

WeSense™ for Android

Use your smartphone as a power quality meter.

- ▶ Power quality measurement adapter and USB charger
- ▶ Android app for analysis and visualisation



1. Application

What happens at the edge of our grids? Around the world, our grids are in transition: small, distributed generators are gaining in importance, switching power supplies, inverters and other active electronic components have become the most important consumers on the low voltage level.

Problems with power quality are becoming ever more frequent, leading to annual losses amounting to billions in both commercial and private sectors.

Using the intelligent WeSense™ charger and corresponding app, it is now possible to utilize your Android phone as a power quality meter – directly at the power outlet.

This is WeSense™

- USB adapter with measurement/charging function¹ plus Android app
- Basic power quality analyser on your smartphone
- Lean and efficient tool focusing on the most common disturbances in today's low voltage grids
- App for online analysis of voltage, frequency, short voltage deviations and harmonics
- Highly accurate measurement, with EN50160 threshold value monitoring
- Elegant and intuitive user interface
- Quick troubleshooting of PQ disturbances, even for non-professionals

Use cases

Used as a standalone device, this measuring system is used for the online assessment of power quality and grid status within industrial, office and residential

facilities. In the case of equipment malfunctions, a quick search for common grid faults can be performed with WeSense™ with minimum effort.

Due to the simplicity of this measuring device, even non-professional users can get results in short time. The measurement system focuses on detecting disturbances inside buildings – complementing classical grid analysers, which are typically used to measure over longer time periods and are often directed towards the upstream distribution system.

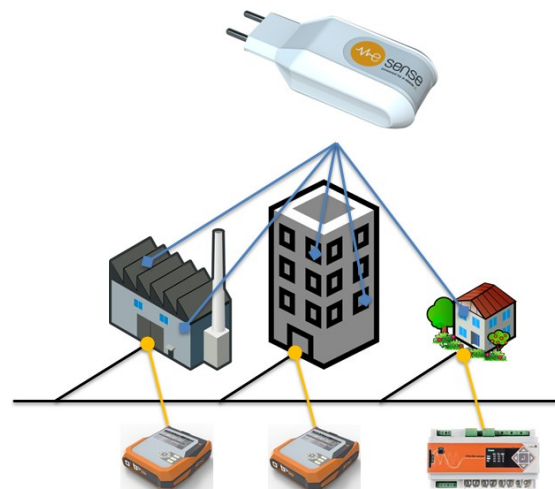


Figure 1 Locations of the measurement adapter

When WeSense™ is deployed in combination with a Class A power quality analyser such as the PQ Box 100/150/200, more in-depth results can be achieved. For example, a comparison between a power quality analyser located at the grid connection point with multiple WeSense™ measurement sites at the edge of the grid can enable better fault location.

¹ Fast charging with up to 1.5A for devices compatible with USB Standard Battery Charging 1.2. Note: Currently no charging function for tablets of the Samsung Galaxy Tab range.

1.1 Device Overview

The WeSense™ measurement system consists of two components:

- USB measurement adapter for physical data acquisition with charging function for connected smartphones.
- Android app for data processing and visualisation. This app can be installed for free on compatible devices. It is available in the Google Play store at http://bit.ly/wesense_en.

Combined with adapter hardware and app, compatible Android phones can be used as measuring device.



Charger
USB charging and measurement

Android App
Analyze + visualize

Figure 2 An overview of the measurement system

Once the app is installed on an Android smartphone, the measurement starts automatically when the charger is plugged into power outlet and connected via USB cable to the Android device.

1.2 Data acquisition

The measurement data can be tracked in real time on various app screens:

- Dashboard
- Time series chart
- Harmonic level
- Power quality monitoring: dip/swell/interrupt, harmonics live analysis, event overview (log book for power quality events)

RMS measurement data processing follows the current network frequency and is performed synchronously with the zero crossings of the grid voltage. The device is able to discriminate automatically between 50 Hz and 60 Hz grids.

Data is collected in two different data classes or reporting rates:

- 10 T / 12 T data class (also known as "200ms data class"): continuous detection of grid voltage and frequency
- 50 T / 60 T data class (also known as "1s data class"): continuous detection of grid voltage, frequency and odd harmonics up to the 15th order

Power quality monitoring: dips, swells, interrupts

At every half period of the voltage, the app compares the last full period RMS value of the phase to neutral voltage U_{LN} with the thresholds given in Table 1. The threshold values are derived from the norm DIN EN 50160.

Table 1 Threshold values used for dip/swell/interrupt detection (% of nominal voltage)

Event	Threshold value
Swell	110 % U_{LN}
Dip	90 % U_{LN}
Interrupt	10 % U_{LN}

After each half interval $1/2 T$, voltage dip/swell/interrupt conditions are tested. Undue voltage deviation is logged immediately and shows up as an entry in the "PQ Event Overview" screen (Figure 4).



Figure 3 Power quality monitoring for dips/swells/interrupts (left); harmonics (right)

The number of all voltage events since inserting the charger are shown in the dip/swell/interrupt screen (Figure 3, left). Furthermore the respective extreme values are given in the form of a graphical needle and a numerical percentage display.

The black needle seen in Figure 3 provides a permanent display of the current value of the mains voltage, as a percentage value. All percentages in this screen refer to the nominal supply voltage U_{LN} (e.g. 230V).

Power quality monitoring: harmonics

The current level of harmonic oscillations are compared to the threshold values of DIN EN 50160 (see Table 2) on a second-by-second basis. The "Harmonics Live Analysis" screen (Figure 3, right) gives – for each harmonic – the percentage of all 50 T / 60 T values which have been found to violate the respective DIN EN 50160 limits.

