



JC3000 FINGER OPERATED JOYSTICK CONTROLLER

INNOVATION IN MOTION

The JC3000 joystick controller is designed for demanding applications in remote control chestpacks or auxiliary functions on industrial vehicles and other man-machine interfaces, where precise control, signal reliability, and compact size are important. The joystick is available with single or dual axis control, and can be specified with a choice of either long life potentiometer tracks, or switched output signals.

Innovative design

With a choice of potentiometer tracks that provide the analog signals proportional to lever movement or 3, 4 or 5 switched outputs per joystick half axis, the JC3000 can be configured to provide a range of output signals and directional/center switching functions. The JC3000's low profile below the mounting panel and short lever height above, allows a number of joysticks to be mounted side by side without lever interference. All electrical signals terminate in a 12-way Hirose connector on each joystick axis, reducing installation time.

Total reliability

The JC3000 is manufactured using mainly cast metal components and includes lever mechanics designed to give smooth proportional control. The lever will withstand a 900N downward static load, with up to 20Nm maximum overload to the lever at full deflection. Long life potentiometer tracks featuring multi-fingered precious metal wipers give low electrical noise and a working life greater than 5 million operations with zero maintenance during this period. The high quality printed switch tracks are also designed to provide a working life greater than 5 million operations.

Features

- Potentiometric or switched sensing
 - Single or dual axis control
- High strength lever with precise proportional control
 - Sealed above the panel to IP66
 - Choice of outputs and switches
- Choice of handles with or without switches
 - Hirose series multi-lock connector

Benefits

- Long life and maintenance-free operation
- Suited to a wide range of operator control functions
- Rugged and smooth lever movement
- Operation in demanding environments
- Enables user configuration for system safety
- Additional operator control functions
- Simple, error free installation



Quality Assurance

Penny+Giles are accredited to BS EN ISO9001:2008. Quality is at the heart of all our systems ensuring the reliability of our products from initial design to final despatch.

Certificate No.LRQ 0924881



EMC Directive 2004/108/EC

The products detailed in this document are supplied as components for installation into an electrical apparatus or system. They are outside the scope of the EEC directive and will not be CE marked.

Compliance Statement

All specification data in this document has been tested and documented by Penny+Giles unless otherwise stated. The qualification and suitability of this product in any customer specific application is the responsibility of the customer unless otherwise agreed with Penny+Giles.

JC3000 FINGER OPERATED JOYSTICK CONTROLLER

Potentiometric sensing



Designed to interface with an electronic controller, the long-life potentiometer track generates analog outputs with switched reference signals that are proportional to the distance and direction over which the handle is moved. The analog output can be configured to provide signals for fault detection circuits, and a center tap provides an accurate voltage reference for the center position or a zero point for a bipolar supply voltage. The electrically independent switch operates with separate contacts each side of the joystick center position, in each available axis.

The key advantages of this technology are its proportional output and the versatility it derives from its simplicity; it consists of a carbon-based potentiometer track with no complex circuitry or electronics, so it is not susceptible to electromagnetic interference or magnetic fields. However, as a contacting device it does have a long, but finite life and due consideration should be given to applications subject to high intensity use or where high dither or vibration may be encountered.

Please ask for details on our contactless Hall-effect joystick range if you have an application which may encounter dither or vibration.

Switched output

The JC3000 can also be supplied with switched tracks on each axis, with options for 3, 4 or 5 switches either side of the center position, in addition to a center off switch. An option for mechanical detents is also available, where the switching positions coincide with the detents, allowing the operator to determine the angular position of the joystick lever easily. The switches operate sequentially as the joystick lever is moved from center to the end stop in each axis.

Custom design

Penny + Giles offer an extensive range of fingertip and hand operated joysticks in standard modular configurations, designed to meet the majority of individual customer needs. We can also customise our designs for OEMs who require something more specialised to their application. Please talk to our technical sales team about your requirements.

Cell manufactured

The modular design of the JC3000 joystick is designed to provide the user with a wide choice of options, but allows rapid build and despatch. Contact your nearest sales office for the latest information on availability.



