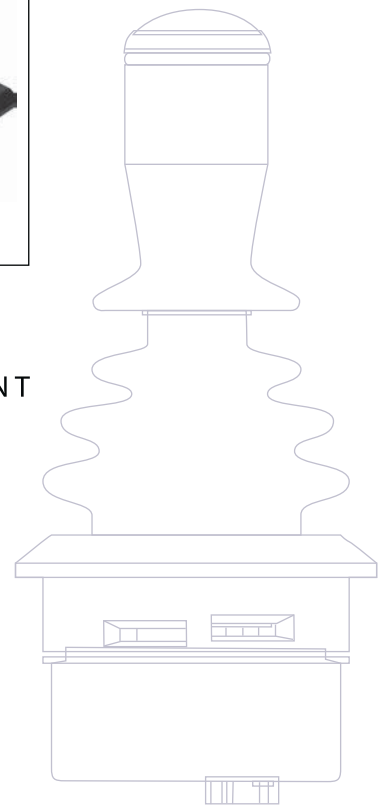
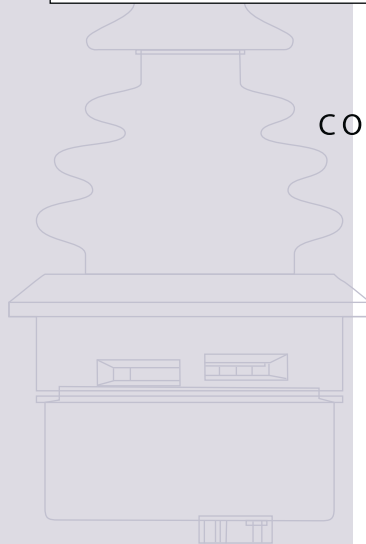
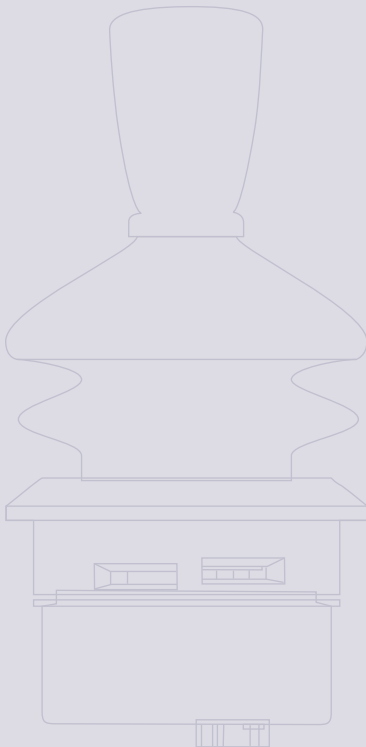
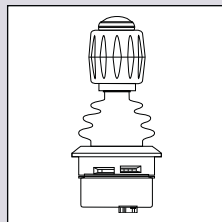
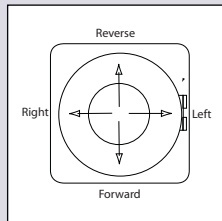
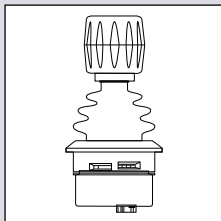


Technical
Information



 TM
COMPLIANT

Revision history

Revision date	Page	Change	Remarks
03/24/2005			Initial release

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Front cover illustrations: 2268, 2269, 2270, F005075, 2271

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PRODUCT OVERVIEW

The JS2000 contactless sensor joystick is a compact device designed for precision fingertip control applications where safety and long, trouble-free life are primary requirements. The compact design is ideal for mounting in low clearance locations such as seating armrests and chest packs. It is suitable for installation in the harsh environments of today's mobile machine operating environment.

This joystick is available with one, two or three axis of control and can accommodate a variety of grips including push-button switch versions.



