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JOYSTICK CONTROLLERS FINGER OPERATED

Innovation In Motion

INNOVATION IN MOTION

The Penny & Giles range of finger operated joystick controllers have been developed for the smooth, precise control of critical functions in a variety of industrial applications where a Human-Machine Interface (HMI) is required. Available in one, two or three axis configurations, the finger operated range has a choice of six different models, with ergonomic handle styles to enable superb proportional control. Each model has a range of selectable options for the most comprehensive matching of the joystick to your application.

Features

Potentiometeric or Hall effect sensing

Single and multi-axis control
Low profile handles

Most models protected to IP65 minimum above the panel

Choice of outputs and switches
Choice of handles with additional functions

Standard connectors

Benefits

- Long life and maintenance-free operation
 Suited to a range of control functions
 Unintentional operation reduced
- Operation in demanding environments
- Enables user configuration for system safety
- Increased operator control
- Simple, error free installation



Ergonomic handles

This range has been developed with operator comfort in mind. By reducing the mental and physical effort required to operate your equipment, Penny & Giles joysticks can help to increase your productivity. The small single axis rockers and controllers require

minimal effort to move the handles, which are styled to fit comfortably with finger and thumb operation. The multi-axis controllers have a choice of handle styles that allow you to select additional functionality for operator controls, with push button switches for 'Person present' detection, or a third axis of proportional control. In addition, the JC400 model can be specified with a choice of three lever forces.

Selection Guide

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



JC025 Page 6 •Single axis rocker •Compact, low profile with a choice of rocker styles and outputs JC030 Page 6 •Single axis rocker •Compact, low profile with a choice of outputs



EMC Directive 89/336/EEC 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.



Quality Assurance Penny & Giles are accredited to BS EN ISO9001:2000

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

JOYSTICK CONTROLLERS



🔜 Innovative design

The Penny+ Giles joystick range are displacement joysticks that provide electrical signals in direct proportion to the movement of the lever. Two different types of sensing technology are utilised in the finger operated controller range.

The JC025, JC030, JC100, JC120 and JC400 models use long life potentiometer tracks with directional/center switching, and the JC2000 model uses non-contact Hall effect sensors.

Potentiometric sensing

Designed to interface with an electronic controller, the long-life potentiometer tracks generate analogue outputs with switched reference signals that are proportional to the distance and direction over which the handle (or rocker) is moved. The analogue output can be factory 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. An 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 linear 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.

Hall effect sensing

The JC2000 model uses non-contact Hall effect sensors to provide one, two or three axes of precision fingertip control, with dual independent outputs in the single and dual axis models for built-in redundancy and increased reliability. The key advantage of using Hall effect sensors is that they offer very long life because they have no contacting parts. They allow a very compact under-panel depth - as much as half the space of comparable potentiometer designs. Hall effect joysticks are more sensitive to electromagnetic interference, but this has been minimised by using appropriate shielding and robust circuit design for all but the most demanding environments.





JC100 Page 8

- Single axis joystick
- Low profile lever with a choice of outputs

JC120 Page 10

- Single axis joystick
- Lower profile lever with a choice of heights, outputs and protective boot
- Narrow width

JC400 Analogue Page 12 JC400 Digital Page 15

- Multi axis joystick
- Compact, minimal size with a wide range of mechanical and electrical options

JC2000 Page 22

- Multi axis contactless joystick
- Compact, minimal under-panel depth with a wide range of mechanical and electrical options

JOYSTICK CONTROLLERS



Total reliability

By using design innovation, careful materials selection and extensive real-life applications knowledge, Penny+ Giles engineers have developed a range of joystick controllers that require no maintenance throughout an expected working life of greater than five million operations (fifteen million operations for the JC2000). We also fit standard electronic connectors to the majority of our joysticks to help reduce both your installation time and the potential for wiring errors during your manufacturing process.

Safety

Joysticks fitted with the long-life potentiometer tracks can have additional resistors connected in series with the main resistive element to limit the output signals to 10-90% or 25-75%. This can be used as part of your systems comparison and error detection routine, where an out of range signal could indicate a wiring fault. Additional independent switch functions are provided for directional and center position indication - vital for system start-up safety. The JC2000 model uses Hall effect sensors and is supplied with dual independent outputs fitted as standard on the single and dual axis versions. The signals can be monitored and compared for failure detection in safety critical applications. See page 26 for application and usage notes on this model.





Custom design

Penny+ Giles offer an extensive range of finger operated joysticks in standard modular configurations, designed to meet the majority of individual customer needs, but we can 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 finger operated joystick range is intended to provide the user with the widest possible choice of standard options, but allows efficient build and despatch by using cellular manufacturing principles. Contact your nearest sales office for the latest information on availability of these joysticks.



RUGGED JOYSTICK CONTROLLERS HAND OPERATED

Penny+ Giles can also supply a range of hand operated joystick controllers for demanding operator control applications in off-highway vehicles and other Human-Machine Interfaces where ultimate strength, reliability and handle functionality are important.

