Direct Current Energy Sensor – DCES Series

Ref: DCES Series

The DCES series are energy metering and monitoring solutions dedicated to DC applications offering advanced functionalities, addressing the unique demands of energy billing in DC fast charging of electric vehicles. Offering current, voltage, energy, temperature measurement, and compliance with legal metrology standards, the DCES series provides an ideal solution for energy metering of all DC applications. The solution is available in different sizes, 600A and 1500A versions, provides cable loss compensation, 4-wire measurement, data authentication, software updates, offers RS485 and CAN communication interfaces, and can communicate with an optional detached display.

S.A.F.E. Software Alliance for E-mobility

Features

- Two sizes: Imax 600A and 1500A
- Range of operation 150…1000 V DC (1500VDC for 1500A version)
- Wide current terminal for busbar mounting
- Bi-directional current and energy measurement
- Operating temperature -40°C to +85°C
- Reinforced insulation
- Accuracy Class B (EN 50470-4), 1% for CTEP/NTEP
- 4-wire measurement and cable loss compensation
- Auxiliary power supply range +12 ... +24 V DC
- Real time data for current / voltage / temperature / power
- Transaction handling with signed OCMF data
- Software updates
- RS485 communication protocol with REST APIs
- Screw mounting
- Sealing of terminals and interfaces

Applications

- Electric vehicle charging infrastructures
- DC systems, energy monitoring
- Renewables, Data centers

Standards

Directives

- MID 2014/32/EU
- Eichrecht MessEV

Standards

- EN 50470-1
- EN 50470-4
- IEC 62052-11
- CISPR32 Class-B emission
- UL94-V0

Advantages

- All electrical measurements combined in unique device
- Simple and easy integration thanks to software tools
- Robust integration in DC electrical systems
- System monitoring and control
- Compliance with legal metrology

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1217 Meyrin
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Caution

In order to guarantee safe operation of the product and to be able to make proper use of all features and functions, please read these instructions thoroughly!
Safe operation can only be guaranteed if the product is used for the purpose it has been designed for and within the limits of the technical specifications.
Ensure you get up-to-date technical information that can be found in the latest associated datasheet under www.lem.com.
Time source to set product's time must be provided by the customer. Product must be time synchronized to operate.
To ensure proper operation, product's logbook completion must be checked periodically.
Vertical position shall be the standard installation for DCES device. For alternative positions contact your LEM sales and technical support. The product must be installed in a protected environment, in an enclosure as per IEC 61851-23.

Caution, risk of electrical shock

Electrical equipment should be installed, operated, serviced and maintained only by qualified personnel. No responsibility is assumed by LEM International SA for any consequences arising out of the use of this material. A qualified person is one who has skills and knowledge related to the construction, installation, and operation of electrical equipment and has received safety training to recognize and avoid the hazards involved.
When installing or changing the product, the conductor to which the product is connected must be de-energized. Ignoring the warnings can lead to serious injury and/or cause damage!
The appropriate torque as defined by the manufacturer shall be applied on product's terminals.

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Product Overview

DCES600

DCES1500

RDU

Operating conditions

Parameter	Symbol	Unit	Min	Typ	Max	Comment
Ambient operating temperature						
DCES	T_A	°C	−40	-	+85[a]	
RDU	T_A	°C	−30	-	+70	Display readibility not ensured between -40…-30°C and +70…+85°C
Ambient storage temperature	T_S	°C	−25	-	+55	
Relative humidity	RH	%	-	-	95	Non-condensing
Mass	m	g		360 1160 100		DCES600 DCES1500 RDU
Impact rating				IK05		According to IEC 62262, with protection cover mounted
Ingress protection rating				IP10		On current terminals
Maximum temperature of current terminals[a]		°C			+110	

