

# HJ series

Rugged hand grip controllers •  
non-contacting Hall effect technology



## DISTINCTIVE FEATURES

- Rugged multi-axis control
- CAN bus J1939-71 & CANopen outputs
- USB protocol options
- Several handle options
- 5 million lifecycles



## ENVIRONMENTAL SPECIFICATIONS

- Operating Temperature: -40 °C to +85 °C (-40 °F to +185 °F)
- Storage Temperature: -40 °C to +85 °C (-40 °F to +185 °F)
- Above Panel Sealing: Up to IP63\*
- EMC Immunity Level (V/M): EN61000-4-8: 2009
- EMC Emissions Level: EN61000-4-3:2006
- ESD: EN61000-4-2:2008



## SENSOR SPECIFICATIONS

- Sensor: Hall effect, single or dual
- Supply Voltage Range: 5 VDC  $\pm$ 0.01 VDC
- Supply Current: 15 mA, +10 mA per axis
- Reverse Polarity Max: -10 VDC
- Transient Overvoltage Max: 16 VDC
- Rationmetric Output Voltage: see options
- Minimum load: 1  $\Omega$
- Return to Center Voltage:  $\pm$ 200 mV (no load)



## MECHANICAL SPECIFICATIONS

- Operating Force: 14.0 N (3.10 lbf)
- Maximum Vertical Impact: 34.5J
- Maximum Horizontal Load: 200 lbf at 8" above panel
- Deflection Angle: 38° ( $\pm$ 19° from center)
- Expected Mechanical Life: 5 million lifecycles
- Mass/weight: 544.3 g (19.2 oz) typical
- Lever Action (centering): Spring center, omnidirectional

\*Most handles. Dependant upon configuration.

The company reserves the right to change specifications without notice.



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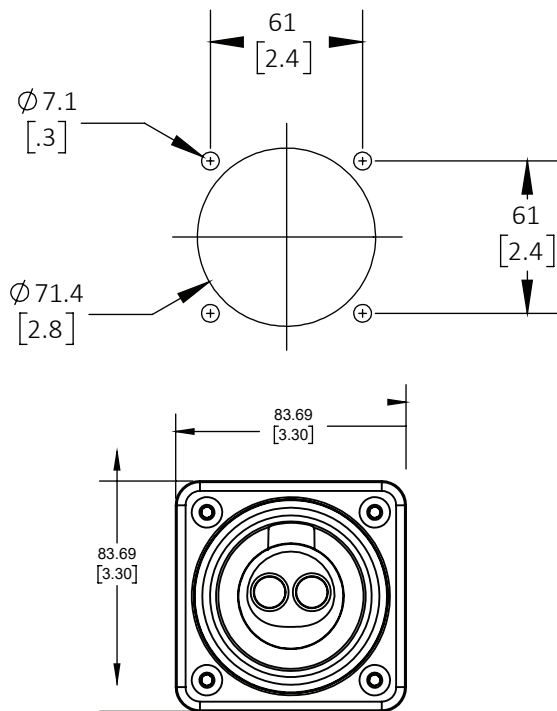


## MATERIALS

- Shaft: Stainless steel
- Boot: Silicone
- Handles: Glass filled nylon
- Body: Glass filled nylon



## PANEL CUT-OUT



## TERMINATION

The HJ series is fitted with a 18" ±0.5" AWG22 wire cable harness. Further non-standard connectors and cable options are available upon request.

WIRE COLOR	SIGNAL
RED	5 VDC for analog outputs within voltage range 0 VDC to 5 VDC 7 VDC to 35 VDC for voltage regulator options
BLACK	Ground
BLUE	X axis data
YELLOW	Y axis data
GREEN	Z axis data
BLUE / WHITE	Redundant X axis
YELLOW / BLACK	Redundant Y axis
GREEN / BLACK	Redundant Z axis
ORANGE	Button 1
VIOLET	Button 2
GREY	Button 3
BROWN	Button 4
GRAY / BLACK	Button 5
BLUE / WHITE	Button 6
YELLOW / BLACK	Button 7
GREEN / BLACK	Button 8
VIOLET / WHITE	Button 9
WHITE	Common

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## CANBUS J1939 SPECIFICATION

- Supply Voltage Range: 7 to 35VDC
- Supply Current: 15mA, +10mA per axis

The HJ series joystick can be configured with a maximum of three axis and ten pushbuttons. All axis and button data are delivered on a CAN 2.0B compliant physical interface. Two additional signals allow configuration of the controller Source Address. Controller messages are delivered per the SAE J1939-71 message protocol.

### CAN MESSAGE PROTOCOL

- Primary axis and button data on Basic Joystick Message 1 (BJM1):
  - Priority: 3
  - Base PGN: 0xFDD6
  - Source address: 0x11<sup>1</sup>
  - Data field: 8 bytes
- Redundant axis data on Extended Joystick Message 1 (EJMI):
  - Priority: 3
  - Base PGN: 0xFDD7
  - Source address: 0x11<sup>1</sup>
  - Data field: 8 bytes
- Note 1: Alternate source addresses can be configured by grounding the blue and/or orange wires.
  - Source address: 0x11: Orange = floating, Blue = floating (default)
  - Source address: 0x21: Orange = floating, Blue = grounded
  - Source address: 0x31: Orange = grounded, Blue = floating
  - Source address: 0x41: Orange = grounded, Blue = grounded

