

# CJ series

Proportional, multi-function hand grip controllers •  
non-contacting Hall effect technology



## DISTINCTIVE FEATURES

One and two axis control

Analog outputs

Rated for 5 million lifecycles

CAN bus and USB output options

Redundant output available



## 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 IP67 (subject to handle configuration)
- EMC Immunity Level: EN61000-4-3: 2006
- EMC Emissions Level: EN61000-4-8: 2009
- ESD: EN61000-4-2: 2008



## ELECTRICAL SPECIFICATIONS

- Supply voltage range: 5.00 VDC  $\pm$ 0.01 VDC
- Reverse polarity Max: -10 VDC
- Ratiometric Output Voltage: See options
- Transient overvoltage max: 16 V
- Output Impedance: 2  $\Omega$
- Return to Center Voltage Tolerance:  $\pm$ 200 mV initial
- Supply Current: 13 mA per sensor



## MECHANICAL SPECIFICATIONS

- Operating Force: 7.6 N (1.70 lbf)
- Maximum Vertical Load: 444.8 N (100 lbf)
- Maximum Horizontal Load: 649.4 N (146 lbf)
- Mechanical Angle of Movement: 40° ( $\pm$ 20°)
- Expected Life: 10 million lifecycles
- Mass /weight: 544.3 g (19.2 oz)
- Lever Action (centering): Spring

\* Operating force: configuration option «L»

The company reserves the right to change specifications without notice.



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## MATERIALS

- Body: Glass Filled Nylon
- Handles: Glass Filled Nylon



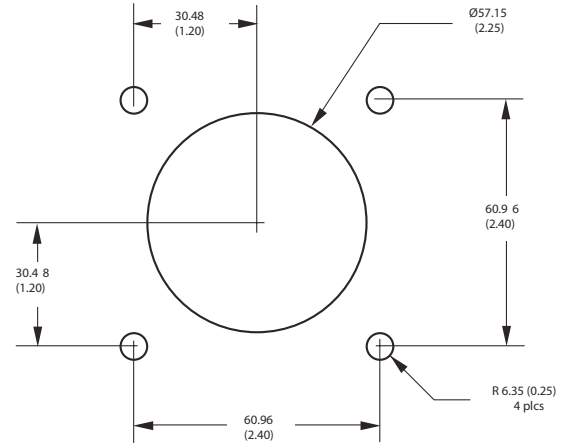
## TERMINATION

The CJ series is fitted with a 18" ±0.5" AWG22 wire 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



## PANEL CUT-OUT



## CAN J1939 INTERFACE SPECIFICATION

The CJ Series utilizes redundant Hall effect sensors to measure the primary X and Y axis. The CAN controller support various button configurations as well as proportional thumbwheels and mini-joysticks for additional axis data.

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 2.0B INTERFACE PARAMETERS

- Baud rate: 250 KHz
- Transmission repetition rate: 50ms
- BJMI/EJMI interval time: 20ms
- Terminating resistor: No  
(available by special request to factory)
- Connection to Deutsch DTM04-6P connector:

Pin	Color	Function
1	White	CAN Lo
2	Green	CAN Hi
3	Blue	Source Address SEL 1
4	Orange	Source Address SEL 0
5	Black	Ground
6	Red	6 - 35 VDC

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## CAN J1939 INTERFACE SPECIFICATION (CONTINUED)

### CAN MESSAGE PROTOCOL

- Primary Axis and button data on Basic Joystick Message 1 (BJM1):
  - Priority: 3
  - Base PGN: 0xFDD6
  - Source address: 0x10<sup>1</sup>
  - Data field: 8 bytes
- Redundant Axis data on Extended Joystick Message 1 (EJM1):
  - Priority: 3
  - Base PGN: 0xFDD7
  - Source address: 0x10<sup>1</sup>
  - Data field: 8 bytes
- Additional thumbwheels and mini-joysticks data on Extended Joystick Message 2 (EJM2):
  - Priority: 3
  - Base PGN: 0xFDD9
  - Source address: 0x10<sup>1</sup>
  - Data field : 8 bytes

