Power Electronic Measurements

CMC Rogowski current probe for measuring hf bearing currents

PEM has developed a flexible, clip-around, current probe to measure high frequency bearing currents in large motor drives. The probe is a modified version of our industry leading CWT range of Rogowski current sensors. This customised probe features:

- An electrostatically screened Rogowski coil. The screen attenuates the effects of unwanted interference due to capacitive coupling from local voltages sources.
- A low frequency (-3dB) bandwidth to attenuate any large fundamental power frequency currents. This significantly improves the SNR for measurement of high frequency bearing currents.
- A high frequency (-3dB) bandwidth of ≥ 10MHz for coil circumferences up to 1m.
- A wide range of Rogowski coil sizes suitable for even the largest machine shafts.
- Option of two outputs:
    - Optional small 3 ½ digit LCD display showing the true rms of the measured current. This enables a quick, simple diagnostic test for the presence of hf bearing currents.
    - A BNC output enabling the engineer to look at the bearing current waveform and perform full diagnostics with an oscilloscope.

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ISO 9001 : 2000
REGISTERED FIRM

Type	Sensitivity (mV/A)	Peak current *BNC output* (A)	Rated current *LCD Display output* (A)	Noise max (mV_{pk-pk})	LF (-3dB) bandwidth f_L typ. (kHz)	LF (<1%) bandwidth typ. (kHz)	HF (-3dB) bandwidth f_H typ. (MHz) *Coil length <1000mm*
CMC015	200.0	30.0	2.0	15.0	19.0	50.0	10.0
CMC03	100.0	60.0	10.0	10.0	7.0	20.0	10.0
CMC06	50.0	120.0	20.0	10.0	2.0	10.0	12.0

Higher current ranges available on request

BNC OUTPUT	± 6.0V corresponding to 'Peak current'
LCD DISPLAY	1.999 – for CMC015 10.00 – for CMC03 19.99 – for CMC06
CALIBRATION AND POSITIONAL ACCURACY	Calibrated to ±0.3% with conductor central in the loop. Supplied with traceable certification Variation with conductor position in the coil loop typically ±2%
LCD DISPLAY ADDITONAL ERRORS	**Crest factor** For a waveform with a crest factor <3 there are no additional conversion errors. For a waveform with a crest factor ≥3 an additional reading error must be added

Crest Factor	Additional Error
3	+ 0.1%
10	+ 1%

RMS conversion error

Due to various non-linearities in the RMS conversion process, and within the bandwidth of the RMS to DC converter, the conversion error will be <0.2% of reading at full scale and 0.4% of reading at 20% full scale current. The errors are quantified below:

	20% Peak current	100% Peak current
Conversion error	+0.2%	+0.12%
Non-linearity error	+0.2%	+0.04%

COIL LENGTHS	330, 500, 700 and 1000mm as standard – up to 10m as custom
CABLE LENGHTS	2.5 and 4m as standard – other cable lengths available as custom
COIL INSULATION	10kV peak Safe peak working voltage to earth. 10kV coils are flash tested at 15kVrms for 60 seconds with the sleeve added. Information about continuous use of the coils at high voltage can be obtained from PEM.
POWER SUPPLY	Battery 4 x AA (1.5V standard alkali batteries) – lifetime approx. 20hrs *-plus-* 2.1/2.5mm socket for 12 to 24V (±10%) DC input

FOR FURTHER DETAILS OF THE GENERAL CWT PERFOMANCE CHARACTERISTICS PLEASE SEE THE FULL TECHNICAL DATASHEET AVAILABLE FROM www.pemuk.com.

Generating the order code

Type + LCD display or BNC only + Power supply	/	Cable length (m)	/	Coil circumference (mm)

e.g. CMC06 – 50mV/A for the BNC output only version, battery supply, 2.5m cable from coil to integrator, 1000mm circumference coil

CMC06 B	/	2.5	/	1000

e.g. CMC 05 – 200mV/A for the BNC output version AND the LCD display, battery supply, 4m cable from coil to integrator, 2000mm circumference coil

CMC015	rms	B	/	4	/	2000

If you have any queries regarding the CMC or require specifications outside our standard ranges please do not hesitate to contact us.

Typical performance characteristics

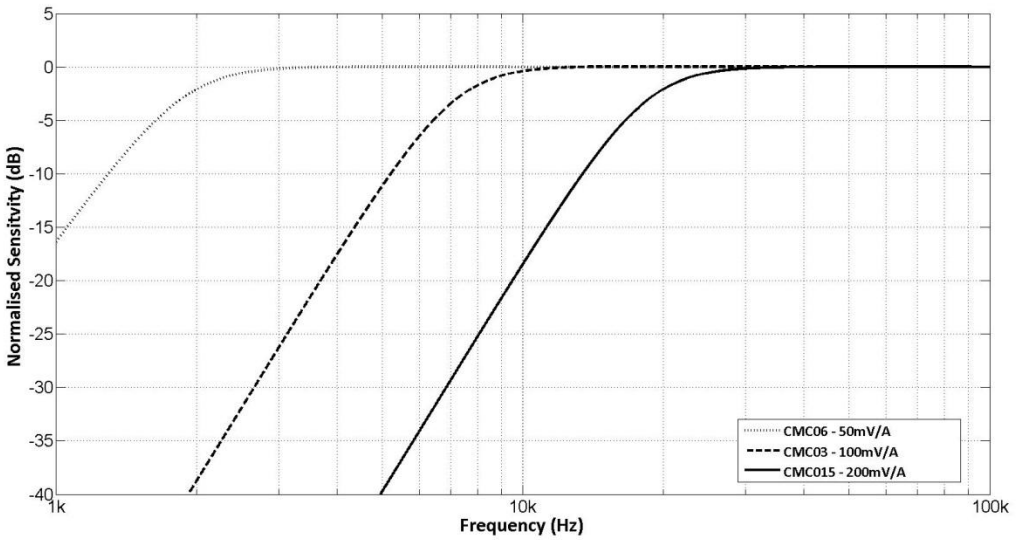

Fig 1. Bode plot of low frequency bandwidth
This is the same for both BNC output and LCD display

