

Overview

PAC8000 Hybrid Control provides a fully integrated solution for process control, logic automation and strategy development. PAC8000 Hybrid Control provides a process engineer with the tools to design, implement, document, and maintain a process control system using advanced control strategies. PAC8000 Hybrid Control consists of a number of open system components.

- ◆ The PAC8000 Hybrid Workbench is an integrated development environment that centralizes and coordinates project data including instrument indexes, control strategies (process and logic) and project management. It configures the control logic and generates an export database to create the operator (HMI) database.
- ◆ A rugged field-mountable Control Platform, consisting of the PAC8000 Hybrid controller (8521-HC-MT) and the 8000 Process I/O system.

Applications

PAC8000 Hybrid Control is designed to satisfy the process automation market, which includes industries like: power generation and electrical distribution, food and beverage, chemicals and petrochemicals, water and waste water, oil and gas pipelines, cement and pulp and paper. PAC8000 Hybrid Control, with its simultaneous support of both process and logic automation strategies, is an ideal solution for process applications that may also require some sequential logic control in a process environment.

PAC8000 Process Control

PAC8000 Process Control is an open, easy-to-use process control engineering and management solution that delivers comprehensive, distributed control system functionality. PAC8000 Process Control is a fully integrated advanced process control and instrument engineering system offering configuration tools, modeling, simulation, troubleshooting utilities, project drawing management and self-documentation. It is a robust solution that provides the flexibility to configure control systems ranging from a few loops to thousands of points. A flexible, scalable design allows cost effective system expansion. In addition, the system's extensive use of industry standards simplifies integration with other applications.

PAC8000 Logic Control

The PAC8000 Hybrid Workbench is your complete tool kit for creating IEC 61131-3 programs. The Workbench fully supports the five IEC 61131-3 automation languages - Ladder Diagram (LD), Sequential Function Chart (SFC), Function Block Diagram (FBD), Structured Text (ST), Instruction List (IL) - plus Flow Chart and is used to develop, download, simulate, debug, monitor, and edit application programs. PAC8000 Logic Control lets you mix programming languages in the same project. Its true Windows interface will guide you through development of your project. The Workbench Simulator will test your programs before startup. Then use the Workbench to dynamically view programs as they run in real-time and make changes on-the-fly.

PAC8000 Control Platform

The PAC8000 controller executes your control strategies and manages all control activities for the I/O modules. It also manages communications on the control network. The controller provides a tight control loop response, providing a control output in response to input data within 100 ms. The controller incorporates a rigorous redundancy model, fieldbus integration for connecting to HART® and a fault tolerant ethernet implementation to deliver reliable system operation in your application. The controller can concurrently execute both PAC8000 Process Control strategies for process control and an IEC 61131-3 control language for logic control applications.

PAC8000 Remote I/O

Remote I/O can be used with PAC8000 controllers, allowing you to further distribute control capability in your plant. Connected with an Ethernet Bus Interface Module (EBIM), Remote I/O communicates with the controller using high-speed peer to peer communications. The Workbench configures both Remote I/O and local I/O in the same way, providing a fully integrated Remote I/O solution.

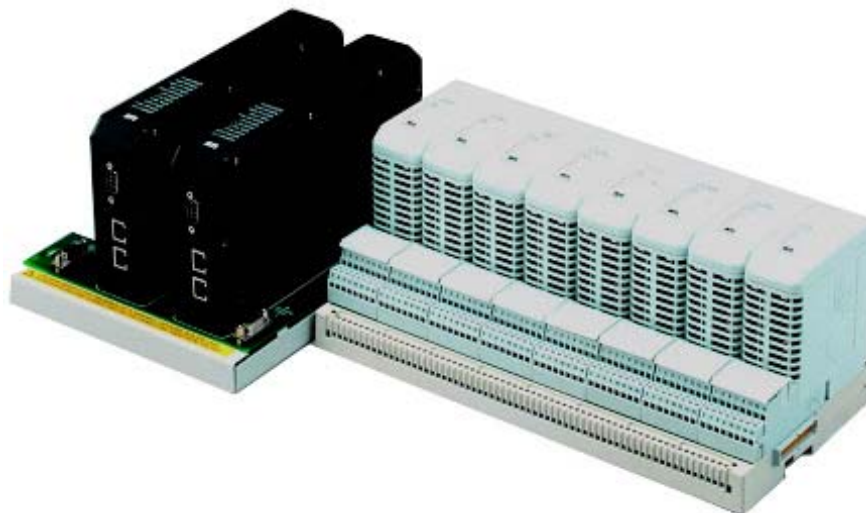
The PAC8000 Control Platform and Remote I/O are built for harsh process applications, operating over the industrial -40°C to $+70^{\circ}\text{C}$ temperature range that is typically associated with field transmitters and meeting ISA's stringent G3 corrosion resistance requirements. The Controller and I/O solution can both be mounted directly in Division 2 /Zone 2 hazardous areas and, when required, can provide a cost effective intrinsic safety solution.



