

ButterflyGyro[™]

STIM202 Multi-Axis Gyro Module

1 FEATURES

- Excellent performance in vibration and shock environments
- 1, 2 or 3 axes offered in same package
 Electronically calibrated axis alignment
- Single-crystal silicon technology
 No intrinsic wear-out effects
- No intrinsic wear
 Low bias instability
- Low bias instability
 Low noise
- Digital interface, RS422
- Fully configurable:
 - 5 different sample rates
 - 5 different bandwidths
 - LP filter -3dB frequency can be set individually for each axis
 - RS422 protocol, bit rate and line termination
 - Selectable output unit: angular rate [deg/s], incremental angle [deg], average angular rate [deg/s] or integrated angle [°]
 - Excellent environmental robustness
- Excellent environm
 Miniature package
- Continuous self-diagnostics

2 GENERAL DESCRIPTION

STIM202 is a cluster of 1, 2 or 3 high accuracy MEMSbased gyros in a miniature package. Any configuration of axes can be provided. Each axis is factory-calibrated for bias, sensitivity and compensated for temperature effects to provide high-accuracy measurements in the temperature range -40°C to +85°C. The unit runs off a single +5V supply.



(38.6mm x 44.8mm x 20.0mm)

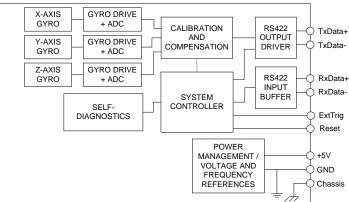


Figure 2-1: STIM202 FUNCTION BLOCK DIAGRAM

STIM202 communicates via a standard high-level RS422 interface. The use of a 32 bit RISC ARM microcontroller provides flexibility in the configuration, like choice of output unit, sample rate, LP filter -3dB frequency and RS422 bit-rate and protocol parameters. All configurable parameters can be defined when ordering or set by customer.

When STIM202 is powered up, it will perform an internal system check and synchronise the gyros. As an acknowledgement of the complete power-up sequence, it will provide special datagrams containing data, like part number, serial number, number of active axis and configuration parameters as mentioned above. STIM202 will then automatically proceed to provide measurement data. Hence the simplicity of use is high: just connect power and STIM202 will provide accurate gyro measurements over the RS422 interface.

The measurement data is transmitted as packages of data on a fixed format (datagram) at intervals given by the sample rate. The datagram is in binary coded format in order to have an efficient transfer of data. In addition to the measurement data itself, the datagram contains an identifier, a status byte and a CRC (Cyclic Redundancy Check) byte to provide high degree of fault detection in the transmissions. The status byte will flag any detected errors in the system.

For more advanced users, the gyro may be put in Service Mode. In this mode all the configuration parameters can be intermediately or permanently changed by overwriting the current settings in the flash memory. In Service Mode the commands and responses are in a human readable format; to enable the use of terminal-type software during typical product integration. Service Mode also provides the ability to perform single measurements, perform diagnostics and obtain a higher detail level of detected errors reported in the status byte.

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ABBREVIATIONS USED IN DOCUMENT 4

| ABBREVIATION | FULL NAME |
|--------------|---------------------------------|
| LSB | Least Significant Byte |
| MSB | Most Significant Byte |
| lsb | Least significant bit |
| LP filter | Low-Pass filter |
| CIC-filter | Cascaded Integrator Comb filter |





5 ABSOLUTE MAXIMUM RATINGS

Stresses beyond those listed in Table 5-1 may cause permanent damage to the device. Exposure to any Absolute Maximum Rating condition for extended periods may affect device reliability and lifetime.

Table 5-1: Absolute maximum ratings

| Parameter | Rating | Comment |
|-------------------------|-----------------------|---|
| Dynamic overload | 5000°/s | Any direction |
| Mechanical shock | 1500g/0.5ms half-sine | Any direction |
| ESD human body model | ±2kV | |
| ESD charge device model | ±500V | |
| Storage temperature | -50°C to +90°C | |
| VSUP to GND | -0.5 to +7V | |
| RxD+ or RxD- to GND | -0.3V to +7V | |
| RxD+ to RxD- | ±6V | with 120Ω Line Termination = ON |
| TxD+ or TxD- to GND | VCC-15V to +15V | |
| NRST to GND | -0.3V to +7V | |
| EXTTRIG to GND | -0.3V to +3.6V | |
| Chassis to GND | 500V | |
| Helium sensitivity | | Not to be exposed to helium concentrations higher |
| | | than those normally found in the atmosphere |

6 SPECIFICATIONS

Table 6-1: Operating conditions

| Parameter | Conditions | Min | Nom | Мах | Unit | Note |
|-----------------------|------------|-----|------|-----|------|------|
| INPUT RANGE | | | ±400 | | °/s | |
| POWER SUPPLY | | 4.5 | 5.0 | 5.5 | V | |
| OPERATING TEMPERATURE | | -40 | | +85 | °C | |





| Parameter Conditions Min Nom Max Unit Note GVRO | Table 6-2: Functional specification | IS | | | | | |
|--|-------------------------------------|---------------------------------|-----------|-----------------|----------|-------------------------|------|
| Full Scale (FS) ±400 °fs 1 Resolution 24 bits °fn Scale Factor Accuracy 0.22 °fn °fn Non-Linearity over ±200°/s 200 pm 2 Bandwidh (3dB) 7 200 pm 2 Compensation time, torn Ref: Figure 8-4 0.68 0.73 0.78 ms 5 Bias encover temperature DT ≤ ±1°C/min 30 °fn 6 8 Bias instability @25°C 0 +260 °fn/g °fn/g °fn/g Angular Random Walk Roti Allan Variance 0.22 °fn/g °fn °fn/g | Parameter | | Min | Nom | Max | Unit | Note |
| Resolution 24 bits Scale Factor Accuracy 0.22 %h Son-Linearly voer ±200's 200 ppm Bandwidth (-3dB) 2622 Hz 3 Group Delay 8 0.88 0.73 0.78 %h Bias Accuracy 8 0.58 0.73 0.78 %h 6 Bias Accuracy 8 -250 0 +250 %h 6 Angular Random Walk Rot 2±1°C/min 30 7h 7h 6 %h Insar Acceleration Effect fc1000Hz 0.1 18 7h/g/ms 6 Vibration Rectification Coefficient fc1000Hz 0.1 7h 7m 7m STIM2022X / Skis version) 5 mrad 7 7 7m 7 Stat Destonumption 1 mrad 7 7 7m 7 Stat Skis version) 5 mrad 7 7 7 7 Stad Skis version 5 C | GYRO | | | | | | |
| Scale Factor Accuracy Non-Linearity over ±200% 0.22 %h 200 %pm 2 Bandwicht (>340) 0.2 262 Hz 3 3 %h 3 3 4 3 3 3 4 3 3 3 3 3 3 3 3 3 3 3 3 3 | Full Scale (FS) | | | ±400 | | °/s | 1 |
| Scale Factor Accuracy Non-Linear Wore ±200's Group Delay Group Del | Resolution | | | 24 | | bits | |
| Non-Linearity over ±200% Bandwicht (34B) Group Delay200 262 283 283 283 284 <br< td=""><td></td><td></td><td></td><td>0.22</td><td></td><td>°/h</td><td></td></br<> | | | | 0.22 | | °/h | |
| Non-Linearity over ±200% 200 ppm 2 Bandwidth (-3dB) 262 Hz 3 Group Delay 262 Hz 3 Group Delay 0.68 0.73 0.78 ms 4 Compensation time, teore AT ≤ ±1°C/min 3 250 0 +250 ?h 6 Bias stroctver temperature AT ≤ ±1°C/min Root Allan Variance 0.5 ?h/ms 6 Bias stroctver temperature Root Allan Variance 0.2 ?h/g, mr 7 7 MisALIGNMENT StimM202X, Y2 (1 axis version) 5 mrad 7 7 STIM202X, Y2 (2 axis version) 5 mrad 7 7 7 7 Stale factor accuracy ±5 % 8 9 9 8 9 Power consumption 1 s 9 1 s 10 s Start-Up Time transmit after Power-On 1 s 9 3 3 3 3 | Scale Factor Accuracy | | | ±0.2 | | % | |
| $ \begin{array}{c c c c c c c c c c c c c c c c c c c $ | | | | 200 | | ppm | 2 |
| $ \begin{array}{c} \operatorname{Group Delay}{} & & & & & & & & & & & & & & & & & & $ | | | | | | | |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$ | | | | | | | |
| $\begin{array}{c c c c c c c c c c c c c c c c c c c $ | | Ref: Figure 8-4 | 0.68 | | 0 78 | | |
| Bias error ovér temperature Bias Instability $\Delta T_{\pm} \pm 1^{\circ} (Cm)$ Rot Allan Variance @25°C30 $\gamma h ms$ $\tau h g^{\circ}$ $\gamma h g^{\circ}$ 6Angular Random Walk@25°C0.2 $\gamma h g$ $\tau h g^{\circ}$ $\gamma h g^{\circ}$ $\tau h g^{\circ}$ 6Linear Acceleration Effect Ubration Rectification Coefficient1 $\gamma h g^{\circ}$ τg° $\gamma h g^{\circ}$ τg° $\gamma h g^{\circ}$ τg° MISALIGNMENT STIM202XY, XZ, YZ (1 axis version)5mrad T7STIM202XY, XZ, YZ (2 axis version)5mrad τ 7STIM202XY, XZ, YZ (2 axis version)25°C ± 5 γc POWER CONSUMPTION Power consumption $25°C$ ± 5 γc Power consumption1s10Start-Up Time Start-Up Time1s9Start-Up Time Parity1s10Start-Up Time Parity1s10Start-Up Time Parity1s10Start Bit Data Length1bits3RS422 Bit-Rate Parity11bitsParityref. Table 6-3 ref. Table 6-333Start Bit Data Length1bits3Parity11bits3Start Bit Data Length1bits3Parity550ns3Start Bit Data Length120QInput resistance Line termination = OFF120QLine termination = OFF Bit3.3V CMOS and TT | | itel. i igule 0-4 | | | | - | 5 |
| Bias Instability Roï Allan Variance @ 25°C 0.5 '/h Angular Random Walk Roï Allan Variance @ 25°C 0.2 '/\hr Linear Acceleration Effect 11 'h /g ''h /g'me ''h /g'me WisALIGMMENT 5 mrad 7 STIM202X,Y.Z,1 (2 xis version) 5 mrad 7 STIM202X,Y.Z,Y.Z,Y.Z,Y.Z,Y.Z,Y.Z,Y.Z,Y.Z,Y.Z,Y.Z | | $\Delta T < \pm 1^{\circ}C/min$ | -230 | | +230 | | 6 |
| Angular Random Walk Root Allan Variance @25°C 0.2 */wh Linear Acceleration Effect 18 */h /g² ms Vibration Rectification Coefficient 1 */h /g² ms STIM202X,Y.Z (1 axis version) 5 mrad 7 STIM202X,Y.Z,Y (2 (axis version) 5 mrad 7 STIM202X,Y.X,Y (2 (axis version) 1 mrad 7 TEMPERATURE MEASUREMENT 825°C ±5 *C 8 Scale factor accuracy #25 % *C 8 Power consumption 1 s 9 1 s 1 Time to transmit after Power-On 1 s 9 1 s 1 Start-Up Time 1 s 9 1 s 1 s 1 s 1 s 1 s 1 s 1 s 1 s 1 s 1 s 1 s 1 s 1 s 1 s 1 <t< td=""><td></td><td>Root Allan Variance</td><td></td><td></td><td></td><td></td><td>0</td></t<> | | Root Allan Variance | | | | | 0 |
| © @25°C 18 %h /g Linear Acceleration Effect Vibration Rectification Coefficient r<1000Hz | | | | | | | |
| Vibration Rectification Coefficient F<1000Hz 0.1 */h q ² ms MISALIGNMENT STIM202X,Y,Z(1 axis version) 5 mrad 7 STIM202X,Y,Z(1 axis version) 5 mrad 7 STIM202X,Y,Z(2 axis version) 5 mrad 7 STIM202X (axis version) 1 mrad 7 TEMPERATURE MEASUREMENT Bias Accuracy * * * Bias Accuracy ±5 % * * Power consumption 1.5 W * * Time to transmit after Power-On 1 s 10 s 11 RS422 Bit-Rate 10 s 11 s 10 s 11 RS422 Bit-Rate 100 samples/s 3 3 s 10 s 11 Start Bit 1 bit bit bit bit bit 3 Parity ref. Table 6-3 3 3 s 3 3 S < | Angular Random Walk | | | 0.2 | | | |
| Vibration Rectification Coefficient F<1000Hz 0.1 */h q ² ms MISALIGNMENT STIM202X,Y,Z(1 axis version) 5 mrad 7 STIM202X,Y,Z(1 axis version) 5 mrad 7 STIM202X,Y,Z(2 axis version) 5 mrad 7 STIM202X (axis version) 1 mrad 7 TEMPERATURE MEASUREMENT Bias Accuracy * * * Bias Accuracy ±5 % * * Power consumption 1.5 W * * Time to transmit after Power-On 1 s 10 s 11 RS422 Bit-Rate 10 s 11 s 10 s 11 RS422 Bit-Rate 100 samples/s 3 3 s 10 s 11 Start Bit 1 bit bit bit bit bit 3 Parity ref. Table 6-3 3 3 s 3 3 S < | Linear Acceleration Effect | | | | 18 | °/h /g | |
| STIM202X,Y,Z (1 axis version) STIM202XY,XZ,YZ (2 axis version) STIM202 (2 axis version) 5 mrad mrad 7 STIM202 (2 axis version) STIM202 (2 axis version) 0 1 mrad 7 TEMPERATURE MEASUREMENT Bias Accuracy @25°C ±5 °C 8 Scale factor accuracy @25°C ±5 °C 8 POWER CONSUMPTION Power consumption 1.5 W Power consumption 1 s 9 Time to transmit after Power-On Time to transmit after Reset 1 s 10 Start-Up Time RS422 Bit-Rate 100 s 11 RS422 Bit-Rate 1 bit s 1 Sample Rate 1 bit bits 3 Start Bit 1 bit bits 3 Start Bit 1 bit 1 bits Parity ref. Table 6-3 3 3 Start Bit 1 bits 1 bits Parity Start Bit 25 0 | | f<1000Hz | | 0.1 | | °/h /g ² rms | |
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| STIM202 (3 axis version) 1 mrad 7 TEMPERATURE MEASUREMENT Bias Accuracy @25°C ±5 °C 8 Scale factor accuracy @25°C ±5 °C 8 POWER CONSUMPTION Power consumption 1.5 W TIMING 1 s 9 Time to transmit after Power-On Time to transmit after Reset 1 s 10 s 11 Start-Up Time 1 s 10 s 11 % 11 s 10 s 11 RS422 Bit-Rate 10 s 11 % samples/s 3 RS422 DROTOCOL x1 1 bit bits 1 bits 7 Start Bit 7 7 48 120 Ω 2 1 3 3 RS422 LINE TERMINATION Line termination = ON 120 Ω 2 1 3 3 3 RS422 LINE TERMINATION Line termination = OFF 48 120 | | | | | | mrad | |
| TEMPERATURE MEASUREMENT Bias Accuracy@25°C±5°C8Bias Accuracy POWER CONSUMPTION Power consumption01.5W1Power consumption1.5W1590Time to transmit after Power-On Time to transmit after Reset1s90Start-Up Time S422 Bit-Rate Start-Up Time1s90RS422 Bit-Rate Accuracy±1%100samples/sSample Rate1000samples/s3RS422 PROTOCOL Start Bit1bitbitsData Length Parity11bitPatte RET (NRST PIN) Logic levelsLine termination = OFF120 48ΩLogic levels3.3V CMOS and TTL compatible Negative transitionmsTrigger Pull-Up ResistorRef: Figure 8-4 Ref: Figure 8-4 Maximum time to transmit, text, NRef: Figure 8-4 Ref: Figure 8-4 Ref: Figure 8-4 Ref: Figure 8-4250 msmsMaximum time to transmit, text, NRef: Figure 8-4 Incement.unit: angular rate increment.angle integrated angle3.3V CMOS and TTL compatible Negative transition S50KQMaximum time to transmit, text, NRef: Figure 8-4 Measurement.unit: angular rate integrated angle250 ms12LatencyCHASSISU8ms13LatencyCHASSISLatency2000µs | | | | | | mrad | 7 |
| Bias Accuracy @ 25°C ±5 °C 8 Scale factor accuracy ±5 % % 8 POWER CONSUMPTION 1.5 W 1 5 % 1 Power consumption 1.5 W 1 s 9 1 s 9 Time to transmit after Power-On 1 s 9 1 s 10 s 11 Start-Up Time 10 s 11 s 10 s 11 10 s 11 11 10 11 11 | | | | | | | |
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| $\begin{array}{cccccccccccccccccccccccccccccccccccc$ | | | | | 1 | | |
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| Parity Stop Bitsref. Table 6-3 ref. Table 6-33 3RS422 LINE TERMINATION Input resistanceLine termination = ON Line termination = OFF120 48ΩRESET (NRST PIN) Logic levelsLine termination = OFF48125Minimum hold time for reset5V CMOS and TTL compatible 5msPull-Up Resistor80100kΩEXTERNAL TRIGGER Logic levels3.3V CMOS and TTL compatible Negative transitionnsPull-Up Resistor3.3V CMOS and TTL compatible Negative transitionnsPull-Up Resistor80100kΩEXTERNAL TRIGGER Logic levels8.100kΩLogic levels Trigger Pull-Up ResistorRef: Figure 8-4 Measurement.unit: angular rate50nsMaximum time to transmit, t _{ext_tx} Time between triggersRef: Figure 8-4 Incremental angle1255msLatency18ms13Latency2000µs11 | Start Bit | | | 1 | | bit | |
| Stop Bitsref. Table 6-33RS422 LINE TERMINATION Input resistanceLine termination = ON Line termination = OFF120 48ΩRESET (NRST PIN) Logic levelsLine termination = OFF48125kΩMinimum hold time for reset5V CMOS and TTL compatiblemsPull-Up Resistor5V CMOS and TTL compatiblemsEXTERNAL TRIGGER Logic levels3.3V CMOS and TTL compatiblekΩPull-Up Resistor80100kΩFrigger Pull-Up ResistorRef: Figure 8-4 Maximum time to transmit, t _{ext_tmin} maximum time to transmit, t _{ext_tmin} angular rate3.3V CMOS and TTL compatible Negative transitionMaximum time to transmit, t _{ext_tmin} incremental angleRef: Figure 8-4 1250µsLatencyIntegrated angle18 ms13 msLatencyLatency2000µs12 | Data Length | | | 8 | | bits | |
| RS422 LINE TERMINATION Input resistanceLine termination = ON Line termination = OFF120 48ΩRESET (NRST PIN) Logic levelsLine termination = OFF48125kΩMinimum hold time for reset5SV CMOS and TTL compatible 5mskΩPull-Up Resistor80100kΩEXTERNAL TRIGGER Logic levels3.3V CMOS and TTL compatible Negative transitionskΩPull-Up Resistor80100kΩPull-Up Resistor8.3V CMOS and TTL compatible Negative transitionssPull-Up ResistorRef: Figure 8-4 Maximum time to transmit, t _{ext_tx} Ref: Figure 8-4 Measurement.unit: angular rate1255msTime between triggersRef: Figure 8-4 Measurement.unit: angular rate1255ms12incremental angle18ms13Latency2000μs13 | Parity | | | ref. Table 6-3 | | | 3 |
| Input resistanceLine termination = ON Line termination = OFF120 48ΩRESET (NRST PIN) | Stop Bits | | | ref. Table 6-3 | | | 3 |
| Input resistanceLine termination = OFF48125kΩRESET (NRST PIN) Logic levelsImage: Stress of the stres | RS422 LINE TERMINATION | | | | | | |
| Input resistanceLine termination = OFF48125kΩRESET (NRST PIN) Logic levelsImage: Stress of the stres | Input resistance | Line termination = ON | | 120 | | Ω | |
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| Minimum hold time for reset Pull-Up Resistor5ms kΩEXTERNAL TRIGGER Logic levels Trigger Pull-Up Resistor3.3V CMOS and TTL compatible Negative transition-Pull-Up Resistor Minimum active low, t _{ext_min} Maximum time to transmit, t _{ext_tx} Time between triggersRef: Figure 8-4 Ref: Figure 8-450nsRef: Figure 8-4 magular rate1255ms12incremental angle average rate1255ms12Latency-2000μs13 | | | 5V CM | OS and TTL con | npatible | | |
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| EXTERNAL TRIGGER Logic levels Trigger Pull-Up Resistor Minimum active low, t _{ext_min} Time between triggers3.3V CMOS and TTL compatible Negative transitionRef: Figure 8-4 Measurement.unit: angular rate incremental angle3550kΩMaximum time to transmit, t _{ext_tx} Time between triggersRef: Figure 8-4 Measurement.unit: angular rate incremental angle1250µsLatencyLatency1255ms12CHASSISLatency2000µs11 | | | - | 100 | | | |
| Logic levels Trigger3.3V CMOS and TTL compatible Negative transitionImage: Comparison of the state of the | | | 00 | 100 | | 1132 | |
| Trigger Pull-Up ResistorNegative transitionMinimum active low, t _{ext_min} Maximum time to transmit, t _{ext_tx} Time between triggersRef: Figure 8-4 Ref: Figure 8-43550kΩ nsMaximum time to transmit, t _{ext_tx} Time between triggersRef: Figure 8-4 Measurement.unit: angular rate1255ms12 msIncremental angle average rate1255ms12 ms13 13LatencyIntegrated angle18ms13 msCHASSISIntegrated angleIIntegrated angleIntegrated angle </td <td></td> <td></td> <td>3 31/ 01/</td> <td></td> <td>mnatihla</td> <td></td> <td></td> | | | 3 31/ 01/ | | mnatihla | | |
| Pull-Up Resistor3550kΩMinimum active low, t _{ext_min} Maximum time to transmit, t _{ext_tx} Time between triggersRef: Figure 8-4 Ref: Figure 8-450nsMeasurement.unit: angular rate incremental angle1255ms12average rate integrated angle1255ms12LatencyImage: Signer | | | | | | | |
| Minimum active low, text_min Maximum time to transmit, text_tx Time between triggersRef: Figure 8-4 Ref: Figure 8-4 Measurement.unit: angular rate incremental angle50nsµs1255ms12average rate integrated angle18ms13LatencyI8ms13CHASSISII111 | | | | - | 11 | 10 | |
| Maximum time to transmit, t _{ext_tx} Time between triggersRef: Figure 8-4 Measurement.unit: angular rate250μsIncremental angle1255ms12incremental angle18ms13average rate1255ms12integrated angle18ms13Latency2000μs113 | | Pof: Figure 9.4 | | 50 | | | |
| Time between triggersMeasurement.unit: angular rate1255ms12incremental angle18ms13average rate1255ms12integrated angle18ms13Latency2000µs110 | Maximum tigs to transmit | | 00 | | 050 | | |
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| incremental angle 1 8 ms 13 average rate 1 255 ms 12 integrated angle 1 8 ms 13 Latency 2000 μs 1 1 1 | i ime between triggers | | | | 055 | | 10 |
| average rate 1 255 ms 12 integrated angle 1 8 ms 13 Latency 2000 μs 1 | | | | | | | |
| integrated angle 1 8 ms 13 Latency 2000 μs 13 CHASSIS Image: Chassing the state of th | | | 1 | | | ms | |
| Latency 2000 µs CHASSIS | | | 1 | | | ms | |
| CHASSIS | | integrated angle | 1 | | 8 | ms | 13 |
| CHASSIS | Latency | _ | | | 2000 | μs | |
| | | | | | | | |
| | | | | | 0.1 | Ω | |