[a] In any case, maximum terminal temperature must not be exceeded

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Insulation coordination

Parameter	Symbol	Unit	DCES600	DCES1500	Comment
Pollution degree	-	PD	2		
Rated Altitude	-	m	3000		
Rated insulation voltage	U_b	V	1000	1500	
Case material	-	-	V0		According to UL94
Insulation between live parts and accessible parts					Isolation between I1,I2, VP, VN and Datalink. PE
Insulation type			Reinforced		
Overvoltage category			II		
Impulse withstand voltage	$\hat{U}w$	kV	6	8	
Test voltage	Ud	V	4400		100% tested in production
Insulation between voltage terminals					Insulation between VP and VN
Insulation type			Basic		
Impulse withstand voltage	$\hat{U}w$	kV	4	5	
Test voltage	Ud	V	2200	2800	

General electrical specifications

Parameter	Symbol	Unit	DCES600	DCES1500	Comment
Rated conventional thermal current	-	A	600	1500	
Rated operational voltage	-	V	1000	1500	
Rated duty	-	-	Uninterrupted duty		
Insertion loss in current path	-	W	10	20	At Imax
Rated short time withstand current – 10ms	I_{CW}	kA	18	45	10ms

Power supply

Parameter	Symbol	Unit	Min	Typ	Max	Comment
Supply voltage	-	V DC	+12		+24	+/- 15%
Power consumption						
DCES600 and DCES 1500	-	W	-	-	2	
DCES600 RDU & DCES1500 RDU	-	W	-	-	10	Max consumption reached when internal display heater is enabled
Supply bridging time[a]	-	ms	30	-	-	
Start-up time[a]	-	s	-	-	5	Active communication, measurement and registering

[a] after crossing bridging time limit, product performs self-reboot within 10 sec to secure internal data.

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Energy measurement and accuracy

Parameter	Symbol	Unit	DCES 600	DCES 1500	Comment
Accuracy class	-	-	B		As per EN 50470-4
Meter Type	-	-	Direct connected meter		
Energy measurement bandwidth	-	-	DC		
Current specification					
Starting current	Istart	mA	480	1200	
Minimum current	Imin	A	6	15	
Transitional current	Itr	A	12	30	
Reference current	Iref	A	120	300	
Maximum current	Imax	A	600	1500	
Voltage specification					
Range of operation	*Un*	V DC	150 … 1000	150 … 1500	
Anti-creep threshold[a]		V DC	110	110	

[a] Anti-creep threshold: energy is not accumulated in registers below this threshold. Monitoring functions are still available.

Energy Metering and Metrology

Parameter	Unit	DCES 600	DCES 1500	Comment
Services	-	Energy Metering / Monitoring / Maintenance		Refer to communication protocol manual for detailed description of APIs
Metering method	-	Transaction based		Readout protected by signature, verification with public key
Transaction readout format	-	OCMF 1.3		
Energy resolution in readout	Wh	0.1		
Parameters	-	Tariff / Cable loss compensation / OCPP settings / user defined		Refer to communication protocol manual for detailed description of parameters
System monitoring	-	Current / Voltage / Temperature / Power / Energy		
Logbook entries	-	204 000		New transactions are blocked when logbook is full
Rated interval	Wh	100		MMQ
Test Output LED[a]	Imp/kWh	10 000	1 000	
Counting direction	-	Bidirectional		Imported and exported energy registers

[a] After reboot, the test output LED is lit as long as the anti-creep mode conditions are met.

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Connection and terminals
DCES

Parameter	Unit	DCES 600	DCES 1500	Comment
Current terminals				I1,I2
Type	-	Stud		
Terminal finish	-	Tin plated		
Size	-	M10	2x M12	
Rated cross section (busbar)	mm	30x10	100x10	
Minimum Tightening torque	Nm	20	50	
Maximum Tightening torque	Nm	24	60	
Voltage measurement terminals				VP, VN
Type	-	Screwless spring type		
Rated cross section	-	1.5mm² without ferrule 1mm² with ferrule		
Datalink interface				
Type		Push in type		
Rated cross section	-	1.5mm² without ferrule 0.75mm² with isolated cable end ferrule		

RDU

Parameter	Unit	RDU	Comment
Datalink interface			
Type		Push in type	
Rated cross section	-	1.5mm² without ferrule 0.75mm² with isolated cable end ferrule	

