

# **LEM Sensor Packages**

**Technical Information** 



Innovative Measurement and Data Technology

LEM Sensor Packages – Copyright

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The correct disposal of old equipment will protect the environment and people from possible negative consequences.

Become familiar with local regulations for separate collection of electrical and electronic equipment.

Follow local regulations and do not dispose of old equipment with household waste.



### **Contact information**

CSM offers support for its products over the entire product life cycle. Updates for the individual components (e.g. documentation, configuration software and firmware) are made available on the CSM website. To keep up to date, it is therefore recommended that you check the download area of the CSM website for updates at least once a month.

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# **1** Technical Information

## 1.1 To which LEM sensor packages does this document apply?

	NOTE!
i	<ul> <li>The information in this document applies to all LEM sensor packages as of revision B.</li> <li>If there are questions concerning the configuration of LEM sensor packages with older revision numbers, please contact CSM Support.</li> </ul>
i	For current measurements in conjunction with LEM sensor packages, it is recommended to use AD4 ECAT MiniModules of type "IG", as this type of measurement module is particularly suitable for measuring low voltages.

## **1.2 General information**

In combination with AD4 ECAT MM series measurement modules, LEM sensor packages can be used to measure currents up to ±1,250 A (LEM LF 1010-S). The LEM current transducer is equipped with a membrane sleeve that supports centric positioning of the cable in the sensor to minimize measurement errors.

An AD4 ECAT MiniModule can measure up to four currents synchronously. The current transducer of the LEM sensor package provides galvanic isolation between the test setup and the measurement technology.

## **1.3 Design and connections**



Fig. 1-1: LEM LF 310-S sensor package with AD4 ECAT MiniModule

Connection	Length	Connection/plug
Power supply $U_{Battery} = 9 - 36 V$	1.5 m	banana plugs
Sensor	3.0 m	firmly connected to the sensor
AD4 ECAT MiniModule	0.75 m	LEMO 1B 8-pole, code G

## **1.4 Connecting LEM sensor packages**

	NOTE!
	There is an arrow on the top of the current transducer (Fig. 1-2, $\textcircled{1}$ ) which indicates the direction of flow of the primary current $I_p$ .
	If the current in the HV cable flows in the opposite direction to the arrow on the top of the sensor, the current output is inverted.
[	
<b>_</b>	The LEM sensor package can be operated with a supply voltage of 9 - 36 V and is equipped with active reverse polarity protection.
	The maximum power consumption depends on the LEM sensor package used.
	→ See "LEM Sensor Package" datasheet for further information.

### Measuring the current I<sub>p</sub> using a LEM sensor package



Fig. 1-2: Measuring the current  $I_p$  using a LEM sensor package

- Feed the HV cable whose current is to be measured through the membrane sleeve (Fig. 1-2, ②) in the current transducer in the direction of the arrow (Fig. 1-2, ①).
- Connect the LEM sensor package to your AD4 ECAT MiniModule.
- Connect the banana plugs to the power supply.

# 1.5 Measurement channel settings in CSMconfig

NOTE!

A LEM sensor package is powered by an external power supply. The sensor excitation provided by the measurement module is therefore not required and can be disabled in the channel configuration dialog (Fig. 1-3, ①).

### 1.5.1 Configuring the measurement channel by reading in the TEDS data

A LEM sensor package is equipped with a TEDS chip (IEEE 1451.4). The TEDS chip comprises the data for the two-point scaling of the LEM sensor package and the setup data for the AD ECAT measurement module.

	NOTE!
i	Depending on whether the data from the TEDS chip is to be read in auto- matically or entered manually, either the option "Automatic" or "Manual" has to be selected in the <b>TEDS Mode</b> selection menu of the <b>TEDS related</b> <b>settings</b> section.
	If in doubt, check the TEDS-specific settings in the Program Settings dialog.

Start CSMconfig and open the channel configuration dialog for the measurement channel connected to the LEM sensor package.

Channel 2 of Device AD	MMEC_30657, S/N 30657, D/N 0	
Channel Name: Comment: Sensor Name:	ADMMEC_30657_A02	OK Cancel
Current Value: Range: Filter: Conversion Disp	???       -10 10 V       Std ( 30 kHz) Butterworth       Excitation:       off	Read TEDS Write Name to TEDS
Formula	Sensitivity (factor)         Offset           Phys [V] =         1         × Signal [V] +         0         V	Zero Adjust
○ Two Points	Signal         Physical           Lower:         -10         V         -10         V           Upper:         10         V         10         V	Auto Offset Auto Scale
		Defaults

Fig. 1-3: Channel configuration dialog

- Glick on Read TEDS.
   Section 2.25
   Click on Read TEDS.
   Section 2.25
   Click on Read TEDS.
   Section 2.25
   Click on Read TEDS.
   Section 2.25
   Sec
  - $\Rightarrow$  The **Read TEDS** dialog opens.

Property	Document	TEDS	
ADMMEC_30657	/ 2 / I_with_LEM_20A	<b>^</b>	
TEDS S/N	3958	3958	
Channel Name	I_with_LEM_20A	I_with_LEM_20A	Cancel
Range	5	5	
✓Unit	A	A	
Excitation	off	off	Show
Sens.L	-5	-5	🔽 equal
Sens.U	5	5	
Phys.L	-20.0189	-20.0189	anequa
Phys.U	19.963	19.963	info 🗌
Cisp.Min	-20.0189	-20.0189	
🌱 Disp.Max	19.963	19.963	
Calib Expires		2025-07-07	

Fig. 1-4: Read TEDS dialog, differences between document settings and TEDS data

In the table, matches between the data stored in the TEDS and the settings in the configuration document are indicated by green check marks. Differences between the TEDS data and the settings in the configuration document are highlighted by a red "unequal" symbol.

