

Elektronische Waage

Testaufbau

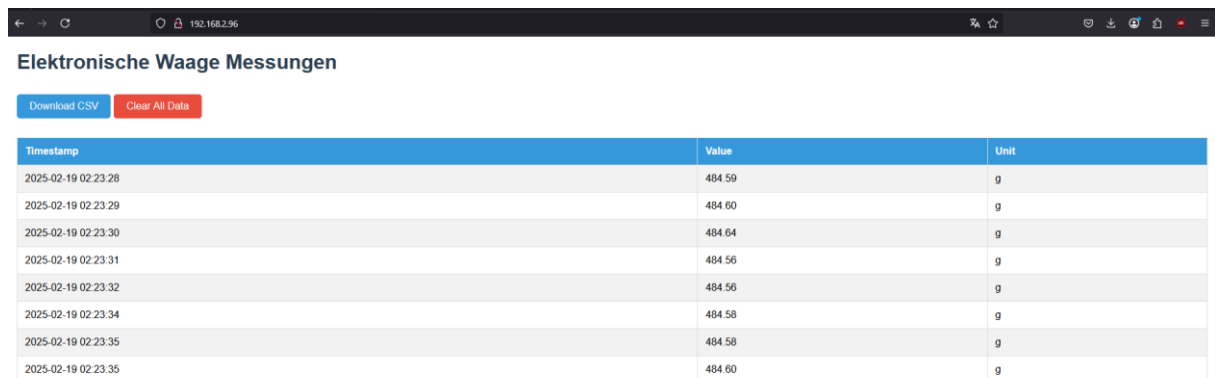
- ✓ Die Waage wurde vor dem Test mit einem 500g- und einem 1kg-Gewicht kalibriert.
- ✓ Alle Messungen wurden auf einer stabilen, flachen Oberfläche ohne Vibrationen durchgeführt.

Wiederholgenauigkeit der Messung

1. Ein 500g Gewicht wurde 8-mal auf die Waage gelegt.
2. Das 1 kg Gewicht wurde auf die gleiche Weise getestet.
3. Die Abweichung zwischen den Messungen wurde aufgezeichnet.

Test Ergebnisse: 490g

Web-Interface



Timestamp	Value	Unit
2025-02-19 02:23:28	484.59	g
2025-02-19 02:23:29	484.60	g
2025-02-19 02:23:30	484.64	g
2025-02-19 02:23:31	484.56	g
2025-02-19 02:23:32	484.56	g
2025-02-19 02:23:34	484.58	g
2025-02-19 02:23:35	484.58	g
2025-02-19 02:23:35	484.60	g

Thonny:

```
>>> %Run -c $EDITOR_CONTENT

MPY: soft reboot
Current Local Time: (2025, 2, 19, 2, 23, 26, 47, 0)
Measurements: ['2025-02-19 02:22:15,974.84,g', '2025-02-19 02:22:42,974.87,g', '2025-02-19 02:22:45,474.90,g']
Loaded Calibration: {'offset': -175258.1, 'unit': 'g', 'raw_500g': None, 'scale_factor': -1127.739, 'raw_1kg': None}
Device IP: 192.168.2.96
wifi: Already connected
Time synchronized
Connecting to MQTT...
MQTT Connected

Starting measurements...
Calibration values - Offset: -175258.1, Scale: -1127.739
Taring...
Calibration Saved: {'unit': 'g', 'raw_500g': None, 'offset': -175395.6, 'raw_1kg': None, 'scale_factor': -1127.739}
Saved Measurement: 2025-02-19 02:23:28, 484.59 g

Saved Measurement: 2025-02-19 02:23:29, 484.60 g
Saved Measurement: 2025-02-19 02:23:30, 484.64 g
Saved Measurement: 2025-02-19 02:23:31, 484.56 g
Saved Measurement: 2025-02-19 02:23:32, 484.56 g

Taring...
Calibration Saved: {'unit': 'g', 'raw_500g': None, 'offset': -175305.9, 'raw_1kg': None, 'scale_factor': -1127.739}
Saved Measurement: 2025-02-19 02:23:34, 484.58 g

Saved Measurement: 2025-02-19 02:23:35, 484.58 g
Saved Measurement: 2025-02-19 02:23:35, 484.60 g
```

