



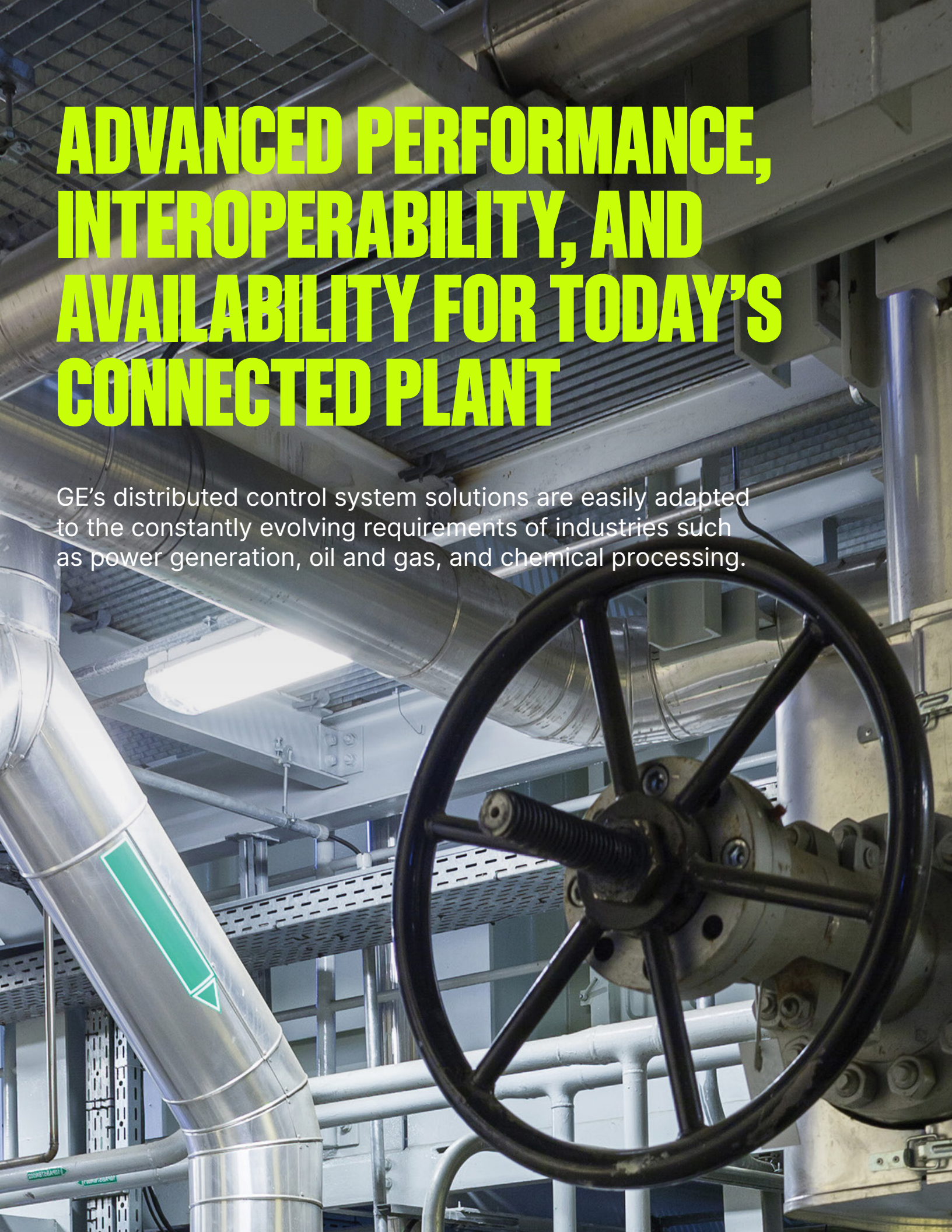
GE VERNOVA

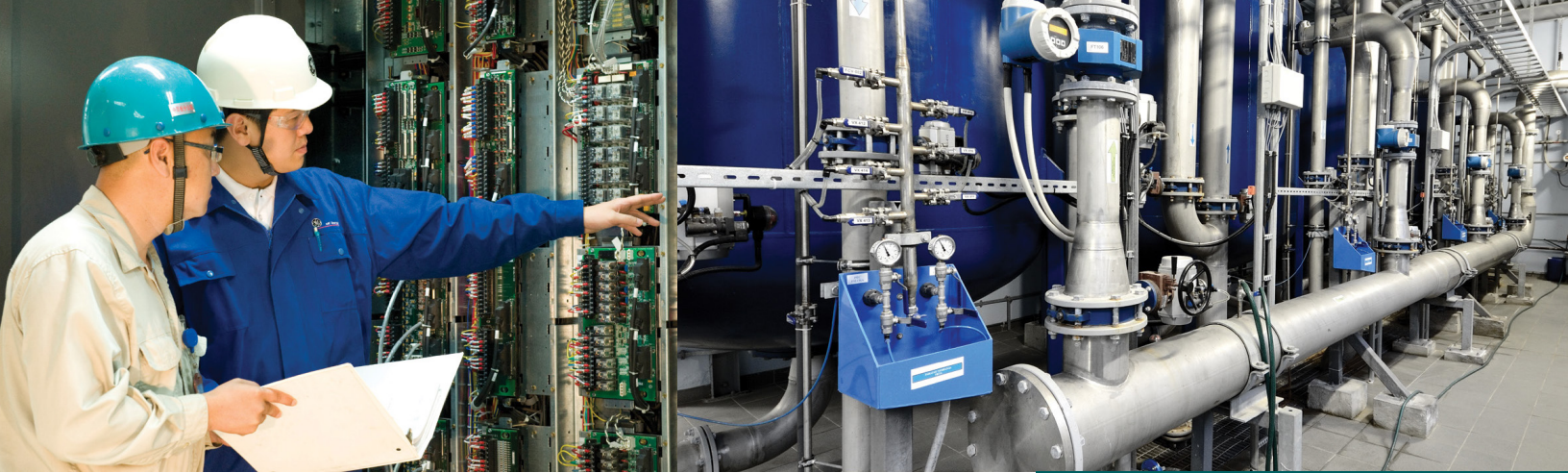
MARK* VIE

INTEGRATED CONTROL SOLUTIONS

ADVANCED PERFORMANCE, INTEROPERABILITY, AND AVAILABILITY FOR TODAY'S CONNECTED PLANT

GE's distributed control system solutions are easily adapted to the constantly evolving requirements of industries such as power generation, oil and gas, and chemical processing.





For businesses that are dependent on decades of uninterrupted machine service, a redundant control system that allows for online maintenance is critical. GE's distributed control solutions are designed to provide the high level of availability and flexibility necessary for today's most demanding applications.

Downtime is one of the greatest detriments to productivity and profitability. It is imperative to have a system in place that provides only the highest levels of system reliability and availability at all times. To meet the needs of today's connected industries, GE has combined its leadership of the Industrial Internet with its rich history of process control to deliver the Mark VIe Distributed Control System (DCS).

A COMPLETE SOLUTION

The Mark VIe control system is a flexible platform used in multiple applications. It features high-speed, networked input/output (I/O) for simplex, dual, and triple redundant systems. Ethernet based I/O can easily be distributed plant wide across all balance of plant applications. Industry standard Ethernet communications are used for I/O, controllers, and supervisory interface to operator and maintenance stations, as well as third-party systems.

The ControlST* software suite is used with Mark VIe controls and related systems for programming, configuration, trending, and analyzing diagnostics. The Distributed Control Solution (DCS) function library accelerates creation of balance of plant application logic. During runtime the system provides quality, time-coherent data in the controllers and at the plant level for effectively managing control system equipment.

