Part type designation	Part number
M-Target for Simulink – SL	00015577-60
M-Target for Simulink – SL AMT	00015577-70
M-Target for Simulink – Internet Download	00015577-90

MathWorks Partner

Enabled by MATLAB & SIMULINK MathWorks

M-Target for Simulink®

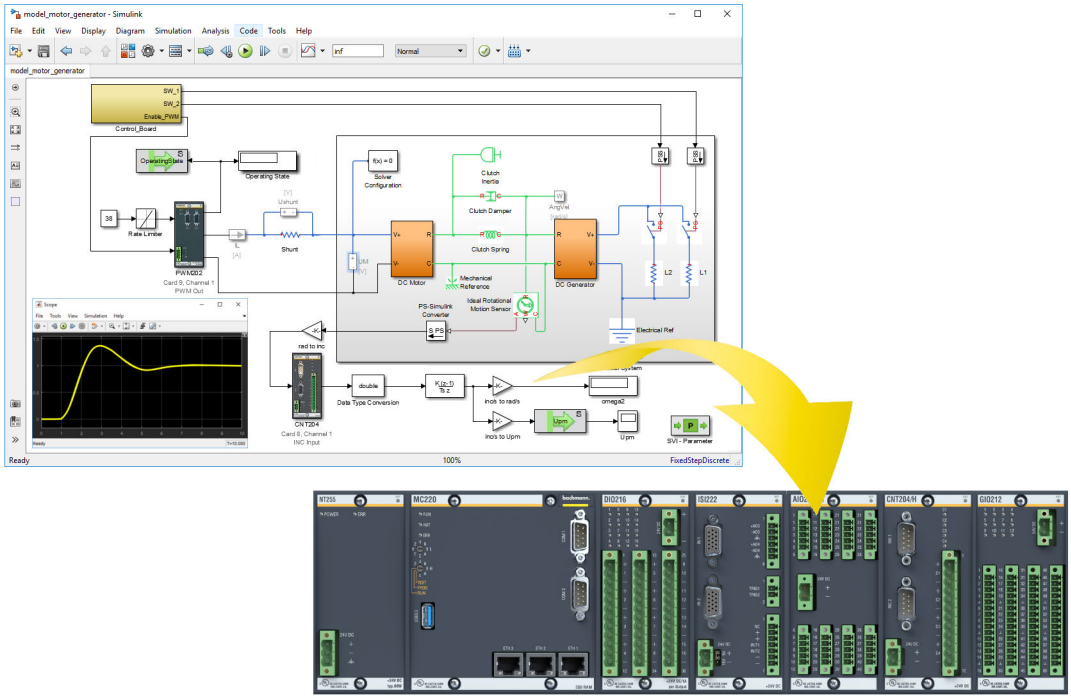
Fast development of controllers and sequence controllers via model-based design

The MATLAB® program package and the associated toolbox, Simulink® from Mathworks Inc. are considered to be the worldwide standard in the area of modeling dynamic systems in technologically demanding processes.

Within this development environment, M-Target for Simulink® integrates the Bachmann controller as a comprehensively supported target system. This allows users to develop their automation program in the well-known graphic programming environment Simulink®. Various program operating states can be tested and optimized in advance using simulation in combination with a plant model. The following code generation and program installation on the Bachmann controller takes place automatically in the background and requires no knowledge of the programming language. This completely integrated toolchain enables efficient, time-saving programming and commissioning of the Bachmann automation system.

