The Eaton GFX machine dynamics sensor. Intelligence in motion.

Global positioning (GPS), speed detection and 3-axis inertial measurement (IMU), NMEA 2000 (CANBus) and NMEA 0183 (RS232)

As off-highway machinery becomes smarter and more dynamic, the need to track vehicle performance and equipment usage is only growing. The Eaton GFX sensor provides the data required to monitor and control intelligent machine functions such as geopositioning and vehicle dynamic sensing. It also enables users to optimize operations such as seeding, harvesting and earthmoving.

The GFX machine dynamics sensor is a GPS position sensor, ground speed sensor and inertial measurement unit (IMU) in one compact device. With the ability to monitor machine speed, acceleration, direction, location, tilt, pitch and roll, the GFX device can help keep operators and their machinery safe and productive. The compact, three-in-one device saves space and reduces costs compared to single-function sensors, while the IP67 rating and wide operating temperature range ensure it can perform in rugged, off-highway environments. Through CANBus or serial output messaging, the GFX device delivers the data you need to enable intelligent machine functions.

Key features:
- IMU provides 3-axis: Linear acceleration, angular rate and magnetic field
- NMEA 2000 (CAN) and NMEA 0183 (RS232) output messaging
- Easy to install and use
- Wide operating temperature range (-40°C to 85°C)
- Compact and rugged package allows for flexible vehicle mounting
- Dustproof and waterproof design, suitable for open-cab environments
- Low current consumption (up to 120mA)
# Technical data

## Size
- 125mm x 43mm x H 22.25mm (Length x width x height)

## Weight
- 160 gram

## Mounting torque
- 1.8Nm ± 0.2Nm

## Mounting size
- 5.35mm hole
- 2 locations

## Color
- RAL 9005 Jet black
- Potted assembly

## Operating voltage & input current
- **Operating voltage**: 5VDC to 36VDC  
  Vehicle battery operated
- **Nominal voltage**: 12VDC and 24VDC
- **Input current**: Up to 120mA at full operating voltage range

## Digital speed output
- **Signal format**: PWM
- **Duty cycle**: 77%
- **PWM frequency**: 36Hz to 1.85KHz for 1kph to 50kph speed  
  Linearly varying
- **Signal amplitude**: Equal to supply input
- **Accuracy**: ±5%
- **Source impedance**: 100Ω ± 10Ω
- **Load impedance**: >3kΩ

**Note:**
1. Digital speed output is disabled at speed less than 1Kph.
2. When digital speed output is disabled, output will be equal to supply input (100% duty cycle).

**Caution:**
Pay attention to Digital Output Pin Wiring. This pin should not be short circuit with ground terminal.

## GPS specification
- **GPS L1 frequency**: 1575.42 MHz
- **Accuracy**: 4.77m CEP  
  Circular error probability (radius of a circle centred on the true value)
- **Acquisition time**
  - Hot start: 4 Sec
  - Warm start: 38 Sec
  - Cold start: 60 Sec
- **Sensitivity**
  - Tracking: -160dBm
  - Acquisition: -145dBm
- **GPS data update rate**: 5Hz
- **SBAS (WAAS, EGNOS) Capable**
Technical data

Electrical specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short circuit protection</td>
<td>Yes</td>
</tr>
<tr>
<td>Short condition: output to battery &amp; input to GND</td>
<td></td>
</tr>
<tr>
<td>CANH &amp; CANL pins: Up to 36V</td>
<td></td>
</tr>
<tr>
<td>TX &amp; RX pins: Up to 32V</td>
<td></td>
</tr>
<tr>
<td>Reverse polarity</td>
<td>Yes</td>
</tr>
<tr>
<td>Up to -36V</td>
<td></td>
</tr>
<tr>
<td>Hot plug</td>
<td>Yes</td>
</tr>
<tr>
<td>Live connection and disconnection to power supply</td>
<td></td>
</tr>
</tbody>
</table>

Connector

<table>
<thead>
<tr>
<th>Connector</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply and I/O connector</td>
<td>Deutsch DTM04-08PA Male type (8 pin)</td>
</tr>
<tr>
<td>Mating connector</td>
<td>Deutsch DTM06-08SA Female type (8 pin)</td>
</tr>
<tr>
<td>GPS antenna connector</td>
<td>SMA Female Board/ bulkhead mount connector Female type</td>
</tr>
</tbody>
</table>

