



ICS DEMO BOARDS

APPLICATION NOTE

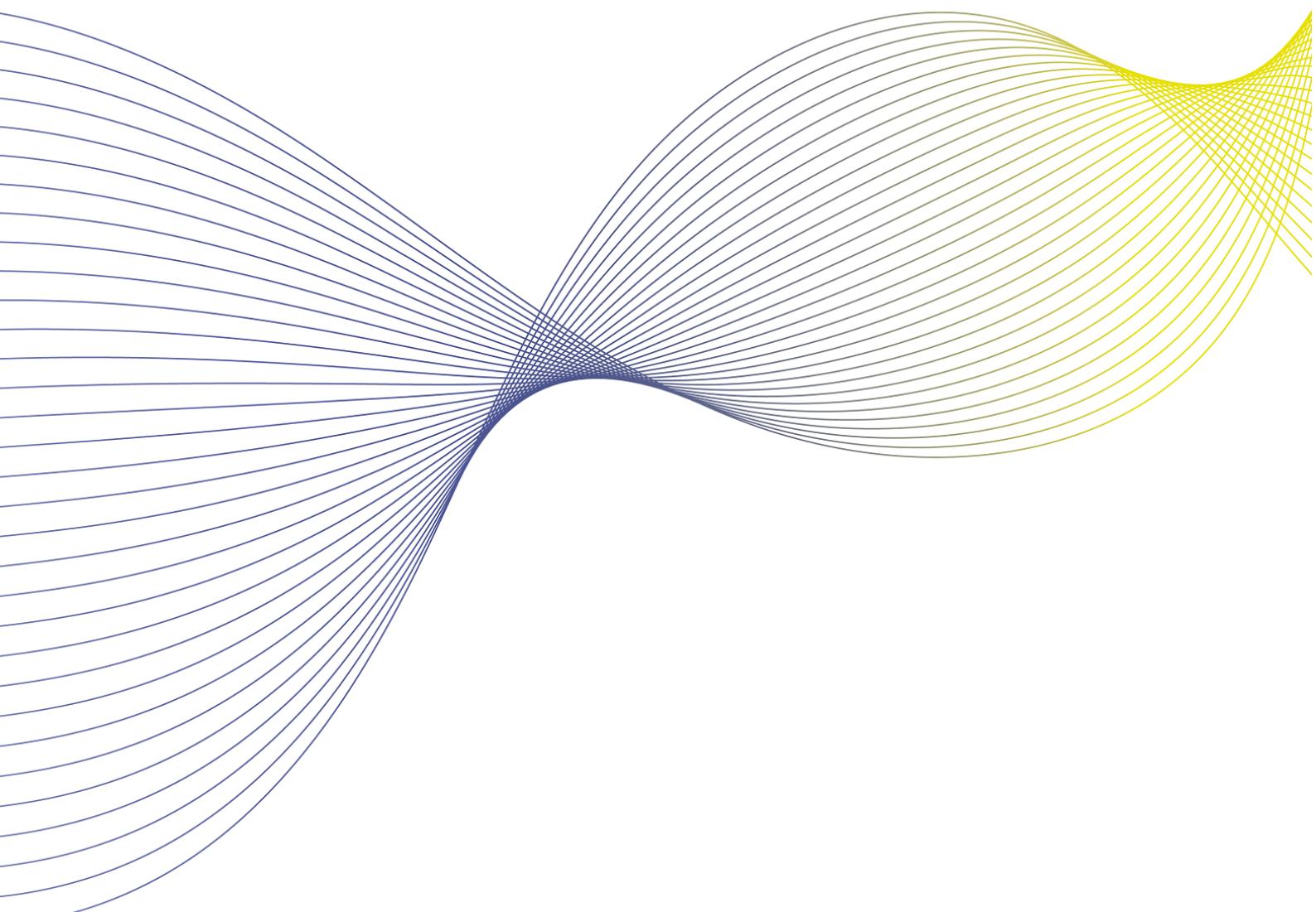


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INTRODUCTION

SAFETY RECOMMANDATIONS



Demo boards should only be used by skilled people.
Incorrect use can lead to equipment damage or personal injury.