### CUSTOM CAN BUS J1939 FIRMWARE (AVAILABLE UPON REQUEST)

- Baud rate of 125 kbps, 500 kbps and 1Mbps (250kbps default)
- Custom CAN address
- Custom CAN bus output

### CAN 2.0B INTERFACE PARAMETERS

- Baud rate: 250 kbps
- Transmission repetition rate: 70 ms\*
- BJMI/EJMI interval time: 20 ms
- Terminating resistor: No (available by special request to factory)
- Standard 22 AWG harness 18" with Deutsch DTM04-6P connector
- Deutsch DTM04-6P connector:

Pin	Color	Function
1	White	CAN Lo
2	Green	CAN Hi
3	Blue	ID Selection LSB
4	Orange	ID Selection MSB
5	Black	Ground
6	Red	7 - 35VDC

\* Transmission repetition rate is dependent upon the joystick faceplate configuration. Faceplates configured with proportional devices feature a 70ms repetition rate. Faceplates without proportional devices may be programmed with a 50ms repetition rate and a reduced interval time.

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## CANBUS J1939 SPECIFICATION (CONTINUED)

### BJM1 DATA FIELD STRUCTURE

START POSITION (BYTE/BIT)	LENGTH (BITS)	FUNCTION
1/1	2	Primary X-axis neutral position status
1/3	2	Primary X-axis left position status
1/5	2	Primary X-axis right position status
1/7 to 2/8	10	Primary X-axis position data
3/1	2	Primary Y-axis neutral position status
3/3	2	Primary Y-axis down position status
3/5	2	Primary Y-axis up position status
3/7 to 4/8	10	Primary Y-axis position data
6/1	2	Button 4 status
6/3	2	Button 3 status
6/5	2	Button 2 status
6/7	2	Button 1 status
7/1	2	Button 8 status
7/3	2	Button 7 status
7/5	2	Button 6 status
7/7	2	Button 5 status
8/5	2	Button 10 status
8/7	2	Button 9 status

### EJM1 DATA FIELD STRUCTURE

START POSITION (BYTE/BIT)	LENGTH (BITS)	FUNCTION
1/1	2	Redundant X-axis neutral position status
1/3	2	Redundant X-axis left position status
1/5	2	Redundant X-axis right position status
1/7 to 2/8	10	Redundant X-axis position data
3/1	2	Redundant Y-axis neutral position status
3/3	2	Redundant Y-axis down position status
3/5	2	Redundant Y-axis up position status
3/7 to 4/8	10	Redundant Y-axis position data
5/1	2	Primary Z-axis neutral position status
5/3	2	Primary Z-axis counter-clockwise position status
5/5	2	Primary Z-axis clockwise position status
5/7 TO 4/8	10	Primary Z-axis position data



## CANOPEN LSS INTERFACE SPECIFICATION

The CANopen LSS interface option follows the CiA305 and CiA401 standards for CAN in automation. The node ID, baud rate and additional configurations can be set and stored in the EEPROM by Service Data Object. The default settings are as follows:

SETTINGS	DEFAULT CONFIGURATION
Baud rate	250 kbits/s
Node ID	20h
Analog (axis) outputs	2A0h (280h + Node ID)
Buttons	1A0h (180h + Node ID)
Heartbeat (500ms)	720h (700h + Node ID)
Axis Resolution	Unsigned 10-bit

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## CANOPEN INTERFACE SPECIFICATION

### CANOPEN INTERFACE PARAMETERS

- Baud rate: 250 kbits/s
- Node ID: 20h
- Buttons: 1A0h (180h + Node ID)
- Analog (axis) outputs: 1A0h (280h + Node ID)
- Heartbeat (500ms): 720h (700h + Node ID)
- Axis resolution: 8-bit
- Network Management: Auto start enabled
- Standard 22 AWG harness 18" with Deutsch DTM04-6P connector
- Deutsch DTM04-6P connector

### DEUTSCH DTM04-6P

PIN	WIRE COLOR	SIGNAL
1	Red	Supply Power (7VDC to 35 VDC)
2	Black	Ground
3	Green	CAN high data
4	White	CAN low data
5	Blue	Node ID Selection (LSB)
6	Orange	Node ID Selection (MSB)

### BUTTON OUTPUT CONFIGURATION

Button status is transmitted in the 8-byte data field of frames with an identifier of 1A0 (default).

IDENTIFIER	BYTE 0	BYTE 1	BYTE 2	BYTE 3	BYTE 4	BYTE 5	BYTE 6	BYTE 7
2A0	Buttons (7:0)	Buttons (15:8)	-	-	-	-	-	-

### ANALOG OUTPUT CONFIGURATION

8-bit analog data is transmitted in the 8-byte data field of frames with an identifier of 2A0 (default).

IDENTIFIER	BYTE 0	BYTE 1	BYTE 2	BYTE 3	BYTE 4	BYTE 5	BYTE 6	BYTE 7
1A0	A_IN0(7:0)	A_IN1(7:0)	A_IN2(7:0)	A_IN3(7:0)	A_IN4(7:0)	A_IN5(7:0)	-	-

### SELECTABLE NODE ID

The Node ID is selectable based on blue and orange wire connection to the ground.

#	BLUE WIRE	ORANGE WIRE	NODE ID
1	Open	Open	20H
2	Ground	Open	21H
3	Open	Ground	22H
4	Ground	Ground	23H

### CUSTOM CANOPEN FIRMWARE - AVAILABLE UPON REQUEST

- Baud rate of 125 kbps, 500 kbps and 1Mbps (250kbps default)
- Custom Node IDs (default 20 hexadecimal)
- 10-bit axis resolution
- 12-bit axis resolution
- Signed bit resolution
- Custom CANopen outputs

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## VOLTAGE REGULATOR SPECIFICATION

The Voltage Regulator allows APEM's Hall effect joysticks to operate with a range of supply voltages.

