

WTS 0406-38

Intelligent Tactile Sensor Module

- User's Manual -





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1 Preface

The WTS 0406-38 is a highly miniaturized tactile sensing module with integrated signal conditioning and a built-in sensor controller that can be operated directly on any PC or industrial control system without the need for an external sensor controller. With its spatial resolution of 3.8 mm it can sample tactile pressure profiles with a high spatial accuracy. The WTS 0406-38 has a built-in USB 2.0 (full speed) interface supporting a CDC device profile that emulates a virtual COM-Port on a PC and an additional UART interface for communication. The WTS 0406-38 is suitable for a wide variety of applications, e.g.:

- Reactive Grasping and Handling
- Service Robotics
- Biomechanics and Robotics Research

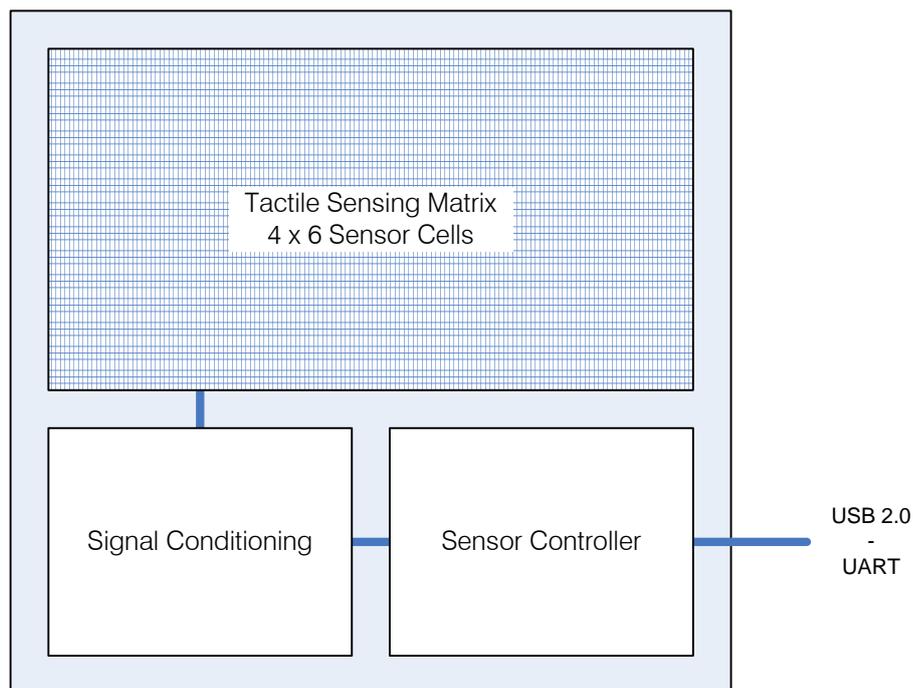


Fig. 1: WTS 0406-38 Block diagram

The built-in sensor controller is compatible to other controllers of our WTS family of intelligent tactile sensors and supports the same command set and an equal functional range.



2 Scope of delivery

The tactile sensing module WTS 0406-38 comes with the following accessories:

- Product Companion CD containing the documentation and the software „WTS Commander“

In addition, following accessories are available:

- Evaluation board with RS-232 and USB interface
- Flex Cable to Mini-USB adapter

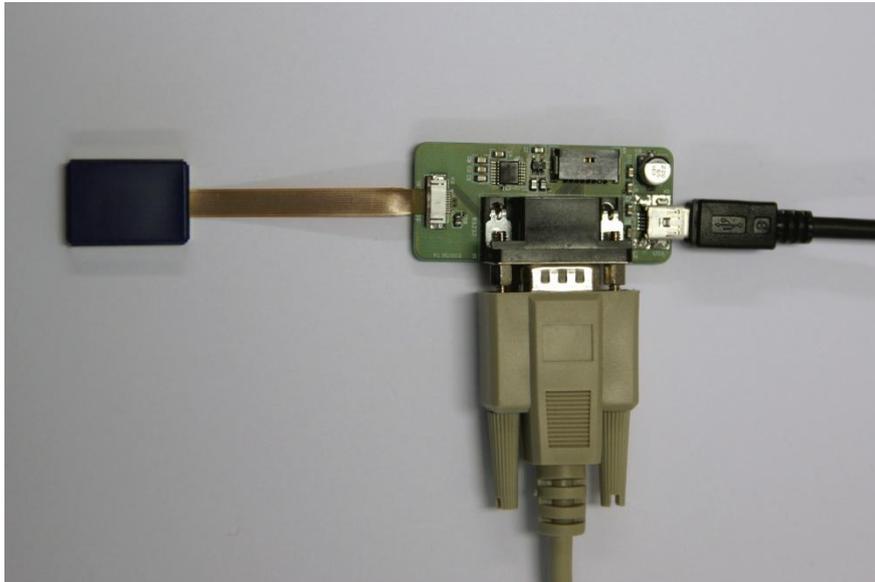
3 Getting Started

Our goal is to provide you with an instantly working tactile sensing system. Everything you need to start using our product is included in the delivery. Please see the following steps to setup your new sensor system. A PC running Microsoft Windows 2000 or XP is required for this:

- First, please unpack your sensor system carefully and make sure no small accessories were left in the packing material.
- Install the Software “WTS Commander” on your PC. It can be found on the enclosed Product CD.

 **If you want to use the software on Microsoft Windows 7, you need to enable “Windows XP Compatibility Mode” for this application.**

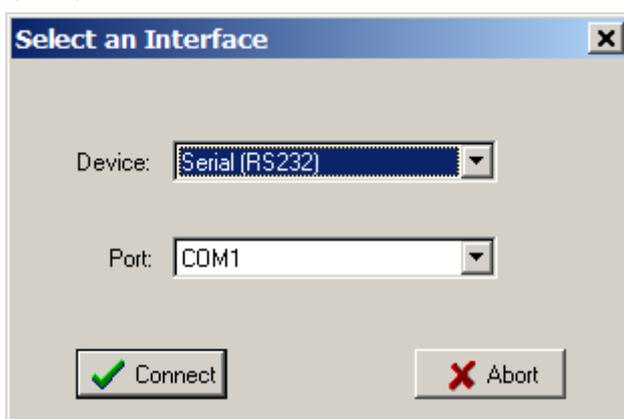
- Connect the WTS 0406-38 to your running PC via the serial interface by using the WTS 0406-38 Evaluation Board as shown on this picture:



The Evaluation Board is powered via USB, so you need to connect it either to a spare USB port on your PC or you may use a USB wall power adapter.

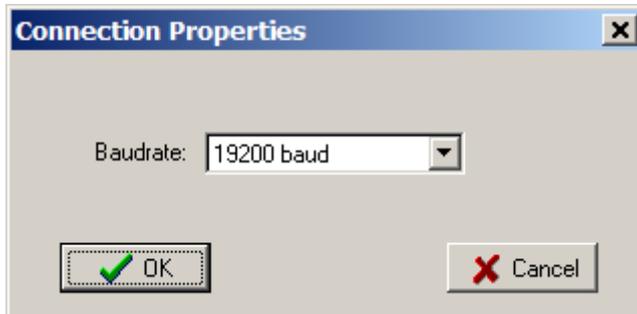
⚠ WARNING: The WTS 0406-38 has LVTTTL-Levels on its UART pins. A suitable converter, e.g. the WTS 0406-38 Evaluation Board, is required to connect the sensor to a standard RS 232 serial port.

- Make sure that the WTS 0406-38 is lying flat on a rigid surface.
- Run the WTS Commander and select Device->Connect from the Menu. You will be asked to specify the interface the WTS 0406-38 is connected to. Select the appropriate serial interface:

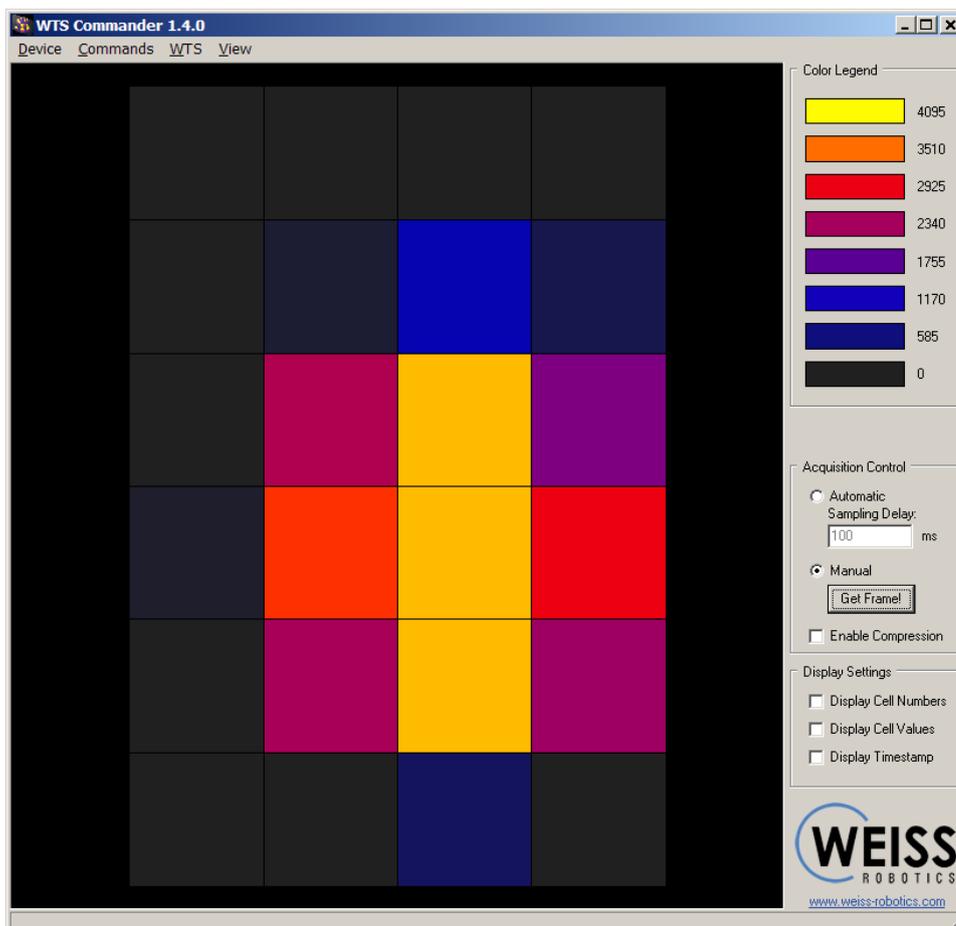




- Press Connect and select the bit rate in the next dialog. By default, the WTS 0406-38 uses a bit rate of 19.200 Baud:



- After the connection was successfully established, you can acquire and display the current pressure profile by using the Acquisition Control pane on the right side.





4 Data Acquisition Firmware

The WTS 0406-38 is supplied with Weiss Robotics' proprietary data acquisition firmware that is fully compatible to other members of the WTS family. The well documented and published communication protocol is identical throughout the members of the WTS family of tactile sensor modules and allows you to integrate our sensing technology in your own applications. The firmware uses the same command syntax on all of its supported interfaces. The full documentation of the command set can be found in the

 **WTS Command Set Reference Manual**

To achieve a higher bandwidth, the firmware supports a compressed transfer of the pressure profile data. This enables a significantly higher frame rate when using slow interfaces like UART.

5 Communication

The WTS 0406-38 supports communication over both USB and UART interface connections. When choosing the USB interface, the sensor uses the Communications Class Device profile (CDC) to provide a virtual COM port on the host's operating system. The baud rate you have to set when connecting with this virtual COM port has no effect.

On Microsoft Windows, the file "wts.inf" is required to install the COM port driver. It can be found on the WTS companion CD.

On Linux, the device is enumerated automatically and can be accessed without any additional driver files. The interface path is `/dev/ttyACMx`, where x is replaced by the number of the actual interface (you can use the `dmesg` command inside a console window to determine it).

 **By factory default, the WTS 0406-38 is configured to use the UART interface for communication with a speed of 19.200 Baud.**

6 Configuration using the Built-In Configuration Shell

The WTS 0406-38 can be configured using its integrated Configuration Shell. It can be accessed by connecting the WTS 0406-38 via its UART interface to a PC that runs a VT-100 compatible terminal emulator (e.g. HyperTerminal on MS Windows XP). For Shell Mode, the following Emulator Settings are used:



- 115200 Baud, 8 Data Bits, no Parity Bit, 1 Stop Bit, no Handshaking (115200-8N1).
- Emulation Mode: VT-100, no local Echo.

To start the Shell Mode, run the Terminal Emulator on your host machine first and then power-up the WTS 0406-38. The sensor will automatically detect¹ the connected terminal, displays a welcome screen and provides a command prompt, as shown here:

```
VT-100 an COM1 - HyperTerminal
Datei Bearbeiten Ansicht Anrufen Übertragung ?
welcome to the system configuration shell
Enter 'help' to get a list of possible commands. To obtain
detailed information about a command, enter <command> help.
Serial Number: 000000112
Firmware version: 1.0.0
Copyright 2011 Weiss Robotics, Germany. All rights reserved.
USER> _
Verbunden 00:00:12 VT100 115200 8-N-1 RF GROSS NUM Aufzeichnen Druckerecho
```

By typing in “help”, the WTS 0406-38 lists the available commands. Each command provides an additional syntax help when typing the command name together with help as parameter (e.g. “config help”) at the prompt.