NHT handle option



K10 handle option



HL0 handle option



ZC1 handle option

JC3000 JOYSTICK CONTROLLER

ANALOG OUTPUT

PERFORMANCE MECHANICAL

Lever breakout torque XY	Nm	0.2
Lever operating torque XY	Nm	0.6 (full lever deflection at $\pm 31^\circ$)
Lever detent torque XY	Nm	0.1 approx.
Maximum allowable torque XY	Nm	12.5 to 20 (full lever deflection, depending on gate and detent options selected)
Lever operating angle	$^\circ$	± 31 max. in X and Y directions (Actual angle will depend on gate selected)
Lever action		Self centering, aligned X and Y
Lever gate profiles		Single axis in X or Y, square or plus
Detent angles	$^\circ$	Nominal Lever angle Gate Code Track Code

± 5.5	-	-	-
± 12	-	-	-
± 18	± 19	$\emptyset 19$	P_3
± 24	± 25	$\emptyset 25$	P_4
± 30	± 31	$\emptyset 31$	P_5

where \emptyset can be 1, S or P, & _ can be N, R, Q, E or L, see page 9

Maximum Z axis torque	Nm	5
Expected life		>5 million operations
Weight	g	205 nominal, without handle fitted

ENVIRONMENTAL

Operating temperature	$^\circ\text{C}$	-25 to +75
Storage temperature	$^\circ\text{C}$	-40 to +85
Environmental protection above the flange		IP66 (IP65 when ZC1 handle is fitted) IEC 60529 (The joystick is unprotected below the flange)

ELECTRICAL Analog Track

Resolution		Virtually infinite
Track resistance ($\pm 20\%$)	k Ω	1.8, 2, 2.9, 5 or 10
Track electrical angle	$^\circ$	± 17 , ± 23 or ± 28 (Depends on gate and track code selected)
Output voltage range	%	0-100, 10-90 or 25-75 of input ($\pm 2\%$) (Depends on analog potentiometer track selected see options page 9)
Center tap voltage (no load)	%	48 - 52 of applied voltage
Center tap angle	$^\circ$	± 2.5
Supply voltage - maximum	Vdc	32
Output current - maximum	mA	5 [†]
Wiper circuit impedance	M Ω	>1 [†] recommended
Insulation resistance		Greater than 50M Ω at 50Vdc

Switch-Directional or Center Off/Center On*

Switch operating angle	$^\circ$	3.75 either side of center position
Supply voltage - maximum	Vdc	30
Load current - maximum	mA	5

* The JC3000 has an additional center switch in each axis. When the handle is moved, the center switch signal will become open circuit ('break before make') before the directional switch closes. This angle is typically less than 1° . The directional and center switches are provided to allow customers to integrate the joystick into their control system in a safe manner. It is recommended that these switches are utilised to ensure a safe condition exists at all times.

DIMENSIONS AND MOUNTING DETAILS

For dimensions, mounting details and installation recommendations see page 8.

[†] The long life resistive elements require a high impedance load in the wiper circuit to minimise the current flowing through the wiper for optimum conditions. Connecting the joystick output to a control circuit/controller with a Wiper Circuit Impedance that is lower than stated above can result in an offset of the output voltage through the travel of the joystick. This may be most noticeable when the joystick is at rest at the centre position. A lower than specified wiper circuit impedance can also result in a higher than stated output current and this in turn will result in a reduced electrical life of the potentiometer element. The potentiometer element must be connected as a Voltage Divider and should not be used as a variable resistor. Use as a variable resistor will result in incorrect operation of the control system.

JC3000 JOYSTICK CONTROLLER ANALOG OUTPUT

ELECTRICAL CONNECTIONS

All potentiometer track and directional/center/handle switch connections terminate in a 12-way Hirose DF3-12P-2DS(01) series connector on each joystick axis – a mating connector and flylead is available (one is required for each axis). The connectors used on the JC3000 joystick are gold plated, therefore the mating connectors should also be gold plated.