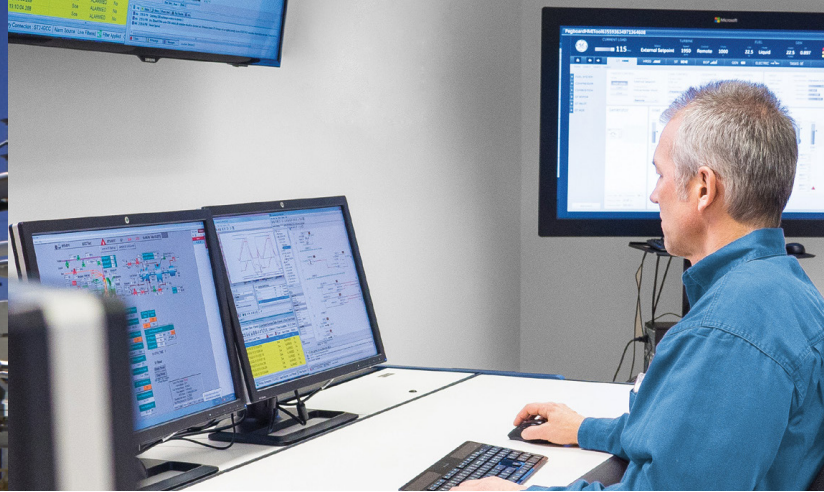
Safety is delivered through the Mark VIeS Safety Management Solution. Based on the Mark VIe platform, the Mark VIeS is a stand-alone safety control system for safety-critical applications that conform to the IEC®-61508 standard. The ControlST software suite simplifies maintenance while maintaining a unique set of certified hardware and software blocks.

The Mark VIe Distributed Control Solution delivers a seamless, integrated, balance of plant solution designed to perform in the extreme conditions found in industries such as:

- Power Generation
- Oil and Gas
- Chemical and Process
- Pulp and Paper
- Mining and Minerals Engineering
- Renewables

The Mark VIe Distributed Control Solution offers:

- A proven solution
- Flexible and highly scalable architecture
- Rapid equipment return to service time with best in class diagnostic tools
- Enhanced productivity and efficiency
- Seamless integration with primary control systems
- Comprehensive design and integration
- Robust maintenance and services offering



A COMPREHENSIVE APPROACH FOR CONTINUOUS OPERATIONS

Our tightly integrated distributed control solutions deliver robust process control with seamless connectivity and automated real-time information management to help you maximize uptime and productivity.

A proven solution

GE brings decades of domain expertise to the Mark VIe Distributed Control Solution. The Mark series of controllers has earned a reputation for superior running reliability in thousands of power generation and infrastructure systems installed globally. These proven philosophies are at the heart of the integrated Mark VIe Distributed Control Solution.

As a global leader in automation and control, within critical infrastructure applications, GE provides cyber security management as an inherent feature of the Mark VIe control family. It assists with the implementation of an effective security policy to ensure system confidentiality, integrity, availability, and providing real-time change monitoring and audit capabilities.

The proven and reliable Mark VIe control platform helps keep operations safe and secure through:

- Connected: 100% Ethernet at all levels
- Flexible: Distributed or centralized I/O
- Scalable: Designed to accommodate evolving systems and applications
- Reliable: Configure for simplex, dual, or triple redundant operation
- High Performance: Local process on each module, computing power grows as system expands
- Rugged: Hardware rated up to 70°C
- Secure: Achilles Level 1 certification

FLEXIBLE AND SCALABLE

Scalable redundancy

Redundancy is a critical feature in a distributed control system design, enabling continuous process operation during system maintenance or repair. The Ethernet backbone of the Mark VIe Distributed Control Solution allows each segment of the system to be configured with different levels of redundancy.

- Controllers can be : Simplex, Dual, or TMR
- IO network (IONet) Communications can be: Simplex, Dual, or TMR
- I/O Modules can be: Simplex or TMR

Every application has different requirements for redundancy depending on the criticality of the process. The Mark VIe control platform provides a wide range of redundancy options for local and remote distribution.

Communications to basic process control system

Industry-standard integration tools are available as plant network gateways and peer-to-peer controller communications for basic process control systems (BPCS).

Shared IO network with GE Mark VIe BPCS

Shared IONet permits sharing of data between Mark VIeS Safety I/O modules and Mark VIe basic process controllers using an Ethernet input/output network. This enables use of a single set of field instruments for both safety and basic process control, reducing the installation and operating costs of your distributed control system.

