



# JC6000 MULTI AXIS JOYSTICK CONTROLLER

### INNOVATION IN MOTION

The JC6000 rugged joystick controller is designed for demanding operator control applications in off-highway vehicles and other man-machine interfaces, where strength, reliability, and handle functionality are important. Available in one or two axis configurations, this joystick can be supplied with non-contact Hall effect sensors or long life potentiometer tracks. The JC6000's compact size, high lever strength and superb proportional control are ideal for applications which include operator controls on a wide range of off-highway vehicles, including cranes, loaders, excavators, access platforms, tractors and harvesters.

#### Handles and grips

The JC6000 can be specified with a choice of handles and grips to increase the functionality of the operator controls. With a choice of push buttons, trigger grips, proportional and switched rockers in a variety of different configurations, users can match their handle selection to suit their unique application.











#### Innovative design

With a choice of Hall effect sensors or potentiometer tracks to provide the analogue signals proportional to lever movement, the JC6000 can be configured to provide a range of output signals, directional and center switching functions, lever forces, and handle styles. CAN output can also be specified on the Hall sensor version for digital communication with vehicle systems.

#### **Features**

- Hall effect or potentiometric sensing
  - Single or dual axis control
- High strength lever with superb proportional control
  - Sealed above the panel to IP66
  - Choice of outputs and switches
  - Choice of handles/grips with or without switches
    - AMP 040 series multi-lock connectors
- Interchangeable with Penny + Giles' JC600 model

#### **Benefits**

- · Long life and maintenance-free operation
- Suited to a range of operator control functions
- · Rugged and smooth lever movement
- Operation in hostile environments
- Enables user configuration for system safety
- Additional operator control functions
- Simple installation
- · Improved performance within the same footprint



#### **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.

Certificate No.LRQ 0924881

# JC6000 MULTI-AXIS JOYSTICK CONTROLLER

#### Total reliability

The JC6000 includes lever mechanics designed to give smooth proportional control, with Hall effect sensors that provide contactless, long life operation up to 15 million operations. Alternative potentiometer tracks featuring multi-fingered precious metal wipers give low electrical noise and a long life of greater than 5 million operations.

#### Safety

The JC6000 with the Hall sensors option has dual outputs fitted as standard, allowing the signals to be monitored and compared for failure detection in safety critical applications. Additional independent switch functions can be specified for directional and center position indication - vital for vehicle system start-up safety. These switch functions are also available with the potentiometer tracks, which can also be specified with padding resistors to limit the output signals to 10-90% or 25-75%, allowing comparison and error detection.

#### **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, 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 JC6000 joystick is designed to provide the user with a wide choice of options, but allows efficient build and despatch using cell manufacturing principles. Contact your nearest sales office for the latest information on availability.



## JC6000 Joystick Controller

#### **PERFORMANCE**

#### **MECHANICAL**

Seat

Lever operating force

breakout\* N 7 or 16

operating\* N 19 or 39 (full deflection)
maximum allowable\*\* N 390 (490 overload)

Lever mechanical angle

single axis only square gate ±20 forward/reverse ±20 in X and Y directions preferred bias on axis

**Expected life** 15 million operations (5 million for potentiometer track version)

**Weight g** 750 without handle fitted

#### **ENVIRONMENTAL**

Operating temperature

°C

-25 to +80 (-25 to +80 with microswitches)

Storage temperature

°C

-25 to +85 (-25 to +85 with microswitches)

Environmental protection
(above the flange)

**Vibration** Level ±3g,10Hz to 200Hz (random) @ 3.6g(rms)

**Shock** 20g, 6mS, half sine profile

**EMC immunity level** 100V/m, 30MHz to 1GHz, 1KHz 80% sine wave modulation, EN50082-2 (1995)

**EMC emissions level**Complies with EN50081-2 (1993), 150kHz to 30MHz, level B **ESD immunity level**IEC61000-4-2 level 4 8kV contact discharge, 15kV air discharge