Mating 12-way connector and flyleads

SA310621 MK1 – Connector, terminals and **100mm long** UL1007 wires – 28AWG (7/0.127mm)
SA310621 MK2 – Connector, terminals and **300mm long** UL1007 wires – 28AWG (7/0.127mm)

Y-Axis Allocation

Output voltage signal
 Switch track N/O (lever forward +Y)
 Not connected
 Potentiometer center tap
 Switch track center on
 Not connected
 Switch track N/O (lever backward -Y)
 Switch track common
 Normally not connected unless ZC1/ZCS handle is fitted (NY and XY code only)
 Potentiometer backward (-V or zero supply)
 Potentiometer forward (+V supply)
 Normally not connected unless ZC1/ZCS handle is fitted (NY and XY code only)

X-Axis Allocation

Output voltage signal
 Switch track N/O (lever right +X)
 Normally not connected unless ZC1/ZCS handle is fitted (XN code only)
 Potentiometer center tap
 Switch track center on
 Normally not connected unless ZC1/ZCS handle is fitted (XN code only)
 Switch track N/O (lever left -X)
 Switch track common
 Not connected
 Potentiometer left (-V or zero supply)
 Potentiometer right (+V supply)
 Not connected

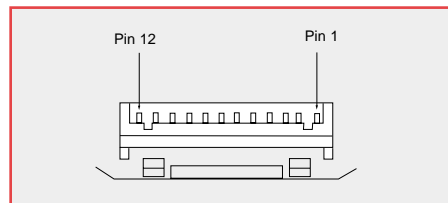
Connector Pin Number

1
 2
 3
 4
 5
 6
 7
 8
 9
 10
 11
 12

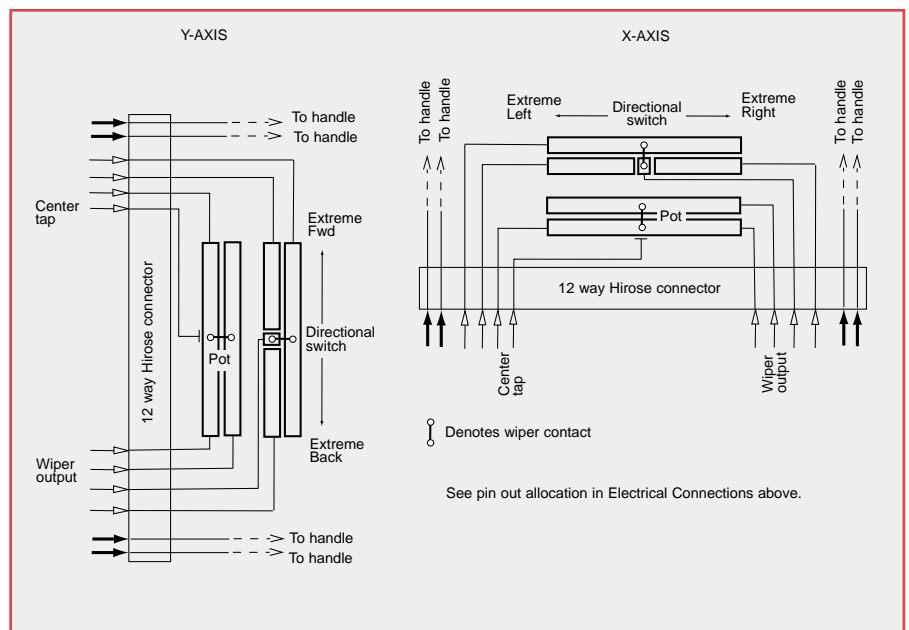
12-way Harness Wire Colour

Black
 Red
 Blue
 White
 Green
 Yellow
 Brown
 Orange
 Grey
 Violet
 Black/White
 Black/Red