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STIM202 Multi-Axis Gyro Module



- Note 1: Output is monotonous and will saturate at ±480°/s
- Note 2: Largest deviation from BSL (Best fit Straight Line) over the range specified
- Note 3: Low-pass filter -3dB frequency can be configured, ref. Table 6-3 and section 6.1.5
- Note 4: Specified group delay is valid for a filter setting = 262Hz. See Table 6-3 to find group delay for other filtersettings
- Note 5: Time to transfer data from gyro-channels to μ C, perform compensation and prepare for datagram transmission. Total delay to start of datagram transmission = group delay + compensation time
- Note 6: rms-value calculated on the residual over two temperature-cycles, ref. Figure 6-4
- Note 7: Ref. Figure 6-1 for definition of reference points used in axes alignment
- Note 8: Temperature calibrated to reflect ambient temperature and not internal temperature Temperature error during first 5 minutes: -20°C to +5°C
- Note 9: Time from Power-On to start of datagram transmissions (starting with part number datagram)
- Note 10: Time from Reset release to start of datagram transmissions (starting with part number datagram)
- Note 11: Time from Power-On or Reset to the reset of the Start-Up bit (Bit 6 in the STATUS byte ref. Table 6-8) During this period the output data should be regarded as non-valid
- Note 12: If time between triggers is longer, counter overflow may occur (ref. 8.2.2.3.6)
- Note 13: If time between triggers is longer, output overflow may occur (ref. 8.2.2.3.2, 8.2.2.3.4)

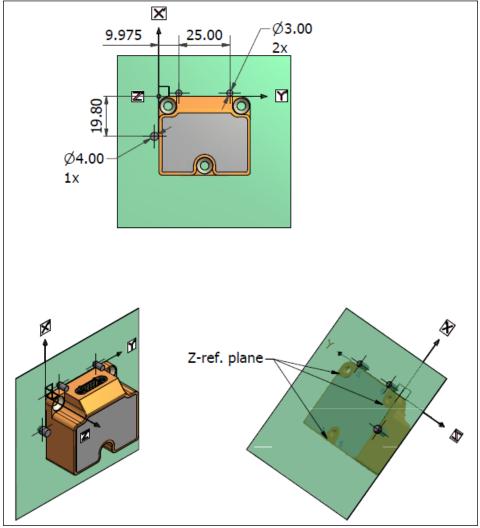


Figure 6-1: Reference points for alignment of axes



DATASHEET



6.1 TYPICAL PERFORMANCE CHARACTERISTICS

6.1.1 Root Allan Variance

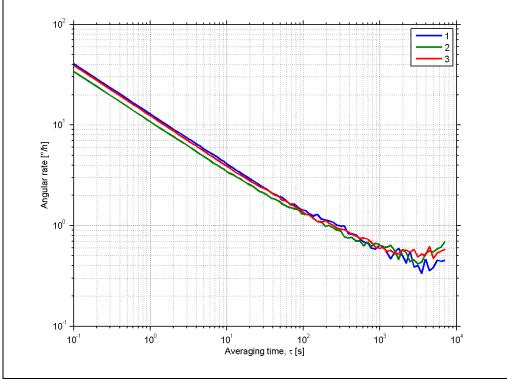
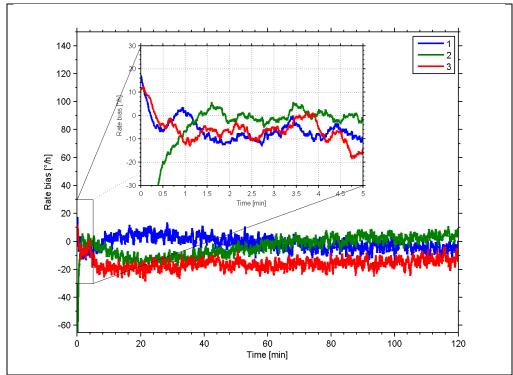


Figure 6-2: Typical Root Allan Variance



6.1.2 Initial bias drift

Figure 6-3: Typical initial bias drift





STIM202 Multi-Axis Gyro Module

6.1.3 Bias drift over temperature

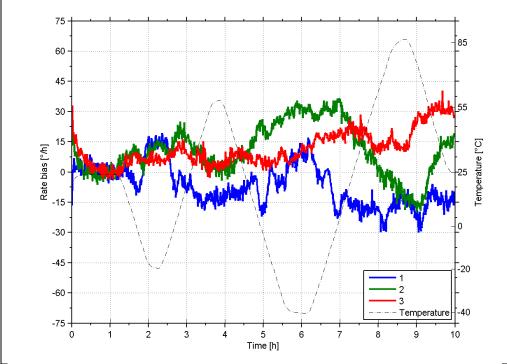


Figure 6-4: Typical bias drift over temperature

6.1.4 Non-linearity

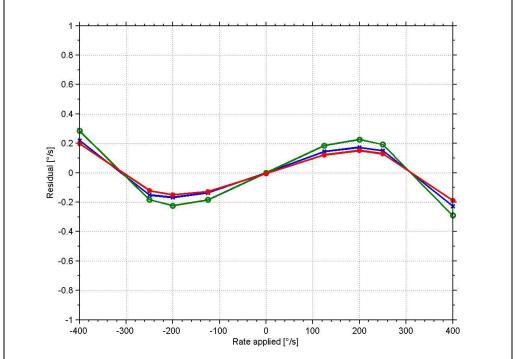


Figure 6-5: Typical non-linearity





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6.1.5 Frequency characteristics

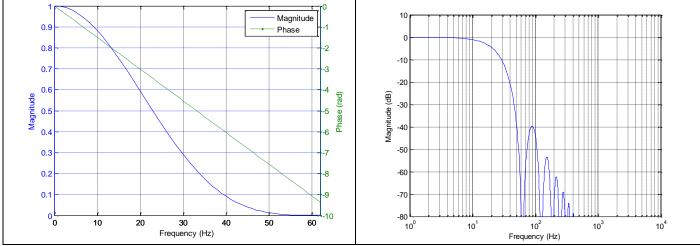


Figure 6-6: Frequency characteristics with low-pass filter -3dB frequency set to 16Hz

