ENGINEERING
TOMORROW

Danfoss

Technical Information

JS7000
Joystick Family

Revision history   *Table of revisions*

Date	Changed	Rev
May 2017	Updated to Engineering Tomorrow design	0801
July 2015	Converted to Danfoss layout and connector ordering number corrected	IA
January 2013	Added option code, corrected description, updated illustrations, minimum load impedance	HA
September 2012	Corrected grip function options for 2 roller/slider/rocker	GA
June 2012	Corrected option code and push-button grip options	FA
May 2012	Addition of CAN+	EA
April 2012	New grip functions	DA
June 2011	Various updates	CA
May 2011	Various updates	BA
March 2011	First edition	AA

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Overview

Description

The JS7000 Joystick features a heavy duty and intuitive design specially developed to meet the harsh operating requirements of today's mobile machines. Dual Hall effect sensing technology ensures reliable long life performance including the most safety critical applications.

The JS7000 ergonomic left-hand and right-hand grip design options enable comfortable and efficient operation for maximum productivity. The vertical grip is a multi-function, ergonomic grip designed for a comfortable human-machine interface with easy-to-use finger tip controls. The grip features a modular design that allows switch and proportional rocker location flexibility.

The JS7000 was designed after extensive research detailing operator needs from live interviews and also in-cab video recording. The JS7000 joystick establishes new industry standards for performance, durability, flexibility and user comfort. The PLUS+1° Compliant JS7000 is well-suited for off-highway machines including backhoe loaders, skid steer loaders, telehandlers, wheel loaders and dozers.

Designed for serviceability, the JS7000 minimizes down time with easy access for replacing grip functions including the boot.

Features and options

- Features
    - Hall effect sensing
    - Two Hall effect sensors per axis for redundancy
    - Dual axis, spring return to neutral
    - Two centering spring force
- Output options
    - Analog
    - CAN 2.0B, J1939 protocol, including separate analog outputs
    - CAN 2.0B, CANopen protocol, including separate analog outputs
    - CAN 2.0B communication, CAN+ pin configuration
- Ergonomic vertical grip options
    - Left hand
    - Right hand
- Grip configuration examples
    - Seven momentary red, black and yellow push-button combinations plus trigger switch
    - Three proportional switches, one momentary push-button, plus trigger switch
    - Two 3-position maintained rocker switches, one proportional roller, one momentary push-button, plus trigger switch
    - Five momentary red, black and yellow with LED push-button combinations, one proportional redundant roller plus trigger switch
- On axis shaft, deflection options
    - ±20° or ±25°

Product configuration model code

The product configuration model code specifies particular features when ordering the . The model code begins with the product family name and the remaining fields are filled in to configure the product with the desired features.

JS7000 product configuration model code

Base

Field	Feature
A	Operational Axis Options
B	Mechanical Options and Centering Force
C	X axis detents
D	Y axis detents
E	Electrical output
F	Electrical Interface and Source Address
G	Mounting
H	Boot
J	Special Hardware Features

Grip

Field	Feature
K	Grip Type
L	Faceplate
M	Push-button switch 1
N	Push-button switch 2
P	Push-button switch 3
Q	Push-button switch 4
R	Push-button switch 5
S	Roller/Slider/Rocker 1
T	Roller/Slider/Rocker 2
U	Mini-Joystick
V	Push-button switch 6
W	Push-button switch 7
X	Roller/Slider/Rocker 3
Y	Push-button switch 8
Z	Operator Present

JS7000 Joystick product configuration model code

A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	U	V	W	X	Y	Z
		N	N	N	N		V	N	N									N	N				N

JS7000 Joystick product configuration model code example

A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	U	V	W	X	Y	Z
M	1	S	M	N	N N N N A 9 0	N	N	N	T V	N N	V R V 2	N N	N N N	N N	N N	N N P	N N	N N N	T B	T Y	N N	S B	N

Product configuration model code

Base model code fields

Base product configuration model code

Product family name					A	B		C	D	E		F			G	H	J
J	S	7	0	0				N	N	N	N					V	N	N

A—Operational axis

Code	Description
M1	Multi axis: ±20°
M2	Multi axis: ±25°

B—Mechanical

Code	Description
SM	Lever operator spring force medium range, 0.6 to 3.2 Nm with 20° of travel option (M1)
	Lever operator spring force medium range, 0.6 to 4.8 Nm with 25° of travel option (M2)
SH	Lever operator spring force heavy range, 1.1 to 4.2 Nm with 20° of travel option (M1)
	Lever operator spring force heavy range, 1.1 to 5.8 Nm with 25° of travel option (M2)

Reference *Standard versus heavy spring torque* on page 39.

C—X axis force profile includes spring return, future options

Code	Description
NN	Standard force profile, result of options A and Option B selection

D—Y axis force profile includes spring return, future options

Code	Description
NN	Standard force profile, result of options A and Option B selection

E—Electrical output

Code	Description
A90	Analog 10-90% output (5 Vdc supply)
CAN	CAN 2.0B communication with Analog (redundant X-Y axis outputs)
CPL	CAN 2.0B communication, CAN+ pin configuration

F—Electrical interface

Code	Description
NNN	None (used only for non-CAN electrical output options, E0NNN or E0A**)
J90	J1939 protocol, source address 0x90 (144 decimal), 250Kbs Baud Rate
J93	J1939 protocol, source address 0x93 (147 decimal), 250Kbs Baud Rate
J96	J1939 protocol, source address 0x96 (150 decimal), 250Kbs Baud Rate

Product configuration model code

F—*Electrical interface (continued)*

Code	Description
J9C	J1939 protocol, source address 0x9C (156 decimal), 250Kbs Baud Rate
K90	J1939 protocol, source address 0x90 (144 decimal), 500Kbs Baud Rate
K93	J1939 protocol, source address 0x93 (147 decimal), 500Kbs Baud Rate
K96	J1939 protocol, source address 0x96 (150 decimal), 500Kbs Baud Rate
K9C	J1939 protocol, source address 0x9C (156 decimal), 500Kbs Baud Rate
P10	CANopen protocol, source address 0x10 (16 decimal), 125Kbs Baud Rate
P13	CANopen protocol, source address 0x13 (19 decimal), 125Kbs Baud Rate
P16	CANopen protocol, source address 0x16 (22 decimal), 125Kbs Baud Rate
P1C	CANopen protocol, source address 0x1C (28 decimal), 125Kbs Baud Rate
N10	CANopen protocol, source address 0x10 (16 decimal), 250Kbs Baud Rate
N13	CANopen protocol, source address 0x13 (19 decimal), 250Kbs Baud Rate
N16	CANopen protocol, source address 0x16 (22 decimal), 250Kbs Baud Rate
N1C	CANopen protocol, source address 0x1C (28 decimal), 250Kbs Baud Rate

G—*Mounting*

Code	Description
T	Top mount
U	Top mount with decorative bezel

H—*Boot*

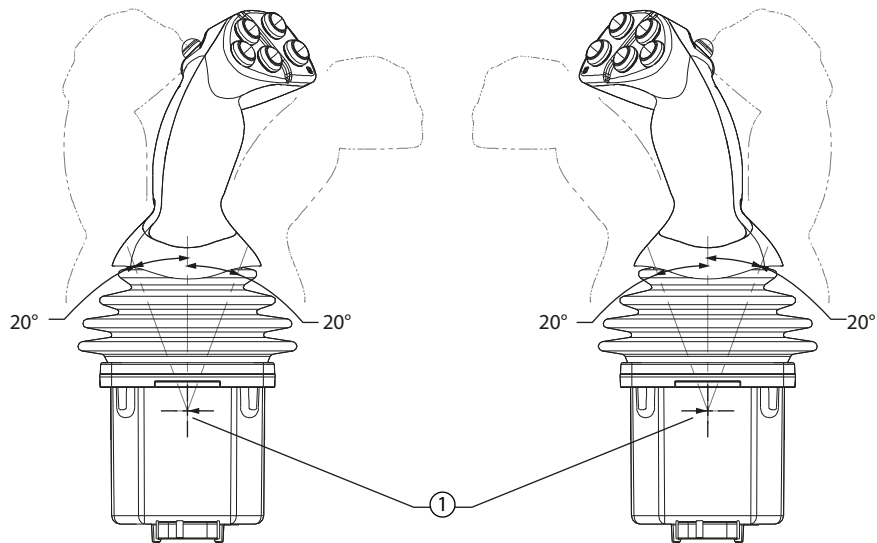| Code	Description
V	Vertical grip boot

J—*Special hardware*

Code	Description
NN	Standard

Product configuration model code

X and Y operation or movement

Left and right handle X and Y operation or movement (20° configuration shown)