MULTI PIN CONNECTOR DIAGRAM



ANALOG TRACK DIAGRAM



JC3000 JOYSTICK CONTROLLER SWITCHED OUTPUT

PERFORMANCE MECHANICAL

Lever breakout torque XY	Nm	0.2																								
Lever operating torque XY	Nm	0.6 (full lever deflection at $\pm 31^\circ$)																								
Lever detent torque XY	Nm	0.1 approx.																								
Maximum allowable torque XY	Nm	12.5 to 20 (full lever deflection, depending on gate and detent options selected)																								
Lever operating angle	°	± 31 max. in X and Y directions (Actual angle will depend on gate selected)																								
Lever action		Self centering, aligned X and Y																								
Lever gate profiles		Single axis in X or Y, Square or Plus																								
Detent angles	°	<table border="0"> <thead> <tr> <th>Nominal</th> <th>Lever angle</th> <th>Gate Code</th> <th>Track Code</th> </tr> </thead> <tbody> <tr> <td>± 5.5</td> <td>-</td> <td>-</td> <td>-</td> </tr> <tr> <td>± 12</td> <td>-</td> <td>-</td> <td>-</td> </tr> <tr> <td>± 18</td> <td>± 19</td> <td>$\emptyset 19$</td> <td>SW3</td> </tr> <tr> <td>± 24</td> <td>± 25</td> <td>$\emptyset 25$</td> <td>SW4</td> </tr> <tr> <td>± 30</td> <td>± 31</td> <td>$\emptyset 31$</td> <td>SW5</td> </tr> </tbody> </table>	Nominal	Lever angle	Gate Code	Track Code	± 5.5	-	-	-	± 12	-	-	-	± 18	± 19	$\emptyset 19$	SW3	± 24	± 25	$\emptyset 25$	SW4	± 30	± 31	$\emptyset 31$	SW5
Nominal	Lever angle	Gate Code	Track Code																							
± 5.5	-	-	-																							
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± 24	± 25	$\emptyset 25$	SW4																							
± 30	± 31	$\emptyset 31$	SW5																							

where \emptyset can be 1, S or P, see page 9

Maximum Z axis torque	Nm	5
Expected life		>5 million operations
Weight	g	205 nominal, without handle fitted

ENVIRONMENTAL

Operating temperature	°C	-25 to +75
Storage temperature	°C	-40 to +85
Environmental protection above the flange		IP66 (IP65 when ZC1 handle is fitted) IEC 60529 (The joystick is unprotected below the flange)

ELECTRICAL

Switch Track

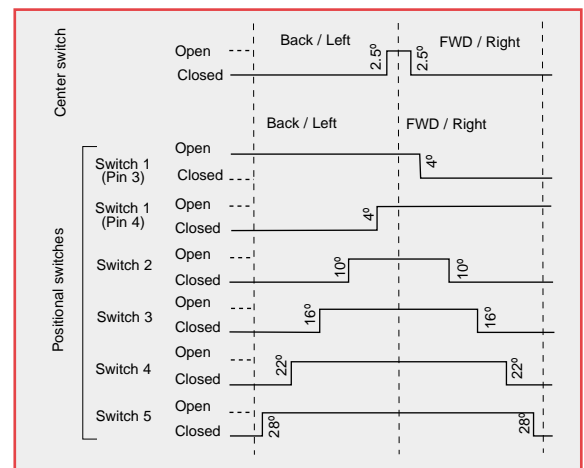
Number of switch positions		3, 4 or 5 either side of center
Number of detents		3, 4 or 5 either side of center (Also option for no detents)
Switch angles	°	(SW1) ± 4 , (SW2) ± 10 , (SW3) ± 16 , (SW4) ± 22 , (SW5) ± 28
Supply voltage - maximum	Vdc	32
Load current - maximum	mA	5
Insulation resistance		Greater than 50M Ω at 50Vdc

Switch-Center Off

Switch operating angle	°	2.5 either side of center position
Supply voltage - maximum	Vdc	30
Load current - maximum	mA	5

SWITCH ACTIVATION DIAGRAM

Switch track output and center switch signals on both X and Y axes are Normally Open at lever center position. Switch sequences close depending on the direction of lever movement and the detent position. See the diagram for the switch activation profile.



JC3000 JOYSTICK CONTROLLER SWITCHED OUTPUT

ELECTRICAL CONNECTIONS

All switch track/center/handle switch connections terminate in a 12-way Hirose DF3-12P-2DS(01) series connector on each joystick axis – a mating connector & flylead is available (one is required for each axis). The connectors used on the JC3000 joystick are gold plated, therefore the mating connectors should also be gold plated.

