HS2 MULTI-AXIS JOYSTICK

Designed for the most demanding applications, the HS2 multi-axis joystick offers durability and performance in a robust package. Available with Hall-Effect, CAN, ProfiBus, ProfiNet & 4-20mA outputs, the HS2 can be configured to a broad range of applications.

**FEATURES & OPTIONS**

- Single or dual axis operation
- Spring return action with open or cross grate
- Metal body and components for maximum durability
- Contactless 3D hall-effect technology
- Sleek design with optional canister on bottom (HS2G)
- Drop-in or panel mounting for easy installation

**OUTPUT OPTIONS**

- Hall-Effect (Redundant)
- CANOpen*
- J1939*
- ProfiBus-DP*
- ProfiNet*
- 4-20mA*  
  *Canister required (HS2G model)

**DESIGNED AROUND DURABILITY**

Boasts a metal housing and stainless steel components that offer mechanical robustness and reliability. Ideal for rugged applications.

**LONG LIFE TECHNOLOGY**

3D hall-effect technology designed to provide a long operating life. Contactless design prevents wear and tear that is typical to industrial joysticks.
HS2 HANDLE OPTIONS

- Thumbwheels
- Rocker switches
- Push buttons
- Triggers*
- Operator Presence Switch*
- Twist Function**

*Exclusive to G58 & FG4
**Exclusive to FG4 & MG13
Other restrictions apply
## HS2 Dimensions & Mounting

<table>
<thead>
<tr>
<th></th>
<th>Drop-in Mounting</th>
<th>Panel Mounting</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A - Depth (No Canister)</strong>*</td>
<td>2 in [51 mm]</td>
<td>2.75 in [70 mm]</td>
</tr>
<tr>
<td><strong>B - Depth with Canister (HS2G)</strong>*</td>
<td>Hall-Effect: 2.55 in [65 mm] CAN: 2.55 in [65 mm] 4-20mA: 2.55 in [65 mm] ProfiBus: 3.35 in [85 mm] ProfiNet: 3.6 in [92 mm]</td>
<td>Hall-Effect: 2.75 in [70 mm] CAN: 3.94 in [100 mm] 4-20mA: 3.94 in [100 mm] ProfiBus: 4.75 in [120 mm] ProfiNet: 4.75 in [120 mm]</td>
</tr>
<tr>
<td><strong>C - Diameter (No Canister)</strong></td>
<td>Hall-Effect: 2.55 in [65 mm]</td>
<td>Hall-Effect: 2.55 in [65 mm]</td>
</tr>
<tr>
<td><strong>C - Diameter with Canister (HS2G)</strong></td>
<td>Hall-Effect: 3.15 in [80 mm] CAN: 3.15 in [80 mm] 4-20mA: 3.15 in [80 mm] ProfiBus: 3.15 in [80 mm] ProfiNet: 3.55 in [90 mm]</td>
<td>Hall-Effect: 3.15 in [80 mm] CAN: 3.15 in [80 mm] 4-20mA: 3.15 in [80 mm] ProfiBus: 3.15 in [80 mm] ProfiNet: 3.55 in [90 mm]</td>
</tr>
<tr>
<td><strong>D - Mounting Flange</strong></td>
<td>4.5 x 4.5 in [114 x 114 mm]</td>
<td>3.05 x 3.05 in [77 x 77 mm]</td>
</tr>
<tr>
<td><strong>E - Mounting Hole</strong></td>
<td>Ø 3.6 in [92 mm]</td>
<td>Ø 1.73 in [44 mm]</td>
</tr>
<tr>
<td><strong>F - Screw Hole</strong></td>
<td>Ø 0.26 in [6.5 mm]</td>
<td>Ø 0.18 in [4.6 mm]</td>
</tr>
<tr>
<td><strong>G - Hole Distance</strong></td>
<td>Ø 3.01 in [76.5 mm]</td>
<td>Ø 2.3 in [58 mm]</td>
</tr>
</tbody>
</table>

*Additional space required on bottom of joystick for cable outlet/D-Sub.
HS2 SPECIFICATIONS

General

Mechanical Life
5 million life cycles

Handle Travel
±20 degrees

Shaft
0.50 in [12mm] diameter
Fits up to 16 wires for handle devices

Impact Force in A-B & C-D Direction
Max. 75 Nm (max. 400 N at 1.5 in [37.5 mm] distance from pivot point)

