FLUKE®

Load studies help save energy and improve safety of power distribution

Application Note

Load studies are extremely useful to industrial energy consumers for safety, operational and financial reasons. These include determining if an existing power distribution system in a plant can cope with new loads, verifying cable and system capacity, balancing load distribution over three phases, keeping track of power factor, and to quantify energy consumption before and after improvements to justify energy saving devices. This application note looks at using the Fluke 1735 power logger in load study applications.

When a building owner wants you to add new loads to an existing service or set of feeders, the first thing you have to is determine whether the existing system will support the new loads.

To answer this question you have to ask another one: What is the highest load the system carries now? Often, local electrical authorities will need to know these answers before they issue permits. You'll also need a comprehensive understanding of today's loading to evaluate the new system, once installed.

To determine the existing equipment's capacity, factor in the incoming conductor size, the ratings of the equipment, and space for new circuits. To determine present loading, you will need to measure the existing loads. Record the demand over a 30-day period and find the maximum demand. This article describes the 30-day recording method, known as a load study.

Local regulations determine when a load study must be performed, exactly what information is required, and the review process. Make sure you understand your local requirements before you start a load study.

Avoid financial penalties

Power factor is one important measurement collected in a load study. Electrical utilities often impose fines if the power factor of a site drops below a contractually agreed value. Keeping track of power factor, and implementing appropriate power factor correction can avoid financial penalties. A load study is therefore also a powerful aid for ensuring that an energy consumer is being charged for what it actually uses.

Recording power with the Fluke 1735

The Fluke 1735 Power Logger is an excellent tool for performing load studies. It includes flexible current probes for connecting around multiple conductors or bus bars, and it has a PC interface and software for downloading and interpreting measurements. The 1735 measures voltage and current on all three phases plus neutral, and records multiple parameters that can help determine system load, including voltage, current, frequency, real power (kW), apparent power (kVA), reactive power (kVAR), power factor, and energy (kWh).

Power factor correction at a wastewater treatment plant

The following example demonstrates two of the benefits of load studies. When a wastewater treatment plant planned to tadd new pump motors to increase capacity, it was first necessary to assess if the existing electrical system and transformer could power the new equipment in addition to the existing loads. Using a **Fluke 1735 Power Logger** to conduct a load study, in which the unit was left for 30 days to measure the existing load on the system, it was determined that the plant had ample capacity on the existing distribution for the new motors.

However, after a short period, the local utility called to inform the plant that its overall power factor had dropped below 95 percent. Electrical utilities watch power factor closely, and a large power consumer can impact a substation's ability to meet demand.

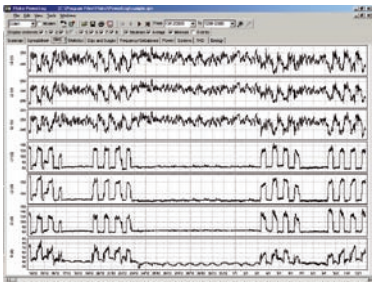
Using a **Fluke Clamp Meter,** the plant electrician checked the motor control center of the newly installed motors and discovered that the power factor was 93 percent. Under the terms of the contract with the electricity utility, this would lead to financial penalties for dropping below 95 percent. Again using the **Fluke 1735** to perform a one-week energy study, enough data was collected to confirm that the drop in power factor coincided with the operation of the new pumps. The problem was solved using appropriate power factor correction at the motor control center. The utility did not have to increase capacity, and the plant successfully avoided power factor penalties.

Performing a load study takes just five steps:

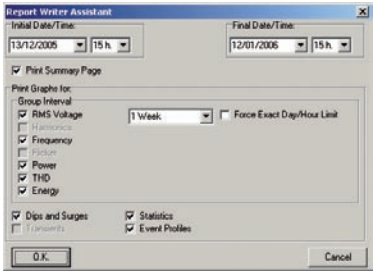
1. Hook up to the feeders or service. For a 3-phase system there will be eight connections: three phase voltages, neutral voltage, three phase currents and neutral
2. Set power system parameters and network topology to match the system being recorded. Verify the nominal voltage (mains voltage) and line frequency are correct.
3. Set the recording time, for example a 15-minute averaging interval and a 30-day recording duration.
4. Start recording the data. In the W (power) position, the Fluke 1735 records min, max, and average every 15 minutes for:
   - Power (in watts for each phase and total)
   - Reactive power (in VARs for each phase and total)
   - Apparent power (in VAs for each phase and total)
   - Power factor (for each phase and average)
   - Average energy (in kWh)
   - Reactive energy (in kVARh).

   The trend screen will plot a new minimum, maximum and average on the display every fifteen minutes, moving from left to right. After 30 days, disconnect the Fluke 1735 from the source, take it to your computer, use the serial cable to connect it, and download the data into the Power Log Software included with the unit.
5. Download and review the measurements. After 30 days of recording with a measurement every 15 minutes, there are 2880 sets of measurements. Power Log creates a graph of this data, making it possible to see the maximum current or power on each phase, compare the three phases and report the largest number. Power Log has a built-in report generator that includes graphs of current and real power, as well as maximum average current on a bar chart.

Fluke 1735 Power Logger



Trend screen



Report generation

FLUKE®

A selection of Fluke Power Quality test tools designed for power load studies

Understanding power load studies is important for industrial maintenance technicians and external contractors involved in power distribution systems and equipment installation. Such studies are essential for determining if a distribution system can handle more loads, measuring power factor, and keeping an eye on energy use and billing. With Fluke dedicated power quality test tools, these tasks are easier to understand, more accurate and may even save precious resources – natural and financial.

Fluke 1735 Portable Power Logger

The Fluke 1735 three-phase portable power logger helps characterize power quality, conduct load studies and capture hard-to-find voltage events. It records power, energy, basic power parameters and harmonics for up to 45 days, and takes just seconds to set up. It is also useful for quantifying energy consumption and testing energy-saving devices.

Fluke 1740 Series Power Quality Loggers

The Fluke 1740 Series Power Quality Loggers are for everyday troubleshooting and analysis of power distribution systems. Three models offer a choice of functions for applications like disturbance analysis, load studies and 'quality-of-service' compliance. Voltage measurement accuracy is Class-A compliant. The easy-to-set-up instruments can capture events and log 500 parameters for 85 days.

Fluke VR1710 Voltage Event Recorder

The Fluke VR1710 Power Quality Recorder, is a single-phase, plug-in voltage quality recorder that offers an extremely easy-to-use solution for detecting and logging power quality problems, allowing for immediate action and less downtime. The VR1710 single phase recorder satisfies the needs of maintenance and facilities management personnel in industrial, utilities, and large service organizations where reliable power quality is essential to the operation of the business. Power quality parameters including RMS average, transients, flicker, and harmonics up to the 32nd are recorded using a user-selected average sample period from 1 seconds to 20 minutes. View graphs and generate reports with included Power Log software.

More information and detailed specifications can be found under **www.fluke.eu**

Fluke. *Keeping your world up and running.®*

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.eu

Printed in the Netherlands 09/06
Data subject to alteration without notice.
Pub_ID 11147-eng, Rev. B