

Application Server and Application Programs

Background

The application server provides the platform within the data processing and monitoring system (DPMS) architecture for running complex calculation and monitoring software applications. The server receives data from the DPMS network, performs run-time calculations and transmits the results back to the network. The data can be displayed on plant computer graphics, or as part of the point review or trending features.

Application servers can also be deployed as data link servers or gateways, configured to stand alone or operate as a dual, redundant pair.

Description

Application servers used to run plant calculations are typically configured using a hot standby redundancy.

The redundant application servers consist of two separate and identical sets of server hardware and software. A concurrent redundancy scheme is used to execute applications, with both the primary and the partner running on a continuous basis. The primary server broadcasts its data to the DPMS information and control network. Its partner executes the same functions as the primary, but does not broadcast its data to the DPMS information and control network until the primary server goes offline.

Application Programs

The application programs are constructed from a set of function blocks that perform calculations. Function block-based application programs are generated by the application builder tool. Application programs may also be generated from a custom source code, which interacts with the functions provided by the application server.

Application Builder Displays

Application builder displays provide a visual representation of the calculation logic using the application builder graphical user interface (GUI). These displays are intended to be used for performing detailed checks of the calculation logic, or for testing or debugging purposes.

Applications Library

Westinghouse maintains a comprehensive set of standard function blocks for application program implementation. The base set of function blocks includes basic arithmetic and logic function blocks, as well as more complex function blocks that perform calculations, such as flow corrections and averages of redundant sensors.

Delta Flux – The purpose of the delta flux program is to compute and monitor the delta flux in the reactor core and to alert the operator when the “delta flux” alarm conditions are encountered. This program can also be interfaced to Westinghouse’s BEACON™ core monitoring program to improve the accuracy of the delta flux information.

Radial Flux Tilts – The radial flux tilts program monitors the symmetry of the radial power distribution in the reactor core and informs the reactor operator of undesirable conditions, should they exist.



Application server and application programs

Flow Corrections – The flow corrections application serves other programs, such as the primary plant performance program, by calculating corrected flow rates to account for differences between actual and calibrated sensor conditions.

Level Corrections – The level corrections program corrects level indications for density and measurement elevation to compensate for differences between actual and calibrated conditions.

Plant Mode Determination – The plant mode determination program monitors predefined sets of selected plant parameters to determine the current plant mode of operation.

Primary Plant Performance Calorimetric – The primary plant performance application calculates the reactor thermal power output.

Rate of Change – The rate of change program calculates gradients that indicate the amount and direction of the changes to the measured value per time unit.

Redundant Sensor Algorithm – The redundant sensor algorithm application produces a single average output from input groups of two to 16 signals. The redundant sensor algorithm application compares these signals to each other to obtain an average value and an associated quality.

Time Averaging – The time averaging application provides a running average of an input over a predefined time period to support other application programs.

Balance of Plant Performance Monitoring – The balance of plant performance monitoring application is intended to alert the plant performance and/or system engineering staff of the potential need for equipment maintenance, or of changes in plant operating conditions, which result in reduced electrical output generation.

Sump Level Monitor – The sump level monitor program provides an estimate of the total sump inflow based on sump level measurements over time.

Primary System Leak Rate – The primary system leak rate program calculates the reactor coolant system leakage rate, as defined by U.S. Nuclear Regulatory Commission (NRC) Regulatory Guide 1.45.

Emergency Response Facility Applications – This set of calculations includes applications required by NRC Regulatory Guide 1.97, NUREG-0737 and NUREG-0696.

It is comprised of calculations required to support safety parameter displays and emergency response guidelines.

DPMS Base Application Programs

As part of any base DPMS, the following application programs are typically included. In many cases, some degree of software modification/configuration is required to align the application programs to the customer's specific plant design. This reconfiguration is simplified using the function block approach to implementing applications.

- Primary plant performance calorimetric calculation
- Redundant sensor algorithm
- Signal smoothing
- Rate of change
- Time averaging
- Plant mode
- DPMS customized applications programs (optional)

Benefits

The application server provides the stability, power and flexibility needed to support modern information and control systems. Using commercially available workstations and operating systems, the application server offers an unprecedented level of performance and power.

The application server is fully compatible with the data processing and monitoring system's information and control network.

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Westinghouse Electric Company
1000 Westinghouse Drive
Cranberry Township, PA 16066

www.westinghousenuclear.com