CSV:

measurement_500g.csv

MQTT:

19.02.2025 23:35:02

✓

"value": 484.6,

"unit": "g",

"timestamp": "2025-02-19 02:23:35"

selected

✓

"value": 484.59,

"unit": "g",

"timestamp": "2025-02-19 02:23:28"

▼ History

19.02.2025 23:35:52

"value": 484.6,

"unit": "g",

"timestamp": "2025-02-19 02:23:35"

19.02.2025 23:35:04(-48.36 seconds)

"value": 484.58,

"unit": "g",

"timestamp": "2025-02-19 02:23:35"

19.02.2025 23:34:02(-62.4 seconds)

"value": 484.58,

"unit": "g",

"timestamp": "2025-02-19 02:23:34"

Test Ergebnisse: 968g

Web-Interface

2025-02-19 02:23:53	964.93	g
2025-02-19 02:23:53	964.93	g
2025-02-19 02:23:54	964.89	g
2025-02-19 02:23:55	964.85	g
2025-02-19 02:23:56	964.64	g
2025-02-19 02:23:57	964.88	g
2025-02-19 02:23:57	965.02	g
2025-02-19 02:23:58	964.92	g

Thonny:

```
>>> %Run -c $EDITOR_CONTENT

MPY: soft reboot
Current Local Time: (2025, 2, 19, 2, 23, 52, 14, 0)
Measurements: ['2025-02-19 02:23:28,484.58,g', '2025-02-19 02:23:29,484.60,g', '2025-02-19 02:23:30,484.64,g', '2025-02-19 02:23:31,484.56,g', '2025-02-19 02:23:32,484.56,g', '2025-02-19 02:23:34,484.58,g', '2025-02-19 02:23:35,484.58,g', '2025-02-19 02:23:35,484.60,g']
Loaded Calibration: {'offset': -175305.9, 'unit': 'g', 'raw_500g': None, 'scale_factor': -1127.739, 'raw_1kg': None}
Device IP: 192.168.2.96
Wifi: Already connected
Time synchronized
Connecting to MQTT...
MQTT Connected

Starting measurements...
Calibration values - Offset: -175305.9, Scale: -1127.739
Saved Measurement: 2025-02-19 02:23:53, 964.93 g

Saved Measurement: 2025-02-19 02:23:53, 964.93 g
Saved Measurement: 2025-02-19 02:23:54, 964.89 g
Saved Measurement: 2025-02-19 02:23:55, 964.85 g
Saved Measurement: 2025-02-19 02:23:56, 964.64 g
Saved Measurement: 2025-02-19 02:23:57, 964.88 g
Saved Measurement: 2025-02-19 02:23:57, 965.02 g
Saved Measurement: 2025-02-19 02:23:58, 964.92 g
```

CSV:

Measurements.csv

MQTT:

Value

<>

QoS: 0
19.02.2025 23:58:43

~

{
 "value": 964.92,
 "unit": "g",
 "timestamp": "2025-02-19 02:23:58"
}

selected

~

{
 "value": 965.02,
 "unit": "g",
 "timestamp": "2025-02-19 02:23:57"
}

▼ History

19.02.2025 23:57:51(-51.75 seconds)

{ "value": 965.02, "unit": "g", "timestamp": "2025-02-19 02:23:57" }

19.02.2025 23:57:16(-35.68 seconds)

{ "value": 964.88, "unit": "g", "timestamp": "2025-02-19 02:23:57" }

19.02.2025 23:56:15(-60.99 seconds)

{ "value": 964.64, "unit": "g", "timestamp": "2025-02-19 02:23:56" }

Abweichung: $\pm 4\text{g}$ → Akzeptabel

Fazit: Die Waage zeigt eine hohe Wiederholbarkeit mit einer maximalen Abweichung von $\pm 5\text{g}$.