#### ELECTRICAL -

#### HALL EFFECT SENSOR

**Resolution** Infinite

**Supply voltage range** Vdc  $5 \pm 0.5$  regulated transient free

Over voltage (maximum) Vdc 15 continuous

Reverse polarity (maximum) Vdc 14.5

Output voltage span - options Vdc  $\pm 25\%$  span - nominal 1.1 to 3.9

±30% span - nominal 1.0 to 4.0 ±40% span - nominal 0.5 to 4.5

Load impedance (minimum)  $k\Omega$  5

Center voltage (no load)%48 - 52 of supply voltageCurrent consumptionmA13 per axis (6.5 per sensor)Insulation resistanceGreater than  $50M\Omega$  at 50Vdc

Output sense The dual outputs rise together in the same direction, increasing with lever forward (and right),

All Hall sensor connections terminate in a 12-way AMP 040 series multi-lock connector in the

decreasing with lever backward (and left)

joystick base. See page 8 for pin identities

Output matching See maximum output difference diagram below

ELECTRICAL CONNECTIONS

Mating 12 way connector and pins SA48061 (AMP 040 12 way connector 174045-2; pins 175062-1)

Mating 12 way harness P49779 (connector, pins and 380mm long cable)

muning 12 way numess

<sup>\*</sup> Measured at 55mm above upper flange face \*\* Measured 130mm above upper flange face

## ELECTRICAL POTENTIOMETER TRACK

 $\begin{array}{lll} \textbf{Resolution} & & \text{Virtually infinite} \\ \textbf{Track resistance \pm 20\%} & & \textbf{k}\Omega & 1.8, 2, 2.9, 5 \end{array}$ 

Track operating angle  $\pm 18$ 

Output voltage range%0-100, 10-90, 25-75 of inputCenter tap voltage%48 - 52 of applied voltage

Center tap angle ° ±2.5

Center tap to switch alignment ° Within 0.5

Supply voltage maximum Vdc 32

Wiper circuit impedance  $M\Omega$  1 minimum recommended\*

Power dissipation @ 25°C W 0.25

**Insulation resistance** Greater than  $15M\Omega$  at 50Vdc

## ELECTRICAL DIRECTIONAL OR CENTER SWITCH (LOW CURRENT)

SWITCH (LOW CURRENT)

Not available with CANbus output

1.5 or 5 either side of center

Supply voltage maximum Vdc 35
Load current maximum mA 200 resistive

ELECTRICAL CONNECTIONS

All primary potentiometer track and directional/center switch connections terminate in a 16-way AMP 040 series multi-lock connector in the joystick base. Secondary potentiometer track connections terminate in an 8-way AMP 040 series multi-lock connector. See page 8 for pin identities

Mating 16 way connector and pins

SA47931 (AMP 040 16 way connector 174046-2; Pins 175062-1)

Mating 16 way harness

P49780 (connector, pins and 380mm long cable)

Mating 8 way connector and pins

SA304522 (AMP 040 8 way connector 174044-2; pins 175062-1)

Mating 8 way harness P303083 (connector, pins and 380mm long cable)

## ELECTRICAL - MICROSWITCH

Not available with CANbus output

**Switch configuration** Two switches per axis. Normally open at lever center position

Switch operating angle ° 2 to 5 either side of center Contact rating 3A @125Vac, 2A @ 30Vdc

**Switch life minimum** 100,000 cycles, cycled at 1Hz, 1A and 12Vdc

Operating temperature °C -25 to +85

ELECTRICAL CONNECTIONS

Microswitch connections in the potentiometer joystick will replace the low current directional/center switches in the 16-way AMP 040 series multi-lock connector in the joystick base. In the Hall sensor joystick, switches terminate in the 8-way connector. See Electrical Connections on page 8 for pin identities

#### CAN OUTPUT VERSION

JC6000 with Hall sensing option can also be supplied with an integrated CANBUS output offering the J1939 protocol. This CANBUS interface meets the requirements of IEC61508 SIL level 1

Supply voltage range Vdc 9 to 36
CAN version CAN 2.0b
Protocol J1939

Under-panel sealing IP66 IEC60529

ELECTRICAL CONNECTIONS

All connections terminate in the 6-way Deutsch DTM04-6P integrated connector

Mating connector and pins P304844 (includes 390mm flying leads)