HIGH VOLTAGE



Improper use of high voltage equipment and demo boards can result in personal injury, equipment damage or death.

ICS products have been designed to be used in high voltage environments, thanks to the high isolation capabilities. Before connecting the demo board, check the isolation limits given in the datasheet cannot be exceeded by the equipment.

Environment should be compatible with high voltage tests, according to local and corporate safety rules.

HIGH CURRENT



Testing at high current dissipates a lot of heat. Take care of every connection, cable diameter and environment to ensure no risk of burn or personal injury.

Our range of sensors can withstand relatively high current on a very small surface. The thermal performance given in the datasheet has been measured using this board, but environment has a huge impact on the performance. Be sure not to perform tests in a closed box, monitor the ambient temperature and equipment temperature. Never exceed the current ratings given in the datasheet.

PURPOSE

Demo boards offer a very convenient solution to evaluate the performance of our ICS (Integrated Current Sensors) in customer application, without the need to design a specific PCB or use complex tools.

Thermal and transient performance given in the datasheet are based on measurements performed on these demo boards.

UNIFORMIZED DESIGN

All LEM ICS demo boards are designed with a similar form factor and thermal performance.

This offers the possibility to easily compare the performance of different products with different packages in similar conditions.

PRESENTATION OF THE DEMO BOARDS