Reliability in harsh environments

GE understands that distributed control systems don't just reside in clean rooms. That's why the Mark VIe Distributed Control Solution provides high performance in the extreme conditions found in many process environments. The processors, network switches, and I/O components are approved for hazardous location, Class 1, Division 2 and the Mark VIe platform can operate in temperatures ranging from -30° to 70° C without fans or other external cooling. That means less downtime for your operations.



ENHANCED PRODUCTIVITY AND EFFICIENCY

Sophisticated application automation tools and seamless data integration between the control system, HMI and enterprise Manufacturing Execution Systems (MES) enable process efficiencies during project execution to reduce delivered cost and improve quality. Enhanced software usability features help maintain a cohesive control system strategy across your enterprise.

INTEGRATION WITH BASIC PROCESS CONTROL SYSTEMS

GE understands the importance of seamless integration between your DCS, safety and basic process control solutions, as well as the need to have quick access to time coherent real time or historical data across all systems within the plant. The Mark VIe platform offers flexibility, scalability, and common configuration based standards and operational interfaces to integrate with basic process control systems.

The Mark VIe platform enables real-time visualization by sharing data through the plant-wide control system, HMIs, data historians, device management systems, and enterprise trending tools.

Key personnel gain access to critical operational information, allowing them to make better, faster decisions to maximize performance while minimizing risk.

LIFECYCLE MANAGEMENT AND SUPPORT

Mark VIe product lifecycle management

The Ethernet-based distributed architecture of the Mark VIe Distributed Control Solution enhances connectivity and improves lifecycle management. It utilizes safe peer-to-peer Ethernet between controllers and I/O to deliver enhanced performance and simplify system design. IONet switches are engineered by GE for long life, extreme environments, and peak performance.

Using 100 MB Ethernet at all levels with execution speeds upwards of 10ms or downwards to 320ms configurable to meet the application needs, MarkVIe utilizes safe peer-to-peer connections between controllers and I/O to deliver enhanced performance and simplify system design. Hot swap capabilities allow for system maintenance without requiring system re-start or configuration downloads, maximizing process and plant uptime.

Functional safety lifecycle management support

For safety applications, Mark VIeS Safety Management Solution utilizes the exSILentia Safety Lifecycle Management Tool to analyze safety instrumented functions (SIFs) and calculate the safety parameters required for specific applications. This software helps customers achieve a new level of consistency and productivity in the design of safety systems.

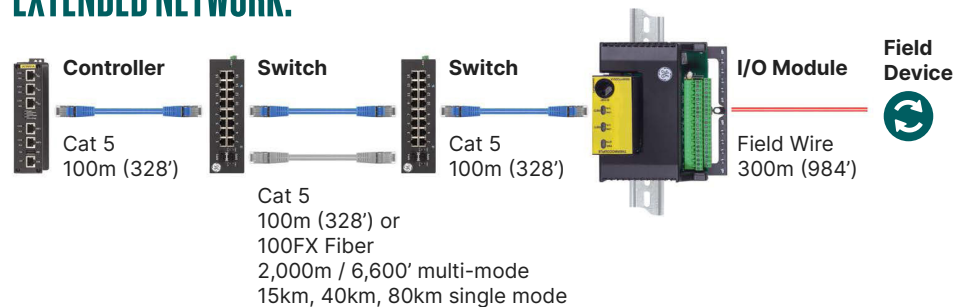
When analyzing a Safety Instrumented Function (SIF) with the exSILentia tools, the entire SIF is evaluated, encompassing sensors, Logic Solver and Final Element.

The functional safety parameters for the Mark VIeS components are incorporated into the logic solver portion of the Exida safety equipment database, enabling the tools to include these components in calculating the safety and operational characteristics for a SIF.