<sup>\*</sup> The long life resistive elements require a high impedance load in the wiper circuit to minimise the current flowing through the wiper for optimum life conditions

# JC6000 JOYSTICK CONTROLLER HOW TO SPECIFY

PERFORMANCE O	PTIONS			CODE			
AXES		Single		NY			
		Dual		XY			
SENSING Output		Potentiometer Px or Pxx selected from below 5k 0-100%, ±5° directional switch 1.8k 0-100%, ±5° directional switch 2.9k 25-75%, ±1.5° directional switch 2k 10-90%, ±1.5° directional switch 2k 10-90%, ±5° directional switch 2k 10-90%, ±5° directional switch Dual outputs per axis, 2k 10-90%, ±1.5° directional switch					
		<b>Dual Hall Effect</b> sensors each axis <b>Hxx</b> with output selected from below <b>Dual Hall Effect</b> sensors each axis and ±1.5° directional switch <b>Bxx</b> with output selected from below  1.1Vdc to 3.9Vdc  1.0Vdc to 4.0Vdc  0.5Vdc to 4.5Vdc					
		CANbus Output Single Axis/Dual Axis Note: Directional track switches not co	urrently available with CANbus output.	HC 1 or 2			
LEVER SPRING	FORCE	Heavy duty, 16N breakout, 39N full d Medium duty, 7N breakout,19N full d		H M			
GATE		Square $\pm 20^{\circ}$ mechanical angle in X $\alpha$	and Y directions	S			
MECHANICAL FEATURES		No lock or detents fitted		NL			
MICROSWITCH		No switch fitted High current microswitches, 2A @ 30	Vdc (Not available with CANbus output)	N Y			
INTERFACE		Standard interface (no electronics) CANbus output, SAE J1939 protocol, 1000 CAN counts	Source Address 33 (HEX) Source Address 34 Source Address 35 Source Address 36	STN JR1 JL1 JC1 JA1			
HANDLE/GRIP See pages 9-15	STYLE	Standard knob, no functions Hand grip with options for buttons or Ergonomic grip with multiple buttons Trigger grip with optional rocker switc No handle No handle, flying leads fitted (allows of	and proportional rockers hing	HKN HB A MG NH NHF			

EXAMPLE ORDER CODE JC6000-XY-PRR-H-S-NL-N-STN-HKN

## JC6000 joystick controller

#### DIMENSIONS

Note: drawings not to scale

#### **INSTALLATION**

The joystick is designed to be fitted from below the mounting panel, through a 70mm 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

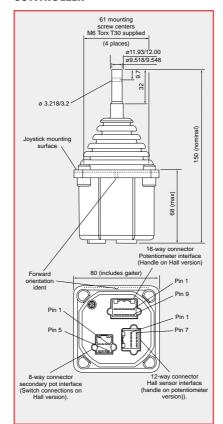
3.5 to 6mm

#### Recommended screw torque

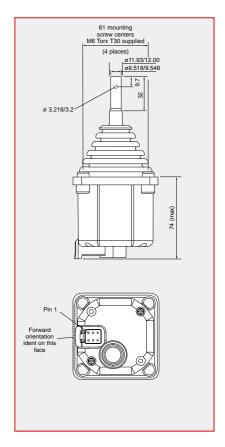
Fixing screws can be driven to a maximum torque of 5Nm when clamped against a 3.5mm thick panel.

The mounting hole depth is 12.6mm. For through-hole installation, the screws can be driven at a torque of 3.5Nm directly through the blind cast holes to remove the cast covers. The joystick mounting flange should be connected to the vehicle chassis or reference plane (normally zero volts).

## POTENTIOMETER AND HALL EFFECT CONTROLLER



#### **CAN OUTPUT CONTROLLER**



#### **CAN OUTPUT OPTIONS**

The sealing of the lower cover meets the requirements of IP66 (IEC 60529) and uses an integrated Deutsch DTM04-6P 6 pin connector with the cover. The use of a suitable sealed mating connector will enable a full IP66 connection to be made. The cover also includes an integrated breather system to ensure pressure regulation under all barometric pressure and temperature conditions without moisture ingress into the joystick.

