Features
- True power-on system
- Straight line connector
- Output over CAN bus
- Various column mounting proposals

Non-Contacting Steering Angle Sensor Type 6002

Introduction

Bourns® Type 6002 Non-contacting Steering Angle Sensor is based on two magneto-resistive (AMR) sensor chips. Each of them converts an angle position of a permanent magnet into two analogue signals (one sine and one cosine signal). A highly efficient algorithm allows for estimating the absolute angular position of a drive shaft that is connected to the device.

Specifications

Angular Position
- Range: ±780 °
- Resolution: 0.1 ° (optional <0.1 °)
- Accuracy: ±2 °

Angular Speed
- Range: ±2000 °/s
- Resolution: 4 °/s

Data and Control Interface
- CAN 2.0A (Optional CAN 2.0B) 500 kbit/s
- Data Rate: 10 ms (optional 5 ms)
- OEM Specific CAN Handlers: Optional
- Zero Position: Adjustable at every position through CAN command
- Diagnostic and Error Handling: Via CAN bus
- Firmware Upgrade: Via CAN bus (Optional OBD programmable)

Power Supply
- Voltage Range: 8-18 V
- Current Consumption: 50 mA (no idle current required)
- Temperature Range: -40 °C to +85 °C

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Connector

Tyco-No. 1-1241370-3

The mating connector's pin layout is shown below:

<table>
<thead>
<tr>
<th>PIN NO.</th>
<th>SIGNAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CAN LOW</td>
</tr>
<tr>
<td>2</td>
<td>CAN LOW</td>
</tr>
<tr>
<td>3</td>
<td>CAN HIGH</td>
</tr>
<tr>
<td>4</td>
<td>CAN HIGH</td>
</tr>
<tr>
<td>5</td>
<td>12 V</td>
</tr>
<tr>
<td>6</td>
<td>GND</td>
</tr>
</tbody>
</table>

CAN Protocol

The device sends a CAN message with the measurement data every 10 msec. An example of a message layout is shown below. OEM-specific CAN handler is optional.

<table>
<thead>
<tr>
<th>CAN-ID Kind of Message</th>
<th>Byte</th>
<th>Bits</th>
<th>Signal Destination</th>
<th>Unit</th>
<th>Measure Range</th>
<th>Measure Range (Digit)</th>
<th>Offset</th>
<th>Resolution (Unit/Digit)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 x 280 transmit</td>
<td>0-1</td>
<td>00-15</td>
<td>Absolute angle position</td>
<td>Degree</td>
<td>-780...+780</td>
<td>57735...7800</td>
<td>0</td>
<td>0,1</td>
<td>Fault/not calibrated/ default: 0x7FFF</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>16-23</td>
<td>Angle speed</td>
<td>Degree/s</td>
<td>-2000...+2000</td>
<td>0...254</td>
<td>0</td>
<td>4</td>
<td>Fault default: 0xFF</td>
</tr>
<tr>
<td>3</td>
<td>24-27</td>
<td>Internal status:</td>
<td>Degree/s</td>
<td>0...3</td>
<td>0...3</td>
<td>0</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>111 = Calibrated and OK</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>101 = Not calibrated</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>110 = Fault</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>100 = Fault and not calibrated</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>000 = Not trimmed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>28-31</td>
<td>Free</td>
<td>0</td>
<td>0</td>
<td>Internal use only</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>32-35</td>
<td>Message counter</td>
<td>0...15</td>
<td>0...15</td>
<td>1</td>
<td>Should be incremented by each message</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>36-40</td>
<td>Check sum</td>
<td>0...15</td>
<td>0...15</td>
<td>1</td>
<td>Check sum: see below</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Absolute Angle Position:
- Signed (integer)
- Angle position [degree] = N · 0.1, for 0 < N ≤ 32767 (N - digital value of the message) = (N-65536) · 0.1, for N > 32767

Angle Speed:
- Unsigned (char)
- Rotation speed [degree/s] = S · 0.4

Specifications are subject to change without notice. Customers should verify actual device performance in their specific applications.
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CAN Protocol (Continued)

Rule to build the check sum:

\[ \text{Temp} \_ \text{result} = \text{lower byte} \]
\[ \text{(Angle position)} \coprod \text{higher byte} \]
\[ \text{(Angle position)} \coprod \text{XOR (Angle speed)} \]
\[ \text{XOR} \]
\[ \text{Internal status} \]
\[ \text{Check sum} = \text{higher nibble} \]
\[ \text{(Temp} \_ \text{result)} \coprod \text{XOR lower nibble} \]
\[ \text{(Temp} \_ \text{result)} \coprod \text{XOR (Message counter)} \]

An example of the message layout for a receive message is shown below.

### CAN Receive Message

<table>
<thead>
<tr>
<th>CAN-ID Kind of Message</th>
<th>Byte</th>
<th>Bits</th>
<th>Signal Destination</th>
<th>Unit</th>
<th>Measure Range</th>
<th>Measure Range (Digit)</th>
<th>Offset</th>
<th>Resolution (Unit/Digit)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>receive</td>
<td>0</td>
<td>0-3</td>
<td>Command word</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>4-7</td>
<td>SAS transmit identifier (SAS ID) bits 0-3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>8-14</td>
<td>SAS transmit identifier (SAS ID) bits 4-10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>15</td>
<td>Free</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Command Word (CW)**

<table>
<thead>
<tr>
<th>CW bit3</th>
<th>CW bit2</th>
<th>CW bit1</th>
<th>CW bit0</th>
<th>Instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>Set up the zero position</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>Clear the old zero position</td>
</tr>
</tbody>
</table>

Other combinations Only for internal use

**Note:**
To set up a new zero position, first it is necessary to delete the old zero position.

Automatic Self-Test

The device checks the angular speed value, which is limited to 1016 degrees per second. If this limit exceeded, the device sends an error message according to the CAN Transmit Message (page 1).

Design and Mechanical Interface

Housing - Device View

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Customers should verify actual device performance in their specific applications.
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Linearity Data

The first graph shows a typical linearity measurement curve taken at room temperature. The second graph shows the deviation (absolute non-linearity) over four turns of the steering wheel.

Output Code and Absolute Linearity

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