Electronics: Sealed to IP68S

EMI/RFI: Per SAE J1113 (typical), contact factory for details

Sand/Dust: Without bellows, withstand per SAE J1455

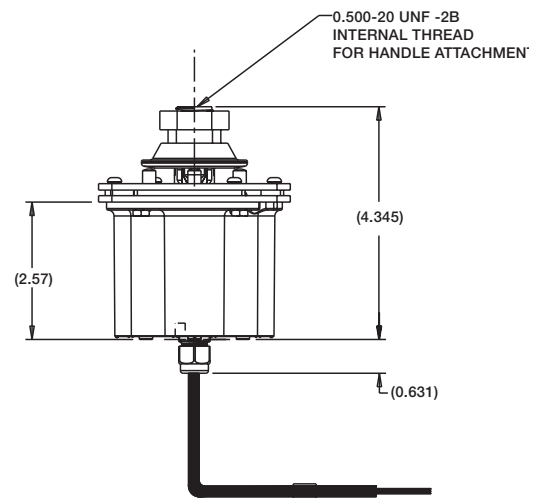
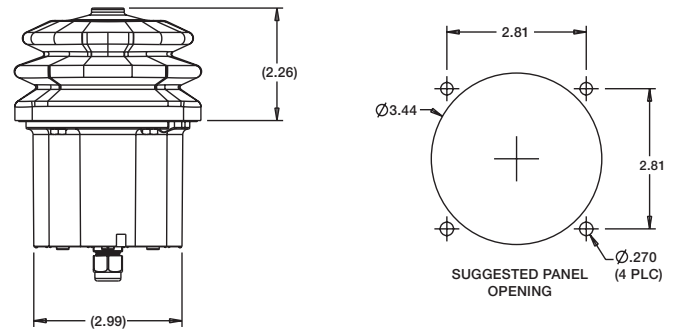
MATERIALS:

Housing: Polyester

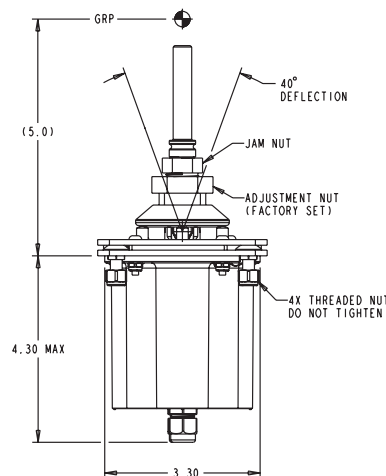
Bellows: EPDM, black

Cable: 22 AWG (19 strands of 34 AWG TSC)

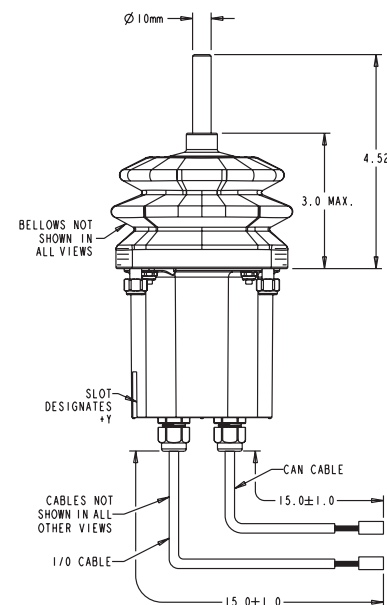
Mounting Hardware: 1/4-20 x 3/4 carriage bolts, self-locking nuts



Hall Joystick



CANbus Technology Joystick
(22 or 24 AWG)



UP TO 10 MILLION OPERATIONAL CYCLES IN ALL DIRECTIONS



JHM with Center P9 Switch



JHM with Hall Effect Rocker

The JHM series Medium Hall Effect Joystick is a full function operator control in a package that will fit in an armrest or on a panel. It utilizes OTTO's patented Hall effect technology for unmatched life and reliability. Electronics are sealed and it has an operational life of ten million cycles in all directions. Additional options include CANopen® and CAN J1939 versions, multiple analog and digital auxiliary control outputs, redundant sensors and a variety of output configurations, along with a variety of grip and switch options.

Features:

- **Designed for armrest & panel mounting**
- **Proven contactless analog output Hall effect technology**
- **Electronics sealed to IP68S**
- **Up to 10 million operational cycles in all directions**
- **Available with a variety of grip & switch options**
- **Redundant sensors available**
- **Various output configurations**
 - CANopen®
 - CAN J1939
 - USB
 - Serial
 - Analog
- **5V standard, 12V & 24V available**
- **Also available in gated and frictional travel versions**
- **RoHS/WEEE/Reach compliant**

Standard Characteristics/Ratings:

GENERAL:

Sensor Type: Hall effect analog, factory programmed with temperature compensation, and ground and supply line break detection, over voltage and reverse voltage protection options.

Design: Contactless sensing

Magnet: Dual bar permanent magnet

ELECTRICAL RATINGS: Rated at 5V @ 20°C Load = 1ma (4.7kΩ)

Electrical	Units	Min	Typ	Max
Supply Voltage	VDC	4.5	5	5.5
Output Voltage Tolerance +Y, -Y, +X, -X 0° Deflection	VDC @ 5V Vcc	-0.25	N/A	+0.25
Output Voltage Tolerance at Full Travel +Y, -Y, +X, -X Direction	VDC @ 5V Vcc	-0.25	N/A	+0.25
Supply Current Per Sensor	mA	N/A	N/A	10
Output Source Current Limit	mA	-1	N/A	1

MECHANICAL:

Mechanical Life: In all directions, 1,000,000 cycles min up to 10,000,000 cycles depending on configuration

Travel Angle: 18° min to 22° max

Overtravel Angle: 0.5° min to 1.5° max

Operating Force: With bellows, 20°C to 85°C at grip 0.5 lb. min to 3.5 lbs. max

ENVIRONMENTAL:

Operating Temp Range: Low force -20°C to +85°C
High force -40°C to +85°C

Electronics: Sealed to IP68S

RFI: Withstand 100V/M, 14KHz to 1GHz

EMI: Withstand per MIL-STD-461D/SAE J1113-22

MATERIALS:

Housing: Thermoplastic, black

Bellows: Neoprene or silicone, black

Wires: Per customer application

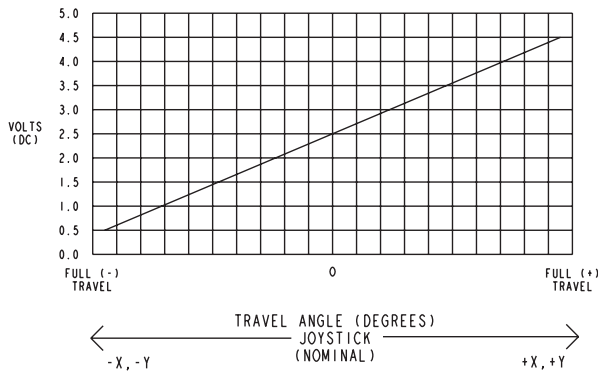
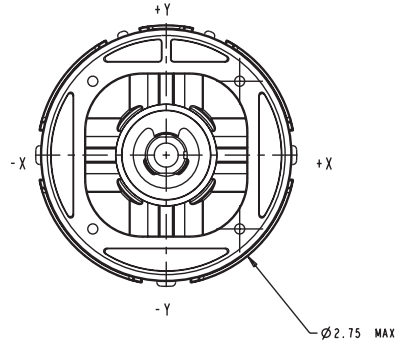
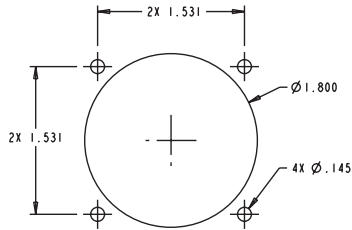
Mounting Hardware: Panhead screws