Features

- Comprehensive toolboxes enable the rapid implementation of application programs
- Reliable automatic code generation eliminates sources of error during the installation of a program on the target controller
- Extensively tested and optimized application programs reduces the required commissioning time



Simulation – Solution development on the computer model and direct download to the M200 Controller System

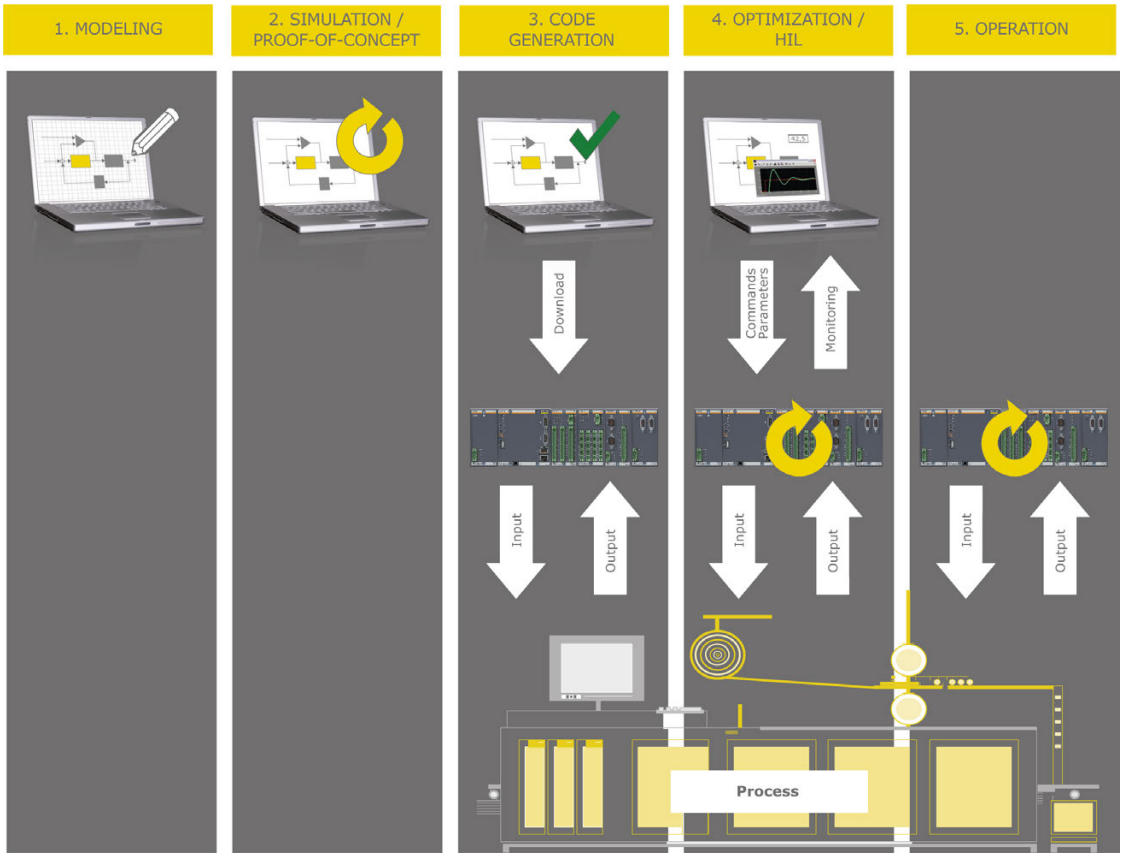
Development process

1. Modeling

Both process (controlled system) as well as controller and control programs are modeled in Simulink®. Using application specific toolboxes reduce the time spent developing the system. Numerous domain-specific products for physical modeling, such as Simscape Electrical™, Simscape Fluids™, Simscape Multibody™ etc. make it easier to the respective process expert to create intuitive, reusable models of the multidomain physical system. For mathematical modeling, MATLAB® and Simulink® also offer a range of ready-to-use algorithms. Established service companies offer additional expertise in all domains.

2. Simulation

The resulting complete model is now simulated offline on the computer. Comprehensive test series of all possible operating conditions or error situations are played through. Iterative model adjustments and new simulations follow seamlessly. The high-quality process/solver for numeric calculation of differential equations also prove themselves outside of simple analytical systems. Outstanding graphic depiction possibilities, such as curves and surface plots and even animated 3D CAD models, optimize the workflow.



