InFusion™ Engineering Environment is a powerful and integrated engineering tool for designing and maintaining I/A Series control strategies and configuring the I/A Series® system.

**FEATURES**

InFusion Engineering Environment (IEE) enables for a user:

- Graphical construction and deployment of I/A Series control strategies
- Construction of re-usable control strategy component and composite designs
- User defined renderings of re-usable control strategy components and composites
- Printed reports of control strategy drawings and supporting information
- Live updates/edits of real-time values superimposed on control strategy drawings.
- Bulk generation of control strategies from stored templates and external project data
- Bulk migration of control strategies from installed I/A Series systems
- Ability to Import and Export control strategy designs
- Ability to create and deploy ArchestrA® IAS Platforms, Engines, Application Objects.
BENEFITS

The InFusion Engineering Environment offers substantial engineering productivity and quality gains to application designers and project engineers during:

- Initial Project Engineering through programmatic interfaces to Third Party applications and external file systems supporting XML information exchange
- For all project lifecycle stages, the documentation is kept in synch with the configuration, as modifications are made
- Large scale expansions and modifications to the then current designs
- Interoperable with other Invensys and Third Party Applications

The IEE offers enhanced value to those users who want to use I/A Series in more than one project by providing the ability to migrate intellectual property from one installation to another with extensive tools to edit that intellectual property to fit the circumstances of the new project.

The IEE offers exceptional value to current users of I/A Series systems wanting to upgrade their existing system to the latest technology by providing utilities to convert the intellectual property residing in their existing system to the paradigms of the new system. This can include graphical representations of control strategies.

The IEE is built upon and conforms to industry standards including Microsoft’s .NET Framework and Invensys’ ArchestrA® Framework. Graphical editors within the IEE utilize and take advantage of Microsoft Visio® as the rendering engine.

The IEE provides graphical design, configuration, deployment and commissioning tool for I/A Series Version 8.2 systems. The graphical design tool for Strategy construction is shown in Figure 1.

The IEE Server supports concurrent client access with record locking.
Figure 1. InFusion Engineering Environment Navigation

**OVERVIEW**

InFusion Engineering Environment is constructed using the Microsoft® desktop metaphor and includes several menus, tool bars and Views including the Template Toolbox and Network View, as shown in Figure 1. The Strategy Editor Area provides a drawing canvas and associated tables and Winforms used for the graphical construction of control strategies.

InFusion Engineering Environment enables the user to design I/A Series Control Strategies, the I/A Series System Configuration and InFusion Application Objects. Control Strategies are assigned to Compounds, which are in turn assigned to I/A Series control stations with a distributed network.

- A control station is the hardware platform that executes the regulatory, sequential, logical and supervisory control strategies each contained in a Compound assigned to the station.
A Compound is the top most control container and is assignable to a physical control station. The Compound contains a set of user designed Strategies.

A strategy template is a configured object representing a functional control entity, engineered to be reusable. The Strategy is a collection of Blocks and inner Strategies that are typically linked together. A Strategy may be instantiated as a control entity such as a Loop.

A Block is the fundamental control element and represents a specific type of control function. I/A Series systems support over a hundred different base types of Block.

STRATEGY CONSTRUCTION

A new strategy is developed by deriving a new template or instance from the base or derived Strategy, naming it and opening it. This creates a new drawing canvas for constructing the Strategy. Base or user derived Block templates are dropped onto the drawing canvas and linked together by connecting exposed parameters on the Blocks via a line drawing. Strategy connectors (inputs or outputs) are created and dropped onto the canvas and linked to block parameters. These are used to link Strategies together either from an inner to outer Strategy as discussed earlier or from a peer-to-peer Strategy connection as shown below.

Figure 2. Constructing a Strategy
Controlling the Execution order of Strategy Components

The IEE enables the user to determine the order of execution automatically based upon the data flow through the Strategy or by manually selecting the order of execution. The order of execution of Blocks/Strategies within a containing Strategy is important to avoid introducing unwanted dead time into the strategy execution order.

Superimposing Live Data Updates on Strategy Diagrams

The InFusion Engineering Environment provides a graphical display that superimposes real time updated values at the connections between blocks in a deployed strategy. It also provides the capability to access deployed control strategies from the Strategy Editor.
The user can also select contained Blocks/Strategies for editing purposes. This enables the user to upload values in the target controller to the database or to download settable parameters in the database to the target controller without implementing a deploy procedure.

**Specifying Block Properties and Behavior**

Once a control Strategy has been designed, its behavior and properties have to be specified. This primarily consists of specifying its constituent parts, namely base and user derived Blocks.