### VOLTAGE REGULATOR, UNIPOLAR

- Supply Voltage Range: 8-35VDC
- Output Voltage Range: 0-5VDC
- Maximum Current: 90mA

### VOLTAGE REGULATOR, BIPOLAR

- Supply Voltage Range: 11-35VDC
- Output Voltage Range:  $\pm 10$ VDC
- Maximum Current: 90mA



## USB SPECIFICATION

- Supply Voltage Range: 5.00VDC
- Maximum current: 70mA
- USB version: 2.0

### USB GAME CONTROLLER

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

#### Features

- USB 2.0 HID compliant "game controller" device
- Easy to install and operate
- Functions determined by controlled application
- 10-bit (0 to 1023) axis resolution

#### Supplied Cable

- USB Male Type A Connector (6.5ft long)



## USB SPECIFICATION (CONTINUED)

### USB CURSOR EMULATION

The Cursor Emulation option converts multi-axis joystick output into a mouse or cursor control device. The Cursor Emulation option is ideal for vehicle applications subjected to dirt and high vibration which makes operating a traditional cursor control device difficult. The Cursor Emulation option is widely used in shipboard and military applications.

#### Features

- HID compliant "mouse" device

#### Button Function

- B1: Left Mouse Click
- B2: Right Mouse Click
- B3: Scroll Button
- B4: Programmable Button (in controlled applications)

#### Supplied Cable

- USB Male Type A Connector (6.5ft long)

### SUPPORTED OPERATING SYSTEMS:

#### Windows Operating System

- Windows 7
- Windows 8.1
- Windows 10

#### Linux Operating System

APEM's USB joysticks are functional with Linux OS, although system compatibility is not guaranteed. The user is responsible for verifying specific Linux OS compatibility.

#### Custom Firmware

Custom configuration and firmware is available upon request. Available options include:

- 8-bit axis resolution
- 12-bit axis resolution
- Signed bit axis resolution
- Custom USB product name

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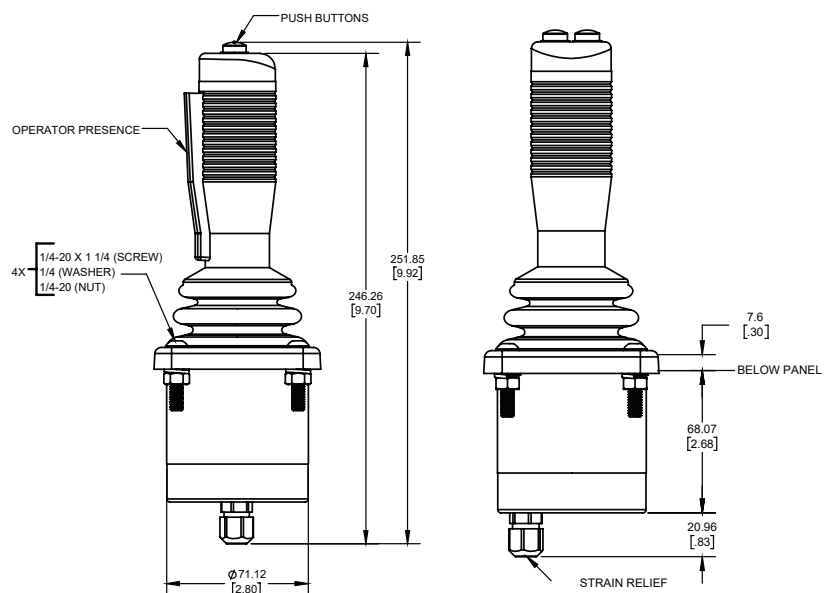
## BUILD YOUR PART NUMBER

HJ	_____	_____	_____	_____	_____	_____	_____	A
SERIES		AXIS		SPRING			SEALING	
		A One B Two		A Standard			E Up to IP63* N None	
								* Dependent on handle configuration
HANDLE	LIMITER PLATE		OUTPUT		HANDLE			
SG Stock Grip Handle	S Square R Round P + Limiter X X axis only Y Y axis only G Square, guided feel H Round, guided feel		A 0V - 5V B 0.25V - 4.75V C 0.5V - 4.5V D 1V - 4V E (0-5V) (5-0V) F (0.25 - 4.75V) (4.75 - 0.25V) G (0.5 - 4.5V) (4.5 - 0.5V)	H (1 - 4V) (4 - 1V) N CAN bus J1939 Q CANopen LSS U USB Joystick, Game Controller T USB Mouse, Cursor Control V Voltage regulator Unipolar Y Voltage regulator Bi-polar ±10VDC	A No Pushbuttons B One top pushbutton C Two top pushbuttons D Top rocker switch (mom-off-mom) E Two top pushbuttons Two side pushbuttons F Operator presence switch G One top pushbutton & Operator presence switch H Two top pushbuttons & Operator presence switch J Operator presence switch & Protective silicone boot K One top pushbutton, Operator presence switch & Protective silicone boot			

### NOTES:

- For more details about :
  - Thumbwheel : see CW series
  - Mini Joystick: see TS series
  - Toggle switch : see MT series
  - Pushbuttons : see IM series