¹ Terminal detection is done by sending a VT-100 Status Request (“\033[5n”). If this is answered with an Okay (“\033[0n”), the sensor enters Shell Mode.



6.1 Setting up the Communication Interface

The communication interface can be configured using the “interface” command. To get the current interface settings, simply type in “interface” at the command prompt. The sensor will respond with the currently used interface settings:

```
USER> interface
Current interface is: USB

USER>_
```

6.1.1 USB

To change the interface to USB, enter “interface usb” on the command prompt. The System responds with “Changing interface to USB.”:

```
USER> interface usb
Changing interface to USB.
Storing system configuration... Done.

USER>_
```

6.1.2 UART

To use the UART interface, you have to enter “interface serial”. The sensor will ask you for the desired bit rate.

```
USER> interface serial
The following bitrates are supported:

1200 Baud    <0>
2400 Baud    <1>
4800 Baud    <2>
9600 Baud    <3>
19200 Baud   <4>
38400 Baud   <5>
57600 Baud   <6>
115200 Baud  <7>
230400 Baud  <8>
460800 Baud  <9>

Please enter your choice (1..9, default: 4):
```



After entering the number for the desired bit rate or simply pressing <ENTER> to use the default setting, the sensor asks to save the new settings and completes:

```
Save settings (Y/N)?y
Changing interface to serial.
Storing system configuration... Done.

USER>_
```

 **The selected interface is only valid for sensor communication. Shell Mode is not affected.**

7 Sensing Area

The complete surface of the WTS 0406-38 is pressure sensitive. Please see the Drawings section for detailed measurement of the sensing area and the location of the sensing cells in respect to the module's border.

 **The sensing area is encapsulated using a cover made of silicone rubber. Please ensure media compatibility before using within your application!**

8 Electrical Connections

The WTS 0406-38 has a flex tail I/O connector for power supply and control that will fit into common 0.5 mm pitch ZIF connectors, e.g. Molex 52746-1071.

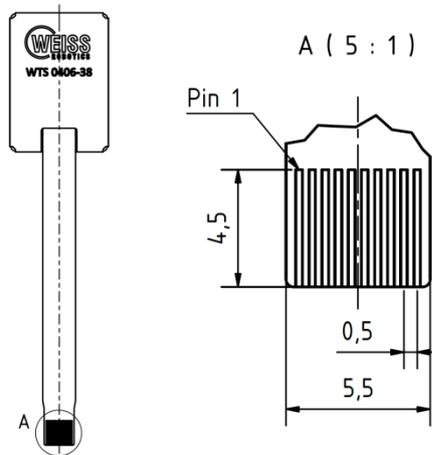


Fig. 2: WTS 0406-38 Connector

Pin Number	Signal	Description
1	F0	Factory Test Pin 0. Do not connect!
2	F1	Factory Test Pin 1. Do not connect!
3	nRST	Reset input. A low level on this pin will reset the integrated sensor controller.
4	GND	Ground.
5	USBD+	USB interface: Data +
6	USBD-	USB interface: Data -
7	TxD	UART interface: Transmit data. LVTTTL levels on this pin.
8	RxD	UART interface: Receive data. LVTTTL levels on this pin.
9	GND	Ground.
10	VCC	Sensor Supply voltage: 5V \pm 10%

Table 1: I/O-Connector Pin Assignment

8.1 Power Supply

The WTS 0406-38 can be operated either by an external power supply of 5V DC. To ensure a good performance of the sensor, the power supply should be of good quality (i.e. free from noise, low impedance) and should provide at least twice the required operating current.



8.2 Level Shifter for the UART Interface

The WTS 0406-38 contains a UART interface that accepts and provides 3.3V LVTTTL levels on its I/O ports. To connect the UART to a standard RS232 interface, e.g. of a PC, an appropriate level shifter is required. An example can be found in the WTS 0406-38 Evaluation Board Schematics, which can be found on the companion CD.

9 Operating and Handling Tips



The following guidelines give you important information on the use of the WTS 0406-38
Please read them carefully!

- Use the correct Power Supply.
The WTS 0406-38 requires a stable and noise-free power supply of $3.3V \pm 10\%$. Higher voltages and/or reverse polarity will destroy the transducer!
- Be cautious of ESD.
Always take precautions against electro-static discharge (ESD) when handling the device. In addition, it is a good practice not to touch any connector pins.
- Place on stable surface.
Before applying a load to the WTS 0406-38's sensing surface, make sure that the module is mounted on a stable and a level surface!
- Avoid high temperature.
Don't exceed the operating temperature of the sensor module, especially when applying a mechanical load to the sensor surface. The sensor will be degraded by doing this!
- Avoid long-time loading.
Do not apply a load for a long time (10mins or longer), since this may degrade the sensor.



- Media compatibility.

Before using the WTS 0406-38 in an application, please make sure that the media used in your application are all compatible to the WTS 0406-38's surface. Don't put mineral oil on the sensor module, since this can alter the color of the silicone cover or may even damage it!

- Cleaning the Sensor.

The sensor surface can be cleaned using silicone-compatible detergents, e.g. isopropyl alcohol. You may use a slightly wet cloth for cleaning.

10 Technical Data

Parameter	Value
Power supply (DC):	5V ± 10%
Power requirement	typ. 50 mA
Integrated interfaces:	USB 2.0 (full speed, CDC Class Device) UART
Matrix configuration	6 x 4 Sensor Cells
Spatial Resolution	3.8 mm
Maximum internal sampling speed of the sensor matrix	260 Frames/sec
Sensor Signal Resolution	12 Bits
Operating temperature range	0 to 40 °C
Logic Levels on RxD-Pin	Low-Level: max. 0.8V High-Level: min. 2.0V
Logic Levels on TxD-Pin	Low-Level: max. 0.4V High-Level: min. 2.4V



11 Dimensions

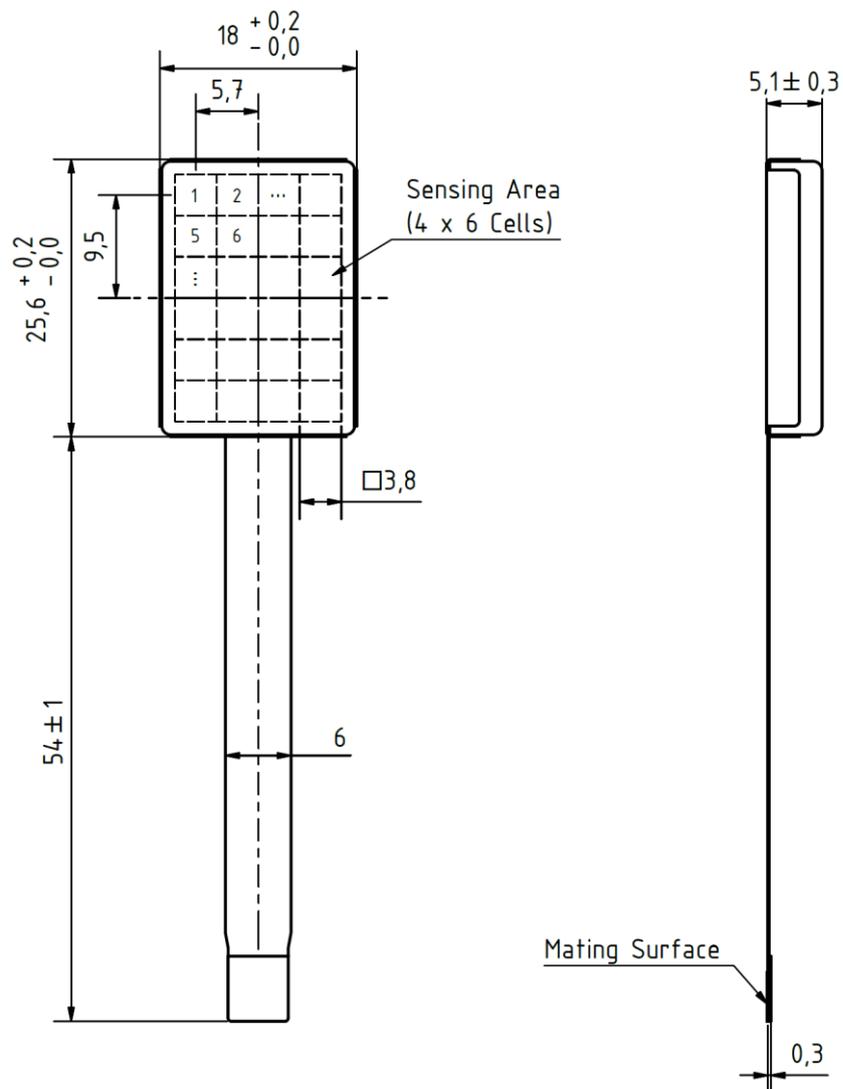


Fig. 3: Mechanical Dimensions



Weiss Robotics GmbH & Co. KG

In der Gerste 2

D-71636 Ludwigsburg, Germany

e-mail: office@weiss-robotics.de

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