Photo F005075

FEATURES AND OPTIONS

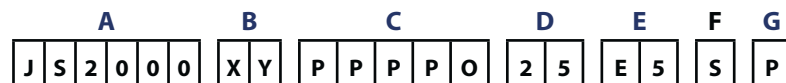
- Redundant sensors
- Contactless Hall effect sensing
- One, two or three axis control
- Multiple gate options
- Spring return to center
- Compact size
- Low operating forces
- Easy installation
- Operating life > 15 M operations
- IP 65 sealing above panel
- CE approved
- Multiple grip options, including twist Z axis

**PRODUCT
 CONFIGURATION MODEL
 CODE**

The Product Configuration Model Code (model code) is used to specify particular features when ordering a JS2000 joystick. The model code begins with the product family name JS2000 and the remaining fields are filled in to configure the product with the desired features.

The model code includes both joystick base and joystick grip information.

Product Configuration Model Code



MODEL CODE SUMMARY

A *Product Series*

Code	Description
JS2000	Series JS2000 Joystick

B *Single or Dual Axis Options*

Code	Description
X	Single axis
XY	Dual axis

C *Axis and Sensor Options*

Code	Description	Axis Option
PPOO	Dual sensor output—same sense	X axis
PNOO	Dual sensor output—opposite sense	X axis
PPPO	Dual sensor output—same sense each axis	XY axis
PPNO	Dual sensor output—same sense X, opposite sense Y	XY axis
PNPNO	Dual sensor output—opposite sense each axis	XY axis
POPOP	Single sensor output—same sense each axis	XYZ axis
PONOP	Single sensor output—same sense X and Z, opposite sense Y	XYZ axis
PONON	Single sensor output—same sense Y and Z, opposite sense X	XYZ axis
NONON	Single sensor output—opposite sense each axis	XYZ axis

Output Sense (Direction)

The dual outputs from any JS2000 joystick can be configured in one of two possible ways. These are designated within the joystick model code as *same sense* (P) or *opposite sense* (N). Refer to the *output sense (direction) diagram*, page 6 for clarification.

The slopes at the lower end start at 20% of supply voltage range (Vs) and at the upper end finish at 80% of Vs.

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 be equal to the applied voltage.

**MODEL CODE SUMMARY
 (continued)**

Output Sense (Direction) Diagram

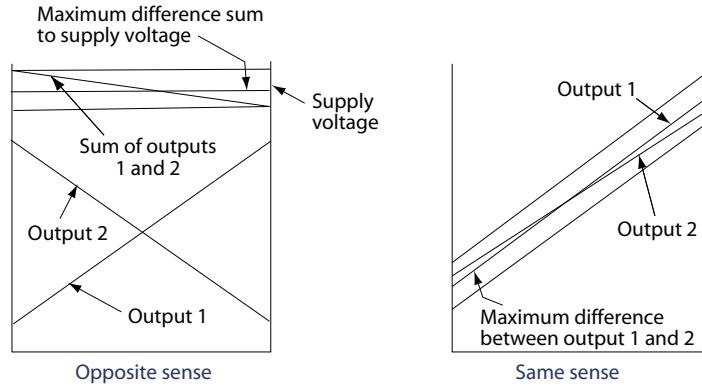


Illustration 2279

D *Output Span*

Code	Description	Axis Option
40	0.5 to 4.5 V DC nominal	X and XY

Dual JS2000 Output Signals (X and XY options)

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 an appropriate safety margin. In addition, machine movement should not be enabled until both outputs from any one axis exceed the center threshold voltage plus a suitable safety margin (for example twice the joystick center deadband).

The outputs in normal use should be within the limits 0.35 to 4.65 V DC. 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.

Single Outputs (XYZ option)

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

Center Tap

A center tap is provided as a means of verifying the integrity of the Vs at the joystick. Clearly a high resistance or open circuit in either the Vs or ground connections will affect the joystick outputs. The normal output at the center tap connection is 49.16 to 50.84% of Vs. A center tap output outside this range indicates a fault in the supply to the joystick Hall sensors.

Output Impedance

Joystick outputs at the center position and the end of travel are specified with infinite load impedance or zero current. The effect of adding 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.