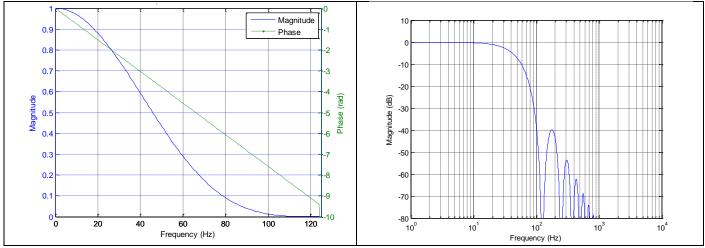


Figure 6-7: Frequency characteristics with low-pass filter -3dB frequency set to 33Hz

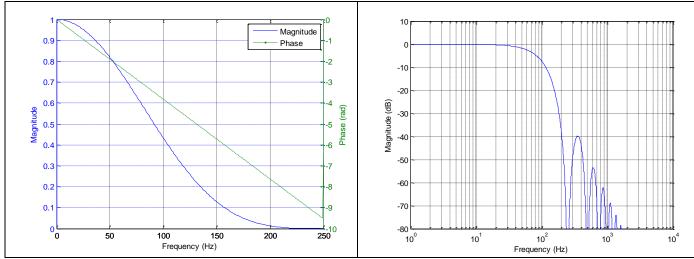


Figure 6-8: Frequency characteristics with low-pass filter -3dB frequency set to 66Hz



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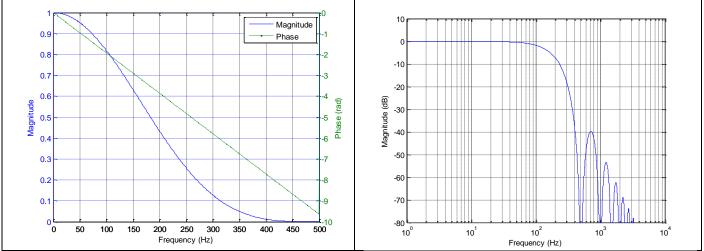


Figure 6-9: Frequency characteristics with low-pass filter -3dB frequency set to 131Hz

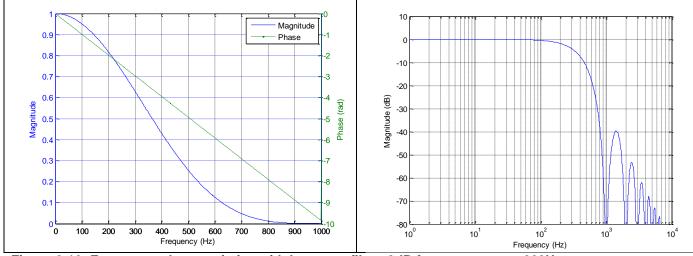


Figure 6-10: Frequency characteristics with low-pass filter -3dB frequency set to 262Hz





6.2 Configurable parameters

Table 6-3: Configurable parameters

| DATAGRAM FORMAT Standard Extended Contains measurements and status byte For future use Standard with CR+LF Rate and temperature Rate and counter Rate and latency Has <cr><lf> added to standard datagram MEASUREMENT UNIT Angular rate [°/s] Incermental angle [°] Has <cr><lf> added to standard datagram MEASUREMENT UNIT Angular rate [°/s] Incermental angle [°] Has <cr><lf> added to standard datagram SAMPLE RATE 125 samples/s 500 samples/s 1000 samples/s 500 samples/s 1000 samples/s 500 samples/s 1000 samples/s 1000 samples/s 131Hz Filter settings are independent of sample rate. Low-pass filters are CIC type filters with linear phase response. Filter settings can be set individually for each axis in Service Mode. Total delay to start of datagram transmission = group delay + compensation time, t_{comp} RS422 PARITY None Odd None</lf></cr></lf></cr></lf></cr> | Parameter | Configurations | | Comments |
|---|------------------|----------------------|-------|--|
| Standard with CR+LF Rate and temperature Rate and temperature Rate and latency Has <cr><lf> added to standard datagram MEASUREMENT UNIT Angular rate ['/s] Incremental angle [°/sample] Average angular rate ['/s] Integrated angle [°] Has <cr><lf> added to standard datagram SAMPLE RATE Angular rate ['/s] Integrated angle [°] Has <cr><lf> added to standard datagram SAMPLE RATE 125 samples/s 250 samples/s 1000 samples/s External trigger Filter settings are independent of sample rate. Low-pass filters are CIC type filters with linear phase response. FREQUENCY -3db freq.: 131Hz Group delay: 3.3Hz Filter settings can be set individually for each axis in Service Mode. 262Hz RS422 BIT RATE 374400 bits/s 460800 bits/s 374400 bits/s 921600 bits/s RS422 PARITY None Odd None</lf></cr></lf></cr></lf></cr> | DATAGRAM FORMAT | Standard | | Contains measurements and status byte |
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| Rate, temperature and counter Rate, temperature and latency MEASUREMENT UNIT Angular rate [°/s] Incremental angle [°/sample] Average angular rate [°/s] Integrated angle [°] SAMPLE RATE 125 samples/s 250 samples/s 500 samples/s 1000 samples/s External trigger Filter settings are independent of sample rate. Low-pass FiltTER -3dB FREQUENCY -3db freq.: 16Hz Group delay: 23.4ms Filter settings are independent of sample rate. Low-pass filters are CIC type filters with linear phase response. FREQUENCY 16Hz 5.9ms Filter settings can be set individually for each axis in Service Mode. RS422 BIT RATE 374400 bits/s 460800 bits/s 1.6ms For any phase response. RS422 PARITY None Odd None Godd | | Rate and counter | ŕ | |
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| 921600 bits/s RS422 PARITY None Odd Odd | | | | |
| RS422 PARITY None Odd | | | | |
| Odd | RS422 PARITY | | | |
| | | | | |
| l Even | | Even | | |
| RS422 STOP BITS 1 stop bit | RS422 STOP BITS | | | |
| 2 stop bits | | | | |
| RS422 120Ω LINE OFF | RS422 120Ω LINE | | | |
| TERMINATION | | - | | |

Refer to chapter 12 for information on how to configure STIM202 when ordering.





6.3 Datagram specifications

Table 6-4: Specification of the Part Number datagram

| Byte# | | | | Bi | it# | | | | Specification |
|-------|-----------------|-----------------------|-----------------|-----------------|-----------------------|-------------------------|-----------------------|-----------------------|---|
| | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | |
| | | | | | | | | | Part Number datagram identifier: |
| 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0x54 for datagrams without CR+LF termination |
| | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0x56 for standard datagrams w.CR+LF |
| 1 | 0 | 0 | 0 | 0 | P1 ₃ | P1 ₂ | P1 ₁ | P10 | Low nibble: 1.digit (BCD) of part number |
| 2 | P2 ₃ | $P2_2$ | P2 ₁ | P2 ₀ | P3 ₃ | P3 ₂ | P3 ₁ | P30 | High nibble: 2.digit (BCD) of part number |
| 2 | F Z 3 | F Z 2 | ΓΖ1 | ΓZ ₀ | г Ј 3 | г J ₂ | г J 1 | г 3 0 | Low nibble: 3.digit (BCD) of part number |
| 3 | P43 | P42 | P41 | P40 | P53 | P5 ₂ | P5₁ | P5₀ | High nibble: 4.digit (BCD) of part number |
| 5 | 1 43 | 1 42 | 1 41 | 1 40 | 1 03 | 1 32 | 1 31 | 1.50 | Low nibble: 5.digit (BCD) of part number |
| 4 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | ASCII character "-" (0x2D) |
| 5 | P63 | P6 ₂ | P6₁ | P60 | P73 | P72 | P7₁ | P7 ₀ | High nibble: 6.digit (BCD) of part number |
| 5 | 1 03 | 1 02 | 1 01 | 100 | 173 | 172 | 171 | 170 | Low nibble: 7.digit (BCD) of part number |
| 6 | P83 | P8 ₂ | P8₁ | P80 | P9 ₃ | P9 ₂ | P9₁ | P90 | High nibble: 8.digit (BCD) of part number |
| - | Ũ | - | 1 01 | | 103 | 1 52 | | 1 30 | Low nibble: 9.digit (BCD) of part number |
| 7 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | ASCII character "-"(0x2D) |
| 8 | P10. | P10. | P10. | P10. | P11 ₃ | D11. | D11. | D11. | High nibble: 10.digit (BCD) of part number |
| 0 | 1 103 | 1 102 | 1 101 | 1 100 | 1 113 | 1 1 12 | 1 1 1 1 | 1 1 10 | Low nibble: 11.digit (BCD) of part number |
| 9 | P11。 | P11 | P11, | P11. | P13₃ | P13. | P13, | P130 | High nibble: 12.digit (BCD) of part number |
| 3 | 1 113 | 1 1 1 2 | 1 1 1 1 | 1 1 10 | 1 103 | 1152 | 1 131 | 1150 | Low nibble: 13.digit (BCD) of part number |
| 10 | r 7 | r ₆ | r 5 | r₄ | ľ3 | \mathbf{r}_2 | r ₁ | r _o | Part number revision. Content of byte represents the ASCII character of the revision. |
| 10 | 17 | 16 | 15 | 14 | 13 | 12 | 1 | 10 | Numbering sequence: "-", "A", "B",, "Z" |
| | | | | | | | | | Cyclic Redundancy Check is performed on all preceding bytes and is generated from the |
| 11 | C 7 | C ₆ | C 5 | C 4 | C ₃ | C2 | C ₁ | C ₀ | polynomial: |
| | | | | | | | | | $x^{8} + x^{2} + x + 1$, seed = 0xFF |
| (12) | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | <cr> only when standard datagrams w.CR+LF have been chosen</cr> |
| (13) | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | <lf> only when standard datagrams w.CR+LF have been chosen</lf> |

Table 6-5: Specification of the Serial Number datagram

| Byte# | | | | Bi | t# | | | | Specification |
|-------|-----------------|-----------------------|------------|-----------------------|-----------------------|------------------|-----------------------|-----------------------|---|
| - | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | |
| | | | | | | | | | Serial Number datagram identifier: |
| 0 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0x5A for datagrams without CR+LF termination |
| | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0x5C for standard datagrams w.CR+LF |
| 1 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | ASCII character for letter "N" |
| 2 | S1 ₃ | S1 ₂ | S1₁ | S1 ₀ | S2 ₃ | S22 | S21 | S2 ₀ | High nibble: 1.digit (BCD) of serial number |
| 2 | 313 | 312 | 311 | 310 | 323 | 322 | 321 | 320 | Low nibble: 2.digit (BCD) of serial number |
| 3 | S33 | S32 | S3₁ | S30 | S43 | S42 | S41 | S40 | High nibble: 3.digit (BCD) of serial number |
| 3 | 333 | 332 | 331 | 330 | 343 | 342 | 341 | 340 | Low nibble: 4.digit (BCD) of serial number |
| 4 | S53 | S52 | S5₁ | S50 | S63 | S62 | S6₁ | S60 | High nibble: 5.digit (BCD) of serial number |
| Ŧ | 353 | 33_{2} | 331 | 33_{0} | 303 | 302 | 301 | 300 | Low nibble: 6.digit (BCD) of serial number |
| 5 | S73 | S72 | S7₁ | S7 0 | S83 | S82 | S8₁ | S80 | High nibble: 7.digit (BCD) of serial number |
| 5 | 573 | 572 | 571 | 570 | 503 | 502 | 501 | 500 | Low nibble: 8.digit (BCD) of serial number |
| 6 | S93 | S92 | S9₁ | S90 | S10. | S10 ₂ | S10. | S10. | High nibble: 9.digit (BCD) of serial number |
| 0 | 393 | 392 | 391 | 390 | 3103 | 3102 | 3101 | 3100 | Low nibble: 10.digit (BCD) of serial number |
| 7 | S11. | S11. | S11. | S11 ₀ | S11. | S11. | S11. | S11. | High nibble: 11.digit (BCD) of serial number |
| 1 | 5113 | 5112 | 511 | 5110 | 5113 | 5112 | 511 | 5110 | Low nibble: 12.digit (BCD) of serial number |
| 8 | S13. | S13. | S13. | S13₀ | S1/. | S14. | S14. | S1/. | High nibble: 13.digit (BCD) of serial number |
| 0 | 3133 | 3132 | 3131 | 3150 | 3143 | 3142 | 3141 | 5140 | Low nibble: 14.digit (BCD) of serial number |
| 9 | х | х | х | х | х | х | х | х | For future use. |
| 10 | х | х | х | х | х | х | х | х | For future use. |
| | | | | | | | | | Cyclic Redundancy Check is performed on all preceding bytes and is generated from the |
| 11 | C ₇ | C ₆ | C 5 | C ₄ | C ₃ | C2 | C ₁ | C ₀ | polynomial: |
| | | | | | | | | | $x^{8} + x^{2} + x + 1$, seed = 0xFF |
| (12) | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | <cr> only when standard datagrams w.CR+LF have been chosen</cr> |
| (13) | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | <lf> only when standard datagrams w.CR+LF have been chosen</lf> |





