Data Aggregation in PowerPad III® and PEL® Instruments

AEMC's Power and Energy Loggers Model PEL instruments provide all the necessary functions and features for power and energy data logging for most 50Hz, 60Hz, 400Hz, and DC distribution systems worldwide. Primary users include contractors performing power system evaluation and monitoring. These instruments measure phase-to-phase, phase-to-neutral, and neutral-to-earth voltage, measuring up to 1000 volts. They also measure phase and neutral current, using a variety of external current sensors. Measurement data is then used to calculate numerous values, including active, reactive, and apparent power and energy; crest factor, harmonics and total harmonic distortion; and others.

The AEMC PowerPad family of instruments combine data logging with sophisticated power quality analysis. These instruments are portable three-phase network analyzers designed to:
- Measure RMS values, powers, and fluctuations of electric hookups
- Deliver a snapshot of the principal characteristics of a three-phase network
- And track variations of specified parameters over time.

These instruments enable utility company technicians and engineers to measure single and three-phase networks, and perform diagnostics and power quality analysis. Trend data can be recorded for days, weeks or even months. Inrush current can also be captured and stored

When recording data, AEMC PowerPad and PEL instruments perform data *aggregation*. This involves determining the average value for a measured parameter over a user-specified time interval. Aggregation saves storage space by reducing the number of measurements recorded over the duration of the recording. It also ensures more accurate and complete data by including all individual measurements in the aggregation, rather than periodically taking single measurements.

The interval over which aggregation is performed can be selected by the user. Some AEMC models allow you to do this through the instrument interface, while others require configuration via AEMC's DataView software.

Some instruments allow aggregation periods as short as one second, while others let you set the period up to one hour. Shorter periods are recommended for short recordings containing minute-by-minute detailed measurements, while longer periods are ideal for monitoring long-term trends for several weeks or months. The typical aggregation period used by utility companies in the U.S. is 15 minutes, while in Europe the period is typically 10 minutes.

Note that aggregation does not affect how often an instrument takes each measurement. Instead, during the recording session the instrument take measurements at a constant rate, such as 128 samples per cycle for the PEL. At the end of each aggregation period, the instrument automatically applies a mathematical formula to determine the average of all the measurements taken. Depending on the instrument and measured parameter, the average is determined by calculating the root mean square, arithmetic mean, or other calculation. This average is then recorded in the instrument memory.

The recorded time of the aggregated measurement depends on the instrument model. On PowerPad instruments, the time stamp of the aggregated measurement for most parameters is the beginning of the aggregation period, while on PEL instruments the time stamp is the end of the period.

For example, if you schedule a recording on the PEL to begin at 12:00 and end at 1:00, and select a 15 minute aggregation period, the recording will consist of 4 measurements (12:15, 12:30, and so on until the final measurement at 1:00). On a PowerPad with the same configuration, most aggregated measurements will be recorded at 12:00, 12:15, and so on, with the final measurement at 12:45. The one exception are energy measurements, which in PowerPad recordings are time stamped at the end of the aggregation period, similar to PEL instruments.

Note that aggregation will only begin or end at clock times evenly divisible by the aggregation period. For instance, if a one-hour recording on the PEL begins at 12:06 with a 15 minute aggregation period, the first aggregation begins at 12:15 and ends at 12:30. Aggregation is then performed every 15 minutes, with the final aggregation ending at 1:00. Although the recording continues until 1:06, no aggregation will be performed for the final 6 minutes. Therefore for this recording, only 3 aggregated measurements will be made.