MODEL CODE SUMMARY
 (continued)

E *Grip Options*






Code	Description	Axis Option
 K1	Standard tapered grip	X and XY
 E	Ergonomic grip	X,XY,XYZ
 E1 - E5		
E1	Ergonomic grip w/ black push button	X,XY,XYZ
E2	Ergonomic grip w/ red push button	X,XY,XYZ
E3	Ergonomic grip w/ green push button	X,XY,XYZ
E4	Ergonomic grip w/ yellow push button	X,XY,XYZ
E5	Ergonomic grip w/ blue push button	X,XY,XYZ
 S	Straight grip	X and XY
 S1 - S5		
S1	Straight grip w/ black push button	X and XY
S2	Straight grip w/ red push button	X and XY
S3	Straight grip w/ green push button	X and XY
S4	Straight grip w/ yellow push button	X and XY
S5	Straight grip w/ blue push button	X and XY

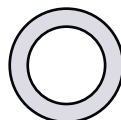
Illustration 2272, 2273, 2274, 2275, 2276

F *Gate Options*

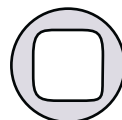
Code	Description	Axis Option
1	Single axis	X
R	Round	XY,XYZ
S	Square	XY,XYZ
D	Diamond	XY,XYZ
C	Cross X	XY,XYZ
P	Plus +	XY,XYZ



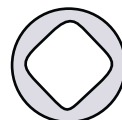
Single axis
Code 1



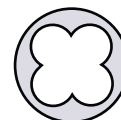
Round
Code R



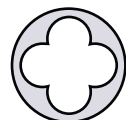
Square
Code S



Diamond
Code D



Cross x
Code C



Plus +
Code P

Illustration 2277

MODEL CODE SUMMARY
 (continued)

Switch Color Option


	Code	Button
	1	Black
	2	Red
	3	Green
	4	Yellow
	5	Blue

Illustration 2278

G *Guided or Non-guided Option*

Code	Description	Axis Option
N	Non-guided feel	X, XY, XYZ
P	Guided feel	XY, XYZ

**DIMENSIONS AND
MOUNTING**

Mounting dimensions in millimeters [inches]

