Electrical Joystick Controllers
for mobile hydraulics
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</table>
1 Joystick, FSE-DP2-02/JG0-M4-02

1.1 Description

This rugged joystick has been designed for professional use in off-road, construction, agricultural and forestry machines as well as industrial materials-handling trucks. The electronics, which directly control two proportional directional valves by means of PWM, are fully integrated into the joystick.

- Fully on-board electronics
- Direct control of two proportional directional valves and two seat valves
- Four toggle switches and one rocker switch for operating on/off directional valves
- USB interface for configuring the joystick
- Minimal installation space is needed
- Reliable zero position
- Hall-sensor technology

1.1.1 Technical data

<table>
<thead>
<tr>
<th>Description</th>
<th>Min</th>
<th>Typ.</th>
<th>Max</th>
<th>Unit</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical power supply</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supply voltage</td>
<td>8</td>
<td>-</td>
<td>30</td>
<td>V DC</td>
<td>Reverse-polarity and overvoltage protection up to +/- 48 VDC</td>
</tr>
<tr>
<td>Current consumption (standby)</td>
<td>-</td>
<td>20</td>
<td>-</td>
<td>mA</td>
<td></td>
</tr>
<tr>
<td>Current consumption (max.)</td>
<td>-</td>
<td>10</td>
<td>-</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>PWM output</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voltage, power output</td>
<td>Vcc</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current, power output</td>
<td>0.3</td>
<td>-</td>
<td>2.5</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Dither frequency</td>
<td>33</td>
<td>200</td>
<td>400</td>
<td>Hz</td>
<td></td>
</tr>
<tr>
<td>Ramp time</td>
<td>10</td>
<td>100</td>
<td>9999</td>
<td>ms</td>
<td></td>
</tr>
<tr>
<td>Deadband setting</td>
<td>10</td>
<td>10</td>
<td>40</td>
<td>%</td>
<td>Defines the deflection range beyond which the outputs are switched on</td>
</tr>
<tr>
<td>Auxiliary output</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voltage, auxiliary output</td>
<td>Vcc</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current, auxiliary output</td>
<td>-</td>
<td>-</td>
<td>2.5</td>
<td>A</td>
<td>For deflection in positive or negative X direction -&gt; Vaux = Vcc</td>
</tr>
<tr>
<td>Delay, auxiliary output</td>
<td>0</td>
<td>0</td>
<td>9</td>
<td>sec</td>
<td></td>
</tr>
<tr>
<td>Toggle switch and rocker switch outputs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Switching current</td>
<td>5</td>
<td>-</td>
<td>A</td>
<td></td>
<td>If the rocker switch and the toggle switches on the keypad are used to directly control solenoids or relays, make sure that the solenoids or relays are equipped with suppression diodes.</td>
</tr>
<tr>
<td>max. switching operations, mech.</td>
<td>10</td>
<td>m</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>max. switching operations, elec.</td>
<td>2.5</td>
<td>m</td>
<td>@ 0.5 A DC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General characteristics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plug connection</td>
<td>Sub-D 15-pin</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protection class</td>
<td>IP 65</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating temperature</td>
<td>-40</td>
<td>-</td>
<td>+80</td>
<td>°C</td>
<td></td>
</tr>
</tbody>
</table>
1.1.2 Dimensions

Mounting dimensions

1.2 Ordering code

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Ordering code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Style with multi-function grip, 4 front buttons, 1 rear button</td>
<td>FSE-DP2-02/JG0-M4-02</td>
<td>100034394</td>
</tr>
</tbody>
</table>

1.2.1 Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Ordering code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installation kit consisting of configuration cable and software CD</td>
<td>FSE-DP2 INSTALLATIONSKIT</td>
<td>100034672</td>
</tr>
<tr>
<td>Serial connection cable (on request)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1.3 Connection diagram

Connection diagram showing power supply, FSE-DP2 Sub-D socket, seat valves, directional valves, and ground connections.
1.4 Pin assignment

