1 Purpose

The sensor is designed for the weight characterization of empty and filled pharmaceutical capsules. It is intended for an inline production environment as well as for lab level applications. The microwave technology based system offers high accuracy, speed and repeatability. A simple calibration procedure for each kind of capsules is sufficient to enable an absolute weight measurement. A potential application is to check for long-term drifts in the filling machine and to adjust the filling level of the capsules according to the specified weight. Additionally, a detection to sort out under- or overfilled capsules is possible.

2 Measurement principle

The sensor is based on the microwave resonance method. This concept includes a microwave cavity resonator whose frequency response is permanently monitored by an evaluation electronics. The individual capsules are guided lengthways through the resonator by an electrically non-conductive transporting tube. Therefore, the capsules have to be separated such that only one capsule is within the resonator at the same time. This transporting tube is of 12 mm nominal outer diameter with circular or quadratic footprint. The inner diameter is selected according to the size of the capsules and should be roughly 0.5 mm - 1 mm greater than the capsules' diameter itself. Suitable materials for the transporting tube are for instance PEEK or Teflon. For production lines where different capsule sizes are manufactured, a number of resonators are recommended that are equipped with the corresponding transporting tubes. This allows for a quick adaption of the setup.
The capsules are dynamically characterized while they travel through the resonator with approximately constant speed. They do not have to be stopped. In order to characterize the capsule weight, the radio frequency electrical effect of resonance frequency detuning is utilized. This change in frequency is proportional to the permittivity and the amount of material inside the resonator.

3 Setup

Figure 1 shows the FT-Sensor 87154Q01 with circular transporting tube (here acrylic) for size 0 capsules with a diameter of 7.5 mm.

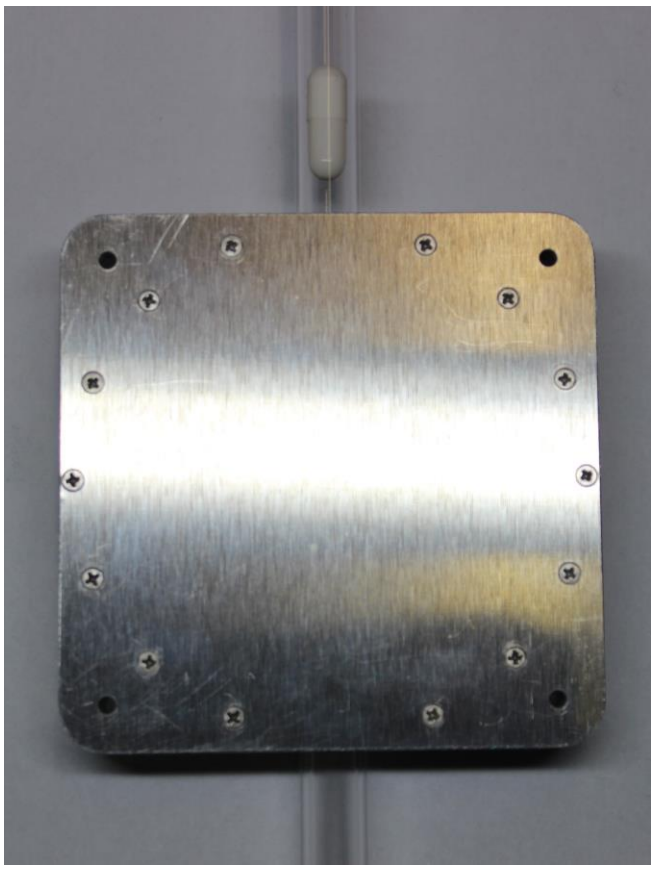


Figure 1: FT-Sensor with size 0 capsule (7.5 mm diameter).

The sensor can be mounted by a fixture at the four holes in the corners. The electrical connection is shown in Figure 2.