Impact Force in Z-Direction
± 300 N (compression and tensile loading)

Environmental

Mechanical Operating Temperature
-40° to +176° F [-40° to +80° C]

Electronic Operating Temperature
-40° to +158° F [-40° to +70° C]

Storage Temperature
-58° to +194° F [-50° to +90° C]

IP Rating
IP65

UL94 Flame Classification
HB

Electrical (Hall-Effect)

Sensor Type
Fully redundant dual-die 3D-hall

Resolution
8-Bit (at 20° lever deflection)

Linearity
Max. +3% rel. linearity

Interfering Magnetic Fields
EN61000-4-8 Level 5

Operating Voltage U_B
5 VDC ± 0.5

Current Consumption:
< 20 mA

Load Consumption
> 10 kΩ

Output Signal
A1 (Standard): 0.5 to 4.5 V Ratiometric
Redundant, Same Direction
Middle Position: 2.5 V ± 0.1 V

A2 (Optional): 0.5 to 4.5 V Ratiometric
Redundant, Inverse

<table>
<thead>
<tr>
<th>Description</th>
<th>Pin</th>
<th>Wire Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Voltage 1</td>
<td>1</td>
<td>Red</td>
</tr>
<tr>
<td>GND 1</td>
<td>2</td>
<td>Brown</td>
</tr>
<tr>
<td>Signal S1, A-B axis</td>
<td>3</td>
<td>Blue</td>
</tr>
<tr>
<td>Signal S1, C-D axis</td>
<td>7</td>
<td>Green</td>
</tr>
<tr>
<td>Supply Voltage 2</td>
<td>5</td>
<td>Orange</td>
</tr>
<tr>
<td>GND 2</td>
<td>6</td>
<td>Black</td>
</tr>
<tr>
<td>Signal S2, A-B axis</td>
<td>4</td>
<td>Violet</td>
</tr>
<tr>
<td>Signal S2, C-D axis</td>
<td>8</td>
<td>Yellow</td>
</tr>
</tbody>
</table>

Standard Output (A1) Example
Redundant, Same Direction

Optional Output (A2) Example
Redundant, Inverse

General Environmental

Electrical (Hall-Effect)
CAN SPECIFICATIONS

**Electrical Details**

Supply Voltage (Vcc)
9 to 36 Volts DC

Absolute Maximum
36 Volts

Supply Current
60 - 100 mA (typ.) 200 mA (max.)

Supply Input
Reverse Polarity Protected

Analog / Digital Inputs
-0.5 mA (10K resistor, 5V source)

Maximum Baud Rate
1Mbps (250kbps default)

**Environmental**

Operating Temperature
-40° to +140°F [-40° to +60°C]

Storage Temperature
-40° to +176°F [-40° to +80°C]

Sealing
Silicone conformal coating

**Diagnostics**

Diagnostic LEDs
One (1) Power LED and One (1) Status LED

Normal Operation
Power LED lit indicates 5V power
Status LED blink once per second

Error
Status LED will blink ten times per second

**Connection**

Connector
Standard 22 AWG harness 18" with Deutsch DTM04-6P connector
Other connectors available upon request

**J1939**

Generic Interface
SAE J1939 71 Standard for joystick
Source Addresses: 0x01 - 0xFE or custom on demand
Priority: 3

Basic Joystick Message 1 (BJM1)
Base PGN: 0xFDD6
X - 3D Hall Analog
Y - 3D Hall Analog

Extended Joystick Message 1 (EJM1)
Base PGN: 0xFDD7
3 Analog Inputs (Thumbwheels)

Lamp Command
4 low-power outputs

Inputs / Outputs
Standard 2 analog joystick inputs (X/Y)
Up to 14 digital inputs
Up to 4 digital outputs*
Up to 6 additional analog inputs*
* Replacing digital inputs

**CANopen**

CANopen Device Profile
DS301, DS401, V3.0 6/08

Terminal Resistance
120R Removable

Basic messaging
X - 3D Hall Analog
Y - 3D Hall Analog
8 Digital Inputs

Extended messaging
8 Analog Inputs

Lamp command
4 low-power outputs

Inputs / Outputs
Standard 2 analog joystick inputs (X/Y)
Up to 14 digital inputs
Up to 4 digital outputs*
Up to 8 additional analog inputs*
* Replacing digital inputs

**Network Management**

Auto start enabled

**Supplies Voltage (Vcc)**

9 to 36 Volts DC

**Absolute Maximum**

36 Volts

**Supply Current**

60 - 100 mA (typ.) 200 mA (max.)

