

APEM

3000 series

Premium Hall effect joysticks



The 3000 Series is the very latest generation in high precision contactless joysticks. With a class leading installed depth of <math><20\text{mm}</math>, it is available in 1, 2 or 3 axes formats. Long trouble-free life is assured with the latest hall effect technology, providing a range of analog signals or custom PWM output options. The 3000 Series also delivers a radically improved mechanism construction that is specifically designed for increased robustness, strength and performance.



KEY FEATURES

- Class leading installed depth <math><20\text{ mm}</math>
- Hall effect sensing
- 1, 2 or 3 axes
- 5V or 3.3V operation
- EMC shielded
- Analog or PWM outputs
- Next generation metal mechanisms
- Dual outputs available



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OPTION SELECTION

SERIES <hr/> 3 3000	GAIN <hr/> 10 +/-10%xV 25 +/-25%xV 30 +/-30%xV 40 +/-40%xV 50 +/-50%xV	HANDLE <hr/> BL Round E Conical Q Skirted AK Push Button AL Third Axis * for more handles see next pages	MODIFIER <hr/> 00 None 20 Guided Feel
CONFIGURATION <hr/> 1 Standard 2 3.3V Operation 3 Dual Outputs 4 Inverse Dual Outputs 5 PWM	LIMITER <hr/> A Single Axis C Cross D Diamond R Round S Square X X Type	BEZEL <hr/> 0 None 4 Circular (below panel) 6 Square (drop-in) 7 Circular (drop-in)	

- **CONFIGURATION 1** provides one proportional output per axis, a center tap reference and a separate center detect output.
- **CONFIGURATION 2** is offered as standard with +/-50% gain, yielding a voltage span from 0V (South) to 3.3V (North).
- **CONFIGURATION 3** joystick operates on 5V and provides two outputs per axis of the same polarity for example Y, Y & X, X. The second set of outputs are accurate to the first within +/-6% of the power supply. The power supply and center tap for the secondary outputs are also completely independent.
- **CONFIGURATION 4** The secondary outputs are of inverse polarity to the primary wipers for example X, -X & Y, -Y. The first and second outputs can be summed and compared to Center Tap to verify that the joystick is operating correctly.
- **CONFIGURATION 5** Operating on a 5V supply the 3000 Series may be selected with a variety of PWM output options. For more details on the type of outputs available please refer to Apem.

Note: The 3.3V supply is created by additional DC/DC conversion within the joystick and therefore the power consumption is greater than a 5V supplied product.

STANDARD OPTION AVAILABILITY

The following table shows which permutations of options are possible.

CONFIGURATION	CT	CD	AXES			SUPPLY		GAIN					LIMITERS						ALL HANDLES	ALL BEZELS			
			X	Y	Z	3.3	5V	10	25	30	40	50	A	C	D	R	S	X					
1	✓	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2	✗	✗	✓	✓	✓	✓	✗	✗	✗	✗	✗	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3	✗	✗	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
4	✗	✗	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
5	✗	✗	✓	✓	✓	✗	✓	✗	✗	✗	✗	✗	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

HANDLE AND BEZEL OPTIONS

For drop-in mounting, please specify bezel option 6 or 7. For sub-panel mounting, no bezel is necessary, unless the boot is required to seal to the face of the panel in which case bezel option 4 should be specified. Further mounting information including panel cut-outs are shown on the following pages.

Note: The company reserves the right to change specifications without notice.

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SPECIFICATIONS

MECHANICAL

Materials Employed	-	Shaft - Stainless Steel Boot - Neoprene Others - Brass, Nylon, ABS
Weight	-	100g (0.20lb) nominal
Breakout Force	-	1.3N (2.86lbf)
Mechanical Angle of Movement	-	36° for X and Y axes (subject to limiter) 50° for Z axis (subject to handle)
Max Load to Mechanism	-	400N (881.85lbf)

ENVIRONMENTAL

Storage	-	-40C to +70C
Operating Temperature	-	-25C to +70C
Seal Above Panel	-	IP65 - Neoprene boot fitted as standard
EMC Emission	-	Complies with EN 61000-6-3:200, CISPR 22:2005 Class B 30MHz-11GHz
Life Cycles	-	10,000,000 cycles (5,000,000 for 3 axes joysticks)
ESD	-	Complies with EN61000-4-2 (extended) +/-8KV (20 contacts) & +/-15KV (20 air discharges)
EMC Immunity	-	100V/m, 80MHz-2.7GHz, 1KHz 80% sine wave modulation, EN 61000-4-3 (extended)
Vibration	-	100Hz - 200Hz @ 0.13g /Hz, total 3.6gRMS (1 Hour in each of the three mutually perpendicular axes)

