



## M-Target for Simulink®

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

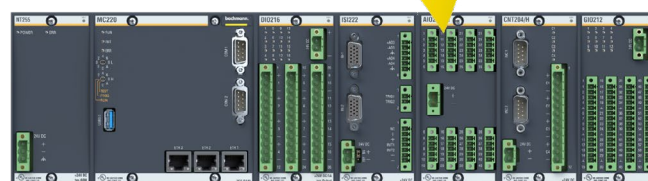
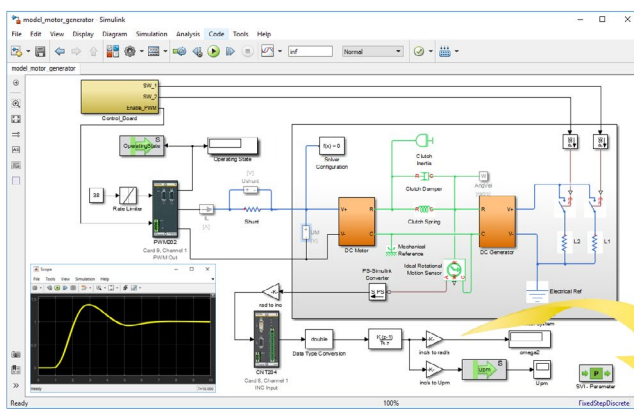
The MATLAB® program package and the associated toolbox, Simulink® from Mathworks Inc. are considered to be the worldwide standard in the area of modeling dynamic systems in technologically demanding processes.

Within this development environment, M-Target for Simulink® integrates the Bachmann PLC 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 PLC 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.

- 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 PLC
- Extensively tested and optimized application programs reduce the required commissioning time.



Item	Item-No.
M-Target for Simulink – SL	00015577-60
M-Target for Simulink – SL AMT	00015577-70
M-Target for Simulink – Internet Download	00015577-90