Mating 12-way connector and flyleads

SA310621 MK1 – Connector, terminals and **100mm long** UL1007 wires – 28AWG (7/0.127mm)

SA310621 MK2 – Connector, terminals and **300mm long** UL1007 wires – 28AWG (7/0.127mm)

Y-Axis Allocation

- Switch track common
- Center off switch
- Switch 1 (lever forward +Y)
- Switch 1 (lever backward -Y)
- Switch 2 (forward & backward)
- Switch 3 (forward & backward)
- Switch 4 (forward & backward)
- Switch 5 (forward & backward)
- Not connected
- Normally not connected unless ZC1/ZCS handle is fitted (NY and XY code only)
- Normally not connected unless ZC1/ZCS handle is fitted (NY and XY code only)
- Switch track common

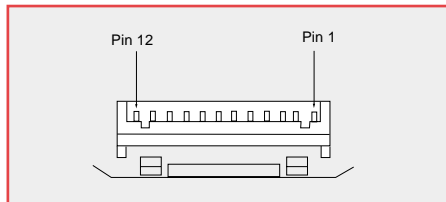
X-Axis Allocation

- Switch track common
- Center off switch
- Switch 1 (lever right +X)
- Switch 1 (lever left -X)
- Switch 2 (right & left)
- Switch 3 (right & left)
- Switch 4 (right & left)
- Switch 5 (right & left)
- Not connected
- Normally not connected unless ZC1/ZCS handle is fitted (XN code only)
- Normally not connected unless ZC1/ZCS handle is fitted (XN code only)
- Switch track common

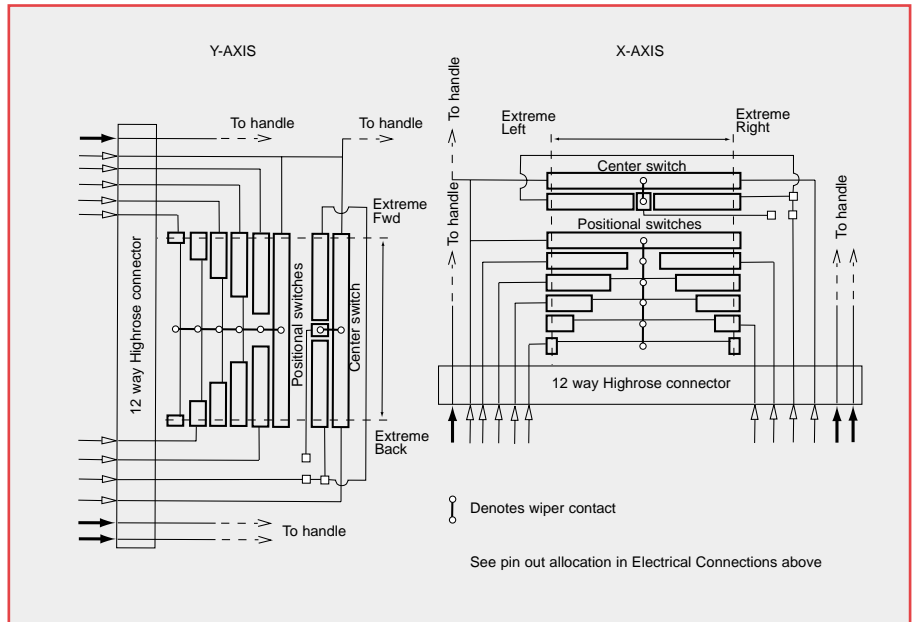
Connector Pin Number 12-way Harness Wire Colour

- 1 Black
- 2 Red
- 3 Blue
- 4 White
- 5 Green
- 6 Yellow
- 7 Brown
- 8 Orange
- 9 Grey
- 10 Violet
- 11 Black/White
- 12 Black/Red