Auflösung der Waage

Ablauf:

- ✓ Die Waage wurde auf 0g kalibriert. (Tared)
- ✓ Es wurden schrittweise kleine Gewichte hinzugefügt (2g, 4g, 5g, 10g).
- ✓ Der Waagen Wert wurde mit den erwarteten Werten verglichen.

Gewicht	Erwartete Messung (g)	Abgelesener Messwert (g)
0g (Tare)	0g	-0.06g
3g	3g	3,75g
5g	8g	9.21g
7g	15g	15.40g
5g	20g	19.22g
8g	28g	26.43g

2025-02-19 02:23:23	-0.06	g
2025-02-19 02:23:23	3.75	g
2025-02-19 02:23:24	9.21	g
2025-02-19 02:23:24	15.40	g
2025-02-19 02:23:25	19.22	g
2025-02-19 02:23:26	26.43	g

```
MPY: soft reboot
Current Local Time: (2025, 2, 19, 2, 23, 22, 27, 0)
Measurements: ('2025-02-19 02:23:29,484.59,g', '2025-02-19 02:23:29,484.60,g', '2025-02-19 02:23:30,484.64,g', '2025-02-19 02:23:31,484.56,g', '2025-02-19 02:23:32,484.56,g', '2025-02-19 02:23:34,484.58,g', '2025-02-19 02:23:35,484.58,g', '2025-02-19 02:23:35,484.60,g', '2025-02-19 02:23:53,964.93,g', '2025-02-19 02:23:53,964.93,g', '2025-02-19 02:23:54,964.89,g', '2025-02-19 02:23:55,964.85,g', '2025-02-19 02:23:56,964.64,g', '2025-02-19 02:23:57,964.88,g', '2025-02-19 02:23:57,965.02,g', '2025-02-19 02:23:58,964.92,g']
Loaded Calibration: {'offset': -175349.2, 'unit': 'g', 'raw_500g': None, 'scale_factor': -1083.987, 'raw_lkg': None}
Device IP: 192.168.2.96
wifi: Already connected
Time synchronized
NTP sync failed:
Connecting to MQTT...
MQTT Connected

Starting measurements...
Calibration values - Offset: -175349.2, Scale: -1083.987
Taring...
Calibration Saved: {'unit': 'g', 'raw_500g': None, 'offset': -175355.9, 'raw_lkg': None, 'scale_factor': -1083.987}
Taring...
Calibration Saved: {'unit': 'g', 'raw_500g': None, 'offset': -175380.8, 'raw_lkg': None, 'scale_factor': -1083.987}
Calibration Saved: {'unit': 'oz', 'raw_500g': None, 'offset': -175380.8, 'raw_lkg': None, 'scale_factor': -1083.987}
Unit switched to: oz
Calibration Saved: {'unit': 'g', 'raw_500g': None, 'offset': -175380.8, 'raw_lkg': None, 'scale_factor': -1083.987}
Unit switched to: g
Saved Measurement: 2025-02-19 02:23:23, -0.06 g
Saved Measurement: 2025-02-19 02:23:23, 3.75 g
Saved Measurement: 2025-02-19 02:23:24, 9.21 g
Saved Measurement: 2025-02-19 02:23:24, 15.40 g
Saved Measurement: 2025-02-19 02:23:25, 19.22 g
Saved Measurement: 2025-02-19 02:23:26, 26.43 g

Taring...
Calibration Saved: {'unit': 'g', 'raw_500g': None, 'offset': -268441.5, 'raw_lkg': None, 'scale_factor': -1083.987}
```

Fazit: Die Waage erkennt Gewichtsveränderungen von bis zu 2 g und zeigt kleine Unterschiede an.

Finale Bewertung:

Test	Ergebnisse	Pass/Fail
Wiederholbarkeit (490g, 968g)	Maximale Abweichung ±4g	Pass
Auflösung (2g, 4g, 5g)	Erkennt Gewichtsänderungen bis zu 2g	Pass