P200069

1. Center of pivot

Product configuration model code

Grip model code fields

Grip product configuration model code

K	L	M	N	P	Q	R	S	T	U	V	W	X	Y	Z
									N	N				N

K—Grip series

Grip		Code	Description
		VL	Vertical Grip, left hand (grip functions shown are example only)
		VR	Vertical Grip, right hand (grip functions shown are example only)

L—Faceplate

Faceplate		Code	Description	Grip function options
		B0	Blank faceplate	— —
		B1	1 push-button	N— —
		B2	2 push-button	N— — P— —
		B3	3 push-button	M— — N— — P— —
		B4	4 push-button	N— — P— — Q— — R— —
		B5	5 push-button	M— — N— — P— — Q— — R— —
		V1	1 roller/slider/rocker*	TPN
		V2	2 roller/slider/rocker*	SPN with TPN SHR with THR SS2 or SS3 with TS2 or TS3 SK2 or SKM or SKF with TK2 or TKM or TKF
		AV	1 push-button	M— —
			1 roller/slider/rocker*	TPN
		BV	2 push-button	Q— — R— —
			1 roller/slider/rocker	T— —
		CV	3 push-button	M— — Q— — R— —
			1 roller/slider/rocker	T— —

Product configuration model code

L—*Faceplate (continued)*

Faceplate		Code	Description	Grip function options
		AZ	1 push-button	M— —
			2 roller/slider/rocker*	SPN with TPN

* Currently only available with the listed grip function options.

M—*Push-button switch 1*
N—*Push-button switch 2*
P—*Push-button switch 3*
Q—*Push-button switch 4*
R—*Push-button switch 5*

Code	Description
NN	None
TB	Black, momentary SPST-NO electro-mechanical push-button
TY	Yellow, momentary SPST-NO electro-mechanical push-button
TR	Red, momentary SPST-NO electro-mechanical push-button
TC	Black, red LED, momentary SPST-NO electro-mechanical push-button
TZ	Yellow, red LED, momentary SPST-NO electro-mechanical push-button
TS	Red, red LED, momentary SPST-NO electro-mechanical push-button

S—*Roller/Slider/Rocker 1*
T—*Roller/Slider/Rocker 2*

Code	Description	Faceplate options
NN	None	
PN	Potentiometer roller	
HR	Proportional roller with redundant output*	L**V2**
S2	Proportional slider*	L**BV**
S3	3-position maintained slider (FNR)*	L**CV**
K2	2-position maintained rocker*	
KM	3-position momentary rocker*	
KF	3-position maintained rocker*	

* Currently only available with the listed grip function options.

U—*Mini Joystick*

Code	Description
NN	None

Product configuration model code

V—*Push-button switch 6* *W*—*Push-button switch 7*

	Code	Description
	NN	None
	TB	Black, momentary SPST-NO electro-mechanical push-button
	TY	Yellow, momentary SPST-NO electro-mechanical push-button
	TR	Red, momentary SPST-NO electro-mechanical push-button

X—*Roller/Slider/Rocker 3*

Switch	Code	Description
	PN	Proportional roller
	HR	Proportional roller with redundant output
	K2	2-position maintained rocker
	KM	3-position momentary rocker
	KF	3-position maintained rocker

Y—*Push-button switch 8*

Switch	Code	Description
	NN	None
	SB	Trigger

Z—*Operator Presence*

Code	Description
N	None

Electrical options

Analog

The analog electrical output option gives a direct voltage output from the joystick's shaft sensors, position switches and grip functions. No signal conditioning is performed.

CAN

The CAN joystick has one fully dedicated CAN channel and three available output options:
- CAN 2.0B, J1939 protocol
- CAN 2.0B, CANopen protocol
- Additional X and Y analog outputs

J1939 messages

The CAN electrical output option broadcasts four J1939 messages to communicate device information:
- Basic Joystick Message 1 (BJM1)
- Basic Joystick Message 3 (BJM3)
- Extended Joystick Message 1 (EJM1)
- Extended Joystick Message 3 (EJM3)

CANopen 2.0B, CANopen protocol

The CANopen output option provides conditioned joystick output information in 2.0B, CANopen message protocol.

Additional X and Y analog outputs

There are two X axis outputs and two Y axis outputs on the CAN joystick. The outputs are linear with respect to the shaft angle. The two outputs of the same axis are complimentary of each other, as the output voltage of one increases, the output voltage of the second decreases. The voltage output ranges from 0.5 to 4.5 Vdc.

Proportional roller output
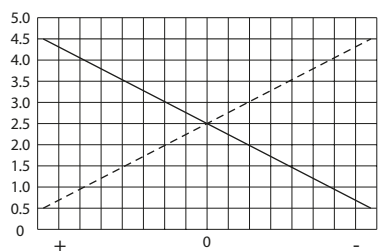
P200078

Volts:	0.5 to 4.5 Vdc
Solid line:	Output 1
Dashed line:	Output 2
Left arrow:	Direction 1 (+ travel)
Right arrow:	Direction 2 (- travel)

CAN+

The CAN+ joystick has one fully dedicated CAN channel and the available option is CAN 2.0B, J1939 protocol.

Electrical options

CAN 2.0B, J1939 protocol

The CAN J1939 output option provides conditioned joystick output information in 2.0B, J1039 message protocol.

J1939 messages

The CAN electrical output option broadcasts four J1939 messages to communicate device information:
* Basic Joystick Message 1 (BJM1)
* Basic Joystick Message 3 (BJM3)
* Extended Joystick Message 1 (EJM1)
* Extended Joystick Message 3 (EJM3)

Output

+5 Vdc sensor power rated: 250 mA

Analog and digital external inputs

The CAN+ joystick has seven digital inputs, four combination analog and digital inputs, and +5 Vdc sensor power.

External inputs	Range	
Digital inputs	0.0 Vdc or 5.0 Vdc	
Analog or digital inputs	Analog: 0.0 to 5.0 Vdc	Digital: 0.0 or 5.0 Vdc

CAN message protocol

SAE J1939 basic joystick message specifications

The JS7000 joystick uses the SAE J1939 basic joystick message to transfer information about the measured status of the X and Y axes of a joystick and the state of switches on the joystick grip.

Basic joystick message structure

Message number	Priority	Base PGN		PDU format		PDU specific		Source address		Data field
		Dec	hex	Dec	hex	Dec	hex	Dec	hex	
1	3	64982	FDD6	253	FD	214	D6	The source address depends on position specified in master model code.		8 bytes
3	3	64986	FDDA	253	FD	218	DA	The source address depends on position specified in master model code.		8 bytes

Message transmission rate: 20 ms

The resulting SAE J1939 basic joystick message PGN on the CAN bus is:

0xCFDD6 *_* or 0xCFDDA *_*

* = joystick source address (hex)

The data field contains the joystick's output information. SAE J1939 data fields contain 8 bytes of data.