PLEASE SEE OUR SEPARATE BROCHURES ON THE JC150 AND JC6000 MODELS



Typical operator controls on

- Aerial lifts, hoists and cranes
- · Loaders, excavators and dozers
- Tractors and harvesters
- Telehandlers
- Forklifts

JC025AND JC030 SINGLE AXIS ROCKER

Developed for applications where compact size and minimal above panel height is paramount, the JC025 and JC030 rockers are very low profile whilst still providing precise fingertip control in one axis. The use of these rockers in a control panel allows designers to develop very low profile assemblies whilst still maintaining the functionality of a much larger single axis joystick. These rockers have been designed for maintenance-free operation throughout an operating life of greater than five million operations.

Typical applications include remote control chest packs, pendant controllers, low profile panel assemblies and control consoles.

PERFORMANCE MECHANICAL

Breakout force	Ν	5*
Operating force	Ν	15* Full deflection
Maximum allowable force	Ν	50* Full deflection
Rocker operating angle	0	± 10
Rocker action		Self centering
Expected life (operations)		> 5 million
Weight	g	30
		*14mm radius from center
ΕΝ ΥΙΒΟΝ ΜΕΝ ΤΔΙ		

TRONMENIAL

Operating temperature	°C	-25 to +70
Storage temperature	°C	-40 to $+80$
Environmental protection		
JC025		IP65 (when correctly panel sealed) IEC 60529
JC030		IP60 (when correctly panel sealed) IEC 60529

ELECTRICAL

Analogue Track

Resolution		Virtually infinite
Track resistance (±20%)	kΩ	1.8, 2, 2.9 or 5
Track electrical angle	0	± 9
Output voltage range	%	0-100, 10-90 or 25-75 of input (± 2%)
Center tap voltage (no load) %	48 - 52 of applied voltage
Center tap angle	0	1.5 either side of center
Supply voltage - maximum	Vdc	22
Wiper circuit impedance	MΩ	Greater than 0.1**
Power dissipation @ 25°C	W	0.25 (no load)
		** The long life resistive elements require a high impedance load in the wiper circuit to

Units supplied with O ring seal

Switch -

Directional or Center Off

Switch operating angle	٥
Supply voltage - maximum	Vdc
Load current - maximum	mA

2.5 either side of center 35

 $Q = 2.9k \ 25-75\%$

5 resistive (or 200 with reduced switch life of 1 million operations)

minimise the current flowing through the wiper for optimum conditions

ORDERING CODES

		JC025	BLK	
Track resist N = 1.8k E = 5k B = 2k	ance 0-100% 0-100% 10-90%			Rocker profile STD = standard V00 = V profile

- Track resistance - **N** = 1.8k 0-100% **E** = 5k 0-100% **R** = 2k 10-90%
- $Q = 2.9k \ 25-75\%$

DIMENSIONS AND MOUNTING OPTIONS

JC025

It is recommended that the JC025 is fitted from the back of the mounting panel using four M3 x 6mm female, self-clinching stand-offs (e.g. PEM ref. CSS M3-6) fitted to the back of the panel at opposite positions. The stand-offs are used in conjunction with four M3 x 6mm pan head screws. The panel cut-out and centers for the stand-offs are as shown in the panel mounting detail below.

No option on rocker profile for JC030



The recommended panel thickness is 3mm. The O ring supplied must be used to seal the JC025 rocker assembly to the mounting panel to enable IP65 protection.

JC030 - V profile only

It is recommended that the JC030 is fitted from the back of the mounting panel using four thread forming screws (supplied). Tighten the screws until initial contact with the body occurs ensuring body/flange relationship is square and flat. Continue tightening in ¼ turn increments until a torque of 0.1 - 0.15Nm is achieved. The panel cut-out and centers are as shown below.



The recommended panel thickness is 3mm. The O ring supplied must be used to seal the JC030 rocker assembly to the mounting panel to enable IP60 protection. Supplied with 4 x panhead Pozidrive self tapping screws for mounting to panel.

Penny+ Giles has designed the JC030 to meet IP60 rating, but it is the final responsibility of the customer to approve the product in it's application.

ELECTRICAL CONNECTIONS

PTFE insulated 7/0.120 (28AWG) flying leads, 300mm long

Description			
Positive voltage supply			
Center tap			
Negative or zero voltage supply			
Output voltage signal			
N/O switch, rocker backward			
N/O switch, rocker forward			
Common terminal for switch			

. ..

Pink/ Grey Yellow/ Red White/ Red Pink Green Blue/ Orange Black

Wire color

JC100 SINGLE AXIS JO YSTICK

Developed for applications where ergonomics and system integrity are paramount, the JC100 is a compact, low profile joystick that provides smooth, precise fingertip control in one axis. The JC100 is sealed to IP66 to enable it to operate in extreme environments. With all the components contained within the handle, and standing only 70mm high, it is ideal for mounting in low profile panels and arm rests. Installation time has been reduced through the use of a standard electronic connector, and the joystick has been designed for maintenance-free operation throughout its operating life of greater than five million operations.