ELECTRICAL

Gain (Output Voltage Span)	-	+/-10% x V to +/-50% x V
Output at Center	-	V/2 +/- (5% x Gain)
Power Supply	-	5V +/-0.5V Transient free (Configs 1, 2, 3, 4 & 5) or 3.3V +/-0.1V (Config 2)
Center Tap Impedance	-	1K1
Center Detect Output	-	Pulled high within joystick via 2K2 to +V, and smoothed to 0V with 100nF
Sensor Type	-	Hall effect
Current Consumption	-	5V - <13mA (Two axes) - <20mA (Three axes) 3.3V - <24mA (Two axes) - <40mA (Three axes)
Loads	-	Minimum 10K, preferred 100K+

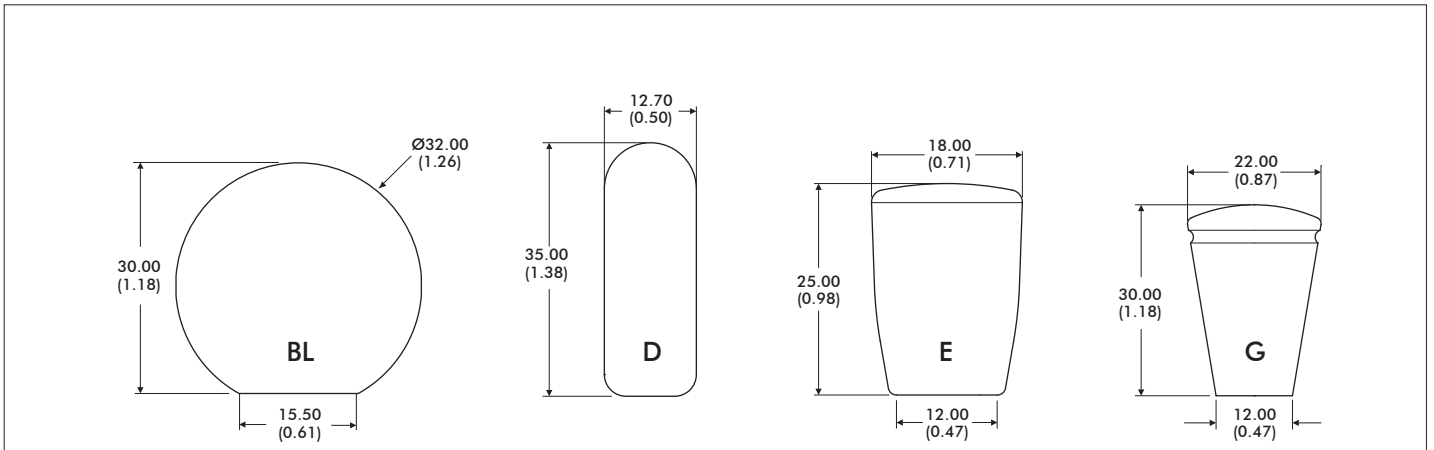
NOTES:

- All values are nominal
- All specifications shown are based on a standard configuration and are provided for guidance only.
- Please refer to Apem for assistance on how to achieve the best performance from your chosen configuration.
- Current consumption may be greater for dual output configurations.