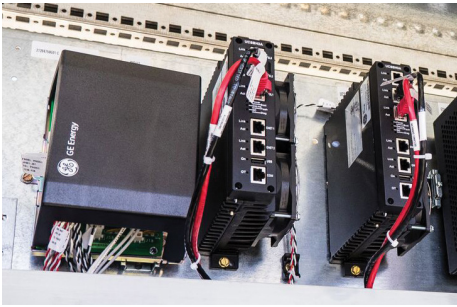
LOCAL NETWORK:



EXTENDED NETWORK:

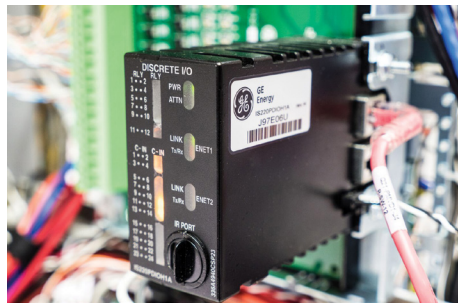


The distributed Ethernet architecture allows for enhanced connectivity and flexibility. Ethernet improves lifecycle management by enabling replacement or upgrade of individual components. The "future-proof" architecture of the Mark VIe platform enables a control system lifetime engineered to exceed expectations.



MARK VIe CONTROLLER

At the heart of the Mark VIe system is the controller that includes the main processor and triplicated Ethernet drivers to communicate with networked I/O, and additional Ethernet drivers for the control network. A set of two or three controllers can be used to provide dual or TMR control. The control logic can be programmed in a combination of function block diagrams (FBD), Sequential Function Chart (SFC), and relay ladder logic (RLD). A real-time operating system executes this control logic and interfaces with the I/O system. In each frame, the controllers read data from the input modules, write data to the output modules, and synchronize variables between controllers in a dual or TMR configuration.



MARK VIe I/O MODULES (I/O CARD & PACK)

Mark VIe I/O modules have three common components: a termination block for field wiring, a terminal board, and I/O pack(s). Modules are DIN rail mounted. Wide gauge wiring eliminates marshalling and lowers costs. Each I/O pack contains two IONet ports and a local processor with a real-time clock synchronized for 1ms time-stamping in the sequence-of-events (SOE) function available on all discrete inputs and outputs. This feature allows customers to select SOE with the click of a button, without the complexity and expense of dedicated SOE hardware or programming special logic into application code. I/O diagnostics and voting are performed at the pack level.

Simplex I/O modules have one I/O pack mounted on the terminal board; TMR I/O modules have three I/O packs mounted to a common terminal board. I/O redundancy is a single selection during hardware configuration, and is transparent to the application code.



IO NETWORK (IONET)

The IO network is a dedicated, full duplex, point-to-point protocol. It supports a deterministic, 100 MB communications network suitable for local and/or distributed I/O modules. IONet switches are a GE design, incorporating extreme environmental capability with superior performance. Standard network protocols such as Profinet, Modbus, Profibus and Foundation Fieldbus can be seamlessly integrated into the Mark VIe system.