Typical applications include remote control chest packs and the control of construction, agricultural or material handling equipment.

PERFORMANCE		
MECHANICAL		
Breakout force	Ν	2.3^{*}
Operating force	Ν	3.4* Full deflection
Maximum allowable force	Ν	50* Full deflection
Lever operating angle	0	± 30
Lever action		Self centering
Expected life (operations)		> 5 million
Weight	g	45
		*At top of handle
EN VIRONMENTAL		
Operating temperature	°C	-25 to +70
Storage temperature	°C	-40 to +85
Environmental protection		IP66† IEC 60529
above flange		Unit supplied with foam gasket seal
		[†] Seal integrity can only be achieved when using sealing gasket supplied and screws are tightened to 0.7Nm. The installer should also ensure the mounting screws are adequately sealed.
ELECTRICAL		
Analogue Track		
Resolution		Virtually infinite
Track resistance (± 20%)	kΩ	4 or 5
Track electrical angle	0	± 28
Output voltage range	%	0-100, 10-90 or 25-75 of input (± 2%)
Center tap voltage (no load)	%	48 - 52 of applied voltage
Center tap angle	0	2.5 either side of center
Supply voltage - maximum	Vdc	32
Wiper circuit impedance	MΩ	Greater than 0.1**
Power dissipation @ 25°C	W	0.25 (no load)
		** 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
Switch -		

Switch operating angle	٥
Supply voltage - maximum	Vdc
Load resistance - minimum	kΩ
Load current - maximum	mA
Typical contact resistance	Ω

5 either side of center 3510 2 (resistive) 150

ORDERING CODES	IDERING	CODES
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Mating connector kit	SA47269
25-75% output voltage range, 5k	JC100-007
10-90% output voltage range, 5k	JC100-002
0-100% output voltage range, 4k	JC100-006

DIMENSIONS AND MOUNTING OPTIONS

JC100

It is recommended that the JC100 joystick is fitted from the top of the mounting panel using four M3 screws (not supplied). The panel cut-out and centers for the screw positions are as shown in the panel mounting detail below.



ELECTRICAL CONNECTIONS

Connection

Mating connector kit (order separately)

FCI DUBO X^{IM} 7 way male connector (76382-307) SA47269 (contains DUBO X^{IM} 65240-007 female connector and 7 pins 76357-301

suitable for AWG 22-30 wire size). Requires crimping pliers (FCI No. HT234) to fit pins to wires.



JC 1 2 0 SINGLE AXIS JOYSTICK

Developed for applications where ergonomics and system integrity are paramount, the JC120 is a minimum width, low profile joystick that provides smooth, precise fingertip control in one axis with a choice of two lever lengths. The JC120 is sealed to IP66 to enable it to operate in extreme environments. Standing only 54 or 64mm high, the JC120 is less susceptible to unintentional operation. With all of the components contained within the handle, it is ideal for mounting in low profile panels and arm rests. Installation time has been reduced through the use of a standard electronic connector, and the joystick has been designed for maintenance-free operation throughout on operating life of greater than five million operations. An optional neoprene boot is available for the short handle version, allowing operation in environments where aggressive materials are present, protecting from dust and dirt ingress.

Typical applications include remote control chest packs and the control of construction, agricultural or material handling equipment.

PERFO RM AN CE					
MECHANICAL		Short handle	Short handle with boot	Long h	nandle
Breakout force	Ν	3.1^{*}	3.8*	2.3^{*}	
Operating force	Ν	5.1*	13.2*	3.4*	Full deflection
Maximum allowable force	N	50*	50*	35*	Full deflection
Lever operating angle	۰	± 30	± 30	±30 (a	or 0-60)
Lever action		Self centering	Self centering	Self ce	ntering or end return
Expected life (operations)		> 5 million	> 1 million for boot (replaceable)	>5 mi	llio n
Weight	g	45	47	45	
		*At top of handle			
EN VIRONMENTAL					
Operating temperature	°C	-25 to $+70$			

EN	۷I	RO	NN	I EN	TAL

Operating temperature	°C	-25 to +70
Storage temperature	°C	-40 to +85
Environmental protection		$\mathbf{IP66}^{\dagger}$ IEC 60529
above flange		†Seal integrity can only be achieved when using sealing gasket supplied and screws are tightened to 1Nm. Sealing gasket not required when neoprene boot is fitted to short handle
		version

ELECTRICAL

Ana	logue	Track
-----	-------	-------

Resolution	
Track resistance (± 20%)	kΩ
Track electrical angle	0
Output voltage range	%
Center tap voltage (no load)	%
Center tap angle	0
Supply voltage - maximum	Vdc
Wiper circuit impedance	MΩ
Power dissipation @ 20°C	W

0

Virtually infinite
4 or 5
± 28
0-100, 10-90 or 25-75 of input (± 2%)
48 - 52 of applied voltage
2.5 either side of center
32
Greater than 0.1**
0.25 (no load)

