EXPERTISE BEYOND CONTROLS

VANGUARD®

Series 5

CCC

The Best of Both Worlds.

Series 5 Vanguard controllers provide a flexible combination of CCC and third-party components:

- Turbomachinery-specific mix of high-speed local I/O

- ProfiBus controllers and slaves

- Rack-mountable chassis with a standard compact peripheral component (cPCI) bus

- Remote I/O

Series 5 Vanguard controllers use a fully deterministic, multitasking operating system. Automation and control programs, including our time-tested algorithms for anti-surge protection and load-sharing, are implemented using the IEC-61131 programming standard. The Windows-based TrainTools® suite provides a comprehensive interface for programming and project engineering.

Powerful, High-Speed Processor

Vanguard is designed to meet the automation and control needs for a majority of turbomachinery trains, no matter how complex. Its powerful processor and multitasking operating system have been specifically tailored to combine high-speed control loops with sequencing logic. Vanguard incorporates advanced self-diagnostic features, particularly in early I/O failure detection, reducing probability of nuisance shutdowns. Vanguard supports a cost-effective and highly scalable distributed I/O sub-system, a comprehensive Windows-based tools suite (including a flexible programming environment), and fast and reliable communication links (including both Ethernet and serial ports).

The standard mission processing unit (MPU) card provides three 100 megabyte Ethernet ports for communication with our TrainTools workstations. It also includes four electrically-isolated RS-485 serial ports for communicating with Modbus masters, or other Series 5, Series 4, or Series 3++ controllers.

Fast Execution Speeds

Vanguard's fast sampling and execution rates help detect I/O failures before the signals are actually used in the control or logic program. Fast scan rates also permit the use of more advanced control algorithms, primarily aimed at improving disturbance rejection response of the system and minimizing operator intervention. For example, field tests show that Vanguard can execute a demanding fuel control application for a low NOx gas turbine with a multitude of control loops in less than 10 milliseconds. CCC's patented, field-tested, and comprehensive surge protection and capacity control algorithms also show improved response resulting from faster execution and scanning rates.

High Resolution Time Stamping

Vanguard's fast scanning and execution rates not only benefit the quality and reliability of control, but also permit reconstruction of significant events with resolution equal to the loop time of the controller. An on-board clock is used to time-stamp process variables, alarms, and events generated by the controller. The data and its associated time-stamp are archived on the TrainTools workstation, and can be available to other systems through an OPC interface.

Specialized Local I/O

Vanguard's chassis-based local I/O card (IOC) is designed to handle critical I/O points that require high processing speeds, such as frequencies from magnetic pick-ups that are used to measure rotational speed. The IOC scans and processes I/O within 2.5 milliseconds. A Vanguard local IOC combines 22 analog inputs, six analog outputs, six frequency inputs, 16 digital inputs, and 14 discrete outputs in one economical package. Based on CCC experience, this I/O mix can satisfy high-speed I/O requirements for many turbomachinery trains. However, multiple IOCs can be installed in the Vanguard chassis if necessary.

Field wiring is connected to up to four field termination assemblies (FTA): two for analog signals and two for discrete signals. These FTAs can be equipped with a full range of conditioning modules, including RTD and thermocouple inputs. While Vanguard controllers are compatible with both CCC and third-party signal conditioning modules, our exclusive, custom-designed conditioning modules provide high and low operating temperatures, extraordinary transient voltage protection, open-circuit detection, and compatibility with turbomachinery-specific field devices.

In duplex systems, each pair of redundant I/O cards share the same FTAs, so failed cards can be replaced without disturbing your field wiring. Both simplex and duplex FTAs support redundant power supplies.

The IOC features comprehensive on-board diagnostics and cooperates with the MPU to trigger redundant system switchovers. By sampling each channel at sub-millisecond rates, it assures overall process stability and minimizes process disturbances.

Secure Remote I/O

Logic and other lower-speed applications use ProfiBus remote I/O, an industry standard for high-speed serial communication between a controller and remotely-located, multi-channel slave assemblies. This is implemented by installing a ProfiBus Master (PBM), usually in combination with our SureLink Remote I/O Assemblies.

Using a certified PBM installed in the Vanguard chassis, a twisted-pair field I/O network can reduce installation costs. The modular design allows for scalable projects and for subsequent I/O expansion without the fear of running out of capacity. The remote I/O bus can be used for hundreds of I/O points while maintaining high performance. With up to a 12-megabytes-per-second communication bus, multiple masters, and a redundant power supply distribution, the network can easily grow to more than 1,000 points.

