



Operator's Manual

Capacitive Accelerometer CB41 and Supply Unit 037

Application

The distinguishing feature of capacitive accelerometers compared to piezoelectric transducers is the possibility to measure acceleration at very low frequencies and static acceleration. That means, besides vibration, also the constant gravitation acceleration can be detected. Thus, the sensor can also be used for tilt measurement.

The low current consumption makes the CB41 a good choice for battery operated equipment.

The Supply Unit for Capacitive Transducers Model 037 provides the operating voltage for the transducer and decouples the output signal.

Function

Main component of the CB41 is a capacitive sensing element. It is manufactured on micro-machined base in multilayer silicon technology. Figure 1 shows the principle of the accelerometer. The measuring element consists of a seismic mass / spring system. It is flexibly positioned between two fixed plates. At an exciting acceleration this differential capacitor changes its capacitance. This very small change of capacitance (10^{-14} 10^{-11} pC) is converted by an electronic circuit into a voltage proportional to the exciting acceleration. The enclosed gas inside the mechanical system causes damping of the resonant frequency of the spring / mass system.

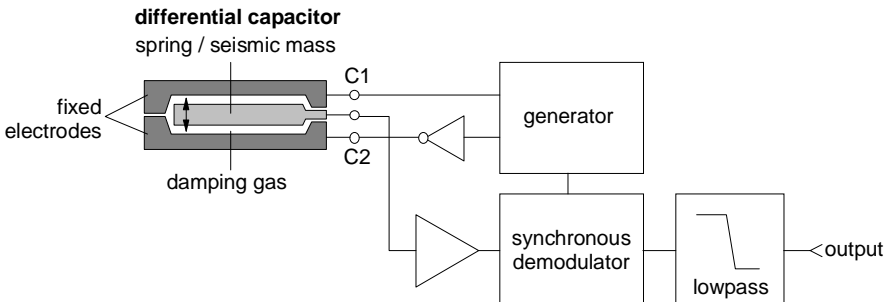


Figure 1: Block diagram

Mounting and Connection

The CB41 has 3 tapped holes with M 3 female metric threads for mounting. Screws with M 2.5 metric thread can also be stuck through these holes.

Alternatively the accelerometer may be mounted adhesively. Fig. 2 shows the measures of the fixing points and the connector pin functions of the connector. Please note that the main sensitivity axis of the CB41 is the direction of the connector.

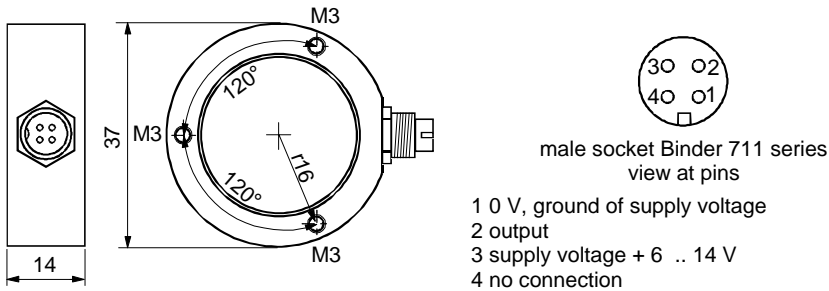


Figure 2: Dimensions and socket pin configuration

Because of its internal stabilization the supply voltage at pin 3 may vary over a wide range. However, the supply voltage should have low ripple and noise components. When measuring the output voltage between pin 2 and pin 1 (ground), it has added an offset voltage of 2 V and is therefore always positive. Thus, the sensors output swings around the 2 V offset.

The easiest way to connect the CB41 to standard measuring equipment is the Supply Unit Model 037, described below.

For a simple function control of the accelerometer you may measure the constant gravitational acceleration ($1\text{ g} = 9.81\text{ ms}^{-2}$). Positioned with the connector facing to the ground the accelerometer delivers an output voltage for 1 g, as given in the data sheet. Positioned with the connector upwards, the output voltage is proportional to -1 g . Putting the sensor with its base on a flat surface you will measure 0 g.

Warning: One of the outstanding characteristics of the CB41 is its high resistance against mechanical shocks. Nevertheless, it is recommended to handle the accelerometer carefully. Particularly during transport and mounting it is important to avoid impacts of the accelerometer to hard surfaces. In such cases an acceleration of several 1000 g may occur, which may damage the micro-machined spring-mass system.

Notice: The sensor case is not connected to ground. In some applications electromagnetic fields may influence the output signal. In this case an external ground connection of the case is recommended.

Tilt Measurement Using the CB41

The possibility to measure static acceleration allows the use of the CB41 as sensor for tilt angles. Fig. 3 illustrates the principle function.