** 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

Switch -

Directional or Center Off

Switch operating angle	0
Supply voltage - maximum	Vdc
Load resistance - minimum	kΩ
Load current - maximum	mA
Typical contact resistance	Ω

5 either side of center
35
10
2 (resistive)
150

ORDERING CODES

Short handle	0-100% output voltage range, 4k	JC120-0001
	with boot fitted	JC120-0011
	10-90% output voltage range, 5k	JC120-0002
	with boot fitted	JC120-0012
	25-75% output voltage range, 5k	JC120-0003
	with boot fitted	JC120-0013
long hondlo		
Long nanole	0-100% output voltage range, 4k	JC120-0004
	10-90% output voltage range, 5k	JC120-0005
	25-75% output voltage range, 5k	JC120-0006
Long handle	0-100% output voltage range, 4k	JC120-0007
	With lever return to backward position	
	Ask for full specification details	
Mating connector	With 0.5m flyleads	SA301649

Neoprene boot For short handle version only **P304856**

DIMENSIONS AND MOUNTING OPTIONS





JC120 short handle - neoprene boot option

Recommended JC120 pitch spacing is 39mm minimum when neoprene boot is fitted



ELECTRICAL CONNECTIONS

Connection Mating connector kit (order separately) 7 pin Molex series latching male (70553-0006)

SA301649 (7 pin Molex series latching female with 0.5m flyleads fitted)

A B C D E F G	Description	Pin Number	Mating Connector/Flylead colour
	Center tap	A	Orange
	Positive voltage supply	B	Yellow
	Output voltage signal	C	Green
	Negative or zero voltage supply	D	Blue
	N/O switch, lever backward (-Y)	E	Red
	N/O switch, lever forward (+Y)	F	White
	Common terminal for switches	G	Black
		Pin A and	E are not connected on JC 120-0007

JC400 MULTI AXIS JOYSTICK ANALOGUE OUTPUT

Developed for use in applications where compact size and functionality are important, the JC400 with analogue output offers proportional fingertip control in up to three axes. The JC400's range of ergonomic handles feature rotary operated potentiometers, or switches, for a third axis of control, or 'Person Present' switches that can be used to improve the integrity of your control system.

Installation flexibility has been provided by using different forms of mounting flanges independent of the function of the joystick and the analogue track models are supplied with side exit cables to minimize the required under panel depth. The joystick has been designed for maintenance-free operation throughout an operating life of greater than five million operations.

Typical applications include remote control chest packs, CCTV camera controls and the operator controls in construction, agricultural or material handling equipment.

PERFO RM AN CE

MECHANICAL

Lever operating force		
breakout	N	2, 2.5 or 3*
operating	N	7.5, 11 or 12* (full deflection)
maximum allowable	N	250* (full deflection)
Lever mechanical angle	•	± 20 in X and Y directions
Lever action (options)		Self centering, aligned X and Y or non aligned
Lever gate profiles (options)		Single axis, square, round, diamond or cross
Expected life		> 5 million operations
Weight	g	150 nominal, without handle fitted
		*50mm above mounting flange face

EN VIRONMENTAL

Operating temperature	°C	-40 to $+70$
Storage temperature	C°	-50 to +85
Environmental protection		IP65 IEC 60529

ELECTRICAL

Analogue Track

Resolution

Track resistance ± 20%	kΩ
Track operating angle	٥
Output voltage range	%
Center tap voltage (no load)	%
Center tap angle	٥
Supply voltage - maximum	Vdc
Wiper circuit impedance	MΩ
Power dissipation @ 20°C	w

4, 5 or 8 ± 16 0-100, 10-90 or 25-75 of input (± 2%) 48 - 52 of applied voltage ± 2.5 30 Greater than 0.1**

0.25 (no load)

Virtually infinite

** 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

Switch -

Dire	ectior	nal o	r Center	Off/	Center	$0 n^{\dagger}$
Switch operating angle °						
~						

Supply voltage - maximum	Vdc
Load current - maximum	mA

† The JC400 has an additional center on switch in each axis

5 either side of center (± 1)

30

5 resistive (or 200 with reduced switch life of 1 million operations)

INSTALLATION

The joystick is designed to be fitted from below the mounting panel, through a 37mm x 37mm square 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 also 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 JC400 joystick has three options for each mounting flange style, which include through holes and thread inserts in the 4mm diameter holes. To maintain an effective seal between the joystick flange and the mounting panel, the mounting screws should be tightened to a suitable torque to match the selected attachment screw size.

