

NEW  
PRODUCT

*Penny+Giles*  
YOUR PARTNERS  
*In Control*

# JC 2000 Contactless Multi-axis Joystick



**Creative solutions  
for position measurement and control**

# Contactless Technology

## JOYSTICK CONTROLLERS

The Penny+Giles JC2000 contactless joystick controller is designed for precision fingertip control applications where safety and long trouble-free life are primary requirements. It is available in one, two or three axis configurations and can accommodate a choice of handles, including push-button switch versions. The JC2000's compact size, low operational force and high reliability are ideal for applications which include powered wheelchairs, disabled mobility vehicles,

robotic teach controllers, co-ordinate measuring machines, medical and CCTV equipment, professional camera controls and radio or infrared chest-packs.



### Innovative design

Hall effect sensors facilitate a contactless single, dual or three axis sensor system which is light and sensitive to operate and offers almost limitless life. Additionally the system eliminates the flexing wires associated with fatigue failure when handle switches are not fitted.

Features	Benefits
<ul style="list-style-type: none"> <li>• Compact size</li> <li>• Depth below panel less than 31mm</li> <li>• Contactless sensing system</li> <li>• No flexing wires (except for handle switch functions)               <ul style="list-style-type: none"> <li>• Dual independent outputs on single and dual axis versions</li> </ul> </li> <li>• Range of handles with or without switch               <ul style="list-style-type: none"> <li>• Aligned seats (low force lever guidance)                   <ul style="list-style-type: none"> <li>• Polarised latching connector</li> <li>• CE Approved</li> </ul> </li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Minimal footprint and weight</li> <li>• Suitable for low profile control panels</li> <li>• Maintenance-free operation</li> <li>• Improved reliability</li> <li>• Allows failure detection by comparing outputs</li> <li>• Additional operator control functions</li> <li>• Improved operator control in pure X and Y directions</li> <li>• Simple installation</li> <li>• Confidence in EMC performance</li> </ul>

## Selection Guide

*Penny+Giles offers the widest choice of options to suit your application.*



**Single axis  
JC2000-T-X**

The single axis JC 2000 can be supplied with all handle options and provides a forward - reverse or left - right lever movement, determined by mounting orientation.



**Two axis  
JC2000-T-XY**

The two axis JC 2000 can be supplied with all handle options and a choice of lever restricting gates to suit particular applications and control functions.



**Three axis  
JC2000-T-XYZ**

The three axis JC 2000 is supplied with the rotating ergonomic (E) handle options only and a choice of lever restricting gates to suit particular applications and control functions.



**EMC Directive 89/336/EEC**  
The joystick products detailed in this document have been tested together as a system, to the requirements of EN50081-1 (Emissions) and EN50082-2 (Immunity).

## Aligned seats and gates - improved control

Aligned axis seats for the X and Y axis are shaped with shallow guides to give a distinct direction for the lever. Moving the lever away from the distinct direction is possible, but an increased lever force is noticed. Lever extent restricting gates guide the full deflection movement of the lever, providing a choice of options to suit specific applications.



## Safety

For super critical applications the single and dual-axis controller provides two independent outputs in each axis, which can be specified with outputs the same or opposed, allowing the signals to be monitored and compared for failure detection.

## Total reliability



The contactless operating system provides a highly reliable solution allowing a fit and forget installation so that zero maintenance programmes can be incorporated within equipment service schedules.

**NO MAINTENANCE**

## Switches

Momentary action push-button switches are available in two handle styles, providing an additional finger operated control function.



## Custom design

Penny+Giles offer an extensive range of joysticks as standard and can in many cases tailor the product to meet the customer's exact requirements. Please talk to our technical sales team about your application.

## Rapid availability

The JC2000 joystick is designed to provide the user with a wide choice of options allowing rapid build and despatch. Call your nearest sales office for the latest information.