**Supply Input**

Reverse Polarity Protected

**Analog / Digital Inputs**

-0.5 mA (10K resistor, 5V source)

**Maximum Baud Rate**

1Mbps (250kbps default)

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Silicone conformal coating

**Diagnostic LEDs**

One (1) Power LED and One (1) Status LED

**Normal Operation**

Power LED lit indicates 5V power
Status LED blink once per second

**Error**

Status LED will blink ten times per second

**Connector**

Standard 22 AWG harness 18” with Deutsch DTM04-6P connector
Other connectors available upon request

**Node ID**

0x01- 0x7F

**Axis & Digital Inputs**

181h (180h + Node ID)

**Analog Inputs**

281h (280h + Node ID)

**Digital Outputs**

201h (200h + Node ID)

**Heartbeat (500ms):**

720h (700h + Node ID)

**Analog Resolution**

8-bit

**Auto start enabled**
**PROFIBUS-DP (ESS094A) SPECIFICATIONS**

**Supply Voltage**
- Operating Voltage $U_B$
  - 10 to 30 VDC
- Max. Operational Voltage
  - 36 V (short circuit protection not granted)
- Max. Ripple Band
  - 10%
**Current Input**
- $U_B = 12 V$: $|< 110 mA$
- $U_B = 24 V$: $|< 60 mA$

**ProfiBus Interface**
- Feature
  - IEC 61158, IEC 61784
- Max. Baud Rate
  - 12 MBaud, automatically deleted
- PNO-Ident No
  - AAAB
- GSD-File
  - TROAAAAB.GSD
- Address
  - Adjustable from 3 to 99
**Transmission**
- RS485
**Termination**
- ohne

**Inputs / Outputs**

**Analog Inputs**
- 4 analog inputs for potentiometer wiper
- 4 analog inputs for center tap pot
- 4x2 digital inputs for direction contacts

**Digital Inputs**
- 16 digital inputs for switches in handle

**Digital Outputs**
- 8 digital outputs for LEDs (5V, 10 mA)
- 4 analog inputs for center tap pot
- 4x2 digital inputs for direction contacts

**Environmental**

**EMC Requirements**
- Spurion radiation according to DIN EN61000-6-3:2007
- Interference rejection according to DIN EN61000-6-2:2006

**Operating Tempature**
- -31° to +158° F [-35° to +70° C]

**Storage Tempature**
- -40° to +176° F [-40° to +80° C]

**Relative Humidity**
- 98% no condensation

**Connection**

**Connector**
- D-sub Plug
  - 9 pin

**Error Messages**

<table>
<thead>
<tr>
<th>LED</th>
<th>Status</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>Off</td>
<td>No Operation</td>
</tr>
<tr>
<td></td>
<td>Fast Blinking</td>
<td>Check Parameters</td>
</tr>
<tr>
<td></td>
<td>Continuous On</td>
<td>Ready for Operation</td>
</tr>
<tr>
<td>Red</td>
<td>Off</td>
<td>No Failure, Bus in Cycle</td>
</tr>
<tr>
<td></td>
<td>Blinking</td>
<td>No Connection to Bus</td>
</tr>
<tr>
<td></td>
<td>Continuous On</td>
<td>Failure</td>
</tr>
</tbody>
</table>

**Data**

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<tr>
<th>Bit</th>
<th>Function</th>
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<tr>
<td>15</td>
<td>8-bit-analog data</td>
</tr>
<tr>
<td>14</td>
<td>10-bit-analog data</td>
</tr>
<tr>
<td>13</td>
<td>Lo-limit-analog value</td>
</tr>
<tr>
<td>12</td>
<td>Hi-limit-analog value</td>
</tr>
<tr>
<td>11</td>
<td>Wire failure</td>
</tr>
<tr>
<td>10</td>
<td>Preswitch set</td>
</tr>
<tr>
<td>9</td>
<td>Revert switch set</td>
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**Digital Inputs**

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<td>Revert switch set</td>
</tr>
<tr>
<td>8</td>
<td>Input</td>
</tr>
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PROFINET (ESS132) SPECIFICATIONS