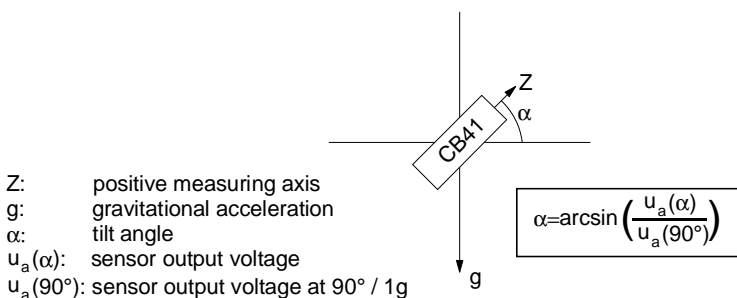


Figure 3: Tilt measurement using the CB41

The accuracy of the tilt angle measurement depends on the following parameters:

- Noise: The inherent random noise of the sensor decides on the resolution of tilt angle measurement. Filtering the measuring signal by means of an external lowpass filter will reduce the noise and so improve the resolution of tilt angle measurement. With a lowpass filter of 10 Hz the tilt angle resolution amounts to 0.5° with the CB41
- Transverse sensitivity: It causes a deviation of the tilt angle of maximum $\pm 3^\circ$. This can be compensated mechanically.
- Offset error of the output signal: Can be adjusted electrically.
- Nonlinearity: $< 0.4\%$ from the measured tilt angle.

Supply Unit Model 037

The Supply Unit 037 is intended for Metra's capacitive accelerometers. It supplies the operating voltage for the sensor circuit. This voltage comes from an internal 9V block battery Type IEC 6F22 with about 20 h operational life or from an external DC power supply, for instance the included mains plug adapter. Figure 4 shows the connectors and controls of the instrument.

Using an external supply voltage, the internal battery will be disconnected from the accelerometer automatically. The center contact of the circular power supply socket (according to DIN 45323) is connected to the positive supply voltage.

To increase battery life it is recommended to move the slide switch into "OFF" position as long as the connected accelerometer is not in use. If no accelerometer is connected the battery will not be discharged, independent of the position of the switch.

The middle position of the slide switch has no function with the CB41.

In position "1.5 V" the output signal oscillates with a maximum modulation of ± 1.5 V around the offset voltage of 2 V, that means, the output voltage changes from 0.5 V to 3.5 V.

The minus pole of the operating voltage is connected with the screen of the output socket.

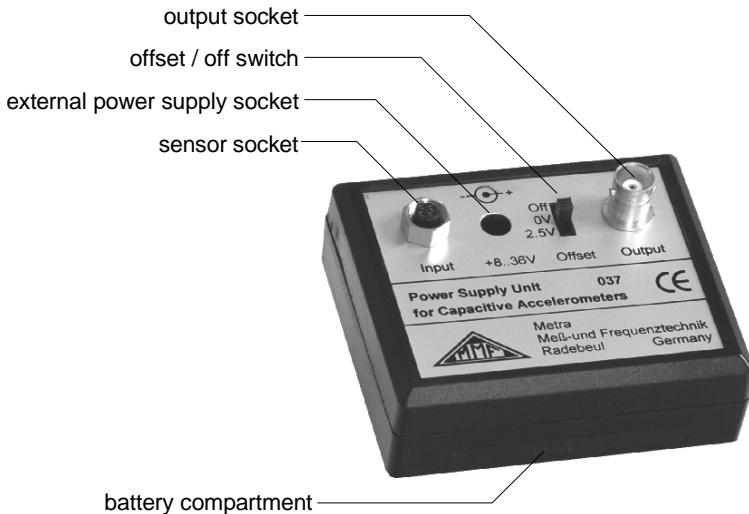


Figure 4: Supply Unit 037

Technical Data

	CB41
Sensitivity	100 mV/g \pm 20 %
Range	\pm 10 g
Offset voltage	+2 V \pm 0.35 V
Linear frequency range (+ 3dB)	0 .. 1000 Hz
Transverse sensitivity	< 5%
Nonlinearity	0.2 % of FSO
Noise density	2 mg/ \sqrt Hz
Temperature coefficient of sensitivity	0.02 %/K
Temperature coefficient of offset voltage	0.8 mV/K
Operating temperature range	-20 .. 100 °C
Maximum shock (half sine 0.5 ms)	2000 g
Supply voltage	+6 .. 14 V
Current consumption	3.3 .. 18 mA
Weight	40 g
Accessories	1.5 m cable
	Extension cables on demand



Declaration of Conformity

Products: Capacitive Accelerometer and Supply Unit
Type: CB41 and 037

Hereby is certified that the above mentioned products
comply with the demands of the following standards:

- EN 50081-1
- EN 50082-1

Responsible for this declaration is the producer:

Metra Mess- und Frequenztechnik
Meissner Str. 58
D-01445 Radebeul

declared by
Manfred Weber
Radebeul, 13th of October, 1999