VIRTUAL MARK VIe CONTROLLER

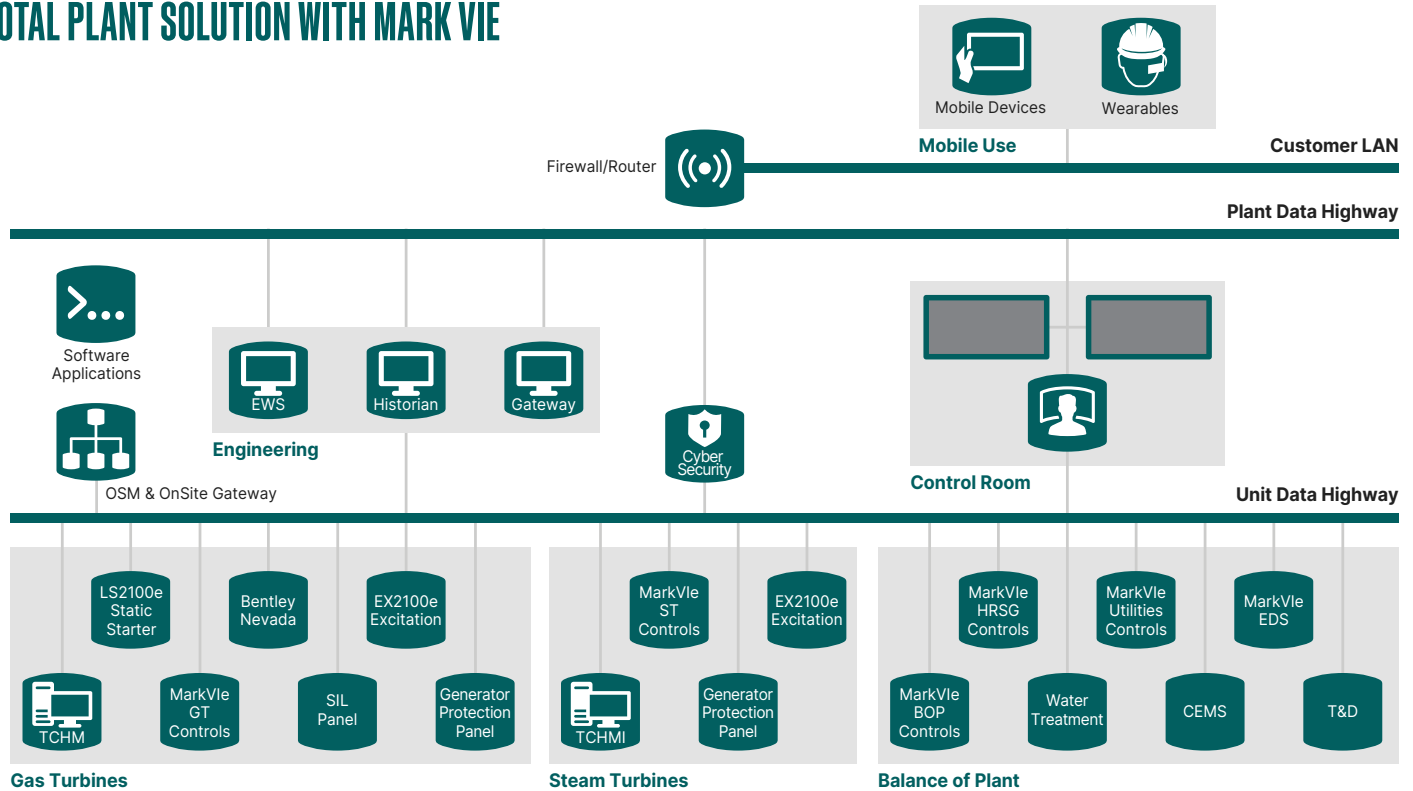
For training and validation, simulation of the process and associated control can be invaluable.

The Virtual Mark VIe provides a virtual, PC-based form of the controller supporting:

- Testing of application program
- Communication interface with ToolboxST application
- Ethernet Global Data (EGD) services
- Process alarm management



TOTAL PLANT SOLUTION WITH MARK VIe



DISTRIBUTED CONTROL MADE EASY

The combination of a single board controller and Ethernet-based I/O network has enabled the Mark VIe and Mark VIeS to support numerous distributed control modes for your plant applications.

Flexible - Scalable Architecture:

- Advanced technology controller with generic IO
- Selectable redundancy options
- Time Coherent Sequence of Event data for all equipment

Common Platform:

- Same hardware and software platform as Turbine-generator
- Eliminate turbine to DCS interface, reduce wiring, improve start-up

Cost Effective - Easy to use:

- Reduce spare parts inventory
- Reduced maintenance and training costs

Reliable:

- 30+ years of proven track records

Industry Codes and Standards

Code - Standard	Mark
CAN/CSA-C22.2 No. 61010-1-12	
UL Std. No. 61010-1 (3rd Edition)	
EN 61010-1 (3rd edition)	
IEC® 60529 Intrusion Protection Codes IP20 minimum (NEMA 1)	
Electromagnetic Compatibility Directive (EMC) 2014/30/EU	
Achilles Level 1 certification, controller security	
DEMKO 13 ATEX, application dependent	
IECeX	
CCC	
UKCA	
ISO 9000	

Safety System Related Codes and Standards

Code - Standard	Mark
CAN/CSA-C22.2 No. 61010-1-12	
UL Std. No. 61010-1 (3rd Edition)	



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GEA35310 (07/2023)