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Because the system can be mounted in the field, it can also provide extensive cost savings by eliminating the need to wire all sensors back to a central controller. With the PAC8000 Controller and its I/O mounted in the field, the only wiring back to a control room is the high-speed control network.

Redundant PAC8000 Controllers

PAC8000 Hybrid Control offers extensive redundancy choices to provide you with several options to assure that your system provides the required system availability, including:

- ◆ Redundant controllers
- ◆ Control networks
- ◆ System power supplies

Peer to Peer Communications

PAC8000 Controllers can communicate with each other on a peer to peer basis, enabling controllers to share data with each other. This capability assures that critical information can be efficiently shared between controllers instead of requiring data to be passed to each controller from the control room.

Benefits Cost saving solution

PAC8000 Hybrid Control takes advantage of Windows 2000 & XP based object-oriented technology, graphical user interfaces and easy to learn software solutions to reduce process control system life cycle expenditures by 30–40%.

One Step Engineering

PAC8000 Hybrid Control eliminates expensive, laborious, and sometimes error prone manual engineering work typically required

during control projects. Manual generation of design documents, bill of materials and wiring diagrams is eliminated. Similarly, repetition of advanced control strategies is no longer necessary; eliminating re-entry of program information and significantly reducing system configuration time. The Workbench configures the control logic and generates and export table that is used to create the operator interface database for many popular HMI packages.

On-line changes

PAC8000 Hybrid allows on-line configuration changes during testing, start-up, and maintenance phases. This significantly accelerates system start-up and reduces operation downtime. It is easy to configure the control project in a single step and automatically generate the point data-base.

Comprehensive Self-Documentation

PAC8000 Hybrid Control automatically generates as-built system documentation including I/O configuration reports, cross reference analysis, bill of materials, instrument index, system start-up, maintenance information and wiring diagrams. Since the drawings are used to develop the control strategy, they are continuously maintained, as the final control strategy is adjusted to an optimum level. You no longer need to update the documentation at the end of the project to assure that it reflects the actual plant configuration; the system drawings are automatically kept current, providing you with significant time savings.

Bussed Field Power

This is a unique, flexible feature that allows field circuits to be powered with a minimum of wiring and termination effort. A single power supply connection to the module carrier can supply two I/O modules (up to 32 channels), without the need for "daisy-chaining" at the field terminals.

Built-in diagnostics

Extended diagnostics are available to provide module and channel status information, including high and low alarm, open circuit detection and line fault detection at the device level and "fail-safe" performance at the module level.

Reduced cable costs

Instrumentation cable pairs terminate locally instead of being run across the plant to the control room. Heavy, expensive sensor cables are replaced by the LAN cable.

Reduced termination costs

Field wiring goes directly to the I/O terminals in the local field enclosure. This means there is no additional cross wiring to marshalling panels.

Flexible system design

Combine analog and logic modules for maximum flexibility and use of space.

High system availability - easy maintenance

Maximize up-time through use of redundant PAC8000 controllers, power supplies and network connections. "Hot swap" modules without affecting system operation or re-configuring, even in hazardous areas.



PAC8000 Hybrid Controller

PAC8000 Hybrid Controller

8521-HC-MT

8000 Process I/O™ hardware

Overview

8000 is a completely modular I/O solution for both general purpose and hazardous area applications. It is based on a carrier system that supports a range of modules and offers a wide variety of I/O functions, including AC mains and intrinsic safety signals, even within the same node.

I/O Modules

I/O modules transfer signals to and from field instruments. Input modules receive signals from transmitters and sensors and convert them into a digital form for presentation to the Controller.

Output modules receive commands from the Controller and transfer them to

actuators. A wide range of modules is available, including types for low-level instrumentation, AC mains and intrinsically safe signals, I/O modules



typically have 4, 8 or 16 field channels.

