Overview

The EcoStruxure™ Foxboro™ DCS Process Automation System's (The Foxboro DCS system) Integrated Control Software provides for the integration of continuous, ladder logic and sequential control in a Foxboro DCS control strategy.

The Foxboro DCS system Integrated Control Software provides a selection of continuous, sequential, and ladder logic control domains. Each domain can be used independently or integrated to meet specific application requirements.

The Control Software provides the user with a comprehensive control strategy and input/output implementation for on/off control, timing, regulatory and feedback applications. Implemented within a block and parameter structure, the Control Software provides the base for the integration of continuous, ladder logic, and sequential control with programmable logic controller functionality.

The software control strategies allow you to mix and match continuous and Programmable Logic Block (PLB) capabilities with sequencing in the same control scheme.

The process control domains – continuous, sequential and batch, and ladder logic – execute in any Foxboro DCS control processor.

The Control Software running in a control processor provides the interface to the Fieldbus subsystem and other I/O subsystems through I/O blocks. These I/O blocks interface to the specific applications executing in the Foxboro DCS Fieldbus Modules (FBMs).

Access to the FBMs and associated devices (for example, field sensors, actuators, Intelligent Field Devices) is through the Control Software in the Foxboro DCS Field Control Processor 280 (FCP280).

An optional fault-tolerant control processor configuration, where two identical control processors (Primary and Shadow) are running in parallel, provides enhanced reliability to the control process.

For more information on the FCP280, refer to *Field Control Processor 280 (FCP280)* (PSS 41H-1FCP280).

Features

- Integration of continuous, sequential, and ladder logic control domains for ease of implementing complex control strategies for a wide variety of process control applications
- Comprehensive set of continuous control blocks (algorithms) for input/output, valve/motor control, regulatory control, computation, logic, and alarming
- Comprehensive set of ladder logic instructions for designing modular solutions to logic control problems in familiar, easy-to-use relay ladder symbols
- High-level sequence programming language provides a comprehensive set of sequence logic instructions for developing sequential, feedback-oriented applications at equipment control level
- Integration of control blocks within groups for ease of configuring control strategies
- EXACT® MV advanced control algorithms provide adaptive feedback and feedforward PID control capability with pre-tuning functions

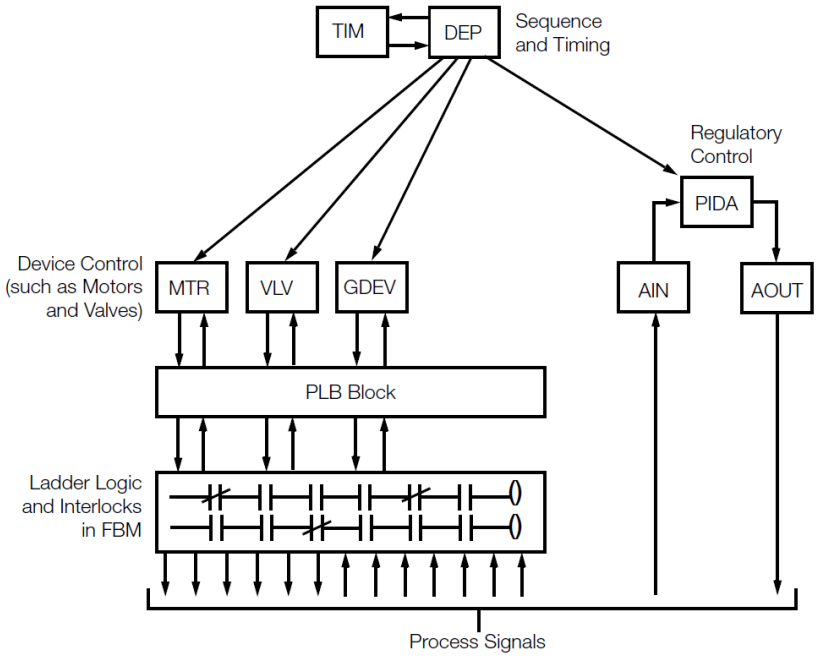
- Configuration of continuous block types, ladder logic, and sequential blocks via the following flexible, intuitive, user interfaces:
  - Foxboro DCS Control Editors (Control Editors), including the Block Configurator, Programmable Logic Block (PLB) Ladder Logic Editor, the Sequence Block HLBL Editor, and the Sequence Block SFC Editor
  - The I/A Series® Configuration Component (IACC) software
  - Integrated Control Configurator
- Reuse of block configurations from one controller to another

Control Software Concepts

Figure 1 shows the integration of continuous control, ladder logic, and sequential control in a single control processor. A block is a member of a set of algorithms that performs a certain control task. The Foxboro DCS control blocks also support user-defined arithmetic and Boolean logic functions, alarm detection and reporting, and shared variables, which are global variables that allow data to be shared across applications within The Foxboro DCS system.