MULTI PIN CONNECTOR DIAGRAM



SWITCH TRACK DIAGRAM

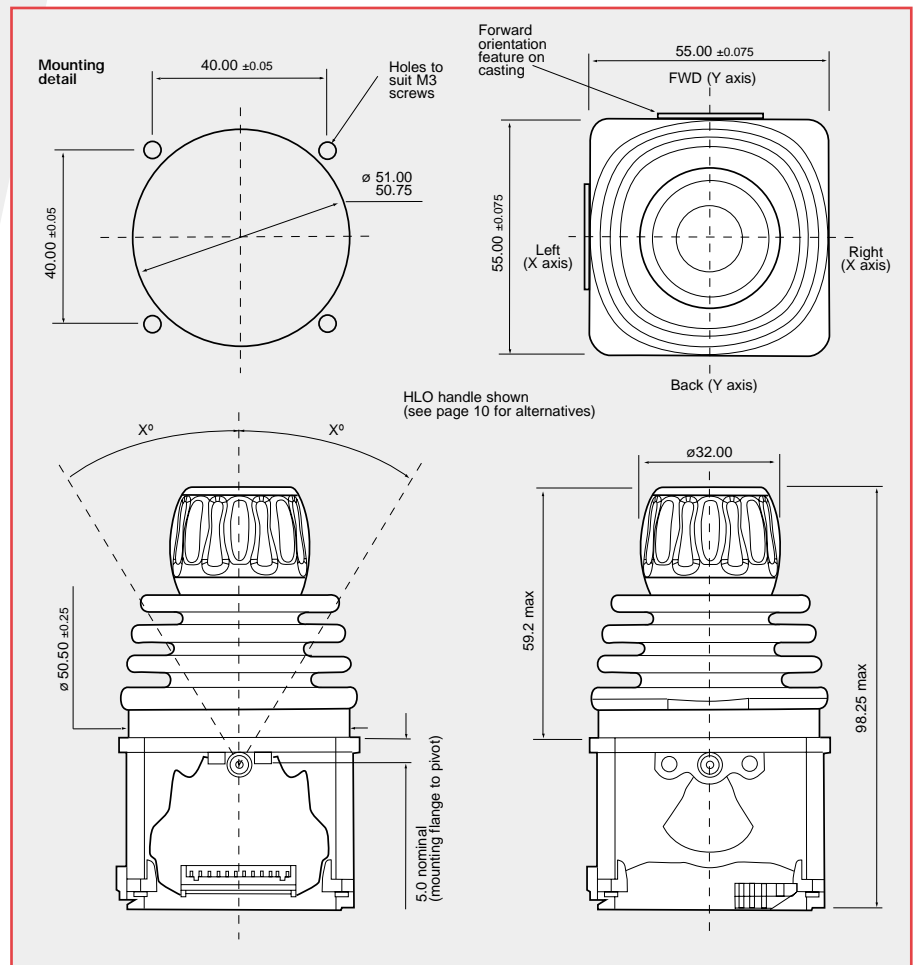


JC3000 JOYSTICK CONTROLLER

DIMENSIONS

Note: drawings not to scale

Lever angle (X°) depends on gate selected.



INSTALLATION

The joystick is designed to be fitted from below the mounting panel, through a 50.75/51.00mm diameter hole. The effectiveness of the joystick flange sealing is dependent on the panel mounting surface being sufficiently rigid to compress the sealing gaiter. The surface finish of the mounting panel is critical to achieving an adequate seal and rough surface finishes, paint chips, deep scratches, etc. should be avoided.

Recommended panel thickness

3.5 to 6mm

Recommended screw torque

The JC3000 joystick requires 4 x M3 screws (not supplied) to attach the flange to the mounting panel. To maintain an effective seal between the joystick flange and the mounting panel, the mounting screws should be tightened to a recommended fixing torque of 1Nm.