## Handle options



Standard tapered X & XY axes Code K1



Ergonomic X & XY axes Code E



Ergonomic with button X, XY & XYZ axes Code E1 - E5



Straight X & XY axes Code S



Straight with button X, XY axes only Code S1 - S5

## Switch options



Black button Code 1



Red button Code 2



Green button Code 3



Yellow button Code 4



Blue button Code 5

switches introduce connecting wires through the handle

## Gate options



Single axis Code 1



Round Code R



Square Code S



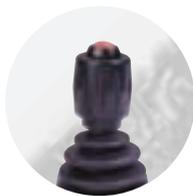
Diamond Code D



Cross x Code C



Plus + Code P



## MECHANICAL

### XY axes

<b>Lever operating force*</b>	
Breakout	1N nominal
Operating	2N nominal (full deflection)
Maximum allowable	300N (XY version) 195N (XYZ version)

### Lever mechanical angle

Single axis only	±20° forward/reverse
Round gate	±20°
Square and Diamond gate	±20° to corners (±14° to flats)
Cross and Plus gate	±20° at extent of axes

### Expected life

15 million operations

### Z axis

<b>Operating torque</b>	
Breakout	0.04Nm
Operating	0.06Nm
Maximum allowable	1.0Nm
<b>Mechanical angle</b>	±20°
<b>Expected life</b>	5 million operations
<b>Weight</b>	90g without handle fitted

## ENVIRONMENTAL

<b>Operating temperature</b>	-25°C to +70°C
<b>Storage temperature</b>	-40°C to +70°C
<b>Environmental protection (above the flange)</b>	IP65 BS EN 60529
<b>EMC immunity level</b>	60V/m, 25MHz to 1GHz, 1KHz 80% sine wave modulation, EN50082-2 (Sept 1995)
<b>EMC emissions level</b>	Complies with EN50081-1 (1992), 30MHz - 1GHz
<b>ESD immunity level</b>	EN50082-2 (1995) ±8kV Contact discharge; ±15kV Air discharge (10 discharges)

## ELECTRICAL

<b>Sensor type</b>	Hall effect
<b>Resolution</b>	Infinite
<b>Supply voltage range (Vs)</b>	5Vd.c. ±0.5Vd.c. regulated transient free
<b>Over voltage maximum</b>	15Vd.c. continuous
<b>Reverse polarity maximum</b>	14.5Vd.c.
<b>Output voltage span</b>	X and Y axis $\left[ \begin{array}{l} \pm 25 \text{ to } \pm 30.6\% \text{ with respect to } V_s/2 \text{ (on axis for R, D and P gates)} \\ \pm 16.5 \text{ to } \pm 21.4\% \text{ with respect to } V_s/2 \text{ (on axis for S gate, extents of C gate)} \end{array} \right.$ Z axis ±22 to ±32% with respect to Vs/2
<b>Output impedance</b>	100Ω each axis
<b>Centre tap voltage (No load)</b>	50%Vs ±1%
<b>Centre tap impedance</b>	1.1kΩ
<b>Return to centre voltage (No load)</b>	X and Y axis Within ±60mV of Vs/2 @ 20°C (±73mV over full temperature range) Z axis Within ±100mV of Vs/2 @ 20°C (±113mV over full temperature range)
<b>Current consumption</b>	17.5mA nominal

## OUTPUT SENSE

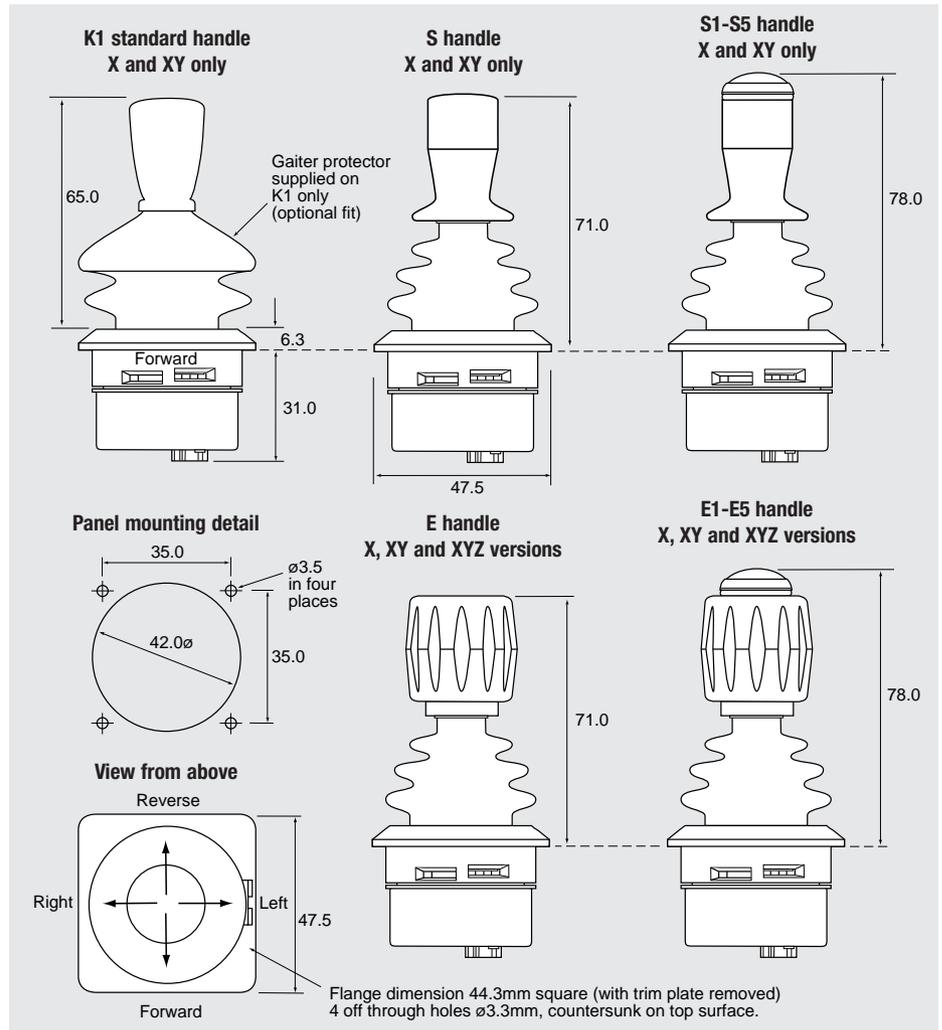
XY axes	The twin outputs of the XY axes can be independently selected to be rising together in the same direction (PP) or opposed (PN). See order code
XYZ	The three axis version can only provide a single output per axis