See next page for electrical connections

## JC6000 JOYSTICK CONTROLLER

#### ELECTRICAL CONNECTIONS

	Pin number	Potentiometer tracks	Hall effect sensors
16-way primary connector	1	Y switch track N/O (lever forward +Y)	Pins 1 to 12 used for handle connections
	2	X switch track center on	See chosen handle style for details
	3	X pot track left	-
	4	X pot track wiper signal	-
	5	X pot track right	-
	6	X pot track center tap	-
	7	X switch track common	-
	8	X switch track N/O (lever left -X)	-
	9	Y pot track backward	-
	10	Y pot track wiper signal	-
	11	Y pot track forward	-
	12	Y pot track center tap	-
	13	Y switch track common	Not connected
	14	Y switch track N/O (lever backward -Y)	Not connected
	15	X switch track $N/O$ (lever right $+X$ )	Not connected
	16	Y switch track center on	Not connected
8-way secondary connector (where fitted)	1	Secondary Y pot track backward	Forward (directional or micro) switch common
	2	Secondary Y pot track center tap	Forward switch output
	3	Secondary Y pot track wiper signal	Backward switch output
	4	Secondary Y pot track forward	Backward switch common
	5	Secondary X pot track right	Left switch common
	6	Secondary X pot track wiper signal	Left switch output
	7	Secondary X pot track center tap	Right switch output
	8	Secondary X pot track left	Right switch common
12-way connector	1	Pins 1 to 12 used for handle connections	+5V supply - sensors 3 and 4
	2	See chosen handle style for connection details	0V supply - sensors 3 and 4
	3	-	+5V supply - sensors 1 and 2
	4	-	0V supply - sensors 1 and 2
	5	-	Forward/backward output - sensor 3
	6	-	Left/right output - sensor 2
	7	-	Left/right output - sensor 4
	8	-	Forward/backward output - sensor 1
	9	-	Not connected
	10	-	Not connected
	11	-	Not connected
	12	-	Not connected
6 pin Deutsch connector CAN output	1	Not available	Ground
	2	Not available	Power
	3	Not available	CAN high
	4	Not available	CAN low
	5	Not available	CAN shield
	6	Not available	Not connected

## JC6000 JOYSTICK CONTROLLER HANDLE OPTIONS



#### **HKN**

The HKN handle is the simplest option available for the JC6000. This handle does not include any additional functionality, but is designed to allow the joystick to be controlled by the operator gripping the handle palm downwards.

#### **NH or NHF**

These options are selected when no handle is required to be fitted. NHF option has wires fitted to the joystick connector on the base, through the operating lever.

#### **HB**

Developed to replicate the functionality of the traditional mechanical handle, the HB range of hand grips can be specified with either a button or rocker switch, mounted into the top of the handle, within easy reach of the operator's thumb. These can be configured as a 'Person Present' feature or, for example, the steer signal for an access platform.



#### A RANGE

Designed to meet the demands for more complex control systems in off-highway applications, the 'A' range of ergonomic hand grips can be fitted with a combination of analogue outputs, push button and 'Person Present' switches. The handle can be specified with two independent analogue outputs generated by proportional rockers which, in turn, provide auxiliary directional switching in addition to the potentiometric output. When coupled with the two axis JC6000 base joystick this unit can provide a four-axis controller.

This handle can also be purchased separately, for fitting to customer levers or assemblies. Ask our sales team for more details on this option.

#### MG

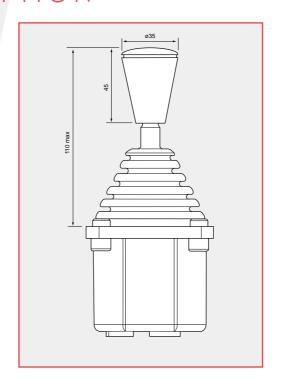
Designed to provide a simple approach to a 'Person Present' handle whilst offering the flexibility of switch options in the top of the handle. The profile of the MG handle ensures the operator's fingers are permanently close to the buttons, minimising operator fatigue and maximising functional control. The handle can be supplied with or without a hand rest and can be configured with a combination of trigger lever, single or dual switches.

