











**2 Tests**
**2.2 TOLERANCE AND RELIABILITY**

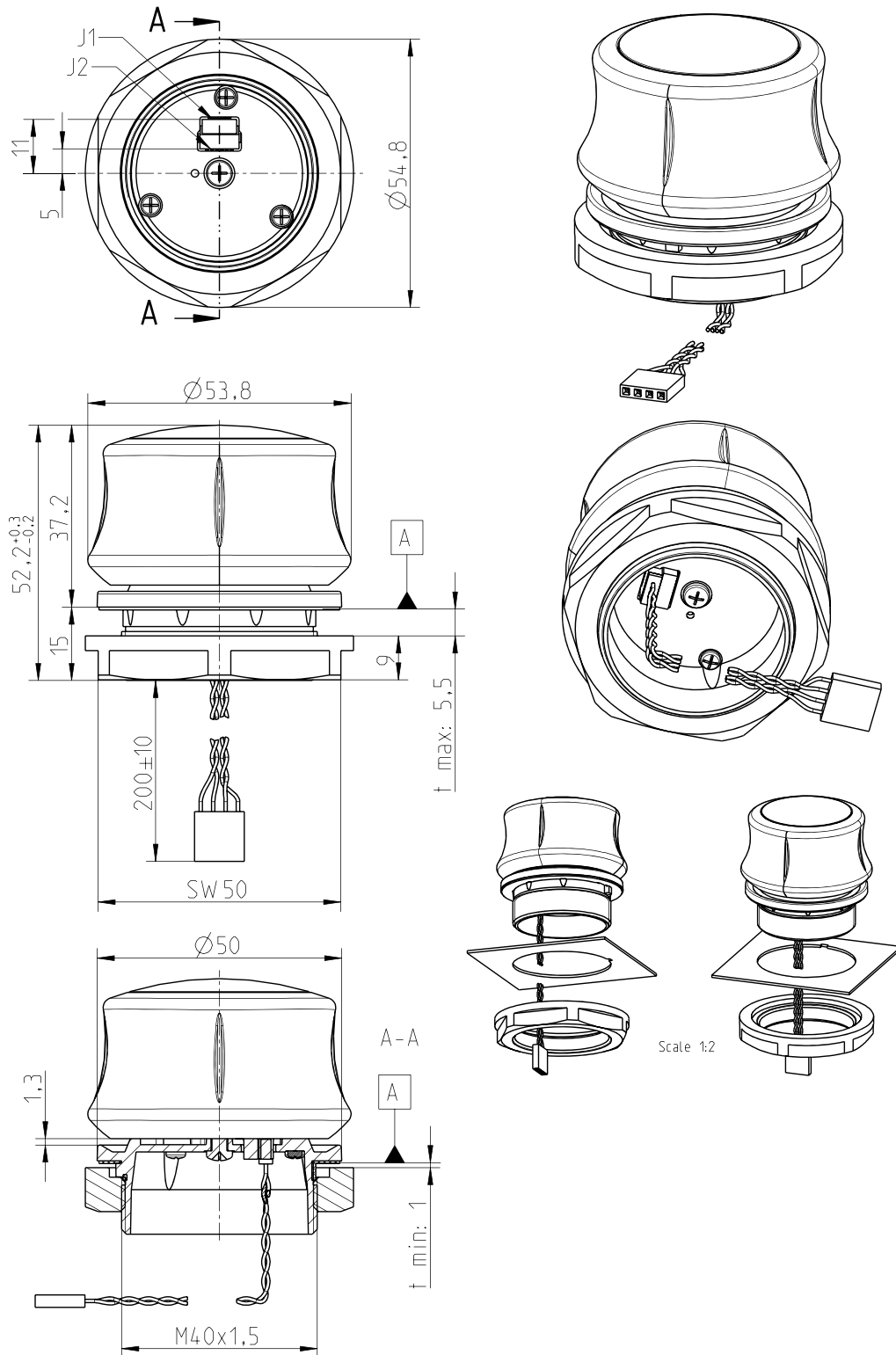
Item	Test Conditions	Specifications
<b>Controller Cap lifetime</b>	(1) Operating speed: 2-3 times/s (2) Force applied at center of cap-side: 7.4N ± 0.9N (740gf ±90gf)	Number of actuations: 1,000,000 times No functional defects for the cap actuation
<b>Drop test (only for reference)</b>	(1) Height: 100cm (2) Floor surface: Steel or concrete (3) Direction: 5 faces, except cable face (4) Number of drops: 5 (one drop per face)	No cracks or breakage (excl. cosmetic scratches). No functional defects for the buttons and Controller Cap actuation. Pop out of buttons and cap-insert is accepted when they can be pushed in again without impact to function