## DIMENSIONS



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## HANDLE OPTIONS - STOCK GRIP (SG)

Handle A



Handle B



Handle C



Handle D



Handle E



Handle F



Handle G



Handle H



Handle J



Handle K



### PUSHBUTTON SPECIFICATIONS.

- Electrical ratings: @28 VDC or 115 VAC, 60/400Hz  
Resistive: 5 A  
Inductive: 3 A  
DWV: 1050 Vrms
- Electrical life: 25,000 cycles
- Mechanical life: 1,000,000 cycles

- Operating temperature: -40 °C to +85 °C  
(-40 °F to 185 °F)
- Operating force: 1.7 lbd. ±0.5 lb.
- Materials:  
Case: Thermoplastic  
Actuator: Thermoplastic  
Terminals: Brass with gold over silver

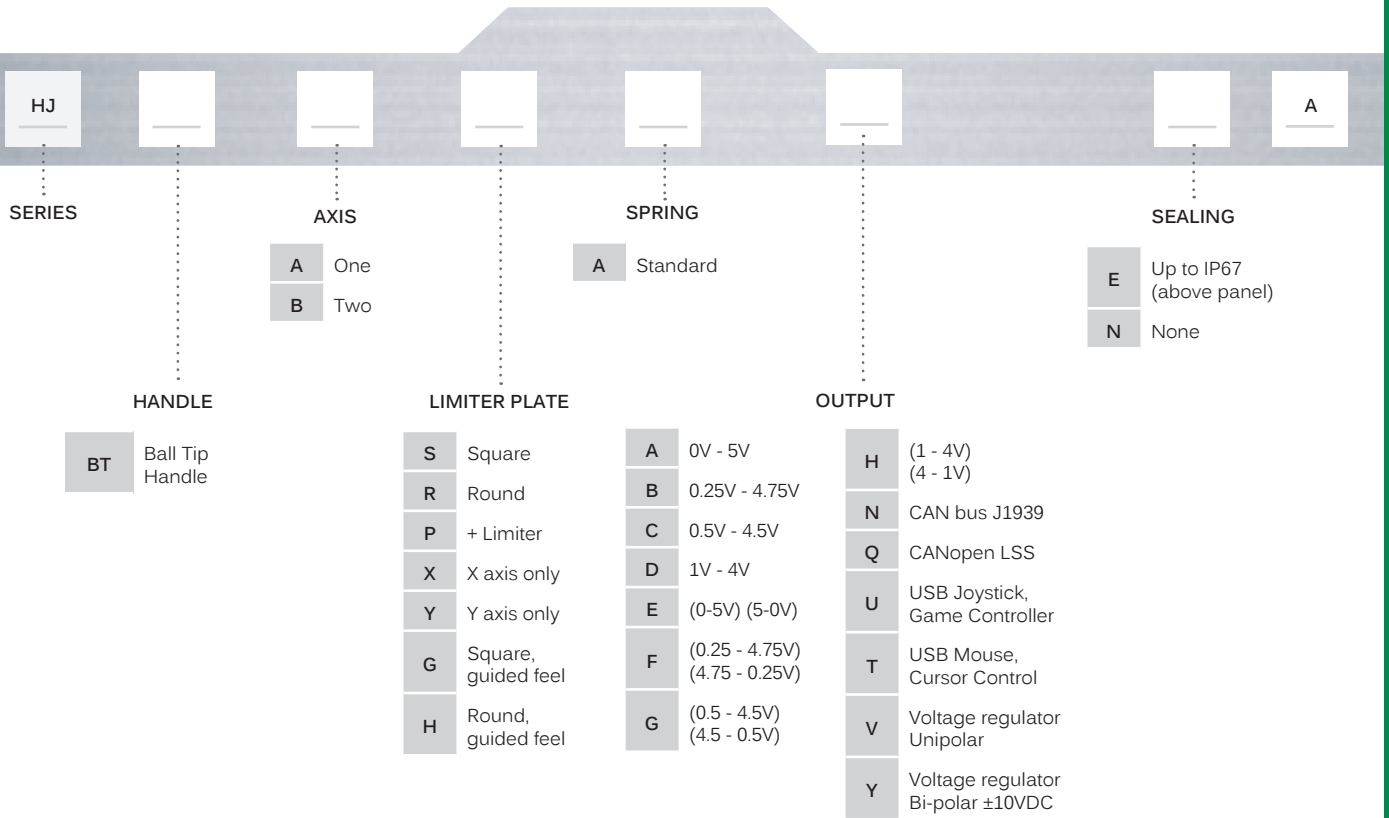


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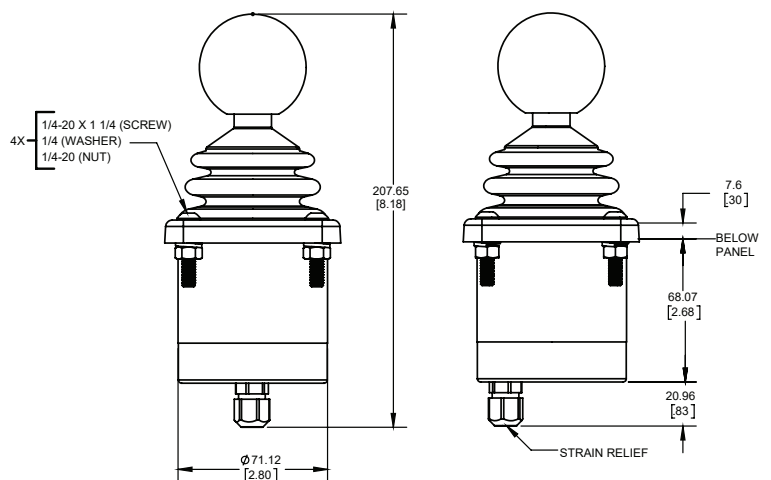
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## BUILD YOUR PART NUMBER