Information in the data field

Byte#	1								2								3 and so on							
Bit#	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8

CAN message protocol

Basic joystick message 1

Parameters and data field locations

Start position (byte/bit)	Length (bits)	Parameter description
1/1	2	Joystick X-axis neutral position status
1/3	2	Joystick X-axis lever left negative position status
1/5	2	Joystick X-axis lever right positive position status
1/7 through 2/1-8	10	Joystick X-axis position (Byte 1 Bit 7 is LSB. Byte 2 Bit 8 is MSB)
3/1	2	Joystick Y-axis neutral position status
3/3	2	Joystick Y-axis lever back negative position
3/5	2	Joystick Y-axis lever forward positive position
3/7 through 4/1-8	10	Joystick Y-axis position (Byte 3 Bit 7 is LSB. Byte 4 Bit 8 is MSB)
5/5	2	Joystick Y-axis detent position status
5/7	2	Joystick X-axis detent position status
6/1	2	Grip button 4 pressed status
6/3	2	Grip button 3 pressed status
6/5	2	Grip button 2 pressed status
6/7	2	Grip button 1 pressed status
7/1	2	Grip button 8 pressed status
7/3	2	Grip button 7 pressed status
7/5	2	Grip button 6 pressed status
7/7	2	Grip button 5 pressed status
8/1	2	Grip button 12 pressed status
8/3	2	Grip button 11 pressed status
8/5	2	Grip button 10 presses status
8/7	2	Grip button 9 pressed status

Data field examples

Byte	1							
Bit	8	7	6	5	4	3	2	1
	The 2 LSB (Least Significant Bit) of X-axis position		X-axis lever right positive status		X-axis lever left negative position status		X-axis neutral position status	

Byte	2							
Bit	8	7	6	5	4	3	2	1
	MSB (Most Significant Bit) X-axis position							

Byte	3							
Bit	8	7	6	5	4	3	2	1
	The 2 LSB (Least Significant Bit) of Y-axis position status		X-axis lever forward positive status		Y-axis lever back negative position status		Y-axis neutral position status	

CAN message protocol

Basic joystick message 3

(CAN+ models only)

Parameters and data field locations

Start position (byte/bit)	Length (bits)	Parameter description
1/1	2	Not used
1/3	2	Not used
1/5	2	Not used
1/7 through 2/1-8	10	Sensor power analog output (pin 8) value
3/1	2	Not used
3/3	2	Not used
3/5	2	Not used
3/7 through 4/1-8	10	Pin 9 analog input value
5/5	2	Not used
5/7	2	Not used
6/1	2	Pin 12 digital input pressed status
6/3	2	Pin 11 digital input pressed status
6/5	2	Pin 10 digital input pressed status
6/7	2	Pin 9 digital input pressed status
7/1	2	Pin 16 digital input pressed status
7/3	2	Pin 15 digital input pressed status
7/5	2	Pin 14 digital input pressed status
7/7	2	Pin 13 digital input pressed status
8/1	2	Not used
8/3	2	Pin 6 digital input pressed status
8/5	2	Pin 18 digital input pressed status
8/7	2	Pin 17 digital input pressed status

CAN message protocol

Basic joystick message (X-axis)

Joystick X-axis neutral position status

Description	Bit status	Remarks
Reports when the current joystick position is in the neutral position for the X-axis of travel	00	Not in neutral position
	01	In neutral position
	10	Error indicator
	11	Not available

Joystick X-axis handle left negative position status

Description	Bit status	Remarks
Reports when the current joystick position is on the negative travel side (back, left, counterclockwise, down) relative to the neutral position for the X-axis.	00	Not on negative side of neutral
	01	On negative side of neutral
	10	Error indicator
	11	Not available

Joystick X-axis handle right positive position status

Description	Bit status	Remarks
Reports when the current joystick position is on the positive travel side (forward, right, clockwise, up) relative to the neutral position for the X-axis.	00	Not on positive side of neutral
	01	On positive side of neutral
	10	Error indicator
	11	Not available

Joystick X-axis position status

Description
The position of the joystick in the relative motion of travel from the neutral position. The position value of 0 is always neutral. The output range of the joystick handle at the end of travel is factory set according to the option specified in the electrical interface options section of the master model code.

The master model code specifies that the full-scale output at the end of each linear zone will be 1000 counts.

⚠ **Warning**

Potential uncommanded machine movement. Per the SAE J1939-71 standard, if the JS6000 joystick internal diagnostics detect a shaft position measurement error, the joystick output will be set to a value of 1022 counts regardless of shaft position. Application software should be written to recognize this error condition to avoid the possibility of unintended machine motion.

Per the SAE J1939-71 standard, if a specific joystick axis is not available, the basic joystick message for the unavailable axis will indicate an output value of 1023 counts. Application software should be written to recognize this condition to avoid the possibility of unintended machine motion.

CAN message protocol

Basic joystick message (Y-axis)

Joystick Y-axis neutral position status

Description	Bit status	Remarks
Reports when the current joystick position is in the neutral position for the Y-axis of travel	00	Not in neutral position
	01	In neutral position
	10	Error indicator
	11	Not available

Joystick Y-axis handle back negative position status

Description	Bit status	Remarks
Reports when the current joystick position is on the negative travel side (back, left, counterclockwise, down) relative to the neutral position for the Y-axis.	00	Not on negative side of neutral
	01	On negative side of neutral
	10	Error indicator
	11	Not available

Joystick Y-axis handle forward positive position status

Description	Bit status	Remarks
Reports when the current joystick position is on the positive travel side (forward, right, clockwise, up) relative to the neutral position for the Y-axis..	00	Not on positive side of neutral
	01	On positive side of neutral
	10	Error indicator
	11	Not available

Joystick Y-axis position status

Description
The position of the joystick in the relative motion of travel from the neutral position. The position value of 0 is always neutral. The output range of the joystick handle at the end of travel is factory set according to the option specified in the electrical interface options section of the master model code.

The master model code specifies that the full-scale output at the end of each linear zone will be 1000 counts.

⚠ Warning

Potential uncommanded machine movement. Per the SAE J1939-71 standard, if the JS6000 joystick internal diagnostics detect a shaft position measurement error, the joystick output will be set to a value of 1022 counts regardless of shaft position. Application software should be written to recognize this error condition to avoid the possibility of unintended machine motion.

Per the SAE J1939-71 standard, if a specific joystick axis is not available, the basic joystick message for the unavailable axis will indicate an output value of 1023 counts. Application software should be written to recognize this condition to avoid the possibility of unintended machine motion.

Joystick button 1-8 pressed status

Bit status	Remarks
00	Button not pressedl
01	Button pressed
10	Error indicator
11	Not available (no button installed)

CAN message protocol

SAE J1939 extended joystick message specifications

The JS7000 joystick uses the SAE J1939 extended joystick message to transfer information about the measured status of up to 3 additional proportional input functions on the joystick grip, and external-to-the-joystick analog inputs. The joystick base X and Y-axis information is available in the basic joystick message.

Extended joystick message structure

Message number	Priority	Base PGN		PDU format		PDU specific		Source address		Data field
		Dec	hex	Dec	hex	Dec	hex	Dec	hex	
1	3	64983	FDD7	253	FD	215	D7	The source address depends on position specified in master model code.		8 bytes
3	3	64987	FDDB	253	FD	219	DB	The source address depends on position specified in master model code.		8 bytes

Message transmission rate: 20 ms

The resulting SAE J1939 extended joystick message PGN on the CAN bus is:

0xCFDD7 *_* or 0xCFDDB *_*

* = joystick source address (hex)

Extended joystick message 1

Parameters and data field locations

Start position (byte/bit)	Length (bits)	Parameter name
1/1	2	Grip X-axis neutral position status
1/3	2	Grip X-axis negative position status
1/5	2	Grip X-axis positive position status
1/7 through 2/1-8	10	Grip X-axis position
3/1	2	Grip Y-axis neutral position status
3/3	2	Grip Y-axis negative position status
3/5	2	Grip Y-axis positive position status
3/7 through 4/1-8	10	Grip Y-axis position
5/1	2	Theta-axis neutral position status
5/3	2	Theta-axis negative position status
5/5	2	Theta-axis position status
5/7 through 6/1-8	10	Theta-axis position
7/3	2	Not used
7/5	2	Not used
7/7	2	Not used

CAN message protocol

Extended joystick message 3

(CAN+ models only)

Parameters and data field locations

Start position (byte/bit)	Length (bits)	Parameter name
1/1	2	Not used
1/3	2	Not used
1/5	2	Not used
1/7 through 2/1-8	10	Pin 10 analog input value
3/1	2	Not used
3/3	2	Not used
3/5	2	Not used
3/7 through 4/1-8	10	Pin 11 analog input value
5/1	2	Not used
5/3	2	Not used
5/5	2	Not used
5/7 through 6/1-8	10	Pin 12 analog input value
7/3	2	Not used
7/5	2	Not used
7/7	2	Not used

Data field descriptions and output ranges for extended joystick messages are similar to those for base X and Y-axis basic joystick messages.