JC3000 JOYSTICK CONTROLLER

HOW TO SPECIFY

PERFORMANCE OPTIONS	FEATURE	CODE
AXES	Single axis in Y direction only - Forward/Backward	NY
	Single axis in X direction only - Right/Left	XN
	Dual axis	XY
GATE Selecting the gate style and angle determines the track code for switched output and 2/3 of the final track code for analog output versions.	Single axis with $\pm 31^\circ$ lever range (Track code = P_5 or SW5)	131
	Single axis with $\pm 25^\circ$ lever range (Track code = P_4 or SW4)	125
	Single axis with $\pm 19^\circ$ lever range (Track code = P_3 or SW3)	119
	Square with $\pm 31^\circ$ lever range in X and Y (Track code = P_5 or SW5)	S31
	Square with $\pm 25^\circ$ lever range in X and Y (Track code = P_4 or SW4)	S25
	Square with $\pm 19^\circ$ lever range in X and Y (Track code = P_3 or SW3)	S19
	Plus with $\pm 31^\circ$ lever range (Track code = P_5 or SW5)	P31
	Plus with $\pm 25^\circ$ lever range (Track code = P_4 or SW4)	P25
	Plus axis with $\pm 19^\circ$ lever range (Track code = P_3 or SW3)	P19
TRACKS - Analog output Final track code element * is determined by the gate/angle previously selected.	Analog potentiometer - 1.8k 0-100% $\pm 3.75^\circ$ directional switch	PN*
	Analog potentiometer - 2k 10-90% $\pm 3.75^\circ$ directional switch	PR*
	Analog potentiometer - 2.9k 25-75% $\pm 3.75^\circ$ directional switch	PQ*
	Analog potentiometer - 5k 0-100% $\pm 3.75^\circ$ directional switch	PE*
	Analog potentiometer - 10k 0-100% $\pm 3.75^\circ$ directional switch	PL*
TRACKS - Switched output	Switched track - 5 switches either side of center	SW5
	Switched track - 4 switches either side of center	SW4
	Switched track - 3 switches either side of center	SW3
LEVER SPRING FORCE	Medium duty 0.2Nm breakout, 0.6Nm full deflection	M
SEAT	Aligned with axis	A
DETENTS	No detent feature - available for all gate code options	D00
	5 each side of center position - option for gate codes 131; S31; P31	D5H
	4 each side of center position - option for gate codes 125; S25; P25	D4H
	3 each side of center position - option for gate codes 119; S19; P19	D3H
INTERFACE	Standard interface - no electronics	STN
HANDLE STYLE See pages 10-11	No handle, plain lever	NHP
	No handle, M5 threaded lever	NHT
	Tapered handle, no functions	K10
	Ball handle, no functions	B00
	Low profile, fluted handle, no functions	HLO
	Handle with momentary push button	ZC1
	Handle with momentary switch action	ZCS

EXAMPLE ORDER CODES

JC3000-XY-S31-PN5-M-A-D00-STN-K10

JC3000-NY-131-SW5-M-A-D5H-STN-ZC1

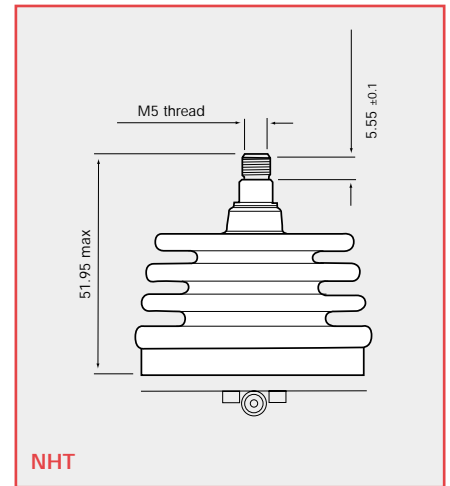
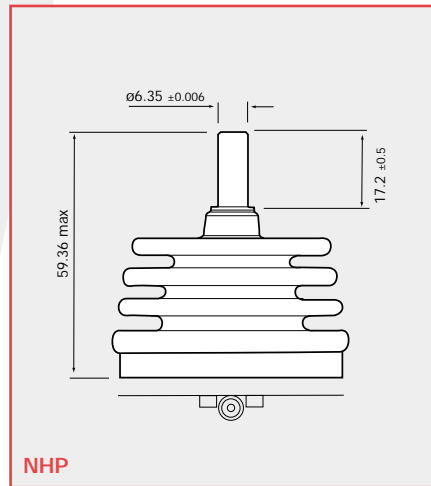
JC3000 JOYSTICK CONTROLLER HANDLE OPTIONS

NHP

No handle, plain lever

NHT

No handle, M5 threaded lever

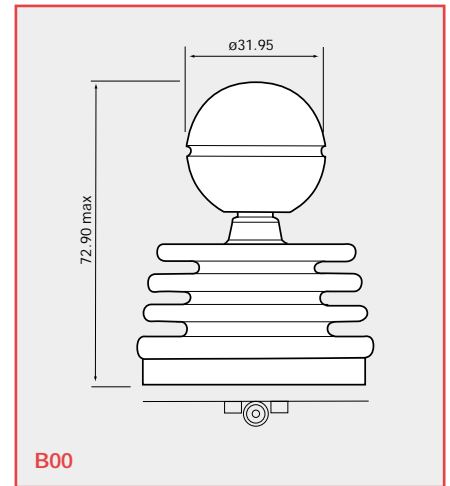
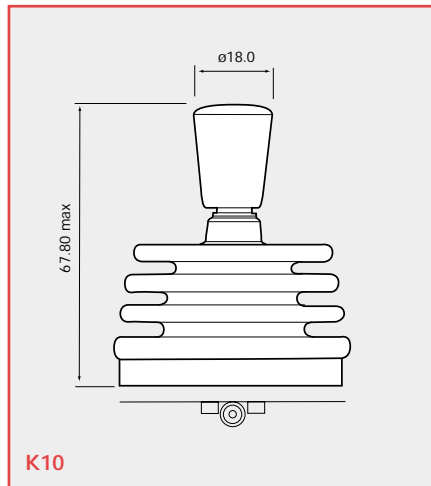


K10

This handle option is a simple tapered style with no switch functions, allowing simple fingertip control.