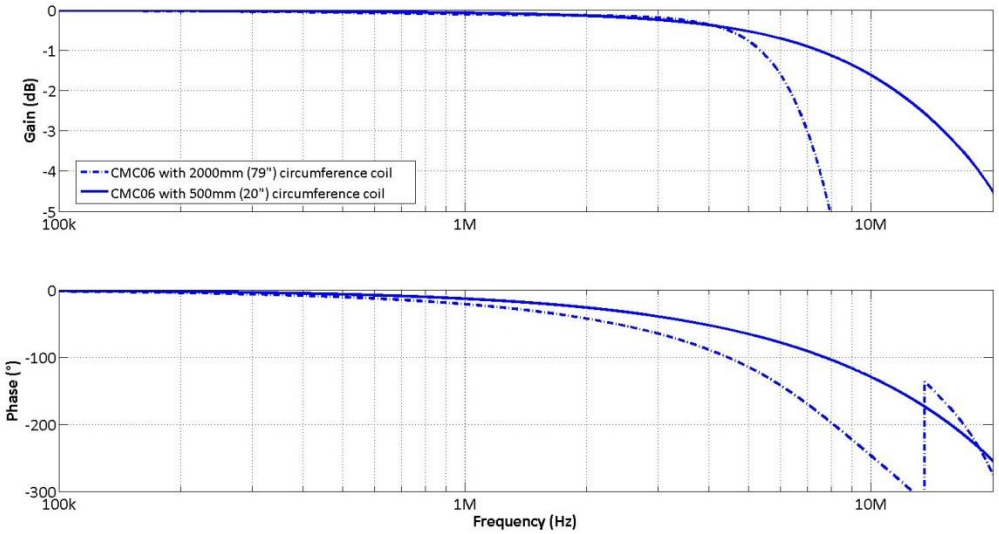

Fig 2. Graph of hf frequency response for a 1000mm coil vs. a 5000mm coil – Model CMC06 50mV/A
BNC output only – Showing the variation of hf performance with coil length

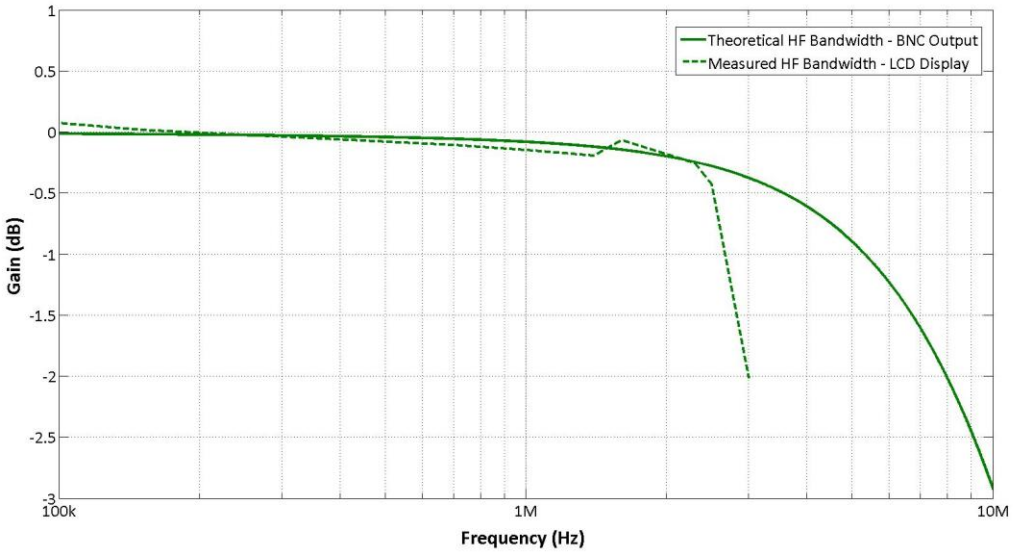

Fig 3. Graph of hf frequency response for a CMC03 with a fixed coil length 1000mm. Compares the BNC output with the hf bandwidth for the output on the LCD display. Current is 20% full scale

The bandwidth on the LCD output is limited by the RMS to DC converter.

Using a precision RMS to DC converter we can offer a 3dB bandwidth of >3.5MHz from 20-100% peak current.

The typical 1%, 10% and -3dB (30%) bandwidth at 100% and 20% full scale is listed in the table below:

Input Current	1% Bandwidth	10% Bandwidth	3dB (30%) Bandwidth
100% Full Scale	400kHz	2.0MHz	4.0MHz
20% Full Scale	200kHz	1.0MHz	3.5MHz

At currents below 20% peak current input the high frequency bandwidth is reduced.