- Click on **Apply** to read the data from the TEDS chip to the configuration document.
  - ⇒ The **Read TEDS** dialog closes. The changed settings are displayed in the channel configuration dialog.

nannel 2 of Device AD	IMMEC_30657, S/N 30657, D/N 0	
Channel Name:	I_with_LEM_20A	ОК
Comment:		
Sensor Name:		Cancel
Current Value:	-0.031611 A	
Panger		
nanye.		T
Filter:	SW-Filter Off	Read TED
Conversion Disp	lay Range Zero Options TEDS Info	Write Nam to TEDS
	Physical Unit A	
	Sensitivity (factor) Offset	Zero Adju
🔿 Formula	Phys [A] = 3.99819 A/V * Signal [V] + -0.02795000 A	
	Signal Physical	
Two Points	Lower: -5 V	Auto Uffs
	Upper: 5 V	Auto Sca
		Defaults

Fig. 1-5: Channel configuration dialog – TEDS settings adopted

 $\rightarrow$  For further information, see the "Read TEDS" section in the CSMconfig online help.

### 1.5.2 Configuring the measurement channel manually

The following section describes how to manually adjust the channel settings depending on the type of LEM sensor package being used.

Start CSMconfig and open the channel configuration dialog of the measurement channel to which the LEM sensor package is connected.

Channel Name: LEM_Sensor_Package OK Comment: Current Battery
Channel Name: LEM_Sensor_Package OK Comment: Current Battery Cancel
Comment: Current Battery
Cancel
Sensor Name:
Current Value:
Current Value:         (2) Range: -55V         Filter: Std (30 kHz) Butterworth •         Excitation: off         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •
Defaults

Fig. 1-6: Channel configuration dialog - settings for LEM LF 310-S sensor package

#### Setting the measurement range and scaling manually (two-point scaling)

The LEM sensor package converts the measured current  $I_p$  into an output voltage  $U_{sensor}$ . To make sure that the voltage supplied by the LEM sensor package is correctly interpreted by the measurement module, some settings have to be adjusted. The following section shows which values have to be adjusted for the corresponding LEM sensor package in the channel configuration dialog (Fig. 1-6).

LEM sensor package	Nominal currrent	<b>Signal</b> (Fig. 1-6, ⑤)		<b>Physical</b> (Fig. 1-6, <b>6</b> )		
		Lower	Upper	Lower	Upper	
LEM LF 210-S/SP3_5	-5 A5 A			- 5 A	5 A	
LEM LF 210-S/SP3_10	-10 A 10 A	-5 V		- 10 A	10 A	
LEM LF 210-S/SP3_20	-20 A20 A		-5 V		- 20 A	20 A
LEM LF 210-S/SP3_50	-50 A50 A				- 50 A	50 A
LEM LF 210-S/SP3_100	-100 A100 A -200 A200 A			-5 V	5 V	- 100 A
LEM LF 210-S/SP3_200				- 200 A	200 A	
LEM LF 310-S	-500 A500 A			- 500 A	500 A	
LEM LF 1010-S	-1250 A1250 A				- 1250 A	1250 A

Tab. 1-1: LEM sensor packages - settings for two-point scaling

i	If there is a calibration certificate for the LEM sensor package, the correspon- ding values from the calibration certificate are to be used for <b>Physical   Lower</b> and <b>Physical   Upper</b> (Fig. 1-6, ⓒ) instead of the values in Tab. 1-1.
---	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

**Example**: To be able to measure a rated current in the range of -500 A..500 A using a LEM LF 310-S, the following settings have to be adjusted:

- $rac{1}{rac{2}}$  Go to Range (Fig. 1-6, 2) and select "-5..5 V".
- Go to Physical Unit (Fig. 1-6, ③) and enter an "A" for Ampere.
- $rac{1}{\sim}$  Enable the **Two Points** option (Fig. 1-6, (4)) to enter the scaling values.
- Enter the following values in section Two Points, Signal (Fig. 1-6, ⑤) and Physical (Fig. 1-6, ⑥):
  - ► Signal | Lower: -5 V
  - ► Signal | Upper: 5 V
  - Physical | Lower: -500 A
  - Physical | Upper: 500 A

#### NOTE!



If the LEM current transducer is exposed to a current multiple times without applying current to the measurement system, a permanent offset may occur ("Magnetic Offset Current", see manufacturer specification).

- Perform a zero adjustment before measurement.
- → For more information, refer to the CSMconfig online help, section "Adjustment Options Zero Adjustment".

### 1.5.3 Transferring configuration data to the measurement module



After finishing the channel configuration, the configuration data has to be transferred to the measurement module.

Gen the device configuration dialog.

NOTE!

- Glick on Write to device.
  - $\Rightarrow$  A confirmation prompt is displayed.
- Click on **OK** to save the modified configuration to the measurement module.
  - $\Rightarrow$  A message indicates the successful reconfiguration of the measurement module.



Further information on how to configure the module can be found in the user guide of the relevant AD measurement module or in the CSMconfig online help in section **Help | Overview**.

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