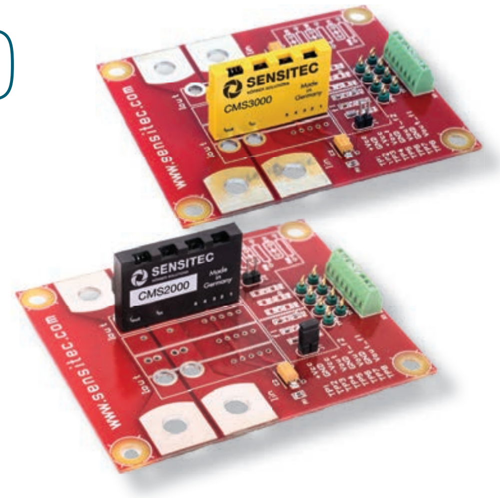
SENSITEC
KÖRBER SOLUTIONS

CMK2000 / CMK3000

MagnetoResistive Current Sensor Demoboards



Product discontinued.
Not to be used for new designs.

The CMK demoboards offer the opportunity to experience the features and benefits of the CMS2000 and CMS3000 current sensors in a quick and simple manner.

The primary current to be measured can be directly connected via screwed connections to a busbar or a cable connector. On the secondary side all signal pins of the CMS current sensor are connected to a screw terminal and additional test pins.

Jumpers can be used to switch the RC filter settings of the voltage output signal. In order to improve the frequency response, a pre-assembled filter can be used. It is also possible to test custom filter settings or use no filter at all.

With easy modifications the voltage output can be changed to a current output. Furthermore the influence of the current feed to the output signal can be evaluated using various current feed options.

Electrical Data

This document is to be used in combination with the data sheet of the corresponding CMS current sensor, containing further detailed information. The latest data sheet is available on the internet at www.sensitec.com.

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{CC}	Supply voltage	±12	±15	-	V

Electrical Data

In accordance with the absolute maximum rating system (IEC60134).

Symbol	Parameter	Min.	Max.	Unit
V_{CC}	Supply voltage	±0.3	±17	V
$T_{amb\_CMK2000}$	Ambient temperature	-25	+85	°C
$T_{amb\_CMK3000}$	Ambient temperature	-40	+105	°C
$T_{B\_CMK2000}$	Busbar temperature of sensor	-25	+105	°C
$T_{B\_CMK3000}$	Busbar temperature of sensor	-40	+125	°C

Stresses beyond those listed under “Absolute maximum ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Handling Instructions

- The CMK demoboard is exclusive designed for evaluating and analyzing the functions of CMS current sensors and only for utilization under laboratory conditions.
- Ensure a good thermal connection of primary current conductor. This has a direct influence on the heat generation in the PCB and thereby the operating life of the demoboard and the accuracy of the sensor.
- The demoboard is designed for all CMS sensor types in the range up to 100 A nominal current. Please take care not to exceed the permissible peak current of the appropriate sensor type!

Features

- Pre-assembled CMS current sensor
- Easy adaption of the CMS current sensors to various applications
- Pre-assembled RC filter for improved frequency response
- Evaluation of customized RC filter settings

Advantages

- No additional engineering effort necessary for test and evaluation
- Simple handling due to common test points and screw terminal