The Control Software also provides communication interface blocks called Equipment Control Blocks (ECBs). ECBs are located in the control processor and provide I/O and control information related to Migration products, FBMs, Field Device System Integrators (FDSIs) and their related devices (such as actuators, sensors, and Intelligent Field Devices, including third-party field I/O devices).

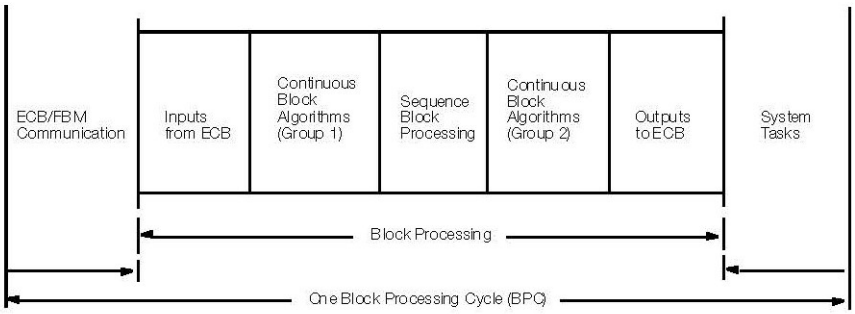
Figure 1. Total Integration of Foxboro DCS Control Software in a Single Control Processor



Block Processing Speed

The control processor processes the control blocks in every Block Processing Cycle (BPC), as shown in Figure 2. The BPC can be set with a wide range of periods from 50 ms to 60 minutes.

Figure 2. Block Processing Cycle (BPC)



At the beginning of block processing, I/O data is read from each Fieldbus Module, for both input and output channels. Data is read at the ECB scan period specified for that module. However, data cannot be read faster than the BPC. At the end of block processing, process outputs are written to each of the Fieldbus Modules.

Station Block

Each control processor contains a station block automatically created to provide global data on control processor system functions. The station block contains information such as:

- Continuous block processing load
- I/O scan load
- Sequence block processing load
- Total control cycle load
- Basic processing cycles and overruns
- Number of bytes of free memory
- Number of peer-to-peer connections
- OM scan load
- Idle time
- Station alarm groups
- Configuration security option

Previous CPs only supported one I/O channel to an HDLC fieldbus (which provides communication to a chain of Fieldbus Modules) directly, or used external hardware, such as the FEM100 (discussed in PSS 31H-2Y14) to support up to four I/O channels. However, the FCP280 supports four I/O channels directly, without the use of such external hardware.

Every HDLC fieldbus' channel requires a software driver in the CP called a *Primary ECB*. Thus, the FCP280's Compound has four Primary ECBs - one for each channel - through which the station block directs all communications. Each of its FBM's ECBs must be assigned to the Primary ECB for the channel on which their FBM resides via a new parameter added to them called "CHAN".

Control Configuration Concepts

The Foxboro DCS control blocks are configured from the Process Engineer's Environment, which provides access to the Block Configurator, Integrated Control Configurator (ICC), or I/A Series Configuration Component (IACC).

The Block Configurator, ICC, or IACC provide for the configuration of Equipment Control Blocks associated with Fieldbus Modules. These blocks provide the means of communicating the control information among the control processors, Fieldbus Modules, actuators, sensors, and Intelligent Field Devices.

Configuration of continuous block types, ladder logic and sequential blocks is accomplished through the Block Configurator, ICC, or IACC. During the configuration process, the configurator recognizes the various block types chosen by the user and is able to identify their unique control domain association. For additional information on:

- Block Configurator, refer to PSS 31S-10EDITOR
- IACC, refer to PSS 21S-2B5 B4.

Block configurations can be reused from controller to controller by importing them into the configuration environment. In this way, the plant intellectual property can be preserved and leveraged.

The Intelligent field devices (IFDs) are configured using the Field Device Manager (FDM). For more information on FDM, refer to PSS 31S-10FDMHRT.

Continuous Control Concepts

To use a cascade and feedforward control strategy as an example, you might build the strategy by selecting the following blocks:

- Three Analog Input (AIN) blocks
- One advanced Proportional/Integral/Derivative (PIDA) control block
- One Proportional/Integral/Derivative (PID) control block
- One Analog Output (AOUT) block.
- One Feedback Tuner Extender (FBTUNE) for PIDA
- One Feedforward Tuner Extender (FFTUNE) for PIDA

In the cascade control strategy shown in Figure 3, each block requires a unique name. This can be any combination of up to 12 characters, for example, FLWTRNS100.

FBTUNE and FFTUNE extender blocks may be linked to the PIDA blocks to provide feedback and feedforward adaptive tuning.