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| Byto# | . sp | CUII | callO | | it# | Jung | juiati | | atagram Specification |
|---------|----------------|----------------|----------------|---------------------|---------------------|---------------------|---------------------|---------------------|--|
| Byte# | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | opeonication |
| | ' | • | J | - | J | - | • | Ŭ | Configuration datagram identifier: |
| 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0x28 for datagrams without CR+LF termination |
| - | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0x2B for standard datagrams w.CR+LF |
| | | | | | | | | | Part number revision. Content of byte represents the ASCII character of the |
| 1 | r ₇ | r ₆ | r 5 | r 4 | r ₃ | r ₂ | r 1 | r ₀ | revision. Numbering sequence: "-", "A", "B",, "Z" |
| 2 | f ₇ | f ₆ | f ₅ | f ₄ | f ₃ | f ₂ | f ₁ | f ₀ | Firmware revision. Numbering sequence: 0, 1,, 255 |
| 3 | h ₇ | h ₆ | h₅ | h4 | h ₃ | h ₂ | h ₁ | h ₀ | Hardware revision. Numbering sequence: 0, 1,, 255 |
| | | | | | | | | | System configuration, Byte 1: |
| | 0 | х | х | х | х | х | х | х | Z axis is inactive |
| | 1 | х | х | х | х | х | х | х | Z axis is active |
| | х | 1 | 0 | 0 | х | х | х | х | LP filter -3dB frequency for Z axis = $262Hz$ |
| | х | 0 | 1 | 1 | х | х | х | х | LP filter -3dB frequency for Z axis = 121Hz |
| | X | 0 | 1 | 0 | X | X | X | X | LP filter -3dB frequency for Z axis = 66Hz |
| 4 | X | 0 | 0 | 1 0 | X | X | X | X | LP filter -3dB frequency for Z axis = 33Hz LP filter -3dB frequency for Z axis = 16Hz |
| 4 | X X | x | x | x | x 0 | x x | x x | X X | Y-axis is inactive |
| | x | x | x | x | 1 | x | x | x | Y-axis is active |
| | x | x | x | x | x | Î | ô | ô | LP filter -3dB frequency for Y axis = 262Hz |
| | x | x | x | x | x | 0 | 1 | 1 | LP filter -3dB frequency for Y axis = 121Hz |
| | x | x | x | x | x | Ő | 1 | 0 | LP filter -3dB frequency for Y axis = $66Hz$ |
| | х | х | х | x | x | 0 | 0 | 1 | LP filter -3dB frequency for Y axis = 33Hz |
| | х | х | х | х | х | 0 | 0 | 0 | LP filter -3dB frequency for Y axis = 16Hz |
| | | | | | | | | | System configuration, Byte 2: |
| | 0 | х | х | х | х | х | х | х | X-axis is inactive |
| | 1 | х | х | х | х | х | х | х | X-axis is active |
| | х | 1 | 0 | 0 | х | х | х | х | LP filter -3dB frequency for X axis = $262Hz$ |
| | х | 0 | 1 | 1 | х | х | х | х | LP filter -3dB frequency for X axis = 121Hz |
| | х | 0 | 1 | 0 | х | х | х | х | LP filter -3dB frequency for X axis = 66Hz |
| ~ | х | 0 | 0 | 1 | х | х | Х | х | LP filter -3dB frequency for X axis = 33Hz |
| 5 | х | 0 | 0 | 0 | X | X | X | х | LP filter -3dB frequency for X axis = 16Hz |
| | X | X | X | X | 1 0 | 0 | 1 | X | Sample rate = External trigger Sample rate = 1000 samples/s |
| | X X | X X | x x | x x | 0 | 1 | 0 | X X | Sample rate = 500 samples/s |
| | x | x | x | x | 0 | 0 | 1 | x | Sample rate = 250 samples/s |
| | x | x | x | x | 0 | Ő | 0 | x | Sample rate = 125 samples/s |
| | x | x | x | x | x | x | x | Ô | Output unit = ANGULAR RATE |
| | x | x | x | x | x | x | x | 1 | Output unit = other than ANGULAR RATE (ref. byte#8) |
| | | | | | | | | | System configuration, Byte 3: |
| | 0 | х | х | х | х | х | х | х | Datagram format = STANDARD+STANDARD w.CR+LF |
| | 1 | х | х | х | х | х | х | х | Datagram format = other than STANDARD (ref. byte#8) |
| | х | 0 | 0 | 0 | х | х | х | х | Bit rate = 374400 bits/s |
| | х | 0 | 0 | 1 | х | х | х | х | Bit rate = 460800 bits/s |
| _ | х | 0 | 1 | 0 | х | х | х | х | Bit rate = 921600 bits/s |
| 6 | х | х | х | х | 0 | х | х | х | Stop bit = 1 |
| | х | Х | х | х | 1 | X | X | Х | Stop bits = 2 |
| | X | X | X | X | X | 0 | 0 | X | Parity = none |
| | X | X | X | X | X | 0 | 1 0 | X | Parity = even Parity = odd |
| | X X | X X | x x | x x | x x | X | x | x 0 | Line termination = OFF |
| | x | x | x | x | x | x | x | 1 | Line termination = ON |
| 7 | | | S 5 | S 4 | S3 | S2 | | S 0 | STATUS byte. Ref.Table 6-8 for specification of the STATUS byte. |
| | | | | | -3 | | | | System configuration, Byte 4: |
| | 0 | 0 | 0 | 0 | x | x | x | x | Output unit = ANGULAR RATE |
| | 0 | 0 | 0 | 1 | | x | | | |
| | _ | - | - | | X | | X | X | |
| | 0 | 0 | 1 | 0 | x | X | х | х | Output unit = AVERAGE ANGULAR RATE |
| | 0 | 0 | 1 | 1 | X | X | X | X | Output unit = INTEGRATED ANGLE |
| | х | х | х | х | 0 | 0 | 0 | 0 | Datagram format = Standard |
| 8 | х | х | х | х | 0 | 0 | 0 | 1 | Datagram format = Extended |
| | х | х | х | х | 0 | 0 | 1 | 0 | Datagram format = Standard w.CR+FL |
| | х | х | х | х | 0 | 0 | 1 | 1 | Datagram format = Rate and temperature, |
| | х | х | х | х | 0 | 1 | 0 | 0 | Datagram format = Rate and counter, |
| | х | х | х | х | 0 | 1 | 0 | 1 | Datagram format = Rate and latency |
| | x | x | x | x | 0 | 1 | 1 | 1 | Datagram format = Rate, temperature and counter |
| | | | | | 1 | 0 | 0 | 0 | Datagram format = Rate, temperature and latency |
| | Х | X | X | X | | - | | | |
| | | | Х | Х | Х | Х | Х | Х | For future use. |
| 9 | х | X | | V | | | | | |
| 9 10 | x x | X | х | Х | х | х | х | х | For future use. |
| | | | | X C ₄ | х С ₃ | x C ₂ | х С ₁ | x C ₀ | Cyclic Redundancy Check is performed on all preceding bytes and is |
| 10 | х | х | х | | | | | | |





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Table 6-7: Specification of the Normal Mode datagram Byte# Bit# Specification Rate, temperature and latency Rate, temperature and Rate and temperature Extended datagram Standard datagram w.CR+LF Standard datagram Rate and counter Rate and latency counter 7 6 5 4 3 2 1 0 Normal Mode datagram identifier: 0 0 1 0 0 0 0 0x90 standard datagram 1 0 0 0 0x92 extended datagram 1 0 1 0 1 0x93 standard datagram w. CR+LF 1 0 0 1 0 0 1 1 0xA0 datagram with rate and 1 0 1 0 0 0 0 0 temperature 1 0 1 0 0 0 1 0 0xA2 datagram with rate and 0 0 0 0 0 0 0 0 counter 1 0 1 0 0 1 0 0 0xA4 datagram with rate and latency 0x99 datagram with rate, 1 0 0 1 0 0 1 1 temperature and counter 1 n 1 0 0 1 1 0 0xA6 datagram with rate, temperature and latency 1 1 1 1 1 1 1 1 **X**23 **X**22 **X**21 **X**20 **X**19 **X**18 **X**17 X16 X axis gyro output. Ref. chapter 2 2 2 2 2 2 2 2 X₁₅ **X**₁₄ **X**₁₃ **X**₁₂ **X**₁₁ **X**₁₀ **X**9 \mathbf{X}_{8} 8.2.2.3 for conversion to units 3 3 3 3 3 3 3 3 **X**7 X_6 **X**5 \mathbf{X}_4 **X**3 **X**₂ **X**1 \mathbf{X}_0 4 4 4 4 4 4 4 4 y₂₃ y₂₂ **y**₂₁ y₂₀ **y**₁₉ y₁₈ **y**₁₇ **y**₁₆ Y axis gyro output. Ref. chapter 5 5 5 5 5 5 5 5 **y**15 **y**₁₄ **y**₁₃ **y**₁₂ **y**₁₁ **y**₁₀ y₉ y₈ 8.2.2.3 for conversion to units 6 6 6 6 6 6 6 6 **У**7 **y**₆ **y**₅ **y**₄ **y**₃ **y**₂ **y**₁ **y**₀ 7 7 7 7 7 7 7 7 Z₂₃ **Z**22 **Z**21 Z₂₀ **Z**19 Z₁₈ **Z**17 Z16 Z axis gyro output. Ref. chapter 8 8 8 8 8 8 8 8 Z₁₀ Z₁₃ **Z**₁₂ Z11 **Z**9 Z_8 Z₁₅ Z14 8.2.2.3 for conversion to units 9 9 9 9 9 9 9 9 Z_7 Z_5 Z_4 Z_3 Z_2 Z_1 Z_0 Z_6 STATUS byte. Ref.Table 6-8 for 10 10 10 10 10 10 10 10 **S**7 S_6 **S**5 S4 S₃ S₂ S₁ S_0 specification of this byte. N/A N/A 11 N/A N/A N/A N/A N/A х х х х х х Х х For future use. N/A 12 N/A N/A N/A N/A N/A N/A For future use. х Х Х х х х Х х N/A 13 N/A N/A N/A N/A N/A N/A х х х х х х х For future use. Tx₁₅ Tx₁₃ Tx₁₂ Tx₁₀ N/A Tx₁₄ Tx₁₁ Tx₉ Tx₈ X axis temperature data. Ref. chapter N/A N/A 11 N/A N/A 11 11 Tx_6 Tx_1 T_{X7} Tx₅ Tx_4 Tx_3 Tx_2 Tx_0 8.2.2.3.5 for conversion to units N/A N/A N/A N/A 12 N/A 12 12 Ty₁₅ Ty₁₀ N/A N/A 13 N/A N/A 13 13 Ty₁₄ Ty₁₃ Ty₁₂ **Ty**₁₁ Ty₀ Y axis temperature data. Ref. chapter N/A Ty₈ $\overline{\mathsf{T}}_{\mathsf{Y}_4}$ $\overline{Ty_3}$ Ty₁ Ty₇ Ty_0 N/A N/A N/A 14 N/A N/A 14 14 $\mathsf{T}\mathsf{y}_6$ Ty_5 Ty₂ 8.2.2.3.5 for conversion to units Tz₁₅ N/A N/A N/A 15 N/A N/A 15 15 Tz_{14} Tz₁₃ Tz₁₂ Tz₁₁ Tz₁₀ Tz₉ Tz₈ Z axis temperature data. Ref. chapter N/A N/A N/A 16 N/A N/A 16 16 Tz₇ Tz_6 Tz_5 Tz_4 Tz₃ Tz_2 $\mathsf{T}\mathsf{Z}_1$ Tz_0 8.2.2.3.5 for conversion to units N/A N/A N/A N/A 11 N/A 17 N/A n₇ n_6 n₅ n_4 n_3 n_2 n_1 n_0 Counter. Ref. chapter 8.2.2.3.6 N/A N/A Latency. Ref. chapter 8.2.2.3.7 for N/A N/A N/A N/A 17 I_{10} I_8 11 I_{12} **l**9 I_{15} **I**₁₄ I₁₃ I₁₁ N/A N/A N/A N/A N/A 12 N/A 18 I_7 conversion to units. **I**6 l₅ 4 l₃ I_2 l₁ l₀ Cyclic Redundancy Check is performed on all preceding bytes and 11 14 11 17 12 13 18 19 is generated from the polynomial: **C**7 C_6 C_5 C_4 **C**3 **C**₂ C₁ C_0 $x^{8} + x^{2} + x + 1$, seed = 0xFF N/A N/A 12 N/A N/A N/A N/A N/A 0 0 0 0 1 1 0 1 <CR> N/A N/A N/A N/A N/A N/A N/A 0 0 0 0 0 <LF> 13 0 1 1







6.4 Status byte

Table 6-8: Interpretation of bits in STATUS byte

| Bit | STATUS bit information | Comment |
|-----|--------------------------------------|--|
| 7 | 0=OK, 1=System integrity error | |
| 6 | 0=OK, 1=Start-Up | |
| 5 | 0=OK, 1=Outside operating conditions | |
| 4 | 0=OK, 1=Overload | Bits 0-2 will flag the overload channel(s) |
| 3 | 0=OK, 1=Error in gyro channel | Bits 0-2 will flag the error channel(s) |
| 2 | 0=OK, 1=Z channel | |
| 1 | 0=OK, 1=Y channel | |
| 0 | 0=OK, 1=X channel | |





MECHANICAL 7

Table 7-1: Mechanical specifications

| Parameter | Conditions | Min Nom Max | Unit | Note |
|--------------------------------|------------|------------------------------|-------|------|
| WEIGHT | | 55 | grams | |
| DUST AND HUMIDITY | | IP56 | | |
| CLASSIFICATION | | 11 30 | | |
| CONNECTOR | | | | |
| Туре | | Nicomatic CMM220 series male | | |
| Number of pins | | 10 | | |
| Contact type | | LF | | |
| PLUG | | | | |
| Proposed plug to fit connector | | Nicomatic CMM-222-S-10-A32 | | |
| Proposed cover to fit plug | | Nicomatic CMM-C2-15 | | |
| FIXATION BOLTS | 2.5mm tool | M4 DIN 7991-A2 | | |
| | 3mm tool | M4 DIN 912-A2 | | |

7.1 **Mechanical dimensions**

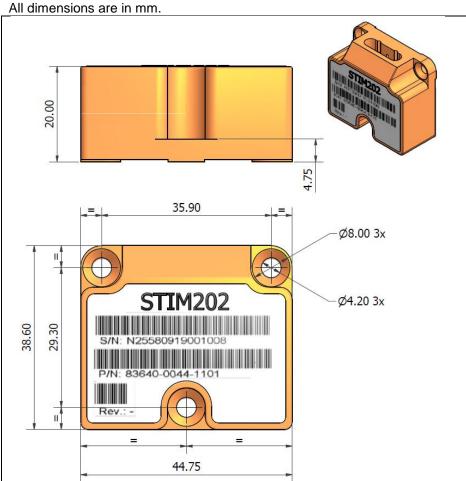


Figure 7-1: Mechanical dimensions



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7.2 Pin configuration

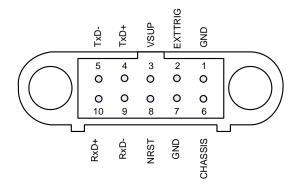


Figure 7-2: Pin configuration as seen from front of STIM202

| | in description | | |
|------|----------------|---------|---|
| Pin# | Label | Туре | Description |
| 1 | GND | SUPPLY | Power ground (0V) |
| 2 | EXTTRIG | INPUT | External trigger input (if not in use, connect to GND) |
| 3 | VSUP | SUPPLY | Power supply (+5V) |
| 4 | TxD+ | OUTPUT | RS422 positive output |
| 5 | TxD- | OUTPUT | RS422 negative output |
| 6 | CHASSIS | CHASSIS | Chassis connection (galvanic isolation from power ground) |
| 7 | GND | INPUT | Test pin: Connect to ground (0V) |
| 8 | NRST | INPUT | Reset (if not in use, connect to VSUP or leave floating) |
| 9 | RxD- | INPUT | RS422 negative input |
| 10 | RxD+ | INPUT | RS422 positive input |

Table 7-2: Pin descriptions

7.3 Definition of axes

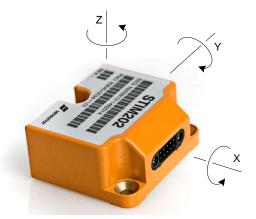


Figure 7-3: Definition of axes



DATASHEET

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8 BASIC OPERATION

STIM202 is very simple to use. After having connected power, the unit will start performing measurements and transmit the results over the RS422 interface without any need for additional signalling or set-up. Figure 8-1 shows the simplest connection set-up for STIM202.

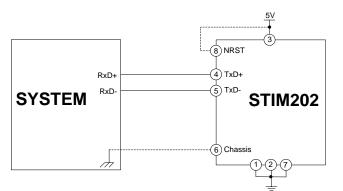


Figure 8-1: Transmit-Only Electrical Connection Diagram

In order to take full advantage of all features of STIM202 the unit needs to be connected as shown in Figure 8-2. In this set-up the system can reset the unit without having to toggle power, external trigger functionality can be utilized, configuration parameters can be changed and extended information like diagnostic information can be read from the device.