MEDIUM HALL EFFECT JOYSTICK

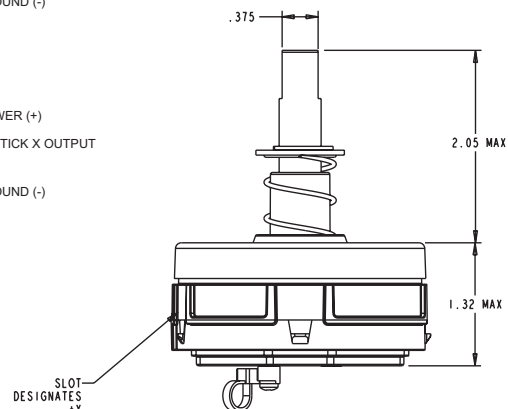
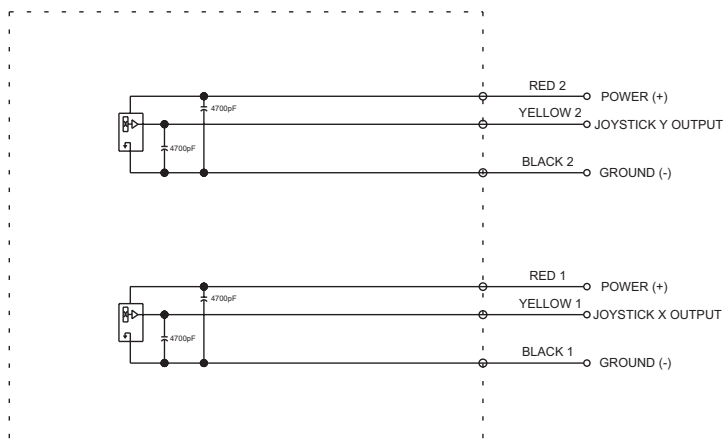
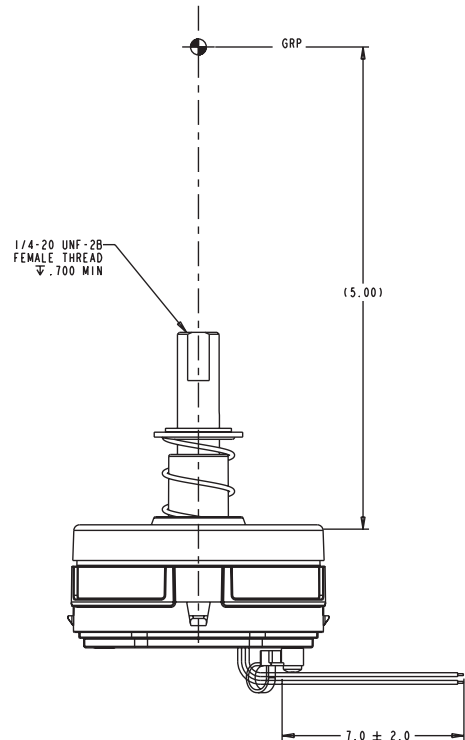
JHM
MEDIUM
JOYSTICK

UP TO 10 MILLION OPERATIONAL CYCLES IN ALL DIRECTIONS

SUGGESTED PANEL OPENING:
RECOMMENDED PANEL THICKNESS: .050 TO .150



Shown is an example of one output per axis configuration. For additional output configurations, contact factory. Redundant sensors are available, please contact factory.



HALL EFFECT



The JHS-F0001 is a single axis, friction hold joystick that was designed for the construction equipment and off-road vehicle market. The key feature of the JHS-F0001 joystick is that the lever does not return to center when released. Designed for use in applications where the output is used to control the speed or direction of the machine or mechanism, allowing the operator to set the speed of movement to focus on steering or other tasks. Favored for its compact size, strength and reliability, the JHS-F0001 is manufactured with non-contacting Hall effect sensors; the electronics are sealed to IP68S. It offers excellent resistance to RFI at 100V/M and EMI per MIL-STD-461D/SAE J1113-22; standard 0.5 to 4.5VDC proportional output and a mechanical life of 500,000 cycles.

Features:

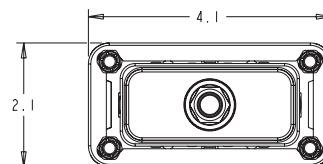
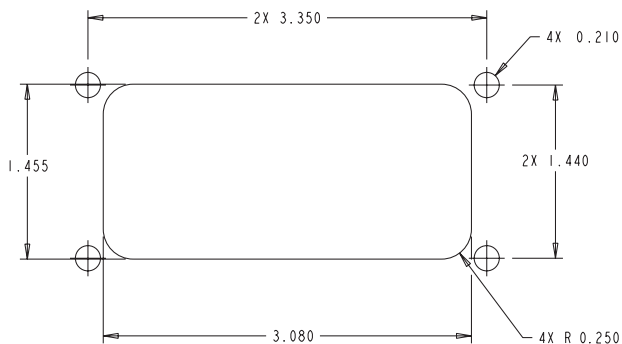
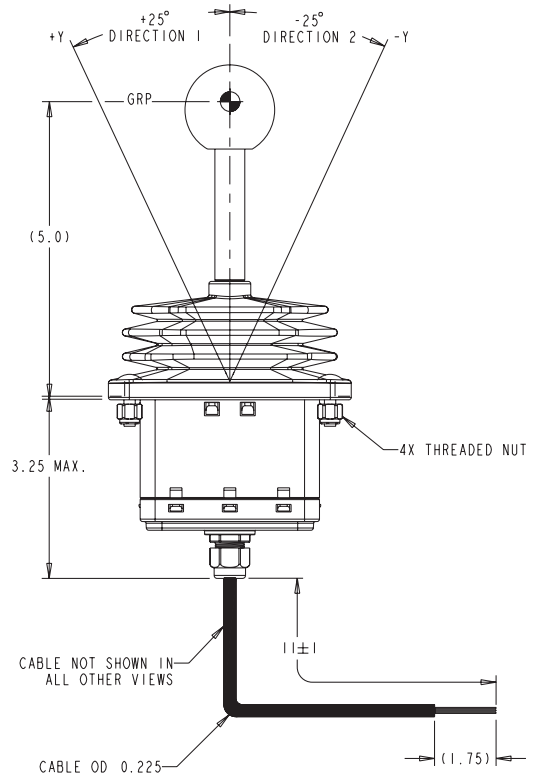
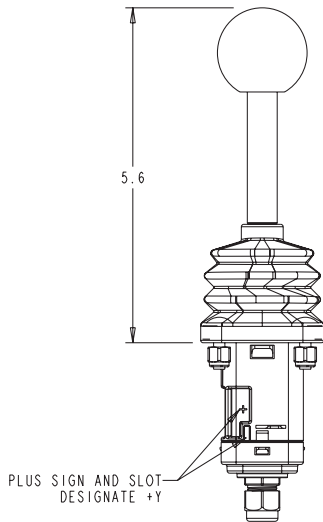
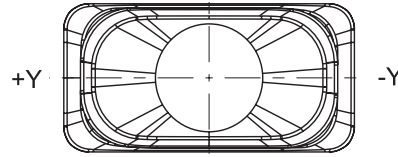
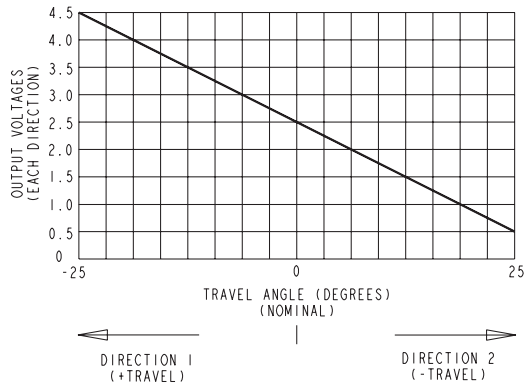
- Rugged compact design
- Hall effect contactless sensing
- Electronics sealed to IP68S
- Excellent proportional control
- Outstanding EMI/RFI immunity
- Redundant output available
- RoHS/WEEE/Reach compliant

Standard Characteristics/Ratings:				
ELECTRICAL RATINGS: Rated at 5V @ 20°C Load = 1ma (4.7kΩ)				
Electrical				
	Units	Min	Typ	Max
Supply Voltage	VDC	4.5	5	5.5
Output Tolerance at Full Travel Direction 1 (+ Travel)	VDC @ 5V Vcc	-.25	N/A	+.25
Output Tolerance at Full Travel Direction 2 (- Travel)	VDC @ 5V Vcc	-.25	N/A	+.25
Supply Current Per Sensor (B = 0, Vcc = 5V, Io = 0)	mA	N/A	N/A	10
ELECTRONICS:				
Seal Integrity:	Electronics watertight per IP68S			
MECHANICAL:				
Mechanical Life:	500,000 cycles			
Travel Angle:	25° typical, 24° min to 26° max			
Operating Force:	3.5 lbs. typical, 2.0 lbs. min to 5.0 lbs. max			
ENVIRONMENTAL:				
Operating Temp Range:	-40°C to +85°C			
Humidity:	96% RH, 70°C, 96 hours			
Vibration:	Per MIL-810F min integrity			
RFI:	Withstand 100V/M, 14KHz to 1GHz			
EMI:	Withstand per MIL-STD-461D/SAE J1113-22			
MATERIALS:				
Basic Handle:	Polyphenylene Blend			
Housing:	Thermoplastic			
Bellows:	EPDM, black (typical)			
Cable:	3/22 AWG (19 strands of 34 AWG TSC) PVC/Polyurethane blend outer jacket			
Mounting Hardware:	10-24 x 3/4 carriage bolts, self-locking nuts			

SINGLE AXIS JOYSTICK WITH FRICTION HOLD

JHS-F
FRICTION
HOLD

SINGLE AXIS HALL EFFECT JOYSTICK WITH FRICTION HOLD



HALL EFFECT

SINGLE AXIS HALL EFFECT JOYSTICK WITH RETURN TO CENTER FEATURE



The JHS-RC0001 is a high reliability single axis, spring-return-to-center joystick, resistant to the levels of temperature, shock, vibration and EMI/RFI typically found in off-highway construction environments. The contactless Hall effect sensor eliminates many of the failures associated with traditional joystick technology. The JHS-RC has been tested to four million cycles with no sign of boot wear and no degradation of electrical performance. The electronics are sealed to IP68S. It offers resistance to RFI at 100V/M and EMI per MIL-STD-461D/SAE J1113-22; standard 0.5 to 4.5VDC proportional output. The JHS-RC is recommended for the construction and off-road vehicle market.