Environmental specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating temperature</td>
<td>-40°C to +85°C</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-40°C to +85°C</td>
</tr>
<tr>
<td>Humidity</td>
<td>90% RH</td>
</tr>
<tr>
<td>Altitude</td>
<td>40000 ft</td>
</tr>
<tr>
<td>Mechanical shock</td>
<td>50Grms, 11mSec</td>
</tr>
<tr>
<td>30Grms, 18mSec</td>
<td>6 pulses at each axis, Total: 36 pulses</td>
</tr>
<tr>
<td>10 pulses at each axis, Total: 60 pulses</td>
<td></td>
</tr>
<tr>
<td>Ingress protection</td>
<td>IP67</td>
</tr>
<tr>
<td>Salt spray</td>
<td>96 hrs. in salt fog atmosphere</td>
</tr>
<tr>
<td>Chemical resistance</td>
<td>Cab mounting Alcohol, detergents, diesel fuel, waxes, spray paint, hydraulic fluid, etc.</td>
</tr>
<tr>
<td>Free fall</td>
<td>&lt;1m</td>
</tr>
<tr>
<td>Vibration</td>
<td>10Hz to 2000Hz, 3.5Grms</td>
</tr>
<tr>
<td>Sine sweep</td>
<td>10Hz to 2000Hz, 2.18Grms</td>
</tr>
<tr>
<td>Random vibration</td>
<td></td>
</tr>
</tbody>
</table>

Communication protocols

<table>
<thead>
<tr>
<th>Protocol</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAN</td>
<td>SAE J1939 Baud rate 250Kbps</td>
</tr>
<tr>
<td>Serial</td>
<td>RS232 Default: 115200 bps Configurable baud rate 9600/19200/38400/57600/115200 bps</td>
</tr>
</tbody>
</table>

LED indication

<table>
<thead>
<tr>
<th>Type</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power ON / OFF</td>
<td>Green Continuous ON when powered up</td>
</tr>
<tr>
<td>Diagnostic / health monitoring</td>
<td>Red Continuous ON when faults persist</td>
</tr>
<tr>
<td></td>
<td>• Over voltage (&gt;36V) &amp; under voltage (&lt;5V)</td>
</tr>
<tr>
<td></td>
<td>• GPS antenna open &amp; short</td>
</tr>
<tr>
<td></td>
<td>• Over temperature fault (95°C)</td>
</tr>
<tr>
<td></td>
<td>• GPS and IMU fault</td>
</tr>
</tbody>
</table>
## Technical data