## DIMENSIONS

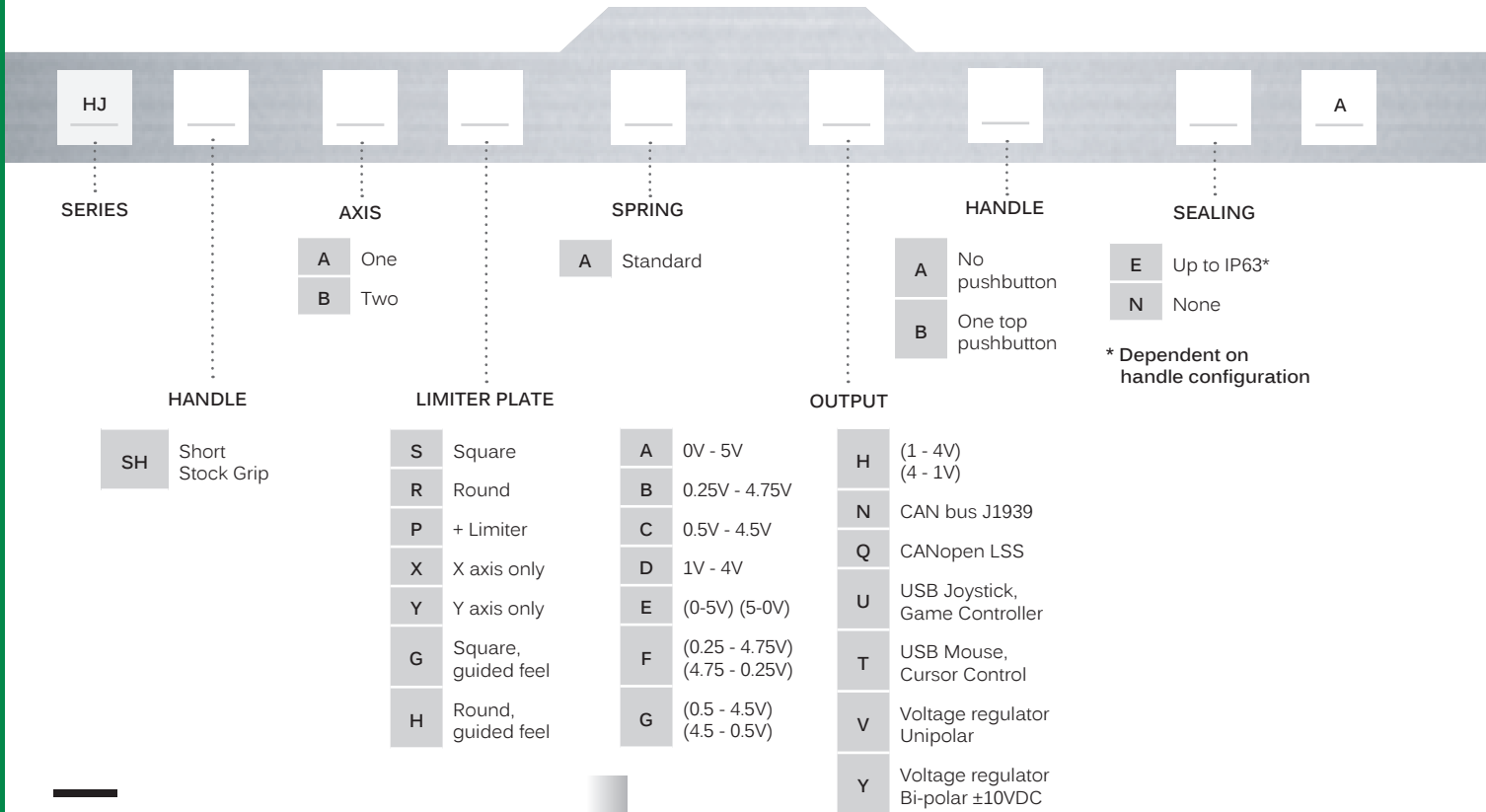


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## BUILD YOUR PART NUMBER

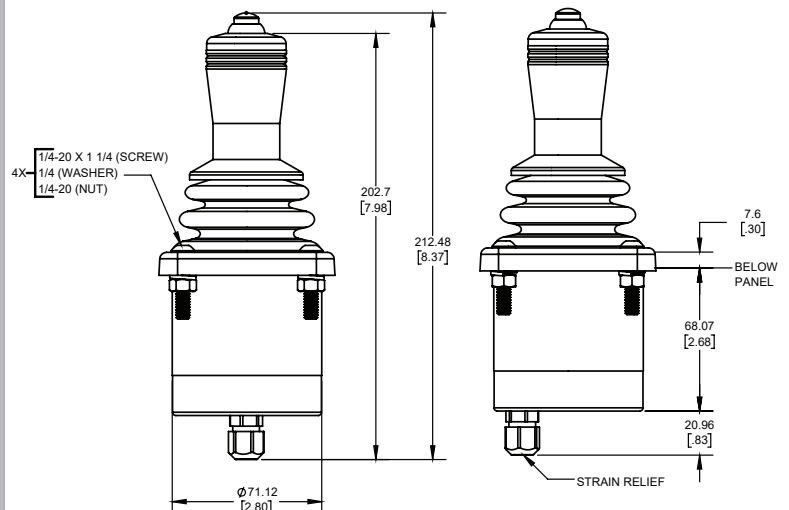


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Terminals: Brass with gold over silver

