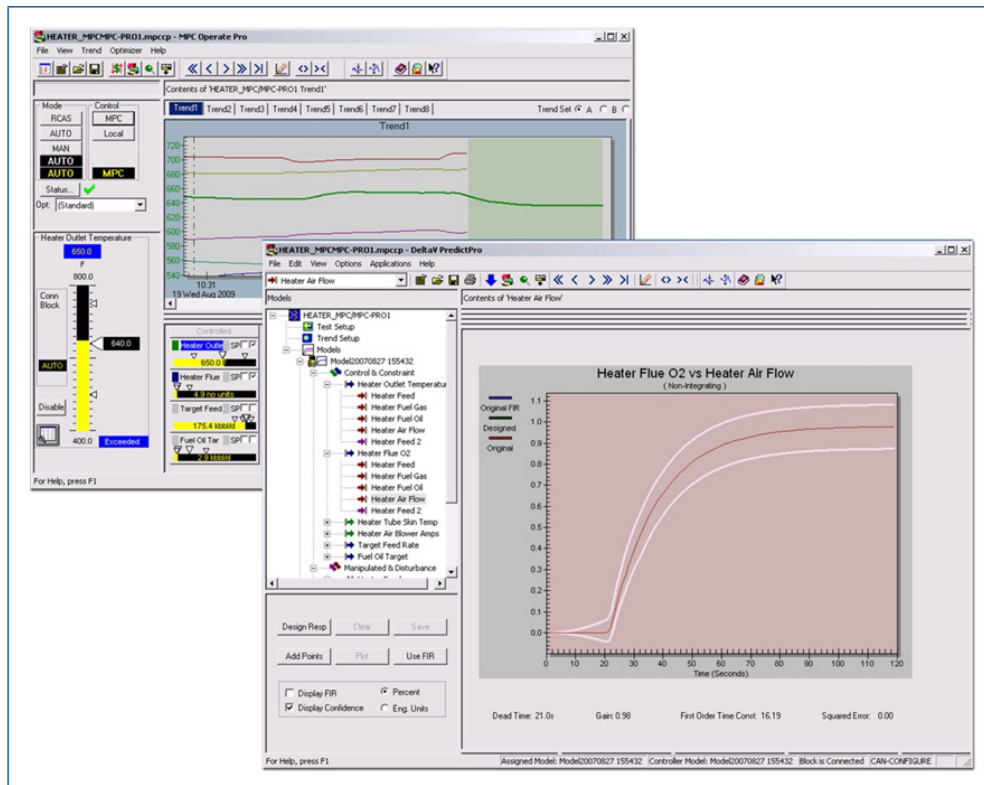# DeltaV™ Predict and DeltaV PredictPro

Powerful model predictive control and optimization available in every DeltaV™ system.

- Improve product quality by reducing variability
- Increase profitability by operating closer to process constraints and limits
- Save time using automated model development
- Test control application and train operators with off-line MPC simulation

Introduction

Obtain greater throughput, reduced variability, and increased profitability by using *DeltaV™ Predict and DeltaV PredictPro* to implement multivariable model predictive control (MPC) strategies. DeltaV Predict and PredictPro use the power of dynamic matrix control to easily address process interaction and difficult dynamics.

Since DeltaV Predict and PredictPro are fully embedded in the DeltaV system, you may use pre-engineered components and function blocks to develop, test, and deploy your multivariable control strategies quickly and easily.

DELTAV™

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Benefits

Improve product quality by reducing variability. The multivariable, model predictive control technology used by DeltaV Predict and PredictPro automatically account for process interactions and difficult process dynamics. DeltaV Predict and PredictPro easily handle excessive deadtime, long time constants, inverse responses, and loop interactions. Through these advanced control techniques, the variability in key process variables can be dramatically reduced.

Increase profitability by operating closer to process constraints and limits. As a result of the reduced process variability provided by DeltaV Predict and PredictPro, it may be possible to increase throughput when plant production is limited by one or more process constraints. Reduced process variability allows for optimal control performance without increased risk of violating operating constraints. Using the embedded optimizer feature of DeltaV PredictPro, throughput may be automatically increased to maintain the plant at one or more constraint limits. The full power of an embedded optimizer (linear program or LP for short) in PredictPro allows even the most complex units to be operated at peak profitability.