Features:

- Rugged compact design
- Hall effect contactless sensing
- Tested to 4 million cycles
- Smooth spring return to center
- +/- 25° travel in a rugged housing
- Outstanding EMI/RFI immunity
- Redundant output available
- RoHS/WEEE/Reach compliant

Standard Characteristics/Ratings:

ELECTRICAL RATINGS: Rated at 5V @ 20°C Load = 1ma (4.7kΩ)

Electrical				
	Units	Min	Typ	Max
Supply Voltage	VDC	4.5	5	5.5
Output Tolerance at Full Travel Direction 1 (+ Travel)	VDC @ 5V Vcc	-.25	N/A	+.25
Output Tolerance at Full Travel Direction 2 (- Travel)	VDC @ 5V Vcc	-.25	N/A	+.25
Output Tolerance at Center	VDC @ 5V Vcc	-.25	N/A	+.25
Supply Current Per Sensor (B = 0, Vcc = 5V, Io = 0)	mA	N/A	N/A	10

ELECTRONICS:

Seal Integrity: Electronics watertight per IP68S

MECHANICAL:

Mechanical Life: 4 million cycles

Travel Angle: 25° typical, 24° min to 26° max

Operating Force: 2.5 lbs. typical, 1.5 lbs. min to 3.5 lbs. max

ENVIRONMENTAL:

Operating Temp Range: -40°C to +85°C

Humidity: 96% RH, 70°C, 96 hours

Vibration: Per MIL-810F min integrity

RFI: Withstand 100V/M, 14KHz to 1GHz

EMI: Withstand per MIL-STD-461D/SAE J1113-22

MATERIALS:

Housing: Thermoplastic

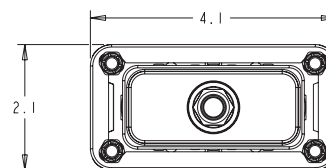
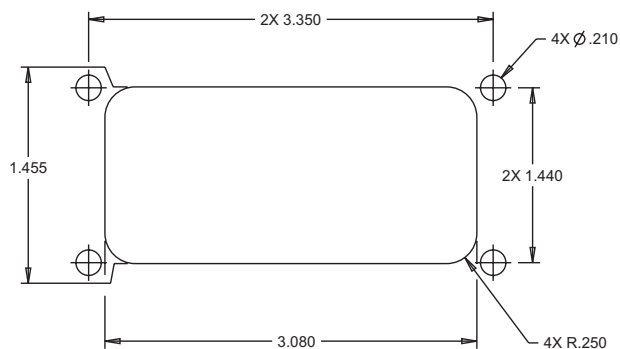
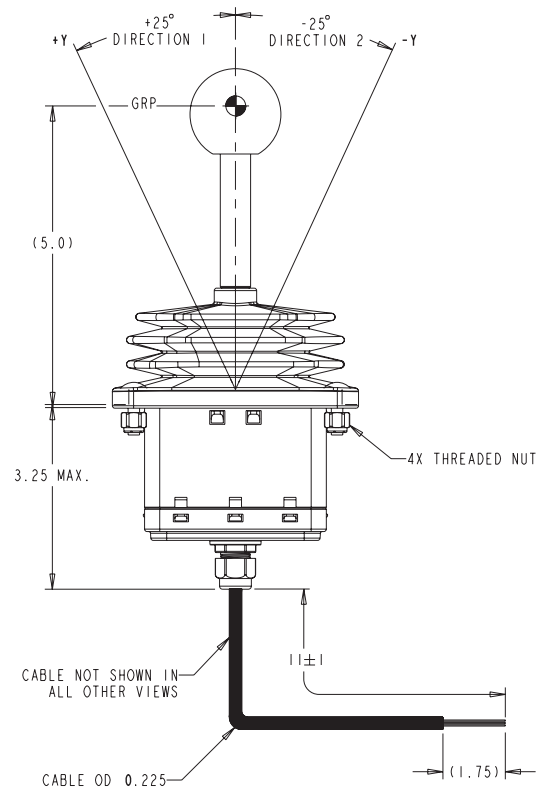
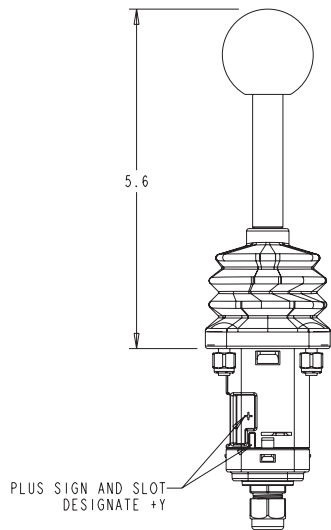
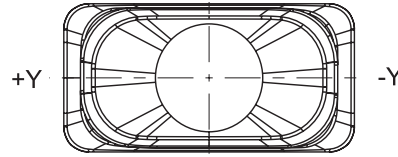
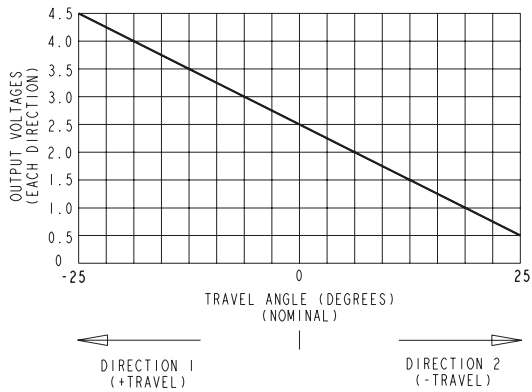
Bellows: EPDM, black (typical)

Cable: 3/22 AWG (19 strands of 34 AWG TSC)
PVC/Polyurethane blend outer jacket

Mounting Hardware: 10-24 x 3/4 carriage bolts, self-locking nuts

SINGLE AXIS RETURN TO CENTER JOYSTICK

SINGLE AXIS HALL EFFECT JOYSTICK WITH RETURN TO CENTER FEATURE



HALL EFFECT

COMPACT DESIGN



Full Boot Shown

Half Boot with P9 Pushbutton Shown

The JHT miniature series Hall Effect joystick's compact design and robust construction is the ideal solution where space is limited and precision control is required. Ideal applications include: robotics, construction equipment, hydraulic controls, medical and surgery equipment, security and surveillance video cameras. The JHT has been tested to five million cycles with no degradation of electrical performance or boot wear. Electronics are sealed to IP68S and the EMI/RFI withstand are per SAE J1113 specifications.

Features:

- Compact design excellent for armrest & panel mounting
- Proven contactless analog output Hall effect technology
- 5 million operational cycles in all directions
- Electronics sealed per IP68S
- Single or omni-directional
- Optional pushbutton switch(es) available
- RoHS/WEEE/Reach compliant

Standard Characteristics/Ratings:				
GENERAL:				
Sensor Type:	Hall effect analog, factory programmed ground and supply line break detection; over voltage and reverse voltage protection			
Design:	Contactless sensing			
ELECTRICAL RATINGS: Rated at Vcc = 5V @ 20°C Load = 1ma (4.7KΩ)				
Electrical				
	Units	Min	Typ	Max
Supply Voltage	VDC	4.5	5	5.5
Output Voltage Tolerance at Center	VDC @ 5V Vcc	-.25	N/A	+.25
Output Voltage Tolerance Full Travel	VDC @ 5V Vcc	-.25	N/A	+.25
Supply Current* (B = 0, Vcc = 5V, Io = 0)	mA	N/A	10	12
Output Impedance	kΩ	N/A	1	N/A
*Single output per axis. Dual axis per output available. Supply current 20mA typical.				
MECHANICAL:				
Joystick Mechanical Life: 5,000,000 cycles in all directions				
P9 Mechanical Life:	1,000,000 cycles			
Travel Angle:	18° min to 22° max, 20° typical			
Overtravel Angle:	0.5° min to 1.5° max, 1° typical			
Joystick Operating Force:	With bellows, at grip 0.5 lb. min to 1.5 lbs. max over temperature range			
P9 Operating Force:	@20°C 8 oz min to 16 oz max, 12 oz typical			
ENVIRONMENTAL:				
Operating Temp Range:	-40°C to +85°C			
Seal:	Electronics seal to IP68S			
RFI/EMI:	Withstand per SAE J1113			
MATERIALS:				
Housing:	Thermoplastic, black			
Bellows:	Silicone, black. Additional materials available, contact factory.			