Grip proportional input naming convention

Proportional input location	Extended joystick message designation
Position 1	X-axis
Position 2	Y-axis
Position 3	Theta-axis

The JS7000 joystick uses the SAE J1939 extended joystick message to transfer information about the measured status of the grip axes of a joystick and external analog input values.

CAN message protocol

SAE J1939 lamp command joystick message specifications

The JS7000 CAN+ joystick is able to accept J1939 joystick lamp command messages to activate button mounted LEDs if they are available.

Lamp command joystick message structure

Priority	Base PGN	PDU format	PDU specific	Source address	Data field
3	39168 (0x00900)	153 (0x99)	Destination Address	The source address depends on position specified in master model code.	8 bytes

Message transmission rate: 100 ms

If the joystick stops receiving joystick lamp command messages, all available button LEDs will be switched off.

The resulting SAE J1939 lamp command joystick message PGN on the CAN bus is:

0xC99 * *

* = joystick source address (hex)

Lamp command joystick message

Parameters and data field locations

Start position (byte/bit)	Length (bits)	Parameter name
1/1	2	Button 1 lamp command
1/3	2	Button 2 lamp command
1/5	2	Button 3 lamp command
1/7	2	Button 4 lamp command
2/1	2	Button 5 lamp command

Button lamp command status

Bit status	Remarks
00	Off
01	On
10	Blinking
11	No change or status

CAN message protocol

SAE J1939 sensor electrical power 1 message specifications

The JS7000 CAN+ joystick is able to send its sensor power voltage output using a SAE J1939 sensor electrical power 1 (SEP1) message.

Sensor electrical power 1 message structure

Priority	Base PGN	PDU format	PDU specific	Source address	Data field
6	64925 (0x00FD9D)	253 (0xFD)	157 (0x9D)	The source address depends on position specified in master model code.	8 bytes

Message transmission rate: 100 ms

The resulting SAE J1939 sensor electrical power 1 message PGN on the CAN bus is:

0x18FD9D * *

* = joystick source address (hex)

Sensor electrical power 1 message

(CAN+ models only)

Parameters and data field locations

Start position (byte/bit)	Length (bytes)	Parameter name
1/1	2	Sensor power voltage 1
3/1	2	Not used
5/1	2	Not used
7/1	2	Not used

CAN message protocol

SAE J1939 (DM1) error messages

SAE J1939 DM1 error messages are supported by JS7000 software.

See the following tables for SPN (Suspect Parameter Number) and FMI (Failure Mode Identifier).

Failure: Voltage Too High

Message	Axis	SPN	FMI
BJM1	X	2660	3
BJM1	Y	2661	3
EJM1	Grip X	2662	3
EJM1	Grip Y	2663	3
EJM1	Grip Theta	2664	3

Failure: Voltage Too Low

Message	Axis	SPN	FMI
BJM1	X	2660	4
BJM1	Y	2661	4
EJM1	Grip X	2662	4
EJM1	Grip Y	2663	4
EJM1	Grip Theta	2664	4

Failure: Input Not Calibrated

Message	Axis	SPN	FMI
BJM1	X	2660	13
BJM1	Y	2661	13
EJM1	Grip X	2662	13
EJM1	Grip Y	2663	13
EJM1	Grip Theta	2664	13

Failure: Redundant Input Failure

Message	Axis	SPN	FMI
BJM1	X	2660	14
BJM1	Y	2661	14
EJM1	Grip X	2662	14
EJM1	Grip Y	2663	14
EJM1	Grip Theta	2664	14

CAN message protocol

CAN automation information

JS7000 joysticks do not support SAE J1939 dynamic addressing, since the joystick source addresses are hard-coded (static). However, JS7000 joysticks are compliant with SAE J1939 address claiming protocol (in the unlikely event another node on the SAE J1939 bus claims an identical source address to the JS7000, the JS7000 may cease communication on the bus, depending on the message priority of the other node).
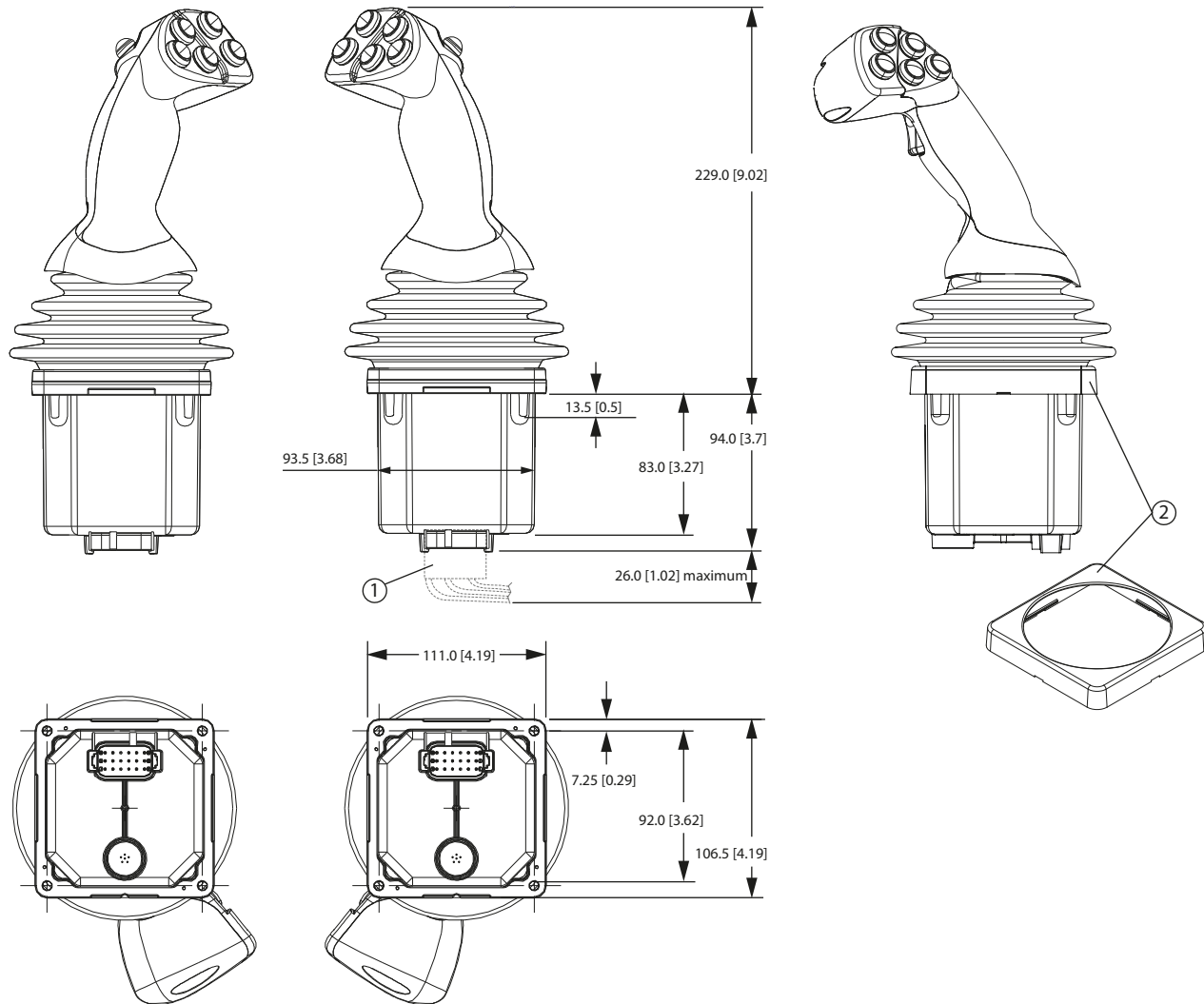
CANopen protocol information