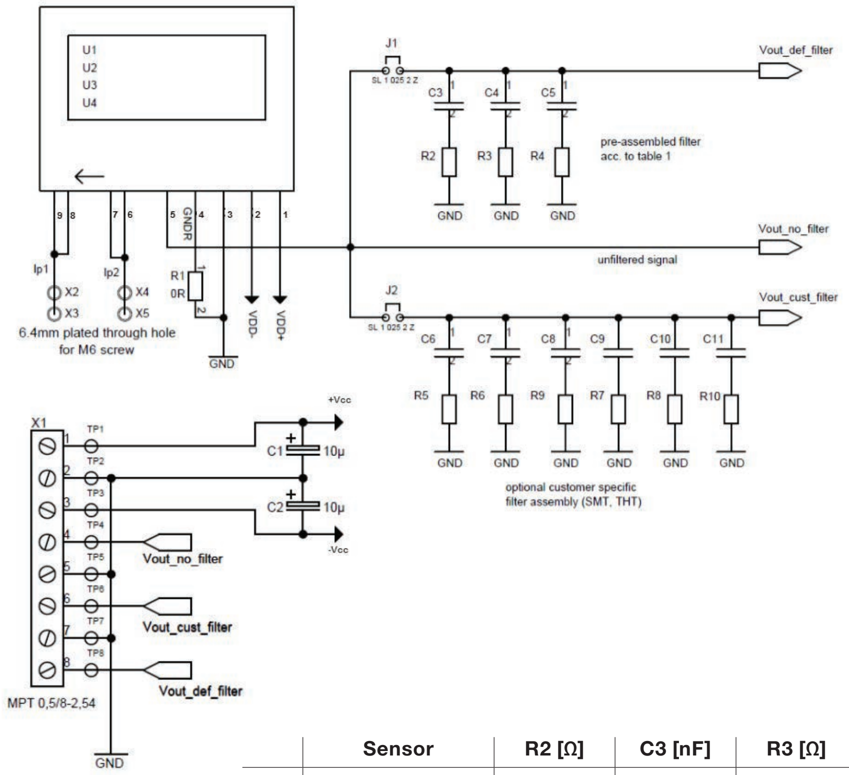
Applications

- Test and evaluation of CMS2000 and CMS3000 current sensors under laboratory conditions
- Wide bandwidth current measurement for laboratory use (especially CMS3000)

ESD

RoHS-Compliant www.sensitec.com

Circuit Diagram



	Sensor	R2 [Ω]	C3 [nF]	R3 [Ω]	C4 [nF]	R4 [Ω]	C5 [nF]
U3	CMS2005-SP3	820	2.2	-	-	-	-
U2	CMS2015-SP3	680	3.3	-	-	-	-
U2	CMS2025-SP3	390	6.8	-	-	-	-
U4	CMS2050-SP3	620	22	0	3.3	-	-
U1	CMS2100-SP3	470	68	390	6.8	-	-
U3	CMS3005ABA	15	3.3	-	-	-	-
U2	CMS3015ABA	33	2.2	-	-	-	-
U2	CMS3025ABA	1000	6.8	22	3.3	-	-
U4	CMS3050ABA	620	22	22	6.8	-	-
U1	CMS3050ABA	330	68	10	10	0	3.3

Fig. 1: Circuit diagram of the CMK2000 and CMK3000 demoboard.

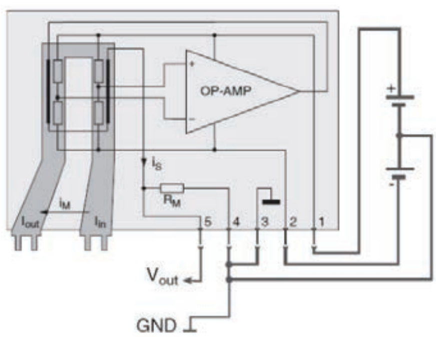


Fig. 2: Pinning of CMS current sensors.

Circuit Description

Power Supply

The demoboard can be supplied by ±12V or ±15V by using TP1, TP2 and TP3. A voltage tolerance of ± 5% is permissible. To prevent voltage drops in situations of sudden load changes the sensor is buffered by 10 µF capacitors on both $+V_{CC}$ and $-V_{CC}$.
This might happen in the case of short circuit situations on the primary current line when the sensor immediately sinks significantly higher compensation current as a result.

Initial Operation

Initially jumper J1 (see Fig. 1) is closed in order to connect the pre-assembled RC-filter. The RC-filter is used to compensate errors that are caused by the skin effect in the frequency response. In this configuration the single-ended filtered output signal is available at TP8. By closing J2 and opening J1 an optional customer specific filter can be used to adapt the filter settings to the customers application and requirements. The according output sig-nal is available on TP6. If J1 and J2 are opened, an unfiltered sensor signal is available on TP4.

