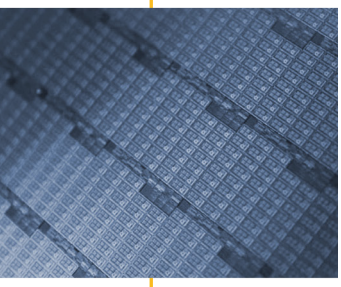
PSL

Application Note

Semiconductor Industry



PQube® Power Quality & Energy Analyzer

Optimized for Embedding Inside Your Tool
Lab-Grade Accuracy
Plug-and-Play Functionality
Built-In UPS
4GB SD Card
No Software Required

RoHS E220936

PQube®
Go Green. Know your power.™

PSL

Semiconductor Industry

Your challenges

Troubleshooting time and cost: why *did* your tool go down?

- Power quality events are a common occurrence at fabs. If severe enough, these disturbances can cause your tool to malfunction.
- Typical disturbances can include harmonics, HF impulses, voltage sags, swells and interruptions, frequency variations and more.
- Not all problems are caused by power disturbances. Operator errors, loose cable connections, tool software bugs can all cause tool failure—but you don't always know. **If you can't explain to your customer why your tool failed, you've got a problem.**
- Trying to "catch" an intermittent problem with temporary equipment can take weeks.
- Sometimes, your field technician will replace a component just to pacify your customer. These "false replacements" are expensive and unnecessary.

Improving tool design and cutting down on the competition

Without data from the field, it is impossible to answer these critical questions for your next generation of tools:

- How much protection does your tool need against voltage dips and swells? High frequency impulses?
- How much power does your tool actually use?
- What fraction of your main circuit breaker rating does your customer actually use? If your customer wants to buy another tool, or several more tools, do they have sufficient power available?

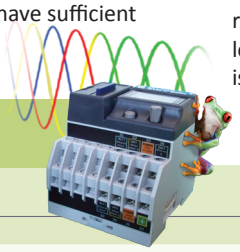
The PQube® solution

Embed a PQube® in your tool to troubleshoot faster and dramatically reduce service costs

- No more waiting for a problem to reoccur when your customer calls for service. The PQube® is small and affordable, with a standard DIN-rail design and reliable communication, and you can install it permanently inside your tool's power cabinet. With the PQube,® all the data is there right when you need it.
- No more expensive power investigations—quickly prove (or rule out) power as the culprit, including the precise event that caused the trouble. Use the PQube's automatic, time-stamped reports to correlate a power event to tool malfunction. And remember: If the PQube® didn't record it, it didn't happen.
- Increased customer trust. The 256-cycle-per-second waveform and RMS graphs are recorded in an easy-to-read format that you can easily share with your customer. You can also label graphs in multiple languages, making global communication a breeze.

Use the PQube® to help you make critical decisions and sell more tools

- Your PQube® automatically reports your power profile on a daily, weekly and/or monthly basis. It records parameters five times per second to keep up with fast-changing conditions.
- With your PQube's recording of the peak current your tool actually requires—often considerably less than your breaker rating and highly dependent on your customer's recipes—your customer can reasonably consider allocating less power to your tool. At fabs where available AC power is a limiting factor, this translates into selling more tools.



PQube® Economics

If you want to receive a copy of our PQube® Economics spreadsheet to calculate your savings based on numbers at your fab, email us at sales@powerstandards.com.

The Numbers

General	
Number of tools	800
Expected life of tool, in years	7
Power disturbances and other problems	
Chance, per month, of a disruptive power disturbance	0.04
Chance, per month, of a problem being incorrectly blamed on power	0.07
Burdened hourly cost of service calls, including support staff	$100.00
Average expenses of service calls (travel, overhead)	$400.00
Average hours per service call	6
Chance, per NTF (no trouble found) service call, of a "false swap"	0.66
Average cost of a "false swap"	$10,000.00
Extended diagnosis - more than 3 engineers, more than 1 week resolution	
Fraction of NTF service calls that result in "extended diagnosis"	0.01
Average number of engineers and support staff in "extended diagnosis" incident	4
Average number of hours per engineer/staff	30
Burdened hourly cost of engineers/staff	$120.00
Probability of external consultant/engineering required, per incident	0.1
Cost of external consultant/engineering, per incident	$5,000.00
Fraction of extended diagnosis incidents that can be avoided with PQube	0.25