**2.3 LIFE TEST**

Item	Test Conditions	Specifications
<b>Burn-In Test</b>	Expose device 24hrs to a temperature of 45°C	No functional defects, no cosmetic degeneration
<b>Mean Time Between Failure</b>	30 EA for 84 day burn-in at 45°C (can differ depending on the available resources at test lab.)	Confidence Level 80% MTBF = 150.000 hours

3 Technical Drawing

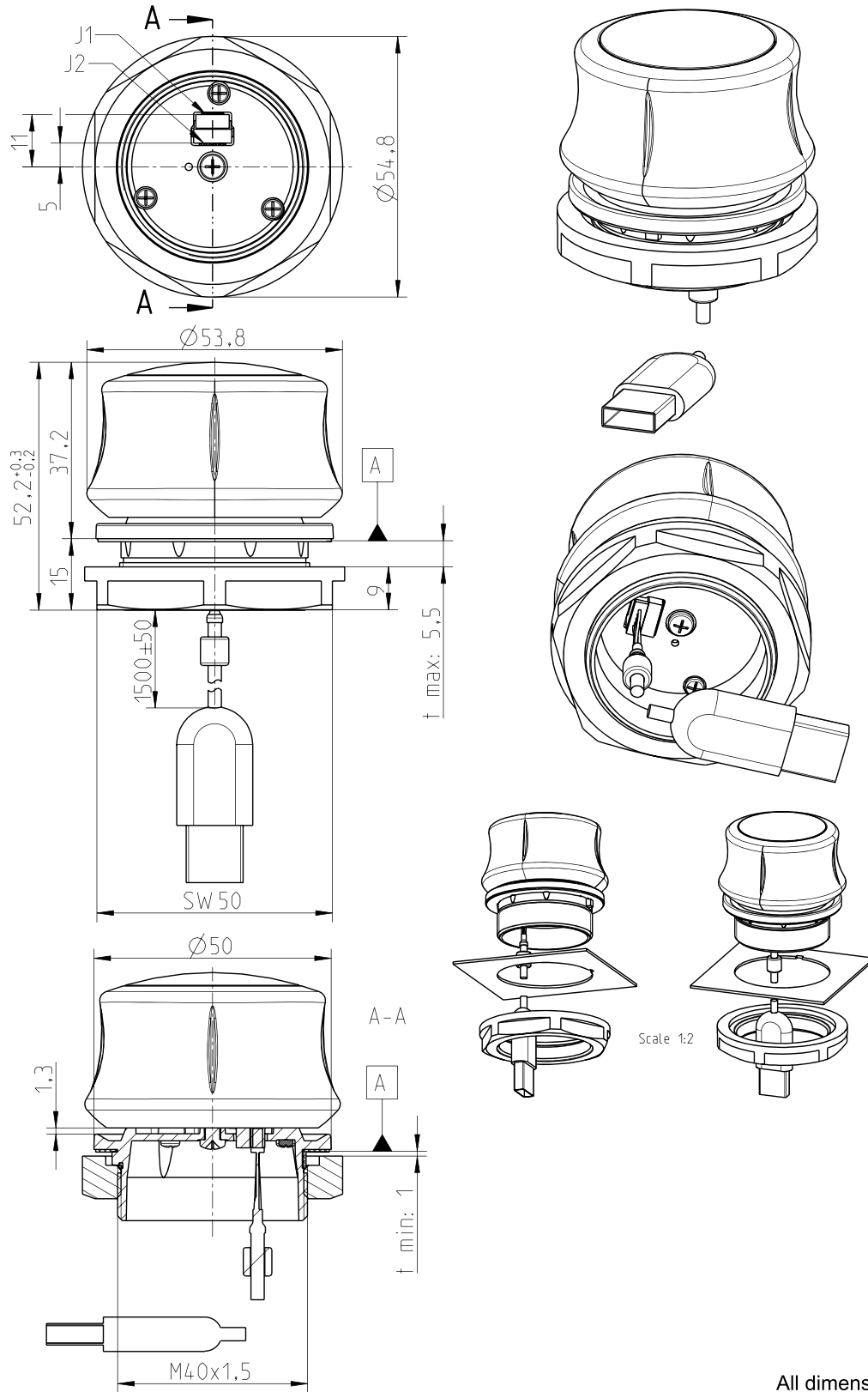
3.1 CASE OUTLINE - UART Interface



All dimensions in mm

3 Technical Drawing

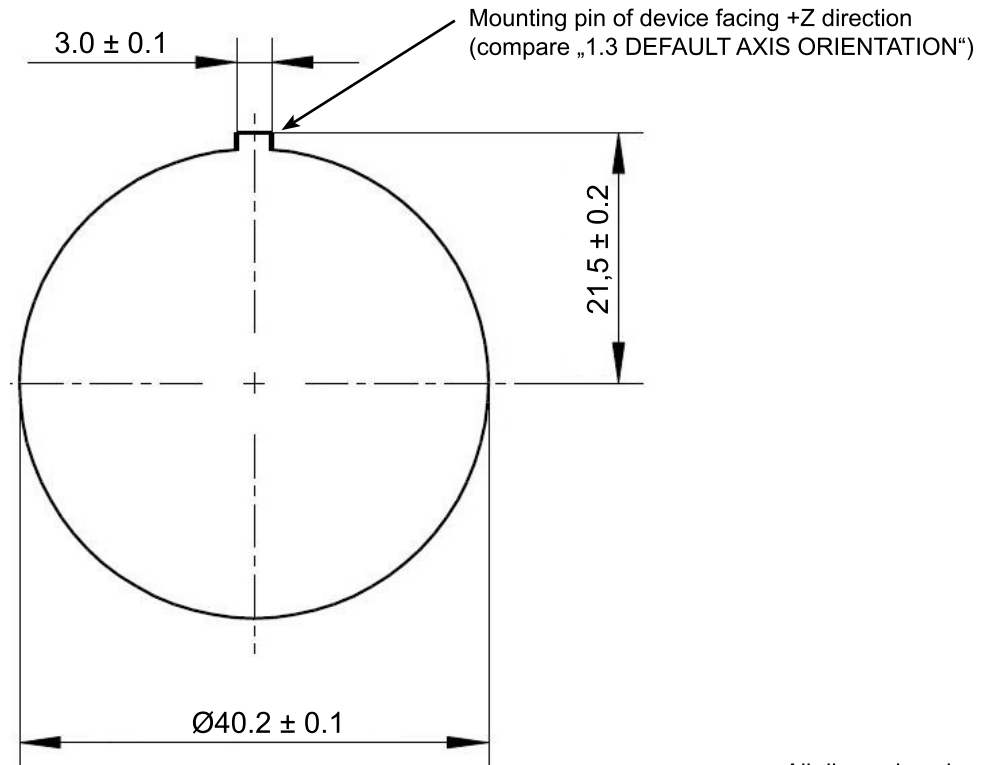
3.2 CASE OUTLINE - USB Interface



All dimensions in mm

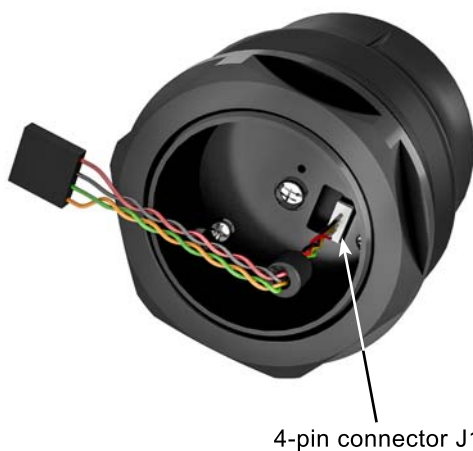
3 Technical Drawing

3.3 MOUNTING HOLE



All dimensions in mm

SpaceMouse®Module UART Interface  
Article number 131034



With art. nr. 131034 a 4 core cable (length 20 cm) is included. For details see section 5.1.2.

SpaceMouse®Module USB Interface  
Article number 131002



With art. nr. 131002 a USB cable (length 1.5 m) with type A connector is included

**5 UART INTERFACE SPECIFICATION**
**5.1 ELECTRICAL**
**5.1.1 Data interface (UART) settings**

The device communicates via serial interface (UART = Universal Asynchronous Receiver Transmitter). The signal levels are 0 Volt (logic 0) or VCC (logic 1), hence they are not RS232 compliant.

**UART settings**

Baud rate	38400
Data bits	8
Parity	none
Stop bits	1
Data rate	max. 100 / s

**5.1.2 4-Pin Connector J1**

The UART Module has a 4-pin male connector with 1,0 mm grid pattern. The length of the provided 4-core twisted pair cable is 200 mm ± 10 mm. Cable connector: JST SHR-04V-S-B with crimp contact SSH-003T-P0.2 Connector on the module: JST BM04B-SRSS-TB

Pin	Function	Wire Color
1	VCC +3.3 V to +5.0 V	red
2	TxD (output)	green
3	RxD (input)	orange
4	GND	black

**5.1.3 Cable**

For connector to UART Module, please refer to chapter 5.1.2 „4 Pin Connector J1“

The connection to a console is achieved by a 4-pin female connector with 2.54mm grid pattern.