Scaled Output Signal

The CMS current sensor's closed-loop principle results in a compensation current proportional to the magnetic field gradient caused by the primary current. A laser trimmed resistance (internal burden resistor RM; compare Fig. 2) in the path to GND inside the CMS current sensors converts the compensation current into an accurate output voltage, available on pin 5 of the sensor. In order to allow scaling of the output voltage, the voltage output can be changed into a current output. After removing R1, the compensation current does not flow through the internal burden resistor RM but directly out of Pin 5 of the sensor. Placing an external resistor between TP4 and TP5 (GND) in that case converts the output current into an output voltage available on TP4.

A current output configuration without R1 might result in an improved EMC-performance, as the burden resistor and RC-filter can be placed closer to the ADC. This also enables the use of longer signal lines without voltage losses of the measured signal. However, in this way the sensor's gain is not calibrated anymore. If required, the gain can be calibrated e.g. by means of a subsequent microcontroller. In addition the RC-filter impedance needs to be adapted if the burden resistance is changed significantly.

Scaling the output voltage can be realized more easily by using an impedance converting operational amplifier circuit. In this case changing the filter settings is not necessary.

In any case it is recommended to use high-impedance inputs for further signal conditioning as any parallel imped-ance to the burden resistor (either RM or a customer specific resistor) changes the total load resistance. Parts of the compensation current flow past the burden resistor, reducing the original voltage conversion rate and hence resulting in an increased gain error.

Current Feed

Especially for the CMS current sensor models with higher nominal primary current, the magnetic field generated by the current feed might influence the characteristic curve. Asymmetries in the field gradient cannot be compen-sated completely and result in nonlinear characteristics. For this reason different current feed directions are recommended depending on the nominal current. The demoboard gives the opportunity to combine four typical current feed directions and evaluate the influence on the sensor's accuracy.

The recommended current feed directions, that are also defined in the datasheets of the sensors, are shown in Fig. 2. For high nominal currents of 100A (CMS2100, CMS3100) it is recommended to feed the current in the direction indicated with the red arrows. For lower currents the direction of the blue dotted arrows should be used.

Changing directions might result in exceeding the specified accuracy for linearity or gain.

Pinning Demoboard

Pad	Symbol	Parameter
1	$+V_{CC}$	Supply voltage (+12 V or +15 V)
2	GND	Ground
3	$-V_{CC}$	Supply voltage (-12 V or -15 V)
4	$V_{out\_no\_filter}$	Unfiltered output voltage
5	GND	Ground
6	$V_{out\_cust\_filter}$	Customer filtered output voltage
7	GND	Ground
8	$V_{out\_def\_filter}$	Pre-defined filtered output voltage
9	IP2	Primary current input
10	IP2	Primary current input
11	IP1	Primary current output
12	IP1	Primary current output

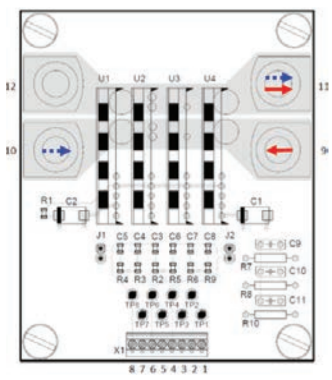


Fig. 3: Connections of a CMK demoboard showing the recommended current feed directions for higher (100A; red arrows) and lower (≤50A; blue dotted arrows) nominal currents.