1.4.1 Plug A (male) - switch functions

<table>
<thead>
<tr>
<th>Pin</th>
<th>Function</th>
<th>Wire colour</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Common switch connection</td>
<td>red</td>
<td>Common connection for all switches. The total current must not exceed 5 A.</td>
</tr>
<tr>
<td>2</td>
<td>Trigger switch</td>
<td>orange</td>
<td>Trigger switch, front (max. 5 A)</td>
</tr>
<tr>
<td>3</td>
<td>Switch 1</td>
<td>green</td>
<td>Switch 1 (max. 5 A) (switch, top left)</td>
</tr>
<tr>
<td>4</td>
<td>NC</td>
<td>violet</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>NC</td>
<td>black</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>Switch 3</td>
<td>brown</td>
<td>Switch 3 (max. 5 A) (switch, bottom left)</td>
</tr>
<tr>
<td>7</td>
<td>NC</td>
<td>yellow</td>
<td>-</td>
</tr>
<tr>
<td>8</td>
<td>Switch 2</td>
<td>blue</td>
<td>Switch 2 (max. 5 A) (switch, top right)</td>
</tr>
<tr>
<td>9</td>
<td>NC</td>
<td>grey</td>
<td>-</td>
</tr>
<tr>
<td>10</td>
<td>Switch 4</td>
<td>white</td>
<td>Switch 4 (max. 5 A) (switch, bottom right)</td>
</tr>
<tr>
<td>11</td>
<td>NC</td>
<td>green/white</td>
<td>-</td>
</tr>
<tr>
<td>12</td>
<td>NC</td>
<td>pink</td>
<td>-</td>
</tr>
<tr>
<td>13</td>
<td>NC</td>
<td>brown/white</td>
<td>-</td>
</tr>
<tr>
<td>14</td>
<td>NC</td>
<td>black/white</td>
<td>-</td>
</tr>
<tr>
<td>15</td>
<td>NC</td>
<td>red/white</td>
<td>-</td>
</tr>
</tbody>
</table>

Note. If the rocker switch and the toggle switches on the keypad are used to directly control solenoids or relays, make sure that the solenoids or relays are equipped with suppression diodes.
1.4.2 Socket B (female) - joystick functions

<table>
<thead>
<tr>
<th>Pin</th>
<th>Function</th>
<th>Wire colour</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+12/24 V (Sensor 1)</td>
<td>red</td>
<td>Power supply 12 V or 24 V</td>
</tr>
<tr>
<td>2</td>
<td>+12/24 V (sensor 2 unused)</td>
<td>green</td>
<td>Unused</td>
</tr>
<tr>
<td>3</td>
<td>Ground (sensor 1)</td>
<td>green/white</td>
<td>Ground</td>
</tr>
<tr>
<td>4</td>
<td>Ground (sensor 2 unused)</td>
<td>black</td>
<td>Unused</td>
</tr>
<tr>
<td>5</td>
<td>NC</td>
<td>white</td>
<td>Unused</td>
</tr>
<tr>
<td>6</td>
<td>X Axis Aux Out</td>
<td>violet</td>
<td>Auxiliary output, X axis</td>
</tr>
<tr>
<td>7</td>
<td>USB-PWR</td>
<td>brown</td>
<td>USB power supply (only needed for parameterisation)</td>
</tr>
<tr>
<td>8</td>
<td>USB-D+</td>
<td>brown/white</td>
<td>USB data line, positive (only needed for parameterisation)</td>
</tr>
<tr>
<td>9</td>
<td>USB-D-</td>
<td>pink</td>
<td>USB data line, negative (only needed for parameterisation)</td>
</tr>
<tr>
<td>10</td>
<td>Y-Axis Aux Out</td>
<td>blue</td>
<td>Auxiliary output, Y axis</td>
</tr>
<tr>
<td>11</td>
<td>X-Axis Out+</td>
<td>orange</td>
<td>Solenoid 1 for the X axis (max. 2.5 A)</td>
</tr>
<tr>
<td>12</td>
<td>X-Axis Out-</td>
<td>yellow</td>
<td>Solenoid 2 for the X axis (max. 2.5 A)</td>
</tr>
<tr>
<td>13</td>
<td>Y-Axis Out+</td>
<td>black/white</td>
<td>Solenoid 1 for the Y axis (max. 2.5 A)</td>
</tr>
<tr>
<td>14</td>
<td>Y-Axis Out-</td>
<td>grey</td>
<td>Solenoid 2 for the Y axis (max. 2.5 A)</td>
</tr>
<tr>
<td>15</td>
<td>NC</td>
<td>red/white</td>
<td>Unused</td>
</tr>
</tbody>
</table>