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Interfaces and communication

General

Parameter	Value	Comment
RS485 datalink		
Protocol	APIs on SLIP framing	Refer to Communication Protocol Manual for detailed description
Baudrate	115 200 bauds	
CAN datalink		Reserved for RDU or for specific demand
Protocol	2.0A	
Speed	500 kbps	
LEDs indicators		
DCES600 & DCES1500	2x LEDs	Status and test LEDs
RDU	1x LED	Test LED

Definition of typical, minimum and maximum values

Minimum and maximum values for specified limiting and safety conditions have to be understood as such as well as values shown in “typical” graphs.
On the other hand, measured values are part of a statistical distribution that can be specified by an interval with upper and lower limits and a probability for measured values to lie within this interval.
Unless otherwise stated (e.g. “100 % tested”), the LEM definition for such intervals designated with “min” and “max” is that the probability for values of samples to lie in this interval is 99.73 %.
For a normal (Gaussian) distribution, this corresponds to an interval between −3 sigma and +3 sigma. If “typical” values are not obviously mean or average values, those values are defined to delimit intervals with a probability of 68.27 %, corresponding to an interval between −sigma and +sigma for a normal distribution.
Typical, maximal and minimal values are determined during the initial characterization of the product.

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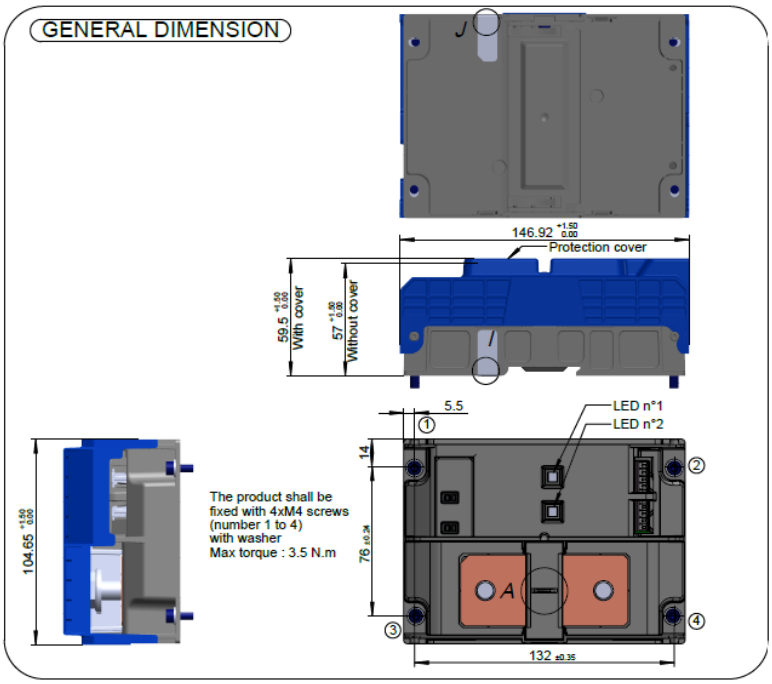
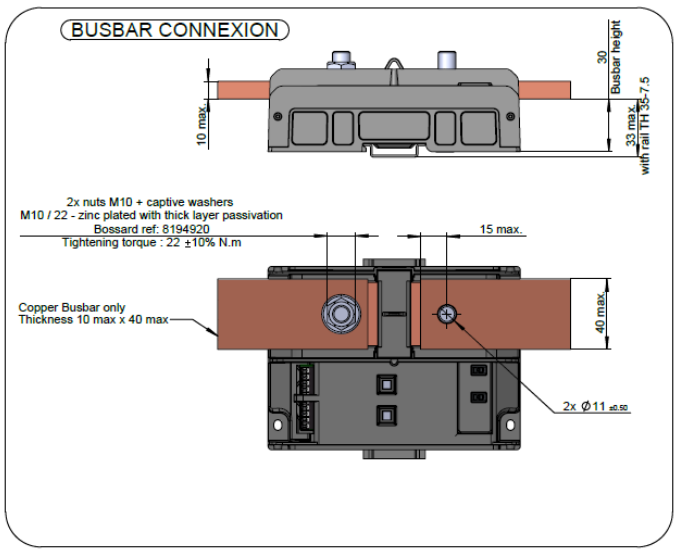
DCES600 dimensions

