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AEMC INSTRUMENTS 112 Series PEL Control Panel



Product Information

Specifications

• Models: PEL 112, PEL 113, PEL 105, PEL 115

• Type: Power & Energy Loggers

• Unbalance Range: 0% to 100%

Product Usage Instructions

- In three-phase AC distribution networks, unbalance (imbalance) is the ratio of the negative-sequence or zero-sequence component to the positive-sequence component.
- An unbalanced percentage indicates network efficiency.

Positive, Negative, and Zero Sequence

- In three-phase networks, there are positive, negative, and zero sequence components.
- Zero sequence represents the balanced phasors' equal magnitude and phase.

Viewing Unbalanced Data in PEL Control Panel

- Access the Real-time Data frame in the PEL Control Panel.
- Click on the Unbalance button to view unbalanced data channels.
- View RMS unbalance values for voltage and current components: Vunb (u0), Vunb (u2), lunb (i0), lunb (i2).
- Ensure unbalanced percentages are close to zero for an efficient distribution system.

Power Parameters

 Below the RMS unbalance data, find power parameters such as fundamental active power for each phase and total power.

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INTRODUCTION

When viewing PEL 112, PEL 113, PEL 105 or PEL 115 real-time data in the
 DataView® PEL Control Panel, you now have the option to display unbalanced data.

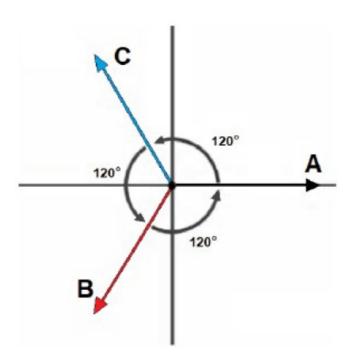
- In three-phase AC distribution networks, unbalance (sometimes referred to as imbalance) is the ratio of the negative-sequence or zero-sequence component to the positive-sequence (fundamental) component.
- This ratio is expressed as a percentage between 0 and 100) %, and can be applied to either voltage or current.
- An unbalanced percentage indicates the efficiency of your distribution network.
 Reducing unbalance can save significant energy costs.
- For example, the power quality standard EN50160 (used primarily in Europe and also applicable in other regions) specifies that unbalance should not exceed 2 % at the point of common coupling (PCC).

POSITIVE, NEGATIVE, AND ZERO SEQUENCE

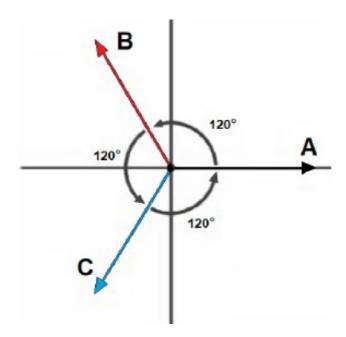
To understand what unbalanced data means for your distribution system, it's important to be familiar with the concept of phase sequence.

In three-phase networks, there are three sets of independent components for both current and voltage. These are called positive sequence, negative sequence, and zero sequence:

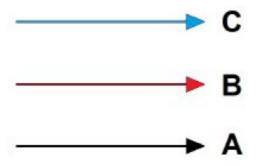
Positive sequence (also called fundamental) represents three equal phasors phase-displaced by 120° with the same phase sequence as the original phasors supplied by generators (A-B-C sequence). The positive sequence component is always present and indicates the current flowing from source to load.



 Negative sequence represents three equal phasors, phase-displaced by 120° with each other, with the opposite phase sequence to that of the original phasors. The negative sequence component displays A-C-B sequence, and indicates current flowing from load to source.



• **Zero sequence** represents the component of the unbalanced phasors that is equal in magnitude and phase.

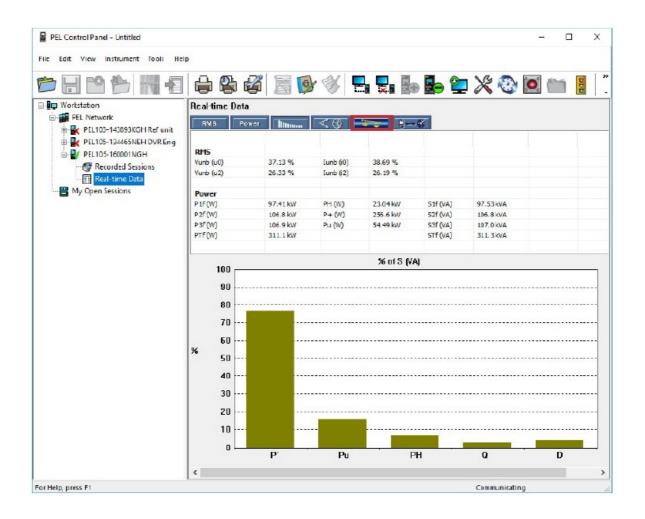


• In a balanced three-phase system operating in normal conditions, only the positive sequence component is present. In the real world, however, 3-phase systems are rarely perfectly balanced. Significantly unbalanced systems indicate the existence of a negative sequence that can be harmful to polyphase loads such as induction motors.