Note 1: Alternate source addresses can be configured by grounding of the blue and/or orange wires.  
 - Source address= 0x10: ORANGE= floating , BLUE= floating (default)  
 - Source address= 0x20: ORANGE= floating, BLUE= grounded  
 - Source address= 0x30: ORANGE= grounded, BLUE= floating  
 - Source address= 0x40: ORANGE= grounded, BLUE= grounded

### 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 (Paddle if 6 button configuration) <sup>2</sup>
7/3	2	Button 7 status (Trigger if 6 button configuration) <sup>2</sup>
7/5	2	Button 6 status
7/7	2	Button 5 status
8/5	2	Button 10 status (Paddle if 8 button configuration) <sup>2</sup>
8/7	2	Button 9 status (Trigger if 8 button configuration) <sup>2</sup>

Note 2: If configured with no buttons, trigger and/or paddle would be positioned in Button n+1 and Button n+2.

### 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

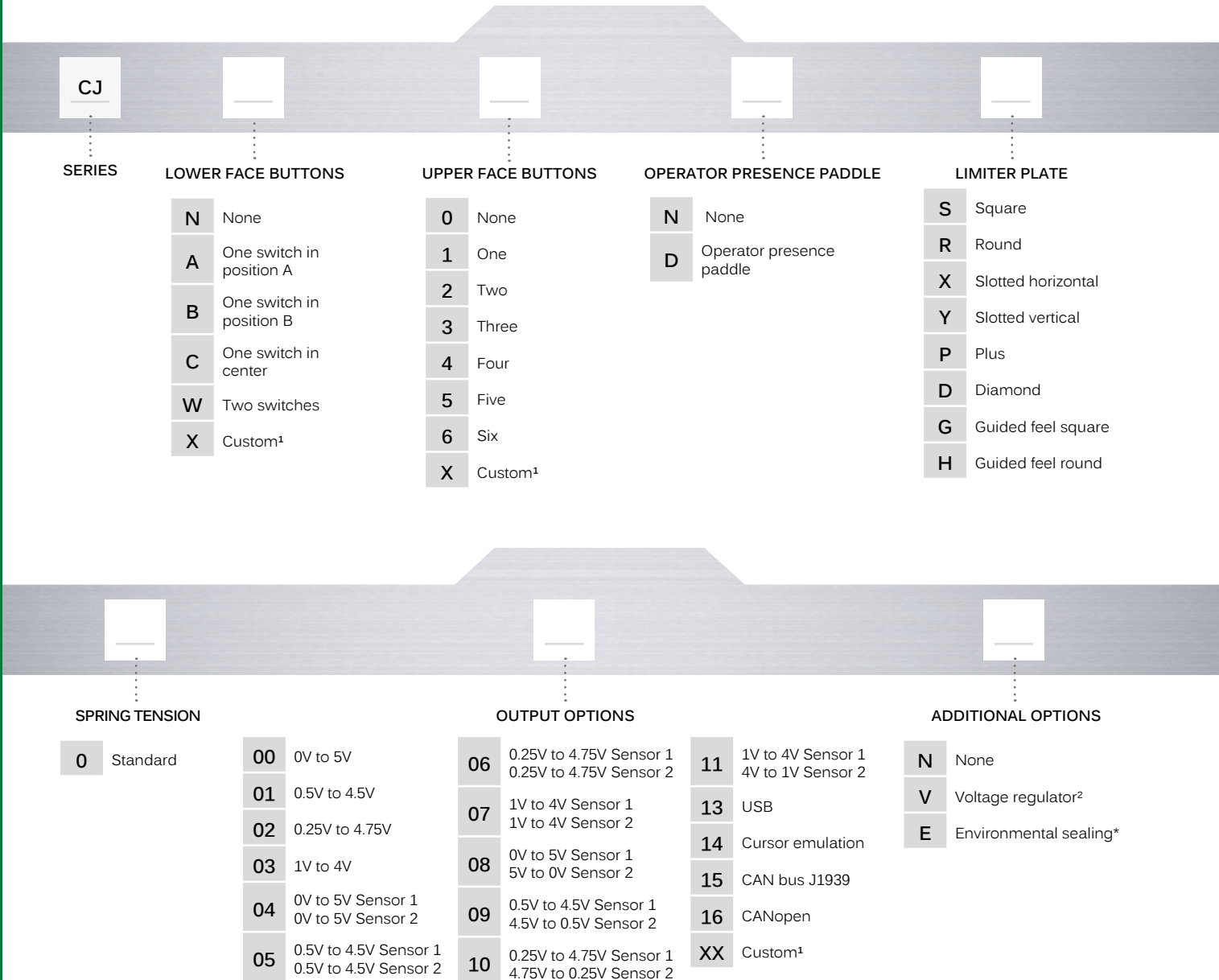
### EJM2 DATA FIELD STRUCTURE:

START POSITION (BYTE/BIT)	LENGTH (BITS)	FUNCTION
1/1	2	A-axis neutral position status
1/3	2	A-axis left position status
1/5	2	A-axis right position status
1/7 to 2/8	10	A-axis position data
3/1	2	B-axis neutral position status
3/3	2	B-axis left position status
3/5	2	B-axis right position status
3/7 to 4/8	10	B-axis position data
5/1	2	C-axis neutral position status
5/3	2	C-axis left position status
5/5	2	C-axis right position status
5/7 to 6/8	10	C-axis position data

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## BUILD YOUR PART NUMBER



SERIES	LOWER FACE BUTTONS	UPPER FACE BUTTONS	OPERATOR PRESENCE PADDLE	LIMITER PLATE
<b>CJ</b>				
<b>N</b> None	<b>N</b> None	<b>0</b> None	<b>N</b> None	<b>S</b> Square
<b>A</b> One switch in position A	<b>A</b> One switch in position A	<b>1</b> One	<b>D</b> Operator presence paddle	<b>R</b> Round
<b>B</b> One switch in position B	<b>B</b> One switch in position B	<b>2</b> Two		<b>X</b> Slotted horizontal
<b>C</b> One switch in center	<b>C</b> One switch in center	<b>3</b> Three		<b>Y</b> Slotted vertical
<b>W</b> Two switches	<b>W</b> Two switches	<b>4</b> Four		<b>P</b> Plus
<b>X</b> Custom <sup>1</sup>	<b>X</b> Custom <sup>1</sup>	<b>5</b> Five		<b>D</b> Diamond
		<b>6</b> Six		<b>G</b> Guided feel square
		<b>X</b> Custom <sup>1</sup>		<b>H</b> Guided feel round

SPRING TENSION	OUTPUT OPTIONS	ADDITIONAL OPTIONS
<b>0</b> Standard	<b>00</b> 0V to 5V	<b>N</b> None
	<b>01</b> 0.5V to 4.5V	<b>V</b> Voltage regulator <sup>2</sup>
	<b>02</b> 0.25V to 4.75V	<b>E</b> Environmental sealing <sup>3</sup>
	<b>03</b> 1V to 4V	
	<b>04</b> 0V to 5V Sensor 1 0V to 5V Sensor 2	
	<b>05</b> 0.5V to 4.5V Sensor 1 0.5V to 4.5V Sensor 2	
	<b>06</b> 0.25V to 4.75V Sensor 1 0.25V to 4.75V Sensor 2	<b>11</b> 1V to 4V Sensor 1 4V to 1V Sensor 2
	<b>07</b> 1V to 4V Sensor 1 1V to 4V Sensor 2	<b>13</b> USB
	<b>08</b> 0V to 5V Sensor 1 5V to 0V Sensor 2	<b>14</b> Cursor emulation
	<b>09</b> 0.5V to 4.5V Sensor 1 4.5V to 0.5V Sensor 2	<b>15</b> CAN bus J1939
	<b>10</b> 0.25V to 4.75V Sensor 1 4.75V to 0.25V Sensor 2	<b>16</b> CANopen
		<b>XX</b> Custom <sup>1</sup>