JHT PART NUMBER CODE

JHT - XX

X

X

XX

X

X

Switch/Boot Style

- 11. With P9 Pushbutton & Full Boot
- 12. With P9 Pushbutton & Half Boot
- 21. Without Pushbutton & Full Boot

Gating*

- 1. Gated, Single axis - Return to Center
- 3. Omni-directional; Round Smooth Feel
- 4. Omni-directional; On-Axis and Off-Axis Guided Feel
- 5. Omni-directional; Round On-Axis Guided Feel

Operating Force

1. 1 lb

Output 1

- AA. 2.5 +/- 2.0VDC
- BB. 2.5 +/- 2.0VDC
- CC. 2.5 +/- 2.0VDC
- DD. 2.5 +/- 1.5VDC
- EE. 2.5 +/- 1.5VDC
- FF. 2.5 +/- 1.5VDC
- GG. 0.5 - 4.5VDC
- HH. 1.0 - 4.0VDC

Output 2

- NONE
- 2.5 +/- 2.0VDC
- 2.5 +/- 2.0VDC
- NONE
- 2.5 +/- 1.5VDC
- 2.5 +/- 1.5VDC
- 0.5 - 4.5VDC
- 1.0 - 4.0VDC

Termination

1. 24 AWG Wire Leads

P9 Button Color**

- N. None
- 1. Red
- 2. Black
- 3. Orange
- 4. Yellow
- 5. Green
- 6. Blue
- 7. Purple
- 8. Gray
- 9. White

*Gated = Restricted movement in XY axis only. Gating icons appear on page 69.

**Applies only to half boot with pushbutton option

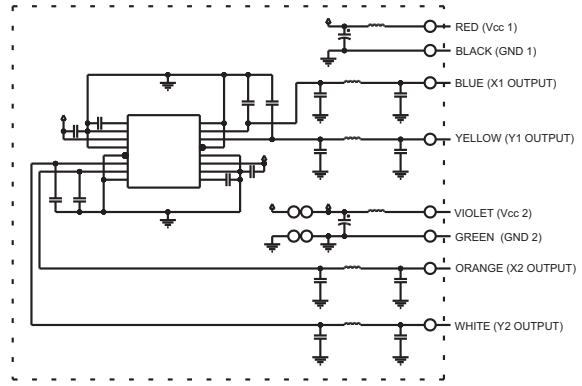
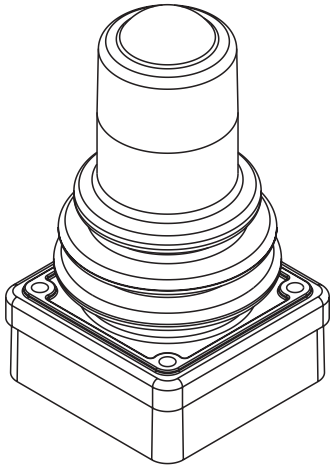
NOTES:

- Outputs are from the center to the full travel position in each direction.
- Options "AA," "BB," "CC," "DD," "EE" and "FF" provide increased voltage in +X, +Y; and decreasing voltage in -X, -Y direction from one output per axis.
- Options "GG" and "HH" provide increasing voltages in all directions (+X, +Y, -X, -Y) from 2 outputs per axis.
- Options "BB" and "EE" provide redundant output 2 which duplicates output 1. Options "CC" and "FF" provide redundant output 2 which is inverse of output 1.

MINIATURE HALL EFFECT JOYSTICK

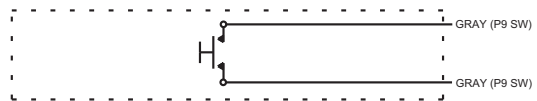
JHT
MINI
JOYSTICK

COMPACT DESIGN



GENERAL SCHEMATIC

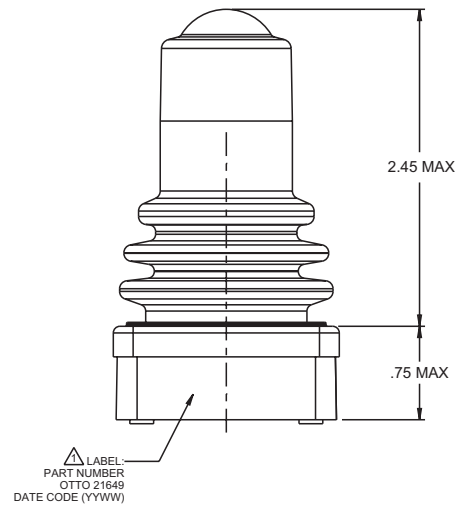
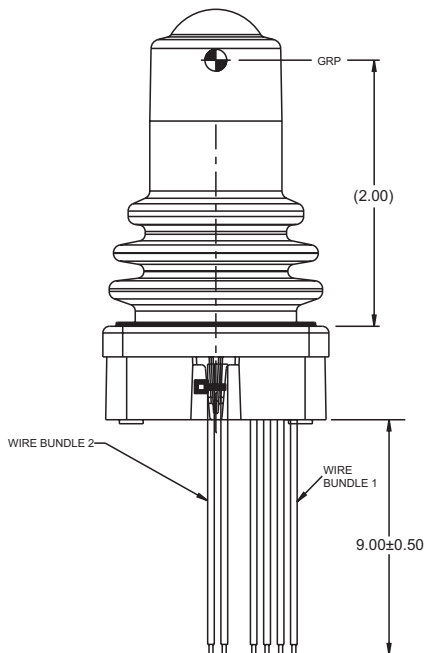
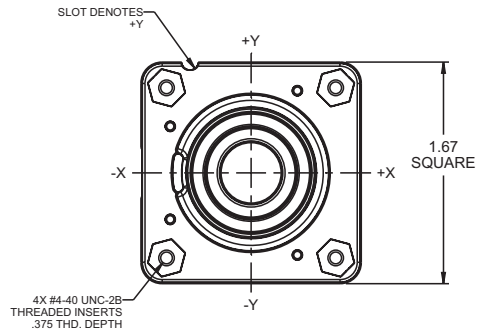
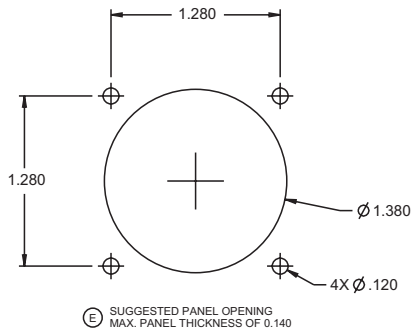
(WIRE BUNDLE 1)
ALL OUTPUTS ARE NOT PRESENT IN ALL CONFIGURATIONS



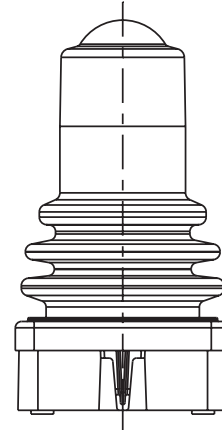
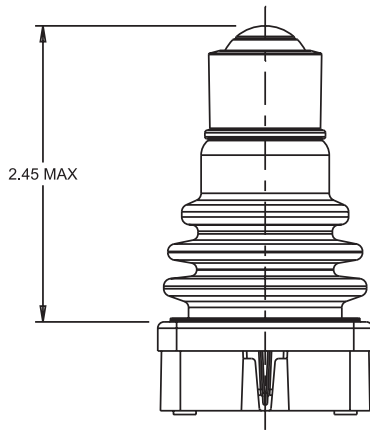
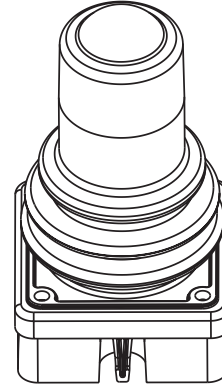
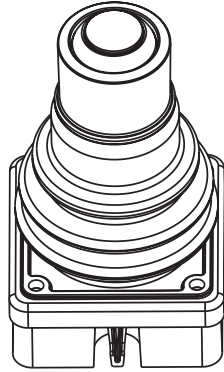
PUSHBUTTON SCHEMATIC

(WIRE BUNDLE 2)
ALL WIRES ARE NOT PRESENT IN ALL CONFIGURATIONS

Full Boot Version Shown



JHT Switch/Style Boot Configuration



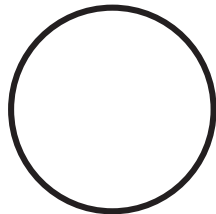
HALF BOOT

FULL BOOT

JHT and JHT Z-Axis Icons Demonstrating Feel*



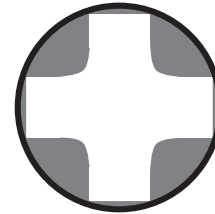
Single Axis



Omnidirectional
Round Smooth Feel



Omnidirectional
On-Axis and Off-Axis
Guided Feel**



Omnidirectional
Round On-Axis
Guided Feel

*Feel defined by shading.