Local I/O is used for high-speed proportional integral derivative (PID) control, while remote I/O is used for plant-wide logic and unit control. The integration of I/O type is seamless, and the user sees no distinction. All PC tools and turbomachinery control applications operate invariant to the type of physical I/O used in the project, and all machine train algorithms are executed in the same common processor.

Simplex or Duplex Chassis

The MPU, IOC, and remote carrier card with PBM are installed in a 19-inch rack-mount chassis featuring a standard compact peripheral component interconnect (cPCI) bus. Both simplex and duplex chassis are available, either of which can have duplex power supplies:

- ▸ The simplex chassis has a single cPCI bus that accommodates one MPU and either five local or three local and one remote I/O cards.

- ▸ The duplex chassis has two cPCI buses, requires redundant MPUs (one for each bus), and accommodates either three local or one local and one remote duplex I/O cards.

Each component card is installed from the front of the chassis, and has a matching transition module that installs from the back. Front panel serial and Ethernet ports are provided for set-up

For more information about our Series 5 Vanguard control systems and other state-of-the-art products from the world leader in turbomachinery control, please contact a CCC office near you. We are uniquely qualified to solve turbomachinery control problems, and we will help you achieve maximum turbomachinery performance regardless of your equipment or process.

Standard Series 5 Features

Like all Series 5 Systems, Vanguard controllers used a fully deterministic, multitasking operating system. Automation and control programs, including our time-tested algorithms for anti-surge protection and load-sharing, are implemented using IEC-61131 standard. Windows-based TrainTools suite provides comprehensive interface for programming and project engineering.

Proven Application Software

At the core of the Series 5 concept are our industry-leading turbomachinery control algorithms, implemented using programming languages and techniques offered by the IEC-61131 standard (formerly IEC-1131).

CCC offers IEC-61131 applications that cover single- and multishaft gas turbine fuel control; steam turbine speed, extraction, and valve-management control; compressor anti-surge, performance, load-sharing, anti-choke, and quench control; and electrical generator load control.

Applications contain control techniques and algorithms that CCC has developed, refined, and successfully implemented time and time again. CCC-developed control techniques include calculating a compressor's proximity-to-surge, innovative combinations of open- and closed-loop control, efficient load-sharing for series and parallel compressors, and turbine over-speed avoidance.
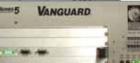
Reliable Real-Time Multitasking

Unlike many control systems and programmable logic controls (PLC), which take shortcuts in this area, the Series 5 operating system delivers true multitasking capabilities that optimize central processing unit (CPU) usage by executing control applications at different rates. Computationally intensive tasks that do not require fast loop times can be executed at a slower rate, while machine control and protection tasks, which absolutely require short loop times, can be executed at a faster rate. To prevent aliasing, I/O signals are filtered based on the execution rate of the customer's application.

Powerful Workstation Software

CCC provides a suite of Windows 2000-based tools, TrainTools, for engineering of and interfacing with all Series 5 systems. This powerful package includes:

- ▶ **Project Builder,** a comprehensive tool for building a project database. It establishes the connection between a process tag, control system I/O designation, and logical name of the process variable used in the software. Project Builder is tightly integrated with the IEC-61131 programming environment, and generates code for downloading to the controller.

- ▶ **Application Editor,** a full-service graphical editor for creating IEC-61131-compliant software. Integration of the Application Editor with the Project Builder saves valuable engineering time by eliminating redundant data entry.

- ▶ **TrainView 2 (TV),** a state-of-the-art object-based graphical interface to all Series 5 controllers, featuring displays that are easily customized to meet specific requirements. TV uses the same data base as the Project Builder, and can be configured using the Project Builder interface.

- ▶ **Alarm Server** provides alarm and event management and reporting facilities. All alarms and events are provided with the controller's time-stamp.

- ▶ **Archiving and Trending** facilities allow high resolution (down to 100 milliseconds) data acquisition and viewing.

Global experience. Global support.

Australia / Brazil / China / India / Italy / Netherlands / Russia
Saudi Arabia / Singapore / U.A.E. / United Kingdom / United States

Contact your local sales representative. Please visit our website:
www.cccglobal.com/offices