

It doesn't take out the garbage... yet

Introducing the Fluke 430 Series Three-Phase Power Quality Analyzer

Application Note

It's about time.

For the last several years, tool users have told Fluke they needed a three phase Power Quality Analyzer to audit and troubleshoot critical power applications in the facility, starting at the service entrance.

No matter whether they were a consultant or a facility technicians, the story was the same: They needed to pinpoint power quality problems quickly, and for that, they needed detailed information. In particularly candid moments, some admitted that if the available monitoring devices

weren't so hard to use, so expensive, or so heavy to lug around, they would probably conduct preventive maintenance more often.

Fluke's answer is the 430 series handheld power quality analyzer.

- Three-phases and four channels
- Rated for use at the service entrance: CAT IV 600 V/ CAT III 1000 V
- Sets up in less than one minute
- Simple, menu-driven interface
- Automated recording and analysis

- Weighs just over three pounds
- Includes analyzer, case, 4 dual-range clamps and 5 voltage clips and leads

Troubleshooting and preventive maintenance for all

Designed for power quality specialists as well as electricians and plant technicians working in industrial, healthcare, business, and public services settings, the Fluke 430 Series is ideal for troubleshooting and preventive maintenance.

The Fluke 430 Series can measure all phases, neutral and ground on virtually every connection in a low voltage electrical distribution system. The analyzer's measurement capabilities encompass all power system parameters including true-rms voltage and current, frequency, power, power consumption (energy), unbalance and flicker. They also automatically capture events like transients (as fast as 5 microseconds and as high as 6 kV), interruptions, rapid voltage changes and dips and swells.

Optimized for mobile applications, these ruggedized instruments operate up to seven hours on a single battery charge – no more searching for an outlet! The large data memory stores up to 50 screens and up to 10 measurements each comprising 32 parameters – including setups and trend data – recorded for more than a year, all of which can be transferred to a PC via FlukeView® software for analysis or use in reports.



Fluke 430 series features

The two most unique features are AutoTrend, which records everything on the screen automatically without setting a trigger, and System-Monitor, a quick diagnosis of system performance against user defined limits. Other features include:

- Viewing stored data while continuing to record.
- Switching back and forth from digital display to trend without interrupting the recording.
- Optically isolated so you can record while downloading information to your PC.
- High resolution, color LCD for viewing multiple parameters and multiple phases simultaneously.
- Waveform capture lets you test for interaction between phases or between voltage and current.
- Triggering on envelope – or – trigger on rms voltage or current.
- Screen cursors allow you to pinpoint problems, quickly.
- Capturing transients and waveform disturbances with 5 μ s resolution.
- Toggling to phase or display at any time for a quick check of phase sequence.

Together these features help to quickly diagnose problems and build benchmarks for predictive maintenance. The following case study provides one such example.

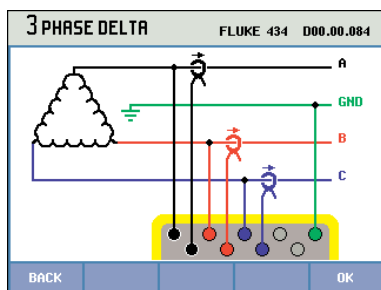
Case study: Three-phase motor failure

For three years in a row, a particularly large three-phase motor would fail twice a year. The facility maintenance manager called in both the electrical contractor and the motor manufacturer, who pointed fingers at each other but failed to resolve anything on site. The facility was left in the middle, with no corrective action, cyclical motor repair costs, and lost production from the repeated downtimes.

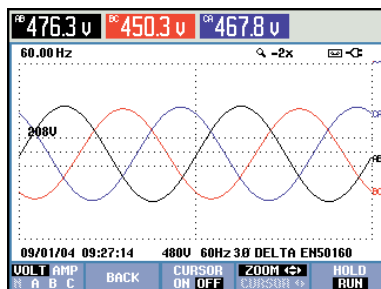
Tired of what was clearly a pattern failure, the facility manager hired an independent consultant. The consultant told the facility manager he would perform a complete power quality survey of the electrical distribution system feeding the motor, determine its operating characteristics and work from there to solve the problem.