### DIMENSIONS

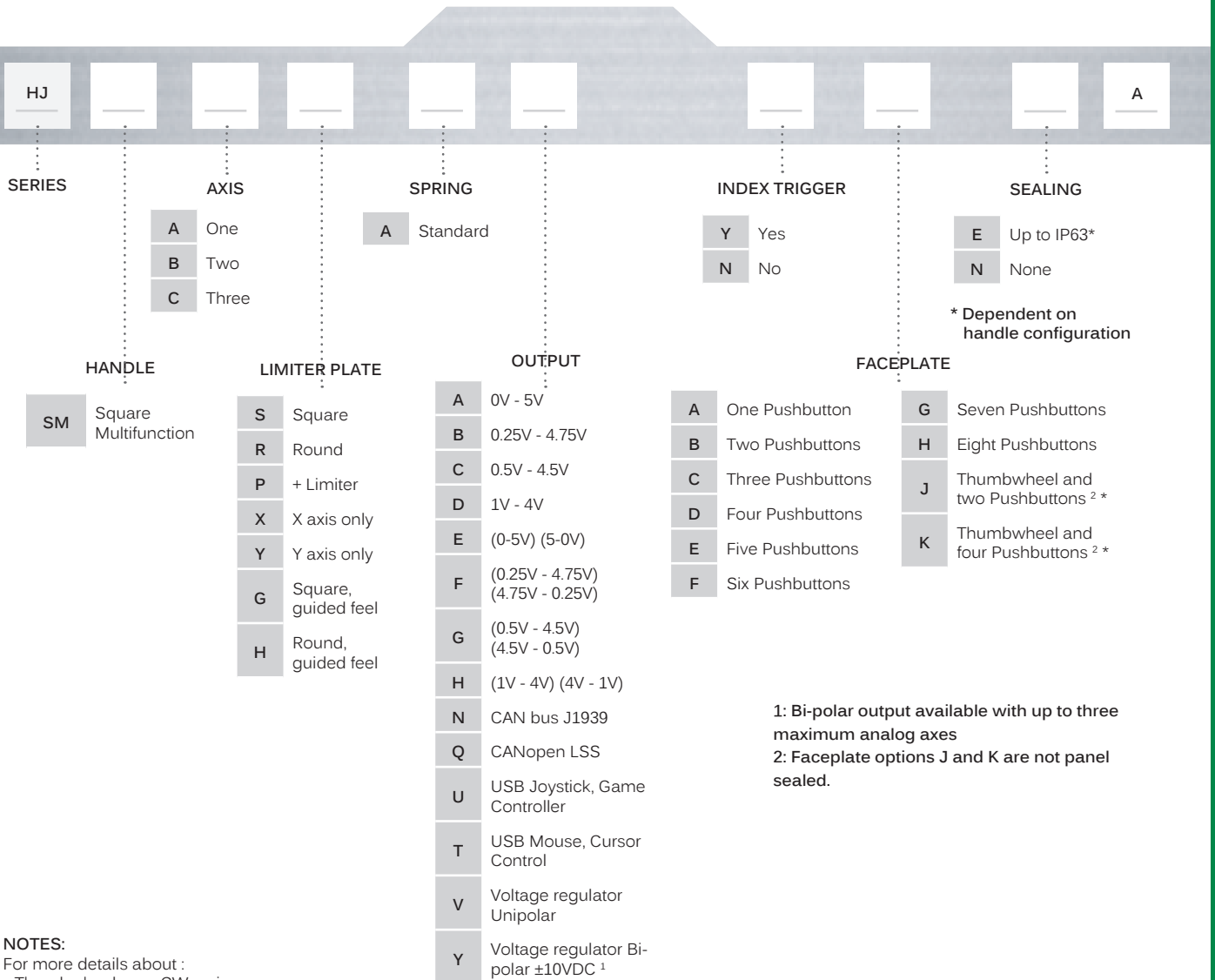


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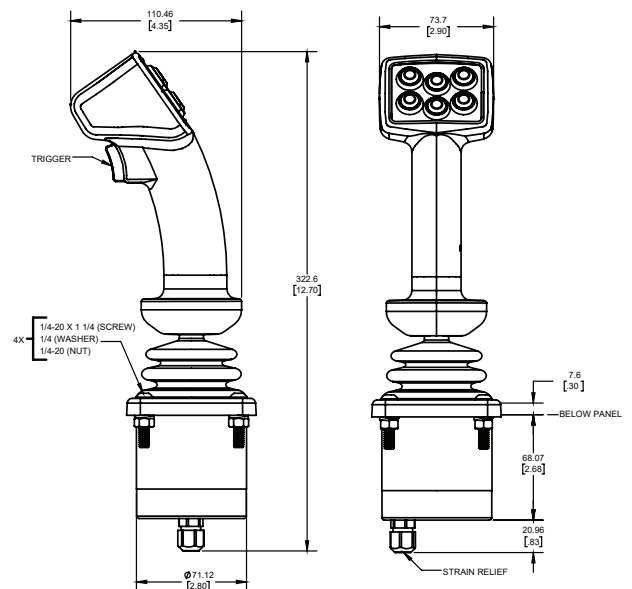


## BUILD YOUR PART NUMBER



1: Bi-polar output available with up to three maximum analog axes  
2: Faceplate options J and K are not panel sealed.