1.5 Parameterisation

The joystick is parameterised via the USB port using the JDBUtility application. A configuration cable is available - Part No. 100034672 (FSE-DP2 installation kit). The JDBUtility application and a guide for configuring the joystick are included on the software CD in the installation kit, or can be obtained directly from Bucher Hydraulics.
2 Joysticks for CAN-Bus systems, FCE*-1A2T***/J6 CAN OPEN series

2.1 Description

The FCE*-1A2T***/J6 joystick is a CAN Bus-ready signal source for 2 axes. The operating principle is non-contacting with Hall technique.

- CAN Bus-ready signal source
- Compact and robust design
- Hall technique
- Reverse voltage protected

2.2 Technical data

<table>
<thead>
<tr>
<th>Description</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage</td>
<td>V DC</td>
<td>9 ... 36 (for V_N = 9 V)</td>
</tr>
<tr>
<td>Temperature range</td>
<td>° C</td>
<td>-25 ... +85</td>
</tr>
<tr>
<td>Enclosure protection</td>
<td>IP</td>
<td>IP 67</td>
</tr>
<tr>
<td>Weight</td>
<td>kg</td>
<td>1.2</td>
</tr>
<tr>
<td>Actuation angle</td>
<td>°</td>
<td>± 25°</td>
</tr>
<tr>
<td>Mid-position</td>
<td>°</td>
<td>± 2°</td>
</tr>
<tr>
<td>CAN protocol</td>
<td></td>
<td>CAN OPEN, 11 Bit Identifier</td>
</tr>
<tr>
<td>Electrical connections</td>
<td></td>
<td>300 mm (± 15 mm) cable; 4 Pin M12 Connector</td>
</tr>
</tbody>
</table>

2.3 Dimensions

2.4 Ordering code

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Ordering code</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAN Bus Joystick for 2 axes, no gate, 2 buttons and 1 analogue rocker switch as a third axis, right handed</td>
<td>FCER-<em>1A2T</em>**/J6 CAN OPEN</td>
<td>100031877</td>
</tr>
<tr>
<td>CAN Bus Joystick for 2 axes, no gate, 2 buttons and 1 analogue rocker switch as a third axis, left handed</td>
<td>FCEL-<em>1A2T</em>**/J6 CAN OPEN</td>
<td>100035992</td>
</tr>
</tbody>
</table>
3 Joysticks for CAN Bus systems, FCE*-2A5T***/J5 CAN OPEN

3.1 Description

The FCE*-2A5T***/J5 joystick is a CAN Bus-ready signal source for 4 axes. It is compact and robust. The handgrip is spring-centred. Within its temperature range, the joystick is temperature-compensated.

- Hall technique
- Compact and robust design
- Reverse voltage protected

3.2 Technical data

<table>
<thead>
<tr>
<th>Description</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage</td>
<td>V DC</td>
<td>9 ... 36 (for (V_N = 9) V)</td>
</tr>
<tr>
<td>Temperature range</td>
<td>°C</td>
<td>-25 ... +85</td>
</tr>
<tr>
<td>Enclosure protection</td>
<td>IP</td>
<td>IP 67</td>
</tr>
<tr>
<td>Weight</td>
<td>kg</td>
<td>2</td>
</tr>
<tr>
<td>Actuation angle</td>
<td>°</td>
<td>± 20°</td>
</tr>
<tr>
<td>Mid-position</td>
<td>°</td>
<td>± 2°</td>
</tr>
<tr>
<td>CAN protocol</td>
<td></td>
<td>CAN OPEN, 11 Bit Identifier</td>
</tr>
<tr>
<td>Electrical connections</td>
<td></td>
<td>300 mm (± 15 mm) cable; 4-Pin M12 Connector</td>
</tr>
</tbody>
</table>