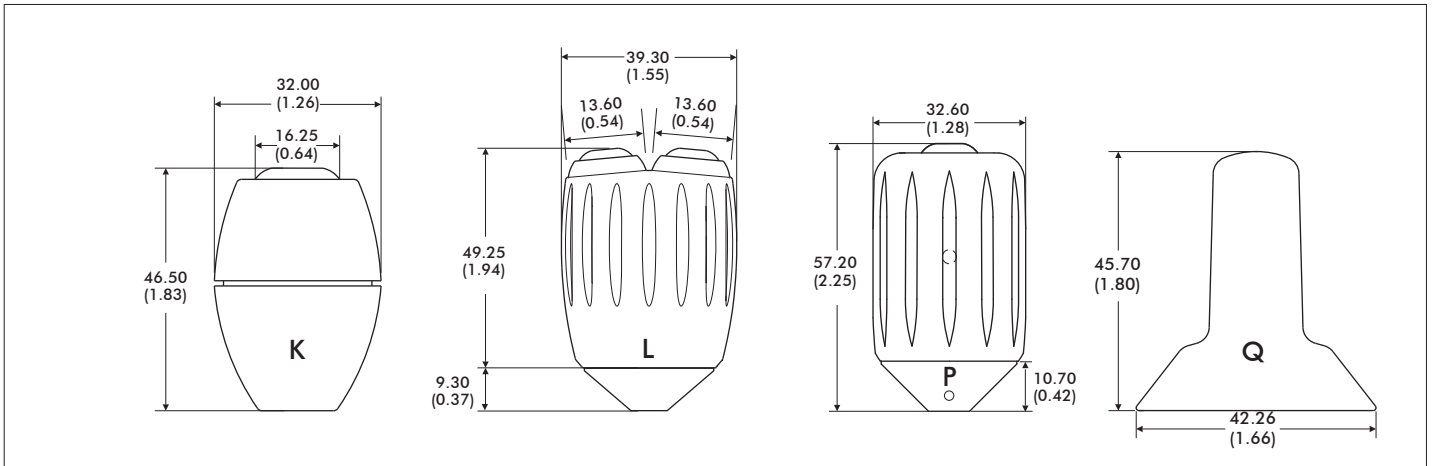
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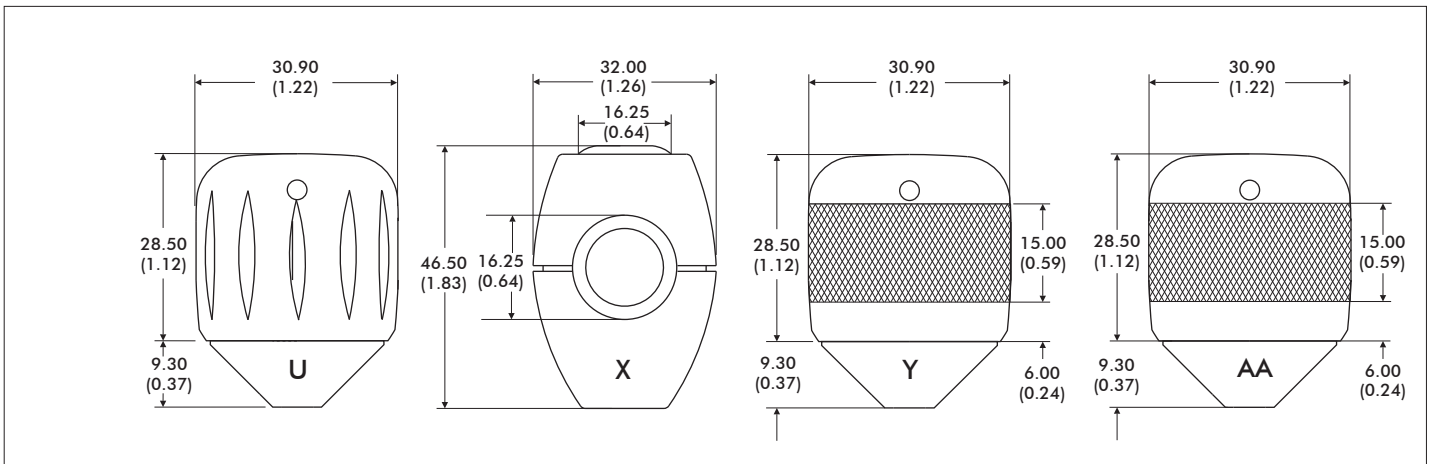
DIMENSIONAL DRAWINGS - HANDLES



MATERIAL	Nylon	Aluminum	Nylon	Phenolic
FINISH	Sparkled Matt	Anodised	Sparkled Matt	Gloss
STANDARD COLOR	Black	Black	Black	Black
OTHER COLORS	Not Available	Not Available	Upon Request	Not Available
NOTES:				



MATERIAL	ABS	Aluminum	Aluminum	Nylon
FINISH	Sparkled Matt	Anodised	Anodised	Sparkled Matt
STANDARD COLOR	Black	Black	Black	Black
OTHER COLORS	Upon Request	Not Available	Not Available	Upon Request
NOTES:	Uses APEM IS Switch	Uses APEM IS Switches Z axis functionality	Uses APEM IS Switches Z axis functionality	



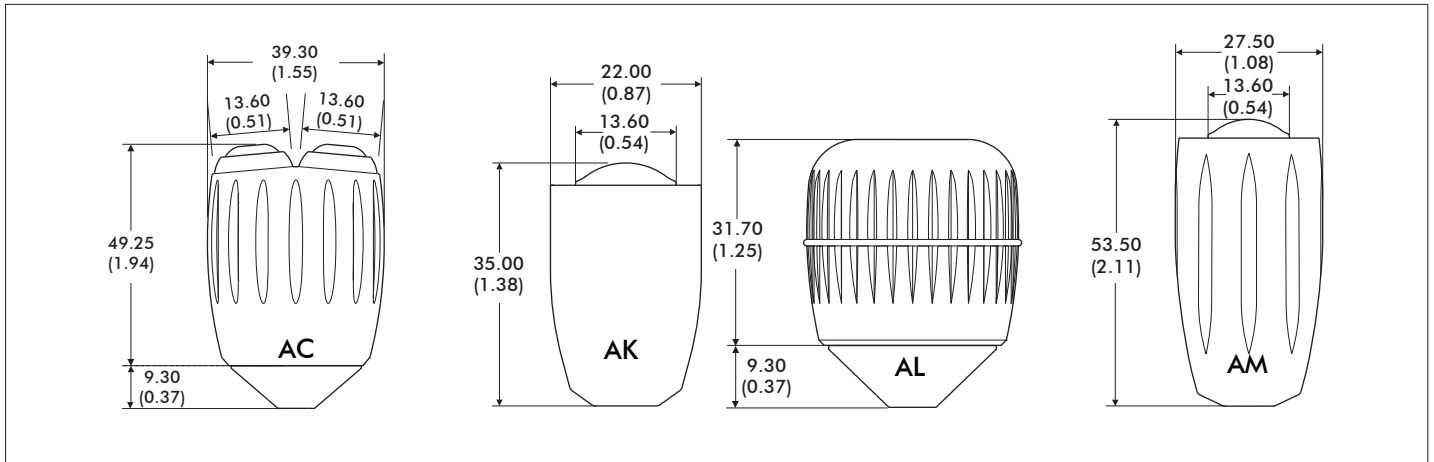
MATERIAL	Aluminum	ABS	Aluminum	Aluminum
FINISH	Anodised	Sparkled Matt	Anodised with Diamond Knurl	Anodised with Diamond Knurl
STANDARD COLOR	Black	Black	Black	Black
OTHER COLORS	Not available	Upon Request	Not Available	Not Available
NOTES:		Uses APEM IS Switches	Z axis functionality	