This handle can also be purchased separately, for fitting to customer levers or assemblies. Ask our sales team for more details on this option.



## HKN HANDLE OPTION

#### **DIMENSIONS**

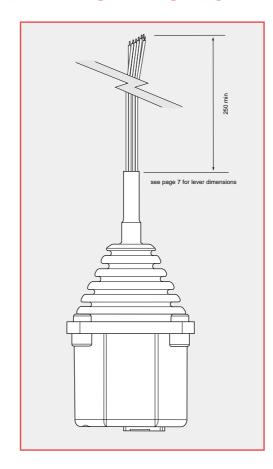


## NH OR NHF HANDLE OPTIONS

## ELECTRICAL CONNECTIONS

Wire size
Wire current

28AWG 1.4A



NH option has no wires fitted.

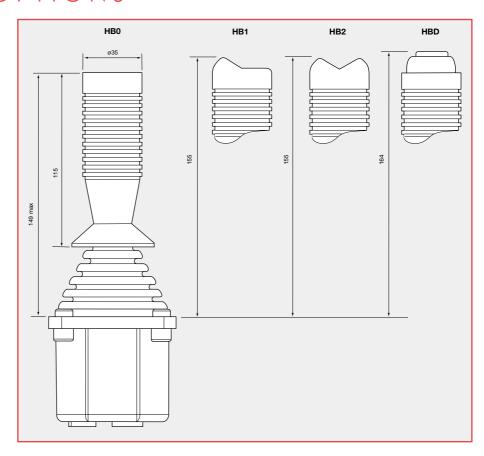
NHF option allows customer to fit own handle style to joystick operating lever.

Pin	Wire color
1	Grey
2	Yellow
3	Red
4	Orange
5	Brown
6	Black
7	Green
8	White
9	Blue
10	Violet
11	Pink
12	Red/Yellow
13	Not connected
14	Not connected
15	Not connected
16	Not connected

NHF handle option note: Wires terminate on the 12-way connector (Potentiometer version), or the 16-way connector (Hall sensor version).

## HB HANDLE OPTIONS

#### **DIMENSIONS**



SPECIFICATION		нво	HB1	HB2	HBD
Maximum height above flange	mm	149	155	155	164
Maximum grip diameter	mm	35	35	35	35
Environmental sealing (IEC 60529)		IP65	IP65	IP65	IP65
Number of switches		0	1	2	1
Action			Momentary rocker	Momentary rocker	Momentary button
Switch operating force	N	-	-	-	7
Maximum current @ 30Vdc	Α	-	2.5	2.5	5
Expected life (operations)		100,000	100,000	100,000	100,000
ELECTRICAL					
CONNECTIONS					
Common terminal			11	11	11
N/O contact switch 1			4	4	1
N/C contact switch 1			1		
N/O contact switch 2				1	

Note: Signals terminate on the 12 way connector (potentiometer version) or the 16 way connector (Hall sensor version)

### A RANGE HANDLE OPTIONS

#### **SPECIFICATION**

Maximum height above flange mm 166 Maximum grip diameter mm 61

**Environmental sealing** 

(IEC 60529) IP65

1 to 6 in the top plate **Number of switches Action** Momentary button

Switch operating force Ν 3 Maximum current @ 50Vdc mA 200 **Expected life (operations)** 1 million

Weight 170 - A2LD option g

°C **Operating temperature** -40 to +70Storage temperature -40 to +80

#### ROCKER

Rocker profile Standard (S) or V profile (V) **Breakout force** Ν 5 at the end of the rocker **Operating force** Ν 15 at the end of the rocker **Mechanical movement** 

mΑ

**Electrical movement** 

**Expected life (operations)** 

Load current (maximum)

Power dissipation @ 25°C

Track resistance **Output voltage** 

Center tap angle

Directional or center off switch Switch gap

Switch supply voltage Vdc

 $\pm 10 (\pm 1^{\circ})$ 

 $\pm 9 (\pm 1^{\circ})$ 5 million

200 (see note on page 5)