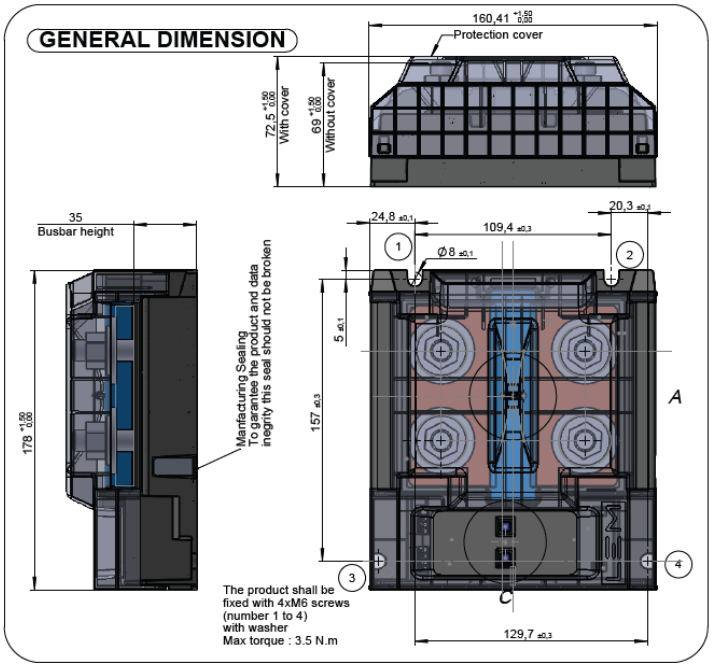
Dimensions in mm

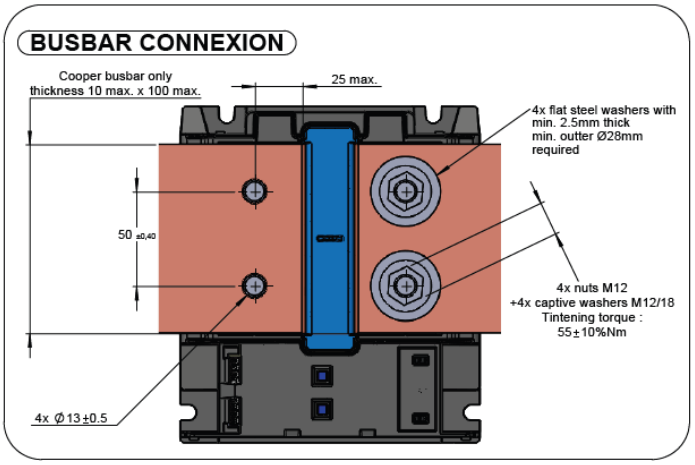




DCES1500 dimensions

Dimensions in mm





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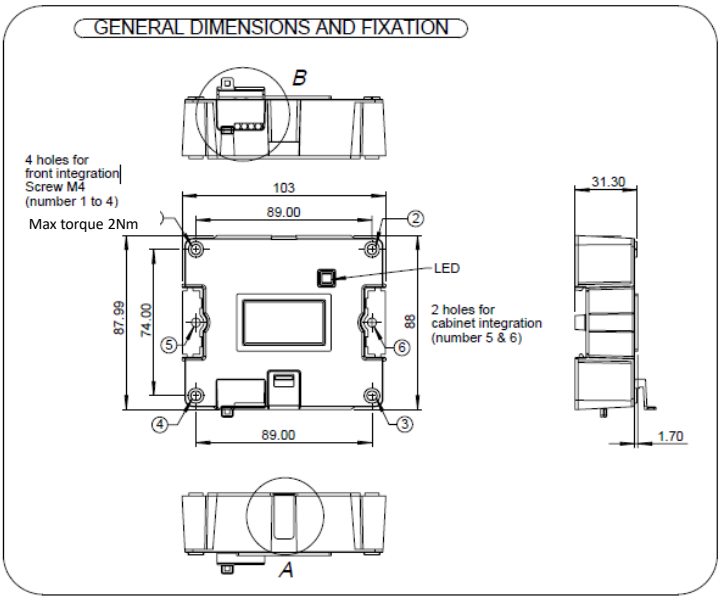
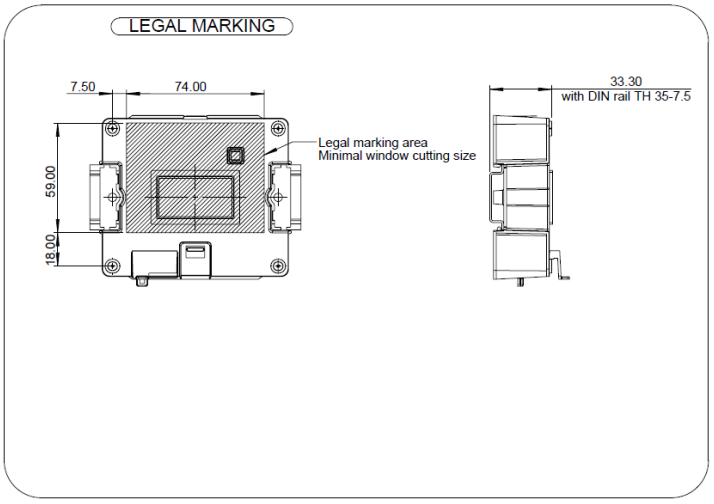
RDU dimensions

Dimensions in mm





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Designation and Codification

DCES product family is defined with the following product offering

- 600A and 1500A current ranges
- Detached display (RDU) as an option

DCES product designation

	D	C	E	S	_	C	0	M	_	6	0	0	0	W	0	0
Meter family DCES : Direct Current Energy Sensor	■	■	■	■												
Communication protocol C: RS485 communication (SLIP)						■										
Cable loss compensation 0 : Default, adjustable							■									
Certification 0 : CE / UL recognized M : Legal metrology (EU) certification								■								
Sensor Unit family 600 : 600A version 1K5 : 1500A version										■	■	■				
Counting direction 0 : direct (I1 ->I2) 1 : reverse (I2 -> I1)													■			
Product option DCES W00 : standard														■	■	■

DCES product designation with detached display

	D	C	E	S	_	C	0	M	_	6	0	0	0	W	0	0	_	R	0	0	_	W	0	0