3. Generation and Download

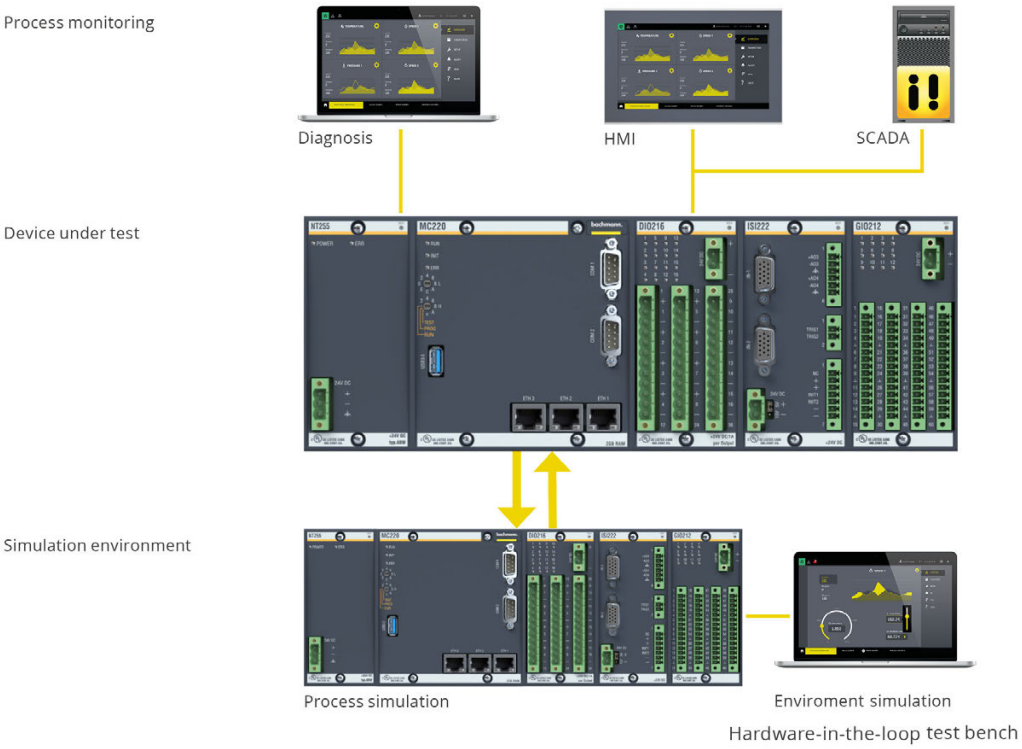
In this step, the process model is first separated from the actual control part. Then a mouse click triggers automatic code generation and preparation of the application program for the real-time system. This can be loaded directly from the Simulink® user interface into the controller. Optionally, libraries can be generated for IEC 61131-3 programs or for C/C++, which are used in the respective development environments in order to create application programs.

4. Test and Optimization

The generated real-time program now runs in the controller. But it can exchange data directly with the Simulink® user interface on the PC through the communication interfaces integrated during code generation. Then, in the so-called "external mode", the actual process values (variables, channel values) are available directly online in Simulink®. At the same time, variable values or internal parameters of the Simulink® blocks can also be changed from there in the real-time program. In this mode, the Simulink® model created by the developer is only the graphic front end for visualization of process values and assignments of parameters. The algorithms are executed on the control system. Using the real process environment, the discovered solution can be verified and further optimized. If necessary, users can switch to a prior process step and make changes there (iterative improvement).

5. Operation

As soon as a satisfactory result is achieved, the project planning PC can be separated from the controller – which continues to run autonomously in real time. All interfaces to parallel-running application programs on the same (or other) controller(s) remain in place.All interfaces to parallel-running application programs on the same (or other) controller(s) remain in place. The published process variables can be depicted through the general engineering tool SolutionCenter or in visualizations.