Save time using automated model development. The easy-to-use identification approach of DeltaV Predict and PredictPro automates the development of the process model used in model predictive control. In most cases, all you need to do is identify the necessary controlled and manipulated variables that will be used. Process testing and collection of the process data are performed automatically. Based on this information, the process model and associated multivariable controller may be generated automatically.

Test control application and train operators with off-line MPC simulation. Before you commission MPC, it is possible to test and train operators on this new way of operating your process. Using the simulation capability provided with DeltaV Predict and PredictPro, you might observe the response to setpoint and load disturbances.

The process model used for developing the MPC block may also be used to simulate the process in order to test the control strategy. The same displays and operator interfaces that will be used for the plant may be used with this simulation capability. Using DeltaV Simulate, your operators can become completely familiar with the control operation before it is commissioned in your plant.

# Product Description

DeltaV Predict

DeltaV Predict offers you an entirely new approach to the implementation of model predictive control. Using the DeltaV Predict MPC Function Block, you can implement multivariable model-based control strategies much easier than with traditional tools. Testing of the process to develop the model used by DeltaV Predict is fully automated. Control design and implementation may be done in a fraction of the time required for traditional techniques.

Unlike many traditional control techniques, DeltaV Predict is designed to provide good control performance, even when the process gain and dynamics change with throughput and operating conditions. This robust control design minimizes or entirely eliminates the need to periodically recommission the controller.
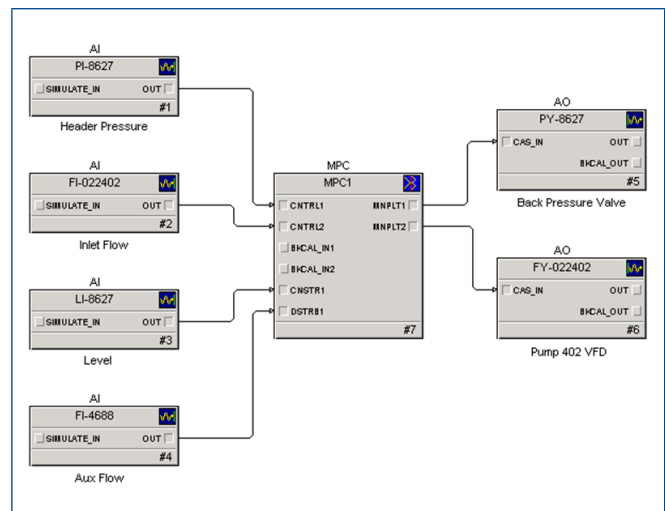
DeltaV Predict Implementation with Function Blocks.

The DeltaV Continuous Historian automatically collects data on the inputs and outputs used by the MPC Function Block. DeltaV Predict will automatically perform the process testing necessary to develop the process model. The data collected during the process testing can be easily viewed, and any anomalous data may be eliminated using easy graphical tools. By selecting the optional expert mode, DeltaV Predict allows the resulting process models to be viewed and edited. The MPC controller is automatically generated from the process model and subsequently downloaded to the MPC Function Block in the DeltaV Controller.
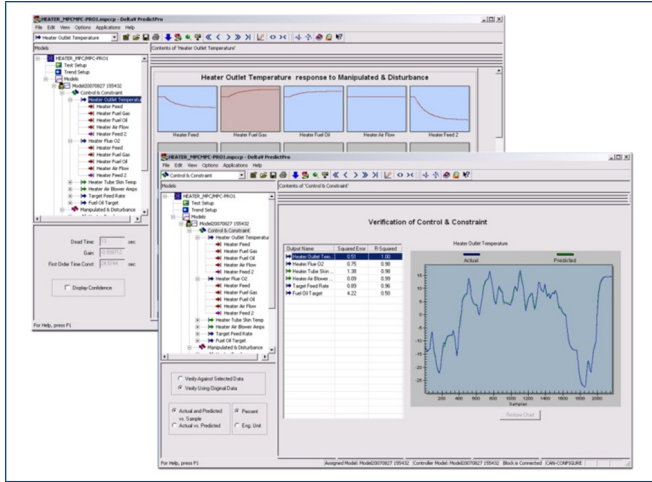
Easily View and Validate Process Models.

A simulation environment is also provided with DeltaV Predict. Using this environment, you can easily test your model predictive control strategies at up to 100 times faster than real-time before putting them in control of your live process.