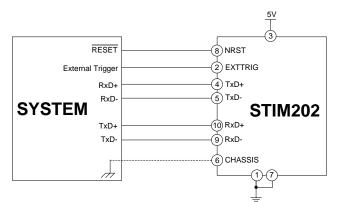


Figure 8-2: Full Function Electrical Connection Diagram

8.1 Reset

STIM202 has a separate reset pin (NRST) in order for the application to reset the unit without having to toggle power.

The reset is active low and has an internal pull-up. Hence the input could be left floating if not in use.

The reset signal is routed to the reset of the microcontroller and effectively forces STIM202 into Init Mode (ref. Figure 8-3 and chapter 8.2.1).



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8.2 Operating modes

The operating modes of STIM202 are shown in Figure 8-3:

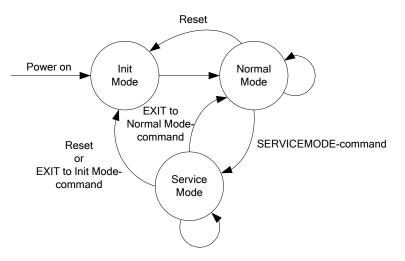


Figure 8-3: Operating modes

8.2.1 Init Mode

Init Mode is entered after power on, after an external reset, when receiving a reset command in Normal Mode or when exiting to Init Mode from Service Mode. In Init Mode the system waits for internal references to settle, resets and synchronizes the gyro measurements channels and transmits three special datagrams containing part number, serial number and configuration data.

Table 6-4 specifies the sequence and contents of the Part Number datagram. Table 6-5 specifies the sequence and contents of the Serial Number datagram. Table 6-6 specifies the sequence and contents of the Configuration datagram.

After having transmitted the special Part Number, Serial Number and Configuration datagrams, STIM202 enters Normal Mode. All these special datagrams can also be requested by commands in Normal Mode, ref. chapter 9.

8.2.2 Normal Mode

In Normal Mode STIM202 will constantly measure the gyro channels at an internal sample rate of 1000 samples/s and transmit at the chosen sample rate, alternatively when receiving an external trigger, dependent on the selected datagram. STIM202 will transmit data regardless of any errors reported in the STATUS byte (ref. Table 6-8). Hence the content of the STATUS byte should continuously be examined.

Table 6-7 specifies the sequence and contents of the datagrams transmitted in Normal Mode.

8.2.2.1 Start-Up

When STIM202 enters Normal Mode from Init Mode, there will be a start-up period where STIM202 is stabilizing the gyros. This is a fixed period as specified in Table 6-2 and bit 6 is set in the STATUS byte (ref. Table 6-8) to communicate this condition. During the start-up period STIM202 will continuously sample, compensate and output data.

There will not be any start-up period when STIM202 is exiting from Service Mode directly to Normal Mode.

8.2.2.2 External trigger

STIM202 can be configured to transmit data only when being externally triggered (ref. chapter 12). Trigger will be on negative going edge. Once having received a trigger signal the STIM202 will transmit one datagram containing the currently available data.

NB: external trigger input is 3.3V logic. The input pin has an internal pull-up, hence the pin can be driven by open-collector logic to avoid the need for external 3.3V logic.

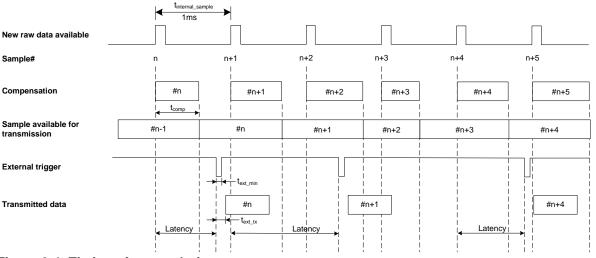


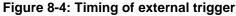
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Note that STIM202 will always transmit the 3 special datagrams when leaving Init Mode even if datagram with external trigger has been chosen and that it will respond in Service Mode as described in chapter 10 regardless of external trigger input.

The timing diagram is shown in Figure 8-4. Latency is the time from the sample has been digitized and low-pass filtered to the external trigger occurs.





8.2.2.3 Output data

8.2.2.3.1 Angular Rate

Angular Rate is available in all datagrams when STIM202 has been configured to output angular rate. The transmitted data will be the last internal sample. E.g. in the case of continuous transmission of datagrams and a sample rate of 250 samples/s, every fourth internally sample will be transmitted.

Equation 1 and Figure 8-5 show how to convert to [°/s]. Note that the output data is represented as two's complement (most significant bit is the sign bit).

Equation 1: Converting output to [°/s]:

 $Output[^{\circ}/s] = \frac{(AR_1) \cdot 2^{16} + (AR_2) \cdot 2^8 + (AR_3)}{2^{14}}$

where AR_1 is the most significant byte of the 24bit output AR_2 is the middle byte of the 24bit output AR_3 is the least significant byte of the 24bit output

| - | | | – AR | 1 — | | | - | • | | | – AR | 2 | | | | • | | | - AR₃ | | | | |
|--------|----------------|----------------|----------------|----------------|--------|----------------|----------------|----------------|----------------|-----------------|-----------------|-----------------|--------|-----------------|-----------------|-----------------|-----------------|-----------------|------------------|------------------|------------------|------------------|------------------|
| Bit 23 | Bit 22 | Bit 21 | Bit 20 | Bit 19 | Bit 18 | Bit 17 | Bit 16 | Bit 15 | Bit 14 | Bit 13 | Bit 12 | Bit 11 | Bit 10 | Bit 9 | Bit 8 | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| Sign | 2 ⁸ | 2 ⁷ | 2 ⁶ | 2 ⁵ | 24 | 2 ³ | 2 ² | 2 ¹ | 2 ⁰ | 2 ⁻¹ | 2 ⁻² | 2 ⁻³ | 2-4 | 2 ⁻⁵ | 2 ⁻⁶ | 2 ⁻⁷ | 2 ⁻⁸ | 2 ⁻⁹ | 2 ⁻¹⁰ | 2 ⁻¹¹ | 2 ⁻¹² | 2 ⁻¹³ | 2 ⁻¹⁴ |

Figure 8-5: Converting output bytes to [°/s]



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8.2.2.3.2 Incremental angle

Incremental angle is available in all datagrams when STIM202 has been configured to output incremental angle. The transmitted data will be the integrated angle since last transmitted sample. E.g. in the case of continuous transmission of datagrams and a sample rate of 250 samples/s, each transmission will contain the integrated angle of four internal samples.

Equation 2 and Figure 8-6 show how to convert to [°/sample]. Note that the output data is represented as two's complement (most significant bit is the sign bit):

Equation 2: Converting output to [°/sample]

$$Output[^{\circ}/sample] = \frac{(IA_1) \cdot 2^{16} + (IA_2) \cdot 2^8 + (IA_2) \cdot 2^8 + (IA_2) \cdot 2^{16} + (IA_2) \cdot 2$$

where IA_1 is the most significant byte of the 24bit output

 IA_2 is the middle byte of the 24bit output

 IA_3 is the least significant byte of the 24bit output

| - | | | – IA ₁ | | | | | ◄ | | | – IA ₂ | | | | | • | | | - IA3 | | | | |
|--------|----------------|----------------|-------------------|--------|-----------------|--------|-----------------|-----------------|--------|-----------------|-------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| Bit 23 | Bit 22 | Bit 21 | Bit 20 | Bit 19 | Bit 18 | Bit 17 | Bit 16 | Bit 15 | Bit 14 | Bit 13 | Bit 12 | Bit 11 | Bit 10 | Bit 9 | Bit 8 | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| Sign | 2 ¹ | 2 ⁰ | 2-1 | 2-2 | 2 ⁻³ | 2-4 | 2 ⁻⁵ | 2 ⁻⁶ | 2.7 | 2 ⁻⁸ | 2 ⁻⁹ | 2 ⁻¹⁰ | 2 ⁻¹¹ | 2 ⁻¹² | 2 ⁻¹³ | 2 ⁻¹⁴ | 2 ⁻¹⁵ | 2 ⁻¹⁶ | 2 ⁻¹⁷ | 2 ⁻¹⁸ | 2 ⁻¹⁹ | 2 ⁻²⁰ | 2 ⁻²¹ |

Figure 8-6: Converting output bytes to [°/samples]

8.2.2.3.3 Average angular rate

Average angular rate is available in all datagrams when STIM202 has been configured to output average angular rate. The transmitted data will be the average of the samples since last transmission. E.g. in the case of continuous transmission of datagrams and a sample rate of 250 samples/s, each transmission will contain the average of the four internal samples.

Note that the configured low-pass filtering is performed prior to calculating the average.

The average is calculated on the samples using the conventional equation for average calculation:

Equation 3: Calculating average:

Average Angular Rate
$$[^{\circ}/s] = \frac{\sum_{m=1.n}}{n}$$

where Angular Rate_m is one angular rate data sampled at 1000 samples/s n is number of samples since last transmission

Conversion to [°/s] is the same as for angular rate and is described in Equation 1.

8.2.2.3.4 Integrated angle

Integrated angle is available in all datagrams when STIM202 has been configured to output integrated angle. The transmitted data will be continuously integrated angle since power-on or reset. The integrated angle takes values in the interval [-4°,4°> and will naturally wrap around with no error message indication in the Status byte.

Conversion to [°] is the same as for incremental angle and is described in Equation 2.

8.2.2.3.5 Temperature

Temperature data for each axis is available in certain datagrams (ref. chapter 12).



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Equation 4 and Figure 8-7 show how to convert to [°C]. Note that the output data is represented as two's complement (most significant bit is the sign bit):

Equation 4: Converting temperature data to [°C]

 $Output [°C] = \frac{(T_1) \cdot 2^8 + (T_2)}{2^8}$

where T_1 is the most significant byte of the 16bit output T_2 is the least significant byte of the 16bit output

T₁ T_2 Bit 15 Bit 14 Bit 13 Bit 12 Bit 11 Bit 10 Bit 9 Bit 8 Bit 7 Bit 6 Bit 3 Bit 2 Bit 1 Bit 0 Bit 5 Bit 4 2⁰ 2⁶ 2⁵ 2^{4} 2^{3} 2² 2¹ 2-1 2⁻² 2⁻³ 2-4 2⁻⁵ 2⁻⁶ 2⁻⁷ 2⁻⁸ Sign

Figure 8-7: Converting temperature data to [°C]

8.2.2.3.6 Counter

A counter is available in certain datagrams (ref. chapter 12). The counter is an unsigned single byte taking values in the interval [0,255].

For the output units Incremental Angle and Average Angular Rate, the counter contains the number of internal samples being represented by the output data.

For the output units Angular Rate and Integrated Angle, the counter will increment by 1 per internal sample. The counter will naturally wrap around with no error message indication in the Status byte.

8.2.2.3.7 Latency

Latency is available in certain datagrams (ref. chapter 12). Latency is an unsigned word taking values in the interval [0 , 65535] µs.

Equation 5 and Figure 8-8 show how to convert to [seconds]:

Equation 5: Converting latency data to [seconds]

 $Output[seconds] = ((t_1) \cdot 2^8 + (t_2)) \cdot 10^{-6}$

where t_1 is the most significant byte of the 16bit output

t₂ is the least significant byte of the 16bit output

| • | | | – t ₁ | | | | | • | | | - t ₂ | | | | |
|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|
| Bit 15 | Bit 14 | Bit 13 | Bit 12 | Bit 11 | Bit 10 | Bit 9 | Bit 8 | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| 2 ¹⁵ ·10 ⁻⁶ | 2 ¹⁴ ·10 ⁻⁶ | 2 ¹³ ·10 ⁻⁶ | 2 ¹² ·10 ⁻⁶ | 2 ¹¹ ·10 ⁻⁶ | 2 ¹⁰ ·10 ⁻⁶ | 2 ⁹ ·10 ⁻⁶ | 2 ⁸ ·10 ⁻⁶ | 2 ⁷ ·10 ⁻⁶ | 2 ⁶ ·10 ⁻⁶ | 2 ⁵ ·10 ⁻⁶ | 2 ⁴ ·10 ⁻⁶ | 2 ³ ·10 ⁻⁶ | 2 ² ·10 ⁻⁶ | 2 ¹ ·10 ⁻⁶ | 2 ⁰ ·10 ⁻⁶ |

Figure 8-8: Converting latency data to [seconds]



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8.2.3 Service Mode

In Service Mode the communication interface is human readable and hence the communication format supports well the use of terminal based software during the development phase, when the configuration of a device needs to be changed or during investigations into an observed problem.

When Service Mode is entered, STIM202 will respond with its configuration information (same as the response to the <u>i</u> (INFORMATION) command, ref: Figure 10-1).

A set of commands are available, ref. Chapter 10, enabling the user to change intermediately or permanently the configuration parameters, display latest measurement results, display higher details on error information and perform a full diagnostic of the unit.

In Service Mode the gyro measurements will still be running in the background, enabling to switch directly back to Normal Mode without the need for any stabilisation time of filters, etc. However the measurement data itself, when STIM202 is in Service Mode are not transmitted and therefore lost. By using the <u>a</u> (SINGLE-SHOT MEASUREMENT) command (ref. Chapter 10.2) it is possible to display single measurement results.

Exiting Service Mode can be done in several ways:

- 1. Using the external reset. This will force STIM202 into Init Mode. Be advised that during Init Mode, all the configuration parameters are loaded from flash. If any of the configuration parameters have been changed during the Service Mode session but not saved to flash, these changes will be overwritten by the content already stored in flash.
- 2. Using the <u>x</u> (EXIT) command. When using this command a parameter is required to decide whether the device should go to Init Mode or to Normal Mode. When exiting to Normal Mode, any of the changes made to the configuration parameters will still be valid. However, if not saved, the configuration parameters will be overwritten by the content already stored in flash at the next power-up or reset.

8.3 Self diagnostics

STIM202 is constantly checking its internal status. The checks include:

- Check of internal references
- Check of gyros (error and overload)
- Check of internal temperatures
- Check of RAM and flash
- Check of supply voltage

When an error situation is detected, the corresponding bit in the STATUS byte (ref. Table 6-8) will be set.

The bits in the STATUS are valid for the data in a single transmission. Hence any error condition is not latched.

In Service Mode it is possible to see the last detected error by using the <u>i e</u> (INFORMATION on LAST ERROR IN NORMAL MODE) command, ref. Chapter 10.1 or run a full diagnostic and see the result of the individual checks by using the <u>c</u> (DIAGNOSTIC) command, ref. Chapter 10.3.



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9 COMMANDS IN NORMAL MODE

Several commands are available in Normal Mode, as listed in Table 9-1. Note that all commands in Normal Mode must be transmitted in upper case letters.