The Results

Number of disruptive power disturbances—total population, total lifetime	**2688**
Number of problems incorrectly blamed on power disturbances—total pop., total lifetime	**4704**
Number of resulting NTF service calls—total pop., total lifetime	**7392**
Number of extended diagnosis incidents—total pop., total lifetime	**73.92**
Average lifetime cost, per tool, of NTF service calls that can be avoided with PQube® (NTF service costs, plus false replacement costs)	**$9,248.25**

Per-Tool Added Value $9,248.25

Power Standards Lab, 2020 Challenger Drive, Suite 100, Alameda CA 94501
Tel +510-522-4400 Fax +510-522-4455 www.powerstandards.com

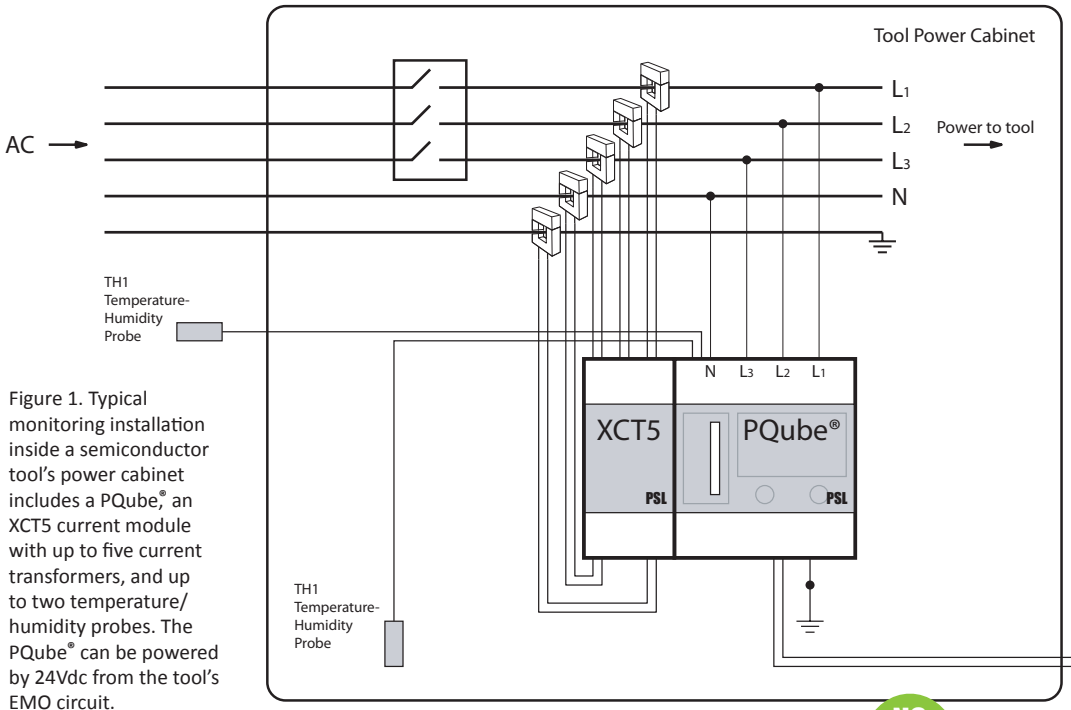


Figure 1. Typical monitoring installation inside a semiconductor tool's power cabinet includes a PQube,® an XCT5 current module with up to five current transformers, and up to two temperature/ humidity probes. The PQube® can be powered by 24Vdc from the tool's EMO circuit.