Meter family DCES : Direct Current Energy Sensor	■	■	■	■																				
Communication protocol C: RS485 communication (SLIP) + CAN						■																		
Cable loss compensation 0 : Default, adjustable							■																	
Certification 0 : CE / UL recognized M : Legal metrology (EU) certification								■																
Sensor Unit family 600 : 600A version 1K5 : 1500A version										■	■	■												
Counting direction 0 : direct (I1 ->I2) 1 : reverse (I2 -> I1)													■											
Product option DCES W00 : standard														■	■	■								
Product option Remote Display Unit R00 : with RDU																		■	■	■				
Product option W00 : default																						■	■	■

	Designation	UCLEM	600A	1500A	Reverse counting	RDU
DCES 600	DCES_C0M_6000W00	90.Z9.52.000.0	x			
	DCES_C0M_6001W00	90.Z9.52.100.0	x		x	
DCES 600 RDU	DCES_C0M_6000W00_R00_W00	90.Z9.52.400.0	x			x
	DCES_C0M_6001W00_R00_W00	90.Z9.52.500.0	x		x	x
DCES 1500	DCES_C0M_1K50W00	90.Z9.65.000.0		x		
	DCES_C0M_1K51W00	90.Z9.65.100.0		x	x	
DCES 1500 RDU	DCES_C0M_1K50W00_R00_W00	90.Z9.65.400.0		x		x
	DCES_C0M_1K51W00_R00_W00	90.Z9.65.500.0		x	x	x

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