ELECTRICAL CONNECTIONS

PVC insulated 7/0.2 (24AWG) flying leads, 240mm long



Description

Y axis forward - positive voltage supply	Green
Y axis center tap	Bro wn
Y axis backward - negative or zero voltage supply	White
Y axis output voltage signal	Black
Y switch track N/O (lever forward + Y)	Pink/Black
Y switch track N/O (lever backward -Y)	Green/Red
Y switch track center on	Red/Brown
Y switch track common	Yellow/Green
X axis right - positive voltage supply	Orange
X axis center tap	Grey
X axis left - negative or zero voltage supply	Red
X axis output voltage signal	Yellow
X switch track N/O (lever right + X)	Orange/Black
X switch track N/O (lever left -X)	Red/Black
X switch track center on	Orange/Red
X switch track common	Purple/Red

Flylead colour

JC400 ANALOGUE OUTPUT HOW TO SPECIFY

PERFORMANCE OPTIONS	FEATURE	CODE
MOUNTING FLANGE	Round flange, 59.8mm diameter with 4 x 4mm through holes Rectangular flange, 47 x 57mm with 4 x 4mm through holes Round, as code A, but with Metric thread inserts (M3 x 0.5p) Rectangular, as code B, but with Metric thread inserts (M3 x 0.5p) Round, as code A, but with Unified thread inserts (4-40 UNC x 0.025) Rectangular, as code B, but with Unified thread inserts (4-40 UNC x 0.025)	A B C D E F
	Single avis with analogue track	V
AXES	Dual axis	XY
TRACKS	Appleaux potentiameter $41, 0.100\% \pm 5^{\circ}$ directional switch	NINI
TRACKS	Analogue potentiometer, $5k$, $10-90\%$, $\pm 5^{\circ}$ directional switch	RR
	Analogue potentiometer, 8k, 25-75%, ±5° directional switch	QQ
DETENTS	Not available with analogue tracks	-/-
DETENTS		
LEVER SPRING FORCE	Light duty, 2N breakout, 7.5N full deflection	LA
	Medium duty, 2.5N breakout, 11N full deflection	MA
	Heavy duty, 3N breakout, 12N full deflection	HA
HANDLE STYLES	Standard handle, no functions	ZC
See page 18	Standard handle with momentary push button	ZC1
	Standard handle with momentary switch action	ZCS
	Rotary Z axis handle with analogue track and directional switch	ZA or ZA2
	Rotary Z axis handle with end of travel switches only	ZAS
C 177	Savara	c
GAIE	Round	R
(lever movement limiter)	Diamond	D
	Cross - only suitable for use with non-switched handles (ZC)	С
CE AT		D
SEAL	Non-aligned	N
	EXAMPLE ORDER CODE JC400-A-XY-NN-/-MA-ZA-S-P	

JC400 MULTI AXIS JOYSTICK DIGITAL OUTPUT

Developed for use in applications where compact size and functionality are important, the JC400 with Digital Output option offers fingertip control in one or two axes, with a choice of handles for a third axis of control. The JC400's range of ergonomic handles feature rotary operated potentiometers, or switches, or 'Person Present' switches that can be used to improve the integrity of your control system.

The Digital track option includes a detent mechanism that provides three sequential positions either side of the center position. The detent positions align with the switch outputs in true X and Y directions only.

Installation flexibility has been provided by using different forms of mounting flanges independent of the function of the joystick, and the digital output joysticks are fitted with standard electronic connectors to minimize installation time. The joystick has been designed for maintenance-free operation throughout an operating life of greater than five million operations.

Typical applications include remote control chest packs, CCTV camera controls and the operator controls in construction, agricultural or material handling equipment.

PERFORMANCE MECHANICAL

MECHANICAL

breakout	Ν	3, 4 or 6*
operating	Ν	12, 13.5 or 18* (full deflection)
maximum allowable	Ν	250* (full deflection)
Lever mechanical angle	0	± 20 in X and Y directions
Lever action (options)		Self centering, aligned X and Y or non aligned
Lever gate profiles (options)		Single axis, square, round, diamond or cross.
Expected life		> 5 million operations
Weight	g	150 nominal, without handle fitted
		*50mm above mounting flange face

3 either side of center 3 either side of center ± 6.6, ± 13.3, ± 20

100 resistive @ 25°C

30

EN VIRONMENTAL

Operating temperature	C°	-40 to $+70$
Storage temperature	°C	-50 to +85
Environmental protection above flange		IP65 IEC 60529

ELECTRICAL

Load current - maximum	mA
Supply voltage - maximum	Vdc
Switch/detent angles	٥
Number of detents	
Number of switch positions	

TRUTH TABLE

Truth table for digital switch track output Y and X axis signals are Normally O pen (0) at lever center position. Switch sequences close (1) depending on direction of lever movement and detent position. Detent Switch Position Output 2 3 Right Left 1 (or Forward) (or Backward) 3 1 1 1 1 0 2 0 1 0 1 1 1 1 0 0 0 1 0 0 0 0 0 0 0 0 0 -1 1 1 -2 0 0 1 1 1 -3 1 1 1 0 1

Note: drawings not to scale

IN STALLATION

The joystick is designed to be fitted from below the mounting panel, through a 37mm x 37mm square 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 also 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 JC400 joystick has three options for each mounting flange style, which include through holes and thread inserts in the 4mm diameter holes. To maintain an effective seal between the joystick flange and the mounting panel, the mounting screws should be tightened to a suitable torque to match the selected attachment screw size.



