Specifications – electrical

Power source 4.1 – 38 VDC
Measuring range (dual mode) ±90° (two-dimensional)
Resolution 0.025° | 0.5 mg (data rate ≤ 5)
Temperature sensor accuracy: ±0.05°/°C (typical)
Power consumption < 30 mA (@ 5 V)

Applications

• Platform control, alignment, and stabilization
• Inclination (pitch and roll) and rotational movement measurement
• Antenna and satellite dish tracking and rotational movement measurement
• Motion and position measurement
• Navigation and GPS compensation
• Robotic position sensing and control
• Position feedback for solar tracking systems
• Agricultural and industrial vehicle tilt monitoring

Specifications – mechanical

Protection IP 67 (housing, connector and cable)
Dimension 1.65” x 2.15” x 1.00”
Material Enclosure: anodized aluminum
(cable is optional as a third party product)
Connection Cable gland
connector M8, 6-Contact (female)

Terminal Assignment

<table>
<thead>
<tr>
<th>Connector</th>
<th>RS232/UART/USB</th>
<th>RS422</th>
<th>RS485</th>
<th>Wire Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pin 1</td>
<td>+Vin</td>
<td>+Vin</td>
<td>+Vin</td>
<td>Brown</td>
</tr>
<tr>
<td>Pin 2</td>
<td>GND</td>
<td>GND</td>
<td>GND</td>
<td>White</td>
</tr>
<tr>
<td>Pin 3</td>
<td>TX</td>
<td>TX+</td>
<td>D+</td>
<td>Blue</td>
</tr>
<tr>
<td>Pin 4</td>
<td>–</td>
<td>TX-</td>
<td>D-</td>
<td>Black</td>
</tr>
<tr>
<td>Pin 5</td>
<td>RX</td>
<td>RX+</td>
<td>–</td>
<td>Gray</td>
</tr>
<tr>
<td>Pin 6</td>
<td>–</td>
<td>RX-</td>
<td>–</td>
<td>Pink</td>
</tr>
</tbody>
</table>

Accessories

Connector and cable MSKS 6F/CS12187 Male cable M8, 6-pin

Features

• Dual mode digital inclinometer
  • Dual-axis, horizontal installation: ±90°
  • Single-axis, vertical installation: ±180°
• High resolution: 0.025° | 0.5 mg
• High accuracy: err. ≤ 0.15°
• Selectable accelerometer range: ±2 g / ±4 g / ±8 g
• Simple ASCII Interface language
• IP 67 compliant connector, cable, and housing
• LED heartbeat and transmission indicators
• Robust aluminum housing
• Low power consumption: < 30 mA (@ 5 V)

40°F to +221°F)

Applications

• Agricultural and industrial vehicle tilt monitoring
• Navigation and GPS compensation
• Robotic position sensing and control
• Position feedback for solar tracking systems
• Twin mode digital inclinometer
  • Dual-axis, horizontal installation: ±90°
  • Single-axis, vertical installation: ±180°
• High resolution: 0.025° | 0.5 mg
• High accuracy: err. ≤ 0.15°
• Selectable accelerometer range: ±2 g / ±4 g / ±8 g
• Simple ASCII Interface language
• IP 67 compliant connector, cable, and housing
• LED heartbeat and transmission indicators
• Robust aluminum housing
• Low power consumption: < 30 mA (@ 5 V)

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† Zero g offset can be easily corrected and saved by user.
‡ Units can be calibrated between -40°C and 85°C on request.
WinCTi-Tilt software

WinCTi-Tilt is a graphical user interface (GUI) software provided by CTi Sensor Inc. for visualization aide, device configuration, and data logging. WinCTi-Tilt is designed to be user-friendly and intuitive to users. The package can be downloaded from the CTi Sensors website.

Serial interface and data format

TILT-30A uses the following ASCII format, very similar to the widely used NMEA 0183 protocol, for data output:

- Default message: \$CSTLT,AXN,AYN,AZN,αX,αY,R,T*CC<CR><LF>
- Optional message: \$CSACC,AX,AY,AZ*CC<CR><LF>

Which:

AXN,AYN,AZN: Normalized X, Y and Z accelerations in milli g
AX,AY,AZ: True X, Y and Z accelerations in milli g
αX,αY: Pitch and Roll angles in degrees, horizontal installation
R: Rotation angle in degrees, vertical installation
T: Internal temperature in degree centigrade
CC: Checksum (Two ASCII characters)
<CR> <LF>: Carriage return, and line feed characters

Example:

- \$CSTLT,+0169.3,+0076.1,+0982.6,+009.75,+004.37,+024.2,+022*5C<CR><LF>  Data rate ≤ 5
- \$CSTLT,+0169,+0076,+0983,+009.8,+004.4,+024.2,+022*4D<CR><LF>  Data rate > 5
- \$CSACC,+0168.9,+0076.9,+0996.7*47<CR><LF>

8-bit Checksum

Checksum is calculated by XORing all characters between \$ and * (not including the $ and the * characters) based on the NMEA standard. It results in two hexadecimal characters, which are sent in ASCII format.
Configuration commands

TILT-30A uses a simple command format which allows user to change the device configuration and request specific information or data. All commands start with a '[' character, and end with a carriage return character. All responses end with a carriage return and newline character. Table I shows the list of the interface commands for TILT-30A series. Letter ‘n’ after '[' character is the unit number which is set to n=1 by default, and can be set by user to any number from 1 to 9.