When you want to use CANopen Joystick, go to *http://powersolutions.danfoss.com/products/electronic-components/joysticks/* and click on the CANopen EDS to open CANopen Object Dictionary

Product installation

Dimensions

Vertical grip, left hand (VL) and vertical grip, right hand (VR) dimensions in millimeters [inches]

229.0 [9.02]

13.5 [0.5]

94.0 [3.7]

93.5 [3.68]

83.0 [3.27]

26.0 [1.02] maximum

111.0 [4.19]

7.25 [0.29]

92.0 [3.62]

106.5 [4.19]

P200070

1. Mating connector (18 pin) with lead wires attached at bottom of base.

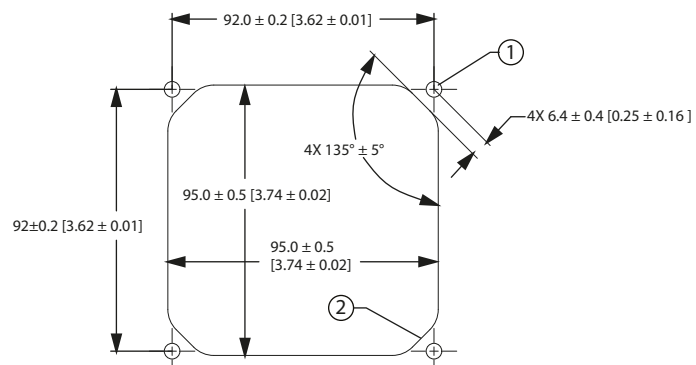As an option, apply a thin line of dielectric grease to assist in assembly and disassembly of connector.

2. Bezel

Product installation

Mounting panel

The JS7000 is designed to be installed from the mounting panel through a 95.0 ± 0.5 (3.75 ± 0.02) opening.

Mounting panel

1. 4X Ø 5.5 ± 0.2 [4X Ø 0.22 ± 0.008] or M5 threaded hole
2. 8X R10 maximum

The mounting flange of the JS7000 should be connected to the vehicle chassis ground.

Product installation

Joystick safety critical functions

For a system to operate safely it must be able to differentiate between commanded and uncommanded inputs. Take steps to detect and manage joystick and system failures that may cause an erroneous output.

For safety critical functions Danfoss recommends you use an independent momentary action system enable switch. You can incorporate this switch into the joystick as an operator presence switch or can be a separate foot or hand operated momentary switch. Disable all joystick functions that the joystick controls when this switch is released.

Ensure the control system looks for the appropriate system enable switch input before the joystick is displaced from its neutral position. Enable functions only after receiving this input.

Applications using CAN joysticks should continuously monitor for the presence of the CAN messages on periodic basis. Messages are to be checked frequently enough for the system or operator to react if the CAN messages lose priority or are no longer received.

Machine wiring guidelines

- Protect wires from mechanical abuse, run wires in flexible metal or plastic conduits.
- Use 85˚ C (185˚ F) wire with abrasion resistant insulation and 105˚ C (221˚ F) wire should be considered near hot surfaces.
- Use a wire size that is appropriate for the module connector.
- Separate high current wires such as solenoids, lights, alternators or fuel pumps from sensor and other noise-sensitive input wires.
- Run wires along the inside of, or close to, metal machine 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 wires through a grommet when rounding a corner.
- Do not run wires near hot machine members.
- Provide strain relief for all wires.
- Avoid running wires near moving or vibrating components.
- Avoid long, unsupported wire spans.
- Ground electronic modules to a dedicated conductor of sufficient size that is connected to the battery (-).
- Power the sensors and valve drive circuits by their dedicated wired power sources and ground returns.
- Twist sensor lines about one turn every 10 cm (4 in).
- Use wire harness anchors that will allow wires to float with respect to the machine rather than rigid anchors.

⚠️ **Warning**

Unintended movement of the machine or mechanism may cause injury to the technician or bystanders. The module will be powered up if battery voltage is applied to the module's output pin. To protect against unintended movement, secure the machine.

🛇 **Caution**

Warranty will be voided if module is damaged.
Avoid significant current driven back through an output pin.

Pinout

Digital and proportional

Digital includes trigger, push-button, and rocker.

Proportional includes roller and slider.

Grip trigger switch	Grip backside

Grip faceplate

Digital outputs rocker options

Grip faceplate example

Grip position 3 example

Proportional analog pinouts

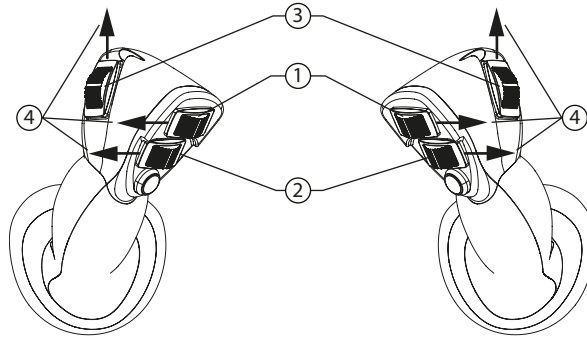*Proportional analog pinouts for proportional roller with redundant output (HR option)*

Position	1 and/or 2		2 and 3		1 and 2 with 3		
	HR		HR		PN, S2, S3		HR
	Roller		Roller		Roller/slider		Roller
	P1	P2	P2	P3	P1	P2	P3
Primary output pins	3	4	4	5	3	4	5
Redundant output pins	5	6	6	3	*	*	6

* Not applicable

Pinout

Vertical roller with switch option

Top view

P200107A

Front view
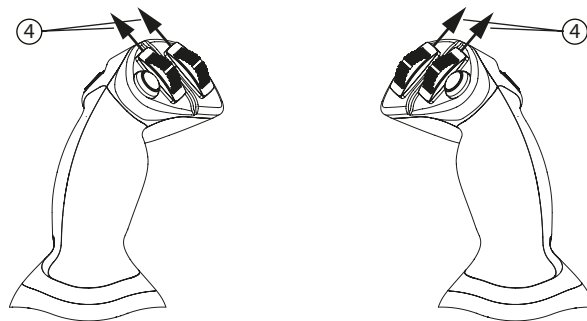
P200107B

1. Position 3 (X00_ _)

2. Position 1 (X00_ _)

3. Position 2 (X00_ _)

4. Increasing output

Pinout

One 18 pin connector

18 pin DEUTSCH connector (DT16-18SB-K004)

P200065
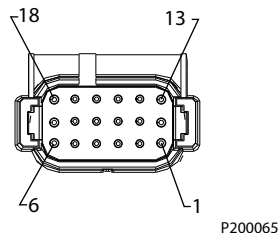
Pinouts

Analog		CAN		CAN+	
Pin number	**Signal name**	**Pin number**	**Signal name**	**Pin number**	**Signal name**
1	Battery Ground	1	Battery Ground	1	Battery Ground
2	+5V	2	Battery Power	2	Battery Power
3	Proportional1*	3	CAN Hi	3	CAN Hi
4	Proportional2*	4	CAN Lo	4	CAN Lo
5	Proportional3*	5	CAN Shield	5	CAN Shield
6	Proportional4*	6	Not Connected	6	Digital Input 7
7	Digital1	7	Reference Ground	7	Sensor Ground
8	Digital2	8	Reference +5V	8	Sensor Power +5V
9	Digital3	9	Not Connected	9	Analog/Digital Input 1
10	Digital4	10	Not Connected	10	Analog/Digital Input 2
11	Digital5	11	Not Connected	11	Analog/Digital Input 3
12	Digital6	12	Not Connected	12	Analog/Digital Input 4
13	Digital7	13	Not Connected	13	Digital Input 1
14	Digital8	14	Not Connected	14	Digital Input 2
15	Proportional Y Axis 1	15	Proportional Y Axis 1	15	Digital Input 3
16	Proportional X Axis 1	16	Proportional X Axis 1	16	Digital Input 4
17	Proportional Y Axis 2	17	Proportional Y Axis 2	17	Digital Input 5
18	Proportional X Axis 2	18	Proportional X Axis 2	18	Digital Input 6