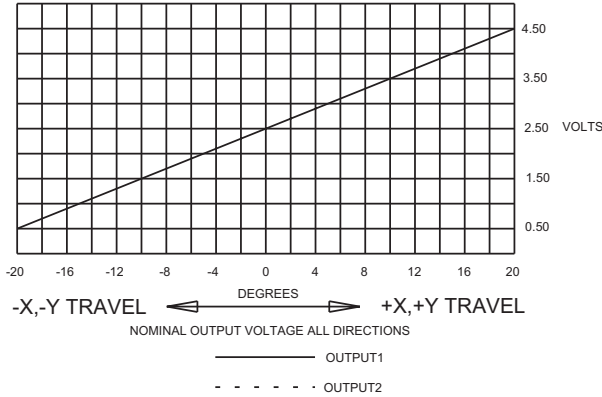
**Full output available in all directions. Contact factory for details.

MINIATURE HALL EFFECT JOYSTICK

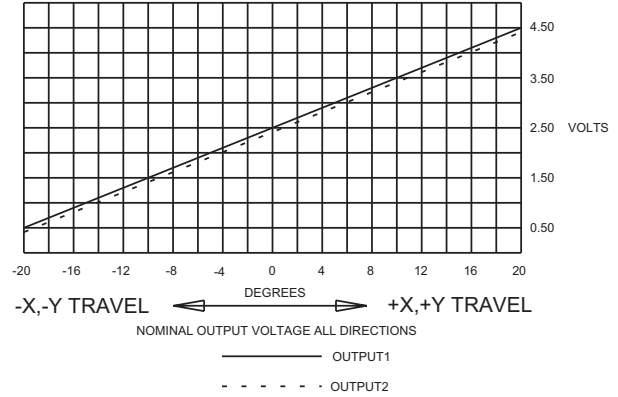
JHT
MINI
JOYSTICK

COMPACT DESIGN

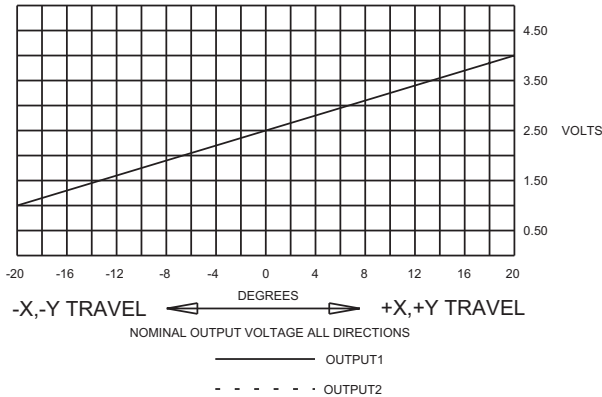
OPTION AA



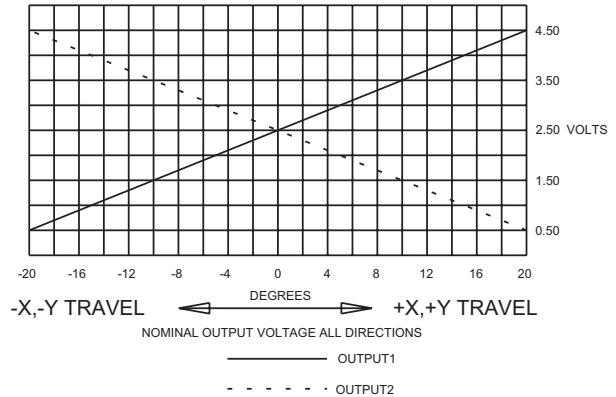
OPTION BB



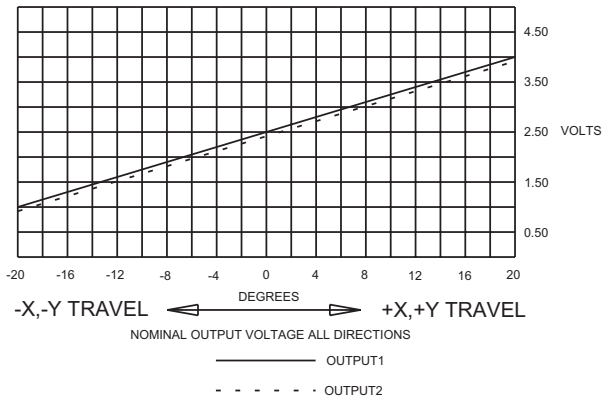
OPTION DD



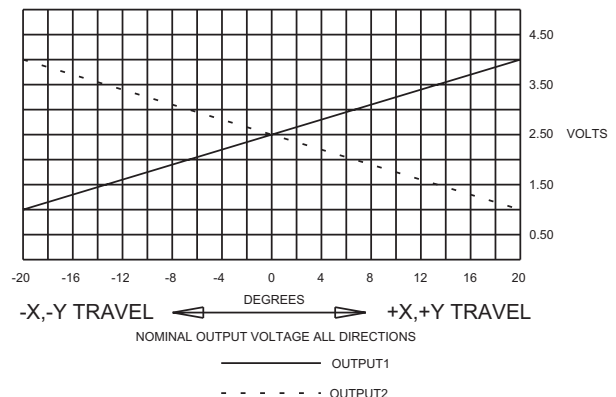
OPTION CC



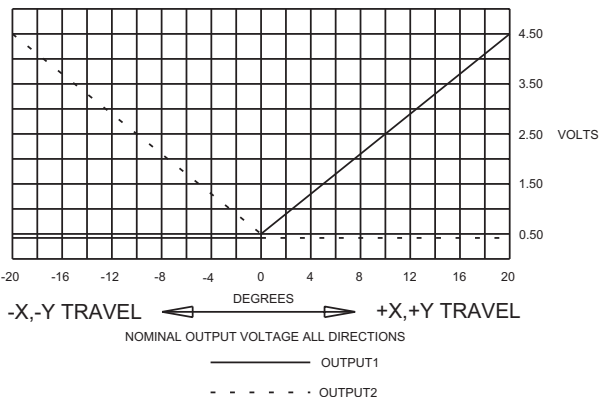
OPTION EE



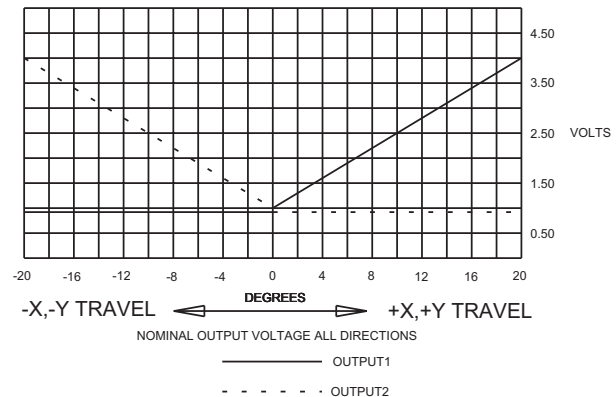
OPTION FF



OPTION GG



OPTION HH



COMPACT DESIGN

JHT Z-Axis



JHT Z-Axis with
Pushbuttons

The JHT Z-Axis Miniature Series Hall Effect Joystick allows for a 60° rotational movement of the knob at the top of the joystick. Z-Axis options include detent, friction hold or spring return to center. Its compact design is the ideal solution where space is limited and precision control is required, while its robust construction is suited for demanding applications. The JHT joystick has been tested to five million cycles in all directions with no degradation of performance. The Z-Axis and/or pushbuttons have been tested to one million cycles. Various gating options are also available. The JHT Z-Axis electronics are sealed to IP68S and can withstand EMI/RFI per SAE J1113 specifications. The JHT Z-Axis has numerous applications and is ideal for construction equipment, unmanned vehicles, hydraulic controls, industrial vehicle controls, medical and surgery equipment and surveillance video cameras.