Table 9-1 Available commands in Normal Mode

| Command | Short description |
|-------------|--------------------------------------|
| N | Transmits one Part Number datagram |
| I | Transmits one Serial Number datagram |
| С | Transmits one Configuration datagram |
| R | Resets the unit |
| SERVICEMODE | Enters Service Mode |

Table 9-2 List of special ASCII characters used in Normal Mode

| Char | Hex | Dec | Short description |
|-----------|------|-----|---|
| <cr></cr> | 0x0D | 13 | "Carriage Return": used as execution character for commands |

No echo of received command characters nor error messages will appear for these commands. Only at the receipt of the complete correct command, STIM202 executes accordingly.

NB: if OUTPUT UNIT is set to INCREMENTAL ANGLE (ref. Chapter 10.7), the transmitted incremented angle in the datagram following any of the requested special datagrams will NOT contain the incremental angle since the last transmitted measurement. Hence the incremented angle occurring during the transmission of a special requested datagram will be lost.

9.1 N (PART NUMBER DATAGRAM) command

General description: Requests transmission of a Part Number datagram (ref. Table 6-4).

Table 9-3 : Available I (PART NUMBER DATAGRAM) command

| Syntax | Response |
|-------------|------------------------------------|
| N <cr></cr> | Transmits one Part Number datagram |

The Part Number datagram will replace the next transmitted Normal Mode datagram.

9.2 I (SERIAL NUMBER DATAGRAM) command

General description: Requests transmission of a Serial number datagram (ref. Table 6-5).

Table 9-4 : Available I (SERIAL NUMBER DATAGRAM) command

| Syntax | Response |
|-------------|--------------------------------------|
| I <cr></cr> | Transmits one Serial Number datagram |
| | |

The Serial Number datagram will replace the next transmitted Normal Mode datagram.

9.3 C (CONFIGURATION DATAGRAM) command

General description: Requests transmission of a configuration datagram (ref. Table 6-6).

Table 9-5: Available C (CONFIGURATION DATAGRAM) command

| Syntax | Response |
|-------------|--------------------------------------|
| C <cr></cr> | Transmits one Configuration datagram |

The Configuration datagram will replace the next transmitted Normal Mode datagram.



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9.4 R (RESET) command

General description: Force a Reset (ref. Figure 8-3).

Table 9-6: Available R (RESET) command

| Syntax | Response |
|-------------|-----------------|
| R <cr></cr> | Resets the unit |

9.5 SERVICEMODE command

General description : Enters Service Mode (ref. chapter 8.2.3).

Table 9-7: Available SERVICEMODE command

| Syntax | Response |
|-----------------------|---------------------|
| SERVICEMODE <cr></cr> | Enters Service Mode |

If the command is received during the transmission of a datagram, it will complete the transmission before entering Service Mode.

When entering Service Mode, the configuration and identification data of the device will be listed, as shown in Figure 9-1:

SERIAL NUMBER = N25580846002002 PRODUCT = STIM202XZ PART NUMBER = 83644-1034-0121 REV D HW CONFIG = M5432 REV 5 FW CONFIG = SWD11768 REV 8 OUTPUT UNIT = [°/sample] - INCREMENTAL ANGLE SAMPLE RATE [samples/s] = 1000 LP FILTER -3dB FREQUENCY, X-AXIS [Hz] = 262 LP FILTER -3dB FREQUENCY, Y-AXIS [Hz] = NA LP FILTER -3dB FREQUENCY, Z-AXIS [Hz] = 262 DATAGRAM FORMAT = STANDARD BIT RATE [bps] = 374400 DATA LENGTH = 8 STOP BITS = 1 PARITY = EVEN LINE TERMINATION = ON

Figure 9-1: Example of response from SERVICEMODE command



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10 COMMANDS IN SERVICE MODE

Several commands are available in Service Mode, as listed in Table 10-1. Note that all commands in Service Mode must be transmitted in lower case letters.

Table 10-1 Available commands in Service Mode

| Command | Short description |
|---------|---|
| i | Lists specific information (e.g. serial number, configuration, error information) |
| а | Performs a single-shot measurement |
| С | Performs a diagnostic of the unit |
| d | Changes datagram format (standard, extended or standard with CR+LF-termination) |
| t | Changes transmission parameters (e.g. bit rate, data length, stop bits) |
| r | Turns line termination ON or OFF |
| u | Changes measurement output unit |
| f | Changes LP filter -3dB frequency |
| m | Changes sample rate |
| S | Saves configuration data |
| х | Exits Service Mode and returns to Normal Mode or Init Mode |
| Z | Restore to factory settings |
| ? | Help function on the available commands in Service Mode |

Table 10-2 List of special ASCII characters used in Service Mode

| Char | Hex | Dec | Short description |
|-----------|------|-----|---|
| <bs></bs> | 0x08 | 8 | "Back Space": deletes last received character (received since last <cr>)</cr> |
| <cr></cr> | 0x0D | 13 | "Carriage Return": typically used as execution character for commands |
| <sp></sp> | 0x20 | 32 | "Space": used to separate command and first parameter |
| ۲, ۲ ۲ | 0x2C | 44 | "Comma": used to separate parameters in a command |
| '>' | 0x3E | 62 | Used together with <cr> as: "Ready to receive new command" prompt</cr> |

When STIM202 is in Service Mode and ready to receive a new command, it will issue the special ASCII character <CR> followed by '>'. As some commands (e.g. SINGLE-SHOT MEASUREMENT command) may respond with a varying number of lines, automated set-ups should look for the special prompt sequence (<CR>+'>') before issuing a new command.

Received characters will be echoed. A command is decoded and executed when receiving the special ASCII character <CR>. <BS> is also recognised and will delete the last received character in the input buffer. The size of the input buffer is 80 characters. <BS> is valid for the characters received since last <CR>.

The command character and first parameter (when applicable) are separated by a space (character 0x20). When there are more than one parameter to a command (e.g. TRANSMISSION PARAMETER command), these must be separated by a comma (character 0x2C).

In the event of an unknown command, inconsistent syntax or incorrect value of parameter(s), STIM202 will respond with an error message. Error messages are on the format:

E<nnn><SP><Error description><CR>

where; nnn is an error number



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10.1 i (INFORMATION) command

General description: Lists various requested information about the device

Table 10-3 : Available i (INFORMATION) commands

| Syntax | Response | |
|---------------------------------|---|--|
| i <cr></cr> | Lists the product configuration and identification data | |
| i <sp><cmd><cr></cr></cmd></sp> | Gives information about the specific parameter | |

Table 10-4 : Allowed values for <cmd> parameter for i (INFORMATION) commands

| <cmd></cmd> | Result | |
|-------------|---|--|
| S | Returns the serial number of the device | |
| n | n Returns the product name of the device | |
| x | Returns the part number of the device | |
| h | Returns the HW configuration and revision of the device | |
| р | Returns the FW configuration and revision of the device | |
| m | Returns the sample rate of the device | |
| f | Returns the LP filter -3dB frequency for each axis | |
| d | Returns the datagram format | |
| t | Returns the transmission parameters of the device | |
| r | Returns the line termination (ON or OFF) | |
| u | Returns the output unit of the device | |
| е | Prints the extended error information from the last detected error in Normal Mode | |

Table 10-5: Error messages for i (INFORMATION) commands

| Error | Message | Possible reason |
|-------|---------------------|--|
| E001 | UNKOWN COMMAND | Command or parameter is not recognised |
| E002 | INCORRECT NUMBER OF | Too many or too few parameters, use of comma between command |
| | PARAMETERS | and first parameter |

SERIAL NUMBER = N25580846002002 PRODUCT = STIM202XZ PART NUMBER = 83644-1034-0121 REV D HW CONFIG = M5432 REV 5 FW CONFIG = SWD11768 REV 8 OUTPUT UNIT = [°/sample] – INCREMENTAL ANGLE SAMPLE RATE [samples/s] = 1000 LP FILTER -3dB FREQUENCY, X-AXIS [Hz] = 262 LP FILTER -3dB FREQUENCY, Y-AXIS [Hz] = NA LP FILTER -3dB FREQUENCY, Z-AXIS [Hz] = 262 DATAGRAM FORMAT = STANDARD BIT RATE [bps] = 374400 DATA LENGTH = 8 STOP BITS = 1 PARITY = EVEN LINE TERMINATION = ON

Figure 10-1: Example of response from i (INFORMATION) command

SERIAL NUMBER = N25580846002002

>i s

>i

Figure 10-2: Example of response from i s (INFORMATION on SERIAL NUMBER) command





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PRODUCT = STIM202XZ

>i n

>i x

>

>

Figure 10-3: Example of response from in (INFORMATION on PRODUCT NAME) command

PART NUMBER = 83644-1034-0121 REV D

Figure 10-4: Example of response from i x (INFORMATION on PART NUMBER) command

>i h HW CONFIG = M5432 REV 5

Figure 10-5: Example of response from i h (INFORMATION on HW CONFIGURATION) command

>i p FW CONFIG = SWD11768 REV 8

Figure 10-6: Example of response from i p (INFORMATION on FW CONFIGURATION) command

>i m SAMPLE RATE [samples/s] = 1000

Figure 10-7: Example of response from i m (INFORMATION on SAMPLE RATE) command

>i f LP FILTER -3dB FREQUENCY, X-AXIS [Hz] = 262 LP FILTER -3dB FREQUENCY, Y-AXIS [Hz] = NA LP FILTER -3dB FREQUENCY, Z-AXIS [Hz] = 262

Figure 10-8: Example of response from i f (INFORMATION on LP FILTER -3dB FREQUENCY) command

>i d DATAGRAM FORMAT = STANDARD

Figure 10-9: Example of response from i d (INFORMATION on DATAGRAM CONTENT) command

```
>i t
BIT RATE [bps] = 374400
DATA LENGTH = 8
STOP BITS = 1
PARITY = EVEN
```

Figure 10-10: Example of response from it (INFORMATION on TRANSMISSION PARAMETERS) command



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>i r LINE TERMINATION = ON

>

>

>

Figure 10-11: Example of response from i r (INFORMATION) command

>i u OUTPUT UNIT = [°/sample] – INCREMENTAL ANGLE

Figure 10-12: Example of response from i u (INFORMATION on OUTPUT UNIT) command

>i e GYRO X-AXIS I-CH OVERFLOW = FAILED

Figure 10-13: Example of response from i e (INFORMATION on LAST ERROR IN NORMAL MODE) command



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10.2 a (SINGLE-SHOT MEASUREMENT) command

General description: Displays the result of latest measurement (measurement process running constantly in the background).

If sample rate has been set to external trigger, the SINGLE-SHOT MEASUREMENT will respond to the measurement result at the latest trigger. Hence if no trigger is received, the command will respond with the same data if sent multiple times.

Table 10-6: Available a (SINGLE-SHOT MEASUREMENT) command

| Syntax | Response |
|-------------|--|
| a <cr></cr> | Displays the result of the latest measurement sample |

Table 10-7: Error messages for a (SINGLE-SHOT MEASUREMENT) command

| Error | Message | Possible reason |
|-------|---------------------|--|
| E001 | UNKOWN COMMAND | Command is incorrectly entered |
| E002 | INCORRECT NUMBER OF | Any characters between command and <cr></cr> |
| | PARAMETERS | |

>a X-AXIS = 1.43255°/s Y-AXIS = NA Z-AXIS = 243.33667°/s STATUS = 00000000 = OK

Figure 10-14: Example of response from a (SINGLE-SHOT MEASUREMENT) command

>a X-AXIS = 0.000716275° Y-AXIS = NA Z-AXIS = 0.121668335° STATUS = 00100101 = NOT OK BIT 5: OUTSIDE OPERATING CONDITIONS BIT 2: ERROR IN Z-CHANNEL BIT 0: ERROR IN X-CHANNEL

>

Figure 10-15: Example of response from a (SINGLE-SHOT MEASUREMENT) command with error flagging







10.3 c (DIAGNOSTIC) command General description: Performs a diagnostic of the unit.

Table 10-8: Available c (DIAGNOSTIC) command

| Syntax | Response | |
|-------------|-----------------------------|--|
| c <cr></cr> | Performs a diagnostic check | |

Table 10-9: Error messages for c (DIAGNOSTIC) command

| Error | Message | Possible reason |
|-------|-----------------------------------|--|
| E001 | UNKOWN COMMAND | Command is incorrectly entered |
| E002 | INCORRECT NUMBER OF PARAMETERS | Any characters between command and <cr></cr> |



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| >C |
|--|
| SERIAL NUMBER = N25580846002002 |
| PRODUCT = STIM202XZ |
| PART NUMBER = 83644-1034-0121 REV D |
| HW CONFIG = M5432 REV 5 |
| FW CONFIG = SWD11768 REV 8 |
| SYSTEM STATUS: |
| RAM CHECK = OK |
| FLASH CHECK = OK |
| STACK STATUS MONITOR = OK |
| STACK TEMPERATURE CONTROL = OK |
| STACK COMMAND HANDLER = OK |
| STACK SAMPLE = OK |
| STACK FLASH = OK |
| MICRO CONTROLLER TEMPERATURE = OK |
| |
| |
| REFERENCE VOLTAGE 5.0V = OK |
| REFERENCE VOLTAGE 2.5V = OK |
| REFERENCE VOLTAGE 2.048V = OK |
| REGULATED VOLTAGE 5.0V = OK |
| REGULATED VOLTAGE 1.8V = OK |
| INPUT VOLTAGE 5.0V = OK |
| VOLTAGE BOOST = OK |
| GYRO X-AXIS: |
| GYRO X-AXIS EXC.FREQ = OK |
| GYRO X-AXIS ASIC TEMP = OK |
| GYRO X-AXIS CONTROLLER SETPOINT DIFF = OK |
| GYRO X-AXIS SENSOR TEMP = OK |
| GYRO X-AXIS COMPENSATED RATE SIGNAL = OK |
| GYRO X-AXIS PWM = OK |
| GYRO X-AXIS CALCULATION OVERFLOW = OK |
| GYRO X-AXIS Q-CH RANGE = OK |
| GYRO X-AXIS I-CH RANGE = OK |
| GYRO X-AXIS DET.DC = OK |
| GYRO X-AXIS EXC.DC = OK |
| GYRO X-AXIS SPI = OK |
| GYRO X-AXIS EXC.AMPL = OK |
| GYRO X-AXIS OVERRUN = OK |
| GYRO Z-AXIS: |
| GYRO Z-AXIS EXC.FREQ = OK |
| GYRO Z-AXIS ASIC TEMP = OK |
| GYRO Z-AXIS CONTROLLER SETPOINT DIFF = NOK |
| GYRO Z-AXIS SENSOR TEMP = NOK |
| GYRO Z-AXIS COMPENSATED RATE SIGNAL = OK |
| GYRO Z-AXIS PWM = OK |
| GYRO Z-AXIS FWM = OK GYRO Z-AXIS CALCULATION OVERFLOW = OK |
| GYRO Z-AXIS CALCOLATION OVERFLOW = OK GYRO Z-AXIS Q-CH RANGE = OK |
| |
| GYRO Z-AXIS I-CH RANGE = OK |
| GYRO Z-AXIS DET.DC = OK |
| GYRO Z-AXIS EXC.DC = OK |
| GYRO Z-AXIS SPI = OK |
| GYRO Z-AXIS EXC.AMPL = OK |
| GYRO Z-AXIS OVERRUN = OK |
| |
| > |
| Figure 10-16: Example of response from c (DI |

Figure 10-16: Example of response from c (DIAGNOSTIC) command



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10.4 d (DATAGRAM FORMAT) command

General description: Changes the datagram format in Normal Mode (ref. Table 6-7).