### Simulation

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

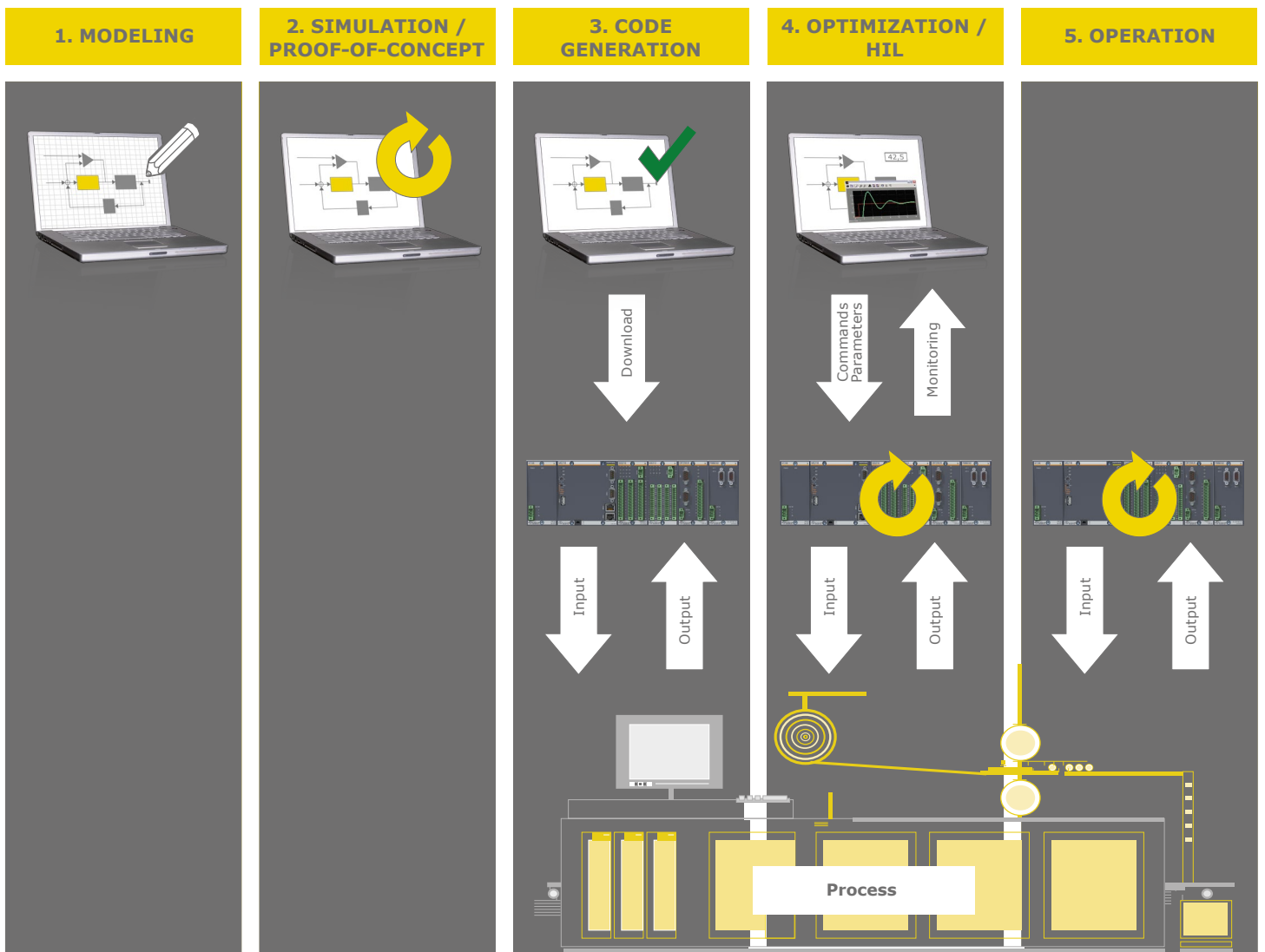
## Development Process

### 1. Modeling

Both plant (physical system) and control systems are modeled in Simulink®. Using application specific tools reduces the time spent developing the system. This is achieved by enabling the developer to use modeling languages native to the domain of interest. Domain-specific products for physical modeling, such as Simscape Electrical™, Simscape Fluids™, Simscape Multibody™, make it easier to create intuitive, reusable models of the multidomain physical system. For mathematical modeling, MATLAB® and Simulink® also offer a range of capabilities. 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 work sequence.



### 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 for the real-time system. This can be loaded directly from the Simulink® 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 applications.

### 4. Test and optimization

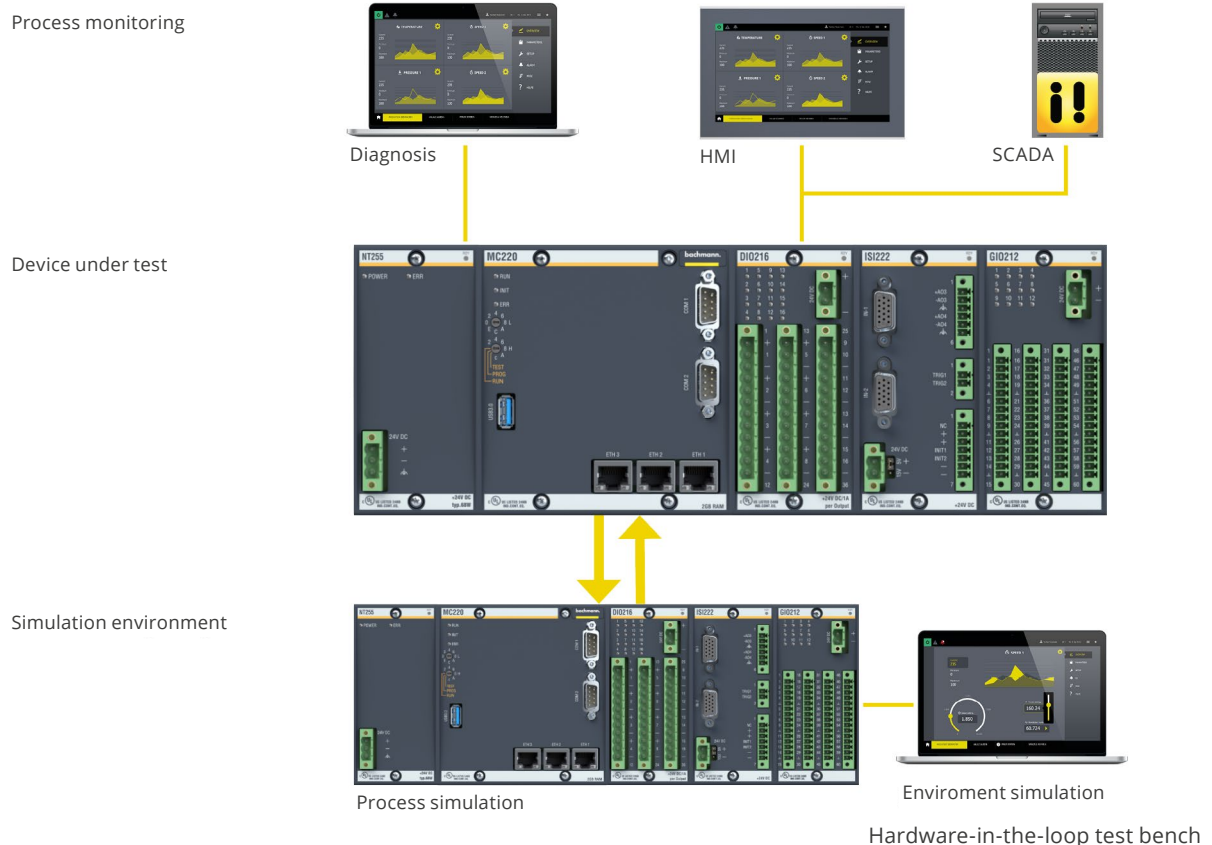
The generated real-time program now runs in the controller. But it can exchange data directly with the Simulink® interface on the PC through the communication interfaces integrated during code generation. Then, in the so-called “external mode”, the actual process values (variables, channel values) are 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.