Features:

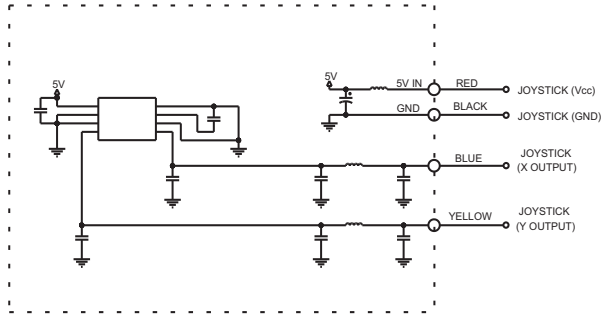
- 60° rotational movement of the knob
- Compact design
- Contactless analog output Hall effect technology
- 5 million operational cycles in all directions (Joystick)
- Joystick electronics sealed per IP68S
- Optional pushbutton switches available
- RoHS/WEEE/Reach compliant

Standard Characteristics/Ratings:				
GENERAL:				
Sensor Type:	Hall effect analog, factory programmed ground and supply line break detection; over voltage and reverse voltage protection			
Design:	Contactless sensing			
ELECTRICAL RATINGS: Rated at Vcc = 5V @ 20°C Load = 1ma (4.7KΩ)				
Electrical - Joystick Z-Axis Return to Center				
	Units	Min	Typ	Max
Supply Voltage	VDC	4.5	5	5.5
Output 1+2 Voltage, +Z, -Z 0° Deflection	VDC @ 5V Vcc	2.25	2.50	2.75
Output 1+2 at Full Travel +Z Direction	VDC @ 5V Vcc	4.25	4.50	4.55
Output 1+2 at Full Travel -Z Direction	VDC @ 5V Vcc	0.45	0.50	0.75
Supply current (per sensor) B = 0, Vcc = 5V, Io = 0	mA	N/A	N/A	10.0
Output - Source Current Limit B = -X, Vo = 0	mA	-1.0	N/A	1.0
Electrical - Joystick Z-Axis Friction				
	Units	Min	Typ	Max
Supply Voltage	VDC	4.5	5	5.5
Output 1+2 at Full Travel +Z Direction	VDC @ 5V Vcc	4.25	4.50	4.55
Output 1+2 at Full Travel -Z Direction	VDC @ 5V Vcc	0.45	0.50	0.75
Supply Current (per sensor) (B = 0, Vcc = 5V, Io = 0)	mA	N/A	N/A	10
Output - Source Current Limit B = -X, Vo = 0	mA	-1.0	N/A	1.0
Electrical - Joystick Z-Axis 3 Detent				
	Units	Min	Typ	Max
Supply Voltage	VDC	4.5	5	5.5
Output 1+2 Voltage, +Z, -Z 0° Deflection	VDC @ 5V Vcc	2.25	2.50	2.75
Output 1+2 at Full Travel +Z Direction	VDC @ 5V Vcc	4.25	4.50	4.55
Output 1+2 at Full Travel -Z Direction	VDC @ 5V Vcc	0.45	0.50	0.75
Supply current (per sensor) B = 0, Vcc = 5V, Io = 0	mA	N/A	N/A	10.0
Output - Source Current Limit B = -X, Vo = 0	mA	-1.0	N/A	1.0
Z-Axis				
Mechanical Life:	1,000,000 cycles in all directions			
	Units	Min	Typ	Max
Travel Angle (Total)	Degrees	56	60	64
Operational Torque with Detent	OZ	10	20	30
Operational Torque with Friction Hold	OZ	1.0	4.0	7.0
Operational Torque Return to Center	OZ	8.0	16	24
ENVIRONMENTAL:				
Operating Temp Range:	-40°C to +85°C			
Seal:	Electronics without pushbutton sealed to IP68S			
MATERIALS:				
Housing:	Thermoplastic, black			
Bellows:	Silicone, black. Additional materials available, contact factory.			

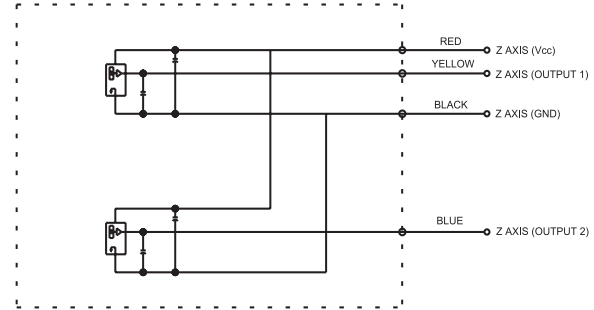
MINIATURE Z-AXIS HALL EFFECT JOYSTICK

JHT
Z-AXIS MINI
JOYSTICK

COMPACT DESIGN

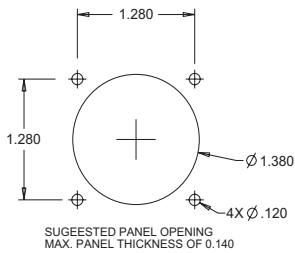


JOYSTICK SCHEMATIC

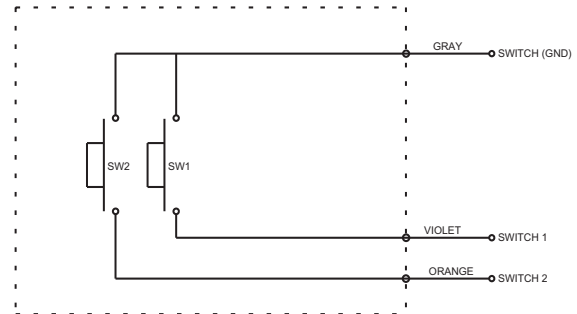
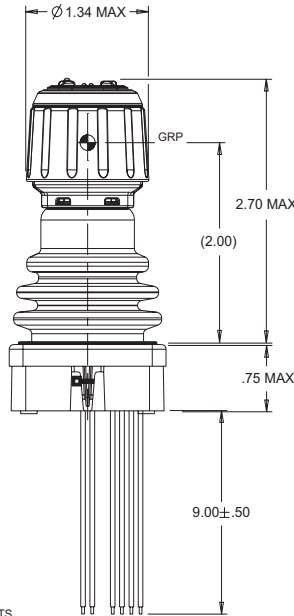
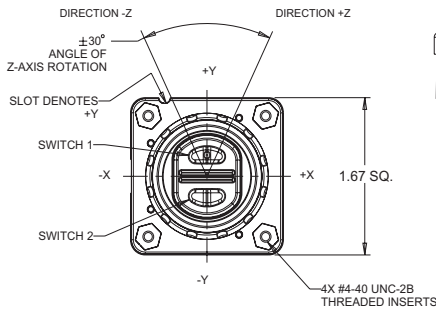