Note that this change will only be effective until STIM202 is initialized, reset or powered off, unless the new setting has been stored in flash using the SAVE-command (ref. chapter 10.10). In order to use or test a new setting in Normal Mode without permanently storing it, this can be achieved by skipping the SAVE-command and using the EXIT n-command (ref. chapter 10.11).

Table 10-10 : Available d (DATAGRAM FORMAT) command

| Syntax | Response | |
|---|--|--|
| d <sp><d_format><cr></cr></d_format></sp> | Changes the datagram format in Normal Mode | |

Table 10-11 : Allowed values for d (DATAGRAM FORMAT) command

| <d_format></d_format> | Result | |
|-----------------------|--|--|
| S | Changes the datagram format in Normal Mode to standard format | |
| е | Changes the datagram format in Normal Mode to extended format | |
| r | Changes the datagram format in Normal Mode to standard format with CR+LF termination | |
| j | j Changes the datagram format in Normal Mode to rate and temperature | |
| k | k Changes the datagram format in Normal Mode to rate and counter | |
| I | Changes the datagram format in Normal Mode to rate and latency | |
| n | Changes the datagram format in Normal Mode to rate, temperature and counter | |
| 0 | o Changes the datagram format in Normal Mode to rate, temperature and latency | |

Table 10-12: Error messages for d (DATAGRAM FORMAT) command

| | Error | Message | Possible reason |
|---|-------|---------------------|--|
| | E001 | UNKOWN COMMAND | Command is incorrectly entered |
| Ī | E002 | INCORRECT NUMBER OF | Too many or too few parameters, use of comma between command |
| | | PARAMETERS | and first parameter |
| | E003 | INVALID PARAMETER | Value of parameter outside valid range |

>d s DATAGRAM FORMAT = STANDARD

>

>d r

Figure 10-17: Example of response from d s (DATAGRAM FORMAT) command

>d e DATAGRAM FORMAT = EXTENDED

Figure 10-18: Example of response from d e (DATATGRAM FORMAT) command

DATAGRAM FORMAT = STANDARD WITH <CR><LF> TERMINATION

Figure 10-19: Example of response from d r (DATATGRAM FORMAT) command



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10.5 t (TRANSMISSION PARAMETERS) command

General description: Changes the transmission parameters for the RS422 interface.

Note that this change will only be effective until STIM202 is initialized, reset or powered off, unless the new setting has been stored in flash using the SAVE-command (ref. chapter 10.10). In order to use or test a new setting in Normal Mode without permanently storing it, this can be achieved by skipping the SAVE-command and using the EXIT n-command (ref. chapter 10.11).

Table 10-13 : Available t (TRANSMISSION PARAMETERS) commands

| Syntax | Response |
|---|---|
| t <sp><bit rate=""><cr></cr></bit></sp> | Changes the transmission bit rate and leaves number of stop bits and parity unchanged |
| t <sp><bit rate="">','<stop bits="">','<parity><cr></cr></parity></stop></bit></sp> | Changes the transmission bit rate, number of stop bits and parity |

Table 10-14: Allowed values for
bit rate> parameter for t (TRANSMISSION PARAMETERS) commands

| bit rate> | Result |
|---------------|--|
| 374400 | Will set the bit rate to 374400 bits/s |
| 460800 | Will set the bit rate to 460800 bits/s |
| 921600 | Will set the bit rate to 921600 bits/s |

Table 10-15: Allowed values for <stop bits> parameter for t (TRANSMISSION PARAMETERS) commands

| <stop bits=""></stop> | Result |
|-----------------------|-----------------------------------|
| 1 | Will set number of stop bits to 1 |
| 2 | Will set number of stop bits to 2 |

Table 10-16: Allowed values for <parity> parameter for t (TRANSMISSION PARAMETERS) commands

| <stop bits=""></stop> | Result |
|-----------------------|----------------------|
| n | Will set no parity |
| е | Will set even parity |
| 0 | Will set odd parity |

Table 10-17: Error messages for t (TRANSMISSION PARAMETERS) commands

| Error | Message | Possible reason |
|-------|-----------------------------------|--|
| E001 | UNKOWN COMMAND | Command is incorrectly entered |
| E002 | INCORRECT NUMBER OF PARAMETERS | Too many or too few parameters, use of comma between command and first parameter |
| E003 | INVALID PARAMETER | Value of parameter outside valid range |

>t 460800,2,e

TRANSMISSION PROTOCOL = 460800 bits/s, 2 STOP BIT(S), EVEN PARITY

Figure 10-20: Example of response from t (TRANSMISSION PARAMETERS) command

Transmission parameters will change after the response as shown in Figure 10-20 has been given.



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10.6 r (LINE TERMINATION) command

General description: Turns the line termination ON or OFF. Line termination should be ON when communicating point-to-point (single master – single slave).

Note that this change will only be effective until STIM202 is initialized, reset or powered off, unless the new setting has been stored in flash using the SAVE-command (ref. chapter 10.10). In order to use or test a new setting in Normal Mode without permanently storing it, this can be achieved by skipping the SAVE-command and using the EXIT n-command (ref. chapter 10.11).

Table 10-18: Available r (LINE TERMINATION) command

| Syntax | Response |
|---|------------------------------|
| r <sp><lineterm><cr></cr></lineterm></sp> | Changes the line termination |
| | |

Table 10-19: Allowed values for r (LINE TERMINATION) command

| lineterm> | Result |
|-----------------------|----------------------------|
| 0 | Turns line termination OFF |
| 1 | Turns line termination ON |

Table 10-20: Error messages for r (LINE TERMINATION) command

| Error | Message | Possible reason |
|-------|-----------------------------------|--|
| E001 | UNKOWN COMMAND | Command is incorrectly entered |
| E002 | INCORRECT NUMBER OF PARAMETERS | Too many or too few parameters, use of comma between command and first parameter |
| E003 | INVALID PARAMETER | Value of parameter outside valid range |

```
>r 0
```

LINE TERMINATION = OFF

>

Figure 10-21: Example of response from r 0 (LINE TERMINATION) command

>r 1 LINE TERMINATION = ON

>

Figure 10-22: Example of response from r 1 (LINE TERMINATION) command



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10.7 u (OUTPUT UNIT) command

General description: Sets the unit of the transmission in Normal Mode to angular rate or incremental angle.

Note that this change will only be effective until STIM202 is initialized, reset or powered off, unless the new setting has been stored in flash using the SAVE-command (ref. chapter 10.10). In order to use or test a new setting in Normal Mode without permanently storing it, this can be achieved by skipping the SAVE-command and using the EXIT n-command (ref. chapter 10.11).

Table 10-21: Available u (OUTPUT UNIT) command

| Syntax | Response |
|---|---|
| u <sp><outunit><cr></cr></outunit></sp> | Changes the unit of the transmission in Normal Mode |

Table 10-22: Allowed values for <outunit> for u (OUTPUT UNIT) command

| <outunit></outunit> | Result |
|---------------------|---|
| а | Changes the unit of the transmission in Normal Mode to angular rate [°/s] |
| i | Changes the unit of the transmission in Normal Mode to incremental angle [°/sample] |
| m | Changes the unit of the transmission in Normal Mode to average angular rate [°/s] |
| S | Changes the unit of the transmission in Normal Mode to integrated angle [°] |

Table 10-23: Error messages for u (OUTPUT UNIT) command

| Error | Message | Possible reason |
|-------|---------------------|--|
| E001 | UNKOWN COMMAND | Command is incorrectly entered |
| E002 | INCORRECT NUMBER OF | Too many or too few parameters, use of comma between command |
| | PARAMETERS | and first parameter |
| E003 | INVALID PARAMETER | Value of parameter outside valid range |

```
>u a
OUTPUT UNIT = [°/s] – ANGULAR RATE
```

Figure 10-23: Example of response from u a (OUTPUT UNIT) command

>u i OUTPUT UNIT = [°/sample] – INCREMENTAL ANGLE

Figure 10-24: Example of response from u i (OUTPUT UNIT) command

>u m OUTPUT UNIT = [°/s] – AVERAGE ANGULAR RATE

Figure 10-25: Example of response from u m (OUTPUT UNIT) command

>u s OUTPUT UNIT = [°] – INTEGRATED ANGLE

Figure 10-26: Example of response from u s (OUTPUT UNIT) command





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10.8 f (LP FILTER -3dB FREQUENCY) command

General description: Changes the low-pass filter -3dB frequency for one or all axes.

Note that filter settings should be considered together with the sample rate in order to avoid issues with folding due to undersampling. No warnings will be issued by STIM202 if e.g. a high filter bandwidth and a low sample rate have been chosen. Also note that change in filter setting will change the group delay, ref. Table 6-3.

Note that this change will only be effective until STIM202 is initialized, reset or powered off, unless the new setting has been stored in flash using the SAVE-command (ref. chapter 10.10). In order to use or test a new setting in Normal Mode without permanently storing it, this can be achieved by skipping the SAVE-command and using the EXIT n-command (ref. chapter 10.11).

Table 10-24: Available f (LP FILTER -3dB FREQUENCY) commands

| Syntax | Response |
|--|---|
| f <sp><-3dBfreq><cr></cr></sp> | Changes the LP filter -3dB frequency for all axes |
| f <sp><-3dBfreq>','<axis><cr></cr></axis></sp> | Changes the LP filter -3dB frequency for a specified axis |

Table 10-25: Allowed values for <-3dBfreq> parameter for f (LP FILTER -3dB FREQUENCY) commands

| <-3dBfreq> | Result |
|------------|---|
| 16 | Will change LP filter -3dB frequency to 16Hz |
| 33 | Will change LP filter -3dB frequency to 33Hz |
| 66 | Will change LP filter -3dB frequency to 66Hz |
| 131 | Will change LP filter -3dB frequency to 131Hz |
| 262 | Will change LP filter -3dB frequency to 262Hz |

Table 10-26: Allowed values for <axis> parameter for f (LP FILTER -3dB FREQUENCY) commands

| <axis></axis> | Result |
|---------------|--|
| x | Will change LP filter -3dB frequency for X-axis only |
| У | Will change LP filter -3dB frequency for Y-axis only |
| Z | Will change LP filter -3dB frequency for Z-axis only |

Table 10-27: Error messages for f (LP FILTER -3dB FREQUENCY) commands

| Error | Message | Possible reason |
|-------|-----------------------------------|--|
| E001 | UNKOWN COMMAND | Command is incorrectly entered |
| E002 | INCORRECT NUMBER OF PARAMETERS | Too many or too few parameters, use of comma between command and first parameter |
| E003 | INVALID PARAMETER | Value of parameter outside valid range |

LP FILTER -3dB FREQUENCY = 66 Hz FOR X-AXIS

>

>f 66.x

Figure 10-27: Example of response from f (LP FILTER -3dB FREQUENCY) command

>f 131

LP FILTER -3dB FREQUENCY = 131 Hz FOR ALL AXES

>

Figure 10-28: Example of response from f (LP FILTER -3dB FREQUENCY) command



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10.9 m (SAMPLE RATE) command

General description: Changes the sample rate in Normal Mode. The sample rate is the same for all gyro channels.

Note that sample rate should be considered together with filter settings in order to avoid issues with folding due to undersampling. No warnings will be issued by STIM202 if e.g. a high filter bandwidth and a low sample rate have been chosen.

Note that this change will only be effective until STIM202 is initialized, reset or powered off, unless the new setting has been stored in flash using the SAVE-command (ref. chapter 10.10). In order to use or test a new setting in Normal Mode without permanently storing it, this can be achieved by skipping the SAVE-command and using the EXIT n-command (ref. chapter 10.11).

Table 10-28: Available m (SAMPLE RATE) command

| Syntax | Response | |
|---|--|--|
| m <sp><sampl.freq><cr></cr></sampl.freq></sp> | Changes the sample rate in Normal Mode | |

Table 10-29: Allowed values for <sampl.freq> parameter for m (SAMPLE RATE) command

| <sampl.freq></sampl.freq> | Result | |
|---------------------------|--|--|
| 125 | Will set sample rate to 125 samples /second | |
| 250 | Will set sample rate to 250 samples /second | |
| 500 | Will set sample rate to 500 samples /second | |
| 1000 | Will set sample rate to 1000 samples /second | |
| 0 | Enables External Trigger | |

Table 10-30: Error messages for m (SAMPLE RATE) command

| Error | Message | Possible reason |
|-------|---------------------|--|
| E001 | UNKOWN COMMAND | Command is incorrectly entered |
| E002 | INCORRECT NUMBER OF | Too many or too few parameters, use of comma between command |
| | PARAMETERS | and first parameter |
| E003 | INVALID PARAMETER | Value of parameter outside valid range |

>m 500 SAMPLE RATE = 500 samples/s

>

Figure 10-29: Example of response from m (SAMPLE RATE) command

>m 0 SAMPLE RATE = EXTERNAL TRIGGER

Figure 10-30: Example of response from m (SAMPLE RATE) command



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10.10 s (SAVE) command

General description: Saves configuration parameters to flash. This will permanently change the configuration parameters and hence be valid after an initialisation or power-off.

The flash used in STIM202 is specified to be capable of minimum 1000 saves. A save-counter has been implemented and when the number of saves exceeds 1000, there will be issued a warning. STIM202 will always attempt to save the configuration when receiving the s (SAVE) command regardless of the content of the save-counter.

Table 10-31: Available s (SAVE) command

| Syntax | Response |
|-------------|--|
| s <cr></cr> | Saves system parameters to flash. This command will require an additional confirmation prior to execution. The confirmation ("Y") is to be responded in upper case letter. |

Table 10-32: Error messages for s (SAVE) command

| Error | Message | Possible reason |
|-------|-------------------------------------|--|
| E001 | UNKOWN COMMAND | Command is incorrectly entered |
| E002 | INCORRECT NUMBER OF PARAMETERS | Any characters between command and <cr></cr> |
| E003 | INVALID PARAMETER | Value of parameter outside valid range |
| E004 | EXCEEDED MAXIMUM NUMBER OF SAVES | Warning appears when maximum number of saves has been exceeded (1000 saves). STIM202 will always attempt to save the configuration when receiving the <u>s</u> (SAVE) command. |
| E005 | ERROR DURING SAVE | System parameters not successfully transferred to flash |

>S

>S

SYSTEM PARAMETERS WILL BE PERMANENTLY CHANGED. CONFIRM SAVE(Y/N): Y SYSTEM PARAMETERS SUCCESSFULLY STORED IN FLASH. NUMBER OF SAVES = 26

Figure 10-31: Example of response from s (SAVE) command when confirming save

SYSTEM PARAMETERS WILL BE PERMANENTLY CHANGED. CONFIRM SAVE(Y/N): N SAVE COMMAND ABORTED.