Supply Voltage
Operating Voltage $U_b$
12 to 28 V, non-bounce protection
Max. Operational Voltage
30 V (short circuit protection not granted)
Max. Ripple Band
10%
Current Input
$U_b = 12\text{V} : |< 110 \text{mA}$
$U_b = 24\text{V} : |< 60 \text{mA}$

Inputs / Outputs

Inputs for Conversion of Lever Deflection in A-B Axis (X)
1x analog input for potentiometer wiper (resolution max. 12 bits)
2x digital input for directions (ground switched, internal pull-up resistors)
1x analog input for controlling wire failure of center taps
Connection suitable for micro-match-plug

Inputs for Conversion of Lever Deflection in C-D Axis (Y)
1x analog input for potentiometer wiper (resolution max. 12 bits)
2x digital input for directions (ground switched, internal pull-up resistors)
1x analog input for controlling wire failure of center taps
Connection suitable for micro-match-plug

Digital Inputs for Internal Devices
8x digital input for push buttons (ground switched, internal pull-up resistors)
Connection suitable for Molex plug-case, 12 pole with crimp-contacts

Digital Outputs for Internal Devices
8x digital TTL-output 5 VDC (max. 10 mA)
Connection suitable for Molex plug-case, 12 pole with crimp-contacts

Environmental
Operating Temperature
-4° to +176° F [-20° to +80° C]
Storage Temperature
-40° to +176° F [-40° to +80° C]
Relative Humidity
98% no condensation
EMV Requirements
Spurious radiation acc. to
DIN EN61000-6-3: 2007 and
DIN EN61000-6-2: 2006

Profinet IO
Feature
IEC 61158, IEC 61784
Profinet Specification
V2.2
Software Stack
V3.1
Conformance Class
Conformance class B
Physical Layer
Profinet 100Base-TX, fast ethernet,
ISO/IEC 8802-3
Output Code
Binary

Cycle Time
$\geq 1$ ms (RT/RT)
Transfer Rate
100 MBit/s, CAT-5 cable shielded (STIP),
ISO/IEC11801
Address:
Per name (given by software), mapping of
name-MAC when booting
Integrated Switch
Yes
Real-time-class
RT class 1 frames (RT), RT class 2 frames
(RT), RT class 3 frames (IRT)

Support of
DCP, LLDP, SNMP
GSMDL-file
DSDLML-V2.2-SPOBU-master control-
ler-20110214.xml
Connection Port 1 / Port 2
Bus-plug M12, 4-pole, female D-coded
Bus Status Display
Each port 2 LED
4-20 mA (ESS149) SPECIFICATIONS

**Electrical**

**Current Output**
4 to 12 to 20 mA

**Voltage Range**
12 to 30 VDC

**Current Consumption**
< 300 mA

**Power on Rise Time**
< 30 ms

**Environmental**

**Operating Temperature**
-13° to +158° F [-25° to +70° C]

**Storage Temperature**
-67° to +212° F [-55° to +100° C]

**EMC Emission**
DIN EN 61000-6-3 (VDE 0839-6-3) /

**EMC Immunity**
DIN EN 61000-6-2 (VDE 0839-6-2) /
03.2006 - EN 61000-6-2:2005

**Connection**

**Connector**
15 pin D-Sub connector

<table>
<thead>
<tr>
<th>Pin</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+24 VDC</td>
</tr>
<tr>
<td>2</td>
<td>0 V GND</td>
</tr>
<tr>
<td>3</td>
<td>Direction Signal Right</td>
</tr>
<tr>
<td>4</td>
<td>Direction Signal Left</td>
</tr>
<tr>
<td>5</td>
<td>Direction Signal Forward</td>
</tr>
<tr>
<td>6</td>
<td>Direction Signal Backward</td>
</tr>
<tr>
<td>7</td>
<td>Current Signal X-Axis</td>
</tr>
<tr>
<td>8</td>
<td>Current Signal Y-Axis</td>
</tr>
<tr>
<td>9</td>
<td>Relay Output 0-Position</td>
</tr>
<tr>
<td>10</td>
<td>Relay Output 0-Position</td>
</tr>
<tr>
<td>11</td>
<td>N.C.</td>
</tr>
<tr>
<td>12</td>
<td>N.C.</td>
</tr>
<tr>
<td>13</td>
<td>For Internal Use</td>
</tr>
<tr>
<td>14</td>
<td>For Internal Use</td>
</tr>
<tr>
<td>15</td>
<td>For Internal Use</td>
</tr>
</tbody>
</table>