Z AXIS SCHEMATIC

(WIRE BUNDLE 2)
ALL WIRES ARE NOT PRESENT IN ALL CONFIGURATIONS



SUGGESTED PANEL OPENING
MAX. PANEL THICKNESS OF 0.140



KEYPAD SCHEMATIC

JHT Z-AXIS PART NUMBER CODE

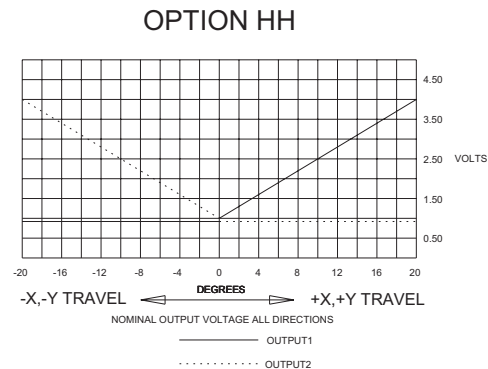
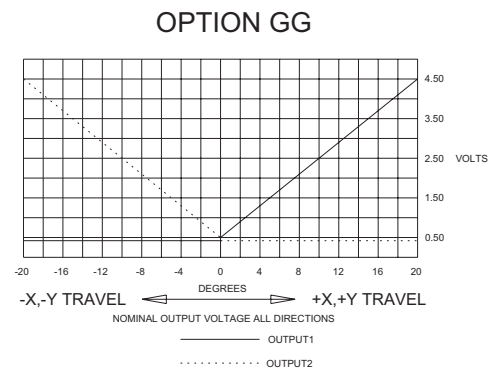
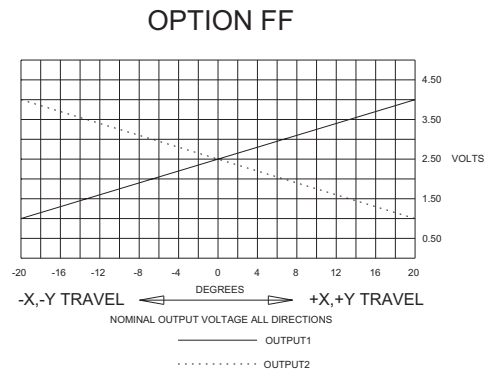
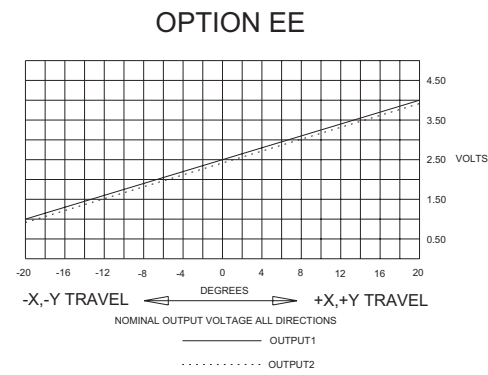
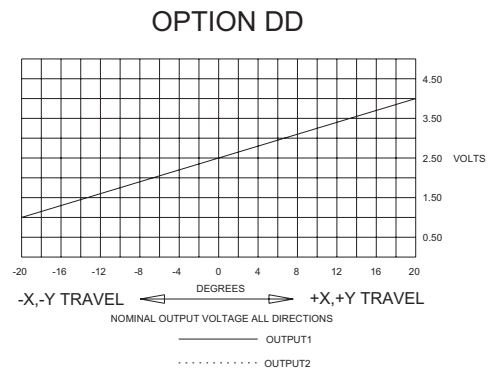
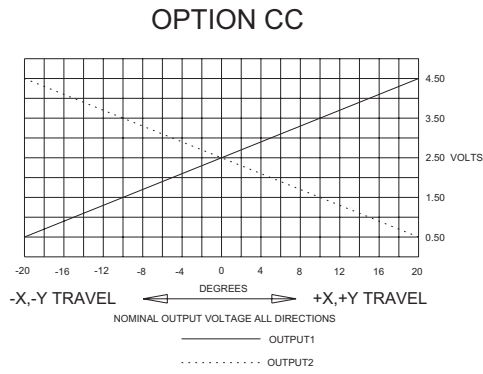
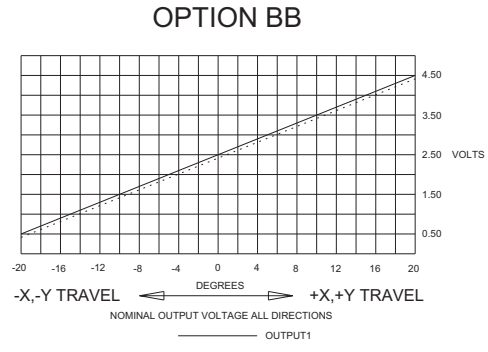
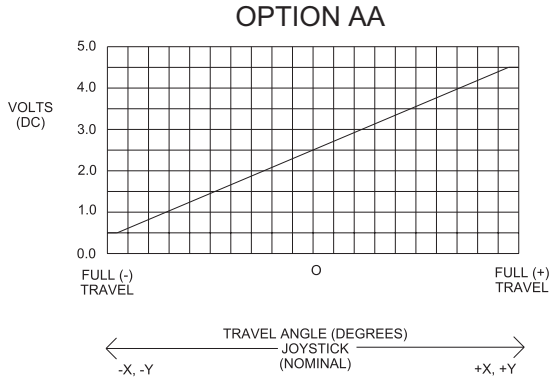
JHT	XX	X	X	XX	X	N
Switch/Boot Style (All Half Boot)	Gating*	Operating Force	Joystick Output 1	Joystick Output 2	Termination	
32. Z-Axis with Detent, Single Output	1. Gated, Single axis – Return to Center	1.1 lb	AA. 2.5 +/- 2.0VDC	NONE	1. 24 AWG Wire Leads	
42. Z-Axis with Friction Hold, Single Output	3. Omni-directional; Round Smooth Feel		BB. 2.5 +/- 2.0VDC	2.5 +/- 2.0VDC		
52. Z-Axis Return to Center, Single Output	4. Omni-directional; On-Axis and Off-Axis Guided Feel		CC. 2.5 +/- 2.0VDC	2.5 +/- 2.0VDC		
62. Z-Axis with Detent, Dual Output	5. Omni-directional; Round On-Axis Guided Feel		DD. 2.5 +/- 1.5VDC	NONE		
72. Z-Axis with Friction Hold, Dual Output			EE. 2.5 +/- 1.5VDC	2.5 +/- 1.5VDC		
82. Z-Axis Return to Center, Dual Output			FF. 2.5 +/- 1.5VDC	2.5 +/- 1.5VDC		
92. Z-Axis with Detent, Single Output with Two Pushbuttons			GG. 0.5 - 4.5VDC	0.5 - 4.5VDC		
A2. Z-Axis with Friction, Single Output with Two Pushbuttons			HH. 1.0 - 4.0VDC	1.0 - 4.0VDC		
B2. Z-Axis Return to Center, Single Output with Two Pushbuttons						
C2. Z-Axis with Detent, Dual Output with Two Pushbuttons						
D2. Z-Axis with Friction, Dual Output with Two Pushbuttons						
E2. Z-Axis Return to Center, Dual Output with Two Pushbuttons						

*Gated = Restricted movement in XY axis only. Gating Icons shown on page 69 in the JHT mini joystick section.

NOTES (Applies to Joystick Output Only):

- Outputs are from the center to the full travel position in each direction.
- Options "AA," "BB," "CC," "DD," "EE" and "FF" provide increased voltage in +X, +Y; and decreasing voltage in -X, -Y direction from one output per axis.
- Options "GG" and "HH" provide increasing voltages in all directions (+X, +Y, -X, -Y) from 2 outputs per axis.
- Options "BB" and "EE" provide redundant output 2 which duplicates output 1. Options "CC" and "FF" provide redundant output 2 which is inverse of output 1.

JOYSTICK OUTPUT CONFIGURATION



OTTO is an industry leader in the integration of J1939 and CANopen® serial bus communications in on and off-highway operator controls. OTTO has extensive experience implementing CAN operating systems in conjunction with the latest generation of operator controls; replacing traditional electromechanical and hydraulic systems with solid state, digital and analog electro-hydraulic control systems. OTTO's product line of electro-mechanical switches, Hall effect devices, pushbuttons and mini joysticks mated to our Hall effect joysticks and control handles provide a CAN based integrated solution for any application.

J1939 offers an industry standard set of defined codes for consistent system integration.

The OTTO J1939 Joystick will work in systems running with 250Kbit/sec processing a message approximately every 10ms. J1939 can be configured into three variations (50, 51, 52 are the default addresses). An external resistor change at the connector pins allows multiple OTTO joysticks to be used on the same bus. Additional joystick addresses can be added by assigning a unique identification during configuration.

CANopen® provides a greater degree of flexibility in defining device IDs and can be remotely configured. CANopen® can also be configured to run with other system baud rates.

Features:

- **Standard configuration for both is three analog input channels & 12 digital input channels with two digital output channels**
- **CAN power accommodates a 9–32VDC power supply**
- **I/O extension for up to 40 digital inputs, eight analog inputs & multiple digital outputs by I²C interface**
- **Both J1939 & CANopen® versions include a failure monitoring feature**
- **EMI/RFI per ISO 11898 89/336 ECC, tested to 100V/M**
- **Operating temperature -40°C to +85°C**
- **Storage temperature -65°C to +105°C**
- **All designs are RoHS and WEEE compliant**



CANbus Joystick

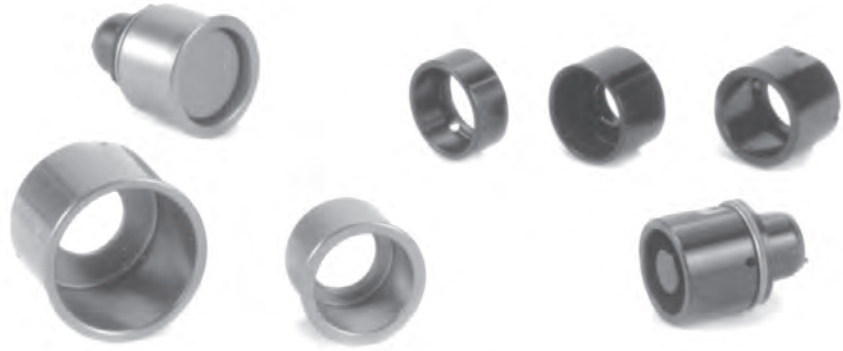


HJFC Foot Pedal
with CANbus Interface

SHROUDS, PANEL SEALS & MOUNTING HARDWARE

Shrouds

Shrouds are added to pushbutton switches to guard against inadvertent actuation. The actuating device must be inserted into the shroud in order to actuate the switch. We have an assortment from which to choose shown here. We are also able to design and fabricate a shape to meet your specifications and application needs.