W 0.25

> Will match JC6000 Y axis resistance † Will match JC6000 Y axis output †

 $\pm 1.5$ 

Standard

2.5 either side of center

† unless requested otherwise

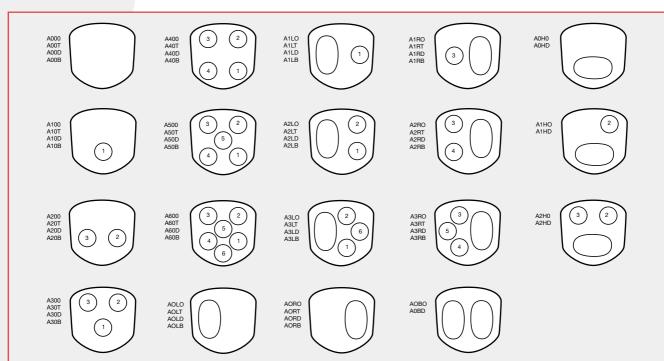
#### **FUNCTIONALITY**

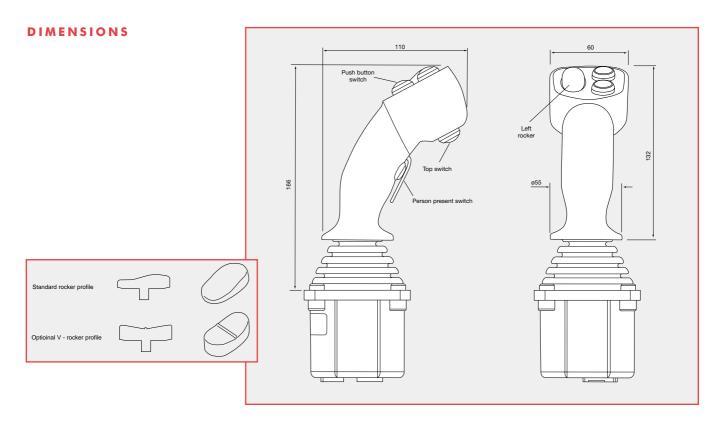
#### **SWITCHES**

#### ROCKERS

	1	2	3	4	5	6	TOP	Person Present	LEFT	RIGHT	HORIZONTAL
SWITCH 1		~	~	~	~	~	~	~	~		
SWITCH 2	~		~	~	~	~	~	~	~		~
SWITCH 3	~	~		~	~	~	~	~		<b>/</b>	V
SWITCH 4	~	~	~		~	~	~	~		<b>V</b>	
SWITCH 5	~	~	~	~		~	~	~		V	
SWITCH 6	~	~	~	~	~		~	V	<b>/</b>		
TOP SWITCH	~	~	~	~	~	1		~	<b>/</b>	V	
PERSON PRESENT	~	~	~	~	~	~	~		~	V	V
LEFT ROCKER	~	~				~	~	V		<b>V</b>	
RIGHT ROCKER			~	~	~		~	<b>~</b>	~		
HORIZONTAL		~	~					~			

#### SWITCH AND ROCKER OPTIONS





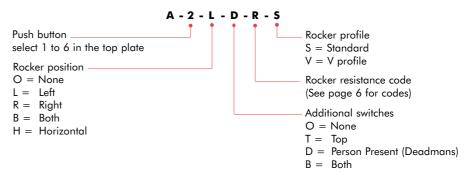
## ELECTRICAL CONNECTIONS

	Pin	Wire color		Pin	Wire color
Common terminal (for all switches)	11	Black	Rocker center tap	6	Yellow/Red*
Switch 1	4	Blue	Rocker zero or negative supply (L, R or H)	10	Pink/Grey
Switch 2	3	Yellow	Rocker output signal (L or H only)	5	Pink
Switch 3	2	Blue/White	Rocker output signal (R)	9	White
Switch 4	1	White/Green	Rocker switch common	11	Black
Switch 5	†	Red	Rocker switch (L forward)	2	Blue/Orange
Switch 6	†	Violet	Rocker switch (L backward)	1	Green
Top switch	†	Pink with marker	Rocker switch (R forward)	3	Yellow
Person present switch	12	Red/Green	Rocker switch (R backward)	4	Blue
Person present switch	8	Black/White	Rocker switch (H left)	4	Blue/Orange
Rocker positive supply (L, R or H)	7	White/Red	Rocker switch (H right)	1	Green