Field terminals

Field terminals provide the interface between the I/O modules and the field wiring. They include fusing and loop-disconnect as options. A mechanical keying system prevents an I/O module from being connected to the wrong type of field terminal. Field terminals

mount onto the module carrier, one to each I/O module. They are clamped firmly by the

I/O module to form an electrical and mechanical assembly of high integrity. They may be replaced in service without removing carriers or disturbing the operation of other modules.



Carriers form 8000's physical and electrical backbone by providing a mounting to support and interconnect the controller, power supplies, I/O modules and field terminals, and carry the address, data and power lines of the internal Railbus. They provide termination points for the LAN and to the I/O modules. I/O module carriers are available to support four or eight I/O modules.



System power supplies

System power supplies are available for the node to convert local AC or DC supplies to power the node or provide field power for I/O modules. 8000's innovative Bussed Field Power scheme for distributing field power avoids complex wiring at the field terminal and minimizes the carrier wiring.



The benefits from this approach are: · reduced commissioning time and cost · reduced process downtime through status monitoring · power loop maintenance costs by using field device diagnostics

8000 in your system

Each PAC8000 node can address up to 64 I/O modules which, depending upon the number of channels per module, can provide up to 1024 I/O points at a single node! A node can consist of a mixture of analog and discrete modules and this gives maximum flexibility to the system designer. Full HART pass-through is provided - the 8000 appears "transparent", allowing the inquiring "agent" to access the HART capabilities of field instruments. GE Fanuc recommends placing no more than 25 nodes on the subnet of a network.

Redundancy options

8000 has been designed to increase availability and minimize downtime. Redundant controllers, LAN Channels and power supplies can be specified as options to increase system availability. Possible down-time is further reduced by ensuring that the system components using active circuitry can be removed and replaced quickly and easily. Even the field terminals can be replaced without interrupting the operation of adjacent I/O modules. Carriers have no active circuitry and are unlikely to need replacement.

Hazardous area applications

The 8000 is a truly field mountable system even in areas where flammable gases are present. It is available in versions to suit different area classification schemes:

a) Equipment and field wiring located in general purpose areas, Class 1, Division 2 hazardous locations or Zone 2 hazardous areas.

b) Equipment mounted in general purpose areas, Class 1, Division 2 hazardous locations or Zone 2 hazardous areas, with field wiring located in Division 1 hazardous locations or Zone 0 hazardous areas.

Carriers



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8000 with general purpose field wiring

Many industry applications do not present an explosion risk from gas or dust hazards. In others, the environment may be classified as a Zone 2 or Division 2 hazardous area, where flammable material is expected to occur only in abnormal conditions. For both of these the 2/2 system provides effective distributed I/O for process control. 8000 supports a full range of I/O module types covering inputs and outputs for both analog and discrete circuits. The node can be mounted out on the plant in a suit-able enclosure providing protection against the environment. Figure 1 shows a node containing all the key components: a PAC8000 Controller, I/O modules on their carriers and a pair of carrier-extenders linked with an extension cable.

8000 with intrinsic safety field wiring

The 8000 Process I/O System is capable of supporting I/O modules with intrinsic safety (IS) field wiring, for connection to certified or 'simple apparatus' field devices in Division 1 or Zone 0 hazardous areas (see Figure 2). A range of I/O module types with IS field circuits for industry-standard DI, DO, AI and AO applications is supported.

I/O modules with built-in protection

All voltage and current-limiting components required for IS protection are incorporated within the I/O module housings, so no external, add-on Zener barriers or galvanic isolators are necessary. IS field terminals are distinguished from other types by blue coloring of the terminal housing. A unique and sophisticated mechanical keying mechanism prevents modules with different protection techniques from being interchanged, so that potentially explosive or damaging conditions cannot occur.

Integrated power supplies

Power for IS I/O modules is derived from integrated, modular power supply units. Each power unit is capable of supplying between eight and twenty I/O modules, depending on the I/O type and mix. Optional power supply redundancy is supported by means of an additional, redundant supply unit connected in an 'n+1' arrangement. In applications with mixed IS and non-IS field wiring, the full facilities of the 'Bussed Field Power' regime are retained for the non-IS part of the system. In nodes populated only with IS I/O modules, a separate system power supply