Connection

Mating connector and pins kit (order separately)



FCI DUBO XTM 2 x 8 way male connector (76385-308) SA47363 (contains DUBO XTM 65239-008, 65239-002 and 65239-003 female connectors and pins 76357-301 suitable for AWG 22-30 wire size) Requires crimping pliers (FCI No. HT234) to fit pins to wires.

DescriptionConnector Pin NumberY axis switch 13Y axis switch 214Y axis switch 316Y axis signal N/O (lever forward + Y)9Y axis signal N/O (lever backward -Y)1Y axis switch track common5

i axis switch track common	9
X axis switch 1	4
X axis switch 2	7
X axis switch 3	10
X axis signal N/O (lever right + X)	2
X axis signal N/O (lever left -X)	6
X axis switch track common	5

JC400 DIGITAL OUTPUT HOW TO SPECIFY

PERFORMANCEOPTIONS	FEATURES	CODE
MOUNTING FLANGE	Round flange, 59.8mm diameter with 4 x 4mm through holes Rectangular flange, 47 x 57mm with 4 x 4mm through holes Round, as code A, but with Metric thread inserts (M3 x 0.5p) Rectangular, as code B, but with Metric thread inserts (M3 x 0.5p) Round, as code A, but with Unified thread inserts (4-40 UNC x 0.025) Rectangular, as code B, but with Unified thread inserts (4-40 UNC x 0.025)	A B C D E F
AXES	Single axis with digital track Dual axis	X XY
TRACKS	Digital - 3 switches either side of center	DD
DETENTS	Only available with digital tracks	D
LEVER SPRING FORCE	Light duty, 3N breakout, 12N full deflection Medium duty, 4N breakout, 13.5N full deflection Heavy duty, 6N breakout, 18N full deflection	LD MD HD
HANDLE STYLES See page 18	Standard handle, no functions Standard handle with momentary switch action Rotary Z axis handle with analogue track and directional switch Rotary Z axis handle with end of travel switches only	ZC ZCS ZA or ZA2 ZAS
GATE (lever movement limiter)	Square Round Diamond Cross - only suitable for use with non-switched handles (ZC)	S R D C
SEAT	Aligned with axis Non-aligned	P N
	EXAMPLE ORDER CODE JC400-B-XY-DD-D-MD-ZC	- R- N

JC400 MULTI AXIS JOYSTICK HANDLE OPTIONS



ZA

The ZA and ZAS handles are designed to give an additional axis of proportional or switched control, using fingertip action to rotate the handle. The handles have a self-centering action when released, and rotate about their center, giving either analogue output with switched reference signals (ZA or ZA2) or end of travel switching only (ZAS).

ZC

The convex top profile of the ZC handle allows for simple thumb control of the JC400 range. 'Person present' switch functions can be incorporated by using the ZC1 external button switch or the ZCS internal switch to verify the change in signals from the joystick, which may help to increase the integrity of your control system.



ZA HANDLE OPTION

PERFORMANCE		ZA, ZA2	ZAS
Max height above flange	mm	80	80
Maximum diameter	mm	39	39
Operating temperature	°C	-25 to +50	-25 to +50
Environmental sealing (IEC	60529)	IP65	IP65

Z AXIS MECHANICAL

breakout	Nm	0.1
operating	Nm	0.15 to 0.25
maximum allowable	Nm	1
Handle mechanical angle	0	± 29 to ± 30
Handle action		Self centering
Expected life		1 million operations

Z AXIS ELECTRICAL

Analogue tracl	k (ZA and	l ZA2 only)
----------------	-----------	------------	---

Resolution		
Track resistance ±20%	kΩ	
Track operating angle	٥	
Output voltage range	%	
Center tap voltage (no load)	%	

3.1 or 5.4 (ZA2)	Supply voltage - maximum	Vdc	30
± 27	Wiper circuit impedance	MΩ	> 0.1**
7-93 or 25-75 (ZA2) of input	Power dissipation @ 20°C	w	0.25(no load)
47 - 53 of applied voltage			

Center tap angle

** 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

Z AXIS ELECTRICAL

Directional or Centre Switch	
Switch operating angle	٥
Supply voltage - maximum	Vdc
Load current - maximum	mA

DIMENSIONS

Note: drawings not to scale

4 either side of center (± 1) 30 2 (resistive)

Virtually infinite

ZA, ZA2

ZAS 20 either side of center (± 2) 30 2 (resistive)



Installation note

The protective rubber cap must be removed before fitting the joystick through the mounting hole. Re-fit the rubber cap after mounting in the panel.