Blocks are available as either base or user derived templates. They are available for reuse in Strategy templates or instances. In all cases specifying the properties and behavior of these blocks is the same. A new Derived Block Template represents a specialization of the original Block type. Typical examples include specializing a base Analog Input block template to represent an iron-constant and thermocouple input block type as shown below.
Other specializations include modifying the appearance or exposing certain features of various function blocks. One example would be to derive a base PIDA block into a specialized SAMA representation of a control entity as shown below:

![Figure 6. SAMA Representation](image)

**Utilizing Strategies**

The IEE Strategy editor enables users to nest Strategies. This specialization process enables the user to create libraries of Strategy Templates that are composed of sets of connected blocks. To illustrate this capability, consider the example below where a Reactor Temperature Control Strategy template that is constructed from inner Strategy templates called CasHOL and SplitRange. These inner Strategy templates are formed from I/A Series block types.

![Figure 7. Construction Process](image)

Notice the yellow connectors in the two inner Strategies become connectable properties of the blocks in the outer Strategy.
Programmable Block Editors

I/A Series systems offer programmable block types including several choices of general purpose calculator style block types [MATH, LOGIC, CALC, CALCA]; a series of block types programmed in the High Level Batch Language [HLBL]; block types programmed in Sequential Function Charts [FoxSFC] and a block type that is programmed in a Ladder Logic Diagram that executes in I/O Modules.

The IEE provides a text editor for programming the High Level Batch Language and a graphical editor for programming Sequential Function Charts and Ladder Logic Diagrams as shown below.

SYSTEM CONFIGURATION

IEE enables the user to construct an I/A Series configuration from standard I/A Series Workstation, Control Station and Fieldbus Modules by instantiating these base types and renaming them according to user preferences. Then the engineer uses the Network View to assign these stations and modules to their designated Unit Areas.

The example below shows five user defined Unit Areas in addition to the Unassigned Hardware node. These are Centrifugation, Purification, Reaction, Solvent Recovery, and Tank Farm. It further shows two workstations and three Controllers assigned to the Reaction Area and two FBMs assigned to the RX0100 Controller.

Figure 8. Programmable Block Editors

Figure 9. Network View of System Configuration
**Bulk Generation of a Project**

The InFusion Engineering Environment offers extensive engineering productivity tools such as the ability to bulk generate a project database from user defined templates combined with project specific information stored in Excel® or .CSV format, I/A Series SaveAll format, IACC Export format, SysDef Export format, or in a proprietary XML document.

Bulk generation has the capability for applying Visual Basic® scripts to selected portions of the grid such as specific strategies or compounds to make bulk edits to the information. Once the user is satisfied with the structure and content, this grid is then used to generate the requisite control strategies and system configuration.
CONTROL STRATEGY DEPLOYMENT

Once a Strategy is correctly assigned to a Compound and the Compound to a Controller, it can be deployed using commands selected from the object in the Deployment View, or one of the other IEE Application Views.

There are three targets updated in the deployment:

- Compounds and blocks are downloaded to the I/A Series system including the assigned Controller and the Compound Summary Access (CSA).
- Security access settings for compound and block attributes are loaded into ArchestrA Security.
- ArchestrA History is updated with the collection points configured in the Compounds and blocks.

When a Strategy or Compound is later modified in IEE, it must be re-deployed to implement the changes in the runtime system. When a Strategy or Compound is re-deployed, only the affected targets are updated, and only the modified parameters are downloaded.

User Defined Application Objects

The InFusion Engineering Environment enables the user to construct Application Objects and deploy them to the InFusion Application Environments hosted by AW70 platforms and ArchestrA® Industrial Application Servers. These are created by the IEE Galaxy Repository. The following example depicts an OLEDB database application created as an Application Object:
ACCESS SECURITY

The InFusion Engineering Environment utilizes an ArchestrA Role-based security model where users subscribe to different roles depending upon their job requirements. Roles have associated access permissions and security groups. Security groups have various plant areas assigned to them.

A user’s subscription to a particular role provides access to specific security groups (plant areas) with specified access permissions (Operate, Secured Write, and so forth) in those groups.

The authentication process is user_name and password.
HARDWARE AND SOFTWARE REQUIREMENTS

IEE Server

- I/A Series Software Version: Supports I/A Series version 8.2
- I/A Series Station type: P91
  - Intel® Pentium® 4, 1.8 GHz (or higher) processor
- Operating System: Microsoft® Windows 2003® Server Software(1)
- Database Software: Microsoft SQL Server 2005(1)(2)
- Memory: 2.0 gigabytes of main memory
- Hard Disk: Recommended: 16.0 GB free memory
- Video Graphic Accelerator Card: 32 MB of memory
- Communications Network: 100 MHz TCP/IP Switched Ethernet

IEE Client

- I/A Series Software Version: Supports I/A Series version 8.2
- I/A Series Station type: P92
- Operating System: Microsoft® Windows XP® Software(1)
- Computer: Intel® Pentium® 4, 1.8 GHz (or higher) processor
- Memory: 2.0 gigabytes of main memory
- Hard Disk: Recommended: 16.0 GB free memory
- Video Graphic Accelerator Card: 32 MB of memory
- Communications Network: 100 MHz TCP/IP Switched Ethernet

(1) Microsoft SQL Server 2005 is included as part of the IEE installation.
(2) Requires Microsoft.NET 2.0 to be installed. Microsoft .NET 1.1 is included as part of the IEE installation.