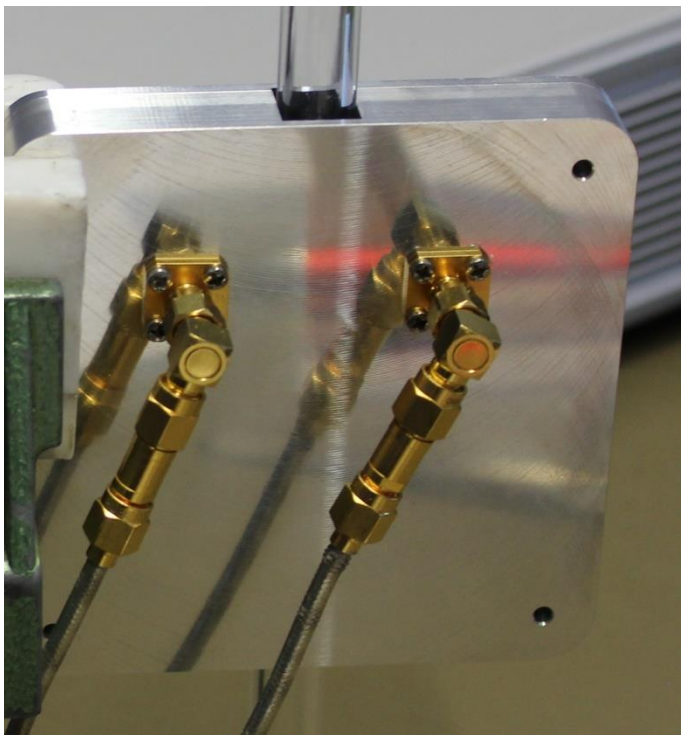
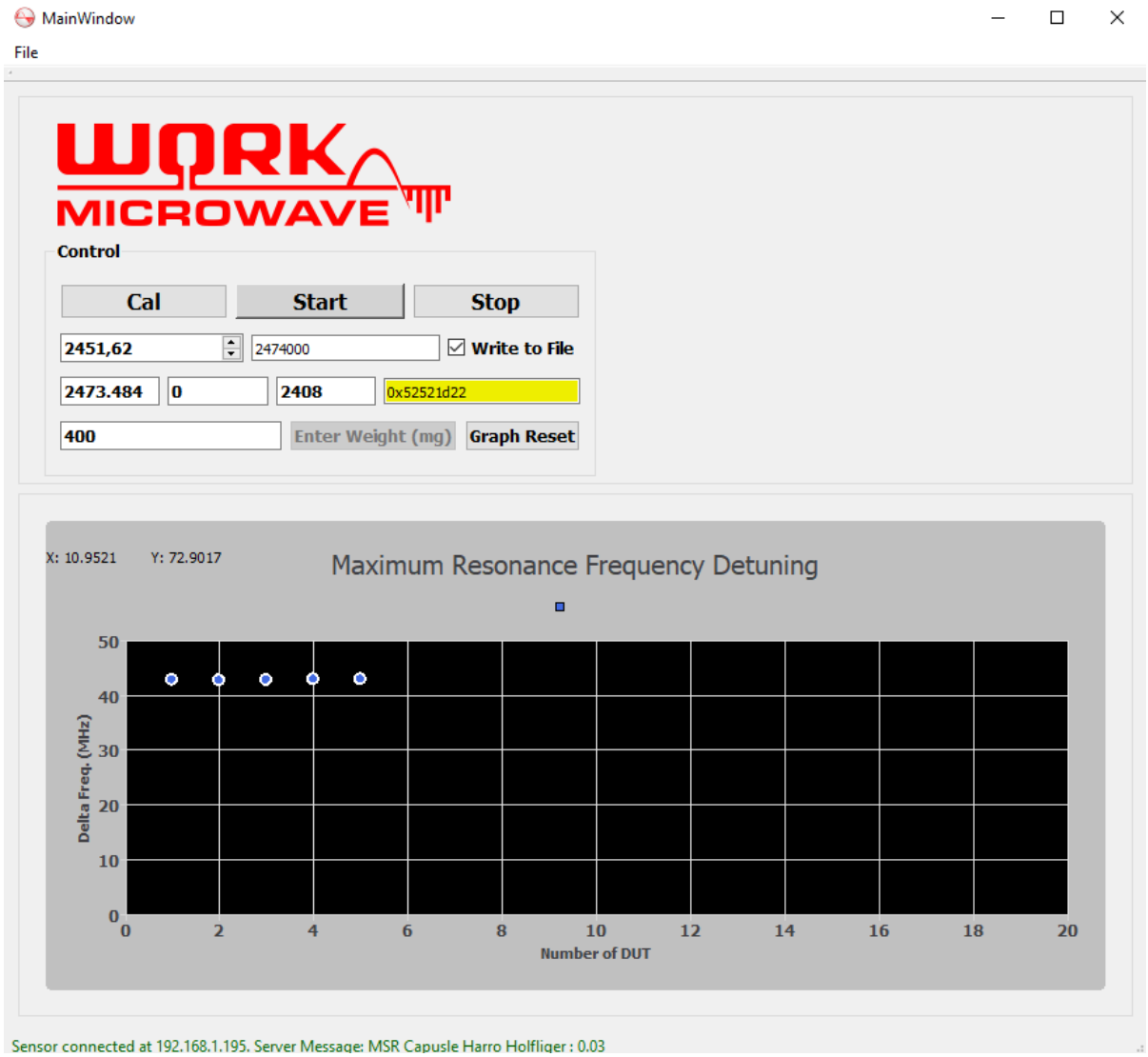


Figure 2: Electrical Connection via SMA Cables.