## CUSTOM DESIGN

Custom handle styles. Alternative mounting flanges. Alternative gate geometry. Please contact our technical sales team.

\* Measured 50mm above upper flange face

## DIMENSIONS



## ELECTRICAL CONNECTIONS

Connection

Mating Connector

8 Pin Berg Minitek™ 90309-008 Shrouded IDC Header

8 Pin Berg Minitek™ 89361-708 IDC Connector (order separately as P302137)

or supplied with 0.5 ribbon cable fitted (order as P302138)

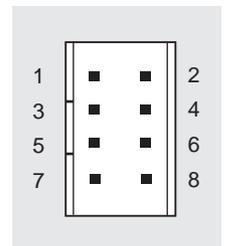
Termination Details

**Pin**

**Number**

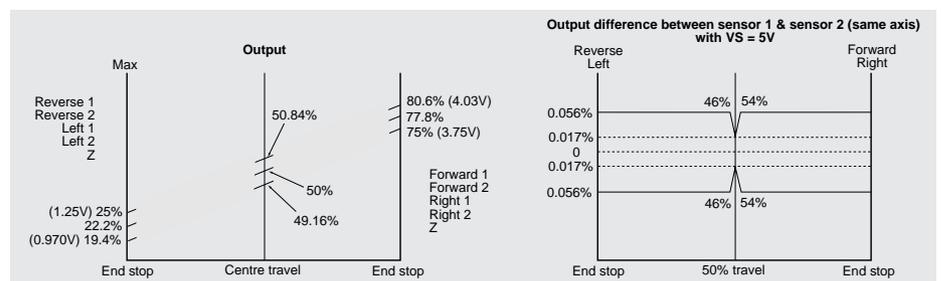
**Description**

Pin Number	XY Joystick	XYZ Joystick
1	Positive voltage supply	Positive voltage supply
2	Left/Right output 1	Left/Right output
3	Zero voltage supply	Zero voltage supply
4	Forward/Reverse output 1	Forward/Reverse output
5	Forward/Reverse output 2	5Vd.c.
6	Centre tap	Centre tap
7	Left/Right output 2	Z Axis output
8	Switch output (NC if no switch)	Switch output (NC if no switch)