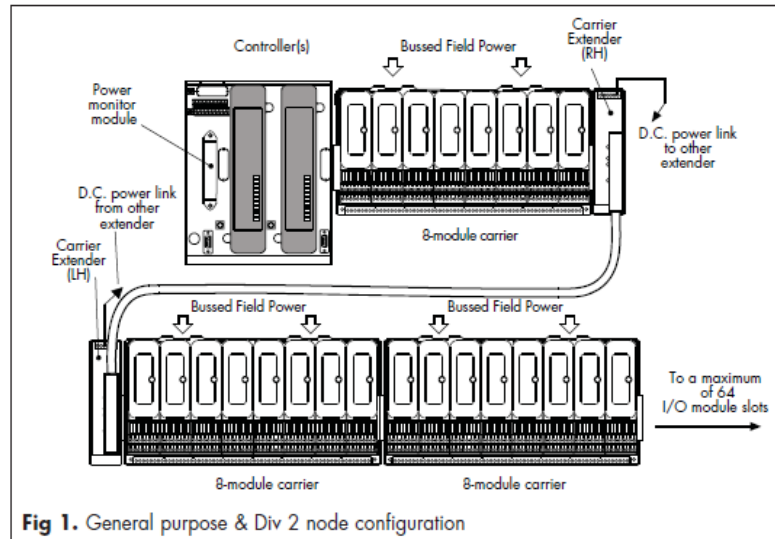


Fig 1. General purpose & Div 2 node configuration

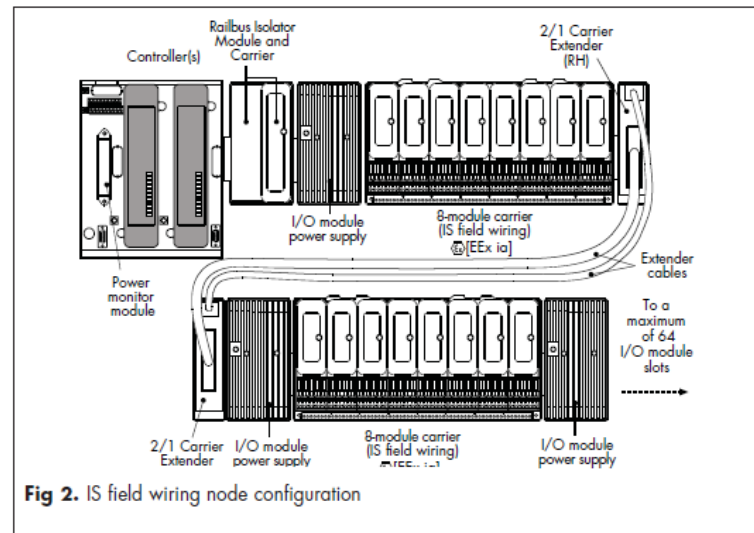


Fig 2. IS field wiring node configuration

module provides power for the Bus Interface Module and 'node services'. Redundancy of this supply is also supported.

Mixed I/O types within a single node

IS and non-IS field wiring types can also be incorporated within one 8000 node. In this arrangement, the two parts of the node are separated by a 'Railbus Isolator' module. The Railbus Isolator provides a section of internal communications bus ('Railbus') for the IS I/O modules which is protected from invasion by damaging fault voltages. Uniquely, a single 8000 node (under the command of one Bus Interface Module) can then support a mixture of certified IS field devices, certified Division 2 or Zone 2 field devices and general purpose I/O, including AC mains circuits. Only one Railbus Isolator is used per 8000 node.



PAC8000 Hybrid Controller

PAC8000 Hybrid Controller

8521-HC-MT

- ◆ *powerful, robust controller for advanced control strategies*
- ◆ *PAC8000 Strategy Builder for process control applications*
- ◆ *IEC 61131-3 software for logic control applications*
- ◆ *process & logic control strategies execute concurrently*
- ◆ *redundant controllers with bumpless transfer*
- ◆ *dual redundant high speed Ethernet connections*
- ◆ *field mountable in harsh process environments*
- ◆ *peer to peer communications between controllers*
- ◆ *on-line configuration and reconfiguration*
- ◆ *HART® passthrough of process and status variables*

Open control platform

The PAC8000 Hybrid Controller is a powerful process controller that can receive, store and execute process strategies and sequential or discrete logic applications concurrently. The controller provides a tight control loop response, providing a control output in response to input data within 100ms. The controller communicates at 10/100MB/second, providing very efficient communications and assuring the system has the capacity for advanced control strategies.

Controller redundancy

Redundant controllers can be used for critical control applications. The redundant controller pair operates in parallel, checking status multiple times through the processing loop enabling the backup controller to continuously monitor the health of the master controller, assuring a rapid and bumpless transfer to the standby controller.

Network redundancy

In addition to controller redundancy, the PAC8000 Controller has two high speed Ethernet ports to provide security of communication. Each port can be connected to an independent LAN which is continuously monitored for its integrity. If the primary port detects a network failure, traffic is immediately switched to the other LAN to maintain full communication.

Executable control programs

Control programs are downloaded to the PAC8000 Controller to provide process control with PAC8000 Strategy Builder and logic control with IEC 61131-3 compatible programming languages. The control programs are held in non-volatile memory to enable them to be restored automatically after power cycling of the controller. The use of a redundant controller also enables a new control program to be downloaded to the standby unit while the process continues. When the download has been completed and verified, the standby can be switched to master status to employ the new program.

Remote Modbus Devices

The PAC8000 Logic Controller communicates via Modbus TCP over Ethernet and can operate in either Modbus Master or Modbus Slave mode to communicate with remote Modbus devices. Each controller also has 2 serial ports that can be configured as a Modbus Master to control and obtain information from Modbus Slaves and other serial devices, such as weigh scales, barcode readers, etc. The serial ports can also be configured as a Modbus Slave, accepting write commands from Modbus Master devices and providing information on its data registers.

Failsafe and automatic cold start

In the event of complete loss of communication the controller will adopt a user-defined failsafe mode and similarly instruct the I/O to take up user-defined failsafe attitudes. In the event of power loss the PAC8000 Controller will perform a cold restart which restores the program(s) and assume a predefined status.



Peer-to-peer communications

PAC8000 Controllers can communicate with each other on a peer to peer basis, enabling controllers to share data with each other. This capability assures that critical information can be efficiently shared between controllers instead of requiring data to be passed to each controller from the control room.

I/O module configuration

The PAC8000 Controller receives full details of all the I/O modules under its control and stores the information in non-volatile memory. At startup the controller downloads to the modules their configuration details, which also include the failsafe states they should adopt in the event of communication failure.

Firmware updates

In keeping with its ability to maintain operations on a continuous basis, a redundant PAC8000 Controller is also capable of receiving a firmware upgrade. In a manner similar to that used for strategy updates, a controller can receive an update to its firmware while in the field. When the upgrade has been confirmed as successful the controller can be returned to full operation as a master or as a protective standby.

HART® pass-through

The PAC8000 controller has the ability to pass smart HART information from field devices to a separate PC workstation, which allows you to readily interface to asset management software applications, to remotely manage the HART information contained in your HART based, field instruments. It works with a variety of asset management packages, including Applied System Technologies' Cornerstone Software or Emerson's Asset Management Solutions. HART passthrough is supported via a serial port and will soon be available over the Ethernet Control Network. Consult the factory for availability of the Ethernet solution.

Environmental stability

Like all of the 8000 series equipment, the PAC8000 Controller is designed for use in harsh environments. It operates over a temperature range of -40°C to +70°C and is resistant to shock, vibration and corrosive environments.

Hazardous area operation

The PAC8000 Controller is designed also to operate in Class I, Division 2 and Zone 2 hazardous areas and can control I/O modules that have field wiring extending into the more hazardous Division 1 and Zone 1 and Zone 0 areas.

Grows as your needs grow

The PAC8000 Hybrid Control System is scalable to your needs. You can add modular I/O to your system as your needs increase. Redundant controllers can be added without the need to power off your system -the backup controller powers up automatically and is



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PAC8000 Hybrid Controller

PAC8000 Hybrid Controller

seamlessly brought online. Don't worry about expanding your system software; your original PAC8000 Hybrid Workbench can address all of your software needs.

Maximum number of nodes

Multiple PAC8000 controller nodes can reside on the same network allowing peer-to-peer communications, as explained above. However, too many nodes can degrade performance, so GE Fanuc recommends placing no more than 25 nodes on the same subnet of a network.

The **PAC8000 Hybrid Controller 8521-HC-MT** contains two powerful embedded software environments that will run executable files downloaded to it from the Workbench.

PAC8000 Process allows the controller to perform the functions of process automation while **PAC8000 Logic** is intended for logic automation applications.

PAC8000 PROCESS OVERVIEW

PAC8000 Process is a process control engineering and management software solution with full distributed process control system functionality. The system is a fully integrated advanced process control and instrument engineering system offering configuration tools, modeling, simulation, troubleshooting utilities, project drawing management and self-documentation.

PAC8000 Process is an open, easy-to-use, robust system providing the flexibility to configure control systems ranging from a few loops to thousands of points. The user can also scale their design allowing cost effective system expansion. In addition, the system's extensive use of industry standards simplifies integration with other application.

Note: For users interested in process applications only, the **8521-PC-MT** PAC8000 Process Controller is available. This is the same physical controller but containing only the PAC8000 Process application. This controller can be programmed with the PAC8000 Process Workbench or the PAC8000 Hybrid Workbench.

PAC8000 Process Workbench

PAC8000 Workbench consists of modular software building blocks that are integrated into a process control solution. The system comprises two integrated components; the Instrument Index and the PAC8000 Strategy Builder.

Instrument Index

The Instrument Index is used to model the process systems input/output by assigning controller, module and point destinations. Using a predetermined template, this task is accomplished as a simple "fill in the blanks" procedure. The Instrument Index uses this information to build the I/O configuration data file. This data file will subsequently be used to cross-link the point attributes to the algorithms on the process control diagrams.

PAC8000 Strategy Builder

Process control logic diagrams are developed using the PAC8000 Strategy Builder. The control strategy is built by selecting the appropriate blocks, assigning symbolic tags, and then connecting the blocks with analog or digital lines, using standard drawing forms and commands. SAMA style drawings define all the functions and parameters that form a process loop. Function block choices include; manual/auto station, function generators, pulse controllers, sequencers, bumpless transfers, PID and other standard function blocks. To further reduce development time template diagrams can be created and reused within the current project or another future

project. For example, a cascade loop can be created and saved for repetitive use to generate additional control loops. When the drawing model is completed, the project diagrams are cross-linked with the I/O database to create:

- ◆ Comprehensive control system engineering documentation.
- ◆ Advanced control strategies.
- ◆ Operator interface database, alarms and faceplates.
- ◆ System maintenance tools.

There is no need to review function block codes, re-enter tags, generate spare parts listings, or match control logic to the operator interface. This allows the user to concentrate on designing control strategies and eliminate the repetitive tasks.

Project Components

In addition to these key design features, PAC8000 Hybrid Control has a wealth of tools and features that simplify the management of the project and provide easy to use interfaces for the user.

Comprehensive Self-Documentation

PAC8000 automatically generates as-built system documentation including I/O configuration reports, cross reference analysis, bill of materials, instrument index, system start-up, maintenance information, and wiring diagrams. The instrument index provides instrument details such as manufacturer, model number, group number, shift and day log, panel wiring information including panel in/out terminal block and panel in/out position, and field wiring information including cable color, size and type.

Database and Tag Import utility

The system generates the appropriate database, tag attributes and alarm parameters. The Tag Import Utility can be used to import a tag list that is already defined in a spreadsheet format. The utility imports a .csv, tab or space separated file directly into the Workbench, saving the need to manually recreate this information if it already exists.

Advanced Control Strategies

The system automatically configures control solutions from straightforward single loops to advanced control strategies. With over sixty process control algorithms, PAC8000 has the solution; whether for regulatory, logic or sequential control. The algorithms provide the logic and analytic functions for complex control strategies such as feed forward, cascade, and multi-variable control. Functions are provided for easily configuring biased multi-output loops as found in steam and water header pressure control. The system automatically accounts for different device capacities, devices in service, and devices in automatic mode. Adaptive tuning functions for PID control is supported. Two and three state device drivers provide the functionality for motor and valve operations with failure alarms, local and remote operation, and interlocks. Sequential step functions with interlocks and first out functionality are easily configured. The system automatically assigns controller addresses, optimizes controller communications and provides I/O card and point alarm status. By supporting portability between alternative open controller platforms, PAC8000 provides considerable flexibility in specifying system hardware.

On-line Maintenance, Tuning and Troubleshooting

Savings in time and system costs are not limited to initial development and start-up. The system provides suggestive tuning capabilities, on-line and off-line control configuration, and intelligent control



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schematics from which the system can be modified and tuned.

PAC8000 Simulator

The PAC8000 Simulator allows the animation of logic diagrams with either simulated data or live, real-time process data. The Simulator is also used for tuning and operator control purposes. I/O diagnostic tags are provided for the operator interface for troubleshooting assistance. Verification of control loop integrity and troubleshooting loop problems can be accomplished quickly and efficiently.

PAC8000 LOGIC OVERVIEW

PAC8000 Logic is a 32-bit software application for distributed control applications. It supports all five IEC 61131-3 languages: Ladder Diagram (LD), Structured Text (ST), Instruction List (IL), Sequential Function Chart (SFC) and Function Block Diagram (FBD), plus the Flow Chart (FC) language

The PAC8000 Hybrid Workbench is used for creating and editing the control code, for simulation, debugging, and on-line monitoring. The code generated by the Workbench is then downloaded to the PAC8000 Controller.

Note: For users interested in logic applications only, the **8521-LCMT** PAC8000 Logic Controller is available. This is the same physical controller but containing only the PAC8000 Logic application. This controller can be programmed with the PAC8000 Logic Workbench or the PAC8000 Hybrid Workbench.

PAC8000 Logic Workbench

The Workbench contains a powerful project management tool that graphically represents and organizes programs, resources, configurations, and networks within a project.

The Workbench provides powerful and intuitive graphical and textual editors. Docking toolbars and resizable split windows, drag-and-drop and cut-and-paste are all implemented to enhance ease-of-use.

The Ladder Diagram (LD) is one of the PAC8000 familiar methods of representing logical equations and simple actions. Contacts represent input arguments and coils represent output results. Each block in the selection list has a description text.

The Structured Text (ST), is a high level structured language with a syntax similar to Pascal but more intuitive to the automation engineer. This language is mainly used to implement complex procedures that cannot be easily expressed with graphical languages. The ST text editor guides the user to the correct syntax and punctuation and provides the best validation and programmer assistance facilities.

The Instruction List (IL) is a low-level language, similar to the simple textual PLC languages. IL is a register-level programming language. PAC8000 Logic has a set of more than 60 IEC functions and function blocks. Users can enlarge this set by writing functions and function blocks in the LD, FBD, ST, and IL languages.

The Sequential Function Chart (SFC) language divides the process cycle into a number of well-defined steps, separated by transitions. The Workbench fully supports graphical Function Chart programming, which is familiar to many engineers.

Function Block Diagram (FBD) is a graphical language which allows the user to build complex procedures by taking existing function blocks from the Workbench library, and wiring them together on screen. The FBD editor allows manual input of variables. The diagrams can be zoomed to view the whole diagram or specific areas in more

detail. User can mix LD and FBD programming in the same chart.

The Flow Chart is an easy to read decision diagram where actions are organized in a graphic flow. The Flow Chart Editor has full support for connectors and sub-programs.

The development process begins with the division of a project into several PLC Loops, also called Resources, identifying their host hardware platforms, and defining the links between them. The physical division of a project is represented by configurations and communications networks. A Configuration represents a hardware platform which contains a single resource.

Program development process

A resource contains several programming units called Program Organization Units (POUs). POU's can be programs, functions or function blocks. Programs can be described in any of the five IEC 61131-3 languages plus Flow Chart.

Linking variables to I/O channels

Before defining the project code, the I/O is defined in the Workbench in the form of a tag database, which identifies the I/O channels and their respective field devices. Once a device is selected, a simple mouse-click 'connects' a variable to a channel.

The Build

To validate the project, the project code must be built. This step is also very useful for syntax checking; all detected errors can be easily located with a simple mouse-click. The generated code is fully publicly documented and supported. The code generator produces the code for each resource.

Simulation

Simulation enables the validation of the project without any hardware. Each resource can be executed cycle-by-cycle, and various system variables, such as the cycle time, can be monitored. Any variable can be monitored or forced.

For debugging with real platforms, or to perform maintenance operations on 'live' systems, changes can be downloaded on-line without stopping the running resources. During the testing phase I/O devices can be set as virtual, if the PAC8000 Controller is not completely ready, or is unavailable to the programmer. Function block instances can be directly debugged from editors. The workbench is intuitive and user-friendly, but to further assist the user, PAC8000 Logic provides HTML-based cross-referenced on-line help system that includes a complete language reference.

The Workbench also offers a document generator. Project items are shown as a tree, the table of contents of the project documentation can be customized by a simple click on each item.

To allow re-use of code, libraries of IEC functions and function blocks can now be developed. Functions and function blocks are designed and tested as in any other projects, but other projects can be linked to these "library project" to allow the use of their functions and function blocks. Once a "library project" has been selected, its blocks can be selected as standard blocks. As libraries, import/export functionality allows the sharing of POU's between projects. It is also a comfortable way to integrate the work of several programmers to constitute the final project.

The Control System

Each downloaded application is a complete distributed application running on the target controller. Multiple applications, running on separate controllers, can be linked together using the peer to peer tool, which identifies tagnames for use across the network. This data exchange mechanism provides a very efficient way of sharing



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PAC8000 Hybrid Controller

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information between multiple controllers.

Project backup and restore

You can create a backup file of your project at any time. This useful feature enables you to save your application in a known state, and if necessary, restore the project to that state. You can import and export resources from one project to another, enabling you to re-use prior work. If the results of importing or exporting resources are unsatisfactory, you can choose to restore the project.

Downloader

The Workbench Downloader is used to download the firmware and control strategy to the controller. With Redundant Controllers, strategy changes can be downloaded to a backup controller without disrupting control in the primary controller. When the download is complete, the backup controller will take over control and update the primary controller with the changes. Control can revert back to the primary controller after these changes are incorporated. Downloading to a simplex controller can be done on-line and without initializing data, the new strategy starting on the next execution cycle.

Remote data table builder for Modbus import

The remote data table is used for connecting to remote Modbus master or Modbus slave devices. Tagnames are assigned to these devices, which are then included in the control strategy. An example of a remote Modbus device is a Modbus TCP compliant H1 Linking device that could be used to bring Foundation Fieldbus H1 data into the control system.

PAC8000

The mission of GE Fanuc is to design, manufacture and distribute modular, open hardware and software technology-based components for use in the PAC8000 demanding real-time system applications. These field-proven components can be "snapped" together to create sophisticated control systems.

CONTROLLER SPECIFICATION

See System Specification for other parameters

LAN INTERFACE

Transmission medium.....100BaseTX or 10BaseT Ethernet
Transmission protocolModbus over High Speed Ethernet
Transmission rates10 - 100 Mbits/s
LAN connector type (x2)RJ45 (8-pin)
LAN Insulation (Dielectric withstand).....1500 V
Action on software malfunction Halt CPU / Reset CPU
Max. nodes on a subnet of a network25

SERIAL INTERFACES (COM 1 & COM 2)

Transmission rates..... 1.2 - 115.2 kbits/s (async.)
Transmission standardRS485 half-duplex
COM 1 connector (on carrier) 9-pin D-type connector (F)
COM 2 connector (on controller) ..9-pin D-type connector (M)

HART® is a registered trademark of the HART Communication Foundation. FOUNDATION™ is a trademark of Fieldbus Foundation, Austin, TX. Modbus® is a registered trademark of Schneider Automation Inc., North Andover, MA.

POWER SUPPLIES

ORDERING INFORMATION

Controller

Order using the following part number:

PAC8000 Hybrid Controller8521-HC-MT

(This Controller includes PAC8000 Process and PAC8000 Logic control software)

Other available options are:

PAC8000 Process Controller 8521-PC-MT

(This Controller includes PAC8000 Process control software)

PAC8000 Logic Controller8521-LC-MT

(This Controller includes PAC8000 Logic control software)

PAC8000 Ethernet BIM..... 8521-EB-MT

(Used for Remote I/O option with any controller)

Workbench

Workbench software is required to configure the control strategy for each controller.

PAC8000 Hybrid Workbench8459-HC-MT

(Will configure PAC8000 Hybrid, Process and Logic controllers and PAC8000 EBIM)

Other available options are:

PAC8000 Process Workbench 8459-PC-MT

(Will configure PAC8000 Process controllers and PAC8000 EBIM)

PAC8000 Logic Workbench8459-LC-MT

(Will configure PAC8000 Logic controllers and PAC8000 EBIM)

Voltage..... 10.9 - 12.6 V dc

Current.....0.4 A (typ.)

..... 0.5 A (max.)

Railbus (12 V) via carrier.....15 mA (max.)

HAZARDOUS AREA APPROVALS

Location of controller..... Zone 2, IIC T5 hazardous areaor
Class 1, Div 2, Groups A, B, C, D T5 hazardous location

Applicable standards:

- ◆ Factory Mutual Research Co., Class No. 3611 for Class I, Division 2, Groups A, B, C, D hazardous locations
- ◆ CSA Std C22.2 No. 213 for Class 1, Division 2, Groups A, B, C, D hazardous locations
- ◆ ATEX Category 3 (for Zone 2 installation) to EN50021:1999 protection type 'n'
- ◆ UL 61010-1 "Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use; Part 1: General Requirements, 2nd Edition

MECHANICAL

Module dimensions.....69 (w) x 232 (d) x 138 (h) mm

Weight (approx.) 1.35 kg



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