

SENTINEL 3+ Battery Monitoring Transducer for Impedance, Voltage and Temperature measurements

The Sentinel 3+ is a state of the art, System on Chip (SoC) digital transducer designed to monitor VRLA, gel or flooded stationary battery systems. Data is transmitted over a dedicated communication bus to proprietary and non-proprietary devices. The Sentinel 3+ has been specially designed to withstand harsh EMC environments resulting from the most recent UPS topologies which produce high Common Mode transient voltages, and induce significant ripple current into the battery.



Electrical data

V_c	DC supply voltage	+ 0.9 .. + 16	V
V_{PM}	DC voltage measurement range	+ 0.9 .. + 16	V
T_{PM}	Temperature measurement range	- 10 .. + 70	°C
Z_{PM}	Impedance measurement range ¹⁾	0.05 .. 250	mΩ
I_c	Typical current consumption @ 2.3 V	55	mA
	@ 13.8 V	20	mA
CMTI	Common Mode Transient Immunity	Max	
	@ 25 °C, $V_{cm} = \pm 600V$, and	20	kV/μs
	repetition frequency 20 kHz		

Accuracy - Dynamic performance data

X_G	Overall voltage accuracy (@ 25°C)	± 0.5	%
	Temperature coefficient of X_G	0.015	%/°C
	Temperature measurement accuracy	± 2	°C
	Impedance measurement repeatability ²⁾	± 2	%
	S-Bus Communication	9600	bps
t_r	Response time	Max	
	Voltage and temperature measurements	20	ms
	Impedance measurement ³⁾	5	s

General data

T_A	Ambient operating temperature	- 10 .. + 70	°C
T_S	Ambient storage temperature	- 25 .. + 85	°C
	Altitude	up to 2000	m
	Max relative humidity without condensing	85	%
m	Mass	52	g
	Standards	EN 50178: 1997 IEC 61010-1: 2001	

Notes: ¹⁾ For measured temperature < + 50 °C

²⁾ In absense of ripple current through the battery

³⁾ To avoid over-heating of the Sentinel an internal timer does not allow more than 1 impedance request every 10 minutes.

Features

- Communication interface isolation 2.16 kV
- Compact design
- Temperature patch
- Fast, simple fittings
- Interface with OEM equipment
- LED status indicator
- DIN rail mounting.

Advantages

- Excellent sensitivity, accuracy, and repeatability
- High current stimulation for secure impedance measurement
- Improved immunity to Common Mode transients in newer UPS topologies (ie. transformerless, using fast IGBTs and/or a floating battery with respect to earth ground).

Applications

- UPS
- Telecommunications
- Battery supplied applications
- Utilities
- Fire & Safety system
- Remote monitoring.

Application Domains

- Energy & Automation
- Industrial.

Ripple current rejection

In a UPS, the current drawn by the inverter contains line frequency harmonic components (mostly 2nd, 4th and 6th). Part of this ripple current flows through the battery, to which is connected the Sentinel.

As the Sentinel itself uses an excitation current for the impedance measurement, so the presence of ripple current can interfere with the measurement and thus cause errors. The table below quantifies the additional error resulting from 1A rms of ripple current, for different combinations of ripple current harmonics and bloc voltage.

Table 1: Additional errors for impedance measurement due to ripple current

Notes:

The error values are the maximum, and are normalized for **1A rms** of ripple current. The error is proportional to the ripple current; for example, if the ripple current was **2A rms** the error will increase by factor 2.

Maximum Z error @ 50 Hz normalized for 1 Arms ripple			
Harmonic number	2 nd	4 th	6 th
Frequency span	97...103 Hz	197...203 Hz	297...303 Hz
12 V	± 1.3 %	± 4.1 %	± 0.7 %
4 or 6 V	± 0.65 %	± 2 %	± 0.35 %
2 V	± 0.3 %	± 0.9 %	± 0.15 %

Maximum Z error @ 60 Hz normalized for 1 Arms ripple			
Harmonic number	2 nd	4 th	6 th
Frequency span	117...123 Hz	237...243 Hz	357...363 Hz
12 V	± 0.8 %	± 1.1 %	± 3.3 %
4 or 6 V	± 0.4 %	± 0.55 %	± 1.65 %
2 V	± 1.3 %	± 0.25 %	± 0.7 %

Important:

The error is random in nature, but the Gaussian distribution is symmetrical around zero. If several individual measurements are averaged (i.e seven daily readings over one week), the ripple error will be dramatically reduced. LEM strongly recommends this filtering method.

Isolation characteristics

	Input/output isolation voltage rms	2.16kV	AC
		Min	
dCp	Creepage distance	4	mm
dCI	Clearance distance	4	mm



Isolation class II, IEC 61010-1 CAT I 600 V DC
Pollution degree PD 2

SENTINEL 3+ BATTERY MONITORING TRANSDUCER

Safety



Sentinel must be used indoor in electric/electronic equipment with respect to applicable standards and safety requirements in accordance with the manufacturer's operating instructions.

Sentinel is intended to be used in measurement category I (CAT I) environment, under IEC 61010-1.

It must not be used in CAT II, III, or IV environments. Furthermore, the maximum operating voltage shall not exceed 600 V, and the maximum transient overvoltage shall not exceed 2.8 kV.