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 management PC can be separated from the controller – which continues to run autonomously in real time. All interfaces to parallel-running applications on the same (or other) controllers remain in place. The published process variables can be depicted through the general engineering tool SolutionCenter or in visualizations.



<b>M-Target for Simulink®</b>	
<b>Areas of application</b>	
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®
<b>Signal interfaces<sup>1)</sup></b>	
Digital signals	24 V uniform signal input (meter-capable, interrupt-capable) 24 V uniform signal output (PWM-capable) 5V TTL input / output
Analog signals	±1 V, ±10 V uniform signal input / output 0(4) to 20 mA uniform signal input / output
Temperature sensor	PT100 PT1000 Thermoelements 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)
<b>Software interfaces</b>	
Process communication	SVI (standard variables interface), SMI (standard module interface) of signals and parameters
Fieldbus protocols	Direct integration of the model communication via Bachmann library blocks: <ul style="list-style-type: none"> <li>• EtherCAT PDO and SDO</li> <li>• CAN PDO and SDO</li> <li>• Bluecom</li> </ul>
Software interface M-Target	C/C++ (M-Target models can be supplemented with legacy code) in the form of software modules or libraries for IEC 61131-3 and C/C++
Automatic code generation for M200	<ul style="list-style-type: none"> <li>• Complete real-time application for M200 (software module)</li> <li>• Libraries for use in M200 real-time applications in C/C++</li> <li>• Libraries for use in M200 real-time applications in IEC 61131-3</li> </ul>
Integration of existing code	Yes (C/C++ as S-function)
File system	Yes, on flash interchangeable media, fixed media, RAM, remanent RAM
Monitoring	<ul style="list-style-type: none"> <li>• External mode« by Simulink® for online monitoring using scopes, displays and workspace blocks in Simulink®</li> <li>• Online monitoring of all SVI variables using the engineering tool Scope3 in SolutionCenter</li> </ul>
MATLAB® – M1 API	MATLAB® access to all SVI variables of a M200 Controller System
Data interface for Co-simulation	Plant model executed on engineering PC easily connectable with control code running on M200 Controller System via provided interface

1) Over Bachmann M200 I/O modules

M-Target for Simulink®	
<b>Real-time systems</b>	
Real-time operating system	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
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
Mix mode	Yes, software modules (processes) in IEC 61131-3 (ST, FBD, IL, LD, SFC), C, C++ can run parallel to Simulink® models
<b>Libraries</b>	
Bachmann I/O and function modules	Yes, contained in M-Target for Simulink® with integrated simulation modes, can be imported from the control system
Function enhancements <sup>1)</sup>	Respective toolboxes from MathWorks
Domain modeling <sup>1)</sup>	Respective toolboxes from MathWorks
<b>System requirements</b>	
Real-time systems	Bachmann M200 CPUs of the series MX, MC und MH
Engineering computer	PC under Windows 10 4 GB RAM, processor Intel Core Duo 2 GHz or better, screen resolution ≥1280 x 1024 TrueColor, >2 GB free HDD, Ethernet interface
Engineering software	MATLAB® with Simulink®, MATLAB Coder™ and Simulink Coder™ (supported versions as M-Target for Simulink® Release-Notes), toolboxes from MathWorks according to application, M-Base Version 4.00 or higher

1) Requirement is suitability for MATLAB Coder™ und Simulink Coder™

Order codes		
Item	Item no.	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®; automatic code generation for the M200 Series based on MATLAB Coder™ and Simulink Coder™. Product support and the delivery of updates within one year 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