The radio frequency electrical connection to the resonator is achieved by SMA cables. The opposite sides of the cables are connected to the two leftmost SMA connectors of the electronics. The electronics is powered by a power supply that generates 24 V and 1 A. The communication with a computer is established by a TCP/IP (LAN) connection. An evaluation software that provides a simple GUI, see Figure 3, is used to set up the sensor system and to perform the calibration. Furthermore, the measurement of the currently characterized capsule is plotted to visually inspect the measurements.



In order to operate a capsule weight sensor at an inline production environment, the GUI is not mandatory. In this case, the whole data is prepared in the sensor electronics and delivered to the customers' interface. Therefore, a proper communication protocol has to be specified and implemented.

4 Dimensions of FT-Sensor

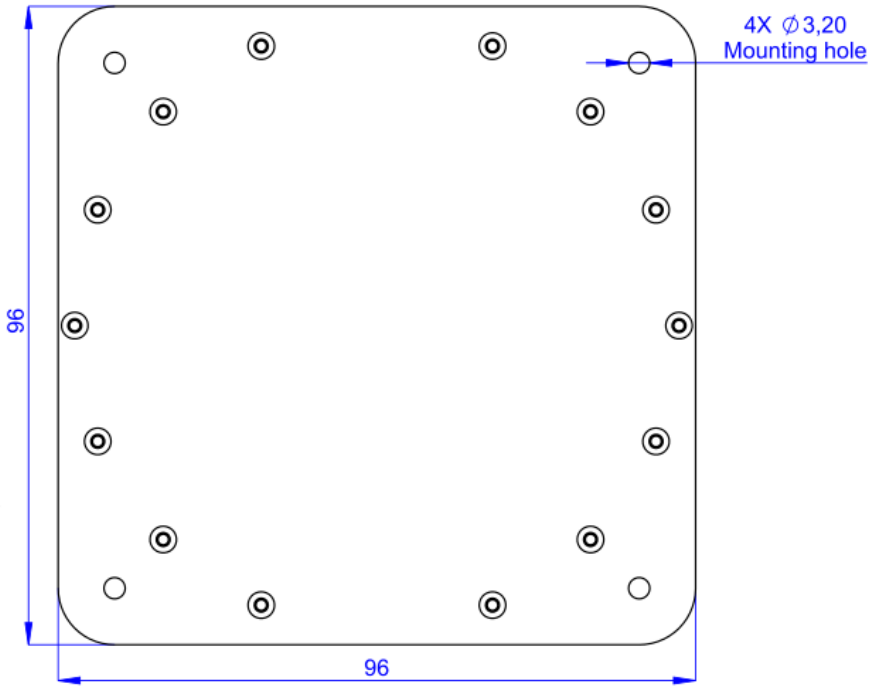


Figure 3: Top view drawing. Units in mm.

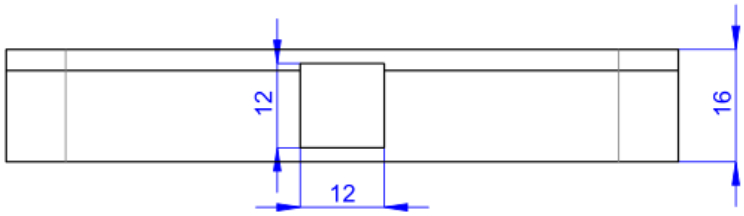


Figure 4: Side view drawing. Units in mm.

5 Technical data

Description		
	Microwave Sensor for the Measurement of Capsule Weight	
Measurement Principle		
	Microwave Resonance Method with Cavity Resonator	
	Frequency Range 2.5 GHz	
	Dynamic Characterization in Transporting Tube	
Measurement Specifications		
	Capsule Weight	50 … 700 mg
	Typical Accuracy (3- Sigma) for 1. Coarse Filling (e.g. Pellets) 2. Fine Filling (e.g. Powder)	 ≤ 3 wt.% ≤ 1.5 wt.%
	Max. Capsule Rate	10 1/s
	Full Sweep Rate (at 128 pt.)	2300 1/s
Supply Voltage		
	Supply Voltage	+20 ... +30V typ: +24V
Current Consumption		
	Operational Current	600 mA @ 24V
	Inrush Current	<1A
Operating Temperature		
	Sensor	0 … 100°C
	Electronics	0 … 80°C
	Recommended Warm Up Time	Min. 1 hour
Weight		
	Electronics	2 kg
	Sensor (Aluminum)	0.5 kg

6 Ordering information

Model-Nr	Description	Connector
87154.MV4.62B	Resonator Body	SMA
87154.MV4.52B	Resonator Cover	
87182.099.00A	Network Analyzer/Sensor System	Power Supply LAN

7 Company address

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