GENERAL DESCRIPTION

OVERVIEW

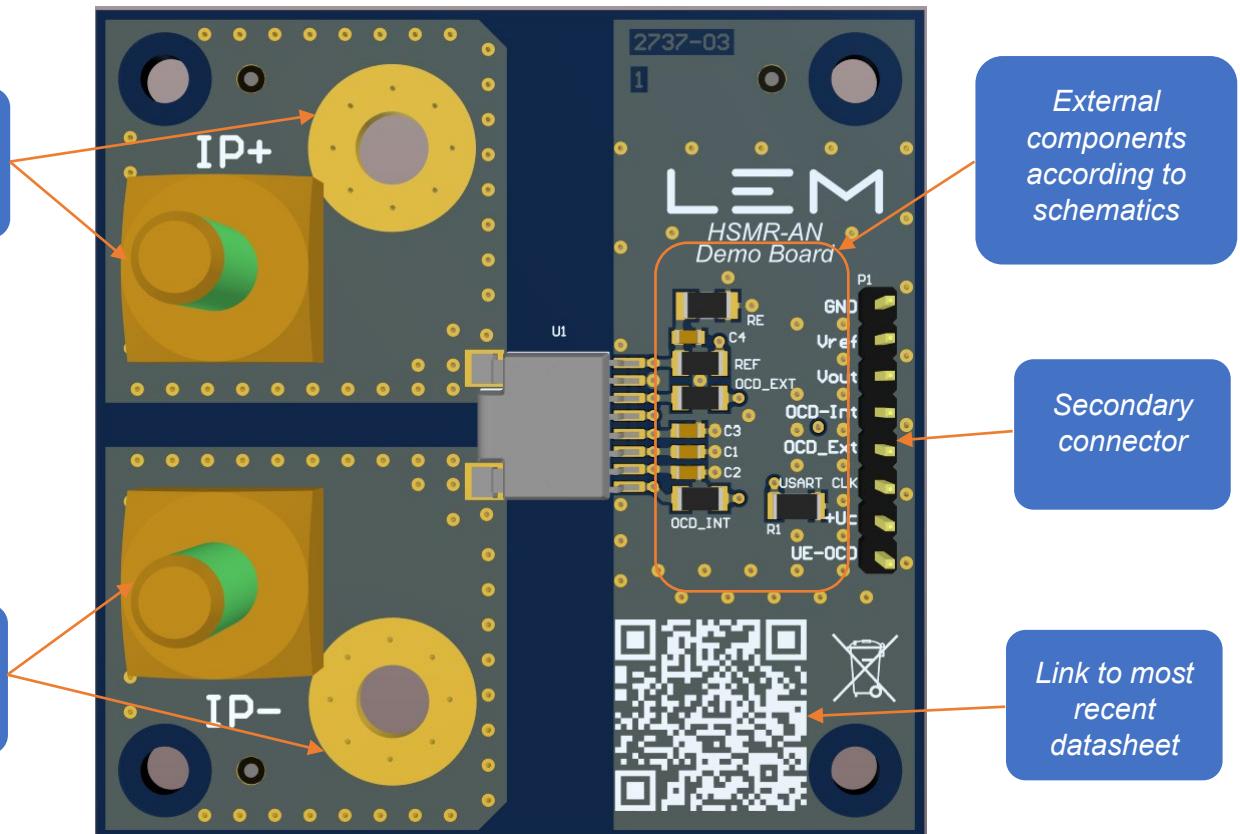


Fig. 1 HMSR AN Demo Board

PRIMARY CURRENT CONNECTION

2 options are available on the board to connect the primary cable:

- Standard hole: fastest solution to connect the primary cables, for example using a fork terminal.



Fig.2: Illustration of a fork terminal adapter

The counterpart is that thermal performance is lower than using the Redcube:

- Redcube terminal: the most reliable connection, insuring the lowest total resistance and the best thermal performance.

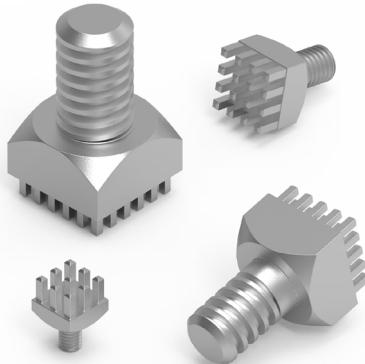


Fig.3: Illustration of Redcube press-fit terminal

We recommend using reference Würth Elektronik 7461098.

SECONDARY CONNECTION

We recommend using Molex 901471108 female connector (or equivalent) to ensure secondary connection.

To reduce as much as possible perturbation, connect the probe directly to the connector or solder coaxial cables (or twisted cables) directly to the connector.

The output should only be connected to a relatively high impedance input. 50 Ohms input impedance will result in an overload for the sensor that will impact performance.

PINOUT

Pin Name	Type	Description
GND	Supply	Supply Ground (0 V)
U_{ref}	Input/Output	Reference voltage pin. Can be forced with an external reference.
U_{out}	Output	Output of the sensor
OCD_Int	Output	Internal Overcurrent Detection pin. Active Low
OCD_Ext	Output	External Overcurrent Detection pin. Active Low
USART_CLK/NC	NC	Connected to GND
$+U_c$	Supply	Supply positive voltage (3.3 V or 5 V)
Ueocd	Input	Set by resistor divider on U_{ref} . Can be set externally.