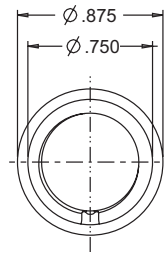


Material:

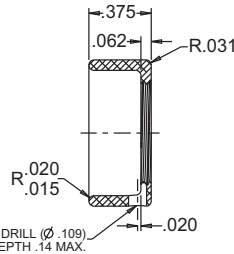
Aluminum alloy, machined to specification.

Finish:

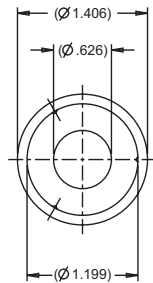
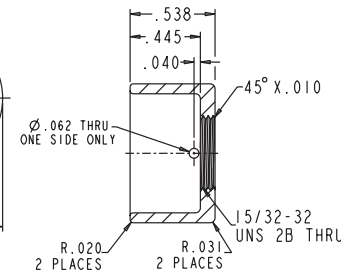
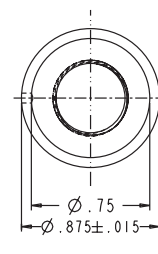
Black anodized. For other color options, contact factory.



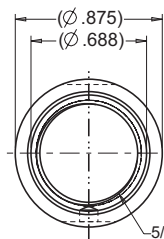
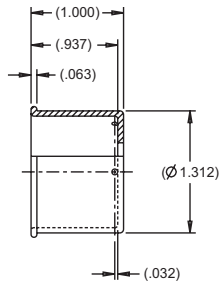
OTTO P/N C300793



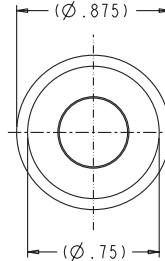
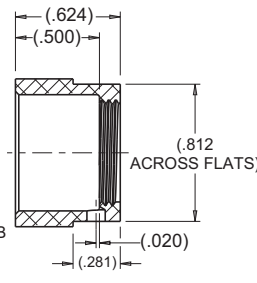
OTTO P/N C300428



OTTO P/N C300302



OTTO P/N C300871



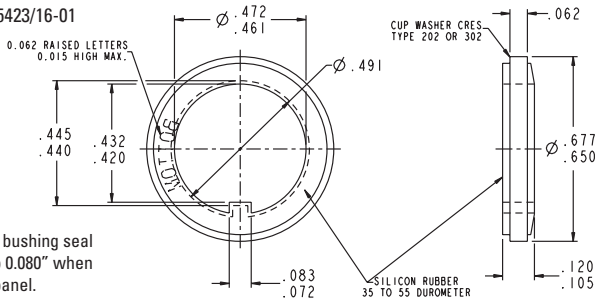
OTTO P/N C300426

Panel Seals

Stainless steel cup washer with silicone rubber seal assures proper watertight panel seal. Mounts behind panel. Approved to MIL-DTL-5423/16. Designed for sealing 15/32" bushing with keyway.

OTTO P/N: 710196

MIL P/N: M5423/16-01



Thickness of bushing seal is reduced to 0.080" when mounted to panel.

Gaskets

O-Rings (Buna)

OTTO P/N	I.D.	OTTO P/N	I.D.
700117	0.250"	802568-010	0.250"
700110	0.469"	802568-015	0.500"
700109	0.625"	802568-016	0.625"

Mounting Hardware

MILITARY P/N

OTTO P/N

BUSHING SIZE (inches)

KEYWAY WASHERS

MS25081-C0	710081-C0	0.250"
MS25081-C4	710081-C4	0.469"
MS25081-C6	710081-C6	0.625"

INTERNAL TOOTH LOCKWASHERS

MS35333-135	710333-135	0.250"
MS35333-136	710333-136	0.469"
MS35333-138	710333-138	0.625"

HEX NUTS—STANDARD

MS25082-C14	710082-C14	0.250-40
MS25082-C21	710082-C21	0.469-32
MS25082-B11	710082-B11	0.625-24

HEX NUTS—WIRE LOCKING

MS21340-04	710340-04	0.469-32
MS21340-05	710340-05	0.625-24

All hardware is stainless steel except MS25082-B11 which is brass, black oxide plated.

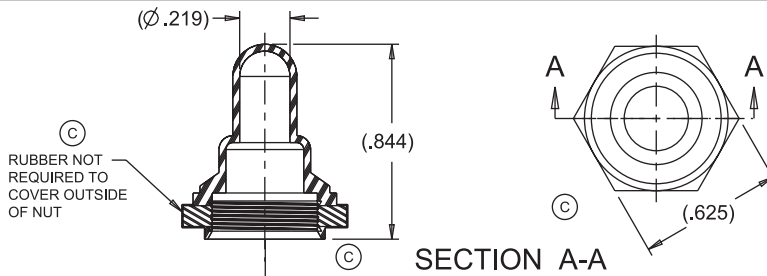
SWITCH BOOTS, TOGGLE BOOTS AND HEX NUTS

HARDWARE

P/N 740191

T9 Toggle Boot with 15/32" Thread

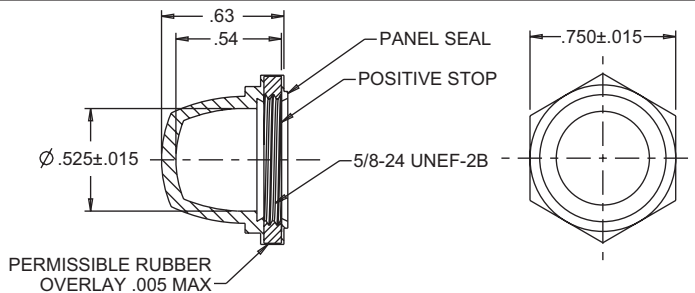
Boot: Black Silicone Rubber
Nut: Brass, Nickel Plated



P/N 700179

P3-6 Pushbutton Sealed Hex Nut
MIL-DTL-5423/7 Type B, Style 2, Size 4

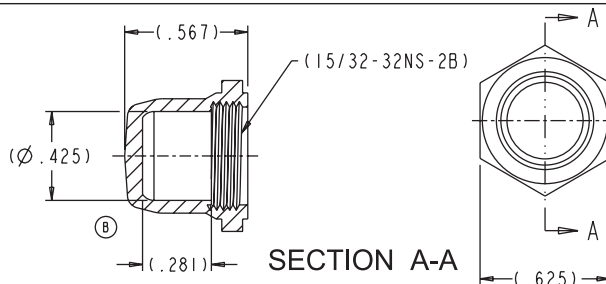
Material: Silicone Rubber
700179-2S = Black, 700179-4S = Yellow
700179-8S = Gray



P/N 740144

P4-4 Switch Boot with Threaded Insert

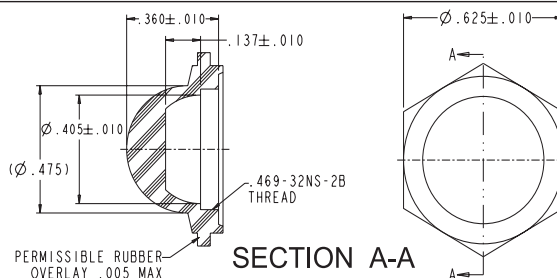
Boot: Black Silicone Rubber
Insert: Brass, Nickel Plated



P/N 701211

P7-6 Pushbutton Boot Hex Nut

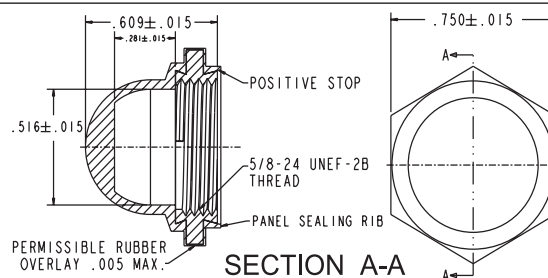
Material: Black Neoprene
Thread: 15/32"



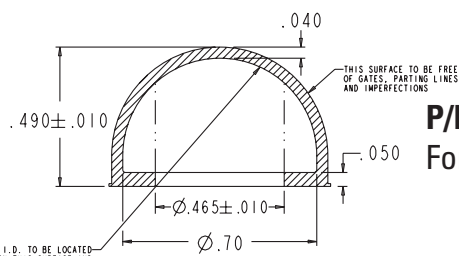
P/N 701170

P3-3, P3-6, P3-7 and P3-8 Pushbutton Boot

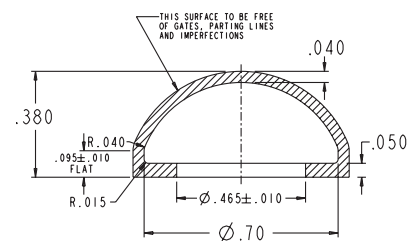
Material: Gray Silicone Rubber
Thread: 5/8"



P7/P9 Sealing Boots



P/N 402246
For Raised Dome



P/N 402339
For Flush Dome