

Multi-purpose measurement tools help utilities increase service and protect revenue

Application Note

Electric utilities are working harder than ever to stay competitive, manage capacity, and protect revenue. To differentiate themselves from competitors, many utilities are offering power quality and other efficiency-related services. As a result, new power quality measurement tools are reflecting this same multi-purpose field service ethic.

The three-phase analyzers that technicians already use to measure power factor and trend power quality now offer user-settable ratios for displaying readings

as if measuring at the primary side of PTs and CTs. They also verify revenue meters.

Enough revenue meters are out of tolerance that a 2001 Electric Power Research Institute study estimated meter-related losses at \$5 million to \$20 million per year for a medium sized U.S. utility.

Using a multi-purpose analyzer such as the Fluke 430 Series allows utility technicians to offer more customer services in less time and quickly audit revenue meters during each site visit.

Power quality, power factor, and demand management

New handheld three-phase power quality analyzers like the Fluke 430 Series are rated for use at the service entrance and will trend data easily, without setup.

To support detailed yet efficient assessments of substations and customers' power, new analyzers:

- Measure voltage, current, frequency, power, power factor, power consumption (energy), unbalance and flicker, harmonics and inter-harmonics on all three phases and neutral
- Log events like dips, swells, and interruptions
- Trend all measurements on-screen, with automatic scaling
- Check conformity to EN50160 limits or to custom limits
- Capture 40 waveforms showing detailed dips, swells, interruptions or transients
- Meet 600 V CAT IV, 1000 V CAT III safety standard required for measurements at the service entrance
- Transfer stored measurements to the PC



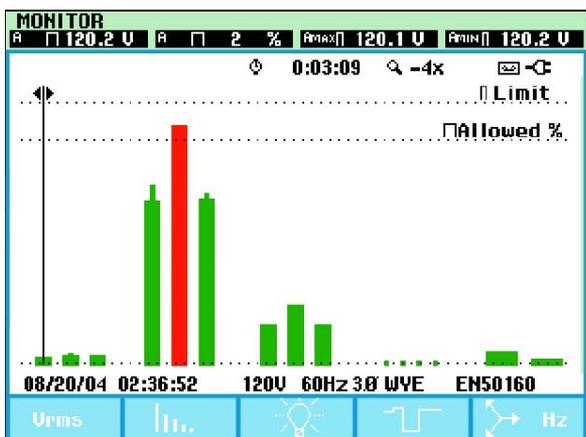
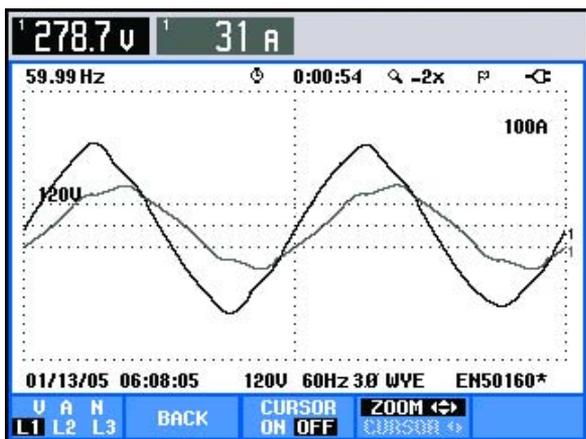
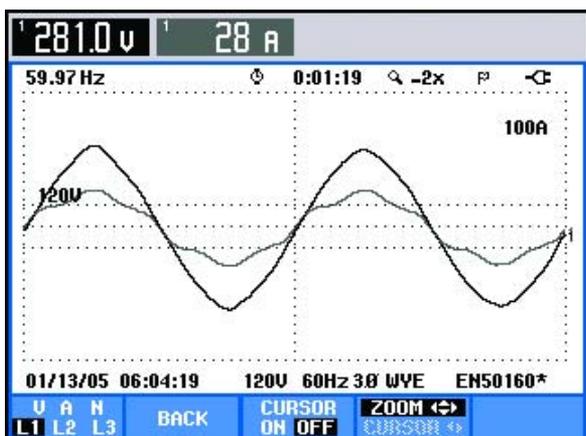


Figure 1. The Monitor function on the Fluke 430 Series allows technicians to check overall power quality against standards—or verify custom-set limits—and to show the customer a clear and convincing go/no-go screen.



2A

Figure 2. Large consumers can install power factor correction or harmonics mitigation that affects the distribution system. Utilities can perform before and after readings to help customers evaluate solutions and to check for impact on distribution. **Figure 2A** shows current lagging voltage at the service entrance of a commercial building. **Figure 2B** shows the same service entrance after applying power factor correction. Applying the correction results in a 10 % reduction in current consumption, but also results in somewhat higher current distortion.