### European Commission Directives

<table>
<thead>
<tr>
<th>Directive</th>
<th>Standard</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conducted Electrical Transient Pulses</td>
<td>ISO 7637:2004</td>
<td>Level: IV for 12V &amp; 24V (all pulses)</td>
</tr>
<tr>
<td>Radiated Emission</td>
<td>CISPR 25:2016</td>
<td>30MHz to 1000MHz</td>
</tr>
<tr>
<td>Bulk Current Injection</td>
<td>ISO 11452-4:2011</td>
<td>Functional Class A 200MHz to 200MHz, 60mA</td>
</tr>
<tr>
<td>Radiated Immunity</td>
<td>ISO 11452-2:2004</td>
<td>Functional Class A 200MHz to 1GHz, 30V/m</td>
</tr>
<tr>
<td>ESD</td>
<td>ISO 10605:2008</td>
<td>Functional Class A - Contact &amp; Air discharge (Powered and Unpowered)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Direct discharge (3 pulses with &gt; 1s interval)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Contact: ±4kV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Air: ±4kV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Indirect Discharge: (50 pulses with &gt; 50ms interval) ±4kV</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conducted Electrical Transient Pulses</td>
<td>ISO 7637:2004</td>
<td>Level: IV for 12V &amp; 24V (all pulses)</td>
</tr>
<tr>
<td>Conducted Immunity</td>
<td>IEC 61000 4-6:2013</td>
<td>Functional Class A 150KHZ- 80MHz, 3Vrms</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.15-0.5MHz: 79 dB(uV)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.5-30MHz: 73 dB(uV)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Average: Product Class A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.15-0.5MHz: 66 dB(uV)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.5-30MHz: 60dB(uV)</td>
</tr>
<tr>
<td>Radiated Immunity</td>
<td>IEC 61000 4-3:2006</td>
<td>80MHz to 6GHz, 3V/m, Class A</td>
</tr>
<tr>
<td>Radiated Emission</td>
<td>EN 55032</td>
<td>30MHz to 6GHz</td>
</tr>
<tr>
<td>ETSI EN 303 413 V1.1.1 (2017-06)</td>
<td></td>
<td>Harmonised EU standard for GNSS essential requirement</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spurious Emission</td>
<td>Reference: Clause No 4.2.2</td>
<td>30MHz-8.3GHz (Radiated &amp; Conducted Method)</td>
</tr>
<tr>
<td>Adjacent Frequency Band</td>
<td>Reference: Clause No 4.2.1</td>
<td>Δ C/N0 ≤ 1 dB</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Conducted Method</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Part 1: Safety requirements (Hazard Based Safety Standard)</td>
</tr>
<tr>
<td></td>
<td>EN 62479:2010</td>
<td>Health: Assessment of the compliance of low-power electronic and electrical</td>
</tr>
<tr>
<td></td>
<td></td>
<td>equipment with the basic restrictions related to human exposure to</td>
</tr>
<tr>
<td></td>
<td></td>
<td>electromagnetic fields (10 MHz to 300 GHz)</td>
</tr>
<tr>
<td>RoHS 2 Directive 2011/65/EU</td>
<td></td>
<td>Restriction of the Use of Certain Hazardous Substances in Electronic and</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Electrical Equipment</td>
</tr>
</tbody>
</table>

### Other Directives

- **FCC SDoc (Suppliers Declaration of Conformity)**
- **FCC part 15B**
- **Part 15-Low Power Unlicensed Devices**
- **Radiated Emissions Section 15.109 (30MHz to 1GHz)**
Mounting diagram

Pin out details

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Pin name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Supply Input</td>
</tr>
<tr>
<td>2</td>
<td>CAN High</td>
</tr>
<tr>
<td>3</td>
<td>RS232 RX</td>
</tr>
<tr>
<td>4</td>
<td>Digital Out - Speed signal</td>
</tr>
<tr>
<td>5</td>
<td>Not used</td>
</tr>
<tr>
<td>6</td>
<td>RS232 TX</td>
</tr>
<tr>
<td>7</td>
<td>CAN Low</td>
</tr>
<tr>
<td>8</td>
<td>Ground</td>
</tr>
</tbody>
</table>

**Note:** Use supply ground for RS232 GND.

ALL DIMENSIONS ARE IN MM
### NMEA 2000 Messages

<table>
<thead>
<tr>
<th>PGN</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>126992</td>
<td>UTC time and date</td>
</tr>
<tr>
<td>129025</td>
<td>Latitude and longitude</td>
</tr>
<tr>
<td>129033</td>
<td>Time, date and local offset</td>
</tr>
<tr>
<td>129026</td>
<td>Course Over Ground (COG) and Speed Over Ground (SOG)</td>
</tr>
<tr>
<td>127250</td>
<td>Heading and Variation</td>
</tr>
<tr>
<td>127258</td>
<td>Age of Service and Variation</td>
</tr>
<tr>
<td>129539</td>
<td>GNSS State and Dilution of Precision Components (DOP)</td>
</tr>
<tr>
<td>129029</td>
<td>GNSS Parameters, Position and Altitude</td>
</tr>
</tbody>
</table>

### NMEA 0183 Messages

<table>
<thead>
<tr>
<th>Message</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>GGA</td>
<td>GPS Fix Data</td>
</tr>
<tr>
<td>ZDA</td>
<td>UTC, day, month and year</td>
</tr>
<tr>
<td>GSA</td>
<td>GPS DDP and active satellites</td>
</tr>
<tr>
<td>VTG</td>
<td>Track Made Good and Speed Over Ground (SOG)</td>
</tr>
<tr>
<td>RMC</td>
<td>Position, velocity and time</td>
</tr>
</tbody>
</table>

### ISOBUS Ground Speed

<table>
<thead>
<tr>
<th>Message</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PGN</td>
<td>Speed Over Ground</td>
</tr>
</tbody>
</table>