<sup>†</sup> depends on other options selected

Note: Signals terminate on the 12-way connector (Potentiometer version), or the 16-way connector (Hall sensor version)

#### **ORDERING CODES**

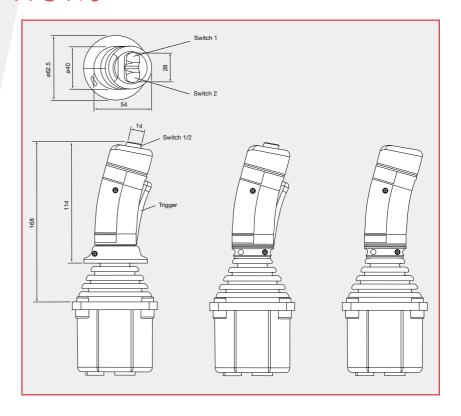


Note: When ordering a handle fitted with a rocker, two profiles can be supplied (S = standard profile; V = v profile) please specify style when ordering.

<sup>\*</sup>Center tap not connected on A3LB and A3RB handles

## MG HANDLE OPTIONS

#### DIMENSIONS



#### **SPECIFICATION**

Maximum height above flange mm 168 Maximum grip diameter mm 40

Environmental sealing (IEC 60529) IP67 (IP66 with trigger switch)

Number of switches 0 to 3

**Action** Momentary Button, Rocker or Trigger

**Switch operating force** 

Trigger Ν 5 7 Switch 1 or 2 Ν 100 Maximum current @ 30Vdc mΑ 1 million **Expected life (operations)** °C -25 to +75**Operating temperature** -30 to +80 °C Storage temperature

HANDLE CODE	Top switch position	Trigger switch	Hand rest
MG00	None	No	No
MG01	1	No	No
MG02	1 & 2	No	No
MG03	1 & 2	Yes	No
MG04	1 & 2	Yes	Yes
MG05	1	Yes	Yes
MG06	1 & 2	No	Yes
MG07	1	No	Yes
MG08	1	Yes	No
MG09	None	Yes	Yes
MG10	None	None	Yes
MG11	None See Electrical Connections for v	Yes wire color codes.	No

## ELECTRICAL CONNECTIONS

# CONNECTIONS Common terminal (for top switches) Switch 1- Left Switch 2 - Right Trigger switch Trigger switch

#### Pin number Wire color

12	Black
6	Blue
3	Green
4	Blue/Orange
5	Vallaur

Note: Signals terminate on the 12-way connector (Potentiometer version), or the 16-way connector (Hall sensor version)  $\,$ 



#### www.pennyandgiles.com

#### Penny & Giles

Position sensors and joysticks for commercial and industrial applications.

15 Airfield Road Christchurch Dorset BH23 3TG United Kingdom +44 (0) 1202 409409 +44 (0) 1202 409475 Fax sales@pennyandgiles.com

36 Nine Mile Point Industrial Estate Cwmfelinfach Gwent NP11 7HZ United Kingdom +44 (0) 1495 202000 +44 (0) 1495 202006 Fax sales@pennyandgiles.com

5875 Obispo Avenue Long Beach CA 90805 USA +1 562 531 6500 +1 562 531 4020 Fax us.sales@pennyandgiles.com

Straussenlettenstr. 7b 85053 Ingolstadt, Germany +49 (0) 841 61000 +49 (0) 841 61300 Fax info@penny-giles.de

The information contained in this brochure on product applications should be used by customers for guidance only. Penny+Giles Controls Ltd makes no warranty or representation in respect of product fitness or suitability for any particular design application, environment, or otherwise, except as may subsequently be agreed in a contract for the sale and purchase of products. Customer's should therefore satisfy themselves of the actual performance requirements and subsequently the products suitability for any particular design application and the environment in which the product is to be used.

Continual research and development may require change to products and specification without prior notification. All trademarks acknowledged.

© Penny+Giles Controls Ltd 2008

Innovation In Motion