## DIMENSIONS



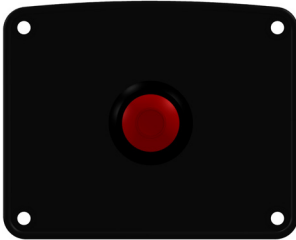
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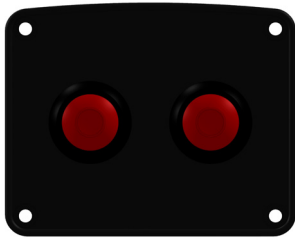


## HANDLE OPTIONS - SQUARE MULTIFUNCTION HANDLE (SM) FACEPLATES

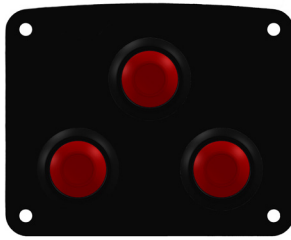
FACEPLATE A



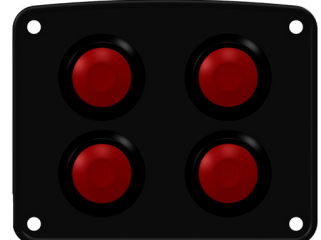
FACEPLATE B



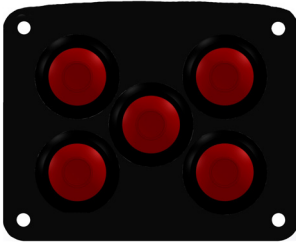
FACEPLATE C



FACEPLATE D



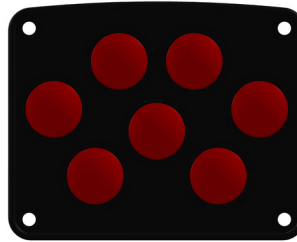
FACEPLATE E



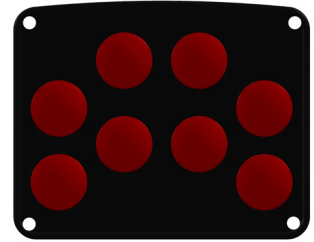
FACEPLATE F



FACEPLATE G



FACEPLATE H



FACEPLATE J



FACEPLATE K



### CW SERIES THUMBWHEEL



- Single axis proportional output
  - Spring return
  - P/N CWB1BK1AXX\*A0
- \* Voltage output = HJ series joystick output

### IM SERIES PUSHBUTTON



- Momentary & snap-action
- Sealed
- P/N IMR7Z462

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## BUILD YOUR PART NUMBER

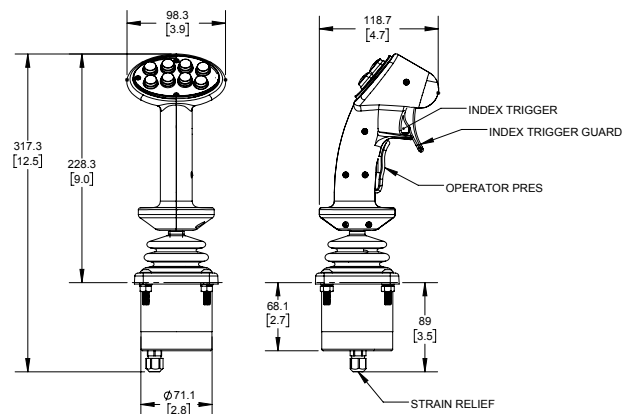
HJ										A
SERIES		AXIS		SPRING		OPERATOR PRESENCE PADDLE	INDEX TRIGGER		SEALING	
		A One B Two C Three		A Standard		Y Yes N No	Y Yes N No G Trigger with guard		E Up to IP63* N None	
	HANDLE		LIMITER PLATE		OUTPUT		FACEPLATE			
	RM Round Multifunction		S Square R Round P + Limiter X X axis only Y Y axis only G Square, guided feel H Round, guided feel		A 0V -5V B 0.25V - 4.75V C 0.5V - 4.5V D 1V - 4V E (0-5V) (5-0V) F (0.25V - 4.75V) (4.75V - 0.25V) G (0.5V - 4.5V) (4.5V - 0.5V) H (1V - 4V) (4V - 1V) N CAN bus J1939 Q CANopen LSS U USB Joystick, Game Controller T USB Mouse, Cursor Control X Voltage regulator Unipolar Y Voltage regulator Bi-polar ±10VDC <sup>1</sup>		A Two Pushbuttons B Four Pushbuttons C Five Pushbuttons D Six Pushbuttons E Eight Pushbuttons F Toggle Switch & Two Pushbuttons G Two Pushbuttons & Toggle Switch H Toggle Switch, Thumbwheel, Two Pushbuttons <sup>2</sup> J Two Pushbuttons, Thumbwheel, Toggle Switch <sup>2</sup>		K Two Axis Miniature Joystick & Two Pushbuttons * L Toggle Switch, Mini Joystick, Two Pushbuttons * M Two Toggle Switches N Two Pushbuttons, Mini Joystick, Thumbwheel * <sup>2</sup> P Four Pushbuttons, Mini Joystick * Q Two Pushbuttons, Mini Joystick, Toggle Switch * R Thumbwheel, Mini Joystick, Two Pushbuttons * <sup>2</sup>	

**NOTES:**

- For more details about :
  - Thumbwheel : see CW series
  - Mini Joystick: see TS series
  - Toggle switch : see MT series
  - Pushbuttons : see IM series
- \* See page 3 for further details

- 1: Bi-polar output available with up to three maximum analog axes
- 2: Faceplate option H, J, N and R can not be panel sealed.