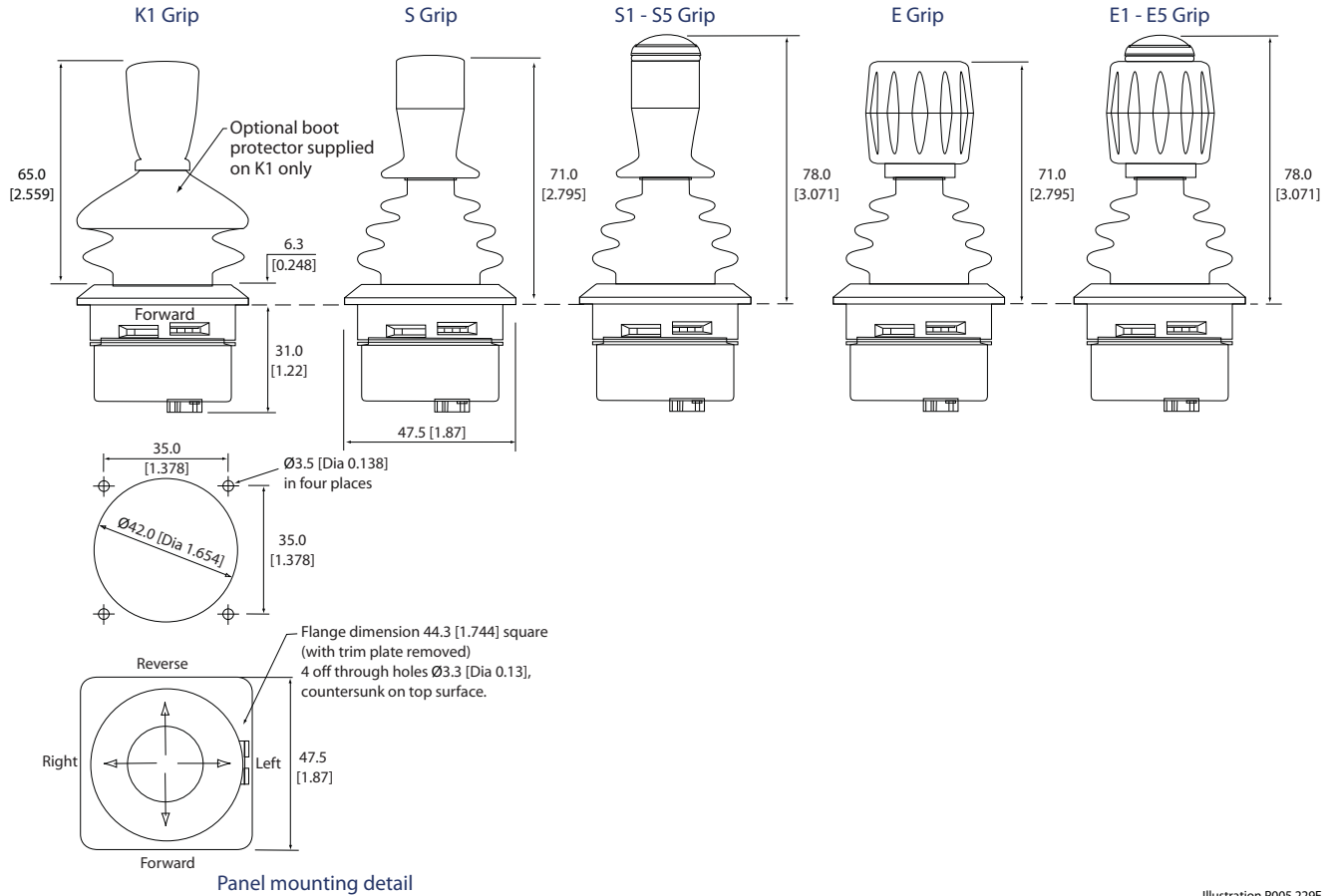
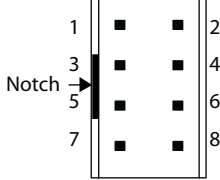


Illustration P005 229E

**CONNECTOR PIN
 ASSIGNMENTS**

<i>Pinout and wiring information</i>		<i>XY Joystick</i>	<i>XYZ Joystick</i>
<p>Bottom View, Joystick Connector</p> 	Pin 1	Supply voltage	
	Pin 2	Left/Right output 1	Left/Right output
	Pin 3	Ground	
	Pin 4	Forward/Reverse output 1	Forward/Reverse output
	Pin 5	Forward/Reverse output 2	5 V DC
	Pin 6	Center tap	
	Pin 7	Left/Right output 2	Z axis output
	Pin 8	Switch output (NC if no switch)	
Switch is connected between pin 1 and 8			

⚠ Caution

Red lead on Sauer-Danfoss mating connector kit is assigned to pin 8.

**MATING CONNECTOR
 DETAILS**

Mating connector specifications	
8-pin FCI Minitek	98414-F06-08U shrouded IDC header
8-pin FCI Minitek	89361-708 IDC connector

Mating connector kit	
<i>Type</i>	<i>Sauer-Danfoss ordering number</i>
Connector with 400 mm [15.75 in] ribbon cable	10102031

**RECOMMENDED WIRING
PRACTICE**

- All Wires must be protected from mechanical abuse.
- Use 85° C wire with abrasion resistant insulation.
- Separate high current wires such as solenoids, lights, alternators, or fuel pumps from control wires. Recommended minimum separation is 300 mm [11.8 in].
- Run wires along the inside of or close to metal machine frame surfaces where possible. This simulates a shield which will minimize the effects of EMI/RFI radiation.
- Do not run wires near sharp metal corners. Consider running wire through grommets when rounding a corner.
- Provide strain relief for all wires.
- Avoid running wires near moving or vibrating components.
- Avoid long, unsupported wire spans.
- All sensors have dedicated wired power sources and ground returns. They should be used.
- Sensor lines should be twisted about one turn every 100 mm [3.94 in].
- It is better to use wire harness anchors that will allow wires to float with respect to the machine frame rather than rigid anchors.