0

 ± 2.5

ELECTRICAL CONNECTIONS

Leads exit from the underside of the mounting flange. PVC insulated 7/0.2 (24AWG) flying leads, 240mm long

Description	Flylead colour	
	ZA	ZAS
Z axis positive voltage supply	Yellow/Red	-
Z axis center tap	Blue	-
Z axis negative or zero voltage supply	Violet	-
Z axis output voltage signal	Pink	-
Z switch track N/O (handle CW + Z)	Yellow/Black	Yellow/Black
Z switch track N/O (handle CCW -Z)	White/Red	White/Red
Z switch track common	Red/Blue	Red/Blue

ZC HANDLE OPTION

ZC 76 23 IP65 0 -

PERFORMANCE

Max baight above fla	nao mm
wax neight above ha	inge inni
Maximum diameter	mm
Environmental sealing	g (IEC 60529)
Number of switches	
Action	
Switch operating for a	e N
Maximum current	mA
Expected life	(operations)

DIMENSIONS

Note: drawings not to scale

ZC1	ZCS
76	76
23	23
IP65	IP65
1	1
Momentary button	Momentary handle depress
3	7
200 @ 50Vdc	100 @ 30Vdc
1 million	500,000



ELECTRICAL CONNECTIONS

Leads exit from the underside of the mounting flange. PVC insulated 7/0.2 (24AWG) flying leads, 240mm long

Description

Common terminal N/O contact switch 1

ZC1/ZCS Flylead colour

Red/Green White/Black

SW HANDLE OPTION

OPTION NO-LONGER AVAILABLE

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JC2000 MULTI AXIS CONTACTLESS JOYSTICK

The 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. Two mounting flange options allow attachment above or below the panel. The JC2000's compact size, low operational force and high reliability are ideal for applications which include powered wheelchairs, robotics, CMM machines, medical and CCTV equipment, professional camera controls and remote controlled chest-packs.

PERFORMANCE MECHANICAL

XY axes

Lever operating force		
breakout	Ν	1 or 3*
operating	Ν	2 or 4.5* (full deflection)
maximum allowable	Ν	300* (XY version) 195N* (XYZ version)
Lever action (options)		Self centering, aligned X and Y or non aligned
Lever gate profiles (options)		Single axis, round, square, diamond, cross or plus
Lever mechanical angle		
single axis only	٥	± 20 in forward/reverse directions
round gate	٥	± 20
square and diamond gate	٥	± 20 to corners (± 14 to flats)
cross and plus gate	o	± 20 at extent of travel
Expected life		15 million operations (5 million with heavy duty spring)
Weight	g	90 without handle fitted
		*Measured 40mm above upper flange face

Z axis (handle style E and HL only)

Handle	rotational	torque	

breakout	Nm	0.04
operating	Nm	0.06
maximum allowable	Nm	1.0
Handle mechanical angle	0	± 20
Handle action		Self centering
Expected life		5 million operations

°C ℃

EN VIRONMENTAL

Operating temperature
Storage temperature
Environmental protection
above flange
EMC immunity level
EMC emissions level
ESD immunity level

ELECTRICAL

Sensor type Resolution Supply voltage range Vs Vdc Over voltage (maximum) Vdc Reverse polarity (maximum) Vdc Output voltage span (options) X, XY and XYZ** Code 25 Vdc Vdc Code 30 Vdc Code 40 Vdc Vdc

$-25 t_0 + 70$		
-40 to $+70$		
IP65 IEC 60529		
60V/m 25MHz to 1GHz	1 KHz 80% sine wave modulation	EN50082-2 (Sent 1995

60V/m, 25MHz to 1GHz, 1KHz 80% sine wave modulation, EN50082-2 (Sept 1995) Complies with EN50081-1 (1992), 30MHz to 1GHz EN50082-2 (1995) ± 8kV contact discharge; ± 15kV air discharge (10 discharges)

Hall effect			
Infinite			
5 ± 0.5 regulated tran	nsient free		
15 continuous			
14.5			
Gate option	Minimum	Nominal	Maximum
1, R, D, C, P	1.25 to 3.75	1.10 to 3.90	0.97 to 4.03
S**	1.67 to 3.32	$1.55 to \ 3.45$	1.43 to 3.57
1, R, S, D, C, P	1.15 to 3.85	1.00 to 4.00	0.85 to 4.15
1, R, D, C, P	0.65 to 4.35	0.50 to 4.50	0.35 to 4.65
S	1.10 to 3.90	0.80 to 4.20	0.50 to 4.50
** consult sales team	for available options		

Output impedance

Center reference output (no load) Center reference impedance Current consumption - max Return to center voltage-no load

Output ramp

DIMENSIONS

Top flange option

Ω 100 each axis

- % 49 - 51 of supply voltage Vs
- kΩ 1.1
- **mA** 24

mV X and Y axis Within ± 60 of Vs/2 @ 20°C (± 73 over full temperature range) XY with gate S Within ± 113 of Vs/2 @ 20°C (± 126 over full temperature range) Z axis Within ± 100 of Vs/2 @ 20°C (± 113 over full temperature range) XY axes The dual 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