Note: The company reserves the right to change specifications without notice.

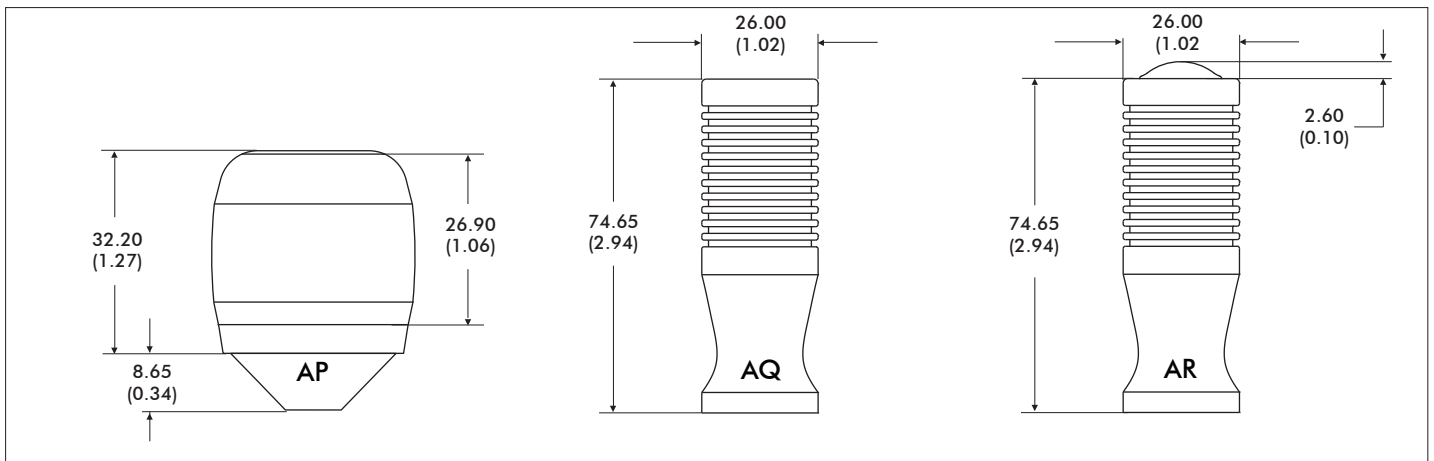
3000 series

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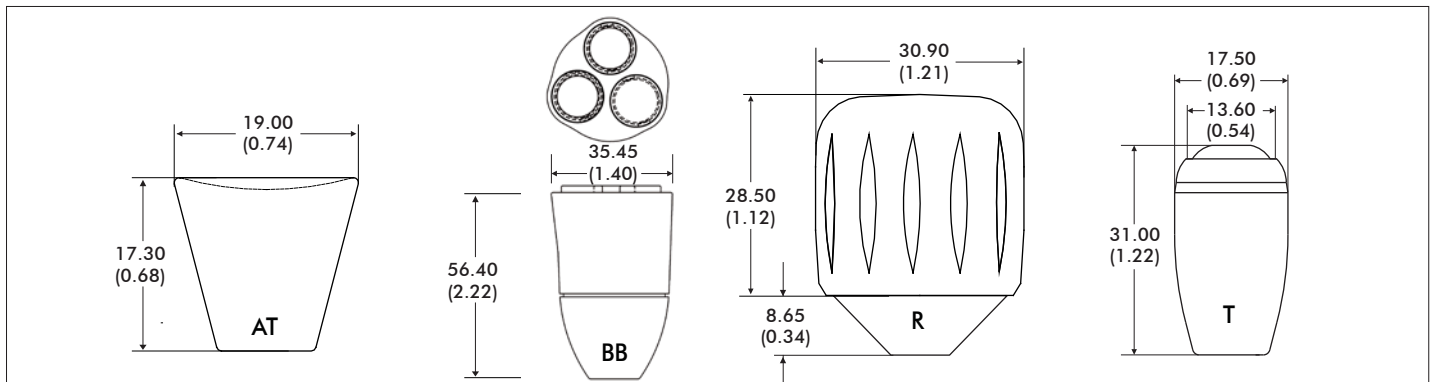
DIMENSIONAL DRAWINGS - HANDLES - continued