Pin	Function	Wire Color
1	VCC +3.3 V to +5.0 V	red
2	GND	black
3	TxD (output)	green
4	RxD (input)	orange

**5 UART INTERFACE SPECIFICATION**
**5.2 PROTOCOL**

The UART Module listens to the following commands:

Function	Command	Answer
Data request command	REQUEST_DATA	0xAC
Zero command	SET_ZERO_POSITION	0xAD
Start auto-data	AUTO_DATA_ON	0xAE
Stop auto-data	AUTO_DATA_OFF	0xAF

**5.2.1 Command structure**

All commands are single byte commands with MSB set to logic 1.

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
1	X	X	X	X	X	X	X

Each command is acknowledged by a response, each response of the 3D-Sensor is terminated by an end-byte 0x8D (MSB is set).

**5.2.2 UART commands**
**SET\_ZERO\_POSITION**

Function: sets the current position of the device as zero-position

Command: 173 (0xAD)

Returns: 0xAD 0x8D

During power-up of the device, the current position of the device is also set as the zero-position.

**AUTO\_DATA\_ON**

Function: starts automatic transmission of data (30ms intervals)

Command: 174 (0xAE)

Returns: 0xAE 0x8D

**AUTO\_DATA\_OFF**

Function: stops automatic transmission of data

Command: 175 (0xAF)

Returns: 0xAF 0x8D

**REQUEST\_DATA**

Function: requests position data from the 3D-Sensor

Command: 172 (0xAC)

Returns: 16 bytes data

Structure: B1 B2 ... B16

## 5 UART INTERFACE SPECIFICATION

Byte 1: start-byte 0x96 (150 decimal); every data set starts with this byte  
Byte 2: high byte of X value  
Byte 3: low byte of X value  
Byte 4: high byte of Y value  
Byte 5: low byte of Y value  
Byte 6: high byte of Z value  
Byte 7: low byte of Z value  
Byte 8: high byte of A value  
Byte 9: low byte of A value  
Byte 10: high byte of B value  
Byte 11: low byte of B value  
Byte 12: high byte of C value  
Byte 13: low byte of C value  
Byte 14: high byte of Checksum  
Byte 15: low byte of Checksum  
Byte 16: end-byte 0x8D; every response ends with this byte

X, Y, Z, A, B, C values and the Checksum are transmitted as unsigned 14-Bit values. This is due to the fact, that the MSB of payload data is always cleared (logic 0).

### Calculating a value:

high byte (X) low byte (X)

14-bit value (unsigned)

$Xvalue = (high\ byte\ (X) * 128 + low\ byte\ (X)) - 8192$

### Transmitted Checksum:

$Checksumtrans = (high\ byte\ (Checksumtrans) * 128 + low\ byte\ (Checksumtrans))$

### Calculating the Checksum:

$Checksumcalc = (Byte1 + Byte2 + \dots + Byte13) \& 0x3FFF.$

By masking the Checksum with 0x3FFF (logic AND operation), the value is reduced to a 14-Bit value.

**6 USB INTERFACE SPECIFICATION**

**6.1 ELECTRICAL & PROTOCOL**

6.1.1 Data interface & Protocol

The SpaceMouse® Module USB is designed for USB 1.1 and 2.0. No additional power source is needed. The module acts like a standard USB joystick with 6 axes.

6.1.2 5-Pin Connector J1

The USB Module has a 5-pin male connector with 1,0mm grid pattern.  
Cable connector: JST SHR-05V-S-B with crimp contact SSH-003T-P0.2  
Connector on the module: JST BM05B-SRSS-TB

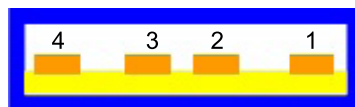
Pin	Function	Wire Color
1	Shield	black
2	GND	black
3	VCC +5.0V	red
4	D-	white
5	D+	green

6.1.3 Cable

For connector to USB Sensor Module, please refer to chapter 6.1.2 „5-Pin Connector J1“.

Electrical	Min	Typ	Max
Supply voltage	4.4V	5.0V	5.25V
Supply current			60mA
Suspend current			0.5mA

Pin-out of USB connector



Pin-out of USB cable

USB Plug	Wire Color	Pin Assigned in PCB	Signal
1	red	3	VCC
2	white	4	D- (inversed DATA)
3	green	5	D+ (DATA)
4	black	2	GND
Shell	drain wire	1	Shield

With Art.nr. 131002 a USB cable (length 1,5m) with type A connector is included