Table 2 Threshold values according to DIN EN 50160 (Harmonic level as percentage of fundamental wave)

H3	5%	H5	6%	H7	5%		
H9	1.5%	H11	3.5%	H13	3.0%	H15	0.5%

Please note that this percentage – which updates every second – refers to the length of the current measurement period. A measurement period extends from the point when the charger is plugged in to when it is unplugged.

A power quality violation due to harmonics is reported if at the time of unplugging the charger has registered more than 5% of the measured values to be above the DIN EN 50160 threshold. The PQ event overview screen (Figure 4) will then show one PQ event for each violating harmonics order.

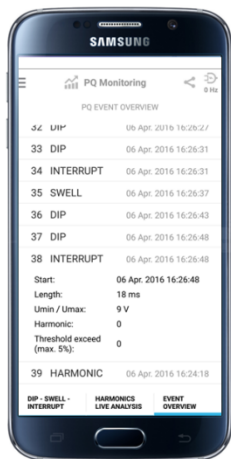


Figure 4 Event overview with power quality events

Using the "share" function on Android phones, both the permanently recorded data as well as any power quality events detected can be exported in the form of CSV files and a screenshot.

2. Technical specifications

Regulations and standards

This device complies with the requirements of EU directives 2014/35/EU and 2014/30/EU.

Applicable standards

EN 60950-1:2006 + A11:2009 + A12:2011 + A1:2010 + A2:2013

EN 61000-6-2:2005

EN 61000-6-3:2007 + A1:2011



A sample of this product was tested in the IECCE CB procedures and conformity determined.

Applicable standards

IEC 60950-1:2005 + A1:2009 + A2:2013 Edition 2



Other applicable standards

Electromagnetic compatibility, immunity for industrial environments	EN61000-6-2
Electrostatic discharges	EN61000-4-2
Radiated, radio-frequency, electromagnetic field immunity test	EN61000-4-3
Electrical fast transient/burst immunity test	EN61000-4-4 (±2 kV)
Surge immunity test	EN61000-4-5 (±1 kV symmetrical, (±2 kV asymmetrical))
Immunity to conducted disturbances, induced by radio-frequency fields	EN61000-4-6
Voltage dips, short interruptions and voltage variations	EN61000-4-11
Electromagnetic compatibility (EMC). Generic standards. Emission standard for residential, commercial and light-industrial environments	EN61000-6-3 (EN55022 Class B)
Electrical safety	EN60950-1
Housing	PC/ABS UL94 V0

Note on environmental protection

After the implementation of the European Directive 2002/96/EC and 2006/66/EC in the national legal system, the following applies: Electrical and electronic devices may not be disposed of with domestic waste. Consumers are obliged by law to return electrical and electronic devices and batteries at the end of their service lives to the public collecting points set up for this purpose or point of sale. Details to this are defined by the national law of the respective country. This symbol on the product, the instruction manual or the package indicates that a product is subject to these regulations. By recycling, reusing the materials or other forms of utilising old devices, you are making an important contribution to protecting our environment.



RoHS
compliant

Android app

System requirements	
Operating system	Runs on devices with Android OS v4.0 (Android 5.0 or higher recommended)
Device recommendation	Optimum results on Samsung Galaxy series (Galaxy S5 or higher)

Power-supply unit with USB charging function

Note: Technical specifications are for $T_a = 25^\circ\text{C}$ and $V_{in}=230\text{ V}_{eff}$ unless otherwise specified.

Input specifications	
Input voltage, nominal	100 - 240 VAC
Voltage range (max.)	90 - 264 VAC
Input frequency	47 - 63 Hz

Output specifications	
Output voltage	5,1 VDC
Output voltage accuracy at $I_{load}=I_{nom}$	$\pm 3\%$
Cable compensation for $I_{load}=0A$ to I_{nom}	4.5 %
Ripple (BW=1MHz)	<1 %
Noise ($\leq 30\text{ MHz}$) at $I_{load}=I_{nom}$; BW=30 MHz	$\leq 1\%$
Short circuit current	$\leq I_{nom}$
Line regulation at $I_{load}=i_{nom}$	$\leq 0.3\%$

Charging function for connected USB devices²

Charging standard	USB Battery charge standard as per specification BC1.2 (DCP und CDP) Meets industry standard YD/T 1591-2009 of the Chinese telecommunications industry
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² Fast charging with up to 1.5A for devices compatible with USB Standard Battery Charging 1.2. Note: Currently no charging function for tablets of the Samsung Galaxy Tab range.

Other charger characteristics

Efficiency (typical)	74 %
Insulation voltage inputs/outputs	3 kVAC
Switching frequency	100 kHz
Operating temperature	0°C to +40°C
Over-temperature protection	Locking for self-protection
Temperature range for transport and storage	-20 ... +70°C

Power quality measurement

Measurement quantity	
Voltage	U_{LN}
Frequency	f
Harmonics	H3, H5, H7, H9, H11, H13, H15
Voltage deviations	Interrupts, dips, swells

Measurement error³

Supply voltage	< 0.1 % V_{nom}
Network frequency	< 0.1 % f_{nom}
Harmonics	< 1 %

³ provisional figures, subject to results of external certification

3. Order Information

Designation	Article no.
WeSense™ - power quality adapter for Android smartphones	101.8000



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Software version:

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Subject to change.

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