Switch is connected between pin 1 and 8

## OUTPUT DETAIL



## JC2000 ORDER CODE

Description	Key (used in order code string)	Feature	Feature Availability		
			X	XY	XYZ
Model	JC2000-T-X	Single axis	yes		
	JC2000-T-XY	Two axis		yes	
	JC2000-T-XYZ	Three axis			yes
Output Sense	PPOOO	dual output - same sense	yes		
	PNOOO	dual output - opposite sense	yes		
	PPPPO	dual output - same sense each axis		yes	
	PPNNO	dual output - same sense X, opposite sense Y		yes	
	PNPNO	dual output - opposite sense each axis		yes	
	POPOP	single output - same sense each axis			yes
	PONOP	single output - same sense X and Z, opposite sense Y			yes
	PONON	single output - same sense Y and Z, opposite sense X			yes
NONON	single output - opposite sense each axis			yes	
Output Span	25	±1.25 Vdc either side of center voltage	yes	yes	yes
Joystick Handle	K1	Standard tapered handle	yes	yes	
	E	Ergonomic handle	yes	yes	yes
	E1	Ergonomic with black push button	yes	yes	yes
	E2	Ergonomic with red push button	yes	yes	yes
	E3	Ergonomic with green push button	yes	yes	yes
	E4	Ergonomic with yellow push button	yes	yes	yes
	E5	Ergonomic with blue push button	yes	yes	yes
	S	Straight handle	yes	yes	
	S1	Straight with black push button	yes	yes	
	S2	Straight with red push button	yes	yes	
	S3	Straight with green push button	yes	yes	
	S4	Straight with yellow push button	yes	yes	
S5	Straight with blue push button	yes	yes		
Gate	1	Single axis	yes		
	R	Round		yes	yes
	S	Square		yes	yes
	D	Diamond		yes	yes
	C	Cross X		yes	yes
	P	Plus +		yes	yes
Seat	N	Non-aligned	yes	yes	yes
	P	Aligned		yes	yes

**Example** JC2000 - T - XY - PPPPO - 25 - E5 - S - P

Two axis version with all outputs same sense, ergonomic handle with blue push button switch, square gate and aligned seat.

## Application and usage notes

### Sealing the joystick to the panel

See panel mounting detail on page 5 for recommended machining detail to accept the JC2000. This is interchangeable with the Penny+Giles JC200 joystick mounting, as well as other manufacturers alternatives.

Prior to installation check that the gate (travel limiter) positioned under the gaiter at the top of the joystick is correctly located and orientated.

The joystick is sealed above the mounting surface to prevent dust and water ingress to IP65 and is supplied with mounting hardware (sealing gasket and trim plate) suitable for mounting from above the panel face. The effectiveness of the seal is dependent on the mounting surface being sufficiently rigid to compress the sealing gasket. The finish of the mounting surface is critical to achieving an adequate seal and rough surface finishes, paint chips, deep scratches etc. should be avoided. The joystick should not be used if the flexible rubber gaiter becomes perforated.

Below the mounting surface the joystick should be allowed to breathe freely but be protected from excessive dust and direct

water spray. Where the joystick is mounted in a control box, the box should be allowed to breathe at its lowest point. If the box is subjected to water spray it may be necessary to provide a waterproof breather at the lowest point.

It is possible to mount the JC2000 from under the panel surface by discarding the trim plate and compressing the base of the flexible gaiter against the panel and mounting flange. This reduces the lever height above the panel, but increases the space required to accommodate the joystick body below the panel. Please contact our technical sales team for details of recommended panel hole size if using this method.

### Mechanical loads

Penny+Giles joystick controllers are robust and designed to suit typical applications. System designers should ensure that the joystick is not positioned where it could be subjected to abuse loads in excess of the maximum allowable load stated in the product specification.

### Modification and usage

Any modification of the joystick by the user is strongly discouraged and will invalidate the warranty and Penny+Giles

liability. The handles supplied with the JC2000 are intended for fingertip and not full hand operation. Handles **must not** be replaced with a taller handle otherwise the increased load applied to the joystick may result in permanent damage.

### User maintenance/adjustment

The JC2000 joystick is supplied by Penny+Giles fully adjusted and ready for installation. There are no user adjustable or maintainable parts within the joystick. Any attempt to dismantle the joystick will invalidate the warranty and may leave the system into which the joystick is installed in a dangerous condition.

### Safety

For a system to operate safely it must be able to differentiate between commanded and uncommanded outputs. System designers should take steps to detect and manage joystick and system failures that may give rise to an erroneous output.

For safety critical functions we recommend that an independent momentary action 'system enable' switch is used. This switch can be incorporated into the joystick as a 'dead-man' switch or can be a separate foot or hand operated momentary switch. All functions controlled by the joystick should be disabled when this switch is released.

The control system should look for the appropriate 'system enable' switch output before the joystick is displaced from the neutral position. Functions controlled by the joystick should not be enabled until this is the case.