Dimensions

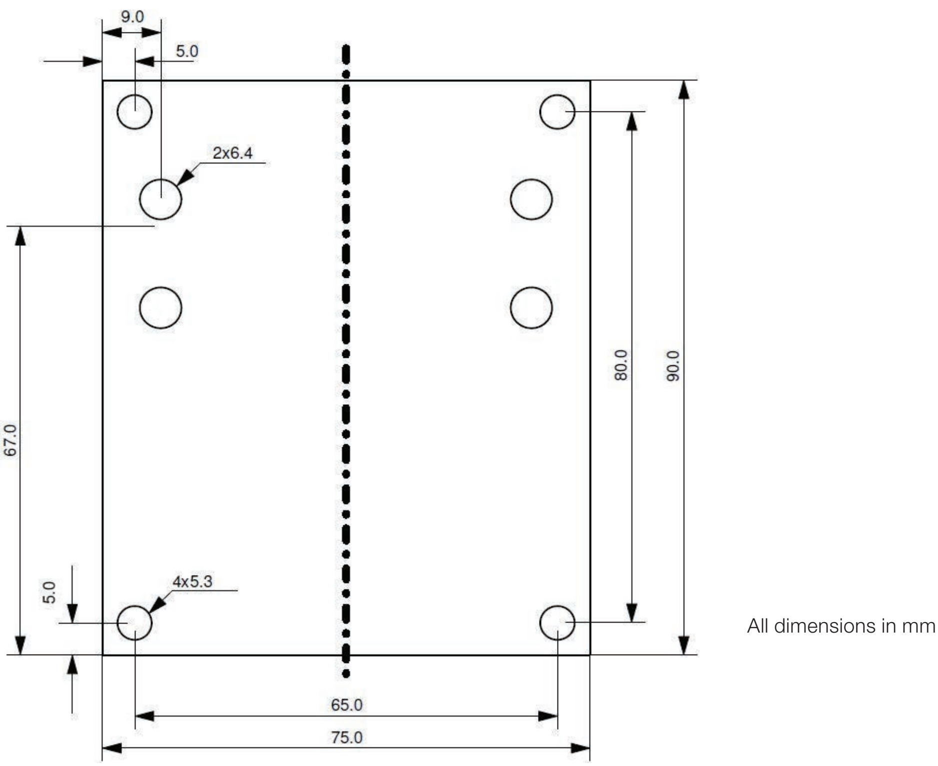


Fig. 4: Outline of the CMK2000 and CMK3000 demoboards. Tolerance ± 0.2 mm unless otherwise specified.

Additional Notes

1. To operate the sensor within the specified accuracy, the following recommendations should be taken into account:
   - The minimum clearance to other sources of magnetic fields (e.g. relays, motors, current conductors or permanent magnets) depends on the strength of the magnetic field. In order to keep the influence of magnetic stray fields on the current sensor signal below 1% (of IPN), both homogeneous magnetic fields and magnetic field gradients at the position of the sensor chip (located at the centre of the primary conductor) should be below 1 kA/m and 15 (A/m)/mm (18.7 µT/mm), respectively. Generally, shielding is possible to avoid influence of magnetic stray fields. Example: A conductor carrying 1 A generates a magnetic field of 20 A/m and a magnetic field gradient of 2.5 (A/m)/mm at a distance of 8 mm.
   - It is not recommended to place multiple sensors on one CMK demoboard.
   - Parts made of ferromagnetic material (e.g. housing parts made of steel) placed in close proximity to the sensor may affect the sensor's accuracy as the magnetic field generated by the sensor's primary conductor may be disturbed. Take care to avoid ferromagnetic screws when connecting primary current lines.
   - Depending on the height of the primary current, the primary current tracks inside the PCB will heat up the demoboard and hence the sensor due to thermal losses. To prevent additional thermal offset drift when measuring accuracy at room temperature, such measurements should be carried out in a quick way.
   - Although the area of the current feeds inside the PCB is fixed for the demoboards, it is possible to in-fluence the temperature rise of the demoboards by increasing the cross-sectional area of the connecting cables. The following diagrams show how the cable cross-section influences the temperature rise of a CMK3100 demoboard at 100A DC:

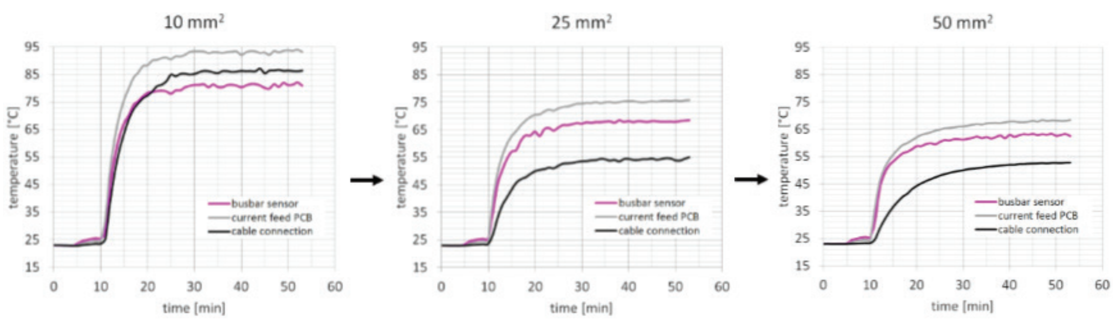


Fig. 5: Influence of different cable cross-sections on the temperature rise of the CMK3100 demoboard after a 100 A DC step at t=10min, measured at different locations.

2. Due to the specific layout of the demoboard, the minimum clearance distance of the PCB is limited to 4.5 mm. Larger clearances can be realized in the customer's layout if required by the application. The actual clearance and creepage distance of the different sensors are specified in the according datasheets and begin for example with 6.1 mm for the CMS2100 and CMS3100.

DATA SHE

The CMS2000 Product Family

The CMS2000 product family offering PCB-mountable THT current sensors from 5 A up to 100 A nominal current for various industrial applications. For quickly evaluating these current sensors the CMK2000 demoboard is available for every sensor type listed below.

Sensor 	Demoboard 	I_{PN} [1]	I_{PR} [2]
CMS2005-SP3	CMK2005-SP3	5 A	20 A
CMS2015-SP3	CMK2015-SP3	15 A	60 A
CMS2025-SP3	CMK2025-SP3	25 A	100 A
CMS2050-SP3	CMK2050-SP3	50 A	200 A
CMS2100-SP3	CMK2100-SP3	100 A	400 A

The CMS3000 Product Family

The CMS3000 product family offers PCB-mountable THT current sensors from 5 A up to 100 A nominal current with a typical bandwidth of 2 MHz for various industrial applications. For quickly evaluating these current sensors the CMK3000 demoboard is available for every sensor type listed below.

Sensor 	Demoboard 	I_{PN} [1]	I_{PR} [2]
CMS3005ABA-KA	CMK3005ABA-KA	5 A	20 A
CMS3015ABA-KA	CMK3005ABA-KA	15 A	60 A
CMS3025ABA-KA	CMK3005ABA-KA	25 A	100 A
CMS3025ABA-KA	CMK3005ABA-KA	50 A	200 A
CMS3100ABA-KA	CMK3005ABA-KA	100 A	400 A

Notes

1) Nominal primary current (RMS).

2) Measurement range (max. 3s for $I_{PN} \leq 50$A or 2s for $I_{PN} = 100$A in a 60 s interval and $V_{CC} = \pm 15$ V).

Safety Notes

Warning!
This sensor shall be used in electric and electronic devices according to applicable standards and safety requirements.
Sensitec's datasheet and handling instructions must be complied with.
Handling instructions for current sensors are available at www.sensitec.com.

Caution! Risk of electric shock!
When operating the sensor, certain parts, e. g. the primary busbar or the power supply, may carry hazardous voltage.
Ignoring this warning may lead to serious injuries!
Conducting parts of the sensor shall not be accessible after installation.

General Information

Product Status

Article	Status
CMK2000 CMK3000	The product is in series production.
Note	The status of the product may have changed since this data sheet was published. The latest information is available on the internet at www.sensitec.com.

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Life Critical Applications

These products are not qualified for use in life support appliances, aeronautical applications or devices or systems where malfunction of these products can reasonably be expected to result in personal injury.

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