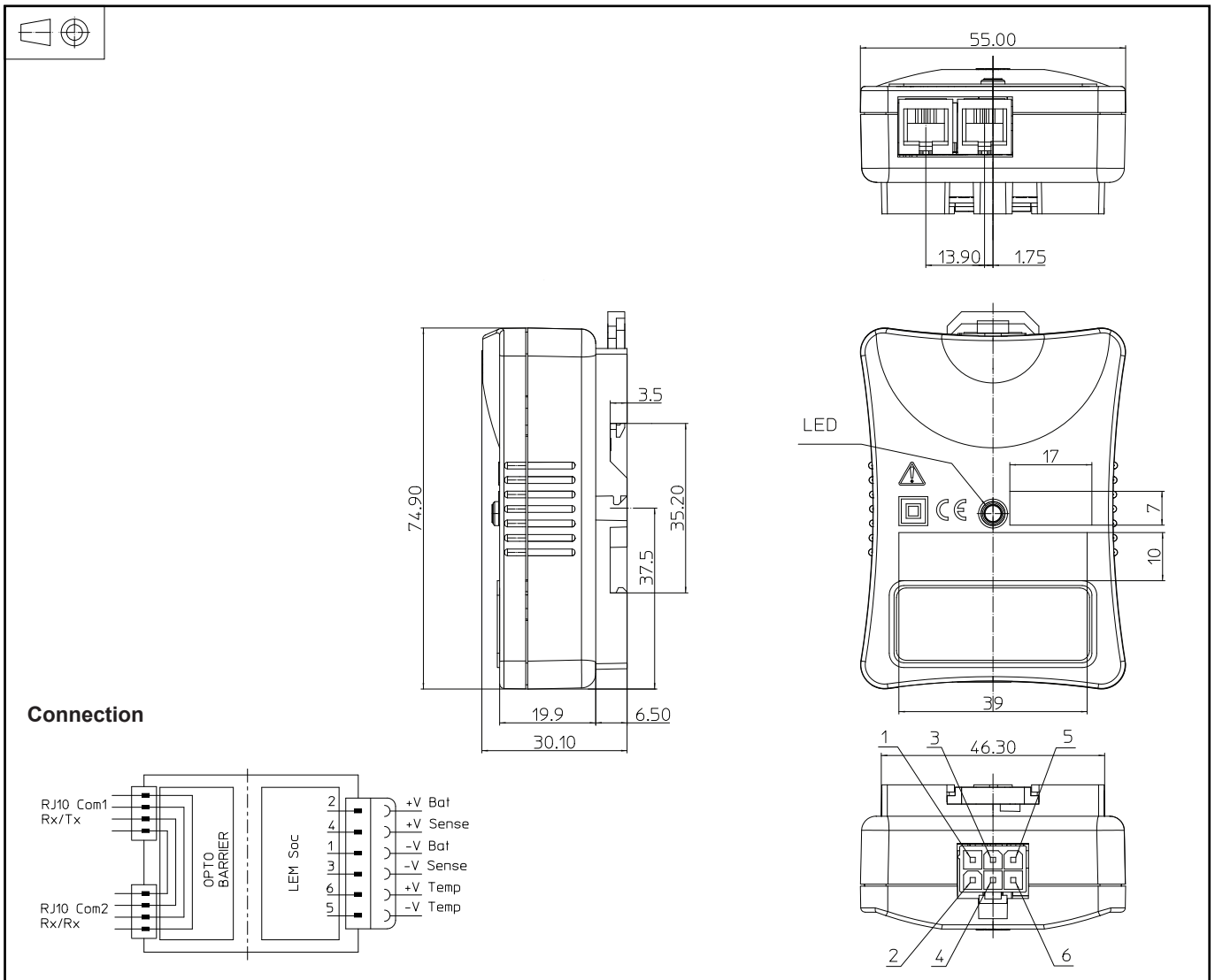
Maximum current used during communication pulse is 0.1 A @ 1.5 V.

In case of battery polarity reversal, the Sentinel's internal fuse will blow and the unit will not be able to operate anymore.



Caution, risk of electrical shock: do not remove any parts of the Sentinel.

Dimensions SENTINEL 3+ BATTERY MONITORING TRANSDUCER



Mechanical characteristics

- General tolerance ± 1 mm
- Module fastening
The Sentinel module is designed to be DIN rail mounted with the possibility of applying Sentinel directly onto the battery by using double sided tape. Please Refer to the user manual for optimum condition of installation.
The double sided tape is not considered as a Sentinel component and therefore its performance is not guaranteed.

Accessories (not included) ¹⁾

- Communication leads (2 x RJ10 - 2 pairs)
 - Module to module (Daisy chain): 400 mm ²⁾
 - Module to end point: 2 m, 5 m, 10 m, 15 m ²⁾
- Power, temperature & Sense leads (1 x minifit - 4 x 4.8 mm Faston - temperature patch) 400 mm and 600 mm ²⁾.
- Battery terminal connection
 - Kelvin washers for M6, M8, M10 & M12 terminals
Please refer to the user manual for accessories installation and uses.

Notes: ¹⁾ LEM will only guarantee the performance of the Sentinel Component with LEM approved accessories.

²⁾ Cable length may change without prior notice.