

TECHNICAL BULLETIN

OPTIMA X SERIES LINE VOLTAGE HANDLING

Preparative ultracentrifuges are a staple in life science research labs. Beckman Coulter has long been a leader in useful innovations that aid in the discovery process and contribute to meaningful research. This paper details the innovations aimed at improving the ability of today's ultracentrifuges to handle line voltage fluctuations and power interruptions.



Brilliance
at every turn.



Optima X Series Line Voltage Handling

Innovative design delivers consistent performance.

Centrifuges are used worldwide as basic research tools. This bulletin details the design elements of the new Optima X Series ultracentrifuges that provide industry-leading capabilities to handle power line voltage supply variations.

Throughout the world, voltage sags, power interruptions, and variances of line voltage occur frequently. In scientific instruments that require constant power for the correct operation of multiple systems, this can cause interruptions, system fault notices, or other unwanted consequences. In the worst-case scenarios, the centrifuge run may be terminated prematurely.

The development team for the new Optima X Series ultracentrifuges responded to this problem by designing a system that accounts for line voltage sags. Previous ultracentrifuges handled voltage sags with multiple tactics. The transformers had a jumper to set the tap selection, which required the voltage range for the various subsystems to be set manually. These include the cooling, drive, and vacuum systems, as well as the graphical user interface. When the line voltage dropped below the lower limit of the selected voltage range (180 ~ 206 VAC, 207 ~ 233 VAC, 234 ~ 264 VAC), the instrument wrote parameters to non-volatile memory to allow the instrument to recover from voltage sag, shut down, and generate a diagnostic message. When voltage returned to the selected operating range, the instrument would restart if the interruption was within the design parameters.

Two major design changes have extended the operating range of the new Optima X Series ultracentrifuges. First, a switching power supply that operates and maintains control of the instrument's systems, with the exception of the drive, all the way to a low of 85 VAC (equivalent to an extreme brown-out condition) was selected. A switching power supply is inherently more efficient than the linear power supply it replaces, resulting in more efficient energy usage. Secondly, software algorithms allow for tracking of various run parameters, such as time of power interruption,

temperature during line sag, rotor speed, and other key operational parameters. This data is used to provide vital information to the customer so they can determine if the run should be continued after the power interruption, or if it should be terminated.

The Beckman Coulter design used in the new Optima X Series varies in fundamental ways from its main competitors, the Hitachi and Sorvall WX Series ultracentrifuges. When a power interruption occurs, the



Hitachi/Sorvall WX Series uses regenerative braking to help maintain voltage in the system. This produces the unintended consequence of decelerating the rotor as quickly as possible. The run can potentially come to a stop if the power sag continues longer than the time required to brake the rotor to a complete stop. The Optima X Series instructs the rotor to coast during a sustained power sag or outage, thus substantially prolonging the time that the run can be salvaged. While the rotor is coasting and the line voltage is above 85 VAC, the instrument user interface is fully functional, and parameters are written to memory to allow the user to ultimately choose how to proceed.

Another key advantage of the Optima X Series ultracentrifuges is the ability to automatically switch transformer taps to conform to the available power supply

voltage. Previous generations of Optima ultracentrifuges required a Field Service Engineer to select the tap to match the local power supply during installation. The Optima X Series is equipped with software that continuously measures line voltage and automatically selects the tap at the beginning of each run to ensure maximum performance. This allows the line voltage to vary over a broad range without affecting instrument operation. As a result, the Optima X Series can tolerate an operating range from as low as 85 VAC to a high of 264 VAC.*

Another advantage of the Optima X Series occurs during a complete power drop-out. Existing units note when the power drop-out occurs, but not necessarily the duration of the interruption. This may require the centrifuge operator to intervene and clear a power diagnostic to continue

* The instrument drive will coast at line voltages below 170 VAC.

operation of the centrifuge. The new Optima X Series uses a more sophisticated design, allowing the system to track the duration of the power interruption, when power is restored, and various other operational parameters during the time of the interruption. The information is used to decide if the parameters have remained within an acceptable range and the run can be continued to completion.

To summarize, the new Optima X Series ultracentrifuges have been designed to provide maximum flexibility and operational consistency, even in the event of power line sags, brown-outs and complete power interruptions. This offers a solution to customers worldwide, but particularly in regions with frequent line voltage fluctuations, which is another example of engineering targeted to assist our customers conducting world-class research and discovery.



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