MATERIAL	Aluminum	Aluminum	Nylon	Aluminum
FINISH	Anodised	Anodised	Sparkled Matt	Anodised
STANDARD COLOR	Black	Black	Black	Black
OTHER COLORS	Not Available	Not Available	Upon Request	Not Available
NOTES:	Uses APEM IS Switches	Uses APEM IA Switch	Z axis functionality	Uses APEM IA Switch



MATERIAL	Santoprene over Nylon	Aluminium	Aluminium
FINISH	Soft Touch	Anodised	Anodised
STANDARD COLOR	Black	Black	Black
OTHER COLORS	Upon Request	Not Available	Not Available
NOTES:	Z axis functionality		Uses APEM IA Switch



MATERIAL	Nylon	Nylon	Aluminium	Stainless Steel
FINISH	Sparkled Matt	Sparkled Matt	Anodised	Natural
STANDARD COLOR	Black	Black	Black	Stainless Steel
OTHER COLORS	Upon Request	Not Available	Not Available	Not Available
NOTES:		Uses APEM IL switch	Z axis functionality	Uses APEM IS switch

1. Dimensions are in mm/(inch)

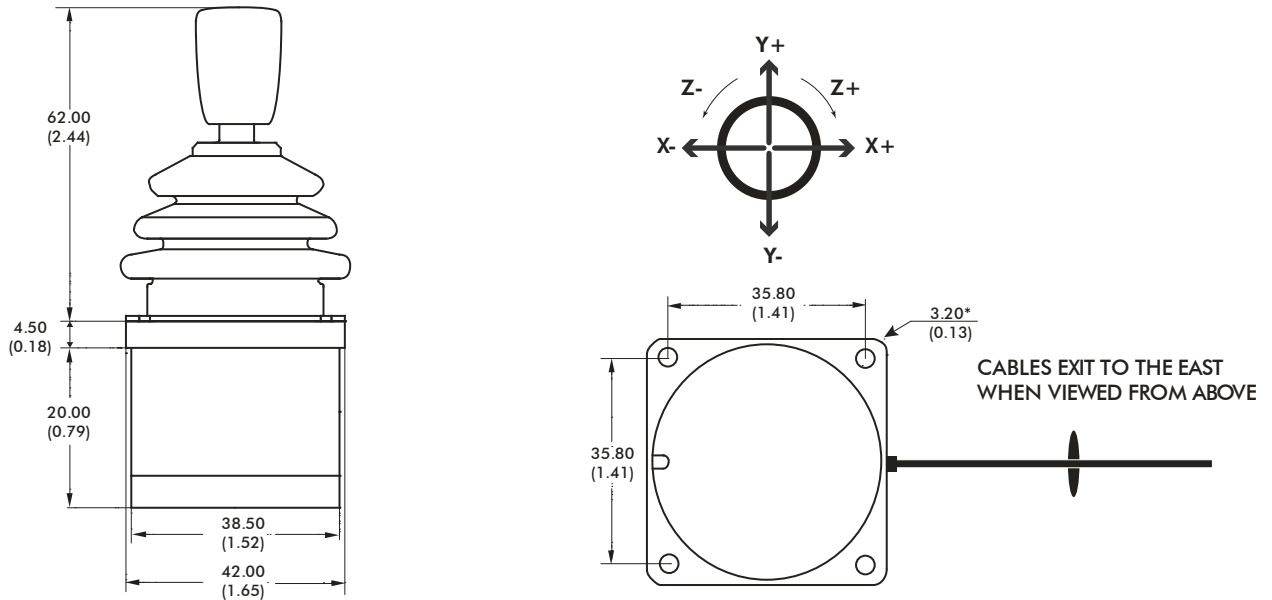
Note: The company reserves the right to change specifications without notice.

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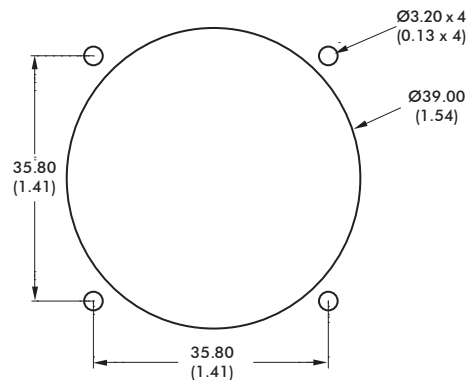
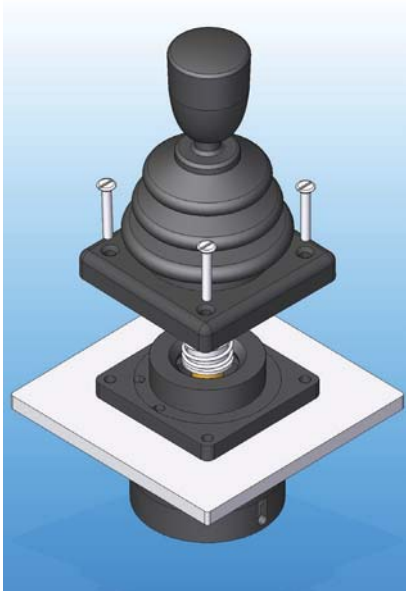
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DIMENSIONAL DRAWINGS - continued