DIMENSIONS Mid flange option X and XY axes only

OUTPUT TRACKING

O utput shown for same direction - PP or NN



ELECTRICAL CONNECTIONS

Mating Connector

8 Pin FCI Minitek[™] 89361-708 IDC Connector (order separately as P302137) or supplied with 0.5m ribbon cable fitted (order as P302138)

Pir				Pir	n Number	Description
	п —		п		XY Joystick	XYZ Joystick
1			1	1	Positive voltage supply	Positive voltage supply
-	μ	_	<u> </u>	2	Left/Right output 1	Left/ Right output
3			4	3	Zero voltage supply	Zero voltage supply
5			4	Forward/Reverse output 1	Forward/Reverse output	
_	Π_	_	Πŭ	5	Forward/Reverse output 2	NC
7	=	-	8	6	Center tap	Center 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						

JC2000 MULTI AXIS CONTACTLESS JOYSTICK HOW TO SPECIFY

PERFORMANCEOPTIONS	FEATURE	CODE	FEATURE AVAILABILITY
MOUNTING FLANGE	Top flange Mid flange (not available with XYZ)	JC2000-T JC2000-M	
AXES	Single axis Dual axis Three axis (only available with top flange)	X XY XYZ	
OUTPUT RAMP	dual output - same ramp dual output - opposite ramp dual output - same ramp each axis dual output - same ramp X, opposite ramp Y dual output - opposite ramp each axis single output - same ramp each axis single output - same ramp X and Z, opposite ramp Y single output - same ramp Y and Z, opposite ramp X	PPOOO PNOOO PPPPO PPNNO PNPNO POPOP PONOP PONON NONON	J J J J J J J J J J J J J J J J J J J J J J J J J J J J J J J J J J
OUTPUT SPAN	1.1 to 3.9 Vdc nominal1.0 to 4.0 Vdc nominal0.5 to 4.5 Vdc nominal	25 30 40	J J J J J J* J J J*
HANDLE STYLES See page 23	Standard tapered handle Ball handle Short ergonomic handle Ergonomic handle Ergonomic with Black push button Ergonomic with Red push button Ergonomic with Green push button Ergonomic with Yellow push button Straight handle Straight with Black push button Straight with Red push button Straight with Green push button Straight with Green push button Straight with Green push button Straight with Yellow push button Straight with Yellow push button	K1 B0 HL E E1 E2 E3 E4 E5 S1 S1 S2 S3 S4 S5	J J J J
GATE (lever movement limiter)	Single axis Round Square* Diamond Cross X Plus +	1 R S D C P	J J J J J J J J J J J J J J J J
SEAT	Aligned with axis Non-aligned	P N	
LEVER SPRING FORCE	Standard duty, 1N breakout, 2N full deflection Heavy duty, 3N breakout, 4.5N full deflection	S H	5 5 5 5 5 5

EXAMPLE ORDER CODE JC2000-T-XY-PPPPO-40-E5-R-P-H

Two axis version with all outputs same sense, 40% output span,ergonomic handle style with Blue push button switch, round gate and aligned seat, with heavy spring.

 $^{*}\mathrm{Consult}$ the sales team for available output span options, when selecting XYZ with S gate option.

GENERAL NOTES ON FINGER OPERATED JOYSTICKS

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 excessive loads greater than the maximum allowable load stated in the product specification.

MODIFICATION AND USAGE

Any modification of a joystick by the user is strongly discouraged and will invalidate the warranty and Penny+ Giles liability. The handles supplied with the finger operated controllers 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

All joysticks are supplied by Penny+ Giles fully adjusted and ready for installation. There are no user adjustable or maintainable parts within the joysticks. 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 inputs. 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 'Person Present' 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.

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.

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.

JC2000 INSTALLATION AND APPLICATION NOTES

SEALING THE JOYSTICK TO THE PANEL

See panel mounting detail on page 23 for recommended machining detail to accept the JC2000. Prior to installation check that the gate (lever movement limiter) positioned under the gater 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 sealing gasket 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. See panel mounting detail on page 23 for dimensions.

DUAL OUTPUTS - X AND XY VERSIONS ONLY

Each JC2000 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 maximum span limits shown on page 22. 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 JC2000 joystick axis can be configured during manufacture in one of two possible ways. These are designated within the joystick specification as same-ramp (P) or opposite-ramp (N). The diagrams, below, show dual outputs;

for single output or a Z axis either output 1 or 2 can be chosen. The ramps at their lower end start at 25%, 20% or 10% of supply voltage and at their upper end finish at 75%, 80% or 90% of supply voltage, depending on output option.

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

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



CENTER TAP

A center 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 center tap connection is 49% to 51% of the supply voltage. A center tap output outside this range indicates a fault in the supply to the joystick.

SINGLE OUTPUTS - XYZ ONLY

Where a JC2000 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.

OUTPUT IMPEDANCE

The outputs at the center 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 23.

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 ± 0.5 V 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.



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Penny & Giles Position sensors, joysticks and solenoids for commercial and industrial applications.

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