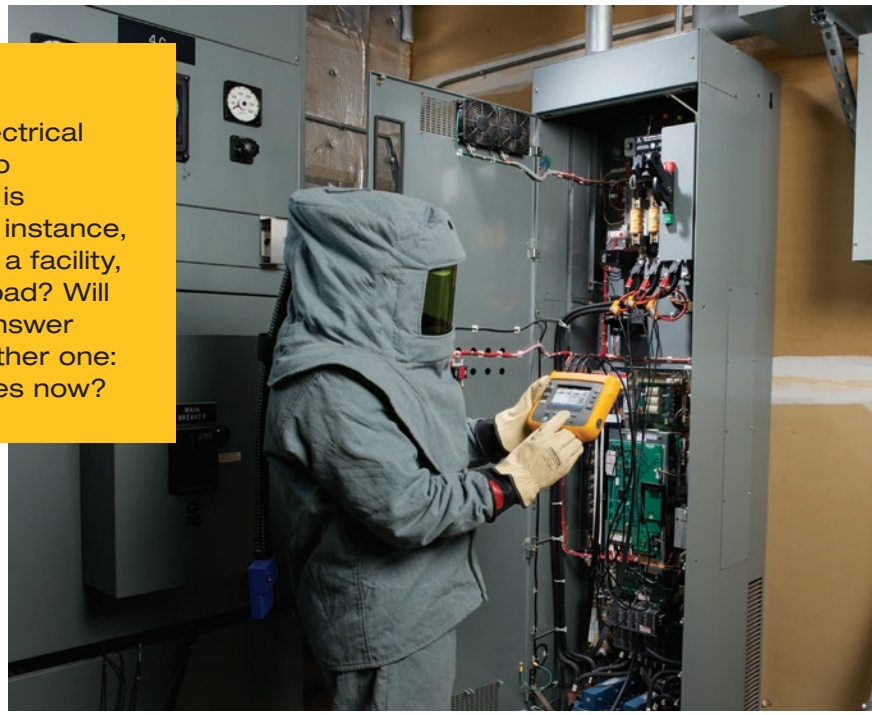
APPLICATION NOTE

A guide to 30 day load studies with Fluke Power and Energy Loggers

When adding new loads to an existing electrical service or set of feeders, the first thing to determine is whether the existing system is capable of supporting the new loads. For instance, if you have a 600 amp service installed in a facility, can you really add another 100 amps of load? Will that put your system over capacity? To answer those questions you have to first ask another one: What is the highest load the system carries now?



What you need to know

Often, local electrical authorities need to know these answers before they issue permits. Plus, you will need a comprehensive understanding of present-day loading in order to evaluate any new system you plan on installing.

To determine 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'll need to either precisely calculate the existing loads, or measure them.

How these calculations are performed across the globe varies but typically some measurement of the consumed current and energy will be used in developing a safe, reliable result to the problem.

In many parts of North America, Article 220 of the 2014 National Electrical Code offers guidance with two methods for determining existing loads and the maximum demand the system is likely to handle.

The NEC defines demand as the power consumption of the loads averaged over 15-minute intervals.

The primary NEC method for determining existing loads and maximum demand is to find the maximum demand during a one-year period. But, this only works if you have a year's worth of demand data.

The alternate method is to record the demand over a 30-day period to find the maximum typical demand. This article describes the 30-day recording method, known as a load study.

The NEC specifies that:

- The highest demand is the highest demand among all feeders.
- You should take measurements when the building is occupied.
- Include heating and cooling loads, whichever is larger, or correct to account for these loads.
- Add in any other periodic loads.

As always, local authorities are responsible for interpreting the electrical code and measurements. Local regulations determine when a load study must be performed, precisely what

FIVE simple steps

To perform a load study with the Fluke Power or Energy Logger

1. **Hook up to the feeders or service.**
2. **Set power system parameters.**
3. **Set the recording time.**
4. **Start recording.**
5. **Download and review the measurements.**

To ensure the logging session is successful remember to check these items.

information is required, and the review process. Make sure you understand your local requirements before you start a load study. The NEC approach provides a logical method that can be adapted to meet local requirements. Performing a load study with a Fluke Power and Energy Logger takes just five easy steps:

1 Hook up to the feeders or service

Using proper personal protective equipment, connect the Fluke Logger to line power and secure the area so no one will tamper with your setup. Ensure the instrument is powered as you don't want to come back to an instrument that has used up all its battery power after a short time. For a 3-phase wye system there will be seven or eight connections (in some cases neutral current is not considered):

- Three phase voltages
- Neutral voltage
- Three phase currents
- Neutral current

2 Set power system parameters

Set the Network Topology to wye or delta, to match the system you are recording. Verify the nominal voltage (Mains voltage) and line frequency is correct. The Fluke Logger includes displays that make it easy to check everything is connected correctly; in some instrument there's even an automatic configuration and correction tool to ensure you are connected and setup correctly. Additionally the waveform and phasor display provide detailed information about the setup.