The MPC Function Block supports execution rates as fast as one second. This fast execution allows DeltaV Predict to be used even for regulatory control in processes far too fast for other MPC solutions.

With DeltaV Predict, you will receive graphical components that make creating your MPC operator interface as easy as for PID. Through this interface, your operator may easily interact with the MPC strategy. The predicted values of controlled and constraint parameters are automatically displayed on the historic trends contained in these views.

DeltaV PredictPro

DeltaV PredictPro greatly extends the features and functionality of DeltaV Predict allowing for much larger dynamic control matrices, enhanced input status handling with simulation, embedded LP optimization, and other advanced algorithm options.

Larger Size. DeltaV PredictPro supports MPC controllers large enough to handle up to 40 process inputs and 80 process outputs. Any combination of controlled and constraint variables totaling 80 or fewer, and any combination of manipulated and disturbance variables totaling 40 or fewer may be used. With a 40x80 controller you can take on larger process units or even multiple smaller units using a single optimized control strategy. Expert users have the option to use advanced modeling tools such as step response editing, prioritization, confidence intervals, and the ability to copy and paste responses between models.

Embedded LP Optimizer. DeltaV PredictPro contains its own embedded linear program for optimizing even the most complex control applications.

Choosing the optimal combination of set points across several independent loops can be extremely difficult for operators, especially when operating conditions are changing.

The embedded optimizer within PredictPro gives you the ability to automatically push the process toward an economically optimal solution based on energy and feed costs and product values, while simultaneously respecting constraints.

Enhanced Status Handling. Larger MPC controllers require more advanced means of handling invalid parameters in order to keep running. PredictPro can be configured to allow continued control with simulated values when input statuses are bad or uncertain or when manipulated variables are not available.
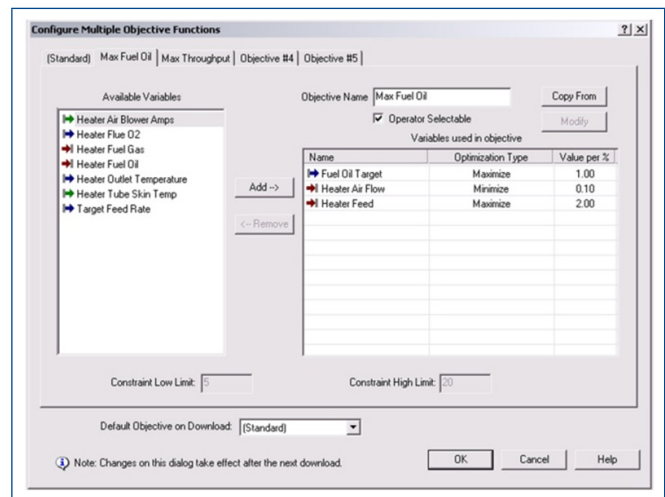
Embedded LP Optimizer Produces Best Economic Results.

PredictPro has the ability to simulate variables between samples when using sampled inputs from an analyzer or other non-continuous measurement. PredictPro can also be configured to use simulated inputs if the input freezes and its status goes to constant. Timers are used to prevent continuous use of simulated inputs over extended periods of time.

Enhanced status handling features coupled with the ability of PredictPro to read device health status from intelligent instruments means that your MPC application will be able to achieve the maximum possible service factor while improving your plant economics.

Advanced MPC Algorithm Options. Advanced MPC features are available with the MPCPlus function block. These advanced features include:

- Non-linear MPC with on-line gain scheduling

- On-line tuning with non-linear CV weighting

- Enhanced move plan calculations and display

- Enhanced LP optimization with CV preferred settling values (PSVs), integrator balancing, and dynamic move coordination

The MPCPlus block advanced calculations require additional computations which are currently only available on DeltaV ProfessionalPlus or Application workstations. MPC redundancy is available for Application workstations.