### Dual outputs - X and XY versions only

Each joystick axis is equipped with two outputs and it is recommended that both outputs are continuously compared to ensure that the difference does not exceed the maximum specified difference plus a suitable 'safety margin'. In addition, machine movement should not be enabled until both outputs from any one axis exceed the centre threshold voltage plus a suitable 'safety margin'. (e.g. 2 x joystick centre tolerance)

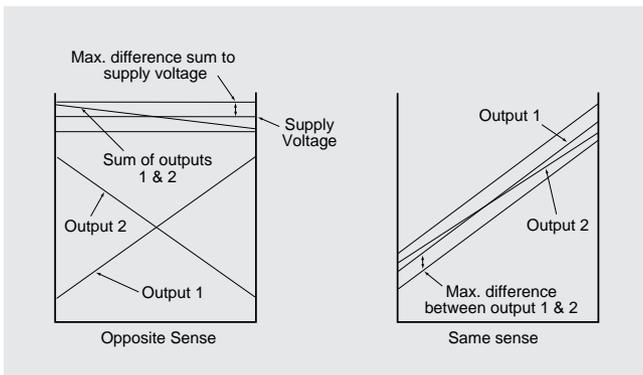
The outputs in normal use are within the limits 0.970V to 4.030V. Any output significantly outside of this range must be regarded as erroneous and appropriate safe action taken. A high value pull-up or pull-down resistance should be added to the X and Y outputs such that in the unlikely event of a wire or connector failure the output will be pulled out of range.

### Dual output sense (direction)

Dual outputs from any joystick axis can be configured during manufacture in one of two possible ways. These are designated within the joystick specification as 'same sense' (P) or 'opposite sense' (N). The diagrams below show dual outputs; for single output or a Z axis either output 1 or 2 can be chosen.

The slopes at their lower end start at 25% of supply voltage and at their upper end finish at 75% of supply voltage.

The differences are shown in the diagrams below.



In the 'same sense' configuration the outputs of an axis can be directly compared to determine the serviceability of the joystick.

In the 'opposite sense' configuration the sum of the outputs from any axis should within limits, equal the applied voltage.

### Centre tap

A centre tapping is provided as a means of verifying the integrity of the supply voltage at the joystick. Clearly a high resistance or open circuit in either the +ve supply or 0V connections will affect the joystick outputs. The normal output at the centre tap connection is 49.16% to 50.84% of the supply voltage. A centre tap output outside this range indicates a fault in the supply to the joystick.

### Single outputs - XYZ only

Where a joystick incorporating only a single sensor per axis is used to control safety critical functions an independent momentary action system enable switch must be provided.

### Joystick integrity check on power up

On system power-up, the system should check that all joystick outputs are in neutral and safety critical functions controlled by the joystick should not be enabled until this is the case.

### Output impedance

The outputs at the centre position and the end of travel are specified with an infinite load impedance or zero current. The effect of adding a finite load impedance will be to source or sink current through the joystick output impedance. The voltage dropped through the joystick output impedance must be taken into account when the system threshold voltages are being defined. The impedance of the JC2000 outputs are specified on page 4.

### Output noise

The JC2000 incorporates Hall effect sensors to detect the position of each of the joystick axes. A side effect of the use of these sensors is electrical noise superimposed on the output, typically of the order of 20mV peak to peak. This noise can be simply filtered out by the user.

### Magnetic immunity

Magnetic screening minimises the sensitivity to external magnetic fields. However the use of the joystick in close proximity to sources of high magnetic fields is not recommended.

### Applied voltages

The JC2000 is designed to operate from a regulated 5Vdc  $\pm 0.5V$  supply, free from voltage transients. Under no circumstances should voltages above 5.5V be applied to the joystick. The outputs from the JC2000 are ratiometric and are dependent on the input voltage.

### Life

Penny+Giles joysticks are designed and tested to provide a working life that is acceptable for the majority of applications. System designers should be satisfied that the life stated in the joystick specification is sufficient for the intended application.

## Available from Penny+Giles

A wide range of instrumentation for measurement and control solutions in industrial and aerospace applications. Please ask for more details.

Penny+Giles quality systems meet the requirements of ISO9001, the Civil Aviation Authority and numerous customer's certification standards.

Quality is at the heart of all our systems ensuring the reliability of our products from initial design to final despatch.

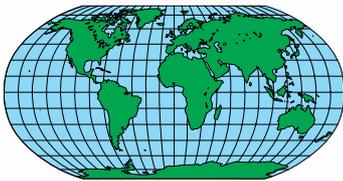


Certificate No. LRQA 0965179



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