## DIMENSIONS



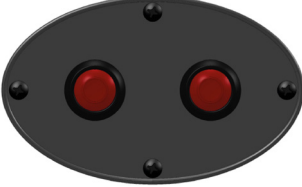
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## HANDLE OPTIONS - ROUND MULTIFUNCTION HANDLE (RM) FACEPLATES

FACEPLATE A



FACEPLATE B



FACEPLATE C



FACEPLATE D



FACEPLATE E



FACEPLATE F



FACEPLATE G



FACEPLATE H



FACEPLATE J



FACEPLATE K



FACEPLATE L



FACEPLATE M



FACEPLATE N



FACEPLATE P



FACEPLATE Q



FACEPLATE R



### CW SERIES THUMBWHEEL



- Single axis proportional output
  - Spring return
  - P/N CWB1BK1AXX\*A0
- \* Voltage output = HJ series joystick output

### IM SERIES PUSHBUTTON



- Momentary & snap-action
- Sealed
- P/N IMR7Z462

### MT SERIES TOGGLE SWITCH



- MOM-OFF-MOM
- P/N MTG72AD2

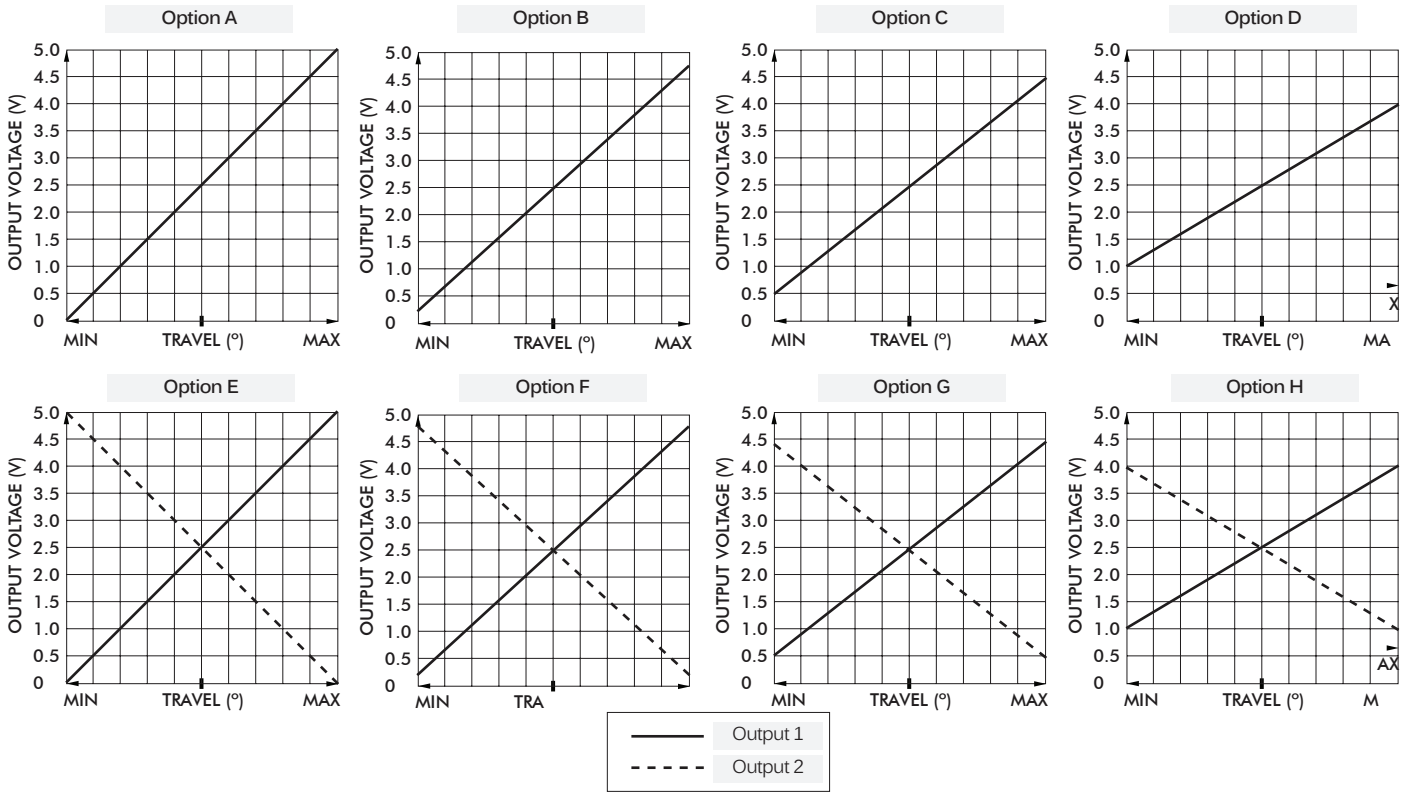
### TS SERIES MINIATURE JOYSTICK



- Two axis proportional output
  - P/N TS1R2SXX\*A
- \* Voltage output = HJ series joystick output

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## VOLTAGE OUTPUT OPTIONS <sup>1</sup>



<sup>1</sup> Voltage outputs are ratiometric to supply voltage.