GENERAL DIMENSIONS



DROP IN MOUNTING - PANEL CUT-OUT & MOUNTING INSTALLATION



The joystick is dropped into the panel cut-out. For panel thickness of <math><3\text{mm}</math>, M3 x 16 countersunk machine screws are recommended.

Please note: Image (left) shows a square bezel, a circular bezel is also available for this option.

NOTES:

1. Dimensions are in mm/(inch)
2. The dimensions shown are for generic 3000 series with E type handle. For specific dimensions of this or any other configuration please refer to Apem.

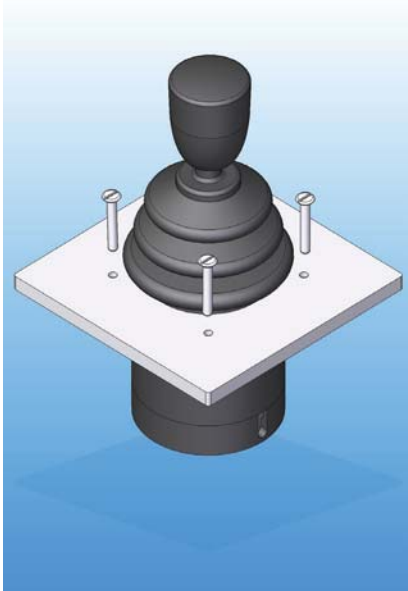
*3000 Series has slotted mounting holes - allows compatibility with mounting pitches of 32.25mm to 35.80mm

3000 series

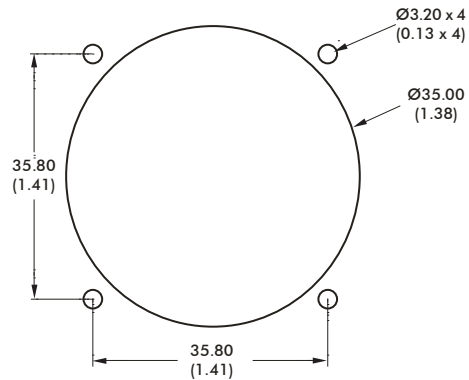
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MOUNTING INSTALLATION

SUB MOUNTING OPTION A - PANEL CUT-OUT & MOUNTING INSTALLATION

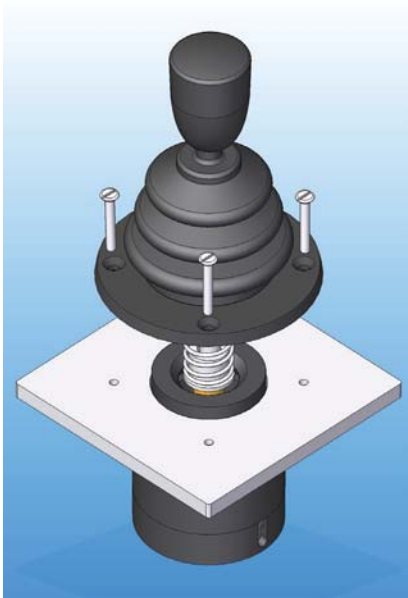


MOUNTING CUT-OUT

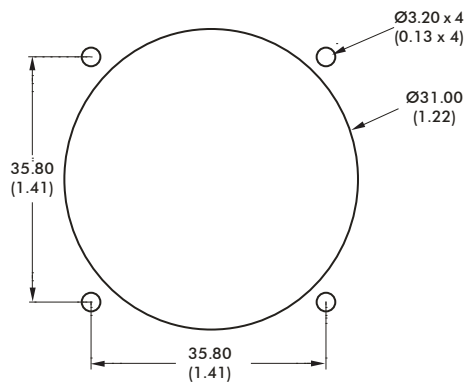


When mounted this way the panel acts as the bezel and no separate bezel is needed. M3 machine screws are recommended.

SUB MOUNTING OPTION B - PANEL CUT-OUT AND MOUNTING INSTALLATION



MOUNTING CUT-OUT



The joystick is mounted beneath the panel and the base of the boot must be brought through the panel cut-out and held in place with the circular bezel. For panel thickness of <3mm, M3 x 16 countersunk machine screws are recommended.