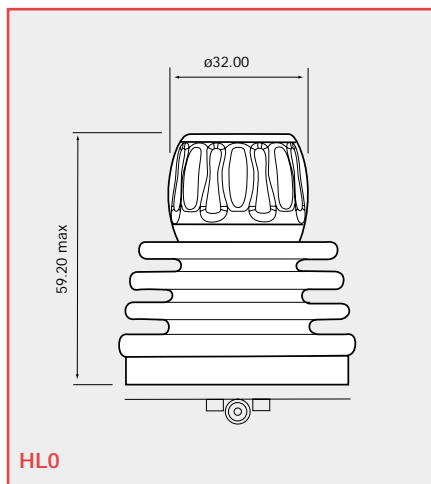
B00

This handle option is a spherical ball style with no switch functions, allowing simple 'finger and thumb' control. The handle has a recessed diametral groove on the circumference to aid grip.



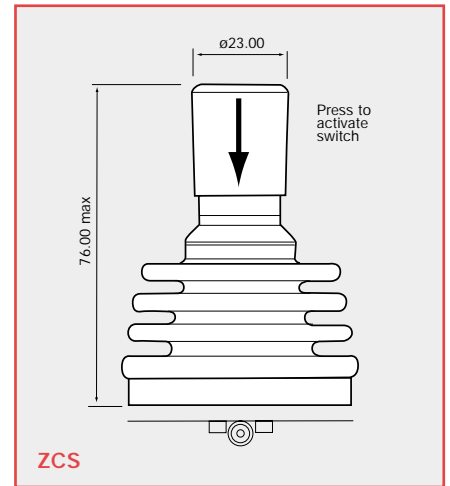
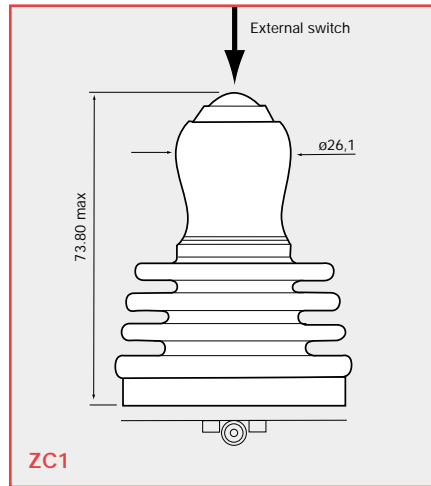
HLO

This handle option is a low profile, fluted style that has a maximum 59.2mm height above the mounting panel. This option allows closer spacing of multiple joysticks within a small surface area - typically in applications like remote control chest packs and robotics equipment.



ZC1 or ZCS HANDLE OPTION

A switch function can be incorporated by using the ZC1 external button switch or the ZCS internal switch to verify the change in signals from the joystick.



PERFORMANCE

Maximum height above flange	mm	
Maximum diameter	mm	
Environmental sealing (IEC 60529)		
Number of switches		
Action		
Switch operating force	N	
Maximum current	mA	
Expected electrical life	operations	

ZC1

73.8
26.1
IP65
1
Momentary button
3
200 @ 50Vdc
1 million

ZCS

76
23
IP66
1
Momentary handle depress
7
100 @ 30Vdc
500,000

ZC1 or ZCS ELECTRICAL CONNECTIONS

Switch connections terminate on the Hirose DF3 series connector. Actual pin allocation depends on the joystick track type and gate selection.

See page 5 for Analog Output version connections.

See page 7 for Switched Output version connections.

Penny+Giles

A Curtiss-Wright Company

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Penny & Giles

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Innovation In Motion

**CURTISS
WRIGHT** Controls
Integrated Sensing

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