3.3 Dimensions

3.4 Ordering code

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Ordering code</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAN Bus Joystick for 4 axes, no gate, 2 analogue rocker switches as a third and a fourth axis.</td>
<td>FCE*-2A5T*** /J5 CAN OPEN</td>
<td>100031878</td>
</tr>
</tbody>
</table>
4 Joysticks for CAN Bus systems, FCE*-T5A1G**/JS3

4.1 Description
The FCE*-T5A1G**/JS3 joystick is a CAN Bus-ready signal source for 3 axes. It is compact and robust. The handgrip is spring-centred.

- Hall technique
- Compact and robust design
- Reverse voltage protected

4.2 Technical data

<table>
<thead>
<tr>
<th>Description</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage</td>
<td>V DC</td>
<td>8 ... 30 (for $V_N = 9, \text{V}$)</td>
</tr>
<tr>
<td>Temperature range</td>
<td>°C</td>
<td>-40 ... +85</td>
</tr>
<tr>
<td>Enclosure protection</td>
<td>IP</td>
<td>IP 65</td>
</tr>
<tr>
<td>Weight</td>
<td>kg</td>
<td>2</td>
</tr>
<tr>
<td>Actuation angle</td>
<td>°</td>
<td>± 20°</td>
</tr>
<tr>
<td>Mid-position</td>
<td>°</td>
<td>± 2° / +0.5°</td>
</tr>
<tr>
<td>CAN protocol</td>
<td></td>
<td>CAN OPEN, 11 Bit Identifier</td>
</tr>
<tr>
<td>Electrical connections</td>
<td></td>
<td>620 mm cable without connector (24 AWG, 0.25mm²)</td>
</tr>
</tbody>
</table>

4.3 Dimensions

4.4 Ordering code

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
<th>Ordering code</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAN Bus Joystick for 3 axes, no gate, right handed</td>
<td>FCER-T5A1G**-JS3</td>
<td>100030293</td>
</tr>
<tr>
<td>CAN Bus Joystick for 3 axes, no gate, left handed</td>
<td>FCEL-T5A1G**-JS3</td>
<td>100030294</td>
</tr>
</tbody>
</table>
5 CAN-Bus System Solution

5.1 The main components of a CAN Bus control system

The CAN-Bus system enables flexible processing of control- and sensor information; from this information it generates the electrical signals required to control the valves. The entire wiring requirement is reduced to a bus cable and a power supply line.

5.2 Advantages

- Increased system safety
- Lower wiring costs resulting from simple cable arrangements
- Greater ease of control
- Range and scopes of functions can be increased at a later date
- Diagnostic programmes
- Modular build simplifies component replacement

5.3 Applications

The CAN-Bus system solution is used to control electrical actuated valves in mobile hydraulic systems. Target applications areas include local authority vehicles, harvesting-, forestry- and construction machinery as well as systems for lifting/lowering and boom/mast positioning. In these applications, the positions and speeds (linear, rotary) of hydraulic actuators are controlled in open-and/or closed-loop mode.

With the advantages described, the CAN Bus system represents an optimum solution for application-specific drive requirements.

5.4 MasterModule ELMR 223

The ELMR223 master module is used as a controller in Bucher CAN bus systems. The module can have up to 24 power outputs and 16 inputs, some of which are configurable.

- programming to IEC 61131-3
- RS232 serial interface
- CAN-Bus (master) with CANopen protocol
- automatic, and program-controlled, data storage in flash EPROM

<table>
<thead>
<tr>
<th>Description</th>
<th>Ordering code</th>
<th>Data sheet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type ELMR223-00*** (without software)</td>
<td>100026514</td>
<td>100-P-700055</td>
</tr>
</tbody>
</table>

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Classification: 470.710.