Table I: Interface commands for TILT-30A series

<table>
<thead>
<tr>
<th>Command</th>
<th>Comments</th>
<th>Response</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>[n&lt;cr&gt;</td>
<td>Ping unit number n</td>
<td>(ln&lt;cr&gt;&lt;lf&gt;)</td>
<td>Acknowledge ping</td>
</tr>
<tr>
<td>[N?&lt;cr&gt;</td>
<td>Request unit number</td>
<td>&gt;Unit Number: n</td>
<td>Returns unit number, default: n=1</td>
</tr>
<tr>
<td>[n#m&lt;cr&gt;</td>
<td>Change unit number n to (non-zero) unit number m, (1\leq m \leq 9)</td>
<td>&gt;New Unit Number: n</td>
<td>n=old unit number, m=new unit number, default: n=1</td>
</tr>
<tr>
<td>[n#FW&lt;cr&gt;</td>
<td>Save unit number into flash memory</td>
<td>&gt;Current Unit Number, n, was written into flash memory as the default Unit Number for this device!</td>
<td>Unit number will be changed permanently, and current unit number will be saved into the flash memory as the default unit number.</td>
</tr>
<tr>
<td>[nV&lt;cr&gt;</td>
<td>Firmware Version</td>
<td>&gt;Firmware Version:d.d</td>
<td>Returns firmware version</td>
</tr>
<tr>
<td>[nS&lt;cr&gt;</td>
<td>Serial Number</td>
<td>&gt;Device n Serial Number:ddddd</td>
<td>Returns 7-digit serial number</td>
</tr>
<tr>
<td>[nBFW&lt;cr&gt;</td>
<td>Save baud rate into flash memory</td>
<td>&gt;Current Baud Rate, dddddd, was written into flash memory as the default Baud Rate!</td>
<td>Baud rate will be changed permanently, and current baud rate will be saved into the flash memory.</td>
</tr>
<tr>
<td>[nDnn&lt;cr&gt;</td>
<td>Data rate setting: (nn= 1, 2, 5, 10, 20, 25, 40, 50, and 100) Hz</td>
<td>&gt;New Output Data Rate: nnn</td>
<td>Default data rate is 2 Hz. New data rate will be saved into the flash memory.</td>
</tr>
<tr>
<td>[nARn&lt;cr&gt;</td>
<td>Selecting accelerometer measurement range: (n=2, 4, 8)</td>
<td>&gt; New Accelerometer Range is: +/-ng</td>
<td>New accelerometer range will be saved into the flash memory (Default range is (\pm 2) g).</td>
</tr>
<tr>
<td>[nZA&lt;cr&gt;</td>
<td>Zero g offset correction for X and Y axes</td>
<td>&gt;Accelerometer Zero Offset Adjusted: X Offset: ddd, Y Offset: ddd</td>
<td>Resolution of the offset registers is 2 mg, with an effective offset adjustment range of -256 mg to +254 mg for each axis.</td>
</tr>
<tr>
<td>[nMxy&lt;cr&gt;</td>
<td>Output messages ON/OFF (x= I: ) Inclinometer data A: Accelerometer data y=S: single message C: Continuous message X: Message Off</td>
<td>Data message will be sent out once, continuously or will be turned off</td>
<td>Example for inclinometer data: (1\text{MIS}:) Sends out one data message (1\text{MIC}:) Continuously sends out data message (1\text{MIX}:) Stops sending out data message</td>
</tr>
<tr>
<td>[nMICFW&lt;cr&gt;</td>
<td>Save output message ON/OFF status into flash memory</td>
<td>&gt;Current ON/OFF message status was written into flash memory as the default status!</td>
<td>Current message ON/OFF status will be saved into flash memory.</td>
</tr>
<tr>
<td>[nFDR&lt;cr&gt;</td>
<td>Factory default reset (firmware version 1.62 and higher)</td>
<td>&gt; Reset to factory default!</td>
<td>Resets the selectable parameters (except baud rate) to their default values.</td>
</tr>
</tbody>
</table>
TILT – 30A
High Accuracy
Three-Axis Accelerometer
Dual-Axis Inclinometer
Datasheet

Dimensional drawing

Part number

<table>
<thead>
<tr>
<th>TILT – XX</th>
<th>X – X – XX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design model</td>
<td></td>
</tr>
<tr>
<td>A1</td>
<td></td>
</tr>
</tbody>
</table>

Interface

| 3 | RS232 |
| 4 | RS422 |
| 8 | RS485 |
| U | USB/UART |
| S | SSI |
| W | Wireless |

Housing material

| A | Aluminum |
| P | ABS Plastic |
| S | Stainless Steel 316L |
| O | OEM (No Housing) |

Family Series

| 05 | Small size board (1”x1”) |
| 10 | Board with multiple interfaces |
| 15 | High accuracy analog inclinometer board |
| 20 | Low cost, ABS plastic enclosure |
| 3x | High accuracy, aluminum enclosure |
| 5x | Dynamic inclinometer, aluminum enclosure |
| 70 | Harsh environment, stainless steel enclosure |

Horizontal installation position

Measuring range: ±90° (two-dimensional)

Default
Y=0

Inclination
Y=+30

Default
X=0

Inclination
X=+30

Vertical installation position

Rotation
R=0

Rotation
R=+45

Rotation
R=90

Rotation
R=+180

Warranty: This product has 18 months limited warranty. For more information, please visit:

www.CTiSensors.com/warranty

This product is fully designed and manufactured in the U.S.A.

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