Measurements

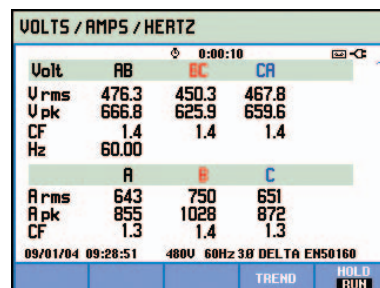
The consultant connected his Fluke 434 Three-Phase Handheld Power Quality Analyzer to the circuit supplying energy to the motor and pushed the View Config button. The diagram confirmed that his connections were proper and that the power type was three-phase Delta.



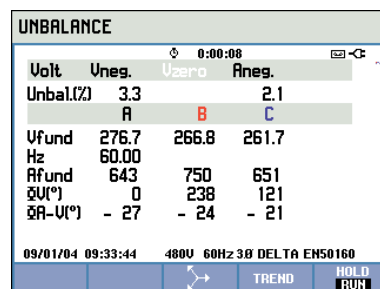
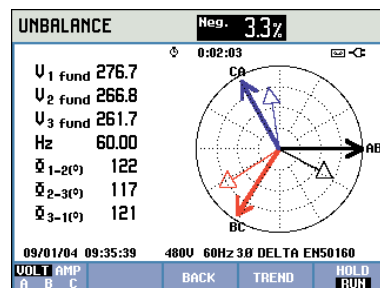
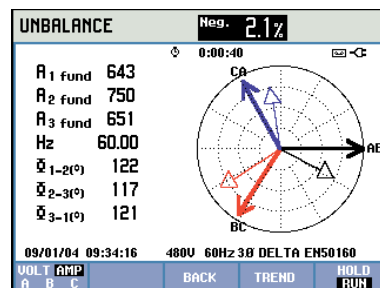
From there, he pushed the Scope button and looked at waveforms and numeric values for all three phases. Judging by the differences between the magnitudes at the top of the screen, there appeared to be a balance problem between the phases.



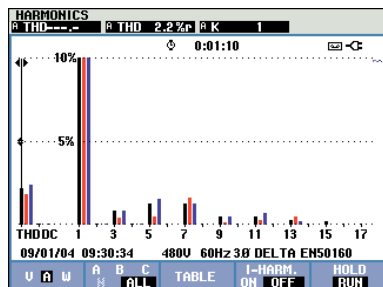
To gather more information, he switched to the numeric readout on the Voltz/Amps/Hertz screen. The current reading there was even higher and still unbalanced.



Switching to the Unbalance screen, he checked the voltage and current values as well as the phase diagram, to see if the motor was operating within acceptable limits.



Lastly, to cover his bases, he selected Harmonics from the menu to make sure frequencies weren't contributing to the problem.



HARMONICS TABLE			
Uolt	AB	BC	CA
THD%	0.2	0.2	0.3
H3%	0.0	0.1	0.1
H5%	0.2	0.2	0.2
H7%	0.2	0.2	0.2
H9%	0.0	0.0	0.0
H11%	0.0	0.0	0.0
H13%	0.0	0.0	0.0
H15%	0.0	0.0	0.0

Analysis

From his unbalance measurements, he could see that an unbalance was causing an excessively large phase current value. He checked the motor specifications and confirmed that phase current exceeded the motor's FLA (Full Load Amperage) rating. Looking at the data for all three phases, he traced the current unbalance to excessive loading on one voltage phase.

The consultant traced the voltage unbalance to a set of equipment installed three years ago. It turned out that all of the internal single-phase loads were connected to the same phase. That last new equipment installation caused such a significant power system voltage unbalance that it created a current unbalance at the motor, increasing the operating temperature of the conductors and motor windings to beyond the limits.

Conclusion

To resolve the situation, the consultant balanced the internal single-phase loads between the three phases, reducing the overall voltage unbalance and consequently, the current unbalance at the motor. This also reduced the elevated phase current value and operating temperature at the motor.

He took new benchmark measurements for future monitoring, transferred all of his saved screens to his computer and printed a before-and-after report for the facility maintenance manager.

While not a power quality expert, the manager could see the difference between the screens. Now he understood why power quality measurements needed to be taken before and after new equipment installation. All of the motor repair and downtime costs had been un-necessary. When the consultant suggested setting up a regular preventive maintenance schedule, the manager agreed.

Fluke. *Keeping your world up and running.*

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