NOTES:

1. Dimensions are in mm/(inch)
2. When sub panel mounting, great care should be taken not to damage the boot, or any of the mechanism under the boot. All panel cut-outs should be free from sharp edges and debris that may damage the boot.

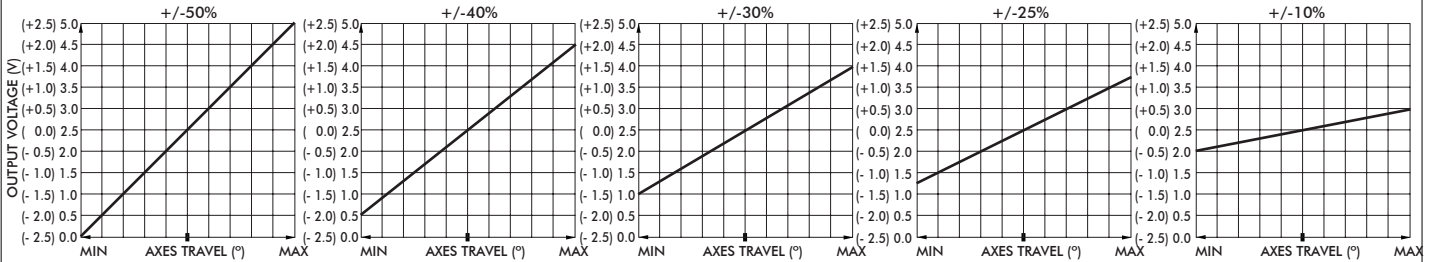
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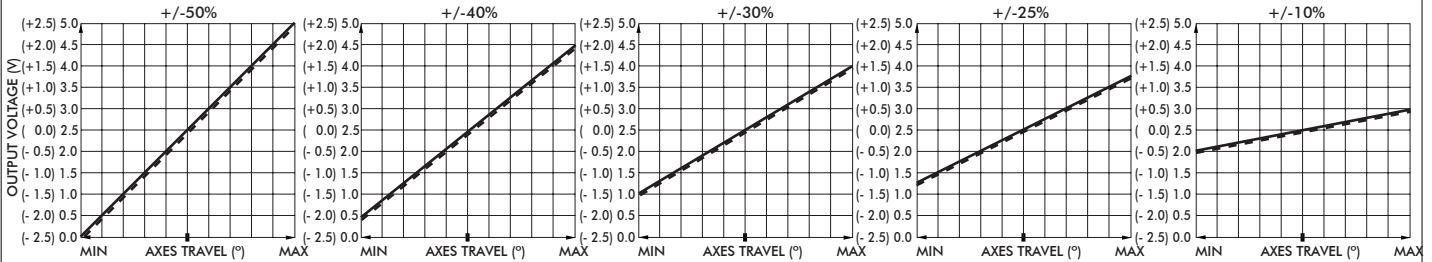
CONFIGURATION OPTIONS

LINEAR OUTPUT OPTIONS

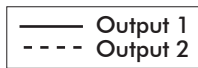
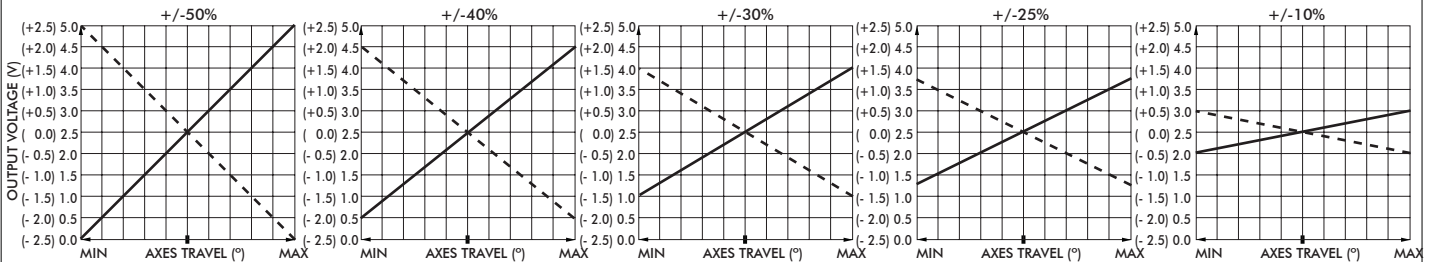
SINGLE OUTPUT - CONFIGURATION 1



DUAL OUTPUT - CONFIGURATION 3



DUAL OUTPUT - CONFIGURATION 4



POWER SUPPLY

The 3000 Series is designed to be powered by a regulated 5V +/- 0.5V power supply. The outputs are ratiometric, making a stable, noise free, power supply essential. The 3.3V version of the 3000 Series requires a power supply accurate to +/-0.1V. The outputs are not ratiometric, the voltage gain is set to 50% as standard, giving an output range from 0 to 3.3V regardless of supply voltage. The power supply to the joystick should be carefully regulated to be within tolerance. Should the power supply change outside of the specified tolerances, permanent damage may occur.