DeltaV Predict and PredictPro Specifications

Feature	DeltaV Predict	DeltaV PredictPro	
	MPC Function Block	MPCPro Function Block	MPCPlus Function Block
Licensing Required for Single Manipulated Parameter Version	NONE	NONE	NONE
Maximum Number of Process Inputs Supported	8, a maximum of 4 Disturbance, and 4 Manipulated parameters	40, any combination of MVs and DVs	40, maximum 20 MV's
Maximum Number of Process Outputs Supported	8, a maximum of 4 Control, and 4 Constraint parameters	80, any combination of control + constraint parameters	80, any combination of control + constraint parameters
Executes in the DeltaV Controller	YES	YES	NO
Executes in the Application or ProPlus station	YES	YES	YES
Fastest Execution Speed	1/second	1/second	1/second
Optimization Support	Constraint Pusher, one optimized parameter	Embedded Linear Program (LP) Optimizer	Embedded LP with PSV and dynamic move coordination
Maximum Number of Optimization Objective Functions per Controller	N/A	5, one predefined for common applications	5, one predefined for common applications
Automated Testing of Process for Model Development	YES	YES	YES
Fir and Arx Models Identified	YES	YES	YES
Verification of Step Response	YES	YES	YES
Model may be Created using Data from Deltav Historian	YES	YES	YES

Feature	DeltaV Predict	DeltaV PredictPro	
	MPC Function Block	MPCPro Function Block	MPCPlus Function Block
Model Creation from Data File Import	YES	YES	YES
Simulation Environment Provided for Testing Control Off-Line	YES	YES	YES
Option to Continue Mpc Control on Loss of Process Input or Output	NO	YES	YES
Sampled Analyzer Support for Process Input	NO	YES, input simulated between samples	YES, input simulated between samples
Mpc Dynamos for Deltav Operator Interface	YES	YES	YES
Mpc Operate Application to Examine Control/View Future Prediction, Diagnostics	YES	YES	YES
Non-Linear Mpc with Gain Scheduling	NO	NO	YES
On-Line Poe / Pom Tuning with Non-Linear Cv Weighting	NO	NO	YES
Enhanced Move Plan Calculations and Display	NO	NO	YES

Licensing

DeltaV Predict and PredictPro is licensed "system wide" by manipulated variables (referred to as MV's or MPC Outputs). Licenses for MPC manipulated variables may be ordered and accumulated in the DeltaV system database. This total number of MPC manipulated variables are then decremented whenever you choose to implement an MPC function block. If you use a function block with 2 MPC MVs, then two MVs will be subtracted from your system-wide total. If you then use another function block with three MPC manipulated variables, subtract three more, and so on.

No license is required for single MV MPC blocks.

The system wide MPC manipulated variable licenses may be applied to Predict or PredictPro applications interchangeably.

When a Predict or Predict Pro license expires, the MPC, MPC Pro, and MPC+ function blocks will continue to execute in the controller. An attempted download to a controller hosting one of the MPC, MPC Pro, and MPC+ function blocks with an expired license will fail with an error indicating the license has expired. If the controller needs to be re-downloaded, the last known good download can be sent using the "Send Last Known Good Download" command from the controller's context menu.

Prerequisites

- A DeltaV Application station or DeltaV ProPlus Station for workstation based applications.

- A DeltaV ProfessionalPLUS Station or Professional Station is required to configure DeltaV Predict or PredictPro.

- For operator training or offline development and testing, the MPC function block may also be executed in a single PC or networked offline system using DeltaV Simulate or Simulate Multi-node.

Ordering Information

Perpetual License - v14 and Earlier Systems or Systems with Existing Perpetual Licenses

Part Description	Model Number
DeltaV Predict/PredictPro, 1 MPC Output—Unlimited usage	Standard
DeltaV Predict/PredictPro, 2 MPC Outputs	VE3152S002
DeltaV Predict/PredictPro, 5 MPC Outputs	VE3152S005
DeltaV Predict/PredictPro, 10 MPC Outputs	VE3152S010
DeltaV Predict/PredictPro, 20 MPC Outputs	VE3152S020

Ordering Information

Subscription License - DeltaV v15.LTS and Later Systems

Part Description	Model Number
DeltaV Predict/PredictPro w-Year Subscription; xx MPC Outputs; Annual Price*	VE3152SwS0xx_YyFYzz*

*Where **w** represents the length of the subscription term in years (1, 3, or 5)

*Where **xx** represents the number of MPC Outputs (02, 05, 10, or 20)

*Where **y** represents the specific year of the subscription term (1, 2, 3, 4, or 5)

*Where **zz** represents a two-digit indicator of the year of purchase (e.g. 23)

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