* Reference *Proportional analog pinouts* on page 29 for proportional roller with redundant output (HR option)

Pinout connections examples

Analog grip pinout connections example				CAN and CAN+ minimum pinout connections example	
Pin number	**Signal number**	**Description**		**Pin number**	**Signal number**
7	Digital1	Faceplate push-button 1		1	Battery Ground
12	Digital6	Back side push-button 6		2	Battery Power
14	Digital8	Trigger switch		3	CAN Hi
3	Proportional1	Face plate proportional 1	PN, S2, S3	4	CAN Lo
5	Proportional3	Back side proportional 3	PN, S2, S3	5	CAN Shield

Mating connector

Mating connector bag assembly

Description	Danfoss ordering number
Mating connector bag assembly	11012648

Mating connector bag assembly contents

Description	Quantity
Connector DEUTSCH, DT16-18SB-K004	1
Terminals DEUTSCH, 0462-201-1631	18

The mating connector bag assembly contains loose parts you must assemble.

Danfoss mating connector

Description	Quantity	Danfoss ordering number
Mating connector with 400 mm (15.75 in) wire harness	1	11012646

The Danfoss mating connector with wire harness features a fully assembled connector with an unterminated wire harness.

Mounting

Guidelines

Maintain joystick mounting position relative to operator. Prefer side control pods mounted to seat base to allow user to set seat location relative to controls:

- Joystick mounting point should height adjust with seat, and preferably move with any seat suspension system, to keep relationship of joystick to operator.
- Seat should have option to adjust fore/aft independent of joystick location for setting reach length depending on operator size, see Image A.

The seat adjustment is the most important basic adjustment to accommodate various sized operator reach envelopes.

- Independent height adjustment for control position relative to seat height would be an extra "nice to have" to fine tune position for individual operator size, see Image B.
- Joystick mounting point should move with seat forward and back- for setting operator position relative to foot controls or change of viewing line of sight.
- Front view plane should remain horizontal. (Reference *Horizontal angle* on page 34, Image D for set angle of mounting plane).
- Spacing of joysticks- depends on seat width (reference *Grip position* on page 36, Image G for armrests centerline):
  - Keep joystick as close to seat as spacing allows.
  - Adjustable spacing would optimize fit to operator.
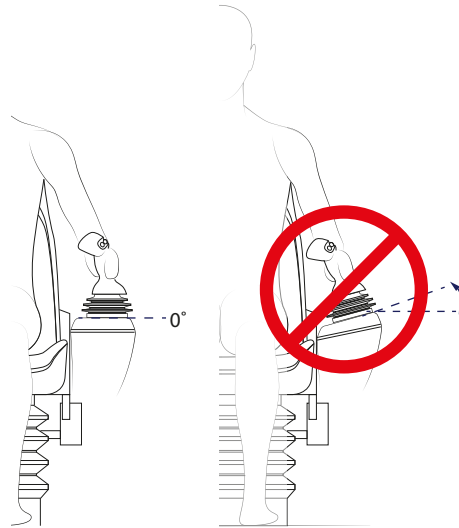
Image A
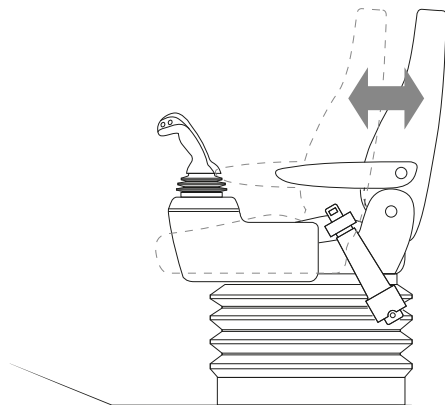
Image B
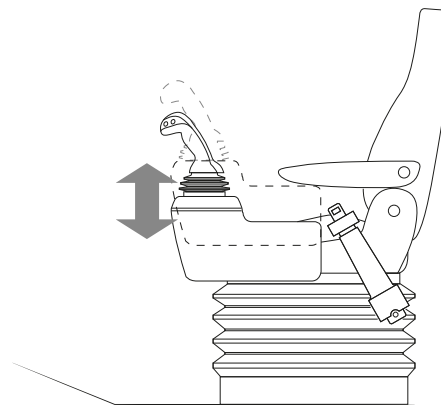
Mounting

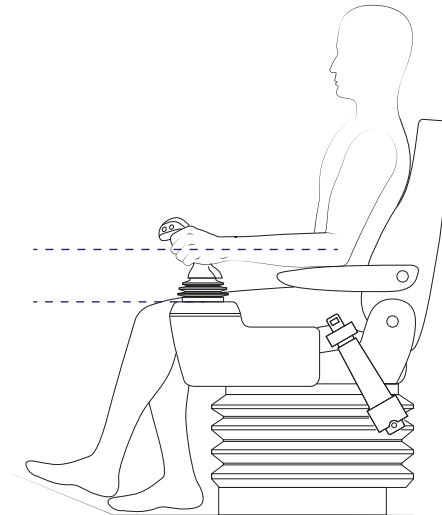**Mounting position**

Horizontal angle

JS7000 ergo shape has inboard angle set for proper wrist/hand position, see Image D.

Image D

This is based on forearm remaining parallel to mounting plane, so mounting plane should be positioned parallel to operator forearm in other operator orientations to optimize grip angle comfort, see Image E.
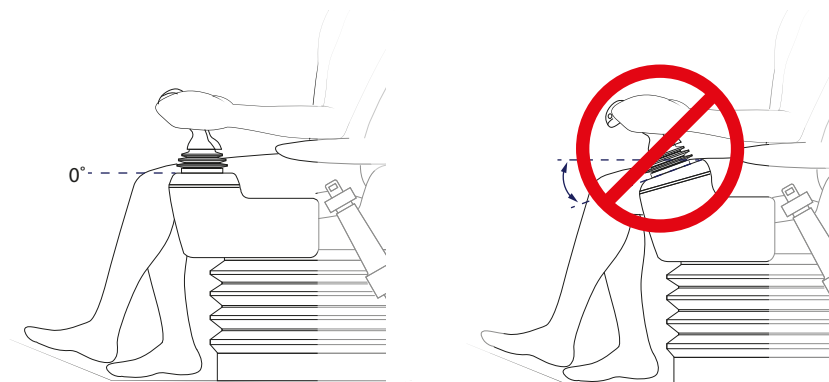
Image E

For smaller operators, closer is better, because the extra width causes reach envelope to expand and outward angle presents weaker arm strength issues. For larger operators, width is needed for legs.