3 Set the recording time

Set the Fluke Logger to 15-minute averaging intervals and a 30-day recording duration. The 15-minute average time is specified in the NEC 220 as the designated period.

4 Record the data

On the Power display the Fluke Logger will display a min, max, and average of these values every 15 minutes:

- 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
- Averages of Energy in kWh and Reactive Energy in kvarh

A live trend screen will appear when selected and plot a new minimum, maximum and average on the display every fifteen minutes, moving from left to right.

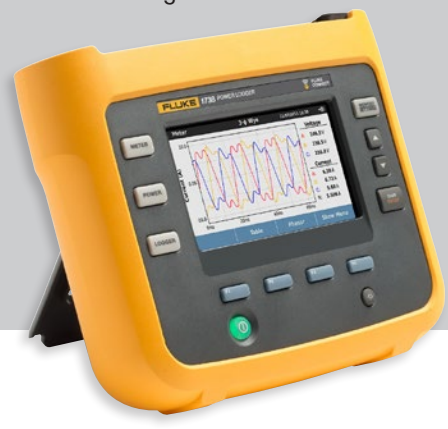
The Fluke Logger can also be set to monitor the 15-minute period in terms of power demand. This demand period is often used by utilities to charge industrial and commercial consumers variable rates. Minimizing this demand can save users money based on their electricity tariff agreement.

During the 30 day measurement period (or designated local period) it's possible to collect the data for review from the instrument on screen or, when using the Fluke 173x loggers, simply by plugging a USB memory stick into the USB port on top of the instrument to download the partial data without interrupting the long term study. Additionaly, some Fluke Power and Energy Loggers allow you to view and review data wirelessly via the Fluke Connect® mobile app and desktop software. The data can be reviewed on the instrument using the basic statistics provided and the stored detailed trends. After 30 days, or when you are satisfied you have the information needed disconnect the Fluke Logger from the source, download the data using either transfer to USB stick of by connecting your computer into the associated product software included with the units.

The Fluke 1738: Three-phase Harmonics and Event Logging

The Fluke 1738 is the ideal tool for recording and analyzing power and energy in commercial and industrial facilities. In addition to recording power parameters for load studies, the Fluke 1738 also:

- Shows voltage and current waveforms on its integrated scope display
- Generates phasor diagrams for three-phase systems
- Measures and monitors harmonic distortion caused by electronic loads
- Captures detailed information on voltage dips and swells caused by load switching and faulty equipment



5 Download and review the measurements

For 30 days of recording, with a measurement every 15 minutes, you will have 2880 sets of measurements. Use application software to graph this data, find the maximum current or power on each phase, compare the three phases and report the largest number.

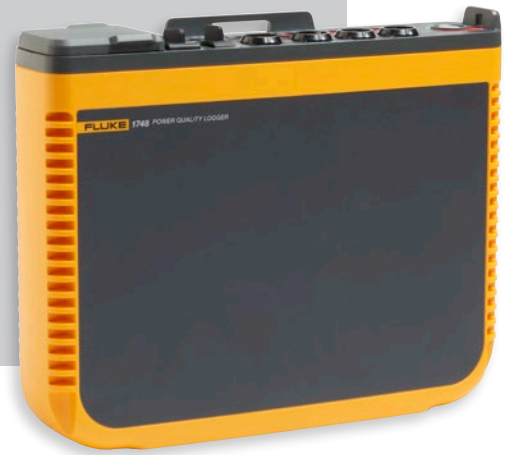
Application software packages usually have a built-in report generator that includes graphs of current and real power, as well as maximum average current on a bar chart. Your report can range from a single current or power number to a full-blown document with graphs and tables. But the ultimate goal is still the same: Get an accurate picture of the system load, help design a safe upgraded system and satisfy electrical authorities.

EXAMPLE: Holmes Electric of Washington state performs an average of three load studies per month. To have the study performed, the building owner pays for any labor and a fee for the use of Holmes' power recorder. Among the hundred or so electricians Holmes has in the field, Dave D'Ambrosio and two other electricians perform most of the load studies. Before an estimator can plan for the job, Dave goes out to the customer site and hooks up the recorder to determine the unused capacity of the current system. The data gathered over a month is used to help the estimator determine whether the existing service or feeders can be used as is, modified, replaced, or supplemented. The data is used in the permit application process, so inspectors can evaluate the electrical plan.

The Fluke 1748: Three-phase Harmonics and Event Logging

The Fluke 1748 is the ideal tool to record and analyze power and energy in industrial facilities and utilities.

- Thinner size to fit inside tight cabinets
- Intended for harsh environments with IP-65 rating
- Ethernet port to access saved data in real-time
- Captures the same detailed information as the 1738



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Web access: http://www.fluke.com

Printed in U.S.A. 11/2017 6006030b-en