Table 1: Pinout description

TYPICAL TEST SETUP

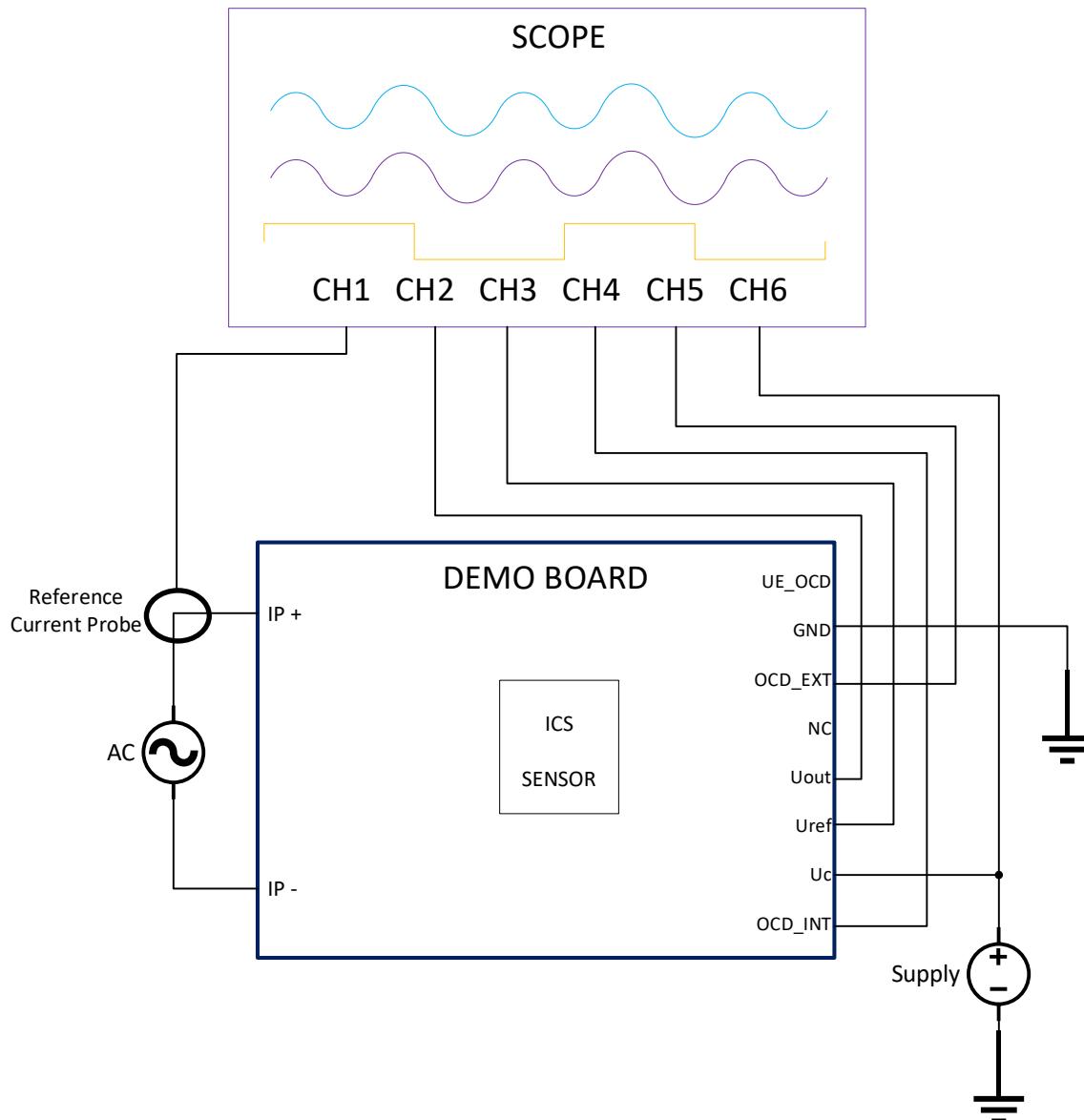


Fig.4: Typical measurement setup

Channel	Type	Description
CH1	Analog	Current reference flowing through the board
CH2	Analog	Output voltage of the sensor
CH3	Analog	Reference voltage. Not connected on ratiometric versions.
CH4	Digital	Internal Overcurrent Detection pin. Active Low
CH5	Digital	External Overcurrent Detection pin. Active Low
CH6	Analog	Supply voltage monitoring (for Ratiometric versions)

Table 2: Signals description

DESCRIPTION OF SIGNALS

CURRENT REFERENCE

To ensure accurate measurement of the current flowing through the sensor, probe must be carefully chosen according to the signal characteristics:

- Working voltage
- RMS / Peak current
- Presence of DC, AC or both
- Bandwidth, slope

SENSOR OUTPUT

The output of the sensor is a voltage proportional to the current input.