Process monitoring
Diagnosis
HMI
SCADA
Device under test
Simulation environment
Process simulation
Enviroment simulation
Hardware-in-the-loop test bench

M-Target for Simulink®

Range of application	
Model-based development	Yes, with Simulink® / automatic code generation
Offline simulation	Yes
Hardware in the loop	Yes
Real-time programming	Yes
Control technology	Yes (PID, Observer, Fuzzy, MIMO etc.)
Signal processing	Yes, synchronous or blockwise processing (frame-based processing)
Process and status machines	Yes, with Stateflow®
Signal interfaces [1]	
Digital signals	24 V uniform signal input (meter-capable, interrupt-capable) 24 V uniform signal output (PWM capable) 5 V TTL input/output
Analog signals	±1 V, ±10 V uniform signal input/output 0(4) mA to 20 mA uniform signal input/output
Temperature sensor	PT100 PT1000 Thermocouples type J, K, T, N, E, R, S, B
Position, angle, location	Incremental encoder, SSI
Force/expansion measurement	Expansion measurement bridges
Vibrations, accelerations	ICP acceleration sensors (up to 50 kS/sec)
Special signals	Step motor triggering, PWM (DC motors)

[1] *Over Bachmann M200 I/O modules*

Software interfaces	
Process communication	SVI (standard variables interface), SMI (standard module interface) of signals and parameters
Fieldbus interfaces	Direct integration of the model communication via Bachmann library blocks: • EtherCAT PDO and SDO • CAN PDO and SDO • Bluecom
Automatic code generation for M200	• Complete real-time application for M200 (software module) • Libraries for use in M200 real-time applications in C/C++ • Libraries for use in M200 real-time applications in IEC 61131-3
Integration of existing code	Yes (C/C++ as S-function)
File system	Yes, on flash interchangeable media, fixed media, RAM, remanent RAM
Monitoring	• "External mode" by Simulink® for online monitoring using scopes, displays and workspace blocks in Simulink® • Online monitoring of all SVI variables using the engineering tool Scope 3 in SolutionCenter
MATLAB® – M1 API	Direct MATLAB® access to all SVI variables of an M200 control system
Data exchange for co-simulation	Plant simulation on engineering PC easily connectable with control program running on M200 control system via integrated interface
Real-time system	
Real-time systems	VxWorks
M200 multi-core processor modules	Application processing on freely selectable core
Multitasking	Yes, preemptive
Several M-Target models	Yes, simultaneously / different priorities possible
Priority levels	255

Real-time system	
Task models	Single-rate/single-task, multi-rate/single-task, multi-rate/multi-task
Cycle times	Freely selectable from 200 µs (application-dependent)
Synchronization	Hardware interrupts (signal interfaces), hardware cycle (sync), CPU
Mixed operation	Yes, software modules (processes) in IEC 61131-3 (ST, FBD, IL, LD, SFC), C, C++ can run parallel to Simulink® models
Libraries	
Bachmann I/O and function modules	Yes, contained in M-Target with integrated simulation modes, can be imported from the control system
Function extensions [1)]	Respective toolboxes from MathWorks
Domain modeling [1)]	Respective toolboxes from MathWorks

[1)] *Requirement is suitability for MATLAB Coder™ and Simulink Coder™*

System requirements	
Real-time system	Bachmann M200 processor modules of the MX, MC and MH series
Engineering computer	PC under Windows 10 4 GB RAM, processor Intel Core Duo 2 GHz or better, screen resolution ≥ 1280 × 1024 TrueColor, > 2 GB free HDD, Ethernet interface
Engineering software	MATLAB® with Simulink®, MATLAB Coder™ and Simulink Coder™ (supported versions acc. to M-Target for Simulink® release notes), toolboxes from MathWorks according to application, M-Base Version 4.00 or higher

Order data

Part type designation	Part number	Description
M-Target for Simulink SL	00015577-60	Development tools for simulation and creation of control programs, closed-loop control programs and sequence programs with MATLAB®/Simulink® and automatic code generation for the M200 series based on MATLAB Coder™ and Simulink Coder™. One year of product support and updates delivery are included in the license.
M-Target for Simulink SL AMT	00015577-70	One-year renewal of product support and of the delivery of updates for M-Target for Simulink®.
M-Target for Simulink Internet Download	00015577-90	M-Target software package installer