INSTALLATION NOTES

- Prior to installation, check that the travel limiter gate positioned under the boot at the top of the joystick is correctly located and oriented.
- The joystick is sealed above the mounting surface to prevent dust and water ingress to IP 65 and is supplied with mounting hardware (sealing gasket and trim plate suitable for mounting from above the panel. 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. It is possible to mount the JS2000 from under the panel surface by discarding the trim plate and compressing the base of the flexible boot against the panel and mounting flange.
- The joystick base below the mounting surface should be protected from dust and direct water spray.

Joystick 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 cause an erroneous output.

For safety critical functions it is recommended that an independent momentary action *system enable* switch be used. This switch can be incorporated into the joystick as a *operator 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 input before the joystick is displaced from its neutral position. Functions enabled by the joystick should not be enabled until this input is received.

Output Noise

The JS2000 incorporated 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 signal, nominally 20 mV peak to peak. The application program can filter out this noise.

Magnetic immunity

The use of the JS2000 in close proximity to sources of high magnetic fields is not recommended.

Supply voltage

The JS2000 is designed to operate from a regulated 5 V DC \pm 0.5 V DC supply that is free from transients. Joystick outputs are ratiometric and are therefore a function of the input voltage.

**MECHANICAL
 CHARACTERISTICS**

XY Axis

Shaft operation force (applied at top of grip)	
Breakout	1 N (0.22 lbf) nominal
Operating	2 N (0.45 lbf) nominal, full deflection
Maximum allowable	300 N (67.44 lbf) XY option, 195 N (43.84 lbf) XYZ option
Shaft mechanical angle	
Single axis option	± 20° forward/reverse
Round gate, XY option	± 20°
Square and Diamond gate, XY option	± 20° to corners, ± 14° to flats
Cross and plus gate, XY option	± 20° at extent of axes
Expected life	15 M operations
Weight	90 g (0.20 lb) base without grip

Z Axis

Operating torque	
Breakout	0.04 N·m (0.03 ft·lb)
Operating	0.06 N·m (0.04 ft·lb)
Maximum allowable	1.0 N·m (0.74 ft·lb)
Mechanical angle	± 20°
Expected life	5 M operations

**ELECTRICAL
 CHARACTERISTICS**

Electrical

Sensor type	Hall effect
Resolution	Infinite
Supply voltage range (Vs)	5 V DC ± 0.5 V DC, regulated
Over voltage, maximum	15 V DC
Reverse voltage, maximum	14.5 V DC
Output voltage range	
X and XY, ± 40% span	Nominal 0.5 to 4.5 V DC
XYZ, ± 25% span	Nominal 1.1 to 3.0 V DC
Output impedance	100 Ω each axis
Center tap voltage (no load)	50% Vs ± 1%
Center tap impedance	1.1 kΩ
Return to center voltage (no load)	X and Y axis—within ± 60 mV of Vs/2 at 20°C (68°F), ± 73 mV over full temperature range Z axis—within ± 100 mV of Vs/2 @ 20°C (68°F), ± 100 mV over full temperature range
Current consumption	17.5 mA, nominal
Output sense, XY axis	The twin outputs of the XY axis can be independently selected to be rising together in the same direction (PP) or opposed (PN)
Output sense, Z axis	The three axis option can only provide a single output per axis

**ENVIRONMENTAL
 CHARACTERISTICS**

Environmental

Operating temperature	-25°C (-13°F) to 70°C (158°F)
Storage temperature	-40°C (-40°F) to 70°C (158°F)
Ingress Protection (IP) rating	IP 65, above panel
EMC immunity level	60 V/m (25 MHz to 1 GHz, 1 kHz sine wave modulation)
EMC emissions level	Complies with EN50081-1 (1992), 30 MHz to 1 GHz
ESD immunity level	±8 kV Contact discharge; 15 kV air discharge (10 discharges)



JS2000 Joystick
Technical Information
Notes

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