Standard voltage probes or coaxial cable soldered on the secondary connector can be used.

REFERENCE VOLTAGE

The reference voltage of the sensor provides a stable and accurate reference to ADC.

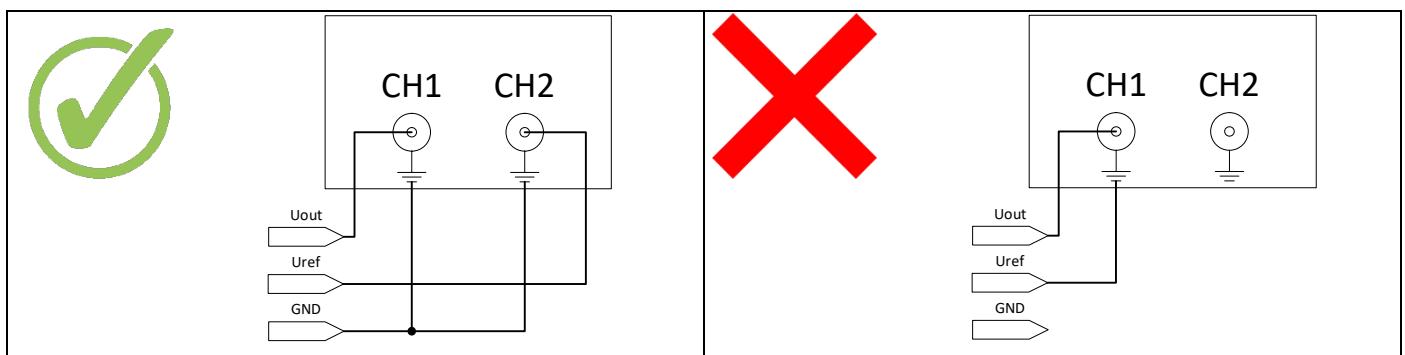
Standard voltage probes or coaxial cable soldered on the secondary connector can be used.

Default use is output, but the reference pin can be used as input: simply connect an external voltage supply, and internal ref. will be superseded by the external.

Reference voltage is not available in ratiometric products, as the 0 A is centered on $U_o/2$ instead of U_{ref} .

In case of measurement in differential mode ($U_{out} - U_{ref}$), you can simply subtract CH2 – CH3 in the MATH scope parameters or use a differential probe.

*In case of measurement in ratiometric mode, subtract CH2 – 0.5*CH6.*



Do not measure $U_{out} - U_{ref}$ by directly connecting U_{ref} to the GND of a scope channel.

INTERNAL OCD

Internal OCD threshold is usually set during production trimming to a value slightly higher than $I_{P\text{M}}$ ($\sim 3 * I_{P\text{M}}$).

If primary current is higher than the threshold (positive or negative), OCD_INT goes from 1 ($+U_c$) to 0 (GND).

EXTERNAL OCD

On the demo boards, External OCD threshold is set by using a resistor divider connected to U_{ref} .

This is a very convenient way to set the threshold, but unfortunately it cannot cover all the configurations:

- U_{ref} is very low on unipolar versions
- U_{ref} is not accessible on ratiometric versions
- Accuracy of the threshold is impacted by the accuracy of resistors.

You can also simply use an external voltage to set the threshold, but the pullup resistor to U_{ref} need to be removed on the board to avoid any perturbation on the reference voltage.

REFERENCES

HARDWARE DESIGN FILES

All the necessary documentation is available on LEM website (schematics, gerber, bill of materials, 3D):

[Experts in current measurement | Current sensor manufacturer](https://www.lem.com/en/experts-in-current-measurement)

Simply scan the QR code on the demo board or type the reference of the sensor in the search icon:

