Bailey Controls™

Bailey infi 90

Overview: Bailey INFI 90®
Strategic Process Management Systems

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The INFI 90 Commitment

Nearly a decade ago, Bailey Controls established an industry standard for distributed digital process control with its introduction of the NETWORK 90® system. Since then, amidst a series of constant evolutionary enhancements, NETWORK 90 has set the pace for new control functionality. Over 14,000 systems have been proven worldwide, delivering the power, the versatility, and the economic return so vital for managing today's complex process operations.

Embodied within this evolution has been a firm commitment – from Bailey to its users – that no future development would ever compromise their investment in NETWORK 90. The advancement of control technology, without penalty to existing system users, characterizes the Bailey mission. Today, this mission expands – to encompass not just a new control system but a new control **philosophy** critical for the challenges ahead.

The effective process manager of the 1990's and beyond can no longer concern himself merely with a plant complex full of vessels, pipes, and valves. He must become far more of a **business** manager, taking direct responsibility for the interface with business decisions based on economic conditions, plant capacity, raw material costs, competitive actions, market demand, and the role each plays in affecting the user's bottom line.

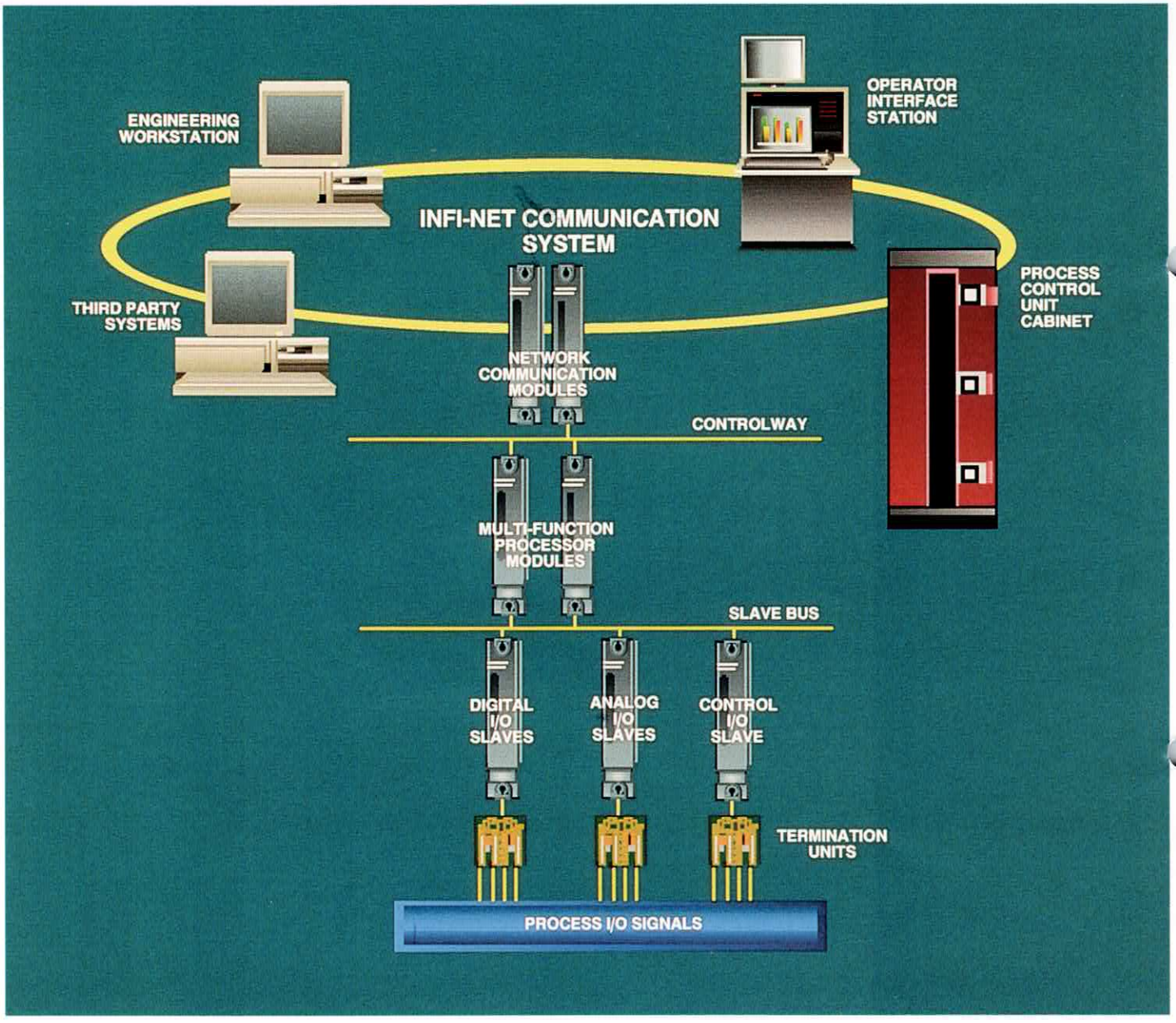
Introducing the age of Strategic Process Management – the new discipline which will shape tomorrow's integration of process and business variables for increased profit and rate of return. Introducing INFI 90 – the new system to meet this challenge.

Bailey INFI 90. It's the marriage between a decade of compatible, proven NETWORK 90 capabilities and extensive new technology for decades more of advanced functionality. Its a scalable, technologically-transparent system whose useful life and return on investment are **increased** with each enhancement. It's a profitable means to bridge the gap between today's control realities and the **infinite** process management opportunities that lie ahead.

That's the INFI 90 commitment.

System Overview

INFI 90 System Architecture



Conceptually, INFI 90 is engineered to bridge the gap between today's control uncertainties and the *infinite* opportunities which await control system users of tomorrow. Technically, it offers greatly advanced functionality, environmentally-hardened packaging, plus a philosophy of upward compatibility which has long been a Bailey trademark exclusive to the industry. Among its technical capabilities are *direct* integration of control strategies with those of Bailey NETWORK 90 – proven at over 14,000 installations worldwide.

Highlighting the INFI 90 system are the following major attributes.

Scalability

Bailey INFI 90 encompasses the entire range of potential control needs from 1/4 DIN, single loop control to corporate-wide strategies affecting hundreds of thousands of variables. From the simplest retrofit to the most elaborate "Greenfield" design, commonality of hardware, configuration and communications strategies permits expansion without obsoleting pieces already in place. Included within this prerequisite for true "technological transparency" is the massive installed base worldwide for Bailey NETWORK 90.

Communications

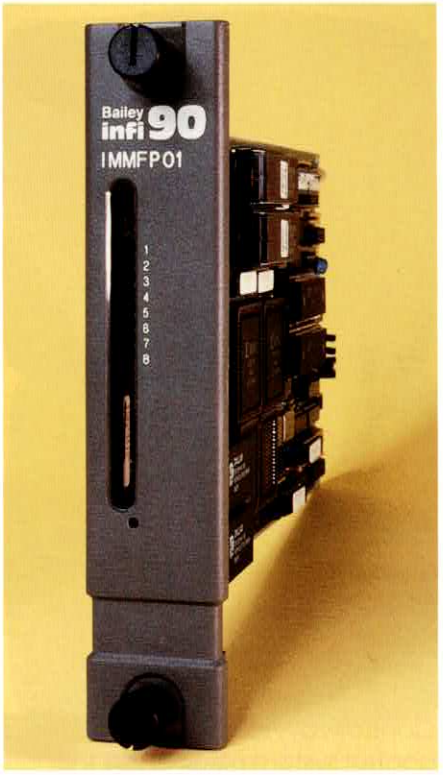
INFI 90 utilizes an advanced multi-layered communications hierarchy which assures tight coupling of information regardless of system size or configuration. The top layer of the communication structure is INFI-NET™. Exceptional data integrity is possible by the use of Real-4 math, providing 24-bit resolution. Security and scalability are achieved via simple redundant coax, twinax or fiber optic cabling between modular system nodes.

Data throughput is increased via advanced data compression, exception reporting and packetizing of information for simultaneous multi-point, multiple-address transmission. 10 MHz, nested central and subordinate communication networks support up to 62,500 discrete control equipment nodes as one powerful, integrated system. Ready interfaces to computers, foreign devices and open system architectures further extend system capabilities to a wide range of user-developed strategies.

The next communication level is Bailey's CONTROLWAY, an ETHERNET-like communication bus improved to provide redundancy and 1 MHz communications at the local node level. Supporting this level is Bailey's unique slave bus, a 500 KHz bus structure that is designed to allow 20 ms scan rates for optimum I/O throughput.

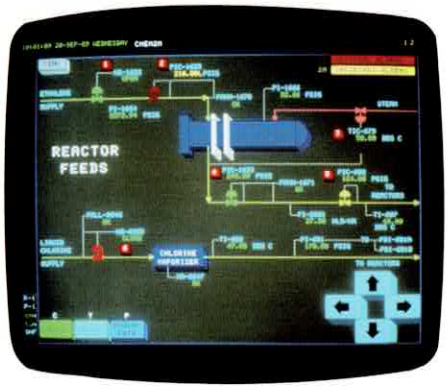
Control Performance

At the heart of any distributed control system is the controller. In 1980, Bailey introduced the dual-loop controller module. This was quickly followed by the family of Multi-Function Controllers that still have not been equalled in the industry. Building on this successful evolution, INFI 90 introduces a new family of Multi-Function Processors. This new generation of controllers utilizes 32 bit microprocessor processing power running at up to 33 MHz.



INFI 90's new powerful processing modules employ the time-proven concept of on-board, user-addressable control algorithms coupled with a wide range of standard packages for advanced implementation. Included among the disciplines readily accessed are embedded artificial intelligence and expert systems, on-line statistical process control, remote serial multiplexing of "smart" field devices, plus a vast library of application-specific strategies. User implementation of the system's 32-bit processing capabilities is diversified via Function Block, BASIC, BATCH, LADDER or "C" language configuration in common hardware. Users can also create their own "customized" function codes with the user-defined function code package.

System Overview (continued)



Reliability

A variety of INFI 90 options permit the easy implementation of redundant control security. Communications redundancy may be achieved throughout the INFI 90 hierarchy, including INFI-NET, Plant Loop, and Controlway, to insure continued control system reliability in the event of interrupted communications. Control and monitoring redundancy is available via Bailey Multi-Function Processors, which may be installed in primary/backup configurations. The backup module constantly tracks and copies control activities, assuming bumpless control in the event of primary module failure.

Operator Interface

Effective user interface, regardless of system scale, is assured by a line of dynamic interactive console products. These range from a 10,000 tag, computer based single window operator station providing X-window support, to a midrange 5,000-tag color graphic Operator Interface Station, to a 1500 tag Process Control View console based on the 80386 personal-computer platform. Advanced monitoring and control, logging, trending, archiving and alarm management capabilities insure both efficient utilization and fast operator acceptance. Varied console configurations include both free-standing and desktop styles for installation throughout corporate office, control room or process environments. INFI 90 consoles offer up to 860 x 1024 pixel resolution and utilize common configuration utilities plus recognized industry standards for color graphics and display presentation.

Power System

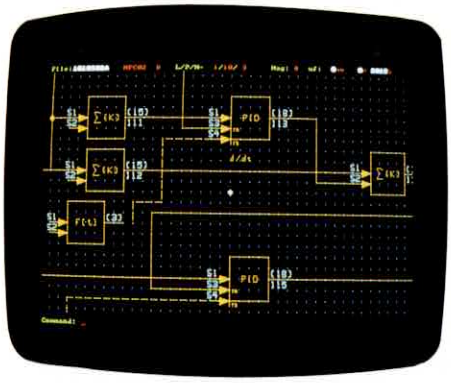
Addressing the critical need for reliable power to both logic and I/O functions, INFI 90 incorporates an exclusive current-sharing, modular power system. Compact, plug-in power modules are grouped to meet system requirements with "n plus one" redundancy, whereby output is shared equally among the primary modules plus one or any number of extra units. Should any module fail, the remaining power supplies automatically adjust their individual outputs to meet overall system load. INFI 90 power modules share the mounting hardware used for system processing modules and, like all processor modules, they may be inserted or removed under power.

Environmental Hardening

Further removing the barriers to true, plantwide process management, INFI 90 offers packaging options ranging from control room to NEMA 4 process-floor suitability. Environmentally hardened modules, cabinets, consoles, power supplies and engineering tools permit secure installation in harsh environments. Designed to satisfy even the strictest marine requirements, this advanced packaging offers superior protection against process-related particulates, corrosion, vibration or cleaning procedures. Extensive human engineering and ergonomics-based design throughout the system assure effective interface and acceptance by plant personnel.

Engineering Tools

To facilitate configuration, tuning, evaluation and documentation of system strategies, INFI 90 offers extensive engineering assistance both on-and off-line. Leading the industry is Bailey's complete line of PC-based Engineering Work Station tools. For comprehensive engineering, these tools permit complete system configuration capabilities. Both console and processor module configuration can easily be completed with CAD-based tools, analyzed using global database concordance capabilities, then quickly downloaded directly to the INFI 90 system. Instant hard copy drawings and printouts provide up-to-date documentation, making the Engineering Work Station the most comprehensive and user friendly configuration tool available. At the local level, hand-held configuration terminals plug in throughout the system to monitor and tune varied functions on demand.



Application Support

Supplementing its powerful system technology, the INFI 90 commitment includes a body of user and application support unsurpassed in the control industry. Manufacturing, sales, installation, training and service support comes from locations in more than 50 countries worldwide – backed by nearly 75 years of Bailey control experience.

Technically, this resource includes application-specific support from a supplier team boasting literally thousands of man-years in-service across the entire range of process industries. The result: Reliable, technologically-advanced systems geared to the specific bottom line-based objectives of INFI 90 customers worldwide.

INFI-NET Communications

To accommodate control strategies of ever-increasing size and complexity, Bailey has developed the powerful INFI-NET Communications system. This plantwide communications network provides a multi-layered hierarchy for the integration of up to 62,500 discrete equipment nodes as one immensely powerful process management system.

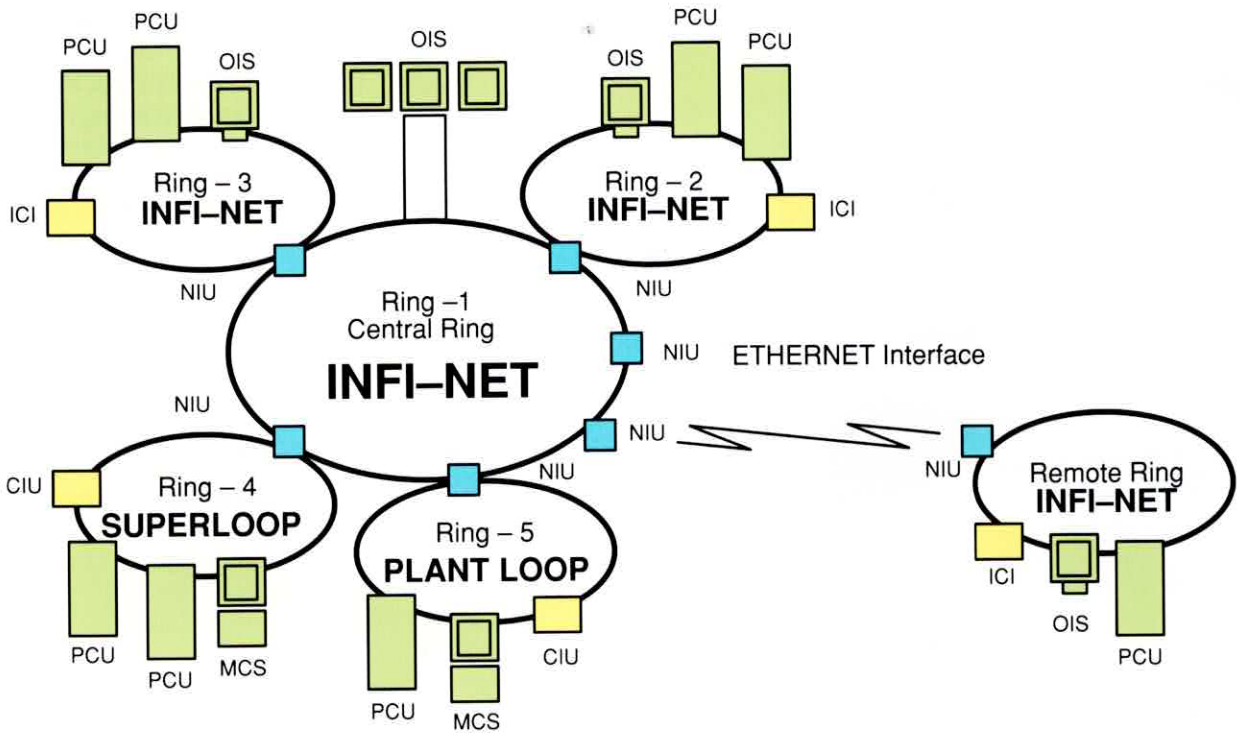
In a typical larger system, a central INFI-NET communications ring interfaces via standard gateways to other INFI-NET subrings, plant computers, and/or existing Bailey NETWORK 90 Superloop or Plant Loop systems. The central ring and its subordinates (up to 250) each support up to 250 nodes, communicating at speeds to 10 Mbaud.

Interfacing to these at the Process Control Unit level is the INFI 90 Controlway (See page 4), a redundant communication bus which links up to 32 intelligent modules at 1 Mbaud. The INFI 90 Slave Bus supports up to 64 I/O slave modules at 500 KHz, while a new Field Bus interface adds direct digital integration of up to 15 field instrumentation devices.

Among the keys to INFI 90's exceptional throughput capabilities are its approaches to data compression via exception reporting and packetizing of information. Exception reporting increases effective bandwidth by passing significant data only from discrete equipment nodes to each communication ring. For larger systems, this concept is extended to transmissions passed from subordinate rings to the central INFI-NET ring.

Packetizing allows the grouping of several distinct messages into one message for simultaneous multipoint, multiple address transmission. Collectively, these advancements permit a system data handling capacity in the tens of thousands of I/O points per second.

Consistent with Bailey's philosophy of scalable, technologically transparent system growth, INFI-NET communications may be quickly expanded in modular fashion to handle process requirements of virtually infinite size. Direct interface to previous NETWORK 90 Plant Loop or Superloop systems, plus standard gateways to external computers or other foreign devices via RS-232 or a direct ETHERNET interface, further extend system scale. Simple redundant coax or twinax cabling offers secure INFI 90 communications at the lowest possible installed cost.

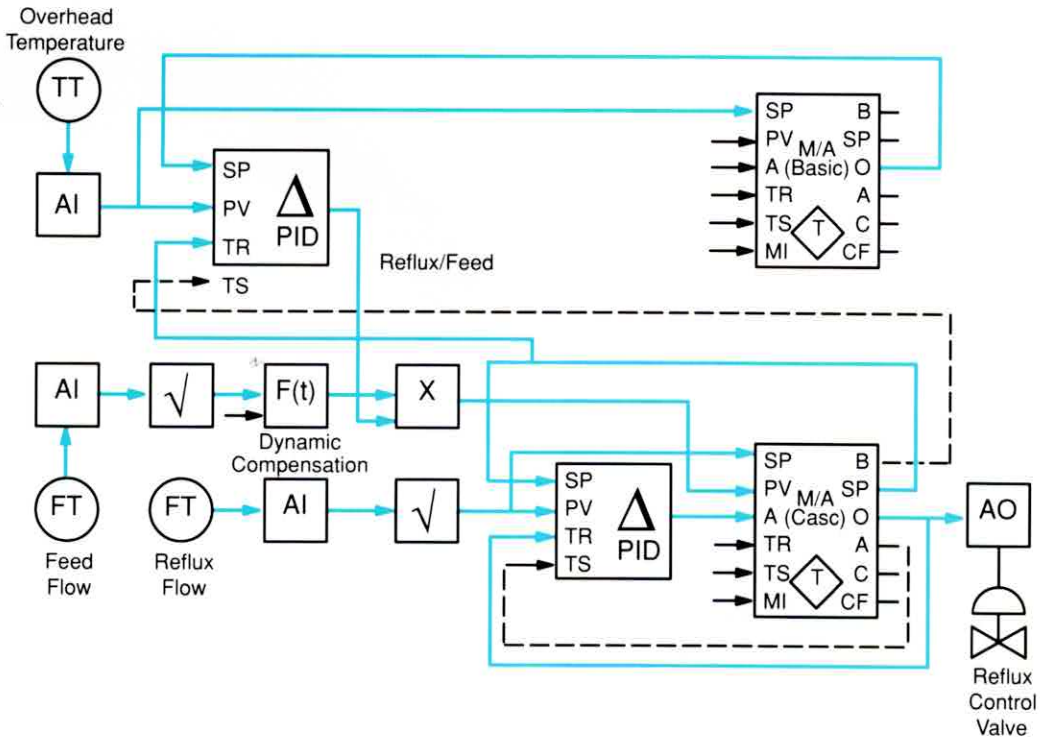


Configuration / Engineering Tools

Unlike application-dependent systems which force the user to employ specific control steps, Bailey INFI 90 offers a large library of over 175 versatile Function Codes, resident in each processor module. These powerful algorithms may be used any number of times, sequenced or nested within on-board Function Blocks (user-addressable memory locations) to deliver widely-varied control strategies without special programming knowledge. Users can also create their own "customized" function codes with the user-definable function code package.

Aiding smooth integration with user-developed control strategies is INFI 90 compatibility with a variety of other configuration techniques – including BASIC, BATCH, LADDER and "C" language execution.

Typical Function Block Implementation



INFI 90 User-Definable Function Codes

FUNCTION BLOCK TYPE

Station
- Station Interface
- Logic Station Interface
- Logic Station
- Indicator Station
- Remote Manual Set Constant
- BASIC Station Manual/Auto
- Cascade Station Manual/Auto
- Ratio Station Manual/Auto

Control
- Pulse Positioner
- PID Control Error Input
- PID Control PV & SP Input
- Adapt
- Smith Predictor
- Sequence Generator
- Device Driver
- Sequence Monitor
- Device Monitor
- Sequence Manager
- General Digital Controller
- Multi-State Device Driver
- Multi-Sequence Monitor
- Advanced PID

Computing
- Function Generator
- Manual Set Constant
- Lead/Lag

Computing (con't)
- High/Low Limiter
- Square Root
- Rate Limiter
- Sum–4 Inputs
- Sum–2 Inputs
- Multiply
- Divide
- Time Delay–Analog
- Constant
- Digital Sum–4 Input with Gains
- Regression
- Moving Average
- Integrator
- Polynomial
- Interpolation
- Matrix Addition
- Matrix Multiplication
- Trigonometric
- Exponential
- Natural Exponential
- Logarithms
- Power
- Parameter Converter
- Adaptive Gain Scheduler

Signal Select
- High Select
- Low Select
- Transfer (Analog)
- Digital Buffer
- Analog Buffer
- Boolean Signal Mutliplexer

Signal Select (con't)
- Real Signal Multiplexer
- Real Signal Demultiplexer

Signal Status
- High Low Alarm
- Test Quality
- Slave Select
- Digital Readback Check

Logic
- Trip
- NOT
- Memory
- Timer
- Qualified OR
- AND–2 Inputs
- AND–4 Inputs
- OR–2 Inputs
- OR–4 Inputs
- Manual Set Switch
- Digital Transfer
- Up/Down Counter
- Elapsed Timer
- Exclusive OR
- 5 Input Rung
- 10 Input Rung
- 20 Input Rung
- Module Bus I/O
- Analog Input/PCU
- Analog Output/PCU
- Digital Input/PCU
- Analog Input List
- Digital Input List
- Module Status Monitor

Communications Loop I/O
- Analog Input/Plant
- Analog Output Exception Report
- Digital Input/Plant
- Digital Output Exception Report
- Remote Control Memory
- Analog Input–Superloop
- Digital Input–Superloop
- Data Acquisition Analog

Field I/O
- Control Interface Slave
- Digital Output Group
- Digital Input Group
- Pulse Rate
- Indicator
- Redundant Analog Input
- Redundant Digital Input
- Pulse Input/Period
- BCD Input
- BCD Output
- Pulse Input/Totalization
- Digital Output Buffer
- Remote I/O
- Pulse Input/Frequency
- Pulse Input/Duration
- Analog Input/Slave
- Frequency Counter Slave
- Hydraulic Servo Slave
- Slave Default Definition
- Wise Transmitter Definition

Executive
- Executive
- Extended Executive
- Segment Control

Other
- Integer Switch
- Set Integer
- Segment
- Configure BASIC
- Invoke BASIC
- BASIC Real Output
- BASIC Boolean Output
- Sequence of Events
- Boolean Recipe Table
- Real Recipe Table
- Jumper/Master Control Relay
- Invoke "C"
- "C" Allocation
- Restore
- Text Selector
- Manual Set Constant
- Remote Motor Control
- Plant Loop Gateway
- BATCH Sequence
- User-Defined Function
- Sequence of Events Slave

Configuration / Engineering Tools (continued)

INFI 90 offers its user a broad range of powerful, user-friendly configuration options, from hand-held terminals which plug in anywhere on the Controlway to graphics-based engineering consoles that permit the development of custom display formats for optimum human interface. In each case, a straightforward "building block" approach permits integration of pre-defined algorithms, advanced programming languages, and specialized user strategies for the most effective process management configuration to suit a given need.

Configuration and Tuning Terminal

This hand-held device plugs in anywhere on the INFI 90 Controlway, interfacing directly via a standard Communication Port Module. A menu-driven, "fill in the blanks" format walks the user through input of each configuration. The operator can add, modify or delete any Function Block within the system. A series of versatile function keys, integral "help" functions, and 64-character LCD display keep the user in constant touch with configuration and troubleshooting – from the process floor or the control room.

Operator Console Configuration

For CRT-based INFI 90 systems, Bailey offers a powerful option for combined operator interface and configuration. Using any system console (see pages 14-17), a complete listing of Function Blocks and process parameters may be viewed from one location. Initial or supplemental configurations can then be entered and locked out to prevent unauthorized changes.

INFI 90 Engineering Work Station

Bringing the concept of Computer Aided Design to process management, Bailey pioneered the PC-based Engineering Work Station (EWS) for fast development of advanced control strategies in "cut and paste" form, for direct download to system modules. Teamed with a plotter or printer, the EWS automatically generates control logic drawings, configuration drawings, module lists, specifications, and Function Block references. From one 80386 personal computer platform, a variety of INFI 90 software packages permit fast implementation of the following engineering strategies.

Computer Aided Design (CAD). Allows the engineer to design, configure, monitor, trend, simulate, and troubleshoot a given control strategy in both on-line and off-line environments. Graphic symbols representing each INFI 90 Function Code are linked by the engineer as the system automatically tracks Function Block and memory usage, then provides cycle execution times. Automatic comparison of CAD files with actual module configuration insures accuracy plus instant, up-to-date documentation.

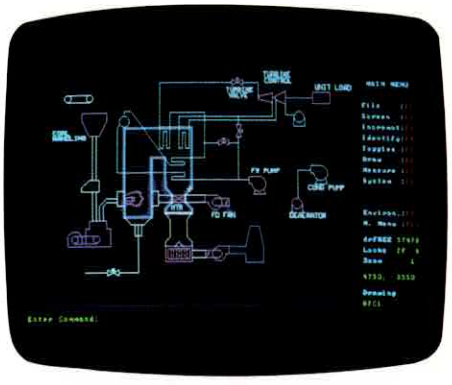
Ladder Logic (LAD). For those users who prefer ladder configuration, the LAD package permits integration of traditional logic rungs for contacts and coils with any of over 175 resident Function Code algorithms. Dedicated symbol keys, cross referencing, and contact tracing functions speed the development and tuning of complex strategies for compilation and direct download to system modules.

Console Configuration Utilities. The Console Configuration Utilities allows the engineer to configure an OIS console or Process Control View (PCV) from the PC-based EWS. Besides providing a large library of standard symbols and displays, the Console Configuration Utilities package offers the ability to create customized process displays, symbols and face plates. A user-friendly, menu-driven system simplifies system database configuration and management. A log/report generation feature allows the user to develop custom, spreadsheet style log reports for the effective presentation of process data.

Batch Language. Bailey BATCH 90™ provides a high level, natural syntax approach to batch sequential step logic. Recipe formulations and procedural subroutines are configured off-line, then stored and executed by Multi-Function Processor (MFP) modules. A dynamic debugging feature allows the engineer to observe code execution statement by statement, then monitor, interrupt, or query the program on-line.

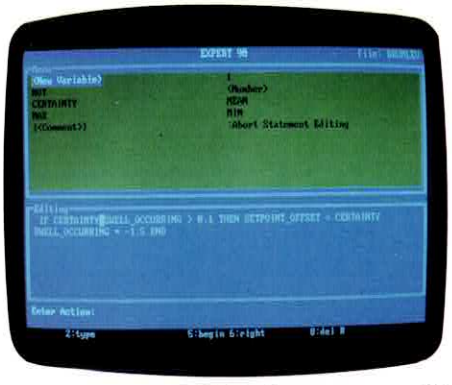
Expert System Language. Bailey EXPERT 90™ provides the first truly distributed artificial intelligence capability available for process management. Running as an embedded element of the MFP module configuration, EXPERT 90 is represented as a series of "if-then" rules which may involve time relationships as well as uncertainty data. Configured as simple statements from the Engineering Work Station, the expert system offers advanced advisory, analytical, and control functions such as "smart" adaptive control, root-cause alarm interpretation and management, or "cause and effect" advisories as a guide to intervention long before operating boundaries are breached.

Relational Data Base. The INFI 90 Relational Data Base is a scalable hardware and software package which allows system-wide correlation of the plant wide data base, control logics, and displays. Its global analysis techniques help provide overall system integrity, traceability of signals, plus a variety of custom, interactive cross-referencing reports. A powerful concordance utility facilitates error checking and I/O signal verification, reconciling any changes made to control logic with their system-wide implications.



Console Configuration Utilities

BATCH 90 Batch Language



EXPERT 90

INFI 90 System Modules

Bailey INFI 90 delivers all the power and functionality of a process computer – without the cost or complexity of the computer system itself. Key to this are the distributed system modules which work individually to isolate and implement critical tasks, then work together to merge these tasks into an integrated process management strategy.

Detailed Product Specifications are available from Bailey on the complete range of INFI 90 components. The summary descriptions offered here explain basic form and functions for those module types integral to most process management applications.

Controller Module

Full process control of either one or two loops is the primary function of the INFI 90 Controller Module. Varied versions offer up to 80 pre-defined function code algorithms (see page 9), including advanced math functions. These are configured in user-assignable blocks of Non-Volatile Memory which retain their configuration even in the event of power loss.

Analog Inputs/Outputs

Process interface for control and data acquisition of analog I/O is provided by a series of standard modules. These modules extend from high level analog requirements such as +10V to -10V and 4-20 mA to low level signals including millivolt, thermocouple, and RTD inputs. All of these analog slave modules provide a direct connect path through the Multi-Function Processor (facing page) into the INFI 90 Strategic Process Management System.

Digital Inputs/Outputs

INFI 90 Digital I/O slaves are an integral part of process control functions using the Multi-Function Processor (facing page). Local I/O capability is achieved through the slaves' ability to sense ac or dc contact closures from and drive equivalent outputs to user devices such as relays, lamps, pushbuttons, etc. INFI 90 digital slaves are available as 16 digital input or 8 or 16 digital output configurations.

Pulse Input Slave Module

This INFI 90 module supports the Multi-Function Processor by processing input signals such as low-level amplitude pulses, sine-waves, logic level pulses, or contact closures from field instrumentation. Each of eight input channels may be configured for the user's choice of three operating modes: Totalizing of input pulses, frequency counting within a specified sample interval, or time-based clock measurement of each input signal period.

Control I/O Slave Module

Field inputs to the Multi-Function Processor (MFP) and the resulting process control outputs are handled by the INFI 90 Control I/O Slave. Analog Signals are converted on board to digital signals for processing. User-specified default values, optional redundancy, plus slave diagnostics by the MFP provide exceptional security for the field I/O.

Remote Input/Output Module

This module operates with the INFI 90 Multi-Function Processor (MFP) to extend powerful control capabilities on a truly plantwide scale. Designed to support central control of INFI 90 slave modules up to 10,000 feet (3048 meters) away, the Remote I/O Module offers 1 Megabit transfer rates, for data current to within 30 milliseconds in typical applications.

Sequence of Events

INFI 90 modules allow for time-tagging of critical events with 1 millisecond plantwide resolution. The sequence of events function records process events and the time of occurrence and generates a log at the operator console. This log is a valuable diagnostic tool for determining progression of events in process upsets.

Interface Modules

A significant part of the INFI 90 system's versatility comes through a series of interface modules which permit the linking of distributed components or the addition of external systems. The most basic of these is the Network Interface/Controlway Interface module pair, which links individual Process Control Units (PCU's) to the INFI-NET communications loop.

Two versatile options are available to link auxiliary computers with INFI 90. The Serial Port Module (SPM) provides an RS-232-C interface between any one PCU and an external standard computer applications program. INFI 90 Computer Interfaces extend this option to the entire control system through a standard link which permits a range of computers from micro to mainframe to serve as a "node" on the INFI-NET communications loop.

Termination Devices

Connections between INFI 90 processing modules and field I/O are provided by a family of compact termination devices which mount inside the PCU cabinet. Terminations are provided as a variety of options, including discrete termination cards, high density termination modules or through direct connect to the front of the module. Field connections are made directly to terminal strips on the appropriate termination device, where signal types are easily configured via on-board dipshunts, dip switches, or jumpers.

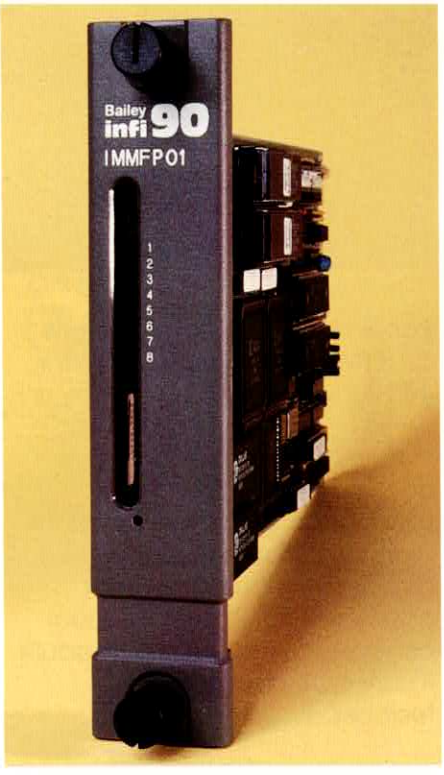
INFI 90 Multi-Function Processor

When other control systems reach for a process computer, INFI 90 reaches inside itself to the Multi-Function Processor (MFP). The MFP is a multiple loop, analog, sequential, batch and advanced control processor. It also provides information processing with advanced data acquisition features.

This immensely powerful plug-in module can monitor over 1,000 points (expandable via remote I/O communications), or control up to 500 process loops with adjustable scan rates as fast as 20 times per second. More than 150 integrated function code algorithms, including analog, sequential, batch, data acquisition, and advanced matrix and modelling functions are available. Up to 10,000 user configurable Function Blocks permit on-board storage of the most complex process management strategies.

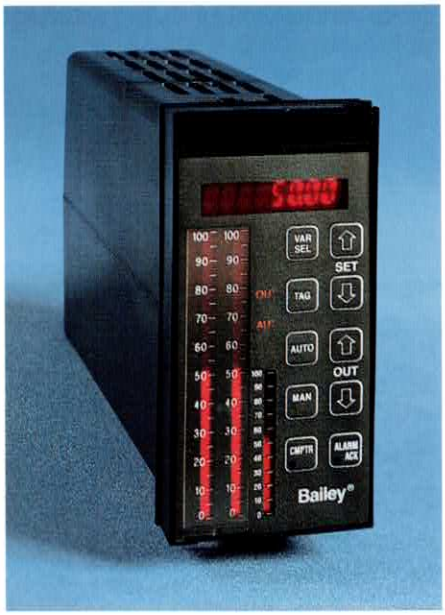
Additional flexibility is achieved in the MFP through the inclusion of BASIC, C, Ladder logic, Batch language, or Expert system language capability. Customized user strategies may be entered in one or more languages for on-board integration with INFI 90 Function Code configuration.

The Multi-Function Processor optionally provides full redundancy. A back-up module may be installed side-by-side with its primary MFP, to constantly track and copy control activities. Should any questions arise regarding the primary MFP's integrity, the redundant module will assume bumpless control – automatically and immediately.



Operator Interface

Regardless of system size or power, effective human interface to process management strategies remains a critical prerequisite. For this reason, INFI 90 includes a variety of dynamic options, ranging from digital hand/auto stations to CRT-based consoles for plantwide operations. Without exception, INFI 90 human engineering provides the optimum balance of user convenience and comfort, plus advanced features for truly strategic process management.



Panel Mount Operator Stations

Effective local interface for INFI 90 systems is provided by a series of versatile hand/auto stations configured for digital control, panel meter, or pushbutton indicating functions. High resolution gas plasma displays, customizable front panels, and bumpless manual control in the event of a module failure typify the powerful features available.

The INFI 90 Analog Control Station (illustrated) is a panel mounted hand/auto device which provides local control interface and indications of process variable, set point, and control output. It may operate as a Basic, Cascade, Bias, or Ratio station. Up to 64 stations may be daisy chained to any INFI 90 Multi-Function Processor module, at distances to 1000 feet.

Process Control View™

Advanced human interface via a cost-efficient personal computer platform is provided by the Bailey Process Control View (PCV). Supplied as either a complete hardware package or software/hardware upgrade kit, the PCV permits interactive, color graphic control from any 80386 compatible PC.

PCV features 640 by 480 resolution interactive color graphics plus advanced logging, trending, archival storage, and alarm management functions. Up to 1500 process tags may be configured, monitored and controlled, with control and display strategies fully transportable to other INFI 90 console products. Password security is available for low-cost control of smaller systems or selectable, decentralized access to larger operations.

Operator Interface Station

INFI 90 Operator Interface Stations (OIS) are a series of operator consoles providing a single "window" into plantwide process operations. Capable of monitoring, control, data acquisition and report documentation, the OIS consoles provide an integrated operations interface to the INFI 90 Strategic Process Management System. Configurable through a common set of engineering tools, operating consistency exists thoughout the OIS console line. Each console is upwardly compatible for future expansion to larger, more powerful consoles.

OIS units support monitoring and control through flexible, dynamic, interactive color-graphic representations of the process. An extensive alarm management capability aids operator intervention and ensures proper operator response to alarms while minimizing nuisance alarms.

A trending package offers an historical perspective of process conditions for analysis of current operations. Data can be displayed as a function of time or other user-defined process variable.

The OIS's logging/report generation package automatically documents process operations. Its archival and retrieval functions digitally store trends, logs and tag data in any combination for future analysis.

The OIS displays system and node status for each device on the INFI 90 communications loop(s), such as control and data acquisition modules, consoles and power supplies. Module tuning and configuration can also be performed via OIS consoles. For security, keylocks protect against unauthorized changes to system operating parameters.

The Operator Interface Series Provides the following range of operator consoles:

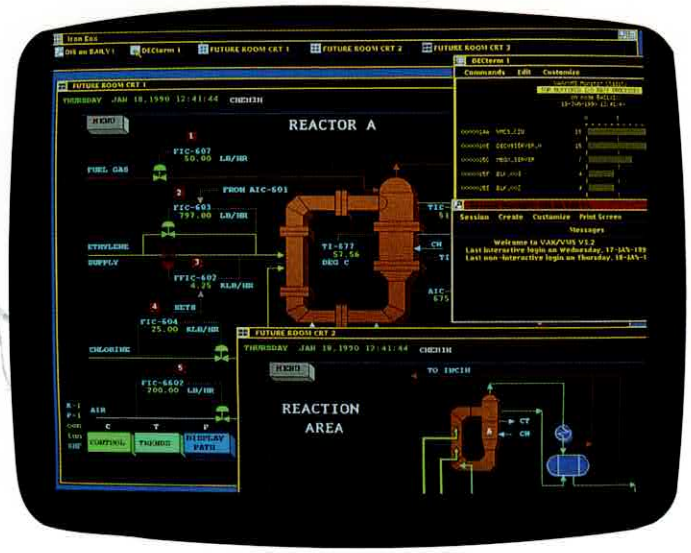
- OIS Series 10 – 1,500 tag, single CRT with base functionality.
- OIS Series 20 – 5,000 tag, dual CRT with enhanced console functionality.
- OIS Series 30 – 10,000 tag, multi-CRT with enhanced console functionality.
- OIS Series 40 – 10,000, multi-CRT, dual network enhanced functionality console with X Window support.

Operator Interface (continued)

OIS Series 40

The OIS Series 40 is a computer-based, dual network operator console providing X Window technology. The OIS Series 40 connects directly to the INFI 90 communication network on one side and ETHERNET on the other. Together, the dual network console integrates operator information requirements for both process control and business decision making.

X Windows provide the means for the OIS Series 40 to interact seamlessly with business information systems and application packages running on other hardware platforms connected via ETHERNET. Utilizing X Windows, interactive process displays are available from the console itself, other consoles on the network, or any computer or other device on the network conforming to the X standard. This provides a true single-window for the operator for both process control and business information and allows the OIS 40 to achieve direct integration of Strategic Process Management Strategies with the INFI 90 system. These strategies include process monitoring and recording, process data analysis, maintenance management, and business and system management.

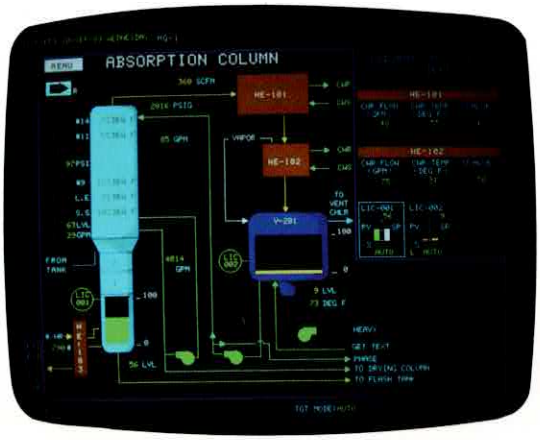


OIS Series 40

Typical INFI 90 Console Display Formats

INFI 90 Consoles offer a wide variety of displays. Typical display formats, on the facing page, include:

- Process Overview Graphic. Summarizes current process status via real-time, interactive pictorials. Allows direct, single-keystroke access to any other display for monitoring and/or control.
- Group Display. Varied control station mimics compress hundreds of traditional instruments into a series of organized color-graphic screens. Familiar panelboard formats ease transition of operator to CRT-based process interface.
- Process Detail Display. "Zooms in" for detail on a given process unit or area, combining graphics, panelboard mimics and trends of specific process parameters, with ready access to hand/auto stations for control.
- Alarm Summary. Most recent alarm conditions and chronology are summarized and/or prioritized for operator review. Categorization by process area, criticality, etc. permits effective management focus and intervention.
- Trend Display. Up to 20 trends, configured in four trend windows, may be displayed on one console screen. Zoom and pan functions facilitate operator analysis of process conditions over varied time spans.
- HELP Display. Operator HELP displays are available for system training and to assist operator actions.



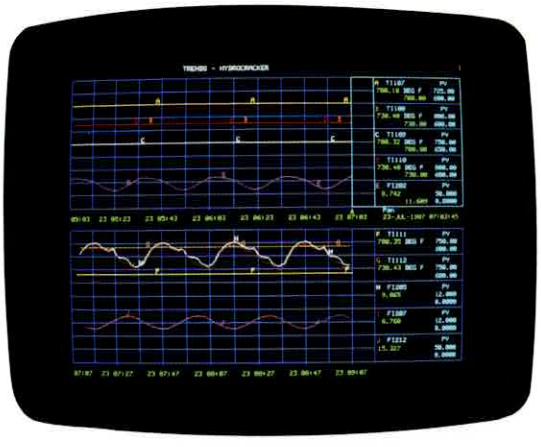
Process Overview Graphic

Group Display

HELP Display

Alarm Summary

Process Detail Display



Trend Display

Operator Interface (continued)

Console Capabilities Summary

Feature/Unit	Process Control View	Operator Interface Stations		
		Series 10	Series 20	Series 30/40
Tag Capacity	1,500	1,500	5,000	10,000
Graphics (Displays)	500	500	1,000	1,500
Trends	500	500	1,000	1,000
Custom Logs	100	100	100	100
Operator Configurable Displays	64	64	25	25
SOE Logs/Reports	20/20	20/20	16/80	32/160
Dynamics/Graphic	100	100	200	200
Max CRTs/Unit	1	1	2	4
Printers/Unit	1	1	2	4
Touchscreen	No	No	Yes	Yes
Trackball or Mouse	No	No	Yes	Yes
Annunciator/Select Panels	No	No	Yes	Yes
Floppy Disk Capacity	1.2 MB	1.44 MB	1.2 MB	1.2 MB (30) 1.44 MB (40)
Hard Disk Capacity	85 MB	85 MB	85 MB	170 MB
Data Archiving Media	Floppy	Floppy	Floppy Mag Tape Optical Disk	Floppy Mag Tape Optical Disk
* Display Resolution	640 x 480	640 x 480	640 x 480	640 x 480 (30) 864 x 1024 (40)
**Max. Trend Storage	7 Days	7 Days	3 Months	3 Months
Operation Temperature, °C	15-32	15-32	4-40	4-40

INFI 90 Plantwide Integration Software

Further extending user versatility for integration of plantwide information and process management strategies, Bailey offers a variety of software packages which provide interface to plant equipment and mini or mainframe computers. These scalable options may be supplied as transportable media, complete with user documentation, or as a fully engineered package by Bailey.

XRS 90 Data Management Software

Bailey XRS 90 is a standard, configurable software package which monitors INFI 90 process management data and permits performance of real-time evaluations of plant processes and equipment. It is designed primarily for use with the Digital Equipment VAX™ Series computers. The Bailey membership in Digital's Cooperative Marketing Program insures exceptional user value through its compatible "turnkey" systems approach.

Supporting the data processing functions inherent within INFI 90, the XRS 90 packaging handles the base data gathering functions, plus a variety of standard, optional, or user-specific applications. Principal capabilities include a common live data base, common data historian with archiving and retrieval, alarm and message processing, display and reporting tools, statistics and plot packages, and a preventive maintenance package. In addition, XRS 90 provides a platform for other application software plus a link to business machines or other computers.

1090 Process Management Software

Bailey 1090 extends the benefits of INFI 90 human interface and distributed data acquisition to a variety of mini/mainframe computer users. This real-time system for supervisory control and data acquisition uses standard INFI 90 modules for data processing functions, supported by a powerful 1090 Operator's/Engineer's console.

Principal 1090 capabilities include a plantwide processing platform; base data acquisition subsystems for calculations, historian/trending, alarm management, and report generation; an integral library of FORTRAN utility subroutines; and an archival system for raw data, events, or logs.

Batch Historian

The Bailey Batch Historian provides on-line real time data collection and compression based on production unit or lot number in addition to time. Information is easily accessed from the Batch Historian for data query or report generation via the operator console. Historian records are stored in ASCII code files which can be utilized by third party software packages for use in business and management applications.

LAN-90™ Factory Floor SPMS

Bailey LAN-90 provides the user with a seamless, real-time application processing interface on the factory floor. LAN-90 software is implemented on a series of factory-hardened personal computers which may be networked via a variety of protocols including ARCNET, ETHERNET, and TCP/IP.

LAN-90 Process Information Control Stations offer a wide range of standard features including process monitoring and control, alarming, real-time spreadsheets, and logging. Compatible applications software developed by Bailey includes Statistical Process Control, Time Series Analysis, Maintenance Management, Production/Inventory Control, Batch Recipe Editor, Batch Historian, and Lab Data Entry.

Plant Device Interface

In addition to these, Bailey has developed over 70 software interface packages which link INFI 90 to programmable controllers or plant devices supporting computer parts from other suppliers. Typically, these are implemented using the INFI 90 Multi-Function Processor, a special "C" program, and an RS-232-C link to the device. A list of available interfaces, or consultation on custom development, is available from Bailey.

INFI 90 Smart Instrumentation Interface

In the past, many process control systems were considered little more than a "black box", isolated both physically and functionally from data acquisition, information processing, and corporate management systems. Low energy costs and prosperous economic times made "open loop" plant management an acceptable approach.

Times have changed.

The evolution of a global business community, coupled with integration of computers into virtually every aspect of commerce, requires today's manufacturers to integrate the most subtle aspects of "process control" within a much farther reaching process management strategy. Nowhere is this need more critical than in transforming once mundane field instrumentation devices into "smart" components of an overall process management system.

Bailey INFI 90 represents far more than just the traditional "control room" array of processing and human interface gear, it encompasses a broad range of smart instrumentation, configured for distributed handling of data acquisition chores once forced to the control room level. Equally important, INFI 90 provides a direct, digital interface between these field instruments and the host control system.

Smart Instrumentation for Varied Needs

To meet the growing demand for control strategies integrated with field devices, INFI 90 includes an unmatched variety of powerful "smart" instruments. This offering includes devices to measure and indicate a wide range of process variables, including pressure, differential pressure, temperature, mass flow, vortex flow, pH, and conductivity.

Equipped with portable communications terminals, these devices free the user from costly maintenance chores at remote locations. Remote configuration, calibration, and diagnostics are among the readily available, plug-in functions. Beyond these, INFI 90 smart devices now handle complex computational functions such as signal conditioning and linearization – for which ancillary control devices were once required.

Wide-Ranging, Remote Communications

Beyond the remote diagnostics and troubleshooting offered by many smart transmitter systems, Bailey smart instruments and INFI 90 team up to provide control room personnel with direct access to wide-ranging functionality. Transmitter calibration, rezeroing, reranging, and configuration may be performed from the INFI 90 operator interface console in a few keystrokes, or as integral functions of an automated control strategy.

Direct access to smart instrumentation from the control room virtually eliminates maintenance visits to the installed instruments themselves. Often, process needs may be met with fewer transmitters, as all units may be configured the same before installation, then automatically rearranged on line. This capability is especially useful in startup situations, where flow range needs may vary greatly from steady state, and in batching operations, where transmitter ranging instructions become an integral part of the recipe download from INFI 90.

Simplified, Smart Field I/O

Interfacing of smart instruments to INFI 90 is handled via a versatile Field Bus which exchanges data with the system's Multi-Function Processor modules. This bus is driven by the Bailey Field Bus Module, a 9600 baud serial link to the INFI 90 Slave Bus.

The INFI 90 Field Bus supports the interconnection of up to 15 Bailey "smart" field devices. Field wiring is limited to the simple twisted pair used for conventional field I/O. The Field Bus Module accepts up to 15 channels of direct digital field device inputs, and relays these messages to the INFI 90 Multi-Function Processor. In turn, the Field Bus Module will route up to 15 channels of direct digital communications back to the field instruments, for cost- and-time-efficient integration of process management strategies.

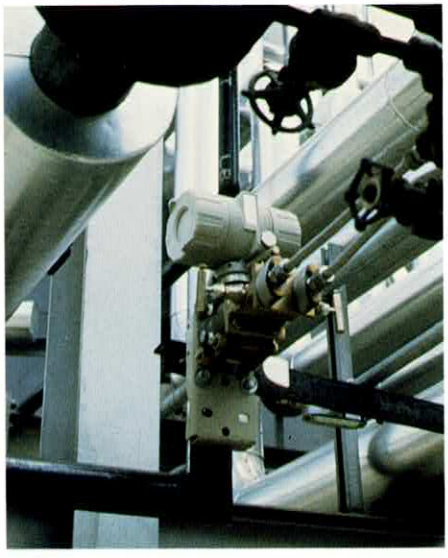
Bailey: Your Worldwide Partner For Process

Since 1916, Bailey Controls has been a leader in the development of state-of-the-art instruments and controls. Bailey's response to thousands – perhaps millions – of user needs has spawned a worldwide resource unsurpassed in the process management industry.

Bailey people, products, systems, and solutions provide an "extra value" to INFI 90 users that is immeasurable in terms of cost or catalog number, yet is invaluable in terms of contribution to profitable process management.

Bailey Field Instrumentation

Beyond the "smart" devices discussed on preceding pages, Bailey Controls boasts a comprehensive line of field instrumentation for measurement, recording, and implementation. Transmitters, flowmeters, analyzers, positioners, actuators, recorders, and indicators for a vast range of process variables begin the Bailey lineup. A worldwide team of stocking representatives and application specialists complete the job of putting reliable instrumentation to work for you.



Bailey Systems Engineering

Whether your process management needs encompass a simple flow loop or a plantwide process, Bailey expertise can help to optimize operations. Our Systems Engineering group, among the largest departments at Bailey, is staffed by professionals with advanced degrees and many years of experience in the process industries. They can help with a wide range of services geared to your application, from tailoring of advanced control strategies to your process, to enhancement or trouble-shooting of existing plant controls, to preconfiguring of your new INFI 90 system for fast startup.

Bailey Field Service

Prompt, personal attention to your equipment service needs. That's the mission of Bailey's Field Service organization – a worldwide team of over 300 professionals dedicated to every aspect of installation, service, and maintenance. Available services range from site planning, installation and startup, to emergency service, to comprehensive contract maintenance for equipment by Bailey or others. Complementing these services are a variety of innovative programs to put spare or emergency parts in your hands when you need them...where you need them. Together, these programs help insure smooth, uninterrupted operation of your plantwide instruments and controls at the lowest possible cost.

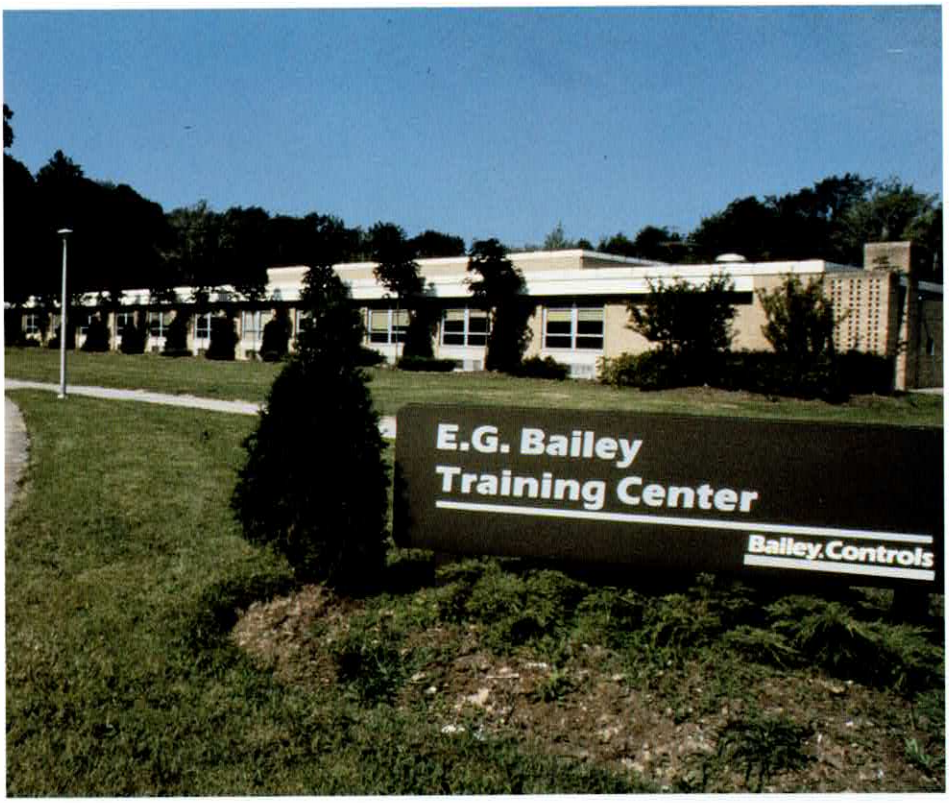
Management

Bailey Training

To help insure efficient utilization of its instrumentation systems, Bailey maintains a network of professional customer training centers. At any of five locations, customers may enroll in a wide range of courses combining both classroom and "hands on" instruction covering INFI 90 and many other topics. Specialized courses may also be presented at the customer's plant via live instructors or video tape. The result: A comprehensive understanding of Bailey systems installed (or about to be) by both technical and management personnel.

Process and Power Plant Simulators

Bailey INFI 90 simulators are designed as an integral part of a cost effective and comprehensive operator training program, ensuring that personnel are equipped for safe and efficient control system operation. Simulators are particularly helpful in preparing to handle process upsets, and for use to develop and test new control logic.



Simulation models are implemented in standard INFI 90 Multi-Function Processors or in stand-alone computers, depending on the level of simulation desired. The control logic and CRT displays are identical to those in actual process conditions, ensuring that skills obtained on the simulator are fully transferrable. An instructor's console is used to control and monitor all aspects of the simulation, including student tracking, simulation parameters, plus freeze, replay, etc.

Simulation models are based on first principals, closely following the actual process through use of energy and mass balance relationships. Models are developed using standard INFI 90 Engineering Work Station software. Easy upgrade in response to changing process needs extends simulator life and reduces the life-cycle costs associated with competitive systems.

Bailey Aftermarket Services

A most significant facet of Bailey's customer support commitment becomes evident after the sale of INFI 90 or other instrumentation products. Aftermarket activities provide customers with ongoing product and technical support unsurpassed in the instrumentation industry. The wide ranging services offered include innovative spare parts programs, software upgrade subscriptions, module upgrade/exchange programs, "smart" enhancements to existing field instrumentation, and an electronic remote database which offers users up-to-the-minute access to new Bailey products, technical literature and service information.

The Tradition Continues...

Technological Transparency:

For more than a decade Bailey has marketed its distributed systems with the firm pledge that no future development would compromise a single user's investment in Bailey Controls. Upward (and downward) compatibility of system components and technologies has been a prerequisite for design. Massive increases in functionality have been added to NETWORK 90 distributed controls, without penalty to the users of installed systems. Modular, "plug in" enhancements have enabled these users to address changing business needs incrementally – without obsoleting pieces in place.

The tradition continues, with Bailey INFI 90.

INFI 90 combines the proven technologies of a decade of NETWORK 90 development with new technologies for decades more of advanced process management functionality. Its compatible architecture permits direct integration with all previous NETWORK 90 control strategies, plus expansion to new capabilities that will be essential for the process management challenges of tomorrow. From the smallest single-loop control application to the most elaborate "Greenfield" system design, INFI 90 delivers the platform for immediate functionality coupled with virtually infinite growth potential.

In many respects, INFI 90 is a type of "insurance policy" for process managers. It has already paid big dividends to those previous Bailey users who can now build upon their installed control base for much greater return. In the future, Bailey's continued commitment to technologically-transparent system expansion will insure these same users – plus thousands of new ones – a continued, competitive edge.

For prompt, personal attention to your instrumentation and control needs or a full listing of Bailey representatives in principal cities around the world, contact the Bailey location nearest you.

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