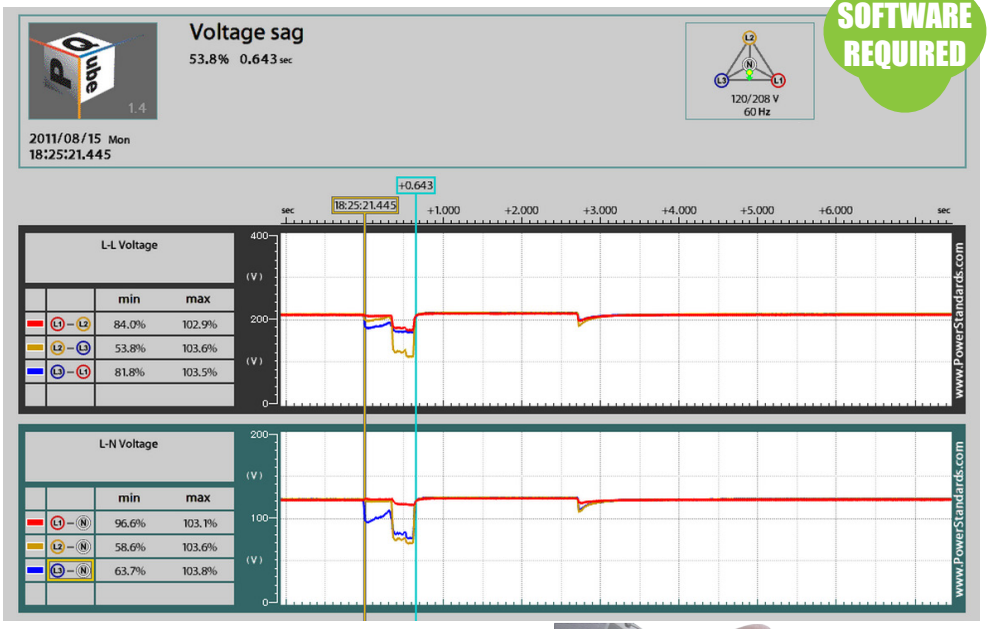


Figure 2. A PQube® graph showing a voltage sag. Voltage sags can cause many problems for a semiconductor tool. Without a PQube,® power-related problems are hard to separate from other problems such as operator errors, software bugs, or loose cable connections.

Your PQube prepares this complete graph for you—no software is required.

Figure 3. A voltage sag event screen and a regular voltage screen from the PQube's color oLED monitor. The event screens shows the date/time stamp of the event, and the magnitude and duration of the sag.

Figure 4. Your PQube® comes with a standard 4GB SD card, capable of storing 2 years of PQube® data on average. You don't need any special software to read the data—just pop into the card reader slot of your computer and view the .GIF and .CSV files with your everyday applications.

Semiconductor Industry

Power Standards Lab, 2020 Challenger Drive, Suite 100, Alameda CA 94501
Tel +510-522-4400 Fax +510-522-4455 www.powerstandards.com

Your PQube® at a Glance

A low-cost, embedded power quality & energy solution specifically made for semiconductor tools:

- Single- and 3-phase power quality & energy monitoring
- Power from 24 Vac and 24~48Vdc
- Directly connect up to 690Vac
- UL, TUV, RoHS, CE, ITC, ABS Shipboard certified
- Highly granular, 256-samples-per-cycle recording
- Power and energy, W, VA, VAR, PF
- Automatic reporting of power quality events—voltage sags, swells, harmonics, high frequency impulses (1 microsecond intervals), and more
- Energy and CO_2 calculations
- Two temperature and humidity channels
- Small and compact—designed for embedding inside the tool's power cabinet
- Internal UPS—keeps recording even if you lose power
- SD card for years of data storage; optional remote communication (Modbus, FTP, email)
- NO SOFTWARE REQUIRED!

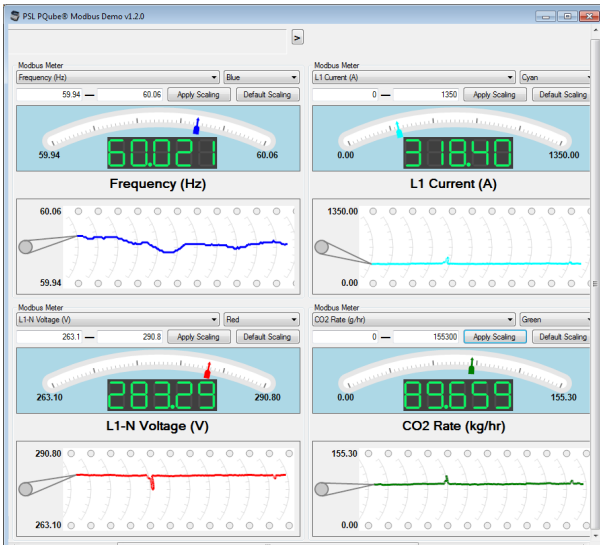


Figure 5. The PQube® Modbus Interface is a remotely accessible, real-time window into all of the PQube's meters. Up to 6 parameter windows allow you to track power parameter changes during different stages of your recipe, and use the information to adjust your recipe to reduce energy consumption.

PQube front terminals

Actual size

PQube back terminals

Our company: www.powerstandards.com
The PQube page: www.pqube.com
Our authorized distributors: www.pqube.com/distributors

Test-drive a PQube® at map.PQube.com.

PQube®
Go Green. Know your power.™