Mounting

Mounting base plane

JS7000 joystick ergonomic design has taken into account forward angle of grip. Do not use vendor supplied side consoles that have forward angle to mounting surface for use with generic, straighter joysticks, see Image C.
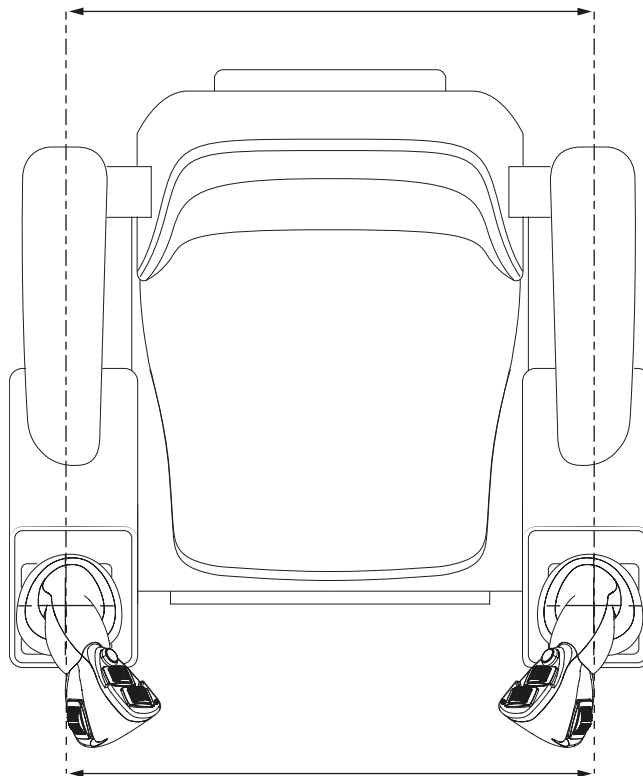
Image C

Mounting

Grip position

The JS7000 has optional grip positions to allow operators to vary hand position to reduce fatigue. Consider seats with adjustable arrests to adjust for optional low handgrip positions, see Image F.

Image F
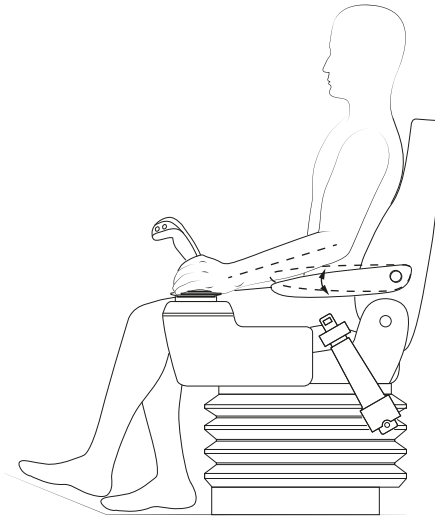
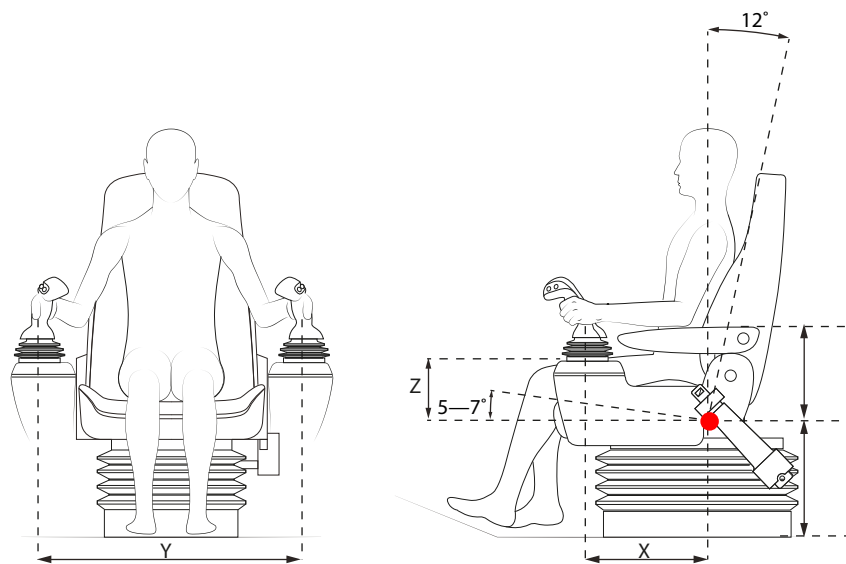Joystick axis roughly centered on armrests centerline in top view, see Image G.

Image G

Mounting

Joystick and operator position

Seating reference point (SRP) is the relative location of the seated operator's hip point.

Large operator, SRP shown in red
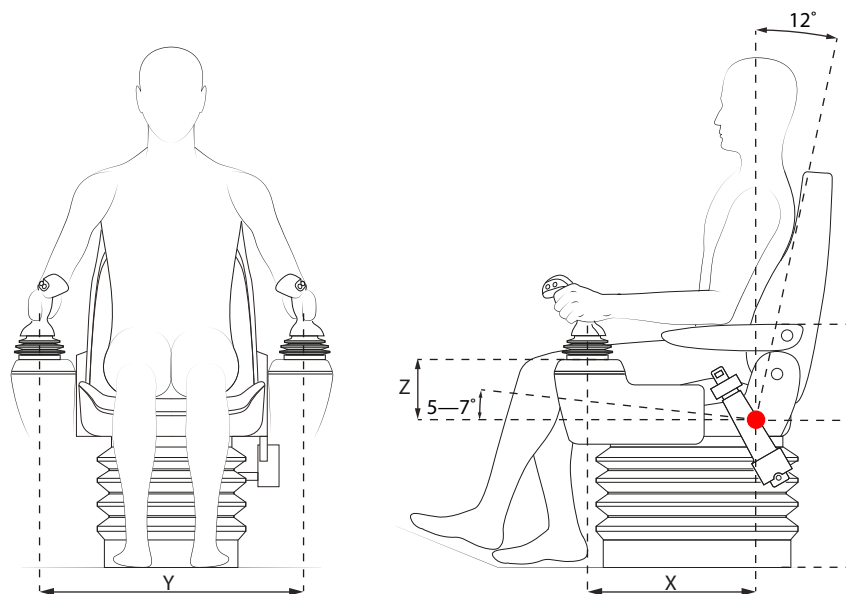
Small operator, SRP shown in red

Adjustment range of seat

Operator	X	Y	Z	Seat height
Large	457 to 483 mm (18 to 19 in)	622 to 660 mm (24.5 to 26 in)	121 mm (4.75 in)	432 mm (17 in)
Small	330 to 356 mm (13 to 14 in)	682 mm (24.5 in)	121 mm (4.75 in)	330 mm (13 in)

Armrest height is approximately 216 mm (8.5 in) for all operators and should be adjustable.

Adjust range of seat in relation to control pod to accommodate approximately 127 mm (5 in) of travel to achieve the range of fit for control reach.

Specifications

Base electrical and environmental specifications

Electrical

| Sensor type	Hall Effect with redundant sensors	
Resolution	Infinite	
Supply voltage	Analog	5 ± 0.5 Vdc
	CAN with redundant analog outputs	9 to 60 Vdc
	CAN+	9 to 60 Vdc
Output	Analog	0.5 to 4.5 Vdc
	Minimum voltage	10% ± 4% Vs
	Center voltage	50% ± 2% Vs
	Maximum voltage	90% ± 4% Vs
	CAN	2.0 B, J1939 and CANopen protocols
	CAN+	2.0 B, J1939
Base maximum current consumption	Analog	45 mA
	CAN	120 mA at 9 V
	CAN+	100 mA at 9 V (without LEDs or sensor power)
Base maximum survival supply voltage	Analog	30 Vdc
	CAN	68 Vdc
	CAN+	68 Vdc

Environmental

Operating temperature	-40° C to 85° C (-40° F to 185° F)	
Storage temperature	-55° C to 85° C (-67° F to 185° F)	
EMI/RFI rating	150 V/m	
Random vibration	Level 2	7.67 Grms
Shock	Level 1	50 g 11 ms
Bump	Level 2	40 g 6 ms
Ingress Protection (IP) rating	IP 66 and 67 above and below panel	

Specifications

Base mechanical specifications

Lever mechanical angle	± 20°
	± 25°
Lever operating torque	Medium: 0.6 to 3.2 Nm over ±20˚ of travel
	Heavy: 1.1 to 4.2 Nm over ±20˚ of travel
Operating life (on each axis)	> 15 million cycles
Weight (base without grip)	725 G (1.8 lb)
Horizontal load maximum (125 mm from the pivot)	1335 N (300 lbs)
Vertical load maximum	6000 N (1350 lbs)