DATAVIEW® PEL CONTROL PANEL

• To view PEL 112, PEL 113, PEL 105 or PEL 115 unbalance data channels in the PEL Control Panel, click the Unbalance button in the Real-time Data frame.

NOTE: The Unbalance button, outlined in red in the illustration below, only appears for the PEL Models 112, 113, 105 and 115 instruments.



At the top of the Real-time Data frame is a table displaying a variety of parameters. The first four are RMS unbalance values:

- Vunb (u0): zero-sequence voltage unbalance
- Vunb (u2): negative-sequence voltage unbalance
- lunb (i0): zero-sequence current unbalance
- lunb (i2): negative-sequence current unbalance

Each of these values is expressed as a percentage of its fundamental value.

For example, in the preceding illustration, Vunb (u0) is 37.13 %. This means that the zero-sequence voltage is 37.13 % the size of the positive sequence voltage. Similarly, the lunb (i0) value indicates the zero-sequence current is 38.69 % the size of the positive sequence current.

• In an efficient distribution system, the unbalance percentages should be close to zero.

The percentages shown in the preceding example indicate that unbalance is a serious issue in the distribution network under measurement, with significant power being lost due to network inefficiency.

 In the Real-time Data frame, below the RMS unbalance data are a number of Power parameters.

NOTE: Some of the power parameters listed in the table may not be displayed, depending on the type of distribution under measurement.

- Pf (P1f, P2f, P3f, PTf): fundamental active power for phase 1, 2, 3, and total, respectively
- PH: harmonics active power
- P+: total fundamental active power of the positive-sequence power (balanced power)
- Pu: active power of the negative and zero sequence components (unbalanced power)
- Sf (S1f, S2f, S3f, STf): fundamental apparent power for phases 1, 2, 3, and total, respectively
- V+: Positive-sequence phase-to-neutral voltage
- V0: zero-sequence phase-to-neutral voltage
- V-: negative-sequence phase-to-neutral voltage
- I+: positive-sequence current
- 10: zero-sequence current
- I-: negative-sequence current

Also, in the Real-time Data frame, below the Power parameters table is a histogram (bar chart) displaying the percentage of P (active power) that is represented by P+, Pu, PH (harmonic active power), Q (fundamental reactive power), and D (harmonic distortion power), respectively.

The following Power parameters are shown by clicking the Power button



- P (P1, P2, P3, PT): active power for phase 1, 2, 3, and total, respectively
- Q (Q1, Q2, Q3, QT): fundamental reactive power for phases 1, 2, 3, and total, respectively
- D (D1, D2, D3, DT): harmonic distortion power for phases 1, 2, 3, and total,

respectively

• S (S1, S2, S3, ST): apparent power for phases 1, 2, 3, and total, respectively .The

relationships between these parameters are as follows:

PTf (total fundamental active power) = P+ (total fundamental balanced power) + Pu

(total fundamental unbalanced power)

• PT (total active power) = PTf + PH (harmonics active power)

• S^2 (apparent power2) = PT^2 + QT^2 (total fundamental reactive power2) + DT^2 (total

harmonic distortion power2)

Ideally, P+ should be at or close to 100 %, while the sum of the remaining variables

should be near zero. The lower the P+ percentage (and thus the higher the total sum of

Pu, PH, Q, and D), the more your distribution system is wasting energy. For instance, in

the preceding illustration P+ is around 77 %. This indicates that inefficiencies in your

distribution system are wasting approximately 23 % of the power received from the

source.

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FAQ

Q: What does an unbalanced percentage indicate?

A: Unbalance percentage indicates the efficiency of the distribution network. Lower unbalance percentages are desirable for energy savings.

Q: How can I reduce unbalance in my distribution system?

A: To reduce unbalance, ensure balanced loads across all phases and consider using balancing devices if necessary.

Documents / Resources



AEMC INSTRUMENTS 112 Series PEL Control Panel [pdf] Instruction Ma

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112 Series PEL Control Panel, 112 Series, PEL Control Panel, Control Panel, Panel

References

- User Manual
- AEMC

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