Figure 10-32: Example of response from s (SAVE) command when not confirming save

>S SYSTEM PARAMETERS WILL BE PERMANENTLY CHANGED. CONFIRM SAVE(Y/N): y SAVE COMMAND ABORTED.

E003 INVALID PARAMETER

>

Figure 10-33: Example of response from s (SAVE) command when not correctly responding to confirmation



ΤМ

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10.11 x (EXIT) command

General description: Terminates Service Mode and returns to Normal Mode directly or via Init Mode (ref. Figure 8-3).

Table 10-33 : Available x (EXIT) command

| Syntax | Response | |
|---|-------------------------|--|
| x <sp><exit_to><cr></cr></exit_to></sp> | Terminates Service Mode | |

Table 10-34 : Allowed values for <exit_to> for x (EXIT) command

| <exit_to></exit_to> | Result |
|---------------------|--|
| n | Terminates Service Mode and return to Normal Mode. If system parameters have been changed compared to flash content, a confirmation is requested before exiting to Normal Mode ("Y" in upper case letter). There will be a 3 seconds hold time between the transmitted command response and execution of the EXIT command. |
| i | Terminates Service Mode and return to Init Mode. If system parameters have been changed compared to flash content, a confirmation is requested before exiting to Normal Mode ("Y" in upper case letter). There will be a 3 seconds hold time between the transmitted command response and execution of the EXIT command. NB: Changes made to system parameters, but not saved, will be overwritten by the data already stored in flash when entering Init Mode. |
| N | Terminates Service Mode and return immediately to Normal Mode (without confirmation if system parameters have been changed compared to flash and without any hold time) |
| I | Terminates Service Mode and return immediately to Init Mode (without confirmation if system parameters have been changed compared to flash and without any hold time). NB: Changes made to system parameters, but not saved, will be overwritten by the data already stored in flash when entering Init Mode. |

Table 10-35: Error messages for x (EXIT) command

| Error | Message | Possible reason |
|-------|---------------------|--|
| E001 | UNKOWN COMMAND | Command is incorrectly entered |
| E002 | INCORRECT NUMBER OF | Too many or too few parameters, use of comma between command |
| | PARAMETERS | and first parameter |
| E003 | INVALID PARAMETER | Value of parameter outside valid range |

SYSTEM RETURNING TO NORMAL MODE.

>x n

>x n

Figure 10-34: Example of response from x n (EXIT) command when system parameters match contents of flash

>x i SYSTEM RETURNING TO INIT MODE.

Figure 10-35: Example of response from x i (EXIT) command when system parameters match contents of flash

CURRENT SYSTEM PARAMETERS DO NOT MATCH FLASH CONTENT. CONFIRM EXIT(Y/N): Y SYSTEM RETURNING TO NORMAL MODE.

Figure 10-36: Example of response from x n (EXIT) command after system parameters have been changed but not saved with confirmed EXIT.



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CURRENT SYSTEM PARAMETERS DO NOT MATCH FLASH CONTENT. CONFIRM EXIT(Y/N): N

>

>x i

Figure 10-37: Example of response from x i (EXIT) command after system parameters have been changed but not saved with confirmed not to EXIT.

>x n

CURRENT SYSTEM PARAMETERS DOES NOT MATCH FLASH CONTENT. CONFIRM EXIT(Y/N): n

E003 INVALID PARAMETER

>

Figure 10-38: Example of response from x n (EXIT) command after system parameters have been changed but not saved with incorrect response to confirmation.

10.12 z (RESTORE TO FACTORY SETTINGS) command

General description: Restores the configuration of the unit to its factory settings.

Table 10-36: Available z (RESTORE TO FACTORY SETTINGS) commands

| Syntax | Response |
|-------------|---|
| z <cr></cr> | Restores the configuration of the unit to its factory settings. |
| | NB: The restored configuration will not be permanent unless it is SAVEd to |
| | flash before EXITing Service Mode, resetting the unit or turning off power. |

Table 10-37: Error messages for z (RESTOR TO FACTORY SETTINGS) command

| Error | Message | Possible reason |
|-------|---------------------|--|
| E001 | UNKOWN COMMAND | Command is incorrectly entered |
| E002 | INCORRECT NUMBER OF | Any characters between command and <cr></cr> |
| | PARAMETERS | |
| E003 | INVALID PARAMETER | Value of parameter outside valid range |

RESTORE TO FACTORY SETTINGS. CONFIRM CHANGE TO FACTORY SETTINGS (Y/N): Y

APPLYING FACTORY SETTINGS

FACTORY SETTINGS APPLIED. TO PERMANENTLY STORE THE SETTINGS, USE THE SAVE COMMAND.

>

>7

Figure 10-39: Example of response from z (RESTORE TO FACTORY SETTINGS) command with no change in transmission parameters.

>z RESTORE TO FACTORY SETTINGS. CONFIRM CHANGE TO FACTORY SETTINGS(Y/N): Y

TRANSMISSION PARAMETERS WILL BE CHANGED. PLEASE CONFIRM (Y/N): Y THE TRANSMISSION CONFIGURATION WILL BE CHANGED TO: TRANSMISSION PROTOCOL = 460800 bits/s, 2 STOP BIT(S), EVEN PARITY

APPLYING FACTORY SETTINGS

FACTORY SETTINGS APPLIED. TO PERMANENTLY STORE THE SETTINGS, USE THE SAVE COMMAND.

>

Figure 10-40: Example of response from z (RESTORE TO FACTORY SETTINGS) command with change in transmission parameters.





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10.13 ? (HELP) command

General description: Help function on the available commands in Service Mode.

Table 10-38: Available ? (HELP) commands

| Syntax | Response | |
|---------------------------------|--|--|
| ? <cr></cr> | Lists the available parameters for this command | |
| ? <sp><hlp><cr></cr></hlp></sp> | Responds with information on the specified command | |

Table 10-39: Allowed values for <hlp> for ? (HELP) command

| <hlp></hlp> | Result | |
|-------------|--|--|
| i | Responds with information on the INFORMATION command | |
| а | Responds with information on the SINGLE-SHOT MEASUREMENT command | |
| С | Responds with information on the DIAGNOSTIC command | |
| d | Responds with information on the DATAGRAM FORMAT command | |
| t | Responds with information on the TRANSMISSION PARAMETERS command | |
| r | Responds with information on the LINE TERMINATION command | |
| u | Responds with information on the OUTPUT UNIT command | |
| f | Responds with information on the LP FILTER -3dB FREQUENCY command | |
| m | Responds with information on the SAMPLE RATE command | |
| S | Responds with information on the SAVE command | |
| x | Responds with information on the EXIT command | |
| Z | Responds with information on the RESTORE TO FACTORY SETTINGS command | |

Table 10-40: Error messages for ? (HELP) commands

| Error | Message | Possible reason |
|-------|---------------------|--|
| E001 | UNKOWN COMMAND | Command is incorrectly entered |
| E002 | INCORRECT NUMBER OF | Too many or too few parameters, use of comma between command |
| | PARAMETERS | and first parameter |
| E003 | INVALID PARAMETER | Value of parameter outside valid range |

>?

- AVAILABLE PARAMETERS:
- i: LISTS SPECIFIC INFORMATION a: PERFORMS A SINGLE-SHOT MEASUREMENT
- c: PERFORMS A SINGLE-SHOT MEASUREMENT
- d: CHANGES DATAGRAM FORMAT
- t : CHANGES TRANSMISSION PARAMETERS
- r: CHANGES THE LINE TERMINATION
- u : CHANGES OUTPUT UNIT
- f: CHANGES LP FILTER -3dB FREQUENCY
- m: CHANGES SAMPLE RATE
- s: SAVES CONFIGURATION DATA
- **z: RESTORES FACTORY SETTINGS**
- x: EXITS SERVICE MODE

>

Figure 10-41: Example of response from ? (HELP) command





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>? i

- i: LISTS THE PRODUCT CONFIGURATION DATA
- i s: RETURNS THE SERIAL NUMBER
- i n: RETURNS THE PRODUCT NAME
- i x: RETURNS THE PART NUMBER
- i h: RETURNS THE HW CONFIGURATION AND REVISION
- i p: RETURNS THE FW CONFIGURATION AND REVISION
- i m: RETURNS THE SAMPLE RATE
- I F. RETURNS THE LP FILTER -3dB FREQUENCY
- i d: RETURNS THE DATAGRAM FORMAT i t: RETURNS THE TRANSMISSION PARAMETERS
- ir: RETURNS THE LINE TERMINATION SETTING
- i u: RETURNS THE LINE TERMINATION SE
- i e: PRINTS THE EXTENDED ERROR INFORMATION FROM THE LAST DETECTED ERROR IN NORMAL MODE
- >

>? c

Figure 10-42: Example of response from ? i (HELP on INFORMATION) command

>? a a: PERFORMS A SINGLE-SHOT MEASUREMENT

Figure 10-43: Example of response from ? a (HELP ON SINGLE-SHOT MEASUREMENT) command

c: PERFORMS A DIAGNOSTIC OF THE UNIT

Figure 10-44: Example of response from ? c (HELP on DIAGNOSTIC) command

>? d d s: CHANGES THE CONTENT OF THE DATAGRAMS IN NORMAL MODE TO STANDARD CONTENT d e: CHANGES THE CONTENT OF THE DATAGRAMS IN NORMAL MODE TO EXTENDED CONTENT d r: CHANGES THE CONTENT OF THE DATAGRAMS IN NORMAL MODE TO STANDARD CONTENT W.CR+LF TERMINATION d j: CHANGES THE CONTENT OF THE DATAGRAMS IN NORMAL MODE TO RATE AND TEMPERATURE d k: CHANGES THE CONTENT OF THE DATAGRAMS IN NORMAL MODE TO RATE AND COUNTER d l: CHANGES THE CONTENT OF THE DATAGRAMS IN NORMAL MODE TO RATE AND LATENCY d n: CHANGES THE CONTENT OF THE DATAGRAMS IN NORMAL MODE TO RATE AND LATENCY d n: CHANGES THE CONTENT OF THE DATAGRAMS IN NORMAL MODE TO RATE, TEMPERATURE AND COUNTER d o: CHANGES THE CONTENT OF THE DATAGRAMS IN NORMAL MODE TO RATE, TEMPERATURE AND COUNTER

Figure 10-45: Example of response from ? d (HELP on DATAGRAM FORMAT) command

>? t t <bit rate>: CHANGES THE BIT RATE [bits/s] t <bit rate>,<stop bits>,<parity>: CHANGES THE BIT RATE [bits/s], NUMBER OF STOP BITS AND PARITY ALLOWED VALUES FOR <bit rate> = 374400, 460800 AND 921600 ALLOWED VALUES FOR <stop bits> = 1 AND 2 ALLOWED VALUES FOR <parity> = n (=NONE), e (=EVEN) AND o (=ODD)

>

Figure 10-46: Example of response from ? t (HELP on TRANSMISSION PARAMETERS) command

>? r r 0: TURNS LINE TERMINATION OFF r 1: TURNS LINE TERMINATION ON

Figure 10-47: Example of response from ? r (HELP on LINE TERMINATION) command





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>? u

u a: CHANGES OUTPUT UNIT TO ANGULAR RATE [°/s] u i: CHANGES OUTPUT UNIT TO INCREMENTAL ANGLE [°/sample] u m: CHANGES OUTPUT UNIT TO AVERAGE ANGULAR RATE [°/s] u s: CHANGES OUTPUT UNIT TO INTEGRATED ANGLE [°]

Figure 10-48: Example of response from ? u (HELP on OUTPUT UNIT) command

>? f

f <-3dBfreq>: CHANGES THE LP FILTER -3dB FREQUENCY [Hz] FOR ALL AXES

f <-3dBfreq>,<axis>: CHANGES THE LP FILTER -3dB FREQUENCY [Hz] FOR A SPECIFIC AXIS

ALLOWED VALUES FOR <-3dBfreq> = 16, 33, 66, 131 AND 262

ALLOWED VALUES FOR $\langle axis \rangle = x, y AND z$

Figure 10-49: Example of response from ? f (HELP on LP FILTER -3dB FREQUENCY) command

>? m m <sampl.freq>: CHANGES THE SAMPLE RATE [samples/s] ALLOWED VALUES FOR <sampl.freq> = 125, 250, 500, 1000 AND 0 (EXTERNAL TRIGGER)

>

Figure 10-50: Example of response from ? m (HELP on SAMPLE RATE) command

>? s s: SAVES SYSTEM PARAMETERS TO FLASH

>

Figure 10-51: Example of response from ? s (HELP on SAVE) command

>? z z: RESTORES FACTORY SETTINGS

>

Figure 10-52: Example of response from ? z (HELP on RESTORES TO FACTORY SETTINGS) command

>? x

x n: EXITS SERVICE MODE AND RETURNS TO NORMAL MODE

x i: EXITS SERVICE MODE AND RETURNS TO INIT MODE

x N: EXITS SERVICE MODE AND RETURNS IMMEDIATELY TO NORMAL MODE

x I: EXITS SERVICE MODE AND RETURNS IMMEDIATELY TO INIT MODE

NB: NON-SAVED SYSTEM PARAMETERS WILL BE OVERWRITTEN BY STORED CONTENT IN FLASH WHEN EXITING TO INIT MODE

>

Figure 10-53: Example of response from ? x (HELP on EXIT) command



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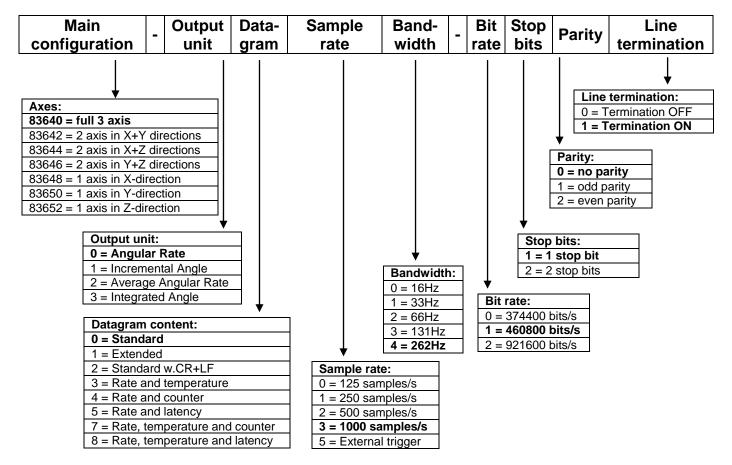
11 MARKING



Figure 11-1: Example of marking of STIM202

12 PART NUMBER / ORDERING INFORMATION

Configuration options in **bold** letters are the standard option.



Example: part number 83640-0032-1211 has the following configuration:

- o X, Y and Z axis
- Angular Rate Output [°/s]
- Standard Datagram
- o 1000 samples/s
- -3dB bandwidth = 66Hz
- Bit rate = 460800 bits/s
- 2 stop bits
- Odd parity
- Line termination ON



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