### NOTES

<sup>1</sup> Contact Technical Sales for custom options

<sup>2</sup> Not available on dual output

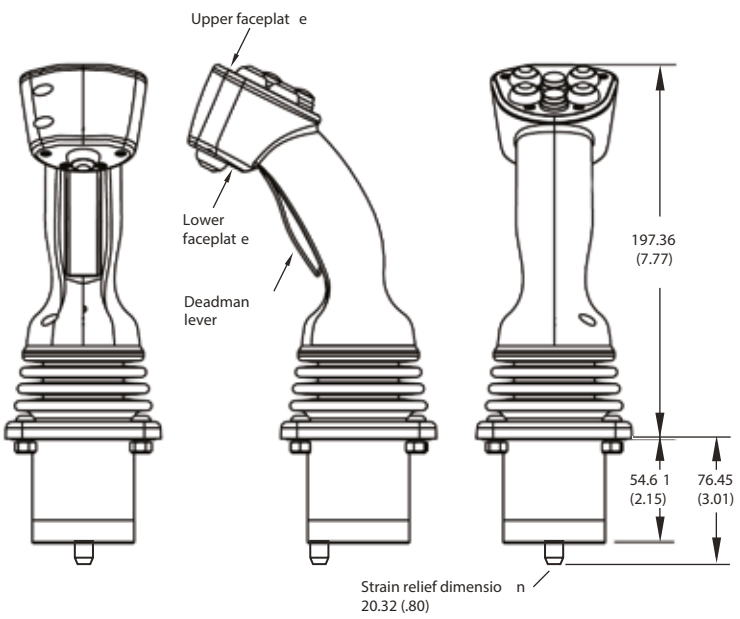
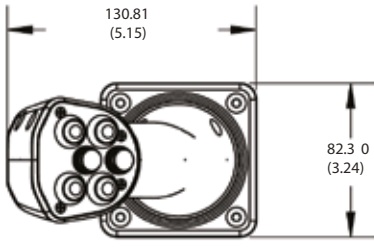
<sup>3</sup> Environmental sealing dependent on specific configuration. Please consult factory for additional information.

\* Mounting accessories: standard hardware includes 4 Phil. screws (6-32x7/8).

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## DIMENSIONS



## LOWER FACE BUTTONS



N



A



B



C



W

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## USB SPECIFICATIONS

- Supply Voltage Range: 5.00 VDC
- Maximum current: 70 mA
- 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
- 12-bit (0 to 4095) axis resolution

#### Termination (supplied cable)

- USB Male Type A Connector (198 cm)  
- (84" +/-1") - overmolded cable - Male Type A USB connector (Output option 13)

### 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. Cursor simulation is only compatible with Window OS.

#### Features

- HID compliant "mouse" device

#### Button Function

- B1: Left Mouse Click
- B2: Right Mouse Click

#### Termination (supplied cable)

- USB Male Type A Connector (185 cm):  
- (72" +/-1") - overmolded cabled - Mini B to Male Type A USB connector (option 0U)

### SUPPORTED OPERATING SYSTEMS: USB GAME CONTROLLER AND CURSOR EMULATION

#### Windows Operating System

- Windows 7
- Windows 8.1
- Windows 10

#### Linux Operating System

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

#### Custom Firmware

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

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



## VOLTAGE REGULATOR SPECIFICATIONS

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

#### Voltage Regulator - Unipolar

- Supply Voltage Range: 8-35 VDC
- Output Voltage Range: see output options
- Maximum Current: 90 mA

#### Voltage Regulator - Bipolar

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

#### Termination (flying leads)

- 28 AWG 20.32 cm (8.0")  $\pm 1.54$  cm (1") PTFE

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