MAGNETIC IMMUNITY AND SYSTEM DESIGN

The 3000 Series incorporates internal magnetic screening to minimise the effect of external magnetic fields. Mounting or operating the joystick close to strong magnetic fields is not recommended. System designers should follow best practice when incorporating the 3000 Series joystick into their products. Care should be taken to decouple the power supply properly and to employ adequate EMC shielding.

MOUNTING

When mounting the joystick, care should be taken to site it in a position that does not make it vulnerable to damage when in use. If the joystick is intended for use in a handheld enclosure then care must be taken to protect the joystick from damage caused by dropping. Basic precautions such as mounting it at the lightest end of the enclosure so it doesn't hit the ground first or by protecting it with a guard should always be implemented for long term reliability. The body of the joystick, on the underside of the panel, must not be subject to water spray, excessive humidity or dust.

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CONFIGURATION OPTIONS - continued

CENTER DETECT (CD)

Where selected, (configuration 1 types) the output on this additional cable will be 0V while the joystick is inactive. Should either the X or Y outputs change outside of the centre tolerance, indicating that the joystick has been operated, the center detect signal will switch to 5V. Within the joystick this output is pulled high by a 2K2 resistor and is decoupled by a 100nF capacitor to 0V. This output is designed for use in applications requiring an enable/disable signal that is separate from the main wipers. It is not recommended for use as a safety feature or a method of "person-present" detection.

CENTER TAP REFERENCE (CT)

Where selected, (configurations 1, 3 and 4) the joystick also outputs a centre reference voltage that is set at 50% (+/-1%) of the supply voltage. This output can be used to check the integrity of the power supply applied to the joystick. A reading on this output, outside of the specified tolerance suggests a problem with the power supply to the joystick. The other purpose of this output is to act as a reference equal to the voltage output when the lever is at center. Measuring the voltage outputs relative to CT rather than 0V eliminates inaccuracies created by variation in supply voltage.

GAIN OPTIONS

The voltage output on the wipers, at full scale deflection is determined by the gain. The gain is expressed as a percentage of the voltage supplied. Therefore (assuming a 5V supply) a joystick specified with +/- 25% gain would yield 1.25V at South, 2.5V at centre and 3.75V at North. A range of gain options are available as standard for configurations 1, 3 and 4. All joysticks are supplied pre-set and no further calibration is needed throughout the lifetime of operation.

OUTPUT IMPEDANCE

The voltage outputs at center and at each end of travel are specified across an infinite load, with no current flowing. The output impedance specified in the electrical specification should be taken into account when designing a system. Load resistance of less than 10K Ohms is not recommended.

MECHANISM

The omni-directional mechanism utilises an extremely robust ball-socket pivot. This construction yields an end product that is extremely resistant to vertical impact. Furthermore it constantly withstands high pull, push, rotational or horizontal forces that the product may be subject to, during life.

SPRINGING

All 3000 Series are offered sprung to center. The standard spring force requires 1.3N (nominally) to off-center the joystick. The 3000 Series may be specified with a lighter spring (1N), or a stronger spring (1.6N).

GUIDED FEEL

The 3000 Series may also be specified with guided feel. A joystick with guided feel moves more readily towards the poles (N, S, E and W) and whilst it can still move away from the poles, the force required to do so is greater. Unless specified otherwise, joysticks are supplied as standard without guiding. This standard configuration allows the user to move the joystick anywhere within the limiter with the same force and without any bias.

CONNECTIONS

The joystick is fitted, as standard, with 150mm long BS6360 rated cables and an industry standard 2.5mm pitch connector(s). Further non-standard connectors and cable options are available upon request.

CONFIGURATIONS 1 & 2

Joysticks are supplied with a seven way connector as standard. If the joystick is specified with a pushbutton handle, the connector will be nine way.

- PIN 1:** 0V (Black)
- PIN 2:** Center Tap Reference (Green)
- PIN 3:** Z Axis Output (Purple) - Where Specified
- PIN 4:** Y Axis Output (Yellow)
- PIN 5:** X Axis Output (Blue) - Where Specified
- PIN 6:** +V (Red)
- PIN 7:** Center Detect (Orange)
- PIN 8:** Pushbutton (Orange)
- PIN 9:** Pushbutton (Orange)

CONFIGURATIONS 3 & 4

Joysticks are supplied with two completely independent cable assemblies, for a truly dual system.

- PIN 1:** 0V (Black)
 - PIN 2:** Center Tap Reference (Green)
 - PIN 3:** No connection
 - PIN 4:** Y Axis Output (Yellow)
 - PIN 5:** X Axis Output (Blue) - Where Specified
 - PIN 6:** +V (Red)
 - PIN 7:** No connection
- For details on configuration 5 pin out, please refer to Customer Support.