Standard versus heavy spring torque
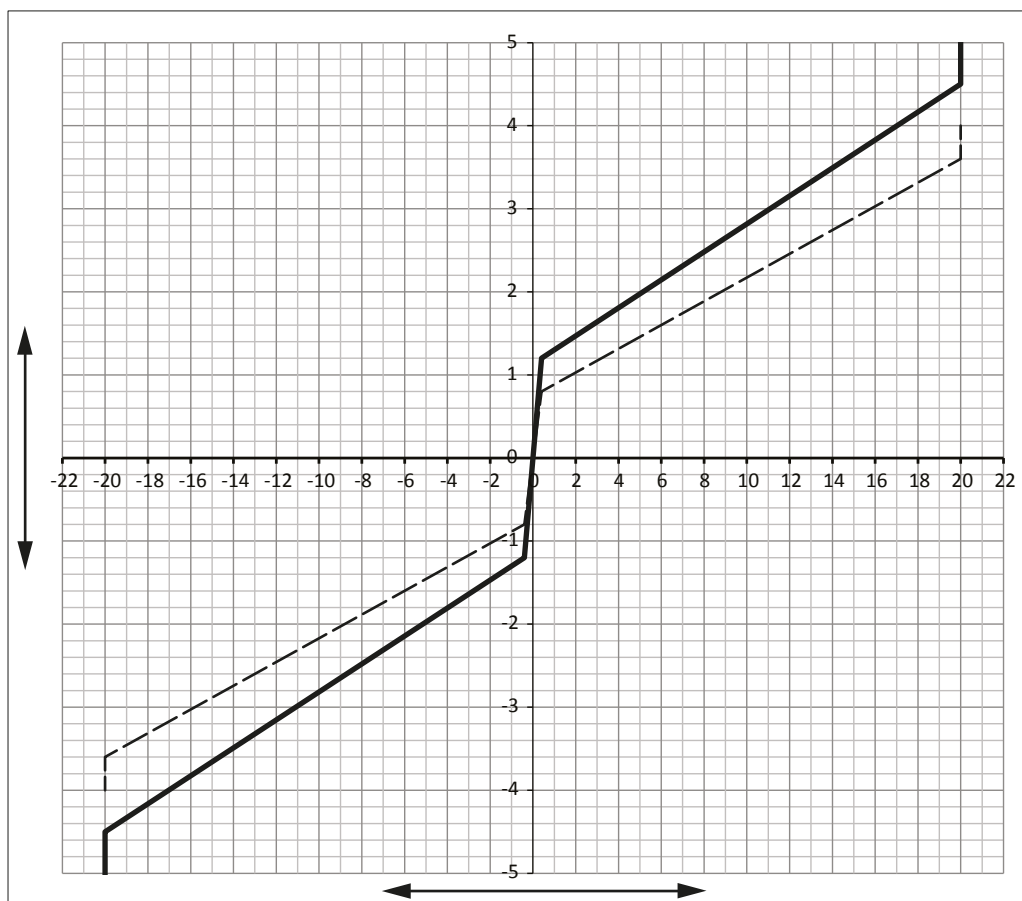
P200104

Vertical arrowheads:	Torque (Nm)
Horizontal arrowheads:	Angle (degrees)
Solid line:	Heavy spring
Dashed line:	Standard spring

Specifications

Grip trigger and push button

Action	Momentary	
Type	Single pole, NO	
Contact rating: Trigger	A at 50 Vdc	
Contact rating: Push-button	A at 50 Vdc	
Contact resistance	Ω maximum	
Push-button with LED rating	A at 5 Vdc	Intensity: 800 mcd
Mechanical life	3 million cycles	
Ingress protection (IP) rating	IP 66 and IP 67	
Operating temperature	-40° C to 85° C (-40° F to 185° F)	

Grip proportional roller

Proportional roller
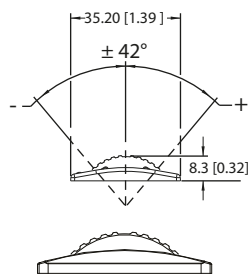
Proportional roller with redundant output mechanical travel
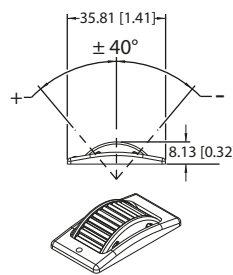
Use proportional rollers only in closed cabin applications.

Proportional roller

| Action	Proportional spring return to center± 42° mechanical travel
Sensing	Hall effect
CAN electrical output	± 0 to 1000 counts from center
Analog electrical output	0.5 to 4.5 Vdc (2.5 Vdc center)
Mechanical life	3 million cycles
Ingress protection (IP) rating	IP 43 in closed cab use only
Operating temperature	-40° C to 85° C (-40° F to 185° F)

Proportional roller with redundant output

Action	Proportional spring return to center ± 40° mechanical travel
Sensing	Hall effect
Minimum output impedance	4.7 K Ohms
CAN electrical output	± 0 to 1000 counts from center
Analog electrical output	0.5 to 4.5 Vdc (2.5 Vdc center)
Mechanical life	3 million cycles

Specifications

Proportional roller with redundant output (continued)

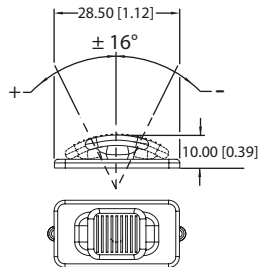| Ingress protection (IP) rating	IP 43 in cab use only
Operating temperature	-40° C to 85° C (-40° F to 185° F)
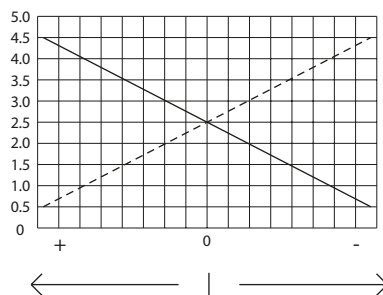
Proportional roller output

P200078

Volts:	0.5 to 4.5 Vdc
Solid line:	Output 1
Dashed line:	Output 2
Left arrow:	Direction 1 (+ travel)
Right arrow:	Direction 2 (- travel)

Specifications

Grip slider

Proportional slider and 3-position maintained slider mechanical travel

Proportional slider

| Action	Proportional spring return to center ± 16˚ mechanical travel
Sensing	Hall effect
Electrical output	
CAN	± 0 to 1000 counts from center
Analog	0.5 to 4.5 Vdc (2.5 Vdc center)
Mechanical life	1 million cycles
Ingress protection (IP) rating	IP 66
Operating temperature	-40° C to +85° C (-40° F to +185° F)

3-position maintained slider

Action	Proportional 3-position (FNR) ± 16˚ mechanical travel
Sensing	Hall effect
Electrical output	
CAN	± 0 to 1000 counts from center
Analog	0.5 to 4.5 Vdc (2.5 Vdc center)
Mechanical life	1 million cycles
Ingress protection (IP) rating	IP 66
Operating temperature	-40° C to +85° C (-40° F to +185° F)

Specifications

Grip rocker switch

Rocker switch
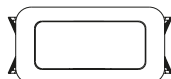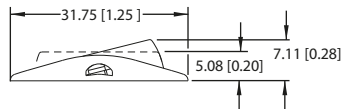
2-position maintained rocker

Action	2-position maintained
Digital electrical output	0.0 Vdc or 5.0 Vdc, two outputs
Mechanical life	100K cycles
Ingress protection (IP) rating	IP 68
Operating temperature	-40° C to 85° C (-40° F to 185° F)

3-position maintained rocker

Action	3-position maintained
Digital electrical output	0.0 Vdc or 5.0 Vdc, two outputs (0.0 Vdc center)
Mechanical life	100K cycles
Ingress protection (IP) rating	IP 68
Operating temperature	-40° C to 70° C (-40° F to 158° F)

3-position momentary rocker

Action	3-position momentary
Digital electrical output	0.0 or 5.0 Vdc, two outputs (0.0 Vdc center)
Mechanical life	100K cycles
Ingress protection (IP) rating	IP 68
Operating temperature	-40° C to 70° C (-40° F to 158° F)

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