

ELECTROMETER

type SM420

December 2021



Scale 1 : 1

Features

- galvanically isolated⁽¹⁾ electrometer⁽²⁾ with a 24-bit AD converter
- differential input⁽³⁾ with the typical⁽⁷⁾ input resistance of $20 \cdot 10^{12} \Omega$ (20 T Ω)
- typical input bias current of $10 \cdot 10^{-15} \text{ A}$ (10 fA)
- last stable digit of measured voltage, the typical weight of 0,1 mV; 4½ digits
- programmable data rates over the range of 20 to 2000 samples-per-second
- significant reduction and predictability of usually large disturbances from the environment
- I2C interface to a computer, or a microcontroller, or the USB via "bridge".

Applications

- measurements by ion-selective probes⁽⁶⁾
- measurement of very high resistances.

Electrometer SM420 coupled with a computer, or a microcontroller, enables almost unlimited data processing, as well as an easy integration with software packages and communication technologies. This electrometer can be used with LabVIEW, Java and similar software, as well as PC, Raspberry Pi and similar computers.

High accuracy measurements, using an ion-selective probe, are provided by the extraordinarily small input current, a high-resolution AD converter and a stable voltage reference. A considerable data rate, up to 2000 samples per second, makes this electrometer suitable for use in automated titration procedures.

The basic component of the electrometer is the 24-bit delta-sigma AD converter, ADS122C04, of Texas Instruments. In addition to the converter, the same package contains many modules and the following are significant for this application: • programmable gain, low noise, differential amplifier⁽⁵⁾, • voltage reference, • oscillator, • temperature sensor, • I2C compatible interface.

The coupling of the AD converter with the computer, or microcontroller, is realized solely via the I2C bus (no additional signals used).

The galvanically isolated AD converter is achieved by the I2C bus isolation, applying an integrated circuit for this purpose.

The electrometer has 16 Kbytes EEPROM for storing calibration data or for other purposes.

When the connectors are not mated, the dimensions of the electrometer are 22 x 41 x 93 mm. With the mated connectors, the degree of protection is IP 65 (protected against water jets). The electrometer can be used in different conditions, from laboratory to industry.

Specifications of the electrometer SM420

#	Parameter	Minimum	Typical	Maximum	Unit
1	Measuring voltage	-2		2	V
2	Last stable digit of measured voltage, the weight		0.1		mV
3	Differential input resistance	10	20		TΩ
4	Differential input bias current magnitude, at 25 °C		10	60	fA
5	Differential input offset voltage magnitude		200	400	μV
6	Samples per second	20	20	2000	1/s
7	-3 dB bandwidth	13.1	13.1	950	Hz
8	Input negative terminal to the "ground" resistance		1		TΩ
9	Working voltage between the "isolated 0 V" and the "ground", peak or DC	0		±560	V
10	Number of stable digits		5.1		1
11	Effective number of bits (ENOB)		17.0		1
12	Resolution, no missing codes, bits		24		1
13	I2C clock frequency	0	100	400	kHz
14	Power-supply voltage	4.5	5	5.5	V
15	Power-supply current		30	45	mA
16	Operating ambient temperature	-40	25	85	°C

Terms

⁽¹⁾ **Galvanically isolated** (or **floating**) electric circuit is a circuit between which, and other electric circuits, exists a high, insignificant, resistance.

⁽²⁾ **Electrometer** is a voltmeter with an insignificantly small input current.

⁽³⁾ **Differential input** is two electrical terminals between which there is a voltage determination. These terminals may be at some voltage to the "ground" (that is, 0 V) of a system.

⁽⁴⁾ **Differential amplifier** is an amplifier with the differential input.

⁽⁵⁾ **Common-mode voltage** is considered as a common component of two voltages (of differential input terminals) relative to the "ground". The arithmetic mean of the two voltages is usually taken as the common-mode voltage.

⁽⁶⁾ **Ion-selective probe, ISE** (or **ion-selective "electrode"**) is a measuring transducer whose output voltage depends on the concentration of specified ions adjoining its ion-selective membrane.

⁽⁷⁾ **Typical value** (or **mode**) is the most often appeared value.

GK 211123, 211124, 211202