2B



Flexible connections for current and potential transformers

The Fluke 430 Series in particular can be connected directly to low voltage services, including 120 V/240 V, 480 V, and 600 V. It can also connect in parallels with primary metering using PT or CT loops and a set of precision 5 A current clamps. Technicians can set custom scale factors, to display readings in primary units. The analyzers support all standard power configurations:

- Single-phase 120/240 V
- Three phase grounded wye
- Three phase delta
- Three phase high leg delta
- Three phase open leg delta
- Single phase and 3 phase IT

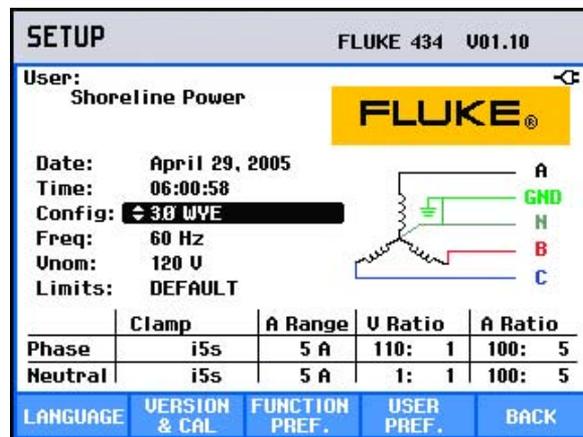


Figure 3. The main setup screen shows probe connections and scale factors for CTs and PTs.

Revenue meter verification

The meter verification test is similar to a hand-switch verification and can quickly uncover tolerance problems. On new analyzers, technicians use a soft-key to conduct the test, with no configuration or accessories needed. The verification can be performed on any electromechanical meter or electronic meter that has an indicator or rotating disk.

Figure 4 shows the Power and Energy display on the Fluke 430 Series. Technicians connect the analyzer and then press the soft-key labeled "MANUAL COUNT +1" to increment the counter each time the marker passes on the revenue meter. Figure 4 shows the results after three revolutions of a meter (pulses). In this case, the value observed from the revenue meter was 4.9 % lower than the 3.148 kWh measurement on the Fluke 434.



Power & Energy				
FULL 0:00:27				
	A	B	C	Total
kW	183.6	165.8	176.7	526.0
kVA	186.5	173.1	177.3	536.9
kVAR	33.1	49.7	14.5	107.6
PF	0.98	0.96	1.00	0.98
DPF	0.99	0.97	1.00	0.99
kWh	1.099	0.992	1.057	3.148
kVAh	1.117	1.036	1.061	3.214
kVARh	0.198	0.298	0.087	0.644
kWh	COUNT * 1.000			= 3.000 (- 4.9%)
START	04/29/05 06:07:05			3
	PULSE CNT	CLOSE	MANUAL	RESET
	ON OFF	ENERGY	COUNT+1	ENERGY

Actual kWh measured by Fluke 434

kWh calculated from counting revenue meter cycles

Figure 4. The Fluke 434 uses four voltage and four current inputs to accumulate and display actual kWh, kVAh and kVARh. Actual values from the Fluke 434 can be easily compared to the revenue meter.

Here's how the manual measurement works:

SETUP FUNC. PREF.			FLUKE 434	V01.10
POWER & ENERGY				
TREND SCALING	PHASE	TOTAL		
PF span	0.55	0.08		
DPF offset	0.30			
DPF span	0.20			
Volt offset	0.28 kV			
Volt span	0.55 kV			
Amp offset	0.13 A			
Amp span	0.20 A			
Demand int.	AUTO			
kWh / μ	1.000			
Cos θ	FULL	PHASE	AUTO	BACK
DPF	FUND.	TOTAL	ON OFF	

Figure 5. Setting the pulse constant to correspond to the revenue meter.

1. Set the scale factors

Set CT and PT scale factors on the analyzer, if necessary. (See Figure 3.) Under the FUNCTION PReferences for the Power and Energy Function, set the pulse constant on the analyzer to match the pulse constant on the revenue meter (K_h). Use the down arrow button to see the pulse constant as shown in Figure 5. Connect the 430 in parallel with the revenue meter.

2. Setup the energy measurement

Select the Power & Energy mode from the main menu and press the Hold/Run softkey twice. Press the TIMED softkey, then specify the number of pulses to count before holding the results on the display. Press START to return to the Power and Energy Screen. Press the ENERGY softkey to open the Energy display. Make sure Pulse Counting is turned on.



Figure 6. Setting the number of pulses to count.

3. Perform the verification

Press the RESET ENERGY softkey to reset the energy counter as the marker passes on the revenue meter. Press the MANUAL COUNT + 1 softkey each time the marker passes.

4. Read the results

After the number of rotations specified in step 2 above, the display will hold. Read the meter error, in percent, from the lower right part of the screen.

Some utilities make a practice of auditing large customer power meters once a month to safeguard revenue. New, multi-purpose power quality analyzers make this kind of personalized field service far more efficient, and feasible. They also provide more customer-friendly data, offering new ways to add value to customer service.

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Fluke Corporation

PO Box 9090, Everett, WA USA 98206

Fluke Europe B.V.
PO Box 1186, 5602 BD
Eindhoven, The Netherlands

For more information call:
In the U.S.A. (800) 443-5853 or Fax (425) 446-5116
In Europe/M-East/Africa (31 40) 2 675 200 or
Fax (31 40) 2 675 222
In Canada (800) 36-FLUKE or Fax (905) 890-6866
From other countries +1 (425) 446-5500 or
Fax +1 (425) 446-5116
Web access: <http://www.fluke.com>

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Printed in U.S.A. 5/2005 2464475 A-US-N Rev A